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StormAudio  
ISR Fusion 20 AVR

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# GODZILLA \* KONG

## THE NEW EMPIRE



## StormAudio

### ISR Fusion 20 AVR

#### 20-Channel Audio Processor With 16 Amplifier Channels

**Doug Blackburn**

StormAudio is a French company that was inspired by the revolution of Immersive Audio for commercial theatres and for home theatre that began in 2011 when both Auro Technologies and Dolby Laboratories demonstrated the expansion of surround sound into Immersive Sound. StormAudio is located in a town close to the northwestern shores of France. From the beginning StormAudio worked closely with Auro Technologies and its Auro-3D immersive sound codec while also embracing DTS and Dolby Immersive Sound solutions. The ISR Fusion 20 is the most expensive AVR I've ever experienced. It is also the most flexible and most feature-laden AVR I've ever experienced. The suggested retail price of \$19,999 makes it an expensive control center in a custom theatre system. But, as high-performance custom-install equipment goes, there is so much "content" in the ISR Fusion 20, that the price is surprisingly justifiable once you appreciate everything it can do. Take the 16 amplifier channels as a feature. In the custom install world, you would be hard-pressed to find stand-alone amplifiers with great sound for less than \$600 per channel. Sixteen channels of amplification alone would cost \$9,600 at \$600 per channel. Rather than re-inventing a room calibration/room acoustics-improving system of their own, StormAudio recognized

the brilliance of Dirac Live's ever-improving room correction and calibration capabilities. Dirac Live is integrated into the ISR Fusion 20 as though it was designed for the ISR Fusion 20.

Most, quite possibly all, ISR Fusion 20s will be sold as part of a new custom installed system or as an upgrade to an existing custom installed home theatre system. The ISR Fusion 20 is the most programmable/customizable AVR I've ever experienced. So much so, that even advanced hobbyists undeterred by the most complex home theatre products will be happy to have installer support to help them understand how to achieve the best possible results that can be extracted from their ISR Fusion 20. For owners who want none of the complexity, while expecting 100 percent of the performance and features of the ISR Fusion, the custom installer/integrator needs only to integrate the ISR Fusion 20 with any of the wide-range of supported home automation systems. These typically have control pads with simple to understand graphic user interfaces. These control systems allow owners to easily deploy even the most complex combinations of ISR Fusion 20 features and settings without ever interacting directly with the ISR Fusion 20. Owners are 'buffered' from the complexities by design. That is a large part of the beauty of complex home theatre

devices like the ISR Fusion 20. The complexity is demanded by the goals of high-performance audio reproduction in a home theatre system. Being able to make the complex device usable by owners who appreciate the complex and advanced capabilities, but prefer to not have to learn how to employ/deploy complex features in their system is one of the main jobs of the custom install team. StormAudio offers additional-cost customer support, Pro Remote Assisted Calibration, that includes Internet-based remote support of the ISR Fusion 20. I experienced this Internet-based support for setup of the ISR Fusion 20 during this review. It made a huge difference in the face of the seemingly endless adjustments possible within the ISR Fusion 20. Left to my own devices, it would have been months before I would be able to achieve as much as Matt, StormAudio's support person for this review, achieved in five hours or so.

The ISR Fusion 20 is described by StormAudio as a real-time multi-SoC hardware platform. The abbreviation "SoC" means "system on chip." SoCs can have multiple "cores" within a single chip to multiply the capabilities. "Real time" refers to the fact that the processing takes place as you view and listen to content. With SoC architecture, you can keep adding processing power until you have enough for the job at hand. Remarkable software developed by StormAudio manages multiple layers of audio processing so that everything done to the audio signals is done in the proper order to produce the best in-room results. StormAudio's software manages audio signal processing using various combinations of processing to achieve decoding, up mixing, and high-quality playback. They use various processing and decoding provided by Auro Technologies, DTS, Dolby Laboratories, IMAX Enhanced, and Dirac Live Room Correction. Add to that all the additional processing options and all the settings for crossover frequencies, crossover slopes, multiple amplifier channels for a single loudspeaker, Preset processing to account for every preset option, and all the other options and settings that can be used if needed, or ignored if not needed.

All of those processing options can be used together or separately. The hardware and software make use of all the latest home theatre features... HDMI inputs and outputs are all HDMI 2.1a and 40 GHz compatible with HDCP 2.3, for example. 4K/UHD video is supported up to 120 Hz, and 8K video is supported up to 60 Hz. The only "limit" on the HDMI ports is that the second HDMI output port is limited to receiving ARC audio while the primary HDMI Output port can receive both ARC and eARC. The primary difference being that ARC is limited to being able to receive only the highest-compression audio with around 12:1 compression. eARC is compatible with any common multi-channel digital audio audio-stream including lossless audio.

Using the ISR Fusion 20 reveals the human touch, the programmers' cleverness, the simplicity of the user interface with the underlying wildly flexible/complex setup hidden from all but the installer and hard-core tinkerer. The support from your installer and, optionally, from StormAudio are major factors in getting everything setup so that the owner gets the maximum benefit from this fantastically configurable wonder-of-an-AVR.

How the heck does StormAudio get 16 Amplifier channels in an AVR smaller than your typical 9- or 11-channel AVR? There's really only one way to do it. Digital amplification with sophisticated power management. StormAudio turned to ICE Power for their leading-edge digital amplifier technology. With something that works as well as ICE Power's Edge digital amplification system,

there was no need for StormAudio to "invent" that technology again. Much better to simply incorporate ICE Power amplifier technology into the ISR Fusion 20.

Cooling the ISR Fusion 20 while allowing flexible placement in a rack or shelf system was obviously on StormAudio's mind while they designed the ISR Fusion 20. A series of three round openings on the left and right sides allow the cooling fans to blow cool air sideways "through" the ISR Fusion 20. In normal use, the fans are silent. The cross flow of cooling air means that on a shelf or in a rack, you can have very little clearance above or below the ISR Fusion 20 and it will still manage to keep itself running cool and collected. The only restriction would be that you wouldn't want to place a hot-running device below the ISR Fusion 20 since rising heat would make the cooling fans in the ISR Fusion 20 draw-in pre-warmed air that's not the best for cooling purposes. Aside from that caveat, I find the cooling design for the ISR Fusion 20 to be completely unobtrusive. I had to play soundtracks uncomfortably loud for the cooling fans to operate at a speed where they made noise audible to people in the audience. But at that point, the soundtrack was so loud, it masked the cooling fan noise. So even when the fans are needed to cool the ISR Fusion 20, the sound in the room keeps you from hearing the fans.

The only time I ever heard the cooling fans operate was at the end of a rather loud scene when it suddenly got quiet. The fans ran at elevated speed for a few seconds before settling to a slower speed that I could not hear any longer. But I had to play the scene louder than I really wanted to listen to it in order to get the fans going fast enough to hear them. I will go out on a limb and say that you will never be annoyed by the sound of the fans in the ISR Fusion 20, even if they aren't isolated from your theatre space in an equipment closet.

The product name, ISR Fusion 20, refers to the 20-channel audio processing capability. With 16 channels of on-board amplification, that leaves four channels with line-level outputs. Those line level outputs can be used to drive amplifiers connected to, or built-in-to subwoofers.

Subwoofers are the power-hogs of a home theatre system. To make bass loud enough to be thrilling during movies and other programming, you need a lot of power. Even modestly-priced subwoofers will have 300 Watts or more power in their internal amplifier. Sometimes the power rating is as high as 3,000 Watts. But remember... twice the amplifier power provides just 3 dB louder audio. So a 3,000 Watt subwoofer amplifier will only make 3 dB more sound than a 1,500 Watt subwoofer amplifier operating at full power. This is why using the line level outputs to operate amplifiers that are driving subwoofers is the best use of those four "extra" channels. That "offloads" the subwoofers' hunger for volts and amps from the ISR Fusion 20's internal amplification system, leaving lots more power for the "regular" loudspeakers.

The ISR Fusion 20 has a universal power supply allowing those of us living in 120 VAC-lands to connect the ISR Fusion 20 to a 20 Amp 120 VAC circuit or even to a 220-240 VAC circuit with 12 Amps to give it even more current to work with. I operated the ISR Fusion 20 on a 120 VAC circuit with a 20 Amp circuit breaker and was unwilling to keep making the sound louder to see if/when the ISR Fusion 20 sounded like it was running out of power. It played so loudly with the mostly 6-Ohm loudspeaker array I was using, 12 loudspeakers and one amplified subwoofer, that there was really no reason to torture myself or the ISR Fusion 20. The ISR Fusion 20 produces fantastic sound quality at very low levels and at very

high levels, a signature of the best sounding standalone amplifiers. At low levels, the noise floor of great amplifiers should be as low as it can possibly get so subtle sounds are not masked by physical or electronic noise. The ISR Fusion 20 was silent in normal operation. It was indistinguishable in sonic signature from the best amplifier channels I've heard in the last 30 years.

### How To Manage Amplifier Power For 16 Channels

It may seem impossible to have 16 channels of amplification in a single AVR chassis. And it seems especially impossible to have 16 amplifier channels in a single AVR chassis that's not particularly large or heavy. But this is the beauty of well-designed switch-mode power supplies and digital amplifier circuits. Dynamic power assignment allows power to be sent to whatever channels need it most. StormAudio partnered with ICE Power of Denmark to include ICE Power's latest Edge digital amplification and power supply technology. A 1999 research project at the Danish Technical University led to the formation of ICE Power to use the new findings to develop practical hardware and software to make better-sounding amplifiers for home and commercial products. If you have been following the development of digital amplification technology over the last 20 years, you should be very familiar with ICE Power. Today they are involved in improving sound from products ranging from cell phones to giant sound systems used for concerts and other entertainment venues. Their technology has been used in Audi, Mercedes, BMW, and Aston Martin vehicles. In the past, virtually all audio components with any nod toward good sound quality had linear power supplies. These required a transformer that was large and heavy. With digital amplification and properly designed switch-mode power supplies, modern AVRs can direct power instantly to the channels needing it the most. Dynamic power assignment allows the ISR Fusion 20 to deliver up to 2,000 continuous Watts of power or 2,500 peak Watts of power to any channels that need power. The only limit is that any single amplifier channel will produce no more than 150 Watts at 8-Ohms or 300 Watts at 4 Ohms.

Your average loudspeaker has an efficiency/sensitivity of something like 89 dB per 1 Watt measured at 1 meter from the front of the loudspeaker. That means if you are about 39 inches from the loudspeaker, you will hear sound at a level of 89 dB with the amplifier producing just 1 Watt of audio power. The worst efficiency I've seen specified for a loudspeaker is 82 dB per 1 Watt at 1 meter. Those particular loudspeakers, then, need to double the amplifier Watts 2.2 times to produce the average 89 dB the average loudspeaker can produce from 1 Watt. The 82 dB loudspeaker produces 85 dB with 2 Watts of power, and 88 dB with 4 Watts of power. This illustrates why a whole system of lower-sensitivity loudspeakers is probably not a good choice for a home theatre system. The highest sensitivity loudspeaker I can recall using myself was rated at 98 dB from 1 Watt measured at 1 meter.

This is where things get tricky. When we talk about how loud sounds are in decibels (dB), there's no scale for what sounds half as loud or what sounds twice as loud. If you have a sound source that is producing 80 dB of sound, changing the SPL (sound pressure level) to 40 dB sounds much quieter than "half as loud." Conversely, a sound pressure level of 160 dB is far louder than "twice as loud." The audio industry has done studies that produce a consensus among a population of listeners. They play sounds at different levels, asking these listeners to decide when something

### StormAudio ISR Fusion 20

#### Features

- HDMI - 7 Inputs HDMI 2.1a & HDCP 2.3
- HDMI - 2 Outputs (both ARC/ Output 1 also has eARC)
- All HDMI Supports - 8K / 4K@120 Hz refresh rate; 40 Gbps
- HDR Support – HDR10, HDR10+, Dolby Vision, HLG
- Channels – 16 powered channels, 4 line-level outputs (XLR), 20 channels of audio processing
- Toslink – 1 for Zone 2 Stereo downmix
- Analog RCA jack audio inputs – 8, configurable as one 7.1 input or 4 stereo inputs
- Analog XLR Stereo audio inputs – 1 pair
- Digital Coax SP/DIF – 3
- Stereo Toslink – 3
- Decoding – 20 channels with upmixing up to 20 channels
- Supported Audio Codecs: Dolby Atmos, Auro-3D, DTS:X Pro, IMAX Enhanced, StormXT ambiance expander, All legacy codecs and sample rates up to 192 kHz
- Supports Multiple theaters & multiple rooms
- Standard and Expert Bass Management
- Multi-way loudspeakers with multiple amplifier channels and multiple crossovers
- Multiple Subwoofers Supported, each with custom/unique Room Correction
- Dirac Live Room Correction with Bass Control module and Active Room Treatment module
- "Room EQ Wizard" software (free audio measurement software) plugin
- Supports Room Music Streaming
- Control Options – Ethernet-TCP/IP-browser, infra-red remote control codes, StormRemote App for mobile and tablet devices (iOS and Android)
- Home Automation System Support - Control4, Crestron, RTI, Savant, ELAN, Logitech Harmony
- USB Type A Ports – 2 for monitoring and upgrades
- Ethernet (no Wi-Fi connectivity)
- IR ports (wired) – 1 input, 1 output
- Backup/Restore - Settings, Presets, Calibrations

#### Specifications

- Universal Power Supply Voltage 100 VAC to 240 VAC 50 Hz/60 Hz
- 16 Amplifier Channels
- Up to 2,000 Watts continuous audio power output with sufficient AC power available
- Peak Power up to 2,500 watts (CEA-490-A)
- Each channel capable of up to 150 Watts with 8 Ohm loudspeakers
- Each channel capable of up to 300 Watts with 4 Ohm loudspeakers
- Two Bridged amplifier channels can deliver up to 500 Watts into 8 Ohms or 500 Watts into 4 Ohms
- THD + Noise at 5 Watts (single ended) < 0.0015%
- Signal to Noise ratio at 5 Watts (single ended) - >100 dB
- Signal to Noise ratio, p-rated (single ended) - >115 dB
- Up to 6 amplifier channels can be bridged in pairs to create 3 bridged outputs to loudspeakers

Designed in France  
Manufactured in France  
Dimensions – 19.33 W x 17.4 D x 6.85 H (inches); add .788 (inches) for feet; add 4-inches for rack-mount ear width (2 inches per side); 4 Rack-Unit form factor  
Weight – 35.3 (pounds)  
Warranty – 5 years parts and labor  
MSRP: \$19,999

#### Company

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seems “twice as loud” or “half as loud” as a reference sound. The general consensus is that doubling or halving the loudness of sound is generally perceived to be around 10 dB. 80 dB would sound roughly “twice as loud” as 70 dB. And 90 dB would sound roughly “twice as loud” as 80 dB.

Amplifier power works differently than “perceived” SPL. Doubling the amplifier power only adds 3 dB to the playback level. So that “average” 89 dB sensitive loudspeaker produces 91 dB with 2 Watts. 94 dB requires 4 Watts. 97 dB requires 8 Watts, and so on. Do we really need at least 100 Watts per channel for home theatre audio? That depends. If you are going to have just two channels producing sound, perhaps you do need at least 100 Watts per channel. But what if you have 16 loudspeakers? If you start with one loudspeaker producing 80 dB from 1 Watt of power, you can have 16 channels produce the same 80 dB of sound with just 1/16 th of a Watt per loudspeaker. As a general rule for home theatre, as the number of loudspeakers increases in the theatre room, you can live with fewer and few amplifier Watts per channel without feeling like the sound got “less loud.” The ISR Fusion 20 has the most stupendous power direction I’ve ever seen specified for an AVR. It can produce up to 2,000 Watts continuous or 2,500 Watts peak. A 117 VAC/60 Hz electrical outlet on a 15 Amp circuit produces just 1,755 Watts of power. That will very slightly “starve” the ISR Fusion 20 of achieving its maximum output power. The better choice would be 117 VAC with 20 Amp service, or 2,340 Watts. The ISR Fusion 20 will operate fine on a 15 Amp outlet, especially if you aren’t using all 16 amplifier channels. But if you want to have enough power to achieve the 2,000 Watts of continuous power, you’ll need a solid 2,400 Watts of power at the AC outlet.

Then there is the issue of using more loudspeakers to make the sound louder without over-taxing the amplifier channels. If you put 10 Watts of power into one loudspeaker and you measure 80 dB at one of your audience seats. You can put 5 Watts of power into two loudspeakers and get the same 80 dB at the seat in question. You can put 2.5 Watts of power into four loudspeakers to get the same 80 dB. Or you can put 1.25 Watts into eight loudspeakers to get the same 80 dB of sound at the seat in question. You can see how an AVR could use this “multiple loudspeaker” trick to make louder sound in the room by using inactive channels to support louder sound in active channels.

## Asian AVR Amplifier Power

Asian AVRs will not increase their power into 4 Ohm loudspeakers at all. They insert a ceramic resistor into the signal path with each loudspeaker when you select 4-Ohm loudspeaker mode. That limits 4-Ohm loudspeakers to receiving no more power than 8-Ohm loudspeakers. The fact that the ISR Fusion 20 can double the delivered power, 300 Watts, to a single 4-Ohm-loaded channel is a stunning specification for any AVR. Further, using bridged mode (two amplifier channels driving one loudspeaker), the ISR Fusion 20 can deliver as much as 500 Watts to a single 8-Ohm loudspeaker or 500 Watts into a 4-Ohm loudspeaker. Being able to get that much power from a late-model conventional, and less expensive AVR is not possible in my experience. And the fact that the channel receiving that much power can be any active channel within the ISR Fusion 20 is also remarkable.

Most people find an average SPL level of 85 dB is very loud. When the average SPL is 85 dB, peak levels in movies can easily reach 95-98 dB. I probably have the average SPL closer to 80 dB for most content since sounds louder than 90 dB are quite loud. The ISR Fusion 20 spec of continuous power up to 2,000 Watts indicates that if you are using 16 loudspeakers with the ISR Fusion 20, you could, if the soundtrack called for it, produce up to 125 Watts of power in each of the 16 channels at the same time. Or up to 150 Watts per channel peak with all channels driven.

## What Can You Configure Inside The ISR Fusion 20?

The short answer is; everything. The ISR Fusion 20 has an IP address once you have connected it to your home’s network. I did that using Ethernet. This allows you to open the ISR Fusion 20’s IP Address in your browser to access the Graphical User Interface that allows the owner or installer to change virtually anything. But StormAudio understands that some owners may wish to be isolated from complex settings so there are three different options when you log in. StormAudio compartmentalizes settings so you can access groups of settings and bypass groups of settings you don’t want to interact with. Expert Setup shows everything in several pages of menus and is primarily, perhaps only, used during the initial installation and setup of your system by your local installer or by StormAudio support. The third mode is Remote Control mode. This is an alternate means of controlling normal operating settings of the ISR Fusion 20. Input selection, volume, mute, channel levels, Presets. The ISR Fusion 20 comes with a handheld remote, but that remote and the Remote Control Web interface are considered “convenience” or “secondary” means of controlling the ISR Fusion



# “The fact that the ISR Fusion 20 can double the delivered power, 300 Watts, to a single 4-Ohm-loaded channel is a stunning specification for any AVR.”

20. Most home theatre systems that will have the ISR Fusion 20 installed as the control center will also include a sophisticated whole house automation system that will include control pads for the home theatre system that make everything easy to use even for those without tech knowledge about the system with the ISR Fusion 20.

The ISR Fusion 20 will save what they call Presets. This is a group of settings that put the system in specific configurations for specific types of entertainment. You can freely name these Presets anything you'd like to name them. You might have a preset for listening to stereo music with just two loudspeakers active and no up mixing. Another preset might be for late-night viewing where you have just five active loudspeakers, disable the subwoofer, turn on dynamic range control (to reduce dynamic range), and reduce the volume level to a quiet, but still loud- enough level. And of course, you can have an “All In” preset with all the loudspeakers and all the subwoofers active. Any sort of combination of equipment processing and tuning of sound can be assigned to any Preset. Presets can be very simple or incredibly complex. It all depends on the requirements for the theatre. You can save up to 20 Presets. And there is a backup and restore function so all the configuration and Presets can be saved once they are all correctly configured. If anything ever results in loss of all the settings, a Restore of your backed-up settings will put them all back as they were.

Presets are so flexible that you can even do tricks like add 80 ms of Audio Delay when you select your Blu-ray Disc Player input in the event your audio and video aren't perfectly sync'd. You might find that input is the only input that needs the additional 80 ms of delay. The ISR Fusion 20 will remember that in your settings for that input. There is a page just for managing Presets so you can see all of them in one place. You can assign one, two or three amplifier channels per loudspeaker if you wish. And there are digital crossover settings within the ISR Fusion 20 so the loudspeakers themselves do not have to have internal (or external) crossovers of their own. You can use parametric equalizers as needed. The list goes on seemingly forever.

## The Techno-Wizardry Of AuroMatic And The Shame Of Movie Studios

Movie studios have decided to cheat the public by almost never using any of the capabilities built-in to Dolby Atmos or DTS:X when they create Immersive Sound soundtracks for theatrical or home movies. Doing that properly requires putting one or more sound engineers at mixing consoles for days at a time while they work out what sounds should appear in height channels, what sounds should be in ear-level channels and what sounds should be in BOTH ear-level and height channels. Dolby and DTS both allow sophisticated placement and movement of objects in 3D space, but you might hear that done properly in one out of 50 movie soundtracks and then it might last for the duration of one helicopter fly-over and never again during an entire two-hour movie. It's quite pathetic. And the studios don't do any better with DTS:X mixing. It's not the fault of Dolby Atmos or DTS:X that their soundtracks are so terrible. The problem is 100 percent created by the studios being interested only in putting “Dolby Atmos” or “DTS:X” on the boxes so they will sell without putting any actual intelligence into their ersatz Immersive Sound soundtracks. With streaming, there's even LESS “name recognition” of Immersive Sound. Streaming programming also never gets actual sound engineers. Instead, for Dolby Atmos soundtracks, they appear to put the original 5.1 or 7.1 mix through Dolby Surround (a terrible sounding upmixer that makes everything sound worse) to upmix the 5.1 or 7.1 to 11.1. Then they encode those 11 fake and bad-sounding channels as though they are 11 discrete channels created by sound engineers at the console. Except studios don't do proper Dolby Atmos or DTS:X soundtracks more than one or two out of 100 titles. DTS:X soundtracks happen the same way, only those are upmixed through Neural:X. Neural:X sounds a little better than Dolby Surround, but not much. To hear these movies with actual decent Immersive Sound, you have to forget the DTS:X or Dolby Atmos decoding completely, and use the AuroMatic upmixer instead. It is a revelation. You simply shouldn't bother with Immersive Sound in 2024 if you don't have AuroMatic in your system.

In *Star Trek Beyond*, there is a scene when 100s or 1,000s of one-man ships swarm Enterprise and gain entry through the hull by making man-sized holes. Once they get inside Enterprise, fight-

ing breaks out all over the ship. Using native decoding, the height channels are silent for this entire boarding scene except for the computer voice saying “Red Alert” several times that comes through in the height channels. There is literally no other sound in the height channels. Yet if you were there on the ship while that was happening, you would be surrounded by the sounds of combat and weapons echoing off the ceiling everywhere... you would be immersed in that sound, but as released by the studios, you get terrible, dumb, awful, and useless Immersive Sound. But turn off Dolby Atmos or DTS:X and switch to AuroMatic and you experience a revelation of realistic on-ship combat and the “Red Alert” announcements remain in the height channels.

## What About Video?

The ISR Fusion 20 has no on-board video processing of any kind. There is an on-screen display for volume level, mute, and type of signal (i.e. Dolby Digital Plus, DTS:X, etc.). But the ISR Fusion 20 otherwise passes all video signals without changing or altering the signal. To my way of thinking, this is the optimum way an AVR should work. TVs have controls for video built-in to the TV. There’s no reason for video adjustment controls to be present in an AVR but every Asian brand adds video controls to their AVRs at some price-point. There’s no need for that processing to exist, but marketing people love long lists of features, even if they are useless features.

## The Techno-Wizardry Of Dirac Live

Let’s get the pronunciation out of the way first... it’s derRACK. Almost a single syllable with emphasis on the “RAC” part of the word. Every company that makes an AVR or audio processor for home theatre has to offer some sort of “sound fixing” technology in their product. The most basic of these systems attempt to linearize frequency response across the audio frequency band from around 200 Hz to somewhere beyond 5,000 Hz, but typically not all the way to 20,000 Hz. The most basic systems do nothing for bass response because making bass response better in a room is very tricky and can be very complex. Each company that makes an audio controller (processor or AVR) has to decide whether they will develop their own acoustic improvement system in-house, or whether they go “outside” to purchase a commercial product that is likely going to do much more than an in-house system. Of course, they pay a fee per device sold if they purchase a third-party system like Audyssey or Dirac Live. Over the years, Anthem, Pioneer, Onkyo, and some other brands have incorporated their own audio processing system in their products. StormAudio took one look at Dirac Live some years ago and realized instantly that for their products, nothing else existed that could do what Dirac could do. The ISR Fusion 20 uses all three levels of Dirac technology that incorporates some rather mind-bending concepts and capabilities that take Dirac into areas unexplored by other technology to make sound better in homes and other venues. The processing power in the ISR Fusion 20 has to be stupendous to manage all the capabilities of the latest versions of Dirac as you will see in the discussion.

Dirac arose out of a university research project run by two professors and four PhD students. Their work resulted in the emergence of Dirac, the company, in Uppsala, Sweden. Today, their

research facilities are in Copenhagen and Bangalore. The company has representation in China, Germany, Japan, the USA, and Korea. Dirac’s primary focus is on improving audio quality in the Home Theater and Auto Sound markets, but they are open to making audio better in every and any application. Dirac’s aim is to improve the sound we hear in as many applications as possible for as many people as possible.

There are three distinct levels of Dirac Live functionality. It is possible that some products offering Dirac Live may not provide all three of the functional modes. Not all products will have the on-board processing power to manage all three of Dirac’s possible room functions for 11 channels, let alone having support for up to 20 channels as the ISR Fusion 20 offers. The first part of Dirac Live’s full suite of processing is Room Correction. Lots of brands deliver something they call “Room Correction.” But the reality of what is delivered is very different. In many cases, the only thing other “Room Correction” does is tries to linearize frequency response within the room. And they might try it with microphone measurements made in three to 10 locations. Linearizing frequency response is a good thing, but it’s far from “Room Correction.” All that’s done with linearizing frequency response is equalization... cutting bumps in response, and raising “valleys” or “depressions” in response. But Dirac Live goes far beyond that also applying time/phase corrections to linearize the time-response within the room; correcting for phase errors and spacing/distance errors of individual drivers in your loudspeakers, finding and eliminating room resonances, and reducing the influence of early and strong sound reflections within theatre and music-listening rooms. Dirac Live also improves impulse response. A “perfect” impulse signal will have a single spike (could be pointing up or down on a graph) with no pre-spike disturbance and no post-spike disturbance. In the real world, sound transducers and electronic pre-amplifier and amplifier circuits add a tiny wiggle just before the impulse, and there are some raggedy residuals following the impulse. Dirac Live “learns” about those extra little bits of sound as it measures the room and each loudspeaker in different locations. Dirac Live creates a very sophisticated filter, the inverse of those little bits of pre-sound and post-sound that should not exist in the world of perfect sound reproduction, and they get “removed” from the sound by Dirac Live.

My system for this review had 12 loudspeakers (one directly overhead, two above the front L and R loudspeakers, two above the side surround loudspeakers and seven normal ear-level loudspeakers with two rear surrounds, two side surrounds and LCR up front. 30 drivers altogether. And each one is being “fixed” in ways other Room Acoustic Improvement software doesn’t even address. The corrections are made up to 192,000 times per second per driver. It seems impossible! And there could be many more drivers than 30 in some systems. These capabilities: time/phase correction, frequency response correction, impulse response correction, room resonance correction, and moderation of strong early reflected sounds are the Dirac Live fundamentals. Together they make up the Room Correction functions of Dirac Live. Some products offer only this level of Dirac Live functionality.

Next is Dirac Live’s much more elaborate Bass Control capabilities. Dirac Live “lesser” versions have Bass Control for only one subwoofer supported. But StormAudio provides the full “multiple subwoofer” version of Dirac Live Bass Control. The Dirac folks say that the Bass Control function uses machine learning and AI for support of multiple subwoofers. The use of those technologies

eliminates up to two days of measurements and calculations, by incorporating customized corrections. Bass Control is so well-integrated into the Dirac Live software, there was literally no point where we were making “Bass Control” measurements. It was always just “Dirac” measurements being made. Dirac Live will allow multiple levels of Bass Control to be assigned also. You can have a mode tailored to produce the best possible sound for a single watcher/listener. Or Bass Control can produce good Bass sound for an audience of two or 10 people or more. We can hear bass down to 16 Hz, the lowest frequency of the lowest note on the biggest pipe organs. The wavelength of 16 Hz is 70.4 feet, while the wavelength of 200 Hz (near the lower-end of male voice sounds) is 5.6 feet. The long bass wavelengths below 200 Hz require some different techniques to “make better bass” than shorter, higher-frequency wavelengths. Dirac Live helps to integrate bass sounds that may be coming from two to 20 loudspeaker channels at the same time. There are a number of different crossover points in action depending on the bass capabilities of each pair of loudspeakers in the room. Dirac Live can integrate all these “customized” crossovers to the subwoofer(s) so that the system is properly tweaked as multiple crossovers get tossed into the mix. Using EQ alone to correct bass response is very problematic because of the long wavelengths, but almost no Room Correction systems use anything more complex than frequency response linearization in the bass frequencies. Dirac Live introduces complex time/phase corrections to the bass frequencies because those long bass wavelengths can be compromised by ignoring time and phase corrections. Further, Dirac Live uses time and phase corrections from multiple directions so no one direction/channel has to do the bulk of the work. Dirac Live creatively uses all-pass filters specifically to improve Bass Control results beyond what is possible with frequency response corrections and time/phase corrections alone. If there are multiple subwoofers, each subwoofer gets its own unique corrections. Using all channels to assist with Bass Control allows options for producing high quality bass at multiple listening positions within the room with far more consistent and noticeably better results than the bass correction capabilities of other systems. There are other companies who make add-on bass control systems, but they do not use other non-subwoofer channels, machine learning, or AI to interact in ways that improve bass quality more than Dirac Live with Bass Control can improve the quality of bass within the room.

Finally, Dirac Live now has an expansion included with the ISR Fusion 20 called Active Room Treatment or ART. ART takes Room Correction to another level. Imagine every loudspeaker in your room helping every other loudspeaker in the room to sound better, even if they are all working/active at the same time. Dirac says that ART calibrates all of your loudspeakers as a unified system so that all the loudspeakers together control the room rather than allowing the room to control the loudspeakers. Bass that is reinforced by the room can “linger” in the room when it is supposed to have disappeared. Active Room Correction detects those issues and uses some number of loudspeakers to “fix” pesky bass problems that are too much for more typical frequency response fixing systems to address. Active Room Correction is also useful for expanding the “zone of good sound” without penalizing the “best seat” while making sound better for peripheral seats. And ART can be used with or without active or passive room treatment devices for bass. Trying to fix bass response with passive or active room treatments means living with devices that are huge... at least 6

feet tall or wide, though longer and bigger work better. These “bass traps” are not discriminant, though. They can harm bass as much as they improve bass, especially if they are not placed in precisely the right spot. And if you want a seat for an audience member in that spot where the bass trap really should be, you have to choose between better bass and another seat. With ART, the compromises and decisions disappear. ART can use loudspeakers anywhere in the room to improve the quality of sound so that every loudspeaker in the room helps every other loudspeaker in the room sound better constantly. If you have room treatments that effectively improve the quality of bass sound, Dirac Live will work with those bass trap devices making the end result even better.

Imagine every loudspeaker in the room reproducing clear and clean sound with good frequency response, good time and phase coherency, and little or no bumps and dips in response. All 20 channels benefit from less distortion from less EQ having to be applied while getting even better corrections than are possible with EQ alone from the Dirac Live software. Twenty x twenty equals up to 400 flavors of correction happening at any and every instant as you watch a movie or listen to music. These “fixes” happening in various channels happen at levels low enough that you never even know they are happening. It’s almost like magic. Keep in mind that Dirac does not want you to notice that any of this is happening. Their ultimate goal is perfect sound in each seat, no matter what. And they are achieving a stunning portion of that goal.

I often sit one seat to the left of the center seat to have the computer accessible for listening notes. I probably hear not-the-perfect-seat sound around 40 percent of the time. With Dirac Live firing on all cylinders, the left-seat sound was barely a downgrade from the center seat. And if I moved the computer monitor far enough to the left on its “move me anywhere” arm, 90 percent of that tiny difference disappeared. I was repeatedly stunned that the left seat sound was so close to the center-seat sound. And this was accomplished with perfect side-surround levels. In the left seat, I do not understand the physics or software abilities that kept the left-side surround from being noticeably louder than the right-side surround. Something considerably more than just a lower level of sound was happening. But I had no comprehension/connection to what that might be, it just seemed natural. But because I was used to hearing less natural sound in the left seat with non-Dirac Live Room Correction, it was very much like being slapped and asked why I didn’t realize what I was hearing before was so... compromised.

I don’t want to over-state the contribution of this complete version of Dirac Live software. But what the hell... the truth is the truth... you cannot, in today’s world, get better sound from an AVR than what is possible with this brilliant ISR Fusion 20 with the full-boat Dirac Live software. Between StormAudio’s decision to work closely with Auro Technologies and their decision to commit fully to providing fully functional Dirac Live software within their product, they have achieved something extraordinary.

My time with the ISR Fusion 20 has revealed a level of performance that I’ve never thought was possible on several levels. There have been nights when I just wanted to experience the ISR Fusion 20’s ability to immerse me in the entertainment. I wanted to forget the reviewing and just soak/bathe/revel in the entertainment. *Dune Part Two*? Don’t get me started. Even with “just” Dolby Digital Plus/Atmos to work with, the AuroMatic-decoded soundtrack was stunning. I feel like I have to say that I easily hear the difference between basic Dirac Live and no room correction. When I then



add Bass Control, there's another pretty obvious level of improvement in the quality of bass in the room. When you then enable Active Room Treatment processing, it's pretty easy to hear the benefits that module brings to the listening party. The ISR Fusion 20 has made me a little giddy about the better-sounding movies and TV shows, but it's all deserved. What a great entertainment enhancer the ISR Fusion 20 has been during this review. The entire system has been elevated to an order-of-magnitude-better sound. How does an AVR manage that feat? I'd have said it was impossible before this review.

Matt, StormAudio's customer support person, set me up with presets in the ISR Fusion 20 that enable three levels of Dirac Live correction: Room Correction alone, Room Correction plus Bass Control, and Room Correction plus Bass Control and plus ART. I was able to switch between all of them to "hear" how Dirac Live has evolved from their original functions through their improved Bass Control module, and their new ART technology that is mind blowing. Imagine your theatre room has 16 loudspeakers and two subwoofers. Imagine 15 loudspeakers providing a little "help" for the sixteenth channel. Then imagine all the loudspeakers helping each other sound better all the time. Imagine the processing power that allows that to happen on the fly for 16 or 20 channels of sound simultaneously! It's stupefying. And it works. Each "Level" of Dirac Live makes the sound better. I never once considered using only Level 1 or Level 2 of Dirac Live other than just to hear them compared to the "full-blown" Level 3 sound. Level 1 and 2 sound perfectly fine, but when you hear Level 3 with all Dirac Live features enabled, there's just no reason to listen without ART or without Bass Control. Anybody would be happy with Level 1 Dirac Live corrections in their system. But with both added modules, the sound with Dirac Live fully engaged is amazing. At first, the changes don't seem huge, but you realize the sound is more natural and less 'soundstage-y.' Sounds are more "anchored" to action in the video. Weapons fire during the beach battle with hostile aliens testing how to best eliminate human targets in *The Edge Of Tomorrow* became more "anchored" to the weapon that produced the sound. Firing sounds of weapons and whizzing-by misses were less "generally sort of over there" and more specifically "right there" as though you could point them out precisely, or trace their path across the room in any direction with more specificity. It doesn't knock you off your seat with wildly better sound. Instead, it quietly seems to be more "present" in the room, more "accurately placed" in the room, and more natural sounding. In fact, some Foley work can sound a little odd if it was originally not "focused" that well in terms of location (left, right, center, higher, lower, more to the side, more to the rear, etc.). All of that becomes more natural. Sounds that interact with each other or overlap within the sound mix have better clarity and separation from other sounds even when they are happening at the same time. Like the jingle-jangle sounds of collecting bonus coins in *Ready Player One* while sliding a vehicle sideways and flipping the door open to let the coins into the vehicle. The squirming squealing tires are not happy-sounding with the 4-wheel drift-to-a-stop to collect the bonus coins. Dirac Live makes each element of the sound during that CGI scene seem natural and "tethered" to the on-screen action. It's quite amusing to hear those very clear coin sounds cut through the screaming tires and noises of other vehicles in the competition.

## The Pleasure Of Music Listening

The ISR Fusion 20 has incredible sonic capabilities when it comes to music. Unfortunately, so many people have never heard

well recorded or well reproduced music in their lifetimes (so far) that they have little appreciation for sitting down with anywhere from nothing to an especially nice adult beverage or some recreational cannabis, turning off the lights, and putting on something interesting. Sit back, enjoy your adult mood-enhancer while doing nothing but focusing on the music. You will be amazed at the experience if you choose good music. Unfortunately, some music is recorded with such disregard for sound quality, that enjoying it on a good system may not even be possible. If your music listening is dominated by MP3 quality streamed music, you have never really heard what music sounds like. And newer doesn't mean better. Those new re-recordings being released by Taylor Swift to stick it to her old producer? First brava to T.S. for the effort to cut that guy hard. Unfortunately, none of the re-releases sound nearly as good as the originals... at least as far back as the 1989 album — I have limits on how far back into the T.S. early years archive I can go. Before 1989 the music was a bit too girly for an old reviewer to have much appreciation.

One of the "issues" you can have with home theatre systems that have lots of loudspeakers is that if there is any residual sound from the AVR or outboard amplifiers, because there are so many loudspeakers in the room, the presence of the noise can be pervasive and subtle at the same time. You may hear the noise floor, but not be consciously aware of it because the level is low. With a stereo system, you typically have just two channels in the room that can produce noise. But when you listen to stereo music in a system with 20 active channels, you have noise-times-20-channels in the room instead of noise-times-two-channels in a conventional stereo system. So, if StormAudio had been haphazard about the noise level produced by the ISR Fusion 20, it could have made for a pretty dismal music listening experience. Fortunately, the ISR Fusion 20 is among the quietest products I've had the pleasure to use. Even with 12 active loudspeakers, there was no audible noise floor. There was no residual hum either, not electronic hum, nor physical vibration hum of the chassis.

For the review, I listened to music in stereo mode several times. Using a short Cat Stevens song called *Tea For The Tillerman*. It has a quiet start and a dynamic finish and includes some well-recorded grand piano. I listened to that song perhaps six or eight times in a day with 12 active channels and a single amplified subwoofer. But only two channels were reproducing the music. The next day, I listened to the song a couple of more times, then I disconnected every loudspeaker except the Left and Right Front loudspeakers so that no noise could reach those other channels. If there had been any level of background noise from the ISR Fusion 20, I would have heard it with 12 active channels. I know that because I can hear the noise floor from Asian AVRs when all channels are connected but only two channels are actively playing music. I've also never heard an Asian AVR that was 100 percent hum-free. Even their expensive flagship AVRs don't bother to have a chassis-ground in the IEC power plug socket. If you replace the original skinny power cord that comes with your expensive Asian AVR and use a power cord with a ground prong and a heavy-gauge ground lead going all the way to the end of the cord where it plugs into the IEC socket, there's no pin/prong for chassis ground in the IEC socket to support a chassis-ground wire. Fortunately, the ISR Fusion 20 does have the added safety and peace of mind of having the chassis grounded with the included or aftermarket power cords.

The ISR Fusion 20 is also as silent, in terms of background noise/noise floor as the most expensive combinations of processor and amplifiers as I've ever experienced. This allows music to sound magical through good quality loudspeakers. The velvety

blackness of the background allows every recorded note to float free in space. It makes it easy to hear how instruments are “placed” left to right and front to back in relationship to the microphones. Of course, typical studio recordings use one microphone per instrument, ruining 90 percent or more of any width or depth cues in the recorded audio. To have the most amazing music listening experiences, you have to seek out recordings made by more enlightened sound engineers and producers who are willing to use more annoying recording techniques, because setup is trickier, to make recordings that retain width and depth information. And those recordings are typically NEVER the popular recordings of the day. Instead, you have to find Miles Davis’ *Kind Of Blue* or Dave Brubeck’s *Time Out*, or some Cat Stevens albums, or Supertramp, or... the list of great-sounding recordings is impressively long these days, but only because the sheer volume of music is gigantic. It’s still down to maybe 5 percent of all music being recorded really well... so well it deserves dedicated listening at home.

I sat down with *Toy Matinee* (name of the group and the album) and listened through the album. One of the tracks includes recordings of wind-up toys being wound up and released to operate. This stunningly recorded interlude produced sound so perfectly delineated you could literally count how many wind-up toys were being operated. Each one in a unique location, left to right, and front to back. Music recorded this well transports you to the musical plane in ways that just aren’t possible with more pedestrian sound quality. The ISR Fusion 20 was also a perfect companion to explore the remixed version of an album heard hundreds of times, The Beatles’ *White Album*. Here the ISR Fusion 2- gets levels and tones so clean and clear that you can hear every little tweak done by Giles Martin, the son of the Beatles’ original producer, George Martin. It’s dangerous business, remixing an iconic album like *The White Album*. Make a mistake, and you’ll never hear the end of it. But Giles’ insights and tweaks are all perfect. You can imagine the four Beatles sitting around and listening to these remixes and wondering why they didn’t do it Giles’ way in the first place. Instruments that were present but so low in level they were mostly lost-in-the-mix have been brought, not to prominence, but brought to a point where you can hear the instrument clearly now. It’s kind of great. You can hear every difference in pitch or level, but it all still sounds fantastic and breathes new life into a 54-year-old recording. That was one of my favorite music listening experiences with the ISR Fusion 20.

I found music listening on the ISR Fusion 20 to be intoxicating, even without the adult beverage or cannabis. Especially with AuroMatic expanding the space occupied by the music. The effect on stereo music recordings makes two-channel music into an immersive musical environment. It is so good, that I won’t voluntarily listen to stereo music any longer if AuroMatic is available. Every other upmix of stereo I’ve experienced sounds worse than the music played in stereo. The ISR Fusion 20 delivers the clarity, beauty of tone, dynamic punch, rhythm, and background silence to transport you into the immersive AuroMatic world of 12 channel (or more) upmix of stereo music. Just don’t expect to get that effect from Dolby Surround or DTS Neural:X, because those are both terrible compared to AuroMatic.

### Movie And TV Program Sound

There are so many variables here, that I feel like there are large

numbers of disclaimers required to explain how/why you get sound that is so disappointing from so many movies and TV shows released in the last five years. It all goes back to the studios choosing to not put human sound engineers on the consoles while creating “Immersive Sound” soundtracks. Their dirty trick of using Dolby Surround (or DTS Neural:X) to create 11.1 sound from the original 5.1 or 7.1 mix more or less guarantees you will hear nothing or next to nothing in the height channels. One movie I viewed in the early days of Immersive Sound had literally no sound in the height layer channels until the end credits started playing and two or three instruments were in the height channels. There was nothing in the height channels during the entire movie from the beginning to The End.

If you, therefore, listen to movies with Dolby Atmos soundtracks and you choose to decode those with Dolby Atmos/Dolby TrueHD decoding, you will be exceptionally disappointed with what you hear from 97 percent of movies and TV shows. If the soundtrack is DTS:X/DTS:HD Master Audio, you will be 96 percent disappointed with every movie or TV program’s sound quality. That is not the fault of the ISR Fusion 20, or Dolby Atmos, or DTS:X. That’s 100 percent the fault of studios who only want your Dolby Atmos or DTS:X light to illuminate on your decoder. They have no intention (or budget) to deliver you an actual properly-done Immersive Sound soundtrack with human intelligence creating the soundtrack.

If you use AuroMatic processing for every movie and TV program, you will have amazing and almost giddy-at-times experiences with better movie soundtracks. There is a scene in *Terminator 2: Judgement Day* where The Terminator has John Carter on the back of his (stolen) Harley-Davidson Fat Boy and they pull into an apartment parking area with buildings on both sides reflecting the sound of the motorcycle through this area like an extra-strong echo chamber. It is one of the most impressive Immersive Sound moments I’ve heard in any movie and it’s all done 100 percent by AuroMatic up-mixing of a movie that did not have an Immersive Sound soundtrack at all.

You will love what the ISR Fusion 20 does for Immersive Sound, in spite of the dirty tricks the studios are foisting on the general public. But only if you use AuroMatic for everything. Save the Dolby Atmos decoding or DTS:X decoding for those fewer-than-10-titles that have had human intelligence behind their immersive soundtracks.

### Conclusion

The ISR Fusion 20 is the best AVR I have experienced in 30 years of reviewing. Nothing else comes close. It’s so far beyond the performance of typical AVRs, it seems like it should be called something else just to differentiate it from the average AVR. This is a glitch-free state-of-the-art audio processor that just happens to have 16 amplifier channels that sound so good there’s no reason to not use the internal amplification, even for your biggest and best loudspeakers. The amplification on the ISR Fusion 20 is next-level stuff that competes head-to-head sonically with expensive and incredibly heavy outboard amplifiers with gigantic transformers in their linear power supplies. If you are lucky enough to have the budget to put a StormAudio ISR Fusion 20 in your system, you will never regret your decision. This is as good as AVRs get. Unconditionally, the ISR Fusion 20 gets my highest possible recommendation. [WSR](#)