4K Production

The question is not Is 4K in my future? The question is When must I be ready to compete in a 4K media world?

As the amount and availability of media increases, the demand for viewers increases as well. Broadcasters and media companies must leverage every advantage. In today’s media landscape, that includes 4K, as it is expected that 140 million homes will be watching 4K programming by 2020.

Grass Valley, a Belden Brand, is leading the way with 4K production solutions in all major product categories that help broadcasters and media companies produce 4K now to tell better stories that capture viewers and keep them glued to the action.

4K Realities

4K offers viewers stunning quality and a more immersive television experience, especially when combined with high dynamic range (HDR) acquisition. It’s an electronic window to the world, with quality that viewers have never seen. One of the lessons learned during the transition from SD to HD was that “content is king”... and it still is. However, that content in 4K can drive viewer loyalty and engagement to an entirely new level — and that drives advertising revenue.

The combination of an end-to-end 4K production workflow — with the new LDX 86 Universe and K2 Dyno Universe families — provides unmatched storytelling flexibility, with the ability to easily switch between HD, 4K and 6X with a convenient eLicense.

Best of all, with Grass Valley 4K production and post solutions, you can shoot and produce 4K today — or be ready for tomorrow — as easily as you do HD, with solutions that take your images from camera to switcher to router to storage. You also have the ability to switch between HD and 4K formats for the ultimate in flexibility, knowing you have 4K when you need it.

You can even leverage the quality of 4K in today’s HD productions. With the K2 Dyno Universe Replay System’s DynoZoom capability, you can shoot replays in 4K, and zoom in up to 400% and still deliver an HD image, with the ability to pan within the 4K image. This gives replay operators and directors an incredible storytelling tool to keep viewers glued to their screens.

4K Infrastructure

Grass Valley 4K products provide a variety of ways to transport 4K, using both SDI-based and IP-based transport schemes.
4K Products at a Glance

**Aquisition**
- LDK 86 4K / LDX 86 Universe
- XCU HD/4K XF IP
- CopperHead 3404

**Post Production**
- EDIUS 8

**Replay and Highlights**
- K2 Dyno Universe

**Routing**
- NVISION 8500 HYBRID Series
- GV Node Real Time IP Processing and Routing Platform

**Storage**
- K2 Summit 3G
- K2 10G RAID

**Signal Distribution**
- Densité
- Densité SDI/IP Gateway

**Production Switchers**
- K-Frame with Carrera or Kayenne Control Panel

**Multiviewer Monitoring**
- Kaleido-MX-4K
LDK 86 4K / LDX 86 Universe

The LDK 86 4K and flagship LDX 86 Universe allows broadcasters and content creators to use the same workflows they use for HD, while delivering the best 4K viewing experience possible. XDR — Extended Dynamic Range — operation (HDR with full 15 F-stops or >800% of regular cameras) is available for all 50/59.94 Hz formats offering a new level of viewer experience.

**KEY FEATURES**

- First 4K camera system based on regular 2/3” imagers and full support of B4 mount broadcast lenses
- Highest 4K sensitivity and dynamic range of any 4K camera on the market
  - 50 Hz: f/12 at 2,000 lux
  - 59.94 Hz: f/11 at 2,000 lux
- Software upgrade to enable 15 F-stops of high dynamic range
- Uses B4 mount broadcast lenses for access to the largest zoom ranges and the longest depth of field needed for most live productions, especially sports
- Global shutter means that fast motion does not cause bending in the images like a rolling shutter

**4K Production (Sample Configuration)**

LDX 4K Cameras (X12) ➔ NVISION Router ➔ K2 Summit 3G 4K (x3) (4 in / 2 out) ➔ NVISION Router ➔ K2 Dyno Universe (x3) ➔ NVISION Router ➔ Karrera/Kayenne & K-Frame ➔ NVISION Router

- 18 4K Inputs in quads or 2SI
- 18 Camera/Server Sources 4-wire, 1080p Direct
- 24 Outputs
- Capable of 24 4K Outputs in quads or 2SI

www.grassvalley.com
XCU HD/4K XF IP
The XCU HD/4K XF IP provides 4K over a single wire 10GigE link. It is used with the same XF Universe camera adapters as the XCU Universe XF, but offers an additional SMPTE 2022-6 IP connection in addition to all the baseband connections.

CopperHead 3404
The CopperHead 3404 fiber transceiver takes the pristine and unrivaled image quality of dual/quad link 4K cameras and delivers it into a multicamera environment for in-studio or outside broadcast productions. The CopperHead 3404 conveniently distributes all of the signals needed for multicamera 4K production using a single tactical or SMPTE hybrid fiber cable, ensuring robust, trouble-free connectivity on any studio or remote production.

The Realities of Grass Valley 4K Cameras
Is it OK to use HD broadcast lenses for 4K?
It is a reasonable compromise as long as:
• You pick HD lenses with good performance
• The camera manages lateral chromatic aberration
• The lens is properly aligned to the mount
If you operate the lens around f/5.6, you can get closer to the resolution of a lens designed for 4K.

Most important: Sensitivity has a direct impact on resolution
With the highest sensitivity and dynamic range of any 4K camera on the market, in many applications you produce the best 4K images possible — even better than cameras with native 4K imagers.
K2 Dyno Universe

Optimized for 4K, the 36-channel K2 Dyno Universe Replay System gives each operator up to six video angles to choose from, instead of being limited to just one or two angles as with traditional replay systems.

AnySpeed allows operators to quickly and smoothly move to the action replay, and then slow down to highlight the details, while avoiding excessively long replay times, with the smoothest playback at any speed from 0% to 200%.

KEY FEATURES

• 4K Replay with HD Pan and Zoom
• HD extraction
• Integrated user interface
• Keyframe preservation
• Makes 4K practical

K2 Dyno Universe Scalability

Possible 4K 4 RU Configurations

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Possible 4K 6 RU Configurations

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K2 Summit 3G

The K2 Summit 3G Production Client provides for synchronized multichannel record and play to support two 4K channels. It is available with IP I/Os for SMPTE 2022-6 connectivity, either installed at the factory or as a field upgrade kit.

With the K2 Summit 3G, you can play different formats back-to-back:

- SD/HD/3G/4K clips
- 720p/1080i
- 1080p 3G
- 2160p 4K
- DV/MPEG/AVC-Intra/H.264/AVCHD encoded clips

K2 10G RAID

With the highest bandwidth in the industry, the K2 10G RAID Storage System cost-effectively supports 4K configurations for both online and nearline storage. With SAS storage drives, 8 Gb/s Fiber Channel hardware RAID controllers, redundant connectivity, hot-swappable power supplies and high-performance bandwidth delivery, you’ll have the highest scalable capacity and performance you want, with the bandwidth and redundancy you need.

Storage architecture supports 10k RPM SAS drives for highest-performance online storage or 7.2k SAS drives for lowest cost/GB of storage

- Gives you the best price/performance with:
  - 7.2k or 10k RPM SAS drives
  - 10 Gb/s Ethernet connectivity
  - 8 Gb/s Fibre Channel connectivity
- Highest bandwidth in the industry
- Easily add to existing systems with scalable bandwidth
- Easily add storage non-destructively to existing systems
- Confidence – redundant components include hot-swappable power supplies, fans, disk drives, RAID controllers, mirrored system drives
- Build systems simply with fewer components, in less rack space, for higher reliability
K-Frame with Karrera or Kayenne Control Panel

K-Frame is a modular approach to production switchers that delivers more creativity for compelling and engaging content with multiformat support including 4K. With K-Frame, you can mix HD content into your 4K production — a necessity for sports productions that use archive footage.

**KEY FEATURES**

- K-Frame gives unsurpassed production quality using world-class control surfaces from the Karrera and Kayenne families. Any panel will connect to any frame.
- Grass Valley E-MEM, macro, intuitive GUI and display technologies are common across all switchers for easy skill migration and show transportability.
- Internal graphics stores along with extensive control of external replay devices and cameras allow complex sports, entertainment and news productions to be executed at all levels of production.
- With up to 6 mix/effects banks in high definition, with the ability to be used in 2 separate productions simultaneously and I/O numbers in SDI of up to 192 in and 96 out (48x24 in 4K) the power put into production values is unmatched.
- 4K productions using powerful mix/effects banks using 3 full keyers per M/E with the option to configure a 6 keyer M/E with full DoubleTake and multiple clean feeds is a feature of the K-Frame system.
- The K-FRM-IO-10GE IP I/O board for the K-Frame video processing engine offers video-over-IP connectivity for Grass Valley production switchers, using either uncompressed SMPTE ST 2022-6 or 4K over 1-wire compressed IP integrating TICO light compression to allow 4K signals to pass using a single 10 GigE SFP connection.
- Connections to the K-FRM-IO-10GE IP I/O board are via SFP fibres or BNCs, either able to carry compressed 4K over 3G connections and for the BNC the ability to handle uncompressed 12G 4K.
- Format flexibility means that a complex show using HD-SDI, SMPTE ST 2022-6 uncompressed IP and 4K over 1-wire compressed signals with 2 Sample Interleave (2SI) will seamlessly integrate into the most complex on-air look.
- I/O connections in SDI feature twin output connections while the K-FRM-IO-10GE IP I/O board features dual 10 GigE SFP connections as well as twin BNC connectors.
- 2SI processing in the K-Frame offers an easier method to incorporate standard production elements into events, while allowing the use of standard 1080p HD sources within those shows.
TICO Lossless Compression: 4K over 1-Wire Signal Transport

TICO, a lossless transport compression scheme created by intoPIX in 2013, allows 12G 4K (UHD-1 / 3840x2160p50/59.94) over SDI and IP-based infrastructures with minimal processing and 4:1 compression. This allows a single 3G-SDI cable to carry a 4K signal, as opposed to four 3G cables where the signal will have to be split into four components and then re-assembled.

Low latency of a few lines of pixels for encoding and decoding are a significant benefit of TICO’s unique line-based wavelet transforms and light entropy coding for live and other real-time signal transport needs. This makes TICO ideal for live productions, especially compared with the latency and complexity of other compression schemes, such as JPEG 2000, H.264 and H.265. Plus, TICO implementation protects current investments in infrastructure.

For those considering video over IP, consider this: TICO works equally well with both SMPTE 2022-6 (Transport of High Bit Rate Media Signals over IP Networks) as well as with the recently published VSF Technical Recommendation TR-03 (Transport of Uncompressed Elementary Stream Media over IP).

TICO KEY FEATURES

- Visually lossless compression up to 4:1
- Even mathematically lossless capable at lower compression ratio
- Robustness to multiple encoding generations
- Fixed & pixel lines-based latency

- Extremely light in FPGA (no external DDR memory)
- Fast & efficient in software
- Resolutions from HD to 4K/8K
EDIUS Workgroup 8

EDIUS Workgroup 8, for enterprise-class workgroup editing, gives you the ability to edit growing files and Dolby Plus/Professional licensing — giving 4K post the real-time speed needed for fast and efficient post production.

K2 4K Integration

EDIUS Workgroup 8 can also edit K2-based 4K (quad) footage, in addition to almost any 4K file-based media.

Note that EDIUS cannot edit TICO-encoded files, as TICO is designed for transporting 12G signals that are compressed to 3G.

EDIUS Workgroup 8 means more formats and more resolutions in real time — including 4K — for the ability to Edit Anything, Anywhere, whether as a standalone user in the field or within network connected production infrastructures. EDIUS Workgroup 8 is the perfect finishing tool for all 4K productions. With more creative options and real-time, no-render editing, EDIUS Workgroup 8 is THE most versatile and fastest nonlinear editing software available.
NVISION 8500 HYBRID Series

NVISION 8500 HYBRID routers combine exceptional resilience with cost, space and power efficiency to make them your ideal 4K routing solution. When 4K is split between four 3G signals (quad link), the NVISION 8500 HYBRID switches all four signals in the same vertical interval so that each quadrant’s timing is maintained.

GV Node Real Time IP Processing and Routing Platform

GV Node delivers a broadcast centric, real time, distributed routing and IP processing node that supports HD/3G/4K IP and SDI workflows with vertically accurate switching and integrated processing, including integrated Kaleido multiviewing for live production, playout and general purpose infrastructure.

With GV Node, common off-the-shelf (COTS) IP switches can be used in broadcast and media facilities with the assurance that these switches offer transparent broadcast-centric operation and processing, supporting SMPTE 2022-6 IP inputs and outputs, as well as TICO visually lossless 4:1 compression for 4K applications.
Densité

For 3G-SDI quad link 4K signal distribution, standard Densité 3G DA cards can be used: four HDA-3911 cards (providing five or seven 4K outputs, depending on card selected) or two HDA-3931 cards (providing either three or four 4K outputs, depending on card selected) are required for each 4K signal.

Densité SDI/IP Gateway

For bridging hybrid SDI/IP production environments, the Densité SDI/IP Gateway card (IPG-3901) supports TICO 4K over a single 3G-SDI cable with lossless 4:1 compression, as well as uncompressed 4K over IP using SMPTE 2022-6 for distribution over 10 GigE networks, and vice versa.

The IPG-3901 provides 2 encode, 2 decode, or 1 encode and 1 decode of TICO 4K signals. It will also provide monitoring input streams in HD or 3G resolution. Also supported is 4K 3G quad link to/from 2 sample interleave conversion. The IPG-3901 also transports the audio and metadata of the first 3G channel within the TICO-encoded 3G stream and vice-versa for decoding.
Kaleido-MX-4K

The Kaleido-MX 4K offers stunningly beautiful, seamless 4K pictures (without visible quadrants) for monitoring 3G/HD/SD SDI formats, as well as enabling multiviewing applications on large 4K screens, providing the benefit of clearer pictures by using the increased resolution. Kaleido-MX 4K is perfect for high-end in-studio TV productions, outside broadcast trucks, as well as playout facilities.

KEY FEATURES

- Up to 16 4K inputs (quad link 3G signals) with prescaler modules
- Up to 64 3G/HD/SD SDI inputs
- Quad link 3 Gb/s output or HDMI 2.0 output at 3840x2160p50/59.94
- Unmatched multiviewer picture quality and superior on-screen graphics
- Ultimate level of layout flexibility, with unlimited signal repetition and sizing across all displays, without blocking, grouping restrictions or bandwidth restrictions

Using 4K UHD display is perfect for multiviewing applications since the higher resolution provides for clearer pictures

4K UHD Source
4 x 3G/1080p

HD or 4K UHD Display

Pixel-perfect stitching of the quad links
Grass Valley provides the entire 4K video production chain with the convenience, interoperability and setup efficiency to make 4K practical and facilitate better storytelling.

**Benefits**

- Switchable HD/4K broadcast cameras, compatible with existing lens
- Unique replay solution with integrated DynoZoom control
- Scalable and upgradable broadcast infrastructure
- Most powerful switcher for 4K production available on the market