



TICO

## Nevion Virtuoso

### TICO UHD/4K Encoding and Decoding

**The Virtuoso TICO Media Functions provide visually lossless lightweight 4:1 compression for transport of UHD and 4K signals with sub-frame latency.**

The media function supports high quality 4:2:2 10-bit encoding and decoding for a range of live production and broadcast contribution use cases

The Nevion TICO Media Functions enable cost-effective transport of 12 Gb/s 4K/UHD video over 10GE IP networks using SMPTE 2022-6/7 or over existing 3G-SDI infrastructure.

The TICO Media Functions runs on both the Virtuoso 10G and 25G High Bit Rate Media Accelerators. Electrical and optical SDI interfaces are supported via video SFPs and breakout cables. ST 2022 and ST 2110 via dual 10GE or 25GE interfaces.

SMPTE ST 2022-7 is supported for network redundancy, answering the need for high availability.

Virtuoso can run multiple instances of the TICO Media Function for high-density applications.

A single TICO instance supports one channel bidirectional encoding and decoding or dual channel encode or decode of UHD sources.

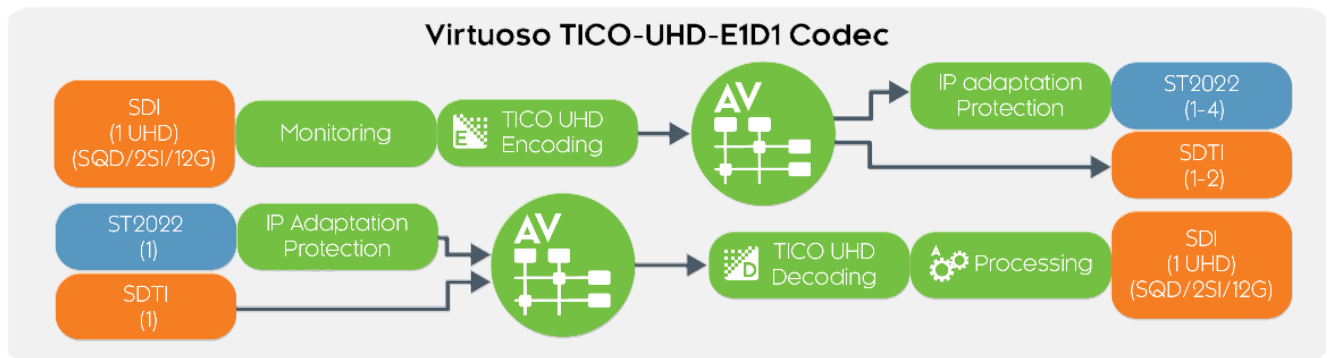
This provides a total of 8 simultaneous UHD encodes and 8 UHD decodes, or 16 channels of UHD encoding or decoding in the Virtuoso MI platform

#### Applications

- Professional broadcast contribution
- Live sports and event contribution
- Studio-to-studio media exchange

#### Key features

- TICO UHD compression
  - High video quality visually lossless compression with low multi-generation loss
  - Sub-frame end-to-end latency
  - Uni or Bidirectional operation
  - Support for HDR; broadcast and film formats
- IP and SDI connectivity
  - Uncompressed UHD/4K video sources using 12G-SDI or SMPTE ST 2110
  - Square division/SQD or 2SI with 4 x 3G/HD-SDI
  - Compressed video on 3G/HD-SDI via video SFPs or IP (SMPTE ST 2022-6)
- Stream protection
  - SMPTE 2022-7 IP protection mechanism for link redundancy
- Monitoring and control
  - Thumbnails of input and output video
  - In-depth service monitoring incl. video freeze/black frame detection and audio silence detection
- Built-in frame synchronizer with PTP support



Functional diagram (HBR 10G)

## TICO compression technology

TICO (Tiny Codec) compression is a lightweight, low-latency image compression technology designed for professional video workflows. It delivers high quality while reducing bandwidth requirements. Because it introduces only a few lines of latency, TICO is well suited for live broadcasting, production where high image quality and real-time performance are essential.

Each frame/field is encoded with 4:2:2 10-bit compression, providing visually lossless video quality at a 4:1 compression ratio using only 25% of the bandwidth required for uncompressed video.

## High density and flexibility

A number of TICO media functions are available to support different applications and workflows. For example, they provide the option to interface uncompressed video as either SDI or as IP ST 2110 streams.

Flexibility of deployment is achieved with options for a bidirection codec or, to increase density, dual encode or dual decode software media functions.

SDI video interfacing is supported on the Virtuoso HBR10 accelerator card. Here the media functions support either simultaneous encoding and decoding of 1 UHD channel or dual channel UHD encode or decode.

This provides a maximum density of either 8 UHD channels of simultaneous encoding and 8 UHD channels of decoding, or 16 channels of UHD encoding or decoding in the Virtuoso MI platform.

Interfacing of uncompressed video over IP networks (ST 2110) is supported on the Virtuoso HBR25 accelerator card. Here the media functions support either dual channel UHD encode or decode.

## UHD over existing infrastructure

The TICO Media Functions are capable of compressing a 12G/6G UHD/4K uncompressed video formats received as single 12G-SDI or as four (4) 3G-HD-SDI signals. In the case of the single channel bidirectional codec software the UHD signal can also be received in square division/SQD or 2SI format.

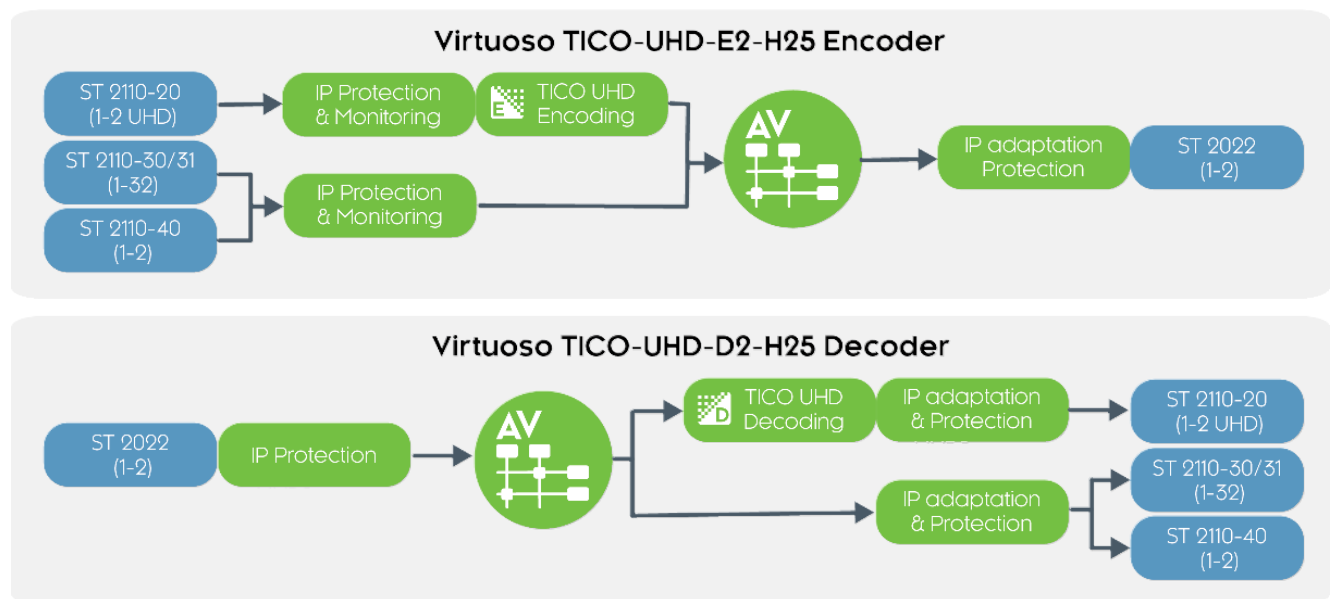
On the HBR10, the TICO codec compresses these SDI inputs to 3G/1.5G allowing broadcasters to reuse their existing 3G-SDI infrastructure for UHD/4K sources. Up to two(2) copies of each compressed signal can be output on SDI (SDTI).

The compressed signal can also be transported over IP networks as a SMPTE 2022-6 RTP/IP stream with embedded audio and ANC data. Up to three (3) UHD/4K signals can be carried on a 10GE link. IP ST 2022-6 transport is supported on both the HBR10 (SDI input) and HBR25 (IP input) software variants.

## Transparent audio & ancillary data

The TICO Media Function supports transmission of embedded audio, 16 channels per input for HD/3G-SDI and up to 32 channels for 12G & 3G-SDI (Level B). Embedding and de-embedding of ST 2110-30/31 audio (Level A/B) to ST 2022-6 (16 channels) is supported. Handling of embedded audio, whether it's linear PCM or pre-compressed audio, is fully transparent.

Similarly, the handling of ancillary data such as closed captioning, active format description, time code and other metadata is fully transparent line-by-line.



Functional diagram (HBR 25G)

## Low latency

The TICO media function software support very low end-to-end latency. This latency is sub-frame for encoding/decoding. In the case of interfacing using S&D the latency is approx. 1 frame.

## Standards compliant transport

All software versions use standards compliant SMPTE ST 2022-6 over IP ensuring compatibility with 3rd parties (supporting TICO compression).

## Reliability and IP protection

Advanced IP protection is enabled by means of dual network interfaces on each accelerator card. Dual 10GE SFP+ ports on the HBR10 and dual 25GE SFP28 ports on the HBR25 card.

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. This 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.

## Flexible SDI interfacing via SFPs

The TICO media functions supported on the HBR10 accelerator support HD/3G/12G-SDI via optical/ electrical video SFPs or HD/3G-SDI signals via Nevision breakout cables.

## PTP timing and sync

Video interfacing using ST 2110 requires synchronization using Precision Timing Protocol (PTP). This provides accurate synchronization for IP video and audio, using IEEE 1588v2 profiles or SMPTE 2059-2. Locking to PTP/TAI ensures fully synchronous operation across any network and any distance. PTP redundancy is supported with automatic bumpless PTP failover switching.

## Automatic A/V synchronization

The TICO decoder includes built-in frame synchronizers with media alignment to PTP/ ST2059 or digital sync inputs. Using the built-in synchronization capabilities of ST 2110, audio and ancillary data is automatically synchronized to the video.

## 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 event.

## In depth monitoring

Comprehensive monitoring is included for both network performance and uncompressed video inputs/outputs. This includes thumbnails for confidence monitoring.

## Video formats

|         |                                                                                                                                                                                                                                                                                                    |
|---------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| HD-SDI  | SMPTE ST 292/ST 274<br>1920x1080P: 23.98/24/25/29.97/30<br>2048 x 1080P: 23.98/24/25                                                                                                                                                                                                               |
| 3G-SDI  | SMPTE ST 425-1: 2017 (Level A and Level B input)/ST 425-5:2015/ST 274/ST 428<br>1920 x 1080p: 50/59.94/60 Hz<br>2048 x 1080p: 47.95/48/50/59.94/60                                                                                                                                                 |
| 12G-SDI | Transmit or receive UHD or 4K signal using 4 (four) HD or 3G-SDI signals (2 sample interleave and square division) or 12G-SDI SMPTE ST 2082-1/10 (Mode 1), SMPTE ST 2036-1<br>3840 x 2160p: 23.98/24/25/29.97/30<br>3840 x 2160p: 50/59.94/60 Hz<br>4096 x 2160p: 23.98/24/25/47.95/48/50/59.94/60 |

## SDI interfaces

|                |                                                                                                                                                                                                                                                                                                                   |
|----------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| SDI interfaces | Video SFP with options for:<br>- Dual channel SDI RX (input)<br>- Dual channel SDI TX (output)<br>- Single channel SDI RX + SDI TX (bidirectional)<br>Video breakout with options for:<br>- Dual channel SDI RX + SDI TX<br>- Dual channel SDI RX with passive loop out<br>All video interfaces support HD/3G-SDI |
|----------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

## Video processing

|                    |                                                                                                                                                                                                            |
|--------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Input/output video | YCbCr, 4:2:2, 10 bit per component                                                                                                                                                                         |
| Colour formats     | ITU-R Rec BT.709<br>ITU-R Rec BT.2020 (4:2:2 10 bit)<br>ITU-R Rec BT.2100 (4:2:2 10-bit for PQ, HLG)                                                                                                       |
| HDR Support        | HLG, PQ and S-LOG3                                                                                                                                                                                         |
| Legalize / clip    | Yes                                                                                                                                                                                                        |
| Frame sync         | Yes with ref sync lock option                                                                                                                                                                              |
| Test pattern       | 75% and 100% Bars, SMPTE RP 219, SMPTE EG 1<br>EIA RS-189-A, EBU TECH-3373 HDR/HLG<br>Flat-field with configurable color<br>Custom test image (BMP/JPG/PNG)<br>Configurable text overlay<br>Moving box/bar |

## Video compression

|                     |                                                                                                                                                    |
|---------------------|----------------------------------------------------------------------------------------------------------------------------------------------------|
| Video compression   | SMPTE RDD 35 TICO profile 2 (decoder compliant with profile 1 and profile 2)                                                                       |
| Compression ratio   | 4:1 (fixed)                                                                                                                                        |
| Latency             | 1 frame (SQD), sub-frame encoding/decoding                                                                                                         |
| Channel density     | TICO-UHD-E1D1<br>1 channels of encoding and 1 channel of decoding, each up to UHD format<br>TICO-UHD-E2<br>2 channels of encoding, each UHD format |
| Video encapsulation | SDI/SDTI (SMPTE ST 425-1:2017 Level A)<br>SMPTE 2022-6 SDI payload over RTP/UDP/IP                                                                 |

## Audio and ancillary data

|                                                                                                                               |                                                                                                                                                                    |
|-------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Audio and ancillary data taken from the first 3G-SDI input and transported transparently for all SMPTE ST 291-1:2011 ANC data |                                                                                                                                                                    |
| Ancillary data                                                                                                                | Pass-through SDI to/from SMPTE ST 2022-6<br>For cross-conversion between 2SI and SQD, SMPTE ST 352 Video Payload ID codes is regenerated for output 3G-SDI signals |

## Video and audio over IP transport

|                 |                                                                                     |
|-----------------|-------------------------------------------------------------------------------------|
| Video over IP   | SMPTE 2022-6 SDI payload over RTP/UDP/IP with internal aggregation using Uplink-10G |
| NMOS support    | NMOS IS-04 Discovery and Registration<br>NMOS IS-05 Connection Management           |
| LLDP            | Status and per interface configuration                                              |
| Link redundancy | Hitless/seamless switching for all RTP flows compliant to SMPTE ST 2022-7:2019      |

## Timing and synchronization

|                     |                                                                                                 |
|---------------------|-------------------------------------------------------------------------------------------------|
| Sync input format   | PTP (IEEE 1588v2:2008)<br>Analog BB/TLS via Virtuoso appliance<br>SDI input via HBR accelerator |
| PTP profile support | PTP default and media profile<br>SMPTE 2059-2 PTP profile                                       |
| PTP redundancy      | Internal PTP failover in Virtuoso MI/RE/FA                                                      |
| Media timing        | SMPTE 2059-1 (phase offset configurable)                                                        |

## Video/audio processing

|                                                         |  |
|---------------------------------------------------------|--|
| Audio                                                   |  |
| - De-embedding audio channels from SDI audio inputs     |  |
| - Embedding audio channels to SDI outputs               |  |
| - Audio routing/shuffling/processing on SDI embedder    |  |
| - Audio delay adjustment - up to 10 seconds per channel |  |
| - Audio level/gain control - per mono channel           |  |
| - Automatic Dolby E realignment on SDI output           |  |
| Video                                                   |  |
| - Video frame synchronization                           |  |
| - Video delay adjustment - up to 10 frames per channel  |  |

## Monitoring

|                                          |                                                                                                                                                           |
|------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------|
| Thumbnails of SDI video input and output |                                                                                                                                                           |
| Content monitoring                       | Thumbnails of SDI video input and output<br>Audio level bars.                                                                                             |
| Advanced monitor                         | Template based monitoring for video/audio.<br>SDI Video black and freeze frame detection.<br>Audio silence and peak level detection.<br>(Licensed option) |

## Media Server Appliance support

Please refer to Nevion Virtuoso Platform datasheet for details.

|             |                                      |
|-------------|--------------------------------------|
| Virtuoso MI | Supported in version 1.4 or higher   |
| Virtuoso RE | Supported in version 1.0.8 or higher |
| Virtuoso FA | Supported in version 2.6 or higher   |

## Accelerator requirement

|                   |                                                                                                                                                        |
|-------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------|
| Accelerator       | HBR 10G Media Accelerator                                                                                                                              |
| Description       | Virtuoso High Bit-Rate media accelerator card. 4x SFP+ ports that can accommodate a combination of 10GE/1GE, optical/electrical video/audio interfaces |
| Product codes     | VIRTUOSO-HW-HBR-SFP4 (24204)                                                                                                                           |
| SFP configuration | Port 1: SDI / Video SFP<br>Port 2: SDI / Video SFP<br>Port 3: 10GE (10GBase-R)<br>Port 4: 10GE (10GBase-R)                                             |
| Video SFP support | Non-MSA 1.5 Gb/s to 12 Gb/s<br>HD-SDI, 3G-SDI: max 2 in + 2 out<br>12G-SDI: max 1 in + 1 out or 2 in<br>Optical and electrical variants                |
| Network interface | 2x 10GE                                                                                                                                                |
| Power consumption | Maximum 45W                                                                                                                                            |

## Software media functions

|               |                                             |
|---------------|---------------------------------------------|
| TICO-UHD-E1D1 | TICO bidirectional UHD Encoder and decoder. |
| TICO-UHD-E2   | TICO UHD Dual channel Encoder (2 channels)  |

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## Video formats

|         |                                                                                                                                         |
|---------|-----------------------------------------------------------------------------------------------------------------------------------------|
| HD-SDI  | SMPTE ST 274<br>1920x1080P: 23.98/24/25/29.97/30<br>2048 x 1080P: 23.98/24/25                                                           |
| 3G-SDI  | Level A and Level B input<br>ST 425-5:2015/ST 274/ST 428<br>1920 x 1080p: 50/59.94/60 Hz<br>2048 x 1080p: 47.95/48/50/59.94/60          |
| 12G-SDI | SMPTE ST 2036-1<br>3840 x 2160p: 23.98/24/25/29.97/30<br>3840 x 2160p: 50/59.94/60 Hz<br>4096 x 2160p: 23.98/24/25/47.95/48/50/59.94/60 |

## Video processing

|                    |                                                                                                                                                                                                            |
|--------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Input/output video | YCbCr, 4:2:2, 10 bit per component                                                                                                                                                                         |
| Colour formats     | ITU-R Rec BT.709<br>ITU-R Rec BT.2020 (4:2:2 10 bit)<br>ITU-R Rec BT.2100 (4:2:2 10-bit for PQ, HLG)                                                                                                       |
| HDR Support        | HLG, PQ and S-LOG3                                                                                                                                                                                         |
| Legalize / clip    | Yes                                                                                                                                                                                                        |
| Frame sync         | Yes with ref sync lock option                                                                                                                                                                              |
| Test pattern       | 75% and 100% Bars, SMPTE RP 219, SMPTE EG 1<br>EIA RS-189-A, EBU TECH-3373 HDR/HLG<br>Flat-field with configurable color<br>Custom test image (BMP/JPG/PNG)<br>Configurable text overlay<br>Moving box/bar |

## Video compression

|                     |                                                                                                                                                        |
|---------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------|
| Video compression   | SMPTE RDD 35 TICO profile 2 (decoder compliant with profile 1 and profile 2)                                                                           |
| Compression ratio   | 4:1 (fixed)                                                                                                                                            |
| Latency             | Sub-frame encoding/decoding                                                                                                                            |
| Channel density     | TICO-UHD-E2-H25<br>2 channels of encoding per Accelerator each UHD format<br>TICO-UHD-D2-H25<br>2 channels of decoding per Accelerator each UHD format |
| Video encapsulation | SMPTE 2022-6 SDI payload over RTP/UDP/IP                                                                                                               |

## Audio and ancillary data formats

|                |                                                                   |
|----------------|-------------------------------------------------------------------|
| Embedded audio | 16 channels (8 stereo pairs) per channel<br>Embedded to ST 2022-6 |
| Ancillary data | Single stream per channel. Pass thru.                             |

## Video and audio over IP transport

|                   |                                                                                                                                                                           |
|-------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Video over IP     | SMPTE 2022-6 SDI payload over RTP/UDP/IP                                                                                                                                  |
| Unc. video        | SMPTE ST 2110-20 video in RTP/UDP/IP<br>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)<br>SMPTE ST 2110-31 AES3 over IP (Level A+B)<br>AES67 compliant (1 to 8 ch per stream)<br>Up to 64 IP audio input and output flows |
| Ancillary over IP | SMPTE ST 2110-40 Ancillary Data over IP<br>Up to 1 input and output flow per channel                                                                                      |
| NMOS support      | SDP (Session Description Protocol)<br>NMOS IS-04 Discovery and Registration<br>NMOS IS-05 Connection Management                                                           |
| LLDP              | Status and per interface configuration                                                                                                                                    |
| Link redundancy   | Hitless/seamless switching for all RTP flows compliant to SMPTE ST 2022-7:2019                                                                                            |
| Network interface | 2x 25GE                                                                                                                                                                   |

## Timing and synchronization

|                     |                                                                |
|---------------------|----------------------------------------------------------------|
| Sync input format   | PTP (IEEE 1588v2:2008)<br>Analog BB/TLS via Virtuoso appliance |
| PTP profile support | PTP default and media profile<br>SMPTE 2059-2 PTP profile      |
| PTP redundancy      | Internal PTP failover in Virtuoso FA/MI                        |
| Media alignment     | SMPTE 2059-1 (phase offset configurable)                       |

## Video/audio processing

|       |                                                                                                                                                                                                                                                                                                                                                                                                       |
|-------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Audio | <ul style="list-style-type: none"> <li>- De-embedding audio channels from SDI audio inputs</li> <li>- Embedding audio channels to SDI outputs</li> <li>- Audio routing/shuffling/processing on SDI embedder</li> <li>- Audio delay adjustment - up to 10 seconds per channel</li> <li>- Audio level/gain control - per mono channel</li> <li>- Automatic Dolby E realignment on SDI output</li> </ul> |
| Video | <ul style="list-style-type: none"> <li>- Video frame synchronization</li> <li>- Video delay adjustment - up to 10 frames per channel</li> </ul>                                                                                                                                                                                                                                                       |

## Monitoring

|                                          |                                                                                                                                                           |
|------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------|
| Thumbnails of SDI video input and output |                                                                                                                                                           |
| Content monitoring                       | Thumbnails of SDI video input and output<br>Audio level bars.                                                                                             |
| Advanced monitor                         | Template based monitoring for video/audio.<br>SDI Video black and freeze frame detection.<br>Audio silence and peak level detection.<br>(Licensed option) |

## Media Server Appliance support

|                                                                 |                                      |
|-----------------------------------------------------------------|--------------------------------------|
| Please refer to Nevion Virtuoso Platform datasheet for details. |                                      |
| Virtuoso MI                                                     | Supported in version 1.4 or higher   |
| Virtuoso RE                                                     | Supported in version 1.0.8 or higher |
| Virtuoso FA                                                     | Supported in version 2.6 or higher   |

## Accelerator requirement

|                   |                                                                                                                                              |
|-------------------|----------------------------------------------------------------------------------------------------------------------------------------------|
| Accelerator       | HBR 25G Media Accelerator                                                                                                                    |
| Description       | Virtuoso High Bit-Rate media accelerator card. 2x SFP28 for 25GE and 1x SFP+ ports that can accommodate optical/electrical video interfaces. |
| Product codes     | VIRTUOSO-HW-HBR25-SFP3 (24645)                                                                                                               |
| SFP configuration | Port 1: Not used<br>Port 2: 25GE (25GBase-LR/SR)<br>Port 3: 25GE (25GBase-LR/SR)                                                             |
| Power consumption | Maximum 45W                                                                                                                                  |

## Software media functions

|                 |                                                                          |
|-----------------|--------------------------------------------------------------------------|
| TICO-UHD-E2-H25 | TICO UHD Encoder (2 channels). IP ST 2110 inputs. Dual 25GE interfaces.  |
| TICO-UHD-D2-H25 | TICO UHD Decoder (2 channels). IP ST 2110 outputs. Dual 25GE interfaces. |



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