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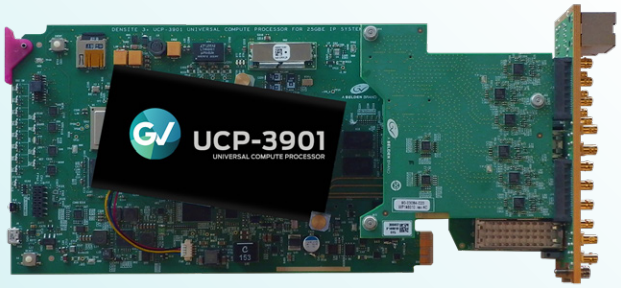
DATASHEET



UCP-3901 Universal Compute Processor for Densité 3+

The UCP-3901 is a user-configurable multichannel video/audio-over-IP transceiver developed for use within low-latency and high-bandwidth Ethernet IP networks. The UCP-3901 provides a hardware platform which can offer different functionality depending on the software option loaded. These options are known as *Software-Defined Cores* (SDCs), and can be purchased through a licensing mechanism and loaded as operational needs demand.

The UCP-3901 Universal Compute Processor can adopt different Software Cores to provide low-latency, high-bandwidth multichannel broadcast processing/routing for SDI, MADI and IP applications.

This flexible powerhouse can deliver up to 16 channels of 3G-SDI, four channels of UHD-SDI (12G or Quad-link) or 8 bidirectional MADI channels, while seamlessly integrating with Grass Valley's broadcast-centric IP routing and management solution GV Orbit to offer, fast, clean and quiet switching.

UCP-3901-25-EP and UCP-3901-50-EP are the Essence Processing core and act as a high-performance, versatile gateway which can encapsulate or de-capsulate up to 16 SDI signals (depending on format) to/from uncompressed SMPTE ST 2110 and/or SMPTE ST 2022-6. Various modes of operation are available offering SDI to IP, IP to SDI or combinations of the two. UHD support is provided via Single Stream and/or Quad Stream for both SDI and SMPTE ST 2110, enabling a seamless transition from SDI<>IP for all system architectures. Multiple SMPTE ST 2110-30 audio flows per channel can be configured to support 1x16 channels, 2x8 channels or 4x4 channels embedding/de-embedding to/from SDI.

UCP-3901-MD is the MADI Gateway core that provides a multichannel MADI to/from IP interface and has been developed to allow high-density audio integration into SMPTE ST 2110 production network. It handles up to 16 MADI signals (8 in & 8 out) over dual 10 GbE or 25 GbE IP links, with the option to provide MADI link redundancy. Up to 64 channels of uncompressed audio MADI can be transported using the SMPTE ST 2110-30 Level A, B and C. Multiple audio flows per MADI can be configured to support 1x64, 2x32 or 4x16 channels.

UCP-3901 is fully compatible with Grass Valley's new broadcast-centric IP routing and network management solution GV Orbit, designed to migrate broadcasters from a traditional baseband routing and control environment to new hybrid SDI and IP workflows.

Key Features

General Features

- Handles up to 16 SDI signals over dual or quad 25 GbE IP links (number of channels dependent on SDI signal format)
- Multiple SDI standards & formats supported including 12G Single-link & 4K UHD SDQS or 2SI 1080p (3G) modes
- SDI embed/de-embed of up to 4 audio flows per channel
- Configuration of Ethernet links to maximize signal distribution points using dual or quad SFPs, or for redundancy as per SMPTE ST 2022-7. When operating as a receiver will dynamically adapt to any stream presented to it (i.e., hitless switching)
- UHD Single Stream SMPTE ST 2110 and 12G SDI I/O
- Supports IGMPv3 source-specific multicast, allowing transmission in multicast groups
- Supports frame-synchronized SDI inputs and outputs, referenced using external blackburst/tri-level analog sync reference
- Fast, clean and quiet switching via make-before-break or break-before-make
- Low delay mode and independent H & V offset available for each channel along with up to two frames of video, and up to 255 ms of audio delay
- Seamless integration with GV Orbit Control, Configuration & Monitoring software including logging & reporting
- SMPTE ST 2022-7 Class A & D seamless protection switching
- SMPTE ST 2059-1 & -2 precision time protocol
- NMOS IS-04 discovery and registration with group hints tag support
- NMOS IS-05 device connection management
- In-band or out-of-band control of NMOS
- Support of DHCP, LLDP and DNS-SD for easy IP configuration
- Both FC-FEC (Fire Code) and RS-FEC (Reed Solomon IEEE) Forward Error Correction are supported
- Dual SFP28 Flexible Ethernet for 25 GbE SFP28 cage:
  - SFP-25G-SR for short-range multimode optical connections
  - SFP-25G-LR for long-range single-mode optical connections
  - 10GBASE-SR for short-range multimode optical connections supported for UCP-3901-25-MD essence only.
  - 10GBASE-LR for long-range single-mode optical connections supported for UCP-3901-25-MD essence only
- 4 x SFP28 used for 50 GbE Essence Processing operations

Essence Processing (EP) Features

- SMPTE ST 2110-20 video including UHD Single-stream
- SMPTE ST 2110-21 Wide/Narrow profile receivers and Narrow senders
- SMPTE ST 2110-30 PCM audio
- SMPTE ST 2110-40 metadata associated with SMPTE ST 2110-20 video stream
- SMPTE ST 2022-6 Transport of High Bit Rate Media Signals (HBRMT) (SDI) over IP Networks

MADI Essence (MD) Features

- Handles up to 16 MADI signals (8 in & 8 out) over dual 10/25 GbE IP links, with the option to provide MADI link redundancy
- Audio delay per IP output stream of up to 128 ms
- Uncompressed PCM audio transport using SMPTE ST 2110-30
- Audio tone generator available for MADI channels, with selectable tone frequencies of 1 kHz, 2 kHz, 4 kHz and 8 kHz
- Audio channel selection per IP stream from 1-64 channels, plus packet time selection of 125 µs, 250 µs, 500 µs, 1 ms and 4 ms
- Source/Destination audio channel shuffling

The UCP-3901 is installed in the established Densité modular frames. Due to their advanced architecture and power density, the UCP-3901 is supported in both the Densité 3+ FR1 and FR4 frames. Two UCP-3901 cards can be installed in the Densite 3+ FR1 frame, giving a density of 32 channels (HD/3G) in 1 RU. With flexibility to configure up to 12 UCP-3901 cards per Densité 3+ FR4 frame, the Densité platform scales to a market-leading density of 192 channels (HD/3G) in a 4 RU frame. The UCP-3901 can also be utilized in an existing GV Node frame. This means space and cost-efficient scaling today and tomorrow.

Densité 3+ FR4

4 RU

12x UCP-3901 = 192 HD/3G Channels

48 x UHD (12G) Channels

Up to 96 Bidirectional MADI Channels

Densité 3+ FR1

1 RU

2x UCP-3901 = 32 HD/3G Channels

Up to 8 x UHD (12G) Channels

Up to 16 Bidirectional MADI Channels

Why should you choose this module?

- Re-purpose existing hardware modules for alternate tasks as network requirements evolve
- Using 25 GbE transport allows multiple signals to be sent over a single fiber reducing link count and minimizing cost
- Improve signal transport efficiency by running multiple SDI signals over a single Ethernet connection enabling linking between existing SDI equipment and future IP network architectures
- Provides a flexible and cost-effective way to integrate MADI audio devices into Ethernet IP networks for efficient signal transport.
- Using IGMPv3 source-specific multicast allows fast configuration of network routes while enabling clean switching at the destination device
- Designed for use with GV Orbit, combined with compliance to IP Open Standards (AMWA NMOS), means easy integration with Grass Valley or third-party network orchestration & management systems

UCP-3901-25-EP Configurations

SD/HD/3G Mode of Operation			
SDI > IP	**IP > SDI**	**Format**	**Capabilities**
8	0	480i59.94, 576i50 720p50/59.94 1080i50/59.94 1080p23.98/25/29.97/50/59.94	1x SDI Frame Sync, 1x 2022-6, 1x 2110-20/30(x4)/40
16	0		1x SDI, 1x 2022-6, 1x 2110-20/30(x4)/40
8	8		
4	12		
0	16		
12	4		**RS-FEC** 1x SDI, 1x 2022-6, 1x 2110-20(RX)/30(x4)/40 1x SDI, 1x 2022-6(RX), 1x 2110-20/30(x4)/40 **FC-FEC** 1x SDI, 1x 2022-6, 1x 2110-20/30(x4)/40
UHD/12G Mode of Operation			
2	2	720p50/59.94 1080i50/59.94 1080p23.98/25/29.97/50/59.94	1x SDI, 1x 2110-20/30(x4)/40
2	2	2160p50/59.94	4x SDI (Quad Link 3G 2SI), 1x 2110-20/30(x4)/40 1x SDI (12G), 1x 2110-20/30(x4)/40 1x SDI (12G), Quad Stream 2110-20/30(x4)/40
2	2	2160p23.98/25/29.97	4x SDI (Quad Link HD 2SI), 1x 2110-20/30(x4)/40

UCP-3901-50-EP Configurations

SD/HD/3G Mode of Operation			
SDI > IP	**IP > SDI**	**Format**	**Capabilities**
8	0	480i59.94, 576i50 720p50/59.94 1080i50/59.94 1080p23.98/25/29.97/50/59.94	1x SDI Frame Sync, 1x 2110-20/30(x4)/40 1x SDI Frame Sync, 1x 2022-6, 1x 2110-30(x4)/40
16	0		1x SDI, 1x 2110-20/30(x4)/40 1x SDI, 1x 2022-6, 1x 2110-30(x4)/40
12	4		1x SDI, 1x 2022-6(RX), 1x 2110-20/30(x4)/40 1x SDI, 1x 2022-6, 1x 2110-20(RX)/30(x4)/40(RX)
8	8		1x SDI, 1x 2022-6(RX), 1x 2110-20/30(x4)/40
4	12		1x SDI, 1x 2022-6, 1x 2110-20(RX)/30(x4)/40 1x SDI, 1x 2022-6(RX), 1x 2110-20/30(x4)/40
0	16		1x SDI, 1x 2022-6, 1x 2110-20/30(x4)/40
UHD/12G Mode of Operation			
4	0	720p50/59.94 1080i50/59.94 1080p23.98/25/29.97/50/59.94	1x SDI, 1x 2110-20/30(x4)/40
2	2		
0	4		
4	0	2160p50/59.94	4x SDI (Quad Link 3G 2SI), 1x 2110-20/30(x4)/40 1x SDI (12G), 1x 2110-20/30(x4)/40 1x SDI (12G), Quad Stream 2110-20/30(x4)/40
2	2		
0	4		
4	0	2160p23.98/25/29.97	4x SDI (Quad Link HD 2SI), 1x 2110-20/30(x4)/40
2	2		
0	4		

Specifications

SDI (Inputs/Outputs)

Physical: 16 HD-BNC/75Ω connectors

SDI Standards:

- SMPTE ST 259M-C (270 Mb/s)
- SMPTE ST 292 (1.485, 1.485/1.001 Gb/s)
- SMPTE ST 424 (2.970, 2.970/1.001 Gb/s)
- SMPTE ST 2082-1:2015 (In = BNCs 1 & 2, Out = BNCs 3 & 4)

Supported Formats:

- SD: 480i59.94, 576i50
- HD: SMPTE ST 274: 1080i59.94, 1080i50, 1080p23.98, 1080p29.97
- HD: SMPTE ST 296: 720p59.94, 720p50
- 3G: SMPTE ST 425 level A (mapping 1)
- UHD: Quad Link 2SI/SDQS 1080p (3G) SMPTE ST 425-5: 1080p59.94, 1080p50
- UHD: Quad Link 2SI/SDQS 1080p (1.5G) SMPTE ST 274: 1080p23.98, 1080p29.97
- 12G: SMPTE ST 2082-10: 2160p59.94, 2160p50

Cable length (Belden 1694A):

- SD: 400m (1300 ft.) at 270 Mb/s
- HD: 165m (540 ft.) at 1.485 Gb/s
- 3G: 120m (390 ft.) at 2.970 Gb/s

Cable length (Belden 4794A):

- 12G: 60m (195 ft.) at 11.88 Gb/s

Jitter:

- HD/SD: <0.2 UI (alignment jitter)
- 3G: <0.3 UI (alignment jitter)
- 12G: <0.3 UI (alignment jitter)

MADI Standards:

- AES10-2003 - 8 inputs, 8 outputs

Reference Input

Physical: HD-BNC/75Ω connector

Standards: SMPTE ST 170/SMPTE ST 318/ITU 624-4 blackburst

Ethernet Port for Media

Physical: Two or four SFP28 sockets for active optical cable, short- and long-reach fiber transceivers

Standard: IEEE 802.3-2008 25 GbE

Performance: Up to 25 or 50 Gb of streaming per direction, dependent on the essence processing license

Ethernet Port for Control

Physical: One electrical RJ45 port

Standard: IEEE 802.3 1000 Mb/s

Electrical

Power: 55W maximum

UCP-3901 UHD Modes

Inputs \ Outputs		UHD Single Stream		UHD Quad Stream (2SI)			UHD Quad Stream (SDQS)		
		1x 12G SDI	1x SMPTE ST 2110-20	4x 3G SDI	4x SMPTE ST 2022-6	4x SMPTE ST 2110-20	4x 3G SDI	4x SMPTE ST 2022-6	4x SMPTE ST 2110-20
UHD Single Stream	1x 12G SDI		●		●	●			
	1x SMPTE ST 2110-20	●		●					
UHD Quad Stream (2SI)	4x 3G SDI		●		●	●			
	4x SMPTE ST 2022-6	●		●					
	4x SMPTE ST 2110-20	●		●					
UHD Quad Stream (SDQS)	4x 3G SDI							●	●
	4x SMPTE ST 2022-6						●		
	4x SMPTE ST 2110-20						●		

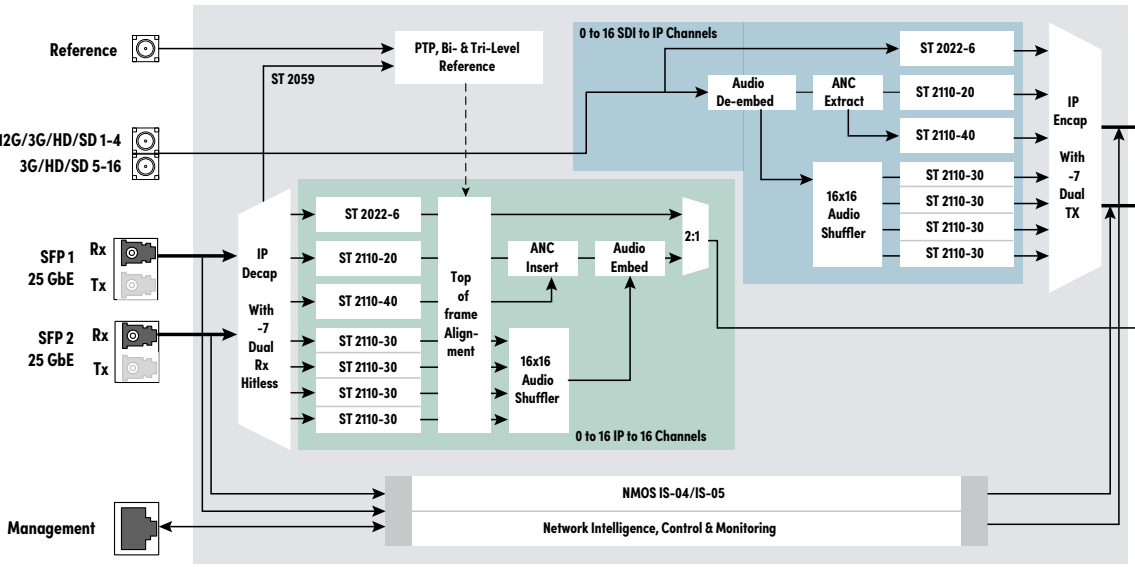
Mode	Formats	Density	Max Channels	Channel Order	SD/HD/3G	BNC Location
1:1 / 4:4*	SD – 3G	High	16x 3G	1-16	1-16	1-16 / 1-4, 5-8, 9-12, 13-16
1:1	SD – UHD	Low	4x UHD	1, 5, 9, 13	1, 5, 9, 13	1, 2, 3, 4
1:4**	SD – UHD	Low	4x UHD	1, 5, 9, 13	1, 5, 9, 13	1, 2, 3, 4
4:1*	SD – UHD	Low	4x UHD	1, 5, 9, 13	1, 5, 9, 13	1-4, 5-8, 9-12, 13-16

* 4:4 can be managed in quad groups using Link Control. In this mode, max. channels is reduced to 4.

** Quad groups occupy 4 channels, single stream (SDI or IP) will occupy master (1, 5, 9, 13) with slave controls/logging.

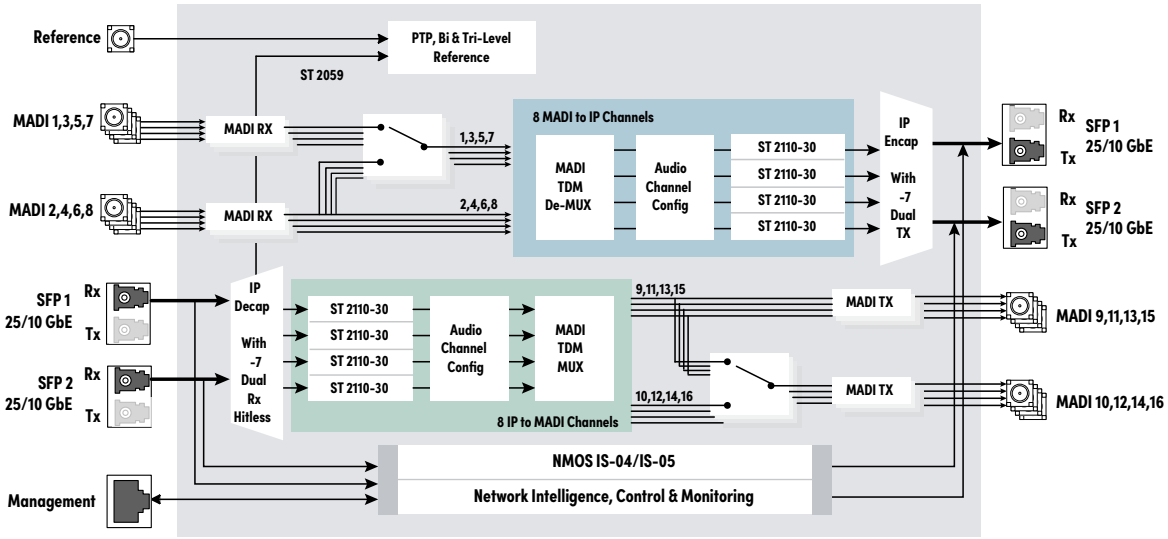
Bandwidth Considerations

Rx IP Format	Video Format	Max IP Rx Channels (static routing)	MBB Routing	BBM Routing
1x SMPTE ST 2110	1080p50	16	Max Rx reduced by 1 for each simultaneous MBB route	No loss of Rx channels
1x SMPTE ST 2110	1080p59	13		
1x SMPTE ST 2022-6	1080p50	14		
1x SMPTE ST 2022-6	1080p59	12		
1x SMPTE ST 2110	2160p50	4		
1x SMPTE ST 2110	2160p59	4		Max Rx reduced by 1 for each simultaneous BBM route

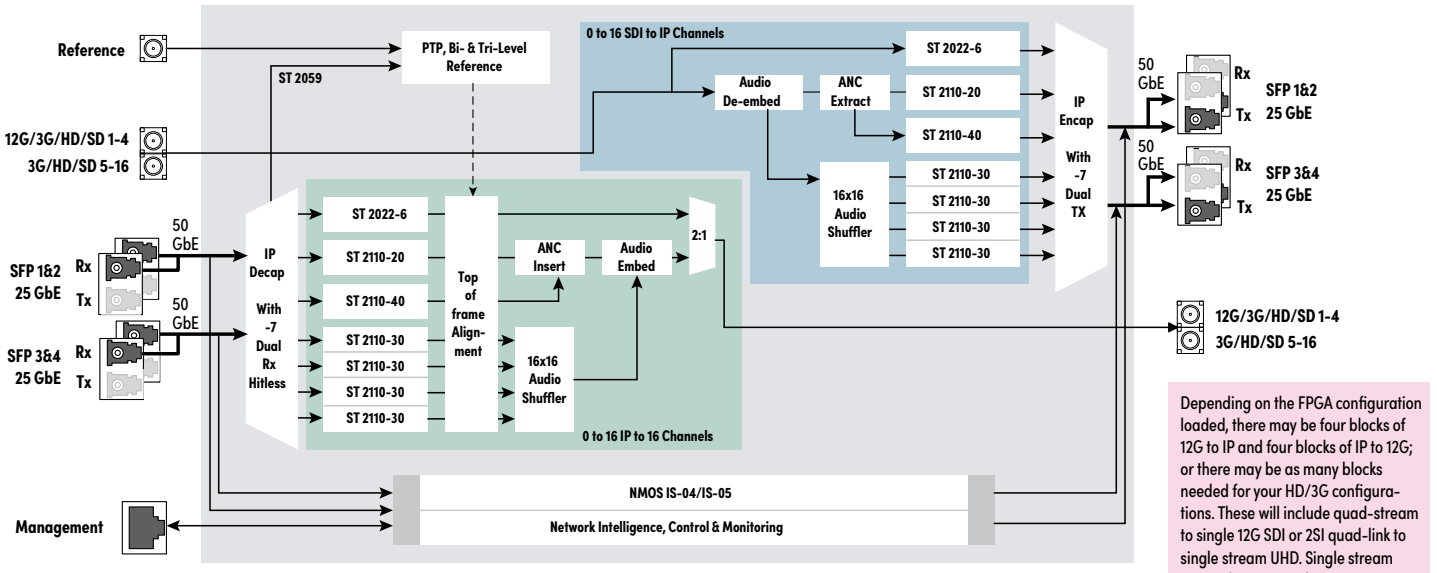


UCP-3901-25-EP Essence Processing Block Diagram

Depending on the FPGA configuration loaded, there may be two blocks of 12G to IP and two blocks of IP to 12G; or there may be as many blocks needed for your HD/3G configura-tions. These will include quad-stream to single 12G SDI or 2SI quad-link to single stream UHD. Single stream UHD only supported in SMPTE ST 2110.



UCP-3901-25-MD Essence Processing Block Diagram



UCP-3901-50-EP Essence Processing Block Diagram

Depending on the FPGA configuration loaded, there may be four blocks of 12G to IP and four blocks of IP to 12G; or there may be as many blocks needed for your HD/3G configurations. These will include quad-stream to single 12G SDI or 2SI quad-link to single stream UHD. Single stream UHD only supported in SMPTE ST 2110.

Ordering

Application Software

UCP-3901-25-EP

Essence processing license for SDI to/from IP with synchronization. For usage up to 25G option (2 x 25G SFP)

UCP-3901-25-MD

Essence processing license for MADI to/from IP for UCP-3901 with 25G or 10G SFPs

UCP-3901-50-EP

Essence processing license for SDI to/from IP with synchronization. For usage up to 50G option (4 x 25G SFP)

Densité 3+ Frame Hardware

UCP-3901

Universal Compute Platform

UCP-3901-3+DRP

Double rear panel for Densité 3+ with HD-BNC

SFP Options

One, two or four SFP28 modules required

SFP-25G-SR

SFP28 25GBASE optical transceiver MMF

SFP-25G-LR

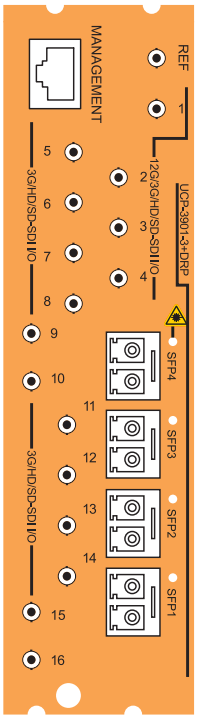
SFP28 25GBASE optical transceiver SMF

FCS-10GE-SR

10GBASE-SR short range SFP for MMF (multimode fiber) supported for UCP-3901-25-MD essence only

FCS-10GE-LR

10GBASE-LR long range SFP for SMF (single-mode fiber) supported for UCP-3901-25-MD essence only



UCP-3901-3+DRP

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