

IQUDC40

12G/3G/HD/SD-SDI 4K UHD Up/Down/Crossconverter

Convert between 4K UHD and HD/SD for re-purposing of existing assets.

The IQUDC40 from Grass Valley is a flexible 4K UHD processing unit able to process and translate both quadrant (square division) and 2SI (2 sample interleave) quad-link formats as well as 12G-SDI single-link signals. Converting to or from 4K UHD to HD/SD allows re-purposing of existing assets, and all common video and audio processing tasks are also covered.

IQUDC40 includes a frame synchronizer, capable of referencing to a SD bi-level or HD tri-level reference and a variable aspect ratio converter with reading and writing of WSS, VI and 2016 AFD signaling (not available in 4K UHD to 4K UHD mode). Video processing includes powerful picture enhancement tools, including edge enhance.

High Dynamic Range and Wide Color Gamut native support allows for:

- S-Log3, HLG or PQ UHD feeds to be integrated into an SDR workflow
- Translation between HDR standards
- Mapping SDR signals for use in HDR productions

IQUDC40 allows users to download 3D LUTs, including full support for loading BBC type I, II & III 1.4 version LUTs.

Audio handling includes channel routing, delay adjustment and level controls. Video metadata such as timecode, SMPTE ST 2020 Dolby®, closed captions and teletext captions can also be passed through the module or processed according to the required output standard.

Why should you choose this module?

- Supporting up to 12G-SDI data rates with high-quality video conversion and frame synchronization allows fully flexible multiformat working, and provides a future proof migration path as digital workflows evolve
- Comprehensive audio processing functions allow complete control over embedded audio signals for applications where channel routing, gain control or delay is required
- Full RollCall and SNMP compatibility allows easy integration with Grass Valley or third-party network management systems providing an all-inclusive monitoring and control solution

KEY FEATURES

- High-quality up/down/crossconversion for SDI video inputs including conversion aperture control and cadence insertion, detection and removal (e.g. 1080i/59 3:2 to 4K23)
- 4K UHD interfacing to translate between 2SI and square division workflows for maximum signal compatibility
- Frame synchronizer with HD tri-sync/SD bi-level reference input, up to 8 frames of video delay and input loss detection with default output of black/pattern
- Aspect ratio conversion including preset ARC maps relative to conversion modes, pan, tilt and size adjustments
- Aspect ratio control (signaling reading and writing) using ETSI WSS and AFD Video Index signaling (RP186, SMPTE ST 2016)
- Video proc features include: gain, offset, hue, horizontal and vertical picture enhancement, color corrector and RGB gamut legalization
- Wide color gamut support with BT709 and BT2020 color space conversion including manual and automatic operation
- High Dynamic Range support including scene-referred and display-referred conversions for SDR to HDR mapping with enhancement, translation between HDR formats — PQ, HLG, S-Log3 and mapping to SDR
- 3D user LUT loading with full support for BBC type I, II & III 1.4 version LUTs
- Metadata support — Closed caption passing or processing for CEA608/708 and OP42/OP47/WST captions, SMPTE ST 2020 handling, VITC or SMPTE ST 12 timecode translation and SID passing including an ancillary data bridge to allow transfer of up to seven different ANC packet types around the converter
- Processing for 16 channels of embedded audio present on the incoming SDI stream with no disturbance during video synchronizer frame wraps or drops
- Audio proc features including: channel routing, gain, invert, channel delay and internal tone generator
- Non-PCM processing features pair level routing and delay compensation. Dolby-E data is passed with a delay to match the video and with co-timed audio frame drop or repeat
- Dolby E support — Detection of PCM/non-PCM audio to SMPTE ST 337/338, pair routing and Dolby E header re-alignment
- Integrated fiber I/O support via SFP module
- Built-in test pattern generator and 8 user configurable memories
- RollCall control and monitoring compatible with standard logging and reporting features
- RollTrack triggers available for detected module states including: input loss and reference loss

SPECIFICATIONS

Inputs & Outputs

SDI bidirectional inputs/outputs:

- 4 (12G/3G/1.5G/270M)
- 4 (3G/1.5G/270M)

Input cable length:

- Up to 44m Belden 1694A @ 12 Gb/s
- Up to 150m Belden 1694A @ 3 Gb/s
- Up to 180m Belden 1694A @ 1.5 Gb/s
- >350m Belden 1694A @ 270 Mb/s

Standards:

- SD: 525, 625, 270 Mb/s SD-SDI SMPTE ST 259
- HD: 720 50/59.94/60p, 1080 25/29/30i, 1.5 Gb/s HD-SDI SMPTE ST 292/SMPTE ST 299
- 3G: 1080/2160 (quad) 50/59.94/60p, 3 Gb/s HD-SDI, SMPTE ST 425 level A, dual-link level B
- 12G: 2160 50/59.94/60p (2SI) (input on BNC 1 only), 12 Gb/s 4K UHD SDI, SMPTE ST 2082-10

UHDTV1 video interfaces:

- Square division (4x 1.5 Gb/s links) for ≤ 30 fps
- Square division (4x 3 Gb/s links) for > 30 fps
- Sample interleaved SMPTE ST 425-3 (2x 3 Gb/s links) for ≤ 30 fps
- Sample interleaved SMPTE ST 425-5 (4x 3 Gb/s links) for > 30 fps

Analog reference:

- 1x analog reference
- Black (HD tri-level and SD bi-level) and blackburst (SD bi-level) selectable from IQH3B frame reference connections or external BNC

Fiber Signal Input

Inputs: Up to 2

Optical: 12 Gb/s UHD-SDI, 3 Gb/s HD-SDI, 1.485 Gb/s HD-SDI or 270 Mb/s SD-SDI

Connector/format: LC singlemode

Standard: SMPTE ST 297-2006

Fiber Signal Output

Outputs: Up to 2

Optical: 12 Gb/s UHD-SDI, 3 Gb/s HD-SDI, 1.485 Gb/s HD-SDI or 270 Mb/s SD-SDI

Connector/format: LC singlemode

Conforms to: SMPTE ST 297-2006

Video Functions

Input source select: SD/HD/4K UHD-SL BNC1, SD/HD BNC5, 4K UHD-QL, SFP1

Input 4K UHD interface: Auto, 2SI, SDQ

Output format: 2160p, 1080p, 1080i, 720p, 625i, 525i

3G output format: Level A/B

Output 4K UHD interface: 2SI, SQD

Output SI PID: 4K UHD, 3G/HD

Output 4K UHD ANC embed: Link 1, all links

Output legalization: Off, 700 mV, 721 mV, 735 mV, 746 mV

Colorimetry: Auto, BT709, BT2020

Test patterns: Off, black, ramp, bars

Default output: Black, Mute

Conversion type: Scene referred/display referred

SDR/HDR input and output format conversions: SDR, HLG, PQ, S-Log3

SDR/HDR clip: Hard/soft

SDR enhance: Off, low, medium, high

PQ level: 1K, 2K, 4K, 10K

User LUT loading (33-cube 3D LUT), 32 entries with full BBC Type I, II & III LUT loading support

Proc amp

Black Level: +100 to -100 mV (0) in 0.8 mV steps

Contrast: -6 dB to +6 dB (0) in 0.2 dB steps

Saturation: -6 dB to +6 dB (0) in 0.2 dB steps

Y Gamma: 0.4 to 1.7 (1) in 0.1 steps

Enhancement

Filter: Vertical and horizontal filters with preset normal, narrow or wide settings

Nonlinear enhancer:

Frequency band selection: Med, high

Six preset enhancement modes

Color corrector

RGB lift: +200 to -200 mV in 0.8 mV steps

RGB gain: +6.0 to -6.0 dB in 0.2 mV steps

Noise reducer: Multiband

Edge enhance: Horizontal & vertical

Additional video-audio delay: 8 frames

Aspect ratio conversion: AFD (SMPTE ST 2016), VI (RP186), WSS (L23) (manual or auto)

SD input format: Normal 4:3, anamorphic 16:9, letterbox 14:9, letterbox 16:9

SD output format: Normal 4:3, anamorphic 16:9, letterbox 14:9, letterbox 16:9

Auto zoom: On/Off

Manual zoom: Zoom ±20%

Audio Shuffle

Input channel 1-16: Disembed 1-16

Output channels 1-16: Processed channels 1-16, tone, silence

Invert phase: Channels 1-16

Audio Control

Channel 1 to 16 gain: +18 dB to -18 dB in 0.1 dB steps

Channel 1 to 16 manual delay: -40 to +200 ms in 1 ms steps

Global manual delay: -40 to +200 ms in 1 ms steps

Tone

Frequency: 100 Hz to 10 kHz in 100 Hz steps

Genlock

Selection: Frame A, frame B, external, input, freerun

Timing: Horizontal and vertical adjustment

Timecode

Source: LTC, VITC

Processing: Follow input, generate

Timecode loss: Freeze, freerun

Metadata:

Closed caption CE608 <> CE708

Teletext subtitles WST/RDD8/2031 conversion

SMPTE ST 2020 output line selection

Ancillary data bridge to allow transfer of up to seven different ANC packet types around the converter

Other Controls

Logging:

Input 1-4 name, type, state

Genlock state

Output standard

RollTrack index: Up to 32 RollTrack destinations

RollTrack sources: Unused, input present, input loss, reference OK & loss

Information window: Video input status, reference status

Factory default: Resets all module settings to factory specified default values and clears memories

Default settings: Resets all module settings to factory specified defaults but does not clear memories

Module information – Reports following module information: Software version, serial number, temperature

General Specifications

Connector/format: BNC/75Ω panel jack on standard IQ connector panel

Return loss: >-15 dB (270 Mb/s, 1.5 Gb/s) >-10 dB (3 Gb/s)

Output jitter: SD-SDI 0.2 UI (10 Hz) / 0.2 UI (1 kHz), 3G/HD-SDI 1.0 UI (10 Hz) / 0.2 UI (100 kHz)

Reference source: External – HD tri-level / SD bi-level / input video syncs

Electrical:

Black (HD tri-level and SD bi-level) and blackburst (SD bi-level)

SD bi-level – RS170A

HD tri-level – SMPTE ST 240 and SMPTE ST 274

Connector/format: BNC/75Ω panel jack on standard IQ connector panel

Embedded audio handling:

HD: 24-bit synchronous 48 kHz to SMPTE ST 299

SD: 20-bit synchronous 48 kHz to SMPTE ST 272-A

Input standard:

(Auto detect) 525, 625

720 50/59.94/60p

1080 50/59.94/60i

1080 50/59.94/60p (levels A and B)

720/1080/2160 23/24/25/29.97/30p

1080 23/24/25/29.97/30PsF, with film detection and processing

2160 50/59.94/60p (levels A and B)

Output standard:

525, 625

720 50/59.94/60p

1080 50/59.94/60i

1080 50/59.94/60p (levels A and B)

720/1080/2160 23/24/25/29.97/30p

1080 23/24/25/29.97PsF, with film detection and processing

2160 50/59.94/60p (levels A and B)

Power consumption

Module power consumption:

20 PR Max

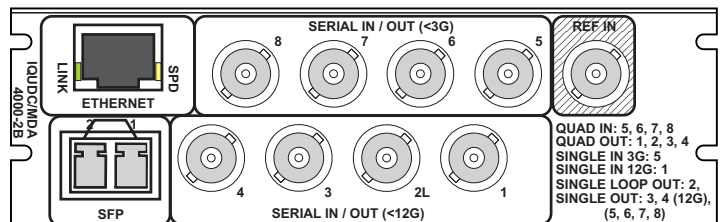
21 PR Max with SFP fitted

ORDERING

IQUDC4000-2B4

UHD-4K format converter with HDR support for quad link and 12G-SDI signals. 1 12G-SDI input with loop-through, 2 12G-SDI capable outputs, 4 3G-SDI input and outputs (selectable), external or frame reference, single 12G capable fiber Tx/Rx

For more details on enclosure types please refer to the IQ Modular Enclosures datasheet.



IQMDA40 INTERFACE OPERATION

Note: The I/O is mode dependent.

- Inputs shown in **BLUE**
- Processed outputs shown in **GREEN**
- Loop output shown in **ORANGE**

Mode 1 – SD/HD/3G up/down/crossconversion

Output Connection	SD	HD 720P (23-60) 1080i (50-60) 1080p (≤30)	3G 1080p-A 1080p-B (>30)	6G 2160p (≤30)	12G 2160p (>30)	Dual Link 2160p 2SI (≤30)	Quad Link 2160p 2SI (>30) SQD (23-60)
BNC 1							
BNC 2	BNC 1 Loop Output						
BNC 3							
BNC 4							
BNC 5							
BNC 6							
BNC 7							
BNC 8							
SFP 1 (Rx)							
SFP 1 (Tx)	BNC 1 Loop Output						
SFP 2 (Tx)							

Mode 2 – SD/HD/3G to 4K UHD-QL + 4K UHD-SL

Output Connection	SD	HD 720P (23-60) 1080i (50-60) 1080p (≤30)	3G 1080p-A 1080p-B (>30)	6G 2160p (≤30)	12G 2160p (>30)	Dual Link 2160p 2SI (≤30)	Quad Link 2160p 2SI (>30) SQD (23-60)
BNC 1							
BNC 2	BNC 1 Loop Output						
BNC 3							
BNC 4							
BNC 5						Channel 1	Channel 1
BNC 6						Channel 2	Channel 2
BNC 7							Channel 3
BNC 8							Channel 4
SFP 1 (Rx)							
SFP 1 (Tx)							
SFP 2 (Tx)							

Mode 3 – 4K UHD-QL to SD/HD/3G

Output Connection	SD	HD 720P (23-60) 1080i (50-60) 1080p (≤30)	3G 1080p-A 1080p-B (>30)	6G 2160p (≤30)	12G 2160p (>30)	Dual Link 2160p 2SI (≤30)	Quad Link 2160p 2SI (>30) SQD (23-60)
BNC 1							
BNC 2							
BNC 3							
BNC 4							
BNC 5						Channel 1	Channel 1
BNC 6						Channel 2	Channel 2
BNC 7							Channel 3
BNC 8							Channel 4
SFP 1 (Rx)							
SFP 1 (Tx)							
SFP 2 (Tx)							

IQMDA40 INTERFACE OPERATION (CONT.)

Mode 4 – 4K UHD-SL to SD/HD/3G

Output Connection	SD	HD 720P (23-60) 1080i (50-60) 1080p (≤30)	3G 1080p-A 1080p-B (>30)	6G 2160p (≤30)	12G 2160p (>30)	Dual Link 2160p 2SI (≤30)	Quad Link 2160p 2SI (>30) SQD (23-60)
BNC 1							
BNC 2				BNC 1 Loop Output			
BNC 3							
BNC 4							
BNC 5							
BNC 6							
BNC 7							
BNC 8							
SFP 1 (Rx)							
SFP 1 (Tx)							
SFP 2 (Tx)							

Mode 5 – 4K UHD-SL to 4K UHD-QL + 4K UHD-SL

Output Connection	SD	HD 720P (23-60) 1080i (50-60) 1080p (≤30)	3G 1080p-A 1080p-B (>30)	6G 2160p (≤30)	12G 2160p (>30)	Dual Link 2160p 2SI (≤30)	Quad Link 2160p 2SI (>30) SQD (23-60)
BNC 1							
BNC 2				BNC 1 Loop Output			
BNC 3							
BNC 4							
BNC 5						Channel 1	Channel 1
BNC 6						Channel 2	Channel 2
BNC 7							Channel 3
BNC 8							Channel 4
SFP 1 (Rx)							
SFP 1 (Tx)							
SFP 2 (Tx)							

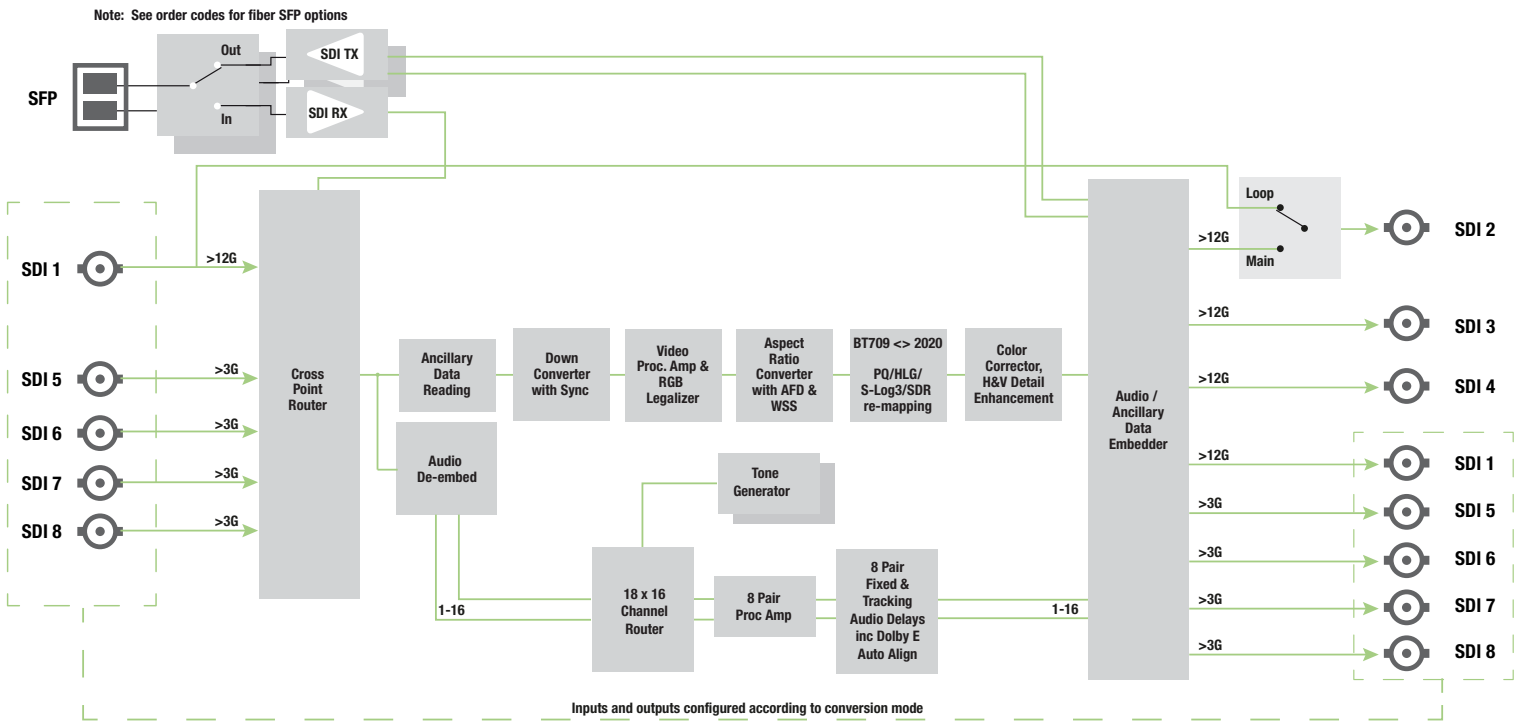
Mode 6 – 4K UHD-QL to 4K UHD-SL

Output Connection	SD	HD 720P (23-60) 1080i (50-60) 1080p (≤30)	3G 1080p-A 1080p-B (>30)	6G 2160p (≤30)	12G 2160p (>30)	Dual Link 2160p 2SI (≤30)	Quad Link 2160p 2SI (>30) SQD (23-60)
BNC 1							
BNC 2							
BNC 3							
BNC 4							
BNC 5						Channel 1	Channel 1
BNC 6						Channel 2	Channel 2
BNC 7							Channel 3
BNC 8							Channel 4
SFP 1 (Rx)							
SFP 1 (Tx)							
SFP 2 (Tx)							

IQMDA40 INTERFACE OPERATION (CONT.)

Mode 7 – 4K UHD-QL to 4K UHD-QL

Output Connection	SD	HD 720P (23-60) 1080i (50-60) 1080p (≤ 30)	3G 1080p-A 1080p-B (>30)	6G 2160p (≤ 30)	12G 2160p (>30)	Dual Link 2160p 2SI (≤ 30)	Quad Link 2160p 2SI (>30) SQD (23-60)
BNC 1						Channel 1	Channel 1
BNC 2						Channel 2	Channel 2
BNC 3							Channel 3
BNC 4							Channel 4
BNC 5						Channel 1	Channel 1
BNC 6						Channel 2	Channel 2
BNC 7							Channel 3
BNC 8							Channel 4
SFP 1 (Rx)							
SFP 1 (Tx)							
SFP 2 (Tx)							



Block Diagram for IQUDC40 Range



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