harman/kardon

AUTOMOTIVE SURROUND PREAMPLIFIER

owner's manual

CSP-1

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FOREWORD

We are very proud you have selected the CSP-1 Automotive Surround Processor. No expense has been spared in the design or manufacture of this product. It is the result of over a decade of extensive research in the field of psychoacoustics - in both home and automotive listening environments.

The audio signal path is unbelievably clean and uncolored as a result of the use of low noise circuitry, metal film resistors and low-loss film capacitors. The high interchannel separation delivers performance that is far superior to the reproduced soundstage from a conventional stereo system.

Every necessary feature and adjustment has been included to assure superior performance in any installation. After listening to high-performance surround sound for just a few hours, you will never again be satisfied with regular stereo.

IMPORTANT
This product must be installed and adjusted properly. Please read this owners manual thoroughly so that you may obtain maximum performance and enjoyment from the CSP-1. This manual should be retained for future reference and to answer operational questions as they arise.

INTRODUCTION

The CSP-1 converts the conventional stereo system in your car into a 5 channel surround sound system on wheels.

The CSP-1 is based upon exclusive Image Steering Technology which has an unparalleled ability to localize multiple sound sources with precise accuracy and complete stability around a listening area.

Your CSP-1 will give you an initial listening impression of dramatically increased depth or spaciousness - a natural sense of acoustics space and size throughout your listening environment. Critical listening will reveal more specific perceptions such as unprecedented freedom from electronic artifacts including image instability, distortions and sonic coloration. The CSP-1 is able to achieve this freedom from artifacts because unlike Digital Soundfield Processors the CSP-1 does not add anything to the music. The CSP-1 simply extracts information already contained in stereo recordings and recreates a natural surround soundfield. With the CSP-1, individual sound sources within the program material will be more sharply defined and localized with multiple events occurring from various directions simultaneously.

DESCRIPTION

The CSP-1 combines a high-separation surround processor, crossover and bass equalizer all in one rugged, compact chassis. It provides a spatially correct panoramic expansion of ordinary stereo program material into a wide-field surround audio format.

The CSP-1 will work excellently on un-encoded audio material but is also compatible with the Dolby MP Matrix (Dolby Surround)™ encoding that is used on some audio recordings.

The Image Steering technology employed within the CSP-1 represents the efforts of Jim Fosgate - a leading authority in the field of multi-channel sound.

The CSP-1 includes a Subwoofer on/off switch to provide full bass response in installations without subwoofers. When the Subwoofer switch is off, the four corner channels are given a full range of musical signal including low bass energy. Be sure the corner speakers can handle low bass energy without bottoming out or distorting. A subwoofer is needed if the corner speakers cannot handle the low bass energy.

The CSP-1 includes an adjustable crossover network. The high frequencies are fed to the surround processor circuitry and the low frequencies are always fed to the subwoofer outputs and are fed to corner channels when the Subwoofer switch is off. We have set 250 Hz as the optimum crossover frequency for most installations. Plug-in networks are available from harman/kardon which allow the user to change crossover frequencies if necessary.

Three subwoofer outputs are provided: stereo L/R and mono. The system can be installed with either a mono subwoofer or stereo left and right subwoofers or both stereo and mono subwoofers. Stereo subwoofers are highly recommended but require extra power and independent enclosures for each speaker. In installations where separate subwoofers are not possible, a lower crossover frequency will usually provide the best results.

FEATURES

The CSP-1 preamplifier works on un-encoded source material
The Image steering process works on both un-encoded and Dolby Surround™ encoded audio source material. Unlike Digital Soundfield Processing, image steering logic does not add anything artificial to the music. The CSP-1 simply extracts spatial information out of standard stereo recordings and recreates a realistic surround sound field.

Panorama control
The CSP-1 allows the user to adjust the width of the sound-stage by using the fader control on the users head unit. (Head unit must have some type of 4 way fader)

Bass Equalizer
The CSP-1 includes a bass equalization circuit which can provide as much as 18 dB of bass signal boost.

Noise Sequencer for easy system setup
The CSP-1 includes a noise sequencer which generates a noise signal that makes optimal speaker level setup a simple task.

2/4 Channel Input Capability
The CSP-1 will accept input in a two or four channel format from the head unit.

Built-in Adjustable High Order Crossover
This built in crossover design allows for a wide choice of user selectable crossover points. Frequency changes are made by installing different resistor modules.

Exceptional Sound Quality
Like all Harman Kardon products, the CSP-1 is designed and manufactured to perform with sonic excellence. The Image Steering preamplifier puts the fewest possible stages of electronics in the signal path for maximum sonic purity.

Fully regulated power supply
The power supply is fully regulated, ensuring stable operation, free of engine noise.

Level trimmers do not affect input or output impedances
The input gain and output level adjustments allow for easy level matching without affecting the input or output impedances of the CSP-1.

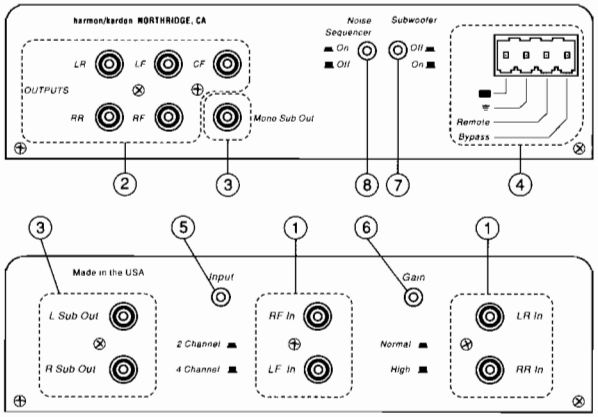
Three separate subwoofer outputs
Stereo L/R and mono subwoofer outputs are provided.

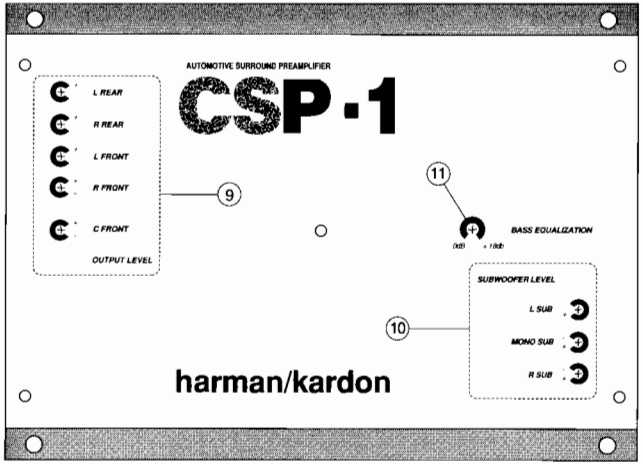
Heavy Duty gold plated input/Output jacks
Gold plated jacks insure excellent low loss contacts which will not degrade over time.

Designed and manufactured in the U.S.A.

Accessories
1. Ground wire (black) (1 pc.)
2. Power supply wire (red) (1 pc.)
3. Remote On wire (yellow) (1 pc.)
4. Bypass switch and plate with built in harness (green) (2 pieces)
5. Mounting screws (1 set)
6. Power Connector (1 pc.)

CONNECTIONS





CONNECTIONS

① **- Input terminals (LF in, RF in, LR in, RR in) -** These should be connected to the line output (or preamplifier output) of the tuner/CD or tuner/cassette. High quality cables with tight-fitting RCA plugs should be used. The Input switch should be set for 2 or 4 channel input as appropriate.

② **- Output terminals (LF, RF, LR, RR, CF) -** These should be connected to the input terminals of the left front, right front, left rear, right rear and center front channel amplifiers respectively (see Installation Diagram).

③ **- Output terminals (Mono Sub out, L Sub Out, R Sub out) -** These outputs should be connected to the inputs of the low frequency power amplifiers. If only one subwoofer is being used the Mono Sub output should be used.

④ **- Power Input connector Receptacle -** The input power connector should be plugged into this receptacle after it has been connected as shown in the system installation diagram.

CONTROLS

⑤ **- Input Switch -** This switch should be set to the "2 Channel" Position when two inputs (LF, RF) are used and the "4 Channel" Position if four inputs are used (LF, RF, LR, RR). Note that the tuner/CD or tuner/cassette fader can be used as a panorama control only if four inputs are connected. Details on the operation of the "Panorama Control" are given in the "Operation" section of this manual.

⑥ **- Gain Switch -** This switch allows for audio level matching between the tuner/CD or tuner/cassette output and the CSP-1 preamplifier input. Typically, the switch should be set to the "Normal" position. If after listening to the audio system, sufficient volume level is not achievable when the tuner/CD or tuner/cassette is turned up, place this switch in the "High" position. The "High" position adds more gain to the audio input stages of the CSP-1.

⑦ **- Subwoofer Switch -** This switch enables a crossover which allows a subwoofer to be used with the CSP-1. The crossover frequency is adjustable as detailed in the "SELECTING NEW CROSSOVER FREQUENCIES" section of this manual. The "Subwoofer" switch should be in the on position only when a subwoofer is connected to one of the subwoofer outputs.

⑧ **- Noise Sequencer Switch -** The noise sequencer switch turns on a test signal that rotates through all five channels and allows for accurate and easy level calibration of the CSP-1 surround sound installation. A complete description of the process of level adjustment using the Noise Sequencer is detailed in the "Setting Speaker Levels" section of this manual.

⑨ **- Output Level Adjustments (L Rear, R Rear, L Front, R Front, and C Front) -** These controls allow for adjustment of the output levels of the CSP-1 preamplifier. These adjustments are used to balance four corner and one center channel speaker levels for optimal surround sound performance. The output levels should be set using the noise sequencer as described in the "Setting Speaker Levels" section of this manual.

⑩ **- Subwoofer Level Adjustments (L Sub, Mono Sub, and R Sub) -** These controls allow for adjustment of the Subwoofer output levels of the CSP-1 preamplifier. These levels should be set as described in the "Setting Speaker Levels" section of this manual.

⑪ **- Bass Equalization -** This control allows the user to boost the bass response of the system by up to 18 dB. This control should be set according to the users taste after the Subwoofer level controls (10) are set for a flat bass response.

The operation of your surround system will be similar to the way it was before the CSP-1 was installed with the exception of the added separation and the three-dimensional sonic performance. The CSP-1 turns on automatically and allows the user to control the panorama setting and the bypass mode.

Panorama Control: Use the front-back fader on the control head unit (available only if using four inputs to the CSP-1) to obtain the desired sound stage width. This may vary from program to program. Use the left to right balance control on the radio or tape player to adjust the left to right system balance. The left to right balance will require little adjustment because of the center channel in a CSP-1 installation. Use the volume control on the tuner/CD unit or tuner/cassette to control system volume.

Bypass Switch: The user bypass switch will normally be set to "on" but can be set to "Bypass" if the user desires to electronically bypass the Image steering preamplifier. In bypass mode, all speakers except the center channel will function with out Image Steering Surround Processing. Some poorly received FM broadcasts will sound more natural in bypass mode.

IMPORTANT

If you find the head unit left/right balance control is always off center for proper left/right system balance, the input gains on the amplifiers are not properly adjusted. Refer to the Amplifier and Speaker level adjustment sections of this manual.

PRECAUTION

This unit is designed for Negative Ground 12 V dc only; avoid installations in locations where your CSP-1 will be consistently exposed to extremely high ambient temperatures, heavy concentrations of dirt or dust, direct rain or moisture or excessive vibration. Avoid reversing positive and negative power supply leads as this may cause damage to the unit.

INSTALLATION CHECKLIST

(see Installation diagram)

1. Before installing the CSP-1 you should decide whether or not you need to change crossover frequency selection modules. Changes in the frequency modules may be necessary if your four corner speakers cannot handle frequencies down to 250 Hz. If changes are necessary follow the instructions in the "Selecting New Crossover Frequencies" section of this manual (located following this section). Note: most installations will not require a change in crossover frequency.
2. Disconnect the negative (ground) cable from the battery of the vehicle.
3. Mount the CSP-1 in desired installation location.
4. Locate the four pin power connector where it can be easily plugged into the CSP-1 after all wiring has been completed.
5. Run the red Positive lead from the power connector directly to the vehicle battery terminal. An additional

fuse (not supplied) should be placed in line with this wire at a location near the battery in order to guard against shorting in the wire run.

6. Run the black Ground lead from the power connector directly to the vehicle frame or other solid ground path closest to the CSP-1 installation site.
7. Run the yellow remote on wire from the power connector to the head unit remote turn on wire.
8. Install the bypass switch in the desired location. The switch may be installed with or without the metal trim panel.
9. Run the bypass switch harness from the location where you have chosen to install the bypass switch to the CSP 1. Connect one of the wires on the switch to the nearest available ground with the other connected to the bypass input on the power connector of the CSP-1.
10. Plug the four pin power connector into the CSP-1.
11. Follow directions in the "SYSTEM ADJUSTMENT" section.
12. Connect either two or four RCA inputs from the head unit into the CSP-1 input jacks.
13. Connect the output jacks of the CSP-1 to the amplifiers as appropriate for your installation.

SELECTING NEW CROSSOVER FREQUENCIES

Crossover frequencies are adjustable by changing two 16 pin DIP resistor packs on the circuit board (see next section for replacement procedure). One is marked "HI PASS", and the other "LOW PASS". The High Pass section affects the high frequencies that are directed to the high-separation surround processor section. The Low Pass section affects the low frequencies that are directed to the subwoofer outputs and corner channels (with the subwoofer switch off). The optimum crossover point is approximately 250 Hz. If the crossover point is made too high, a loss of separation can result; if the crossover point is made too low, a loss of bass can result.

Differences among various loudspeakers may require a different frequency than the standard 250 Hz. A higher crossover point may be necessary if the five main speakers have a very limited output capability at 250 Hz (this is rare). A lower crossover point may be necessary if stereo subwoofers are not used. The 250 Hz crossover point should be auditioned before making a change. It will usually be satisfactory. The optimum crossover point may be different than conventional stereo installations due to the high-separation directional effects capability of the surround processor.

If your system requires crossover frequencies different from the factory settings, they can be obtained by determining new resistor module values and then replacing the factory modules with modules of the new values. To determine the new values, see the following chart.

The resistor value can also be calculated by dividing 820,000 by the desired crossover frequency.

$$R = \frac{820{,}000}{\text{Crossover Frequency}}$$

Standard Resistor Value	Crossover Frequency
2.7KΩ	300Hz
3.3KΩ	250Hz
3.9KΩ	200Hz
4.7KΩ	175Hz
5.6KΩ	150Hz
6.8KΩ	120Hz
8.2KΩ	100Hz
10KΩ	80Hz
12KΩ	70Hz
15KΩ	55Hz

The chart only shows standard resistor module values. Many of these values are available from your Harman Kardon car audio dealer. As an alternative they can also be obtained from electronic components dealers.

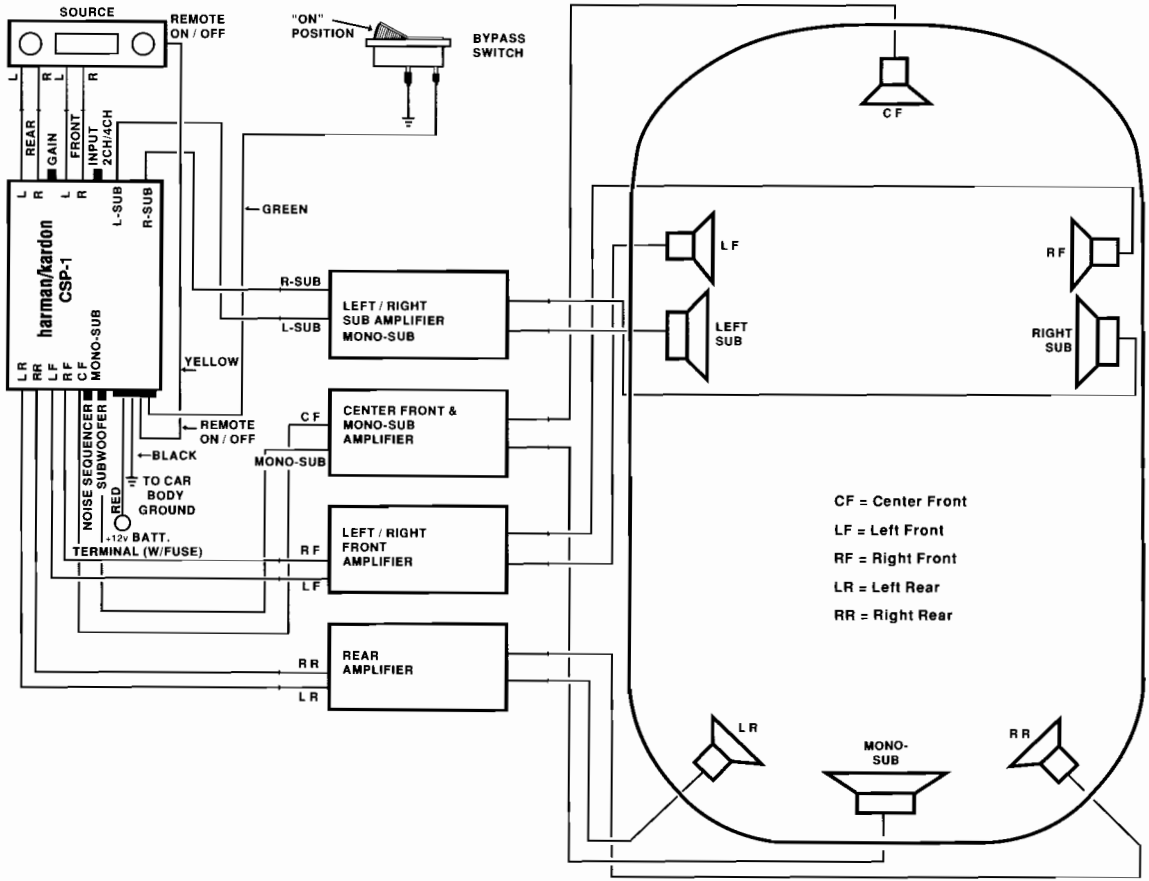
Due to the nature of surround sound processing we recommend against the use of crossover frequencies below 150 Hz and above 300 Hz on the "Hi Pass" crossover.

HOW TO REPLACE A RESISTOR MODULE

To replace a resistor module, use the following procedure:

1. Turn off the car audio system. This will prevent loud "pops" that may damage some speakers.
2. Touch one of the input or output jacks with your finger to eliminate any static charge.
3. Remove all of the power, input and output connectors and jacks.
4. Remove the mounting screws from the CSP-1 and remove the unit from the vehicle.
5. Take off the bottom cover of the enclosure by first removing 3 screws from the input signal end plate, 2 screws from the bottom corners of the output signal endplate, and 3 screws from each blank side of the case. Next slide the bottom cover backwards until the endplate clears the input jacks and then lift the cover off.
6. Find the appropriate resistor module on the circuit board. They are marked "HI PASS" and "LOW PASS" and are located on the end of the circuit board near the input RCA jacks.
7. Using a small screwdriver, slowly and gently pry the module up first at one end and then at the other end. Repeat prying up each end until the module is loose and can easily be taken away by hand. Be careful not to bend the pins.
8. Insert the new resistor module. They are symmetrical and cannot be inserted backwards. Gently push the module firmly into the socket. Be careful not to bend the pins.
9. Re-install the bottom cover plate.
10. Re-mount the CSP-1 using the four mounting screws.
11. Reconnect the power, input and output connectors and jacks.
12. Turn on the audio system power.

INSTALLATION DIAGRAM



SPEAKER PLACEMENT AND SELECTION

For optimum surround performance, speaker placement and matched frequency response is very important. Five identical speakers positioned three across the front and two in the rear provide the best performance. If it is not possible to use a center speaker that is identical to the other speakers then choose a speaker that closely matches the high and midrange performance of the left and right front speakers. A subwoofer system further enhances system performance.

The Left and Right front channel speakers should be mounted in the front doors or the dashboard. The left and right surround channel speakers should be mounted in the rear of the car as close to the back corners as possible. Reflecting the radiated sound from the back speakers off the rear of the car interior and rear window is preferable to aiming them directly forward. Some hatchback vehicles are exceptions to this rule.

The center front channel speaker should be mounted in the center area of the dashboard and need not have bass response below the 250 Hz factory hi pass crossover setting. If the center channel speaker has limited output capability at the 250 Hz hi pass setting, then it may be necessary to add an additional passive hi pass crossover for the smaller center channel speaker. This additional passive hi pass crossover can be built by placing an appropriate value capacitor in series with the smaller center channel speaker.

Note: In unusual cases a qualified installer may wish to reduce center vs. left and right front channel separation depending on power handling and the location of the center channel speaker. The factory setting of the CSP-1 is for maximum center to front channel separation and is ideal for most installations. The CSP-1 front to center channel separation can be adjusted if necessary using the procedure that follows.

The Center Front Separation potentiometer is located under the bottom cover, which can be removed using the procedure given in the "How to replace a resistor module" section of this manual. The potentiometer adjustment is located in the upper right corner of the circuit board near the "LR" output RCA jack and is labeled "CF Sep" and "R70". At the full clockwise or max position the control causes all mono signal to be sent to the "Center Front" channel output - this is the factory setting for maximum separation and is ideal for most installations. At the counter clockwise position the control sends all mono signal equally to both the left and right front outputs and no signal to the center front output. This control should only be adjusted by a knowledgeable installer in unusual installations but typically should be left at the factory setting for maximum separation. There are no other installer adjustable controls inside the CSP-1 case.

Subwoofers can be mounted on the left and right sides of the car in the kick panels, doors, or rear deck. An excellent combination is to use smaller stereo subwoofers mounted in the forward area and a large mono subwoofer mounted in the rear.

AMPLIFIER SELECTION

Unlike many other center channel systems, the CSP-1 center channel should be powered with an amplifier that is of equal or greater power rating to the amplifier used on the left and right front channels. Ideally, the rear channel speakers should also be powered at the same level as the front channels. The subwoofer amplifier should be powered as appropriate for the amount of bass output desired in the installation.

2/4 INPUT SWITCH

Set the input switch to either the 2 or 4 input setting depending on how many RCA inputs are connected from the head unit to the CSP-1.

INPUT GAIN SWITCH

Set the Input Gain Switch to normal. If the output level of the processor seems low during latter listening tests, this switch may be changed to the high gain setting for better matching with the output level of the head unit.

SUBWOOFER SWITCH

The subwoofer switch should be turned on only in installations which have a subwoofer. The subwoofer switch engages a high pass crossover on the four corner channel speakers. This allows bass frequencies to be reproduced only by the subwoofers attached to the left, right or mono subwoofer outputs of the CSP-1.

AMPLIFIER LEVEL ADJUSTMENTS

Before adjusting speaker levels, center the left-right and front-back balance controls on the tuner/cassette or tuner/CD. Set the CSP-1 bypass control to the bypass mode. Play a well-recorded stereo source and adjust the amplifier input levels and/or CSP-1 output levels for a roughly even channel balance, left-right and front-back.

Re-adjust the amplifier input levels and CSP-1 output levels as necessary to obtain the best signal to noise performance. As a general rule the input level controls on the amplifier should be set as low as possible while still providing adequate volume levels when the CSP-1 output levels are set at near their half way point. If the amplifier

hiss is too loud, turn up the CSP-1 and turn down the amplifier gain or visa versa to achieve the best signal-to-noise performance. Adjust subwoofer levels for bass output equivalent in level to the other speakers. Increase in bass output can then be achieved with the bass equalizer after completing all other level adjustments.

SYSTEM PHASING CHECKOUT

Please note that you must be certain there is proper phasing throughout the system before final level calibration can be accurately and reliably established. Accurate phasing of the loudspeakers in the system is also essential for precise localization of images and deep bass response. Insure proper phasing by verifying that the speaker wiring color coding indicates correct phasing connections between all amps and speakers.

After system phasing checks are completed use the internal noise sequencer within the CSP-1 to verify proper hookup. The burst of noise will come from the LF, CF, RF, LR, and RR speakers and move clockwise around the car.

SETTING SPEAKER LEVELS

Adjusting the CSP-1 output levels is done after completing all amplifier level adjustments and verifying correct phasing of all speakers as discussed in the two previous sections.

A dB Sound Pressure Level (SPL) meter is required to properly adjust output levels of the CSP-1 in conjunction with the built in noise sequencer. The noise sequencer button is located on the end panel of the CSP-1. The goal is to set the volume at the primary listening position to read the same dB SPL level (C-weighted, slow mode) from each speaker. The levels of each speaker may be adjusted with the individual speaker level controls. You should use the meter pointing straight up at the roof so as not to favor one speaker over another.

Ideally, the "average" setting of the individual output level controls should be near the middle of their range. The simplest way to achieve this is to set a single channel's output level control in the middle of its range and then use the reading obtained on this speaker (with the noise sequencer button on) as the reference SPL level. Then adjust the rest of the individual output level controls to match the reference sound pressure level using the test tones generated by the noise sequencer.

In the absence of a dB SPL meter, it is possible to set the output level controls by ear. Use the built-in noise sequencer on the CSP-1 to adjust all volumes to sound the same as they cycle around the various speakers. The test signal is bandwidth-limited pink noise to minimize the problem of timbre shifts influencing the setting of levels. Even so, using non-matched speakers, especially mis-matched Left-Front, Center, or Right-Front, may make it difficult to judge proper balance due to variations in spectral balance. Simply get as close as you can! The system will then be reasonably well balanced.

SUBWOOFER LEVEL ADJUSTMENT

The CSP-1 provides three subwoofer outputs. The subwoofer level controls adjust the level at the subwoofer output jacks. Adjust the subwoofer level controls for the desired balance of sound. For best results, the subwoofer level should be matched to the level of the satellites. Any desired bass boost should be achieved with the Bass Equalizer adjustment, not the subwoofer level control.

BASS EQUALIZER ADJUSTMENT

The patented Bass Equalizer circuit included in the CSP-1 allows amplitude and frequency compensation with only a single rotary control. It will provide a full, solid foundation of bass energy unmatched by any other equalizer. Adjust the control for the desired low bass boost. This control can be set once and forgotten. Adjust the regular bass control on the tuner/cassette or tuner/CD for normal variations in program material.

FUSE REPLACEMENT

To prevent circuit board damage in the event of a component failure, there is a 1.5 ampere 3AG-type fast blow fuse in the power supply. It is doubtful that the fuse will fail unless there is a serious failure of certain parts within the CSP-1. In the event of a fuse failure, replace it with the same value and type. The fuse is located inside the unit and can be accessed by removing the bottom cover using the directions given in the "How to Replace a Resistor Module" section. Contact your retail dealer of Harman Kardon products for authorization to return the unit to the factory for repair if the fuse fails repeatedly.

TROUBLESHOOTING

Problem	Probable Cause	Remedy
No sound	Remote, +12 V or Ground wires not connected.	Connect them per instructions.
	Input or output signal cables not connected properly.	Connect them per instructions.
	In-dash unit, external processor or power amplifiers not working properly.	Trouble shoot them per their owner's manual.
	Fuse Blown	Replace fuse per instructions in this manual.
Engine or alternator noise in the sound	Ground terminal not connected to a chassis ground point.	Re-locate ground wire connection.
	Input or output signal cables are picking up noise from +12V or ground wires from the amplifiers.	Run power lead directly to "+" battery terminal. Re-position the signal cables away from the amplifier power wires. Or, add power line filters to the amplifier's +12V wire.

Problem	Probable Cause	Remedy
High "hiss noise"	CSP-1 output signal levels are set too low.	Amplifier gains may be to high. Re-set all signal levels as per the CSP-1 manual sections titled "Amplifier and Speaker Level Adjustments".
No surround effect	Bypass mode selected	Place bypass switch in "on" position
Unit Dead	Unit Wired Incorrectly	Check all Wiring. Make sure power plug is firmly plugged in. Check to verify that power wiring is not reversed.
	Fuse Blown	Replace fuse

SPECIFICATIONS

Automotive Surround Preamplifier	CSP-1
Subwoofer Channels Low-Pass Frequencies	*250 Hz, 18 dB/octave rolloff (can be varied from 55 Hz - 300 Hz)
High Channel High-Pass Frequencies	*250 Hz 18, dB/octave rolloff (can be varied from 55 Hz - 300 Hz)
Input/Output Gain	+20 dB (gain switch on High)
Maximum Output Level (0.2% THD)	2 Volts RMS
THD at 2 Volts, 1 kHz	Less than 0.2 %
Frequency Response	10 Hz - 100 kHz ±2 dB (sub-woofer switch in the off position)
Bass Eq	0 to + 18 dB boost @ 45 Hz
Signal to Noise Ratio (A-WTD, 2.0 Volts)	>95 dB
Input Impedance	34 kΩ
Output Impedance	100 Ω
Static Inter-channel Separation	35 dB minimum: typically better than 40 dB
Fuse Size and Type	1.5 amp, Type 3AG Fast Blow
Mechanical Size/Weight	10 1/8 "x 7 1/8 "x 1 1/2"/3 lbs 5 oz

* denotes factory setting