

HIGHLIGHTS

ON-BOARD AUDIO

- Embedded audio
- AC-3, E-AC-3 and Dolby E pass-through
- MPEG-1 Layer II, AC-3 2.0 and AAC/HE-AAC 2.0 v1 and v2 encoding

AIC

- Analog, AES and embedded audio
- AC-3 pass-through
- MPEG-1 Layer II, AC-3 2.0 and AAC/HE-AAC 2.0 v1 encoding

AHC-RAC

- AES & embedded audio
- AC-3, E-AC-3 and Dolby E pass-through
- MPEG-1 Layer II, AC-3 2.0 and AAC/HE-AAC 2.0 v1 and v2 encoding

AHC-561

- AES and embedded audio
- Dolby E to AC-3 2.0 and 5.1 decode/re-encode
- Dolby E to E-AC-3 2.0 and 5.1 decode/re-encode



The level of complexity in traditional headends is increasing significantly. With the ever-expanding rollout of new digital services and the acceleration of HD and MPEG-4 AVC deployments, the quantity of multiformat video and audio content that arrives from multiple sources is also on the rise. Baseband architectures struggle to handle this transition. In addition, cable, satellite and telco operators that embrace video-over-IP technology require a solution that enables them to seamlessly process audio sources that match the target output format.

Harmonic Electra™ 8000 universal encoders address these issues with a versatile family of optional audio input modules.

ELECTRA AUDIO FUNCTIONALITY

All Electra 8000 encoders support embedded audio and natively compress up to three stereo pairs of MPEG-1 Layer II as standard. AC-3 2.0 and 5.1, Dolby® Digital Plus (E-AC-3) and Dolby E audio can be passed through. Encoding of Dolby Digital 2.0 (AC-3) and AAC/HE-AAC 2.0 v1 and v2 audio is available by firmware license.

Three plug-in modules are available to extend Electra's audio encoding capabilities:

AIC

The AIC module accepts balanced or unbalanced analog audio, in addition to AES3. AC-3 2.0 and 5.1 audio can be passed through. Two stereo pairs of MPEG-1 Layer II, AC-3 2.0 and AAC/HE-AAC 2.0 v1 audio can be encoded.

AHC-RAC

The AHC-RAC module accepts AES3 audio input. Dolby E, AC-3 2.0 and 5.1, E-AC-3 2.0 and 5.1, and Dolby E audio can be passed through. Encoding of three stereo pairs of AC-3 2.0 or 5.1, AAC/HE-AAC 2.0 v1 and v2, and MPEG-1 Layer II 2.0 audio is available by firmware license.

AHC-561

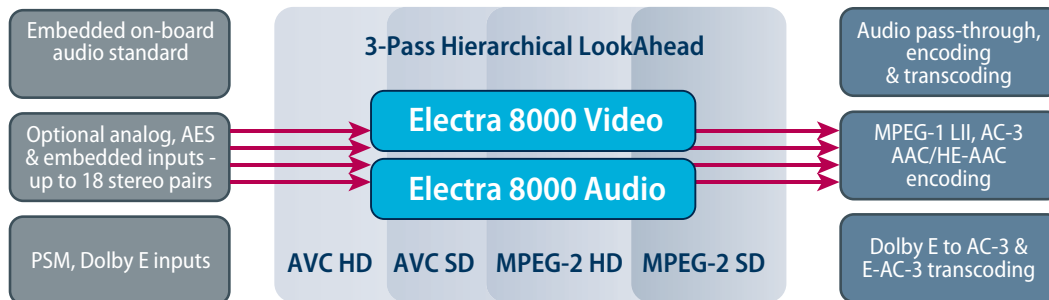
The AHC-561 module accepts AES3 audio input. Dolby E to AC-3 2.0 and 5.1 decode/re-encode, simultaneous Dolby E to AC-3 2.0 and 5.1, or simultaneous Dolby E to E-AC-3 2.0 and 5.1 decode/re-encode are supported.

SOLUTION BENEFITS

- **Enhanced Performance** — With audio encoding and transcoding integrated into the Electra chassis, and a choice of analog, AES or embedded inputs, encoder density is increased, signal management is simplified and operating costs are reduced.
- **No-Compromise Encoding** — Electra delivers the highest audio encoding quality for MPEG-1 Layer II, AC-3, E-AC-3, Dolby E, AAC and HE-AAC audio.
- **Wide-Ranging Audio Services** — Electra supports stereo and multichannel audio encoding, as well as pass-through of all major audio formats, including MPEG-1 Layer II, AC-3, E-AC-3, Dolby E, AAC and HE-AAC.
- **Efficient Delivery of New Services** — Electra is well-suited for both new and transitioning headend architectures. By providing AC-3 transcoding, Electra encoders greatly simplify the turnaround of pre-compressed feeds. Operators can also take a given input feed and multicast it in different formats, or pair it with MPEG-2 and AVC audio for new service introductions to tiered set-top boxes.

TECHNICAL ADVANTAGES

- **Density** — With the ability to support three stereo encodes per card (or one 5.1 encode), and availability of up to five cards per chassis, Electra supports up to 18 stereo encodes, reducing box count and wiring, and simplifying the headend.
- **Simplified Management** — Integrating audio encoding functionality into the Electra chassis — including pass-through, compression and transcoding — results in reduced system complexity, fewer single points of failure, and lower OPEX and CAPEX.
- **Format Conversions** — The ability to transcode Dolby E and AC-3 2.0 to E-AC-3 and AC-3 5.1, along with the ability to decode and downmix AC-3 5.1 to 2.0, results in a more efficient workflow.
- **All-IP Infrastructure** — IP input is a must-have capability for encoders. The optional Harmonic FLEX™ dual video and audio decoder expands the IP capability of the Electra platform by providing native IP input. The result is a more scalable and lower-cost transition to IP-based service.
- **Network Management** — Harmonic's NMX Digital Service Manager™ works with Electra encoders to simplify mass configuring, monitoring and automated redundancy in both centralized and distributed architectures.



The following table summarizes the compression support for each of the audio adapters:

	On-Board (Standard)	AIC (Option)	AHC-RAC (Option)	AHC-561 (Option)
Electra 8000				
Embedded Audio	Supported	Supported	Supported	Supported
External Analog	N/A	Supported	N/A	N/A
External Digital Audio (AES3, BNC)	N/A	Supported	Supported	Supported
Max Number of Pairs	3 (from same group)	2 (from same group)	3 (from same group)	3 (from same group)
Max Number of 2.0 Encodes	3	2	3	N/A
Max Number of 5.1 Encodes	1	0	1	1
Dolby Metadata	N/A	Fixed	Serial	N/A
Electra 8000 Audio Pass-Through				
MPEG-1 Layer II Pass-Through	N/A	N/A	N/A	N/A
AC-3 Pass-Through (2.0/5.1)	Supported	Supported	Supported	N/A
E-AC-3 Pass-Through	Supported	N/A	Supported	N/A
DOLBY E Pass-Through	Supported	N/A	Supported	N/A
Electra 8000 Audio Codec Support				
Codec Limitations	One codec/adaptor	Two codecs/adaptor	One codec/adaptor	Dolby only
MPEG-1 Layer II Encoding	3 stereo pairs	2 stereo pairs	3 stereo pairs	N/A
SPPC (MPEG-1 Layer II) Encoding	N/A	4 mono	N/A	N/A
AC-3 2.0 Encoding	3 stereo pairs	2 stereo pairs	3 stereo pairs	N/A
AC-3 5.1 Encoding	N/A	N/A	Single 5.1 surround	N/A
AAC/HE-AAC 2.0 (v1)	3 stereo pairs	2 stereo pairs	3 stereo pairs	N/A
AAC/HE-AAC 2.0 (v2)	3 stereo pairs	N/A	3 stereo pairs	N/A
AAC/HE-AAC 5.1	Single 5.1	N/A	Single 5.1	N/A
Dolby E to AC-3 2.0 Transcoding	N/A	N/A	N/A	Supported
Dolby E to AC-3 5.1 Transcoding	N/A	N/A	N/A	Supported
Dolby E to AC-3 2.0 and AC-3 5.1 Transcoding (simultaneous)	N/A	N/A	N/A	Supported
Dolby E to E-AC-3 2.0 and E-AC-3 5.1 Transcoding (simultaneous)	N/A	N/A	N/A	Supported

ANALOG AUDIO SPECIFICATIONS (AIC MODULE ONLY)

THD + Noise	< 0.05% at 1 kHz with 48 kHz sampling
Frequency Response	< 3 dB 20 Hz to 20 kHz at 384 kbps/48 kHz

MPEG-1 LAYER II AUDIO COMPRESSION

Encoding Bitrate	
Mono	32 to 192 kbps
Stereo	64 to 384 kbps
Sampling Frequencies	48 kHz for all inputs, or 32 kHz or 44.1 kHz for external digital

AC-3 TWO-CHANNEL AUDIO COMPRESSION

Encoding Bitrate	
Mono	56 to 640 kbps
Stereo	96 to 640 kbps
Sampling Frequencies	32 kHz, 44.1 kHz or 48 kHz

AC-3/E-AC-3 PASS-THROUGH

Channels	2.0 or 5.1
Pre-encoded Bitrate	96 to 640 kbps
Sampling Frequencies	32 kHz, 44.1 kHz or 48 kHz
Audio Delay/Advance	-500 ms to +500 ms
Mode (for use with external third-party audio encoders)	
Automatic Null Insertion	0 to 640 kbps

AUDIO HARDWARE OPTIONS

Model	Description
IOM-AHC-561	Optional multichannel audio encoding board for Electra encoders supporting AC-3 5.1 encoding, E-AC-3 5.1/7.1 encoding, or Dolby E to AC-3/E-AC-3 transcoding
IOM-AHC-RAC	Optional multichannel audio encoding board for Electra encoders supporting AC-3 2.0, AC-3 5.1, AAC 2.0, AAC 5.1, HE-AAC v2 2.0 or HE-AAC v2 5.1 audio encoding
IOM-AIC	Optional stereo audio encoding board for Electra encoders supporting MPEG-1 Layer II, AC-3 or AAC/HE-AAC compression, or AC-3 2.0/5.1 pass-through

FIRMWARE OPTIONS

License	License to Enable Function
FW-ELC-8K-AUD-AAC-MC	One native AAC/HE-AAC multichannel (5.1) audio encode
FW-ELC-8K-AUD-AAC-ST	One native AAC/HE-AAC stereo (2.0) audio encode
FW-ELC-8K-AUD-DD-MC	One native AC-3 multichannel (5.1) audio encode
FW-ELC-8K-AUD-DD-ST	One native AC-3 stereo (2.0) audio encode
FW-ELC-8K-ANYAUDIO-DD-MAIN	One, two or three native AC-3 stereo (2.0) or one native AC-3 multichannel (5.1) audio encode
FW-ELC-8K-XCODE-DD-TO-MP1LII	AC-3 2.0 or 5.1 to MPEG-1 Layer II 2.0 recoding (with appropriate downmixing) on the optional AHC-RAC audio adapter or on-board audio processor of Electra 8000 encoders
FW-ENC-XCODE-DD-TO-DDPLUS-MC-561	Transcode of AC-3 multichannel (5.1) to E-AC-3 multichannel on any encoder
FW-ENC-XCODE-DD-TO-DDPLUS-ST-561	Transcode of AC-3 stereo (2.0) to E-AC-3 stereo on any encoder
FW-ENC-XCODE-DOLBYE-TO-DD-MC-561	Transcode of Dolby E to AC-3 multichannel on any encoder

HEADQUARTERS

Americas Sales
4300 North First Street
San Jose, CA 95134 U.S.A.
T 1 800 828 5521 inside the U.S.
+1 408 542 2559 outside the U.S.
F +1 408 490 6001

ASIA-PACIFIC

Harmonic Technologies (HK) Ltd
Level 23, Office Tower
Langham Place, 8 Argyle St
Mongkok, Kowloon Hong Kong
T +852 3713 9300
F +852 2116 0083

EUROPE AND MIDDLE EAST

United Kingdom
250 Fowler Avenue, Ground Floor
IQ Farnborough
Farnborough Hampshire GU14 7JP
United Kingdom
T +44 (0)1 252 555 400
F +44 (0)1 252 377 171

Africa, India, Russia and CIS Countries

10 Haamel St
Park Afek
Rosh Ha'ayin, 48092 Israel
T +972.3.9007777
+972.3.9007800
F +972.3.9007766

