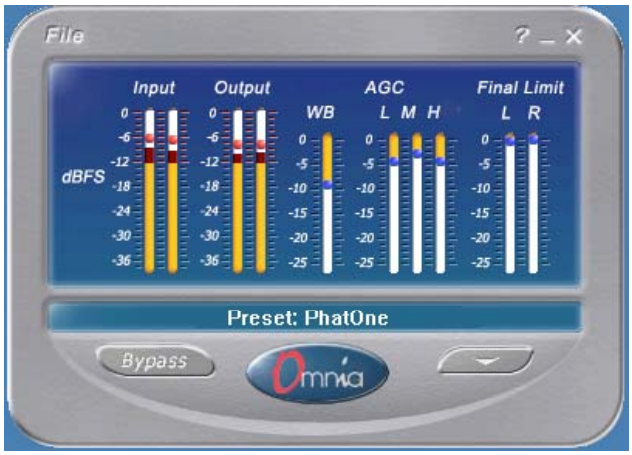

OMNIA A/X

Software Based Audio Processor

Installation and Operation Guide
Version 1.05

October 2003

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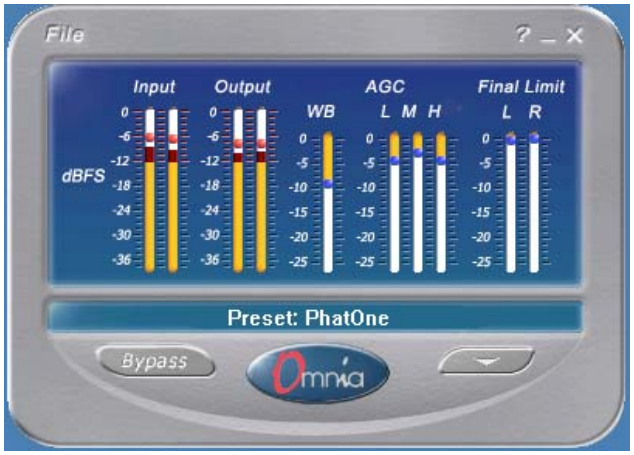


Introduction

The audio industry employs dynamics signal processing for many aspects within a broadcast station, recording studio, mastering facility, and numerous other requirements. From simple compression of a microphone channel, to special desired effects in the production studio, and on through the creation of dial-dominance in the transmission path, processing has always been a hardware based implementation. Even with the evolution of digital signal processing (DSP), processors are still physical *boxes* that engineers, producers, and program directors *tweak* as they desire to achieve that signature sound. But where is it all headed as technology moves into a different form or box? The personal computer has revolutionized our culture, and it now can provide us with the required machine cycles of power to accomplish many of the tasks we ask DSP chips to perform.

We introduce to you a new audio processing platform that is available as a pure software utility…Omnia A/X! Our research and design efforts revealed how dedicated hardware functions are now reduced to software applets, or plug-in modules. The ability to download a processor into the radio studio facility of tomorrow is made possible today. Now, a processing system is as easily configurable with the point and click of the mouse. We've come a long way from swapping out boxes in the equipment rack room to simple downloading of executable files! With workstations becoming the mainstay in the studio facility, the audio processor also has a place in those machine cycles as current technology allows us to further create a synergy of technical resources.

Our Omnia processors dominate the airwaves the world over. We are on the fast track as the *best kept secret* in the recording and mastering field. The products that have helped us achieve this success are based upon innovative ideas in the area of dynamic audio processing. Thus, it keeps within our mission to *raise the innovation bar* yet again and migrate our processing efforts into the true executable software domain. Chances are that soon *others* will follow.

Omnia A/X is not only a software processing solution, it's an affordable device that has numerous applications. It's modeled after the highly successful Omnia.3net, our DSP based 3-Band processor. From basic audio production, to recording, mastering, webcasting, and workstations, Omnia A/X offers what other rack mountable, or PC based *hard-card* products do, but it doesn't require the overhead of these other products. It makes use of the processing power available with current faster PC resources. Today, off the shelf PC's contain more than enough power to perform dynamics processing and serve up audio streams in a single computer, or web-server.

Compare that to the use of dedicated audio hardware that performs these same functions. Those not only cost more to acquire, but also consume more technical rack space, as well as infrastructure. Just think, we're approaching the day where *everything* will emanate from a single machine! Omnia A/X is a step in that direction.

Motivation

The worldwide broadcasting industry has over 15,000 radio stations. All of which employ some form of dynamics audio processor in the transmission path. This does not even count the plethora of production utilities that require some form of dynamics application. The digital workstation, audio console, and routing switchers have revolutionized the broadcasting industry. It is now possible to completely operate an entire facility from a single computer. *Every* function for on-air purposes is now in one digital form or another. The increasing ability of software packages for the broadcaster to synergize between one-another continues to grow, and the future is looking brighter with respect to an eventual single system solution where the entire facility will operate out of some form of workstation-like system.

Development has now been done in the area of audio processing as well. We have reached that day when the *box in the rack* can be replaced with a simple software (S/W) package on a machine. In some smaller applications, this has begun already! Consider when everything will become S/W created from some single-ended system that has a low-level RF output that is coupled into a transmitter, or remains in the digital realm as it is routed via the Internet. Part of that system will include a processing function, as is performed today using hardware (H/W) devices.

There are more than 5,000 Internet radio-station-like audio webcasters. Like their over-the-air counterparts, these can all benefit from dynamics processing. Every radio station uses audio processing and there is no reason to believe that webcasters wouldn't want it, too. Television stations also employ processing, just as Internet video services will, as they grow in sophistication.

The growing power of PCs makes a software version of an audio processor for this application possible. With 700+ MHz Pentium IIIs now mainstream, it is possible to have a reasonable processor together with an encoder on one PC. As network bandwidth increases, there will likely be more webcasters entering the fray – and more concern about audio quality as the services become more mainstream.

While many are doing it, webcasting is a developing business and no clear models to achieve profitability have emerged. Many webcasts are simply simulcast radio stations. In most cases, these stations do not see webcasting as a particularly important activity. Internet websites like Yahoo, CNET, Amazon, and many others have audio as content, and some take it seriously. Yet more webcasters are very small, operating the equivalent of vanity press. Because no path to profitability has yet been found, most webcasters must operate at low cost. Thus, $3,000.00 for an audio processor is probably too much for the vast majority to pay. A streaming "starter kit" (for 60 listeners) costs $3,000.00 at Real Networks. Microsoft's package is a free download. The cost of entry level processing needs to be in proportion.

Further, the webcasting space is dominated today by people who have a lot of computer experience and are more comfortable with a software approach than a hardware box. Perhaps they have a sense that change happens so quickly that they want to have the flexibility that software on a general machine offers.

Another barrier to adoption of the hardware processors is the signal path. With current audio processors, the computer playing out the audio must send the audio via an analog sound card. Then the computer doing the subsequent encoding must receive the audio again via a sound card. While this works well enough, many potential customers perceive it as being awkward.

Effective processing divides audio into multiple frequency bands and dynamically adjusts levels to be optimum. On the surface, this is a simple function. But to get the sound appropriately optimized without adding undesirable "artifacts" is a tricky blend of art and science involving many trade-offs. Expert ears coupled with audio design expertise are required to get the engineering work accomplished – and these are rare combined skills.

Transmitting audio on the Internet requires bitrate compression. Uncompressed stereo audio would require 25x more capacity than possible over a 56kbps modem. Even broadband connections will require compression so that audio doesn't take all of the available capacity, leaving nothing for web surfing or companion video content. The perceived quality of audio that undergoes this compression is very much improved with the addition of dynamics processing. The benefit is unambiguously dramatic. Every potential customer who has had a demonstration prefers the sound of processed audio.

Omnia A/X is a stand-alone software signal processor. It does not require a dedicated PC card to operate as it utilizes the host processor inside the computer. Omnia A/X was designed as an applet for a production suite, mastering, Internet streaming, or stored-file applications. The dynamics processing algorithms are based upon the highly successful *Omnia.3net,* which is a hardware based DSP audio processor.

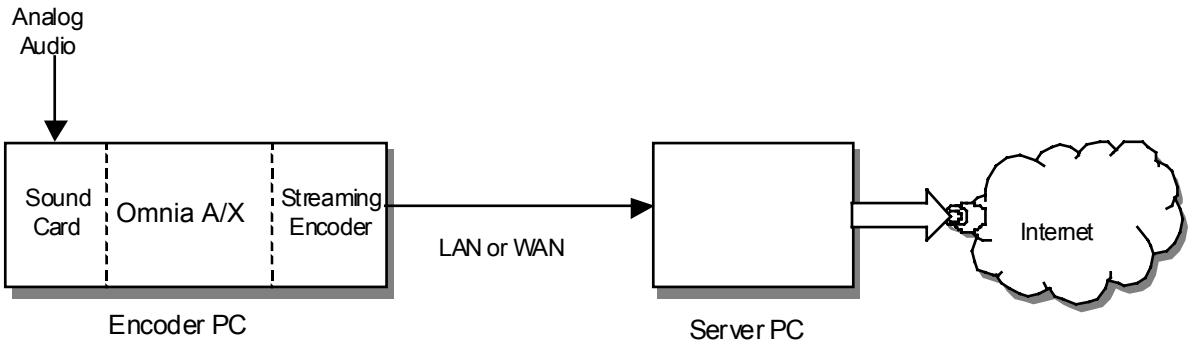


Figure-1

Windows Audio Interface Omnia A/X makes the processed audio available via a WAVEIN driver. This driver makes the Omnia output appear as a virtual sound card. Other applications can use the processed audio by reading it directly from Omnia's audio driver.

Audio Processing Omnia A/X performs internal calculations with precision sufficient to guarantee 24-bit dynamic range. Omnia A/X employs the following processing architecture:

- *Wideband AGC*
- *3 Band Combined Compressor/Limiter*
- *HF EQ*
- *Adjustable Bandwidth Lowpass Filter*
- *Final Look-Ahead Limiter*

User Interface

A graphical user interface provides access to all user settings and presents all feedback information. The following items are incorporated:

Controls

The main window has the following menu items and controls:

- *File*
- *Open, Save, Save As* (for presets)
- *About*
- *Minimize*
- *Close*
- *Bypass*
- *Open Audio Block Window*

The audio block window has the following blocks. Each will have the listed controls, accessible by clicking on the block to open a sub-window:

• *Input*
• *Input gain*
• *Selectable Lowpass Filter For Bandwidth Control*
• *X-Over*
• *Wide-Band AGC*
• *Drive control that will determine the amount of audio level driving this section*
• *A "speed" selector that will select "slow," "medium," or "fast" operation*
• *3 Bands Of A Combined AGC/Limiter*
• *Drive control for each band*
• *The same speed controls as above for the WB-AGC*
• *High-Frequency EQ Enhancer:*
• *Mixer*
• *Final Limiter*
• *Output Gain*

Displays

The interface shows the following display elements:

• *Input and Output Level Meters*
• *WB AGC Bargraph Meter*
• *Bargraph Meter For Each Of The 3 Processing Bands*
• *Bargraph Metering for the Final Look-Ahead Limiter*

Presets

Presets work like the hardware processor counterpart. These are a way for users to have multiple processing styles, be able to store and recall them, etc. Presets include most of the user adjustable settings.

With presets it's possible to:

• Save and recall presets to/from disk.
• Select from among currently loaded and factory presets.
• Select factory presets optimized for common internet broadcasting configurations.

Hardware Requirements

Encoding and processing are both CPU-intensive operations. Indeed, it is only recently that it has become possible to do real-time audio operations on PCs. Only a few years ago, DSP plug-in cards were necessary for serious audio functions. Omnia A/X may be run simultaneously with Real or Microsoft's streaming encoders on a Pentium III 800+ MHz machine.

Installation

Before installing the software, confirm that the computer fulfills the hardware requirements regarding processing power. The audio input/output function must be defined as well. If using an audio I/O card to access Omnia A/X, make sure that a high quality sound card is chosen.

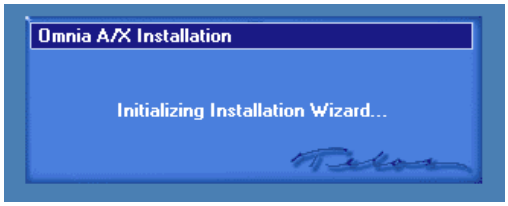
System Requirements

PC Requirements:

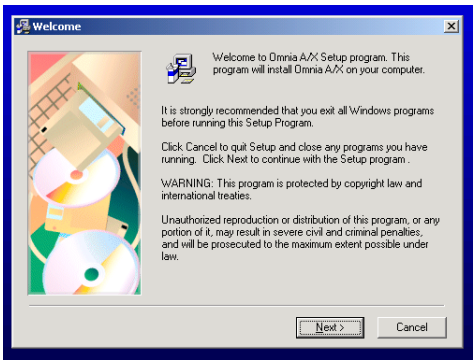
CPU: Pentium III 800MHz or greater
OS: Windows 2000, NT, and XP
Drives: CD-ROM required for installation; 2 MB minimum disk space required
Memory: 16 MB (Minimum) – 32MB or greater (recommended)
Video Card: SVGA card capable of 16-bit color and 800x600 resolution. 1024x768 resolution (Recommended)
Audio I/O: Professional grade sound card, and/or network interface to transport audio files/signals

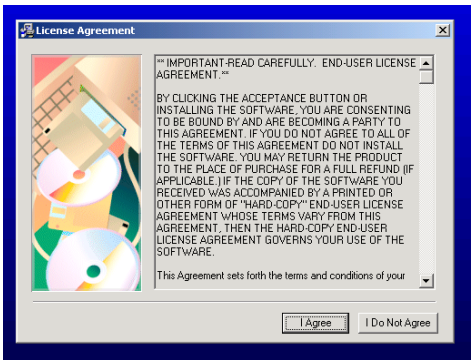
Installing From CD-ROM

Insert the CD-ROM into the computer. Locate the *Omnia A/X 1.00.exe* icon and double-click on it to launch the installer.

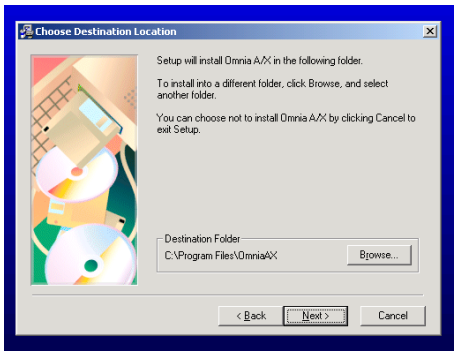


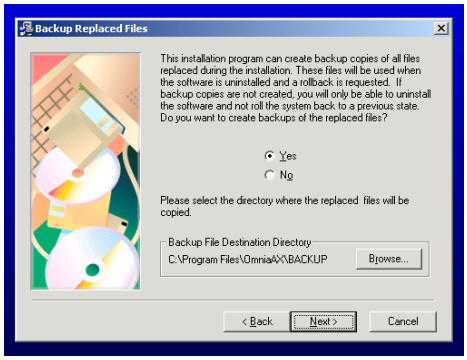
Once the Install Wizard has loaded, the following screens will appear.

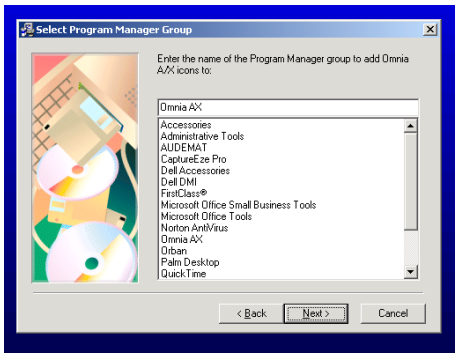


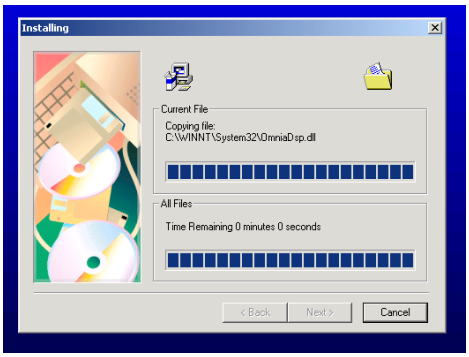


Upon completing the License Agreement, continue the install process.

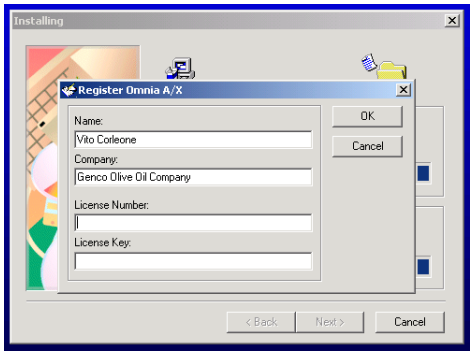


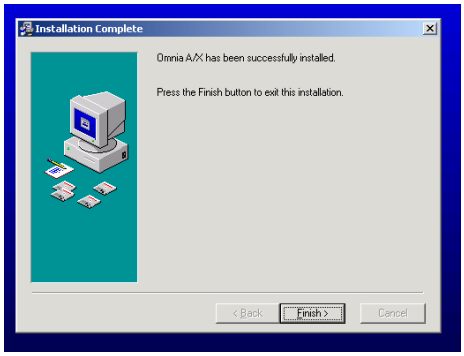






The next screen will require the *License Number* and *License Key*. They must be properly entered or Omnia A/X will only operate in the *BYPASS* mode. Locate the *License Number* and *License Key* that was received with the product, and enter it at this time (NOTE: The license information is not case sensitive).





Upon restarting the system, Omnia A/X is ready to roll!

Installing A Downloaded Copy

If the installer was downloaded from *www.omniaaudio.com,* locate the installer application icon. Double-click on it to launch the installer. Follow each of the instructions as described in the previous above.

Operation

Omnia A/X is the Omnia3.net processor, except it's completely implemented in software. The only hardware, per say, is the computer platform that is running the application. The algorithms in Omnia A/X are exactly the same as the rack mountable hardware counterpart. The only difference is the number of parameters to adjust is limited. If you are familiar with Omnia.3net, then Omnia A/X is even easier to understand.

Input/Output (I/O) Considerations

One of the factors that differentiates Omnia A/X from hardware, or hard-card counterparts, is the I/O aspects. Once installed, Omnia A/X becomes a part of the computer system. Therefore, whatever I/O resources that have been allocated to the PC, are now the same resources for Omnia A/X. We strongly recommend that if the intended I/O is by way of a sound card, then make sure that a professional grade card is employed. Most off the shelf PC mega-store sound cards are of moderate audio quality, at best. Omnia A/X is an affordable audio processor that does deliver audiophile performance. But to achieve this, good I/O to the PC is required.

Omnia A/X processes sound received from an external audio source – e.g. through the input of standard Windows®

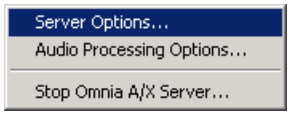
compatible sound card. The processed sound can be played back via a sound card, or it can be made available to other applications for recording or encoding via a virtual sound driver. This document is a quick guide to get you started configuring Omnia A/X's input and output.

Input & Output of Audio via Sound Card(s)

Follow these steps to process audio received from a sound card and play it out through the same or another sound card. This in effect turns your PC into an audio processor.

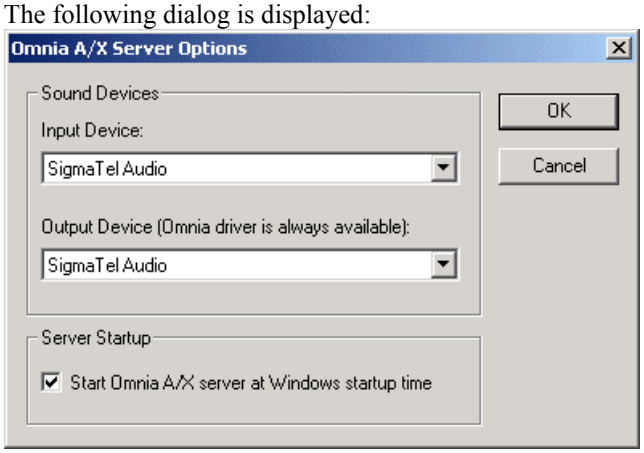
1. Start Omnia A/X Server. The application starts silently (except for the first time, see step 3) and is shown as the icon in the task bar:

2. If the Server Options dialog pops up when you start the Omnia A/X server then skip this step and continue with step 3. Otherwise right-click the icon to display the application menu:



   Select "Server Options…" from the menu.

3. The following dialog is displayed:

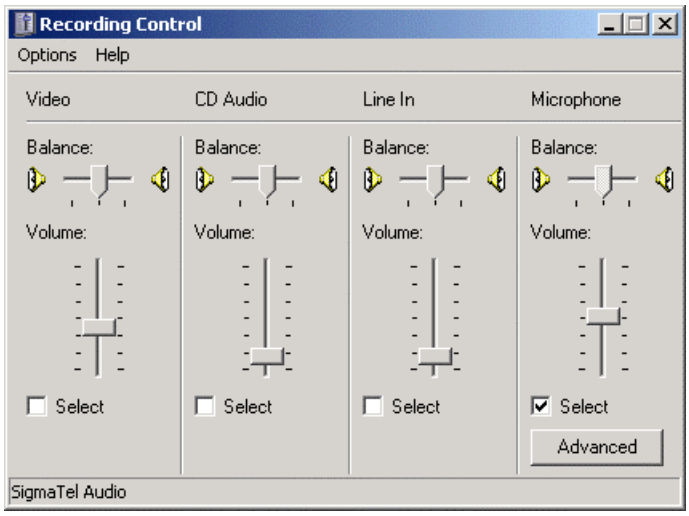


   Select the desired audio card(s) for input and output then click the "OK" button.

4. Open the Windows "Recording Control" mixer by double clicking the volume icon in the task tray, (or, if necessary through the *Programs/Accessories/Entertainment/Volume Control* "Start" menu.

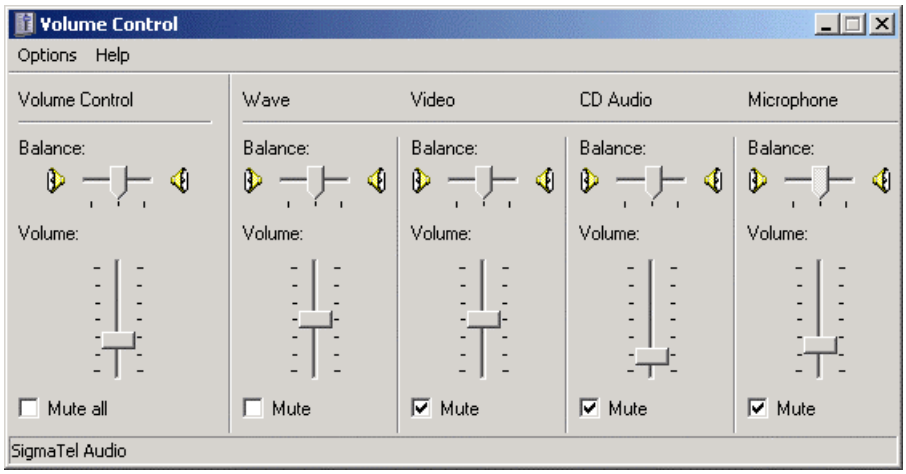
   If the top of the screen does not read "Recording Control" (see below) click on Options/Properties, select the button labeled "Recording" then click "OK".

Select the input source you wish to use. In this example we are using the microphone input as the audio source.



5. Click on Options/Properties and select the "Playback" button then click “OK”.

   Under playback options, mute all sources except for the Wave. This will ensure that only the processed audio will be played back through the audio card.



6. You are now listening to processed audio received from the audio card. See the

Use Processed Audio in Other Applications

You can use the Omnia A/X processed audio in any application that can receive audio from a Windows audio device. This includes recording applications (Soundforge, CoolEdit, etc.) or encoding applications (Windows Media Encoder, etc.). In order to access the processed audio simply configure your application to read from the "OmniaAX" audio device instead of your audio card.

Starting Up

Omnia A/X Server can be launched from the Windows *Start* menu, under *Programs/OmniaAX*.

NOTE: Launching the program for the first time may display the *Server Options* dialog. Take a look at the section above for information about configuring the input and output audio.

Omnia A/X is now active and ready for use indicated by the icon on the task bar. Right-click this icon to display a menu of available options.

Server Options… Brings up the Server Options dialog. This allows you to select the audio input and output. You may also choose to start the Omnia A/X server at Windows startup here.

Audio Processing Options… Displays the main control panel for Omnia A/X. This displays the audio meters and allows you to adjust the audio processing options.

About… Displays version information for the application.

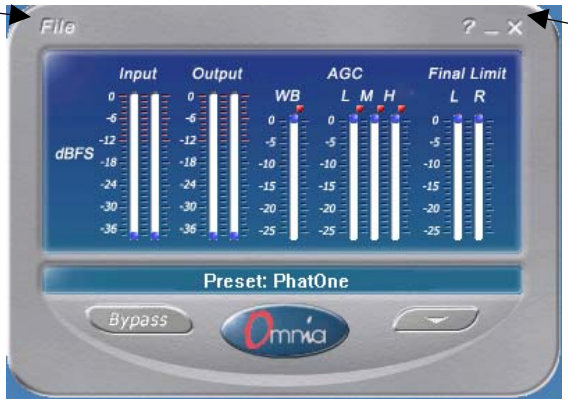
Stop Omnia A/X Server… Stops audio processing and exits the server.

Audio Processing Options Window

File Functions

The *Main Screen* menu bar actions are illustrated below:

File Functions:
Load...
Save
Save As...
Exit



Close Window

A mouse-click on ***File*** will open a pull down menu that displays the four actions that can be invoked: *Load, Save, Save As,* and *Exit*.

Load: Used for loading a processing preset.

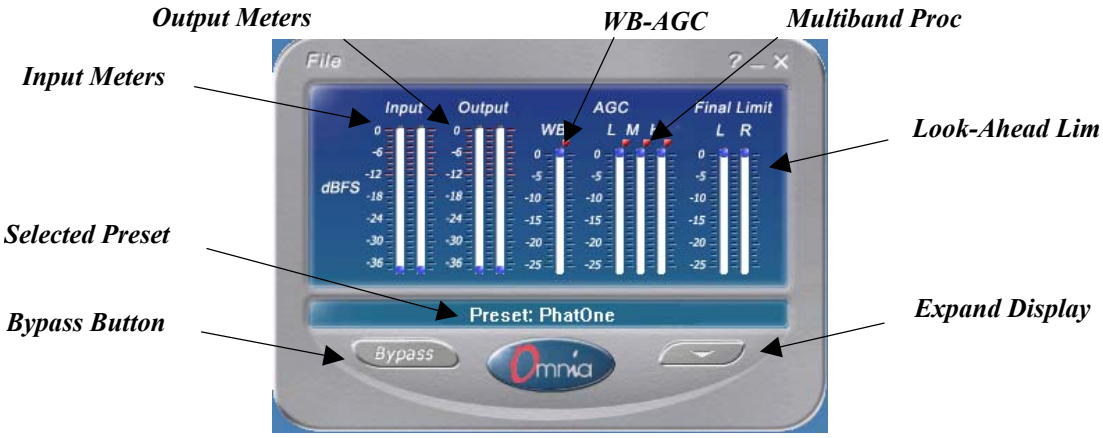
Save: Allows overwriting the existing loaded preset.

Save As: After modifying parameters, this creates a new preset file.

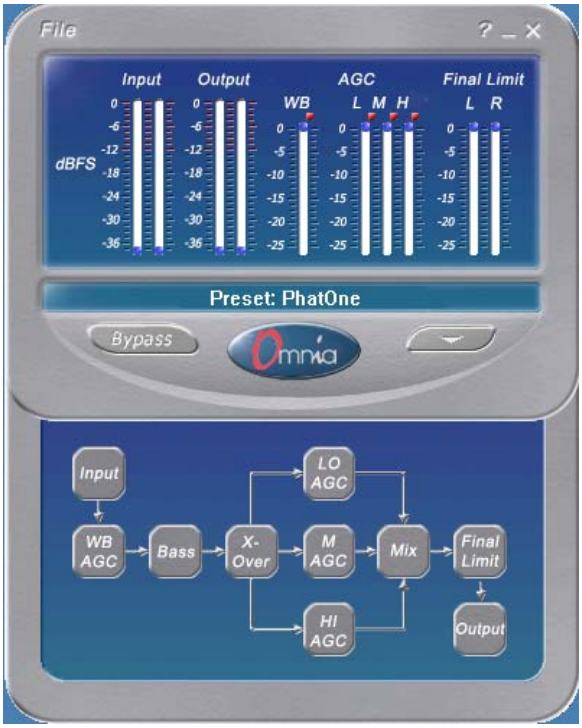
Close: Closes the window. The Omnia A/X server is still processing audio in the background.

Display Functions

The bargraph display is a straightforward representation of what the Omnia A/X is doing.



From the *Main Screen*, there are only two buttons that have any affect: *Bypass* and *Expand Display*. Mouse-click on the *Expand Display* button to reveal the *Block Diagram*.



Processing Audio

Omnia A/X is intuitive and easy to use. Applying audio will activate movement on the bargraphs, and this is confirmation that processing is occurring. Before making adjustments, it helps to know how to interpret the metering displays.

Understanding The Bargraphs and Indicators

The bargraphs are capable of indicating more than just level information. The *texture* and *density* of the audio signal can be observed, based upon the dynamic action of the bargraphs, and peak-responding balls. Of interest are the red or blue balls that appear at the end of the yellow bargraphs, as they indicate peak level. The yellow bar section represents the RMS average of the signal. Wide dynamic range will display a separation between the balls and the bargraph, whereas signal with little peak information will cause the balls to ride on the crest of the bargraph. The bargraphs can indicate up to 25 dB of gain reduction.

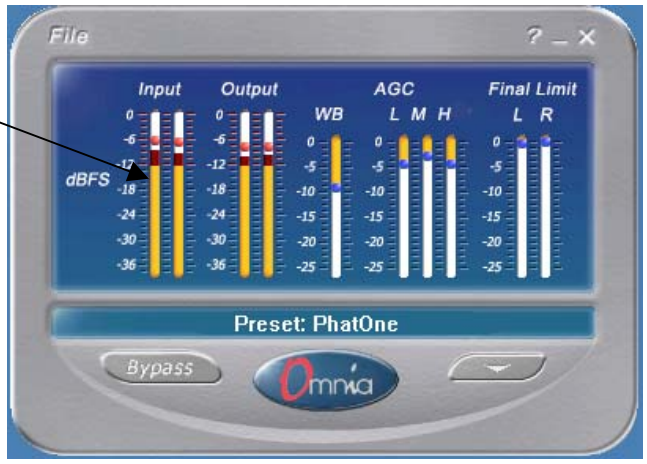
The bargraphs provide a wealth of information about the processing control in Omnia A/X. The algorithms automatically adapt the style of compression/limiting control being employed on a moment-by-moment basis. This can be deduced if the metering is studied over time. During normal operation, the indicators will have a dynamic "bounce" that you will be able to get a feel for. Every now and then, you will see the processor react quickly and show a larger amount of gain reduction. Notice that the response is very fast. This action will recover very slowly, and return to "rest" with the main bargraph. This action will be easily noticed on material that is very dynamic in texture. More on this below.

Another feature unique to Omnia A/X is processor "*Hold"*. During brief pauses in audio, the bargraphs will "freeze" and the *GATE* indicators will show the processor has entered the *Hold* mode of the algorithm. This is most easily noticed when there is a "dry" voice being processed.

The *Input/Output* level meters will change from yellow to red whenever the level exceeds –12dBfs. Also, the blue balls will change from blue to red on the *Input/Output* displays. In the dynamic processing section the balls will always indicate blue.

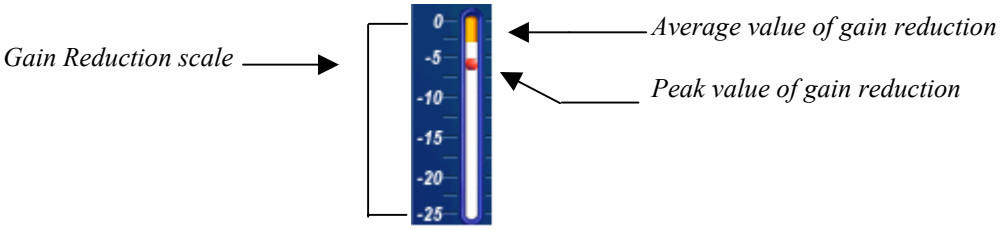
Note: The input and output levels are displayed relative to 0dB full scale (0dBfs). The *0* indicator on the input/output bargraphs means that every available bit of signal level is being used at that time! There is nothing more in the level department, except to create distortion…*nasty sounding distortion!*

Peak Level Above –12dBfs



Interpreting the Gain Reduction Meter Displays

Through careful observation of the processing bargraphs, significant information can be acquired and analyzed about the audio signal on a moment-by-moment basis. The yellow bar shows the average value of the gain reduction, while the floating ball indicates the peak value of gain reduction.



Gain reduction meter (typical)

Since the processing algorithms in Omnia A/X 'adapt' to the audio, it is capable of performing many different processing functions at different times. The processing display bargraphs may appear to indicate different kinds of operation with different program material. This behavior is primarily based on dynamic range differences in the applied program material. For program material that is already processed or lacking dynamic range, the bargraphs will indicate differently than with material that possesses a high degree of dynamic range. This is because audio signals that lack dynamic range, naturally or by previous processing, will possess a lower peak to average ratio. Conversely, audio signals with a wide dynamic range possess a higher peak to average ratio. The Omnia A/X adapts differently to each case.

For program material that has low dynamic range (or high RMS and low peak levels), there will be more activity in the WB-AGC sections and less activity in the Multiband Processors. This behavior is due to the WB-AGC response to high RMS energy, while the Multiband section is reacting to lower peak energy. Sometimes the Multiband section may not indicate any action at all. For Omnia A/X, this is completely normal! Examples of this behavior might be seen with heavily processed commercials or music, or with music passages of sustained level. A good example is the Aerosmith CD “Pump.” This recording has very little dynamic range. Try any up-tempo selection from this disk and you will see the Wideband-AGC section make initial adjustments along with small amounts of limiting. Once adjusted, the Wideband-AGC section will stay deep in gain reduction, although with little movement, and action within the limiters will be minimal.

When the programming has wide dynamic range (low RMS and high peak levels), the opposite will occur. The Multiband section becomes active, while the WB-AGC section will appear not to respond as much. During these events, the Multiband sections could be working aggressively, while the WB-AGC section indicates little activity. Good examples of programming able to cause this behavior: vocal passages, live voice, classical music, and passages with high transient levels. Good test examples: almost anything classical, as well as almost anything by Steely Dan!

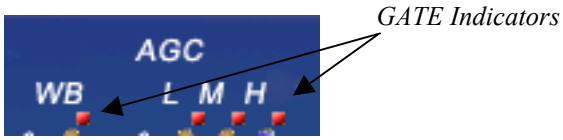
Also keep in mind that the WB-AGC section is designed to operate much more slowly than the Multiband sections, primarily because of the nature of each function. Remember that the WB-AGC section operates on the program's RMS energy. During gain calculations, the incoming program's “average” level is established, and gain adjustments, if needed, are made based on those calculations. This is why the WB-AGC sections will appear to move slower as it makes changes over relatively long time periods.

The intent of the Multiband section is to normalize the spectral balance and provide control of the peak levels. Peak energy must be detected and adjusted in a quick and accurate manner while, at the same time, not interfering with the sonic integrity of the audio signal. For this reason, the Multiband sections operate faster, with special background instructions to govern their behavior, and strictly on an as-needed basis.

Since the processing displays are capable of providing a wide range of information, we do not recommend setting up the system based on any specified meter indications. Instead, we recommend setting up the processing by using your ears to judge the sound. We've provided the meters only to analyze the signals and aid you in adjusting the

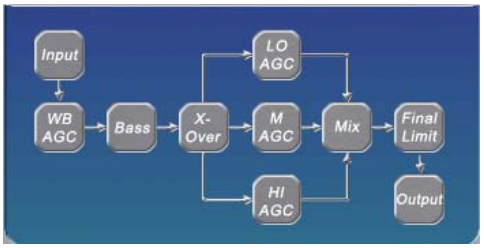
specific parameters needed to achieve your desired sonic results. Like a speedometer, the meters are a guide, not the road!

The red *ticks* that appear above the *WB (Wideband AGC), L (Low-Band AGC), M (Mid-Band AGC),* and *H (High-Band AGC)* bargraphs are the *GATE* indicators. They display *GATE* activity. The *GATE* function is described above in the section titled "Understanding the Bargraphs and Indicators". The *GATE* indicators are always off if the associated *GATE* is turned off.



Processing Adjustments

Here's where the action is! A block diagram depicts the flow of the audio signal, and illustrates the processing functions that are available to adjust. A mouse-click on a *button* will provide access to that function.



Block Diagram

Input

A mouse-click on the *Input* button displays the input section *sub-menu*. There are adjustments for the individual Left/Right channels. Drag the slider-bar to adjust the respective level. Then click *OK*. This will close the sub-menu. There is a 30dB range of adjustment between –20dB and +10dB.

Using normal program audio, a correct gain setting results in **peak** indications (the "bouncing balls") hitting -12 dBFS (where the level meters turn red) or a little higher. This corresponds to system headroom of 12 dB. You may adjust for more headroom if you wish (lower indications), but setting the input level for less headroom (higher meter indications) is strongly discouraged.

WB-AGC (WideBand AGC)

A very flexible wideband leveler section provides smooth, transparent control of the input program. This is achieved through two significant Omnia innovations, a dual referenced release gate and a hidden, intelligent "makeup" gain algorithm. The dual gate reference is a unique process that correlates the dynamics of the audio input signal to a "rolling" reference level, and from that information makes conditional decisions affecting the character of the release function.

A hidden, Make-Up Gain, control signal determines when the amplitude of the input program suddenly falls to a reduced level. It then adjusts the side chain gain in order to "fill in" the softer program passages so that the average level is increased. This allows the AGC function to operate with slower time constants, while significantly increasing the average audio level. These slower overall time constants yield lower intermodulation distortion, contributing to Omnia's trademark sound.

Using Classical music for an example, the orchestra often plays *forte*, and then enters abruptly into a quiet passage. Conventional AGC algorithms would hold the softer passage down until it was able to slowly recover at the static release time setting, making such passages nearly inaudible at normal listening levels. Omnia A/X's *makeup gain* function allows a hidden, faster time constant to provide quick recovery, but *only during the softer passage.* As soon as the orchestra starts to play louder, the "makeup" time constant yields control back to the primary AGC circuit, returning gain to the previous platform level. This sophistication preserves the dynamic integrity of the signal while greatly enhancing the listenability of the program.

This is the first processing section within the Omnia A/X, so the controls in this section affect the overall signal, its density, and hence affect every other processing section following it. The job of the Wideband AGC is to erase long-term audio level fluctuations, while doing so in a very unobtrusive manner. This sub-menu provides a few parameters that tailor the action of this section.

Drive: The sets the audio level that enters the *WB-AGC*. Increasing the *Drive* will produce more compression. This control is calibrated between –6dB and +6dB, and adjusts the signal level into the Wideband AGC. It should be adjusted to net approximately 12dB of gain reduction with typical programming. Too little gain reduction can defeat the "leveling" function of the Wideband AGC. Too much gain reduction has little additional benefit. Nominal gain reduction values for the Wideband AGC are between 10 and 15dB.

Release: Controls the speed of recovery for any given amount of gain reduction. Faster action yields less dynamic range and the presence of more density to the audio. The *Release* control sets the time constants in relative terms using *Slow, Medium,* and *Fast*. Because the time constants are program-dependent, calibrating these controls in absolute time values (ms/dB) would be useless—therefore we use simple terminology.

GATE: When set to *ON*, it will *freeze* the gain at the last level of processing action that occurred before the audio signal fell below the threshold of operation. This control helps to minimize "pumping", and the increase of background noise during pauses in programming.

Clicking *OK* after adjusting any of the parameters in this section will save the change and close the sub-menu.

Bass

This section contains the Bass EQ controls. In the Omnia A/X's unique signal processing architecture, these controls are placed in their optimal position — just before the multiband processor sections. Each of the ***Deep Bass*** and ***Phat Bass*** controls can boost the level up to 12 dB. Be careful here not to overdrive the following sections or over emphasize these lower frequency ranges. When used properly this specialized low frequency enhancement tools can deliver the thunderous bass and warmth that the Omnia is known for, and it can do so without making the sound muddy.

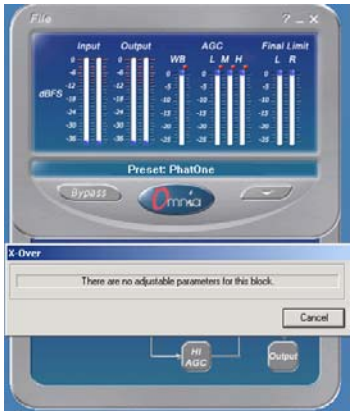
Deep Bass EQ: For those who demand *thunderous* bass, the Omnia A/X has it! Up to 12 dB of "thunder" can be added to shake your walls! This is not a simple bass boost, but a rather sophisticated concept that takes into consideration the time alignment of the low frequencies as they pass through the entire system. It allows a loud, clean low end, with absolutely no sacrifice to the overall loudness of your signal. The ***Deep Bass*** function is a shelf boost at 85 Hz, utilizing a phase compensated 12dB/octave slope to emulate the EQ function.

Phat Bass EQ: Phat Bass is a unique enhancement that adds filtered harmonics of the lower registers to the upper bass frequencies. The algorithm extracts information contained in the initial attack to do its work, and low frequency texture is therefore emphasized. Older recordings sound fuller (or phatter) with the added illusion of loudness. ***Phat Bass EQ*** also helps radios with small speakers sound like they have more bass than they actually do.

X-Over

Phase Linear, Time Aligned Crossover: Most multiband audio processors make a compromise in the crossover area in order to provide a flat dynamic frequency response. This is done to avoid audible peaks or dips in the recombined frequency response as the individual band gains change during processing. In an effort to minimize this problem, most processors use a fixed phase-offset in the crossovers. While such treatment helps to minimize frequency response peaks and dips, it also results in a loss of phase linearity, increasing "smearing', and reducing musical clarity.

In Omnia A/X's implementation, the crossover network is carefully time-aligned so that the recombined spectrum remains flat, regardless of the amount of gain control being applied within any band. This true phase linear response assures that harmonic overtones are not displaced in time. The result: the truer, more natural, and more musical Omnia sound. The crossover frequencies are not adjustable.



Multiband AGC Sections

Similar in character to the wideband AGC described above, but expanded to three bands, this section has the ability to significantly add power and loudness to the audio while tailoring and pre-processing it for delivery to the final limiter section. The system uses different algorithms for each of the bands: The low and mid bands use a *feedback* configuration, which produces a larger, warmer sound on lower frequencies. The high band utilizes a *feedforward* design that maintains a more open, natural and musical texture on higher frequencies.

As with any multiband processor, improper adjustment can exaggerate noise at high frequencies, particularly with older recordings that possess a good deal of tape hiss. This can especially occur if the highest AGC band is driven so that significant gain reduction occurs, and the band's gating control is set to the lower end of the scale. During audio segments that have little or no HF content, the AGC will try to increase its gain in an effort to restore treble balance. Even during periods when the gate function is in the default ***Freeze*** mode, the problem might still exist with some programming.

Since the user parameters are the same for all three bands, only the LF Band will be detailed here.

Drive: The sets the audio level that enters the *WB-AGC*. Increasing the *Drive* will produce more compression. This control is calibrated between –6dB and +6dB, and adjusts the signal level into the Wideband AGC. It should be adjusted to net approximately 12dB of gain reduction with typical programming. Too little gain reduction can defeat the “leveling” function of the Wideband AGC. Too much gain reduction has little additional benefit. Nominal gain reduction values for the Wideband AGC are between 10 and 15dB.

Release: Controls the speed of recovery for any given amount of gain reduction. Faster action yields less dynamic range and the presence of more density to the audio. The *Release* control sets the time constants in relative terms

using *Slow, Medium,* and *Fast*. Because the time constants are program-dependent, calibrating these controls in absolute time values (ms/dB) would be useless—therefore we use simple terminology.

GATE: When set to *ON*, it will *freeze* the gain at the last level of processing action that occurred before the audio signal fell below the threshold of operation. This control helps to minimize "pumping", and the increase of background noise during pauses in programming.

MIX

This is where the three multiband processors are mixed together. Use care in adjusting this section, as too much level from one particular band may cause an excessive amount of emphasis to that range of frequencies. Such adjustment may also drive the final limiter bands in that range of frequencies too hard, causing the sound to become unnatural, dense, and squashed. As explained earlier, if your desire is to "EQ" the sound, you should perform that function using the drive levels in the multiband section. The mixer is primarily intended for minor "EQ" changes to the overall sound. There is a +/-6dB range of adjustment for each band.

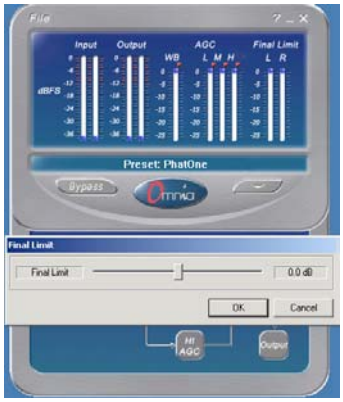
Final Limiter

Omnia A/X employs a lookahead limiter to provide absolute and precision peak control. This limiter has been designed to minimize processing side-affects like IMD, which are usually associated with limiters of this type. Using an innovative design that cancels intermodulation products before they develop, allows this limiter to sound extremely transparent. The limiting function is derived using numerous control signals that monitor one another.

This type of peak controller is used instead of a clipper because it does not generate the same high levels of THD as a Clipper does. THD causes added difficulties in a coded audio system, as the harmonics generated from the clipping action, create added artifacts in the encoder. These are especially annoying at high frequencies.

On the other hand, a lookahead limiter, yields extremely low levels of THD, although it will create some IMD component, and this allows the audio coder to operate with minimal sonic artifacts.

There are tradeoffs in how each of these peak controllers sound when they are set to produce added loudness. When a clipper is pushed, the audio may appear *edgier.* This is from the added harmonic content. In contrast, the lookahead limiter will appear *busier,* or dense as the action of the control signal may be heard, when more limiting is applied.

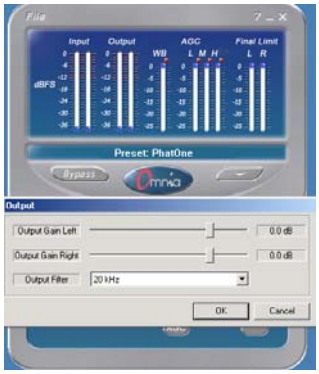


Limiter Drive: Here is where the loudness versus quality is most evident! This limiter's adjustment range is +/-3 dB, in 0.1dB steps. It is advisable to make minor changes, primarily as the 'loudness fine tuner'. Be careful; there is a lot of available power here!

Output

The peak output level adjustment is done using the individual Left/Right output controls. The control range is from –26dB to +6dB of gain. This level is normally set to the maximum input level, or just below it, of the device that the Omnia A/X is connected to.

Output Filter: For webcasting applications, especially at lower bitrates, it is sometimes desirable to reduce the audio bandwidth. This is particularly useful if you are using a low cost sound card to feed and external encoder as the filtering in many sound cards in inadequate. A pull-down menu provides eight different filter response curves that can reduce the spectrum down to 4kHz.



Bypass

The processing can be bypassed simply by clicking on the *BYPASS* button located on the main screen. This is a simple and fast method to compare the before and after affects of the processing.

Presets: Loading and Saving

Presets allow different processing setups to be quickly loaded into the system. Numerous factory presets have been provided for you to use as starting points for customizing your sound. A "preset" is simply a large table of values representing all of the control values for every control listed in the menu tree. When you *Choose* a preset, the control values are loaded into the processing structure, reconfiguring the Omnia A/X.

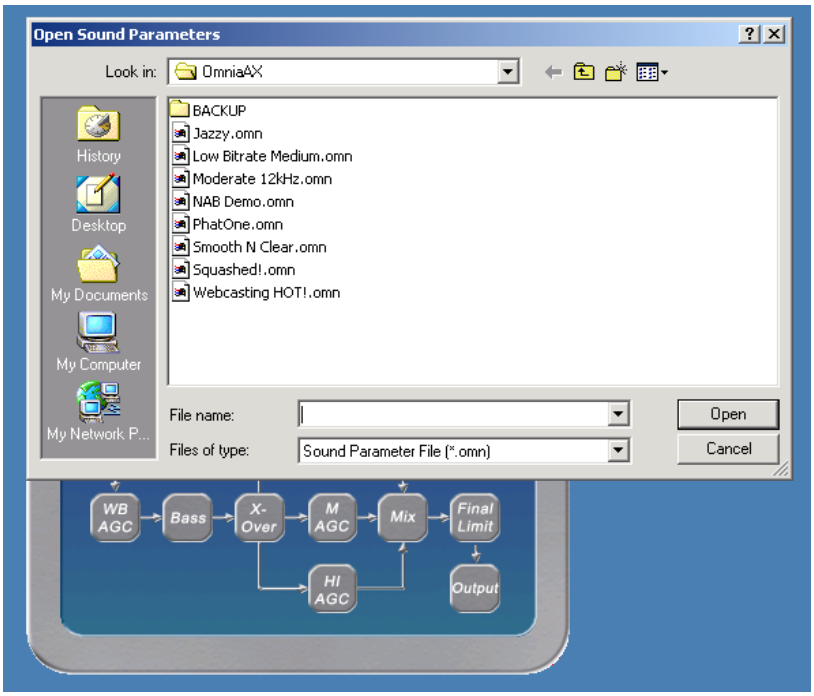
Omnia/Telos does not warrant in any way that these presets are *de facto standards* for the names that we used when we designed them. The factory presets were created as starting points, but they are not engraved in stone! Always rely on our factory presets to get you started. Then, once you find the preset that most closely matches the sound you're after, you can customize more to your liking.

Loading a Preset

From the main processing display, click upon *File* in the menu bar. Scroll over the pull down menu and then click on *LOAD* once it is highlighted. The *Open Sound Parameters* box will appear. This will display a list of the available presets.

The default folder/directory that contains the presets is: *C:/Program Files/Omnia AX/.* If a different directory was chosen during setup, or another directory was created in *Windows,* then navigate to that directory using conventional *Windows* operation.

Once the preset list is available, point and click on the desired preset, and it will be loaded into Omnia A/X.



Modifying Presets

Once a preset has been loaded, modifying it is easily done via the buttons on the block diagram. Point and click to any of the buttons to access the desired processing parameter. Upon completion of adjustments, click *OK*. This will confirm the adjustment and also close the menu box.

From the main screen, it is easy to observe if a loaded preset has been modified. An asterisk(*****) will appear next to the preset name. The asterisk is removed either by reloading a preset, or saving the changes that have been made.

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Saving Presets

There are two save functions for presets: *SAVE* and *SAVE AS*. The *SAVE* function will simply overwrite any changes to the loaded presets. Whatever adjustments that were been made, are now be contained in the preset that is displayed on the main screen. The *SAVE AS* mode will create a new preset name for the parameters that are now contained in Omnia A/X. Use this function to create User Presets.

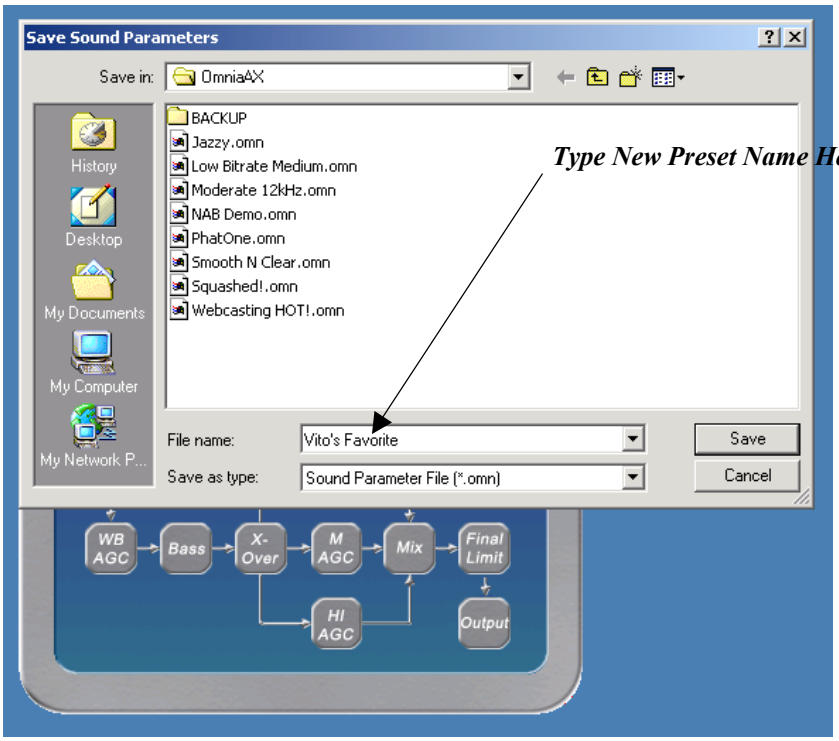
Save

From the main processing display, click upon *File* in the menu bar. Scroll over the pull down menu and then click on *SAVE* once it is highlighted. The changes that were made are now saved to the preset that was already loaded.

Save As

From the main processing display, click upon *File* in the menu bar. Scroll over the pull down menu and then click on *SAVE AS* once it is highlighted. The *Save Sound Parameters* box will appear. This will display a list of the available presets.

Type the name of the new preset in the *File Name* box that appears near the bottom. Click the *Save* button to confirm. The preset has now been saved, and it will appear on the main screen. It the example shown here, *Vito's Favorite* has been chosen to be the name of a new preset.



The default folder/directory that contains the presets is: *C:/Program Files/Omnia AX/.* If a different directory was chosen during setup, or another directory was created in *Windows,* then navigate to that directory using conventional *Windows* operation.

Fine Tuning Omnia A/X

Our goal is to provide dramatic sonic improvements by Omnia A/X right out of the box. We know that you will want to tailor one or more of the presets slightly to create a more "custom" sound, or you might really delve in and significantly modify the parameter settings to create their own unique "signature sound."

About Loudness and Fatigue

If you're an audio processing expert, you'll find what we've included within the Omnia A/X to be powerful tools. If you're new to audio processing, we recommend proceeding with caution and with knowledge of your goals.

Getting the most out of your Omnia A/X processor (or any other processor for that matter) starts with knowing your objectives beforehand, and knowing where you can make tradeoffs. If your goal is to create a hot master ***and*** obtain extreme amounts of detail and quality, keep in mind that there *are* limits. Reaching one goal is usually at the expense of the other. There will always be those individuals who feel that louder, at any cost, is better. The added distortion from the endless and pointless pursuit of raw loudness may generate negative effects on listeners. Be careful.

Having said all of this, we firmly believe that Omnia A/X will get you closer to your ideal than any other processor or combination of processors available today. It is definitely capable of generating moment-to-moment loudness; it has the *muscle.* It also maintains that famous Omnia *clarity* sought after by top engineers all over the world. We encourage all end-users to utilize the power of the Omnia A/X to create good, *competitive* loudness while maintaining a higher degree of quality.

Clarify Your Processing Objectives

Whether one is seeking better overall quality or specific spectral improvements, try to articulate and write down your goals. Do you want a little more loudness or "presence" in the final master or stream? Are there certain characteristics of the sound of other recordings that you like, want to emulate, or just surpass? Are there any you want to avoid? When adjusting processing, please give thought—real thought, to how you'd like your final master to sound. What do we mean by that? Well, if your desire is to add loudness, and in most cases it probably will be, decide on the *degree* of loudness that you want.

The Adjustment Procedure

1. Review your objectives.

2. Once you're up and running, start with a degree of processing that is similar to what you'd normally use and then, if desired, become more aggressive. A careful approach is less likely to draw hasty, or even negative, opinions.

3. Listen for a while, then adjust, and listen for a while again. Try to avoid the temptation to continuously "fiddle" with adjustments, just moments after getting the system running. Remember that you should evaluate the operation over time, not moment to moment!

4. While making changes to the system, we recommend that you do not make hasty or radical changes. Also, do not make too many different adjustments all at once. If too many parameters are changed at one time, it is hard to determine which change made the difference you may hear. That can be frustrating, whether the change made your station sound better or worse. Take your time. In order for you to become comfortable with your new sound, you should learn the limits of each control. We suggest making changes in increments of no more than +0.5 dB or -1 dB, or in 1 or 2 step increments. Try turning different functions on and off. Working this way, you will be able to get a better feel for the sound that the Omnia A/X is capable of producing.

5. Use the “sleep on it method:” Spend time adjusting and then listening, and when the system gets to a point where it sounds good, stop! While making changes to processing, there does come a time when the ears become less and less sensitive to the adjustments you're performing. Ears tire, and that's why spreading the adjustment period over a number of days is recommended. If what you've done still sounds good after you have “slept on it,” stop adjusting. If you're not quite there yet, continue with small iterations until you’re satisfied. If you are homing in on your goals, you'll find that each day the discrepancies become smaller and you’re making fewer adjustments.

6. When you get it where you like it, **stop and enjoy!**

Getting the Sound You Want

If you believe that your desire is to process aggressively, here are some suggestions that should help you achieve that goal. Conversely, if you have the rare luxury to strive for increased sound quality, we have suggestions for you too! Omnia A/X is designed to minimize the impact of the quality vs. loudness trade-off.

We recommend that before starting the process of *cranking it up* just for the sake of raw loudness, try to decide what sonic characteristics you feel are lacking in your final sound. In many instances, it’s not just about increasing the drive to the limiter. It can be as simple as creating an *illusion* of added loudness by changing a single time-constant parameter. There are even known instances where the use of *stereo enhancement* created the necessary apparent loudness. Please don’t bite at the first temptation to *crank* the system. Sometimes the old adage of *less is more* really applies!

Before delving into alternative processing possibilities, please give the next brief section some thought. It may help provide you with some needed direction in your overall processing plan.

A Word about Loudness

Making this confession is a little like telling your parents you dented the car. But here it goes: It’s OK for your final mix to be loud…*very loud!*

In the past, loudness was a problem due to the limitations of the processors of the day. In the quest for ultimate loudness, you probably either adjusted (or modified) your old processor well outside of its “safe” range, or pushed the 0dBfs ceiling level in the signal chain and accepted the byproducts of the interactions and conflicts among them.

Omnia A/X has changed all of that! It's been designed to look at the incoming audio, and *know* how to make your final mix consistently loud, and without the artifacts or grunge created by your current processor. Omnia A/X makes loudness an effortless exercise.

One more confession. It’s also OK for your master to *not* sound loud, yet sound incredibly musical and grunge-free, because the Omnia A/X has given you the choice. It is a system that maximizes the audio quality of your signal, yet at the same time satisfies your competitive requirements.

Quality versus Loudness

The trade-off between quality and loudness is primarily determined by how you choose to use the limiting and clipping sections. While each function alone will generate added loudness, they each have different advantages, as well as side effects.

When excessive limiting is used, intermodulation distortion is increased, making the audio sound "mushy", and "smeared." The added short term density can also cause the audio to be “tight”, “squashed", or “dense.” The "dynamics" artifacts caused by excessive limiting might sound like “pumping,” “breathing.” The rule for limiting is "a little goes a long way!"

When excessive clipping is used, harmonic distortion is increased. The audio level is in effect “running into the brick wall.” Too much clipping can cause the audio to sound “broken-up,” “torn,” “rough,” or “edgy.” As you

might imagine, the harder the limiters and clippers are driven, the louder the audio perception. However, you are also much more likely to encounter increased intermodulation and/or harmonic distortion.

The following sections are provided to assist you in designing the personality of your sound. As we said earlier, there is no precise recipe for setting up audio processing. While there are some basic fundamentals that you can use to get started toward the sound that you desire, it may require a concerted effort with extended listening and subtle processing changes over time to achieve your ultimate goal. Just remember to know your goals, take your time, and adjust methodically.

Increasing Loudness

Try to resist the temptation to just *crank up* the aggressive processing sections, like the limiters. Those will add loudness of course, but usually at the cost of quality. Many times, building a little more RMS level in the AGC sections will do the trick instead, and with no obvious sonic penalties. The following are some suggestions on where to begin to make changes. We suggest that you them in the order described.
Increasing loudness can be accomplished in four ways:

1. Alter the following parameters in the AGC sections:
- Increase the ***AGC Drive*** to the **WB** (wideband) AGC section.
- Increase the ***Drive*** to each band of the Multiband AGC screen.
- Increase the ***Release*** time settings in each band to make it operate faster.

2. Drive the Final Limiter section harder.

3. A combination of the above steps, but in small increments! It might sound crazy, but it's true! In this situation, resist the temptation to make too many changes at once. When that occurs, it becomes difficult to determine why the result of an adjustment did or did not make sense. Focus on one specific area of your sound at a time. Once that area is satisfactory, then move the focus to the next area, as needed.

Based upon the above suggestions, you can experiment with different styles of processing. Some prefer to have their processing be perceptibly loud, but dynamic. This may give the illusion of loudness, retaining detail and clarity, and reducing listener fatigue. This can be done by centering your efforts in the multiband section, and avoiding heavy use of the final limiter. One trick that works well is to use fast release times in the multiband limiters, but do not let them produce more than 5 dB - 7 dB of gain reduction. This keeps the IM distortion of the limiters to a minimum, and doesn't "over-squash" your sound. Adjusted in this manner, the Limiter sections are relied upon to generate higher long-term RMS levels, which translates into increases in perceived loudness.

If the quest is to produce a "loud and proud" signature, then the limiters should be leaned upon a bit more. *Loudness at all costs* is usually the reason for moving the processing in a direction like this. Using larger amounts of drive to the multiband limiters, along with faster release times will generate a signal of high short-term density. The effect of the processing set in this manner is that the audio is consistently loud at all times . . . a wall of sound. The drawback is that the *density* can cause fatigue. While Omnia A/X is designed to minimize fatigue, it is capable of generating large amounts of density that could eventually lead to fatigue. Be careful!

Adding More Detail—When Loudness Isn't the Last Word

Now that we've "squashed the grape," lets look at what it takes to undo a heavily processed signal. Basically, just reversing the procedures listed above will do the trick:

1. Reduce the drive to the Final Limiter.

2. Back off on the influence of the multiband stages:
- Reduce the amount of ***Drive*** to each band in the multiband.
- Reduce the ***Release*** times to slow down recovery.

3. Ease up on the Wideband-AGC sections:
- Reduce the ***Drive*** to the WB AGC.
- Reduce the ***Release*** time to operate slower.

Backing off the Limiting sections first will allow the processing to retain a level of competitive loudness while enhancing quality, and the overall dynamic texture will be affected less. Start with reducing the ***Limiter*** amount in

0.5 dB steps. It's surprising how much detail can be restored from just a small change of 0.5 dB. Generally, changes in the ***Limiter*** drives will have the most noticeable effect on quality, but it will also affect the relative loudness level, too. You'll need to find a "happy medium" that's right for you.

Equalization Changes

Tailoring the shape of the overall audio spectrum can be done in three different sections:

1. The relative ***drive*** settings in the multiband AGC menu. These controls set the drive levels of the multiband AGC sections.
2. The settings of the multiband ***Mix***er controls.

Both options will provide noticeable change in EQ. We suggest you use the first listed option. In this case, an EQ change is still followed by a *dynamically* controlled stage. Therefore any excessive EQ change can be 'undone' by the subsequent AGC.

The last option, adjusting the *Mixer*, is designed to provide a final *minor* trim to the spectrum. If you've noticed that we calibrated these controls in 0.10 dB steps, then you know what we mean when we say these controls are for fine trim! Since this stage is *after* all of the dynamic AGC and Limiting, a radical change in level in the *Mixer* will result in additional and possibly excessive limiting of audio in that band. We suggest that changes implemented here be limited to no more than about 1.0 dB. Naturally, the decrease in mix level can be done to any desired amount.

Thunder Bass

Omnia A/X has the power to shake the walls with low end! If your source material has it, Omnia A/X will put it in the mix, and with muscle! Making changes to this characteristic is done using the following parameters, and for maximum effectiveness, in the order listed:

1. In the Enhance Menu, increase the amount of ***Deep Bass*** boost.
2. In the Enhance Menu, increase the amount of ***Phat Bass*** boost.
3. Increase the drive to the *LF AFC* with the appropriate control in the ***LO AGC*** screen.
4. Speed up the ***Release*** times of the LF ***LO AGC*** section.
5. Slightly increase the *Low* control in the *Mixer* section

When it comes to processing, moderation is the key! If all of the above steps are utilized in the pursuit of more bass, then severe low frequency over-enhancement can occur. Excessive bass boost can produce the illusion that the presence and high frequencies have been lost. They are still there, but are being acoustically masked by the lower frequencies.

Generally, an increase in the Enhance Menu's ***Bass*** boost functions alone will provide more than sufficient enhancement to the low end.

Reducing Codec Artifacts

Dynamics processing is an extremely useful tool that will reduce audible artifacts from lossy-compression codecs. High frequencies tend to be the first perceptible annoyances, followed by that *swishy-swirly* water like sound that's quite common at lower bitrates. These artifacts can be reduced, and in some cases eliminated, when the audio processor is applied as a tool.

Generally, it's understood that as codec bitrates are reduced, so is the audio bandwidth. Omnia A/X contains selectable low pass filters in the *Output* section. Reducing the audio bandwidth through filtering will help. Additionally, the upper band of processing can be reduced in the *MIX* section, which will allow that band to act as a dynamic governor. Operating the HF Band in the *slow* release time will reduce HF density which improves intelligibility as the encoder masking algorithm is not loaded as heavily with HF content.

Applications

Streaming (webcasting)

One of the biggest advantages to Omnia A/X is the ability to employ it for streaming applications. As stated earlier, it's possible to install both Omnia A/X and the audio encoder on the same PC. It's compatible with all the favorite *flavors* of streaming codecs. It's recommended that a PC of moderate MIPS be employed. The suggestion here is at least a CPU that operates at 800mHz or more.

File Based Storage

In a production workstation, Omnia A/X provides the ability to process audio files for storage. This is extremely useful when archiving material, or performing normalization to file based content.

Mastering/Post Production

This is somewhat related to the above section, as more mastering is now done in the workstation domain. The difference being that the end result usually ends up in compact disc (CD), or recorded form somewhere. Restoration of old audio masters benefit extremely well as they can be transferred into a workstation where Omnia A/X is installed.

Recording/Production/Broadcast

Probably the most common application, where the need is to have access to a processor for a host of operations. Omnia A/X is extremely versatile in its capabilities.

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If You Need Help!

- Omnia Customer Support personnel are available in Cleveland, Ohio, USA, Monday through Friday between 9:00 A.M. and 6:00 P.M., Eastern Time. If outside the U.S.A., see below.

Via the World Wide Web

The Omnia Web site has a wide variety of information that may be useful for product support, applications information, software updates, etc. The URL is: http://www.omniaaudio.com.

Via E-Mail

The customer service e-mail address for Omnia is: support@omniaaudio.com.

Via Phone & Mail (USA and non-European Countries)

Customer service is available by telephone, Monday – Friday between 9:00 A.M. and 6:00 P.M., USA Eastern time zone.

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