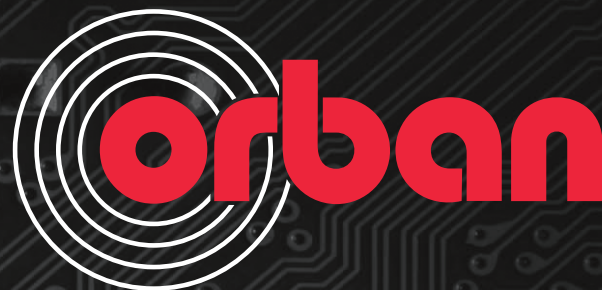


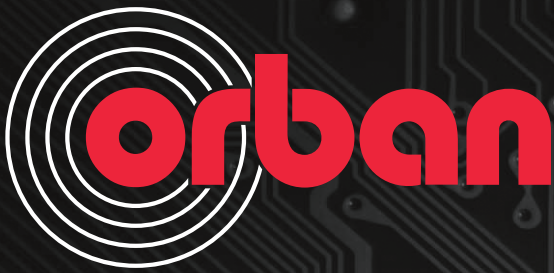
# OPTIMOD-AM 9400



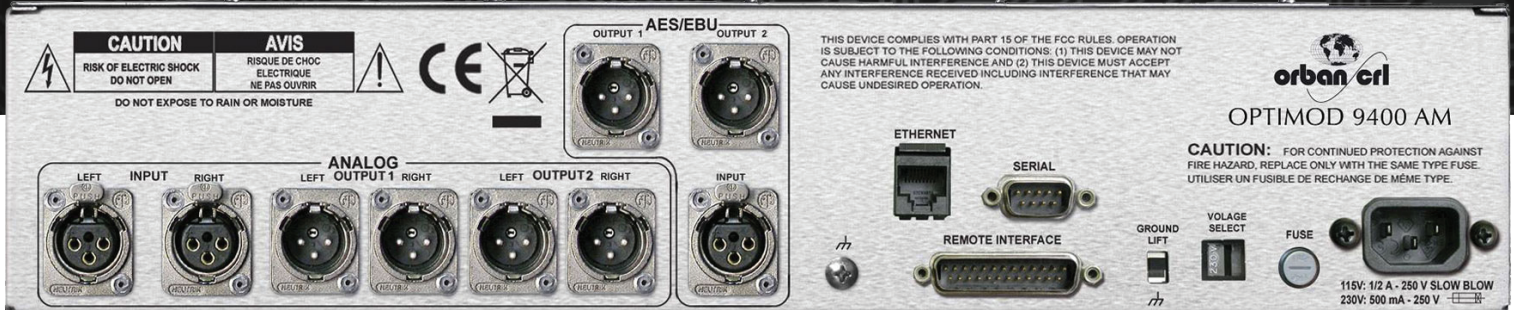
## Key Features of the OPTIMOD-AM 9400

### Making the Most of the AM Channel

- **Broadcast Versatility**  
The 9400 is suitable for long wave, medium wave, and shortwave (HF) broadcasts.
- **Rides Gain**  
The 9400 rides gain over an adjustable range of up to 25dB, compressing dynamic range and compensating for operator gain-riding errors and for gain inconsistencies in automated systems.
- **Increases Density and Loudness**  
OPTIMOD-AM 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.
- **iBiquity HD-AM® Support**  
OPTIMOD-AM 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 and satellite radio.
- **Stereo Processing**  
The 9400 is a stereo processor that fully protects CQUAM® transmissions, conservatively complying with Motorola's processing requirements that negative peak modulation on the left and right channels be limited to -75% modulation.



# OPTIMOD-AM 9400



- **Compensates for the High and Low-Frequency Rolloffs**

OPTIMOD-AM 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. OPTIMOD-AM also fully supports the NRSC standard pre-emphasis curve.

## Controllable and Adjustable

- **Wide Variety of Factory Presets**

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 OPTIMOD-AM 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**

OPTIMOD-AM contains a versatile real-time clock, which allows automation of various events (including recalling presets) at pre-programmed times.

- **Test and Alignment**

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.





# OPTIMOD-AM 9400

- **Line-Up Tone Generator**

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

- **Upgradeable**

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).

- **Remote Control**

The 9400 can be remote-controlled by 5-12V pulses applied to eight programmable, optically isolated "general-purpose interface" (GPI) ports.

- **PC Remote Software**

9400 PC Remote software runs under Windows XP and higher. 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

- **Transmitter Bandwidth as Necessary to Meet Government Regulations**

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 500Hz 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.

- **Analog & Digital Options**

The 9400 includes analog and AES3 digital inputs.

- **Transformerless, Balanced 10kΩ Instrumentation-Amplifier Circuits**

The analog inputs are transformerless, balanced 10kΩ instrumentation-amplifier circuits. The analog outputs are transformerless balanced, and floating (with 50Ω impedance) to ensure highest transparency and accurate pulse response.



# OPTIMOD-AM 9400

- **Tunes out Tilt and Ringing in the RF Transmission Path**  
OPTIMOD-AM 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. You can set equalization independently in the stereo sum and difference channels, facilitating adjustment in CQUAM AM stereo facilities.
- **Two Sets of Analog Stereo Outputs & Two AES3 Outputs**  
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 sample-rate converters and can operate at 32 kHz, 44.1 kHz, 48, 88.2, and 96 kHz sample rates. The pre-emphasis status and output levels are separately adjustable for the analog and digital outputs.
- **Easy Installation**  
OPTIMOD-AM 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.
- **RFI-Suppressed**  
All input, output, and power connections are rigorously RFI-suppressed to Orban's traditional exacting standards, ensuring trouble-free installation.
- **Meets All Standards**  
The 9400 is designed and certified to meet all applicable international safety and emissions standards.



# OPTIMOD-AM 9400

## Product Overview

For over 30 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! Orban's all-digital 9400 OPTIMOD-AM Audio Processor can help you achieve the highest possible quality in AM shortwave, medium wave and long wave broadcast sound. OPTIMOD-AM delivers louder, cleaner, brighter, FM like audio with an open, fatigue free quality that attracts listeners and holds them.

OPTIMOD-AM was designed to deliver a high quality FM-like sound to the listener's ear by pre-processing for the limitations of the average car or table radio. The 9400 supports iBiquity's HD AM® in-band on-channel digital radio system. The digital radio processing can also be used for simulcast satellite radio, netcast, DAB+, DRM or DRM+ digital broadcasts. 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.

Before the 9400, if you wanted an Orban AM audio processor that provided no-compromise, independent, multiband processing for analog AM and digital radio, 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 and/or for Internet streaming. 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.

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 independently adjustable processors in one.

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 CQUAM® installations, conservatively complying with Motorola's processing requirements that negative peak modulation on the left and right channels be limited to -75% modulation. This is truly one AM processor that does it all.

The HD AM processor provides 15 kHz audio bandwidth (per iBiquity's specifications) regardless of the bandwidth setting of the processing intended for the analog channel. 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. There are several HD factory presets tuned specifically for low bitrate codecs. These presets have "LBR" in their names.



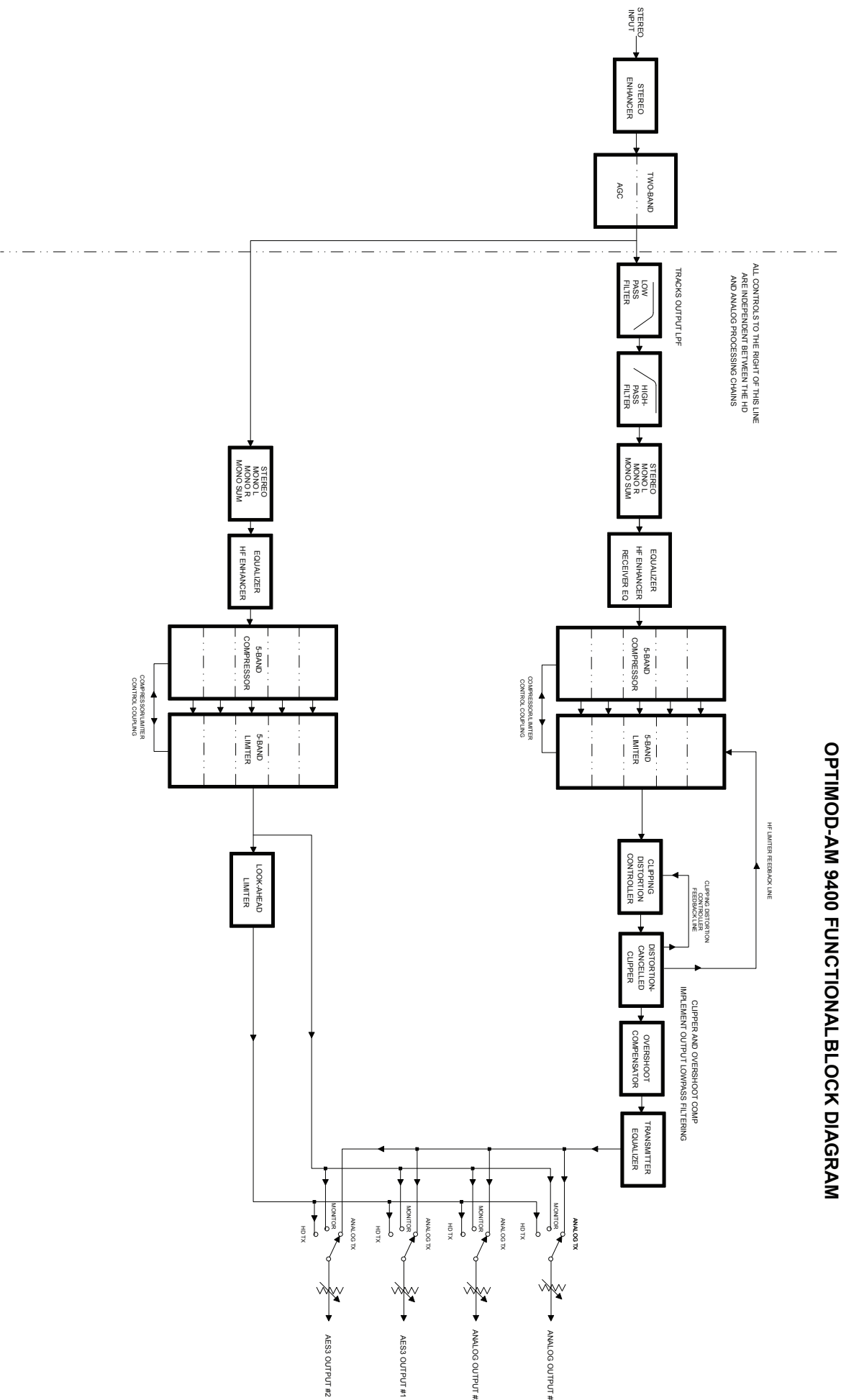


# OPTIMOD-AM 9400

The 9400 comes with a wide variety of factory presets to accommodate almost any user requirement. The user can readily modify these presets or customize them with easy one-knob LESS-MORE control. Modified presets 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. Quick Setup guides you through 9400 setup for your primary analog AM transmitter. It is appropriate for users with modern transmitter plants and without special requirements such as setting up HD Radio processing or CQUAM AM stereo processing.

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.

# OPTIMOD-AM 9400 FUNCTIONAL BLOCK DIAGRAM





# OPTIMOD-AM 9400

## Key Technical 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.

***Except as noted, specifications apply for measurements from the analog left/right input to the analog left/right output.***

## Performance

### **Frequency Response (Bypass Mode; Analog Processing Chain):**

$\pm 0.2$  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):**

$\pm 0.2$  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.

### **Processing Resolution:**

Internal processing has 24 bit (fixed point) or higher resolution; uses Motorola DSP56362 DSP chips.





# OPTIMOD-AM 9400

**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. Unit can be set up to comply easily with ITU-R and NRSC spectrum masks. Filter can be set to be  $-0.1$  dB,  $-3.0$ , or  $-6.0$  dB down at the edge of the passband, trading off ringing against brightness.

**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 15 ms. Monitor output with 5 ms. delay emits the digitally-processed signal before the look-ahead limiter.

## Installation

### *Analog Audio Input*

**Configuration:**

Stereo

**Impedance:**

$>10\text{k}\Omega$  load impedance, electronically balanced

**Nominal Input Level:**

Software adjustable from  $-9.0$  to  $+13.0$  dBu (VU).



# OPTIMOD-AM 9400

**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 sample rate, which the 9400 then decimates to 32 kHz in DSP using an ultra-high-quality image-free synchronous sample rate converter.

**Filtering:**

RFI filtered, with high-pass filter at 0.15 Hz (–3 dB).

***Analog Audio Output*****Configuration:**

Two stereo pairs, capable of driving two transmitters.

**Source Impedance:**

50Ω, electronically balanced and floating.

**Load Impedance:**

600Ω or greater, balanced or unbalanced. Termination not required or recommended.

**Output Level (100% peak modulation):**

Adjustable from –6 dBu to +24 dBu peak, into 600Ω 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).

**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.



# OPTIMOD-AM 9400

**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 $\Omega$  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 Output*

**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.

**Word Length:**

Software selected for 24, 20, 18, 16 or 14-bit resolution. First-order highpass noise-shaped dither can be optionally added. Dither level automatically adjusted appropriately for the word length.

**Connector:**

Two XLR-type, male, EMI-suppressed. Pin 1 chassis ground, pins 2 and 3 transformer balanced and floating, 110 $\Omega$  impedance.





# OPTIMOD-AM 9400

**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/sec on RJ45 female connector.

***Remote Control (GPI) Interface*****Configuration:**

Eight (8) inputs, opto-isolated and floating.

**Voltage:**

6–15V AC or DC, momentary or continuous. 9VDC 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 VAC or 200–264 VAC, switch-selected on the rear panel, 50–60 Hz, 40 VA.

**Connector:**

IEC, EMI-suppressed. Detachable 3-wire power cord supplied.



# OPTIMOD-AM 9400

**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 1.75" x 14.25" / 48.3 cm x 4.5 cm x 36.2 cm. One rack unit high.

**Shipping Weight & Dimensions:**

18 lbs / 8.2 kg - 23" x 23" x 6"

**EMI:**

Tested according to Cenelec procedures. FCC Part 15 Class A device.

***Warranty*****Five 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.

