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audio processing



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FM modulation

# OPTIMOD-FM 5500

If you're trying to make it  
all add up, we suggest —

*the new*  
Optimod math.

5-Band + 2-Band + 5-Band Ultra-Low Latency Processing + Stand-Alone Stereo



OPTIMOD-FM 5500 puts coveted five-band and two-band OPTIMOD processing into a single rack unit package and brings it to you at the most affordable price ever. The 5500 replaces OPTIMOD-FM 5300 and 2300, offering the functionality of both processors in a new, cool-running package.

Quality sound is what 5500 is all about — sound that attracts audiences by providing a polished, professional presentation regardless of format and source material. Exceptional versatility allows you to adjust the processor's audio texture to brand your audio, knowing that the resulting signature sound will remain consistent, cut-to-cut and source-to-source. Branding builds businesses and no other processors have the consistency to brand your sound like OPTIMODs.

## OPTIMOD-FM 5500: Competitive OPTIMOD sound in a compact package at the most affordable price ever.



The 5500 can also be used as a superb stand-alone stereo encoder with latency as low as 2 ms and full overshoot limiting in both the left/right and composite baseband domains. When used in this mode, the 5500 must be driven (usually via an STL) by a full-featured FM audio processor (like Orban's 8600) that incorporates preemphasis-aware HF limiting and peak control. In both modes, the 5500's stereo encoder helps deliver a transmitted signal that's always immaculately clean and perfectly peak limited, with full spectral protection of subcarriers and RDS/RBDS regardless of the amount of composite limiting.

The 5500 is the ideal choice for network broadcasters who process with Orban's flagship OPTIMOD-FM 8600 at the network origination point and who need a processor at every transmitter to eliminate STL overshoots (using the 5500's stand-alone stereo encoder mode) and/or to process local insertions while also eliminating network STL overshoots (using the 5500's audio processor / stereo encoder mode). Moreover, the 5500's two modes make it easy for large government and network broadcasters to manage its inventory of spares because any 5500 can be used as a stereo encoder with or without audio processing.

Available in both modes, the built-in, defeatable ITU BS412 multiplex power controller allows the 5500's output to meet even the most stringent European government regulations.




 details

Next and Previous buttons scroll display horizontally to access hidden menu items.

Bright, legible LCD display allows you to recall, edit, and save presets, and to set up system technical parameters like input and output levels.

MPX Power Gain Reduction meter monitors operation of ITU-R BS.412 MPX Power Controller.

Input level meters. Full featured, full-time LED metering makes it easy to set up the 5500.

Composite left and right output meter.



LCD contrast adjustment optimizes the display to your preferred viewing angle.

Four context-sensitive soft keys repurpose themselves for the task at hand.

Dedicated keys for Escape, Recall Preset, Edit Preset, and System Setup.

Gain reduction meters for AGC and multiband compression.

Knob lets you easily customize presets and tweak system setup parameters.

New in 5500 is a 10 MHz frequency reference input allows the stereo pilot tone frequency to be locked to GPS or another high-accuracy frequency standard. This improves the performance of single-frequency networks in areas where coverage of the transmitters overlaps. Also new is a cool-running, energy-efficient switching power supply and use of the latest dual-core DSP chip technology from Freescale Semiconductor.

With the 5500, your signature sound is just a preset away. An easy, one-knob Less/More adjustment allows you to customize any factory preset, trading cleanliness against processing artifacts according to the requirements of your market and competitive environment. Full Control gives you the versatility to customize your audio further. And, if you're a hard-core processing expert, you can explore Advanced Control to tweak presets at the same level as Orban's factory programmers.

This versatility makes the 5500 a superb choice for any format. Its five-band processing is ideal for any pop music format (even the most competitive and aggressive CHR), while phase-linear two-band processing yields ultra-transparent sound for classical, classic jazz, and fine arts formats. Regardless of your choice, 5500's optimized technology ensures unusually high average modulation and coverage for a given level of subjective quality.

versatility  
doesn't  
stop

with  
sound



Unlike many lesser processors, the 5500 handles speech particularly well — it's always clean, even when you process for loudness.

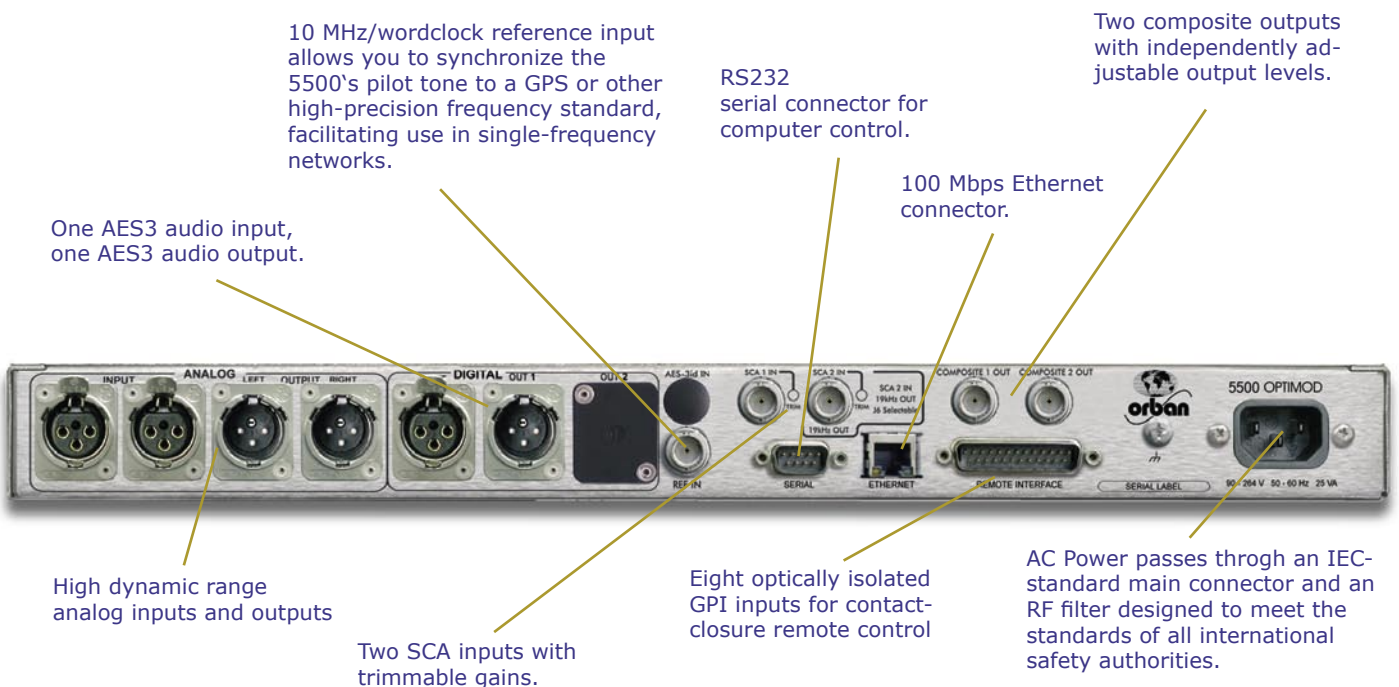
Versatility doesn't stop with sound. The 5500's built-in stereo encoder, AES/EBU digital inputs and outputs, and analog I/O permit hassle-free interfacing to any broadcast plant, whether the 5500 is located at the studio or the transmitter. Tight band limiting to 15 kHz means you can use any uncompressed digital STL to pass 5500-processed audio from studio to transmitter without compromising on-air loudness — there's no need to use STLs having 44.1 or 48 kHz samplers.

always clean...  
even when you process  
for loudness

If you want to locate the 5500 away from the studio, you'll be pleased by its three separate remote control ports — GPI contact closures, RS232 serial, and built-in Ethernet for TCP/IP networks. The serial and Ethernet ports are supported by the supplied 5500 PC Remote Control application. This Windows® 2000/XP/Vista/7 application allows you to do even more with the 5500 than you can do through its front panel, making remote control a pleasure.

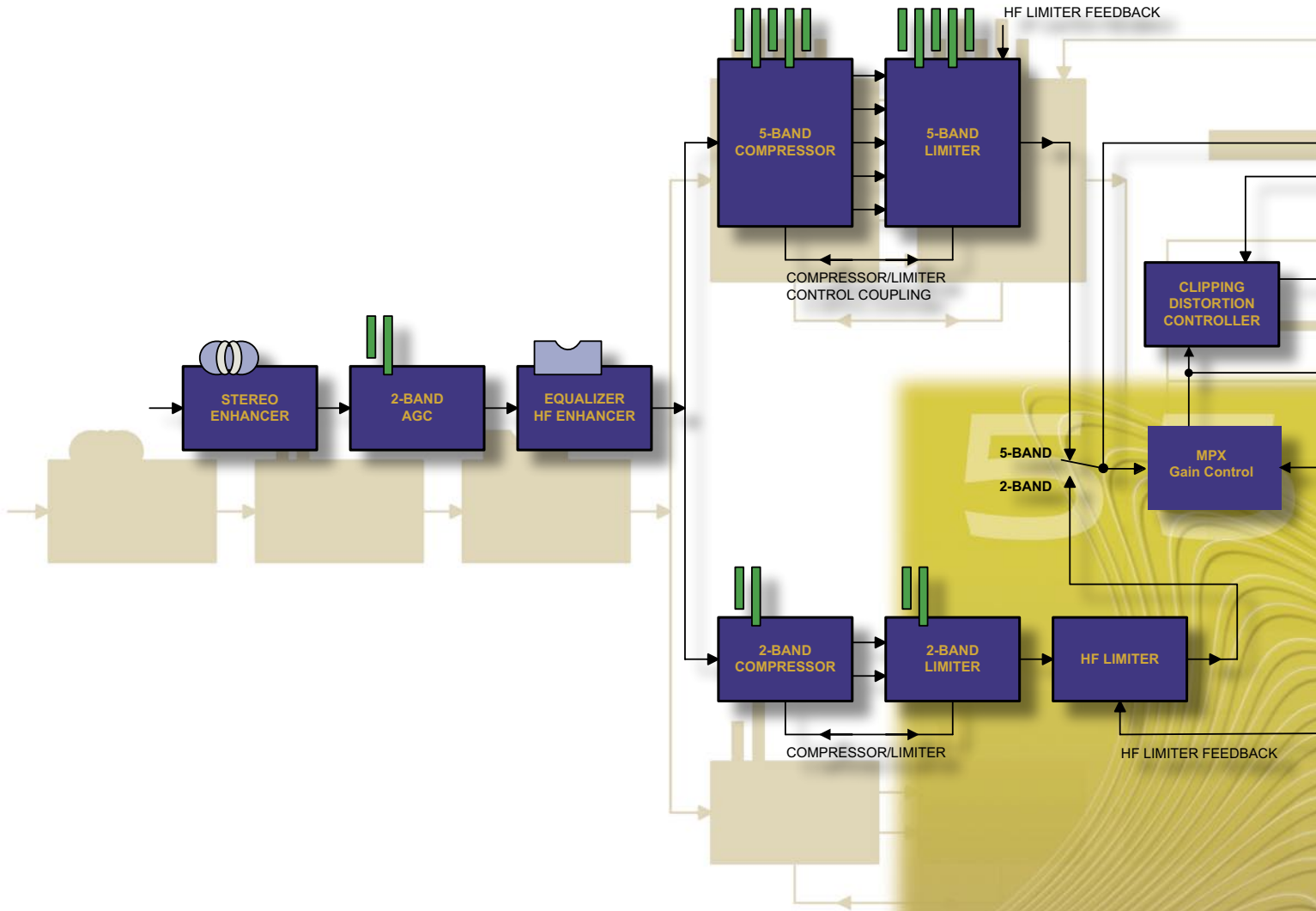
Built-in clock-based automation lets you automatically daypart the processing. You can control many other 5500 operating parameters too; the 5500's feature set fully exploits the processor's DSP and computer-based control architecture. To ensure absolute accuracy, you can automatically synchronize the clock to an Internet timeserver.

If you're concerned about latency because you need to feed live talent headphones off air, be assured that the 5500's ultra-low-latency (5 ms delay) processing will keep the most finicky talent happy. Or use optimum latency (15 ms delay) processing for the most competitive sound with delay that's still low enough to satisfy most any talent.





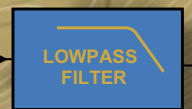
# Simplified Block Diagram



# Stand-Alone Stereo Encoder

## Simplified Block Diagram

TUNABLE 15, 16, 17 kHz  
BYPASSABLE



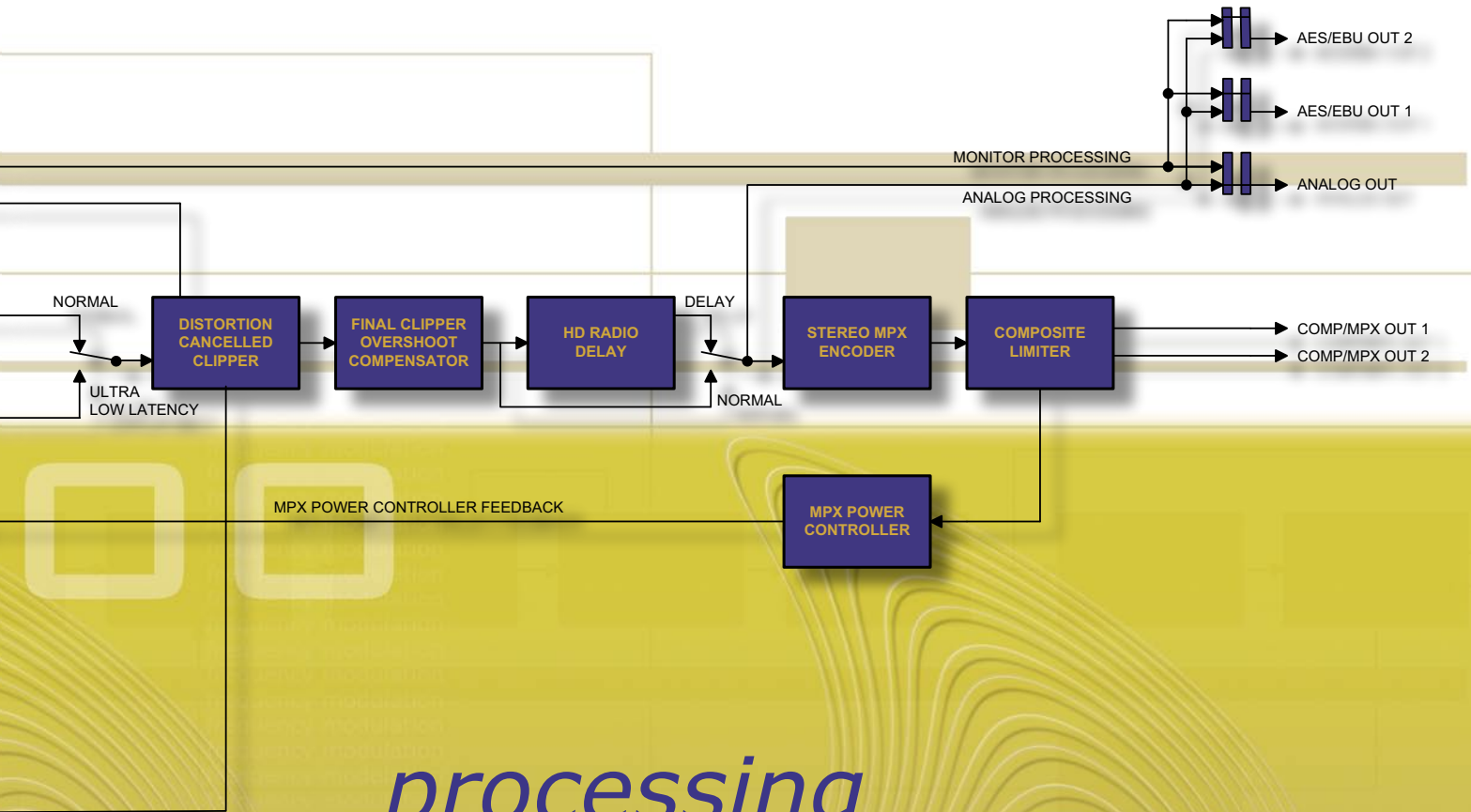
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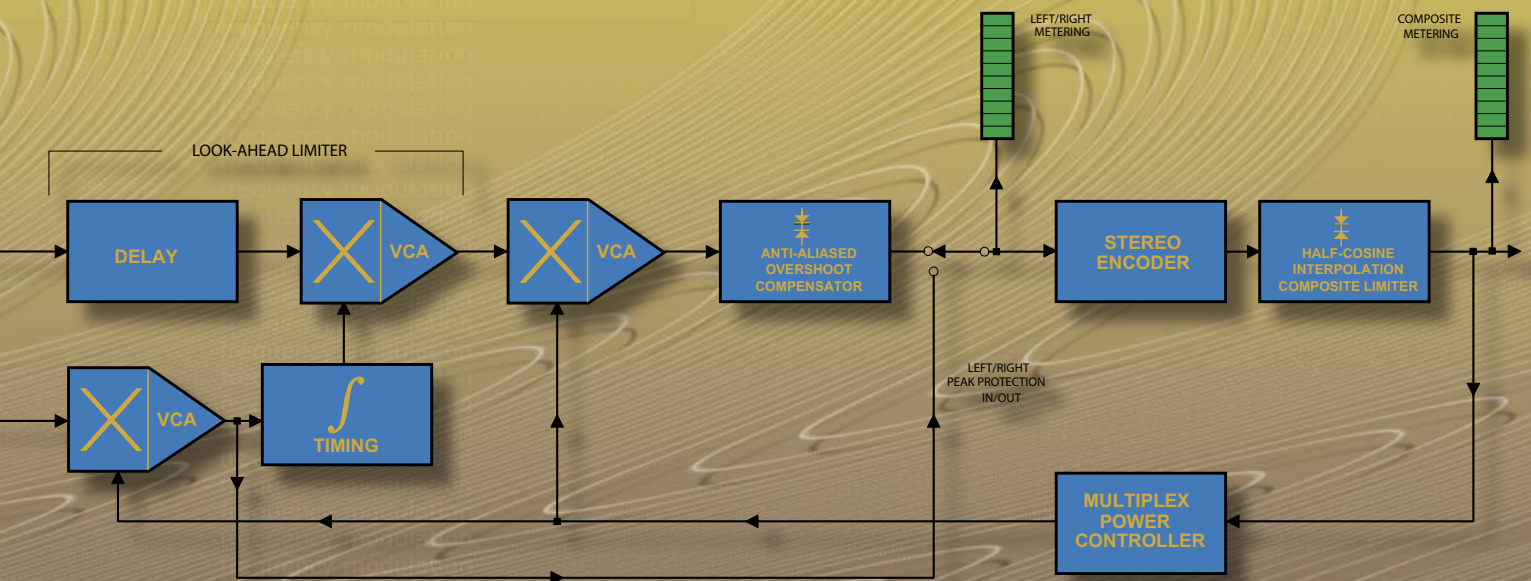
FM

FM



# processing

that will keep even the most finicky talent happy



## about the 5500's

The signal flows through the 5500 through the following blocks:

**Input Conditioning:** The 5500 operates at 32 kHz samplerate and power-of-two multiples thereof (up to 512 kHz in the stereo encoder).

Despite myths circulating in the marketplace regarding the alleged superiority of higher samplerates in processors for analog FM stereo transmission, 32 kHz is, in fact, an efficient and excellent-sounding choice for a basic samplerate. 32 kHz allows us to use DSP cycles more efficiently, adding features that really improve the sound. By strictly limiting the output bandwidth to 16 kHz, it also makes it easier to protect the stereo pilot tone and RDS subcarriers spectrally. Although a 16 kHz bandwidth limitation is more than is strictly needed to protect the pilot tone, the RDS requires protection over a substantially wider bandwidth ( $\pm 2$  kHz) and 16 kHz provides this protection.

A defeatable 30 Hz 18 dB/octave high-pass filter and a defeatable phase rotator complete the input-conditioning block. These have both been features in Orban FM processors for many years. Most users will defeat the 30 Hz filter and leave the phase rotator in-circuit, although the choice is always yours.

**Stereo Enhancement:** The 5500 provides a stereo enhancement algorithm 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). By operating only on transients, the 222 increases width, brightness, and punch without unnaturally increasing reverb (which is usually predominantly in the L-R channel).

Gating circuitry detects "mono" material with slight channel or phase imbalances and suppresses enhancement so this built-in imbalance is not exaggerated. It also allows you to set a "width limit" to prevent over-enhancement of material with significant stereo content, and will always limit the ratio of L-R / L+R to unity or less.

**Two-Band Gated AGC:** The AGC is a two-band device, using Orban's patented "master/bass" band coupling. It has an additional important feature: target-zone gating. If the input program material's level falls within a user-settable window (typically 3 dB), then the release time slows to a user-determined level. It can be slow enough (0.5 dB/second) to effectively freeze the operation of the AGC. This prevents the AGC from applying additional, audible gain control to material that is already well controlled. It also lets you run the AGC with fast release times without adding excessive density to material that is already dense.

The AGC contains a compression ratio control that allows you to vary to ratio between 2:1 and essentially  $\infty$ :1. Lower ratios can make gain riding subtler on critical formats like classical and jazz.

**Equalization:** The 5500 has steep-slope bass shelving equalizer and three bands of fully parametric bell-shaped EQ. You can set the slope of the bass shelving EQ to 6, 12 or 18 dB/octave and adjust the shelving frequency.

The 5500's bass, midrange, and high frequency parametric equalizers have curves that were modeled on the curves of Orban's classic analog parametrics (like the 622B), using a sophisticated, proprietary optimization program. The curves are matched to better than 0.15 dB. This means that their sound is very close to the sound of an Orban analog parametric. They also use very high quality filter algorithms to ensure low noise and distortion.



# audio processing

The 5500 HF Enhancer is a program-controlled HF shelving equalizer that was originally introduced in Orban's 2200 OPTIMOD-FM. It intelligently and continuously analyzes the ratio between broadband and HF energy in the input program material, and can equalize excessively dull material without over-enhancing bright material. It interacts synergistically with the five-band compressor to produce sound that is bright and present without being excessively shrill.

**Multiband Compression:** The multiband compressor can be operated in five-band or two-band mode. In addition to using a special high-frequency limiter, we control high frequencies with distortion-canceled clipping. The clipper in the 5500 operates at 256 kHz samplerate and is full anti-aliased. A clipper, embedded in the crossover, protects bands 1 and 2 from transient overshoot.

This clipper has a shape control, allowing you to vary the "knee" of its input/output transfer curve from hard (0) to soft (10).

**"Intelligent" Clipping:** The 5500 prevents excess clipping distortion by dynamically reducing the drive level to the clippers as required, using an intelligent analysis of the clipping distortion produced in the final clipper and overshoot compensator.

**DSP-derived Stereo Encoder:** The 5500's stereo encoder operates at 512 kHz samplerate to ease the performance requirements of the D/A converter's reconstruction filter, making it possible to achieve excellent stereo separation that is stable over time and temperature.

**Composite Limiter:** Orban has traditionally opposed composite clipping because of its tendency to interfere with the stereo pilot tone and with subcarriers, and because it causes inharmonic aliasing distortion, particularly between the stereo main and sub-channels. Protecting the pilot tone and subcarrier regions is particularly difficult with a conventional composite clipper because appropriate filters will not only add overshoot but also compromise stereo separation — filtering causes the single-channel composite waveform to "lift off the baseline."

Nevertheless, we are aware that many engineers are fond of composite clipping. We therefore undertook a research project to find a way to peak-control the composite waveform without significantly compromising separation, pilot protection, or subcarrier protection, and without adding the pumping typical of simple gain-control "look-ahead" solutions.

We succeeded in our effort. The 5500 offers a patented "Half-Cosine Interpolation" composite limiter that provides excellent spectral protection of the pilot tone and SCAs (including RDS), while still providing approximately 50 dB of separation when a single-channel composite waveform is clipped to 3 dB depth. To ensure accurate peak control, the limiter operates at 512 kHz samplerate.

While the processing never clips the pilot tone, the extra spectrum generated by the processing can fall into the 19 kHz region, compromising the ability of receivers to recover the pilot tone cleanly. Therefore, the 5500's composite processor has a 19 kHz notch filter to protect the pilot tone. This filter does not compromise stereo separation in any way.

# features & benefits

## USER-FRIENDLY INTERFACE

### LCD and full-time LED meters

An **LCD** and **full-time LED meters** make setup, adjustment and programming of OPTIMOD-FM easy — you can always see the metering while you are adjusting the processor. Navigation is by dedicated buttons, soft buttons (whose functions are context-sensitive), and a large rotary knob. The LEDs show all metering functions of the processing structure (Two-Band or Five-Band) in use.

### Universal transmitter protection & audio processing for FM broadcast

The 5500 provides **universal transmitter protection and audio processing** for FM broadcast. It can be configured to interface ideally with any commonly found transmission system in the world.

### Pre-emphasis limiting for the two standard pre-emphasis curves of 50 $\mu$ s & 75 $\mu$ s

The 5500 provides **pre-emphasis limiting** for the two standard pre-emphasis curves of 50  $\mu$ s and 75  $\mu$ s. Its pre-emphasis control is seldom audibly apparent, producing a clean, open sound with subjective brightness matching the original program.

### Tight peak control at all its outputs

The 5500 achieves extremely tight **peak control** at all its outputs — analog left/right, AES3 left/right, and composite baseband.

### Stereo encoder integrated with audio processing

By integrating the **stereo encoder** with the audio processing, the 5500 eliminates the overshoot problems that waste valuable modulation in traditional external encoders.

### Stereo encoder has two outputs with independent level controls

The stereo encoder has **two outputs with independent level controls**, each capable of driving 75  $\Omega$  in parallel with 47,000 pF (100 ft / 30 m of coaxial cable).

### Bandwidth-limiting & overshoot compensation

The 5500 prevents aliasing distortion in subsequent stereo encoders or transmission links by providing **bandwidth-limiting** and **overshoot-compensated** 15 kHz low-pass filters ahead of the 5500's audio outputs and stereo encoder.

### Anti-aliased clippers

**Anti-aliased clippers** running at 256 kHz samplerate prevent any trace of "digital clipper" sound.

## FLEXIBLE CONFIGURATION

### Analog & AES3 digital inputs & outputs

The 5500 includes **analog** and **AES3 digital inputs and outputs**. Both digital input and digital output are equipped with sample-rate converters and can operate at 32 kHz, 44.1 kHz, 48, 88.2 and 96 kHz samplerates. The pre-emphasis status and output levels are separately adjustable for the analog and digital outputs.

### Internal, DSP-based stereo encoder (with a patented "half-cosine interpolation" composite limiter operating at 512 kHz samplerate)

The 5500 has an **internal, DSP-based stereo encoder** (with a patented "half-cosine interpolation" composite limiter operating at 512 kHz samplerate) to generate the pilot tone stereo baseband signal and control its peak level. The composite limiter is a unique, "you can only do this in DSP" process that beats composite clippers by **preserving stereo imaging** while **fully protecting the stereo pilot tone, RDS/RBDS and subcarriers**.

### Transformerless, balanced 10 k $\Omega$ instrumentation-amplifier circuits

The analog inputs are **transformerless, balanced 10 k $\Omega$  instrumentation-amplifier circuits**, and the analog outputs are transformerless balanced, and floating (with 50  $\Omega$  impedance) to ensure highest transparency and accurate pulse response.

### Two independent composite baseband outputs with digitally programmable output levels

The 5500 has **two independent composite baseband outputs** with digitally programmable output levels. Robust line drivers enable them to drive 100 feet of RG-59 coaxial cable without audible performance degradation.

### Two subcarrier inputs

The 5500 has two **subcarrier inputs** that are mixed with the output of OPTIMOD-FM's stereo encoder before application to the composite output connectors. One input can be re-jumpered to provide a 19 kHz pilot reference output. Each input has an internal level trim to accommodate subcarrier generators with output levels as low as 220 mV.

### Precise control of audio bandwidth to 15 kHz

The 5500 precisely **controls the audio bandwidth** to 15 kHz. This prevents overshoots in uncompressed digital links operating at a 32 kHz samplerate and prevents interference to the pilot tone and RDS (or RBDS) subcarrier.

# features & benefits

## FLEXIBLE CONFIGURATION *(continued)*

Defeatable, extremely accurate  
**multiplex power limiter**

The 5500 has a defeatable **multiplex power limiter** that controls the multiplex power to ITU-R BS412 standards. An adjustable threshold allows a station to achieve maximum legal multiplex power even if the downstream transmission system introduces peak overshoots into the 5500-processed signal. Because this limiter closes a feedback loop around the audio processing, it allows the user **to adjust the processor's subjective setup controls freely** without violating BS412 limits, regardless of program material. The multiplex power limiter acts on all outputs (not just the composite output). It reduces clipper drive when it reduces power, simultaneously reducing clipping distortion. To prevent audible gain pumping, a user-adjustable gain offset control allows the user to minimize the amount of gain control that the controller performs.

**10 MHz clock / wordclock reference input**

The 5500 has a **10 MHz clock / wordclock reference input**, which can be used to lock the stereo pilot tone to a high precision external reference like a GPS-based frequency standard.

This facilitates using the 5500 in single-frequency network applications.

**Rigorously RFI-suppressed**  
input, output & power connections

All input, output and power connections are **rigorously RFI-suppressed** to Orban's traditional exacting standards, ensuring trouble-free installation.

**Certified**

The 5500 is designed and certified **to meet all applicable international safety and emissions standards.**

## ADAPTABILITY THROUGH MULTIPLE AUDIO PROCESSING STRUCTURES

**Complete audio processing system**

A **processing structure** is a program that operates as a **complete audio processing system**. Only one processing structure can be on-air at a time. OPTIMOD-FM realizes its processing structures as a series of high-speed mathematical computations made by Digital Signal Processing (DSP) chips.

**Three processing structures**

The 5500 features three processing structures: **Optimum Five-Band** (or "Multiband"; 15 ms delay) for a consistent, "processed" sound, free from undesirable side effects, **Ultra-Low-Latency Five-Band** (5 ms delay) for environments where talent monitors live off-air and they object to the delay of Optimum Five-Band and **Two-Band** for a transparent sound that preserves the frequency balance of the original program material. A special Two-Band preset creates a no-compromise **"Protect"** function that is functionally similar to the "Protect" structures in earlier Orban digital processors. The Optimum Five-Band and the Two-Band structures can be switched via a mute-free crossfade; switching to or from the Ultra-Low Latency Five-Band structure causes the audio to mute momentarily.

**Rides gain** over an adjustable  
range of up to 25 dB

The 5500 **rides gain** over an adjustable range of up to 25 dB, compressing dynamic range and compensating for both operator gain-riding errors and gain inconsistencies in automated systems.

**Multiband compression,  
limiting & clipping**

The 5500 **can increase the density and loudness of the program material** by multiband compression, limiting, and clipping. This improves the consistency of the station's sound and increasing loudness and definition remarkably, without producing unpleasant side effects.

Two-Band processing structure  
is **phase-linear**

The 5500's Two-Band processing structure is **phase-linear** to maximize audible transparency.

**5500 PC Remote application**

The 5500 **can import and run any 8300, 8400, 8500 or 8600 "LL" (Low-Latency) preset** via the 5500 PC Remote application. This means that you can use an 8300, 8400, 8500 or 8600 to develop presets for 5500, provided you do not use features in the other processors not supported by the 5500. (If you try to import a preset that uses features unsupported by 5500, the 5500 will interpret that preset as best it can by using its available processing features.)



# features & benefits

## CONTROLLABLE

### Eight programmable, optically isolated "general-purpose-interface" (GPI) ports

The 5500 **can be remote-controlled** by 5 - 12V pulses applied to eight programmable, optically isolated "general-purpose interface" (GPI) ports.

### 5500 PC Remote software

**5500 PC Remote software** is a graphical application that runs under Windows 2000/XP/Vista/7. It communicates with a given 5500 via **TCP/IP over modem, direct serial and Ethernet connections**. You can configure PC Remote to switch between many 5500s via a convenient organizer that supports giving any 5500 an alias and grouping multiple 5500s into folders. Clicking a 5500's icon causes PC Remote to connect to that 5500 through an Ethernet network, or initiates a Windows Dial-Up or Direct Cable Connection if appropriate.

The PC Remote software allows the user to access all 5500 features (including advanced controls not available from the 5500's front panel), and allows the user to archive and restore presets, automation lists, and system setups (containing I/O levels, digital word lengths, GPI functional assignments, etc.).

### Versatile real-time clock

OPTIMOD-FM contains a **versatile real-time clock**, which allows automation of various events (including recalling presets) at pre-programmed times. The clock can be synchronized automatically to an Internet timeserver.

### Bypass Test Mode

A **Bypass Test Mode** can be invoked locally, by remote control (from either the 5500's GPI port or the 5500 PC Remote application) or by automation to permit broadcast system test and alignment or "proof of performance" tests.

### Built-in line-up tone generator

OPTIMOD-FM contains a **built-in line-up tone generator**, facilitating quick and accurate level setting in any system.

### Upgradeable Software

OPTIMOD-FM's **software can be upgraded** by running Orban-supplied downloadable upgrade software on a PC. The upgrade can occur remotely through the 5500's Ethernet port or serial port (connected to an external modem) or locally (by connecting a Windows® computer to the 5500's serial port through the supplied null modem cable).

## STAND-ALONE STEREO ENCODER OPERATION

### Samplerate and multiples thereof

The samplerate is 64 kHz and multiples thereof, up to 512 kHz. The internal audio bandwidth is high enough to prevent overshoot caused by spectral truncation of the left/right input signals that are band-limited to 18 kHz or lower.

### Low-pass filtering

15, 16 or 17 kHz linear-phase low-pass filtering can be applied to the input signal. To minimize input/output delay, this filter can be bypassed, which is appropriate if the input signal is correctly band-limited by the audio processor driving the 5500.

### Left/right domain overshoot limiter

A **left/right domain overshoot limiter** is available. This uses the same technology as Orban's 8218 stand-alone stereo encoder, combining look-ahead and band-limited clipping techniques to control STL-induced overshoots while minimizing artifacts.

### Dual-mode composite limiter

A **dual-mode composite limiter** is available. It can operate in either "Half-Cosine Interpolation" mode or conventional hard clipper mode. The "Half-Cosine" mode provides better separation and preservation of stereo imaging, while the "Hard" mode provides brighter sound because it creates waveforms that are closer to square waves.

Both modes provide excellent spectral protection of the pilot tone and subcarrier regions. To ensure accurate peak control, the limiter operates at 512 kHz samplerate.

### J.17 de-emphasis

The 5500 can apply **J.17 de-emphasis** to the input signal.



# features & benefits

## STAND-ALONE STEREO ENCODER OPERATION *(continued)*

### ITU412 multiplex power controller

A high-accuracy **ITU412 multiplex power controller** is available, with user control over the multiplex power threshold.

This allows you to compensate for overshoots in the signal path upstream from the 5500, preventing excessive reduction of the multiplex power.

### Flat or pre-emphasized input signal

The input signal can be **flat or pre-emphasized** to 50  $\mu$ s or 75  $\mu$ s.

### Silence alarm and digital audio fault tally outputs

**Silence alarm and digital audio fault tally outputs** are available.

### Inputs and outputs

All normal 5500 **inputs and outputs** are available, including **analog and digital inputs, two composite outputs** with independent level controls and **two subcarrier inputs** (one of which can be repurposed to emit a **19 kHz pilot reference output** for RDS/RBDS generators).



*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 make certain comparisons with other processing equipment.*

Specifications apply for measurements from analog left/right input to stereo composite output and to FM analog left/right output.		
PERFORMANCE	<b>Frequency Response</b> (Bypass Mode)	Follows standard 50 $\mu$ s or 75 $\mu$ s pre-emphasis curve $\pm 0.10$ dB, 2.0 Hz – 15 kHz. Analog left/right output and digital output can be user-configured for flat or pre-emphasized output.
	<b>Noise</b>	Output noise floor will depend upon how much gain the processor is set for (Limit Drive, AGC Drive, Two-Band Drive, and/or Multi-Band Drive), gating level, equalization, noise reduction, etc. The dynamic range of the A/D Converter, which has a specified overload-to-noise ratio of 110 dB, primarily governs it. The dynamic range of the digital signal processing is 144 dB.
	<b>Total System Distortion</b>	(de-emphasized, 100% modulation) <0.01% THD, 20 Hz – 1 kHz, rising to <0.05% at 15 kHz. <0.02% SMPTE IM Distortion.
	<b>Total System L/R Channel Separation</b>	>57 dB, 20 Hz – 15 kHz; 60 dB typical.
	<b>Polarity</b>	(Two-Band and Bypass Modes): Absolute polarity maintained. Positive-going signal on input will result in positive-going signal on output.
	<b>Processing Samplerate</b>	The 5500 is a "multirate" system, using internal rates from 32 kHz to 512 kHz as appropriate for the processing being performed. Audio clippers operate at 256 kHz (and are anti-aliased), while the composite limiter operates at 512 kHz. In stand-alone stereo encoder mode, minimum samplerate is 64 kHz.
	<b>Processing Resolution</b>	Internal processing has 24 bit (fixed point) or higher resolution.
INSTALLATION	<b>Analog Audio Input Configuration</b>	Stereo.
	<b>Impedance</b>	>10 k $\Omega$ load impedance, electronically balanced.
	<b>Nominal Input Level</b>	Software adjustable from -4.0 to +13.0 dBu (VU).
	<b>Maximum Input Level</b>	+27 dBu.
	<b>Connectors</b>	Two XLR-type, female, EMI-suppressed. Pin 1 chassis ground, Pins 2 (+) and 3 electronically balanced, floating and symmetrical.
	<b>A/D Conversion</b>	24 bit 128x oversampled delta sigma converter with linear-phase anti-aliasing filter. Converter outputs 64 kHz samplerate, which the 5500 then decimates to 32 kHz in DSP using an ultra-high-quality image-free synchronous samplerate converter. In stand-alone stereo encoder mode, 64 kHz output of converter is not downsampled.
	<b>Filtering</b>	RFI filtered.



INSTALLATION	<b>Analog Audio Output</b>	
	<b>Configuration</b>	Stereo. Flat or pre-emphasized (at 50 $\mu$ s or 75 $\mu$ s), software-selectable.
	<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>	(100% peak modulation): Adjustable from -6 dBu to +24 dBu peak, into 600 $\Omega$ or greater load, software-adjustable.
	<b>Signal-to-Noise</b>	$\geq$ 90 dB unweighted (Bypass mode, de-emphasized, 20 Hz - 15 kHz bandwidth, referenced to 100% modulation).
	<b>Crosstalk</b>	$\leq$ -70 dB, 20 Hz - 15 kHz.
	<b>Distortion</b>	$\leq$ 0.01% THD (Bypass mode, de-emphasized) 20 Hz - 15 kHz bandwidth.
	<b>Connectors</b>	Two XLR-type, male, EMI-suppressed. Pin 1 chassis ground, Pins 2 (+) and 3 electronically balanced, floating and symmetrical.
	<b>D/A Conversion</b>	24 bit 128x oversampled, with high-pass filter at 0.15 Hz (-3 dB).
INSTALLATION	<b>Filtering</b>	
	RFI filtered.	
	<b>Digital Audio Input</b>	
	<b>Configuration</b>	Stereo per AES3 standard, 24 bit resolution, software selection of stereo, mono from left, mono from right or mono from sum.
	<b>Samplerate</b>	32, 44.1, 48, 88.2 or 96 kHz, automatically selected.
	<b>Connector</b>	XLR-type, female, EMI-suppressed. Pin 1 chassis ground, pins 2 and 3 transformer balanced and floating, 110 $\Omega$ impedance.
	<b>Input Reference Level</b>	Variable within the range of -30 dBFS to -10 dBFS.
	<b>J.17 De-emphasis</b>	Software-selectable.
	<b>Filtering</b>	RFI filtered.
	INSTALLATION	<b>Digital Audio Output</b>
<b>Configuration</b>		Stereo per AES3 standard. Output configured in software as flat or pre-emphasized to the chosen processing pre-emphasis (50 $\mu$ s or 75 $\mu$ s), with or without J.17 pre-emphasis.
<b>Samplerate</b>		Internal free running at 32, 44.1, 48, 88.2 or 96 kHz, selected in software. Can also be synced to the AES3 digital input at 32, 44.1, 48, 88.2 or 96 kHz, as configured in software.
<b>Word Length</b>		Software selected for 24, 20, 18, 16 or 14-bit resolution. First-order high-pass noise-shaped dither can be optionally added, dither level automatically adjusted appropriately for the word length.
<b>Connector</b>		XLR-type, male, EMI-suppressed. Pin 1 chassis ground, pins 2 and 3 transformer balanced and floating, 110 $\Omega$ impedance.
<b>Output Level</b>		(100% peak modulation): -20.0 to 0.0 dBFS software controlled.
<b>Filtering</b>		RFI filtered.
<b>Sync Input</b>		
<b>Configuration</b>		Accepts 1x wordclock or 10 MHz reference signals, automatically selected. The DSP master clock can be phase-locked to these signals, which in turn phase-locks the 19 kHz pilot tone frequency, facilitating single-frequency network operation. The digital output sample frequency can also be locked to these signals.
<b>Level</b>		Unit will lock to 1x wordclock and 10 MHz squarewaves and sinewaves having a peak value of 0.5 V to 5.0 V.
<b>Connector</b>	BNC female, grounded to chassis, non-terminating to allow reference signals to be looped through via an external BNC "tee" connector (not supplied).	
INSTALLATION	<b>Composite Baseband Output</b>	
	<b>Configuration</b>	Two outputs, each with an independent software-controlled output level control, output amplifier and connector.
	<b>Source Impedance</b>	0 $\Omega$ voltage source or 75 $\Omega$ , jumper-selectable.
	<b>Load Impedance</b>	37 $\Omega$ or greater. Termination not required or recommended.
	<b>Maximum Output Level</b>	+12.0 dBu (8.72 Vp-p).
	<b>Pilot Level</b>	Adjustable from 6.0% to 12.0%, software controlled.
	<b>Pilot Stability</b>	19 kHz, $\pm$ 0.5 Hz (10 to 40 $^{\circ}$ C).
	<b>D/A Conversion</b>	24-bit.
	<b>Signal-to-Noise Ratio</b>	$\geq$ 85 dB (Bypass mode, de-emphasized, 20 Hz - 15 kHz bandwidth, referenced to 100% modulation, unweighted).
	<b>Distortion</b>	$\leq$ 0.02% THD (Bypass mode, de-emphasized, 20 Hz - 15 kHz bandwidth, referenced to 100% modulation, unweighted).
	<b>Stereo Separation</b>	At 100% modulation = 3.5Vp-p, > 57 dB, 30 Hz - 15 kHz.
	<b>Crosstalk-Linear</b>	$\leq$ -80 dB, main channel to sub-channel or sub-channel to main channel (referenced to 100% modulation).
	<b>Crosstalk-Non-Linear</b>	$\leq$ -80 dB, main channel to sub-channel or sub-channel to main channel (referenced to 100% modulation).
	<b>38 kHz Suppression</b>	$\geq$ 70 dB (referenced to 100% modulation).

INSTALLATION	<b>Composite Baseband Output (continued)</b>	
	<b>76 kHz &amp; Sideband Suppression</b>	≥ 80 dB (referenced to 100% modulation).
	<b>Pilot Protection</b>	60 dB relative to 9% pilot injection, ±250 Hz (up to 2 dB composite processing drive).
	<b>Subcarrier Protection (60-100 kHz)</b>	≥ 70 dB (referenced to 100% modulation; with up to 2 dB composite limiting drive; measured with 800 line FFT analyzer using "maximum peak hold" display).
	<b>57 kHz (RDS / RBDS) Protection</b>	50 dB relative to 4% subcarrier injection, ±2.0 kHz (up to 2 dB composite processing drive).
	<b>Connectors</b>	Two BNC, shell connected to chassis ground, EMI suppressed.
	<b>Maximum Load Capacitance</b>	0.047 microfarad (0 Ω source impedance). Maximum cable length of 100 feet / 30 meters RG-58A / U.
	<b>Filtering</b>	RFI filtered.
	<b>Subcarrier (SCA) Inputs</b>	
	<b>Configuration</b>	Subcarrier inputs sum into composite baseband outputs before digitally controlled composite attenuator.
<b>Impedance</b>	>600 Ω.	
<b>SCA Sensitivity</b>	Variable from 220 mV p-p to >10 V p-p to produce 10% injection. Sensitivity is adjustable by an internal PC-board-mounted trim pot.	
<b>Connectors</b>	Two BNC, unbalanced and floating over chassis ground, EMI suppressed.	
<b>19 kHz Pilot Reference</b>	SCA2 input can be re-jumpered to provide a 19 kHz pilot reference output.	
<b>Remote Computer Interface</b>		
<b>Supported Computer and Operating System</b>	IBM-compatible PC running Microsoft Windows® 2000/XP/Vista/7.	
<b>Configuration</b>	TCP/IP protocol via direct cable connect, modem, or Ethernet interface. Suitable null modem cable for direct connect is supplied. Modem and other external equipment is not supplied.	
<b>Serial Connector</b>	RS232 on DB-9 male connector, EMI-suppressed. Uses PPP to provide for direct or modem connection to the 8500 PC Remote application.	
<b>Ethernet Connector</b>	Female RJ45 connector for 10 – 100 Mbps networks using CAT5 cabling. Native rate is 100 Mbps. Provides for connection to the 8500 PC Remote application through either a network, or, using a crossover Ethernet cable, directly to a computer.	
<b>Ethernet Networking Standard</b>	TCP/IP.	
<b>Remote Control (GPI) Interface</b>		
<b>Configuration</b>	Eight (8) inputs, opto-isolated and floating.	
<b>Voltage</b>	6 – 15V AC or DC, momentary or continuous. 9 VDC provided to facilitate use with contact closure.	
<b>Connector</b>	DB-25 male, EMI-suppressed.	
<b>Control</b>	User-programmable for any eight of user presets, factory presets, bypass, test tone, stereo or mono modes, analog input, digital input.	
<b>Filtering</b>	RFI filtered.	
<b>Tally Outputs</b>		
<b>Circuit Configuration</b>	Two NPN open-collector outputs.	
<b>Voltage</b>	+15 volts maximum. Do not apply negative voltage. When driving a relay or other inductive load, connect a diode in reverse polarity across the relay coil to protect the driver transistors from reverse voltage caused by inductive kickback.	
<b>Current</b>	30 mA maximum.	
<b>Indications</b>	Tally outputs can be programmed to indicate a number of different operational and fault conditions, including Input: Analog, Input: Digital, Analog Input Silent, AES Input Silent and AES Input Error.	
<b>Power</b>		
<b>Voltage</b>	85 – 264 VAC, 50 – 60 Hz, 30 VA.	
<b>Connector</b>	IEC, EMI-suppressed. Detachable 3-wire power cord supplied.	
<b>Fuse</b>	2.5A, 20mm Quick Acting HBC, mounted on the power supply circuit board.	
<b>Grounding</b>	In order to meet EMI standards, circuit ground is hard-wired to chassis ground.	
<b>Safety Standards</b>	ETL listed to UL standards, CE marked.	
<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>Dimensions (W x H x D)</b>	19" x 1.875" x 14.25" / 48.3 cm x 4.8 cm x 36.2 cm. One rack unit high.	
<b>RFI / EMI</b>	Tested according to Cenelec procedures. FCC Part 15 Class A device.	
<b>Shipping Weight</b>	21 lbs. / 9.5 kg.	
<b>Warranty</b>		
<b>Two Years, Parts and Service</b>	Subject to the limitations set forth in Orban's Standard Warranty Agreement.	

Because engineering improvements are ongoing, specifications are subject to change without notice.



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