

## DSP-AZ1 Digital Home Theatre Amplifier

# T E C H N I C A L   R E P O R T

Yamaha asserts its technological leadership in home theatre audio  
with the incomparable DSP-AZ1.

Flawless sound quality, extensive versatility and full sound format compatibility.

A technological achievement that takes the home theatre  
experience to a new level.



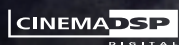
# The World's Pre-eminent Home Theatre Amplifier

Pre-eminent means "standing above others" and that's exactly what this amplifier does. From its extraordinary sound quality, to its wide array of surround programs and other advanced functions, to its unmatched CINEMA DSP technology, to its compatibility with every movie sound format, and even to its impressive design, this is an amplifier that has no equal. Once again, Yamaha asserts its leadership in home theatre — with the DSP-AZ1.



## DSP-AZ1

Digital Home Theatre Amplifier

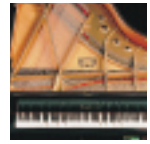


## DIGITAL TOP·ART

- Digital ToP-ART
- Powerful New Yamaha 32-Bit CINEMA DSP LSI (YSS-938)
- Yamaha 44-Bit CINEMA DSP Processing LSIs (two YSS-910s)
- Compatibility with Dolby Pro Logic II, Dolby Digital, Dolby Digital EX, DTS Digital Surround, DTS-ES, DTS-ES Matrix 6.1, DTS-ES Discrete 6.1, DTS Neo:6 and DTS 96/24
- 42 Surround Programs (62 Variations)
- Burr-Brown 192-kHz/24-Bit Digital-to-Analog Converter System for All 10 Channels
- Digitally Regulated Volume Control
- Uncompromised Power Amplifier Stage Design

## A company uniquely qualified to produce the finest home theatre components.

Yamaha has been one of the most popular and innovative manufacturers of home audio components for more than three decades. In the 90s, we helped make the dream of home theater a reality, and went on to lead the industry with the world's most sophisticated technology and components. Now we offer a wide range of products for every budget and preference, all of which realize our commitment to superb sound quality.



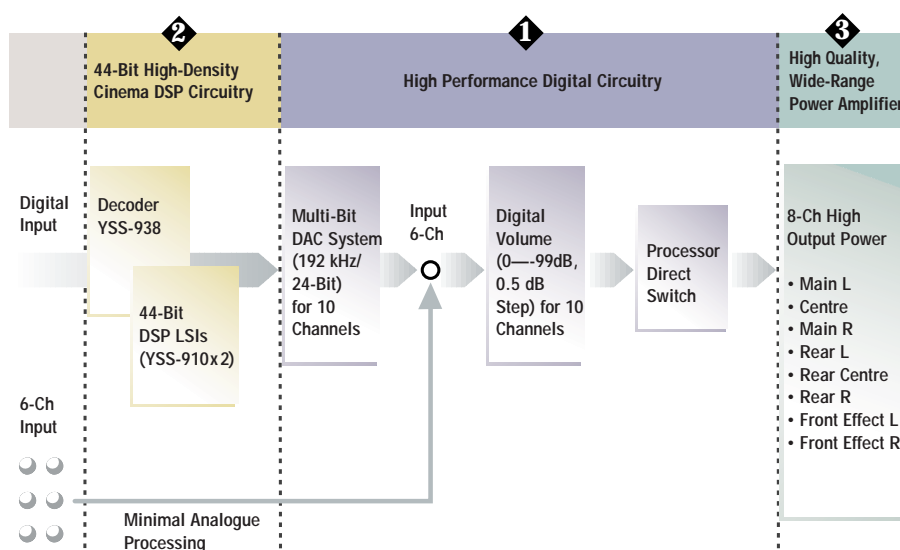
Yamaha can develop products and technologies unlike any others because it is a company unlike any other. The world's largest producer of musical instruments, it also operates a worldwide music school and has an acoustic division that designs concert halls. Furthermore, it actually designs and produces its own LSIs, which are the world's most sophisticated microprocessors for electronic instruments and audio components. All of this expertise comes together in the design and manufacture of audio products that deliver the same "Natural Sound" quality as Yamaha's renowned grand pianos and other instruments.



C O N T E N T S	
Introduction .....	2
A Unique Company .....	3
Digital ToP-ART .....	4 - 9
Extensive A/V Connections and Convenient Features .....	10 - 11
CINEMA DSP .....	12 - 19
HiFi DSP .....	20 - 21
Convenient "Set Menu" .....	22
Parameter Control Functions .....	23
Specifications/Surround Programs .....	Back Cover

# DIGITAL TOP-ART

Total Purity  
Audio Reproduction Technology



## The Digital ToP-ART Concept

From digital input, through digital processing, to amplification, maximum signal quality is maintained every step of the way.

Digital ToP-ART (Total Purity Audio Reproduction Technology) is the name Yamaha has given to a design philosophy whose goal is to maximize digital quality while minimizing analogue circuitry. The culmination of the best digital engineering and design possible today, it brings together several key elements to create the best-sounding, easiest-to-use A/V components available. In the DSP-AZ1, Digital ToP-ART can be divided into three categories.

- 1 **High Performance Digital Circuitry** with Burr-Brown 24-bit BiCMOS Sign-Magnitude DACs for all 10 output channels, a Digitally Regulated Volume Control with 99dB range and a Processor Direct Switch.
- 2 **High Density CINEMA DSP Circuitry** with Yamaha original 44-bit DSP LSIs (two YSS-910s) and newly developed decoding LSI (YSS-938).
- 3 **High Quality, Wide Range Power Amplifier Section** with low-impedance design, superior power transistors, gigantic heat sinks and many other advantages.



## High Performance Digital Circuitry

Positioned between the DSP circuitry and the power amplifier stage, the High Performance Digital Circuitry makes a large contribution to the DSP-AZ1's outstanding audio performance. It exemplifies the Digital ToP-ART concept of maximizing the quality of the digital circuitry while minimizing analog circuitry, and also adheres to the ToP-ART philosophy of logical, straight-line circuit layout for optimum signal purity. Yamaha's superior LSI technology as well as our long experience in designing both home and professional audio circuit boards are responsible for the high performance and reliability of this circuit. It is composed of a DAC block, a volume control block and the Processor Direct circuitry.

### Superior Digital-to-Analogue Converter System

For the important digital-to-analogue converters, Yamaha has chosen the PCM1704 manufactured by the high-end audio expert, Burr-Brown. The DSP-AZ1 uses 10 of these DACs, for the eight main channels and the two subwoofer outputs. The PCM1704 is a high-performance, precision 24-bit BiCMOS Sign-Magnitude DAC with ultra-low distortion of only 0.0008% (K-grade THD + N) and S/N ratio of 120dB. It offers superior low level linearity, with excellent full-scale performance under varying operating conditions. Its major benefit is performing accurate sound field reproduction for high quality multi-channel reproduction such as Dolby Digital and DTS. For two-channel stereo, the PCM1704 provides outstanding separation and accurate musical delineation. An additional advantage is its 192kHz/24-bit conversion capability, making it compatible with the latest (and future) high resolution digital audio sources.

### Digitally Regulated Volume Control

Digital volume controls have become popular in home audio products, but for various reasons, analogue is the better choice for this key component. Yamaha has combined the best of both by designing a high precision digital device (Crystal Semiconductor CS3310 LSIs) that controls an analogue signal. This provides two benefits. First, a digitally controlled device is more accurate for balancing levels between channels and offers much finer



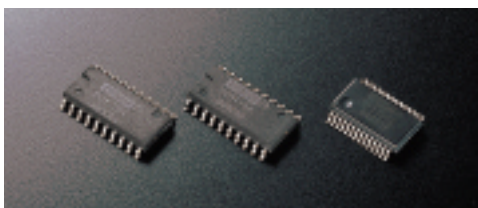
*The elegantly designed, compact processing board ensures optimum performance for multi-channel audio sources. It has a fully shielded cabinet to prevent interference.*

control than an analog device. In the DSP-AZ1, the control range is from 0dB to -99dB in extremely accurate 0.5dB steps throughout the entire range, with negligible gang error. This wide range and narrow steps mean that greater attenuation is possible, with precision even at low volume levels. Second, an analogue volume control permits good signal resolution of very low signal levels. This is important for subtle signals that are often masked by louder signals and are not resolved as clearly.

The DSP-AZ1 also features an improved rotary knob axis that provides a superior tactile sensation as the knob is turned. Finally, the selected volume level and a bar graph display are both shown on the front panel display and the on-screen display.

### Processor Direct Switch

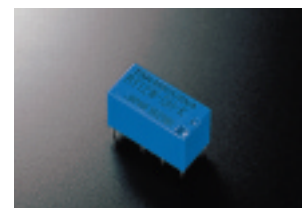
The DSP-AZ1 has a Processor Direct Switch that when engaged, provides a direct signal connection between the processor board and the power amplifier section. As a result, the regulated digital volume device avoids the wiring on the circuit board, thus bypassing all control circuits. This shortens the signal path, feeding the pure, robust signal directly to the eight amplification channels for cleaner, more efficient operation and higher quality sound.



*Burr-Brown 192 kHz/24 Bit PCM1704 DAC Systems*



*High-Quality Digital Volume Devices (Crystal Semiconductor CS3310 LSIs)*



*Highly Reliable Relay Device (for Processor Direct Switch)*

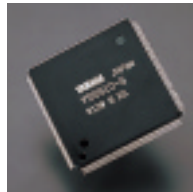
## 44-Bit High-Density Cinema DSP Circuitry

With CINEMA DSP, Yamaha has raised digital sound field processing to the state of fine art. This proprietary technology gives movies much greater impact in your home theater, affording all the realism, excitement and nuance that the director intended to convey.



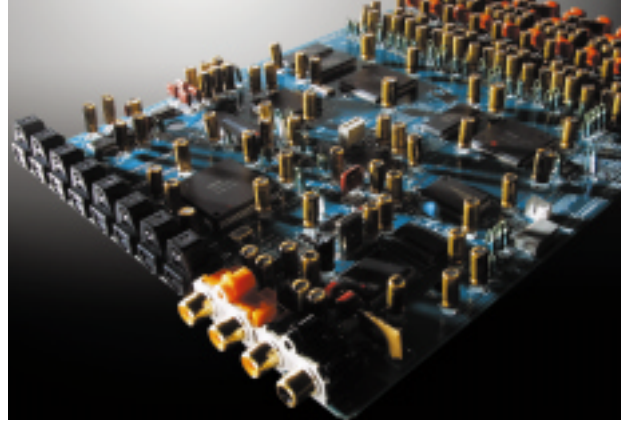
### 44-Bit CINEMA DSP

The DSP-AZ1 utilizes a 44-bit DSP LSI, the Yamaha YSS-910. This powerful computer offers extremely precise calculation of signal data — each additional bit provides twice the resolution and half the distortion — meaning it can resolve subtle audio nuances that bring the listening experience closer to reality than to reproduction. Two YSS-910s are used, one for processing sound fields, the other for processing SILENT CINEMA, Virtual CINEMA DSP and system configurations (controlling system parameters digitally reduces noise and improves precision). Because two are used, each is able to operate at higher speeds and with greater precision. The circuitry also includes the supremely accurate.



YSS-910 44-Bit DSP LSI

What's more, the YSS-910 provides accurate synchronization of images and sound, known as "lip-sync." Most audio LSIs do not have the necessary speed and precision to handle this, but with the YSS-910, not only has accurate lip-sync been achieved, but its



parameters can be adjusted by the user.

### Advanced Decoding Circuitry Including Yamaha's Exclusive YSS-938 32-Bit Floating Point Quantization LSI

The decoding circuitry performs Dolby Pro Logic II, Dolby Digital, Dolby Digital EX, DTS Digital Surround, DTS-ES, DTS-ES Matrix 6.1, DTS-ES 6.1 Discrete, DTS 96/24, and DTS Neo:6 decoding with extreme accuracy, as well as all digital sound field processing. It also outperforms other systems in the precise synchronization of images and sound. Its low 3V power consumption minimizes digital noise.



YSS-938 32-Bit Floating Point Quantization LSI

The YSS-938 is without a doubt the most powerful and sophisticated audio LSI ever created.



DSP-AZ1 Digital Home Cinema Amplifier

### Tri-Field and Quad-Field CINEMA DSP

Tri-Field CINEMA DSP projects three sound fields into the home cinema, resulting in a powerfully realistic three-dimensional soundscape for 5.1 channel sound. Quad-Field CINEMA DSP adds an additional rear center sound field, allowing enjoyment of 6.1-channel movie sound formats. See pages 12-19 for detailed information.

### Optimum Space Utilization

The use of highly integrated LSIs allows an interior design that maximizes power and sound quality by positioning all the digital processors and related circuitry in one small area. This leaves most of the space open for the power amplifier components: transformers, capacitors, heat sink and so on. This means that these parts can be much larger than usual for greater power, that they can be separated for minimum chance of interference, and that circuits can be arranged in straight lines for maximum signal purity.

### Wide Choice of Surround Sound Programs

The DSP-AZ1 lets users select from 42 surround programmes which include a total of 62 variations. These are divided into HiFi (music) and CINEMA DSP (movie) programmes. Users can choose them according to the type of music or movie they are listening to, and can also have fun experimenting with various combinations (rock music in a church, for example).

What's more, each of these programmes has a number of parameters that can be "fine-tuned" to bring out the best of a CD or movie soundtrack. This capability is often cited in reviews as a distinct Yamaha advantage. In *Sound &*

*Vision's* review of the DSP-AZ1, for example, the reviewer stated that, "with suitably subtle settings in the Village Gate mode, the (jazz) CD sounded exceptionally natural, with well-placed ambience and remarkably cohesive, three-dimensional timbres. In fact, it was among the most realistic reproductions of nightclub jazz piano that I've ever heard. Cool!" (More details on pages 18, 19 and 23.)

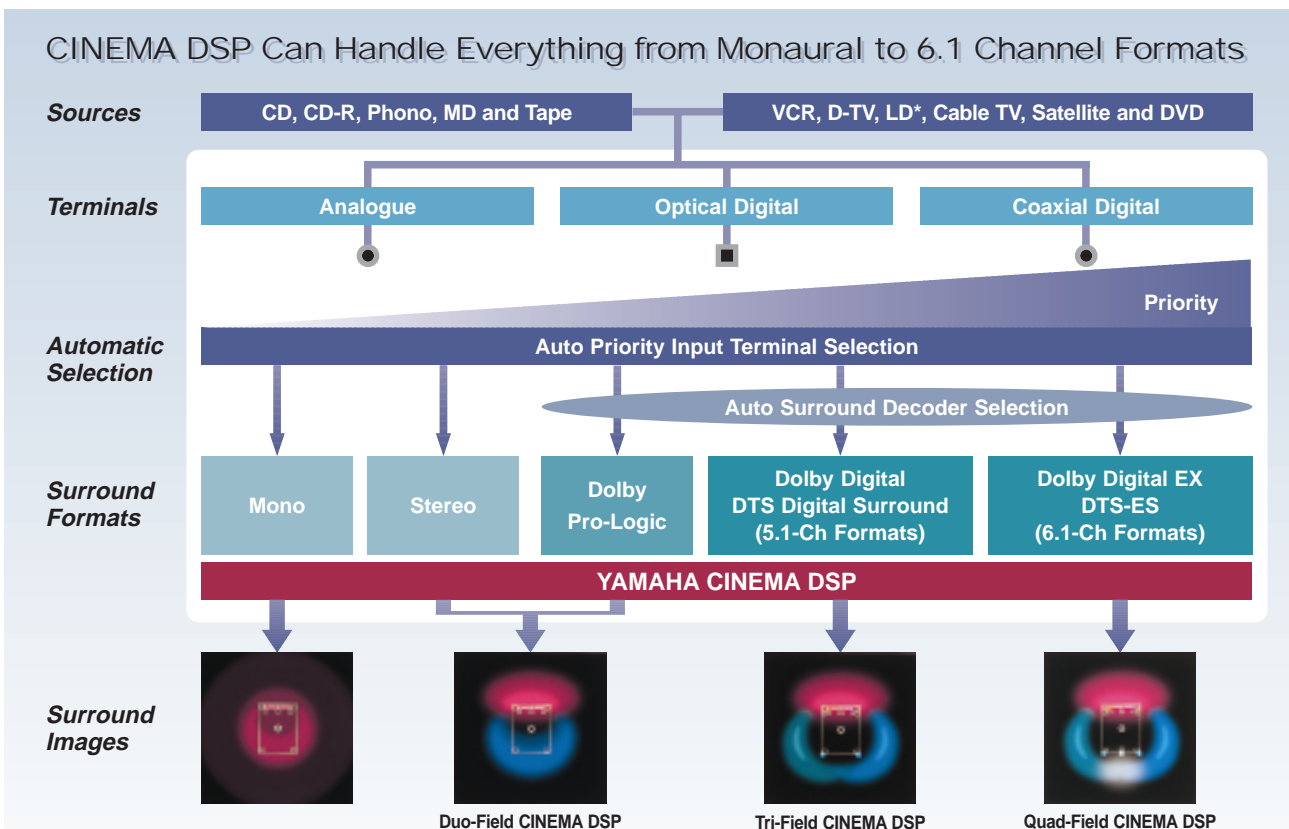
### Auto Priority Input Terminal Selection and Auto Decoder Selection

The DSP-AZ1 input terminals will handle any kind of input signal. According to the type of signal, terminals are selected in priority order of RF (AC-3), coaxial digital, optical digital and analogue. Furthermore, according to the type of movie sound format, the proper decoder and surround sound programme are automatically selected. For example, if the Movie Theater Sci-Fi programme is selected and the input is a DTS-ES signal, the DTS-ES decoder is automatically engaged and the program switches to Movie Theater DTS-ES Sci-Fi.

### SILENT CINEMA and Virtual CINEMA DSP

CINEMA DSP technology has enabled Yamaha to provide two additional surround sound listening options with the DSP-AZ1. A SILENT CINEMA mode offers the surround sound feeling of multi-channel music or movie sources through ordinary headphones, while Virtual CINEMA DSP lets listeners enjoy the effects of CINEMA DSP surround sound without using rear speakers. (More details on page 13/14.)

*silent*  
**CINEMA**



\* With LD player connected to RF (AC-3) terminal, this signal has first priority.

● Some DVD discs do not have 6.1-channel sound format data, so Auto selection does not operate. In this case, use the EX/ES button on the remote control, which allows selection of Discrete 6.1, Matrix 6.1 or Off.



## High Quality, Wide-Range Power Amplifier Section

The DSP-AZ1 is designed to deliver the full impact and dynamism of movies by supplying generous amounts of power (including bass power!). That's why despite all the digital processing magic, it is first and foremost a powerful receiver. By drawing on our long years of amplifier expertise (we've created some of the world's legendary power amps and preamps) and refusing to make any compromises on quality, we've endowed the DSP-AZ1 with awesome capabilities. It incorporates a powerful 8-channel amplifier with high dynamic power and sophisticated circuitry like linear damping.

### Total Low-Impedance Design

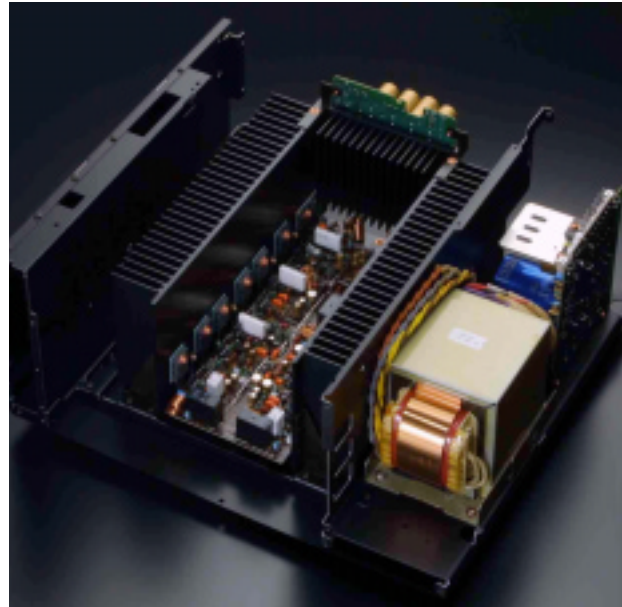
All current signal paths, from the power supply to the power amplifier to the speaker drive circuits, utilize a low-impedance design. This improves the separation characteristics among multi-channels and allows the use of a wider variety of low-impedance speakers.

### 8-Channel High Power, Discrete Amplifier Configuration

The DSP-AZ1 will deliver as much as 130W (RMS) of power at a negligible 0.015% distortion to each of six channels (two main, two rear, one centre and one rear centre). Plus 45W to each of the two front effect channels. This is more than enough to fill even the largest rooms with vibrant music and Richter-scale sound effects.

### High Dynamic Power Capability

The DSP-AZ1 is capable of delivering large amounts of reserve power for accurate reproduction of the high energy peaks that are especially prevalent in digital audio sources. This emphasizes the music's dynamic qualities and provides a sharper sound image.



*Ultra-heavy-duty chassis with two large, anti-resonance, aluminium-extruded, naturally cooled anodized heat sinks.*

### Linear Damping (Main L/R and Centre Channels)

Level variations due to high amp impedance tend to reduce an amplifier's damping factor, and frequency variations cause it to fluctuate. This circuit cancels the effect of these variations, maintaining a high, stable damping factor, for superior articulation of all sounds and better frequency response.

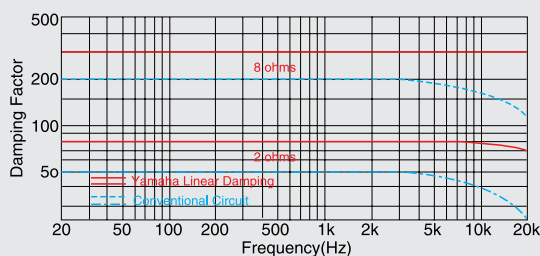
### Anti-Vibration, Anti-Resonance Chassis and 1.6mm ToP-ART Base

Supporting the heavy heat sinks, transformer, and circuit board is Yamaha's 1.6mm ToP-ART base, which has exceptional anti-resonance and damping characteristics. Beneath this base is the bottom of amplifier, part of the heavy chassis which is also designed for maximum vibration damping.

### Naturally Cooled Anodized Heat Sinks

The two large, anti-resonance, aluminium-extruded, naturally cooled heat sinks undergo black anodization processing to ensure maximum heat dissipation efficiency. They are located on the base frame with the power amplifier circuit boards to prevent interference with the preamplifier and digital processing sections. The fact that they are naturally cooled means that they are so efficiently designed that a fan is not necessary for cooling. The power block is equipped with a fan, but it is only used for extreme heat build-up and is not activated during normal operation, preventing the occurrence of even the slightest unwanted noise.

**Damping Factor Characteristics**



### Linear Damping

*Yamaha's Linear Damping maintains a high, stable damping factor even at frequencies from 10 to 20 kHz, where it generally tends to fall off. The result is superior articulation of all sounds.*





DSP-AZ1 Digital Home Cinema Amplifier

### Every Internal Component Is a Top Performer — And It Makes a Difference!

In order to realize the goals of massive power and superlative sound quality, Yamaha technicians completely re-evaluated all the parts used in previous amplifiers. As a result, many were replaced with more expensive or custom-designed units.

#### ● Extra-Large Custom-Made Block Electrolytic Capacitors

Developed specifically for the DSP-AZ1, the 27,000 $\mu$ F block electrolytic capacitors use low-magnification foil and are exceptionally high quality.

#### ● Extra-Large (9.8kg), Low-Impedance Transformer

The massive power supply transformer has a new core material and improved design, allowing it to output 200VA, 20% higher than the previous model. Cables have been upgraded from 22-gauge to 20-gauge.

#### ● Wire-Wrapped Connectors

The connectors from jumper cables to PCB, transformer, etc, are wire-wrapped, as shown in the photo. This takes a great deal of effort (so much, in fact, that Yamaha is the only manufacturer who does it), but provides much greater signal reliability.

#### ● FE Mica Capacitors and Metallic Mylar Film Capacitors

At this level of sound quality, even these small parts make a difference. The high precision FE mica and metallic mylar film capacitors use polypropylene material and are the highest performance types on the market.

#### ● High Performance Power Transistors

Superior power transistors, upgraded from 150W in the DSP-AV1 to 180W, enable the DSP-AZ1 to achieve a wide bandwidth with frequency response extending to 100kHz. Although human hearing only extends to about 20kHz, the

harmonics of these frequencies go much higher, and reproducing them enhances overall tonality and musicality. This also means that the DSP-AZ1 will perform superbly with the next generation of wider range digital audio products such as DVD-Audio and SACD.

#### ● Schottky Barrier Diodes

Low forward voltage drop and fast switching make these diodes ideal for fast switching applications, contributing to the high S/N ratio.

#### ● Twin Direct Signal Path Speaker Relays

Speaker switching is accomplished by relays right in front of the speaker terminals, rather than at the switch position. This results in a shorter signal path and minimum output impedance.

#### ● High Quality Printed Circuit Board

The printed circuit board is made of new material and has impedance-reducing extra-thick 70 $\mu$ m copper foil to maintain high signal quality.

#### ● Inlet-Type Power Cable

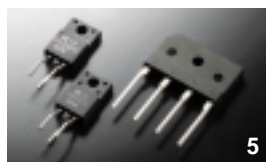
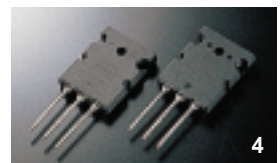
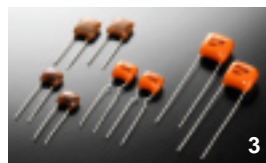
The inlet-type power cable is separate, rather than attached to the unit. It is a thicker type (16-gauge) than ordinary power cables, for higher power handling capacity.

#### ● Thick PC Board Wiring with 1.6mm $\phi$ Copper Jumper Cables

The audio signal is routed within the amplifier through exceptionally thick, top quality wire, ensuring that signal purity is maintained.

#### ● Improved Preamplifier Power Supply

A large capacity, stable-voltage preamplifier power supply with an extra-large heat sink ensures rock-steady operation for analogue and digital signal processing and video signals. And with no interference from the power amplifier section, this power supply is unaffected by noise.



(1) Extra-Large Custom-Made Block Electrolytic Capacitors, (2) Wire-Wrapped Connectors, (3) FE Mica Capacitors and Polypropylene Film Capacitors Using Copper Foil, (4) High Performance Power Transistors, (5) High Sound Quality Schottky Barrier Diodes, (6) Twin Direct Signal Path Speaker Relays and (7) Inlet-Type Power Terminal

# All the A/V Connections Needed for the Present and Into the Future! Plus a Host of Convenient Features.

## Full Complement of Input/Output Terminals

The rear panel provides input terminals for all audio and video sources, as well as those for future digital broadcasting such as Digital TV, Cable TV and Satellite Digital TV. All digital inputs are designed to be compatible with the 96kHz format (coaxial inputs are 192kHz compatible). All A/V input terminals are equipped with S-video terminals. In addition, RCA pin jacks allow switching to component video to achieve higher picture quality. The changeover device for the component video signal uses reliable relay connectors and does not go through the amplifier section in order to avoid any deterioration of picture quality.

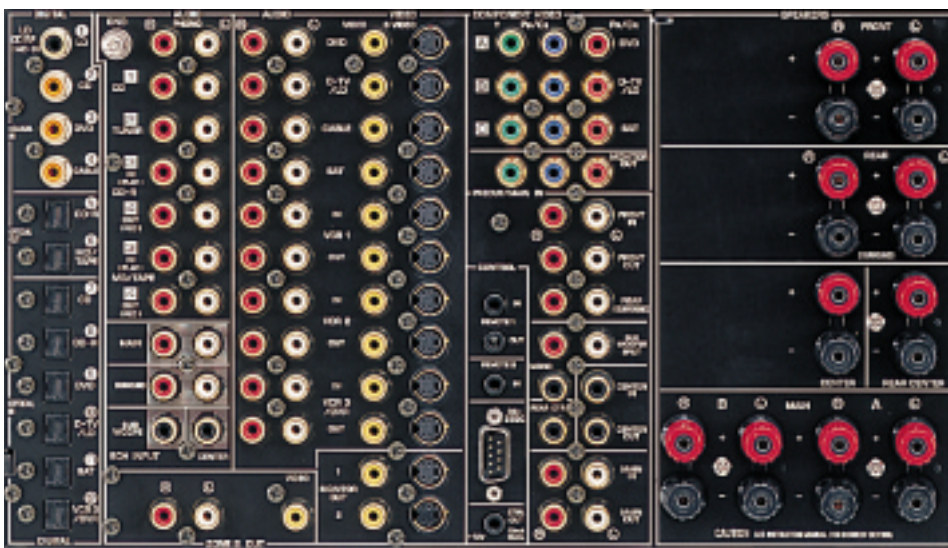
There are also two video monitor output terminals, so the unit can be connected to both a TV monitor and a projector (projection TV) simultaneously (the Component Video Monitor Out signal is HDTV compatible).

## Ready for Custom Installation

As befits a high performance home cinema amplifier, the DSP-AZ1 is ideal for use in custom installations. It is equipped with an RS-232C interface that allows two-way communication between the amplifier and a touch-pad controller. It provides interactive control functions that are more versatile than that of an ordinary remote control, and has Zone 2 output that enables multi-room control capability. It also provides +12V trigger output.

## Mono/Split Subwoofer Output Terminals

5.1 and 6.1 channel sound formats include an LFE (Low Frequency Effect) channel, an important factor in adequate reproduction of low frequencies. The DSP-AZ1 offers Mono and Split Subwoofer Output terminals, and the low frequencies of channels programmed by the speaker mode programming function can be output from the subwoofer.



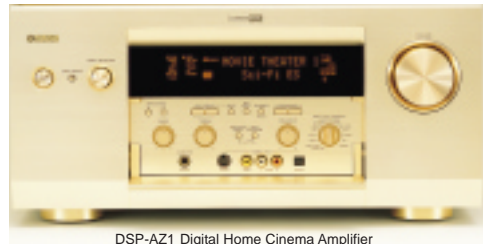
## Extensive Connections for System Building

- 7 Optical and 3 Coaxial Digital Input Terminals (fixed and assignable except front panel Video Aux), and 1 RF (AC-3) Input Terminal which can also be used as a Coaxial (fixed and assignable) Terminal
- 2 Optical Output Terminals (fixed and assignable)
- 3 Component Video Input Terminals (fixed and assignable) and 1 Component Video Monitor Output Terminal
- 8 A/V (with S-Video terminals) and 5 Audio Input Terminals
- 3 A/V (with S-Video terminals) and 2 Audio Output Terminals
- 6-Channel External Decoder Input Terminals for Future Sound Formats
- Pre-Main, Center and Front Effect Couplers, and Rear and Rear Center Preout Terminals
- Custom Installation Compatibility
  - Zone 2 Out
  - IR Port
  - Control Out (+12 V Trigger Out)
  - RS-232C Interface
- Upgrade Capability (through RS-232C Interface) for Future Sound Formats and Software

DSP-AZ1 Inputs and Outputs

	Analog		Digital				Video					
	In	Out	Coaxial		Optical		Composite		S Video		Component Video	
	In	Out	In	Out	In	Out	In	Out	In	Out	In	Out
PHONO	■				■							
TUNER	■		■		■							
CD	■		■		■	■						
CD-R	■	■	■		■	■						
MD/TAPE	■	■	■		■	■						
DVD	■		■		■	■						■
D-TW/LD	■		■	RF (AC-3)	■	■	■		■			■
LD			■									
CABLE	■		■		■	■	■		■			■
SAT	■		■		■	■	■		■			■
VCR 1	■	■	■		■	■	■	■	■	■	■	■
VCR 2	■	■	■		■	■	■	■	■	■	■	■
VCR 3/DVR	■	■	■		■	■	■	■	■	■	■	■
VIDEO AUX	■				■	■	■		■		■	
MONITOR Out									■			■
ZONE 2 Out		■						■				

Fixed (■), Fixed/Assignable (■) and Assignable (■) Terminals.



DSP-AZ1 Digital Home Cinema Amplifier



**Oil-Damped Hidden Control Panel**

Front Panel Aux Input Terminals with Optical Digital and S-Video Terminals: Auxiliary terminals with optical digital input make it convenient to connect a digital game machine so you can enjoy DVD games and movies.

Subwoofer level is easily adjusted with a test tone.

**Total Convenience**

A comprehensive On-Screen Display with a convenient Set Menu allows selection and adjustment of a wide variety of functions. It even includes a speaker display that makes it easier to balance speaker output in the Speaker Test Mode. DSP programmes can be selected with the remote control so the listener can compare the effects from the listening position.

**Rec Out Selector**

The audio or video source can be recorded on VCR 1, 2 or 3 or CD-R or MD/Tape. By using the Rec Out Selector, a popular Yamaha feature, users can record a different source from the one they are listening to.

**HDTV Compatible Component Video Out**

The frequency response of the Component Video Monitor Out signal is DC—100MHz, making it compatible with HDTV monitors.

**Fixed and Assignable Terminals**

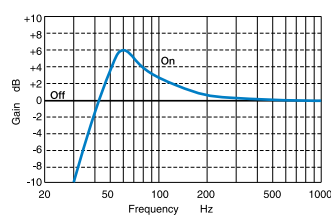
Yamaha offers terminals that can be either independently assigned to sources or defaulted to fixed settings.

**Bass Extension**

Turn the bass extension switch on to provide +6dB boost to the main speakers' low end centred at 60Hz.

Frequencies under 50Hz will be cut by 12dB/oct. to prevent overdrive.

*Bass Extension Characteristics*



**Direct-Access Remote Control Unit Is Easy to Understand and Operate**

The DSP-AZ1 comes supplied with a powerful remote control that puts you in complete command of its many functions — and those of other components as well. Compatible with most brands of audio and video equipment, it has extensive learning capability (up to 563 keys) and a very large memory capacity (up to 150 keys when only Yamaha codes are used). It also comes pre-encoded with many television and component codes. A five-character LCD window identifies source selection and other useful information.

When using this remote, the operation buttons in the component control area have different functions for each type of component in the system. Any component can be controlled by pressing its respective input button, whereupon the LCD window will show the name of the input. A unique “rename” function allows each input to be renamed with up to five characters. For easier operation in low light situations, the LCD and control keys functional with the chosen component can be backlit.

The unit also includes separate keys for TV power, volume, input and channel selection. Other frequently used functions are easily accessible on the front, while lesser used keys are located under the sliding panel at the bottom.

Another interesting and useful feature is the ability to programme the unit with multi-command functions, or Macros, that can be initiated with a single touch. 15 different Macro sequences can be input, with a maximum of 10 commands per Macro, enough for extensive control of very sophisticated systems.

Despite all this “power,” the remote control consumes very little electricity. Unlike other remotes with LCD displays, it was designed for very low power consumption and won't wear out batteries at a rapid pace.





# Yamaha CINEMA DSP for Home Cinema: Dramatically Different Than Other Systems.

## There's simply nothing else like it.

Only Yamaha Digital Home Cinema can provide an audio experience that not only sounds like a theatre, but actually sounds better than some theatres. The reason is CINEMA DSP, a unique technology that enables movies to be heard with the same degree of realism and impact that the directors and sound engineers intended. Not only is the surround sound field larger, deeper and richer, but it is not necessary to adjust speaker placement. CINEMA DSP brings out the full potential of all movie sound formats, including the newest ones, and even selects the correct format automatically. Extensive listening tests have confirmed that it is simply the best system for enjoying home theater sound.

## Going Beyond Conventional Multi-Channel Systems

Conventional 5.1 and 6.1 channel audio reproduction systems base their sound on Dolby Digital and DTS decoding, using matrix and steering technologies to create surround sound effects. Yamaha CINEMA DSP is much more advanced, actually creating richly realized independent sound fields that merge to envelop you in an unmatched surround sound experience. With dialogue, music and effects from the presence (front) and rear sound fields (plus rear centre with 6.1-channel Quad-Field CINEMA DSP), it will seem as if the walls of your room have disappeared and you are in the middle of your own immense theatre!

## Conventional 5.1-Channel/ 6.1-Channel System

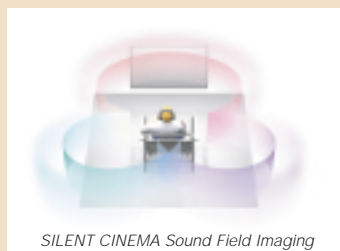


## Two Unique Yamaha Features Made Possible by CINEMA DSP

### SILENT CINEMA: Enjoy Movies Without Disturbing Others.

**silent CINEMA** The SILENT CINEMA mode allows private listening enjoyment of multi-channel music or movie sound, including Dolby Digital and DTS Digital Surround, through ordinary headphones. Yamaha DSP and HRTF technology (explained on right) make it possible.

All the listener needs to do is connect a pair of headphones to the DSP-AZ1 and they will enjoy an accurate simulation of 5.1-channel surround sound in complete privacy. They can even select from

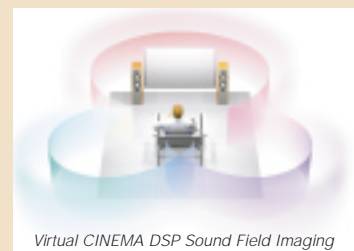


SILENT CINEMA Sound Field Imaging

among the many CINEMA and HiFi DSP programmes to vary the sound field. Ideal for late night listening when you don't want to disturb others, or if other noises are disturbing you.

### Virtual CINEMA DSP: Surround Sound from Only Two Speakers.

Virtual CINEMA DSP, like SILENT CINEMA, is based on HRTF technology, and also employs aggressive crosstalk cancellation technology. With just two left and right speakers, Virtual CINEMA DSP will create virtual rear left/centre/right speakers, giving listeners the sense of being in a full-



Virtual CINEMA DSP Sound Field Imaging



## Quad-Field CINEMA DSP



Rear Left  
Surround/Effect  
Sound Field

Rear Centre  
Surround/Effect  
Sound Field

Rear Right  
Surround/Effect  
Sound Field

Presence (Front)  
Sound Field

Surround/Effect

Music

Dialogue

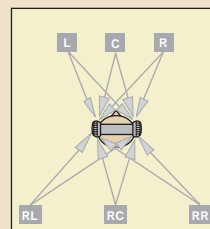
scale surround sound field. So even in rooms with no space for rear speakers, they can enjoy the full effects of Dolby Digital and DTS movie sound formats. If the system includes a centre speaker, Virtual CINEMA DSP will provide the rear channel sound.

### HRTF (Head-Related Transfer Functions) Technology

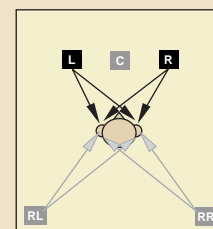
Transfer functions refer to the transmission of sound to the ears and between the external ears and eardrums. Head-related refers to the method of measuring transfer functions by placing clinical probe microphones in the ear channels of people in anechoic chambers and recording measurements at many positions around their heads.

Using these "HRTF maps," Yamaha engineers were able to direct sound into the ears via headphones that accurately reproduces speaker sound from various directions. This is the basis of SILENT CINEMA.

Virtual CINEMA DSP is also based on HRTF, and employs aggressive crosstalk cancellation technology. In essence, the crosstalk signals from the left speaker to the right ear and vice-versa are cancelled and replaced by new signals that simulate rear speakers. Thus you perceive surround sound without actually having rear speakers.



SILENT CINEMA Principle



Virtual CINEMA DSP Principle

# The Basics of CINEMA DSP: How It Turns a Home Into What Can Truly Be Called a Theatre.

## Movie Surround Formats

A good movie soundtrack is a complex interplay of sound fields: the actors' voices clearly fixed on the screen, the sound effects positioned according to where they would be if the audience was in the middle of the scene, and the music enveloping the audience in a natural manner. The soundtrack is "designed" in a dubbing theatre that has sound mixing and movie screening equipment, and encoded with one or more of the movie sound formats (see Brief Guide to Movie Sound Formats).

## Movie Theater Sound Versus Home Theater Sound

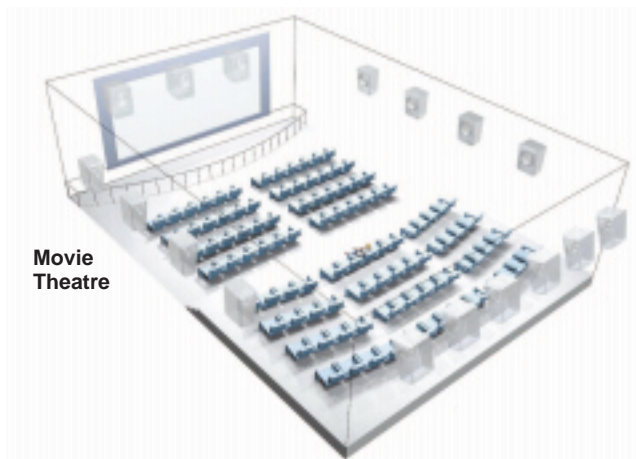
However, even though the sound formats using Dolby and DTS technology improve sound localization, movement and other factors, they cannot provide the same sense of "presence" and "realism" obtained in a movie theatre.

The major difference between a movie theatre and a home entertainment room is of course, the size. If theatre sound was reproduced with no modification in a home, there would be a big difference in the feeling of scale. Another difference is in the number and positioning of the speakers. In a movie theatre, the sound is designed so that it can be accurately reproduced using numerous speakers

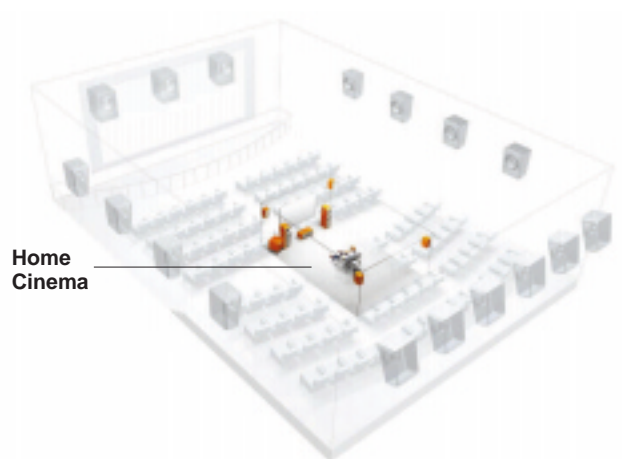


embedded in the left, right and rear walls and positioned so that they emphasize the relationship between sound from the screen and from each channel. This provides a more uniform quantity of sound to the wide audience area.

The overwhelming advantage of CINEMA DSP is that it complements and expands the Dolby- and DTS-processed sound to overcome the differences in facilities, acoustics



Movie Theatre



Home Cinema

## ● Comparison of Movie Sound Formats

Surround Formats	Dolby Pro Logic	Dolby Digital	Dolby Digital EX	DTS Digital Surround	DTS-ES	DTS 96/24
Media	DVD, VCR, TV, LD, CD	DVD, LD	DVD, LD	DVD, LD, CD	DVD	DVD
Reproduction Channels	4 Channels	1 — 5.1 Channels	6.1 Channels	5.1 Channels	6.1 Channels	5.1 (6.1) Channels
Channel Configuration	Left, Center, Right and Surround	Left, Centre, Right, Left Surround, Right Surround and LFE	Left, Centre, Right, Left Surround, Centre Surround Right Surround and LFE	Left, Centre, Right, Left Surround, Right Surround and LFE	Left, Centre, Right, Left Surround, Centre Surround, Right Surround and LFE	Left, Centre, Right, Left Surround, Right Surround and LFE
Encode System	Matrix	AC-3 (Digital)	AC-3 (Digital)	Coherent Acoustics	Coherent Acoustics	Coherent Acoustics
Sound Process	Matrix	Discrete	Discrete and Matrix	Discrete	Discrete and/or Matrix	Discrete (Discrete and Matrix)
Frequency Response (Front)	20–20,000 Hz	20–20,000 Hz	20–20,000 Hz	20–20,000 Hz	20–20,000 Hz	20–40,000 Hz
Frequency Response (Rear)	100–7,000 Hz	20–20,000 Hz	20–20,000 Hz	20–20,000 Hz	20–20,000 Hz	20–40,000 Hz
Resolution Ratio		20 Bit	20 Bit	20 Bit	20 Bit	24 Bit
Sampling Frequency		48 kHz	48 kHz	48 kHz (LD/CD: 44.1 kHz)	48 kHz (LD/CD: 44.1 kHz)	96 kHz
Conversion Rate (CD/LD)		348 kbps (LD)	348 kbps (LD)	1,411 kbps	1,411 kbps	1,411 kbps
Conversion Rate (DVD)		448 kbps	448 kbps	1,536 kbps	1,536 kbps	1,536 kbps
Remarks			Centre surround signal is matrix processing.		Centre surround signal is discrete or matrix processing	

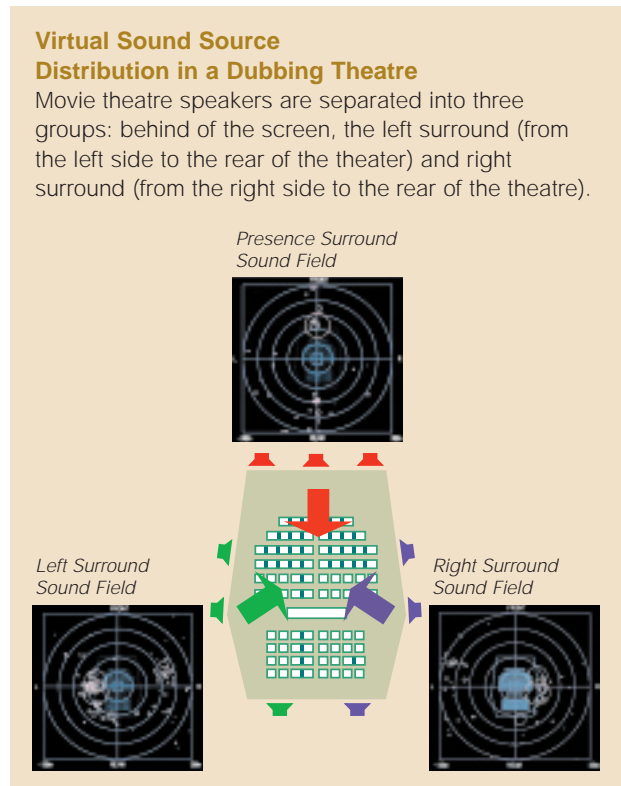
and dimensions between movie theatres and home listening rooms. In other words, it is able to preserve the localization and directionality of the sound track as it was created by the movie sound designer, while creating a soundscape that gives the sensation of being as expansive as in a theatre.

Further, with surround sound programs specifically designed to match certain movie genres, the sound can actually be a more accurate reflection of what the director and sound engineer intended listeners to hear.

### Sound Field Measurement and Analysis

There are three basic sound source directions as seen from the listening position: the front direction, the left rear direction and the right rear direction. In developing its surround sound programmes, Yamaha used proprietary techniques perfected over the years to measure the virtual sound sources in these three directions: the sound field created by the center speaker, representing the front direction, and the two sound fields made by each of the multiple surround speakers in the left and right rear directions.

These are shown in the illustration: Virtual Sound Source Distribution in a Dubbing Theatre. Each diagram for the virtual sound sources in the three sound fields shows a completely different pattern of distribution. The effects of the multiple surround speakers on the wall surfaces are observed in the right and left surround channel sound fields. Each of these three sound fields is treated independently, providing the ideal digital sound processing for the various Dolby and DTS sound formats.



## Brief Guide to Movie Sound Formats

### ● Dolby Pro-Logic

Dolby Lab's basic 4-channel format, widely used in ordinary theatres and for home videos.

### ● Dolby Pro Logic II

Improved version of Dolby Pro-Logic for music and movies. With a more intelligent matrix decoder, it is suitable for both stereo and surround-encoded sources. It offers "bass management" as well as the option of incorporating "width," "dimension" and "panorama" controls.

### ● Dolby Digital

The most popular 5.1-channel home cinema sound system. An improvement over Dolby Pro-Logic in that it offers: 1) Full frequency response in all channels (3Hz — 20kHz), 2) discrete surround channels, and 3) a separate track for bass only, called the Low Frequency Effects channel.

### ● Dolby Digital EX

Dolby's latest surround format, this is Dolby Digital with an added centre rear channel. The rear centre channel is actually matrixed into the two rear channels, and is extracted upon playback. (Formerly called Dolby Digital Surround EX, or Dolby Digital Matrix 6.1.)

### ● DTS Digital Surround

The basic DTS 5.1 channel sound format. Uses a higher data rate than Dolby Digital.

### ● DTS-ES Matrix 6.1

Very similar to Dolby Digital EX. Uses a different rear centre channel decoding method.

### ● DTS-ES Discrete 6.1

DTS-ES uses its large bandwidth to provide a fully discrete rear centre channel, as opposed to a matrixed one.

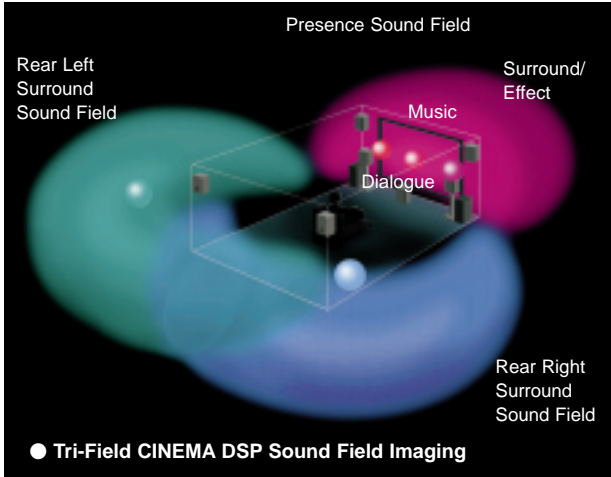
### ● DTS Neo:6

Provides 5.1 or 6.1 channels of matrix decoding from stereo matrix material. Also decodes Extended Surround matrix soundtracks and has a Music mode to expand stereo non-matrix recordings to 5.1 or 6.1 channels.

### ● DTS 96/24

Delivers 96kHz/24-bit high resolution audio for 5.1 channel surround sound on DVD discs. The benefits are greater bit depths for extended dynamic range and high sampling rates for wider frequency response.

# Tri-Field CINEMA DSP: Creating Realistic Cinema Sound



### Three Discrete Sound Fields

Utilizing the extensive data accumulated from acoustic testing and from working closely with movie sound technicians, the Tri-Field CINEMA DSP system creates three discrete (independent) sound fields. A Presence sound field locates the dialogue from the actors on the screen and also provides front sound effects and music, and two stereo Surround sound fields (left rear and right rear) produce a large-scale sound environment with a three-dimensional feeling of depth and properly positioned sound sources.

### Software Is the Secret of Our Success

Although the DSP-AZ1 does use the world's most sophisticated audio LSIs (described on page 6), the true secret of the success of Tri-Field CINEMA DSP lies in Yamaha's outstanding sound field software, that is, the digital processing of the data that is programmed into the

chips. This is where Yamaha's expertise in music, acoustics, and the manufacture of consumer and professional audio equipment comes into play. The overwhelming sense of realism is due to fact that data from real sound fields is used (performance venues and the dubbing theatres that movie sound technicians use), processed in ways that only Yamaha can achieve.

In a movie theatre, the large space serves to enhance the realism and draw the viewer into the film, and ideally, a home cinema should provide the same experience. Other systems, however, can only give you the sense of watching from the outside, whereas with Tri-Field CINEMA DSP, you feel as though you are actually INSIDE the scene.

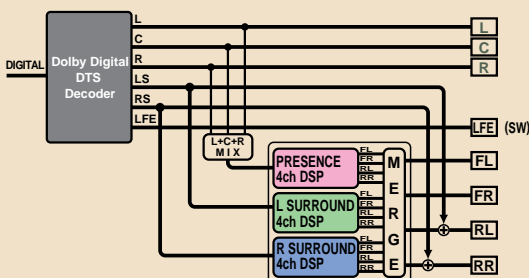
### Two More CINEMA DSP Benefits

One of the main advantages of CINEMA DSP is the large choice of sound field programmes that Yamaha has developed. These are designed to match specific movie sound formats, types of movies, and other sources. They include several multimedia modes for television shows, concert videos, sporting events and video games. (See pages 18-19.)

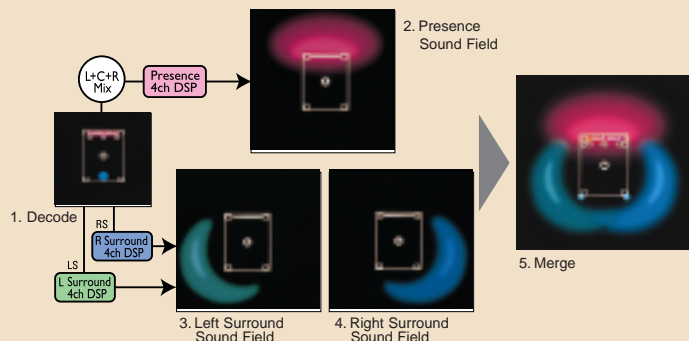
Another benefit is that unlike other home cinema systems, the full sonic potential of CINEMA DSP is realized in rooms of any size and shape. Performance is not dependent upon the acoustic character or quality of the room, because all processing is done electronically by sophisticated microprocessors, not by using the rear or side walls to reflect sounds.

### CINEMA DSP's Sound Field Processing System (Dolby Digital/DTS Digital Surround Sources)

1. Left, Centre and Right sounds are directly output to individual channels as sound sources.
2. L, C, and R signals are modified, mixed, then subjected to presence 4-channel DSP sound field processing.

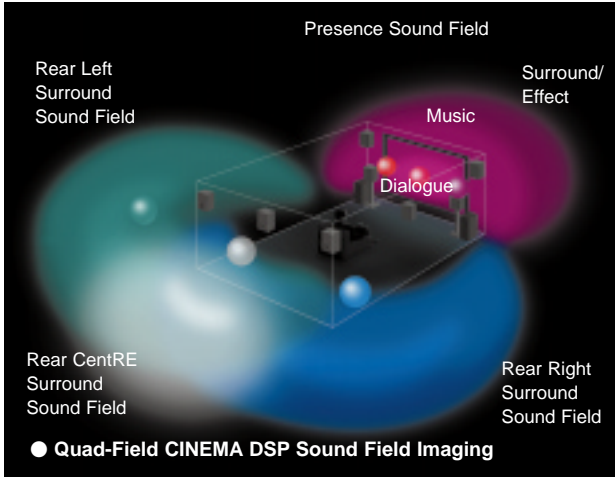


3. LS and RS signals are subjected to left-surround and right-surround 4-channel DSP sound field processing, respectively.
4. The presence sound field and left/right surround sound fields are merged, and the data from these sound fields is output from four effects speakers.
5. The outputs may further undergo reverberation processing.





# Quad-Field CINEMA DSP: The Best Way to Enjoy 6.1 Channel Sound



The DSP-AZ1 is equipped to handle all existing movie sound formats, including the latest digital surround formats with a rear centRE channel. The block diagram shows the circuitry that makes this possible.

## 1 Encoding Stage

A 6.1 channel dubbing theatre is used for mixing the soundtrack for 6.1 channel movie sound production. A matrix encoder is used to encode the left and right surround signals with the rear centre channel, after which encoding is done by the Dolby Digital or DTS encoders.

## 2 DVD Disc Preparation

If the DVD disc was created using the 6.1 channel matrix encoding process, 6.1 channels of sound will be reproduced upon playback, provided that there is a matrix decoder in the rear channels and a sixth channel of amplification. The DSP-AZ1 has the matrix decoder built-in and 6 channels of

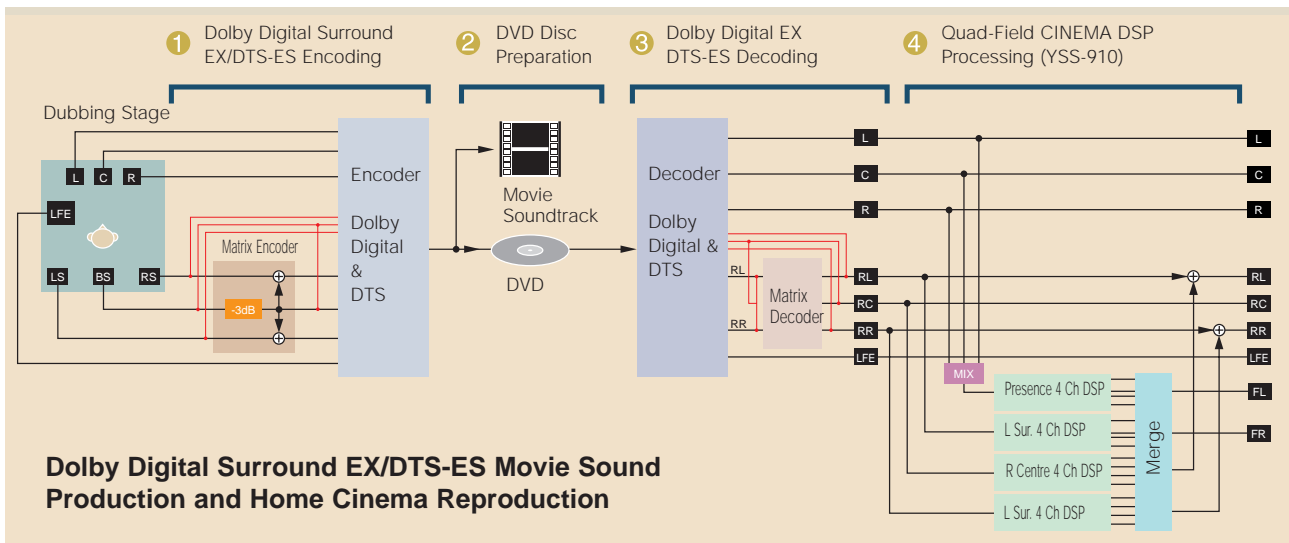
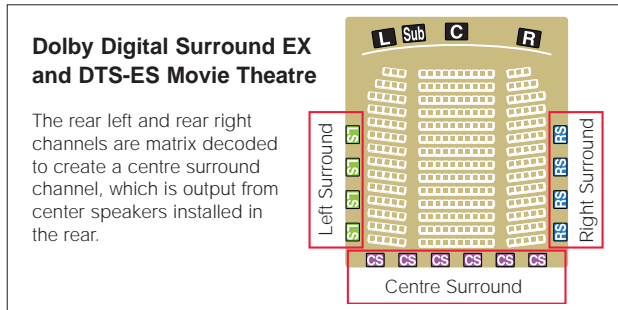
amplification, ensuring full enjoyment of all Dolby Digital and DTS-encoded movies.

## 3 Dolby Digital EX/DTS-ES Decoding

The audio signal is first decoded to 5.1 channels, then the rear centre channel is derived from the left and right channels by the matrix decoder. The sixth channel of sound has the same full frequency response as the other channels, except the LFE. When a disc encoded with rear centre channel information is detected, the 6.1 Matrix Auto function automatically activates the matrix decoder. However, enjoyment of 6.1 sound is not limited to the playing of specially encoded discs. Most 5.1 channel encoded discs contain information in the surround channels that can be extracted to provide a rear centre channel. Thus, even DVD discs that are encoded with only 5.1 channels of sound can reproduce rear centre channel sound by manually activating the matrix decoder. DTS-ES 6.1 Discrete decoding also takes place in this stage.

## 4 Quad-Field CINEMA DSP Processing

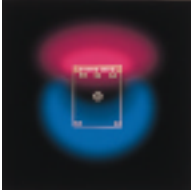
After Dolby/DTS decoding, the signals are processed by the Quad-Field CINEMA DSP processor, bringing out the full benefits of 6.1 channel sound, including a superior sense of front to rear depth and soundstaging.



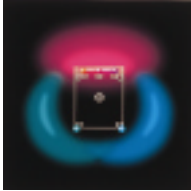
# Listeners Can Choose from a Wide Variety of Sound Field Programmes

## MOVIE THEATER 1

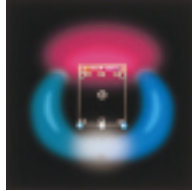
Stereo Input  
(70mm Spectacle)



5.1-Channel Input  
(Tri-Field CINEMA DSP)



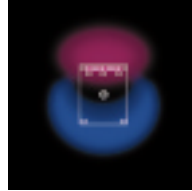
6.1-Channel Input  
(Quad-Field CINEMA DSP)



### Spectacle

This programme transports you into the middle of the scenes you are watching. In a very wide space, every sound, even large sounds, are heard clearly. A new level of sound realism.

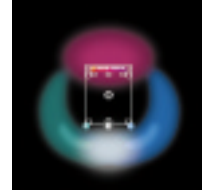
Stereo Input  
(70mm Sci-fi)



5.1-Channel Input  
(Tri-Field CINEMA DSP)



6.1-Channel Input  
(Quad-Field CINEMA DSP)

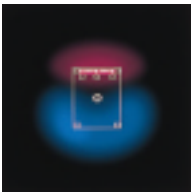


### Sci-Fi

Reproduces dialogue, music and effects of the latest SF high-tech movie soundtracks with excellent separation. Capable of conveying the impression of a huge space.

## MOVIE THEATER 2

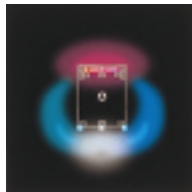
Stereo Input  
(70mm Adventure)



5.1-Channel Input  
(Tri-Field CINEMA DSP)



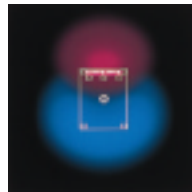
6.1-Channel Input  
(Quad-Field CINEMA DSP)



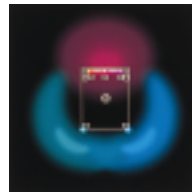
### Adventure

Designed for action movies, this programme has moderate reverberation to simulate the newest movie theatres with dead acoustics. Dialogue is centered and expressive.

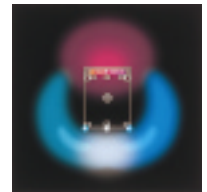
Stereo Input  
(70mm General)



5.1-Channel Input  
(Tri-Field CINEMA DSP)



6.1-Channel Input  
(Quad-Field CINEMA DSP)

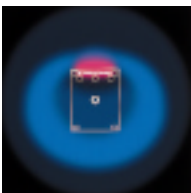


### General

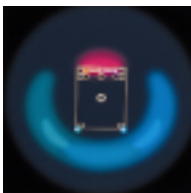
Moderate reverberation results in clear dialogue, with a three-dimensional sound field around and behind the screen for a soft, expansive sound. Presence sound field is well balanced.

## ENTERTAINMENT

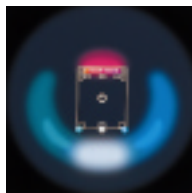
Stereo Input



5.1-Channel Input  
(Tri-Field CINEMA DSP)



6.1-Channel Input  
(Quad-Field CINEMA DSP)

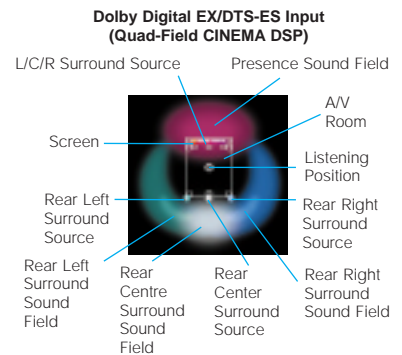


### Game

Adds a deep, spacious feeling to video game sounds.

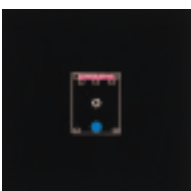
## DSP Sound Fields

Depending on the type of input signal and DSP programme selected, sound fields are projected as shown to the right.

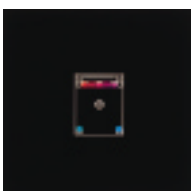


## DOLBY PRO-LOGIC, DOLBY PRO LOGIC II, DOLBY DIGITAL, DOLBY DIGITAL EX, DTS DIGITAL SURROUND, DTS-ES MATRIX 6.1, DTS-ES DISCRETE 6.1, DTS NEO:6 and DTS 96/24

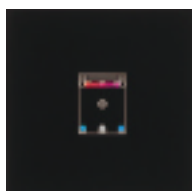
Stereo Input  
(Dolby Pro-Logic)



5.1-Channel Input  
(Dolby Pro Logic II, Dolby Digital, DTS Digital Surround and DTS 96/24)



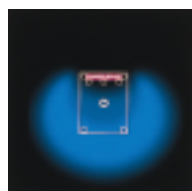
6.1-Channel Input  
(Dolby Digital EX, DTS-ES Matrix 6.1, DTS-ES Discrete 6.1, NEO:6 and DTS 96/24)



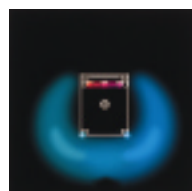
### Surround Format Direct Output Programs

Front L/C/R channels' decoded signals are output as is, and surround signals only are processed by four-channel DSP. The result is an extremely large-scale surround sound field. For precise reproduction of the various movie sound formats.

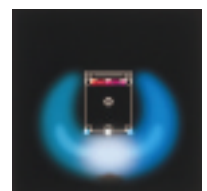
Stereo Input  
(Dolby Pro-Logic/Enhanced)



5.1-Channel Input  
(Dolby Pro Logic II, Dolby Digital and DTS Digital Surround/Enhanced)



6.1-Channel Input  
(Dolby Digital EX, DTS-ES Matrix 6.1, DTS-ES Discrete 6.1, NEO:6 and DTS 96/24/Enhanced)



### Enhanced

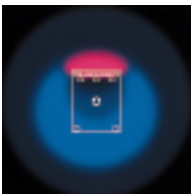
Surround format decoders provide precise decoding for faithful sound reproduction. Superior separation, with smooth movement and good localization.

The DSP-AZ1 provides 42 surround programmes that include a total of 62 variations. Designed to match various movie genres and types of sources, they create a strikingly realistic listening experience. The "correct" programme variation is automatically set according to the source and programme selection. Also, by using the remote control, listeners can switch programmes from their seat to compare the different effects.

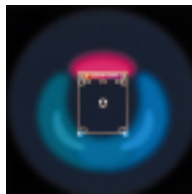


### CONCERT VIDEO 1

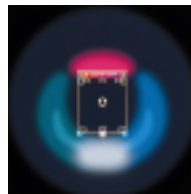
Stereo Input



5.1-Channel Input  
(Tri-Field CINEMA DSP)



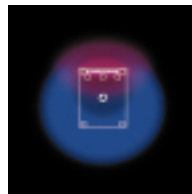
6.1-Channel Input  
(Quad-Field CINEMA DSP)



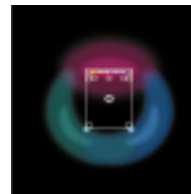
#### Pop/Rock

This programme is for recreating live music venues. Its presence sound field enhances the action on stage. The surround sound field extends far behind the screen.

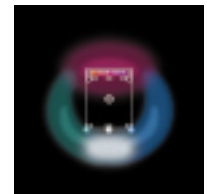
Stereo Input



5.1-Channel Input  
(Tri-Field CINEMA DSP)



6.1-Channel Input  
(Quad-Field CINEMA DSP)

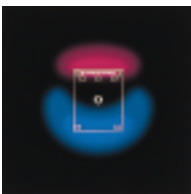


#### DJ

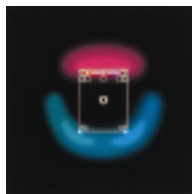
The presence sound field uses opera house data, while surround uses concert hall data. You'll hear the DJ's voice with exceptional clarity and music with rich depth.

### CONCERT VIDEO 2

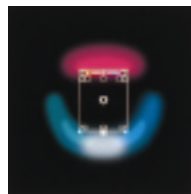
Stereo Input



5.1-Channel Input  
(Tri-Field CINEMA DSP)



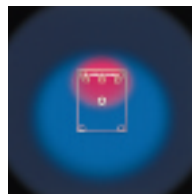
6.1-Channel Input  
(Quad-Field CINEMA DSP)



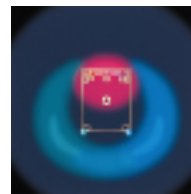
#### Classical/Opera

Reverberation is moderate to improve the clarity of musical instruments and voices. In the case of operatic recordings, on-stage action and singing are clearly localized.

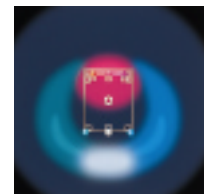
Stereo Input



5.1-Channel Input  
(Tri-Field CINEMA DSP)



6.1-Channel Input  
(Quad-Field CINEMA DSP)

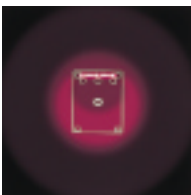


#### Pavillion

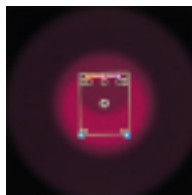
On-stage vocals are clearly recreated with depth. Reverberations with delay enhance the live sense you experience only at a large concert in a pavillion setting.

### TV THEATER

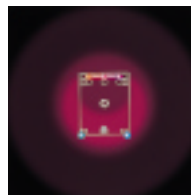
Stereo Input



5.1-Channel Input  
(Tri-Field CINEMA DSP)



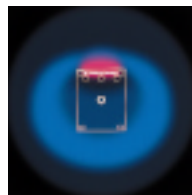
6.1-Channel Input  
(Quad-Field CINEMA DSP)



#### Mono Movie

This is a programme for classic movies and other mono sound sources. Moderate application of reverb creates a natural three-dimensional sound space.

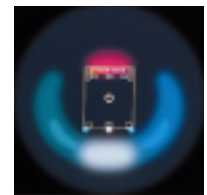
Stereo Input



5.1-Channel Input  
(Tri-Field CINEMA DSP)



6.1-Channel Input  
(Quad-Field CINEMA DSP)



#### Variety/Sports

When listening to the stereo broadcast of a sports programme, the commentator's voice will be in the center, with the crowd noise spreading out to the sides.

## YAMAHA EMC CENTRE

The EMC (Electro-Magnetic Compatibility) Centre stands in a quiet mountain setting where there are few sources of electro-magnetic noise. Its facilities include two open sites and a electro-magnetic signal-free room that can meet various nation's standards, as well as interference verification facilities of many kinds that can accurately measure

unnecessary electro-magnetic signals produced by digital instruments. Yamaha products are tested here from the development stage in order to create products that meet all types of strict electro-magnetic standards.



# HiFi DSP for Music: Recreating Sound Fields on the Basis of Real-World Data.

Digital Sound Field Processing is a technology developed by Yamaha in 1986 to measure the sound fields, or acoustic characteristics, of concert halls, jazz clubs and other performance spaces. It is capable of bringing the realism of a live performance into your listening room.



## The Sound Field of a Hall Affects the Music

The sound you hear in a concert hall contains not only the sound that comes directly from musical instruments but also early reflections — the sound that reaches you after reflecting off the walls and ceiling — and late reverberations — the sound that bounces off the ceiling and walls many times before it reaches you, gradually attenuating in level.

Components of these reflections are different from hall to hall, according to size, building materials and other factors. That's why each hall has a unique sound field.

## Yamaha HiFi DSP Uses Actual Sound Field Data

The DSP-AZ1's HiFi DSP programs incorporate sound field data recorded at concert halls, opera houses, and other musical venues in the United States and Europe. To gather this data, our engineers used a system called Single Point Quad Miking. Four microphones are placed in close proximity to capture direct and reflected sounds, which are

recorded. Each reflection is then resolved by a correlating process which determines the location and strength of its "virtual" sound source. A virtual sound source is the hypothetical source of a reflected sound, and is represented in terms of the direction from which a reflection comes, the time it takes to reach the listener, and its strength. A distribution pattern of virtual sound sources and echoes is then generated by projecting three-dimensional spatial information on a two-dimensional plane, making it possible to see the character of a sound field expressed as a graphical pattern of reflections.

## Synthesizing Sound Fields Based on Actual Data

The real-world data that constitutes the basis for programmed sound fields is processed by Yamaha's DSP system. Four effect speakers are used, of which two are chosen from moment to moment, depending on sound location. This means a sound can be localized in any direction by adjusting the levels of signals going to two speakers providing stereo effects whichever two of the four speakers are selected. The distance to the virtual sound source is calculated on the basis of delay time, and a delay function controls the output signal from the speaker.

## Measurement and Reproduction of Imaginary Sound Source Distribution in All Directions

The actual sound field data used by the DSP-AZ1 accurately reproduces each of the important initial reflected sounds, even the direction. The data represents imaginary sound source distributions such as the one shown in the diagram. The centre of the diagram represents the point where the data was gathered, with the top being the stage direction. The concentric circles represent the delayed reflected sound as the actual distance traveled, with 1 meter equivalent to about 3/1,000 second.

Each of the small circles represents each of the sources of the reflected sound that reaches the ears of the listeners. Assuming that there was a source of reflected sound on a line extended in the direction that the sound was ultimately heard after it was reflected, this is the imaginary sound



The Single Point Quad Miking system precisely measures the acoustic patterns of a sound space.



Single Point Quad Miking Microphone



Virtual sound sources are blue or white rounds. Round scale is a reflection strength.



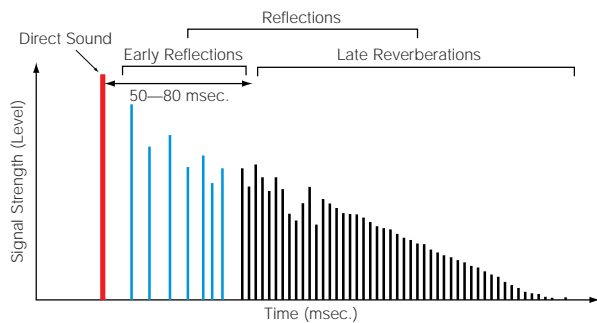
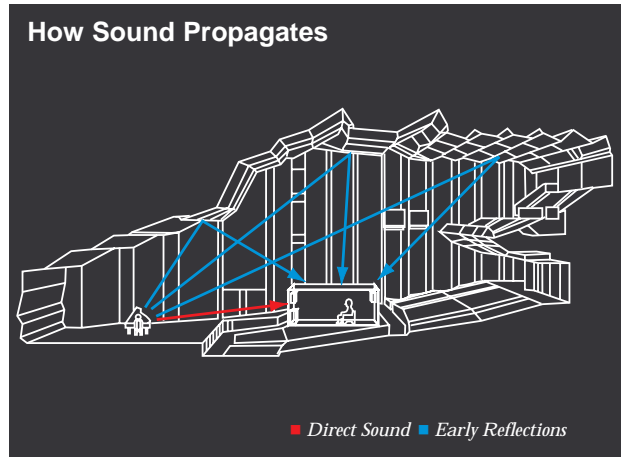
source. The size of the circle represents strength, while the direction from the centre point represents the direction the final reflected sound travels from. The greater the delay in the reflected sound, the further it is located from the centre point.

### Early Reflection and Reverberation Processing

HiFi DSP processing consists of early reflection processing and sometimes also reverberation processing. The sound field of a concert hall or jazz club, for instance, is recreated by early reflection processing alone; reflections essentially determine the character of the space.

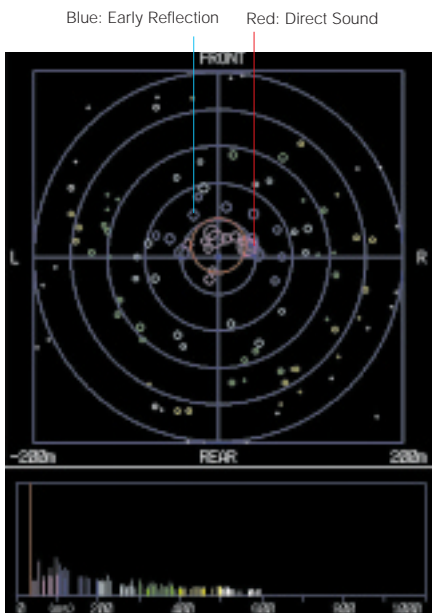
### The Result is Realistic Sound

With Yamaha Digital Sound Field Processing it is thus possible to recreate the actual sound of a venue. When Jazz Club mode is selected, for instance, you are listening to the acoustical characteristics of a real jazz club. Maybe it's the Village Gate Club or the Cellar Club, both in New York City. Or select "stadium" and hear your favourite rock group in Anaheim Stadium. Yamaha Digital Sound Field Processing makes it possible to hear your favourite artist perform in the venue of your choice.



### The Bottom Line

With an extremely wide floor, the 300-seat club has a realistically live sound field.



**Imaginary Sound Source Distribution of Sound Field Data**  
Sound source distribution with listening position at centre. Each circle represents an actual or reflected sound source, showing strength and position.

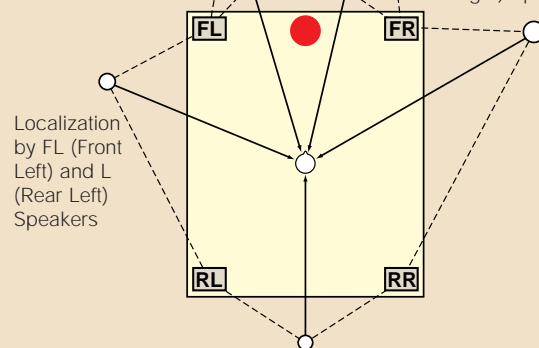
EFCT TRIM 0 dB  
INIT. DELAY 30 ms  
ROOMSIZE 1.0  
LIVENESS 5  
S. DELAY 5 ms\*  
\* Dolby Digital/DTS Input

### Localization of Virtual Sound Sources by Four Effect Speakers

Localization by FL (Front Left) and FR (Front Right) Speakers

Localization by FL (Front Left) and FR (Front Right) Speakers

Localization by FR (Front Right) and RR (Rear Right) Speakers



Localization by RL (Rear Left) and RR (Rear Right) Speakers

# Convenient “Set Menu”

The “Set menu” consists of eighteen items featuring the speaker set functions, center graphic equalizer, CINEMA EQ and parameter initialize, etc. You can choose the appropriate item and adjust or select the values as necessary.

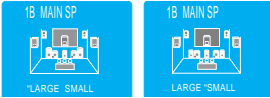
## 1. Speaker Set Functions

Programmes the output mode that is best for the speaker type and programmes the signals that output the LFE (Low Frequency Effect) and bass signals.

### 1A. Center Speaker Mode: Large, Small or None



### 1B. Main Speaker Mode: Large or Small



### 1C. Rear L/R Speaker Mode: Large, Small or None



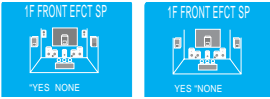
### 1D. Rear Centre Speaker Mode: Large, Small or None



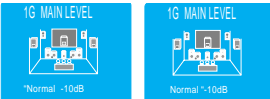
### 1E. LFE (Low Frequency Effect)/Bass Out (Bass Out Mode): Subwoofer, Main Speaker or Both



### 1F. Front Effect Speaker Mode: Yes or None

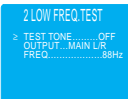


### 1G. Main Level Mode: Normal or -10 dB



## 2. Low Frequency Test

Tests the relation between the sounds from the subwoofer and other speakers.



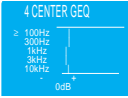
## 3. Headphone Tone Control

Controls the headphone tonal balance (bass and treble: -6 dB to +3 dB).



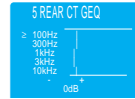
## 4. Centre Graphic Equalizer

Controls the equalizer for adjusting centre speaker response to match the main speakers (5-band: -6 dB to +6 dB).



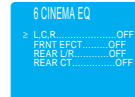
## 5. Rear Center Graphic Equalizer

Controls the equalizer for adjusting rear center speaker response to match the rear effect speakers (5-band: -6 dB to +6 dB).



## 6. Cinema Equalizer

Independently controls the tonal response of main left, main centre, main right, front effect, rear centre and rear effect speakers.



- 6A Main L/R and centre equalizer
- 6B Front effect equalizer
- 6C Rear L/R equalizer
- 6D Rear centre equalizer

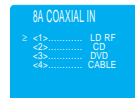
## 7. Input Rename

Changes the input name.



## 8. I/O Assignment

Changes jack assignments to match the components that are connected. (bass and treble: -6 dB to +3 dB).



- 8A Coaxial input terminals
- 8B Optical output terminals
- 8C Optical input terminals
- 8D Component video input terminals

## 9. Input Mode

Designates input mode for sources connected to the Coaxial (Optical) In jack when the unit is turned on.



- AUTO: Automatically detects signal and sets correct mode.
- LAST: Selects last input mode for that source.

## 10. Parameter Initialize

Returns programme parameters that have been changed to their original values.



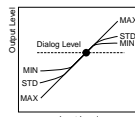
## 11. LFE Level

LFE level: LFE signal level (Dolby Digital and DTS)



## 12. Dynamic Range

Dynamic Range: dynamic range control.



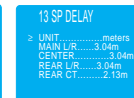
- This function lets you control the dynamic range of Dolby Digital sources to enjoy the mode best suited to the viewing circumstances: from a mode that lets you enjoy cinematic dynamic range to a mode perfect for late-night viewing.
- MAX mode that provides the full dynamic range of a cinema.
- STD mode with a dynamic range recommended by sound engineers for general home viewing.
- MIN mode most suitable for late-night viewing. Highest compression ratio provides dynamic range close to that of TV broadcasts.

## 13. Speaker Delay Time

For adjusting the center and rear center speaker delay times.



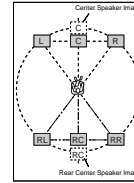
msec setting



Meters setting



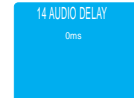
Feet setting



Ideally, the centre and rear centre speakers should be the same distance from the listening position as the main speakers. This is rarely the case, however, so this feature is used to delay the signal to make the distances sound the same. Adjusting centre speaker delay is important for giving depth to the dialogue.

## 14. Audio Delay Time

For adjusting the delay time of all channels, with DTS or Dolby Digital sources.



## 15. Display Set

Controls Dimmer level (the brightness of indicators on the unit [-4 to 0]), OSD Sift (the position of on-screen display [-5 to +5]), and Blue Back (the screen color).



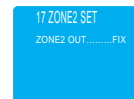
## 16. Memory Guard

Prevents changes in programmed levels and parameters.



## 17. Zone 2 Set

Selects the zone 2 mode.



Cuts the tuner signal from the Zone 2 Out signal. This means that the tuner of the Zone 2 receiver can be chosen from any of the rooms.

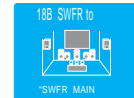


## 18. 6-Ch Input Set

Selects the Auto mode of Dolby Digital/Matrix 6.1 and DTS-ES decoding.



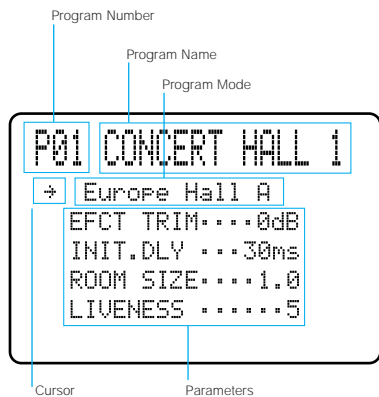
- CENTER: Input signals are output from the centre speaker.
- MAIN: Input signals are directed to the main speakers at the same level.



- SWFR: Input signals are output from the subwoofer.
- MAIN: Input signals are directed to the main speakers at the same level.

# Parameter Control Functions

CINEMA DSP and HiFi DSP have sound field programs preset for the re-creation of the most effective sound fields. Normally there is no need to change programs. And should you change programs, you can restore the preset values by initializing parameters from the Set Menu.



## Effect Trim

### EFCT TRIM (Effect Trim)

- This parameter adjusts the level of all the effect sounds within a narrow range.
- Control Range: -3 dB to 3 dB

## Initial Delay

### INIT. DLY (Initial Delay)

- This parameter changes the apparent distance from the source sound by adjusting the delay between the direct sound and the first reflection heard by the listener.

- Control Range: 1—99 milliseconds

### P. INIT. DLY (Presence Initial Delay)

- adjusts the delay between the direct sound and the first reflection in the presence sound field.

- Control Range: 1—99 milliseconds

### RC. INIT. DLY (Rear Center Initial Delay)

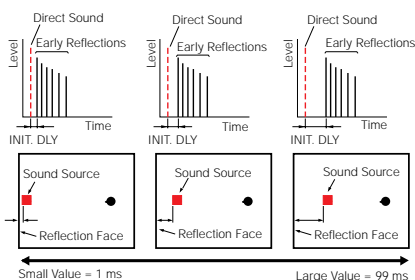
- This parameter adjusts the delay between the direct sound and the first reflection in the rear center sound field.

- Control Range: 1—49 milliseconds

### S. INIT. DLY (Surround Initial Delay)

- This parameter adjusts the delay between the direct sound and the first reflection on the surround side of the sound field. You can only adjust this parameter when at least two front channels and two rear channels are used.

- Control Range: 1—49 milliseconds



## Room Size

### ROOM SIZE (Presence Room Size)

- This parameter adjusts the apparent size of the surround sound field. The larger the value, the larger the surround sound field becomes.

- Control Range: 0.1—2.0

### RC. ROOM SIZE (Rear Center Room Size)

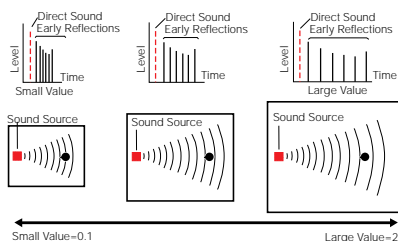
- This parameter adjusts the apparent size of the rear center sound field.

- Control Range: 0.1—2.0

### S. ROOM SIZE (Surround Room Size)

- This parameter adjusts the apparent size of the surround sound field.

- Control Range: 0.1—2.0



## Liveness

### LIVENESS

- This parameter adjusts the reflectivity of the virtual walls in the hall by changing the rate at which the early reflections decay.

- Control Range: 0—10

### RC. LIVENESS (Rear Center Liveness)

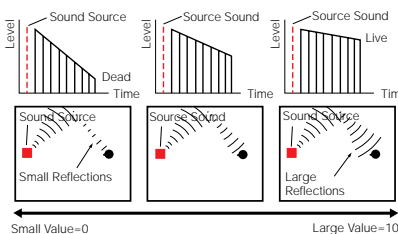
- This parameter adjusts the apparent reflectivity of the virtual wall in the rear center of sound field.

- Control Range: 0—10

### S. LIVENESS (Surround Liveness)

- This parameter adjusts the apparent reflectivity of the virtual walls in the surround sound field.

- Control Range: 0—10



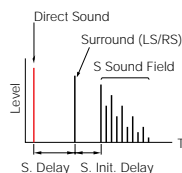
## Surround Delay

### S. DLY (Surround Delay)

- This parameter adjusts the delay between the direct sound and the first reflection in the surround sound field.

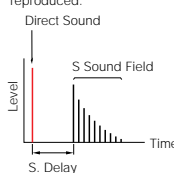
- Control Range: 1—49 milliseconds (The range depends on the signal formats)

### Dolby Digital or DTS (Multi-Channel) input



### PCM, Analog, Dolby Digital or DTS (2-Channel) input

The surround sound field is not reproduced.

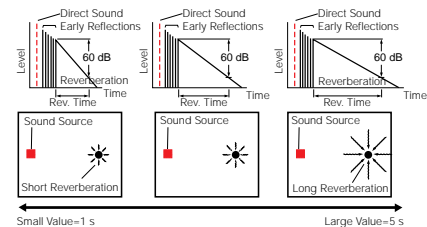


## Reverberation Time

### REV. TIME (Reverberation Time)

- This parameter adjusts the amount of time it takes for the dense, aubaquequent reverberation sound to decay by 60 dB (at 1 kHz). This changes the apparent size of the acoustic environment over an extremely wide range.

- Control Range: 1.0—5.0 seconds

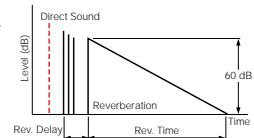


## Reverberation Delay

### REV. DELAY (Reverberation Delay)

- This parameter adjusts the time difference between the beginning of the direct sound and the beginning of the reverberation sound.

- Control Range: 0—250 milliseconds

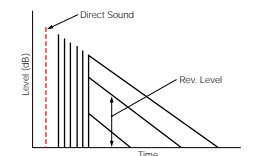


## Reverberation Level

### REV. LEVEL (Reverberation Level)

- This parameter adjusts the volume of the reverberation sound.

- Control Range: 0—100%



## For 8-Channel Stereo

- CT LEVEL (Center Level)
- RL LEVEL (Rear Left Level)
- RC LEVEL (Rear Center Level)
- RR LEVEL (Rear Right Level)
- FL LEVEL (Front Left Level)
- FR LEVEL (Front Right Level)

- These parameters adjust the volume level of each channel in 8-channel stereo mode.
- Control Range: 0—100%

## For Dolby Pro Logic II Music

- PANORAMA extends the front stereo image to include the surround speakers for wraparound effect.

- Control Range: Off/On

- DIMENSIONS gradually adjusts the sound field either towards the front or towards the rear.

- Control Range: -3—STD—+3

- CENTER WIDTH adjusts the center image from all three front speakers to varying degrees.

- Control Range: 0—7

## For DTS Neo:6 Music

- C. IMAGE (Center Image) extends the front stereo image to include the surround speakers for wraparound effect.

- Control Range: 0—0.5

# DSP-AZ1

## Digital Home Cinema Amplifier

### DSP-AZ1 Main Specifications

Min. RMS Output Power	Main Ch	130 W +130 W (0.015% THD)
(8 ohms, 20–20,000 Hz)	Centre Ch	130 W (0.015% THD)
(8 ohms, 20–20,000 Hz)	Rear Ch	130 W + 130 W (0.015% THD)
(8 ohms, 20–20,000 Hz)	Rear Centre Ch	130 W (0.015% THD)
(8 ohms, 1 kHz)	Front Effect Ch	45 W + 45 W (0.05% THD)
DIN Standard Power	Main Ch	200 W +200 W
(4 ohms, 1 kHz,	Centre Ch	200 W
0.7% THD)	Rear Ch	200 W +200 W
	Rear Centre Ch	200 W
	Front Effect Ch	65 W + 65 W
High Dynamic Power, Low-Impedance Drive Capability	Yes	
Dynamic Power/Ch (8/6/4/2 ohms)		165/200/260/360 W
Linear Damping	Yes	
Damping Factor (8 ohms, 20–20,000 Hz)		200 (main/centre channels)
Input Sensitivity/Impedance		
CD (100 W/8 ohms)		150 mV/47 k-ohms
Phono (MM)		2.5 mV/47 k-ohms
Main In		1 V/47 k-ohms
Frequency Response (CD, Main L/R)		10–100,000 Hz +0/-3 dB
Tone Control Characteristics		
Bass	Bass/Cut (50 Hz)	+3 dB/-6 dB
	Turnover Frequency	350 Hz
Treble	Boost/Cut (20 kHz)	+3 dB/-6 dB
	Turnover Frequency	3.5 kHz
Centre/Rear Centre Graphic Equalizer Characteristics		
	Frequencies	100 Hz/300 Hz/1 kHz/3 kHz/10 kHz
	Boost/Cut	+6 dB/-6 dB
	Q	0.7
Cinema Equalizer Characteristics		
High Shelving Filter	Frequencies	1 kHz to 12.7 kHz
	Boost/Cut	+6 dB/-9 dB
Parametric Equalizer	Frequencies	1 kHz to 12.7 kHz
	Boost/Cut	+6 dB/-9 dB
	Q	1.85
Total Harmonic Distortion (20–20,000 Hz)		
Phono (MM) to Rec Out (1 V)		0.01%
CD to Preout (Main L/R, 1 V)		0.005%
Main In (Sp Out L/C/R, 65 W/8 ohms)		0.005%
Signal-to-Noise Ratio (CD)		100 dB (250 mV)
Monitor Out Frequency Response		
Composite/S-Video		5 Hz to 10 MHz -3 dB
Component Video		DC-100 MHz -3 dB
Dimensions (W x H x D)		435 x 211 x 471 mm
Weight		28 kg



Yamaha's unique technology for the creation of sound fields is capable of powerfully reproducing the three-dimensional environment that movie sound engineers aim to convey, in any audio format from monaural to the latest 6.1-channel digital surround. It is compatible with DVD and all other A/V sources.

Yamaha CINEMA DSP technology has received a patent in the U.S. (Patent No. 5,261,005).

For details please contact:

Visit us at our website: <http://www.yamaha-audio.co.uk>

### DSP-AZ1 Surround Programmes: 42 Surround Programmes (62 Variations)

HiFi DSP Programmes		Variations
HALL 1	● Hall A in Europe	1
	● Hall B in Europe	1
	● Hall C in Europe	1
HALL 2	● Hall D in U.S.A.	1
	● Hall E in Europe	1
	● Live Concert	1
CHURCH	● Tokyo	1
	● Freiburg	1
	● Royaumont	1
JAZZ CLUB	● Village Gate	1
	● Village Vanguard	1
	● The Bottom Line	1
ROCK CONCERT	● The Roxy Theatre	1
	● Warehouse Loft	1
	● Arena	1
ENTERTAINMENT	● Disco	1
	● Party	1
	● 8 Ch Stereo	1
Programme Subtotal	<b>18</b>	<b>18</b>
CINEMA DSP Programmes		Variations
ENTERTAINMENT	● Game	1
CONCERT	● Pop/Rock	1
VIDEO 1	● DJ	1
CONCERT	● Classical/Opera	1
VIDEO 2	● Pavilion	1
TV	● Mono Movie	1
THEATER	● Variety/Sports	1
MOVIE	● Spectacle	5
THEATER 1	● Sci-Fi	5
MOVIE	● Adventure	5
THEATER 2	● General	5
ENHANCED	● Enhanced	5
Programme Subtotal	<b>12</b>	<b>32</b>
Surround Formats		Variations
	● Dolby Digital	1
	● Dolby Digital/Matrix 6.1	1
	● DTS Digital Surround	1
	● DTS 96/24	1
	● DTS-ES Matrix 6.1	1
	● DTS 96/24 ES (6.1)	1
	● DTS-ES Discrete 6.1	1
	● Dolby Pro Logic	1
	● Dolby Pro Logic II Music	1
	● Dolby Pro Logic II Movie	1
	● DTS Neo:6 Music	1
	● DTS Neo:6 Cinema	1
Programme Subtotal	<b>12</b>	<b>12</b>
<b>Programme Total</b>	<b>42</b>	<b>62</b>

- Remarks**
- HiFi DSP Programmes
  - A/V Programmes
  - CINEMA DSP
  - Tri-Field CINEMA DSP Capable
  - Quad-Field CINEMA DSP Capable

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YAMAHA ELECTRONICS UK LTD  
200 Rickmansworth Road Watford Herts WD18 7GQ

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