APPLICATION NOTE

OPERATIONS FOR ALL CAMERA FORMATS AND FRAME RATES
AS OF MULTICAM 15.1
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INTRODUCTION

Today’s creative television professionals have a broad range of camera formats from which to choose.

They may be required to shoot in standard definition; in HD (720p or 1080i) as interlaced or progressive; in Full-HD (1080p) or in higher resolution emerging formats such as Ultra HD-4K (2160p) or (4320p - 8K).

The production may also need live slow-motion replays, which require high-speed camera capture. This could be super slo-mo (ranging from 2x to 16x the standard framerates) or it could be much higher frame rates from specialty cameras.

To ensure secure operations, it is vital that whatever the camera input or the program output, the control of replays should be handled in precisely the same way. The operator should not be forced, in the heat of the live production, to rethink the way of working because of a specific camera format.

The EVS XT Series of servers (XT4K, XT3 and XTNano) can ingest and replay many different formats. The user interface controls of these respective servers (LSM and XTNano Sportlight) can enable the selection, preparation and enable variable speed replays of any recording while ongoing.

STANDARD CAMERAS

SDI CONNECTIONS

Any camera providing standard SDI outputs can be easily connected to single input channels of the XT4K, XT3, XS4K, XS3 or XTNano live servers, and this includes 1080p which connects with 3G-SDI.

4K Ultra HD cameras (3840 x 2160 progressive) can use Quad-SDI (four 3G-SDI) or 12G-SDI server inputs to the server. In case of Quad-SDI (square-division or 2-sample interleave), the signals are the entry point of the full UHD-4K landscape, and handled by the LSM operator as a normal camera input.

In each case, the camera or other content requires a single channel of the live server, and is selected and controlled as a single channel by the LSM operator without the need for any other configuration.

IP CONNECTIONS

Any cameras supporting IP interfaces, using SMPTE 2022-6 for conveying signals may also be utilized with XT4K and XS4K series of servers. This I/O will also support future AIMS roadmap formats for separated essence flows covered in SMPTE 2110.

Gateway convertors are available for XT3 and XS3 series of servers for IP I/O.
HIGH SPEED CAMERAS

To achieve high-quality slow-motion replays, it is common to use cameras that acquire video faster than the normal production frame rate, to allow the replay to be slowed down without impairing quality.

Although different camera vendors have different product names for their systems, the products are generally grouped into two categories:

- **Super motion or super slo-mo:**
  - cameras operating at between two times (100~120 fps) and sixteen times (800~960fps) the normal frame rate, and being continuously recorded in the production server

- **Delivery of content:** Super motion cameras have multiple video outputs on their CCU, typically as SDI ‘phases’ today. This delivery of video phases enables temporal content towards an EVS replay server, and provides the high quality ‘SuperMotion’ replays that the industry and consumers appreciate. This also allows the user to have flexible playback access to every frame of video, because everything frame is retained. The user can playback at the normal live playback rate of 100%, or perform variable playback at any speed from 100% to 1600% playback speeds.

- **Speed and Reaction:** Due to the EVS server being in an always recording state, and able to playback the content during record, this provides the user with fast access to every replay during the event.

- **Hyper motion:**
  - cameras operating at 1000 fps or more, and recording in short bursts onto an internal camera memory buffer which have to be processed and subsequently transferred from camera to the server afterwards

  - Hyper motion cameras operate at very high frame rates (up to 3000 fps). The limitations of data communication mean that these cannot be streamed in real time from the camera. Instead, the high-speed content is stored in a memory buffer inside the camera or its CCU.

  - The buffer is continually refreshed in a first-in/first-out (FIFO) system so the operator always has access to the most recent material. To create a clip, the operator simply stops recording to preserve the content of the buffer. This can be performed at the CCU, or from the LSM controller to define a new playback from this buffer.

  - The content is then processed and streamed in a linear fashion into the EVS server’s record channel. Once recorded, it is available to the LSM operator for replay in exactly the same way as any other clip, except for a much greater level of replay speed. Because of their very long replay times – a 1000 fps shoot would present a five second event over 100 seconds – hyper motion replays are often used for “beauty” replays, after the main action or in extended breaks.
The ability to show extreme slow motion replays of action is very popular with audiences, particularly in building emotion and enthusiasm around an event.

SUPER MOTION WIRING

Considering the example of a 3x super slo-mo camera, the CCU delivers the camera over three SDI outputs: one for frame 1, one for frame 2 and one for frame 3 in the group which occupies the time taken by a single standard camera frame.

Newer generations of cameras have employed new methods to deliver these previously described phases of content towards the EVS live servers. To convey the individual phases of content, they have combined two phases into a single 3G-SDI using a method called Dual-Stream. This allows the delivery of more content with less cables, and in turn allows more flexible configurations to be possible in the EVS server configurations.

By routing the combined output of the CCU to the production switcher, the camera can also be used live as part of the main broadcast coverage. The popular super motion cameras are built on the same optics and signal processing as standard cameras, meaning that their outputs are a good match and can be intercut with live cameras. This eliminates the need for additional operators while providing good coverage of all parts of the field of play. It also reduces the number of seats lost from sale to accommodate the camera and cameraman.

Because the camera is creating more frames than the standard, it means that the replay can be slowed down significantly and display more temporal quality. Referring to a six times super motion camera as example, the action can be slowed to one-sixth of real time without repeating any frames of playback, thus translating into better perceived quality for slow motion.
This is significantly important, particularly in sports productions. It allows the viewer to appreciate the skills of the athletes and it helps audiences understand what has happened, seeing precisely what took place in an incident not perceived for the naked eye. Viewers particularly enjoy slow motion replays, and the clean image quality from super motion cameras make the experience even better for storytelling.

When a replay is performed, the LSM operator identifies the content required. Even though physically it involves more than one server channel for input, logically they are managed together so the operator performs precisely the same actions and keystrokes selecting a super motion replay as a replay from a standard camera.

As in any replay, the T-bar of the LSM controller is used to vary the speed of the replay instant by instant, providing them the same operational interface regardless of the speed of the camera being used.

**BENEFITS**

Live event producers have ever more creative ways of engaging with their audiences, including high-resolution cameras and perhaps most important high quality slow motion replays, from two or three times slower than normal to 20 or more. These are being used to add production value to live events, which attract and retain audiences.

**CONTINUOUS SUPPORT**

The EVS server infrastructure is continually being developed and receives software updates to support all of these varieties of cameras, and those to be developed in the future. Solutions are available which support all professional camera solutions on the market today.

**SAME UI FOR EVERY SUPPORTED CAMERA**

The real key benefit is that the EVS hardware supports these different technologies, but with largely uniform operations. The EVS LSM controller removes the complexity from the realtime operator who uses the same functionality whatever the application: identify the clip, setting in and out points if necessary; cuing the playback; and using the T-bar to vary the speed of the replay. The same actions apply whether the LSM is controlling one or multiple physical server channels.

The result is fast, responsive and accurate playback of any channel, including stunning slow motion replays, at any time.

**NATIVE SUPER MOTION ARCHIVE**

In combinasion with XFile3, EVS’ file archive and transfer solution, Super Motion clips can be backed up and later restored while preserving the native high speed content from the camera.
# HIGH SPEED CAMERAS SUPPORTED

## SUPER MOTION

<table>
<thead>
<tr>
<th>Manufacturer</th>
<th>Model</th>
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<th>1080p</th>
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CUSTOMER SUPPORT

Our clients range from TV stations to video equipment rental companies and production houses worldwide. EVS’ key priority is to make sure that its clients keep performing at the highest possible level. We listen to our customers, identify operating workflows, anticipate needs, and suggest effective and reliable solutions, so that they in turn can offer top-quality productions to millions of TV viewers across the globe.

CUSTOMER SUPPORT

EVS is dedicated to making sure its products are functioning in a way that meets your needs and expectations. We offer technical support 24/7 from each of our regional offices, so you can rest assured that someone will always be available to answer any question that may arise.

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