



audio processing



OPTIMOD-FM
2300v2

Protect RDS
subcarriers
and your stereo pilot tone
while getting all the loudness
your channel can legally deliver —

clean up
your sound.



Orban's OPTIMOD-FM 2200 audio processor / stereo encoder was renowned in the broadcast industry for delivering that big OPTIMOD sound at a slimmed-down price. OPTIMOD-FM 2300 builds on the 2200's sound, adding stereo enhancement, more powerful equalization, anti-aliased clipping, composite limiting, and full remote control facilities. AES/EBU digital input and output is now standard, as is clock-based automation. Switching between "Two-Band Normal" and "Two-Band Purist" processing is now gap-free.

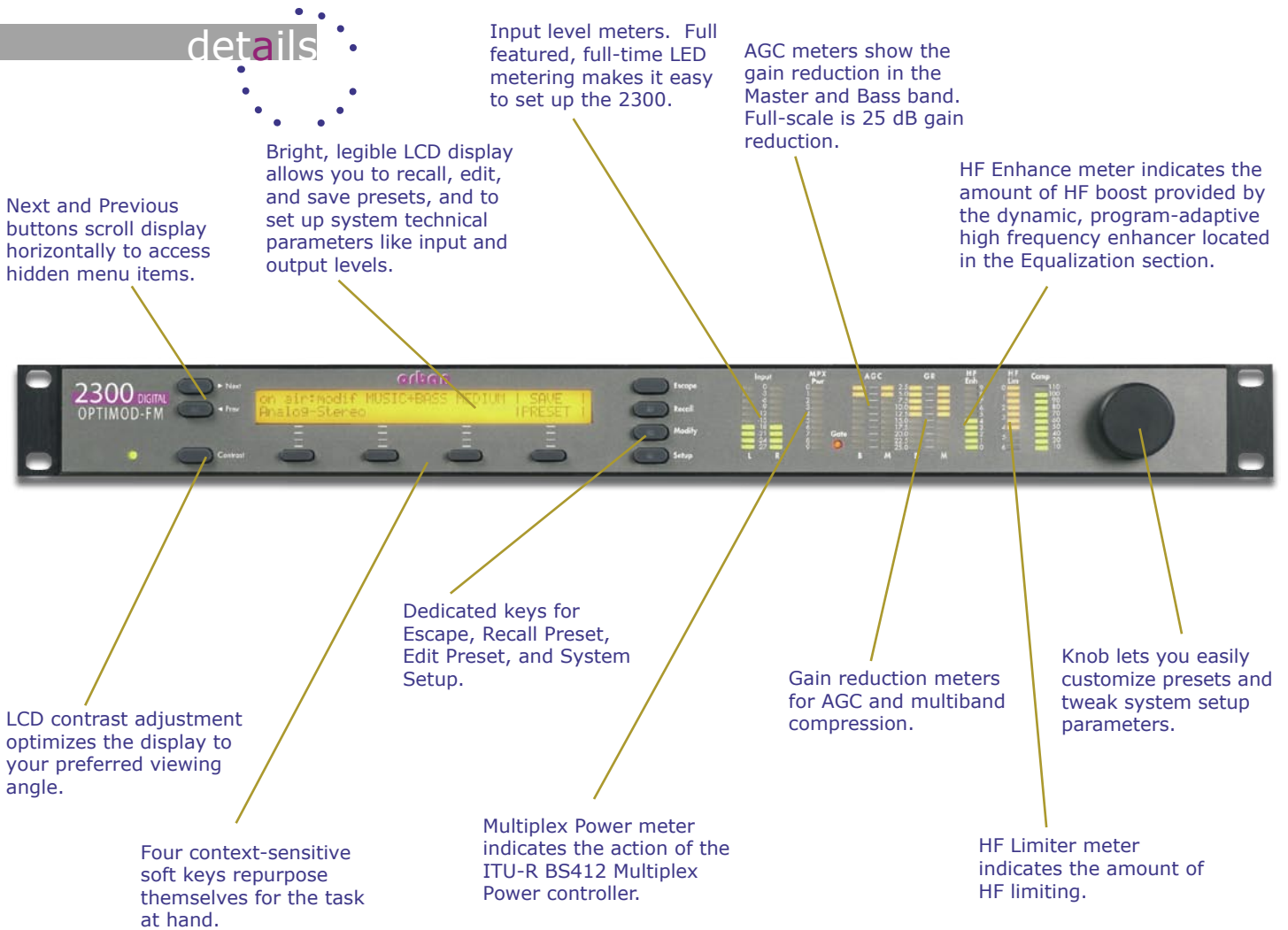
OPTIMOD-FM 2300: Digital Audio Processor with Stereo Encoder



The 2300 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 2300 must be driven (usually via an STL) by a full-featured FM audio processor (like Orban's 8500) that incorporates preemphasis-aware HF limiting and peak control. In both modes, the 2300'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 2300 is the ideal choice for network broadcasters who process with Orban's flagship OPTIMOD-FM 8500 at the network origination point and who need a processor at every transmitter to eliminate STL overshoots (using the 2300's stand-alone stereo encoder mode) and/or to process local insertions while also eliminating network STL overshoots (using the 2300's audio processor /

details



stereo encoder mode). Moreover, the 2300's two modes make it easy for large government and network broadcasters to manage its inventory of spares because any 2300 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 2300's output to meet even the most stringent European government regulations.

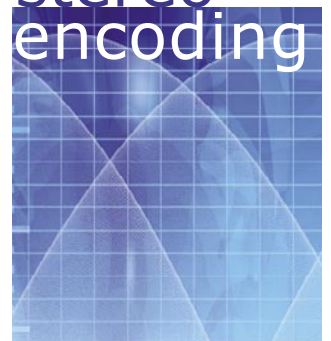
When you use the 2300's audio processing, your signature sound is just a preset away. An easy, one-knob Less/More adjustment allows you to customize any factory preset, trading cleanliness against processing artifacts according to the requirements of your market and competitive environment. Full Control gives you the versatility to customize your audio further.

This versatility makes the 2300 work well with any format. The 2300's optimized technology ensures unusually high average modulation and coverage for a given level of subjective quality.

immaculately

clean

stereo
encoding



The compact 1u form factor makes the 2300 at home in any rack, while its solid, competitive sound makes it an ideal choice for medium and small market stations, non-commercial and educational stations, and any other broadcasters whose aspirations exceed their budgets.

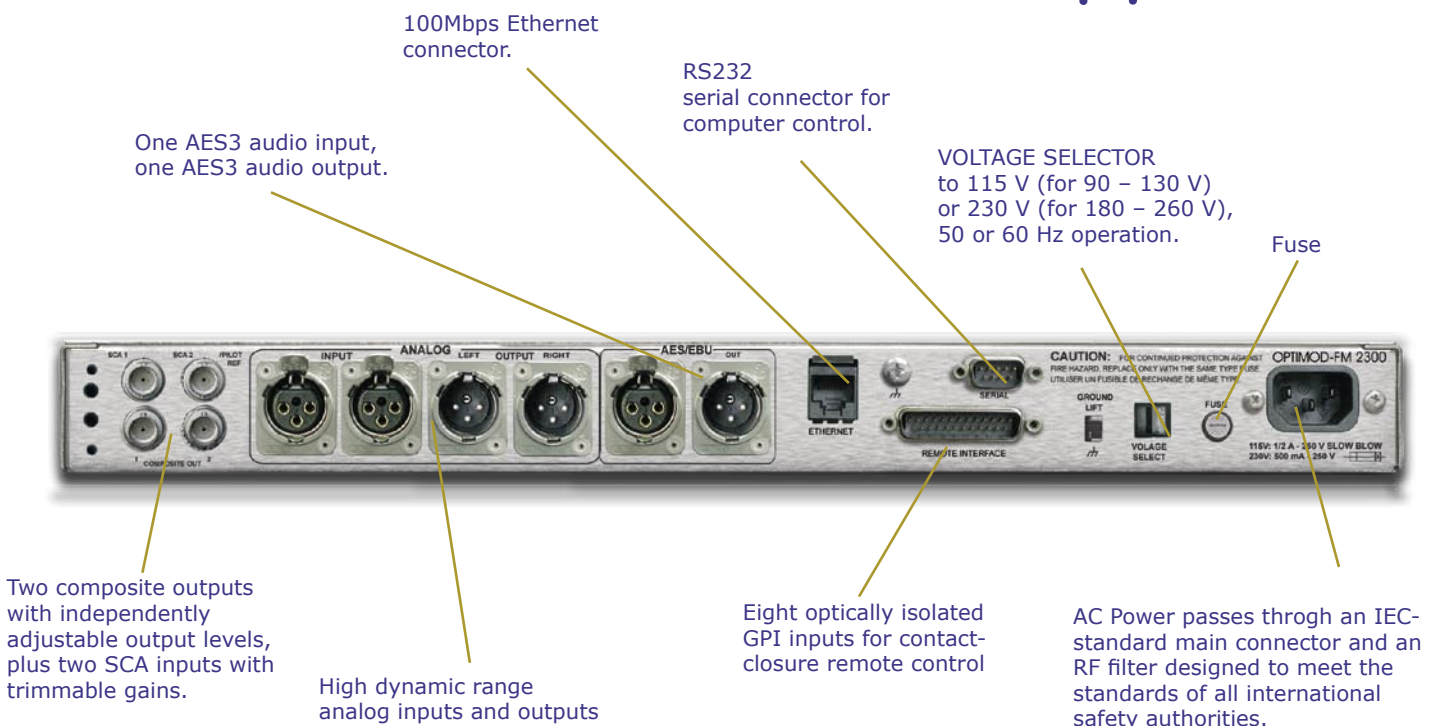
Like its predecessor, the 2300 is remote controllable via eight programmable GPI ports. However, unlike its processor, the 2300 is equipped for remote control via RS232 serial or Ethernet ports, and comes with a full-featured remote control application that runs on Windows 2000 or XP.

If you're concerned about latency because you need to feed live talent headphones off air, you'll be pleased to know that the 2300's processing has only about 5 ms delay, which will keep talent happy. In stand-alone stereo encoder mode, delay is as low as 2 ms.

All input, output and power connections are rigorously RFI-suppressed to Orban's traditional exacting standards, ensuring trouble-free installation. Moreover, the 2300 is designed and certified to meet all applicable international safety and emissions standards.

full-featured I/O
that works in any transmission facility

2300v2



features & benefits

ADVANCED PROCESSING

Universal transmitter protection & audio processing for FM broadcast

The 2300 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.

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

The 2300 has an **internal, DSP-based stereo encoder** (with a patented "**half-cosine interpolation**" **composite limiter** operating at 512 kHz sample rate) to generate the pilot tone stereo baseband signal and control its peak level. This 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**.

Defeatable, extremely accurate multiplex power limiter

In both modes, the 2300 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 2300-processed signal. 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.

Two-band window-gated AGC rides gain

In audio processor mode, the 2300 features a versatile Two-Band processing structure that can be set for loudness processing or for "purist" processing, depending on the user-configurable crossover type (either allpass or phase-linear). In addition, the 2300's **two-band window-gated AGC** 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.

Precise control of audio bandwidth to 15 kHz

In audio processor mode, the 2300 precisely **controls the audio bandwidth** to 15 kHz. This prevents overshoots in uncompressed digital links operating at a 32 kHz sample rate and prevents interference to the pilot tone and RDS (or RBDS) subcarrier. In stand-alone stereo encoder mode, 15, 16 and 17 kHz lowpass filters can be activated as necessary to complement the audio processor driving the 2300.

ABSOLUTE CONTROL OF PEAK MODULATION

Pre-emphasis limiting for the two standard pre-emphasis curves of 50 μ s & 75 μ s

The 2300 provides **pre-emphasis limiting** for the two standard pre-emphasis curves of 50 μ s and 75 μ s. Its pre-emphasis control is seldom audibly apparent, producing a clean, open sound with subjective brightness matching the original program.

Peak control at all outputs

The 2300 achieves extremely tight **peak control** at all its outputs — analog Left/Right, AES/EBU Left/Right, and composite baseband.

Integrated stereo encoder to eliminate the overshoot problems

By integrating the **stereo encoder** with the audio processing, the 2300 eliminates the overshoot problems that waste valuable modulation in traditional external encoders.

FLEXIBLE CONFIGURATION

Analog and AES/EBU digital inputs & outputs

The 2300 includes **analog** and **AES/EBU** digital inputs and outputs. Both digital input and digital output are equipped with sample-rate converters and can operate at 32, 44.1, 48, 88.2 and 96 kHz sample rates. The pre-emphasis status and output levels are separately adjustable for the analog and digital outputs.

Transformerless, balanced 10 k Ω instrumentation-amplifier circuits

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

Two independent composite outputs with digitally programmable output levels

The 2300 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 2300 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. The other input has an internal level trim to accommodate subcarrier generators with output levels as low as 220 mV.

features & benefits

CONTROLLABLE

LCD & 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're adjusting the processor. Navigation is by dedicated buttons, soft buttons (whose function is context-sensitive), and a large rotary knob.

Remote Control

The 2300 **can be remote-controlled** by 5-12 V pulses applied to eight programmable, optically isolated "general-purpose interface" (GPI) ports.

2300 PC Remote application

2300 PC Remote software is a highly graphical application that runs under Windows® 2000 and XP. It communicates with a given 2300 **via TCP/IP** over **modem, direct serial** and **Ethernet connections**. You can configure PC Remote to switch between many 2300s via a convenient organizer that supports giving any 2300 an alias and grouping multiple 2300s into folders. Clicking a 2300's icon causes PC Remote to connect to that 2300 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 2300 features (including advanced controls not available from the 2300'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.

Bypass Test Mode

A Bypass Test Mode can be invoked locally, by remote control (from either the 2300's GPI port or the 2300 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

OPTIMOD-FM's software **can be upgraded** by running Orban-supplied downloadable upgrade software on a PC. The upgrade can occur remotely through the 2300's Ethernet port or serial port (connected to an external modem), or locally (by connecting a Windows® computer to the 2300's serial port through the supplied null modem cable).

IN STAND-ALONE STEREO ENCODER MODE

High internal audio bandwidth

The sample rate 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.

Precision 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.

Silence alarm and digital audio fault tally outputs

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

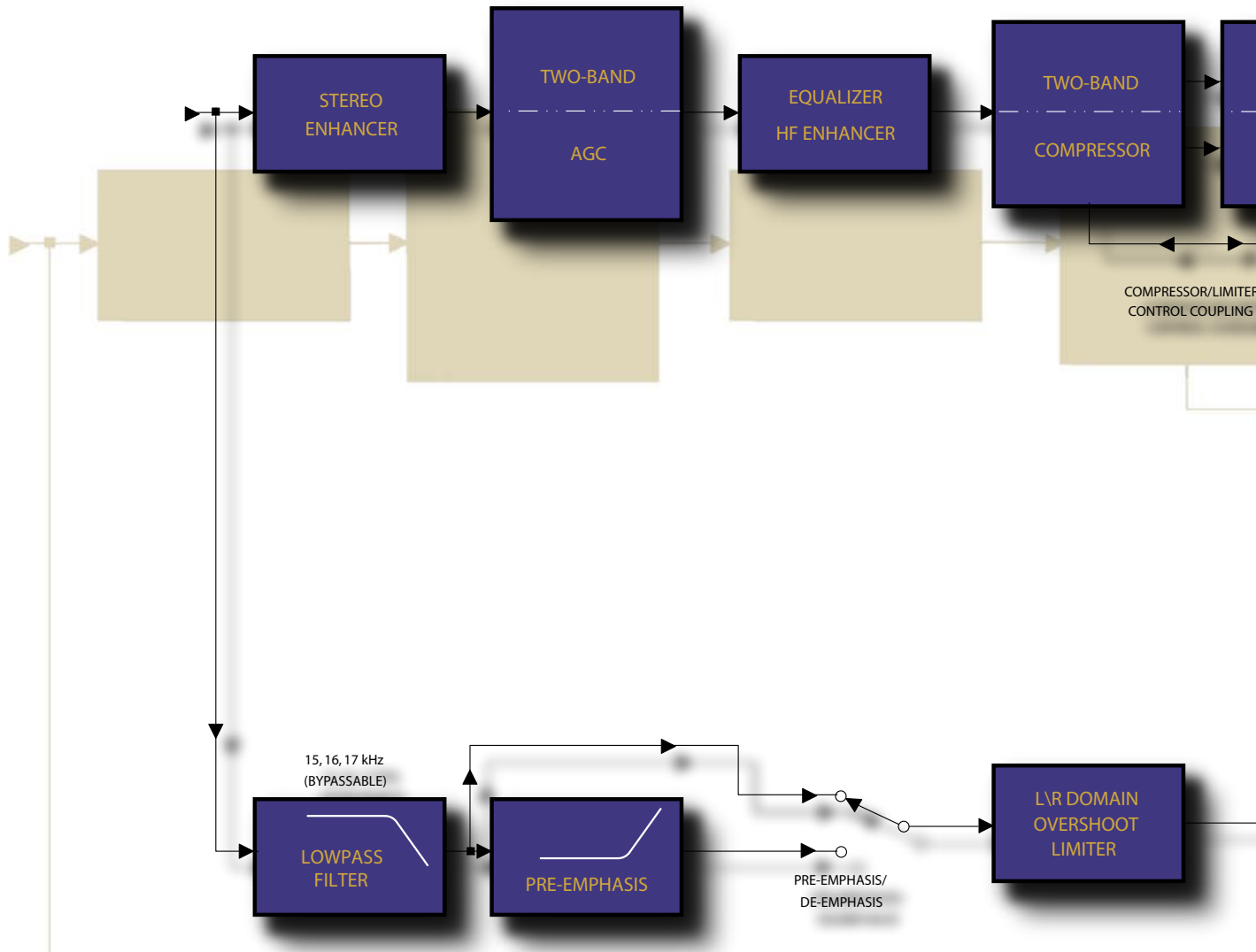
Inputs & Outputs

All normal 2300 **inputs and outputs** are available,

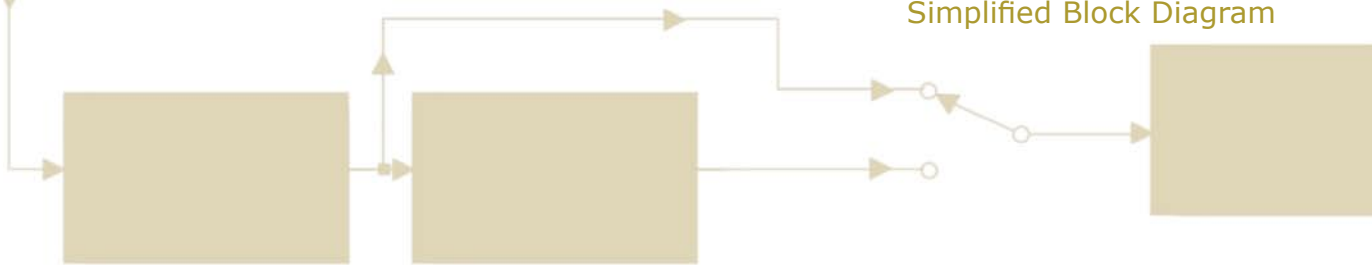
advanced processing

for FM stations with high aspirations & modest budgets

about the 2300's



OPTIMOD-FM 2300 Version 2
Simplified Block Diagram



FM

FM

FM

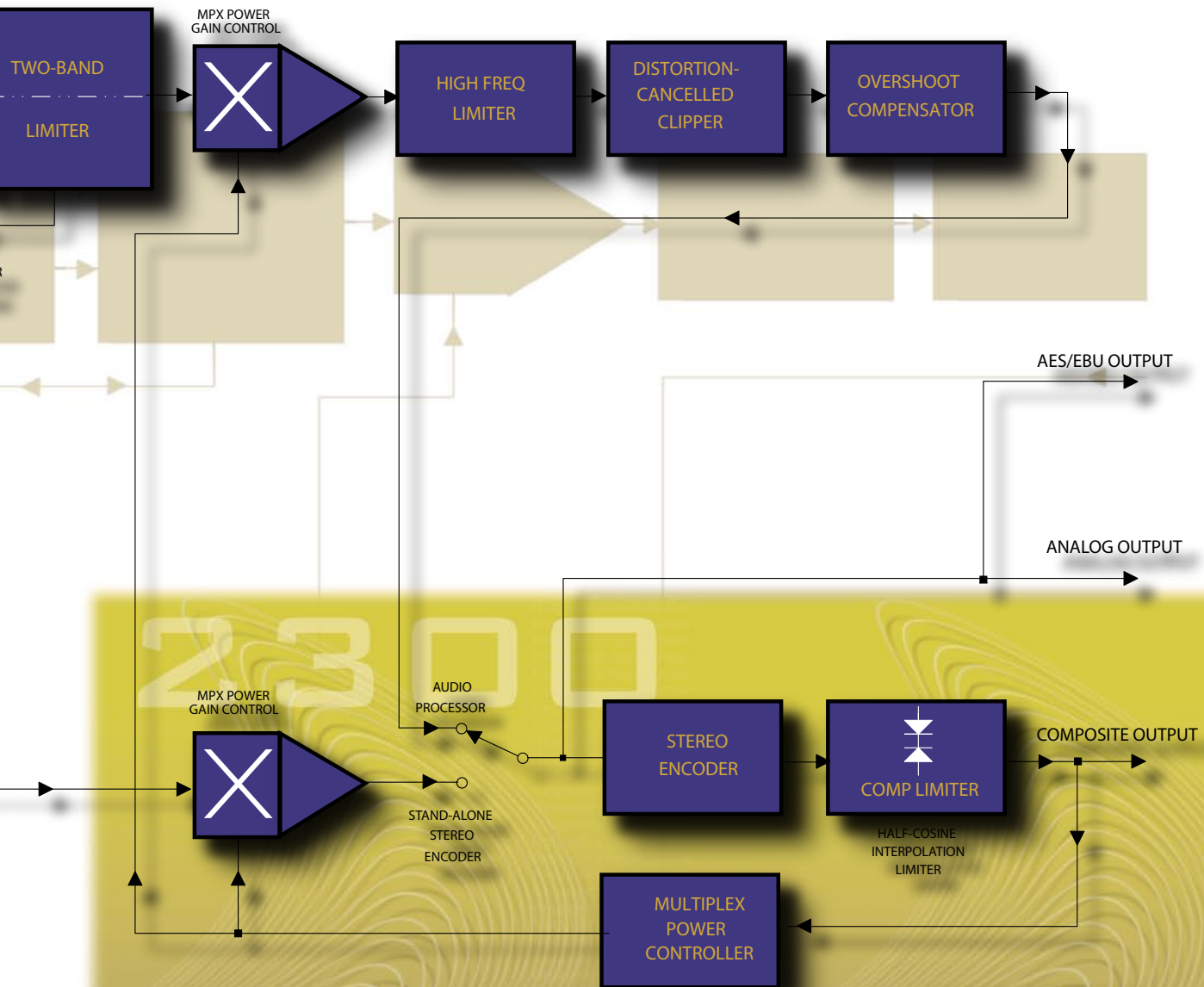
FM

FM

FM

FM

audio processing



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.

Specifications apply for measurements from analog left/right input to stereo composite output and to FM analog left/right output.		
PERFORMANCE	Frequency Response	Follows standard 50 μ s or 75 μ s pre-emphasis curve ± 0.05 dB, 2.0 Hz–17 kHz (stand-alone stereo coder mode); ± 0.10 dB, 2.0 Hz–15 kHz (audio processor mode, below threshold of compression and limiting). Analog Left/Right output and digital output can be user-configured for flat or pre-emphasized output.
	Noise (stand-alone stereo encoder mode, de-emphasized)	<85 dB below 100% modulation.
	Noise (audio processor mode)	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 digital signal processing path has 144 dB (24-bit) dynamic range.
	Total System Distortion (de-emphasized, 100% modulation)	<0.01% THD, 20 Hz–1 kHz, rising to <0.05% at 15 kHz. <0.02% SMPTE IM Distortion.
	Total System L/R Channel Separation	>50 dB, 20 Hz – 15 kHz; 60 dB typical.
	Polarity (Two-Band Purist or Bypass Modes)	Absolute polarity maintained. Positive-going signal on input will result in positive-going signal on output.
	Processing Sample Rate	The 2300 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, sample rate is 64 kHz to 512 kHz.
Input/Output Delay	~5 ms (audio processor mode); 2 ms (stereo encoder mode; L/R overshoot limiter off); 6 ms (stereo encoder mode; L/R overshoot limiter on).	
INSTALLATION	Analog Audio Input	
	Configuration	Stereo.
	Impedance	>10 k Ω load impedance, electronically balanced. (No jumper selection available for 600 Ω . Through-hole pads are available on I/O module for user-installed 600 Ω termination.)
	Nominal Input Level	Software adjustable from -4.0 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 sample rate, which the 2300 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	Stereo. Flat or pre-emphasized (at 50 μ s or 75 μ s), software-selectable. In stand-alone stereo encoder mode, this output emits the same signal that drives the core stereo encoder DSP and includes the effects of input lowpass filtering (if activated) and overshoot limiting.
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 – 15 kHz bandwidth, referenced to 100% modulation).	
L/R Crosstalk	≤ -70 dB, 20 Hz – 15 kHz.	
Distortion	$\leq 0.01\%$ THD (Bypass mode, de-emphasized) 20 Hz – 15 kHz bandwidth.	
Connectors	Two 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, with 64 kHz output sampling rate.	
Filtering	RFI filtered.	
INSTALLATION	Digital Audio Input	
	Configuration	Stereo per AES/EBU 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 Output	
	Configuration	Stereo per AES/EBU standard. Output configured in software as flat or pre-emphasized to the chosen processing pre-emphasis (50 μ s or 75 μ s), with or without J.17 pre-emphasis. In stand-alone stereo encoder mode, this output emits the same signal that drives the core stereo encoder DSP and includes the effects of input lowpass filtering (if activated) and overshoot limiting.
	Sample Rate	Internal free running at 32, 44.1, 48, 88.1 or 96 kHz, selected in software. Can also be synced to the AES/EBU digital input at 32, 44.1, 48, 88.1 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	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.	

INSTALLATION	Composite Baseband Output		
	Configuration	Two outputs, each with an independent software-controlled output level control, output amplifier and connector.	
	Source Impedance	0 Ω voltage source or 75 Ω , jumper-selectable. Single-ended, floating over chassis ground.	
	Load Impedance	37 Ω or greater. Termination not required.	
	Maximum Output Level	+12.0 dBu (8.72 Vp-p).	
	Minimum Output Level	-12 dBu (0.55 Vp-p) for 0.5 dB adjustment resolution.	
	Pilot Level	Adjustable from 6.0% to 12.0%, software controlled.	
	Pilot Stability	19 kHz, ± 0.5 Hz (10 to 40 $^{\circ}$ C).	
	D/A Conversion	24-bit	
	Stereo Encoder Signal-to-Noise Ratio	≤ -85 dB (Bypass mode, de-emphasized, 20 Hz - 15 kHz bandwidth, referenced to 100% modulation, unweighted).	
	Stereo Encoder Distortion	$\leq 0.02\%$ THD (Bypass mode, de-emphasized, 20 Hz - 17 kHz bandwidth, referenced to 100% modulation, unweighted).	
	Stereo Encoder Separation	At 100% modulation = 3.5Vp-p, > 60 dB, 30 Hz - 15 kHz. At 100% modulation = 1.0 - 8.0 Vp-p, > 55 dB, 30 Hz - 15 kHz.	
	Crosstalk-Linear	≤ -80 dB, main channel to sub-channel or sub-channel to main channel (referenced to 100% modulation).	
	Crosstalk-Non-Linear	≤ -80 dB, main channel to sub-channel or sub-channel to main channel (referenced to 100% modulation).	
	38 kHz Suppression	≥ 70 dB (referenced to 100% modulation).	
	76 kHz & Sideband Suppression	≥ 80 dB (referenced to 100% modulation).	
	Pilot Protection	-60 dB relative to 9% pilot injection, ± 250 Hz (up to 2 dB composite processing drive).	
	INSTALLATION	Subcarrier Protection (60 - 100 kHz)	≥ 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).
		57 kHz (RDS / RBDS) Protection	-50 dB relative to 4% subcarrier injection, ± 2.0 kHz (up to 2 dB composite processing drive).
Connectors		Two BNC, floating over chassis ground, EMI suppressed.	
Maximum Load Capacitance		0.047 μ F (0 Ω source impedance). Maximum cable length of 100 ft / 30 m RG-58A/U.	
Filtering		RFI filtered.	
Subcarrier (SCA) Inputs			
Configuration		Subcarrier inputs sum into composite baseband outputs before digitally controlled composite attenuator.	
Impedance		600 Ω .	
SCA1 Sensitivity		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.	
SCA2 Sensitivity		Fixed at 772 mV p-p to produce 10% injection.	
Connectors		Two BNC, unbalanced and floating over chassis ground, EMI suppressed.	
19 kHz Pilot Reference		SCA2 input can be re-jumpered to provide a 19 kHz pilot reference output.	
Remote Computer Interface			
Configuration		TCP/IP protocol via direct cable connect, modem, or Ethernet interface.	
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 VAC or DC, momentary or continuous. 9 VDC 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.		
Tally Output			
Number of outputs	Two.		
Configuration	NPN open-collector.		
Can indicate	Input: Analog, Input: Digital, Analog Input Silent, AES Input Silent, AES Input Error.		
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.		
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 $^{\circ}$ F / 0 to 50 $^{\circ}$ C for all operating voltage ranges.		
Humidity	0 - 95% RH, non-condensing.		
Dimensions (W x H x D)	19" x 1.875" x 14.25" / 48.3 cm x 4.8 cm x 36.2 cm. One rack unit high.		
RFI / EMI	Tested according to Cenelec procedures. FCC Part 15 Class A device.		
Shipping Weight	19 lbs / 8.7 kg		
Warranty			
Two Years, Parts & Service	Subject to the limitations set forth in Orban/CRL's Standard Warranty Agreement.		



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