

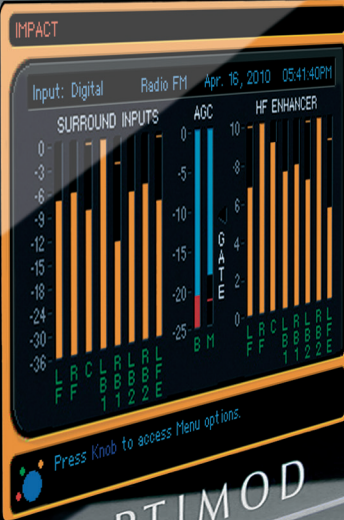


audio processing



orban

8685 SURROUND AUDIO PROCESSOR



OPTIMOD

OPTIMOD SURROUND 8685

SURROUND
TV
SURROUND

From the market leader
in TV audio processing —
surefire loudness control for surround —

stop loudness problems
cold.



Experience has shown that the mass television audience wants two things from television audio: dialog should be comfortably intelligible and commercials should not be irritatingly loud compared to program material. Home theater owners may want the opportunity to watch feature films while hearing a wide dynamic range signal. However, even these viewers usually consume television in a much more passive way when viewing garden-variety programs. To be an acceptable part of the domestic environment, television sound cannot overwhelm household members not interested in viewing (not to mention neighbors, particularly in multi-family dwellings). For a variety of reasons, the dynamic range of sound essential to the intelligibility of the program should not exceed 15 dB in a domestic listening environment. Underscoring and ambient sound effects will, of course, be lower than this.

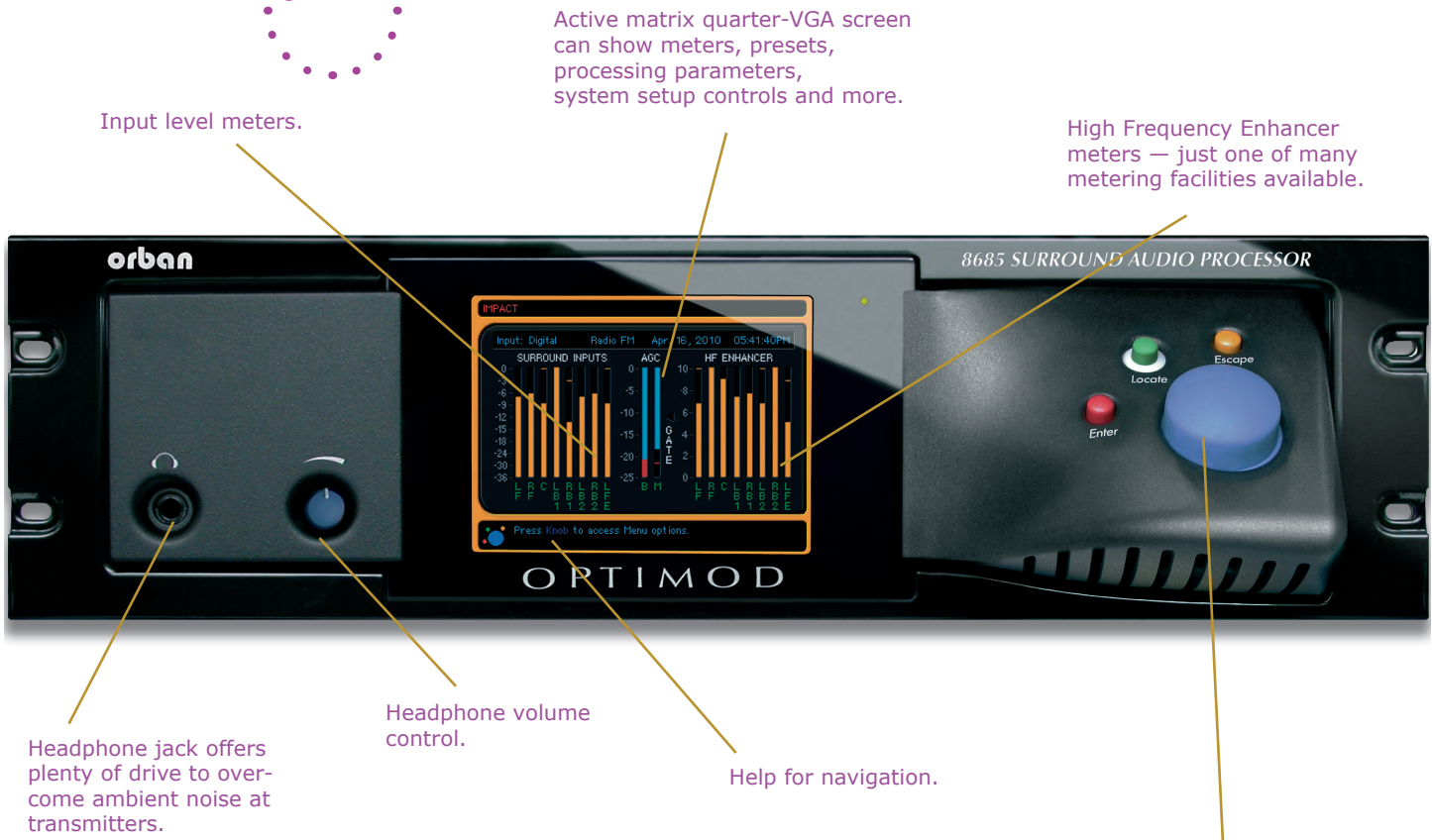
The issue of loud commercials is particularly important. In the U.S., it is against Federal Communications Commission rules to broadcast irritatingly loud commercials. As a result of viewer complaints, the FCC has twice investigated the problem and has recently been tasked by the U.S. Congress (via the CALM Act) to make rules preventing non-program material in digital television broadcasts from being louder than program material.



Orban Television Audio Processing – Sound That Keeps Audiences Listening.

Orban understands such issues well. Since 1980, we have provided analog television broadcasters with industry-standard dynamics processors: OPTIMOD-TV 8180, 8182, 8282, and 8382. In 1998, we introduced OPTIMOD-DAB 6200 — two-channel processing specifically tailored for digital channels using lossy compression like Dolby's AC-3, which is used for ATSC transmissions. Our 6300, introduced in 2006, is a second-generation two-channel processor for digital channels, including DTV, DAB and netcasting.

In typical analog television practice, all audio is applied to a single transmission audio processor that automatically controls the average modulation and the peak-to-average ratio while smoothing out transitions between program elements. Simple compression and peak limiting cannot do this effectively. Starting with the 8182, all OPTIMOD-TV processors have incorporated the CBS Loudness Controller™.


 details


Developed after 15 years of psychoacoustic research at CBS Laboratories, the CBS LC accurately estimates the amount of perceived loudness in a given piece of program material. If the loudness exceeds a preset threshold, the controller automatically reduces it to that threshold. The CBS algorithm has proven its effectiveness by processing millions of hours of on-air programming and greatly reducing viewer complaints. It measures very well when monitored with an ITU-RBS.1770 or R-128 loudness meter.

In ITU parlance, the CBS LC relies on a “short-term” loudness measurement that takes into account the human ear’s loudness integration time — approximately 200 milliseconds. The CBS algorithm’s attack time is fast enough to prevent audible and irritating loudness overshoots — blasts of sound that have viewers scrambling for their remote controls. Loudness control is always smooth and unobtrusive. Unlike “long-term” loudness measurement and control technologies, the CBS LC recognizes that a piece of program material whose average loudness seems acceptable according to a long-term loudness measurement may nevertheless have short sections whose loudness should be reduced because it is extremely annoying. While main purpose of this processing is to control the loudness of commercials, other exuberantly mixed elements can also benefit.

(A good example is applause with whistling.)

for processing demands of

5.1
7.1



OPTIMOD-Surround 8685: Effective Automatic Loudness Control for Up to 7.1 Channels

For many years our television customers have been asking for OPTIMOD-quality surround sound processing along with the ability to process the local insertion of news, weather and sports independently. Our customers know that there is no substitute for the smooth, natural-sounding control that only OPTIMOD provides, particularly with speech material.

Orban's response is the 8685. This next generation OPTIMOD provides the function and control necessary for up to eight channels simultaneously. It can help you achieve the highest audience satisfaction in digital audio broadcasting, digital television, and netcasting.

excellent loudness consistency...

The 8685 features OPTIMOD-quality two-band and five-band audio processing for surround sound broadcasting and netcasting. Thanks to versatile compression ratio controls and a mastering-quality look-ahead peak limiter, the 8685 is also ideal for mastering audio in broadcast productions as well as productions intended for media such as DVD and Blu-ray.

The 8685 starts with the technology of Orban's popular OPTIMOD 6300 and takes it to the next level with surround processing that reflects the latest psychoacoustic research into loudness perception. The 8685's CBS Loudness Controller works in both two-band and five-band modes. Third generation improvements reduce annoyance better than simple loudness control alone, doing so without audible gain pumping.

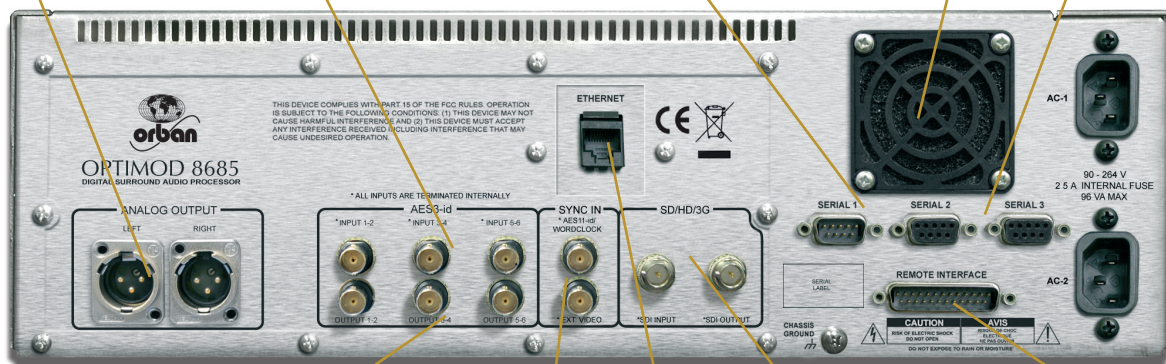
Two analog outputs can emit any output channel or channel pair, including a stereo downmix of the multichannel processing's outputs.

Five AES3id digital inputs – highly configurable via remote-controllable internal routing switchers. The optional HD-SDI board offers HD-SDI I/O along with three AES3id inputs and outputs.

RS232 serial connector for computer control, simple ASCII remote control and future developments.

Dual-redundant power supplies with automatic switchover.

Two RS485 can accept and emit Dolby Digital® metadata.



Six AES3id outputs – highly configurable via remote-controllable internal routing switchers.

Sync input, configurable to accept AES11id or wordclock sync.

HD-SDI input and output supports upto 3Gb/s (3G) rates.

100 Mbps Ethernet facilitates network control.

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

In November 2009, the ATSC published a Recommended Practice entitled Techniques for Establishing and Maintaining Audio Loudness for Digital Television (ATSC a_85-2009), which recommends use of the ITU-R BS.1770 long-term loudness meter algorithm to measure loudness. We have verified that the CBS Loudness Controller as implemented in the 8685 (as well as in Orban's two-channel 6300 and 1101 processors) effectively controls long-term loudness as measured by the BS.1770 algorithm.

The 8685 is two processors in one, offering surround processing for either 7.1 channels or 5.1 channels plus three independent 2.0 channel processors (equivalent to OPTIMOD 6300 processing) that can operate stand-alone with their own CBS Loudness Controllers. Additionally, the first 2.0 processor's output can be mixed into the left and right front channels of the surround processing so that the surround processing's Loudness Controller and lookahead limiters control the loudness and peak level of the mix. Built-in CBS Loudness Meters indicate the subjective loudness of the surround and 2.0 channel processing.

The multichannel and 2.0 processors can operate with separate audio processing parameters like release times, although all 2.0 processors have the same parameters. For example, the 2.0 processing could be set up for relatively heavy processing to make a newsroom feed more consistent, while the main processing was set up more conservatively to correct network material and commercials unobtrusively.

Because the 2.0 processors have their own loudness controllers and peak limiters, another important application is processing subchannels in digital television. Up to three 2.0 subchannels can be processed simultaneously.

The 8685 is built on Orban's flagship hardware platform. This features a GUI displayed on a quarter-VGA active matrix color LCD, making it easy to do all setup and adjustment from the 8685's front panel. To minimize latency and to achieve highest reliability, the 8685 uses a dual hardware architecture. Freescale 24-bit DSP chips do all audio processing while a separate microcontroller supports the GUI and control functions. Even if this controller malfunctions, the 8685 will continue to process audio normally. Minimum latency of the fully processed signal is 21 milliseconds, which can be padded to exactly one frame of delay for any video standard. The low latency headphone feed (containing all processing except for peak limiting) has a latency of approximately 6 ms.

The 8685 and

There are three important pieces of metadata in the AC3 bitstream.

- Dialog Normalization, which in essence sets the receiver's volume control to complement the dynamic range of the program material being transmitted.
- Line-Mode Dynamic Range Control, which allows the receiver to perform wideband dynamics compression if the listener chooses.
- RF-mode Dynamic Range Control, which applies more extreme compression.

When used correctly, these can help address the problem of inconsistent loudness between different sources while allowing viewers to individually choose the amount of dynamic compression they hear. However, experience so far has shown that the metadata implementation in the broadcast chain has often been too haphazard to prevent audience irritation.

Orban believes that the most realistic approach to handling AC3 dialog normalization is a hybrid approach. It is important to consider carefully what program material will truly benefit from the ability to be heard with unprocessed dynamic range. Prime-time dramatic shows, newer feature films, and classical music concerts all use dynamic range for dramatic impact and are therefore candidates for full exploitation of the AC3 DRC metadata.

Dolby Digital® (AC3) Metadata

Material that airs with full Dynamic Range Control implemented should be refined in production so that it sounds polished and consistent without further processing. Each show, film, and concert must have a dialog normalization value pre-assigned to it, derived from a long-term loudness meter or by human audition. It is probably impractical to pass through, without review, dialog normalization values created by program and commercial providers because some commercial providers will inevitably try to game the system to make their commercials excessively loud. Instead, if dialog normalization is to be actively used in transmission, the broadcaster must strip its existing value from the program and then must preview each piece of program material, replacing the value with one that will ensure consistency from one piece of program material to the next.

Even program segments whose Dialnorm value is set automatically according a long-term loudness measurement like ITU BS.1770 and R-128 may still have short-term loudness peaks that are extremely annoying. Any program material that will not benefit from being heard with full dynamic range should be processed with the 8685 so that viewers can hear the audio comfortably. They should not be blasted by loud effects or commercials or being forced to strain to understand dialog. Most program material, including commercials, live news, sports, most documentaries, game shows, talk shows, soap operas, and pop music videos and concerts, can receive 8685 processing. The 8685 controls subjective loudness very well, so a single dialog normalization value can be applied to all program material whenever the 8685 is online. The advantage of this strategy is that the 8685 will guarantee that all of this material is comfortably listenable and that commercials are not excessively loud. With the possible exception of sport and some concerts, this program material does not rely on extreme dynamic range to make its point, so it is unlikely that compression will damage the artistic integrity of this programming -- no one needs

more dynamic range on talk shows or on the local news! The 8685 can smoothly activate and defeat its dynamics processing on-air via GPI triggers or other remote control, so it is easy to implement this strategy.

Another important 8685 feature is "automatic re-equalization" of program material. The 8685's multiband compressor can automatically re-equalize program material towards a preset target spectral balance by applying more gain reduction to frequency bands containing more power. The 8685's compressor's band coupling controls determine the maximum amount of re-equalization permitted.

In the two-band compressor, re-equalization controls excessive bass, which can otherwise cause muddy balances. The five-band compressor can perform more detailed automatic re-equalization, which can be particularly useful for program material such as live news and for any material where dialog intelligibility is a problem. Approximately 60% of digital OPTIMOD-TV users use two-band compression; the rest use five-band compression.

Dynamic range compression in Dolby Digital (using DRC metadata to achieve compression at the receiver) is a simple dynamic gain adjustment performed over the entire audio bandwidth; it does not do automatic re-equalization. The level detector determining the amount of DRC compression can be frequency-contoured to mimic the equal-loudness curves of the ear and has the ability to "look ahead" at upcoming program level changes. This is sufficient for many applications, but may be improved with the addition of a multiband device like the 8685 to handle certain programming that may not get sufficient treatment from a single-band device like that in DRC.

The 8685 can convey and process Dolby Digital metadata. See Conveying and Re-authoring Dolby Metadata in the Specifications section.

features & benefits

USER-FRIENDLY INTERFACE

Color LCD and large rotary knob

A large (quarter-VGA) **color liquid crystal display** (LCD) makes setup, adjustment and programming of the 8500 easy. Navigation is by a miniature joystick, two dedicated buttons, and a large rotary knob. The LCD shows all metering functions of the processing structure in use.

Navigation Joystick

Use the Locate **joystick** to navigate through a menu that lets you recall a preset, modify processing (at three levels of expertise), or to access the system's setup controls.

ABSOLUTE CONTROL OF PEAK MODULATION

Precise control of peak levels

The 8685 **precisely controls peak levels** to prevent digital clipping. The maximum level of the digital samples is controlled to better than 2%.

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

While **primarily oriented toward "flat" media**, the 8685's 2.0 channel processor can also provide pre-emphasis limiting for the two standard pre-emphasis curves of 50 μ s and 75 μ s. This allows it to protect pre-emphasized microwave links, satellite uplinks and similar channels where protection limiting or light processing is required.

Note that the 8685's 2.0 channel processing cannot provide simultaneous, independent audio processing for flat and preemphasized channels. Even though one output may be pre-emphasized while other is flat, the only difference between the outputs is that the "flat" output has de-emphasis applied to it after the processing while the preemphasized output does not.

FLEXIBLE CONFIGURATION

Four processors in one

A gain-coupled multichannel processor for **up to 7.1 channels**, plus three additional, **independent 2.0 channel processors** (whose performance is equivalent to an OPTIMOD 6300) that can be used for many tasks such as processing the audio for a second language or up to two ATSC subchannels. Because the output of 2.0 processor #1 can be mixed into the LF and RF outputs of the multichannel processing, the 2.0 channel processors can also be used to **process independent feeds** (like the output of a sports truck, news truck, or newsroom) before they are mixed with the station's main multichannel audio path.

Separate audio processing parameters for surround and 2.0 processors

The multichannel and 2.0 processors can operate **with separate audio processing parameters** like release times. For example, the 2.0 processing could be set up for relatively heavy processing to make a newsroom feed more consistent, while the main processing was set up more conservatively to correct network material and commercials unobtrusively.

AES3id Inputs & Outputs

The base 8685 configuration includes **five AESid digital inputs** and **six AES3id outputs**, all **transformer-coupled**. These inputs and outputs appear on BNC connectors and have 75 Ω impedance. The digital inputs and digital outputs have samplerate converters and can operate at 32, 44.1, 48, 88.2 and 96 kHz samplerates. The **optional HD-SDI I/O board** instead offers **HD-SDI I/O, three AES3id inputs, three AESid outputs and one (+ loop) video sync reference input**.

Configurations via remote-controllable internal routing switchers

OPTIMOD 8685's inputs and outputs are highly configurable **via remote-controllable internal routing switchers**. Additionally, the outputs of the multichannel and 2.0 processing chains can be independently configured to emit the output of the **AGC** or the output of the **multiband compressor/limiter**, all configurable to use or bypass look-ahead limiting.

features & benefits

FLEXIBLE CONFIGURATION *(continued)*

Use **8685** as an **AES splitter** Via the internal output routing switcher, a given output signal can be applied to more than one hardware output. This allows using the 8685 as an **AES splitter**.

Stereo analog monitor output For both the base I/O configuration and the optional HD-SDI module, a **stereo analog monitor output** appears on XLR connectors on the rear panel. It can be configured to emit any 8685 output signal, including a downmix of the multichannel audio. The analog outputs are transformerless, balanced, and floating (with 50 Ω impedance) to ensure highest transparency and accurate pulse response. They can be used to drive a transmitter, although their normal function is monitoring.

Stereo headphone jack A **stereo headphone jack** is available on the front panel. It can be configured to emit any 8685 output signal and is independent of the stereo analog monitor output.

RS485 ports for Dolby Digital Metadata I/O Two **RS485 serial ports** allow the 8685 to **accept and emit Dolby Digital metadata**. If the optional **HD-SDI module** is installed, metadata can also be de-embedded and re-embedded in the **HD-SDI V-AUX** area and, if the **Dolby E modules** are installed, de-embedded from and re-embedded into **Dolby E data** that is conveyed either through from the HD-SDI connection or the AES3id connections.

Dual-mono mode The 8685's 2.0 processing offers a **dual-mono** mode that allows two entirely separate mono programs to be processed, facilitating multiple-language operation.
In this mode, both processing channels operate using the same processing parameters (like release time); you cannot adjust the two channels to provide different processing textures.

Sync Input An **audio sync input** is configurable to accept **AES11id** or **wordclock sync**. You can synchronize the output samplerate of all AES3id outputs to this input. You can also **synchronize the outputs to the AES3 digital input #1 or to the 8685's internal clock**.
The sync source of each AES3 output is independently selectable.

Dual power **Dual power supplies** with independent AC line inputs provide redundant operation.

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

Certified The 8685 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 8685 realizes its processing structures as a series of high-speed mathematical computations made by Digital Signal Processing (DSP) chips.

Two processing structures The 8685 features two processing structures: **Five-Band** for a spectrally consistent sound and **Two-Band** for a more transparent sound that preserves the frequency balance of the original program material.

"Protect" function A special Two-Band preset creates a no-compromise **"Protect"** function that is functionally similar to the "Protect" structures in earlier Orban digital processors.

features & benefits

ADAPTABILITY THROUGH MULTIPLE AUDIO PROCESSING STRUCTURES *(continued)*

Rides gain over an adjustable range of up to 25 dB

The 8685's **AGC rides gain** over an adjustable range of up to 25dB, compressing dynamic range and compensating for both operator gain-riding errors and gain inconsistencies in automated systems. The AGC output is available to drive STLs, so the 8685 can be used as a studio AGC.

Switching between processing structures

The Five-Band and the Two-Band structures can be switched via a **mute-free crossfade**.

Phase-linear processing structures

The 8685's processing structures are all **phase-linear** to maximize audible transparency.

Mastering-quality noise and distortion performance

The 8685's equalizers and crossovers use 48-bit arithmetic to ensure **mastering-quality noise and distortion performance**.

CBS Loudness Controllers™

The 8685 includes third-generation **CBS Loudness Controllers™** for DTV applications. **Separate loudness controllers are available in the multichannel and 2.0 processing chains** and work with the both Two-Band and Five-Band structures. The third-generation improvements **reduce annoyance more than simple loudness control alone**, doing so without audible gain pumping. Attack time is fast enough to prevent audible loudness overshoots, so the control is smooth and unobtrusive.

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. It is particularly useful when processing for netcasts or mastering for any low bitrate channel.

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 or mastered by other processing than OPTIMOD. There are several factory presets tuned specifically for low bitrate codecs.

CONTROLLABLE

Eight programmable, optically isolated GPI ports

The 8685 **can be remote-controlled** by 5-12 V pulses applied to eight programmable, optically isolated "general-purpose interface" (GPI) ports.

8685 PC Remote software

8685 PC Remote software is a smooth, responsive graphical application that runs under Windows XP, Vista and 7. It communicates with a given 8685 **via TCP/IP** over **modem, direct serial** and **Ethernet connections**. You can configure PC Remote to switch between many 8685s via a convenient organizer that supports giving any 8685 an alias and supports grouping multiple 8685s into folders. Clicking an 8685's icon causes PC Remote to connect to that 8685 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 8685 features 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.).

features & benefits

CONTROLLABLE (continued)

Remote administration over TCP/IP

An API provides **remote administration over TCP/IP via the RS232 serial or Ethernet ports**. The 8685 hosts a TCP/IP terminal server to allow external control of the 8685 from either a Telnet/SSH client or a custom third party application. All commands are **simple text strings**. You can recall presets, operate the input and output routing switchers and more. Password security is provided.

Versatile real-time clock

The 8685 contains a versatile **real-time clock**, which allows automation of various events (including recalling presets) at pre-programmed times. To ensure accuracy, the clock can be synchronized to an Internet timeserver.

Silence Alarm & Tally Outputs

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

Bypass Test Mode

A **Bypass Test Mode** can be invoked locally, by remote control (from either the 8685's GPI port or the 8685 PC Remote application), or by automation to permit broadcast system **test and alignment** or "proof of performance" tests.

Built-in line-up tone generator

The 8685 contains a built-in **line-up tone generator**, facilitating quick and accurate level setting in any system.

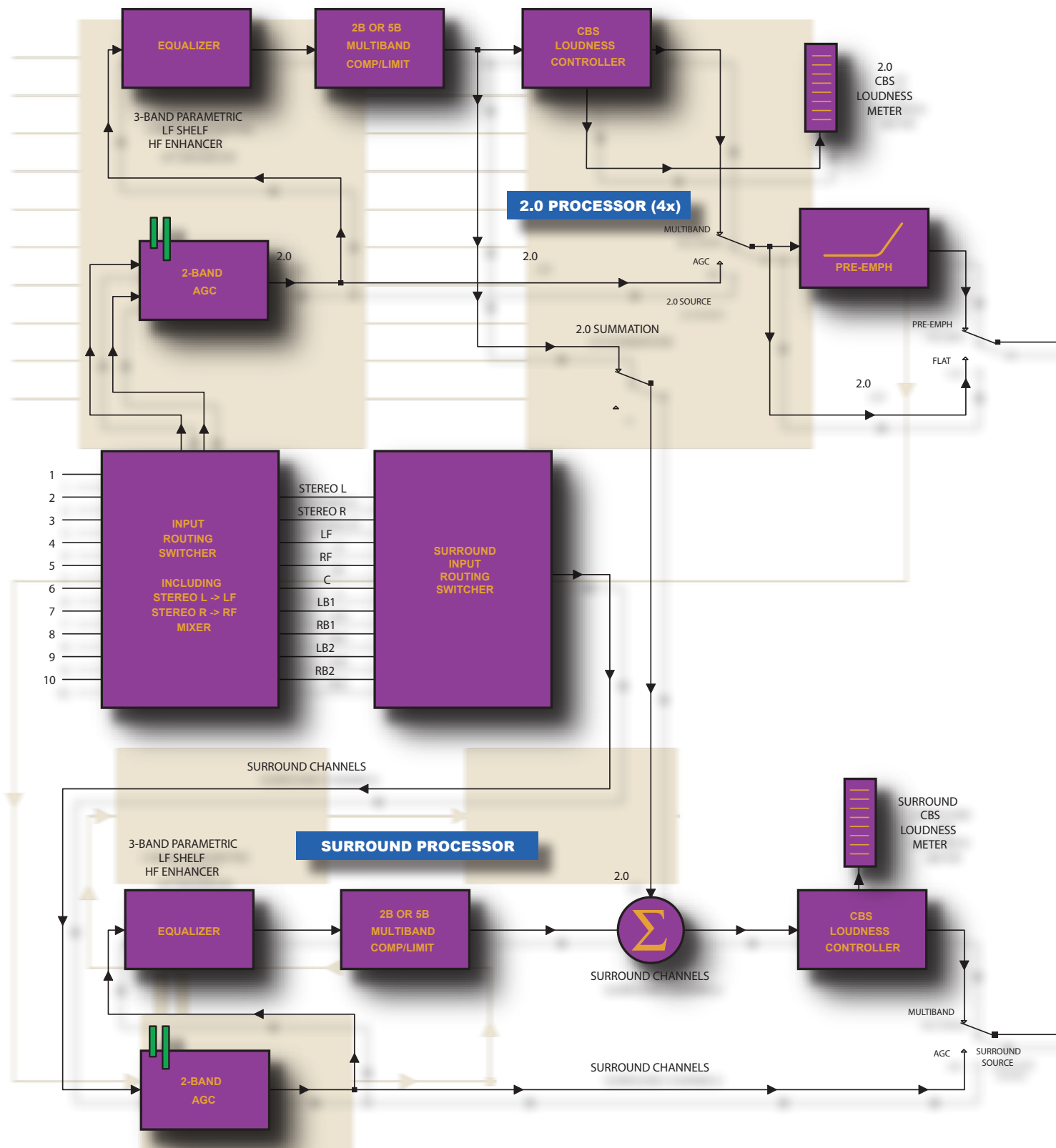
Software Upgrade

The 8685's software **can be upgraded** by running Orban-supplied downloadable upgrade software on a PC. The upgrade can occur remotely through the 8685's Ethernet port or serial port (connected to an external modem) or locally (by connecting a Windows® computer to the 8685's serial port through the supplied null modem cable).



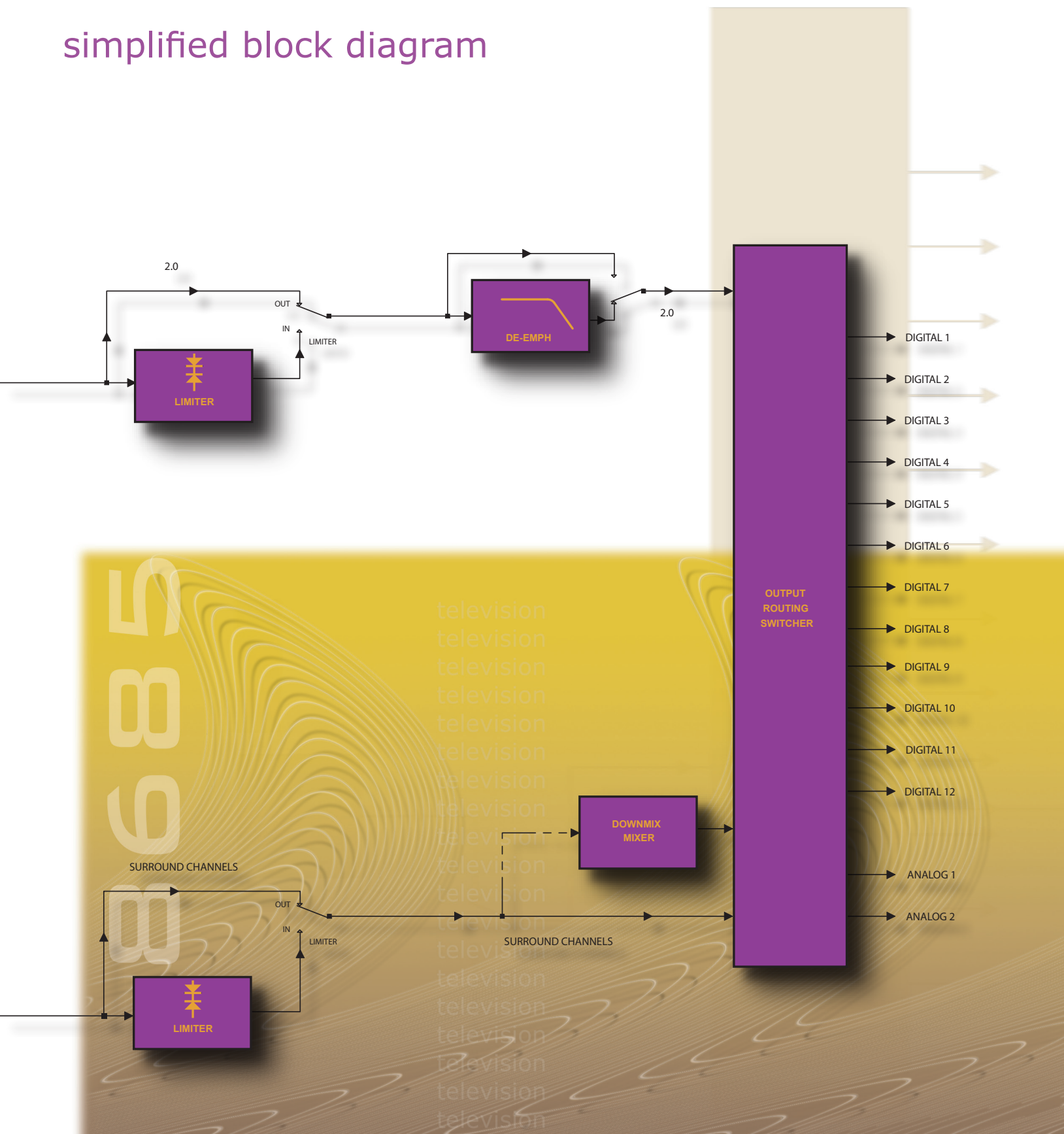
Optimod technology

surrounding and serving your audience

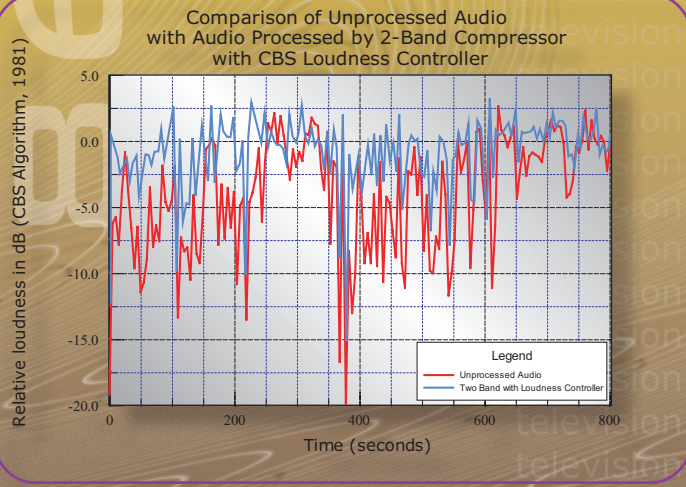
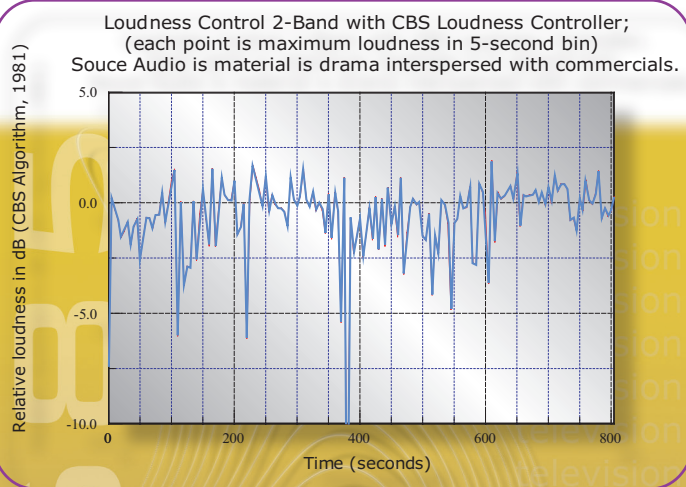
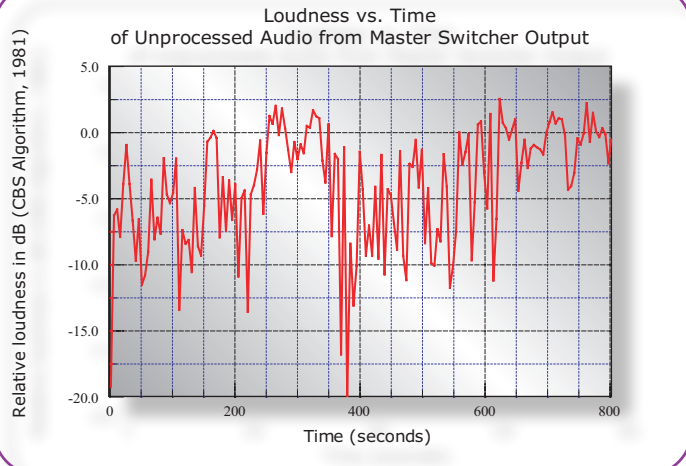


SURROUND TV SURROUND T

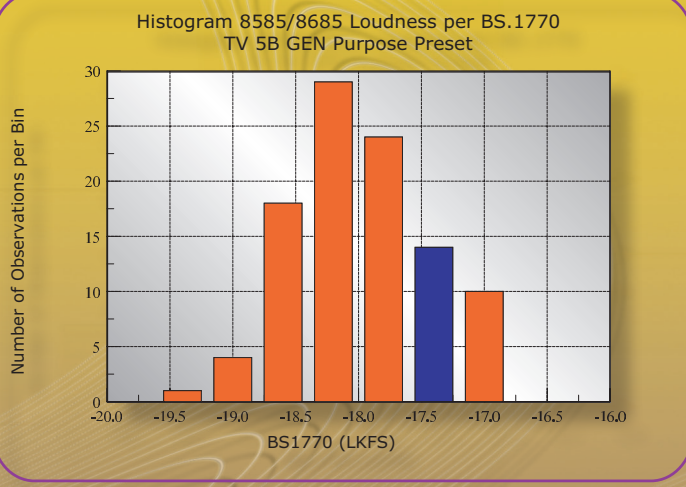
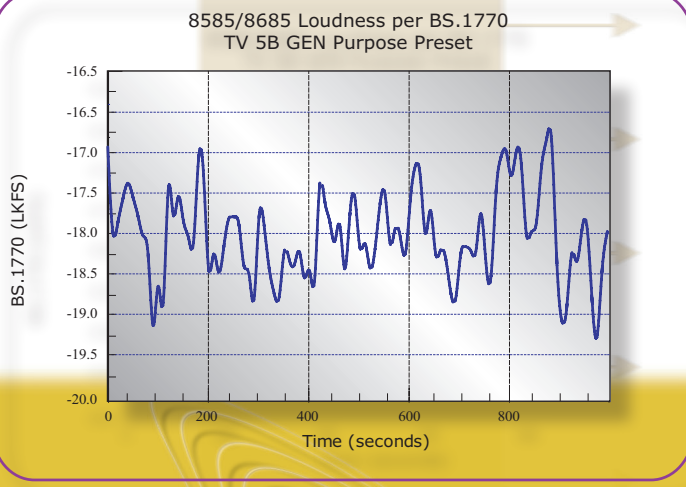
simplified block diagram



Automatic Loudness Control in Television Broadcast: Orban's Implementation of the CBS Loudness Meter and Loudness Controller



Loudness control of the 8585/8685 when loudness is measured using the ITU-R BS.1770 algorithm



Penteo 2.0 to 5.1 Upmixing

When the 8585 (the 8685's predecessor) was first introduced, we chose not to include 2.0 to 5.1 surround synthesis. There were several technical reasons (including stereo and mono downmix compatibility), but our dominant concern was the subjective quality of the algorithms, none of which sounded fully convincing and some of which sounded downright ridiculous.

Since then, we have evaluated and licensed the Penteo® Surround "panorama slicing"™ algorithm (<http://www.penteosurround.com>). For the first time, we heard an upmix that sounds like discrete five-channel while preserving the balance of the stereo source without coloration. We were particularly impressed by Penteo's ability to place dialog firmly in the center channel even when the mix includes other elements placed around the stereo soundstage. Moreover, Penteo surround material downmixes back to the original stereo, absolutely respecting the vision of the original mixing engineers.

"The Penteo system is based on entirely new stereo analysis" says John Wheeler, Penteo, LLC founder and inventor of the new technology. "We believe it's the first truly significant breakthrough in the art of converting stereo into 5.1 surround sound in the last 15 years."

Orban's Penteo upmixer for the 8685 resides in a stand-alone 1 rack unit chassis that is controlled by the 8685 via an Ethernet connection. The Penteo unit will only upmix if it detects a controlling 8685 on the same subnet; otherwise it will remain in "pass-through" mode.

The Penteo upmixer has three AES3 inputs and three AES3 outputs. In an 8685 without the optional HD-SDI I/O card, the Penteo upmixer is placed immediately before the 8685's inputs in the signal chain. In 8685s with the HD-SDI card, the card's three AES3 inputs and outputs allow the Penteo upmixer's I/O to be wired in a loopthrough configuration that allows audio originally embedded in the HD-SDI bitstream to be sent to the Penteo upmixer and then to the 8685 for loudness processing.

The Penteo upmixer expects stereo material to be applied to its Lf/Rf input. Program-adaptive automatic mode switching is available, where the Penteo detects whether its input is receiving stereo or 5.1 material and automatically activates upmixing if it detects stereo. If 5.1 material is detected, it is passed through to the Penteo's output with the same delay as the upmixed material, preserving lip-sync. One can also control the Penteo's modes from the 8685 by using its GPI, clock-based automation, terminal mode via RS232 or Ethernet, or PC Remote via RS232 or Ethernet.

The combined delay of the Penteo and 8685 processing is a minimum of about 214 ms and can be padded to exactly 7 frames of video. The 8685's optional HD-SDI card automatically delays the video to maintain lip-sync. In installations without the HD-SDI card, the video delay must be implemented elsewhere.

HD SDI and Dolby E Option Board

The 8685 is available with an optional HD-SDI interface board that can optionally support Dolby-E encode and decode. The board can de-embed up to eight channels of audio, send them to the 8685's DSP for audio processing, and then re-embed them with video that has been delayed to maintain A/V sync. There are four variants (see Specifications section for details).



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	Frequency Response (Bypass Mode)	Surround Processing: ± 0.10 dB, 20 Hz – 20 kHz for 44.1 kHz or higher input/output samplerates. At 32 kHz input and/or output samplerate, the passband is reduced to approximately 14.7 kHz. 2.0 Processing: Depending on settings, is flat or follows standard 50 μ s or 75 μ s pre-emphasis curve ± 0.10 dB, 20 Hz–20 kHz (except at 32 kHz; see above). Output can be user-configured to be flat or pre-emphasized. (Pre-emphasis limiting is offered to accommodate certain older analog studio/transmitter links.)
	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.
	Polarity (Bypass Mode)	Operate Mode when processing chain is configured for linear phase): Absolute polarity maintained. Positive-going signal on input will result in positive-going signal on output.
	Internal	Processing Samplerate: 48 kHz. We believe this provides maximum audible transparency by minimizing numerical "noise" in the equalizers and filters while still preserving a pure, transparent sound. The double-precision equalizers and crossover filters used throughout the 8685 produce at least 6 dB lower noise and nonlinear distortion than they would at 96 kHz.
	Processing Resolution	Internal processing has 24 bit (fixed point) or higher resolution; uses Freescale (formerly Motorola) 250 MHz dual-core DSP chips.
	Delay	The minimum available input/output delay is approximately 20 ms with look-ahead limiting active and 6 ms with look-ahead limiting bypassed. This can be padded to exactly one frame of 24, 25, 29.97 or 30 frames / second video up to a maximum delay of 50 ms.
	Surround Processing Stereo Coupling	All channels of the AGC and compressors are coupled using r.m.s. summation. The user can select whether or not the LFE channel contributes to the r.m.s. sum in the AGC and compressor control sidechains. Peak limiters in the multiband compressor limiter and look-ahead limiters all operate uncoupled to prevent transients in a given channel from causing audible loudness modulation in other channels.
	2.0 Processing Stereo Coupling	Stereo or dual-mono. In dual-mono mode, both processing channels have the same subjective adjustments (as determined by the active preset) but are otherwise independent, making this mode appropriate for dual-language transmissions. In stereo mode, the user can set the maximum permitted gain difference between the channels in each band of the multiband compressor/limiter. 2.0 Stereo/Dual-Mono operating mode can be set via GPI, Ethernet and serial connections, internal clock-based automation, and AES3 Status Bits.
	Loudness Level Meter (x3)	One meter for the surround processing and one meter for the 2.0 processing, both meters realized in software. In the 2.0 processor's dual-mono mode, each mono channel has its own loudness meter. Meter can be displayed on the 8685's front-panel screen and on its PC Remote software. There are two meters, a short-term meter and long-term meter, which are displayed simultaneously. The long-term meter uses the ITU BS.1770 algorithm. The short-term meter's display time constants are matched to the loudness integration time of the human ear, reaching steady-state level in approximately 200 ms and having a decay time constant of approximately 300 ms. The short-term meter uses the Jones & Torick algorithm developed at CBS Technology Center. (B. L. Jones & E. L. Torick: "A New Loudness Indicator for Use in Broadcasting," J. SMPTE, September 1981, pp 772-777.)
	Base Configuration	
Digital Audio Input (x5)		
Configuration	Each of five hardware inputs accepts two audio channels per AES3id standard, 24 bit resolution. Internal programmable routing switcher allows any of the 10 physical input channels to be routed to the LF, RF, C, LB1, RB1, LFE, LB2, RB2, STEREO L, or STEREO R inputs of the audio processing. For the 2.0 processing, unit can detect Stereo or Two-Channel status bits appearing at Input #1 and switch the 2.0 processor between stereo and dual-mono modes.	

INSTALLATION	Digital Audio Input (continued)		
	User Bits	Unit can pass AES3id User Bits from Input #1 to Output #1.	
	Sampling Rate	32, 44.1, 48, 88.2 or 96 kHz, automatically selected.	
	Connector	BNC, female, shell bypassed to chassis via 1000 pF capacitor, EMI-suppressed. 75 Ω impedance, terminated.	
	Input Reference Level	Variable from -30 dBfs to -10 dBfs.	
	Filtering	RFI filtered.	
INSTALLATION	Digital Audio Output		
	Configuration	AES3id. Internal, remote-controllable routing switcher allows sending LF, RF, C, LB1, RB1, LFE, LB2, RB2, STEREO L, STEREO R, DOWNMIX L and DOWNMIX R to any hardware output channel.	
	Sampling Rate	Internal free running at 32, 44.1, 48, 88.1 or 96 kHz, selected in software. Can also be synced to the AES3id Input #1, or to the sync input (which supports AES11id and word-clock) at 32, 44.1, 48, 88.1 or 96 kHz, as configured in software. (Passband is limited to approximately 14.7 kHz when using 32 kHz input and/or output samplerate.)	
	Word Length	Software selected for 24, 20, 18, or 16-bit resolution. First-order highpass noise-shaped dither can be optionally added, Dither level is automatically adjusted to complement the word length.	
	Connector	BNC, female, shell bypassed to chassis via 1000 pF capacitor, EMI-suppressed. 75 Ω impedance, terminated.	
	Output Level	(100% peak modulation): -20.0 to 0.0 dBfs software controlled.	
INSTALLATION	Filtering		
	RFI filtered.		
	Optional HD-SDI Input/Output Interface Module		
	Option #1		
	HD-SDI Input/Output Interface Module	Replaces the base I/O module, which offers only AES3id input/output. Supports 1.5 Gbit/s HD-SDI (SMPTE 292M; up to 720p and 1080i) and 3.0 Gbit/s single-wire HD-SDI (SMPTE 424M; 1080p).	
		Includes three AES3id inputs, three AESid outputs, one (+ loop) video reference input, and a pair of analog outputs. In addition to the ability to receive and emit The program audio, the AES3id I/O can be configured as a loop-through to support Orban's external Penteo upmixer. The AES3id I/O offers the same performance as the AES3id I/O in the base configuration above.	
Sockets exist to accept Dolby E encoder/decoder modules; unit is field-upgradeable to support Dolby E.			
Includes up to 11 frames of video delay to preserve A/V sync. Normal 8685 loudness control processing requires one frame of delay; the Penteo upmixer requires an additional seven frames of delay.			
Includes a video reference input (per SMPTE 274M and SMPTE 296M) that can be used to correctly align Dolby E frames with video per Dolby's requirements (SMPTE RDD 6-2008 and Dolby Labs published specifications) in cases where HD-SDI is not in use. When HD-SDI is in use, frame sync is obtained from the HD-SDI input stream.			
Option #2			
HD-SDI Input/Output Interface Module with Dolby E Decoder	Base configuration (Option #1) with the addition of a Dolby E Decoder module. Can accept a Dolby E bitstream from HD-SDI or AES3id inputs and decode it to PCM for 8685 audio processing or for direct AES3id and HD-SDI outputs. Supports Dolby E metadata received through HD-SDI and RS485 interfaces.		
Option #3			
HD-SDI Input/Output Interface Module with Dolby E Encoder	Base configuration (Option #1) with the addition of a Dolby E Encoder module. Can encode PCM outputs from the 8685 audio processor or PCM received from HD-SDI or AES3id inputs into the Dolby E bitstream.		
	Can emit Dolby E metadata from an RS485 serial port and through HD-SDI.		
Option #4			
HD-SDI Input/Output Interface Module with Dolby E Decoder and Encoder	Base configuration (Option #1) with the addition of Dolby E Decoder and Encoder modules.		
	Accepts and emits Dolby E bitstreams from the HD-SDI and AES3id I/O. Supports Dolby E metadata through HD-SDI and RS485 serial ports.		
INSTALLATION			



Optional HD-SDI Input/Output Interface Module

Conveying and Re-authoring Dolby Metadata

The 8685 can, via an SMPTE Rdd06-2008-compliant RS-485 serial connection, via an HD-SDI connection (when the optional HD-SDI module is installed), or via embedded Dolby-E metadata (when the optional Dolby-E modules are installed in the HD-SDI module), automatically convey its active surround metadata value to a downstream Dolby Digital encoder like the Dolby DP-569, which must be set up according to its operating instructions to receive and act upon this input.

This greatly reduces the possibility that operator error will cause the wrong value of surround metadata to be transmitted to consumers.

To emit an Rdd06-2008-compliant signal, the 8685 must be receiving a valid input stream that is compliant with Rdd06-2008 — this is necessary to synchronize the output metadata to video frame boundaries per the Dolby specification.

When a valid input stream is present, the 8685 passes this stream unchanged to its output except for the following modifications:

- The `ac3_dialnorm` word in the output metadata stream is reauthored so it is the same as the 8685's active Dialnorm value.
- The `ac3_dynrng` word in the output stream is set to 0, indicating that the downstream AC3 encoder must reauthor the line-mode DRC metadata, following the level compression profile found in the `ac3_dynrng1` word in the input metadata.
- The `ac3_compre` word in the output stream is set to 0, indicating that the downstream AC3 encoder must reauthor the RF-mode DRC metadata, following the level compression profile found in the `ac3_compr1` word in the input metadata.

Base and HD-SDI Configurations

Analog Audio Outputs

Configuration	One pair of outputs, which can be configured in software to emit LF, RF, C, LB1, RB1, LFE, LB2, RB2, STEREO L, STEREO R, DOWNMIX L, DOWNMIX R, LF/RF, C, LB1/RB1, LB2/RB2, STEREO L/R, and DOWNMIX L/R signals.
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	\geq 100 dB unweighted (Bypass mode, 20 Hz - 20 kHz bandwidth, referenced to 100% modulation).
Distortion	\leq 0.01% THD (Bypass mode, de-emphasized) 20 Hz - 20 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.
Filtering	RFI filtered.

Sync Input

Configuration	Can accept wordclock or AES11id (75 Ω) sync, automatically selected.
Connector	Female BNC, shell grounded to chassis.
Termination	Unterminated. Use an external 75 Ω terminator if the 8685 is the last item in the chain.

Remote Computer Interface

Configuration	TCP/IP protocol via direct cable connect, modem or Ethernet interface. Modem is not supplied.
Serial Port	115 kbps RS232 port DB-9 male, EMI-suppressed.
Ethernet Port	100 Mbit/s on RJ45 female connector.

RS485 Serial Interface (x2)

Hardware	115 kbps RS485 port DB-9 male, EMI-suppressed.
Compatibility	Designed to be hardware-compatible with Dolby Digital® hardware that sends and receives Dolby Digital metadata. (Metadata I/O is not supported by 8685 V 1.0 software. We expect to support it in a future software release.)

INSTALLATION	Base and HD-SDI Configurations	
	Remote Control (GPI) Interface	
	Configuration	Eight (8) inputs, opto-isolated and floating.
INSTALLATION	Voltage	6 – 15V AC or DC, momentary or continuous. 12 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.
INSTALLATION	Filtering	RFI filtered.
	Tally Outputs	
	Circuit Configuration	Two NPN open-collector outputs.
INSTALLATION	Voltage	+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.
	Current	30 mA maximum.
	Indications	Tally outputs can be programmed to indicate a number of different operational and fault conditions.
INSTALLATION	Power	
	Voltage	100 – 264 VAC, automatically selected, 50 – 60 Hz, 75 VA.
	Connector	IEC, EMI-suppressed. Detachable 3-wire power cord supplied.
INSTALLATION	Configuration	Two independent power supplies with independent IEC input connectors. Power supply health is monitored and the good supply is automatically connected to the load should one supply fail.
	Safety Standards	ETL listed to UL standards, CE marked.
	Environmental	
INSTALLATION	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 5.25" x 15.5" / 48.3 cm x 13.34 cm x 39.4 cm. Depth shown indicates rack penetration; overall front-to-back depth is 17.75" / 45.1 cm. Three rack units high.
INSTALLATION	RFI / EMI	Tested according to Cenelec procedures. FCC Part 15 Class A device.
	Shipping Weight	28 lbs. / 12.7 kg
	Warranty	
	Two Years, Parts and Service	Subject to the limitations set forth in Orban's Standard Warranty Agreement.



www.orban.com

r11-2011_RO/Lo/tt

ORBAN Headquarters

8350 East Evans, Suite C4 | Scottsdale, AZ. 85260 USA
[p] +1 480.403.8300 | [f] +1 480.403.8301 | www.orban.com

Northern California Design Center Group

14798 Wicks Blvd. | San Leandro CA 94577 USA
[p] +1 480.403.8300 | [f] +1 480.403.8301 | [e] info@orban.com

ORBAN Europe GmbH

Businesspark Monreposstr. 55 | 71634 Ludwigsburg Germany
[p] +49 7141 22 66 0 | [f] +49 7141 22 66 7 | www.orban-europe.eu

ORBAN Netherlands B. V.

Signaal 74 | 1446 XA Purmerend, Netherlands
[p] +31 299 40 25 77 | [f] +31 299 40 29 04