

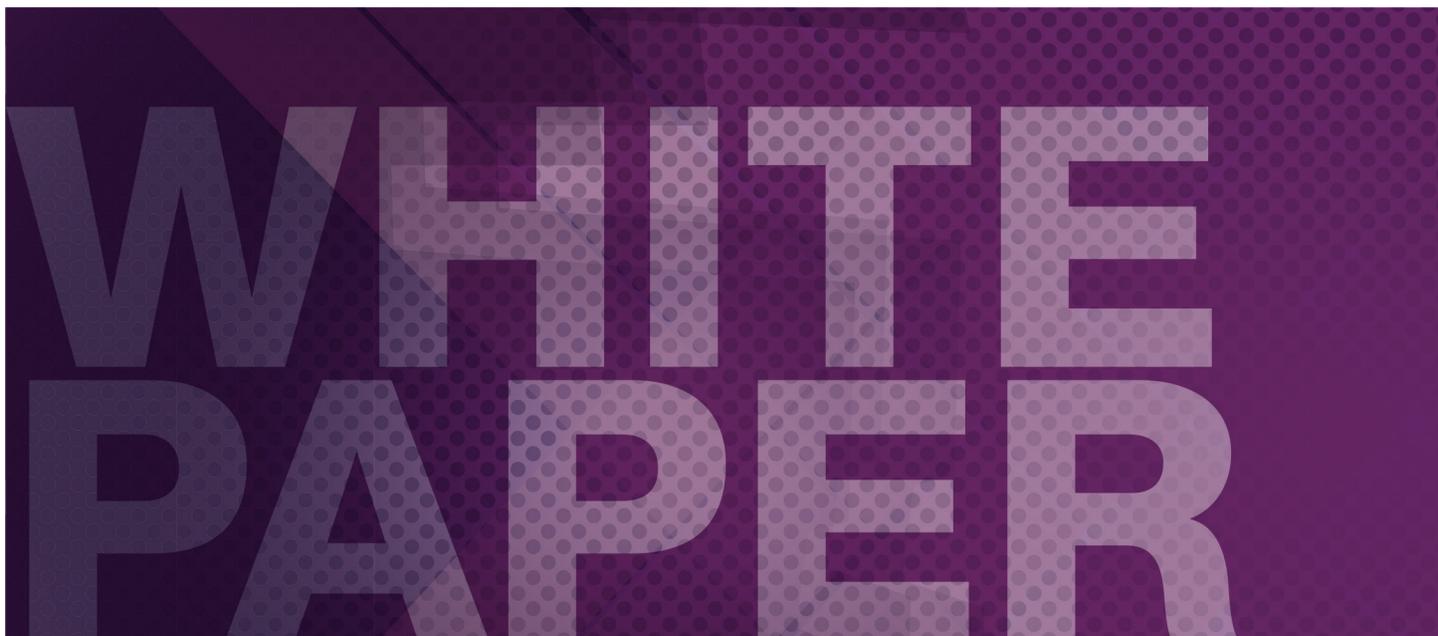


grass valley
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AnySpeed K2 Dyno Replay System

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Replay is quickly becoming the most important tool in a live sporting event. Producers require every possible advantage to tell the best stories and keep viewers engaged. Historically, the industry has faced many challenges in embracing high frame-rate camera systems until Grass Valley, a Belden Brand, introduced the LDX XtremeSpeed (XS) 6X super slow-motion camera and its counterpart, the K2 Dyno Replay System with the K2 Dyno S Replay Controller.

K2 Dyno's AnySpeed takes high-speed recording and playout to the next level with control previously unavailable in any system, enabling the full use of the dynamic range of playback speeds. The AnySpeed algorithm is now included in all 6x SSM K2 Dyno S software releases.

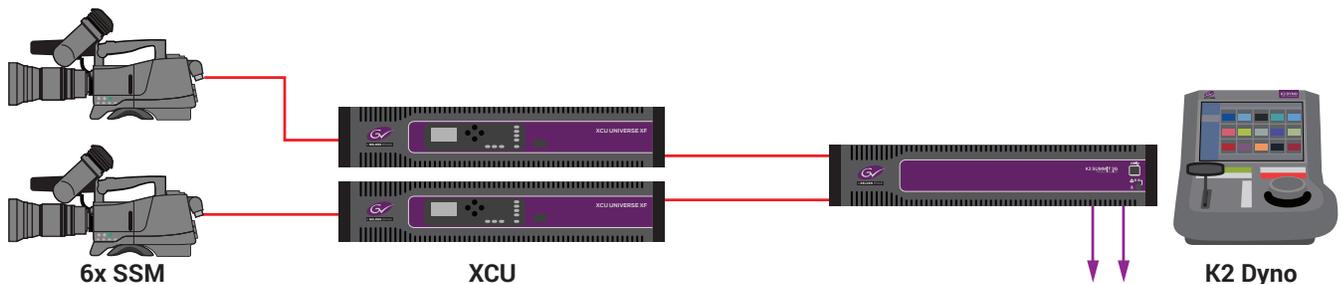
Introduction

In live sports productions, the camera allows the director to tell an incredible visual story. For the producer, the replay system is the most valuable tool to expand on that storyline and continue to develop additional details as the story changes. That is the great thing about sports, the story is virtually organic and ever-changing. With a replay system, significant moments, minute influences and momentous achievements can be revisited time and time again. Sometimes, seemingly unrelated moments, when put together in a playlist, play out as a fantastic expression of success or opportunity missed. With every evolution of our solutions we focus on developing tools that help both the director and producer do the best work possible.

Grass Valley, a Belden Brand, has created the most compelling storytelling pairing with the LDX XtremeSpeed (XS) 6X high frame-rate super slow-motion camera and the K2 Dyno Replay System with the addition of AnySpeed, which enables the full use of the dynamic ranges of playback speeds. Developed in tandem, LDX XS captures 360 frames per second and has the world's first algorithm to compensate for "flickering" in artificial lighting, while the K2 Summit is the industry's first high frame-rate dual record server. See the following video: https://www.youtube.com/watch?v=fSe_949fMXU

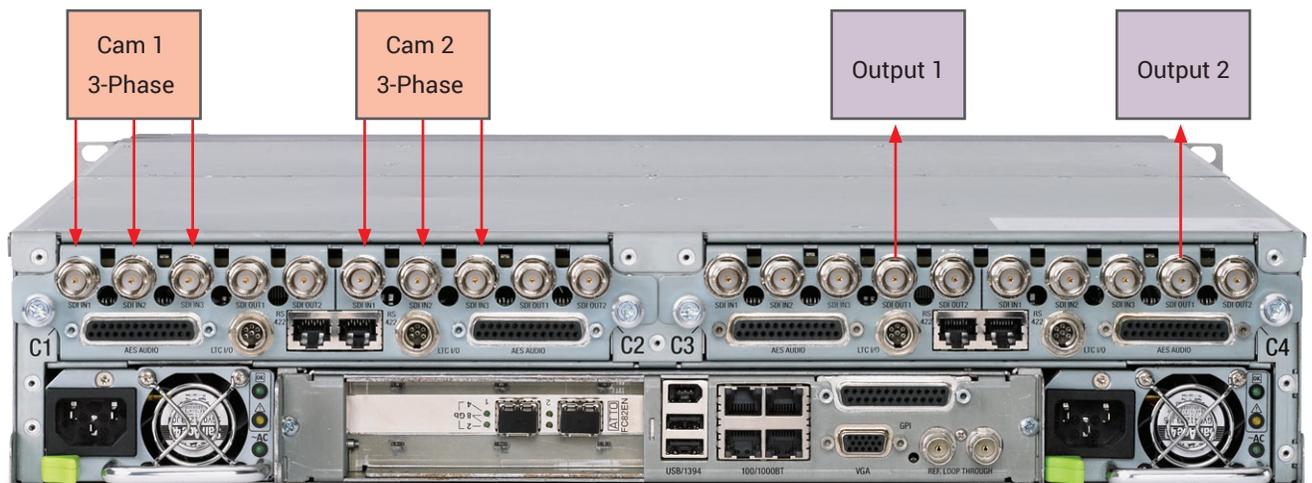
K2 Summit Connections

Simple, three-cable connections between the Grass Valley XCU XtremeSpeed XF Fiber base station and the K2 Summit for each of the three 1080i or 720p phases, plug into either of the two input channels. This setup allows for two simultaneous output channels, both capable of independent playlists with mix effects. While the camera input signals must be the same format, the output can be a mix of 1080i or 720p.



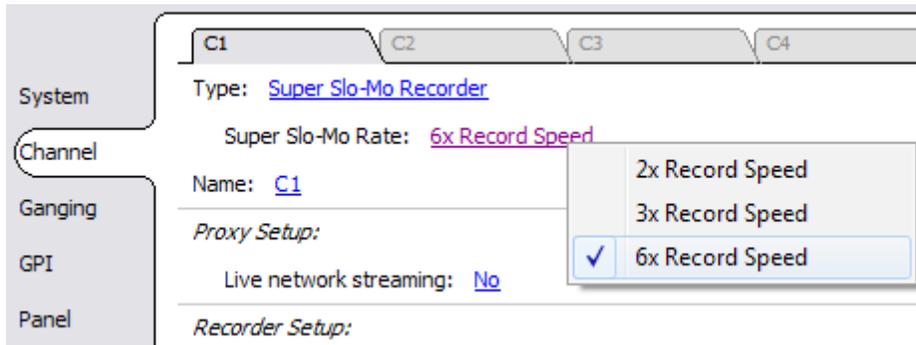
With the optional ChannelFlex licensing enabled, in the event that only one LDX XS 6X SSM camera is to be used, the other input channel can be configured to support three additional standard 1080i or 720p input signals. Therefore, the industry-standard channel count can be maintained at a 4-in/2-out configuration. Playlists can mix 6X and standard clips.

With ShareFlex enabled between K2 Summit servers, K2 Dyno users can share the 6X recording over a standard gigabit Ethernet connection.



Appcenter Configuration

The menu for AppCenter remains the same, only the choices are new. Starting with K2 Summit v.9.3, users make their normal selection of Super Slow-Mo, but now have the additional choice of 6X.

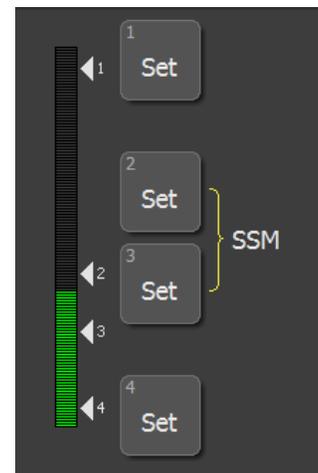


The other choices (2X, 3X) still remain. No other modifications are necessary. The channel output choices are also standard. As for the K2 Dyno controller, starting in v.3.3 and only available on K2 Dyno S models, the channel setup GUI at Startup registers that 6X SSM has been selected.

K2 Dyno S Replay Controller Setup

Some minor setup changes are required for the best performance and use of LDX XS 6X SSM and AnySpeed. The K2 Dyno T-Bar should be properly configured to create the ideal landing pad area prior to the default 6X playback zone. This area is the low-end of the T-Bar range from 0-16% speed. Seventeen percent (17%) is the “rounded up” value applied to 6X content. The area from 18%-100% is considered the high-end. (PIC)

Both the low-end, 6X and high-end zones can be modified in size to best fit the operator’s needs. In a sporting event such as cricket, the size of the low-end might be the largest zone, which allows the operator to select the appropriate speed of a replay well below 6X or 17%. However, in football, many replays will be conducted at 17% and up to 100%. The great feature of the K2 Dyno S Replay Controller is the functionality to adjust these ranges at any time.



Anyspeed

The AnySpeed feature enables full use of the dynamic ranges of playback speeds. Other systems in the market require the rendering of frames and playback at a fixed speed. Therefore, neither full “real-time” speed or super slow-motion speed can ever be exceeded. This is a major issue and obstacle to telling a replay story in a timely manner. Remember that for every second of recorded content it requires six times as long to show the replay in 6X. With AnySpeed, time can be virtually “compressed” by only showing the desired parts in 6X and then “ramping” up to a higher speed, including 100%.

For example, a defensive play that happens at one end of the field and leads to a scoring play at the opposite end can be shown by replaying the defensive action at 6X (17%), the long passes and quick

runs at 90%, and then slowing back down to 6X for the incredible assist and score. Traditionally, it would require nearly 40 seconds to show the entire play at 17% and no producer would commit to that. Now, with AnySpeed, the same play can be continuously shown in a matter of seconds from a single camera. Smooth T-Bar control over the video provides a consistent delivery of frames without jumping or stuttering.

As the K2 Summit can run in Loop Mode, this supports virtually endless recording of 6X content. When the requirement is for content to be archived for later use, all 360 fps are exported. At a later time, these clips may be imported and used with AnySpeed functionality fully intact.

Challenges Facing The End User

Challenge	K2 Dyno Replay System Solution
The slo-mo camera records in the camera body and can only perform “burst” recordings.	K2 Dyno operates in Loop Mode and continuously records even while playing replays or playlists.
Only one camera can be recorded at a time.	K2 Dyno allows for two 6X SSM cameras to be recorded.
Replay of content is at a fixed speed.	AnySpeed allows for 0-200% replay speeds.
Channel output must remain in the same format as the recorded input.	K2 Summit supports dual 720p and 1080i output of two channels at the same time regardless of input.
Recorded content can only be exported as a “real-time” clip.	K2 Dyno exports all 360 fps to retain the image quality for external use.
T-Bar has no settings. 0-100% is the only offering.	K2 Dyno T-Bar settings may be modified to suit the operator.
Operating in SSM mode only allows for one additional standard camera resulting in a loss of two record channels.	K2 Summit can be configured to enable three additional cameras while recording a 6X SSM feed.
No standard features with current high-frame rate systems.	Everything that is standard with K2 Dyno is standard in 6X mode as well — even multiple pause points to “freeze” the action.
10X systems offer high resolution, but no time for that speed of replay.	AnySpeed at 9% playback mimics that of 11X and still has full range to ramp at lower or higher speeds.

Exceeding Expectations

AnySpeed on the K2 Dyno Replay System continues to excite the live broadcast industry. Not only is the fantastic quality of the image enhanced by dynamic speed control, but the constant recording and instant access to any frame of video at any time is a giant leap in technological advancement. Along with the common workflow and the ability to use playlists in a normal setting, and sharing of the content both over a network connection or sending to external devices, K2 Dyno delivers an important level of comfort and stability.

Technical Points

- 1080i/720p – AVC-Intra 100 or DVCPRO HD
- 50 Mb/s or 100 Mb/s
- 360 fps
- Replay speed 0-200% “AnySpeed”
- Up to 46 hours recording RAID-1 on 12 SSDs
- 2-SSM 6X input / 2-SSM 6X outputs or 1-SSM 6X input + 3 standard / 2 outputs
- Cross codec playback
- Cross format playback
- Loop or non-loop modes
- ShareFlex ready
- Export content to external storage
- Share content with legacy products
- Utilize with EDIUS on K2 Dyno S Replay Controllers
- Available only on K2 Dyno S Replay Controllers
- Requires Mezzanine board

“K2 Dyno with AnySpeed may lead a transition to mobile units with multiple super-slo-mos.” says Garvin. “It’s even conceivable that, a few years from now, the traditional instant replay will be completely replaced by super-slo-mo replay with variable speed — i.e., every replay from every camera can be anything from normal to 1/12th speed.”

Philip Garvin – President Mobile TV Group
Read more at bit.ly/SVGAnySpeed



“I can’t say enough good things about K2 Dyno. We use it all the time — best of all, we can use at regular speed or super slo-mo, whatever tells the best story. Our video guy loves it — variable speed replay is a game changer.

The best thing about the system is that it is always in record, no trigger required. We can play at 100 percent through the stuff that doesn’t need to be slo-mo and slowed for the emphasis of the play. We have two of them and it’s a great producer tool.

Kenneth Miller – Executive Producer –
MLB productions on Root Sports

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