radio

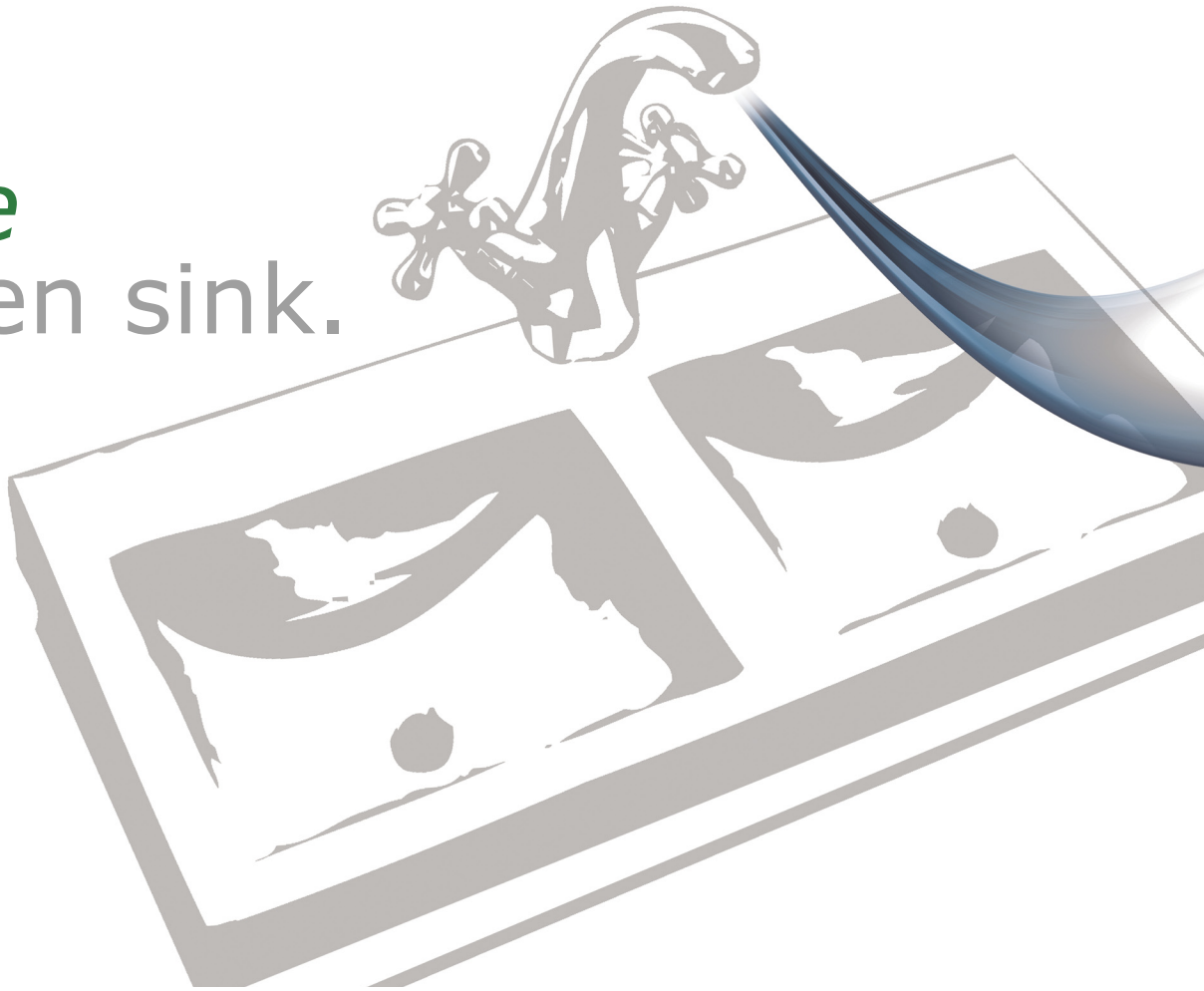
orban

audio processing

OPTIMOD-AM 9400

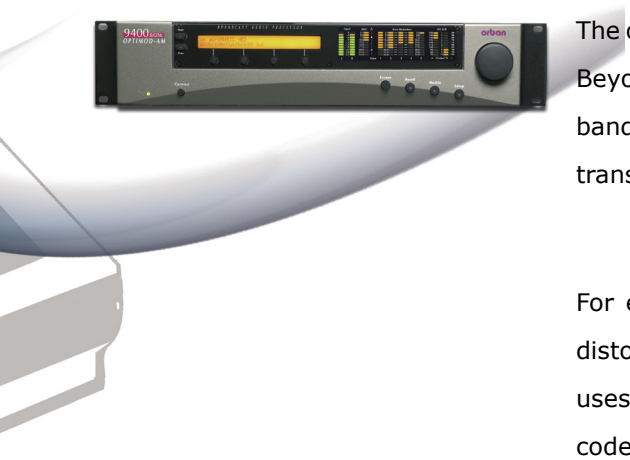
When it comes to no-compromise, independent, multiband processing for analog AM and digital radio, the OPTIMOD-AM 9400 does it all. This processor is one box with two of everything —

but the
kitchen sink.



Until now, if you wanted an AM audio processor that provided no-compromise, independent, multiband processing for analog AM and digital radio (like iBiquity's HD-AM™ system), you had to buy two boxes. Orban's OPTIMOD-AM 9400 changes all that by offering two independently adjustable processing chains: one for the analog channel and one for the digital channel.

OPTIMOD-AM 9400: No-Compromise all-in-one processing for analog AM and digital radio channels.



The only processing common to the two channels is the AGC and stereo enhancer. Beyond this front-end processing, you get two of everything: Equalizer, five-band compressor/limiter, and peak limiter, each optimized for its intended transmission channel.

For example, the analog-chain peak limiter uses Orban's exclusive multiband distortion-canceled clipper and overshoot compensator, while the digital chain uses an advanced, low-IM look-ahead limiter to make the most of low bitrate codecs. Moreover, both processing chains are stereo, making the 9400 ideal for C-QUAM® installations. This is truly one AM processor that does it all.

details

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

Positive and negative modulation meters.

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

Input level meters. Full featured, full-time LED metering makes it easy to set up the 9400.

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

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

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

Gain reduction meters for AGC and multiband compression.

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

We realized early on in the 9400's design process that AM stations need more than just AGC and peak limiting on their digital channels. Particularly because of the preponderance of talk on AM, these stations also need Orban-quality five-band compression and limiting to ensure spectral consistency and smooth source-to-source continuity on the digital channel. However, the analog and digital five-band compressor/limiters require very different thresholds and time constants. Appropriate equalization settings and peak limiting technologies are very different as well. That's why the 9400 is essentially two processors in one.

truly one AM processor that **does it all**

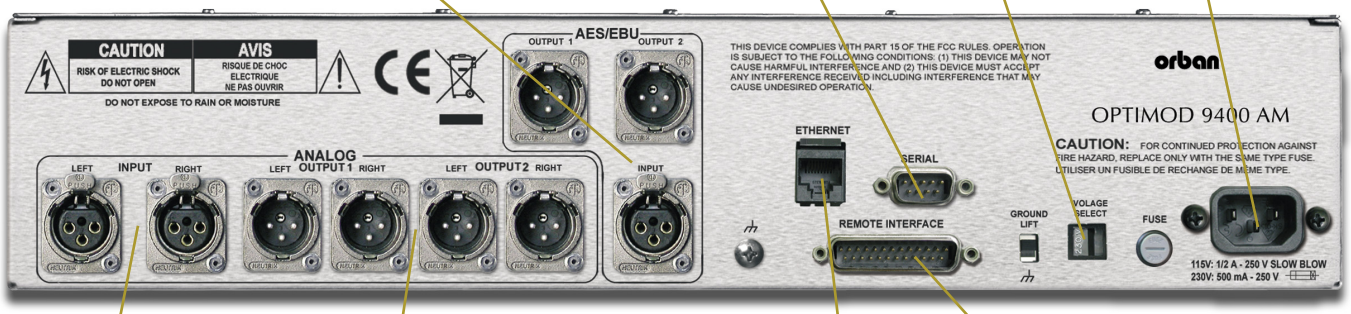
Thanks to its unified design, the 9400 costs substantially less than a two-box configuration. It is also easier to control — you only have to program the time-of-day automation once and you only need one set of remote control connections. Yet the 9400 has everything necessary to provide optimum processing for both channels.

For over 20 years, OPTIMOD-AM has dominated the sound of major-market AM radio. The 9400 distills all of Orban's experience into the best OPTIMOD-AM ever. Regardless of whether you have a major-market station or just want your station to sound like one, OPTIMOD-AM 9400 is right for you.

unified design

less cost

details



RFI suppressed power connector.

RS232 serial connector for computer control.

Line voltage selector.

One AES3 audio input, two AES3 outputs.

Two stereo pairs of analog outputs for two transmitters.

Stereo analog inputs.

100 Mbps Ethernet facilitates network control.

Eight optically isolated GPI inputs for contact-closure remote control.

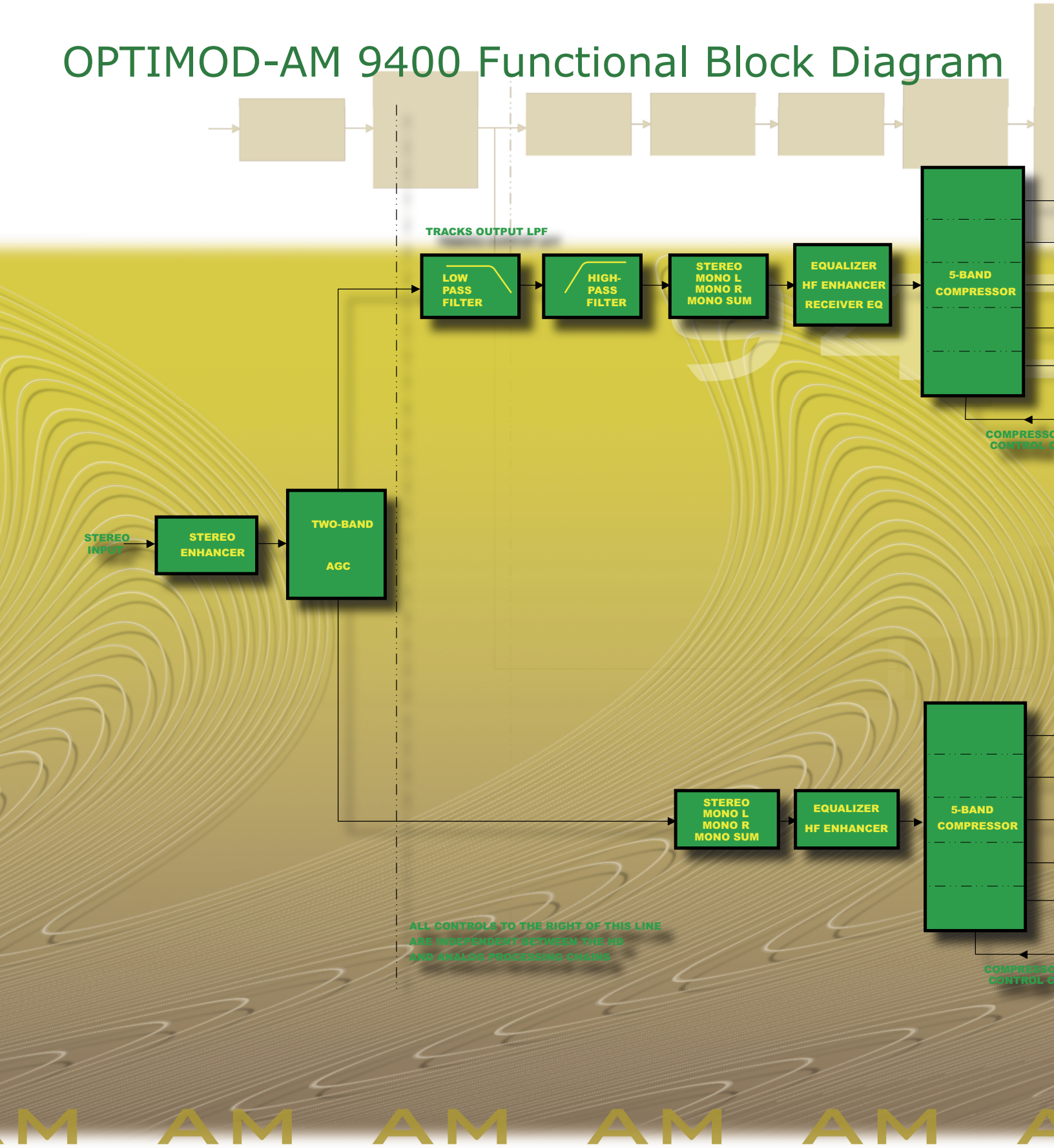
features & benefits

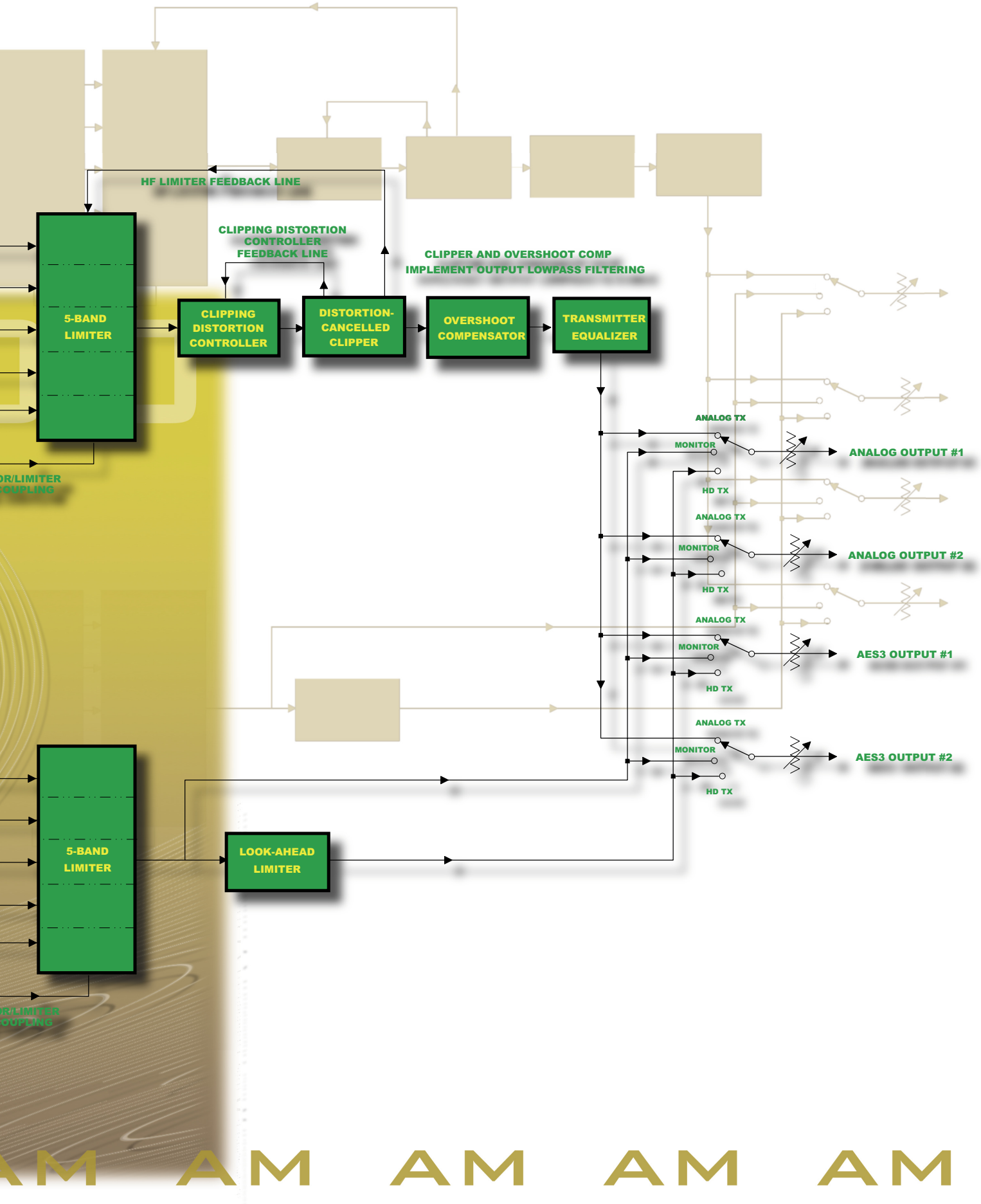
MAKING THE MOST OF THE AM CHANNEL	
Band	The 9400 is suitable for long wave, medium wave, and shortwave (HF) broadcasts.
Gain-riding	The 9400 **rides gain** over an adjustable range of up to 25 dB, compressing dynamic range and compensating for operator gain-riding errors and for gain inconsistencies in automated systems.
Multiband Limiting & Multiband Distortion-canceling Clipping	The 9400 **increases the density and loudness of the program material** by multiband limiting and multiband distortion-canceling clipping, improving the consistency of the station's sound and increasing loudness and definition without producing audible side effects.
Peak Control	The 9400 **precisely controls peak levels** to prevent overmodulation. **Asymmetry** in the analog processing channel is adjustable from 100% to 150% positive peak modulation.
Program Equalizer	The 9400 **compensates for the high- and low-frequency rolloffs of typical AM receivers** with a fully adjustable program equalizer providing up to 20dB of high-frequency boost (at 5 kHz) without producing the side effects encountered in conventional processors. This equalizer can thus produce extreme pre-emphasis that is appropriate for very narrow-band radios. OPTIMOD-AM's fully parametric low- and mid-frequency equalizers allow you to tailor your air sound to your precise requirements and desires. The 9400 also fully supports the NRSC standard pre-emphasis curve.
Processing Compliance	The 9400 is a **stereo processor** that fully protects C-QUAM® transmissions, conservatively complying with Motorola's processing requirements that negative peak modulation on the left and right channels be limited to –75% modulation.
iBiquity HD-AM® Support	The 9400 **supports the iBiquity HD-AM® system**. Except for common stereo enhancement and AGC, the HD-AM processor is an independent processing chain with its own set of user-adjustable parameters, maintaining 15 kHz audio bandwidth (per iBiquity's specifications) regardless of the bandwidth setting of the processing intended for the analog channel. To ensure source-to-source consistency, the HD-AM processing includes full five-band compression/limiting that is independent of the five-band compression/limiting in the analog processing chain. This output can also be used for **netcasts**.
Orban's PreCode™ Technology	Orban'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.
CONTROLLABLE AND ADJUSTABLE	
Factory Preset Controls	The 9400 comes with a **wide variety of factory presets** to accommodate almost any user requirement. Two LESS-MORE controls (one for the analog processing chain and one for the digital chain) easily modify any factory preset. The user (via FULL MODIFY) can further customize the presets, and these can be stored and recalled on command. Advanced Control (accessible from the PC Remote application) facilitates detailed sound design using the same controls that were available to the factory programmers.
LCD and Full-time LED Meters	An **LCD** and **full-time LED meters** make setup, adjustment and programming of the 9400 easy — you can always see the metering while you're 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.
Real-time Clock	The 9400 contains a versatile **real-time clock**, which allows automation of various events (including recalling presets) at pre-programmed times.
Proof of Performance Tests	A Bypass Test Mode can be invoked locally, by remote control (from either the 9400's GPI port or the 9400 PC Remote application), or by automation to permit broadcast system **test and alignment** or "proof of performance" tests.

features & benefits

Software	**OPTIMOD-AM's software can be upgraded** by running Orban-supplied downloadable upgrade software on a PC. The upgrade can occur remotely through the 9400's Ethernet port or serial port (connected to an external modem), or locally (by connecting a Windows® computer to the 9400's serial port through the supplied null modem cable).
Built-in Line-up Tone Generator	The 9400 contains a built-in **line-up tone generator**, facilitating quick and accurate level setting in any system.
Remote Control	The 9400 can be **remote-controlled** by 5-12V pulses applied to eight programmable, optically isolated "general-purpose interface" (GPI) ports.
9400 PC Remote Software	9400 **PC Remote software** runs under Windows 2000 and XP. It communicates with a given 9400 **via TCP/IP over modem, direct serial,** and **Ethernet** connections. You can configure PC Remote to switch between many 9400s via a convenient organizer that supports giving any 9400 an alias and grouping multiple 9400s into folders. Clicking a 9400's icon causes PC Remote to connect to that 9400 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 9400 features (including advanced controls not available from the 9400'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 INSTALLATION	
Bandwidth Control	The 9400 controls the **transmitted bandwidth of the analog channel as necessary to meet government regulations**, regardless of program material or equalization. The high-frequency bandwidth of the analog processing channel can be switched instantly in 500 Hz increments between 4.5 kHz and 9.5 kHz. The lower cutoff frequencies meet the output power spectral density requirements of ITU-R 328-5 without further low-pass filtering at the transmitter, while the 9.5 kHz filter meets the requirements of the NRSC-1 standard (North America). The 5.0 kHz filter makes the analog AM bandwidth compatible with HD-AM transmission. The lowpass filters have parametric cutoff shapes, allowing you to trade off filter ringing against frequency response flatness.
Four-parameter Transmitter Equalizer	The 9400 **compensates for inaccuracies in the pulse response (tilt, overshoot, ringing) of transmitters and antenna systems** with a powerful four-parameter transmitter equalizer. A built-in square-wave generator makes adjustment easy. Four sets of equalizer parameters can be stored and recalled, allowing you to program day and night variations for two transmitters.
Analog and AES3 Digital Inputs and Outputs	The 9400 includes **analog** and **AES3 digital** inputs. The analog inputs are **transformerless, balanced 10 kΩ instrumentation-amplifier circuits**. The analog outputs are transformerless balanced, and floating (with 50 Ω impedance) to ensure highest transparency and accurate pulse response. **Two sets of analog stereo outputs** and **two AES3 outputs** accommodate as many as four transmitters. Outputs can be switched independently to emit the **analog-channel signal**, the **digital-channel signal**, or a **low-delay monitor signal** suitable for talent headphones.
Sample Rate Converters	Both the digital input and the two digital outputs are equipped with **samplerate converters** and can operate at 32, 44.1, 48, 88.2 and 96 kHz samplerates. The pre-emphasis status and output levels are **separately adjustable** for the analog and digital outputs.
Installation	The 9400 is **usually installed at the transmitter**, replacing all processing normally employed at the transmitter site, including compressor, protection peak limiters, clippers, and high- and low-pass filters normally included within the transmitter. It can also **be installed at the studio** if an uncompressed digital STL is available.
Monitor Rolloff Filter	The 9400 comes with a passive **Monitor Rolloff Filter** to accurately simulate the frequency response of an average receiver, for use in studio monitoring.
RFI Suppression	All input, output, and power connections are **rigorously RFI-suppressed** to Orban's traditional exacting standards, ensuring trouble-free installation.
Safety Standards	The 9400 is designed and certified to meet **all applicable international safety and emissions standards.**

OPTIMOD-AM 9400 Functional Block Diagram




HF LIMITER FEEDBACK LINE
CLIPPING DISTORTION CONTROLLER FEEDBACK LINE
CLIPPER AND OVERSHOOT COMP IMPLEMENT OUTPUT LOWPASS FILTERING
5-BAND LIMITER
CLIPPING DISTORTION CONTROLLER
DISTORTION-CANCELLED CLIPPER
OVERSHOOT COMPENSATOR
TRANSMITTER EQUALIZER
ANALOG TX
MONITOR
HD TX
ANALOG OUTPUT #1
ANALOG OUTPUT #2
AES3 OUTPUT #1
AES3 OUTPUT #2
5-BAND LIMITER
LOOK-AHEAD LIMITER

AM AM AM AM AM

specifications

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.

PERFORMANCE PERFORMANCE PERFORMANCE	*Except as noted, specifications apply for measurements from the analog left/right input to the analog left/right output*	
	Frequency Response (Bypass Mode; Analog Processing Chain)	±0.2 dB, 50 Hz – 9.5 kHz, or as determined by user-settable high-pass and low-pass filters.
	Frequency Response (Bypass Mode; Digital Processing Chain)	±0.2 dB, 5 Hz – 15 kHz, or as determined by user-settable low-pass filter.
	Noise	Output noise floor will depend upon how much gain the processor is set for (Limit Drive, AGC Drive, Two-Band Drive, and/or Multiband 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.
	Total System Distortion (de-emphasized, 100% modulation)	<0.01% THD, 20 Hz – 1 kHz, rising to <0.05% at 9.5 kHz. <0.02% SMPTE IM Distortion.
	Total System L/R Channel Separation	>50 dB, 20 Hz – 9.5 kHz; 60 dB typical.
	Polarity (Bypass Mode and Digital-Channel Processing)	Absolute polarity maintained. Positive-going signal on input will result in positive-going signal on output. The analog-channel processing employs phase rotation to maximize loudness so the polarity on this channel will be frequency-dependent.
	Processing Sample Rate	The 9400 is a "multirate" system, using internal rates from 32 kHz to 256 kHz as appropriate for the processing being performed. Audio clippers operate at 256 kHz and are fully anti-aliased.
	Processing Resolution	Internal processing has 24 bit (fixed point) or higher resolution; uses Motorola DSP56362 DSP chips.
	Low-Pass Filter (processing for analog modulation)	4.5, 5.0, 5.5, 6.0, 6.5, 7.0, 7.5, 8.0, 8.5, 9.0 or 9.5 (NRSC) kHz as set by user. All filters have selectable parametric shapes with response down 0.1, 3, or 6 dB at the stated cutoff frequency. This trades off brightness against filter ringing.
	Low-Pass Filter (processing for digital modulation)	15 kHz.
	High-Pass Filter (processing for analog modulation)	Constrained by user settable fifth-order "quasi-elliptical" highpass filter to 50, 60, 70, 80, 90, or 100 Hz. All filters have equal-ripple (Chebychev-like) passbands, and 25 and 35 Hz notches for transmitter protection.
	High-Pass Filter (processing for digital modulation)	1 Hz, not user-adjustable.
	Processing Topology	The stereo enhancer and two-band AGC are common to the analog and digital processing chains. The processing path splits after the AGC. The analog path receives equalization, five-band compression, distortion-controlled and -canceled clipping, overshoot compensation, and transmitter equalization. The digital path receives equalization, five-band compression, and look-ahead limiting. The parameters of the equalizers, five-band compressors, and peak limiters in the two paths are separately and independently adjustable.
	Processing Delay (processing for analog modulation)	Approximately 17 ms.
	Processing Delay (processing for digital modulation)	Approximately 24 ms. Monitor output with 5 ms delay emits the digitally-processed signal before the look-ahead limiter.
	Delay Difference between Analog AM and Digital Processing Chains	Fixed at 5.778 ms, regardless of processor control settings.
INSTALLATION	***Analog Audio Input***	
	Configuration	Stereo.
	Impedance	>10 kΩ load impedance, electronically balanced.
	Nominal Input Level	Software adjustable from -9.0 to +13.0 dBu (VU).
	Maximum Input Level	+27 dBu.
	Connectors	Two XLR-type, female, EMI-suppressed. Pin 1 chassis ground, Pins 2 (+) and 3 electronically balanced, floating and symmetrical.
	A/D Conversion	24 bit 128x oversampled delta sigma converter with linear-phase anti-aliasing filter. Converter outputs 64 kHz samplerate, which the 9400 then decimates to 32 kHz in DSP using an ultra-high-quality image-free synchronous samplerate converter.
	Filtering	RFI filtered, with high-pass filter at 0.15 Hz (-3 dB).
	Analog Audio Output	
	Configuration	Two stereo pairs, capable to driving two transmitters.
	Source Impedance	50 Ω, electronically balanced and floating.
	Load Impedance	600 Ω or greater, balanced or unbalanced. Termination not required or recommended.
	Output Level (100% peak modulation)	Adjustable from -6 dBu to +24 dBu peak, into 600 Ω or greater load, software-adjustable.
	Signal-to-Noise	≥90 dB unweighted (Bypass mode, de-emphasized, 20 Hz – 9.5 kHz bandwidth, referenced to 100% modulation).

***Analog Audio Output** (continued)*	
L/R Crosstalk	≤ -70 dB, 20 Hz – 9.5 kHz.
Distortion	≤0.01% THD (Bypass mode, de-emphasized) 20 Hz – 9.5 kHz bandwidth.
Connectors	Four XLR-type, male, EMI-suppressed. Pin 1 chassis ground, Pins 2 (+) and 3 electronically balanced, floating and symmetrical.
D/A Conversion	24 bit 128x oversampled.
Filtering	RFI filtered.
Digital Audio Input	
Configuration	Stereo per AES3 standard, 24 bit resolution, software selection of stereo, mono from left, mono from right or mono from sum.
Sampling Rate	32, 44.1, 48, 88.2 or 96 kHz, automatically selected.
Connector	XLR-type, female, EMI-suppressed. Pin 1 chassis ground, pins 2 and 3 transformer balanced and floating, 110 Ω impedance.
Input Reference Level	Variable within the range of -30 dBFS to -10 dBFS.
J.17 De-emphasis	Software-selectable.
Filtering	RFI filtered.
Digital Audio Outputs	
Configuration	Stereo per AES3 standard. Both outputs can be switched independently to emit either the signal processed for analog modulation, the signal processed for digital modulation, or the low-delay monitor signal.
Sample Rate	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.
Connector	Two XLR-type, male, EMI-suppressed. Pin 1 chassis ground, pins 2 and 3 transformer balanced and floating, 110 Ω impedance.
Output Level (100% peak modulation)	-20.0 to 0.0 dBFS software controlled.
Filtering	RFI filtered.
Remote Computer Interface	
Configuration	TCP/IP protocol via direct cable connect, modem, or Ethernet interface. Suitable null modem cable for direct connect is supplied. Modem is not supplied.
Serial Port	115 kbps RS-232 port DB–9 male, EMI-suppressed.
Ethernet Port	10 or 100 Mbit/s on RJ45 female connector.
Remote Control (GPI) Interface	
Configuration	Eight (8) inputs, opto-isolated and floating.
Voltage	6 – 15 V AC or DC, momentary or continuous. 9 V DC provided to facilitate use with contact closure.
Connector	DB–25 male, EMI-suppressed.
Control	User-programmable for any eight of user presets, factory presets, bypass, test tone, stereo or mono modes, analog input, digital input.
Filtering	RFI filtered.
Power	
Voltage	100 – 132 V AC or 200 – 264 V AC, switch-selected on the rear panel, 50 – 60 Hz, 40 VA.
Connector	IEC, EMI-suppressed. Detachable 3-wire power cord supplied.
Grounding	Circuit ground is independent of chassis ground, and can be isolated or connected with a rear panel switch.
Safety Standards	ETL listed to UL standards, CE marked.
Environmental	
Operating Temperature	32 ° to 122 °F / 0 ° to 50 °C for all operating voltage ranges.
Humidity	0 – 95% RH, non-condensing.
Dimensions (W x H x D)	19” x 3.5” x 14.25” / 48.3 cm x 8.9 cm x 36.2 cm. Two rack units high.
RFI / EMI	Tested according to Cenelec procedures. FCC Part 15 Class A device.
Shipping Weight	22 lbs / 10.0 kg
Warranty	
Two Years, Parts and Service	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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