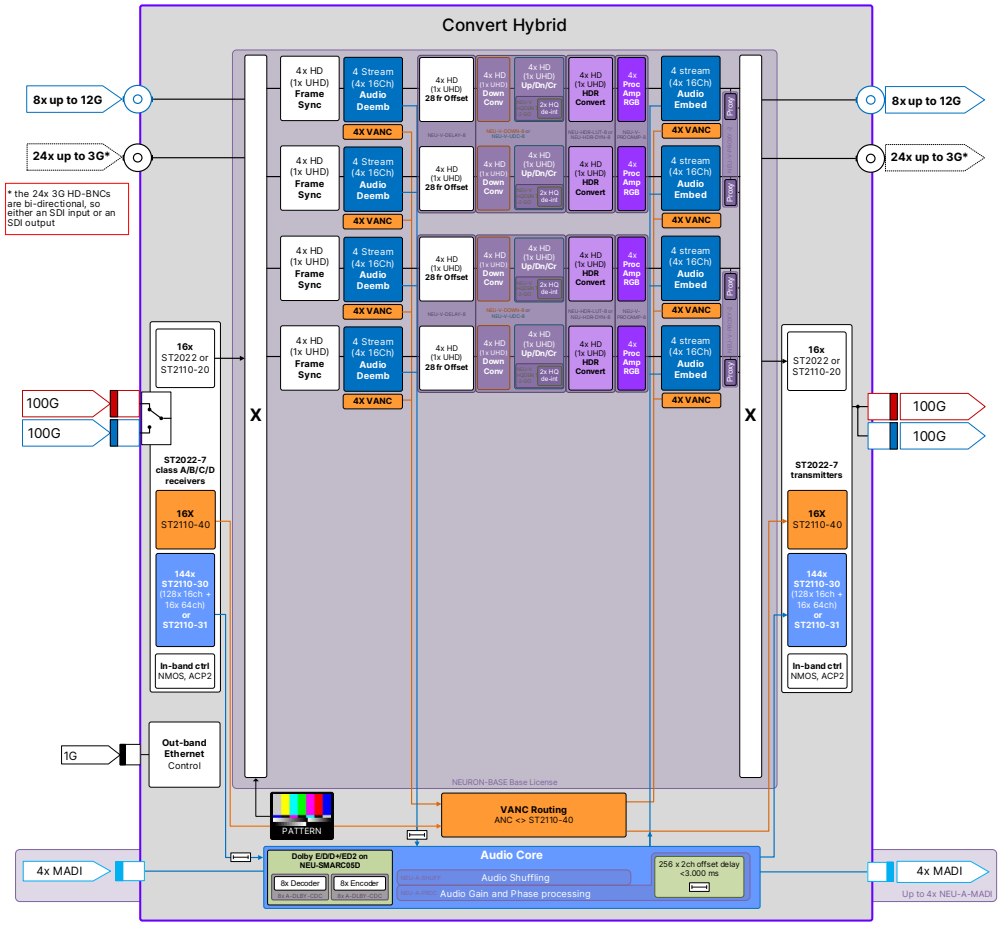
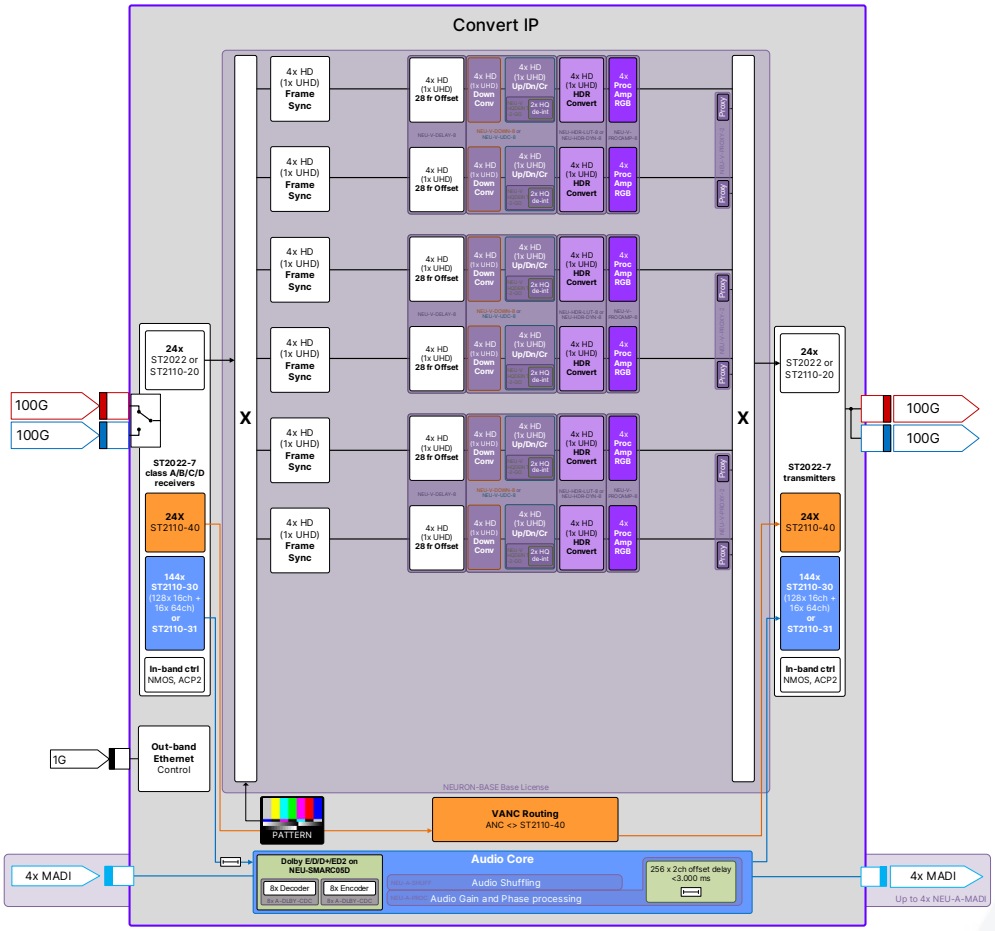
Neuron

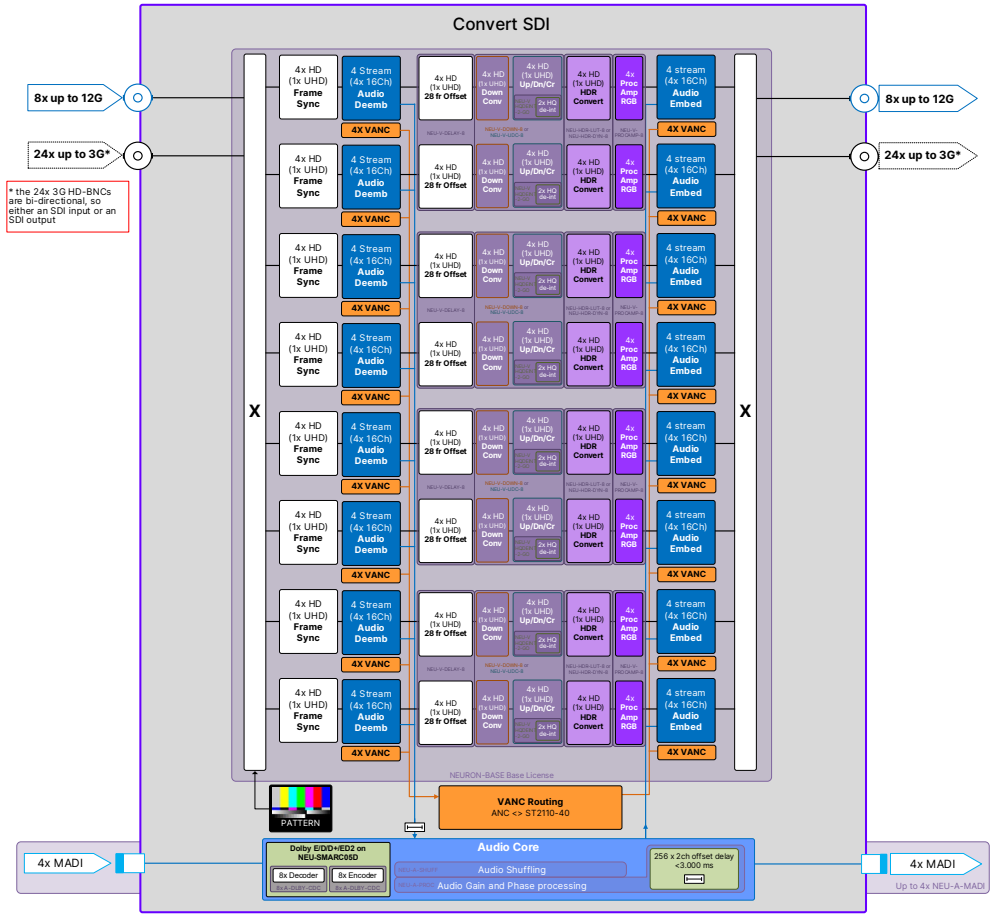
CONVERT

Realtime format conversion, color space conversion and other processing for IP, SDI and Hybrid environments

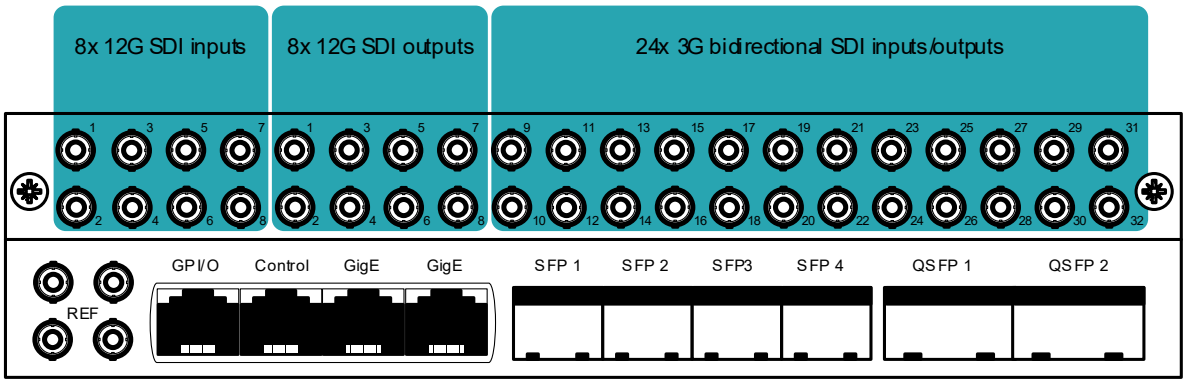
Block schematics of the configurations






Convert SDI
8x up to 12G
24x up to 3G*
* the 24x 3G HD-BNCs are bi-directional, so either an SDI input or an SDI output
4x HD (1x UHD) Frame Sync
4 Stream (4x 16Ch) Audio Deemb
4X VANC
4x HD (1x UHD) 28 fr Offset
4x HD (1x UHD) Down Conv
4x HD (1x UHD) Up/Dn/Cr
2x HQ de-int
4x HD (1x UHD) HDR Convert
4x Proc Amp RGB
4 stream (4x 16Ch) Audio Embed
X
8x up to 12G
24x up to 3G*
NEURON-BASE Base License
PATTERN
VANC Routing
ANC <> ST2110-40
4x MADI
Dolby E/DD+/ED2 on NEU-SMARC05D
8x Decoder
8x Encoder
Audio Core
Audio Shuffling
Audio Gain and Phase processing
256 x 2ch offset delay <3.000 ms
4x MADI
Up to 4x NEU-A-MADI

I/O Panel

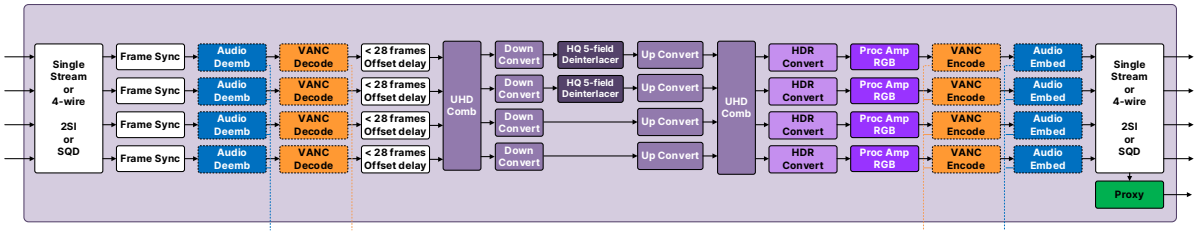


I/O capacities

	SDI inputs	ST2110-20 and ST2110-40 in streams[1]	ST2110-30/31 in streams[1]	SDI outputs	ST2110-20 and ST2110-40 out streams[1]	ST2110-30/31 out streams[1]
Convert Hybrid	8x up to 12G or 32x up to 3G[2]	4x up to 2160p or 16x up to 1080p	128x 16ch and 16x 64ch	8x up to 12G or 32x up to 3G[2]	4x up to 2160p or 16x up to 1080p	128x 16ch and 16x 64ch
Convert IP	-	6x up to 2160p or 24x up to 1080p	128x 16ch and 16x 64ch	-	6x up to 2160p or 24x up to 1080p	128x 16ch and 16x 64ch
Convert SDI	8x up to 12G or 32x up to 3G[3]	-	-	8x up to 12G or 32x up to 3G[3]	-	-

[1]) Redundant -7 streams
[2]) Since Convert Hybrid has 16 processing paths, the maximum density of SDI ↔ IP gateways is 16. You can however use the unused BNC connectors as extra SDI outputs (distribution amplifiers).
[3]) Since Convert SDI has 40 BNCs and 32 processing paths, the maximum density of SDI inputs to SDI outputs is 20 FHD in to 20 FHD out. It can however simultaneously process 8 UHD signals so e.g. down converting 8x 12G UHD inputs to 32x 3G 1080p outputs (including 1 to 4 distribution amplification) is possible with one Convert SDI.

Video Processing paths



Depending on the configuration (SDI, IP or Hybrid) Neuron **Convert** can have up to 8 of these UHD (=4x 1080p) processing paths. 4 paths in the Hybrid, 6 paths in the IP and 8 paths in the SDI configuration. Depending on the active licenses, these processing paths include frame syncs, audio and VANC de-embedders, video offset delay (optional), up/down/cross converters (optional), high quality deinterlacers (optional), HDR converters (optional), color correcting proc amps (optional), VANC and audio embedders and audio gain/phase/shuffle functionality (optional). Also optional is that Convert can generate downscaled 1080p “proxies” of each UHD stream (single stream/1-wire), to send to Neuron View without it having to use the capacity of 4 FHD inputs.

Audio Core

The internal audio core of a **Convert Hybrid** has the following I/O:

Audio Core Inputs	Audio Core Outputs
16x 16 channels from the deembedders	16x 16 channels to the embedders
128x 16 channels from ST2110-30 input streams	128x 16 channels to ST2110-30 output streams
16x 64 channels from ST2110-30 input streams	16x 64 channels to ST2110-30 output streams
4x 64 channels from MADI inputs	4x 64 channels to MADI outputs
256x 2 channels processed (delayed) audio	256x 2 channels to audio processor (delay)
8x 8 channels from Dolby Decoders	8x 2 channels to Dolby Decoders
8x 2 channels from Dolby Encoder	8x 8 channels to Dolby Encoders
4.176 channels in	**4.176 channels out**

The internal audio core of a **Convert IP** has the following I/O:

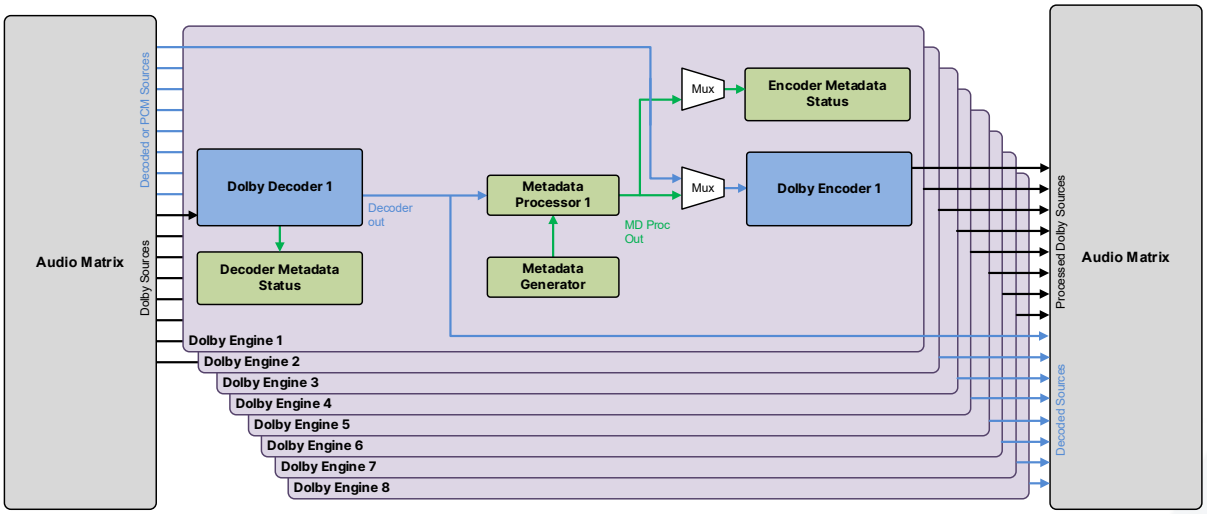
Audio Core Inputs	Audio Core Outputs
0 channels from deembedders	0 channels to embedders
128x 16 channels from ST2110-30 input streams	128x 16 channels to ST2110-30 output streams
16x 64 channels from ST2110-30 input streams	16x 64 channels to ST2110-30 output streams
4x 64 channels from MADI inputs	4x 64 channels to MADI outputs
256x 2 channels processed (delayed) audio	256x 2 channels to audio processor (delay)
8x 8 channels from Dolby Decoders	8x 2 channels to Dolby Decoders
8x 2 channels from Dolby Encoder	8x 8 channels to Dolby Encoders
3.920 channels in	**3.920 channels out**

The internal audio core of a **Convert SDI** has the following I/O:

Audio Core Inputs	Audio Core Outputs
32x 16 channels from the deembedders	32x 16 channels to the embedders
0 channels from ST2110-30 input streams	0 channels to ST2110-30 output streams
4x 64 channels from MADI inputs	4x 64 channels to MADI outputs
256x 2 channels processed (delayed) audio	256x 2 channels to audio processor (delay)
8x 8 channels from Dolby Decoders	8x 2 channels to Dolby Decoders
8x 2 channels from Dolby Encoder	8x 8 channels to Dolby Encoders
1.360 channels in	**1.360 channels out**

Dolby Processing

All Convert models can optionally decode and encode Dolby E, Dolby Digital and Dolby Digital Plus and encode Dolby ED2 (no ED2 decoding). There are 8 engines to decode and/or encode Dolby (licensed per decoder and encoder). **Processing Dolby ED2 requires 2 engines**. Below diagram visualizes the processing capabilities of the Dolby engines.



All Dolby processing requires the NEU-SMARC-05D expansion board.

Features

Neuron **Convert** is a multi-channel video and audio processor developed for low-latency and high-bandwidth IP, SDI or Hybrid-based infrastructures. **Convert** is capable of processing 1080p or 2160p signals and transport them over redundant (ST2022-7) IP streams and/or SDI I/O. The **Convert Hybrid** can process up to **16x** 1080p (= 4x 2160p) channels, **Convert IP** can process up to **24x** 1080p (= 6x 2160p) channels, and the **Convert SDI** can process up to **32x** 1080p (= 8x 2160p) channels. Since 2 of these boards fit in a Neuron frame, the density per RU is twice the processing capacity per board.

All **Convert** identities can perform many different video and audio processing functions. Depending on the active licenses it can perform frame syncing, audio and VANC de-embedding, video offset delay (optional), up/down/cross conversion (optional) with high quality deinterlacing (optional), HDR conversion (optional), color correcting proc amps (optional), VANC and audio embedding and audio gain/phase/shuffling processing (optional). Also optional is generating downscaled 1080p copies (proxies) of each UHD stream, to send to a Neuron View or other multiviewer, without it having to use the capacity of 4 FHD inputs. Combining four 1080p paths will offer UHD processing. Virtually any baseband signal can be processed, from 720p all the way up to 2160p.

If a **Convert Hybrid** is expanded with the optional SDI I/O module, 40 HD-BNC SDI connectors are added to allow easy integration of IP into existing SDI baseband operations, simultaneously acting as bridge.

Optionally **Convert** offers additional audio I/O with 4x MADI licenses (MADI SFPs not included) and up to 8 Dolby D/D+/E/ED2 encoders and 8 Dolby decoders, licensable per decoder and encoder. The Dolby E encoding and decoding licenses require the SMARC expansion module to be installed on the processing board.

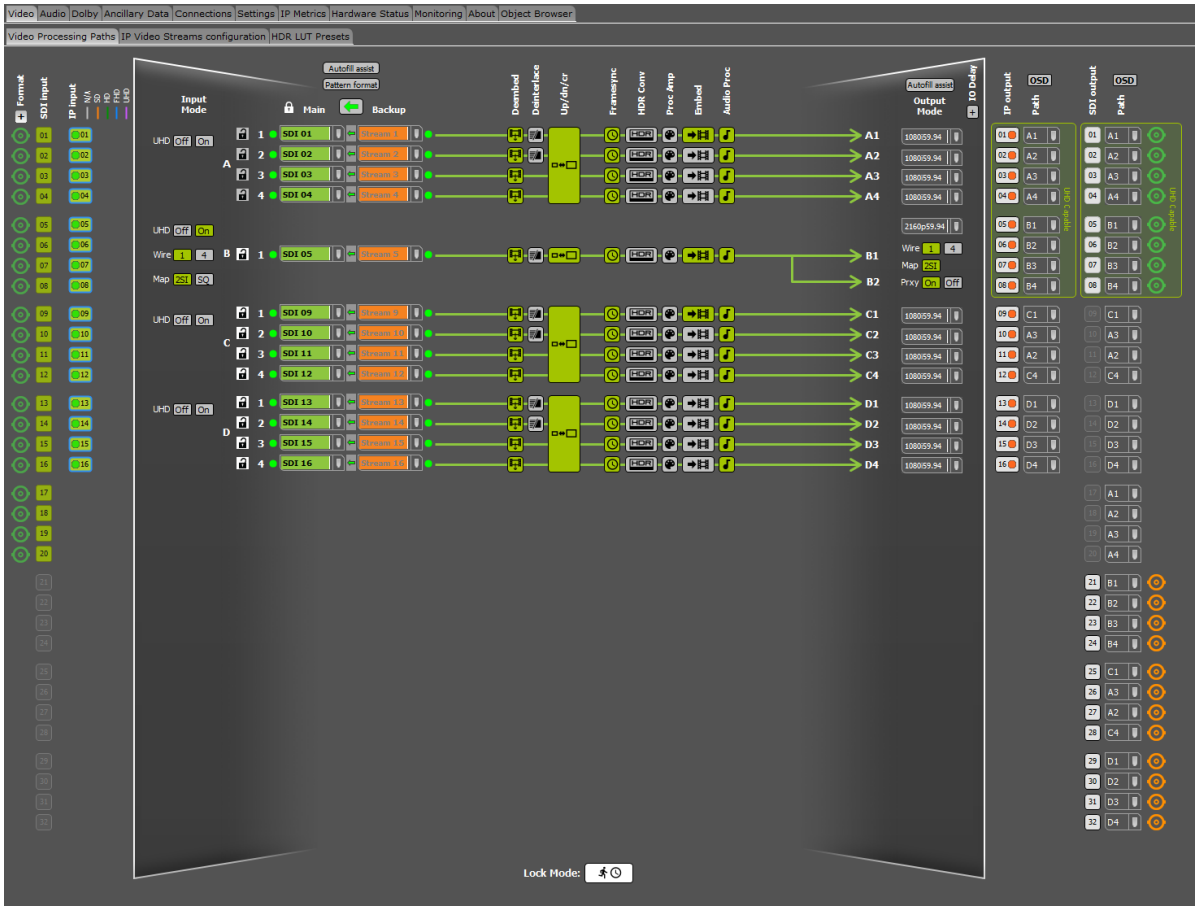
- Standards supported: UHD (single wire, 4 wire SQD/2Si), FHD Level-A and HD on 50Hz and 59.94Hz. Supported framerates: 2160p 60/59.94/50/30/29.97/25/24/23.98, 1080p 60/59.94/50/30/29.97/25/24/23.98, 1080i 60/59.94/50 and 720p 60/59.94/50
- Up to 24 ST2110-20 (video) input and output streams on **Convert IP**
- Up to 16 ST2110-20 (video) input and output streams on **Convert Hybrid**
- Up to 24 ST2110-40 (ancillary data) input and output streams on **Convert IP**
- Up to 16 ST2110-40 (ancillary data) input and output streams on **Convert Hybrid**
- Up to 144 ST2110-30/31 (audio) input and output streams of which 128 are 16ch and 16 are 64ch on **Convert Hybrid** and **Convert IP**
- Up to 16 channels of bridging SDI to/from IP on **Convert Hybrid** (requires SDI expansion board)
- Up to 16 (**Hybrid**), 24 (**IP**) or 32 (**SDI**) channels frame-sync to local clock on external ref (B&B or PTP)
- Up to 16 (**Hybrid**) or 32 (**SDI**) times 16 channel audio de-embedding or embedding
- Transparency of VANC data to ST2110-40 in SDI and vice versa with possibility to shuffle streams
- All inputs can be mapped to any main or backup (auto switchover) input of the processing paths
- **Optional:** video offset delay of up to 28 frames (= 0.5 seconds of FHD/UHD and 1 second of 1080i/720p)
- **Optional: Either** FHD / UHD down conversion **or** FHD / UHD up/down/cross conversion
- **Optional:** 2x high quality 5-field motion compensated de-interlacers per 4 FHD processing paths
- **Optional:** LUT-based HDR conversion
- **Optional:** RGB and YCbCr ProcAmp / color correction
- **Optional:** Audio gain/phase/delay
- **Optional:** Downscalers to generate 1080p copies (proxies) of 1-wire 2160p streams for multiviewers
- **Optional:** Up to 4x 64 channels bi-directional MADI IO
- **Optional:** Mono channel audio shuffling of up to 4.172 x 4.172 channels (depending on identity), controllable via SW-P-08
- **Optional:** Up to 8 Dolby encoders and Dolby decoders capable of handling D/D+/E/ED2 (requires NEU-SMARC-05D) (ED2 encoding takes up 2 licenses)
- Clean switch and fast switch capabilities between all inputs (IP and/or SDI)
- Dual QSFP28 100Gb/s single-MAC
- PTP Network timing with slave functionality, compliant with SMPTE ST2059-2 (BMCA)
- External black burst inputs
- Possibility to output 2x Analog bi-level reference locked to PTP fully adjustable over a frame in pixel increments
- Redundant IP streams in and out (ST2022-7 class A/B/C/D compliant)
- Multicast and unicast, configurable per streams
- Compatible protocols: ACPv2, DNS, IGMPv2, IGMPv3, LLDP, DHCP, SDP, NMOS IS-04, NMOS IS-05, 802.1as, ST2059-1/2, ST2022-7 class A/B/C/D, ST2110-20/30/31/40

Applications

- Multi-channel real-time audio and video processing and conversion
- Universal SDI ↔ IP bridge for IP-based infrastructures networks (Convert Hybrid)
- Universal Up/down/cross format conversion for SDI and IP environments
- HDR conversion for SDI and/or IP environments
- Dolby processing of SDI embedded and/or IP audio streams
- Outputs at shader position
- Ultra-fast clean switching
- Enabling local or remote productions over private or commercial networks
- Network attached processor

Default interface (Cerebrum)

Neuron **Convert** can be configured and controlled with Cerebrum free of charge. This means you can add any number of Neurons to the System View of Cerebrum without requiring any licenses. In Cerebrum, **Convert** can be configured using these easy-to-use and intuitive graphical user interfaces:



Ordering information

Hardware options:

- **NEU-BASE-BOARD:** Neuron base processing board. Requires at least one of the base licenses listed below)
- **NEU-SDI40-BOARD:** Neuron SDI IO expansion board with 8x 12G in, 8x 12G out and 24x 3G bidirectional IO on HD BNC. Requires NEU-BASE-BOARD
- **NEU-SMARC-05D:** Neuron SMARC A5 CPU module for Dolby Encoding/Decoding. Requires NEU-BASE-BOARD

Software options:

CONVERT HYBRID Base license (SDI and IP I/O)	
NEURON-BASE-GO	**Base License** for BRIDGE, CONVERT, COMPRESS & PROTECT Identities for up to 32x FHD or 8x UHD. **Includes embedding, de-embedding, frame syncs and IP and SDI I/O.** CONVERT Hybrid has 16x FHD or 4x UHD processing paths
CONVERT HYBRID Optional licenses	
NEU-AVD-DELAY-8-GO	**Offset delay** license (up to 28 frames) for 8 FHD (=2 UHD) channels. Max. 2 per CONVERT Hybrid.
NEU-V-PROCAMP-8-GO	RGB/YCbCr **color correction/Proc Amp** license for 8 FHD (=2 UHD) channels. Max. 2 per CONVERT Hybrid.
NEU-V-PROXY-2-GO	**Video proxy** license for 2x UHD to HD proxy generation. Downscales 2 UHD input streams to 1080p for use in Neuron View. Max. 2 per CONVERT Hybrid.
NEU-V-DOWN-8-GO	**Down conversion** license for 8x FHD or 2x UHD including 8x low-latency deinterlacers. Max. 2 per CONVERT Hybrid.
NEU-V-UDC-8-GO	**Up/down/cross conversion** license for 8x FHD or 2x UHD including 8x low latency deinterlacers, Max. 2 per CONVERT Hybrid.
NEU-V-HQDEINT-2-GO	2x high quality 5 field deinterlacers, requires 1x CON-V-UDC. Max 4 per CONVERT Hybrid.
NEU-V-HDR-LUT-8-GO	**LUT based HDR↔SDR and HDR↔HDR** conversion license for 8x FHD or 2x UHD. Max. 2 per CONVERT Hybrid
NEU-A-SHUFF-GO	**Audio Shuffle** license. Enables audio shuffling on mono level for all available audio channels and streams. Max. 1 per **processing board**.
NEU-A-PROC-GO	**Audio Processing** license for audio gain/phase and delay. Max. 1 per **processing board**.
NEU-A-MADI64-GO	**MADI I/O** license. 64 channels in and 64 channels out. **Requires MSA SFP (not included).** Max. 4 per **Processing board**.
NEU-A-DLBY-CDC-GO	**Dolby encoder/decoder** license. **Requires NEU-SMARC-05D**. Max. 16 per **processing board** (8 encoders and 8 decoders)

CONVERT

CONVERT IP Base license (IP I/O)

NEURON-BASE-GO	**Base License** for BRIDGE, CONVERT, COMPRESS & PROTECT Identities for up to 32x FHD or 8x UHD. **Includes embedding, de-embedding, frame syncs and IP I/O.** CONVERT IP has 24x FHD or 6x UHD processing paths and only IP I/O.

CONVERT IP Optional licenses

NEU-AVD-DELAY-8-GO	**Offset delay** license (up to 28 frames) for 8 FHD (=2 UHD) channels. Max. 3 per CONVERT IP.
NEU-V-PROCAMP-8-GO	RGB/YCbCr **color correction/Proc Amp** license for 8 FHD (=2 UHD) channels. Max. 3 per CONVERT IP.
NEU-V-PROXY-2-GO	**Video proxy** license for 2x UHD to HD proxy generation. Downscales 2 UHD input streams to 1080p for use in Neuron View. Max. 3 per CONVERT IP.
NEU-V-DOWN-8-GO	**Down conversion** license for 8x FHD or 2x UHD including 8x low-latency deinterlacers. Max. 3 per CONVERT IP.
NEU-V-UDC-8-GO	**Up/down/cross conversion** license for 8x FHD or 2x UHD including 8x low latency deinterlacers. Max. 3 per CONVERT IP.
NEU-V-HQDEINT-2-GO	2x high quality 5 field deinterlacers, requires 1x CON-V-UDC. Max. 6 per CONVERT IP.
NEU-V-HDR-LUT-8-GO	**LUT based HDR↔**SDR and HDR↔HDR conversion license for 8x FHD or 2x UHD. Max. 3 per CONVERT IP.
NEU-A-SHUFF-GO	**Audio Shuffle** license. Enables audio shuffling on mono level for all available audio channels and streams. Max. 1 per **processing board**.
NEU-A-PROC-GO	**Audio Processing** license for audio gain/phase and delay. Max. 1 per **processing board**.
NEU-A-MADI64-GO	**MADI I/O** license. 64 channels in and 64 channels out. **Requires MSA SFP (not included).** Max. 4 per **Processing board**.
NEU-A-DLBY-CDC-GO	**Dolby encoder/decoder** license. **Requires NEU-SMARC-05D**. Max. 16 per **processing board** (8 encoders and 8 decoders)

CONVERT SDI Base license (SDI I/O)

NEURON-BASE-GO	**Base License** for BRIDGE, CONVERT, COMPRESS & PROTECT Identities for up to 32x FHD or 8x UHD. **Includes embedding, de-embedding, frame syncs and SDI I/O.** CONVERT SDI has 32x FHD or 8x UHD processing paths and only SDI I/O.

CONVERT SDI Optional licenses

NEU-AVD-DELAY-8-GO	**Offset delay** license (up to 28 frames) for 8 FHD (=2 UHD) channels. Max. 4 per CONVERT SDI.
NEU-V-PROCAMP-8-GO	RGB/YCbCr **color correction/Proc Amp** license for 8 FHD (=2 UHD) channels. Max. 4 per CONVERT SDI.
NEU-V-DOWN-8-GO	**Down conversion** license for 8x FHD or 2x UHD including 8x low-latency deinterlacers. Max. 4 per CONVERT SDI.
NEU-V-UDC-8-GO	**Up/down/cross conversion** license for 8x FHD or 2x UHD including 8x low latency deinterlacers, Max. 4 per CONVERT SDI.
NEU-V-HQDEINT-2-GO	2x high quality 5 field deinterlacers, requires 1x CON-V-UDC. Max. 8 per CONVERT SDI.
NEU-V-HDR-LUT-8-GO	**LUT based HDR↔**SDR and HDR↔HDR conversion license for 8x FHD or 2x UHD. Max. 4 per CONVERT SDI.
NEU-A-SHUFF-GO	**Audio Shuffle** license. Enables audio shuffling on mono level for all available audio channels and streams. Max. 1 per **processing board**.
NEU-A-PROC-GO	**Audio Processing** license for audio gain/phase and delay. Max. 1 per **processing board**.
NEU-A-MADI64-GO	**MADI I/O** license. 64 channels in and 64 channels out. **Requires MSA SFP (not included).** Max. 4 per **Processing board**.
NEU-A-DLBY-CDC-GO	**Dolby encoder/decoder** license. **Requires NEU-SMARC-05D**. Max. 16 per **processing board** (8 encoders and 8 decoders)

Specifications

Reference I/O

Connector Type	Micro BNC (HD BNC)
Number of inputs	1
Number of outputs	2, Loop input or analog reference out
Termination	75 Ohms when not looped
Bi-Level	PAL/NTSC Black Burst ITU624

Gigabit Ethernet

Connector Type	RJ45
Number	1
Standards	10/100/1000 Base-T
Protocols streaming	AES67, ST2059
Protocol control	ACPv2
Cable	Shielded twisted pair

QSFP Cages

Number of cages	2
Standards	QSFP28, 100GbE
Protocols	ST2022-6, ST2110, AES67, ST2059

SFP Cages

Number of cages	4
Standards	MSA
Protocols	MADI

Serial video inputs (optional)

Standard	SMPTE ST 2082, HD-SDI ST292, ST296 ST274,3G-SDI ST424 (Level A) ST425-1
Number of Inputs	8
Connector type	Micro BNC (HD BNC)
Signal Level	800mV
DC Offset	0V±0.5V
Overshoot	Within 10% of signal level
Return Loss	>15dB up to 1.5GHz, >10dB up to 3GHz

Serial video outputs (optional)

Standard	SMPTE ST 2082, HD-SDI ST292/ST296/ST274, 3G-SDI ST424 (Level A)/ST425-1
Number of Inputs	8
Connector type	Micro BNC (HD BNC)
Signal Level	800mV
DC Offset	0V±0.5V
Overshoot	Within 10% of signal level
Return Loss	>15dB up to 1.5GHz, >10dB up to 3GHz

Serial video bi-directional connections (optional)

Standard	HD-SDI ST292/ST296/ST274 3G-SDI ST424 (Level A)/ST425-1
Number of Inputs	24
Connector type	Micro BNC (HD BNC)
Signal Level	800mV
DC Offset	0V±0.5V
Overshoot	Within 10% of signal level
Return Loss	>15dB up to 1.5GHz, >10dB up to 3GHz

Miscellaneous

Weight	Approx. 2050gr
Operating temp.	0°C to +40°C
Dimensions	400 x 193 x 42mm (LxWxD)

Electrical

Voltage	+12V nominal (tolerance:-1V/+0.5V)
Power	100-120Watts