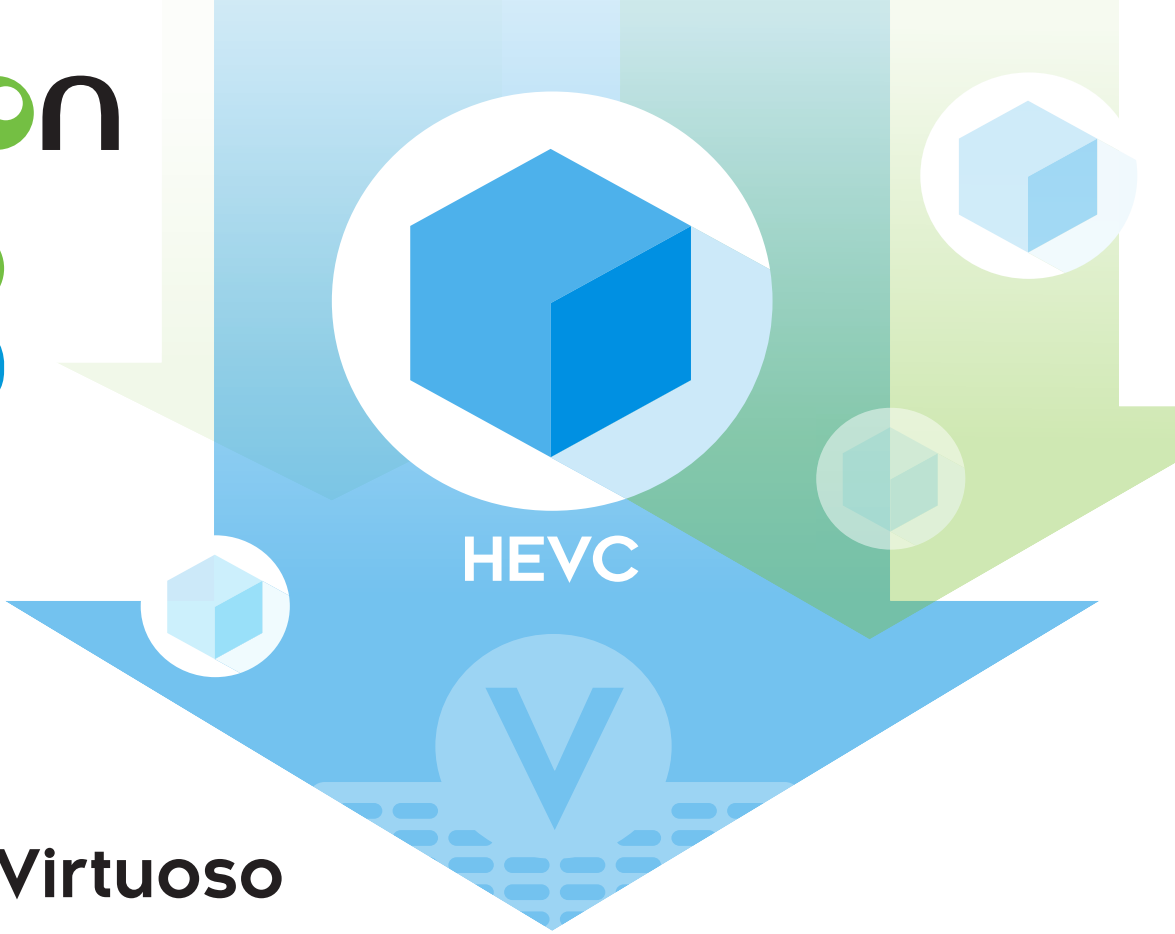
datasheet

Virtuoso Media Function



Nevion Virtuoso

HEVC/H.265

The Nevion Virtuoso HEVC/H.265 media function provides low bit rate encoding and decoding with both high picture quality and low end-to-end system latency.

The media function supports 4:2:2/4:2:0 10-bit and 4:2:0 8-bit encoding and decoding for a range of use cases including contribution and ground-to-cloud applications.

Virtuoso can run multiple instances of the HEVC/H.265 Media Function for high-density applications.

The standards compliant Transport Stream over IP encapsulation ensures perfectly synchronized transport of video, audio and ancillary data, as well as interoperability with 3rd party equipment.

The HEVC Media Function runs on the Virtuoso Low Bit Rate (LBR) Media Accelerator and supports electrical/optical SDI interfaces via video SFPs or Nevion breakout cables and native IP video ST 2110 interfacing.

A single HEVC media function supports encoding or decoding of up to 4 HD/3G or 1 UHD signal, providing, for example, 28 encoders per 1RU in Virtuoso MI or 20 encoders per 1RU in Virtuoso RE.

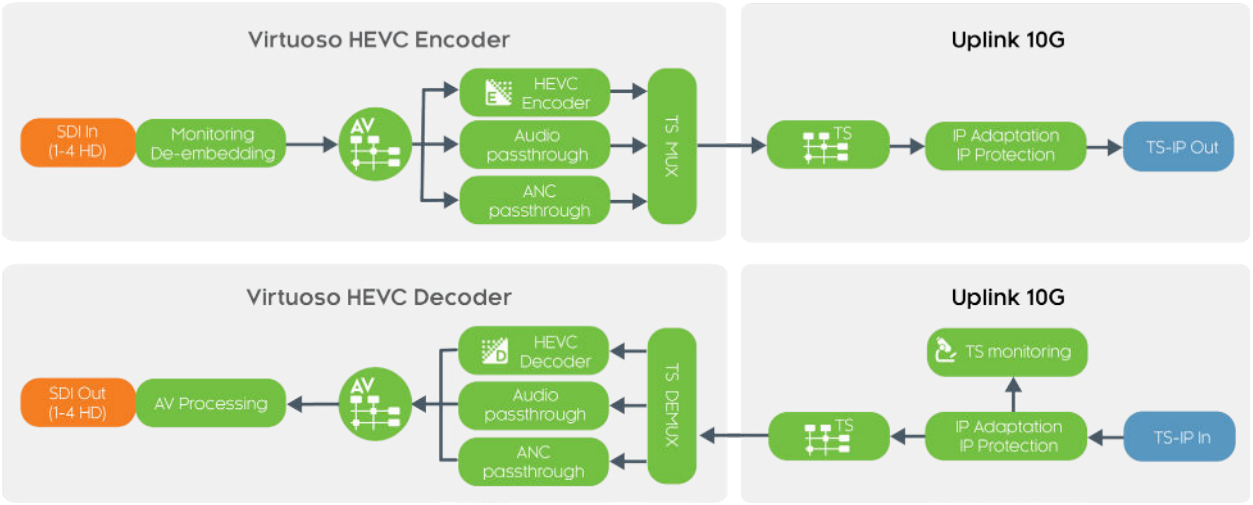
The HEVC Media Function, combined with Nevion's advanced protection mechanisms, enables real-time transport of professional media with low bandwidth utilization, combined with high quality and availability.

Applications

- Professional broadcast contribution
- Live sports and event contribution
- Managed video services over IP
- Ground-to-Cloud ingress applications

Key features

- HEVC/H.265 compression for video
  - Multi-channel HD encoding and decoding
  - Best in class video quality
  - Low end-to-end latency
  - 4:2:2/4:2:0, 10-bit and 4:2:0, 8-bit modes
  - 16-channel audio pass-through with matrix
- Standards-based interfacing
  - HEVC in Transport Stream over IP (MPEG2)
  - Native ST 2110 interfacing (-20/21/30/40)
  - HD/3G-SDI optical and electrical via SFPs
- Video/Audio processing
  - Built-in frame synchronizer with PTP support
  - Audio and ANC embedding/de-embedding
  - Automatic audio/ANC synchronization
- Stream protection
  - SMPTE 2022-7 for all RTP media input flows
  - Supports FEC and Launch Delay Offset (LDO)
- Monitoring and control
  - TS monitoring (ETSI TR 101 290 Priority 1, 2 and 3)
  - User-friendly web GUI and REST API control



Functional diagram HEVC-TS-E4/D4 (LBR)

High video quality and low latency

HEVC (high Efficiency Video Coding) also known as H.265—is an advanced video compression standard developed to deliver high-quality video at significantly lower bitrates than other video codecs like JPEG-XS and H.264.

Ideal for bandwidth-limited live and remote production, the HEVC codec offers high compression, high picture quality and low latency, achieving over 100:1 compression ratios for UHD with around 200ms latency.

H.265/HEVC compression technology

Video is encoded using HEVC/H.265 with native 8/10-bit resolution and 4:2:2/4:2:0 chroma sampling and 80 Mbit/s video elementary stream achieving high quality using a fraction of the bandwidth required for uncompressed video.

Typical bandwidth usage for HD video ranges from 8 Mbit/s to 100 Mbit/s depending on content and quality requirements and expectations.

The Sony HEVC ASIC on which the media function is built also supports Ultra Low Latency (ULL) – a capability that will be added in a future release.

When to use HEVC in TS over IP

Nevion Virtuoso offers multi-channel HEVC HD encoding or decoding capabilities on a single Virtuoso accelerator module (with each Virtuoso supporting multiple accelerator modules).

For WAN applications the sweet spot of HEVC in TS is for media transport of multiplexed video and audio with built-in program timing and metadata information, simplifying hand-off between broadcasters and service providers, or different broadcaster locations.

High density and flexibility

Different input formats, SDI or IP, allow the different workflows to be accommodated.

The HEVC in TS media functions have two configurable operating modes supporting either encoding or decoding. In both modes up to 4 HD channels are supported (or 1 UHD channel in a future software release). The Uplink 10G media function is used for TS over IP adaptation, protection and monitoring.

The max density of HEVC Transport Streams per Uplink in Virtuoso MI/RE, is determined by the data throughput limitation of the Uplink module (see datasheet).

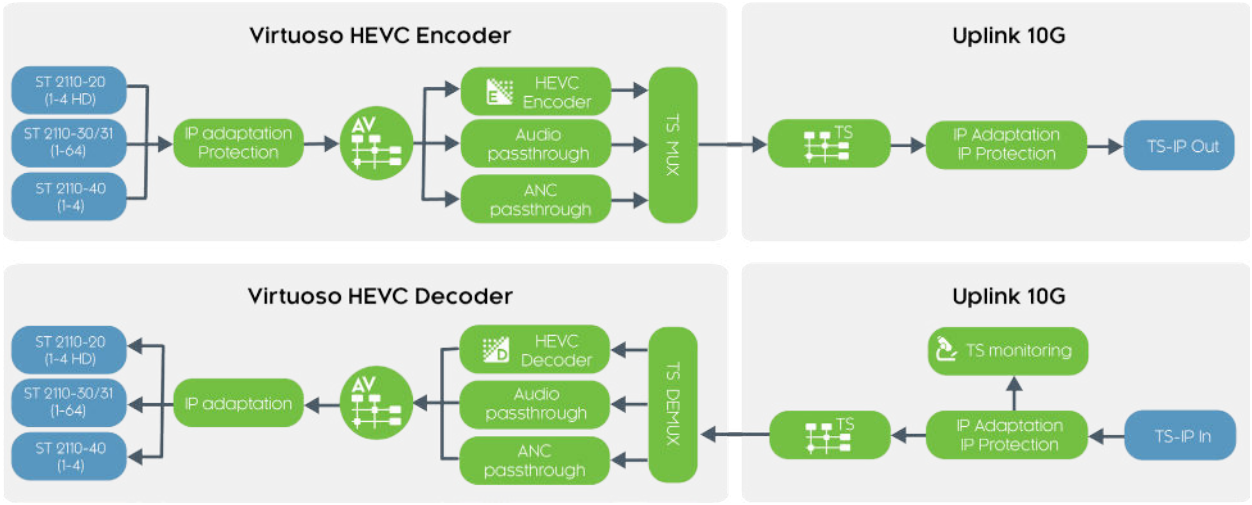
HEVC media functions running on the Virtuoso LBR accelerator, support a maximum density of 28 HD channels in Virtuoso MI and 20 HD channels in Virtuoso RE. Both platforms are 1RU in size. For UHD formats, up to 7 channels in MI and 5 channels in RE will be supported.

A mix of encoding and decoding in the same Virtuoso chassis possible and is configured per LBR accelerator card. Similarly, HD and UHD can be combined and is configured per LBR card.

Latency optimization

The HEVC media function and Nevion's Low Bitrate accelerator combines the very latest coding technology to achieve the best in class HEVC solution for picture quality and low latency.

Options are available to configure streams to use either standard latency or optimized latency modes, with end-to-end latency as low as 13 frames.



Functional diagram HEVC-IP-TS-E4/D4 (LBR)

Standards compliant transport

The software uses MPEG-2 compliant transport SMPTE ST 2022, in TS over IP, ensuring compatibility with 3rd party devices.

Flexible video interfacing

Input to the HEVC encoder can be uncompressed video in either SDI format (**HEVC-TS-E4/D4**) or IP SMPTE ST 2110-20 (**HEVC-IP-TS-E4/D4**).

Optical/electrical video SFPs or Nevion breakout cables are supported for SDI inputs/outputs

Transparent audio & ancillary data

The HEVC media function supports transmission of up to 16 channels of embedded audio for HD and 3G-SDI with full source audio routing matrix.

Handling of embedded audio, whether it's linear PCM or pre-compressed audio, is fully transparent. Similarly, handling of ancillary data such as closed captioning, active format description, time code and other metadata is fully transparent line-by-line.

Robust operation with frame sync

The decoder includes a number of features to ensure a robust operation and graceful degradation in the presence of IP transport impairments; buffering for IP jitter compensation, packet reordering, error correction and highly efficient error concealment, and a built-in frame synchronizer with analog and digital sync inputs.

The encoder supports SDI input switching with built-in frame store for clean changeover on loss of input.

Reliability and IP protection

Standards-based Forward Error Correction FEC) is supported in the Uplink-10G with SMPTE ST 2022-1 to detect and correct intermittent packet loss. The software also supports alarm-based input switching between different TS inputs.

Transmitting the same RTP/IP stream across dual, fully diverse network links enables receivers/decoders to utilize SMPTE ST 2022-7 Seamless IP Protection Switching, which gives error-free transport even in case of severe packet loss or link outages as long as a packet arrives on either of the two network links. Support for ST 2022-7 requires the protection license.

Launch Delay Offset (LDO) is also supported.

Built-in TS monitoring probe

Monitoring of signals at demarcation points between e.g., a broadcaster and a service provider, is key to quickly identify and resolve issues.

In Virtuoso, all ASI and IP Transport Stream inputs are monitored according to ETSI TR 101 290 Pri 1 alarm conditions. The advanced monitoring option adds Pri 2 alarms, PCR validation and jitter measurements, as well as PSI/SI table analysis.

Test image transmission

An encoder can be configured to transmit an internally generated test image or an uploaded image at a configurable, constant bitrate, with configurable text overlays and moving patterns, to allow efficient testing of contribution links prior to a live production.

Virtuoso HEVC/H.265 Media Function

Video formats

HD-SDI	SMPTE ST 292/ST 296/ST 274/ST 2048 1280 x 720p: 50/59.94/60 1920 x 1080i: 25/29.97/30 1920 x 1080p: 25/29.97/30
3G-SDI	SMPTE 424 (Level A)/ ST 274/ST 2048 1920 x 1080p: 50/59.94/60

Video/audio processing

nput/output video	YCbCr, 4:2:2,10 bit per component
Colour formats	ITU-R BT.709 (HDTV) ITU-R BT.2100 HDR (HLG / PQ)
Legaliziation	Yes
Frame sync	Integrated frame store on SDI input/SDI output with option to lock to reference sync.
Sync input format	Analog BB/TLS via Virtuoso appliance. SDI input via LBR accelerator. PTP via 10G on HBR card
Test patterns	75% and 100% Bars, SMPTE RP 219, SMPTE EG 1 EIA RS-189-A, EBU TECH-3373 HDR/HLG Flat-field with configurable colour Custom test image (BMP/JPG/PNG) Configurable text overlay Moving box/bar
Input signal loss	Freeze frame, option to fallback to test image
Audio processing	Audio routing matrix Audio mono shuffling. Audio delay up to 10 seconds per channel. Audio gain control per channel. Option for automatic Dolby E re-alignment. Processing available on decoder SDI output.

Video compression

Video compression	HEVC (ISO/IEC 23008-2 and ITU-T recommendation H.265)
Compression mode	Encoding or Decoding
Video sampling	YCbCr, 4:2:2,10 bit per component YCbCr, 4:2:0,10 bit per component YCbCr, 4:2:0,8 bit per component
GOP	Structure: IPPP Length: Configurable
Video bitrate	Variable 8-100Mbps Picture quality guarantee (lower limit) 12Mbps: Recommened operating point HD: 25-35Mbps
Latency	Standard mode: 23 frames Optmised mode: min. 13 frames
Channel density	Up to 4 channels of HD per LBR accelerator

HEVC-TS-E4/D4

SDI interfaces

SDI interfaces	Inputs and outputs per accelerator: 3G/HD-SDI - Up to 4 inputs or 4 outputs 12G/3G/HD-SDI Video SFP with options for: - Dual channel SDI RX (input) - Dual channel SDI TX (output) - Single channel SDI RX + SDI TX (bidirectional) - Optical and electrical variants 3G/HD-SDI video breakout with options for: - Dual channel SDI RX + SDI TX - Dual channel SDI RX with passive loop out

Audio and ancillary data formats

Embedded audio	16 channels (8 stereo pairs) per video Transparent for linear PCM 20 or 24-bit audio (48kHz) AES3 non-PCM audio pass-through ST302 transport in TS (2x AES3 per PID)
Audio compression	To be confirmed.
Ancillary data	Fully transparent for ST 2038 ancillary data, including but not limited to Time code (SMPTE 12M), Closed captioning (SMPTE 334-1), Active format description (AFD, SMPTE 2016-3) and OP-47

HEVC-IP-TS-E4/D4

Video and audio IP interfaces

Unc. video	SMPTE ST 2110-20 video in RTP/UDP/IP SMPTE ST 2110-21 Narrow Sender (type N) and Wide Receiver (type W)
Audio over IP	SMPTE ST 2110-30 PCM audio (Level A+B) SMPTE ST 2110-31 AES3 over IP (Level A+B) AES67 compliant (1 to 8 ch per stream) Up to 64 IP audio input and output flows
Ancillary over IP	SMPTE ST 2110-40 Ancillary Data over IP Up to 4 IP input and output flows
NMOS support	SDP (Session Description Protocol) IS-04 Discovery and Registration IS-05 Device Connection Management IS-08 Audio Channel mapping BCP-003-01 Security for NMOS APIs

Signal monitoring

Unc video	Freeze and black frame detection (licensed) Audio template monitoring: presence, peak and silence (licensed)
RTP/IP monitoring	Bit rate per flow Packet/datagram rate per flow RTP stream continuity Packet delay variation (PDV/jitter) Packet inter-arrival time (IAT)
Alarm log	Persistent alarm log with 100,000 entries.

Virtuoso HEVC/H.265 Media Function

HEVC-TS-E4/D4 and HEVC-IP-TS-E4/D$

MPEG-2 Transport Stream

TS over IP	SMPTE 2022-2 RTP/UDP/IP (CBR)
Input/Output TS	SPTS up to 100 Mbps
Program information	Encoder output: PAT, PMT
AES3 audio	SMPTE 302 pass-through (48 kHz, 20 or 24-bit) One audio channel pair per PID
Throughput	Refer to Uplink-10G release notes for details

Input TSoIP signal monitoring

Basic TS monitoring	ETSI TR 101 290 Pri 1 alarms Listing of services and components Listing of PIDs with bit rates and counters Listing of PSI/SI tables TS and per PID bitrate alarms
Adv. TS monitoring	ETSI TR 101 290 Pri 1 and 2 alarms (Licensed) PCR validation and jitter measurements PSI/SI table decoding and analysis

IP transport and protection

TS/IP encapsulation	TS over RTP/UDP/IP. Virtuoso MI/RE: HBR module running UPLINK-10G media function is used for TS/IP input/output.
Protocols	RTP, UDP, IP, ICMP, ARP, IGMPv2/v3, Diffserv/ TOS, 802.1Q (VLAN tag), 802.1P (VLAN priority).
Jitter / PDV	Buffering for IP jitter/PDV compensation Up to 50 ms receiver buffer
Link redundancy	Hitless/seamless switching for all RTP flows compliant to SMPTE ST 2022-7:2019 Class C (High skew) Up to 450 ms differential path delay in MI/RE
Loss protection	SMPTE ST 2022-1 Forward Error Correction 1D Column only, 2D Column and Row Block and Non-block aligned matrix

Property	Values
L (Min, Max)	1, 254
D (Min, Max)	4, 32
LxD (Max)	1024
L+D (Max)	254

Extended FEC	Support for extended matrix size L*D < 960, max L+D 244, e.g. 240 x 4)
LDO	Launch delay offset for single path temporal diversity using SMPTE ST 2022-7)..

Media Server Appliance support

Please refer to Nevion Virtuoso Platform datasheet for details.

Virtuoso MI	Supported in version 2.0 or higher
Virtuoso RE	Supported in version 2.0 or higher

Accelerator requirement

Accelerator	LBR media accelerator (LBR)
Description	Multi-channel low bitrate Media Accelerator (HW module). 4x SFP ports that accommodate a combination of 25GE SFP28 and video SFPs/Video breakout cables.
Product codes	VIRTUOSO-HW-LBR-SFP4 (25910)
SFP configuration	Port 1: Video SFP for SDI in/out (E4/D4) Port 2: Video SFP for SDI in/out (E4/D4) Ports 3 and 4: SFP28 in ST 2110 mode
Video SFP support	Non-MSA 270 Mb/s to 12 Gb/s HD-SDI, 3G-SDI, 12G-SDI Optical and electrical variants Nevion video breakout cables
Power consumption	Maximum 45W

Software media functions

HEVC-TS-E4	HEVC HD/UHD Encoder (up to 4 channels)
HEVC-TS-D4	HEVC HD/UHD Decoder (up to 4 channels)
HEVC-IP-TS-E4	HEVC HD/UHD Encoder IP ST 2110 inputs (up to 4 channels)
HEVC-IP-TS-D4	HEVC HD/UHD Decoder IP ST 2110 outputs (up to 4 channels)
Product code	VIR-SW-HEVC-COMP-ADV (26145) VIR-SW-HEVC-HD4-UHD1 (25911)

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