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DiviCom®
Electra® 8000

## Universal SD/HD MPEG-2 and AVC Encoder

HIGHLIGHTS

- Multi-codec support: capable of MPEG-2 or AVC encoding of SD or HD video

- High quality ultra-low bit-rate encoding with Hierarchical LookAhead™ and pre-processing

- Supports all SD and HD formats (hardware capable up to 1080p 50/60)

- Up to 4 channels per chassis (1RU)

- High quality integrated decoding with FLEX™ technology option

- Capable of multiple output streams per input channel for applications such as PiP, SDV or HD time-shifting

- Built-in broadcast quality Up/Down-converter

- Integrated statmux with DiviTrackMX™

- Statmux over IP in LAN and WAN environments with DiviTrackIP™

Harmonic's DiviCom Electra® 8000 is the world's first single rack-unit (1-RU) encoder with multi-resolution, multi-standard, multi-service and multi-channel capabilities. The high performance Electra 8000 significantly enhances bandwidth efficiency and provides up to four standard definition (SD) or high definition (HD) channels of superior quality constant bit-rate (CBR) or variable bit-rate (VBR) video using either MPEG-2 or AVC[1] encoding. Its groundbreaking architecture and unrivalled feature set eases operational requirements of density and power efficiency, and facilitates the launch of new value-added video services.

Leveraging Harmonic's expertise and market leadership, the Electra 8000 is the first truly converged high quality distribution encoder on the market, and the most advanced encoding platform for Cable, Satellite, IPTV or Terrestrial applications available today.

Leapfrogging current best-in-class MPEG-2 and AVC compression platforms, the Electra 8000 enables deployment of new services such as HD, and increases ROI on existing bandwidth. The flexible hardware platform can easily be reconfigured with a firmware upgrade, for new applications such as migrating from SD to HD AVC.
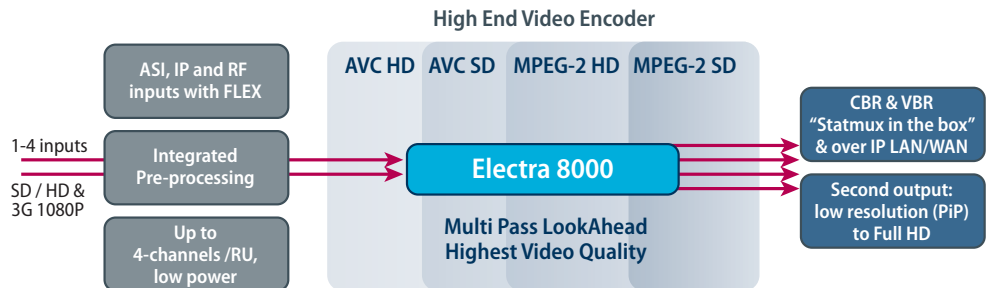
Sample Use Case	Input Type	Sample Main Output	Sample Second Output	Benefits
Satellite / IPTV Up conversion	SD	SD MPEG-2 (VBR) or SD AVC (CBR)	HD AVC 720P (CBR or VBR)	Enrich HD lineup Better quality on large displays
IPTV Dual bit-rate	HD	HD AVC (4Mbps CVBR)	HD AVC (8Mbps CVBR)	HD eligibility Watch & record HD, multiple TVs
Broadcast Down conversion	HD	HD MPEG-2 (VBR)	HD or SD MPEG-2 (CBR)	SD business continuity
Cable SDV / Time-shift	HD	HD MPEG-2 (VBR) 3:1 or 4:1	HD MPEG-2 (CVBR)	SDV or Time-shifted TV

BUSINESS BENEFITS OF THE ELECTRA 8000

- **Best CAPEX choice** – Able to handle either MPEG-2 or AVC (in 4:2:0) and any format (hardware capable of supporting SD, HD, 1080p24 and 1080p50/60) the IP-based Electra 8000 is the ultimate high-end distribution encoder that can be repurposed for different uses over time. Its unrivalled flexibility makes it the clear choice for CAPEX investment.

- **OPEX and environmentally friendly** – Able to house up to 4 encoders in a 1RU chassis and with a power consumption of less than 70W per service[2], the dense Electra 8000 is the perfect fit for operators mindful of their carbon footprint, energy costs and rack space.

- **Expanded HD lineup** – Featuring an integrated broadcast quality up-converter, the Electra 8000 is ideally suited for a new range of applications such as HD simulcast of the existing premium SD channel lineup.

- **SD MPEG-2 business continuity** – The growing trend towards producing and distributing content exclusively in HD creates business continuity issues with legacy SD MPEG-2 set top boxes. The Electra 8000 can simultaneously generate both an SD MPEG-2 and an HD AVC output from a single HD input.

- **4:1 HD MPEG-2 for Cable** – The Electra 8000 can encode up to 4 statistically multiplexed HD MPEG-2 services within a single chassis, from HD-SDI, IP or ASI inputs. While delivering video compression performance exceeding previous solutions, this solution also offers native support for reception of AVC compressed content.

- **Increased channel capacity for Satellite** – Thanks to new compression gains, the Electra 8000 is designed to reclaim bandwidth by increasing the channel count per transponder. Its wide range of hardware and software options covers local and remote site scenarios with an emphasis on agility and quality of service.

- **Better quality and increased reach for IPTV** – Designed to deliver broadcast quality HDTV under 5 Mbps, the Electra 8000 increases eligibility for HD. Its native support for dual bit rate output further increases reach while offering watch and record capabilities over xDSL networks.

- **ATSC "Station-in-a-Box"** –the Electra 8000 is the perfect solution for ATSC stations looking to enhance subscriber experience and increase ad revenue by enabling new services at a lower cost. A standalone unit can encode and statistically multiplex up to 4 SD and/or HD services, and re-multiplex external PSIP tables, resulting in a full ATSC multiplex.

TECHNICAL BENEFITS OF THE ELECTRA 8000

- **Compression performance** – Engineered around a unique multi-pass architecture and based on the latest silicon (ASIC) and programmable (DSP/FPGA) technologies, the Electra 8000 offers unequalled gains[3] in video compression efficiency over currently available products.

- **Leverages the Electra platform's rich feature set** – The Electra 8000 inherits all the platform level features and options introduced on prior Electra generations, including: IP or ASI outputs, support for multiple audio processing cards, support for Digital Program Insertion (DPI), and FLEX integrated decoder with IP, 8VSB or ASI inputs.

- **Integrated statistical multiplexing** – The Electra 8000 streamlines system architectures by enabling "statmux-in-a-box" with Harmonic's DiviTrackMX™.

- **Next generation IP-based statistical multiplexing** – The Electra 8000 enhances the efficiency and flexibility of statistical multiplexing with DiviTrackIP™ either in LAN or distributed WAN environments. The Electra 8000 can support up to 300ms of WAN round trip delay, auto-adjust to the IP network variations and form pools — up to 64 channels each — with any Electra encoder models.

- **Integrated high quality second resolution output** – The Electra 8000 redefines the streaming of multiple resolution channels from the same video input— from low resolution, including CIF and QVGA, for picture-in-picture applications, all the way to full HD for SDV or time-shifted TV.

- **Built-in broadcast quality up/down converter** – Integrating a high quality scaling engine and motion compensated de-interlacing, the Electra 8000 makes the launch of differentiated services — such as an all-HD broadcast of the SD lineup — simple and cost effective.

- **Enhanced pre-processing** – The Electra 8000 offers advanced integrated noise reduction capabilities, including Harmonic's signature Motion Compensated Temporal Filtering (MCTF). It also includes an adaptive deblocking filter designed to attenuate the compression artifacts present in the video source.

- **Expanded audio tool set** – Able to natively encode up to 3 stereo pairs, the Electra 8000 supports a variety of optional audio cards designed to address audio processing scenarios such as pass-through of pre-compressed audio, native encode multichannel or transcode from Dolby® E sources.

- **Friendly management** – The Electra 8000 can be simply configured through a standalone web interface or with Harmonic's NMX Digital Service Manager™ for mass configuring, monitoring and automated redundancy in centralized or distributed architectures.

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VIDEO SPECIFICATIONS

Video Compression and bit rate (CBR/VBR) 4:2:0 encoding	MPEG-2 MP@ML (1 to 15Mbps) MPEG-2 MP@HL (2 to 24 Mbps) MPEG-4 AVC MP@L3 (0.3 to 8 Mbps) MPEG-4 AVC HP@L4 (1 to 20 Mbps)
Video Processing	LookAhead multi-pass processing Scene-cut and fade/dissolves detection Dynamic GOP management with adaptive I picture and B picture placement Automatic input format (1080i or 720P) detection and switching
Video Input Filtering	Motion compensated temporal filter (MCTF) Horizontal filter, Deblocking filter
Aspect Ratios	4:3 and 16:9
SD Resolutions and frame rate	Vertical: 576i@25, 480i@29.97 Horizontal: 720, 704, 640, 544, 528, 480, 352 pixels
HD Resolutions and frame rate	720P @50 and 59.94, x 1280 and 960 pixels 1080i @25 and 29.97, 1080PsF24, x1920, 1440, 1280 and 960 pixels
Ancillary Resolution	Option: 96x96, 128x96 (AVC MP@L1.3)
Closed Captioning	CEA 608 from Line 21 or CEA 708 VANC extraction per SMPTE 334M CEA 708 external caption server per SMPTE 333M
Ancillary data and VBI	Digitized waveform or VANC extraction per SMPTE 2031 AFD and Bar, VITC, AMOL, TV Guide WST (Teletext), Inverted WST, WSS, VPS
Digital Program Insertion	SCTE35 insertion via SCTE104 triggers (DPI)
Up Conversion	480i29.97 to 720P59.94 or 1080i29.97 576i25 to 720p50 or 1080i25

AUDIO SPECIFICATIONS

Input Type	Embedded in SDI Optional module: digital AES
Number of Channels (native encoding)	Up to 3 stereo pairs or one 5.1 multichannel per video service Option: up to 5 Audio encoding modules, each supporting 3 stereo pairs or one 5.1 service
Audio Formats	MPEG-1 Layer II, Dolby Digital (AC-3), AAC, HE AAC (v1 and v2) native encoding AC-3 and AAC/HE AAC pass-through Optional audio encoding module supporting DolbyE inputs for transcode into Dolby Digital and Dolby Digital Plus, as well as native encode in Dolby Digital and Dolby Digital Plus
Operating Modes	Mono, stereo
Encoding Bit-Rate	MPEG Audio Layer II: 56 to 384 kbps Dolby Digital (AC-3): 56 to 448 kbps AAC: 32 to 384 kbps / HE AAC: 32 to 128 kbps
Sampling Frequencies	32 kHz, 44.1 kHz, 48 kHz
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

INPUTS AND OUTPUTS

Video Inputs	Up to 4 Serial Digital inputs capable per SMPTE 259M (SD-SDI) or SMPTE 292M (HD-SDI) 75 Ohms BNC connectors
Audio Inputs	Default: Embedded audio; up to 3 stereo pairs or one multi-channel Option: Digital (AES3 or S/PDIF)
Transport Outputs	MPEG-2 Transport Stream over UDP/IP (redundant 100/1000 BaseT connectors)

SYSTEM MANAGEMENT

NMX Digital Service Manager	
Standalone web user interface	

POWER

Input Voltage Range	85-132 VAC or 170-264 VAC 42-60 VDC
Line Frequency	47-63 Hz
Typical Consumption	110 W for ELC-8010 (1 channel) 160 W for ELC-8020 (2 channels) 210 W for ELC-8030 (3 channels) 260 W for ELC-8040 (4 channels)

ENVIRONMENTAL

Cooling	9 fans; air flow front to side
Operating Temperature	0º to +50º C +32º to +122º F
Storage Temperature	-20º to +80º C -4º to +176º F
Operating Humidity	< 95% non-condensing
Electromagnetic Compliance	FCC Part 15 Class A CE Mark (EN 55022 Class A and EN 50082-1:1997)
Safety	UL 1950 and cUL C22.2#950 EN 60950 ROHS Directive 2002/95/EC

PHYSICAL

Dimensions (W x H x D)	19" x 1.75" x 24" (1RU) 48.26 cm x 4.45 cm x 60.69 cm
Weight	24 lbs. / 11 kg

Notes:

1. Also known as H.264 and MPEG-4 Part 10.

2. An Electra 8040 chassis (with 4 encoders) uses less than 260W

3. Content and sequence dependant. Typical values at usual operating bit rates.

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