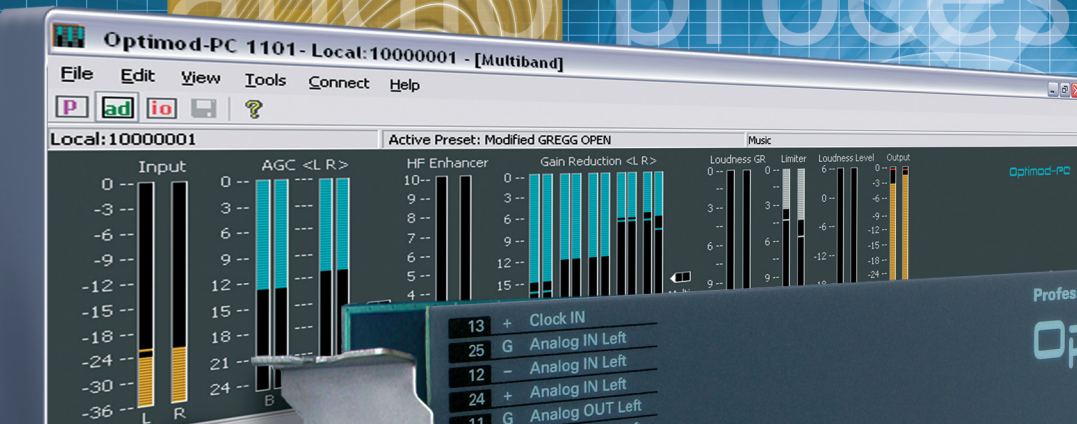




# audio processing



Connection List

- All Connections
- Local 1000001

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Professional Audio Processor/Sound Card

## Optimod-PC 1101

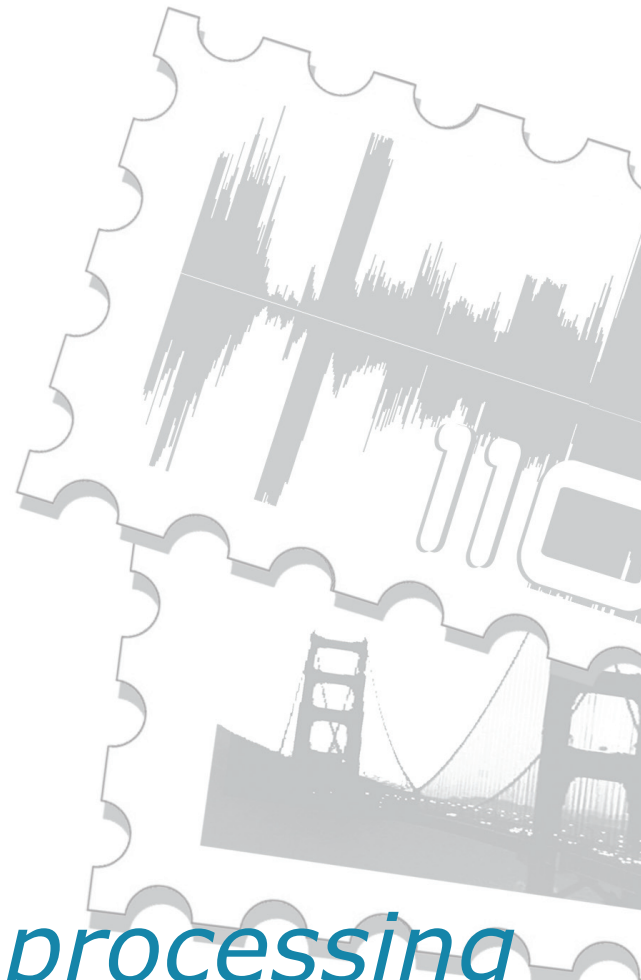
orban

13	+	Clock IN
25	G	Analog IN Left
12	-	Analog IN Left
24	+	Analog IN Left
11	G	Analog OUT Left
23	-	Analog OUT Left
10	+	Analog OUT Left
22	G	Analog IN Right
9	-	Analog IN Right
21	+	Analog IN Right
8	G	Analog OUT Right
20	-	Analog OUT Right
7	+	Analog OUT Right
19	G	Digital OUT 2
6	-	Digital OUT 2
18	+	Digital OUT 2
5	G	Digital IN 2
17	-	Digital IN 2
4	+	Digital IN 2
16	G	Digital IN 1
3	-	Digital IN 1
15	+	Digital IN 1
2	G	Digital OUT 1
14	-	Digital OUT 1
1	+	Digital OUT 1
	+	Clock IN

# Optimod-PC 1101

From Orban,  
the most experienced provider  
of broadcast audio processing  
for AM, FM and television stations worldwide —

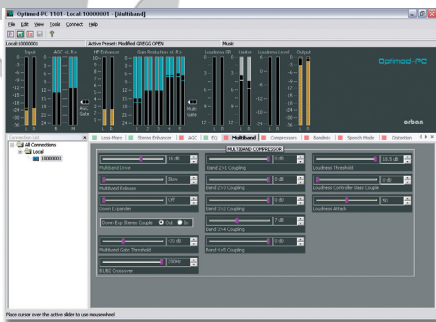
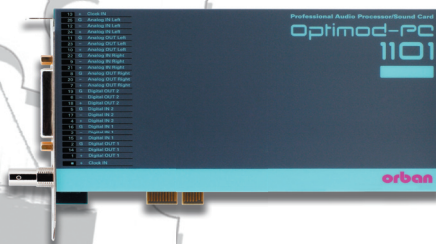
*fully professional processing*  
on a PCI or PCIe sound card  
for Windows computers



OPTIMOD-PC 1101 was designed for professionals. It has dedicated, broadcast-quality digital signal processing on-board for audio processing, mixing, and routing. OPTIMOD-PC processing is more reliable than software-based processors that run native on the computer's CPU because the operating system can never starve OPTIMOD-PC's processor or mixer for processing cycles. This allows more instances of an encoding application to run glitch-free on the computer's CPU, which provides higher reliability and lower operating costs because fewer CPUs are required for large operations.

OPTIMOD-PC is suitable for both live streaming and on-demand programming. Its three on-board Freescale DSP56367 DSP chips provide a loud, consistent sound to the consumer by performing stereo enhancement, automatic gain control (AGC), equalization, multiband gain control, peak-level control, and subjective loudness control. Moreover, the 1101 is equipped with professional AES/EBU digital inputs and outputs, plus balanced analog inputs and outputs that can operate at professional +4 dBu reference levels while resisting pickup of hum and noise.

## "Major-Market" processing for digital media and channels



OPTIMOD-PC is available in two versions — the 1101 for PCI bus systems and the 1101e for PCIe (PCI Express). OPTIMOD-PC's audio driver allows it to appear as two standard sound devices to the computer's operating system. With one OPTIMOD-PC, netcasters can replace selected content (such as commercials in a program originally created for radio broadcast) and inject watermark encoding for ratings. This approach maintains the same audio processing path on both program and inserted audio, delivering a polished, consistent sound while eliminating the number one listener complaint: Loud commercials.

While primarily oriented toward "flat" media, OPTIMOD-PC can also provide pre-emphasis limiting for the two standard pre-emphasis curves of 50  $\mu$ s and 75  $\mu$ s. This allows it to protect pre-emphasized analog satellite uplinks and similar channels where protection limiting or light processing is required and makes it ideal for use as a studio AGC driving transmitter-located OPTIMODs.

Without OPTIMOD-PC processing, audio can sound dull, boring, thin or inconsistent in any combination. OPTIMOD-PC's multiband processing automatically levels and re-equalizes its input to the "major-market" standards expected by the mass audience. It also helps overcome background noise in mobile listening environments and helps you stand out from poorly processed streams.





Broadcasters have known for decades that this polished, produced sound attracts and holds listeners. Orban has long been the number one vendor of stand-alone transmission processing to professional broadcasters worldwide. Commercial broadcasters think nothing of spending upwards of \$10,000 to sculpt their audio with an OPTIMOD! Audio processing can help create an audio environment or mood. A broadcaster's revenue depends on audience share and broadcasters know that compromising their processing is false economy.

Professional radio broadcasters would never consider going on the air without audio signal processing. They consider it a vital aspect of their program content. This carefully crafted content is what holds listeners and keeps them coming back. Since 1975, OPTIMOD algorithms have dominated the world market for professional radio and television audio processing and have been improved continuously since then. OPTIMOD-PC puts this technology inside your computer.

There are many gain/peak control devices and software available to perform dynamics processing. Many of these tools are designed for recording studio applications as effects compressors/limiters for individual microphone or instrument tracks. These devices' controls need to be tuned carefully for the specific material being processed — they are not "set and forget" processors. Moreover, most do not process mixed program material without introducing objectionable audible artifacts, particularly when called upon to gain-ride input material having widely varying levels.

sculpt or tailor  
audio

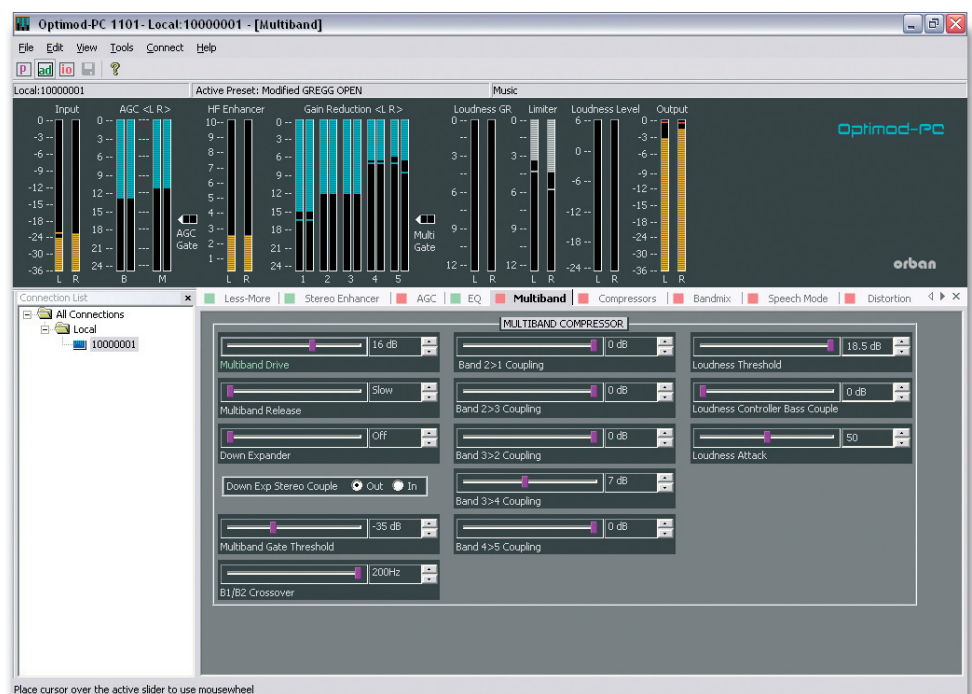
with  
the  
1101  
and  
1101e



A broadcast audio processor should ideally be “seen, but not heard.” OPTIMOD processing algorithms simultaneously control audio gain and peaks, artistically, musically and naturally, to give the illusion that processing is not taking place. Moreover, OPTIMOD algorithms intelligently adapt themselves to the input program material. Once OPTIMOD-PC is tuned for the sound texture required for the broadcast or netcast format (which is made easy by OPTIMOD-PC’s many format-specific presets), it will provide excellent consistency regardless of the level or texture of the original program material. OPTIMOD-PC’s automatic gain control and equalization achieve a consistent sound, while accurate peak control maximizes loudness. Booming bass is tightened; weak, thin bass is brought up; highs are always present and consistent in level.

Thanks to OPTIMOD-PC, a netcaster who wants to maximize audience share no longer has to make do with toy processing, ineffective CPU-hungry plug-ins and inappropriate recording studio plug-ins. OPTIMOD-PC offers full broadcast-quality OPTIMOD processing on a card — an economical, space-saving alternative to conventional stand-alone boxes. But thanks to its tight integration into the PC, OPTIMOD-PC offers more features than any stand-alone processor. Among others, these include two digital inputs with mixing of asynchronous sources, two digital outputs, and sound card emulation that allows OPTIMOD-PC to talk through the operating system to applications running on the host.

full broadcast quality  
maximizes audience share



To bring out the best in the low bit-rate codecs used in netcasting, you should preprocess an Internet audio signal to condition it prior to encoding. The appropriate preprocessing has much in common with the preprocessing required for DAB, HD Radio™, CD mastering or digital satellite. OPTICODEC-PC can provide this processing.

Conventional AM, FM or TV audio processors that employ pre-emphasis/de-emphasis and/or clipping peak limiters do not work well with perceptual audio coders such as Orban OPTICODEC-PC® MPEG-4 AAC/HE-AACv2 streaming encoder. The pre-emphasis/de-emphasis limiting in these processors unnecessarily limits high frequency headroom. Further, their clipping limiters create high frequency energy — distortion — that the perceptual audio coders have to encode, wasting bits. None of these devices has the full set of audio and control features found in OPTIMOD-PC.

Peak clipping sounds bad even in uncompressed digital channels because these channels do not rely on pre-emphasis/de-emphasis to reduce audible distortion. Instead of peak clipping, OPTIMOD-PC uses look-ahead limiting to protect the following channel from peak overload.

OPTIMOD-PC's PreCode™ technology manipulates several aspects of the audio to minimize artifacts caused by low bitrate codecs, ensuring consistent loudness and texture from one source to the next. PreCode includes special audio band detection algorithms that are energy and spectrum aware. This can improve codec performance on some codecs by reducing audio processing induced codec artifacts, even with program material that has been preprocessed by other processing than OPTIMOD. There are several factory presets tuned specifically for low performance, low bitrate codecs.

Unlike some other codec preprocessors, PreCode™ does not suck the punch and life out of music. Instead, PreCode™ strikes an artistic balance between liveliness and artifact reduction, ensuring that the cure is never worse than the disease.

PreCode™ brings out  
the best in low-bitrate codecs

OPTIMOD-PC is also an excellent mastering processor, offering soft knee multiband compression with knee and ratio controls available separately for

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each band. OPTIMOD-PC's low-IM look-ahead limiter can typically achieve 12 dB of gain reduction before it produces objectionable artifacts — this limiter is exceptionally loud and clean.

Digital mixing is crucially important to a netcaster who needs to control commercial content and insertion. Unlike most sound cards, OPTIMOD-PC allows you to mix an analog source, two digital sources and two Wave sources. For example, you could run a playout system on your computer while using the three hardware inputs for a live microphone feed, commercial insert, and network insert. Or you could run the commercial insert playout software on the same computer as the main playout system, using OPTIMOD-PC's second Wave input to separately route the outputs of the two playout systems to the card. In most cases, an external mixer isn't needed, making OPTIMOD-PC a more economical system solution than a low-priced sound card combined with external hardware. OPTIMOD-PC is also perfect for podcast production.

For applications like commercial insertion, an API provides complete remote administration over TCP/IP and/or Serial. The OPTIMOD-PC Service application hosts a TCP/IP terminal server and a serial interface to allow external control of the OPTIMOD-PC cards from either a software Telnet/SSH terminal client, a custom third party application, or a hardware device such as a Broadcast Tools SRC-16. All OPTIMOD-PC Mixer and System Controls are accessible and all commands are simple text strings. You can adjust and monitor levels, tweak the processor's sound, save and recall presets, and more. Password security is provided.

OPTIMOD-PC comes with over 20 great-sounding presets that make it easy to create a sonic texture that's just right for your target audience. If you want to customize a preset, you can start with an easy LESS-MORE control. If that's not enough, tweak over 50 parameters to hone your sound to perfection. OPTIMOD-PC's deep interface will never hold you back as your processing expertise increases, yet its carefully crafted design insulates you from the details if you need great sound right now.

You can expect a considerable increase in loudness from OPTIMOD-PC processing by comparison to unprocessed audio (except for audio from recently mastered

PC PC PC PC PC





CDs, which are often overprocessed in mastering). Broadcasters generally believe that loudness relative to other stations attracts an audience that perceives the station as being more powerful than its competition. We believe that the same subliminal psychology holds in netcasting.

Figure 1-1 shows a 15-minute snapshot of program audio as it emerged from the on-air mixer of a major Los Angeles radio station. Source material included music, speech, and commercials. Notice the large inconsistency in peak and average level between one program source and the next. Figure 1-2 shows the same material after being processed through OPTIMOD-PC, using the Gregg preset. Notice that program levels are now consistent from source to source.

Figure 1-1: Unprocessed Audio

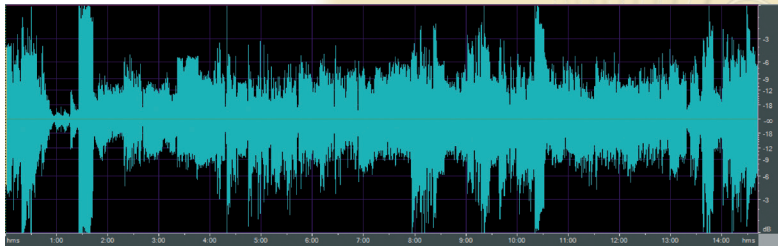
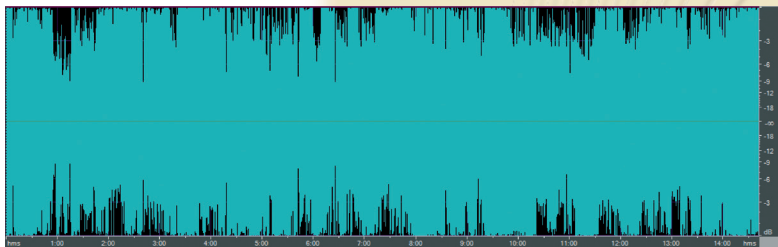


Figure 1-2: Same Audio Processed Through OPTIMOD-PC



It is important to understand that peak or average file normalization does not accomplish what OPTIMOD-PC processing can. Normalization applies a fixed loudness adjustment to the entire file — it's like setting a volume control once and only once. On the other hand, OPTIMOD-PC processing constantly adjusts spectral balance and loudness to achieve a consistency that brands your sound.

This particularly important during transitions from one program element to the next and is one of the key techniques that major-market radio stations use to achieve their polished, "produced" audio texture.

Make your audio all it can be and get this turbo-powered, economical processing solution today.

PC

PC

PC

PC

PC

# features & benefits

## GENERAL FEATURES

<b>OPTIMOD-quality digital audio processing</b>	On a PCI sound card that pre-processes audio for consistency and loudness before it is transmitted or recorded.
<b>Available in two versions</b>	<b>1101</b> for <b>PCI</b> sockets and <b>1101e</b> for <b>PCIe</b> (PCI Express) sockets.
<b>Applications</b>	include netcasting, HD Radio® (both primary and secondary digital channels), DAB and other dedicated digital radio services, FMExtra™ and other digital subcarriers, mastering, audio production and many others.
<b>Supplied WAVE drivers</b>	Allow OPTIMOD-PC's processed output to pass through the PCI bus to the CPU, driving standard PC applications like Orban's OPTIMOD-PC MPEG-4 HE-AAC, as well as well as Microsoft or Real streaming encoders. OPTIMOD-PC's audio driver allows it to appear as <b>two sound devices</b> to the computer's operating system. The driver (with the aid of concurrently running third-party software) also allows OPTIMOD-PC to receive <b>audio over IP</b> from the host computer's network connection. Drivers are available for <b>32 and 64-bit Windows XP, 32 and 64-bit Windows Vista, and 32 and 64-bit Windows 7.</b>
<b>Orban PreCode™ technology</b>	Manipulates several aspects of the audio to minimize artifacts caused by low bitrate codecs, ensuring consistent loudness and texture from one source to the next. PreCode includes special audio band detection algorithms that are energy and spectrum aware. This can improve codec performance on some codecs by reducing audio processing induced codec artifacts, even with program material that has been preprocessed by other processing than OPTIMOD.
<b>Two-Band automatic gain control</b>	With window gating and selectable L/R or sum/difference processing; compensates for widely varying input levels.
<b>Bass equalizer and parametric equalizer</b>	Shelving <b>bass equalizer</b> and three-band <b>parametric equalizer</b> let you color the audio to your exact requirements.
<b>Low-IM look-ahead limiter</b>	Effectively limits peaks while ensuring that low-bit-rate codecs operate optimally without overload.
<b>Precisely controls peak levels</b>	To prevent overmodulation or codec overload. The peak limiter can be set up to control "flat" transmission channels or channels pre-emphasized at 50 µs or 75 µs.
<b>Pre-emphasis limiting</b>	While <b>primarily oriented toward "flat" media</b> , OPTIMOD-PC can also provide <b>pre-emphasis limiting</b> for the two standard pre-emphasis curves of 50 µs and 75 µs. This allows it to protect pre-emphasized <b>satellite uplinks and similar channels</b> where protection limiting or light processing is required. Because analog television FM aural carriers are lightly processed, OPTIMOD-PC can also be used to process these.  <i>Because its processing topology is most effective with "flat media", OPTIMOD-PC cannot provide extreme loudness for pre-emphasized radio channels. Use one of Orban's OPTIMOD-FM processors for this application.</i>
<b>Dual-mono architecture</b>	OPTIMOD-PC's <b>dual-mono architecture</b> allows entirely separate mono programs to be processed in 5-band mode, facilitating dual-language operation. In mono mode, each channel has its own CBS Loudness Controller and Loudness Meter.  <i>In this mode, both processing channels operate using the same processing parameters (like release time); you cannot adjust the two channels to provide different processing textures.</i>
<b>Balanced analog input</b>	With 24-bit A/D converter is always active, mixing with the two digital inputs.
<b>Balanced analog monitor output</b>	With 24-bit D/A converter.
<b>Two AES3 or S/PDIF digital inputs</b>	With high-quality sample rate conversion to allow two asynchronous digital sources to be mixed: Ideal for network operations using local commercial/announcement insertion.
The <b>second digital input</b>	also accepts AES3 house sync, synchronizing the AES3 output sample rate to the sample rate of the sync input.
<b>Accepts sample rate</b> from 32 to 96 kHz	Digital inputs <b>accept any sample rate</b> from 32 to 96 kHz without manual configuration.

# features & benefits

## GENERAL FEATURES *(continued)*

<b>Two AES3 digital outputs</b>	At 32, 44.1, 48, 88.2 or 96 kHz sample rate.
<b>Two Wave inputs</b>	from any PC audio application (like a playout system) that can emit standard Wave audio. Audio from the Wave inputs can be mixed and switched with OPTIMOD-PC's hardware inputs. Because there are two inputs, you can operate two PC applications simultaneously and mix and/or switch their Wave outputs inside OPTIMOD-PC, such as content/commercial insertion systems.
<b>Internal processing</b>	Occurs at <b>48 kHz</b> sample rate and <b>20 kHz</b> audio bandwidth.
<b>Full PCI bus-mastering</b>	Minimizes load on the host computer's memory and CPU.
<b>I/O Mixer application</b>	Permits versatile routing and switching of processed and unprocessed audio from and to OPTIMOD-PC's inputs and outputs, and to and from the host computer's WAVE audio.
<b>Terminal Control API</b>	For network or localhost control and automation of all I/O Mixer functions and Preset switching. Status is broadcast to all active clients.
<b>Serial Control API</b>	Allows OPTIMOD-PC to be controlled either by ASCII serial commands or by a serial-to-contact-closure device such as a Broadcast Tools SRC-16.
<b>MS Windows Mixer API</b>	Support in parallel to the existing Orban Mixer allows standard Microsoft Windows audio applications to control OPTIMOD PC's inputs and outputs.
<b>MS Windows Metering API</b>	Windows applications using this API will display audio levels. (Many broadcast playout systems use this.)
<b>Freescale DSPs</b>	DSP chips do all the audio processing — there is no extra DSP load on your computer's CPU, freeing more CPU cycles for encoding bit-reduced audio.
<b>Full coprocessing</b>	Coprocessing independent of the host computer's CPU means that audio will ordinarily continue to pass through the card from its hardware inputs to its hardware outputs during a host computer soft reboot or crash. (Of course, Wave inputs and outputs will stop working because these are dependent on operating system services.)
<b>Twenty standard presets</b>	OPTIMOD-PC ships with over <b>twenty standard presets</b> , which correspond to different programming formats. These presets have already been tested and field-proven in major-market radio netcasting, digital radio, and direct satellite broadcasting applications (both radio and television) worldwide. There are also special-purpose presets for mastering, studio AGC, pure peak limiting and low bitrate encoding applications.
<b>An easy-to-use graphic control application</b>	Runs on your PC and can act as a client to control any number of OPTIMOD-PC cards, either locally or in other PCs on your network via TCP/IP. The Orban software offers a server function, allowing other computers on your network to address cards located in your PC. (This server software is installed automatically as part of the OPTIMOD-PC installation process and runs as a Windows Service.)
<b>Custom presets</b>	The Control application allows you complete flexibility to create <b>your own custom presets</b> , to save as many as you want to your local hard drive and to recall them at will.
<b>Orban ClockLock™ technology</b>	ClockLock™ locks the 1101's output sample rate to an external 10 MHz, word clock, or AES3/AES11 reference. Both AES3 outputs and WAV output can be locked, which prevents buffer underflows and overflows in downstream software and hardware. ClockLock uses a phase-locked loop with crystal VFO to ensure low jitter and will lock to 32, 44.1, 48, 88.2 and 96 kHz samplerates.
<b>ADAPTABILITY THROUGH MULTIPLE AUDIO PROCESSING STRUCTURES</b>	
<b>Multiple processing structures</b>	A processing structure is a program that operates as a complete audio processing system. Only one processing structure can be active at a time. Just as there are many possible ways of configuring a processing system using analog components (such as equalizers, compressors, limiters and clippers), there are several possible processing structures achievable by OPTIMOD-PC. OPTIMOD-PC realizes its processing structures as a series of high-speed mathematical computations made by Digital Signal Processing (DSP) chips.
<b>Five-Band and Two-Band processing structures</b>	OPTIMOD-PC features two processing structures: <b>Five-Band</b> (or Multiband) for a consistent, "processed" sound, free from undesirable side effects and <b>Two-Band</b> for a tastefully controlled sound that preserves the frequency balance of the original program material.



# features & benefits

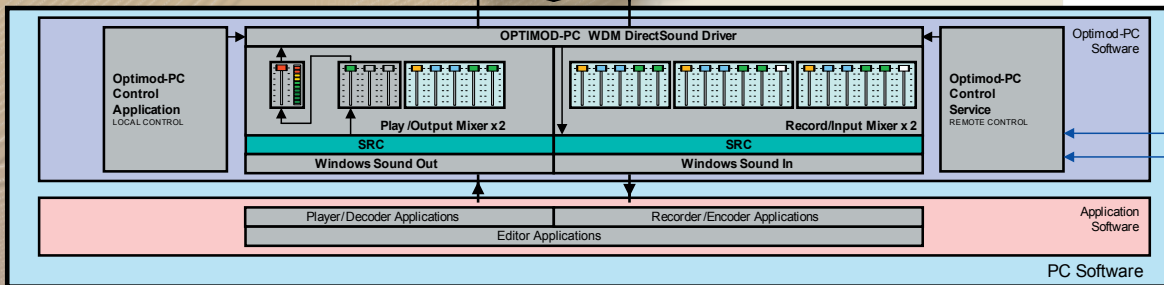
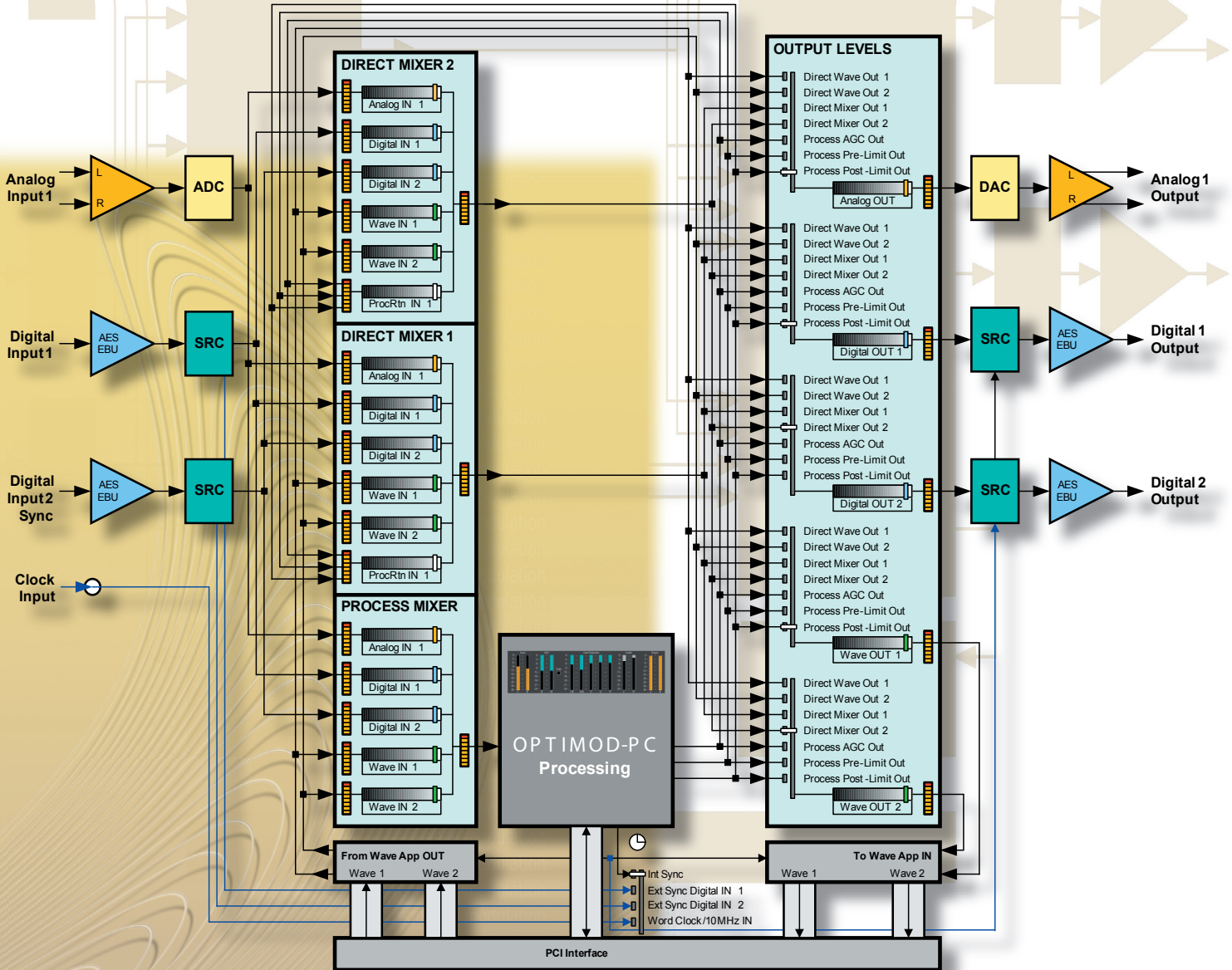
## ADAPTABILITY THROUGH MULTIPLE AUDIO PROCESSING STRUCTURES *(continued)*

<b>Protection Limiter</b>	The Two-Band structure can also be tuned to operate as a <b>Protection Limiter</b> , providing up to 25 dB of safety limiting with minimal side effects.
Increased <b>density</b> and <b>loudness</b>	OPTIMOD-PC <b>can increase the density and loudness</b> of the program material by multiband compression and look-ahead limiting, remarkably improving sonic consistency while increasing loudness and definition, all without producing unpleasant side effects.
Smooth automatic <b>gain riding</b>	OPTIMOD-PC <b>rides gain</b> over an adjustable range of up to 25 dB, compressing dynamic range and compensating for operator gain-riding errors and for gain inconsistencies in automated systems.
<b>Phase-linear</b> processing structures	OPTIMOD-PC's processing structures are all <b>phase-linear</b> to maximize audible transparency.
Change by <b>smooth cross-fade</b>	OPTIMOD-PC can be changed from one processing structure to another with a <b>smooth cross-fade</b> .
Two styles of <b>stereo enhancement algorithms</b>	The 1101 provides two different <b>stereo enhancement algorithms</b> . The first is based on Orban's patented analog 222 Stereo Enhancer, which increases the energy in the stereo difference signal (L-R) whenever a transient is detected in the stereo sum signal (L+R). The second stereo enhancement algorithm passes the L-R signal through a delay line and adds this decorrelated signal to the unenhanced L-R signal. Gating circuitry prevents over-enhancement and undesired enhancement on slightly unbalanced mono material.
Two-Band <b>automatic gain control</b>	Two-Band <b>automatic gain control</b> with window gating and selectable L/R or sum/difference processing compensates for widely varying input levels.
<b>Two-band</b> and <b>five-band compressors</b>	With <b>parametric soft-knee compression curves</b> allow you to <b>fine-tune the audio to your exact requirements</b> and make OPTIMOD-PC an excellent <b>mastering processor</b> .
<b>Low-delay monitoring path for talent headphones</b>	The output of the two-band or five-band compressor can be routed directly to the card's outputs, bypassing the delay in the look-ahead limiter and facilitating creation of a <b>low-delay monitoring path for talent headphones</b> .
<b>Low-IM look-ahead limiter</b>	Effectively limits peaks while ensuring that low-bit-rate codecs operate optimally without overload.
<b>CBS Loudness Controller™</b>	<b>Limits subjective loudness to a preset threshold</b> , making the 1101 an <b>ideal processor in sound-for-picture applications</b> by <b>taming loud commercials</b> before they annoy and alienate the audience. The Loudness Controller uses the 1981 Jones & Torick algorithm developed at CBS Technology Center and further refined by Orban.
<b>Two independent loudness controllers</b> and <b>two loudness meters</b>	<b>CBS Loudness Meter™</b> measures the <b>subjective loudness of the 1101's output</b> and is displayed in the 1101's control application meter window. In dual-mono mode, there are <b>two independent loudness controllers</b> and <b>two loudness meters</b> available.
<b>Transparently supports Dolby Digital® dialnorm metadata</b>	If you tell the 1101 the <b>dialnorm value</b> you are sending to Dolby Digital receivers and use a "TV" processing preset, your transmission will <b>automatically have the same loudness</b> as other properly aligned Dolby Digital sources. This makes the 1101 an excellent choice to process ATSC subchannels.
<b>Very high quality peak limiting</b>	A pure peak limiting preset is available. It allows the 1101 to perform <b>very high quality peak limiting in mastering applications</b> .
<b>AGC functionality</b>	OPTIMOD-PC can be used as for automatic gain control, <b>AGC</b> (including peak limiting) to protect a studio-to-transmitter link (STL), optimally using the STL's native dynamic range.

*versatility*

for sound-for-picture or audio-only applications

# Operational Block Diagram



It is impossible to characterize the listening quality of even the simplest limiter or compressor based on specifications because such specifications cannot adequately describe the crucial dynamic processes that occur under program conditions. Therefore, the only way to evaluate the sound of an audio processor meaningfully is by subjective listening tests.

Certain specifications are presented here to assure the engineer that they are reasonable, to help plan the installation, and to facilitate making certain comparisons with other processing equipment.



SPECIFICATIONS	<b>System</b>	
	<b>Number of Audio Processors</b>	One stereo or two independent mono audio processors, each consisting of the following cascaded processing elements: Internal Processing: Input → Stereo Enhancer → Two-Band defeatable AGC with window gating → Five-Band Equalizer/HF Enhancer → Multiband Compressor → Look-ahead Limiter → Automatic Loudness Controller → Output.
	<b>Number of Channels</b>	The 1101 audio driver allows it to appear as two standard sound devices to the computer operating system. Each of the two sound devices can handle one stereo channel or two mono channels. The channels can be mixed and routed via a three-bus mixer ("Processed", "Direct 1" and "Direct 2"); however the 1101 can only apply stereo or dual-mono audio processing to the output of the "Processed" bus. The remaining two "Direct" busses are applied to the Output Routing Switcher but cannot be further processed. See block diagram.
	<b>Frequency Response</b> (Bypass software running)	±0.1 dB, 2 – 20,000 Hz.
	<b>Input/Output Delay</b>	Adjustable from 25 ms to 62 ms in 1 ms steps. Presets available for one frame of: 30 fps (33.33 ms), 29.97 fps (NTSC color video; 33.37 ms), 25 fps (most PAL video; 40 ms) and 24 fps (film; 41.67 ms). "Minimum" delay is also available; this delay will vary according to the processing structure in use and crossover mode settings.
	<b>Internal Filters</b>	10, 11, 12, 13, 14, 15 and 20 kHz can be used to provide additional anti-aliasing for low sample rate services, such as Internet Streaming Encoders, Eureka-147 (24 kHz mode), iBiquity® HD AM™ (IBOC) (32 kHz) and Digital Radio Mondiale.
	<b>Internal Sample Rate</b>	48 kHz.
	<b>Wave Sample Rate</b>	8 – 96 kHz.
	<b>Internal Resolution</b>	24-bit fixed point (3 x 150 MHz Freescale DSP56367).
	<b>Input/Output Resolution</b>	24-bit.
SPECIFICATIONS	<b>Peak Control Accuracy</b>	If output samples are synchronous with internal samples, maximum overshoot of any output sample is 0.1 dB. This is true at 48 kHz output sample rate. If sample rate conversion after internal processing makes output samples asynchronous with internal samples, output samples can overshoot as much as 1dB (0.3 dB typical).
	<b>Phase Response</b>	All dynamics processing is linear-phase (constant group delay). Equalizers are minimum-phase.
	<b>AGC (Automatic Gain Control)</b>	±12 dB / 24 dB gain range, Two-Band, Gate and Window enabled.
	<b>Stereo Enhancer</b>	Two styles available: (1) Orban-patented L-R dynamic expansion triggered by L+R transients; (2) L-R delay.
	<b>Multiband Compressors</b>	-24 dB gain range, Five-Band and Two-Band, selectable by mute-free crossfade.
	<b>Equalizers</b>	Shelving Low Bass EQ, selectable 6 dB, 12 dB or 18 dB/octave. Three-band Parametric EQ with analog-style bell-shaped curves. Program Adaptive HF Enhancer.
	<b>Limiter</b>	-12 dB gain reduction range; Look-ahead; IM distortion reduced; competitive with the best dedicated mastering limiters; achieves high loudness with a remarkable lack of side-effects
	<b>Loudness Controller</b>	Constrains subjective loudness to a user-adjustable threshold via the 1981 Jones & Torick CBS Technology Center algorithm as further refined and developed by Orban. The algorithm also drives a subjective loudness meter, which is displayed on the 1101's GUI. In dual-mono mode, there are two independent loudness controllers and meters.
	<b>Number of Factory Presets</b>	More than 20, each with 19-step LESS-MORE control. Presets are fully customizable with FULL CONTROL. In addition to presets for full processing, there are also "AGC", "Look-ahead Limiter" and "mastering" presets. There are also presets for analog television that uses an FM aural carrier.
	<b>Number of User Presets</b>	Essentially unlimited. User presets can be saved on the host hard drive or on other storage devices.
SPECIFICATIONS	<b>Wave Audio Input</b>	
	<b>Number of Inputs</b>	Two.
	<b>Configuration</b>	Stereo.
	<b>Sound Devices</b>	Two.
	<b>Driver</b>	Multi-client Driver allows 1101 to appear as two standard sound devices to the computer operating system. The input can therefore be received from multiple software applications running on the host computer system by use of standard operating system sound device driver calls. For example, this could include single or multiple player applications, such as an audio playout system with multiple players, content insertion system, or audio over IP routed into the host computer through an Ethernet port, and/or multiple streaming audio encoders. Because the driver is multi-client, it allows it to source multiple applications simultaneously. A versatile mixer and router application allows you to mix digital, analog, and wave inputs to three busses (one with OPTIMOD-PC processing and two without) and to route the outputs of the "Processed" and "Direct" busses to the Analog, Digital, and Wave Outputs in any configuration or combination, such that any output can receive any bus or the unprocessed Wave Input. Content insertion systems that would normally require two sound devices can be configured to work with one 1101 OPTIMOD-PC, requiring only one PCI or PCIe slot per program source.
	<b>Sample Rate</b>	8 – 96 kHz. Asynchronously Sample Rate Converted by Driver.
	<b>Sync</b>	Internal free running or External. Either AES/EBU, Word Clock, or 10 MHz input can be used as source for external sync. Wave data will be clocked to software-configurable Internal or External sources.
	<b>Input Level</b>	Variable within the range of -20 to 0 dBFS (Peak) in 0.5 dB steps. Software-adjustable via OPTIMOD-PC Mixer Application and Windows Mixer API.



**Wave Audio Output**

<b>Number of Outputs</b>	Two.
<b>Configuration</b>	Stereo.
<b>Sound Devices</b>	Two.
<b>Driver</b>	Multi-client Driver allows 1101 to appear as two standard sound devices to the computer operating system. The output can therefore be routed to multiple software applications simultaneously, such as audio encoders, recorders, and content insertion systems running on the host system, and/or the card physical outputs via the Mixer Application. Software applications running on the host system do not require the use of physical cables to connect Wave Inputs and Outputs to applications, eliminating any unnecessary digital sample rate conversion. Content insertion systems that would normally require two sound devices can be configured to work with one 1101 OPTIMOD-PC, requiring only one PCI or PCIe slot per program source.
<b>Sample Rate</b>	Internal free running at 32 kHz, 44.1 kHz, 48 kHz, selected in software. External Sync to either AES/EBU or Word Clock Input at 32 kHz, 44.1 kHz, 48 kHz, 88.1 kHz, 96 kHz or 10 MHz, all $\pm 0.05\%$ .
<b>Sync</b>	Internal free running or external. Either AES/EBU, Word Clock or 10 MHz input can be used as source for external sync. AES/EBU and Word Clock input must be 32, 44.1, 48, 88.1 or 96 kHz, $\pm 0.05\%$ . Wave data will be clocked to software-configurable Internal or External sources.
<b>Jitter</b>	Less than 10 ns rms.
<b>Output Level Control</b>	Peak level is adjustable from -20 to 0 dBFS in 0.1 dB steps. Software-adjustable via OPTIMOD-PC Mixer Application and Windows Mixer API.

**Analog Audio Input**

<b>Number of Inputs</b>	One pair.
<b>Configuration</b>	Stereo.
<b>Impedance</b>	>10 k $\Omega$ impedance, electronically balanced, floating and symmetrical.
<b>Nominal Input Level</b>	-10 dBu / +4 dBu VU, -2 dBu / +21 dBu PPM. Software-adjustable via OPTIMOD-PC Mixer Application and Windows Mixer API.
<b>Maximum Input Level</b>	+20 dBu, peak.
<b>Reference Level</b>	-20 dBFS. -10 dBu / +4 dBu VU Input Level produces -20 dBFS when Input Level fader is 0 dB.
<b>A/D Conversion</b>	24-bit 128X oversampled delta sigma A/D converter with linear phase anti-aliasing filter.
<b>Audio Connector</b>	DB-25, EMI suppressed.

**Analog Audio Output**

*Note that this output is primarily for monitoring. Nevertheless, it has been designed for low noise, distortion, and overshoot and can drive an STL or transmitter in an analog facility. Peak control will not be as good as at the digital output because transmitted samples will be asynchronous with peak-controlled internal samples. Like the other OPTIMOD-PC outputs, the source of this output can be switched between the computer's WAVE output, the output of OPTIMOD-PC's Direct Mixer, OPTIMOD-PC's peak limiter output and OPTIMOD-PC's multiband compressor output. Because most of the delay occurs in the peak limiter, using the multiband compressor output can make headphone monitoring much more comfortable for live talent when live microphone inputs are used.*

<b>Number of Outputs</b>	One pair.
<b>Configuration</b>	Stereo.
<b>Source Impedance</b>	50 $\Omega$ , electronically balanced and floating.
<b>Load Impedance</b>	600 $\Omega$ or greater, balanced or unbalanced. Termination not required or recommended.
<b>Output Level</b>	+4 dBu nominal; Clip level +18 dBu unbalanced, +24 dBu balanced. Software-adjustable via OPTIMOD-PC Mixer Application and Windows Mixer API.
<b>Signal-to-Noise</b>	96 dB unweighted signal-to-noise re +24 dBu, 20 Hz – 20 kHz (bypass mode).
<b>Distortion</b>	<0.01% THD (bypass mode), 20 Hz – 20 kHz. (Note: To prevent out-of-band noise caused by noise shaping from causing falsely high noise readings, noise and distortion specifications must be verified by a bandpass filter having a very sharp cutoff at 20 kHz.)
<b>D/A Conversion</b>	24-bit 128X oversampled D/A with linear phase anti-imaging filter.
<b>DC Offset</b>	Less than 10 mV differential offset.
<b>Highpass Filter</b>	-3 dB 2.0 Hz.
<b>Audio Connector</b>	DB-25, EMI suppressed.

**Digital Audio Input**

<b>Number of Inputs</b>	Two, each with Sample-Rate Converter. The two inputs can accept asynchronous inputs and these can be mixed. One of the inputs can also be configured as sync reference to lock output sample rate to the sample rate at this input.
<b>Configuration</b>	Stereo AES/EBU (AES3-1992/AES18) or S/PDIF, 24-bits resolution; software selection of stereo, mono from left, mono from right, or mono from sum (as source to use as a mono processor).
<b>User Bits</b>	AES18 compliant. Incoming User Bits will pass through to Digital Output. User Bits can also be inserted or extracted via Serial or Ethernet using OPTIMOD-PC Control Application.
<b>Impedance</b>	Transformer balanced and floating, 110 $\Omega$ impedance, AES/EBU.
<b>Sample Rate</b>	20 – 96 kHz.
<b>Input Level</b>	Variable within the range of -20 to 0 dBFS (Peak) in 0.5 dB steps. Software-adjustable via OPTIMOD-PC Mixer Application and Windows Mixer API.
<b>Internal Input</b>	See 'Wave Audio Input' above.
<b>Audio Connector</b>	DB-25, EMI suppressed.
<b>Word Clock</b>	DB-25, EMI Suppressed and/or BNC; input accepts 1x word clock at 32, 44.1, 48, 88.2 and 96 kHz or 10 MHz sine or squarewave.

**Digital Audio Output**

<b>Number of Outputs</b>	Two.
<b>Configuration</b>	Two-channel per AES/EBU-standard (AES3-1992) or S/PDIF (consumer) standard, software selectable.
<b>Output Level Control</b>	Peak level is adjustable from -20 to 0 dBFS in 0.1 dB steps. Software-adjustable via OPTIMOD-PC Mixer Application and Windows Mixer API.

<b>Digital Audio Output</b> (continued)	
<b>Sample Rate</b>	Internal free running at 32, 44.1, 48, 88.1 or 96 kHz, selected in software. Can also be synced to either AES/EBU input at 32, 44.1, 48, 88.1 or 96 kHz, all $\pm 0.05\%$ .
<b>Word Length</b>	Selectable 24, 20, 18 or 16-bit. Optional dither can be added, with level adjusted appropriate to word length. This is first-order noise-shaped dither. (i.e., white TPDF dither of peak amplitude equal to the quantizer step size with noise shaping spectral density of 6 dB/octave.) It sounds substantially quieter than white triangular PDF dither but, in contrast to more extreme noise-shaped dither, it adds only 3 dB unweighted noise by comparison to white PDF dither.
<b>Sync</b>	Internal free running or external. Either AES/EBU, Word Clock or 10 MHz input can be used as source for external sync. AES/EBU and Word Clock input must be 32, 44.1, 48, 88.1 or 96 kHz, $\pm 0.05\%$
<b>Frequency Response</b>	DC - 20,000 Hz $\pm 0.1$ dB (Digital I/O).
<b>Signal-to-Noise</b>	100 dB (referenced to -20 dBFS Lineup Level) (Digital I/O).
<b>Dynamic Range</b>	120 dB (bypass mode) (Digital I/O).
<b>THD+N</b>	0.0006 %, 1 kHz, -1 dBFS (bypass mode) (Digital I/O).
<b>Crosstalk</b>	Infinite (Digital I/O).
<b>Internal Output</b>	See 'Wave Audio Output'.
<b>Audio Connector</b>	DB-25, EMI suppressed.
<b>Audio Cable Assembly</b>	
<b>Optional</b>	DB-25 plug-in 6' / 1.8 m I/O cable assembly, terminated in XLR connectors. Audio Inputs are XLR Female, Audio Outputs are XLR Male, Clock Input is BNC Female. Some applications will not require the use of external audio I/O, and therefore do not require a cable. Cable wiring is Tascam compatible.
<b>Power</b>	
<b>PCI Connector</b>	+3.3 V at 1.1 A, +12 V at 260 mA maximum.
<b>PCIe Connector</b>	+3.3 V at 1.3 A, +12 V at 260 mA maximum.
<b>Computer</b>	
<b>Minimum System Requirements</b>	Minimum System Requirements: Recommend Intel CPU and Chipsets. Microsoft Windows 2000 - Intel Pentium IV 800 MHz RAM 64 MB, 128 MB recommended. Microsoft Windows XP - Intel Pentium IV 1.0 GHz, RAM 128 MB, 256 MB recommended. Microsoft Windows Vista - Intel Pentium IV 1.0 GHz, RAM 512 MB, 1024 MB recommended. This provides the minimum recommended CPU power to control an arbitrary number of OPTIMOD-PC cards with external audio sources. Audio player and/or encoding software will require additional CPU power.
<b>Bus</b>	PCI Version 2.2 compliant; 32-bit; 33 MHz; transfer rate up to 132 MB/s. Will operate in 3.3 V or 5 V PCI slot and bus extenders. PCI-X 2.0 compliant. Plug and Play supported. PCIe: PCIe 1x Version 1.1 compliant. 250/500 MB/s. Plug and Play supported.
<b>Audio Drivers</b>	Microsoft Windows 2000/XP: WDM Audio DirectSound; multi-client; bus-mastering. 32/64-bit. Microsoft Windows Vista: WDM Audio; DirectSound; multi-client; bus-mastering 32/64-bit. Microsoft Windows 7: WDM Audio; DirectSound; multi-client; bus-mastering 32/64-bit.
<b>Software</b>	Mixer application provides complete control of digital mixer and all hardware settings.  The control application provides subjective adjustment controls of the audio processing and remote administration. It also allows factory and user presets to be recalled from and save to a host storage device such as a hard disk drive or removable drive. The control application client addresses multiple OPTIMOD-PC cards, either housed in the local host or anywhere on a TCP/IP network or by local serial communication. The control application also functions as a server, interfacing cards installed in a given host computer with the network for control and monitoring.
<b>API</b>	Microsoft Windows Mixer Control API is supported for Input and Output switching and levels. This provides compatibility with Windows applications that use standard Microsoft Windows Mixer calls and enumeration.  The IP API provides complete remote administration over TCP/IP. The OPTIMOD-PC Service application hosts a TCP/IP Terminal Server to allow external control of the OPTIMOD-PC cards from either a Telnet/SSH client or a custom third party application. All OPTIMOD-PC Presets and Mixer Controls are accessible and all commands are simple text strings. Telnet/SSH: RFC 318 compliant basic subset. Compatible with Windows Telnet and PuTTY Telnet clients. TCP/IP Port user assignable.  The Serial API provides complete remote administration over serial port communication. The OPTIMOD-PC Service application hosts a serial terminal server to allow external control of OPTIMOD-PC cards from either a terminal client or a custom third party application. All OPTIMOD-PC Presets and Mixer Controls are accessible and all commands are simple text strings. Compatible with terminal programs such as Windows HyperTerminal and PuTTY VT-100 clients. COM Port user assignable from COM1 to COM100.
<b>Status Monitoring</b>	SNMP RFC 1157 compliant. Monitors all Audio Input and Output presence, Mixer Control status, Active Preset, Control Application Connections and Control Client Connections.
<b>Regulatory</b>	
<b>Certifications</b>	CE and FCC Class B, RoHS compliant.
<b>Environmental</b>	
<b>Operating Temperature</b>	32 to 122 °F / 0 to 50 °C for all operating voltage ranges.
<b>Humidity</b>	0 - 95% RH, non-condensing.
<b>Size</b>	PCI Standard Full Height / Short Length (L x H x W): 6.6" x 4.2" x 0.75" - 168 mm x 107 mm x 19 mm.
<b>Shipping Weight</b>	4 lbs. / 1.8 kg with cable assembly. 2.0 lbs. / 1.0 kg 1101 OPTIMOD-PC Card. 2.0 lbs. / 1.0 kg 1101 Cable Assembly.



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