





Warning: To reduce the risk of fire or electric shock, do not expose this unit to rain or moisture. Do not open the cabinet. Refer servicing to qualified personnel only.

Caution: To prevent electric shock, do not use this (polarized) plug with an extension cord receptacle or other outlet unless blades can be fully inserted to prevent blade exposure.



The lightning flash with arrowhead symbol, within an equilateral triangle, is intended to alert the user to the presence of uninsulated "dangerous voltage" within the product's enclosure that may be of sufficient magnitude to constitute a risk of electric shock to persons.



The exclamation point within an equilateral triangle is intended to alert the user to the presence of important operating and maintenance (servicing) instructions in the literature accompanying the unit.

### Important Information For The User

**Note:** This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. The limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communication. However, there is no guarantee that harmful interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.

- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician or help.

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) this device must accept interference received, including interference that may cause undesired operation.

**Note:** Changes or modifications may cause this unit to fail to comply with Part 15 of the FCC Rules and may void the user's authority to operate the equipment.

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## Important Safeguards

### Always Use 120V AC

This unit is designed for operation with 120V AC unless specifically noted on the shipping container or AC power cord. Never connect the unit to an outlet supplying a higher voltage. This may create a fire hazard.

### Handle the AC Power Cord Gently

- Do not disconnect the plug from the AC outlet by pulling the cord; always pull the plug itself. Pulling the cord may damage it.
- If you do not intend to use your unit for any considerable length of time, disconnect the plug from the AC outlet.
- Do not place furniture or other heavy objects on the cord, and try to avoid dropping heavy objects upon it. Also do not make a knot in the power cord. Not only may the cord be damaged, it can also cause a short circuit with a consequent fire hazard.

## Place of Installation

Place the unit on a firm and level surface. Avoid installing your unit under the following conditions:

- Moist or humid places.
- Places exposed to direct sunlight or close to heating equipment.
- Extremely cold locations.
- Places subject to excessive vibration or dust.
- Poorly ventilated places.

Do not obstruct the ventilation slots on the top surface of the unit by placing objects over them. Otherwise, the temperature inside the unit may rise, possibly affecting its long-term reliability.

## Do Not Open the Cabinet

To prevent shock hazard, do not tamper with internal components for inspection or maintenance. Harman International does not guarantee against performance degradation resulting from any modification.

If water, a hairpin, wire, or other object enters the unit, immediately extract the plug from the AC outlet to prevent shock and consult your dealer or Harman International service department. If you use the unit under this condition, it may cause a fire or shock hazard.

## Moving the Unit

Before moving the unit, be sure to pull out the power cord from the AC outlet and disconnect the interconnecting wires with other units.

## Cleaning

When the unit gets dirty, wipe it with a soft dry cloth. If necessary, wipe it with a soft cloth dampened with mild soapy water and then with a dry cloth. Never use benzene, thinner, alcohol or other volatile agent, and avoid spraying an insecticide near the unit.

# Harman/Kardon Model AVP1A Digital Servo Logic Surround Processor

## FOR PEOPLE WHO DON'T READ MANUALS

Please read this one.  
The time you invest will be worth it.

If you feel you absolutely do not have time to read it just now, here is a short list of key information you will need in order to get the most from your Model AVP1A. Reviewing these points will take only a few minutes.

### **PLANNING AND INSTALLATION GUIDES:**

An introduction and overview of surround sound,  
Home THX Audio, and the AVP1A.

- Installing your AVP1A
- Calibrating and using your AVPIA
- Fine Tuning your system

The time you can save by having this information at  
your fingertips will more than pay for itself.

IF YOU DON'T HAVE TIME TO READ THIS MANUAL, A  
STEP-BY- STEP QUICK INSTALLATION GUIDE IS PROVID-  
ED ON THE NEXT PAGE. IN ORDER TO ACHIEVE OPTIMUM  
SYSTEM PERFORMANCE, IT IS STILL ESSENTIAL THAT  
YOU READ AND UNDERSTAND THE MATERIALS PRESENT-  
ED IN THIS MANUAL. THE LUCASFILM THX DEMONSTRATION  
VIDEODISC "WOW!" IS REFERRED TO IN THIS  
MANUAL. WE SUGGEST THAT YOU READ THE INFORMA-  
TION PROVIDED ELSEWHERE IN THIS MANUAL  
DESCRIBING THE MATERIALS PROVIDED ON "WOW!".

## A Step-By-Step "Quick Guide" Installation of Your Model AVP1A

1. You will require the following items: Left/right front speakers, two surround speakers, necessary audio amplifiers, and an audio-video source plus necessary interconnect cables. Additional options include a center channel speaker, and subwoofers or THX - certified loudspeaker components.

2. Place the speakers and connect them to your amplifiers. Be sure to observe proper polarity. A typical front speaker placement diagram is found on page 11. A dipolar surround speaker placement diagram is found on page 12. A Home THX Audio System block diagram is found on page 15.

3. Connect the appropriate interconnect cables between the outputs of the Model AVP1A to the audio amplifier inputs. Be sure to turn off the electronic crossover if you are not using a subwoofer. The push switch is found on the rear panel of the AVP1A. Also note that an electronic crossover is provided for a subwoofer on the surround channels as well. If your surround speakers have woofers of less than eight inches in diameter, we suggest that you leave the surround channel electronic crossover engaged.

4. Connect the output of an audio-video source such as a laser disc player or HiFi VCR to the AVP1A.

5. Turn on the AVP1A.

b. Using the hand held remote control, set the following:

**MODE:** Dolby Pro Logic or Home THX Cinema.

**CTR:** On, if a center speaker is used.

**REF:** On.

**INPUT CALIBRATE:** Auto position.

**PAN:** CTR position on.

**DELAY:** Set to 20 ms.

7. Make sure the Bass EQ is turned off (full counterclockwise) and set the Input Level control to the 12 o'clock position.

8. On the front panel of the AVP1A, turn on the Noise Sequencer. The test signal will start at left front channel and go clockwise around the room. If you are not using side speakers, turn off the side channel output switch on the rear panel. Adjust the Output Trim Level controls so that the volume is the same from each speaker at the listening location. We recommend the use of a sound pressure level meter, if available, set for "C" weighting, "slow". Set each speaker for 85 dB sound level using the internal noise sequencer.

9. Turn off the Noise Sequencer. Select a Dolby Surround encoded movie on laser or hifi VCR to verify system performance.

10. Read the rest of this manual for additional information regarding the fine tuning of your system!

## Motion Picture Sound: A Brief History

In the early 40's, the large movie studios owned their own theatres and could enforce quality standards. In those days motion picture theaters provided higher quality sound reproduction than home radios or phonographs.

An anti-trust action forced the studios to sell their theatre holdings in the 50's. When the theatres became independently owned, each theatre could choose which films it wanted to show. In turn, the studios eliminated their technical staffs which had been responsible for maintaining sound quality standards. As a result, the quality of sound in the theaters failed to keep pace through the 50's and 60's.

The turning point came in the 70's with the introduction of the Dolby Stereo recording process by Dolby Laboratories. The consumer electronics market tends to think of Dolby exclusively as a noise reduction system used in cassette decks, but a significant portion of Dolby's business is in the professional audio industry. Dolby Stereo allows four channels of sound to be recorded on the two available optical soundtracks of a 35mm movie print, with excellent results. One of the first commercial successes of this new technology was STAR WARS in 1977.

The impact of STAR WARS on the movie-watching public is hard to overestimate. The quality of the sound track caught everyone's attention and changed what people expected from film sound. Suddenly, people rushed to see new releases in better-sounding theatres, and the ones which upgraded their sound systems were rewarded with increased revenues.

Unfortunately, there was no standard of performance for the sound systems in theatres. Even the best auditoriums sounded different from each other and from the sound the director heard in the film studio because of variations in room acoustics and sound system. In 1982, George Lucas gave his full support to create a new movie theatre sound system standard: the THX Sound System.

The THX Sound System was designed to complement and enhance the playback of Dolby Stereo, which was the established standard for film sound recording. THX picked up where Dolby Stereo left off, encompassing standards and technologies for power amplifiers, speakers, patented Lucasfilm technology and the acoustics of the theatres themselves to ensure the best possible reproduction of movie soundtracks.

By 1991, THX systems had been installed in nearly 500 movie theatres and studios worldwide, with many more in various states of construction. THX has become the industry standard for post-production mixing facilities as well as for theatres and or studios.

In 1986 the sales and rental of home video software equalled theatrical ticket sales. George Lucas found himself back where he started - with no control over how his films would actually sound in the home. For that reason, the Lucasfilm Home THX Audio System was designed to accurately bring the theatre experience home.

## The Goal Of LUCASFILM Home THX Audio Systems

The film industry has a clearly-defined standard for the reproduction of film soundtracks. In practice, however, achieving the standard is quite challenging. Perhaps the best method for measuring the success of various systems is by looking at their acceptance by the professionals who use them. The THX Sound System clearly dominates the field, both in theatres and in film studio dubbing stages.

If you wish to hear the soundtrack as the director did, you must duplicate the sonic experience of the dubbing stage in your home. And the majority of all standardized dubbing stages now use THX Sound System.

The objective of Lucasfilm Home THX Cinema is to bring precisely this performance standard to a home environment in order to give the filmmaker a transparent path between his creation and the experience of the viewer.

In general terms, this requires solving the problem of transferring sound from a large movie theatre or dubbing stage to a smaller home environment without compromising its character (a non-trivial task, in view of the radically differing acoustical properties of large and small rooms). In addition, there are many specific design objectives which define the total performance of the system:

- A wide frequency range, extending to the limits of audibility
- Smooth naturally balanced overall sound and excellent dialog intelligibility
- A wide dynamic range with extremely low distortion
- Well-matched timbre (tonal balance) between front speakers and surround speakers
- Precise localization of specific sounds
- Envelopment by ambient soundfield
- Superb performance with non-film music sources

## Planning and Installation Guides

### **A Checklist For Planning and Installing Your Home THX Audio System.**

#### **Introduction and Overview**

The AVP1A is the most advanced surround processor/control center yet produced, incorporating state of the art surround processing circuitry. The AVP1A also features Lucasfilm Home THX Audio processing circuitry which has been specifically designed to provide new levels of enhancement to motion picture soundtracks. In addition to extensive audio capabilities, the AVP1A incorporates a comprehensive audio-video switcher. The entire unit is microprocessor controlled utilizing both liquid crystal and LED display systems to provide visual indication of the operational status.

#### **Music Surround Listening Parameters**

The AVP1A incorporates a comprehensive menu of pre-programmed modes for playback of music sources. Some settings may be altered to suit listening tastes or environmental requirements.

#### **Motion Picture Listening Parameters**

Four parameters for the playback of motion picture soundtracks are provided including: Dolby Pro Logic, THX Home Cinema (Pro Logic surround decoding and THX audio processing) 70mm Motion Picture and 35mm Motion Picture.

A complete description of AVP1A surround parameters is found on page 7.

#### **AVP1A Features**

In addition to a wide range of listener-selectable surround parameters, the AVP1A provides a number of unique and beneficial operating procedures. These include: automatic input balance calibration, a built-in test noise sequencer, output level trim controls, bi-ampable main and surround channels, A/V input switching, and a separate A/V record output circuit.

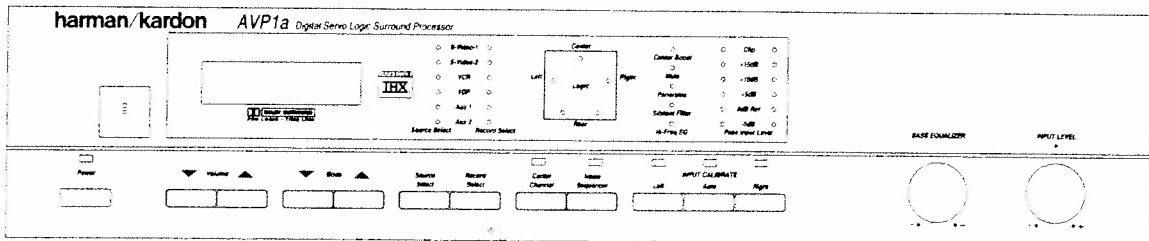
Descriptions of AVP1A features are found on page 20.



## harman/kardon AVP1A

The AVP1A THX controller incorporates a combination of existing technology and new, proprietary and patented Lucasfilm developments. This enables the system to take advantage of existing standards for film sound for maximum compatibility, while also improving home reproduction quality of film soundtracks (which were, after all, recorded for playback in large auditoriums). The entire controller package is a combination of:

- Proprietary harman/kardon surround technology for use with both surround encoded and non-encoded stereo audio sources
- Dolby ProLogic Surround for encoded motion picture, stereo CDs, and television audio soundtracks
- THX re-equalization, de-correlation, timbre matching circuitry
- A THX electronic crossover for bi-amplification of the main front speakers and a separate electronic crossover for optional bi-amplification of the surround channels
- Level Calibration to the original sound pressure levels heard in the theatre



## AVP1A Operating Parameters

The AVP1A offers a full array of surround parameters which will accommodate all types of music and movies. Conventional motion picture surround processing technology was never intended for music reproduction, so virtually every other manufacturer of surround processors has chosen to offer digital soundfield processing, or "DSP", for music listening enhancement. While DSP is rather technically ambitious, the results are often artificial. Digitally-generated reverberation or effects are added to the natural or studio-created ambience of the original recording. The result is usually not representative of the original recording or the desired new venue.

The AVP1A surround parameters are tailored for specific movie and music applications. We suggest that you experiment with the various modes. A limited amount of audio signal delay is available to enhance some modes. Changes you may make in audio signal delay settings are automatically stored in selected modes. The following descriptions of each mode will help you to select the appropriate one for your specific listening tastes.

### **ROCK**

This mode was designed to give an exciting presentation of typical multi-track rock recordings. The Rock mode is unique in that it provides full frequency range, stereo surround channels. No other processor is capable of delivering true stereo surround.

Any audio signal delay setting may be used, (up to 80

ms) and the Panorama control may be adjusted to suit the recording. (An explanation of the Panorama function is found on page 16 in this manual.) The logic steering speed is "fast". In the Rock mode, you can expect to hear a full soundfield which totally surrounds you with a significant amount of back channel information.

Music that has a great deal of stereo separation will be reproduced with an excitement and intensity that is similar to listening through headphones but with the visceral impact that only dynamic loudspeaker systems can produce. The Rock mode will also yield exciting results with most New Age and electronic music as well.

### **POPULAR**

The Popular music mode is intended for a natural presentation of the majority of popular music titles. The perspective is more frontal and not quite as "wrap-around" as the Rock mode. The surround channels are monophonic and are full frequency response. Any audio signal delay setting may be selected, (up to 80 ms) as well as Panorama. Logic speed is "fast". The Popular mode is the most universal for a wide variety of music, including rock, light rock, Broadway shows, etc.

### **JAZZ**

The Jazz mode is particularly well suited to any live recording of popular or jazz music. The soundstaging will be primarily frontal with ambience coming from the surround speakers. Separation of instru-

ments will not sound exaggerated, but will sound like an ensemble playing in front of you. The natural room acoustics of the recording environment will be preserved. The Jazz mode delivers full-range mono surround channels with variable time delay, Panorama and "fast" logic speed. "New" jazz and fusion music also benefit from this mode. Blues fans will find the Jazz mode the most effective, especially on live recordings.

### **CHAMBER**

This music mode is a "purists" mode suitable for any music where minimum processing is desired. It is a passive circuit (no steering logic) similar to the L-R circuit often erroneously referred to as the "Hafler" circuit. This circuit extracts ambience from a natural stereo recording and places it in the surround channels. Front channels are completely unprocessed. A special equalization curve is applied to the surround channels to emulate the natural decay of high frequencies over distance for more natural hall ambience. Chamber music is natural and enveloping in this mode, as are all small acoustic ensembles. The listener is placed close to the performance.

### **ORCHESTRA**

The Orchestra mode, like Chamber, uses no processing on the front channels, and center channel is disengaged. Orchestra mode applies steering logic only to the surround channels only with a narrow matrix providing a "mid-hall" perspective. This setting is ideal for larger symphonic works. You may switch on, at your option, the center channel speaker in the 'Orchestra' mode. Steering logic is engaged on the front sound stage when the center speaker is switched on. Audio signal delay settings may be extended to 80 ms.

### **70MM MOTION PICTURE**

The decoding matrix is identical to the one used in

the Dolby Pro Logic mode, but with a more extended frequency response on the surround channels. Audio signal delay settings may be extended to 50 ms. There is controlled blending of left/right front channel information into the left/right back channel outputs to provide an increased sense of spaciousness from stereo soundtracks with little or no encoded surround information. The 70MM mode increases the excitement level of Dolby Surround encoded soundtracks.

### **35MM MOTION PICTURE**

This mode provides improved performance over Dolby Pro Logic. The mode features higher speed steering logic and a more extended frequency response on the surround channels. Audio signal delay settings may be extended to 50 ms.

### **DOLBY PRO LOGIC**

This is the consumer version of the system used in theatres to decode four channels of sound from the film's optical soundtrack and provides performance identical to that of theatrical Dolby decoders. The proprietary harman/kardon discrete circuit topology used within the AVP1A delivers Pro Logic decoding with superb sonic quality. Audio signal delay settings range from 15 to 30 ms in 5 ms increments.

**MONO ENHANCE:** This mode generates a synthesized surround field from a monaural source. A pleasing, spatial effect can be derived from older music recordings, mono TV broadcasts, or movies mixed in mono. The Panorama control is operative in Mono Enhance.

**BYPASS:** The Bypass mode allows the listener to electronically remove the AVP1A surround processing circuits from the audio signal path. Only the left and right front speakers and subwoofers remain functional. A single buffered gain stage with remote control of volume remains in the signal path.

## Lucasfilm Home THX Cinema

Lucasfilm Home THX Cinema incorporates Dolby Pro Logic surround decoding along with additional audio enhancements.

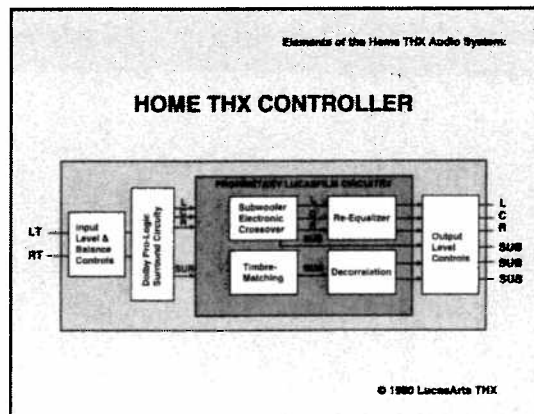
**RE-EQUALIZATION:** Re-Equalization is necessary to compensate for the fact that the soundtracks in films often sound "bright" in a home environment. This results from a combination of the way we perceive sound in large auditoriums vs. small rooms and the theatre equalization which has become standardized throughout the movie industry. The Re-Equalization circuitry compensates precisely for these differences, restoring the sound to its natural balance and minimizing listening fatigue by reducing harshness in the high frequencies.

**DE-CORRELATION:** The AVP1A incorporates a proprietary de-correlation circuit which alters the phase/time relationships between surround channels to diffuse the perceived sound. This eliminates the mono effect in the surround channels and helps to restore the enveloping characteristic that is a system design goal.

**TIMBRE-MATCHING:** The timbre or tonal balance of sound changes depending on whether it comes from in front of you or from the sides. This has to do with the shape of the outer ear. This is especially noticeable when the director pans a sound from the front channels into the surround channel. The character of the sound changes as the effect moves from the front to the surrounds, even when the speakers are perfectly matched. This may reduce the realism of the effect.

Fortunately, this characteristic can be compensated for by use of very specific and proprietary equalization applied to the surround channels only. Timbre-matching circuitry is included in the AVP1A.

**BI-AMPLIFICATION:** This technique of separately powering the main speakers and subwoofer(s) dramatically reduces distortion while expanding the useful dynamic range of the system. System distortion is substantially reduced. In addition, bi-amplification enables the front speakers to be significantly reduced in size without any penalty in performance, allowing them to be more easily placed for the best imaging. The AVP1A includes a specific low frequency, steep-slope electronic crossover specifically designed to match the requirements of Home THX speakers.



## Planning Your Home Surround Audio System

Home surround systems are primarily intended for use with video. The AVP1A, however, has been especially designed to work equally well with both non-encoded sources (CDs, cassettes, broadcast television and records) as well as surround-encoded video sources (motion pictures and broadcast television).

You can use existing equipment to begin building a complete Home THX Audio System. Although it will not be a full-fledged THX Audio System until it is complete, the incremental improvements will be clearly heard as each step is taken toward the goal.

You should start with the AVP1A THX controller and upgrade the system a step at a time by adding either THX dipolar surround speakers or the front speakers with a subwoofer.

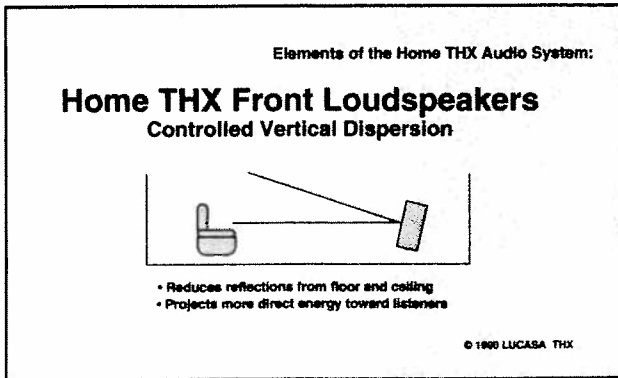
**PLEASE NOTE:** The THX specification includes an electronic crossover for the front speaker system. If you are using THX speakers without the AVP1A, or other THX controller, some provision must be made for an appropriate crossover between the subwoofer(s) and the front speakers.

The list of equipment needed for a complete harman/kardon Home THX Audio System installation is straightforward.

- A AVP1A THX controller.
- At least seven channels of amplification.
- Identical THX left, center and right front speakers with appropriate stands or mounting brackets to facilitate aiming them directly at the primary listening area.
- One or more THX subwoofers (depending on room size) designed for use with the THX front speakers.
- A pair of THX dipolar surround speakers with appropriate stands, or attached mounting brackets to position them at least two feet above ear level when seated.
- Assorted interconnecting cables and speaker wires.

### Position of components: Electronics

- Keep noisy components away.
- Hide distracting indicators (LEDs).
- Consider IR receiver by the screen.
- Provide cooling for power amps.
- Aim for short speakers cables (unless in high RF fields where low levels might pick up noise).



A home theater also requires a large screen television and the best possible video sources. The best A/V sources are laserdisc or home satellite followed by off-the-air television, cable or VHS HiFi.

A 31"-35" direct-view television may be appropriate in smaller rooms but cannot impart the theatrical experience of having your field of vision dominated by the size of the image on the screen. Attaining this effect with a 35" television requires sitting uncomfortably close to the screen.

### ELECTRONICS PLACEMENT

- Cabinets should be used to conceal equipment which must be placed near the screen. The lights and visual displays on the equipment should not distract the viewer.
- Ample ventilation must be provided, preferably through convection, to avoid fan noise.

### VIDEO VIEWING REQUIREMENTS

- The primary seating areas should be centered in front of the picture.
- NTSC video looks best at a seating distance from 3-5 times the width of the screen for maximum perceived clarity, however, you may choose to sit as little as 2.5 times the screen width to achieve maximum visual impact and involvement.
- Ambient light should be minimized to maximize video contrast performance particularly with projection video display systems.
- The main front speakers should flank the screen and be placed with reasonable symmetry with respect to adjacent walls.
- The screen should be well away from side walls. The front speakers have broad horizontal dispersion and it is best to minimize side wall reflections.

### SPEAKER PLACEMENT

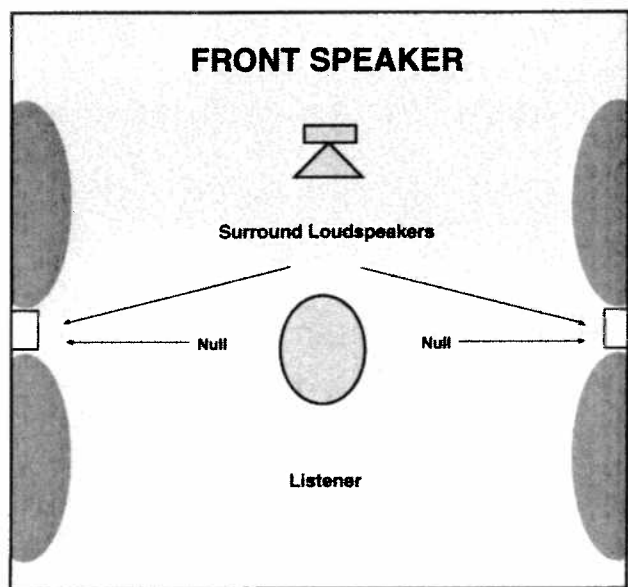
The AVP1A may be used with conventional, high quality speaker systems or with Home THX - certified loudspeaker systems. There are some general installation guidelines that apply to both types of systems in terms of achieving optimum performance.

- Select speakers designed to meet your system requirements. Don't, for example, flush-mount a book shelf speaker designed for different mounting applications. If the room is quite large, you may require two or more subwoofers to achieve optimum performance. Acoustically dead rooms may require higher efficiency speakers to achieve louder sound levels.

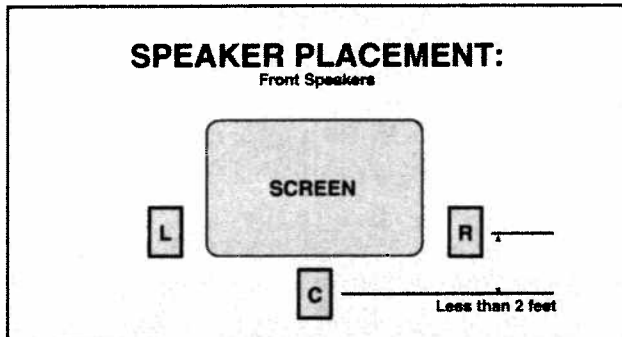
If you have questions regarding the proper installation of your speakers consult your dealer or the manufacturer.

### MAIN LEFT, (CENTER, RIGHT SPEAKERS (LCR)

- The Left and Right front (L/R) speakers should be placed close to the edges of the screen to eliminate the disorientation which results when sounds appear to occur well away from their visual on-screen location. Some allowance must be made for those installations involving screens smaller than five or six feet measured diagonally. Placing the speakers immediately beside a small screen usually reduces stereo separation to unacceptable levels. Some experimentation may be in order, but as a rule of thumb, try to place the L/R front speakers no more than 18" to 24" inches from the sides of the screen.



- Try to avoid placing the L / R front speakers too close to side walls or room corners. They should usually be placed no closer than 18" to 24" from corners and side walls. Conventional speakers should be-toed in slightly towards the seating areas. THX certified speakers will usually require no toe in, however some toe-in will assure even lateral coverage of the seating area and reduced sidewall reflections.



- THX LCR speakers are designed to be used vertically only. If they must be either above or below the screen they must be properly aimed towards the listener. Proper aiming is critical because THX speakers are intentionally quite directional in the vertical plane to focus sound energy.
- The Center speaker should be directly above or below the screen. When possible, try to keep the center speaker tweeters as close to the level of the tweeters in the L/R speakers, (no more than a two foot difference) so that lateral audio pans do not create noticeable changes in vertical localization.
- Placing the LCR speakers below the screen is preferable since aiming them upward maximizes the useable listening area. Placing the Center speaker directly in front of a television is fine as long as it does not obscure any portion of the screen, provided it is magnetically shielded. All THX LCR speakers are magnetically shielded.

### SUBWOOFER PLACEMENT

- Subwoofers do not have to be placed extremely close to the front channel speakers but placement will affect the low bass.

- Leave yourself some leeway during final installation for minor movements to minimize room modes. Corner placement will yield the most deep bass, but this excites the maximum number of standing waves resulting in uneven frequency response. Use of multiple subwoofers will increase bass output and allows one subwoofer to smooth irregularities created by room modes. Placement near a video projector is acceptable since all THX subwoofers are magnetically shielded.

### SURROUND SPEAKER PLACEMENT

- THX - certified surround speakers should be located to the sides of the listeners instead of behind them. If the viewing area is more than one row deep, place the surround halfway back within the area. If architectural constraints prevent ideal placement of the surrounds it is generally best to err on the side of being further to the rear of the room.
- The surround speakers should be located at least two feet above the listener for the best results. And they should be located at equal heights for uniform frequency response. Placement close to the ceiling will result in slightly more mid-bass performance. Try to place them so the null is aimed towards the seating area.
- THX dipolar surround speakers should be placed so the positive polarity side of the speaker faces towards the front of the room.
- Conventional surround speakers should be placed behind the listening area and should also be placed mid wall level or higher.

A more focused surround sound effect will result by aiming the speakers towards your listening area. If you prefer a more diffuse surround sound effect, then aim the speakers across the back of the listening area. The THX de-correlation circuitry within the AVP1A will help to create the proper effect for motion picture listening but will be automatically defeated in other surround modes designed for listening to non-encoded music sources.

## Remote Control Functions

All major operating functions of the AVP1A can be accessed from the hand held remote control. A diagram and operating functions are described below. The hand held remote transmitter has an effective range of approximately 35 feet. If you experience reduced range or erratic performance replace the batteries inside the hand held remote control. If the AVP1A is installed behind your seating area or in an enclosed location, you may wish to consider the use of a remote infra-red sensor. Contact your retail dealer for additional assistance.

**BACK LEVEL:** Raises or lowers the surround channel level.

**REF:** Restores system to preset reference level.

**PANORAMA:** Widens or narrows the stereo stage. Panorama is not operative in Pro Logic or THX Home Cinema mode.

The CTR button below the PAN button turns off Panorama.

**AV INPUTS.** AV1, 2, VCR, LD, CD, AUX, provide direct access to any AV source.

**DELAY:** Adjusts the Time Link setting from 15 to 30 ms in Pro Logic and Home THX Cinema with additional options in music, 70mm wide and 70mm modes.

**SURROUND PARAMETERS:** Selects various modes for music and movies.

**SIB:**(Sibilant filter) This filter reduces center channel dialog leakage in the surround channel.

**RE-EQ:** This filter is automatically engaged in the Home THX Cinema mode. It can also be disengaged, if desired, in the Home THX Cinema mode or engaged in other surround modes.

**MASTER VOLUME:** These buttons raise or lower the total system volume.

**CTR ON:** This button turns the center channel on or off.

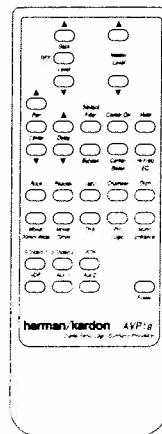
**MUTE:** This button turns the audio output on or off.

**CTR BOOST:** This button raises the center speaker level by 3 dB.

**BYPASS:** This mode bypasses all processing except the electronic crossover, if used. The master volume control remains operative.

**POWER:** This button turns the AVP1A inputs/outputs on or off. Some digital section power supplies remain operative.

**INPUT CALIBRATE:** The auto button selects the automatic balance circuit. The left/right buttons allow manual adjustment of input audio signals.





## Installing Your AVP1A

For convenience of operation, we suggest that you run all your main audio and video sources through the AVP1A. Four inputs (including the tape monitor input) accept audio and composite video sources while the remaining two accept audio and S-type (Y/C) video from S-VHS, S-Beta, and some laser video players and satellite receivers.

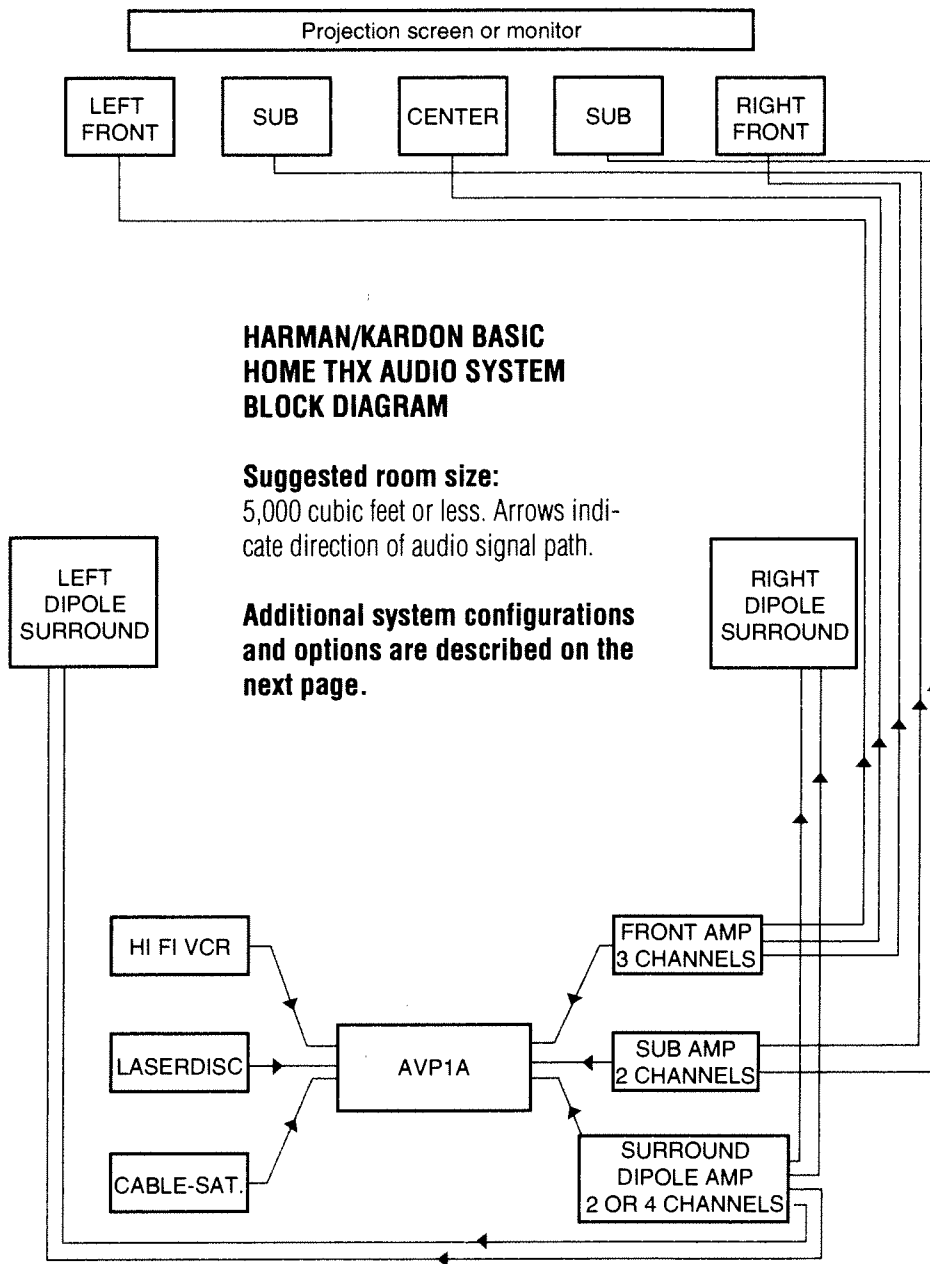
The AVP1A does not transcode the video signals. Composite video will only appear on the composite video outputs (monitor and record). Likewise, S-type signals will only appear on the S-type outputs.

The AVP1A can become the heart of a home entertainment environment. Every type of consumer audio source can be used with the AVP1A except a turntable. If you wish to use a turntable/cartridge with the AVP1A, you will require a pre-amplifier or stereo receiver to provide proper pre-amplification and RIAA equalization for the magnetic phono cartridge. The main output or tape record output from the preamp or receiver should be connected to one of the six audio input on the AVP1A.

The main audio outputs of the AVP1A are designed for use with either THX - certified or conventional speakers. The electronic crossover switch (on the back panel) must be engaged when using THX (certified speakers, separate subwoofer and LCR speakers).

If you have a small room and are only using one subwoofer, use the Mono Sub output.

If you are using a single pair of conventional surround speakers or THX dipolar surround speakers, use the LB (left back) and RB (right back) outputs. You will have to reverse the polarity of the surround speakers with that of the front speakers!



## AVP1A Front Panel Display

The display system used on the AVP1A uses a combination of light emitting diodes (LED) and liquid crystal display (LCD) with a wide viewing angle.

**PRIMARY FUNCTIONS.** Surround operating modes, volume settings, time delay settings, and panorama settings, are displayed on the liquid crystal panel. The selected surround operating mode is always displayed. Changes in volume (front or back channels), time delay settings, and panorama settings, are momentarily displayed (about ten seconds) on the second line of the liquid crystal display.

**INPUT LEVEL.** The input gain control on the front panel is adjusted to illuminate the Input Calibrate display to 0 dB. Then, the channel output trim controls on the back of the AVP1A are individually adjusted to to achieve proper output levels with sufficient headroom and freedom from amplifier or speaker overload.

**OUTPUT VOLUME.** Volume settings have a range from -80 to + 15. These settings do not necessarily relate to dB equivalents. Normally, the output volume level is set to the 0 REF setting when playing reference "0 dB" level signals from videodiscs and VHS HiFi video cassettes.

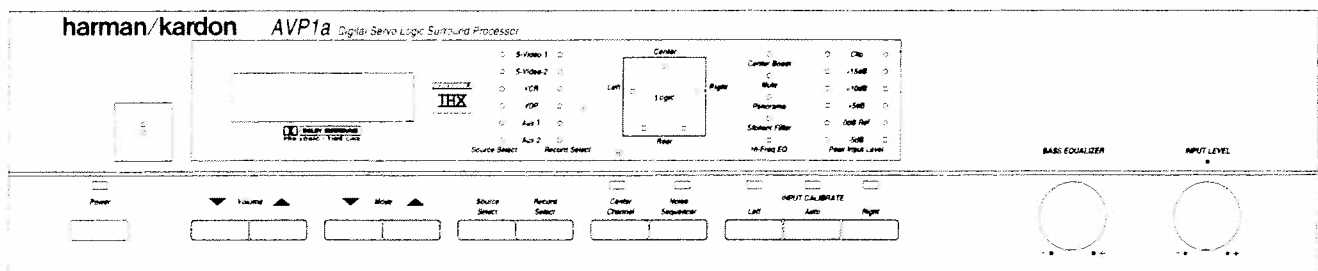
**AUDIO SIGNAL DELAY.** Delay settings can be adjusted from 15 to 30 ms in the Pro Logic or THX Cinema modes,

up to 50 ms in 70mm Movie and 35 mm Movie surround modes, and up to 80 ms in some music modes. Changes in audio signal delay settings are automatically retained in the memory of the AVP1A.

**PANORAMA.** Panorama settings may be adjusted from - 50 to + 50 and will vary to taste depending on the individual recording. Panorama cannot be engaged in the Pro Logic or THX Cinema modes. Panorama settings cannot be stored because they are also program source dependent.

**SECONDARY FUNCTIONS.** These include: Center Channel On or Off, Sibilant and Re-Equalization (Re-Eq) Filters, Mute, Source, Record Select, Center Front Boost, are displayed by LEDs behind the front panel window. The status of functions including Center Front On/Off, Noise Sequencer, Input Balance, are displayed by LEDs directly above the button which turns the function on or off.

The Re-Eq and Center Front Channel On functions may be selected in all music modes. Center front channel is Off when Chamber or Orchestra surround modes are selected but it can be engaged, if desired. Re-Eq is only selected automatically in the THX Cinema mode but it may be disengaged in the THX Cinema mode or engaged in other modes. Because the need of Re-Eq in non-THX modes is program source dependent, it cannot be stored in other modes.



## Set-up & Calibration

### TESTING FOR PROPER SPEAKER POLARITY

Proper polarity throughout the system is required before level calibration can be established. Wiring the loudspeakers in proper polarity is essential for precise localization of images and bass response - both important goals of the Home THX Audio system. Achieving proper polarity is made more complicated if amplifiers of different types are used in the system. Some amplifier designs invert the polarity of their output relative to the input signal. Speakers attached to these amplifiers must have their polarity inverted again to get it back where it belongs. Some speaker models, such as certain JBL models, use inverted polarity inputs (the Red terminal is negative while the Black terminal is positive).

The best way to ensure proper polarity in any home audio system is to compare each speaker to a single speaker which is used as the reference for the system. We will use the Left front speaker as the reference in our example. Check the wiring color code on both the amplifier and speaker jacks to verify correct polarity.

**L-R POLARITY:** Check Left-Right polarity by listening to both speakers in the stereo bypass or center speaker off mode. Listen for a solid center image. If in doubt, reverse the leads on the Right speaker only and compare the results. Speakers with mis-matched polarity will have a poorly-defined image smeared all over their end of the room. Some listeners will even feel strange pressure sensations in their ears! If you have any doubt, try using the pink noise on Chapter 6 of WOW! - this should make the difference extremely clear.

**L-C POLARITY:** Check Left-Center polarity in the Home THX Cinema mode by feeding mono program material (dialog, or Chapter 6 of WOW!) and setting the input balance to the left so as to get equal sound pressure levels out of both the left and center speakers. Again, listen for a solid image between the left and center speakers

**RELATIVE SUBWOOFER POLARITY-** If multiple subwoofers are used, it is important to have their polarity with regard to each other correct. Reverse the polarity of one of the two subwoofers while program material with deep bass is playing (being careful not to momentarily short the two speakers leads to one another). The pink noise on Chapter 6 of WOW! can be used as a constant source of bass energy by shutting off all speakers except the subwoofers. You will immediately notice either a loss or an increase in bass. The correct polarity is the one which exhibits the most bass.

**ABSOLUTE SUBWOOFER POLARITY:** It is also important for both subwoofers to have the correct polarity with regard to the rest of the system. Now that the LCR speakers are all matched, play some program material (or Chapter 6 of WOW!) with significant energy around 80 Hz. Reverse the polarity of all subwoofers in the system and listen again. The polarity with the greatest bass output in this vital region is correct. (A third-octave warble tone centered on 80 Hz is ideal for this test and is available on some test compact discs.)

**SURROUND POLARITY:** Using the Pro Logic mode (not the THX mode), stand by the screen and face the surround speakers. With strong surround program materials (such as Chapter 11 on WOW!), you should hear a solid center image between the surround speakers and your standing position.

**ADDITIONAL HINT:** After system polarity checks are completed, use the internal noise generator in the AVP1A to verify proper hookup. The burst of noise should start at left front and move clockwise around the room. The Noise Sequence switch on the rear panel of the AVP1A should be set to turn off the L and R Side outputs.

Note: If dual-drive surrounds are used it is very important that you observe proper polarity.

Read the instructions packaged with the dipoles for additional installation and hookup or if you are only going to use the dipoles with a single stereo amplifier.

### **INPUT LEVEL CALIBRATION**

It is necessary to adjust the input level of sources in order to get the best results from your AVP1A. This adjustment yields the best dynamic range from the surround decoder circuitry, preventing overload distortion or excessive background hiss. Correct calibration also ensures accurate tracking of the steering logic and the modified Dolby B noise reduction system in the Dolby Pro Logic circuitry.

A test tone (Chapter 5 on WOW!) can be used in conjunction with the front panel LED level display to calibrate the system. Feed in the test tone and adjust the input level so that the 0 dB LED just reaches full intensity. Under normal operating conditions, the red LED should never do more than flicker occasionally (which indicates input overload).

If no test tone is available, you can still calibrate the system with reasonable accuracy by turning up the input level control until the 0 dB LED glows brightly during medium level passages in movies, but not high enough to illuminate the red LED. Movies are duplicated at slightly different audio levels, so you may need to touch up this adjustment occasionally. You may expect a 1 to 3 dB variation among various film transfers.

### **AUTO BALANCE / INPUT BALANCE**

The Automatic Input Balance circuit corrects improperly bal-

anced software, which tends to pull the dialog off center. These channel errors occur in the multiple copying stages between the original master and your source. In most cases the autobalance circuitry within your AVP1A will provide extremely accurate correction. Occasionally, some software may have errors beyond the correction ability of the internal circuitry. To manually correct for such imbalances, press the left or right button located on the right side of the front panel of the AVP1A to turn off the autobalance circuit. You may also perform these same functions from the remote control. With the Center output on but with the Center Speaker amplifier turned off, push the left or right channel button to minimize leakage of center channel dialog to left or right speakers. The liquid crystal display will indicate the amount of level change. Turn the center channel amplifier back on to restore normal system operation. When you wish to restore Autobalance operation, push the AUTO button (located between the left and right buttons) to disengage manual balance.

### **OUTPUT LEVEL CALIBRATION**

The AVP1A provides individual channel output level controls. These allow you to compensate for differences in amplifier and speaker sensitivities and for placement variations from installation to installation. These set-and-forget adjustments are essential for reproducing proper soundstaging and image localization. These controls are located on the rear panel of the AVP1A just above the audio output jacks.

The output levels are adjusted after completing the input level adjustments. Once input/output level calibration is completed, system volume changes are made using the up/down buttons on the infrared remote control.

The best way to adjust the output level controls is by using a dB Sound Pressure Level (SPL) meter in conjunction with the internal bandwidth-limited pink noise generator in the AVP1A. The goal is to set the volume at the primary listening position to read 85 dB SPL (C-weighted low mode) from each speaker in sequence, using the individual output level controls. You should use the meter pointing straight up towards the ceiling.

The "average" setting of the individual output level controls should be ideally near the midrange of their rotation. The simplest way to achieve this is to set the Master Volume at 0 REF on the liquid crystal display and then adjust each individual channel output trim control (located on the rear panel) until a 85 dB SPL is achieved. The Master 0 REF setting becomes the calibrated playback setting for any software which has been dubbed carefully, with proper attention to soundtrack levels. Some adjustments to the input level and input balance controls may be required to compensate for soundtracks with different levels and channel balance.

In the absence of a dB SPL meter, it is possible to set the output level controls by ear. Use the built-in test noise generator in the AVP1A 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-THX-certified loudspeakers may make this more difficult to judge, due to variations in spectral balance between the various speakers—especially mismatched left/right and center speakers. Simply get as close

as you can! The system should then be reasonably well balanced, although of course it is not actually calibrated for precise playback levels.

### ADJUSTING THE DOLBY TIME LINK<sup>(tm)</sup> DIGITAL AUDIO SIGNAL DELAY SYSTEM

All Dolby Pro Logic decoders incorporate an audio signal delay to the rear speakers. The AVP1A incorporates two high-performance, discrete-circuit channels of Dolby Time Link.

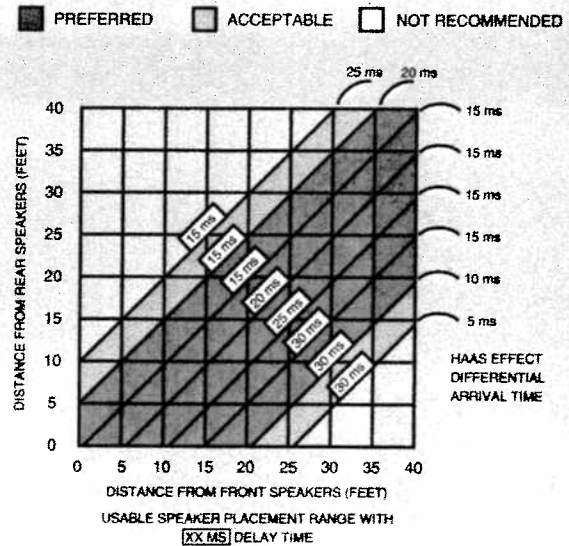
The Dolby Pro Logic process occasionally yields erroneous leakage of front channel sounds to the rear. Time Link, a digital signal delay circuit, is used to reduce the perceived level of leakage because of the "Hass" or precedence effect. When the front channel information leaks into the surround speakers, we end up hearing this leakage out of the surround speakers following the arrival (at our ears) of the front channel information

Time Link allows the sound coming from the front speakers to reach the viewer before the arrival of sound from the surround speakers.

The optimum Time Link setting depends on the distance between the main seating area and the front speakers, and the distance between the main seating area and surround speakers.

Refer to the graph for choosing the best setting in any given situation - measure the two distances and look to where they meet on the graph. The shaded areas will indicate the best setting for the delay.

If in doubt, simply set Time Link for 20 ms of delay. The setting will be stored in the memory of the AVP1A until you change it. You may also use Time Link to enhance and align arrival times of certain music surround modes available in the AVP1A. The audio signal delay settings can be stored for each applicable music or movie mode independently of the Pro Logic or Home THX Cinema modes.



## AVP1A User Features

The AVP1A incorporates a number of operational features which have been designed to enhance the performance and versatility of your home surround audio system. An explanation of the features and their uses follows each feature listing.

**VARIABLE BASS EQUALIZATION:** This rotary control located to the left of the input gain control, allows boost of bass frequencies to compensate for the bass rolloff of most full range loudspeakers in the 30 to 70 Hz range. The total amount of boost available is + 17 dB over a relatively narrow range to avoid adding "chestiness" to the sound of voices. Normally, only a small amount of boost should be used to avoid overloading both the power amplifier and the speaker. Bass EQ is only available on the front subwoofer outputs and the main left and right front channels (when the THX electronic crossover is disengaged).

The full counterclockwise setting is off. Clockwise rotation introduces boost. As boost is turned up, the center point of the boost range is moved up. As an example, a positioning between the 8 and 9 o'clock setting on the control may deliver maximum boost about 35-40 Hz while a 12 o'clock setting will move the area of maximum boost up to about 50-60 Hz. If you are using THX-certified subwoofers, or other high quality subwoofer systems, little, if any, boost will be required once proper output levels are established.

**SIBILANT FILTER:** This function accessible via the remote control, engages special circuitry which minimizes crosstalk in the surround channels caused by speech sibilants but without causing loss of high frequency detail. An indicator light on the front panel indicates when the sibilant filter is engaged. Use the sibilant filter whenever you hear sibilant sounds from dialog present in the surround channel.

**RE-EQUALIZATION CURVE:** This circuit is a part of the AVP1A Home THX control system but is sometimes useful with other program sources. It can be manually switched in when using other surround parameters besides Home THX Cinema. When Home THX Cinema is selected the Re-Equalization filter is automatically engaged. An indicator light on the front panel indicates when the Re-Equalization filter is engaged.

A motion picture sound track may sound "bright" in the home because the original equalization curve was designed for far-field listening and for special equalization that is standardized in the film industry. The Re-Equalization circuitry compensates for those differences and restores normal spectral balance for the near-field listening environment of the home.

**THX ELECTRONIC CROSSOVER:** The AVP1A has a built-in electronic crossover especially designed for use with Home THX -certified loudspeaker systems. It may also offer excellent results with other subwoofer/satellite speaker systems. Consult with the manufacturer of the speaker system. The crossover frequency of the electronic crossover is centered at 80 Hz. A switch on the rear panel of the AVP1A engages the crossover. When disengaged, the left and right front channel audio outputs operate full range but the subwoofer outputs still remain active.

**SURROUND ELECTRONIC CROSSOVER:** Some listeners may prefer some bass extension in the surround channel particularly with some music surround settings. The main surround outputs have a rolloff below 80 Hz at 12 dB/octave. A mono subwoofer surround output is provided. A small woofer (8" to 10") with a response to 40-50 Hz may be desirable for use in some environments. A switch on the rear

panel of the AVP1A, adjacent to the front channel crossover, switches the surround electronic crossover in and out. When using Home THX - certified dipolar surround speakers, be sure the electronic crossover is engaged, even if you aren't using a subwoofer. This will prevent overload of the dipolar surround speaker by audio frequencies below 80 Hz. An output level trim control for the surround subwoofer is located on the rear panel.

**TEST NOISE GENERATOR:**The built-in noise generator sequences bandwidth-limited pink noise around the room to each speaker location. The duration of the noise burst is limited to two seconds in the Dolby Pro Logic and Home THX Cinema modes. The duration is extended to approximately four seconds in the other surround modes.

The trim controls, which can be adjusted by hand without the need for special tools, are located on the rear panel of the AVP1A.

A switch on the rear panel (next to the electronic crossover switches) eliminates the noise burst to the side channel/front dipole driver outputs for use with a single pair of point source-type surround speakers, or when using THX dipolar surround speakers.

**PANORAMA:** This feature, accessible via the remote, adjusts the width of the stereo stage. Some recordings may not have enough stereo separation, and may sound monophonic. Other recordings may have too much separation and sound exaggerated. Adjusting the panorama circuit to widen or narrow the stereo stage will correct most recordings. When the panorama button on the remote control is engaged the liquid crystal display will provide an indication of the amount of correction.

**MUTE:** This function totally mutes the output of the AVP1A.

**CTR BOOST:** This function, accessible via the remote, increases the output level of the center front channel by 3 dB. Pushing the CTR Boost button a second time restores center front level to normal. CTR boost may be required when listening to some film tracks with non-THX speakers.

**STEERING LOGIC DISPLAY:** This five point display provides a visual indication of steering activity. As an example, a center front signal, such as dialog, will illuminate the center LED while surround encoded signals will illuminate the bottom LED. During use with a stereo signal the entire array will constantly change illumination levels on a dynamic basis. A monophonic audio source will only illuminate the center LED. Because of the wide dynamic range of Digital Servo Logic(tm), when no audio signal is present, the LED indicators may differ in illumination as a result of normal production variations and the varying noise floors of audio sources in the system.

**SOURCES:** The various audio-video sources are directly selected from the remote control. Source up/down select buttons are provided on the front panel of the AVP1A which allow selection in the event of loss of the remote control.

**RECORD SELECT:** This function, available only from the front panel of the AVP1A, selects the A/V source for recording purposes or to be viewed at a secondary location. The record output stereo audio is unprocessed. Composite video is not transcoded to S-type video or vice-versa.

**REMOTE INFRARED SENSOR JACK** This miniature input jack, located on the rear panel, accepts inputs from a remote infrared transmitter/sensor or remote key pad. It is provided for custom installation applications. Consult your dealer or harman/kardon for additional application information.

**ACCESSORY CONTROL OUTPUT:** This five-pin standard DIN jack located on the right bottom corner of the AVP1A can provide trigger signals for an outboard electrical control box to turn on the system electronics, lower or raise a projection screen, dim or raise room lighting, etc. Consult your dealer or harman/kardon for additional application information.

**DISPLAY CONTRAST CONTROL:** This manual rotary control is located on the underside of the left side of the front panel. The relative contrast of the liquid crystal display can be changed with this control.



## Fine Tuning Your Audio Systems

The procedures outlined in the previous sections should allow proper performance of your system. There are several things you can do to "tweak" the installation even further.

In many cases, the concepts contained in this section are not necessary to achieve the kind of impact the AVP1A and a Home THX Audio System can provide. The following ideas and suggestions are for the most demanding installations, or when the room itself presents a special challenge.

### **ACOUSTICAL PROBLEMS IN LISTENING ROOMS**

The Home THX Audio System addresses many of the problems common to high quality reproduction of music or soundtracks in a home environment. For example, the dispersion pattern of the front LCR speakers minimizes the effects of floor and ceiling reflections. Still, there are many variables which are beyond the control of a manufacturer. Room reflections create spurious false images and "comb filter" interference effects which alter the tonality of the system while degrading the localization of specific sounds. Larger rooms sustain echoes which degrade dialog intelligibility and detail. All rooms have standing waves which emphasize certain frequencies at the expense of others, based on the dimensions of the room.

Other concerns include environmental noise, which is often greater than people realize. Although they might become accustomed to its presence and "tune it out," it still reduces the perceived low-level resolution of the system. In addition, the profound bass capabilities of a Home THX Audio System can create distracting rattles which lesser systems might never evoke.

It can be tempting to try to solve all of these problems with the indiscriminate use of sound-absorbing products, but even this technique has its pitfalls.

All of these common acoustical problems will be addressed in this section. Once again, these techniques are not necessary for a successful Home THX Audio System installation. Rather, they are provided to solve occasional problems and to provide further enhancement possibilities.

### **ROOM REFLECTIONS**

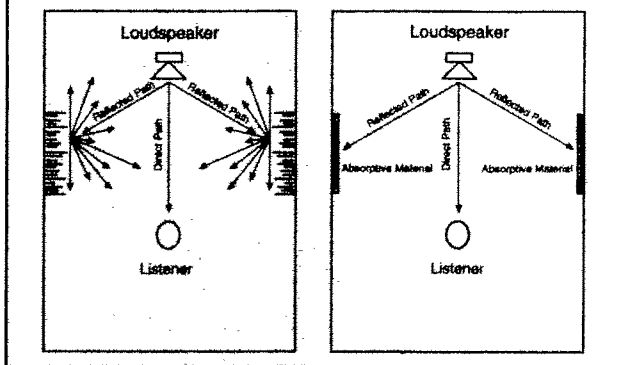
The most troublesome room reflections are usually the first reflections of the LCR speakers off the floor, ceiling and side walls. These reflections reach the listeners ears delayed with respect to direct sounds and blur the perceived image. They can also degrade dialog intelligibility, through the same mechanisms.

The design of the THX LCR speakers minimizes the floor and ceiling reflections. As an extra enhancement, it is often a good idea to place a thick, absorptive carpet between the front speakers and the listening position, just to further reduce this primary reflection from floors with hard surfaces. A rug made from wool will have more uniform absorption characteristics than one made from synthetic fibers.

The THX LCR speakers have broad dispersion in the horizontal plane in order to ensure a wide usable listening area. This design choice can induce reflections off of the side walls, especially in installations where they are relatively close to the front speakers. These reflections can be reduced simply by angling the left and right speakers inward somewhat.

If giving the speakers some "toe-in" is not enough, the next step is the strategic placement of absorptive materials on the side walls. These range from commercially available fiberglass and dense foam to heavy draperies and even large, overstuffed furniture. The optimal position for these materials can be found with a small hand mirror and an assistant. Sit at the primary listening position and have the assistant slowly

## SOLUTIONS TO ROOM REFLECTIONS: DIFFUSION AND ABSORPTION



slide the mirror along the wall. When you can see any of the front speakers reflected in the mirror, mark the wall at the mirror for later placement of absorptive material.

A variation of this method is especially helpful in rooms which are already fairly "dead" acoustically. Rather than using absorptive material in homes like these, try using diffusion instead. Commercially built diffusers are available but large bookcases and irregularly shaped furniture will also serve the same purpose. They reflect sounds in a highly randomized way which effectively "scatters" the sound in all directions. Place the diffuser where you would otherwise place the absorptive material (using the "mirror trick"), to break up the first early reflections and scatter them randomly throughout the room.

Commercially available fiberglass, foam and diffusion panels may not be aesthetically acceptable in many installations, particularly when the home theatre room serves multiple purposes. All of these materials can be covered with acoustically-transparent cloth for design considerations. It is important that the cloth be acoustically transparent, however, or else the effectiveness of the absorptive material will be greatly reduced. The simplest test for this is to hold a large sample of the cloth in front of a speaker playing the pink noise found in Chapter 6 of the WOW! laserdisc. If you can move the cloth in front of the speaker without hearing a difference, you are all set.

Large expanses of glass can be challenging. They reflect mid and high audio frequencies but often pass bass energy through almost as though they didn't exist. The result is a

characteristically bright, rough sound which can be difficult to correct electronically. The best treatment is generally the heaviest insulated drapes which can be found. (Incidentally, these serve double duty, controlling light which might otherwise fall on the screen.)

The materials just discussed here are ineffective at lower frequencies. See the discussion on Standing Waves for more information about treating environments with low frequency response problems.

### EXCESSIVE USE OF ABSORPTIVE MATERIALS

People are sometimes tempted to go overboard with absorptive material once they discover how powerful its use can be. While the ideal home theatre should be considerably "deader" acoustically than a typical living room, it still needs some reflectivity and diffusion. In particular, the surround speakers depend on non-absorptive surfaces for their operation, since they radiate virtually no sound directly at the listeners.

The best arrangement of the absorptive and non-absorptive surfaces in the room can be seen in the diagram below. Most of the room surfaces are relatively absorptive, with the notable exception of the rear wall and the highest portions of the other walls, which should be diffusive.

### "SLAP" ECHOES

"Slap" echoes are common in rooms which have parallel walls with little or no absorption or diffusion. Sounds tend to bounce back and forth between the parallel wall many times before they die out, causing a characteristic bright, "zingy" sound and interfering with the intended tonal balance and acoustic nature of the soundtrack.

Walk slowly through the room, clapping your hands. No clear reflections should be heard at any point in the room—especially not near the primary seating area. Listen for a "flutter echo" of the hand clap (a rapidly-repeating percussive sound, indicative of the sound bouncing between two parallel walls) Again, the best home theatres are fairly "dead" acoustically. This allows the program material and the playback system to create the environment, rather than having the room's native acoustic signature color everything. You can also use the hand claps in chapters 17 and 18 of WOW!

The solution for slap echoes is usually a combination of absorption and diffusion. Specifically, placing absorptive material behind the front speakers (heavy drapes, fiberglass, dense foam) and diffusion in the rear of the room (bookcases, irregularly-shaped furniture, etc.) will deliver the greatest benefits. This will effectively suppress the slap echoes while at the same time providing a diffusive surface in the rear for the surround speakers. This enhances the enveloping characteristic of the surrounds even further.

In those relatively rare cases where you have the luxury of building the home theatre room from scratch, consider using non-parallel surfaces in the construction of the room. A difference of as little as  $6^\circ$  will break up the slap echoes very effectively. For example, "flaring" the side walls out from the front by approximately  $6^\circ$  and having the ceiling rise toward the rear of the room at a comparable rate will dramatically improve the room's acoustics, if the wall design is solid and the angles are clearly intentional from the outset.

## RATTLES

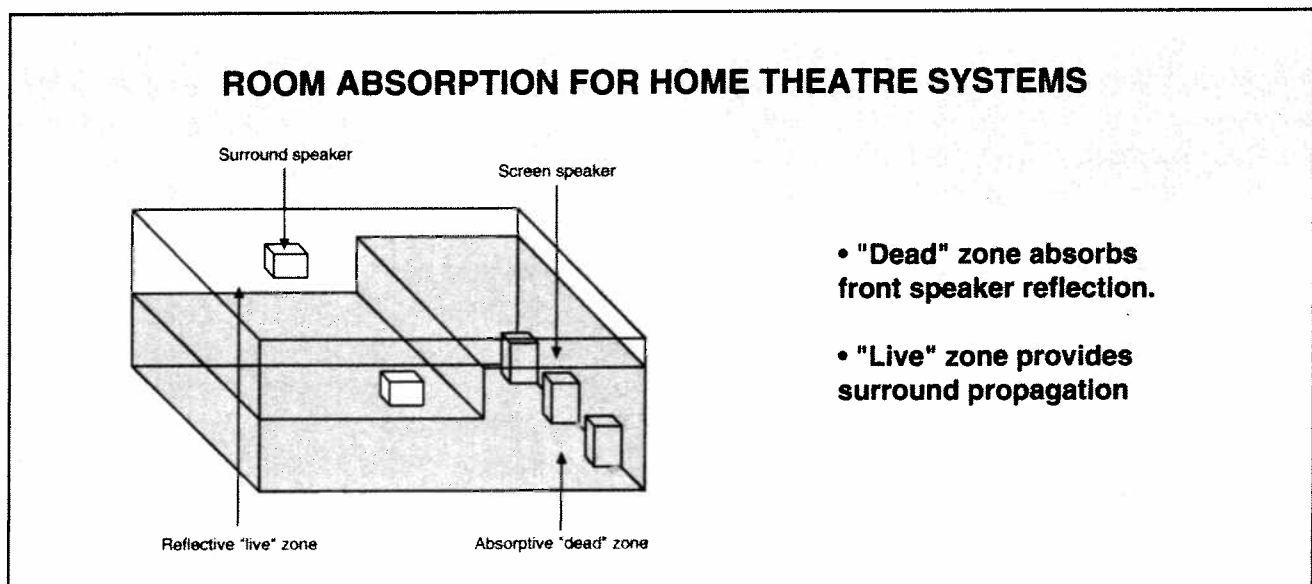
Rattles in the room are structural resonances (as opposed to standing waves, which are airborne resonances) which the system may stimulate due to its broad frequency response and wide dynamic range. They are particularly prominent for sounds in the lower frequencies, and can sound like distortion. Sources of rattles include: furniture, loose window frames, walls, lighting, fixtures, ventilation

systems, and even knick-knacks on various shelves around the room. The simplest way of identifying these rattles is by using the Rattle Test found on WOW! (Chapter 16). This is an extremely slow low frequency sweep from 20 Hz to 500 Hz, recorded at reference level. 10dB of output level increase over standard level might be necessary to allow hearing all the room rattles. Be careful with this test, as it is also a severe test of associated amplifiers and speakers.

As the sweep makes its way up the frequency range, you will probably find a surprising number of rattles in your room. All of these rattles will occur at one time or another during music or movies, but are usually perceived as background noise or distortion in the system.

Once identified, eliminating the rattles is usually straightforward. As an example, small pieces of felt can be affixed to the back of a painting (in the bottom corners) to prevent audible rattles against the wall. Likewise, strips of felt can be wedged into a loose window rattling in its frame. Recessed lighting fixtures can be tightened up. A piece of cloth can be placed under offending knick-knacks.

Every Home THX Audio System should be subjected to the rattle test at least once—the difference in low level resolution and in freedom from pseudo-distortion is sometimes large, and the effort involved is quite small.



## BACKGROUND NOISE

The effect of background noise on system performance is dramatic, yet often overlooked. Most people might think of it as merely a minor inconvenience, yet it has a profound effect on the way we perceive sound.

The presence of more-or-less constant background noise alters the way we perceive volume, since subjective loudness is a relative measure. In a quiet room, even a 70 dB SPL sound can seem fairly loud. In a noisy convention center, the same volume would be barely audible. Since there is a practical upper limit to both the volume to which we should expose ourselves and to the volume a given system can reproduce, having a relatively noisy environment effectively limits the perceived dynamic range of the program material. This, in turn, limits the dramatic effect which might have been intended by the director (or the performer, if listening to music).

Constant background noise also obscures, or masks, low-level signals which are frequently important in films, and music as well. Many scenes use subtle ambient noises to set the mood prior to an important event—without the full perception of the whispered secret or the barely-heard creaking of a door, the impact of the following scene is diminished.

It has been demonstrated that even a relatively narrow-bandwidth noise can effectively reduce our hearing acuity over a broad range of frequencies, far greater than the noise itself. When you add up all the various sources of noise from electric motors, noisy heating/cooling systems, outside noises, plus noises that even audio and video components can introduce such as noisy transformers, motors in laser players, or projector fan noise, our ability to discern the low-level information in the soundtrack is greatly compromised—and the director's intention along with it.

## BACKGROUND NOISE SOLUTIONS

Many sources of noise in a home environment can be addressed simply. Locating the home theater in the basement often removes it from many household noises as well as isolating it from the other family members. Taking care to completely seal windows and doors can also make a significant difference in reducing outside noise.

Heating and cooling systems are more challenging.

Sometimes, the answer may be as simple as using a "whistle-free" diffusion grille rather than one which creates undue noise from turbulence. In cases of new construction, using larger-diameter air ducts for lower air velocity is very beneficial. You can go further by using ductwork which is lined with acoustically-absorptive material. Where possible, longer ducts which have several turns further reduce the sound of the airflow, by eliminating the straight path from the heating/cooling system to the room.

Some of the construction techniques used to minimize the transmission of external sounds into the listening environment include:

- Double or triple layers of sheet rock (gypsum board).
- Double wall construction, meaning two complete sets of studs (preferably stuffed with fiberglass insulation).
- Double wall construction with staggered studs (minimizes transmission of vibrations from one set of studs to the next).
- Floating floor construction (again, preferably stuffed with fiberglass; this also can enhance the perceived bass, since the subwoofers may cause structural vibrations through the false floor which then get transmitted up through furniture).
- Seal all windows, doors, vents.
- Seal and caulk all apertures in the wall (electrical outlets, through-wall plumbing, etc.).

Finally, transient noises (traffic on the street, dripping faucets, etc.) distract your attention away from the program material, and remind you that you are in your home theatre/living room rather than a participant in the action of a movie.

## STANDING WAVES

A "standing wave" is what causes a pipe of a particular length in a large pipe organ to have its characteristic pitch. The pipe literally amplifies certain frequencies, based on its length and the wavelength of the frequency.

A typical rectangular room has three characteristic "lengths," and thus three fundamental standing wave frequencies. In addition, multiples of these frequencies are also amplified.

These frequencies are often referred to as “room resonances” or “room modes”—that is, the frequencies at which the room tends to vibrate of its own accord. These resonances lead to uneven frequency response, the greatest problems being in the 60-150 Hz range for a typical domestic living room. (At lower frequencies in larger room.)

Unfortunately, there is no way to eliminate the effects of standing waves completely. The best that can be done is to minimize their effect through a variety of strategies.

### **STANDING WAVE SOLUTIONS: ROOM RATIOS**

In new construction, the best way to minimize the audibility of standing waves is to plan for an even distribution of them, so that their effects do not “pile up” on top of each other. In this regard the ratios of room dimensions are the critical factor. Rooms having equal dimensions are the worst, since the standing waves in all directions reinforce one another. Room dimensions which are even multiples of one another are also to be avoided where possible.

### **STANDING WAVE SOLUTIONS: SPEAKER PLACEMENT**

Speaker placement also has an effect on standing waves and their audibility. In particular, placement of any speaker (including subwoofers) where the wall and the floor meet will tend to stimulate all of the available standing waves, causing the most irregular response. The displacement required to minimize a particular standing wave depends on its frequency, with lower frequencies requiring more movement owing to their longer wavelengths. As a result, minimizing colorations due to standing waves often requires significant adjustment of subwoofer placement. Leave yourself some latitude with regard to subwoofer placement when planning your system—the final adjustment will probably have to be done on something of a trial-and-error basis.

### **STANDING WAVE SOLUTIONS: ABSORPTIONS**

In theory, it is possible to damp standing waves with absorptive material. The difficulty is that the thickness of the absorptive material would have to be approximately one-half the wavelength of the lowest frequency requiring damping. This means a five-foot thickness of fiberglass would be required in order to damp everything down to 100 Hz—not very practical.

Standing wave energy tends to be concentrated in the corners of rooms, which is why these are the worst places for subwoofers. Because of this fact, it may be possible to break them up somewhat by “breaking up” the corner. This can be accomplished by placing a column of thick, absorptive materials in the corners (covered by acoustically transparent cloth, of course). The column ought to be at least a foot on a side, and run from floor to ceiling. A variation on this theme is to run an absorptive panel diagonally across the corner, leaving open air space behind it. Neither of these techniques is more than a partial solution, at best, but they are easily tried and sometimes quite effective.

### **STANDING WAVE SOLUTIONS: ROOM EQUALIZATION**

If a room exhibits severe standing wave problems, the best solution is to know your own limitations—hire a trained acoustician. These professionals have the necessary background to analyze the various room modes and recommend appropriate action. This will sometimes take the form of a custom-designed bass trap, which may be easily constructed. But it takes specific skills to determine its optimal design.

On other occasions, careful third-octave analysis and equalization may be appropriate. Optimize everything else that you can, then use EQ, if necessary, to “touch up” the room. This is its best use. If everyone used EQ this way, it wouldn’t have the bad reputation that it has in home consumer electronics circles. Professionals use it all the time, with excellent results—because they know its limitations and how to apply it.

Never equalize a room by ear. Room analysis is not as straightforward as it may seem. The analysis should be done using equipment with at least one-third octave resolution, using both spatial and temporal averaging. The final electronic equalization should be applied by means of a one-third octave graphic equalizer at a minimum.

In any event, rooms requiring this level of treatment are relatively rare, and the skills necessary to handle them properly are highly specialized. Do not hesitate to use the professional services of an acoustician when you need them.

## Suggested Demonstration Titles

The THX disc, WOW!, features a number of sections with exciting and entertaining demonstrations of the various aspects of motion picture sound tracks including low frequency response, dynamics, and surround effects. There are also many other discs which will provide outstanding demonstrations of surround for both music and movies.

A large number of compact discs have been released encoded with Dolby Surround over the last year. These encoded titles, along with the tens of thousands of well-recorded stereo recordings available, provide a vast library of recorded music material for use with your AVP1A processor.

A short list of film titles is provided below which provide exceptional audio mixes.

\* **EXERCISE CAUTION!** The bass energy and recorded levels on these discs can damage or destroy speakers and subwoofers when played at high sound levels.

**AII STAR WARS**  
**AII STAR TREK**  
**AII INDIANA JONES**  
**THE ABYSS (THX laserdisc re-issue)**  
**AIR AMERICA**  
**ALIENS (Director Cuts)**  
**AMEDEUS**  
**APOCALYPSE NOW\***  
**(REISSUE WIDESCREEN)**  
**BACKDRAFT**  
**BACK TO THE FUTURE**  
**BACK TO THE FUTURE III**  
**BATMAN**  
**BETLEJUICE**  
**BLACK RAIN**  
**BLADERUNNER**  
**(REISSUE WIDESCREEN)**  
**BRAINSTORM**  
**DANCES WITH WOLFES**  
**DICK TRACY\***  
**GHOST**  
**HAMBURGER HILL**  
**HOME ALONE**  
**THE HUNT FOR RED OCTOBER**  
**IMAX: THE DREAM IS ALIVE \***  
**JACOB'S LADDER**  
**LADYHAWKE**  
**THE MISSION**  
**MEMPHIS BELLE**  
**OUT OF AFRICA**  
**PREDATOR**  
**PREDATOR 2**  
**ROBIN HOOD**  
**RUSTLERS RHAPSODY**  
**THE ROCKETEER**  
**THE RIGHT STUFF**  
**TEENAGE MUTANT NINJA TURTLES**  
**TOTAL RECALL**  
**WITCHES OF EASTWICK**

## Troubleshooting

Symptom	Probable Cause	Solution
No output from one or more channels	<ul style="list-style-type: none"> <li>• Defective cables</li> <li>• Defective amplifier</li> </ul>	<ul style="list-style-type: none"> <li>• Check/replace cables or fuses</li> <li>• Verify that the signal source is operating and providing proper signal output to the power amplifiers</li> <li>• Verify proper operation of remote control</li> </ul>
No center channel output	<ul style="list-style-type: none"> <li>• Amplifier not turned on</li> <li>• CTR button not engaged</li> </ul>	<ul style="list-style-type: none"> <li>• Check amplifier</li> <li>• Check AVP1A</li> </ul>
Poor or smeared imaging	<ul style="list-style-type: none"> <li>• Poor room acoustics</li> <li>• Poor program source</li> <li>• Improper polarity</li> </ul>	<ul style="list-style-type: none"> <li>• Use absorptive material to minimize early reflections</li> <li>• Check another program source; program is synthesized stereo from mono source (broadcast stereo TV)</li> <li>• Aim speakers at listening area; check polarity</li> </ul>
Indistinct dialog	<ul style="list-style-type: none"> <li>• Slap echoes</li> <li>• Miscalibration of center channel output level</li> </ul>	<ul style="list-style-type: none"> <li>• Add absorption or diffusion materials</li> <li>• check levels using WOW! disc or internal test noise sequencer</li> </ul>
Clipping distortion	<ul style="list-style-type: none"> <li>• Input level miscalibration</li> <li>• Inadequate power amps</li> <li>• Subwoofer level too high</li> <li>• Excessive room absorption</li> <li>• Poorly recorded program source</li> <li>• Excessively high playback levels</li> </ul>	<ul style="list-style-type: none"> <li>• Recalibrate input level controls</li> <li>• Use larger amplifiers</li> <li>• Adjust subwoofer level of crossover</li> <li>• Remove absorption selectively</li> <li>• Try alternative program source</li> <li>• Restore normal playback levels</li> </ul>
Too little or Too much bass	<ul style="list-style-type: none"> <li>• Misadjusted subwoofer level</li> <li>• Severe room modes or bass loss due to room construction</li> </ul>	<ul style="list-style-type: none"> <li>• Adjust level by using built-in test signals</li> <li>• Move subwoofers to improve performance</li> </ul>
Uneven surround coverage	<ul style="list-style-type: none"> <li>• Poor speaker placement, strong reflections</li> <li>• Excessive absorption near surrounds</li> </ul>	<ul style="list-style-type: none"> <li>• Place surrounds according to THX spec</li> <li>• Add absorption and/or diffusion materials</li> <li>• Remove absorptive material to provide surround</li> </ul>

## Specifications

### **Output Channels:**

Three main channels, three front subwoofer outputs (left, mono, right), four surround (left side, left back, right side, right back), and mono surround subwoofer output

### **Frequency response:**

1Hz -50kHz +/- 3dB main channels (crossover bypassed)  
Frequency response of surround channels is dependent on surround parameter selected

### **Subwoofer:**

1Hz-80 Hz; 12 dB/octave rolloff above 80 Hz

### **THX Electronic Crossover:**

80 Hz @ 12 dB/octave high pass; 24 dB/octave low pass as per Lucasfilm THX requirements (crossover is defeatable)

### **Maximum Output:**

7 volts rms front channels; 3.5 to 7 volts rms surround channels  
depending on surround mode selected. Rated output:  
- 1.5 volts rms all channels

### **THD/IMD:**

Main channels - less than 0.05% at rated output  
Surround Channels - less than .1% at rated output

### **Autobalance Range:**

+/-5.5 dB imbalance error; defeatable when manual correction is necessary

### **Bass EQ:**

0 to + 18 dB boost @ 40Hz. Bypassed in full counterclockwise setting

### **Input Sensitivity/Impedance:**

70mV to 3.4 V @ 100K ohms

### **Output Impedance:**

300 ohms unbalanced

### **Signal to Noise:**

All outputs, better than -95 dB "A" weighted referenced to rated output

### **Static Interchannel Separation:**

35 dB minimum; typically better than 40 dB in Motion Picture, Dolby Pro Logic and Home THX Cinema surround modes with center channel and crossover engaged

### **Dimensions/Weight:**

17.1" wide x 15" deep x 3.8" high (3.5" high with support feet removed); 15 pounds net; 6.8 kilos

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