



ChannelFlex for the K2 Summit 3G/K2 Solo 3G Media Servers

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The K2 Summit 3G is described as a four-channel media server, the K2 Solo 3G as a two-channel media server. But users were looking at the back panel and wondering why there were a lot more connectors than there were channels. The answer is ChannelFlex, which introduces the concept of streams, where a single channel might involve multiple streams of video, for video plus key, 3D, Super Slo-Mo or ISO camera recording.

Introduction

The original design of the K2 Summit media server platform was to support the needs of live and studio production environments. One of the key concepts was redefining a “server channel” to better meet user requirements. The initial product release of K2 Summit implemented a traditional concept of a channel being a simple single video stream, audio tracks, timecode and ancillary data, but it was apparent from the K2 Summit rear panel (Figure 1) that much more was planned. Users would ask: “Why are there three inputs and two outputs on each channel?”

With the release of software version 7.2 and optional K2 AppCenter Elite software license, a new set of channel configurations that we call ChannelFlex have been enabled. ChannelFlex brings the capability to record signals from two and three times frame rate cameras, record and playback of video plus key or 3D (left-eye and right-eye), and to record two camera ISOs all with a single K2 Summit 3G or K2 Solo 3G channel.

ChannelFlex brings significant flexibility, but there are limitations so care must be taken to ensure that platform resources are not over-subscribed. This application note will explain how all this new functionality works and rules for configuration in the context of our supported applications.



Figure 1 – K2 Summit rear panel.

What is a “Standard” K2 Summit 3G Channel?

A “standard” channel is bidirectional (can quickly be programmatically changed between record and play back) and includes a single video stream, up to 16 audio tracks, a timecode track and an ancillary data track. If K2 AppCenter Pro is licensed, then the SDI Out2 can be selected to display superimposed information over the video (such as timecode, clip name, audio activity monitors, etc.). Figure 2 highlights the connectors that are operational during record and play back. There is a single control (RS-422 or Ethernet) and a single LTC connection for each channel. Audio is selected from either AES (8 tracks/4 AES pairs) or embedded (16 tracks/8 AES pairs).

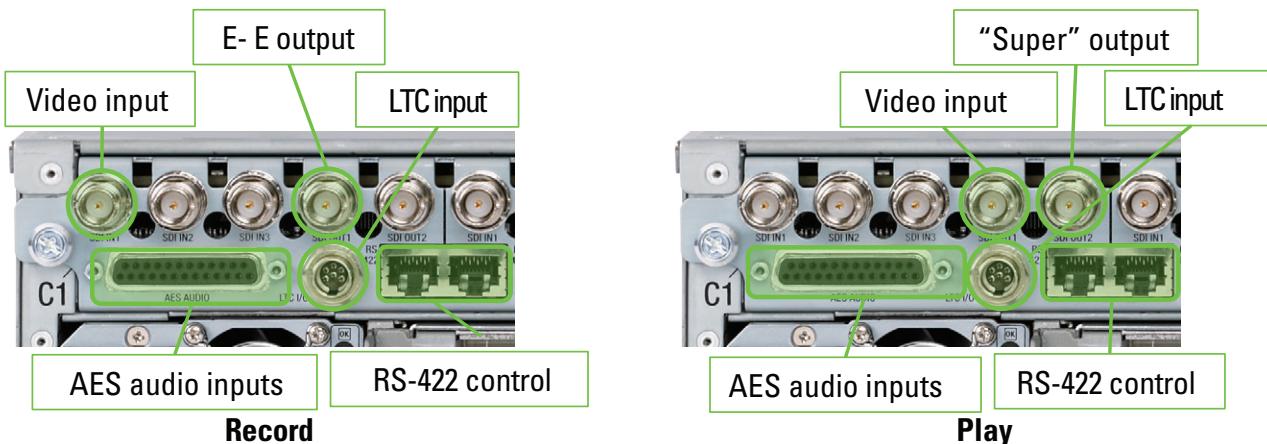


Figure 2 – “Standard” K2 Summit Channel I/O connection.

What is a “Standard” K2 Summit 3G Channel? (Cont.)

The structure of the clip shown in Figure 3 is easily recognizable as a group of essence files: video, audio, timecode and data each with a corresponding indexing file, xml reference file for the clip that provides the association of the essence files and a jpeg thumbnail file (keyframe still image). If the compression type is one supported by Apple QuickTime, then a QuickTime reference file is also present to be used by editors such as Final Cut Pro.

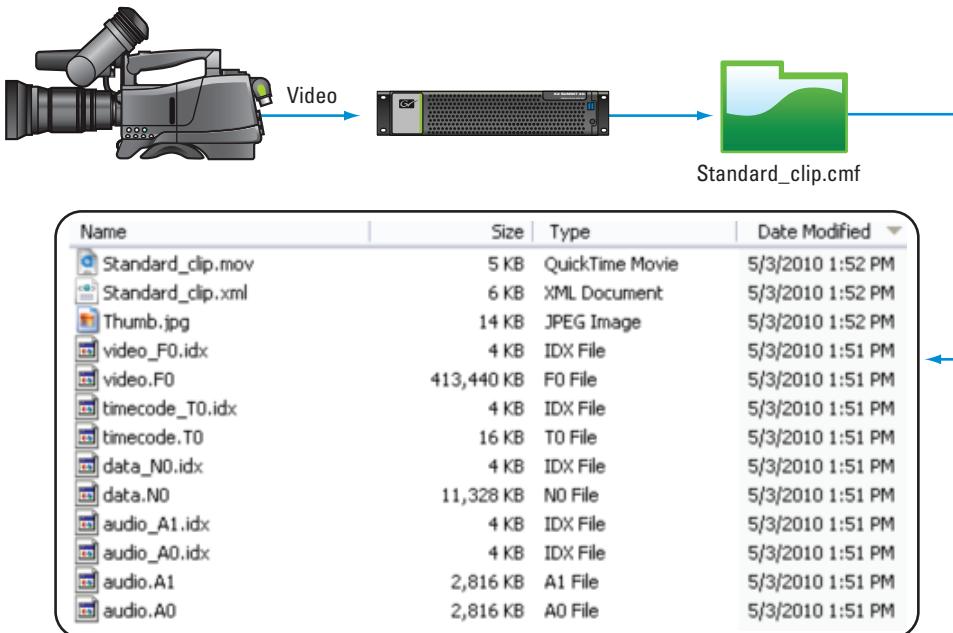


Figure 3 – A “Standard” clip.

The Properties view in K2 AppCenter gives more user-friendly views of the clip information and allows for some ability to manipulate tracks and alter or enter clip information (such as aspect ratio).

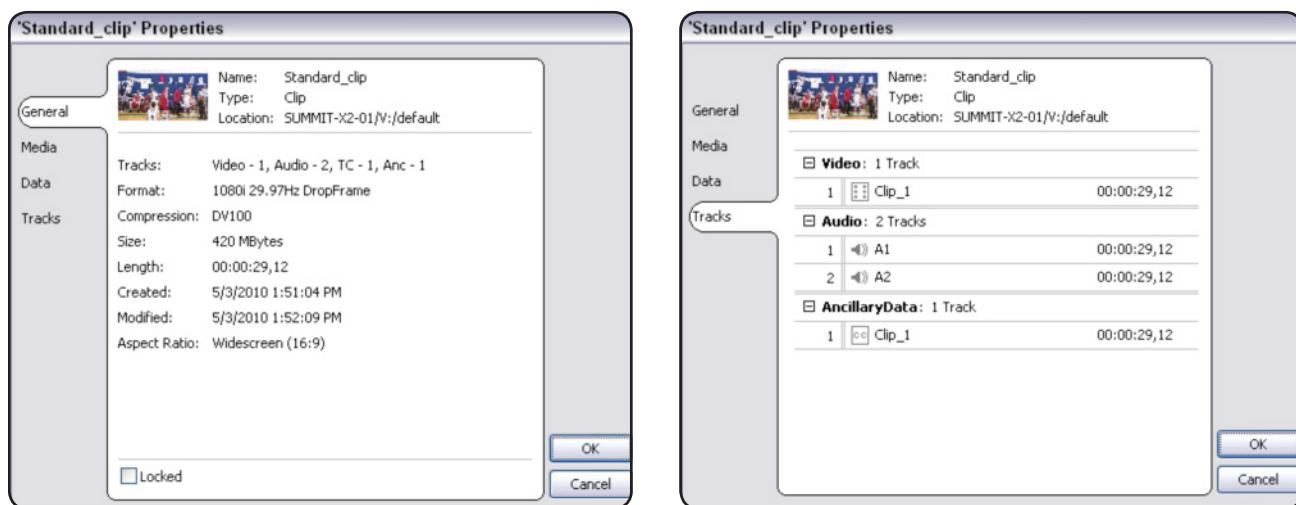


Figure 4 – “Standard” clip properties.

CHANNELFLEX: The Basics

ChannelFlex is sold as part of the K2 AppCenter Elite application suite (see feature comparison chart in Appendix A) which can be purchased as a software option to K2 Summit 3G and K2 Solo 3G or is included in the K2 Dyno S and Elite packages, the K2 Solo 3G Elite and in the Kayenne ClipStore. It adds four new channel modes: 3D / Video + Key recorder, 3D / Video + Key player, Multicam recorder and Super Slo-Mo Recorder (SSM) which is selectable for either 2X or 3X speed. These new channel modes are selectable on a channel-by-channel basis through the configuration menu of K2 AppCenter Elite as shown in Figure 5.

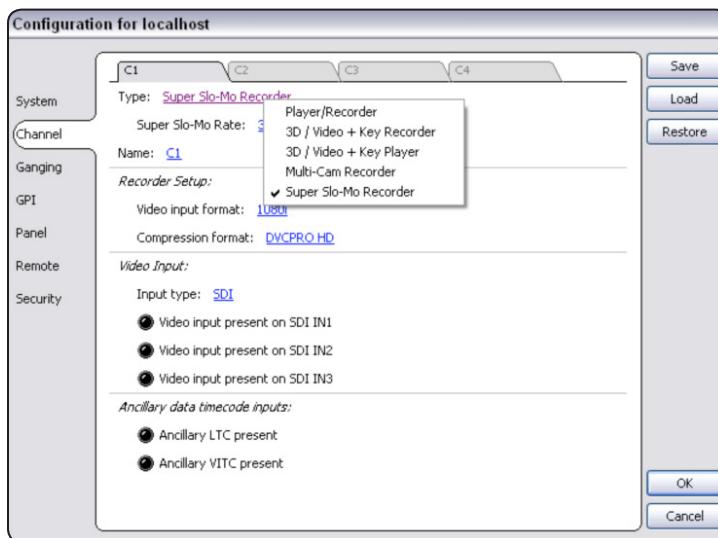


Figure 5 – New ChannelFlex configuration screen.

3D/Video+Key Recorder Mode

3D/Video+Key Recorder mode configures a K2 Summit 3G or K2 Solo 3G channel into a dual video stream recorder that creates a single clip with two video tracks. When this mode is selected there is a status indication provided for video input present on both the SDI IN1 and SDI IN2 inputs for the channel (see Figure 6). Along with the video streams, audio, timecode and ancillary data are also recorded if selected. Up to eight audio tracks can be recorded from either the AES/EBU inputs or from the embedded audio on the SDI IN1 input as shown in Figure 7.

In Figure 8 you can see the physical connections used in this mode. It should be noted that the output SDI OUT1 and SDI OUT 2 provide E-E monitor outs of the respective inputs. Regardless of whether the inputs have left-eye and right-eye signals or video plus associated key signal from a graphics device, the resulting clip creates the same set of files as shown in Figure 9.

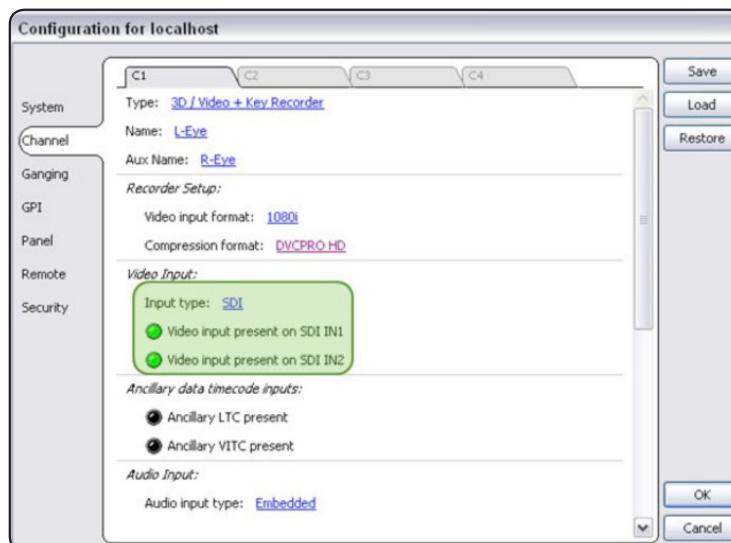


Figure 6 – 3D/Video+Key Recorder mode configuration screen.

3D/Video+Key Recorder Mode (Cont.)

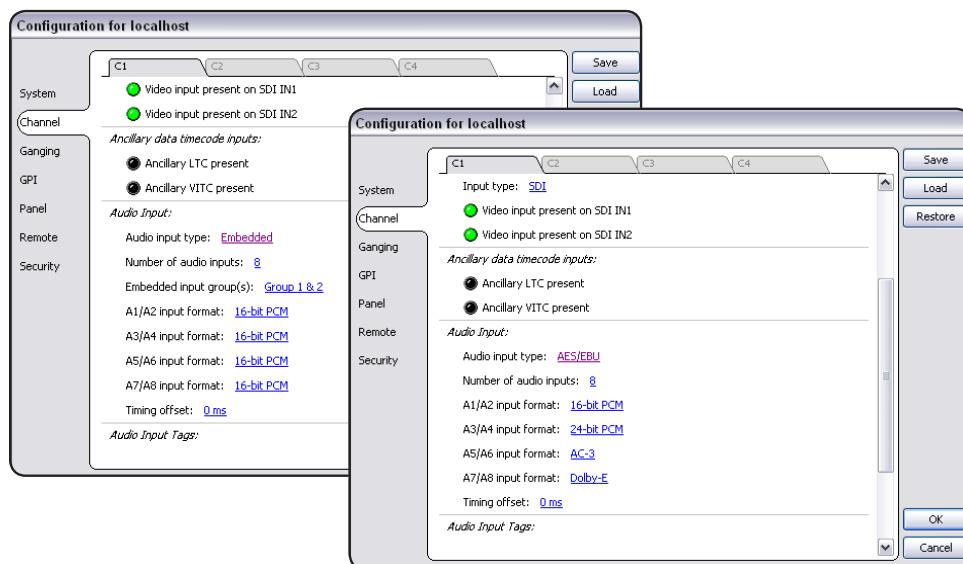


Figure 7 – 3D/Video+Key Recorder audio selections.

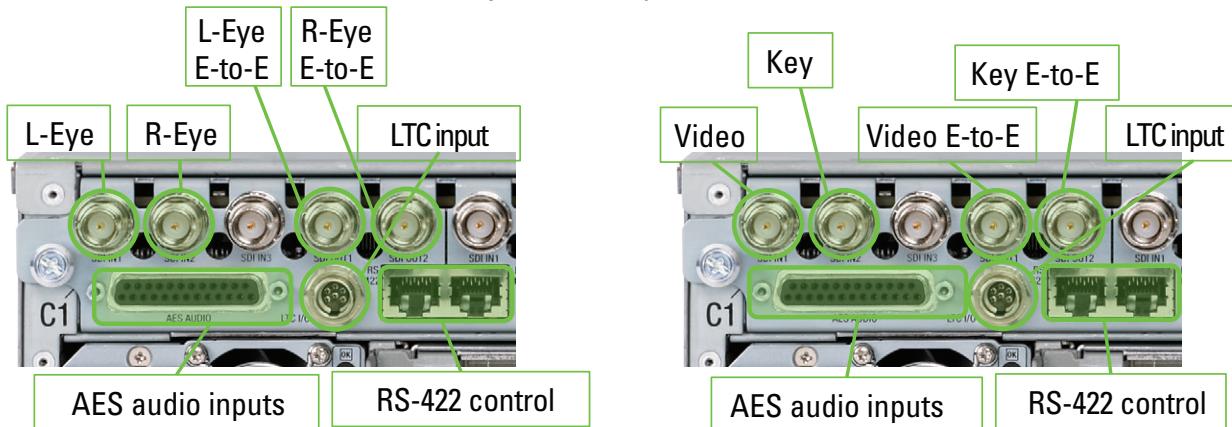


Figure 8 – 3D/Video+Key Recorder audio selections.



| Name | Size | Type | Date Modified |
|-----------------|------------|-----------------|-------------------|
| 3D_V+K_clip.mov | 8 KB | QuickTime Movie | 5/3/2010 1:09 PM |
| 3D_V+K_clip.xml | 8 KB | XML Document | 5/3/2010 1:09 PM |
| audio.A0 | 1,984 KB | A0 File | 5/3/2010 11:11 AM |
| audio.A1 | 1,984 KB | A1 File | 5/3/2010 11:11 AM |
| audio.A2 | 1,984 KB | A2 File | 5/3/2010 11:11 AM |
| audio.A3 | 1,984 KB | A3 File | 5/3/2010 11:11 AM |
| audio_A0.idx | 4 KB | IDX File | 5/3/2010 11:11 AM |
| audio_A1.idx | 4 KB | IDX File | 5/3/2010 11:11 AM |
| audio_A2.idx | 4 KB | IDX File | 5/3/2010 11:11 AM |
| audio_A3.idx | 4 KB | IDX File | 5/3/2010 11:11 AM |
| Thumb.jpg | 14 KB | JPEG Image | 5/3/2010 11:10 AM |
| timecode.T0 | 12 KB | TO File | 5/3/2010 11:11 AM |
| timecode_T0.idx | 4 KB | IDX File | 5/3/2010 11:11 AM |
| video.F0 | 290,628 KB | F0 File | 5/3/2010 11:11 AM |
| video.F1 | 290,628 KB | F1 File | 5/3/2010 11:11 AM |
| video_F0.idx | 4 KB | IDX File | 5/3/2010 11:11 AM |
| video_F1.idx | 4 KB | IDX File | 5/3/2010 11:11 AM |

Figure 9 – A 3D/Video+Key clip.

3D/Video+Key Player Mode

3D/Video+Key Player mode configures a K2 Summit 3G or K2 Solo 3G channel into a dual video stream player. If a 3D/Video+Key clip is loaded into the channel, then SDI OUT1 will play the video.f0 file (originally recorded on SDI IN1) and SDI OUT2 will play the video.f1 (originally recorded from SDI IN2). If embedded audio is selected, it will only be on the SDI OUT1 output. Both the SDI OUT1 and SDI OUT2 outputs will have ANC data if selected. When in the 3D/Video+Key Player mode, the “Super out” feature is not available. If a clip that only contains a single video track is loaded into a 3D/Video+Key Player channel, white will be played back on the SDI OUT2 to enable the keyer to pass the video on SDI OUT1 full frame.

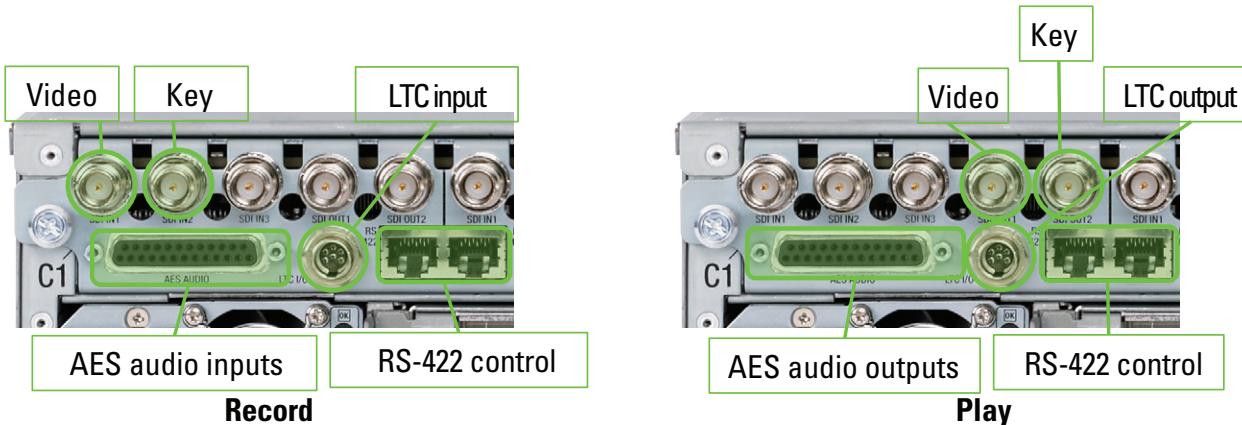


Figure 10 – 3D / Video+Key I/O Player connections.

Multicam Recorder Mode

Multicam Recorder Mode configures a channel to record two video streams creating two files in the same manner a ganged record would operate using two separate channels without ChannelFlex enabled. The new “Aux name” selection allows unique names to be given to each of the records for monitoring either in the AppCenter monitor display or using Super out on the E-E outputs.

In this mode audio is limited to a maximum of eight audio tracks, timecode and ancillary data. Audio can be selected from either AES or embedded audio sources and tracks can be associated with both files created or split as shown in Figure 13.

The file structure, shown in Figure 14, shows the two standard files that are created as a result of a single record being initiated. The typical usage in this mode is for recording ISO¹ feeds or different camera angles at a live event or in a studio production. A good example of this is when multicam record is used with the K2 Dyno Replay System where it can be configured to record six camera angles for replay using a single K2 Summit 3G and K2 Dyno S Replay Controller. In these types of situations it is not necessary to have independent control of each video stream since all records are initiated simultaneously. Files created in this mode are standard files that play on a standard player/recorder channel and can be transferred using standard K2 tools. In Figure 12 you can see the physical connections used in this mode. It should be noted that the SDI OUT1 and SDI OUT2 outputs provide E-E monitor outs of the respective inputs.

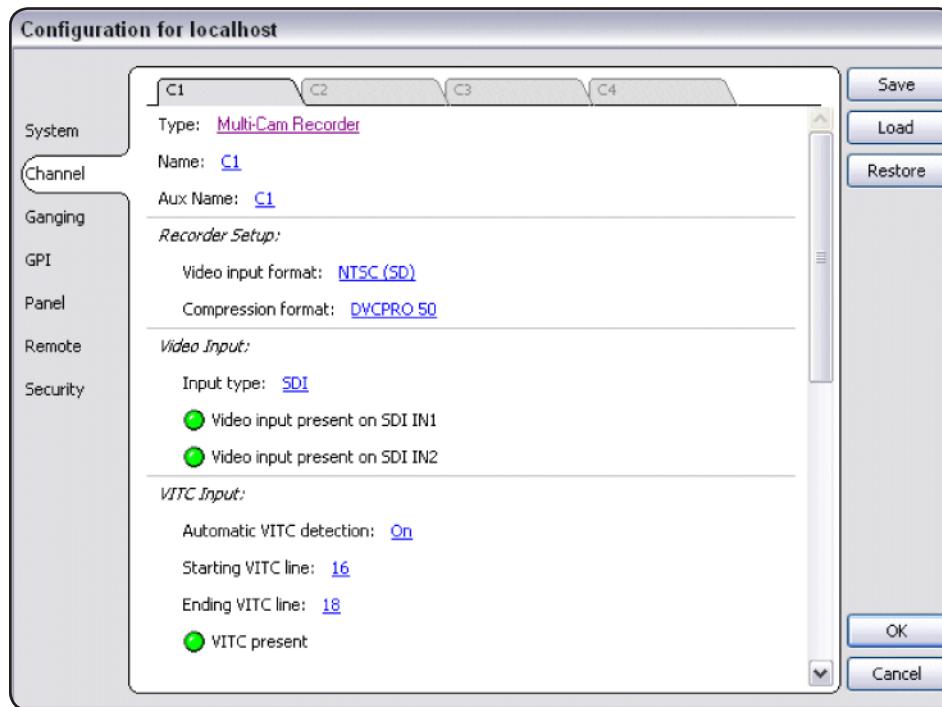


Figure 11 – Multicam Recorder configuration screen.

¹ISO is a term used to refer to when individual cameras in a production are being recorded for replay or to capture multiple angles of an event. Cameras have their own “isolated record” in addition to the recording of the output of the production switcher.

Multicam Recorder Mode (Cont.)

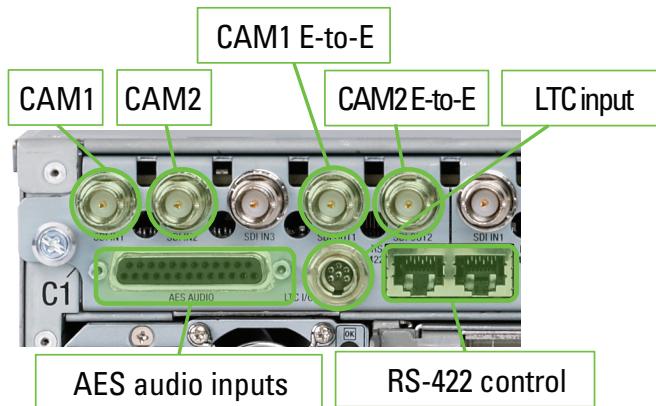


Figure 12 – Multicam Recorder I/O connections.

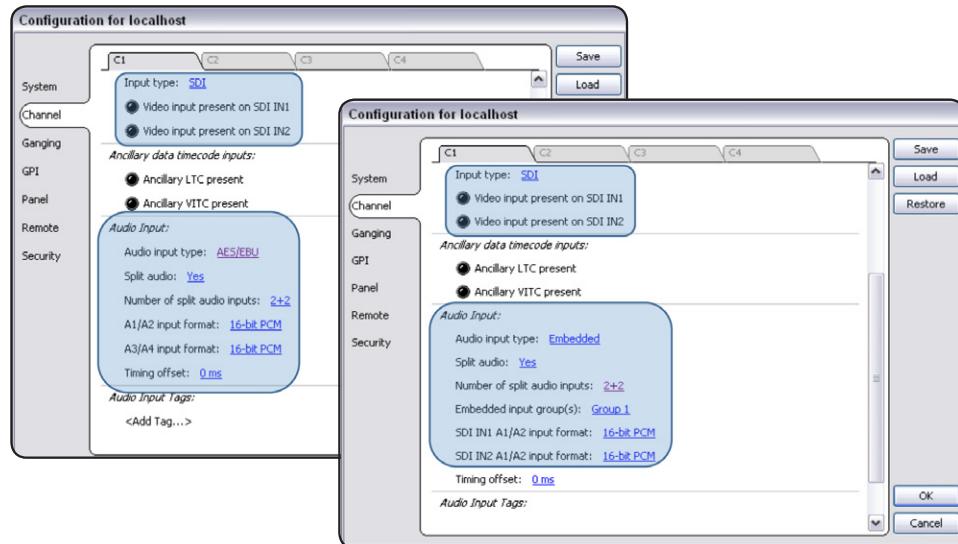


Figure 13 – Multicam Recorder audio selections.

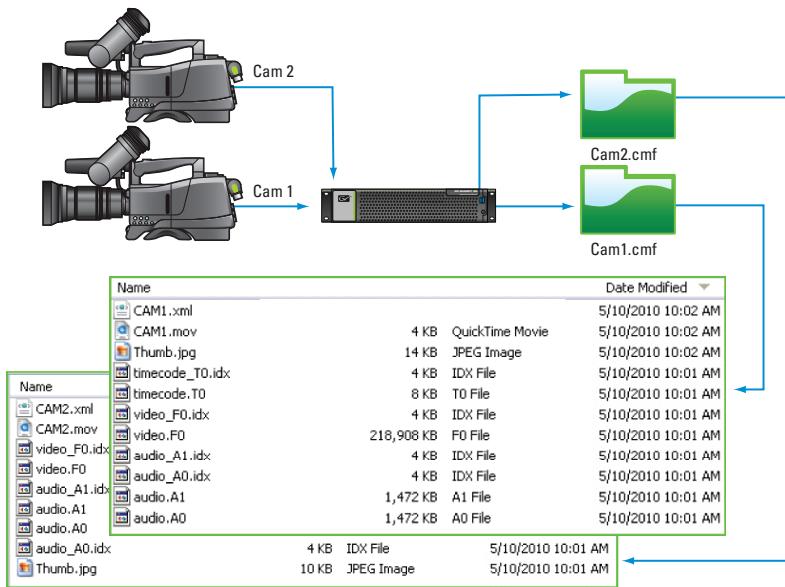


Figure 14 – Multicam File structure showing two “standard” files.

Super Slo-Mo Recorder Mode

High-quality Super Slo-Mo (SSM) HD cameras (2X and 3X frame rate), produced by Grass Valley (LDK 8300) and Sony (HDC 3300), require an external storage and processing system to provide the full quality that the camera can deliver. The K2 Summit 3G in Super Slo-Mo Recorder Mode is capable of capturing all frames from these cameras over a two or three wire interface (referred to as phases) and then storing the frames in a fashion that can be played back at standard broadcast resolutions and frame rates. When using a 2X frame rate, SDI IN1 and SDI IN2 are used. When using a 3X frame rate, all three SDI inputs are used.

Each output frame of the camera is a standard 1X frame rate signal that makes up a portion (1/2 or 1/3) of the frames that make up the 2X or 3X frame rate signal. The E-E output on SDI OUT1 presents the phase 1 signal as a 1X frame rate signal for monitoring. In the record process, the K2 Summit 3G interleaves the frames from the inputs to create a single file. No audio is recorded with SSM clips.

Since the incoming signal is a multiple of standard 50 or 59.94 frame rates, timecode will be the same value for two or three consecutive frames. This is not an issue for most applications and the frames are uniquely identified by timecode user bits. SSM files play on a standard channel and can be transferred using standard tools.

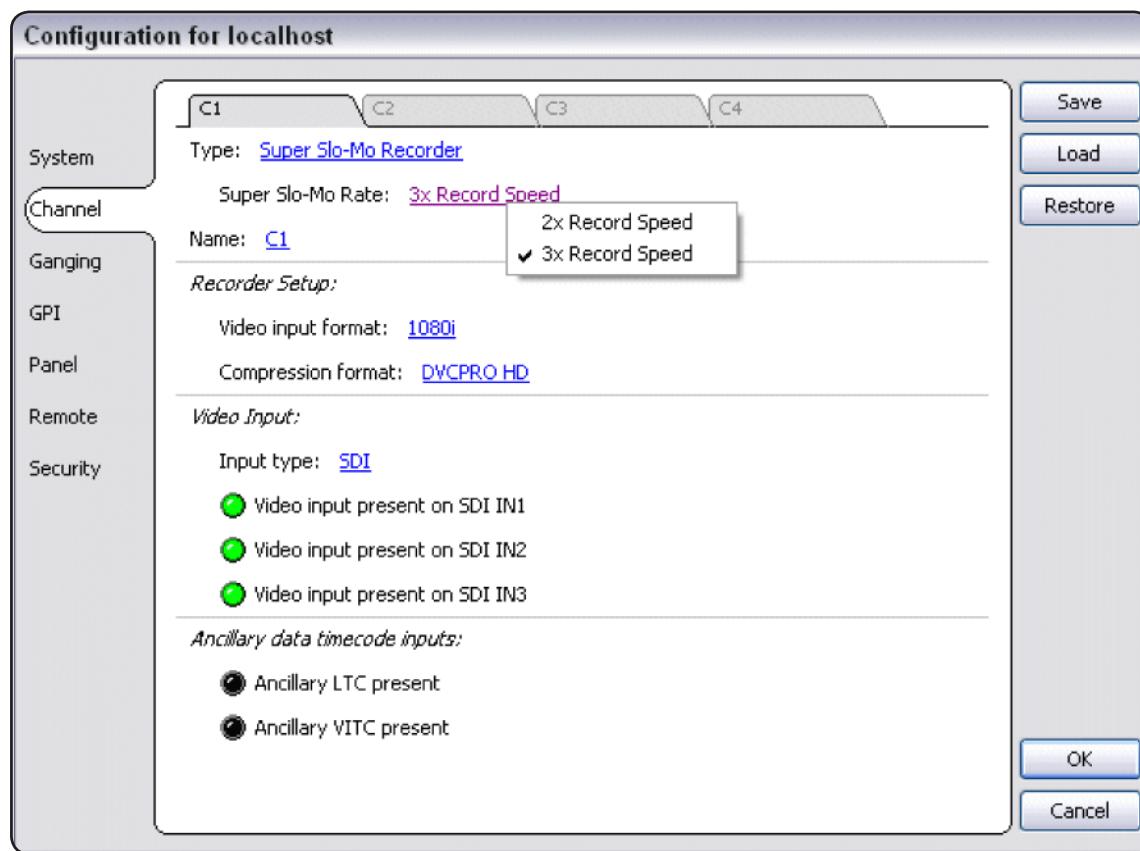


Figure 15 – Super Slo-Mo Recorder configuration screen.

Super Slo-Mo Recorder Mode (Cont.)

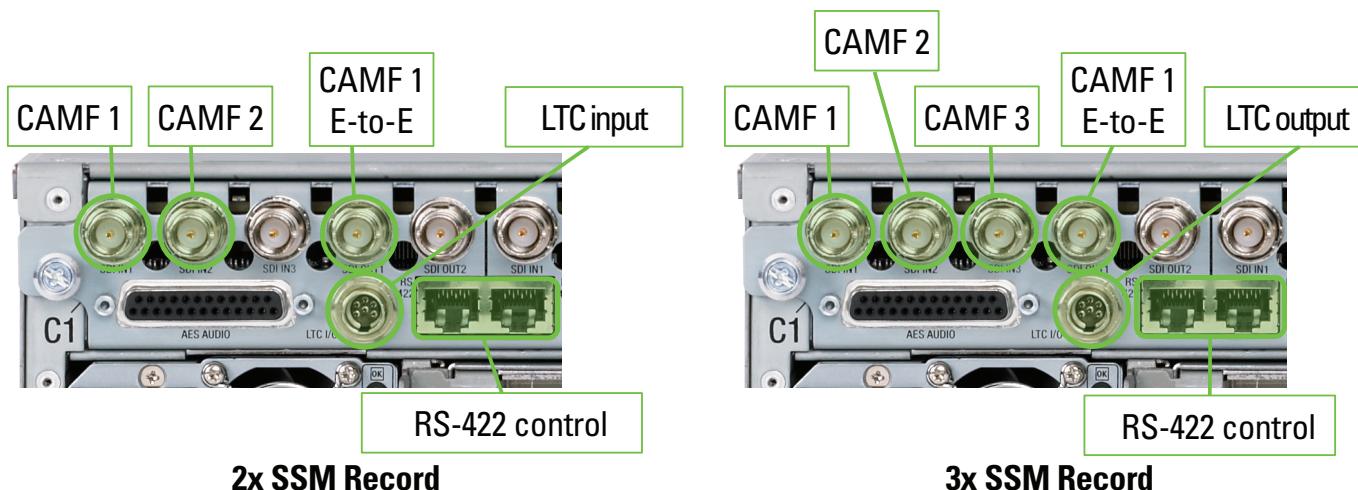


Figure 16 – Super Slo-Mo recorder I/O connections.

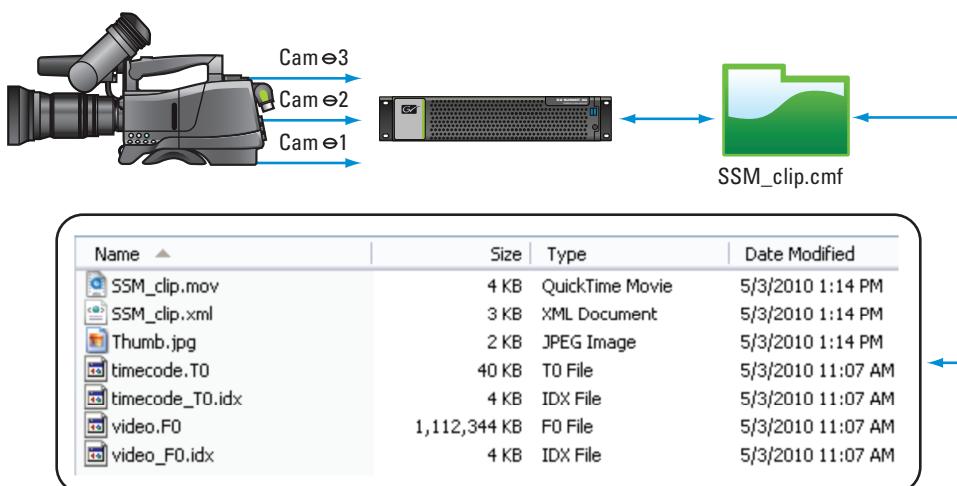


Figure 17 – Super Slo-Mo file.

Key things to remember when you're selecting any of the ChannelFlex modes:

There are still only four controllable channels on the K2 Summit 3G (two on the K2 Solo 3G)

Each physical channel has only one real time processor, a single RS-422 connection and is controlled as a single entity.

There are limitations in the combination of types of channel

This is due to system bandwidth and processing limits in the platform. Refer to Appendix A for supported configurations.

Not all compression formats are supported in all modes

All the ChannelFlex modes involve additional video streams, which means more instances of encoders and decoders and there are physical limitations. In general: MPEG-2 dual video stream mode is supported only with an additional hardware/software option; DV, AVC-Intra and DnXHD support dual video stream modes; and DVCPRO HD, AVC-Intra and DNxHD supports 2X/3X Super Slo-Mo. Refer to Appendix C for a summary of the ChannelFlex modes, including the supported codecs.

Channels are only configurable through K2 AppCenter Elite

There is no way to programmatically (via a control protocol) change the configuration of a channel. If you want to change between a standard bidirectional channel and a ChannelFlex mode you must do it through the configuration screen in AppCenter, it cannot be done through a protocol or K2.NET.

Appendix A – Supported Configurations

| Typical Configurations (1) | RTIO (2) | Record | Play | FTP MB/s (1) | K2 Dyno PA DLC MB/s (3) | Comments (4) |
|--------------------------------|----------|------------------|-------|--------------|-------------------------|---|
| K2 Summit 3G Standalone | 370 | — | — | — | 15 | |
| 4 Rec/Play Channels | — | Any 4 | | 40 | — | |
| K2 Dyno Pack | — | 2 | 2 | 40 | — | |
| K2 Dyno Pack | — | 3 | 1 | 40 | — | |
| K2 Dyno Pack Elite | — | 4 | 2 | 32 | — | |
| K2 Dyno Pack Elite | — | 6 | 1 | 28 | — | |
| K2 Dyno Pack Elite – SSM | — | 1 SSM 1 Multi | 2 | 28 | — | |
| K2 Dyno Pack Elite – SSM | — | 2 SSM | 2 | 25 | — | |
| 3D K2 Dyno Pack | — | 3 V/K | 1 V/K | 25 | — | |
| Switcher 4 x 3D/Video/Key | — | Any 4 | | 25 | — | <ul style="list-style-type: none"> • 1 off-speed play is possible concurrently with FTP • 2 channels may off-speed play. Do not use FTP. Also, adding a third off-speed play will impact the fourth play channel • In 2-head queuing applications (e.g., switchers Video/Key), up to 2 off-speed plays or FTP are possible, but not both |
| K2 Solo 3G | 170 | — | — | — | 15 | |
| 2 Rec/Play Channels | — | Any 2 | | 32 | — | Two off-speed plays reduce FTP bandwidth. |
| K2 Dyno 3G Solo | — | 1 | 1 | 32 | — | Off-speed fully supported |
| K2 Dyno 3G Solo Elite | — | 2 | 1 | 25 | — | Off-speed fully supported |
| K2 Dyno 3G Solo Elite | — | 1 SSM | 1 | 17 | — | FTP or off-speed play, but not both. Attempting both may impact record |
| Switcher 2 x 3D/Video/Key | — | Any 2 | | 17 | — | FTP or off-speed play, but not both. Any off-speed play could impact record |
| K2 Summit SAN | — | — | | — | — | |
| Fibre Channel | — | — | | — | — | Clients can get enough bandwidth to support configurations above without any limitations |
| iSCSI | — | — | | — | — | Client is limited to about 100 MB/s of bandwidth. It should only use combinations of channels that stay below a total of 100 |

Notes:

1. All data is with drive rebuild in progress (K2 Summit 3G) and DV100. Lower bit rate compression settings will yield more FTP bandwidth. FTP bandwidth is cumulative for multiple streams — a single stream will be less.
2. The RTIO setting must be updated:
 - K2 Summit 3G changes from 250 to 370
 - K2 Solo 3G changes from 200 to 170
 The RTIO setting can be updated three ways:
 - New unit ships from Manufacturing
 - Storage Utility > Make File System
 - Manually edit a configuration file. Contact Service Support for more info
3. Each K2 Dyno Production Assistant DLC connection takes 15 MB/s from FTP.
4. Off-speed play means >1x.

Appendix B – K2 AppCenter Feature Comparison Chart

| Feature | AppCenter (standard) | AppCenter Pro | AppCenter Elite |
|---|-------------------------|---------------|-----------------|
| Record | ✓ | ✓ | ✓ |
| Continuous record | ✓ | ✓ | ✓ |
| Play | ✓ | ✓ | ✓ |
| Sub-clipping | ✓ | ✓ | ✓ |
| Playlists | ✓ | ✓ | ✓ |
| Playlist import | | ✓ | ✓ |
| Channel ganging | | ✓ | ✓ |
| Audio track assignments | | ✓ | ✓ |
| Import and add tracks from other clips | | ✓ | ✓ |
| Scheduled record per channel (not playlist) | | ✓ | ✓ |
| Scheduled playback per channel (not playlist) | | ✓ | ✓ |
| “Live” mode (chase play) | | ✓ | ✓ |
| Video monitor in control view | ✓ | ✓ | ✓ |
| Expanded live monitor view on VGA output | ✓ | ✓ | ✓ |
| Enhanced super out on each channels SDI OUT2 | | ✓ | ✓ |
| Plays with M/E transition | | ✓ | ✓ |
| Flying M/E transitions | | ✓ | ✓ |
| ChannelFlex suite | | | ✓ |
| Multicam (dual record – 2 clips) | | | ✓ |
| Video + Key | | | ✓ |
| Video + Key file import using QT32 (After Effects and others) | | | ✓ |
| 3D – Left Eye + Right Eye | | | ✓ |
| Super Slo-Mo x2 | | | ✓ |
| Super Slo-Mo x3 | | | ✓ |

Appendix C – CHANNELFLEX Summary

| Channel Mode | Supported Codec(s) | Audio Support | SDI IN1 | SDI IN2 | SDI IN3 | SDI OUT1 | SDI OUT2 | Description | Media File |
|-------------------------|--|---------------|-------------------------|-------------------------|-----------------------|-----------------------|-----------------------|---|--|
| Standard | DV/MPEG/AVC-Intra | 16 tracks | Video | Not used in this mode | Not used in this mode | Video | Video* | Standard bidirectional channel | Single file with video, timecode, ANC and 16 audio tracks |
| Multicam | DV/AVC-Intra, DNxHD, MPEG-2 with hardware option | 16 tracks | Video 1 | Video 2 | Not used in this mode | Not used in this mode | Not used in this mode | Synchronized record two video signals. Playback on a standard channel | Two files each with 1 video track (V1 & V2) and ANC data from the associated video. Timecode can either be selected from the input videos embedded timecode or from the LTC input from the channel. Audio tracks for each clip can come from among the following: group 1 (4 tracks) of the embedded audio, can be split between up to 4 contiguous tracks of AES audio or can share groups 1 and 2 (8 audio tracks) of the embedded audio of SDI-1 of the channel |
| 3D/Video + Key Recorder | DV/AVC-Intra, DNxHD, MPEG-2 with hardware option | 16 tracks | Video/ fill or left-eye | Video/ key or right-eye | Not used in this mode | Video | Key | Synchronize record of two video signals | Single file with 2 video tracks (video + key), timecode, ANC and up to 8 audio tracks . Dual track File created by adding Key track to file with fill video or by doing a video + key record |
| 3D/Video + Key Player | DV/AVC-Intra, DNxHD, MPEG-2 with hardware option | 16 tracks | Video/ fill or left-eye | Video/ key or right-eye | Not used in this mode | Video left-eye | Video right-eye | Synchronized playback of two video signals | Single file with two video tracks (left-eye/right-eye), timecode, ANC and up to 8 audio tracks |
| Super Slo-Mo x2 | DVCPro HD, AVC-Intra, DNxHD | None | Phase 1 | Phase 2 | Not used in this mode | Not used in this mode | Not used in this mode | 2 x frame rate record. Note a 2X or 3X SSM file is played out on Standard channel configuration | Single file with 2x frame rate video, timecode and ANC. No audio |
| Super Slo-Mo x3 | DVCPro HD, AVC-Intra, DNxHD | None | Phase 1 | Phase 2 | Phase 3 | Not used in this mode | Not used in this mode | Synchronized record or playback of two inputs. Note a 2X or 3X SSM file is played out on Standard channel configuration | Single file with 3x frame rate video, timecode and ANC. No audio |

* With super out feature

DNxHD requires an additional software license



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