

RX-V1

Digital
Home Theater
Receiver

Unrivaled Digital Performance with Yamaha's Newest Design Concept — Digital ToP-ART



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Digital Cinema for the 21st Century



At Yamaha, we've declared the millennium to be a new era of cinema sound.

We'll be releasing new technologies and products that will give you a more exciting, realistic experience no matter how you watch movies: on a home theater system, in a movie theater, or on a computer.

One of the first of these is the RX-V1.

Yamaha is already the leader in home theater sound, having established our position with our extraordinary CINEMA DSP technology and products like the hugely successful DSP-A1.

The RX-V1 introduces a new design concept, new technologies and new features that make it a truly exciting "breakthrough" product.

Home theater was born in the 20th century. Now in the 21st century, starting with the RX-V1, it's coming of age.



The RX-V1: An all-new species in the evolution of the receiver.



Why a new species? Because the RX-V1 exhibits a combination of intelligence, capabilities and audio performance far beyond any previous or current receiver.

By intelligence we mean four different application-specific LSIs that handle all the decoding and digital signal processing. Designed by Yamaha, manufactured by Yamaha, these microcomputers are the most sophisticated in the industry. They put more processing capacity in the RX-V1 than in any other audio component.

By capabilities we mean 54 different sound field programs that let you change the perceived shape and acoustics of your home theater room to match every audio and video source. The ability to “fine-tune” 14 parameters for every program. An on-screen menu with 18 items that you can control at will. New modes like SILENT CINEMA for headphones and Virtual CINEMA DSP for use without rear speakers. And much more.

By audio performance we mean the ability to realize the full potential of any source you choose to listen to. Thanks to a design philosophy that puts audio quality before any other consideration. And more than enough power to handle the entire dynamic range of DVD discs, as well as deep bass from the rear center channel, with virtually no distortion even at high volumes.

You'll love the control, you'll thrill to the power, but in the final analysis, it's the incredible sound quality that makes this receiver so captivating. The RX-V1 is evolution at its best.



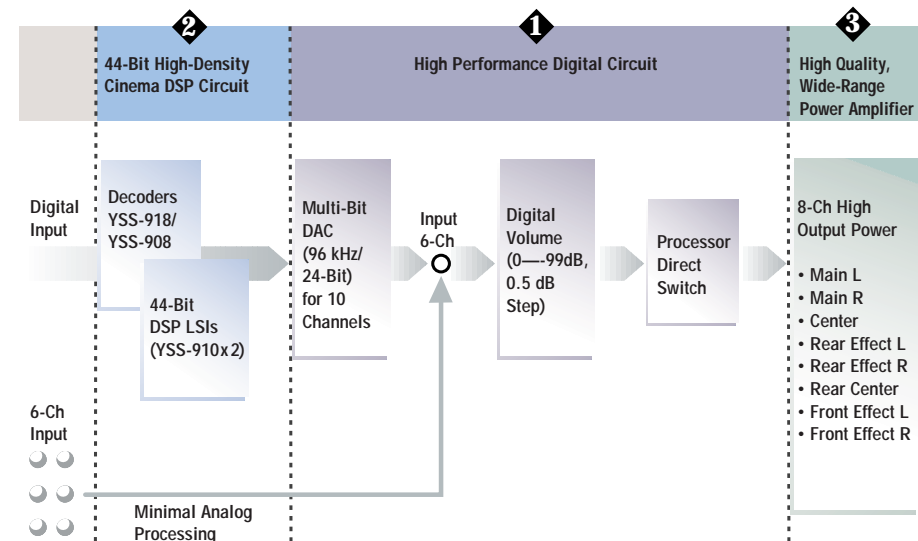
DIGITAL ToP·ART

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 analog 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 RX-V1, 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 the world's first 44-bit DSP LSIs (two YSS-910s) and two decoding LSIs (YSS-918 and YSS-908).
- 3 High Quality, Wide Range Power Amplifier with low-impedance design, superior power transistors, gigantic heat sinks and many other advantages.



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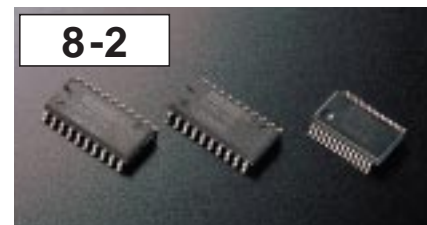
Digital ToP-ART

High Performance Digital Circuit

Positioned between the DSP circuitry and the power amplifier stage, the High Performance Digital Circuit makes a large contribution to the RX-V1'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-Analog Converters

For the important digital-to-analog converters, Yamaha has chosen the PCM1704 manufactured by the high-end audio expert, Burr-Brown. The RX-V1 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-

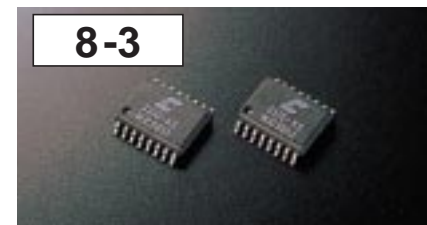


96 kHz/24 bit PCM1704 DACs



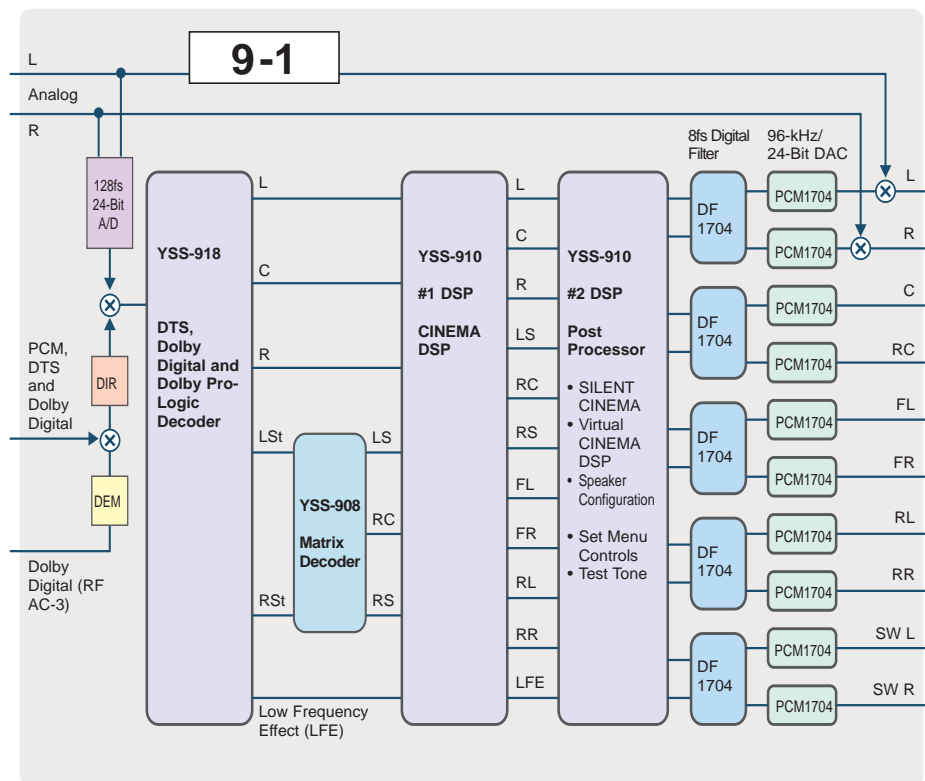
High Sound Quality Multi-Function Processing Board

grade THD + N) and S/N ratio of 120dB. It offers superior low level linearity, with excellent full-scale performance under



High-Quality Digital Volume Devices

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 96kHz/24-bit decoding capability, making it compatible with the latest (and future) high resolution digital audio sources.



High Sound Quality Multi-Function Processing Board Block Diagram

Digitally Regulated Volume Control

Digital volume controls have become popular in home audio products, but for various reasons, analog is the better choice for this key component. Yamaha has combined the best of both by designing a high precision digital device that controls an analog signal. This provides two benefits. First, a digitally controlled device is more accurate for balancing levels between channels and offers much finer control than an analog device. In the RX-V1, 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 (20dB more than



previous models) and narrow steps mean that greater attenuation is possible, with precision even at low volume levels. Second, an analog 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 RX-V1 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 RX-V1 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 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.

TECHNICAL NOTE

DVD



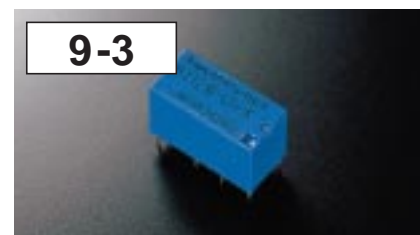
Following videotapes and laser discs, DVD was known as the "next generation" of digital

media, but in terms of home theater, it is the "now generation." The superiority of DVD comes from its tremendous capacity, its convenience (DVD discs are the same size as CDs) and its phenomenal sound and image quality. On the DVD disc, a movie's images and soundtrack are stored in digital form in multiple information layers, often on both sides of the disc. Discs are able to hold an entire movie, plus information about the movie, interviews, different language tracks, and other information. The soundtrack is stored in digital 5.1-channel form, generally in either the Dolby Digital or DTS formats, so the quality is superb.

Of course, a DVD disc is only as good as the equipment it is reproduced on, which is why a high quality DVD player and receiver are essential. Needless to say, the RX-V1 more than fulfills the requirements for realizing the full potential of the DVD experience.

DVD-Audio

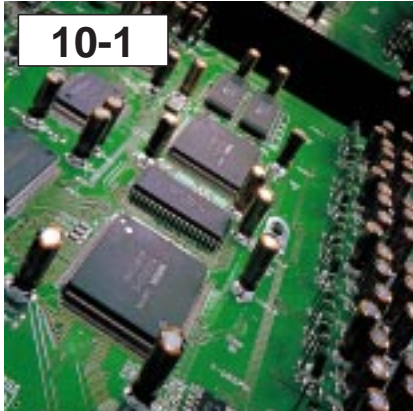
This recently introduced audio format brings the full capabilities of DVD discs to the task of sound reproduction. DVD-Audio uses a 12cm optical disc, the same size as a CD, but with the ability to reproduce frequencies up to about 100kHz, compared with 20kHz for CDs. Although we can't hear frequencies above 20kHz, it has been shown that these frequencies affect the lower frequencies and result in a more natural sound.



High-Reliability Relay Device (for Processor Direct Switch)

Digital 2 ToP-ART

High Density CINEMA DSP Circuitry



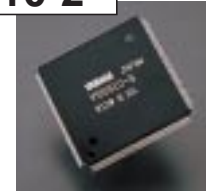
With CINEMA DSP, Yamaha has raised digital sound field processing to the state of fine art. This proprietary technology truly makes movies come alive in your home theater, affording all the realism, excitement and nuance that the director intended to convey. And now these benefits have been further extended with SILENT CINEMA and Virtual CINEMA DSP.

44-Bit CINEMA DSP

The RX-V1 utilizes, for the first time in a consumer-use audio product, 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

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YSS-910 44-Bit DSP LSI

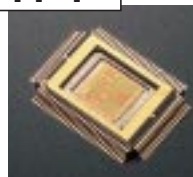
RX-V1 Surround Programs • Note: All DSP programs are available in the SILENT CINEMA and Virtual CINEMA DSP modes.

Program Name	Analog Input	Dolby Digital Input	DTS Input	Dolby Digital/Matrix 6.1 Input	DTS-ES Input
HALL 1	Hall A in Europe	←←←	←←←	←←←	←←←
	Hall B in Europe	←←←	←←←	←←←	←←←
	Hall C in Europe	←←←	←←←	←←←	←←←
HALL 2	Hall D in U.S.A.	←←←	←←←	←←←	←←←
	Hall E in Europe	←←←	←←←	←←←	←←←
	Live Concert	←←←	←←←	←←←	←←←
CHURCH	Tokyo	←←←	←←←	←←←	←←←
	Freiburg	←←←	←←←	←←←	←←←
	Royaumont	←←←	←←←	←←←	←←←
JAZZ CLUB	Village Gate	←←←	←←←	←←←	←←←
	Village Vanguard	←←←	←←←	←←←	←←←
	The Bottom Line	←←←	←←←	←←←	←←←
ROCK CONCERT	The Roxy Theatre	←←←	←←←	←←←	←←←
	Warehouse Loft	←←←	←←←	←←←	←←←
	Arena	←←←	←←←	←←←	←←←
ENTERTAINMENT	Disco	←←←	←←←	←←←	←←←
	Party	←←←	←←←	←←←	←←←
	Game/Amusement	←←←	←←←	←←←	←←←
CONCERT VIDEO 1	Pop/Rock	●←←←	●←←←	●←←←	●←←←
	DJ	●←←←	●←←←	●←←←	●←←←
CONCERT VIDEO 2	Classical/Opera	●←←←	●←←←	●←←←	●←←←
	Pavilion	●←←←	●←←←	●←←←	●←←←
TV THEATER	Mono Movie	●←←←	●←←←	●←←←	●←←←
	Variety/Sports	●←←←	●←←←	●←←←	●←←←
MOVIE THEATER 1	70mm Spectacle	●Dolby Digital Spectacle	●DTS Spectacle	●Dolby Digital Spectacle 6.1	●DTS Spectacle ES
	70mm Sci-Fi	●Dolby Digital Sci-Fi	●DTS Sci-Fi	●Dolby Digital Sci-Fi 6.1	●DTS Sci-Fi ES
MOVIE THEATER 2	70mm Adventure	●Dolby Digital Adventure	●DTS Adventure	●Dolby Digital Adventure 6.1	●DTS Adventure ES
	70mm General	●Dolby Digital General	●DTS General	●Dolby Digital General 6.1	●DTS General ES
DOLBY/DTS SURROUND	Pro-Logic Enhanced	●Dolby Digital Enhanced	●DTS Digital Sur. Enhanced	●Dolby Digital Enhanced 6.1	●DTS Digital Sur. Enhanced ES
	Pro-Logic Normal	●Dolby Digital Normal	●DTS Digital Sur. Normal	●Dolby Digital/Matrix 6.1	●DTS Digital Sur. ES

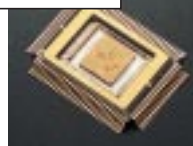
Remarks ■: HiFi DSP Programs ■: AV Programs ●: CINEMA DSP ●: CINEMA DSP Tri-Field CINEMA DSP

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-918 LSI for Dolby Digital and DTS decoding, and the YSS-908 LSI for rear center channel decoding. As a result of all this processing power, you enjoy sensational CINEMA DSP effects, with a choice of 54 surround programs.

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"YSS-918" (top) and "YSS-908" (bottom)

Enjoyment of New Movie Audio Formats

The RX-V1 has 12 CINEMA DSP programs which support Dolby Digital/Matrix 6.1 and DTS-ES encoded sound sources. It also provides the same power as the other channels to a rear center speaker to be used with these formats.

SILENT CINEMA

This new mode gives you private listening enjoyment of multi-channel music or movie sound, including Dolby Digital and DTS surround, through ordinary headphones. It's made possible by the high-density 44-bit DSP LSI, using a new CINEMA DSP algorithm for three-dimensional sound based on

HRTF (see box). When the headphones are plugged in, the speaker outputs turn off automatically and the receiver switches to the SILENT CINEMA mode. When using wireless headphones, connecting one transmitter to the RX-V1 lets you use two headphones to share the experience with a friend. Both the headphone and DSP indicators illuminate in SILENT CINEMA mode.

Virtual CINEMA DSP

Yet another new feature offered on the RX-V1, Virtual CINEMA DSP lets you

enjoy the effects of CINEMA DSP surround sound without using rear speakers (in custom installations where some rooms don't have rear speakers). It can be used with the main/center/front effect speakers or even with just the two main left and right speakers. The Virtual CINEMA DSP is activated when you select the rear speaker "None" setting, and the suitable mode is automatically set according to the sound field program. Both the Virtual and DSP indicators illuminate when the mode is activated.

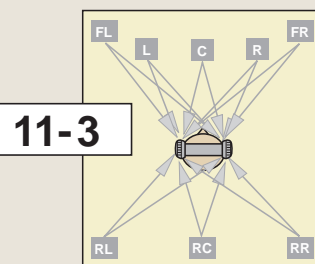
HRTF (Head-Related Transfer Functions)

Transfer functions refer to the transmission of sound to the ears and between the ears and the brain. 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

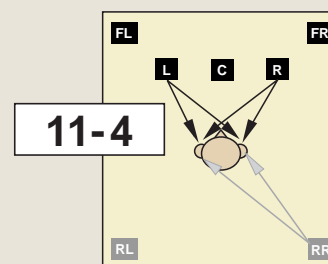
sound into the ears via headphones that accurately reproduces speaker sound from various directions. This is the basis of SILENT CINEMA.

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 canceled and replaced by new signals that simulate rear speakers. Thus you perceive surround sound without actually having rear speakers.



SILENT CINEMA Principle

All DSP programs are available in the SILENT CINEMA and Virtual CINEMA DSP modes.



Virtual CINEMA DSP Principle

TECHNICAL NOTE

Dolby Digital



Dolby Digital, the latest movie sound format from Dolby Laboratories,

provides "5.1" channels of sound: left, right, center, left surround, right surround and a low-frequency channel for bass. Its advantages include better defined front sound, superior imaging and a wider sound field, as well as true stereo surround sound, so you can hear subtle sound movements in the background that you previously couldn't hear. In addition, with Dolby Digital, each channel is independent from the others and can be individually adjusted for peak performance. So even when levels are set with reference to dialogue, there is still room for fine adjustment of each channel's level.

DTS Digital Surround



DTS Digital Surround made news when it was used for the sound in Jurassic Park and has since been adopted by many movie theaters. It records 5.1-channel sound on CD-ROM (rather than on the film) with a reduced digital sound compression rate that greatly improves sound quality.

DTS Digital Surround provides the wide dynamic range typical of discrete recording systems, high sound clarity, and reproduction with good separation. Thanks to the low compression rate, the sound has depth, the links between channels and the S/N are extremely good, and imaging sounds natural. It achieves master quality sound reproduction transparent to the original 5.1-channel master.

3

Digital ToP-ART

High Quality Power Amplifier

Despite all the digital processing magic, the RX-V1 is of course, 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 RX-V1 with awesome capabilities. It incorporates a powerful 8-channel amplifier with an additional rear center power amplifier.

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 the channels and allows the use of a wider variety of low-impedance speakers.

High Performance Power Transistors

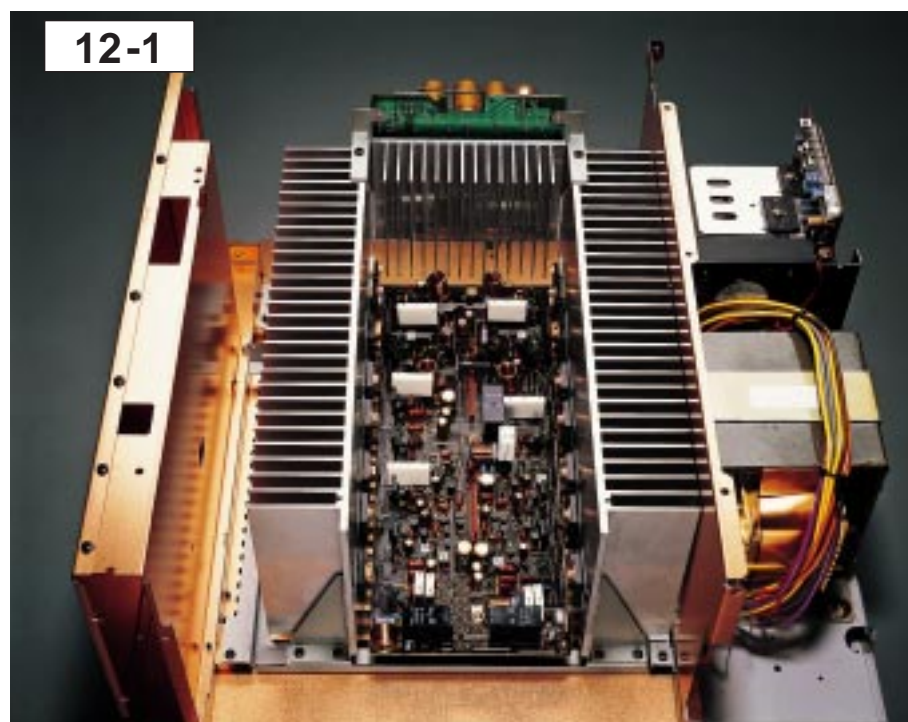
Superior power transistors enable the RX-V1 to achieve a wide bandwidth with frequency response extending to 100kHz, within a 3dB tolerance.

Although human hearing only extends to about 20kHz, the harmonics of these frequencies go much higher, and it is important that these harmonics be

reproduced along with the fundamental frequencies we hear. The RX-V1 transistors employ a wide bandwidth design, enabling them to reproduce the high harmonics, which enhances overall tonality and musicality. This also means that the RX-V1 will easily handle even the next generation of digital audio products such as wider range DVD-Audio.

Naturally Cooled Heat Sinks

Large anti-resonance, aluminum-extruded, naturally cooled heat sinks for efficient heat dissipation 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



RX-V1 Interior View

The RX-V1 interior is dominated on both sides by the massive, anti-resonance, aluminum-extruded, naturally cooled power amp heat sinks, and an additional heat sink for the stable-voltage preamplifier power supply.

12-1

12-2



High Precision FE Mica Capacitors and Metallic Mylar Film Capacitors with Copper Leads

12-3



High-Quality Audio Chemical Capacitors

12-4



Low Magnification Foil Block Chemical Capacitors

12-5



Superior High-ft Type Power Transistors

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.

Improved Preamplifier Power Supply

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

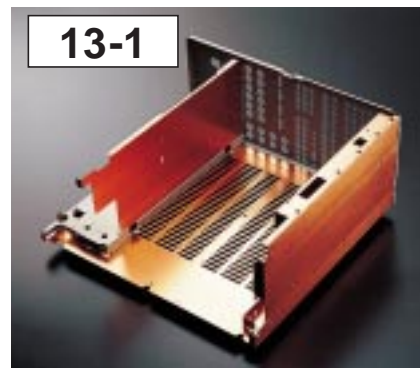
Finest Parts Used Throughout

The RX-V1 uses new high quality capacitors such as high precision FE mica capacitors and metallic mylar film

capacitors with copper leads for the low signal path and very reliable metal-plated ceramic-cased resistors for the power amplifier section, preventing resonance during high signal levels to the power transistors. The block chemical capacitors for the power supply section use low magnification foil and new high quality audio chemical capacitors. The extremely heavy (8.5kg/18.7lbs.), super low-impedance power supply transformer enables exceptional speaker drive capability.

Copper-Plated Bottom Cover and Shielding Cases

A copper-plated bottom cover with a low-impedance surface on the power amplifier section and shielding cases around the DSP board help to maintain the high sound quality.



13-1

Superb Sound Quality

The RX-V1 has High Dynamic Power, Low-Impedance Drive capability and a Linear Damping Circuit. This means it can deliver large amounts of reserve power for accurate reproduction of the high energy peaks that are common in digital audio sources.

RX-V1 Digital Home Theater Receiver

DIGITAL
TOP·ART

CINEMA DSP
Tri-Field

DOLBY DIGITAL
DIGITAL SURROUND

6 CH
EXT. INPUT



13-2

TECHNICAL NOTE

Logical Interior Design

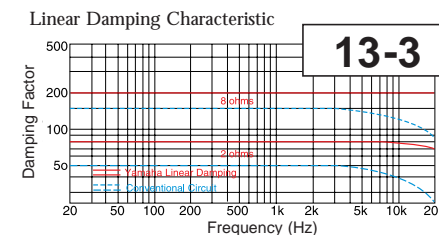
The use of highly integrated LSIs permit amplifier design that places priority on quality by positioning all DSP components into a small area inside the unit. This leaves most of the space open for the power amplifier components: extra-large transformers, capacitors, heat sinks and so on. The result is movie and music sound fields with astounding quality and presence.

High Dynamic Power Capability

The RX-V1 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.

Linear Damping Circuit

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.



13-3

Extensive A/V Connections and Convenient Facilities

Increased Number of Input/Output Terminals

The rear panel provides independent LD, CD and DVD input terminals, as well as increased digital input terminals 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. All A/V input terminals are equipped with S-video terminals. There are also two independent video monitor output terminals, so the unit can be connected to both a TV display and projector (projection TV) simultaneously. In addition, the RX-V1 provides RCA pin jacks for 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.

Custom Installation Compatibility

As befits a high performance home theater

receiver, the RX-V1 is ideal for use in custom installations. It is equipped with an RS-232C interface that allows two-way communication between the receiver 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. The remote control has a Zone 2 mode that allows it to be operated as a room 2 controller.

Auto Priority Input Terminal Selection and Auto Decoder Selection

Digital input terminals are provided to handle any kind of digital input. Functions are programmed to select priority in order of RF (AC-3), coaxial digital, optical digital and analog when different digital formats are input from the same source. The sound decoder is also automatically selected and processed according to the combination of the format of input signals and the selected sound field programs,

while DSP sound field processing is optimized at the same time. If 70mm MOVIE THEATER Sci-Fi, for example, is selected and the input is a DTS signal, the DTS Digital Surround decoder is automatically engaged and a switch is made to DTS Sci-Fi. If the signal is Dolby Digital, then a switch is made to Dolby Digital Sci-Fi, whereas if the input is PCM or analog, 70mm Sci-Fi is enabled. If a LaserDisc is played on Dolby Digital, the demodulator starts up and input automatically switches to RF (AC-3). Dolby Digital/Matrix 6.1 and DTS-ES modes can be set for auto selection or switched off.

Mono/Split Subwoofer Output Terminals

New audio formats have LFE (Low Frequency Effect) added to them, an important factor in adequate reproduction of low frequencies. The RX-V1 has Mono and Split output terminals, and the low frequencies of channels programmed by the speaker mode programming function can be output from the subwoofer. Subwoofer level is easily adjusted with a test tone.

RX-V1 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	
Phono	■												
CD	■		■		■								
MD		■			■								
Tape	■	■											
DVD	■		■		■		■		■			■	
LD	■		● RF (AC-3)		■		■		■			■	
D-TV	■				■		■		■			■	
CBL/SAT	■		■		■		■		■			■	
VCR 1	■	■			■		■	■	■	■		■	■
VCR 2	■	■					■	■	■	■		■	■
VCR 3	■	■					■	■	■	■		■	■
Video/Aux	■						■		■			■	
Monitor 1									■				■
Monitor 2									■				■
Zone 2		■							■				

■ Three component video inputs from among these eight can be selected.

Extensive System Connections

In addition to the 6-channel external decoder input terminals, there are pre-main and center couplers, and rear effect, rear center and front effect channel preout terminals, subwoofer outputs (mono and split), zone 2 out for custom installation and speaker impedance selector. All speaker terminals are 2-way binding type (banana plug compatible). (Photo: RX-V1 US model)

15-1



Oil-Damped Hidden Control Panel

Total Convenience

A comprehensive On-Screen Display with a convenient Set Menu lets you select and adjust a wide variety of functions. It includes a speaker display that makes it easier to balance speaker output in the Speaker Test Mode. You can select each of the DSP programs with the remote control so you can compare the effects from your listening position.

Rec Out Selector

The audio or video source can be recorded on VCR 1, 2 or 3 or Tape or MD. Using the Rec Out Selector, you can record a different source from the one you are listening to.

Bass Extension

Turn the bass extension switch on to provide +6dB boost to the main speaker's low end centered at 60Hz. Frequencies under 50Hz will be cut by 12dB/oct. to prevent overdrive.

Tuner Section Features High Quality, Easy Operation

In addition to utilizing the Direct PLL IF Count Synthesizer Tuning system, the RX-V1 also makes station selection easy. You can preset as many as 40 stations for instant one-touch tuning, and with each one the tuning mode (stereo or mono) is also memorized. Auto FM Station Memory will automatically preset the 40 strongest stations on the dial for you. You can then use Preset Editing to rearrange them into groups.

15-2



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

The RX-V1 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 program 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.

15-3



15-4



LCD Display and LED Lighting with functional keys backlit.

15-5



Hidden Control Panel

CINEMA DSP: How Yamaha Makes It Worth Your While to Watch Movies at Home.

16-1

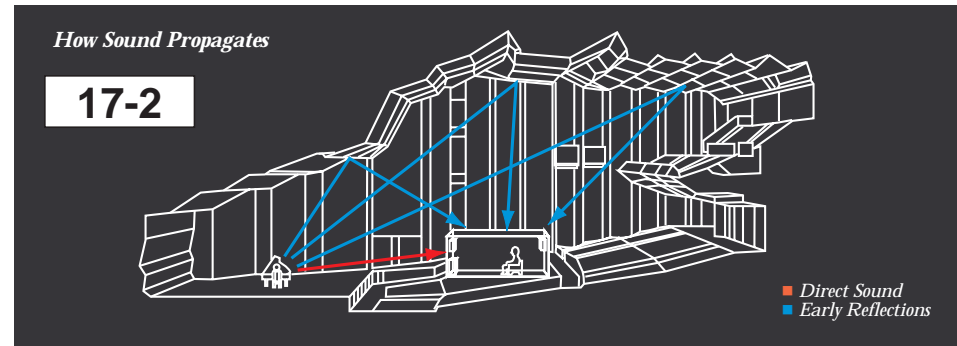


Recreating Sound Fields on the Basis of Real-World Data

The Sound Field of a Concert Hall Greatly Affects 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.



17-2

Synthesizing Sound Fields Based on Actual Data

The real-world data that constitutes the basis for programmed sound fields is adjusted 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 — so that you get 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.

DSP Uses Actual Sound Field Data

The RX-V1's DSP programs incorporate sound field data recorded at concert halls, opera houses, and other musical venues in the United States and Europe, such as New York's Bottom Line, whose sound field is shown here. To gather this data, our engineers used a system called the "Closely Located Four Point Microphone Method." Four microphones are placed on the same plane or in proximity to each other to capture pulsive sounds, and their impulse responses are recorded.

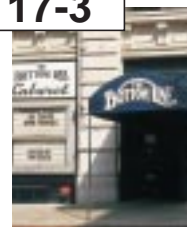
17-1



Closely Located Four Point Microphone

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 — a 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.

17-3



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

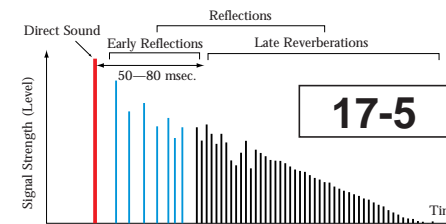
Imaginary Sound Source Distribution of Sound Field Data

17-4



EFCT TRIM	0 dB
INIT.DELAY	30 ms
ROOMSIZE	1.0
LIVENESS	5
S. DELAY	5 ms*

* Dolby Digital/DTS Input



17-5

Measurement and Reproduction of Imaginary Sound Source Distribution in All Directions

The actual sound field data used by the RX-V1 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 center 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 source. The size of the circle represents strength, while the direction from the center 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 center point.

Early Reflection and Reverberation Processing

DSP consists of early reflection processing and 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.

Virtual Sound Source Distribution of Programmed Ambience Data

17-6



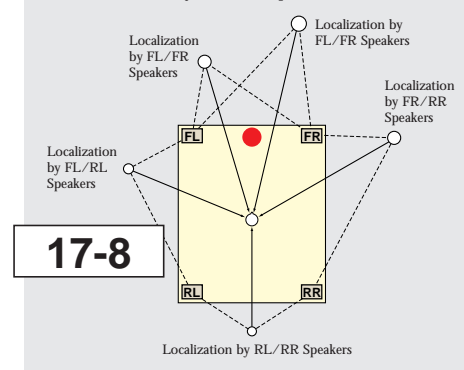
Reflections and Virtual Sound Sources Assigned to 4 Channels

17-7

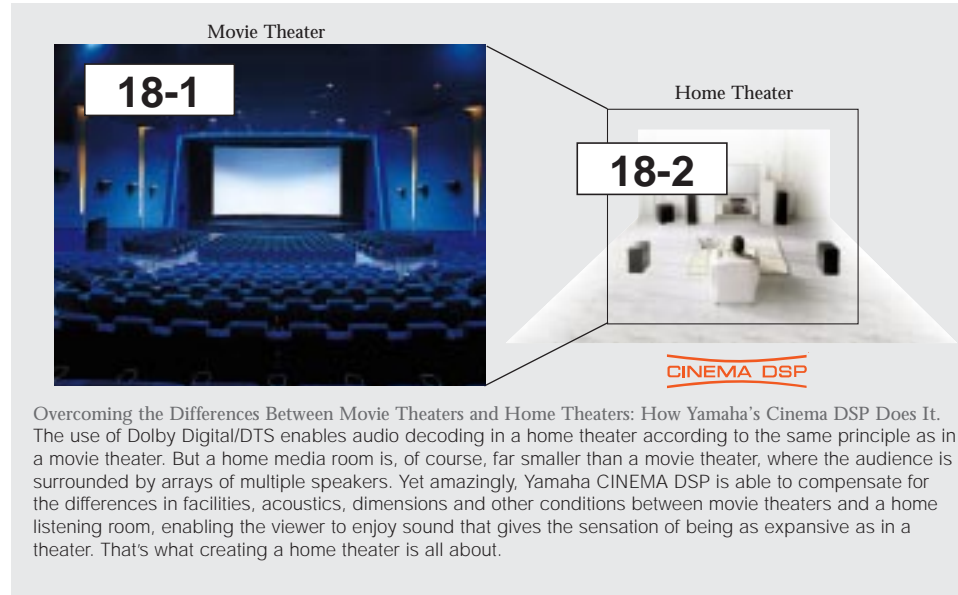


Localization of Virtual Sound Sources in All Directions by 4 Effect Speakers

17-8



Developing New Digital Theater Sound: Improved CINEMA DSP.



Movie Surround Formats

There are three types of surround sound formats developed for movie theater use that can be enjoyed at home: Dolby Pro-Logic, widely used in ordinary theaters and for home videos, and Dolby Digital and DTS that are used for LaserDisc and DVD. The latter two formats feature five independent main channels and a subwoofer channel, the newest surround stereo format, and are encoded from the same master tapes as those used for movies.

Movie Sound Design

Movie sound is designed to be integrated so that the voices are clearly fixed on the screen, sound effects are behind them, the music spreads out behind that, and the surround sound envelopes the audience.

The sound is "designed" in a dubbing theater that has sound mixing and movie screening equipment. The film sound track is encoded in the surround formats described above, and is recorded on tapes and discs for home use.

Movie Theater Sound Versus Home Theater Sound

A major difference between movie theater sound and home sound is in the positioning of the speakers. In a movie theater, the sound is designed so that it can be reproduced as desired using multiple surround speakers embedded in the left, right and rear walls and positioned so that they emphasize the relationship between sound from the screen and channels. This provides a more uniform quantity of sound to the wide audience area.

There is a large difference in the absolute volume of space between a theater where there are at least several hundred seats and a family listening room, and that produces a big difference in the feeling of scale if the sound from a theater is reproduced, with no modification, in a home.

Correcting these differences enables sound reproduction in the home that is closer to the ideal.

Sound Field Measurement and Analysis

Sound source directions can be separated

into three basic ones as seen from the listening position: the front direction, the left rear direction and the right rear direction. We measured the sound field that is created by the center speaker, representing the front direction, and the sound fields made by each of the multiple surround speakers in the left and right rear directions.

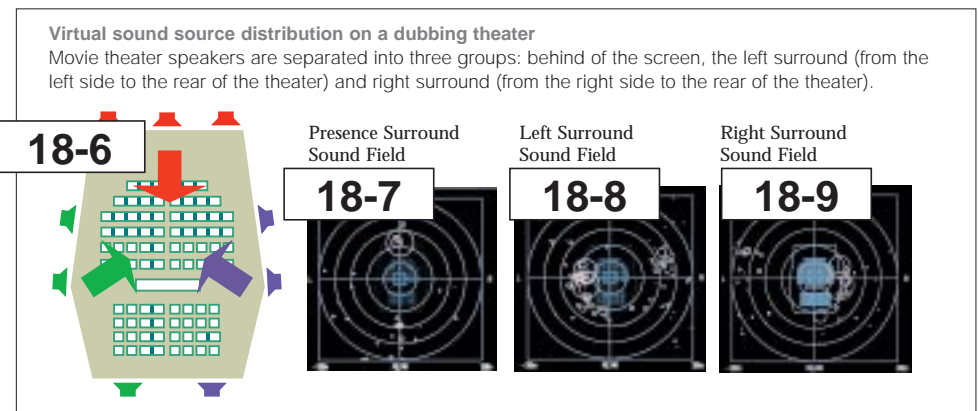
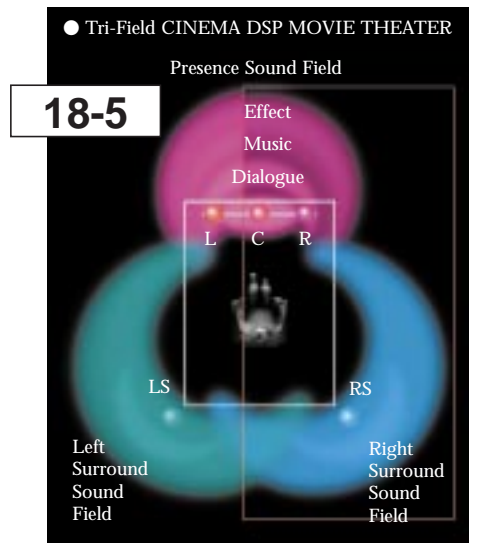
Each diagram for the three virtual sound sources shows a completely different pattern of distribution, and, naturally, the sound fields are independent for each of the different sound sources. The effects of the multiple surround speakers on the wall surfaces are observed in the right and left surround channel sound fields. Priority is given to processing each of three independent sound fields in the ideal sound processing for Dolby Digital and DTS 5.1-channel software.

Tri-Field CINEMA DSP for Use with Dolby Digital and DTS Brings Out the Best in Movie Sound Design

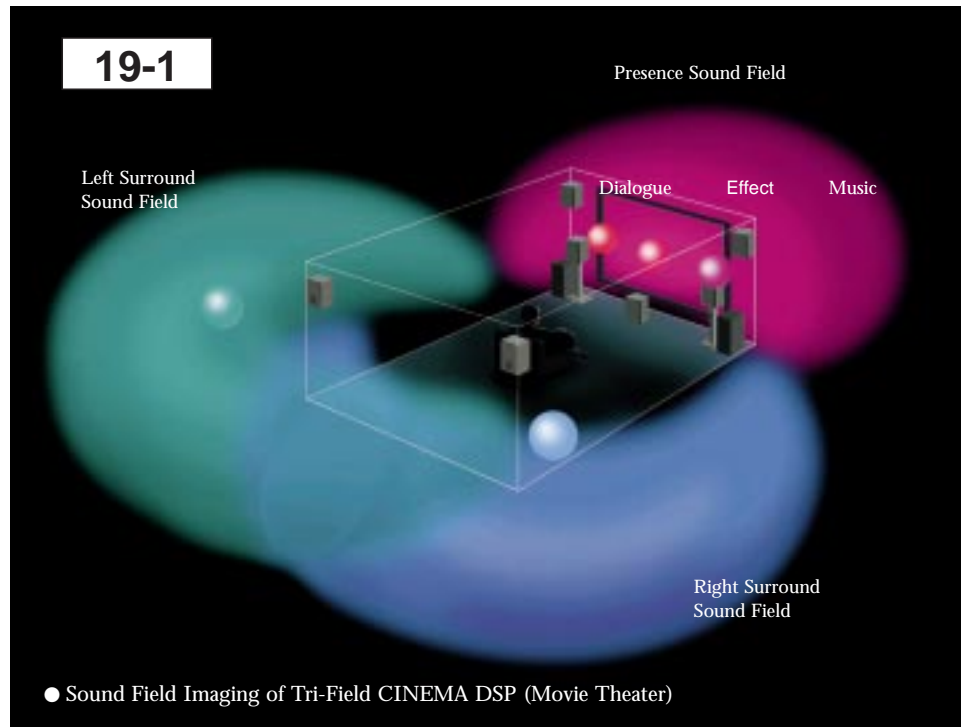
Based on the results of these analyses,



Tri-Field CINEMA DSP positions three sound fields. One is a presence sound field that ideally presents the fixed voice positions, sound effects and music, and the other two are independent stereo sound fields that create a large-scale surround space suitable to the source position of the left and right channels, thus giving a three-dimensional feeling of depth to the three front channels in the screen direction.

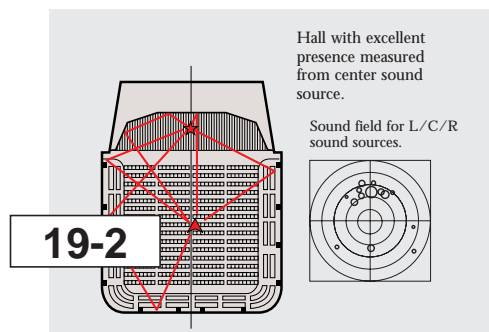


Tri-Field CINEMA DSP Processing for Creating Realistic Sound.



The diagram above shows that Tri-Field CINEMA DSP processing combines three DSP sound fields with 5.1-channel output from the Dolby Digital decoder or DTS decoder.

In presence sound field processing, the



L, C and R signals from the decoder are first weighted and then processed by the DSP block shown in red. Similarly, the DSP blocks shown in blue and green independently process the left and right surround channels.

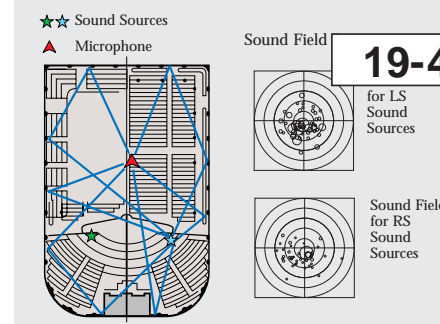
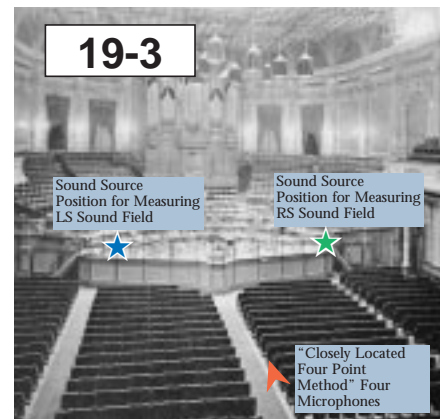
Each DSP block has four-channel output that differs in each direction away from the front of the listener to create reflected sound in all directions.

The Presence Sound Field

The use of opera house sound field data in the processing of this sound field adds realism to dialogue and gives music and sound effects a palpable feeling of "presence." Only the initial reflecting sound component is used, in order to avoid excess reverberation and prevent any loss in vocal clarity.

The Stereo Surround Sound Field

The sound field of a large concert hall with excellent acoustics is used to obtain a surround sound field that provides a large-scale surround feeling and smoother continuity with the front sound field. Data was obtained by placing sound sources at the left and right of the stage for the stereo channels and measuring the sound reflecting in all directions toward the audience.

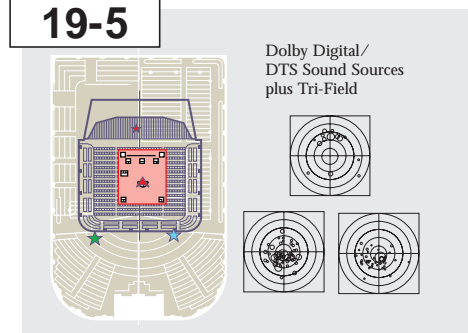


We reversed all measured data for front and back and used it so that the rear (the stage) would be the sound field in order to combine the left and right surround channels.

Synthesizing Tri-Field and Decoder Outputs

The three groups of four-channel DSP-processed sound field outputs are merged and concentrated in four directions: left and right front effect and left and right rear effect. These are synthesized with the decoder output to provide a final output of eight channels, including the subwoofer channel.

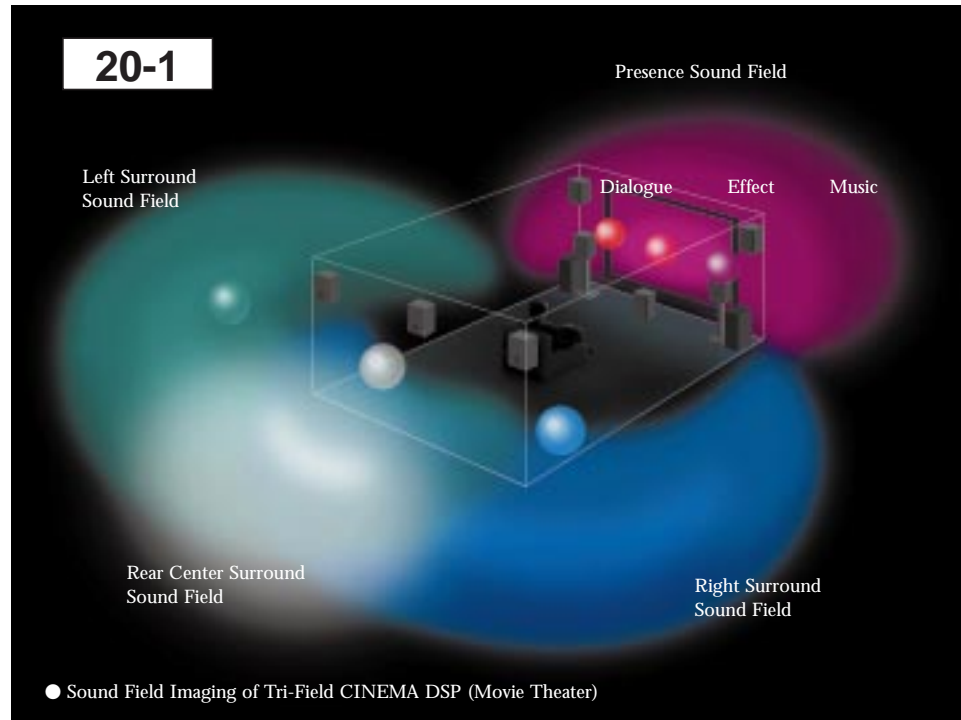
The acoustic space that Tri-Field CINEMA DSP obtains from these eight channels is indicated by the synthesized space in the diagram below.



The sound synthesized from eight channel speakers (left, center, right, left-effect rear, right-effect rear, left-effect front, right-effect front and subwoofer) in the room of a private home reproduces the space acoustics of the hall shown in black for voice, music and sound effects from the front. The surround channels reproduce the sound field acoustics of the hall shown in tan.

Tri-Field CINEMA DSP has different acoustic characteristics for the space at each sound source position, and by using only the initial reflected sound and not reverberations, it creates an acoustic space that is physically impossible to build. By utilizing the ideals of movie sound design, Tri-Field CINEMA DSP enables your private cinema to become a magnificent "real" theater.

Full Enjoyment of Dolby Digital/Matrix 6.1 and DTS-ES



The RX-V1 is equipped to handle all existing movie sound formats, including the digital surround types that have a rear center channel. The block diagram shows the circuitry that makes this possible.

(1) Encoding stage

A 6.1 channel dubbing theater 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 center rear channel sound, after which encoding is done by the Dolby Digital or DTS encoders.

(2) DVD Disc preparation

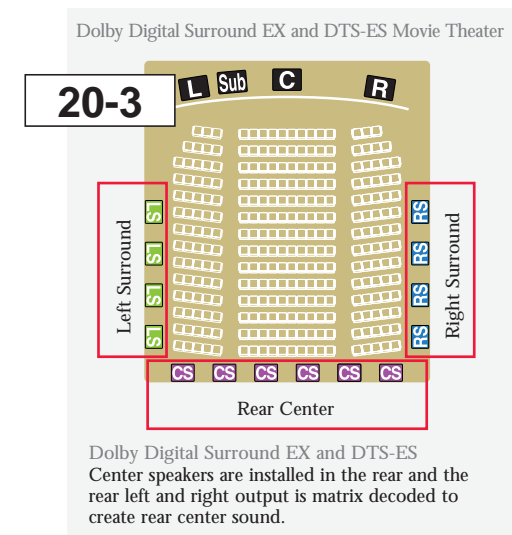
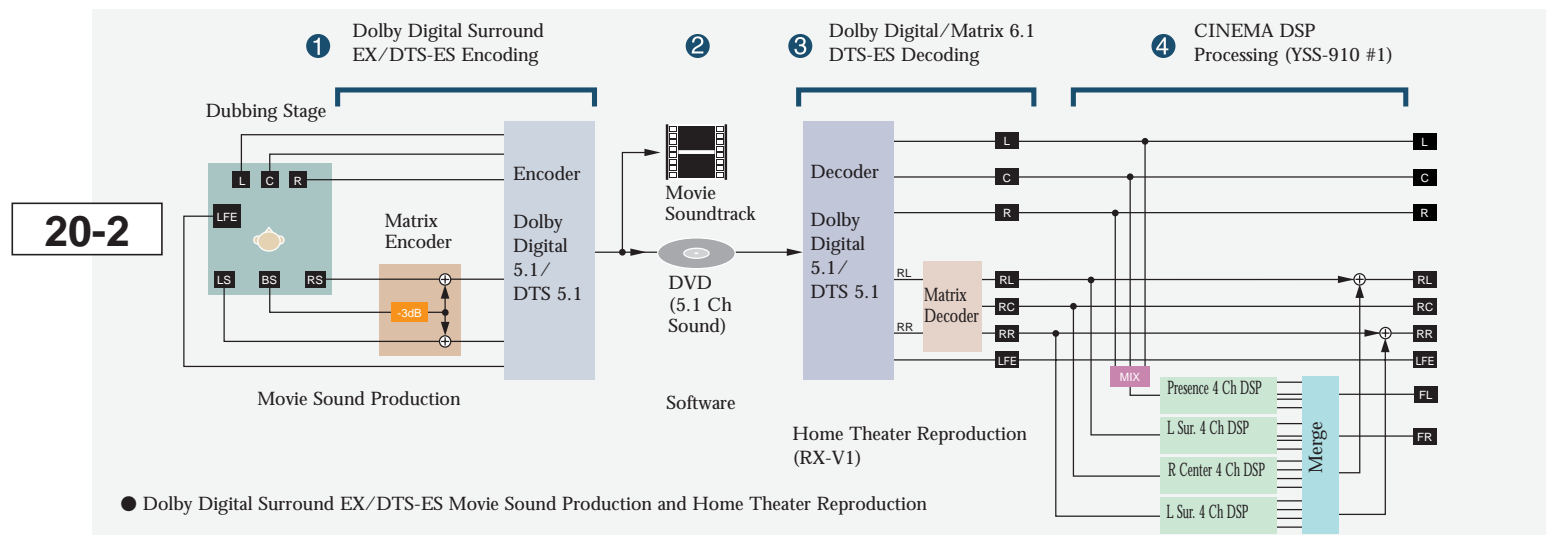
If the DVD disc is created using the 6.1 channel matrix encoding process, 6.1 channels of sound will be reproduced upon playback providing that there is a matrix decoder in the rear channels and a sixth channel of amplification. The RX-V1 has the matrix decoder built-in and 6 channels of amplification for enjoyment of Dolby Digital and DTS programs produced in this new format.

(3) Matrix Decoder

The audio signal is first decoded to 5.1 channels, then the center rear channel sound is derived from the left and right channels by the matrix decoder. The sixth channel of sound has full frequency response the same as all other channels, except LFE. When a disc which is deliberately encoded with center rear channel information is detected the 6.1 Matrix Auto function automatically activates the matrix decoder. However, enjoyment of 6.1 sound is not at all limited to the playing of specially encoded discs. Most 5.1 encoded discs naturally contain information in the surround channels that can be extracted to provide a center rear channel. Thus, even DVD discs that are encoded with only 5.1 channels of sound can reproduce center rear channel sound by manually activating the matrix decoder when playing such discs.

(4) CINEMA DSP Sound Field Processing

A 6.1 channel DVD disc can be enjoyed using Yamaha CINEMA DSP enabling you to enjoy a greater sense of front to rear depth and soundstaging, recreating the movie theater experience at home.



CINEMA DSP: An Amazing Variety of Sound Field Programs

MOVIE THEATER 1

70mm Spectacle

This program 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.

70mm 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

70mm Adventure

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

70mm 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.

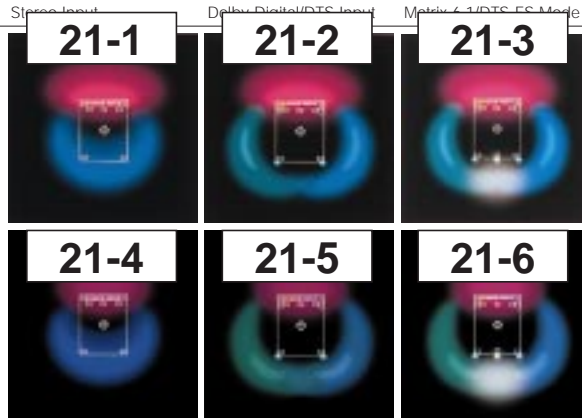
DOLBY PRO-LOGIC

Dolby Pro-Logic Enhanced

Dolby Pro-Logic, Dolby Digital and DTS decoders provide precise decoding for faithful sound reproduction. Superior separation, with smooth movement and good localization.

Dolby Pro-Logic Normal

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.



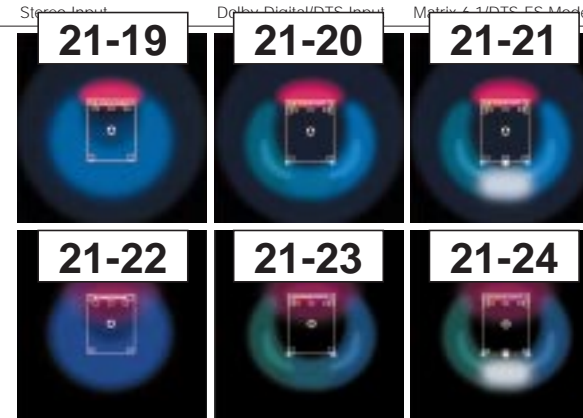
CONCERT VIDEO 1

Pop/Rock

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

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.



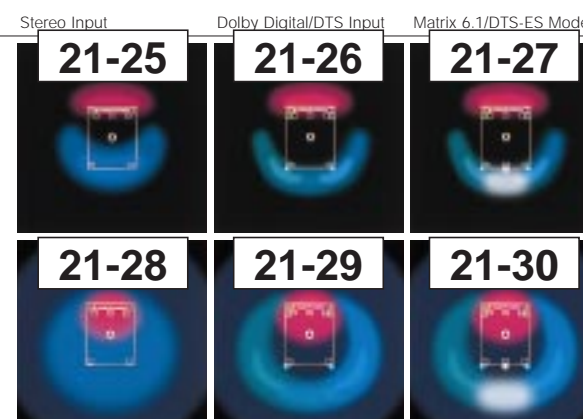
CONCERT VIDEO 2

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.

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.



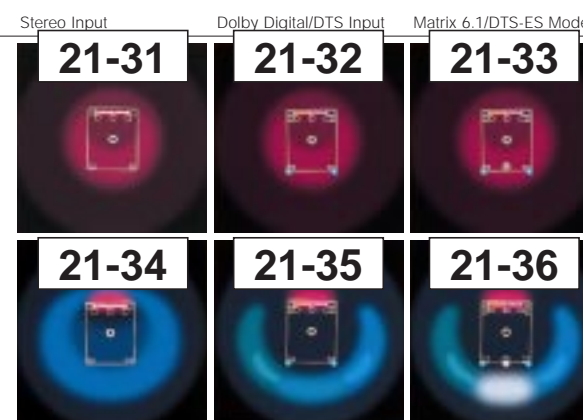
TV THEATER

Mono Movie

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

Variety/Sports

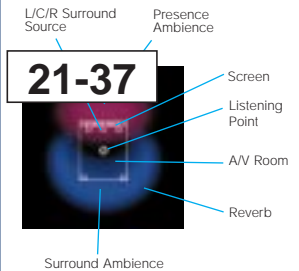
When listening to the stereo broadcast of a sports program, the commentator's voice will be in the center, with the crowd noise spreading out to the sides.



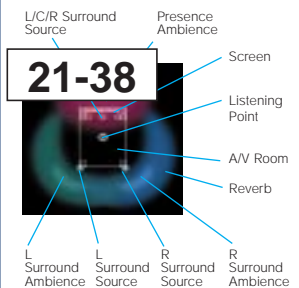
Ambience Representations of DSP Programs

E/R (Early Reflections):
Program that uses the ambience data of early reflections.
E/R + Rev (Reverberations):
Program that uses the ambience data of early reflections and reverb.

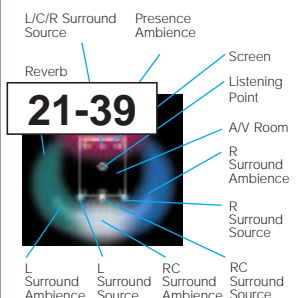
PCM/Analog Input



Dolby Digital/DTS Input



Matrix 6.1/DTS-ES Mode



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

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

22-1 SPEAKER SET
Press +/- Key!

22-2 Center Speaker Mode: Large or Small
22-3 22-4

22-5 CENTER SP
→LRG SML NONE

22-6 Main Speaker Mode: Large or Small
22-7 22-8

22-9 Rear L/R Speaker Mode: Large or Small
22-10 22-11

22-12 REAR L/R SP
→LRG SML NONE

22-13 Rear Center Speaker Mode: Large or Small
22-14 22-15

22-16 REAR CT SP
→LRG SML NONE

1E. LFE (Low Frequency Effect)/Bass Out (Bass Out Mode): Subwoofer, Main Speaker or Both
22-17 22-18 22-19

22-20 LFE/BASS OUT
→SW MAIN BOTH

22-21 Front Effect Speaker Mode: Yes or No
22-22 22-23

22-24 Main Level Mode: Normal or -10dB
22-25 22-26

2. Low Frequency Test

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

22-27 22-28 22-29

22-30 22-31

22-32 22-33 22-34

22-35 22-36 22-37

3. Dolby Digital Set

22-35 22-36 22-37

22-38 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.

22-39 Dialogue Level

22-40 Dialogue Level

- 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.

4. DTS Set

22-41 22-42 22-43

5. Speaker Delay Time

For programming the center and rear center speaker delay

22-44 22-45 22-46

22-47 Center Speaker Image

6. Audio Delay Time

22-48 22-49 22-50

22-51

7. Center Graphic Equalizer

22-52 22-53

8. Rear Center Graphic Equalizer

22-54 22-55

9. Cinema Equalizer

22-56 22-57 22-58

22-59 22-60 22-61

10. Headphone Tone Control

22-62 22-63 22-64

11. Parameter Initialize

22-65 22-66 22-67

22-68

12. 6.1/ES Auto

22-69 22-70

13. Memory Guard

22-71 22-72

14. Component Video Input

22-73 22-74

15. Input Mode

22-75 22-76 22-77

22-78

16. Input Rename

22-79 22-80 22-81

17. Dimmer

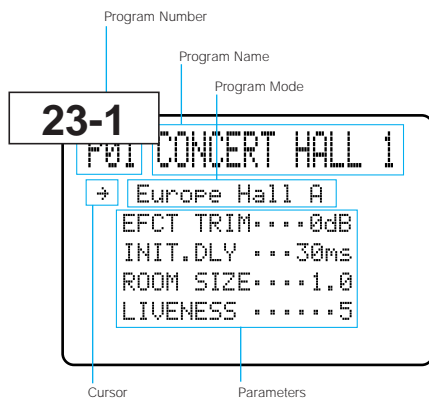
22-82 22-83

18. Zone 2 Set

22-84 22-85 22-86

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.

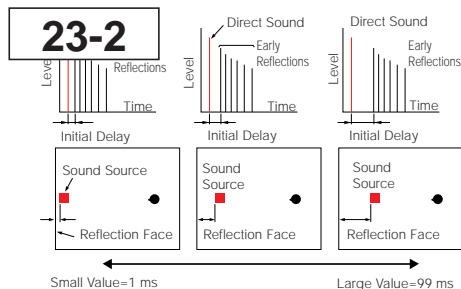


EFCT TRIM (Effect Trim)

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

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



RC. INIT. DLY (Rear Center Initial Delay)

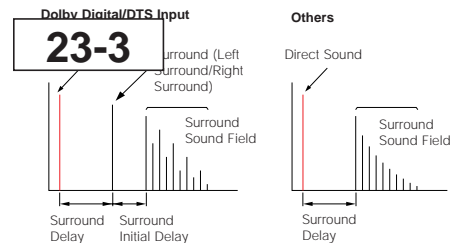
- This parameter adjusts the delay between the direct sound and the first reflection in the rear center sound field.
- Control Range: 1—99 milliseconds

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—99 milliseconds (15—30 milliseconds for Dolby Pro-Logic)

S. DLY (Surround Delay)

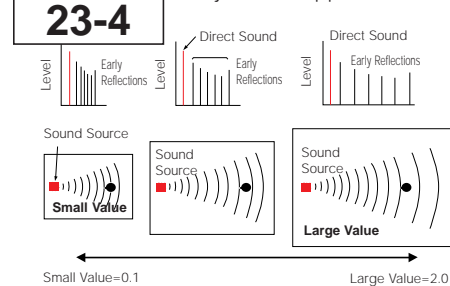
- This parameter adjusts the delay between the direct sound and the first reflection in the surround sound field.



- Control Range: 1—99 milliseconds (15—30 milliseconds for Dolby Pro-Logic) (0—15 milliseconds for Dolby Digital/DTS)

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)

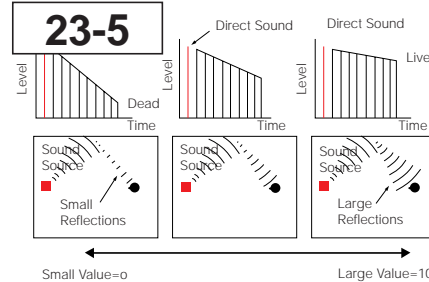
- This parameter adjusts the apparent size of the rear center sound field.
- Control Range: 0.1—2.0

S. ROOM SIZE (Surround Room Size)

- This parameter adjusts the apparent size of the surround sound field.
- Control Range: 0.1—2.0

LIVENESS

- 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



S. LIVENESS (Surround Liveness)

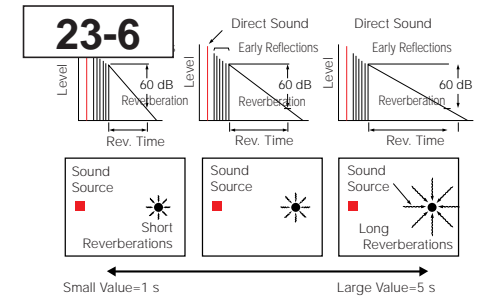
- This parameter adjusts the apparent reflectivity of the virtual walls in the surround sound field.
- Control Range: 0—10

RC. LIVENESS (Rear Center Liveness)

- This parameter adjusts the apparent reflectivity of the virtual wall in the rear center sound field.
- Control Range: 0—10

REV. TIME (Reverberation Time)

- This parameter adjusts the amount of time it takes for the dense, aubaequent reverberation sound to decay by 60 dB (at

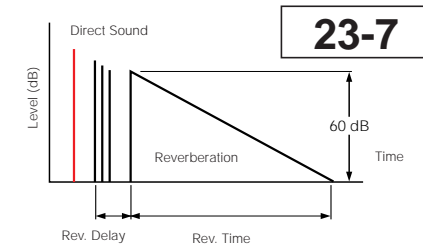


1 kHz). This changes the apparent size of the acoustic environment over an extremely wide range.

- Control Range: 1.0—5.0 seconds

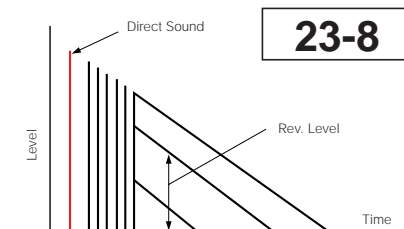
REV. DELAY (Reverberation Delay)

- 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



REV. LEVEL (Reverberation Level)

- This parameter adjusts the volume of the reverberation sound.
- Control Range: 0—100%



RX-V1 Specifications

<AUDIO SECTION>

Min. RMS Power	(8 ohms, 20–20,000 Hz)	
Main Ch	(0.015% THD)	110 W + 110 W
Center Ch	(0.015% THD)	110 W
Rear Effect Ch	(0.015% THD)	110 W + 110 W
Rear Center Ch	(0.015% THD)	110 W
Front Effect Ch	(0.05% THD)	35 W + 35 W
High Dynamic Power, Low-Impedance Drive Capability	Yes	
Dynamic Power/Channel	8/6/4/2 ohms	150/180/240/340 W
Linear Damping Circuit Yes		
Damping Factor (L/C/R)	(8 ohms, 20–20,000 Hz)	200
Power Bandwidth (Stereo Driven)	(0.04% THD, 55 W/8 ohms)	10–50,000 Hz
Input Sensitivity/Impedance		
CD	(100 W/8 ohms)	150 mV/47 k-ohms
Phono		2.5 mV/47 k-ohms
Main In		1 V/47 k-ohms
Headphone Output/Impedance	(CD, 40 mV, 8 ohms)	150 mV/100 ohms
Frequency Response	(CD, Main L/R)	10–100,000 Hz +0/-3 dB
RIAA Equalization Deviation	(Phono MM)	20–20,000 Hz ±0.5 dB
Tone Control Characteristics		
Bass	Turnover Frequency	350 Hz
	Boost/Cut	±10 dB/50 Hz
Treble	Turnover Frequency	3.5 kHz
	Boost/Cut	±10 dB/20 kHz
Center Graphic Equalizer Characteristics		
Frequencies		100, 300 Hz, 1 k, 3 k, and 10 k-Hz
	Control Range	±6 dB
	Q	0.7

Cinema Equalizer Characteristics

High Shelving Filter		
Frequencies		1 k to 12.7 k-Hz
Control Range		-9 to +6 dB
Parameter Equalizer		
Frequencies		1 k to 12.7 k-Hz
Control Range		-9 to +6 dB
Q		1.85
Bass Extension Characteristics		
(Main L/R)		+6 dB/60 Hz
Total Harmonic Distortion (20–20,000 Hz)		
Phono (Rec Out)		0.01% (1 V)
CD (Pre Out, Main L/R)		0.005% (1 V)
Main In (Sp Out, 55 W/8 ohms)		0.005%
Signal-to-Noise Ratio (IHF-A-Network, Effect Off)		
CD (Input Shorted)		96 dB
Phono MM (5 mV Input Shorted)		86 dB

<VIDEO SECTION>

Video Signal Level	(Composite)	1 Vp-p/75 ohms
Video Signal Level	(S-Video)	Y=1 Vp-p/75 ohms C=0.286 Vp-p/75 ohms
Video Signal Level	(Component)	Y=1 Vp-p/75 ohms Cb/Cr=0.7 V/75 ohms
Video Maximum Input Level		1.5 Vp-p
Video Signal-to-Noise Ratio		50 dB
Monitor Out Frequency Response		5 Hz to 10 MHz -3 dB

<TUNER SECTION>

Direct PLL IF Count Synthesizer Tuning	Yes	
40-Station Random Access Preset Tuning	Yes	
FM 50dB Quieting Sensitivity (IHF, 1 kHz, 100% Modulation)		
	Mono	1.6 µV (15.3 dBf)
	Stereo	23 µV (38.5 dBf)
FM Alternate Channel Selectivity (±400 kHz)		75 dB

FM Signal-to-Noise Ratio (IHF)		
	Mono/Stereo	81 dB/75 dB
FM Harmonic Distortion (1 kHz)		
	Mono/Stereo	0.1%/0.2%
FM Frequency Response (20—15,000 Hz)		±1 dB
AM Usable Sensitivity		300 µV/m
AM Signal-to-Noise Ratio		52 dB

<GENERAL SECTION>

Dimensions	(W x H x D)	471 x 211 x 473 mm; 17 ⁷ / ₁₆ " x 8 ³ / ₁₆ " x 18 ³ / ₁₆ "
Weight		28 kg, 61 lbs, 11 oz.

24-1



Black Finish

24-2



Gold Finish

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Theater photos in this catalog: Warner Mycal Cinemas "Minato Mirai".

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