With the ever-expanding rollout of new digital services and the acceleration of HD and MPEG-4 AVC deployments, the level of complexity in traditional headends has increased significantly. Today's baseband architectures are ill-equipped to handle this transition smoothly, as content is coming from multiple sources and in many formats. In addition, cable, satellite and telco operators are embracing video-over-IP technology at a rapid pace, and are looking for a solution that can enable them to seamlessly migrate to an IP-based service. Harmonic's FLEX™ dual decoder module is a powerful solution that addresses these issues.

FLEX delivers highly flexible video and audio decoding capabilities as an option for Harmonic’s Electra™ or Ion® encoder chassis. A single FLEX module is able to decode up to two (2) incoming channels, and an appropriately configured encoder can deliver up to four (4) channels in a single rack-unit (1-RU). The highly versatile FLEX decoder module will decode AVC or MPEG-2 in either standard definition (SD) or high definition (HD) 4:2:0 formats, thereby eliminating the dependency on ingress formats.

FLEX is a unique gateway designed with the flexibility to deliver pre-compressed video to any Electra or Ion encoder. FLEX supports both ASI and IP inputs, the most efficient interfaces used to route and transport pre-compressed video feeds.

By offering an IP input interface to the encoder, FLEX delivers a key technology required for the industry’s continued migration to all-IP headends. This option enables operators to source content from IP networks or IP-ready RF demodulators/descramblers. This solution greatly reduces overall system cost and complexity, supports the most common video and audio formats in use today, and was developed to meet the current and future needs of multi-service providers.

**DUAL DECODER SOLUTION**

**HIGHLIGHTS**

- Integrated decoding for Electra™ and Ion™ encoder product lines
- Dense and versatile, decodes up to two services per card
- Transport Stream inputs via GbE IP, ASI and BVSB available to support DVB & ATSC applications
- Video Decoding: SD, HD MPEG-2 and AVC video; CBR or VBR
- HD to SD down-conversion
- Confidence monitoring video port
- MPEG-1 Layer II and Dolby® Digital (AC-3) Audio decoding
- Dolby® Digital AC-3, AAC, HE AAC, and MPEG-1 Layer II audio pass-through, up to 8 channels
- Level Magic™ Audio Level Control/Adjustment
- Vertical Interval Data Services, EBIF, SCTE-35, and DVB subtitles pass-through
- Controlled via NMX Digital Service Manager™ or standalone web GUI
Electra™/Ion™ FLEX™ DUAL DECODER SOLUTION

Solution Benefits

- **Enhanced performance**
  With decoding integrated into the Electra or Ion chassis and a choice of IP, ASI or BVSBI inputs, density is increased, management is simplified and operating costs are reduced.

- **“No-compromise” transcoding**
  Highest video and audio decoding quality combined with Harmonic’s robust and proven compression technology result in the highest re-encoding quality.

- **Wide-ranging audio services**
  FLEX supports pass through of all major audio formats, including MPEG Layer II, Dolby® Digital, AAC, and HE AAC with support for stereo and multi-channel audio. The Level Magic™ audio level control option addresses a perennial problem for service operators, enabling unattended control of audio level consistency.

- **Ideal for applications**
  FLEX is particularly well suited for new or transitioning headend architectures. The turnaround of pre-compressed feeds is now greatly simplified. Operators can take a given input feed and multicast it in both MPEG-2 and AVC formats for new service introductions to tiered set-top boxes.

Technical advantages

- **Density**
  By decoding up to two (2) channels per card, FLEX integrated in an Electra or Ion encoder delivers up to four (4) HD or SD channels per RU. Collapsing audio and video decoding functionality into the encoder reduces box count, reduces wiring and simplifies the headend.

- **Simplified management**
  Integrating decoding functionality into Harmonic’s encoder chassis with elimination of external ASI & SDI routing results in reduced system complexity, reduced single points of failure and lower OPEX and CAPEX.

- **Vertical ancillary services**
  FLEX supports the delivery of ancillary data for services such as teletext, closed captioning, DVB subtitles, EBIF and DPI.

- **Format conversions**
  Flex supports HD to SD down conversion plus the ability to decode and down mix Dolby Digital 5.1 to stereo.

- **Enables source redundancy**
  the all-IP infrastructure increases the resiliency of systems by enabling automatic failover to local or remote backup sources.

- **Robust decoding capability**
  FLEX is based on robust and field proven upgradable SoC technology enabling Harmonic’s video quality enhancements.

- **Support for all-IP infrastructure**
  Harmonic was an early pioneer of IP-enabled video delivery. FLEX expands the IP capability of Harmonic’s product line by offering native IP input functionality in Harmonic’s best-in-class Electra and Ion platforms. The result is a more scalable and lower-cost transition to IP-based service. IP is the new “must have” input to the encoder.

- **Network management**
  Harmonic’s NMX Digital Service Manager™ simplifies mass configuring, monitoring and automated redundancy in both centralized and distributed architectures.
**SPECIFICATIONS**

**VIDEO SPECIFICATIONS**
- Video Compression and bit rate (CBR/VBR) 4:2:0 encoding options
- Video Decoding [4:2:0]: MPEG-2 MP@ML, MPEG-4 AVC MP@L3, MPEG-2 MP@HL, MPEG-4 AVC HP@L4 VBR, CBR.
- Video Formats: 480i29.97, 576i25, 720P59.94, 720P50, 1080i29.97, 1080i25
- Aspect Ratios: 4:3 and 16:9

The same input PID can be declared multiple times to allow FLEX to decode and reencode the same video program multiple times.

**AUDIO DECODING SPECIFICATIONS**
- FLEX supports firmware licensable options for audio decoding
- Audio Formats: MPEG-1 Layer II, Dolby Digital (AC-3) 2.0 or 5.1
- Operating modes: Mono, stereo, multichannel (5.1), and multichannel down-mix to stereo
- Decoding capacity:
  - Dual decoder mode: Up to 4 stereo or one AC-3 5.1 and 1 stereo 5.6 to 448
  - Single decoder mode: Up to 8 stereo or 2 AC-3 5.1 and 2 stereo
- Static level control: -20 dB to +20 dB

The same input PID can be declared multiple times to allow FLEX to decode and reencode the same audio program multiple times.

**AUDIO PASS-THROUGH SPECIFICATIONS**
- FLEX supports firmware licensable options for audio pass-through
- Number of Channels: Up to 8 PIDs per video service
- Audio Formats: MPEG Layer II, Dolby Digital (AC-3), AAC, and HE AAC

**LEVEL MAGIC™ – AUDIO LEVELING SPECIFICATIONS**
- FLEX supports firmware licensable options for audio level adjustment
- Audio leveling capacity:
  - Dual decoder mode: Up to 3 stereo or one AC-3 5.1
  - Single decoder mode: Up to 6 stereo or 2 AC-3 5.1

**VERTICAL INTERVAL SERVICES PASS-THROUGH SPECIFICATIONS**
- Pass-through: EBIF, DPI (SCTE-35), Teletext, Inverted WST, WSS, AFD, VITC
- Closed captioning: CEA-608 and CEA-708

**INPUT MODULE OPTIONS**
- **IP Interface (optional module)**: Gigabit Ethernet
- **IP Ports**: 2 independent ports
- **Connector**: 2 x SFP (copper)
- **Speed**: 1 Gbps over port
- **IP Encapsulation**: MPEG-2 TS over UDP/IP
- **MPEG-2 TS Format**: 188/204 Bytes per TS packet MPTS and SPTS
- **Maximum Bit-Rate**: 80 Mbps per port
- **Addressing**: Unicast and multicast
- **Management**: IGMP, ARP, ICMP

**ASI Interface (optional module)**
- **Connector**: 4 x BNC, 75Ω
- **MPEG Format**: 188/204 Bytes per TS packet
- **Processing**: 1 MPTS/SPTS per port
- **Up to 8 stereo or 2 AC-3 5.1
- **Up to 160 Mbps per port**

**BVSF Interface (optional module)**
- **Type F connector per IEC 60169-24
- **ATSC-compliant 8-VSB signal reception
- **Tuning**: Channels 2 through 59
- **Sensitivity**: 83 dBm/6 MHz
- **Dynamic Range**: >80 dB

**OUTPUTS**
- **Video Outputs**: 1 per decoded channel with video only, SDI or HD-SDI
- **Audio Outputs**: 1 additional per channel for confidence monitoring only
- **Connector Type**: DIN 1.0/2.3 (DIN 1.0/2.3 to BNC adapters are available)

**SYSTEM MANAGEMENT**
- **NMX Digital Service Manager**: All encoder models
- **Web GUI control**: When running in standalone mode

**POWER (AS FURNISHED BY HOST ENCODER CHASSIS)**
- **Input Voltage Range**: 85-132 VAC or 170-264 VAC 42-60 VDC
- **Line Frequency**: 47-63 Hz
- **Typical Consumption**: 24 W per FLEX module

**ENVIRONMENTAL AND PHYSICAL**
- **Compliant with RoHS Directive**: 2002/95/EC as amended

**HARDWARE OPTIONS**

<table>
<thead>
<tr>
<th>Model Number</th>
<th>Description</th>
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<tbody>
<tr>
<td>IOM-FLEX-DHC</td>
<td>Optional video/audio decoding module for ION and Electra encoders. Supports up to 2 video and 2 audio services per card with firmware options.</td>
</tr>
<tr>
<td>IOM-GBE</td>
<td>Dual Gigabit Ethernet input module for Electra and Ion encoders</td>
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<tr>
<td>IOM-ASI</td>
<td>DVB-ASI input/output module for Electra and Ion encoders</td>
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<tr>
<td>IOM-BVSF</td>
<td>ATSC receiver input module for Electra and ION encoder</td>
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