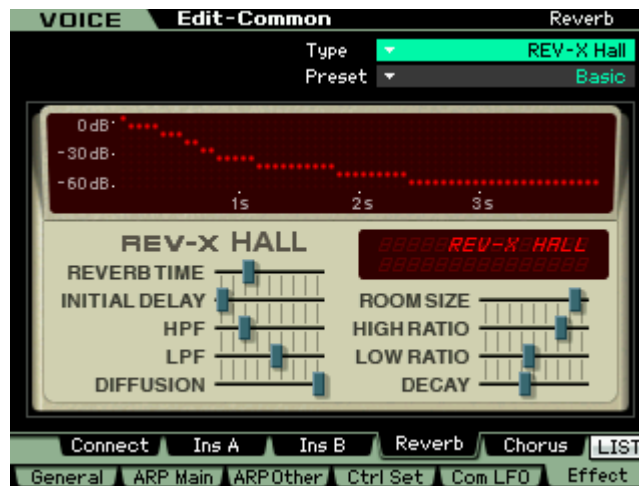# YAMAHA

POWER USER

Motif XS:

EFFECT PROCESSORS – Reverberation

Reverberation: Rev-X – SPX – ProR3

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DEFINITION: Reverb can be defined as the decay in sound after the signal source has stopped its vibration. It is the aura of sound left in the environment. Because much of what a human hears is non-direct sound, reverb is very important. The sound of music does not go direct from the source to your ears; it bounces off of the ceiling, the floor and the walls of the environment in which you and the musical source are located. This has a profound influence on what you hear and your enjoyment of same. In recording, artificial reverberation units became a kind of necessary evil when "close miking" techniques became the norm. Placing a microphone close to a sound source affords the engineer greater acoustic isolation of that sound. The trade-off being that it negates a lot of the influence of the room environment – it is not how we as humans are used to hearing sound sources. The benefits of isolation pay off during mixdown and outweigh the type of distant microphone techniques that proceeded it. The artificial reverb gives us back a sense of environment and distance.

YAMAHA HISTORY in EFFECTS: Yamaha Corporation has been one of the pioneer companies in the development of Digital Signal Processing (DSP). The Yamaha **DSP1** was the first true environment modeling processor found in home theatre surround systems in the early 1980's. It was based on the analysis of some of the great concert halls of the world. DSP1 actually stood for Digital Sound-field Processing. The studio effect processor, **REV1** (circa 1984) revolutionized digital effect processing and was found in many well equipped recording studios of the era. More recently Yamaha has developed the groundbreaking **SREV1** (Sampling Reverberator) which employs digital convolution processing and the ability to sample, analyze and mimic any environment. When placed in an acoustic environment the SREV1 could do analysis of that environment by bouncing noise off the surfaces and recording the results. The **SREV1** could then faithfully recreate the original reverberation, with accurate reflection detail identical to that produced had the sound been heard in that environment. The unit could be taken to the concert hall and then reproduce its characteristics to overcome what gets lost when you "close mic" musical instruments. With over half-million steps per sample (approximately 520,000) and with more than 32 proprietary Yamaha DSP chips, the SREV1 sets a new standard for natural reverberation.

The research and development in the area of natural sounding signal processing never stops at Yamaha… Recently introduced for Yamaha high-end digital pianos is the **iAFC** (Instrument Active Field Control). This is a sophisticated technology that gives the player a "virtual soundboard and resonant cabinet" in a digital piano sound system. An interactive system (that uses built in microphones) **iAFC** picks up sound as it bounces off the acoustics of a room and then makes automatic adjustments in real time to recreate the acoustic sound of a real piano.

Eventually all this technology finds its way to the professional synthesizer products – which can benefit greatly by its inclusion. Such is the case with the technology first developed for the SPX2000, SPX1000 and the ProR3 reverberation processors… found throughout the Motif XS.
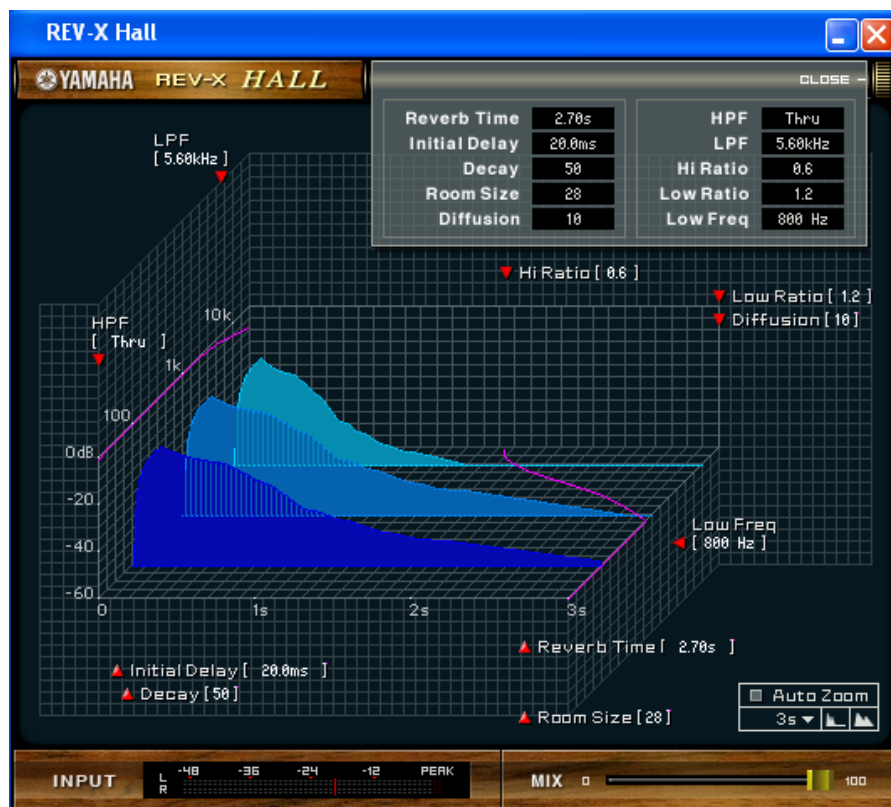
IN THE MOTIF XS: The **REV-X** effect algorithm (type) was introduced in the Yamaha studio grade **SPX2000** Professional Multi-Effect Processor.

The new reverbs feature the newly developed REV-X algorithm, delivering rich, high-density reverberation with smooth decay, spaciousness, and depth that brings out the best in the original signal. Rev-X Hall and Rev-X Room algorithms in the Motif XS takes on-board signal processing for synthesizers into a new era of quality and control functionality. (The screen shot at left is from the SPX2000 Editor – it gives you a graphic idea of what is occurring within the Rev-X algorithm). The algorithm is extremely programmable - you get to control how that space affects your music.

<u>**UNDERSTANDING THE PARAMETERS**</u>:
Initial Delay: Simply the time between the sound source (original signal) and the start of reverberation. This gives you your first sense of the size and shape of the environment. Your ear-brain can determine your distance from the room surfaces by how long it takes for the reverb to start. Although you may not be always be conscientious of the time difference between the arrival of the source versus the reflected sound,

this plays a large part in the "feel" for your position within the environment. In a very large hall there is a significant initial delay. Sound travels at 775ft. per second. So if the Initial Delay is set 200ms (1/5th of a second), you are in a very large room (reflected sound must travel a total of approximately 155ft. before it reaches your position).

High Ratio and Low Ratio: Length of the high frequency or low-frequency reverberation. These times are specified as a proportion of the REV TIME. If this value is set to 1.0, the length will be the same as REV TIME. You can use these values to simulate the absorptiveness of the walls and ceiling. HI.RATIO indicates the decay of the high-frequency range, and LO.RATIO indicates the decay of the low-frequency range. Independent control of the high frequency and low frequency content is very important in creating (or recreating) a specific environment. High frequencies tend to reverberate because of the shorter wavelengths when they hit a surface they tend to bounce back into the room. But the length of time they remain is always less than lower frequencies – high frequency content gets absorbed quickly by the environment. Low frequencies on the other hand do not tend to reverberate in the same manner, when they hit a surface they tend to move that surface. Not as direct as high frequencies their effect and duration is longer. This explains why when you are next door to the party you only hear (feel) the low frequencies, which are moving the wall, while the high frequencies reflect and remain in the room with the source.

High Pass Filter: A filter that cuts the low-frequency portion of the effect and lets the high-frequencies pass. Frequency components <u>lower</u> than the frequency specified here will be cut. With a setting of "Thru" this filter will do nothing. This filter does not affect the original sound only the reverberation signal.

Low Pass Filter: A filter that cuts the high-frequency portion of the effect and lets the low-frequencies pass. Frequency components <u>above</u> the frequency specified here will be cut. With a setting of "Thru" this filter will do nothing. This filter does not affect the original sound only the reverberation signal.

Diffusion: Density and left/right diffusion of the reverberation. Increasing this value will increase the density, and produce a stronger sense of spaciousness.

Room Size: Size of the reverberant space. Increasing this value simulates a larger space. You can use this to simulate the absorptiveness of the walls and ceiling. Changing this value will change the REV TIME value.

Decay: Shapes the envelope of the reverberation. This simply changes the way in which the reverberation dies out. You can have the signal die out naturally or you can create a rather abrupt end for special effects.

How they work: Call up the **Full Concert Grand** Voice in [VOICE] mode
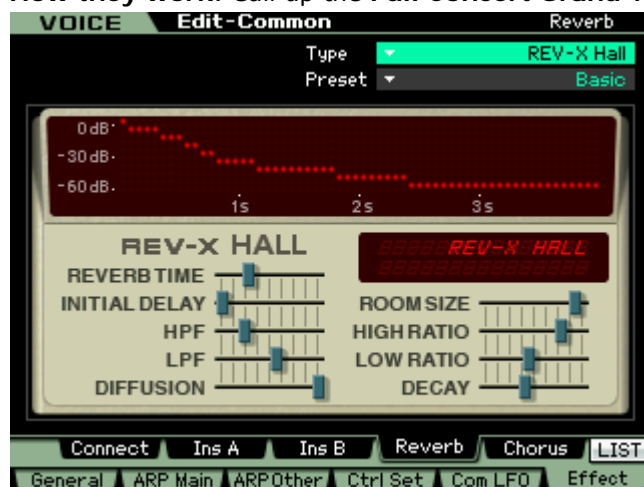
Navigate to the REV-X effect: Press [F6] EFFECT
As is true with many of the new Effects in the Motif XS you get more than just a single default setup. When you are on the EFFECT CONNECT Edit page you can select the processor to edit via the [SF] buttons. The **REV-X** type will be found in the dedicated REVERB processor.
Press [SF4] REVERB to view the Edit parameters for the selected Reverb type.

Listed beneath the effect TYPE (upper right corner) is a parameter called PRESET, highlight this and press [SF6] LIST to view the various 'suggestions' – we refer to them as suggestions because you are encouraged to tweak the parameters listed above to fit the requirements for your music. Try out several of the suggestions and see if you can see why they are named as they are – these 'suggestions' were created by professional sound engineers. In general, applying effects is a very subjective thing – what sounds good is not an absolute and varies greatly with the instrumentation, the genre and the actual musical performance. Read through the parameters to get an idea of what they are responsible for and design the environment accordingly. If you had this kind of control over the playing environment in the real world it would require a team of construction workers, interior decorators and an architect!

Also included in the Motif XS are reverb types from the legendary **SPX1000** and **ProR3** processors. If you have attended a concert or seen any major act on tour over the last 10 years you have probably heard these processor products in action. Each revolutionized effect processing.

SPX has been synonymous with "professional multi-effect processor" since the 1980's, and has been found in the equipment racks of both sound reinforcements systems and recording studios the world over. Starting with the groundbreaking SPX90, (continuing with the SPX90II, the SPX900, SPX990, SPX1000) and the current SPX2000. The **ProR3** ushered in the third generation of Yamaha digital signal processors and introduced high quality, high density, and high-resolution 32-bit performance to the world of professional audio.

Working with these reverberation processor types and with the VCM (Virtual Circuit Modeling[1]) technology in the Motif XS will allow you to create an unprecedented high quality mix. No other company has as respected a name in both professional signal processing and synthesis technology. Yamaha has pushed the bar much higher when it comes to no-compromise workstation sound quality and functionality.
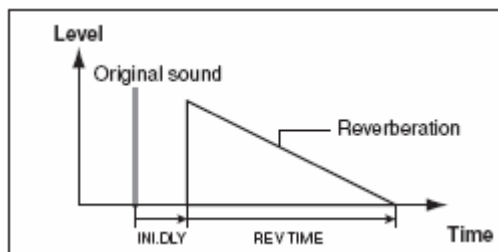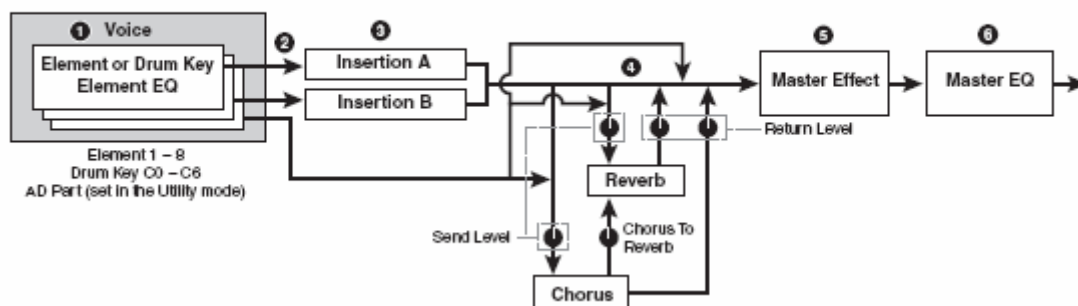
In the Voice mode (shown above) the routing of signal flows from left to right. At position (1) the individual Element (multi-sample) or individual drum Key can be routed (2) to one of three destinations (3) INSERTION A, INSERTION B or THRU (no insertion effect). Next (4) you have an opportunity to then send or not send a portion of the signal to the Chorus processor and/or Reverb Processor (referred to as the SYSTEM effects). You also can route the output of the Chorus processor to the Reverb. Next the System Return levels combine the signal back to the main flow where it proceeds to the Master Effect (5) and the Master Equalizer (6) before going to the main L&R Outputs.

Insertion Effects are basically a part of the Voice – they can be assigned physical controllers and can be manipulated in real-time. They become a part of the performance of the Voice. The algorithms (or types) of effects in the INSERTION processors include Reverbs, Delays, Chorus, Flangers, Phase Shifters, Auto Pan/Tremelo, Rotary Speaker, Distortions, Compressors, Wah-Wah, Lo-Fi, Tech and DJ-effects, Harmonic Enhancer, Pitch Change, Early Reflection, etc.

System Effects are basically ones that you have a send amount as you would on a console with an AUX send. They include the two processors: Reverb and Chorus. The name "Chorus" should really be Short-time based effects as it includes Flangers, Phasers, and Delays in addition to Chorus. It is in the SYSTEM REVERB

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[1] Virtual Circuit Modeling is the topic of a separate Power User series of articles and refers to the vintage processor types found in the Motif XS effects engine.

processor where you will find the REV-X algorithm. The Reverb type in the INSERTION library is the SPX1000 Reverb. This is the ideal place for it as it is usually applied to the overall sound.

Call up the principal piano Voice: **FULL CONCERT GRAND**
On the main screen you will notice that [AF1] Assignable Function button 1 is set to "reverb send". When the [AF1] button is pressed (LED = ON) you can recall a pre-determined amount of reverb send, instantly changing the environment. The amount that this is set to will be determined by the CONTROLLER SET assignment:
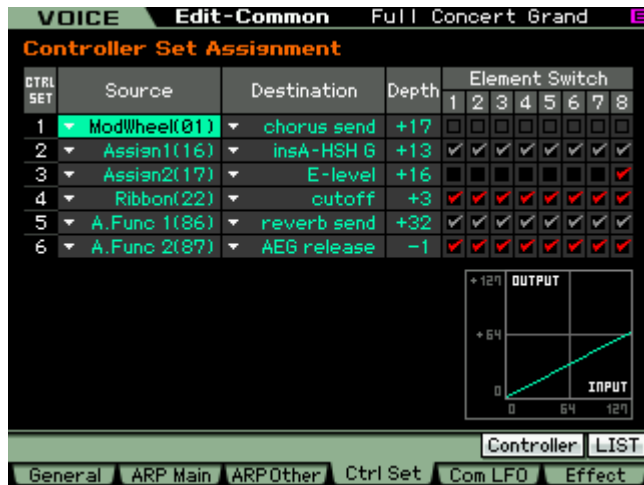
Press [EDIT]
Press [COMMON EDIT] if necessary. The top line of the screen will indicate your current situation.
Press [F4] CTRL SET (Shown at left)

Here you will see that Controller Set #5 has the Source "A.Func 1 (86)" set to "reverb send" and the Depth value is +32

Set this Depth parameter to the amount you would like to be your pre-determined send amount. A setting of +32 places you in the center of a very large concert hall.

FYI: The Assignable Function 1 button will output a Control Change message (cc=86) when pressed. This can be recorded to the sequencer.

REVERB SEND can alternatively be accomplished manually by the [SELECTED PART CONTROL] matrix on your upper left front panel. Simply press the button to select row 2 "TONE 2" and use knob #7: REVERB send to control the amount. [AF1] will override this send amount and always recall what you have pre-determined as outlined above… allowing you switch between setting if and when required.

If you wish to keep your EDIT you can store your version of the FULL CONCERT GRAND to any of the 384 USER locations; USER 1, USER 2, USER 3 banks each of 128 locations.

Other types of "reverberations": In the Motif XS you also have a special type of reverberation unique to the piano. As the world's largest manufacturer of musical instruments and one the world leading piano manufacturers, Yamaha spends millions of dollars in R&D developing technology to improve the subtle nuance that makes up musical tones. In the S90 ES we introduced for the first time in a *true synthesizer* the DAMPER RESONANCE Insertion Effect – which simulates the soundboard of an acoustic piano.
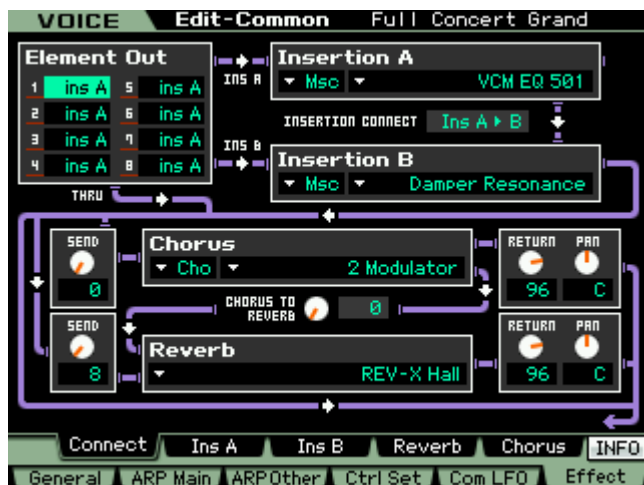
In the EFFECT CONNECT screen shown at left, you can see that INSERTION B is set to this DAMPER RESONANCE. This effect is associated with your sustain pedal and will only be activated when the pedal is engaged. In an acoustic piano this is when the felt dampers are removed from the strings of the currently engaged notes and the soundboard will ring or reverberate with the motion of those strings. It is a uniquely pianoforte function – and will transport you to the experience of playing a real acoustic piano. It is one of those subtle nuances that, although not always heard over the other instruments, makes playing a piano the unique experience it is…try it.

As you execute a flourish up the keyboard depress the sustain pedal "feel" the soundboard! And yes, this Damper Resonance is a completely programmable effect. There will be a separate Power User article on the Damper Resonance and Half-Damper functions found in the Motif XS. However, I felt it necessary to mention this Damper Resonance effect here because it

is a particularly specific type of reverberation and it is one of those very special articulations you will find all over the Motif XS.

I should briefly mention here, as well, while on the subject of nuance, the KEY OFF SAMPLE is another of those articulations (to be covered in another article) that determines the sound inside the piano. What this is dealing with is the sound when the hammers of a piano, for example, fall back into place and the felt damper returns to the string there is a distinct end to the tone and to the reverberation inside the piano. This is handled by a specially controlled sampled Element. It will only be heard when the key is released while the note is sounding (and not being held by the sustain pedal, of course). Previously, this KEY OFF sample function was only found in Yamaha P-series, PF-series, CP-series and Clavinova electric pianos… never before in a true synthesizer (not even the S90 ES). Of significance to this article is that the reverberation of the Damper Resonance, Key Off sample and the sustain pedal work together to make the subtle performance of piano works on the XS a completely natural experience. The Reverberation system "inside" the piano is just as important as the reverberation in the outer environment of the room.

FYI: KEY OFF samples are used to great affect on the Clavinet Voice "Pedal Wah Clavi" and the Harpsichord Voice called "Hipsichord", as well. Also of particular note is the electric guitar: "59 Combo AF1&2" – the Key Off sample here gives this Voice a "feel"; you can really get an image of picking the strings.

Conclusion: In my years as a recording engineer, and particularly when I was teaching audio engineering, I learned that everyone hears differently. And there is no right or wrong when it comes to these things, however, there is common sense. Think about things in terms of reality. This does not mean you have to stay with those bounds, not at all. Just think about what would happen in the real world, so that when you are doing something that qualifies as Science Fiction, you are doing so on purpose. There is no law that says you can't have a reverb that sounds like the Grand Canyon, just be aware that as a musician you describe a room environment as "musician friendly" based on its reverberant quality. Just enough is a good thing – but nobody really liked the gig in the gymnasium… there is a reason for that. I guess I am just saying that you should use these tools with some thought and you will be able to get great results, no matter what it is you are going after.