CARVER

CT-17 Remote Control Sonic Holography®
Preamplifier/Tuner with Dolby Pro Logic Surround

Owner's Manual

CARVER

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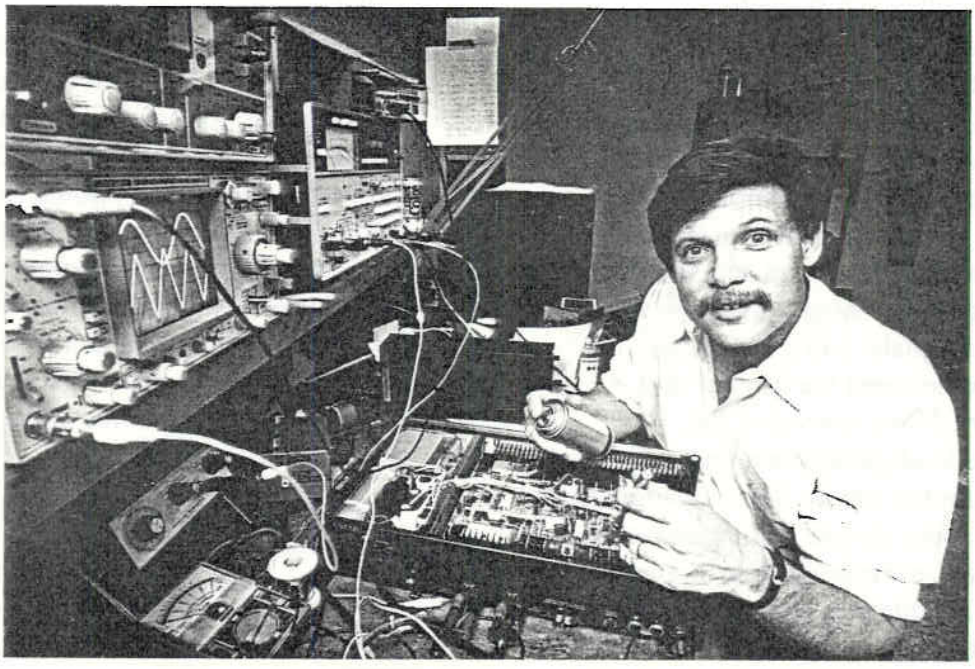

1. Introduction

A Message From Bob Carver

Congratulations on purchasing a Carver CT-17 Preamplifier/Tuner. We believe its sophisticated engineering and meticulous craftsmanship will provide you with many years of listening enjoyment.

At the heart of the CT-17 is a high-quality "straight wire" preamplifier with extremely low noise and distortion, high slew rate and wide bandwidth. To that, we've added incredibly flexible and sophisticated switching capabilities for video and even multiple outputs for room-to-room sound systems.

Yet at the same time the CT-17 is also a superb FM/AM tuner featuring our Asymmetrical Charge-Coupled FM Detection (ACCD) Circuitry which significantly reduces multipath distortion and other types of common FM stereo interference.

The CT-17 also features Dolby Pro Logic Surround. This is Dolby's most advanced surround sound technology and closely approximates the Dolby Stereo effects found in many state-of-the-art theaters. Instead of just front and rear channels, Dolby Pro Logic Surround uses four different outputs and five amplifier channels. Key to the system is a center channel which has active logic steering, provides highly accurate off-axis position accuracy, and aids across-screen movement simulation. If you are a video movie fan, you will be greatly impressed at just how much Dolby Pro Logic Surround adds to a home theater system.

We're very proud to note that the CT-17 is using Dolby Laboratories LATEST version of Pro Logic Circuitry. If you look at the front of the CT-17, you'll see one button missing that is on many other current decoder models: an input balance control. Differences in stereo levels required special calibration and made enjoying Dolby Pro Logic Surround less convenient if more than one type of video source was often used. The CT-17 has Automatic Input Balance Control. You need set up relative channel levels

just once and then enjoy, no matter what kind of video sound input you're using.

Finally, we have naturally added our newest and most advanced version of our patented Sonic Hologram Generator. Sonic Holography® sound processing will increase listening pleasure and enjoyment by bringing a completely new perspective to your favorite music not possible till now. It will bring you an actual improvement in the quality of listening via 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® will paint a sonic picture that's remarkably believable and convincing. You'll experience a perceptible heightening of sound stage depth as well as width.

I might add that Sonic Holography® and Dolby Pro Logic Surround are not only compatible but complementary. The increased sound field size possible with Sonic Holography® enhances the surround sound effects, especially with Pro Logic's additional center channel system.

The CT-17 seems pretty complicated, but once you're familiar with its controls, you'll find it easy to use. Especially with the ultra-complete remote control unit which is included. To get the most from your CT-17, Sonic Holography® and Dolby Pro Logic Surround, be sure to read all safety, installation, and operating information in this manual. By carefully following the set-up instructions and recommendations you'll soon be experiencing the enhanced sound qualities made possible by ACCD, Sonic Holography® and Dolby Pro Logic Surround.

Again, let me thank you for choosing Carver. I am proud to present to you the best in craftsmanship and design found in the CT-17.

Robert W. Carver
Chairman of the Board,
CARVER CORPORATION

2. Fast-Track Express Set-Up Hints

This is a very useful note written by one of our dealers after having used the CT-17 for a while. It's for those of you who are relatively fluent with audio hook-up but need to know what's DIFFERENT about the CT-17.

"The Carver CT-17 Tuner/Preamp is a marvel of compactness, particularly given the number of audio/video functions it supports—AM-FM tuner, audio preamp, video switcher, Dolby Pro Logic decoder, Sonic Hologram generator, with a remote control which supports most of its front panel functions. It greatly reduces "chassis clutter" in A/V installations, providing high quality circuits for each function. Because it has several functions which you may not be familiar with, we have listed below some of the important ones and some relevant notes about them which are essential for proper operation of your unit.

"The external processor circuit is a little unconventional. Since there was no room on the front panel for a toggle for this circuit and since most external processors have their own defeat switches, Carver has strapped the EXT PROC IN/OUT terminals together for use without a processor. *If you do not have a processor be sure to leave these strapped, since the MAIN OUTs will not work otherwise.*

"In its compact design Carver has necessarily had to limit some of the controls on the front panel. The Front Panel and Remote Control sections of the manual explain which controls appear only once. Note that the remote also provides basic controls for a Carver CD player [TL3300, SD/A 450, SD/A 490t, TL3200, DTL50, DTL100, and DTL200], reducing the need for more than one remote control at your listening location.

"The CT-17 has the latest Sonic Hologram circuit. Bob Carver has made substantial improvements in these features which add width and depth to the soundstage. In our listening tests, we have noticed improved naturalness and correctness in instrument placement. Sonic Holography takes some special setup to realize this improvement in imaging; we urge you to read the section in the manual which describes this setup. We think you will feel that your efforts are substantially repaid.

"Similarly, Dolby Surround requires correct calibration for the Pro Logic steering to locate sounds appropriately. Dolby has included a calibration tone to help you with setup; once the channels are balanced, you can use the master volume control to control the level of all channels. The SURROUND MODE and CENTER MODE controls make important differences in the operation of the various channels. Pages 34 and 35 of the manual provides a good overview of this operation.

". . . The Carver AV-64 configurable amplifier or new AV-63 was specifically designed to provide center and real channel amplification; we will be glad to demonstrate this amplifier for you. Alternatively, you can use any additional stereo amplifier—one channel driving the center speaker and the other the rear speakers. The manual includes a good discussion on amplifier selection and configuration for surround operation. We will be happy to advise you on the choice of additional amplifiers, speakers, and wiring.

"The CT-17 has two output circuits with independent source and level controls, allowing you to control two separate sets of signals in different rooms. For example, you can drive two different video monitors and power amplifiers with a single VCR and the CT-17, or you could use the CT-17 to operate a complete surround video operation in one room and direct the output from your CD player to another room. Carver's Remote System Link is designed to work with the CT-17 to provide infrared control from the remote

location. You can also use the REMOTE/RECORD circuits to make a recording from one source while listening to another source. . .

"The video switcher circuits provide for two devices—one "play only" and one "play/record". Connect a video disk player, a source VCR, the "video out" from a cable convertor box or the output from a camcorder to VIDEO 1. Connect your target VCR to VIDEO 2. Select VIDEO 1 on the REMOTE/RECORD panel to copy the material on VIDEO 1 to VIDEO 2. We recommend the use of high quality interconnects between video components because of the complexity of the signal.

"The CT-17 is a complex unit. Initially you may find it a little more difficult to operate than an ordinary preamp. If you do not get expected results, consult the Troubleshooting section at the back of the manual and review the settings of the controls and the LED panel which shows the special features and modes you have selected. As you use the CT-17, you will become more familiar with its circuits and controls.

"We hope that you will be as impressed with the CT-17's features and performance as we are. We carry the Carver line because we believe Carver products provide high end performance at an affordable price. The CT-17 seems to out-Carver Carver."

Our thanks to August Systems of Champaign, Illinois for this valuable introduction.

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3. How This Manual Is Organized

This may seem like a VERY large and very intimidating manual. In many ways, the CT-17 is actually FOUR different components (audio/video preamplifier, tuner, Sonic Hologram Generator, Dolby Pro Logic Surround Decoder with new Automatic Input Balance Control). So you're actually reading the equivalent of FOUR different manuals. However, instead of splitting things up that way, we've chosen to separate the "special" functions such as Dolby Pro Logic Surround from the general hook-up and operation information. That way, you can get your new CT-17 hooked up and working first; then explore its more sophisticated functions later.

On the following pages, you'll read descriptions of the front panel, back panel and remote functions. Next a section on how to hook up the CT-17 with your existing audio and video components. Then a section detailing operating steps for common functions such as choosing inputs, setting and selecting tuner presets, making tape copies, etc.

Then the manual addresses three different, more specialized topics: Dolby Pro Logic Surround, Sonic Holography® and multi-room configurations.

The final section covers troubleshooting, warranty, service and specifications.

4. Prior to Installation

Unpacking

Carefully unpack your CT-17 and keep the original carton and packing materials for moving, shipment, or long-term storage.

Upon opening the box, please check for any visible sign of damage that did not appear on the outside of the box. If you do encounter what appears to be concealed damage, please consult your Carver Dealer before proceeding to further unpack or install the unit.

Important Paperwork

Make sure to save your sales receipt. It is extremely important to establish the duration of your Limited Warranty, and for insurance purposes.

Next, make a note of the serial number which is located on the back of the CT-17. Record it in the space provided below for convenient reference.

Model: **CT-17**

Serial Number: _____

Purchased at: _____

Date: _____

Take a moment to fill out and return the Warranty Card that came with the CT-17 and return it to Carver. In the event that you misplace your sales receipt, having your Warranty Card will assist us in honoring the warranty.

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5. General Description

The CT-17 combines the functions of an audio/video preamplifier and an FM/AM tuner. A Dolby Pro Logic Surround Sound Decoder and Sonic Hologram Generator are also included.

For normal stereo operation, a 2-channel power amplifier must be connected to the CT-17. For Dolby Pro Logic Surround, "hall" and "simulated stereo" effects, five power amplifier channels are recommended.

Two VCR's (sound and video), a compact disc player, two tape decks, a turntable, one additional audio component and an external processor may be connected to the CT-17.

The CT-17 includes a handheld infrared remote control with 39 functions including several not found on the front panel of the component.

6. Front Panel

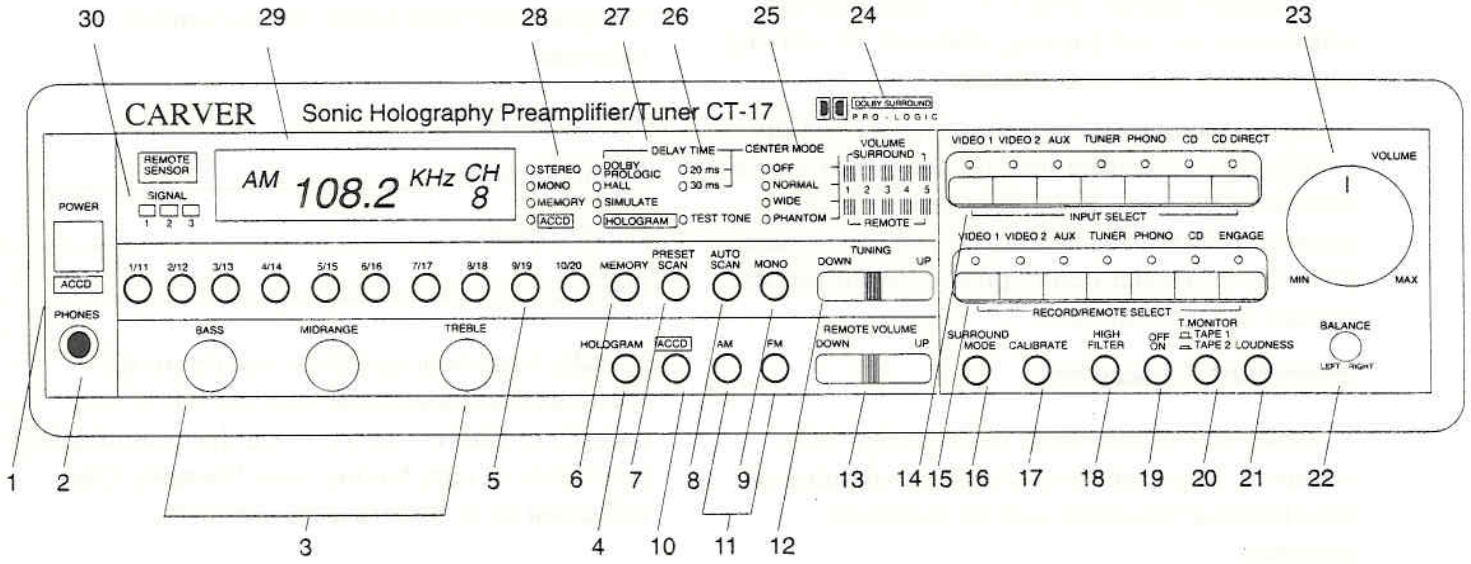


Figure 1 CT-17 Front Panel

The following is a brief description of the function of each CT-17 panel button and control. Please refer to Figure 1.

1. Power. This is the CT-17's ON/OFF switch. It also affects the two SWITCHED convenience receptacles on the back of the unit. The CT-17 employs an electronic "clamper" to mute the main outputs and headphone output during turn-on and turn-off. This reduces loud transients which could damage a speaker system. This muting system will turn off the signal to your power amplifier:

A) For about 3 to 5 seconds after initial power-on, whether by the front panel power switch or from the CT-17 remote.

B) Immediately at turn-off, whether by the power switch or by external switches.

2. Headphone Jack. All conventional dynamic headphones may be plugged in here. Headphone impedance may be from a few ohms to several thousand ohms, although output level may vary depending on impedance. The headphone jack is driven by a separate internal amplifier, designed to provide the extra voltage and current gain needed. The signals present at the headphone jack are identical to those at the CT-17's main outputs. It is recommended that headphones be unplugged from the CT-17 when not being used to avoid risk of damage to them at high volume settings.

3. Treble, Midrange and Bass Tone Controls. Three-band tone controls are provided on the CT-17. At their center detent position, there is no boost or cut. Maximum rotation in either direction produces 8dB of boost or cut. Bass tone control is centered at 100Hz; midrange at 1000Hz; treble at 10kHz.

4. Hologram. This button activates the Sonic Hologram Generator in the CT-17. Sonic Holography® can restore the 3-dimensionality of a live performance through special signal cancellation and time delay circuitry. It works with any stereo source including CDs, records, tapes, stereo videotapes and laser discs. *The*

HOLOGRAM function has a corresponding LED indicator in the display section of the CT-17. HOLOGRAM may also be selected from the remote control.

NOTE: Sonic Holography® Sound Processing System requires careful set-up and adjustment of your speakers. Please consult Section 14 of this manual before experimenting with the HOLOGRAM button.

5. FM/AM Preset Buttons. The CT-17 lets you preset up to 20 different AM and FM stations in any combination. Each of ten buttons are numbered with two different presets: For example, 4 and 14. Once stations are entered into memory, pressing a button *once* quickly calls up the lower numbered preset (Number 4 in our example). Holding the button down *longer* calls the second, higher numbered presets (Number 14 in our example). You may use as few or as many of the presets as you choose. Both presets on a single button need not be used. *All 20 presets may also be recalled from the CT-17's remote control.*

6. Memory. This button is used to *record* station presets. Instructions for its use begin on page 26 in Section 10. *MEMORY has a corresponding LED indicator in the display section of the CT-17.*

7. Preset Scan. When pressed, PRESET SCAN plays a 5-second sample of each station preset, beginning with Preset 1, continuing through Preset 20 and then starting again with Preset 1. When you have found a station you want to keep listening to, press PRESET SCAN again. The preset scan process will stop and the CT-17 tuning section will remain on the preset which has been selected.

8. Auto Scan. When AUTO SCAN is activated, pressing the UP/DOWN TUNING rocker causes the tuner to automatically seek and stop at the next strong AM or FM station which can be tuned by the CT-17. The tuning bar must be pressed each time you wish to scan for another station.

9. Mono (FM). Removes the L-R signal from a stereo FM broadcast, further eliminating multipath interference. The CT-17's Asymmetrical Charge-Coupled FM Detection Circuit (ACCD) is capable of "salvaging" stereo FM signals which have some multipath interference but also a small portion of unaffected L-R signal. If the L-R portion is 100% distorted, ACCD cannot help. At such times, the signal may be switched to mono by pushing this button.

NOTE: The CT-17 MONO button does not affect other input signals such as records or CD's. *MONO has a corresponding LED indicator in the display section of the CT-17.*

10. ACCD. The Asymmetrical Charge-Coupled FM Detector is a patented circuit incorporated into the CT-17. Because FM stereo transmission is inherently prone to multipath interference, even the most "advanced" conventional tuner circuitry is forced to deal with a potentially flawed signal. Only Carver ACCD Tuner Circuitry is capable of restoring — literally transforming a multipath-ridden FM station into a clean, clear signal. It separates the FM signal's stereo (L-R) and mono (L+R) components, rejecting up to 80% of the fragile, distortion-filled stereo signal. The 15-20% of the signal which is "clean" is used to accurately recreate the rest of the stereo signal. You hear clean, clear FM with accurate frequency response, wide dynamics and ambient stereo information...even when a high portion of the L-R (stereo) FM signal is being ravaged by multipath. *ACCD has a corresponding LED indicator in the display section of the CT-17.*

11. AM & FM Selectors. These select which broadcast band will be received by the CT-17's tuning section. They are also used when programming a station preset. *Both have corresponding LED indicators in the display section of the CT-17.*

12. Up/Down Tuning. For manual tuning, simply press the UP or DOWN portion of this rocker switch. The tuner's "dial position" will move in small increments which correspond to

the possible frequencies which can be assigned to FM and AM stations. *UP/DOWN TUNING is also possible from the CT-17 remote control.*

13. Remote Volume. This is a secondary volume control for use with room-to-room (remote) systems which have speakers in other parts of your house. The CT-17 is one of the few preamplifiers (and ONLY preamplifier/tuner) which actually has two completely different sets of output circuits. In other words, it is literally TWO preamplifiers in one chassis — including two totally separate sets of outputs. This means that you can, for example, enjoy a compact disc on your main stereo system and feed the CT-17's tuner output to another room. How to take advantage of this unique feature — and how to interface it with remote sensors or Carver's RemoteSystemLink™ — are covered in Section 16 of this manual. *REMOTE VOLUME has a corresponding control on the CT-17 remote control.*

14. Primary Input Select Buttons. The CT-17 gives you a choice of up to eight different sound sources (Tape inputs work in a slightly different way and so are not grouped with the Input Select buttons). The other six sources are selected by pressing one of the source buttons. An appropriate LED will light up above the sound source button you have pushed (or selected by remote control).

VIDEO 1 and **VIDEO 2** receive both the audio and video inputs of a VCR, laser disc player or CDV. When either of these sources are selected, video will be available at the video MONITOR out socket on the back of the CT-17. When VIDEO 2 is selected on the front panel, the VIDEO 2 OUTPUT is disengaged to prevent feedback.

AUX may be used for any other additional line level stereo component such as a third cassette or reel-to-reel deck, satellite video sound feed, input directly from a stereo TV, etc.

TUNER selects the CT-17's own internal quartz-synthesized FM/AM tuner.

PHONO is designed to receive the input of standard moving magnet cartridges which produce at least 5 mV of signal.

CD selects your compact disc player. Note that the signal is routed through all of the CT-17's signal processing circuits including tone controls, etc.

CD Direct. While the CT-17's electronics are unusually noise and distortion-free, some serious listeners wish to hear a CD through the shortest possible signal path. Pressing the CD DIRECT button eliminates the Sonic Hologram Generator, high filter, loudness, and tone control circuitry between the CD input and the CT-17's output stage. Only BALANCE and VOLUME are operable. We encourage you to experiment with this option.

NOTE: Make sure that CD and CD Direct are both selected when using CD DIRECT with the Surround Mode feature.

AM, FM, PHONO, CD, VIDEO 1, VIDEO 2 and AUX may also be selected from the remote control.

15. Record/Remote Select. This is a second set of input selectors which serve two purposes:

1) They select the input source for making a recording;
2) When ENGAGE is off, they assign the sound source for a REMOTE, secondary system.

Recording Input Source Selection. The CT-17 allows you to make recordings from one source while listening to another source over your stereo system. For example, you could be copying a compact disc to tape or VHS Hi-Fi VCR while listening to FM. Or you could be transcribing records onto a cassette while listening to a movie in Dolby Stereo. See page 26 of Section 10 for step-by-step instructions on how to use the CT-17's RECORD/REMOTE SELECT for taping. The ENGAGE button is activated during the recording process.

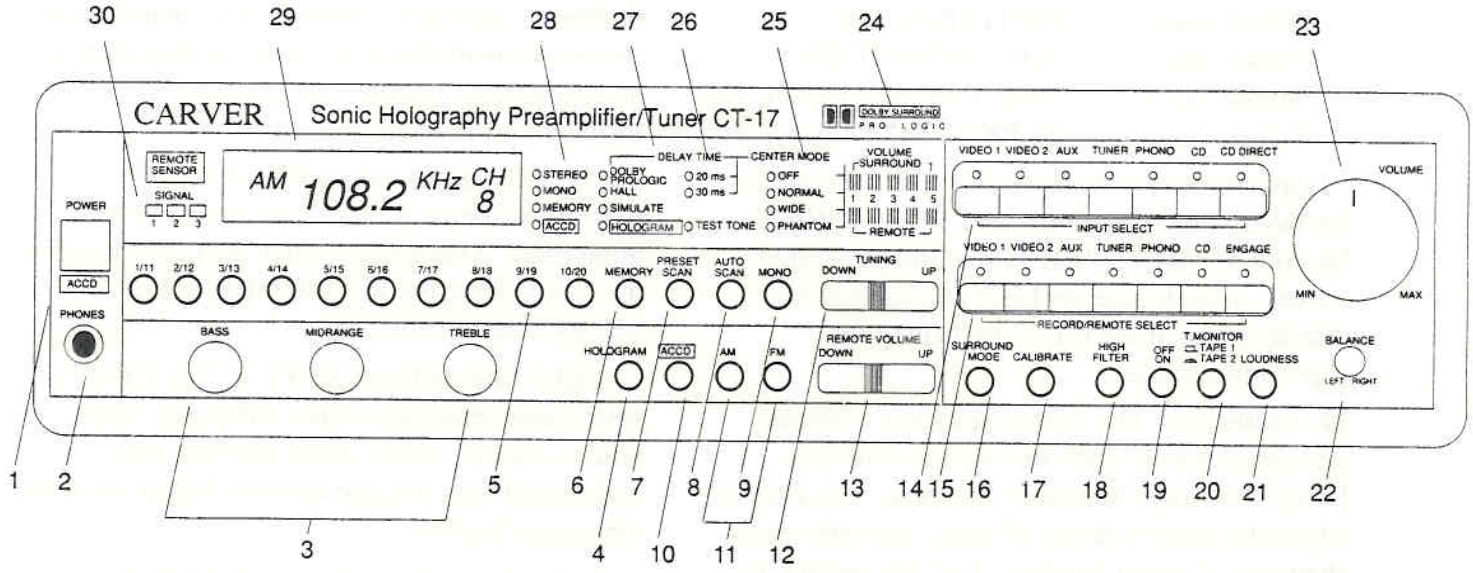


Figure 1 CT-17 Front Panel

Secondary (Remote System) Source Selection. When you're not making tapes, the same bank of selection buttons controls the sound source that's routed to another amp and remote speakers. This allows you to play one sound source (for example a cassette deck) in your main listening room and enjoy FM background music in another part of your house. The CT-17 may be used in this manner with an optional remote relay system or manually just by adding another power amplifier and wire to speakers in other rooms. See Section 17 for more details.

Engage. All the buttons in the RECORD/REMOTE SELECT row are the same as the main INPUT SELECT — except for ENGAGE. ENGAGE changes the function of this bank of input selectors. When it is OFF, any of the other RECORD/REMOTE SELECT sources such as CD, Phono, Tuner, etc., are routed to the remote outputs of the CT-17.

When ENGAGE is ON, the REMOTE OUT outputs carry the same source information as is carried by the PRE OUT outputs.

NOTE: All of the source selection buttons in the RECORD/REMOTE SELECT bank are audio-only. The CT-17 will not send video to a secondary, remote system.

ADDITIONAL NOTE FOR REMOTE ROOM SYSTEM USERS: ENGAGE should be left OFF if you are selecting sound sources from another room.

16. Surround Mode. The CT-17 provides three different effects which make use of rear channel speakers:

1. *Dolby PRO LOGIC Surround Sound* — for use with Dolby Surround-encoded videotapes or laser discs.
2. *HALL* — a spatial simulation which provides an airy, 3-dimensional effect to mono or stereo sources.
3. *SIMULATE* — simulated stereo for monophonic sources such as regular television broadcasts. Because these effects utilize sophisticated inter-channel phasing instead of a crude comb filter, at least four speakers (two front, two back) are required.

The three different effects are selected by "cycling" through a set of four options. Each push of the button advances you to the next surround mode:

Not pushed	SURROUND MODES OFF
Pushed once	PRO LOGIC ON
Pushed again	HALL EFFECT ON
Pushed again	SIMULATED STEREO ON
Pushed again	SURROUND MODES OFF

Another way to think of it is: PUSH ONCE for Dolby Pro Logic Surround, PUSH TWICE for Hall, PUSH THREE TIMES for simulated stereo. In each case, an LED will light in the display panel of the CT-17 to display the appropriate mode.

17. Calibrate. This button activates a special test signal which alternates between the five Dolby Pro Logic Surround speakers. It is used to adjust the relative levels of front, rear and center channels. Consult Section 12 of this manual for details.

18. High Filter. The HIGH FILTER reduces the level of high frequencies above 10,000 Hz (3dB down at 10K). It may be used to reduce noise on older phonograph records, cut tape hiss, reduce hiss on regular TV broadcasts or further lower the threshold of FM or AM background noise. Its use is not recommend on material which is rich in high frequencies such as compact discs, CDV's or laser discs with digitally-encoded soundtracks.

19. Tape Monitor - On/Off. Works in conjunction with TAPE 1/TAPE 2. When this button is pressed IN you will hear the signal which has been sent to a tape deck and returned to the CT-17. When the button is OUT, you will hear whatever source has been selected from the INPUT SELECT bank (14).

VERY IMPORTANT NOTE!!! During recording, TAPE MON ON/OFF works very differently than you might think. IT SHOULD BE OFF when recording. See the example below.

NOTE: Silence will result if the TAPE MONITOR ON/OFF button is pushed in when the cassette deck is not playing, recording or if there is no deck connected to that tape monitor loop.

NOTE: If you have an outboard signal processor, such as a Carver ECS-U, equalizer or surround sound decoder, a tape monitor loop is one connection option. See Section 9, Installation for details.

20. Tape Monitor - Tape 1/Tape 2. Selects the output of Tape 1 or Tape 2 to be monitored. Also selects which deck is to receive the "send" from the RECORD/REMOTE SELECT input bank (15).

VERY IMPORTANT NOTE!!! The CT-17's tape system probably works differently than you're used to. Please make sure that you understand this. It's also covered farther on in the Operation Section.

Let's take an example: A cassette deck plugged into the CT-17's TAPE 1 IN and TAPE 1 OUT sockets.

To play back: Press TAPE MON ON and leave TAPE 1/2 in the OUT (TAPE1) position.

To record: Leave TAPE MON in the OFF position (OUT) and simply press TAPE 2 to monitor your source.

21. Loudness. This is a special equalization circuit designed for realistic music reproduction at low, "background" listening levels. Due to certain characteristics of the human ear, we aren't as sensitive to low frequencies at modest sound levels as we are to midrange and high frequencies. The loudness circuit compensates for this by boosting low frequencies, creating a more balanced sound at background listening levels. We recommend that this be switched off for surround listening.

22. Balance Control. Adjusts the left/right distribution of sound to your speakers. It is useful when one speaker is closer to your listening position than the other, or with some poorly recorded material which has more of one channel than the other. The sweep of the CT-17's BALANCE control is *intentionally not linear.* That is, small movements off center produce smaller shifts in the stereo image per degree of rotation than near the extreme left and right

positions. This makes slight adjustments more convenient.

23. Volume Control. This function is also available on the remote control included with your receiver.

24. Volume Displays. Two LED displays are provided for easy visual feedback as to the relative levels of surround and remote channels. The displays should be used for comparison purposes only.

25. Surround Sound Center Channel Mode Displays. The front, center channel output of the CT-17 may be switched between three different modes. These are selected from the remote control ONLY. See Sections 8 and 12 for further explanation.

26. Digital Delay Time Indicators. A switchable 20-30 millisecond delay time is provided to further fine tailor the processed Dolby Pro Logic Surround sound. It is selected from the remote control ONLY. See Sections 8 and 12 for further explanation.

27. Surround Sound Mode Indicators. See No. 16 (SURROUND MODE button).

28. Tuner Mode Indicators. The STEREO indicator lights up when an FM stereo station is encountered while tuning. The MONO switch must be OFF for this LED to light. MONO, MEMORY and ACCD lights correspond to the appropriate tuner function button.

29. Digital Display. The CT-17's fluorescent panel contains the tuning section's digital frequency read-out and channel (preset) display.

30. FM Signal Strength Meter. Indicates the relative strength of incoming FM signals.

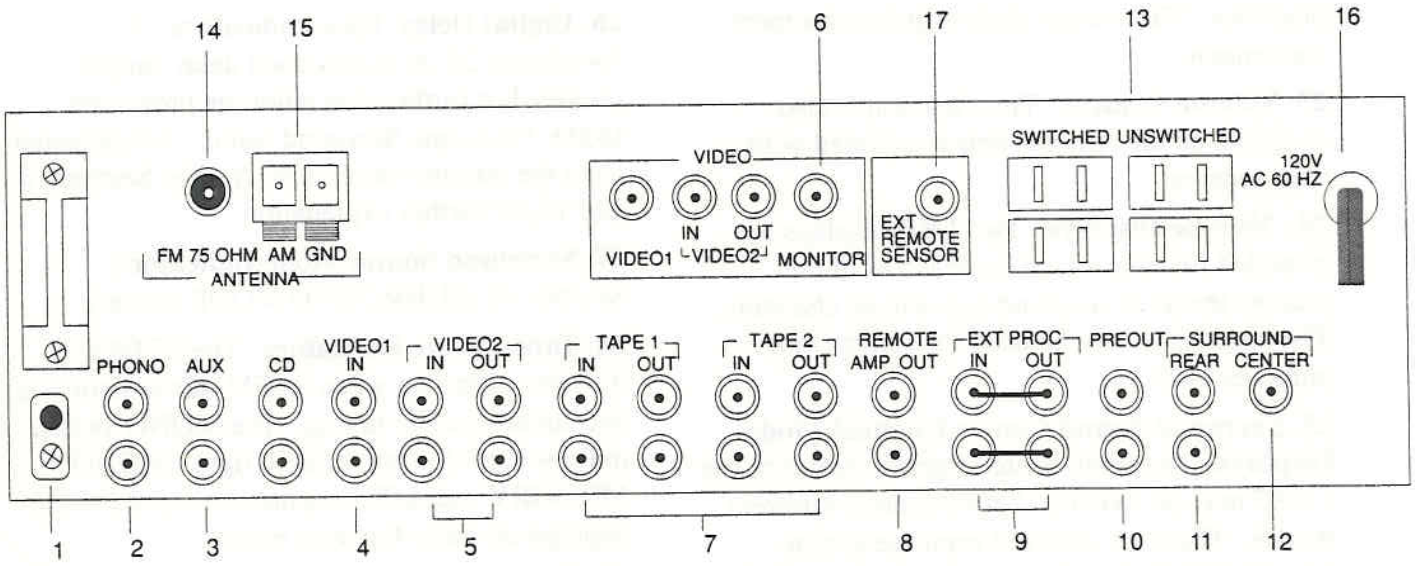


Figure 2 CT-17 Rear Panel

7. Rear Panel

Most of the inputs and outputs on the back of the CT-17 are self-explanatory. The following are descriptions of connections which may require further consideration.

1. Ground. If your turntable has a separate grounding lead (usually a single wire terminated with a spade lug), connect it to this screw terminal.

2. Phono Input (M/M). This phono circuit has a total gain of 36db, appropriate for moving magnet cartridges. Its input impedance consists of 47K ohms resistance in parallel with a capacitance of 150pf. If you are using a low-output moving coil cartridge, you will need a step-up device such as the Carver MC-T.

NOTE: Do not plug line level inputs such as CD players, tape decks, VCR's, etc. to this input. Severe overloading and distortion will result.

3. Aux inputs. Any line level audio source may be connected to the AUX inputs. It is not designed for phono inputs.

4. Video 1 (sound inputs). VIDEO 1 is designed for playback only. Thus it only includes INPUTS for stereo sound and video. If you use a VCR for playback only or have a CDV, laser disc player, satellite dish receiver, etc., this is where it should be connected.

5. Video 2 (sound inputs and outputs). VIDEO 2 includes both inputs and outputs. This means you can record audio from any of the other CT-17 inputs, or audio and video from the VCR or laser disc connected to VIDEO 1. VHS Hi-Fi or Beta Hi-Fi VCR's make excellent audio tape recorders — their signal-to-noise ratio and frequency response rival digital recorders and you can get up to six hours of high quality audio on a single videocassette.

6. Monitor. This is the CT-17's video output to a TV monitor or monitor/receiver. We recommend a high quality RCA-type interconnect for this hook-up since high frequency information up to 5,000,000 Hz is being conducted. Consult your Carver dealer for details.

7. Tape Monitor "Loops". The CT-17 has two sets of tape monitor inputs and outputs. Hook-up is relatively straight forward unless you're using

a 3-head deck. Special instructions are provided on page 24.

8. Remote Out. The CT-17 has two sets of main outputs: REMOTE OUT and PRE OUT. REMOTE OUT is designed for use with a second power amplifier and speakers in another part of your house. See Section 16 for details. If you are not creating such a multi-room system, REMOTE OUT will probably not be used.

9. External Processor In/Out. This feature does not have a corresponding button on the front of the CT-17 (basically, we ran out of room!). However, it is extremely useful for signal processing components which are either 1) left in the system all the time (such as the Bose speaker equalizer) or 2) have their own "defeat" switch which eliminates them from the circuit path (virtually all equalizers, expanders, etc.).

NOTE: Don't remove the connecting "U"'s which have been inserted into these sockets unless you intend to use an external processor which can return the signal to the CT-17.

10. Pre Out. These outputs are connected to your power amplifier.

11. Surround Out. Stereo outputs for left and right rear channel speakers. These should be connected to another power amplifier.

12. Center Out. This is a mono output for the special center channel speaker which distinguishes Dolby Pro Logic from "regular" Dolby Surround. It should be connected to one channel of a power amplifier.

NOTE: Dolby Pro Logic rear channel surround sound output is actually MONO. You can achieve the full "5-channel" Dolby Pro Logic Surround effect with just four amplifier channels. See Section 11 for details.

13. Convenience outlets. Four additional AC outlets are provided on your Carver CT-17. The two marked SWITCHED are only live when the CT-17's power switch is pushed. They are useful for other components which you use every time you play your system such as an equalizer, a speaker equalization box, etc.

NOTE: Do not plug power amplifiers into the CT-17's SWITCHED convenience outlets.

Two UNSWITCHED AC outlets are also provided. They are always live as long as the CT-17 is plugged into the wall. A device connected to one of these outlets may be left permanently on, or may be switched off with its own switch.

NOTE: In order to avoid turn-on transients, devices plugged in here should be powered up BEFORE the CT-17 is turned on.

NOTE: The total power drain on these receptacles should not exceed 1000 watts.

14. 75-ohm FM Antenna Terminal. You may connect directly to your local cable television system (consult your local cable operator for details), connect a 75-ohm antenna, or use the 300-ohm dipole antenna with the balun adaptor supplied.

CAUTION: Extreme care must be used when connecting your preamplifier/tuner to an external outside TV/FM antenna. See the Notice at the front of this manual. If you're not 100% sure of the procedure, consult qualified installation personnel.

15. AM Antenna hook-up. The AM loop antenna provided is adequate for good AM reception in most areas. Adjust the antenna for best sound. It may also be wall-mounted with the supplied bracket.

16. AC Line Cord. The CT-17 is designed to be plugged into a properly polarized outlet. (See Safety Instructions 17 and 18 at the beginning of this manual). The CT-17 may be attached to an extension cord or multiple outlet plug, provided they have the proper polarization (one wider and one narrower prong. If you are using an extension cord, we recommend 16 gauge or heavier.

17. Remote Sensor Connection. The CT-17 can be used with many external remote sensors (also called infrared receiver/booster systems) as well as with Carver's more elaborate RemoteSystemLink™ room-to-room system.

Virtually all external remote sensor systems have a standard 3.5mm phone jack output which plugs into this socket on the CT-17 (see page 25).

8. Remote Control

Batteries

The CT-17's wireless infrared remote requires two AA batteries. Remove the battery compartment door on the back of the remote control by sliding it outward parallel to the surface of the remote. Insert the batteries supplied, making sure to match the positive (+) and negative (-) ends as indicated by the diagram inside the battery compartment.

Remote Operation

The remote control unit will work in a range of approximately 20 feet in front of and about 30 degrees to either side of the preamplifier/tuner. If the remote control begins to occasionally not respond, 1) check its batteries; 2) make sure the infrared projection area on its tip is clean; 3) check that the CT-17's infrared remote sensor square is not dirty or blocked from direct line-of-sight contact with the remote.

Remote "Differences"

Seven EXTRA functions are found on the remote which are NOT found on the CT-17 front panel:

SURROUND Volume UP & DOWN
CENTER Volume UP & DOWN
CENTER MODE
DIMENSION (Delay Time)
REMOTE
MUTE
Four CD Transport controls

Remote Functions

1. Volume Control Functions. You can set three different individual volume levels with the CT-17 remote controls. Two of these are for adjusting relative Dolby Pro Logic Surround gain levels in a multi-speaker system: SURROUND and CENTER. Once they are adjusted, the MASTER control is used to actually control overall volume during listening.

If you *aren't* taking advantage of Dolby Pro Logic Surround, you will only need to adjust the MASTER volume.

REMOTE volume allows you to adjust the loudness of a second system in another room. It is especially valuable when used with Carver's RemoteSystemLink™ or remote transmitter systems, since you can take your CT-17 remote with you and use it in another part of the house. This signal is unaltered by tone, Holography, High Cut and Loudness controls.

2. Surround Sound Functions. CENTER MODE and DIMENSION control aspects of the CT-17's surround sound functions. The center channel is operational in Dolby Pro Logic mode. Front *center* channel output may be switched between three different modes: NORMAL, WIDE, PHANTOM and OFF (See Section 11 for details). The three different effects are selected by "cycling" through a set of four options.

Each push of the button advances you to the next CENTER MODE:

Not pushed	NO CENTER CHANNEL
Pushed once	NORMAL (used with Pro Logic) ON
Pushed again	WIDE center channel effect

Pushed again	PHANTOM center channel effect
Pushed again	NO CENTER CHANNEL

DIMENSION selects a 20 or 30 millisecond delay time for the Dolby Pro Logic Surround, Hall and Simulated Stereo modes. (To change the delay time, Dolby Pro Logic mode must be ON.) Its use depends on listening tastes and room/system configuration. We discuss this function in more detail in Section 12.

3. Tuning Control Functions. UP and DOWN tuning buttons correspond to the rocker switch on the CT-17's front panel. Ten preset buttons are included, each of which activates two different FM or AM presets. An ACCD button is also provided near the bottom of the remote.

NOTE: To select a preset from 1 to 10, press the remote preset button *once quickly.* To select a preset from 10 to 20, hold the appropriate button down *for several seconds.*

4. Input Functions. These include AM, FM, PHONO, CD, VIDEO 1, VIDEO 2, AUX and REMOTE.

5. CD Transport Functions. The CT-17 remote control may be used to activate four functions of many Carver compact disc players: PLAY, PAUSE/STOP (depending on whether the button is pressed once or twice) and SKIP which lets you skip ahead or back through the tracks.

6. Other Functions. Along with master POWER (on/off), there are buttons for activating SONIC HOLOGRAPHY® circuits and muting the CT-17's sound. When depressed, the MUTE button reduces the master volume level by 20dB. When the MUTE function is activated, the green LED in the master volume control knob turns red. Pressing the MUTE button again restores the previous sound level and the green LED. MUTE does not affect the REMOTE (second system) output.

7. Remote. If you're in another room and are using a remote transmitter system to "communicate" with the CT-17, REMOTE allows you to select a secondary source in the other room. Just press REMOTE and then select the source for the remote system.

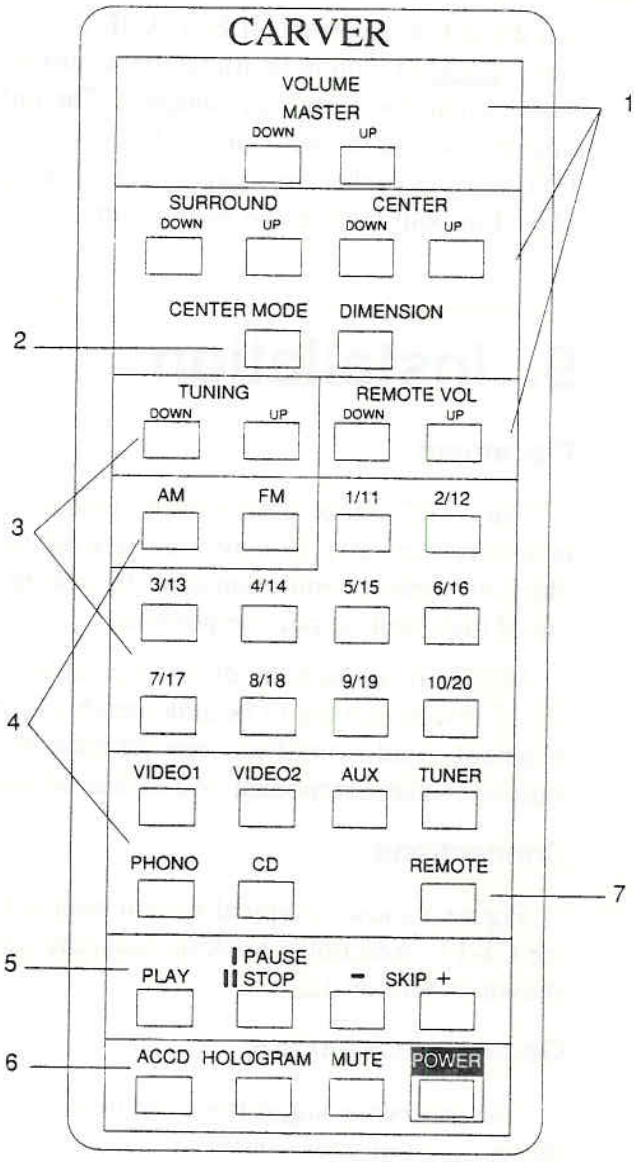


Figure 3 Remote Control

Once a remote source is selected, the remote control automatically reverts back to main system source select. The REMOTE button must be pushed again in order to select another source for the remote system. If the REMOTE button is pushed and no remote source is immediately selected, it will remain in remote source select mode until a source is finally selected by the remote control.

VERY IMPORTANT: ENGAGE (on the front panel of the CT-17) MUST be OFF for REMOTE

(on the remote) to work. If ENGAGE is well...engaged, you must trudge back into the main system room and dis-engage it. The only time this would be necessary is if you've pushed ENGAGE in so that the same source is being played in both remote and main room.

If you leave ENGAGE off, you can still change both the main room and the remote room source using the CT-17 remote control from either room.

9. Installation

Placement

The CT-17 can be placed in any position including vertically. However, be sure not to block its vertical ventilation areas by setting it on top of high heat output components.

NOTE: To avoid hum, do NOT place the CT-17 directly on top of or underneath a Carver Magnetic Field Amplifier. Separate them by at least one other component or 2 inches of space.

Connections

Figure 5 shows a typical system built around the CT-17. Additional hook-up diagrams are shown in Section 12.

General hook-up tips

The following suggestions can help you get the most out of your system:

- Make sure all components are OFF before making any connections.
- Use high quality interconnects. Cheap, worn or frayed patch cords will not only degrade the sound, but can also be a source of hum and RF noise. Special higher-quality interconnects are available in many grades. These are often used from CD-to-preamplifier, preamplifier-to-power amplifier and video connections. Consult your Carver dealer for details.
- Double-check that *"left's go to left's* and *right's go to right's"*. It is general practice to use RED patch cord plugs for RIGHT channel connections and WHITE or BLACK patch cord plugs for LEFT connections. Whatever way you choose, remain consistent while hooking up all of your components.
- Make sure that turntable input cables are well away from both power cords and speaker wires to eliminate the possibility of induced hum.

Specific CT-17 Considerations

- An external processor such as an equalizer, dynamic expander, etc. may be connected either to the EXTERNAL PROCESSOR plugs on the back of the CT-17 or into a tape loop. If you are using a 3-head tape deck, we recommend connecting the signal processor to the EXTERNAL PROCESSOR loop.
- Remember that the EXTERNAL PROCESSOR loop connections on the back of the CT-17 are not switchable from the front panel. Make sure the component you hook up to them has its own "defeat" button. Since this loop is "daisy-chained" with the main outputs of the CT-17, the status of the external processor will affect the entire signal path. If the component is off, no signal will reach the CT-17's PREAMP OUT outputs.

If you're not using an EXTERNAL PROCESSOR or have connected it to a TAPE loop, leave the metal "U" plugs in the sockets.

- Video 1 is an input only. Video 2 includes audio and video outputs for recording or dubbing.
- Connections for a 3-head cassette or reel-to-reel deck are somewhat unusual and

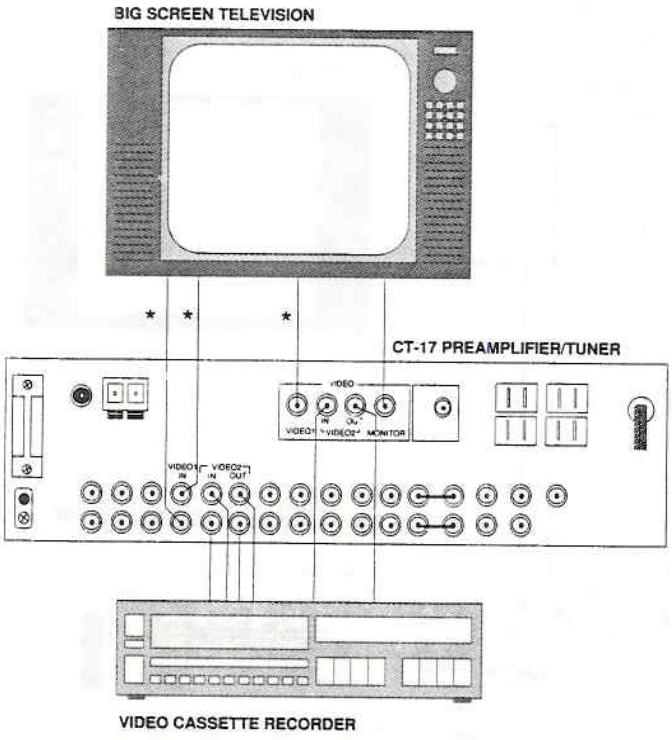


Figure 4 Video Connections

are covered in a special hook-up. (See Fig. 6.) An alternate version of this hook-up is also used for two separate external processors (Fig. 7).

Video Considerations

- The CT-17's video MONITOR output is designed to connect to a TV which has an RCA socket-type video input.
- If you have just one VCR, connect it to VIDEO 2 as shown in Figure 5.
- If you have a play-only video device such as a laser disc player, satellite dish receiver, CDV, or a second VCR, connect it to VIDEO 1 as shown in Figure 5.
- Many "deluxe" remote control cable boxes also have an RCA type video output and often a line level audio output as well. These may be connected to VIDEO 1 on the CT-17.

* Many stereo televisions and bigscreens have both AUDIO and VIDEO outputs. These may be connected to VIDEO 1, allowing you to enhance the built-in TV speakers with your main stereo system loudspeakers. By connecting the TV's VIDEO OUT to the CT-17's VIDEO 1 IN, you can record what you're watching on TV through a VCR hooked up to VIDEO 2 IN.

A Word About FM Antennas

Even the finest tuning section can't do much if it can't get a good signal. If you live in a suburban area, chances are good you won't need a very elaborate antenna system. If you're in a rural area, heart of a city or want to receive extremely distant stations, a simple dipole antenna like the one provided with your CT-17 might not be sufficient, even with the magic of ACCD.

Basically, the most important consideration is height. The higher the antenna the better because radio waves travel in a straight line. If your antenna is free and clear of obstruction, it will perform better and you'll gain signal strength. A roof-mounted antenna is also much less likely to cause multi-path distortion from room reflections and passing cars, and will cause less hiss from low signal strength.

Dipole antennas tend to be susceptible to noise because they aren't very directional, and because they're usually mounted inside the home. Depending on your specific area and location, signal strength will be adequate at best. This is due to the lack of directionality and, in most cases, height of the antenna. But there are some advantages, including low cost. (One came with your CT-17, right?) In all fairness, the type of dipole antenna we provided will work well in many different places and situations. It should at least be used so you can start enjoying FM programming right away, before settling on another antenna system or commercial cable.

Powered indoor antennas are another possibility. Some new designs have come out

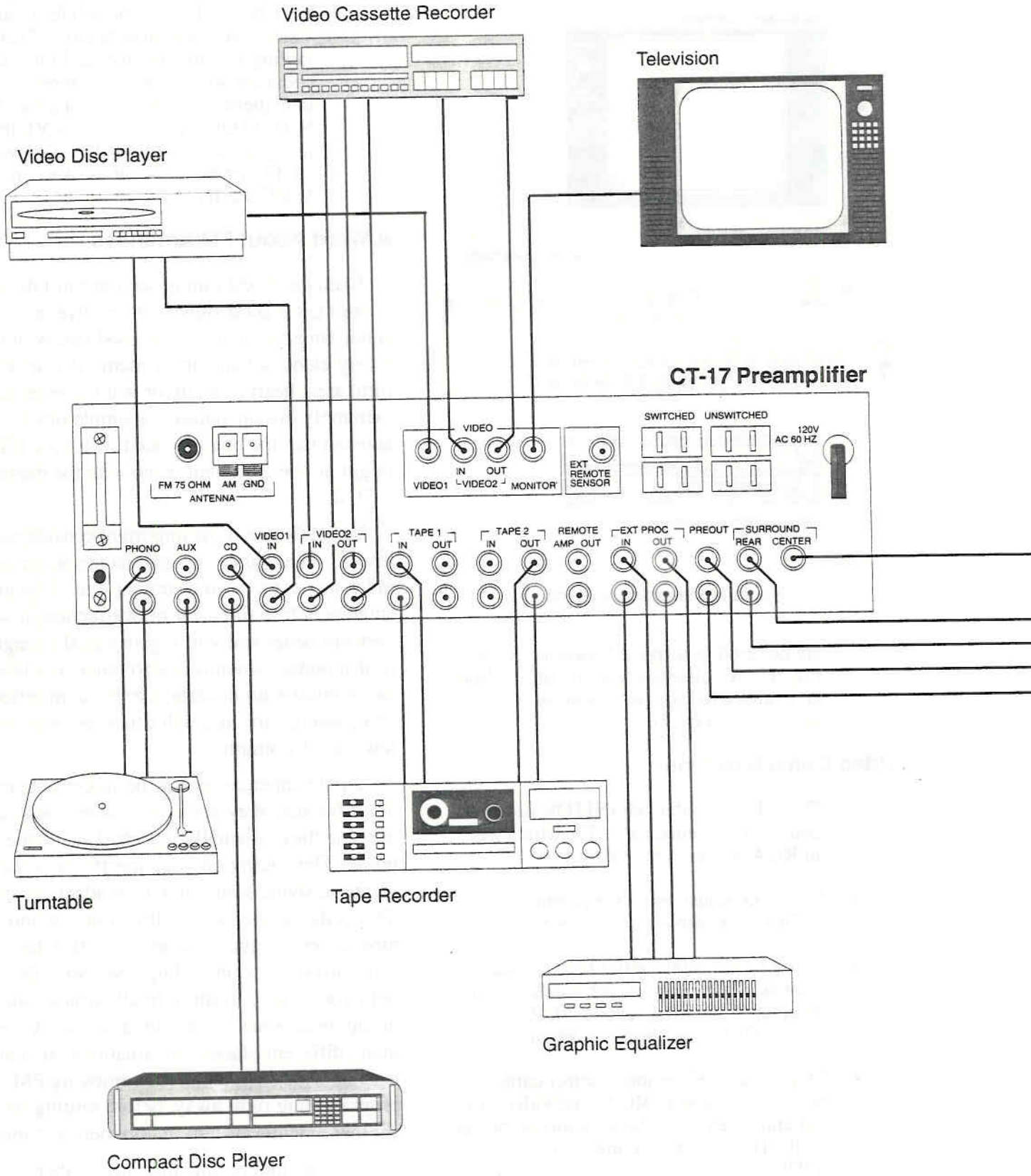
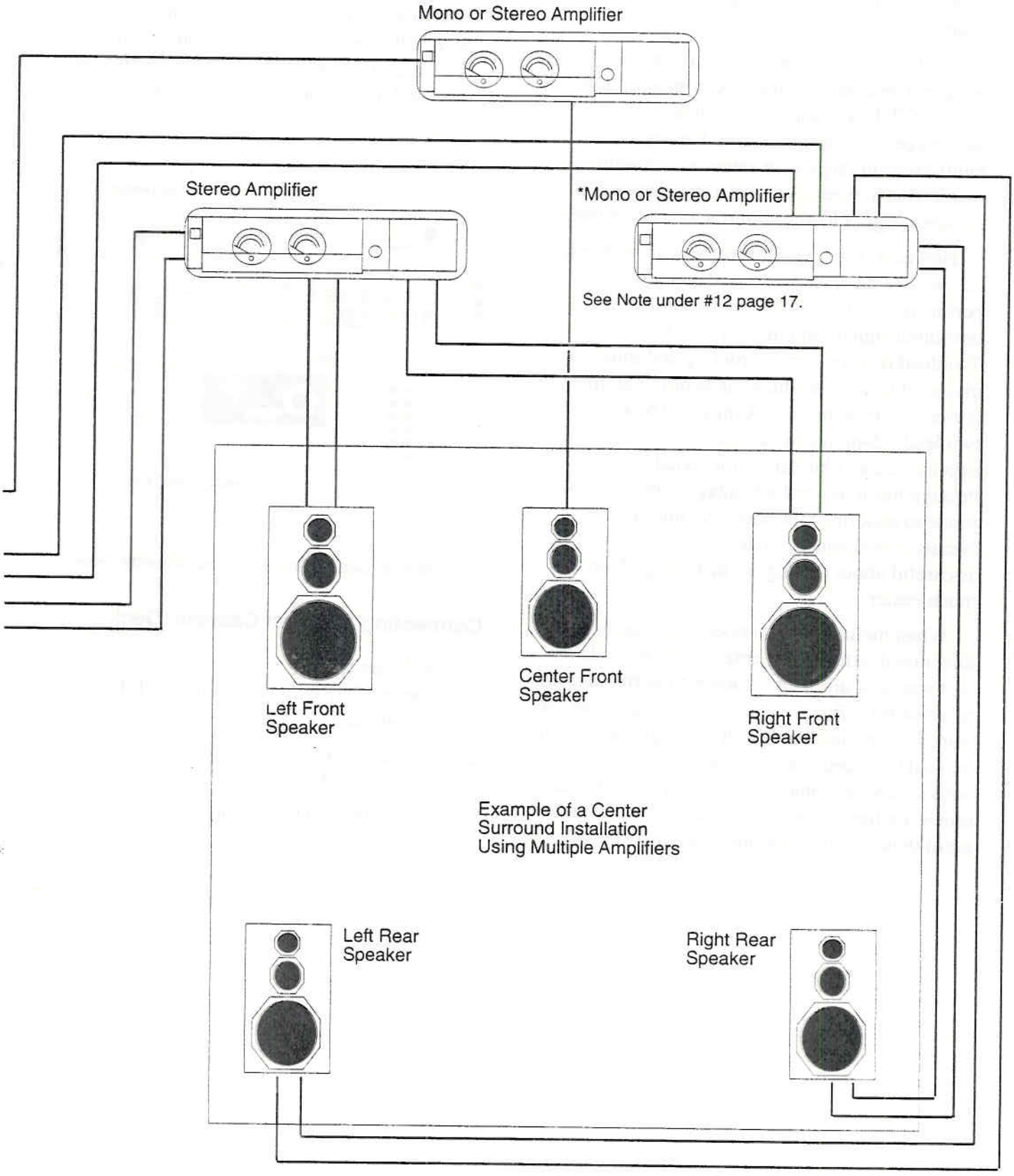


Figure 5 System Interconnections



recently which provide high gain in a small, attractive package and your choice of directivity or non-directivity, depending on how the antenna is oriented.

Feedlines are another important part of getting good FM reception. If the link from your antenna to your CT-17 is poor, you'll cancel any advantage from height or from having a multi-element, high-gain antenna. 300-ohm twinlead is inexpensive, and if it's properly installed, signal losses within it are reasonable.

However, if the twinlead is poorly installed, it can act like an antenna itself, degrading the performance of the CT-17 by picking up extra unwanted signals and interference noise. Twinlead requires careful routing and must be insulated from everything made of metal, like gutters, other wires, etc. Compared to average twinlead, 75-ohm coaxial cable is more expensive and a bit harder for signals to get through but it has real advantages, too. It's not prone to pick up extra noise and interference because it's shielded. Also, you don't have to be as careful about routing, so installing 75-ohm is much easier.

When mounted and connected properly, a directional outdoor FM antenna can provide the best signal of all, with the lowest interference and noise factor. But you have to do it right (see the warnings and information at the beginning of this manual). Indeed, the greatest disadvantage to outdoor FM antennas is the cost of the antenna, mounting hardware, and a rotator if you want to point these highly directional antennas in more than one direction. But when properly installed, an outdoor antenna can, in most areas pull in an incredible number of stations for the CT-17's ACCD processor to clean up. Which design you choose will depend on your FM listening habits and, of course, your location. Consult with your Carver dealer for more antenna insights.

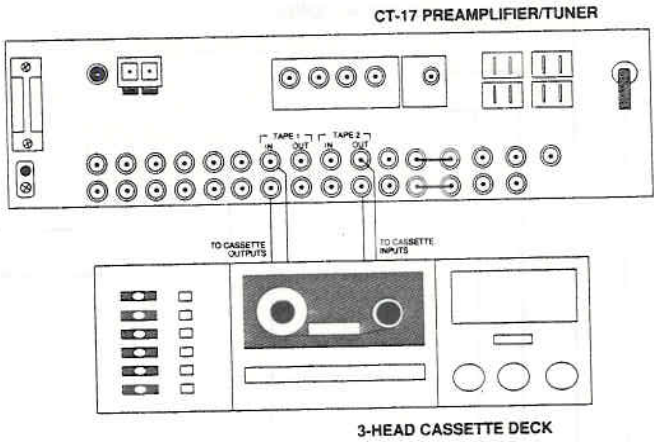


Figure 6 Connecting a 3-Head Cassette Deck

Connecting a 3-head Cassette Deck

See Figure 6.

1. Connect TAPE 2 OUT to the INPUTS of the 3-head cassette deck.
2. Connect TAPE 1 INPUTS to the OUTPUTS of the cassette deck.
3. See Section 10 for operating instructions.

Connecting Two Cassette Decks

See Figure 7.

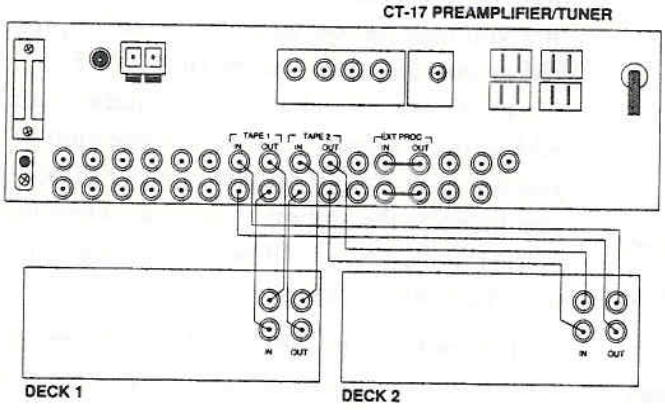


Figure 7 Connecting Two Cassette Decks

1. Connect TAPE 1 IN to the OUTPUTS of Cassette Deck 1.
2. Connect TAPE 1 OUT to the INPUTS of Cassette Deck 2.
3. Connect TAPE 2 IN to the OUTPUTS of Cassette Deck 2.
4. Connect TAPE2 OUT to the INPUTS of Cassette Deck 1.
5. See Section 10 for operating instructions.

Connecting an External Remote Sensor

The CT-17 can be used with many brands of external remote sensors which use a receiver in another room connected to a cable. This allows you to use the CT-17 remote in some other part of your house. See Figure 8.

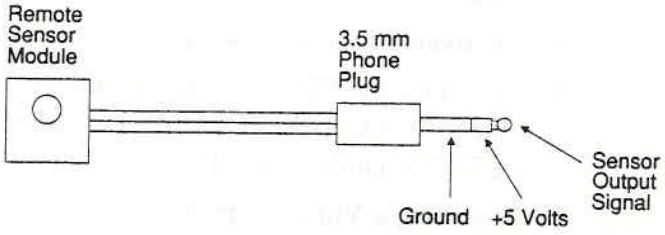


Figure 8 Connecting the External Remote Sensor

CAUTION: Unplug the CT-17 from the AC outlet before connecting or disconnecting the remote sensor from the back of the chassis.

10. Operating Steps

This section includes procedures for common CT-17 operations. Surround sound and remote (room-to-room) instructions are covered in Sections 11 and 17.

A. Selecting and Playing a Music Source (Other Than Tape)

1. Turn on the CT-17.
2. Turn on your power amplifier.
3. Press the appropriate INPUT SELECT button.
4. Make sure the volume control is turned down.
5. Activate the sound source.
6. Advance the CT-17's volume control or press the "+" MASTER VOLUME button on the CT-17's remote control.

B. Selecting a Video Source

1. Turn on the CT-17.
2. Turn on your power amplifier.
3. Turn on the VCR, TV, cable box, etc.
4. Press either VIDEO 1 or VIDEO 2 on the INPUT SELECT row of buttons.
5. Make sure the volume control is turned down.
6. Activate the video source.
7. Advance the CT-17's volume control or press the "+" MASTER VOLUME button on the CT-17's remote control.

C. Tuning an FM or AM Station

1. Turn on the CT-17 and the power amplifier.
2. Make sure the appropriate antenna is connected to the CT-17.
3. Select TUNER from the INPUT SELECT buttons.
4. Select AM or FM by pressing the appropriate button.
5. Advance the CT-17's volume control about 1/4 of the way.
6. Activate AUTO SCAN, then press the tuning bar until the desired station has been reached.

D. Setting FM/AM Station Presets

Your Carver CT-17 can memorize and recall up to 20 FM and AM stations in any order. Note that you may devote as many of the 20 presets to FM as you like (not just the first 10). For example, you could have 17 FM stations and 3 AM stations preset. Our only suggestion is that you put your station presets in order of how often you listen to the station. That way when you hit PRESET SCAN, you'll be previewing your favorite stations first.

The memory inside the CT-17 will retain preset information for about 3 days after it is disconnected. This helps prevent information loss when moving your system around or from power outages.

1. Tune in the station you want to preset.
2. Press the MEMORY button on the front of the CT-17. The MEMORY LED on the display will light up.
3. Now press the appropriate preset button. Press it once quickly to set the lower (1-10) preset number; push it and hold it down for several seconds to enter the higher (11-20) preset number. You will see the preset number appear on the numeric display.
4. When the MEMORY LED turns off, the station has been entered into the receiver's memory.
5. Repeat Steps 1-4 for up to 20 stations.

NOTE: If a station was already entered into a given preset, it will be erased if you choose the same preset number for a new station.

E. Playing an Audio Tape

1. Turn on the CT-17 and power amplifier.
2. Press in the TAPE MONITOR ON/OFF button.
3. Depending on which tape monitor loop the deck is connected to, select either TAPE 1 or TAPE 2.

4. Press play on the cassette deck.
5. Adjust the CT-17's volume control or press "+" and "-" on the remote control.

F. Recording with a 3-Head Cassette Deck

1. With ENGAGE OFF, TAPE MONITOR ON/OFF pushed IN and TAPE SELECT to 1, and the deck connected as shown in Figure 6, select the playback source on the Record/Remote Select row of Input Select buttons. Start the playback source and the record deck. The source will record onto the recording deck and the output from the recording deck can be monitored at the PREOUT. Pushing the Tape/Source Select button on the 3-head cassette deck will allow you to monitor either the source or the tape as it is being recorded. Pushing the TAPE MONITOR ON/OFF button OUT on the CT-17 will allow you to listen to another source selected with the Primary Input Select buttons at the PRE OUT while the recording is taking place.

G. Copying a Tape from Deck 1 to Deck 2

1. Turn on the CT-17, power amp and both cassette decks.
2. Make sure that the source deck is connected to TAPE 1 and the copy deck to TAPE 2.
3. With the ENGAGE switch ON, push in the TAPE MONITOR ON/OFF button and select the TAPE 1 position.
4. Start both playback and record cassette decks.
5. TAPE 1 can be monitored at the PRE OUT jacks. *NOTE:* Selecting TAPE 2 will allow dubbing from Deck 2 to Deck 1.

H. Copying a Tape While Listening to Another Source

1. Connect the recording deck as shown in Fig. 6. Connect the playback deck output to an unused input on the CT-17 such as AUX. Connect the TAPE 1 output from the CT-17 to the source deck's input jacks.
2. With the ENGAGE button OFF, AUX (or whatever the source deck is connected to) selected on the PRIMARY and REMOTE/RECORD Input Select buttons, and TAPE 1 monitor selected, start both playback and record decks.
3. With the TAPE MONITOR ON/OFF button IN, the recording deck can be monitored at the PRE OUT. If it is a 3-head deck, pushing the Source/Tape button on the deck will allow you to monitor either the source or the tape as it is being recorded. With the TAPE MONITOR ON/OFF button OUT, the playback deck can be monitored at the PRE OUT. Changing the selection on the Primary Input Select buttons allows you to listen to another source while recording.

I. Copying a Video Source

1. Turn on the CT-17 and power amp.
2. Turn on the two video sources connected to VIDEO 1 and VIDEO 2. VIDEO 1 should be the source; VIDEO 2 the copying deck.
3. With ENGAGE OFF, press VIDEO 1 on the RECORD/REMOTE SELECT input bank.
4. Start both the video source (hooked to VIDEO 1) and the VCR which is making the copy (hooked to VIDEO 2).
5. The video being sent to the MONITOR output is from the source deck.

J. Copying a CD to Video Tape

1. Turn on the CT-17 and power amp.
2. Connect the VCR that is making the copy to VIDEO 2.
3. With ENGAGE off, press CD on the RECORD/REMOTE SELECT input bank. Selecting another audio source on the MAIN INPUT SELECT bank will let you listen to something else while the recording is taking place. If ENGAGE is on, press CD on the MAIN INPUT SELECT bank. However, you may not listen to another audio source.
4. Start both the CD and the VCR.

11. Connections and Speaker Set-up for Dolby Pro Logic Surround

If you're a movie buff, you owe it to yourself to use the CT-17 as the centerpiece for a true home video theater. In its complete configuration, Dolby Pro Logic Surround requires four to five amplifier channels and five speakers, and the results are spectacular.

Figure 9 shows a complete 5-speaker Dolby Pro Logic Surround hook-up; Figure 10 shows the suggested placement of the loudspeakers. Figure 11 shows an alternative for even more impressive bass reproduction which is a hallmark of Dolby Stereo and Dolby Surround. It makes use of our AV-Sixty Four 4-channel Magnetic Field Power Amplifier which includes a built-in electronic crossover for subwoofer operation.

Speakers for Surround Sound

Main speakers. Obviously, your main Front Left and Front Right speakers should be of the highest quality possible. They should have excellent dynamic range and wide frequency response, especially if they are your primary audio-only listening system. Carver's Amazing Loudspeakers work very well for this purpose.

Since Dolby Pro Logic Surround includes a center channel, your main Front Left/Front Right speakers can be placed farther away from the TV monitor (than is normally recommended). The benefits are two-fold. First, the TV image is psychoacoustically enlarged without losing on-screen centered dialog. Second, the main speaker system needn't be video shielded.

Rear surround channel. The sounds which emerge from Rear Left and Rear Right speakers are not full-range. Rather, the Surround channel frequency range is limited (100 Hz - 7 KHz) output is strictly midrange and treble. This suggests that you don't need extremely expensive, full-range speakers for rear channels. The main considerations should be 1) *size* and 2) *non-directivity*. We recommend mounting rear speakers high enough up so that rear channel sound can be dispersed throughout the viewing area. That usually necessitates a smaller speaker which can be wall-mounted. Since bass reproduction is not critical, bookshelf and even "mini-monitors" work well for this purpose assuming they have fairly wide dispersion

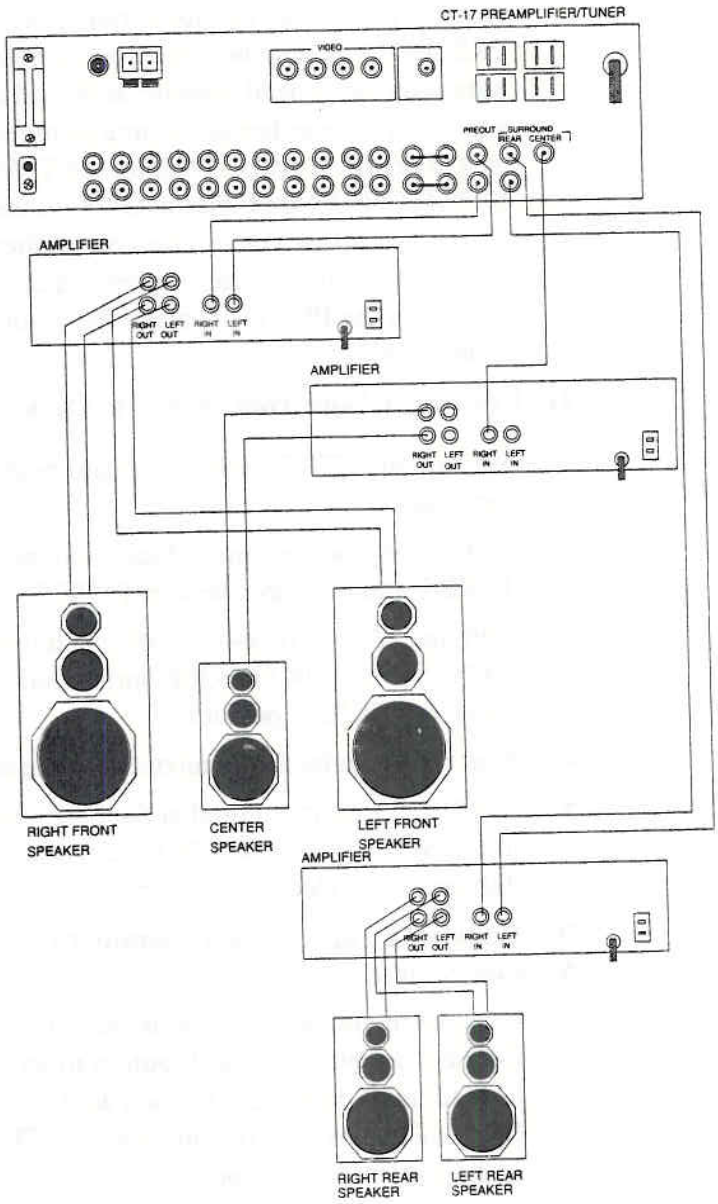


Figure 9 5-Speaker Pro Logic Hook-up

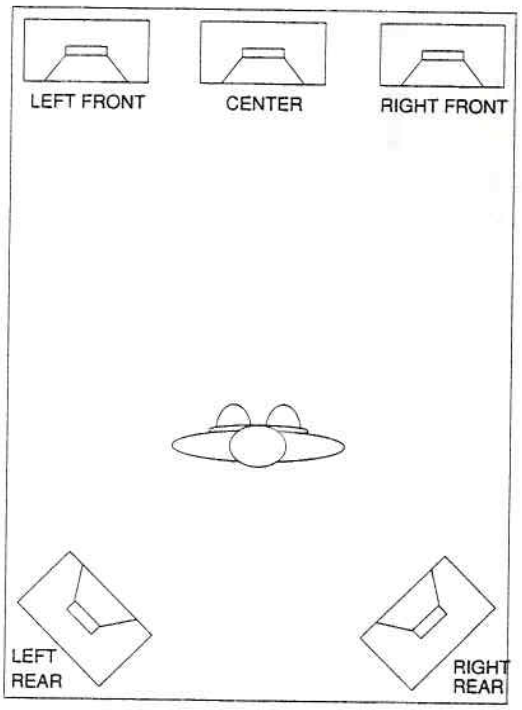


Figure 10 Speaker Placement for 5-Speaker Hook-up

patterns. See Figure 12. In a theater, Dolby Stereo is achieved with multiple rear channel speakers. To achieve the same effect with just two rear speakers requires a design which can disperse its sound across the listening area.

Center Channel. The Dolby Pro Logic center channel is mainly midrange and high frequencies. The considerations for choosing a center speaker boil down to 1) *video shielding*, and 2) *what you can buy just one of.* Video shielding is obviously important. A loudspeaker contains magnets whose force extends past the enclosure. These flux lines can severely distort a TV picture and actually damage the set. Since the center channel must be placed just under or above the TV, make sure to use a design which is specifically video shielded.

Amplifiers for Surround Sound

Front Channels. Select an amplifier which can deliver as much power as the Left Front and Right Front speakers can handle. This is especially critical when using laser disc video sources with digitally encoded soundtracks or CDV's. We recommend a Carver TFM 22, TFM-25 (225 watts RMS/ch. each) or TFM-45, TFM-42 (375 watts RMS/ch. respectively).

Rear Surround Channels. No more than 60 watts per channel is necessary. Many experts recommend as little as 10 or 15 watts. Because many small bookshelf speakers are relatively inefficient, we recommend basing your rear channel amp choice on the speakers' minimum and maximum power specifications. Try to select an amp which falls toward the high end of the speaker's power specs, i.e., a 60 watt/ch. amp for a speaker with a 25 watt minimum and an 80 watt maximum.

Center Channel. This will again depend on the speaker, and an amplifier should be chosen that will provide enough power to match the speaker's power specs. Since the center speaker is mostly dialog, there need not be concern about providing extra power for low frequency reproduction. You might consider using a Carver 4-channel AV-Sixty Four. Two channels can be used in mono to provide 120 watts for the front center channel and 60 watts each for the rear surround channels.

Speaker wire

The speaker wire from the rear channel amp to the rear surround speakers can be as thin as 18-gauge. However, the cable from the center channel amp to the center speaker should be as thick as the wire you use for your main speakers.

Three "Compromise" Approaches

4 Channels/Single Rear Channel Speaker. If you simply cannot afford five individual amplifier channels, it IS possible to get away with four. This means just two stereo power amplifiers (or our AV-Sixty Four if 60 watts is sufficient for each front channel). The key is the fact that Dolby Surround rear channels are mono. This means that you can use a single power amp channel and connect two 8-ohm impedance rear channel speakers in parallel to its outputs. This will work with HALL and SIMULATED stereo,

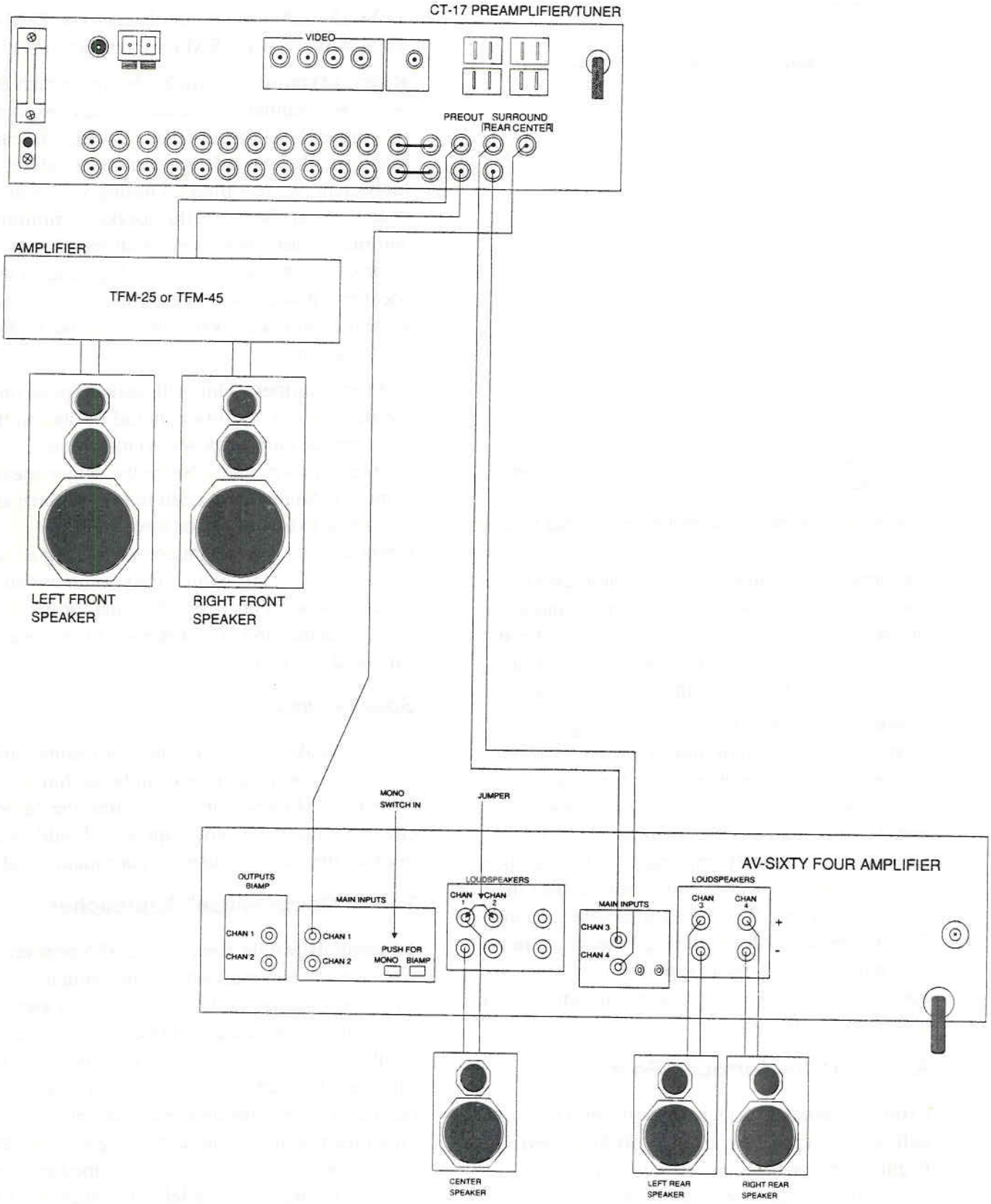


Figure 11 Pro Logic Set-up with AV-Sixty Four Amplifier Driving Center Channel and Left and Right Rear Channels

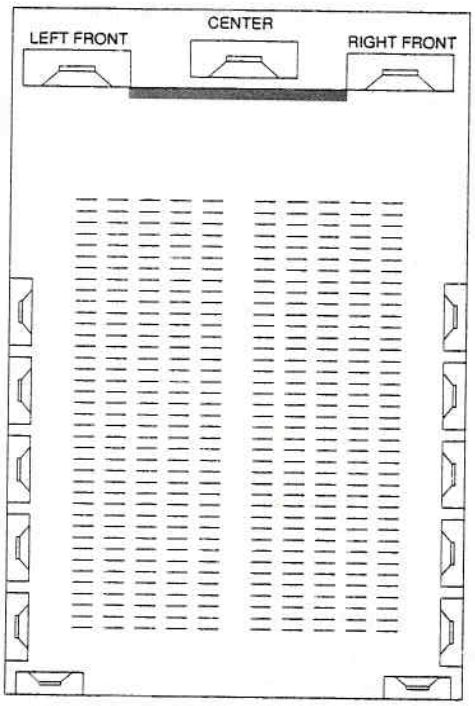


Figure 12A Rear Speakers in Dolby Stereo Surround

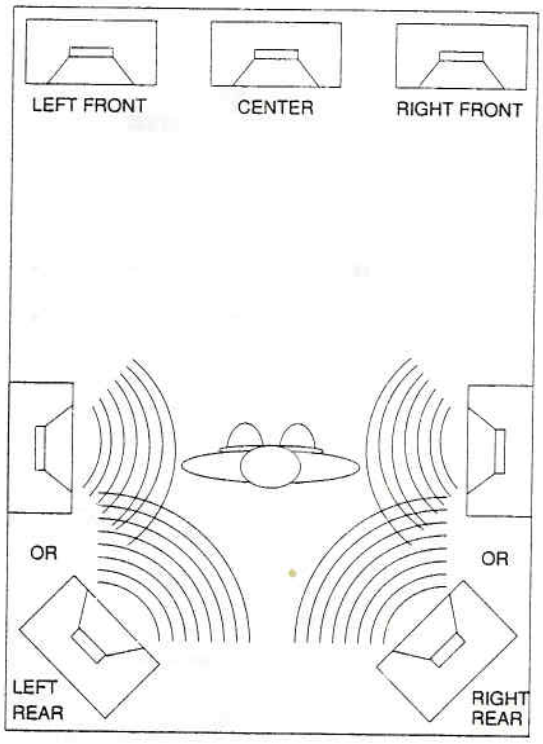


Figure 12B Dispersion Patterns of Rear Speakers

since the rear channels are also mono in these modes (Fig. 13.)

4 or 5 Channels/Single Rear Speaker. One problem is that speakers are often sold in pairs. If you need to economize further, you can use just one rear channel speaker, since Dolby Surround information is monophonic. However, the "compromise" is that you will lose some of the "surround" effect because the distribution of sound from the single rear speaker will be diminished.

4 Channels/No Center Speaker. The most obvious benefit of the Dolby Pro Logic Surround system over passive Dolby Surround is the addition of an active center channel output. However, allowances have been made for use of the Dolby Pro Logic Surround decoder without a center speaker. Simply select PHANTOM mode with the CENTER MODE button on the CT-17 remote control.

To avoid excessive "spread" of dialog, the left and right front speakers may be moved closer together. Feel free to experiment.

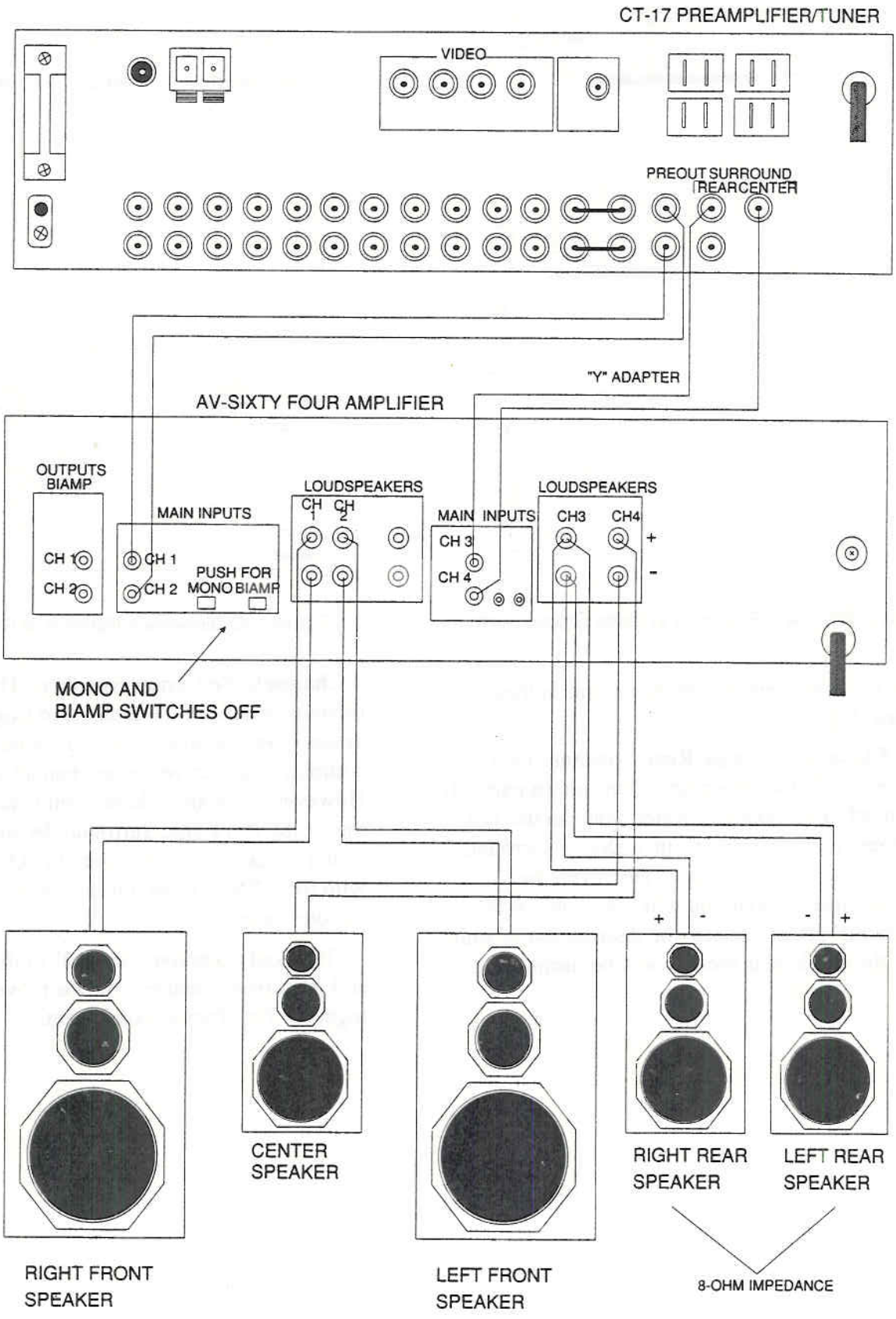


Figure 13 4 Channels/Mono Rear Channel Set-up

12. Dolby Pro Logic Surround and Surround Sound Operation

First, let's review the controls which are critical to all CT-17 Surround Modes.

SURROUND MODE (Front panel only). Selects:

1) **Dolby PRO LOGIC Surround Sound** — for use with videotapes or laser discs encoded with Dolby Surround. *Also affects non-encoded tapes or audio music selections;*

2) **HALL** — a spatial simulation which provides an airy, 3-dimensional effect to mono or stereo sources. *May be used on sources not encoded with Dolby Surround such as CD's, FM, records or tapes;*

3) **SIMULATE** — Simulated stereo for monophonic sources such as regular television broadcasts. May also be used on monophonic records and videotapes with mono sound tracks. Because this effect utilizes sophisticated inter-channel phasing, at least four speakers (two front, two back) are required.

The three different effects are selected by "cycling" through a set of four options. Each push of the button advances you to the next surround mode:

Not pushed	SURROUND MODES OFF
Pushed once	PRO LOGIC ON
Pushed again	HALL EFFECT ON
Pushed again	SIMULATED STEREO ON
Pushed again	SURROUND MODES OFF

Another way to think of it is: PUSH ONCE for Dolby Pro Logic, PUSH TWICE for Hall, PUSH THREE TIMES for simulated stereo. In each case, an LED will light in the display panel of the CT-17 to display the appropriate mode.

CALIBRATE (Front panel only). This button activates a special test signal which alternates between the five Pro Logic speakers (actually it "stops" for 2 seconds each at four different places: Front Right, Center, Front Left and Rear Surround since this is a mono source). The tone is "pink noise" which has been specially equalized so that it psychoacoustically appears to be the same tone whether it's coming from the front or smaller rear speakers. Before critical listening with Dolby Surround-encoded video sources, you MUST calibrate the system to balance all four speaker channels (Left, Right, Surround, and Center) in relation to each other. After that, you should only need to use the MASTER volume control. If you change speakers, rearrange your listening room, move or inadvertently push the wrong volume buttons, you'll need to re-calibrate the system. For best tracking of the MASTER volume control, make sure the loudness switch is OFF.

CENTER MODE (Remote only). This switch "cycles" through four different modes: OFF, NORMAL, WIDE and PHANTOM. Each mode is displayed with an LED on the CT-17 front panel.

When in the OFF position, no sound will come from the center channel.

When using Dolby Pro Logic Surround, NORMAL should be selected. WIDE expands the sound slightly, and PHANTOM should always be used if you have not employed a center channel speaker.

Center mode is not operational in HALL or SIMULATED modes.

DIMENSION (Remote only). Dolby Pro Logic Surround circuitry uses a delay on the embedded Dolby Surround information. The delay circuit can be switched from 20 to 30 milliseconds of delay time.

In *DOLBY PRO LOGIC* mode, it will have some effect on the dimensionality and spaciousness of the surround sensation. There is no right or wrong setting. Simply experiment with both the 20- and 30-millisecond modes

while listening to the same passage on a videotape or laser disc encoded with Dolby Surround.

NOTE: DIMENSION can be selected in Dolby Pro Logic mode only.

DIMENSION has minimal effect when in *SIMULATED stereo or HALL mode.*

SURROUND/CENTER volume controls (Remote only). These adjustments aren't intended to be used on a regular basis. They were placed on the remote because you need to sit in your normal listening position to adjust relative levels during the Dolby Pro Logic Surround calibration process. Once this calibration has taken place, you can make overall volume adjustments with the MASTER volume at the top of the remote.

A Few Words About Dolby Surround Video Sources

Not all movies are Dolby Surround-encoded, even if they're VHS Hi-Fi-encoded stereo or digital laser disc audio. Look for the Dolby Surround logo on the box. Most major "blockbuster" movies have Dolby Surround soundtracks, however. Dolby Surround begins as theatrical Dolby Stereo. Creating such a multi-channel soundtrack is far more expensive and time-consuming than a conventional mono soundtrack. There are some surprising selections out there with fantastic Dolby Surround effects.

In fact, MTS stereo TV broadcasts of movies with Dolby Stereo broadcasts contain a surprising amount of surround sound information. If you have a stereo TV which receives MTS, try decoding a movie broadcast with the CT-17. You may be surprised. This won't work on many programs which are merely synthesized stereo. Trying to "decode" Dolby Surround on them merely results in strange noise and crosstalk. Opt for Simulated Stereo or just use the front channels. But on "The Major Movie of the Week" which WAS Dolby Stereo in the theaters, it can work fairly well.

An increasing number of major network television programs are now encoded using Dolby Surround as well. This will be revealed in the opening or closing credits of the show. There are even a few CDs which are now Dolby Surround-encoded.

Operation

A. Calibration. Before critical listening with Dolby Surround-encoded movie tapes, you MUST calibrate the system to balance all four speaker channels (Left, Right, Surround, and Center) in relation to each other.

1. Turn on the CT-17.
2.. Turn on the amplifiers driving the Left, Right, Rear, and Center speaker channels.
3. Set the CT-17 BALANCE control to its center (12 o'clock) position.
4. Make sure that HI CUT, LOUDNESS and HOLOGRAM buttons are in their OUT position and that tone controls are set to their center (12 o'clock position).
5. Cycle the SURROUND MODE button on the CT-17 front panel until the DOLBY PRO LOGIC LED lights in the display.
6. Cycle the CENTER MODE button on the CT-17 remote control until NORMAL lights on the LED display. (NOTE: If you are not using a center channel speaker, set CENTER MODE to PHANTOM.)
7. Press CALIBRATE on the CT-17 front panel.
8. Seat yourself in the main viewing position on a centerline with the TV set.
9. Increase the MASTER volume until you hear a roaring noise. This is a 2-second "pink noise" tone which will alternate from the Right Main speaker to the Center Channel to the Left Main Speaker to the Surround Speakers. It will "go around" as long as the CALIBRATE button remains pushed.
10. Turn up the MASTER, SURROUND and CENTER volume controls until you hear sound from all five speakers. If you're not

hearing sound in the REAR or FRONT speakers, check your connections carefully. If no sound is coming from the CENTER channel, double check that CENTER MODE is set on NORMAL.

11. Now adjust the SURROUND and CENTER volume controls until the sound level is the same from all five speakers. The pink noise test signal needs to be relatively loud for proper evaluation, so if you're having trouble judging when the sound is equal from each speaker, turn up the MASTER volume a bit. To adjust the relative levels of Left FRONT and Right FRONT speakers, use the BALANCE control on the CT-17 front panel.
12. Return the CALIBRATE button to its OFF position.
13. Make all subsequent volume adjustments with the MASTER volume control only, either from the CT-17 front panel or the remote control.

B. Basic Dolby Pro Logic Surround Operation (video only)

1. Turn on the CT-17.
2. Turn on the amplifiers driving the Front, Rear and Center speaker channels.
3. Cycle the SURROUND MODE button on the CT-17 front panel until the DOLBY PRO LOGIC LED lights in the display.
4. Cycle the CENTER MODE button on the CT-17 remote control until NORMAL lights on the LED display. (NOTE: If you are not using a center channel speaker, set CENTER MODE to PHANTOM.)
5. Set the INPUT SELECT mode to either VIDEO 1 or VIDEO 2 to select your VCR, laser disc, CDV or other Dolby Surround encoded program material.
6. Begin playback of the Dolby Surround encoded tape or disc.
7. Advance the MASTER volume control to the desired listening level.

C. Other Surround Modes (video or audio)

1. Turn on the CT-17.
2. Turn on the amplifiers driving the Front, Rear and Center speaker channels.
3. Cycle the SURROUND MODE button on the CT-17 front panel until the HALL or SIMULATE LED lights in the display.
4. Set the INPUT SELECT mode to any of the input options.
5. Begin playback of the record, CD, tape, FM, AM or video source.
6. Advance the MASTER volume control to the desired listening level.

Special Note

SURROUND SOUND OPERATION WHEN IN CD DIRECT MODE:

For correct operation of Dolby Pro Logic Surround, Hall, or Simulate modes, when CD DIRECT mode is selected, both the CD and CD DIRECT buttons should be pushed.

If a different source is selected on the MAIN INPUT SELECT bank, you will hear it in the rear speakers.

13. How Dolby Pro Logic Surround Works

By the latter '70's, Dolby Stereo was established as a stereophonic system having three to six channels to enhance the action and drama of theatrical presentations. The most obvious feature of Dolby Stereo is an additional channel of sound that is distributed along the sides and back of the theater to "surround" the audience with sound.

In Dolby Stereo (surround) coding, the center channel is combined in equal portions on both left and right channels. Surround channels are encoded onto the left and right channels by phase shifting both channels plus and minus 90 degrees and then adding this information to the respective front channels. It provides the correct orientation for theater playback by use of complex analog *logic steering* circuits.

Dolby Laboratories then devised a simple method to emulate the overall effect of Dolby Stereo in a home environment by recovering the surround sound effects. Known as Dolby Surround, it is a greatly simplified circuit without logic steering and with no separate center channel. Instead a "phantom" channel must be created from the Left Front and Right Front speakers.

Dolby Pro Logic Surround features improved spatial articulation and expansive listening area through use of a true center channel and *active logic steering* circuitry. The center channel is removed from the left and right channels for accurate positioning and separation and fed through a discrete speaker. To decode the surround channels, the differences between the front channels are extracted, delayed, sent through a low-pass filter and then processed by modified Dolby B-type noise reduction. An adaptive matrix is used to actively derive the left, center, right and surround signals contained in the sound track. The matrix is actually a complex analog computer which breaks down the encoded signals and reassembles them into four different channels.

As Dolby Laboratories puts it, "key points are increased channel separation, active center channel which serves to anchor dialog on-screen for a variety of seating positions, built-in noise sequencer for easy system calibration and (in the case of the CT-17) an automatic balance control which continually optimizes the decoder operation by balancing the right and left inputs".

NOTE: Manufactured under license from Dolby Laboratories Licensing Corporation. Additionally licensed under one or more of the following patents: U.S. numbers 3,632,886, 3,746,792 and 3,959,590; Canadian numbers 1,004,603 and 1,037,877. "Dolby" and the double-D symbol are trademarks of Dolby Laboratories Licensing Corporation.

14. Set-Up for Sonic Holography®

After installing and connecting the CT-17 to the rest of your stereo system, you'll probably be tempted to begin playing music and experimenting with Sonic Holography®. 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 following section and follow the instructions and recommendations exactly.

Initial Loudspeaker/Chair Placement

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 1) accurate relationships between the loudspeakers and listening chair, and 2) dealing with reflected sound off surfaces in the listening room.

The real key to this process are the 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 stunningly live imaging Sonic Holography® brings to your favorite music.

Basic Set-Up Steps

To perform the set-up, you'll need a tape measure and listening chair. Refer to Figure 14 and follow this 5-step procedure:

1. Make sure the loudspeakers are away from side and rear walls as indicated in Figure 14.
2. Move the loudspeakers so they are exactly six feet apart and on direct axis with the listening chair with direct sound from both panels.

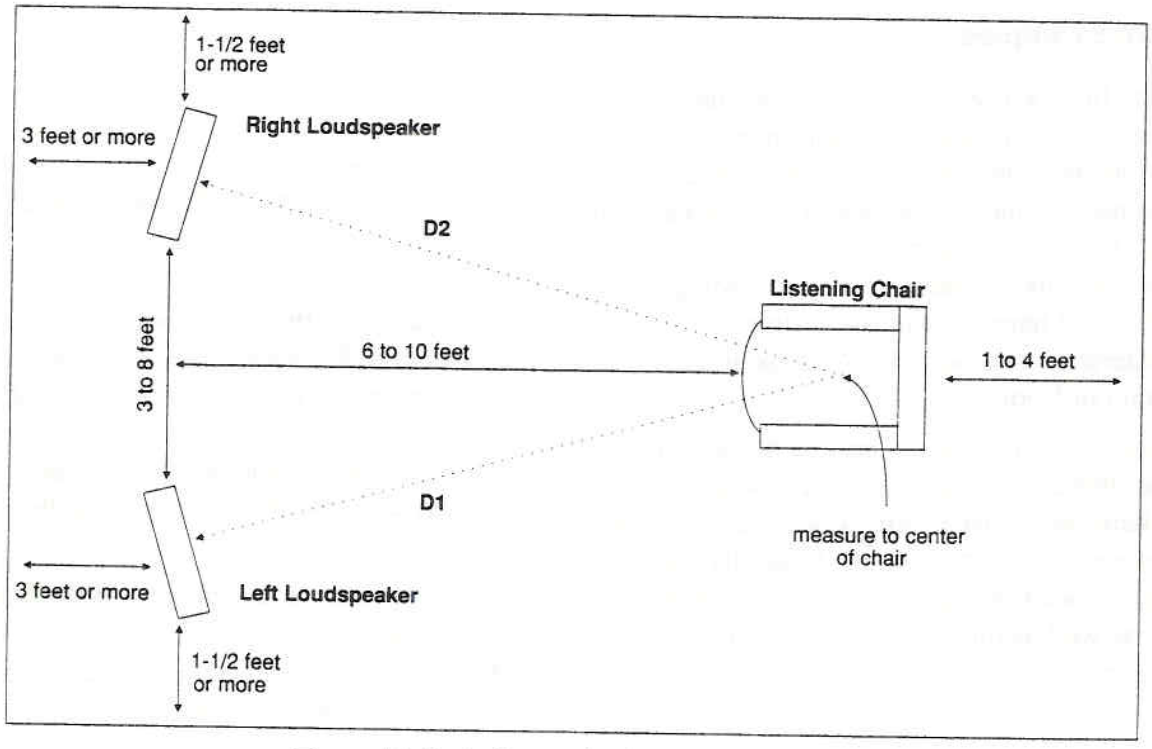


Figure 14 Basic Set-up for Sonic Holography®

3. Adjust the toe-in of the speakers so that the outer edge is ONE INCH closer to you than the inner edge.
4. Place your listening chair so that it is not directly against the rear wall of the listening room.
5. Carefully measure the distance from the CENTER of the left speaker's top woofer to the CENTER of the listening chair. Repeat the measurement for the right speaker. Adjust the chair so that both distances (D1 and D2 in Figure 14) are exactly the same. Accuracy within 1/4 INCH is desired.

The goal of these steps 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 followed the above instructions, a seated listener in the chair should have a ready-made window for initial experiments with the Sonic Holography® Sound Processing System. You'll undoubtedly have to make some minor adjustments but this should get things going.

Room Examples

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 of Room A:

Here the loudspeakers project the wide throw of the room, yielding a large stage width. Room B, where the loudspeakers project the long span of the room, has large depth. Naturally the choice of positioning depends on your personal taste, as well as furnishings and overall room arrangement.

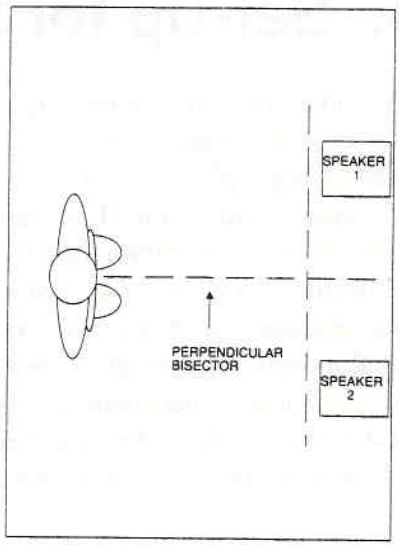


Figure 15A Sample Room A

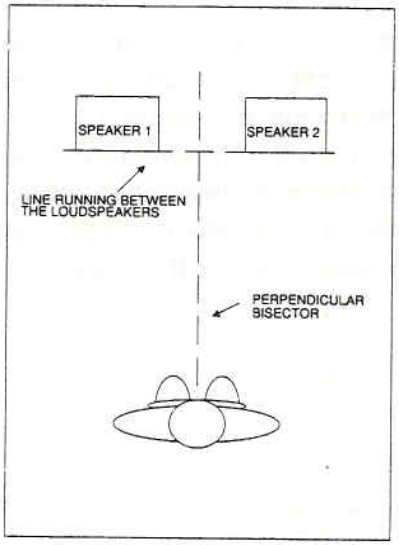


Figure 15B Sample Room B

Sample Rooms C, D, E and F show configurations that won't work well with Sonic Holography®, though these same set-ups are often quite acceptable for conventional stereo playback. 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 H uses a "trick" to get the loudspeakers almost against the wall behind them. This consists of a sound-deadening panel

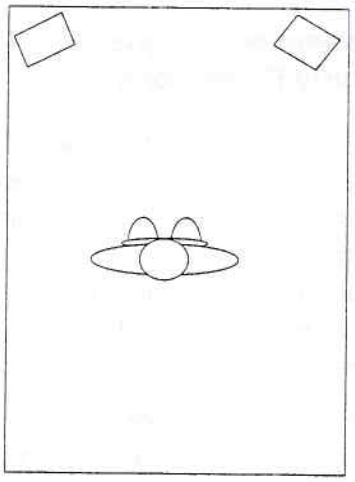


Figure 15C Sample Room C

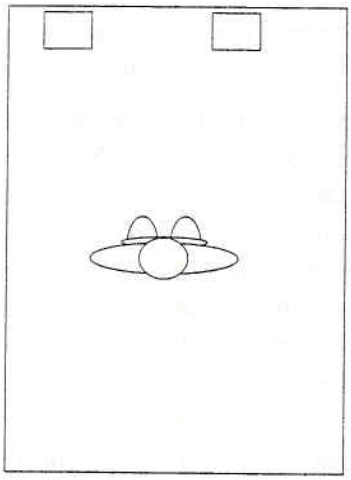


Figure 15D Sample Room D

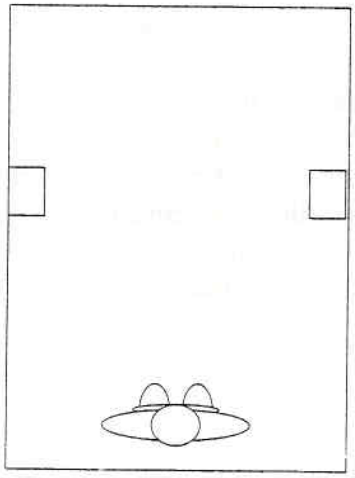


Figure 15E Sample Room E

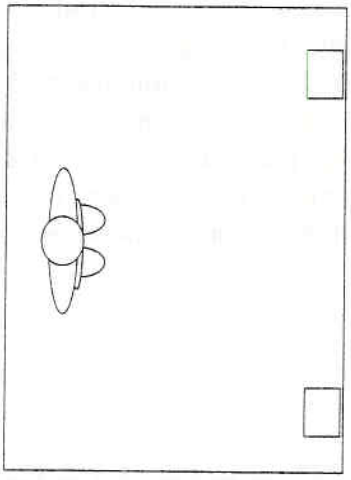


Figure 15F Sample Room F

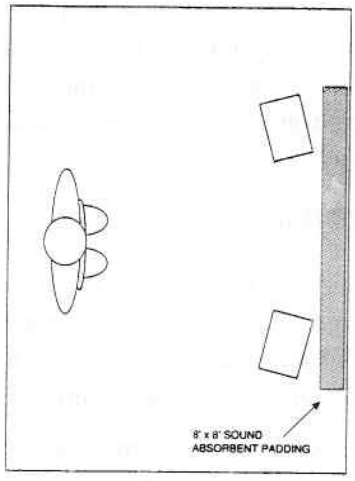


Figure 15G Sample Room G

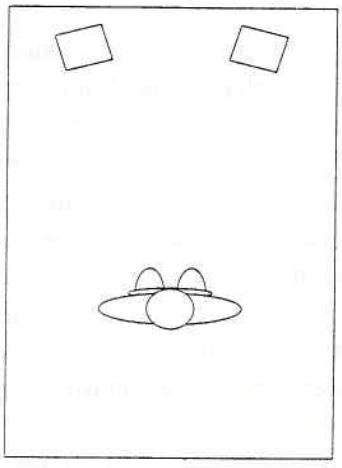


Figure 15H Sample Room H

placed behind the loudspeakers, right against the wall. We'll come back to Room H in a moment.

Refer again to the diagram of Room B which 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 about one to four feet behind them. 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.

Loudspeaker Designs and Early Reflections

The Sonic Holography® Sound Processing System 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. However, 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.

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15. Sonic Holography® Operation

A Properly Functioning Image in Sonic Holography®

Before listening to some musical selections in Sonic Holography®, you should know what you will be listening for. With correctly positioned loudspeakers and listening chair, the Sonic Hologram Generator system should cause musical instruments and other sound sources to spread out in a large 45° to 95° arc in front of you. 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 may even seem to clearly emerge from outside the walls of the listening room.

A "Test Flight"

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.

First, take a couple of minutes to "preflight check" 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 "+" speaker terminals on the amplifier or receiver 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, we recommend that you switch it out of the CT-17's signal path. 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. If you are using a record for a sound source, inspect the phono stylus and cartridge for proper phasing, wear, and tracking. 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 CT-17's BALANCE control to "center." Set the 3 tone controls to their center (12 o'clock) position.
6. Press the CT-17's HOLOGRAM button.
7. Play a stereo recording with only a few instruments and the human voice for first-time attempts at Sonic Holography.®

You should now hear Sonic Holography® in action.

Fine Tuning

Carefully adjusting the following speaker parameters will result in the best possible holographic image:

1. Tilt-back angle and toe-in angles.
2. Distance of speakers and listening chairs from back wall.
3. Room reflections.

Tilt-back and toe-in angles. If you are in a seated position, decreasing the tilt-back angle of most typical speakers will result in more high frequency and less midrange energy at your listening position. It will also lower the soundstage closer to the ground. If you are in a standing position, these effects are reversed. Decreasing the tilt will result in less high frequency energy and will bring the midrange slightly forward.

It is possible to find a tilt-back angle that will allow the tonal balance to remain unchanged from sitting to standing. This specific angle may or may not result in the preferred tonal balance. We recommend that you determine your favorite tilt-back angle while seated. But remember, changing the tilt angle will also change the height of the sonic image. The less tilt, the lower the placement of the image. Increasing the tilt angle will, however, often enhance the dimensionality of the soundstage.

Toe-in (the lateral angle of the speakers) also affects Sonic Holography.® When experimenting with speaker angle, make sure that the speakers are equally toed in. This can be done by measuring the distance from the inner and outer corners to the back wall of the listening room.

Distance from back wall. 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).

Room reflections. For the best possible sonic hologram generation, the area around and behind your speakers should be relatively dead. If the back and side walls are too reflective, they may generate additional sound reflections which can interfere with 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." Thus random sound reflections reach a listener long after the direct sound, establishing a uniform sound field. The reflections most in need of correction in your listening room 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, standing 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. 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 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.

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 while smeared or fuzzy on the untreated side.

The wall directly behind the loudspeakers should also be as non-reflective 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. 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.

Sound reflecting off a bare wood or tile floor can also reduce the Sonic Hologram effect 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 your new Carver CT-17, 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 somewhat in front of the loudspeakers can also break up floor reflections.

16. How Sonic Holography® Works

Sonic Holography® is a complex method of processing stereo signals which corrects 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. Consider Figure 16a.

It shows what occurs during a live musical event. Each ear receives one sound arrival. The timing of these arrivals is processed by your brain and converted to information about where the music is coming from.

Figure 16b represents conventional stereo. The recorded sound of the band is reproduced by both left and right loudspeakers. If your left ear ONLY got a sound arrival from the left speaker and your right ear ONLY got a sound arrival from the right speaker we wouldn't need Sonic Holography®. Unfortunately, each ear hears BOTH speakers. This results in each ear getting an extra, confusing sound arrival of information which contradicts the original position of the band. The best your brain can do is "construct" a fuzzy "stereo" image. This problem of FOUR total arrivals is, incidentally, why stereo is so much more pronounced when you listen to isolated stereo headphones.

To review what we've covered so far, in real life a sonic event (such as the band in our illustration) can never create more than TWO sonic arrivals: One at the left ear and one at the right ear. Stereo playback through speakers causes FOUR arrivals. Those extra, second-sound arrivals confuse our ear/brain system, masking clues as to the exact positioning of the sound sources.

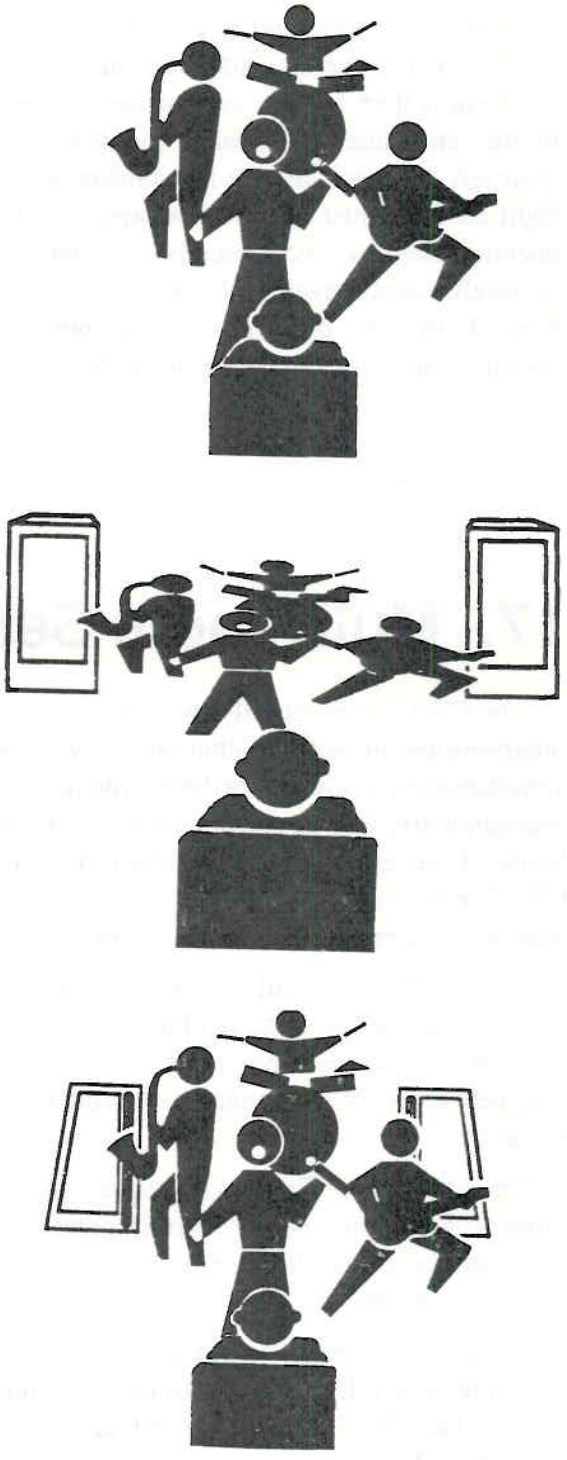

Figure 16, from top to bottom, a) Live musical events with timing and phase cues, b) Conventional stereo timing cues lost due to multiple arrivals, c) Sonic Holography® restores realism completely with timing, phase, and amplitude cues.

The CT-17's Sonic Hologram Generator eliminates the extra sonic arrivals that occur in conventional stereo playback.

This is accomplished by canceling out the unwanted second-sound arrivals from each loudspeaker to the opposite-side ear (Figure 16c). Each ear is then free to concentrate its attention on the same-side loudspeaker. In other words, your left ear hears just the left loudspeaker; your right ear hears just the right loudspeaker. This is accomplished by electronically-generated crosstalk signals from each stereo channel and feeds them to the opposite-side channel. The signals your CT-17 generate 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 cross talk signals arriving from the opposite loudspeaker.

Of course, this is a very simplified explanation of how the Sonic Holography® Sound Processing System works. In addition to the electronic crosstalk-signals, the CT-17 uses delay timing and filtering circuits for creating the same types of filtering and delay caused by our heads.

17. Multi-room Set-up and Operation

The CT-17 is essentially two audio preamplifiers in one. In other words, you can simultaneously play two different music sources independently into two different areas of your home. Both can be controlled from the same CT-17 remote or via Carver's RemoteSystemLink™ room-to-room system.

Figure 17A, 17B and 17C show three different ways to use the CT-17 to send music to different parts of your home. They represent three different levels of convenience, complexity and expense.

The hook-up in Figure 17A requires nothing more than a second power amplifier and wire to run from the amp to built-in or external speakers in another room.

Figure 17B is essentially the same system but with a remote Infrared Pick-Up plugged into the back of the CT-17. This pick-up relays signals from the CT-17's remote control to the CT-17, allowing you to use the same remote in another room. IR (InfraRed) Pick-Ups are available from many sources and any which use a 3-conductor jack system are compatible with the CT-17.

Figure 17C represents a true, built-in, multi-zone room-to-room system such as Carver's RemoteSystemLink™. This type of system uses a special system interface box which then sends line level signals to individual power amplifiers in different rooms. You can use the CT-17's remote or Carver's PRH-1 Universal Remote Control. Such a system gives you access to all the remote control operations of any component which uses an infrared remote, including CD players, cassette decks, etc.

The key to the CT-17's multi-room capabilities is its second set of input selectors, the RECORD/REMOTE SELECT bank of buttons. Because this set of controls is also used for recording purposes, your second remote room system will receive that music source during the recording process. Also, the signal present at the REMOTE OUT sockets on the back of the CT-17 is not affected by the preamplifier's tone controls,

high cut filter, loudness, Sonic Hologram Generator or Surround Sound circuitry.

Considerations

- Although remodeling or new home construction are obviously the best times to add a remote system, you can take advantage of the CT-17's double output system even if you rent a house or live in an apartment. Once you get used to having background music or a ball game or other different sound sources in your bedroom, den, workshop, patio, spa area, etc., you'll wonder how you ever did without it. If you have kids whose musical tastes are different than your own, you'll REALLY appreciate it. At maximum, a secondary system like this requires running just three wires along your baseboards.

- In systems such as those shown in Figures 17A & B, the only real limitation is speaker wire run length. The audio signal will be degraded if you use cable which is too thin (always a temptation in order to make it more unobtrusive).

For runs up to 50 feet, use 14-gauge or under for 100-400 watt amplifiers and 16 or 18-gauge for lower powered amps.

For runs over 50 feet up to as much as 150-feet, use no thinner than 8-gauge wire or a special speaker wire such as SuperFlex by Monster Cable.

Never use smaller than 18-gauge under any circumstances.

Always use multi-stranded wire.

- Determine the impedance of the speakers you're using in your secondary system. If they are 8 ohms, you'll probably be able to use TWO sets of speakers, increasing the range and capability of the system. Just make sure not to use two sets of 4-ohm speakers unless your secondary system power amplifier is specifically rated for continuous 2-ohm operation.

- Avoid the temptation to put the secondary system power amplifier in another room to cut the speaker cable wire run. Line level RCA-type patch cords severely cut high frequencies and may pick up interference if they are longer than 20 feet.

Playing both main and secondary systems at the same time.

1. Make sure that the CT-17, remote and main system power amplifiers and music sources are turned on.
2. Press the appropriate INPUT SELECT button either on the front panel or with the remote control.
3. Make sure that the volume control is turned down.
4. Activate the sound source.
5. Advance the CT-17's volume control or press the "+" MASTER VOLUME button on the CT-17's remote control.
6. Make sure that the REMOTE VOLUME control is turned down, either on the front panel or remote control.
7. With ENGAGE OFF, select a secondary sound source from the RECORD/REMOTE INPUT bank of buttons on the CT-17 front panel.

   OR

8. On the CT-17 remote, press REMOTE and then select an input source WITHIN FIVE SECONDS.
9. Advance the REMOTE VOLUME CONTROL, either on the CT-17 front panel or remote control.
10. Repeat Step 7/8 to change music sources.

Playing only the secondary system.

1. Make sure that the CT-17, remote system power amplifier and desired music source are turned on.
2. Make sure ENGAGE on the main front panel is not ON.

3. Make sure that the REMOTE VOLUME control is truned down, either on the front panel or remote control.
4. Select a secondary sound source from the RECORD/REMOTE INPUT bank of buttons on the CT-17 front panel.

   OR

5. On the CT-17 remote, press REMOTE and then select an input source.
6. Advance the REMOTE VOLUME CONTROL, either on the CT-17 front panel or remote control.
7. Repeat Step 4/5 to change music sources.

About RemoteSystemLink™. Carver's multi-room sound system is called RemoteSystemLink™. It allows you to have music in 5, 10, 15 or more rooms with full control over your EXISTING REMOTE-CONTROLLED COMPONENTS from any of those rooms. Instead of using special components which are hard to upgrade and may not have the features you want, it consists of a special RSI-1 Remote System Interface box which connects to the CT-17, an in-wall remote transmitter, plus infrared "eyes" and built-in power amplifiers in each room. You can take the CT-17's remote control with you or use a Carver PRH-1 Universal Remote.

Each in-room 30+30-watt power amplifier also has an external input, so that CD players, portables, TV's, VCR's, etc., can be plugged directly in for independent listening. Thus you can actually have THREE different sound sources going in different parts of the house.

For more information on RemoteSystemLink™ and how it beautifully compliments your new CT-17, call 1-800-443-CAVR Monday through Friday, 8AM to 4PM PST.

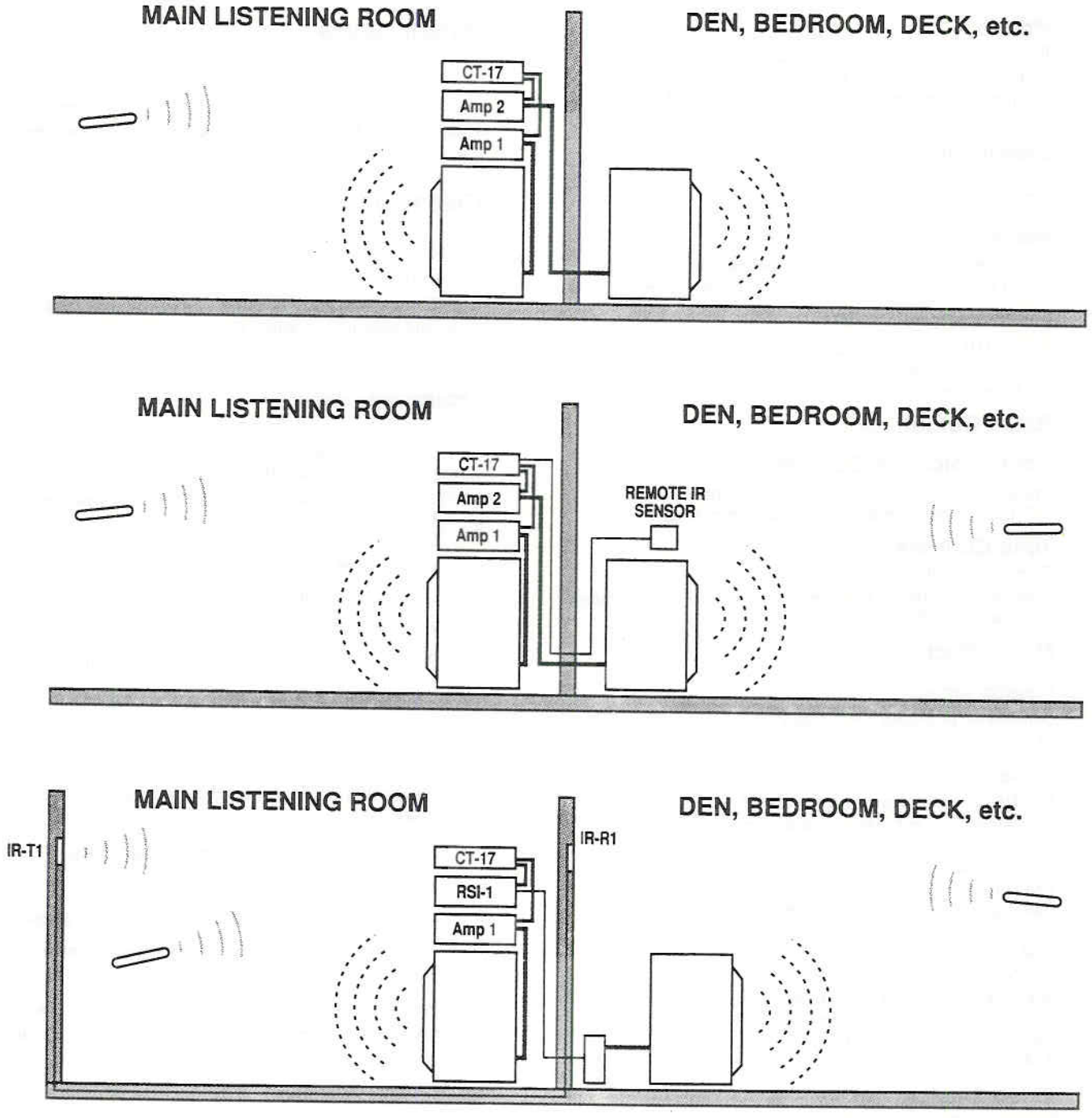

Figure 17 A (top) Basic Multi-room Installation; B(middle) Multi-room Installation with Infrared Pick-up; C(bottom) Multi-room Installation with RemoteSystemLink™.

18. Technical Information and Service Assistance

Specifications

Phono:
RIAA + 1.0dB "extended" RIAA curve
Overload, 150mV at 1kHz
Frequency Response: 20Hz - 20kHz ±0.5dB
(High Cut Filter, Tone, Hologram OUT)

Sensitivity:
Phono, 2.7mV
CD/Tape/AUX, 180mV

Noise:
Phono, 84dB, IHF A-weighted, below 5Vrms at 1kHz
Line Level, 98dB, IHF A-weighted, below 2Vrms

Distortion:
THD, 0.01% or less, below 3Vrms
IM (CCIR or SMPTE), 0.05% or less
TIM, unmeasurable

Rated Output: 6V

Sonic Hologram Generator:
Image Resolution, 5 horizontal, 20 vertical
S/N ratio at rated reference, greater than 85dB

Tone Controls:
Turnover, 100Hz, 1kHz, 10kHz
Boost/Cut, ±8dB for bass and treble, ±6dB for midrange
Loudness, +3dB at 100Hz

Mute Effect: -20dB

Headphone:
Sensitivity at preout 1V, 125mV
Maximum output at preout 1V, 400dB

Tuner Section:
FM IHF Usable Sensitivity, 14.3dBf
FM Sensitivity for 50dB quieting (mono), 18.3dBf
FM S/N, 78dB
FM IF Rejection, 82dB
FM Capture Ratio, 3.0dB
FM Harmonic Distortion, 0.10%
FM Alternate Channel Selectivity, 72dB
AM Suppression, 62dB
FM Stereo Separation, 46dB
AM THD (2mV) 30% modulation, 1.2%
AM Selectivity at S/N/20 ±10kHz, 38dB
AM Image Reject, 46dB
AM IF Rejection, 65dB

Video Section:
Frequency Response, 10Hz-5mHz ±1.5dB
Input Impedance, 75 ohms
Video Input and Output, 1.0Vp-p

Size: 19" x 3-1/2" x 12.25"

Weight: 12 lbs (5.4kg)

Patent Notice

The circuitry and application of the CARVER Sonic Holography® Sound Processing System are protected by United States Patent 4,218,585 and corresponding foreign patents.

Cleaning

You'll want to wipe off the CT-17'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.

Troubleshooting

If you're having trouble or suspect a problem, try some simple trouble shooting first. More likely than not, the problem lies elsewhere in the system — not with the CT-17.

No sound

1. CT-17 power off.
2. Line cord disconnected.
3. Poor fit between plug and wall receptacle.
4. Power off at wall receptacle (check with tester or lamp).

No sound (power OK and on)

1. CT-17 INPUT SELECT set to inactive output.
2. TAPE MONITOR button pushed in with no tape running.
3. External processor hooked to rear panel jacks is not turned on.
4. MUTE button on CT-17 remote is activated.
5. Selected input not functioning.
6. Input level controls turned down on power amplifier.
7. Speaker cables connected to wrong set of power amplifier speaker outputs.
8. Program source misadjusted. For example, tuner is between stations, tape is on a blank segment, CD player is on pause.

No sound in one channel

1. Defective cable from CT-17 to power amplifier or music source to CT-17.
2. Speaker wire loose or disconnected.

3. CT-17 BALANCE control fully clockwise or counterclockwise.
4. Imperfect contact in lever or slide switch in program source electronics or signal processor.
5. Speaker fuse blown.
6. Power amplifier malfunctioning.

No sound when AM or FM is selected.

1. No AM loop antenna has been connected.
2. No FM dipole or external antenna has been connected.

No picture from TV monitor.

1. Correct VIDEO input has not been selected.
2. Video component is not turned on.
3. Video component has been connected incorrectly (i.e., VCR OUTPUT to CT-17 VIDEO 2 OUTPUT, etc.)
4. Faulty cable between CT-17 MONITOR output and television.

No sound from rear speakers.

1. Rear power amplifier is not turned on.
2. SURROUND volume control on CT-17 remote is turned down.
3. One of the three SURROUND modes (Pro Logic, Hall or Simulate) has not been selected with the SURROUND MODE button.

Video sound is thin when using just Surround and Main Front Speakers.

1. CENTER MODE is incorrectly set to NORMAL or WIDE. It must be set to PHANTOM if a center channel speaker is not being used.

No sound from center channel.

1. Center channel power amplifier is not turned on.
2. PRO LOGIC has not been selected with SURROUND MODE button.
3. CENTER MODE is set to OFF or PHANTOM.
4. Center channel VOLUME is turned down.

AUTO SCAN will not stop at any stations.

1. No FM antenna connected or it is too small to pick up any signals.

Loud howl, squeal or whistle while taping.

1. TAPE MONITOR is engaged while microphones are connected to tape deck for recording.

Sonic Hologram doesn't seem to do anything.

1. Follow directions closely in Sections 14, 15, and 16 of this manual.

Dolby Pro Logic Surround has no apparent effect.

1. Dolby Pro Logic Surround has not been selected from front panel SURROUND MODE button.
2. The videotape is not Dolby Surround-encoded or may be mono. Look for the Dolby Surround logo on the jacket. Sometimes the tape label itself is not marked, so if you are renting and the store puts the tape in another box, be sure to determine this before you rent it.
3. Improper adjustment of relative Front, Center and Surround channels. Re-calibrate as per instructions in Section 11.
4. Respective Front, Center and Surround channels are not connected properly. Check CT-17-to-amp and amp-to-speaker connections.

Stereo TV broadcast with Dolby Pro Logic decoding has no effect or improper effect.

1. Station signal phase shifting or left/right out of phase.
2. Stereo simulator used by station. Switch to "stereo" and phone station to complain.

Solo voices or instruments sound thin, shrill or distorted.

1. Treble controls set to maximum boost.
2. Phono cartridge wired out of phase.
3. Speakers are connected out of phase.

Sound is weak when PHONO input is selected.

1. A moving coil cartridge which has a low output has been connected. Add a step-up transformer such as the Carver MCT-1.

Hum and constant noise.

1. Defective signal cables.
2. Improper fit between signal cable plug and sockets.
3. Signal cables have been routed too closely to AC cables, power transformers, motors or TV sets.
4. Turntable or cassette deck may be oriented in such a way that it is picking up induced hum from internal AC wall wiring. Change component's position slightly.
5. Power amplifier is extremely high gain (characterized by the need to use only very low settings of the CT-17 volume control). If the amplifier has input level settings, reduce them. If not, contact Carver Corporation Service Department.

Intermittent noise, static or hum caused by RFI interference from CB, TV or AM radio.

1. Determine where the RFI is entering the system by disconnecting individual sound sources, then the CT-17, then the power amplifier.
2. Use interconnect cables with better shielding.
3. Wrap turntable input cables in foil.
4. After checking with your power amplifier manufacturer, place 0.01 microfarad capacitor across speaker terminals.

Remote control won't work.

1. Batteries are dead or missing.
2. Remote is too far from or at too much of an angle from the remote sensor on the receiver.
3. Remote sensor on receiver or transmitter panel on remote are dirty.

Remote will not select source for second system.

1. The ENGAGE button must be OFF in order for the REMOTE button on the remote control to operate.

Service Assistance

We suggest that you read the LIMITED WARRANTY completely to fully understand what your service coverage constitutes and its duration. Please promptly complete and return the WARRANTY REGISTRATION CARD for validation of your LIMITED WARRANTY. Also be sure to save the sales receipt in a safe place. It will be necessary for warranty service.

If your CT-17 should require service, we suggest you first contact the Dealer from whom you purchased it. Should the Dealer be unable to take care of your needs, you may contact the CARVER Service Department by writing CARVER CORPORATION, Service Department, P.O. Box 1237, Lynnwood, WA 98046. We will then direct you to the nearest in our national network of Authorized Warranty Service Centers, or give you detailed instructions on how to return the product to us for prompt action.

We wish you many hours of musical enjoyment. If you should have questions or comments, please write to us at the address below.

CARVER CORPORATION
P.O. Box 1237,
Lynnwood, WA 98046
(206) 775-1202

19. CT-17 Signal Switching Chart

ENGAGE OFF
TAPE MONITOR OFF

	INPUT/OUTPUT JACKS						
TAPE SELECT	Tape 1 In	Tape 1 Out	Tape 2 In	Tape 2 Out	Video 2 Out	Pre Out	Remote Out
Tape 1/2 Out	X	X	X	Remote	Remote	Main	Remote
Tape 1/2 In	X	Remote	X	X	Remote	Main	Remote

ENGAGE OFF
TAPE MONITOR ON

	INPUT/OUTPUT JACKS						
TAPE SELECT	Tape 1 In	Tape 1 Out	Tape 2 In	Tape 2 Out	Video 2 Out	Pre Out	Remote Out
Tape 1/2 Out	Active	X	X	Remote	Remote	Tape 1	Remote
Tape 1/2 In	X	Remote	Active	X	Remote	Tape 2	Remote

ENGAGE ON
TAPE MONITOR OFF

	INPUT/OUTPUT JACKS						
TAPE SELECT	Tape 1 In	Tape 1 Out	Tape 2 In	Tape 2 Out	Video 2 Out	Pre Out	Remote Out
Tape 1/2 Out	X	X	X	Main	Main	Main	Main
Tape 1/2 In	X	Main	X	X	Main	Main	Main

ENGAGE ON
TAPE MONITOR ON

	INPUT/OUTPUT JACKS						
TAPE SELECT	Tape 1 In	Tape 1 Out	Tape 2 In	Tape 2 Out	Video 2 Out	Pre Out	Remote Out
Tape 1/2 Out	Active	X	X	Tape 1	Tape 1	Tape 1	Tape 1
Tape 1/2 In	X	Tape 2	Active	X	Tape 2	Tape 2	Tape 2

NOTE:

[X] means disconnected (no input or output).
[Main] means Primary Input Select (upper selection bank) determines the output.
[Remote] means Record/Remote Select (lower selection bank) determines the output.