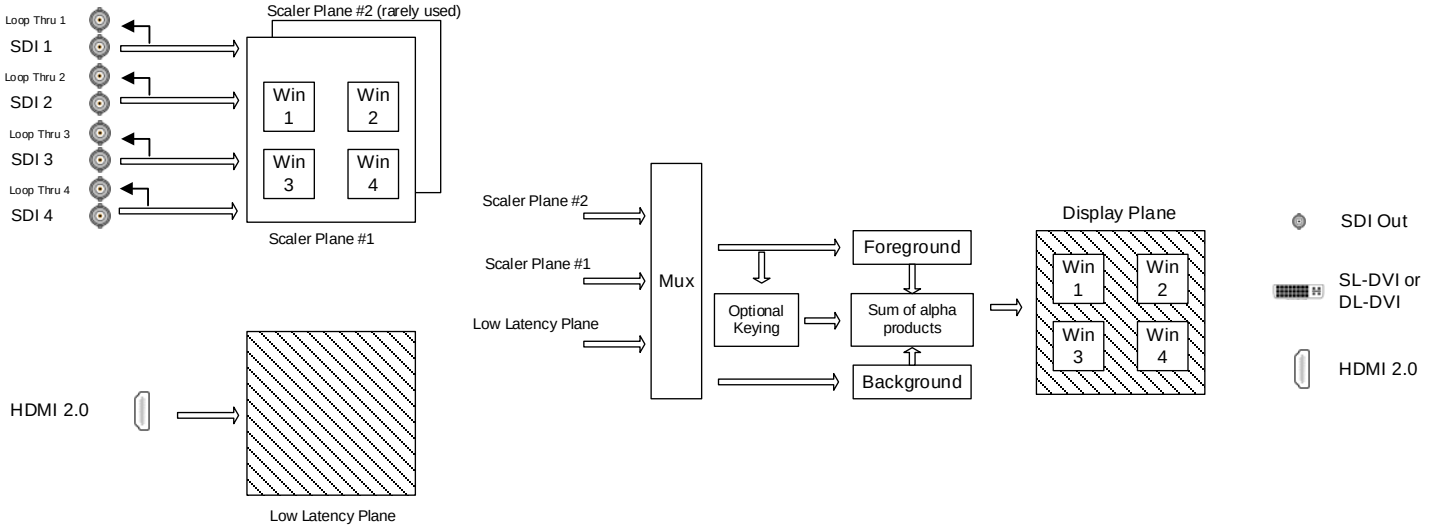
SP4 Multi-Input 3G-SDI Converter

Supports 1 to 4 3G-SDI inputs, combining and driving 3G-SDI, DVI, or HDMI 2.0 (up to 4K)

HDMI 2.0 input for optional keying or as background to SDI PIP.

Applications include:

- *PIP with up to 3 SDI windows within a 4th SDI input (1080P or less)*
- *Quad viewing of 4 3G-SDI inputs (Input 1080P or less, Output up to 4K)*
- *Rectangular SDI windows with background imagery from HDMI 2.0 input*
- *Alpha blend between layers, plus optional keying, with HDMI 2.0 input or one or more SDI inputs as keyed foreground, and HDMI 2.0 input or one or more SDI inputs as background.*



SP4 3G-SDI Converter

The SP4 provides conversion and combining functions for up to 4 SDI video inputs (up to 3G-SDI) plus (1) HDMI 2.0 input (from 1080P to 4K). Various video combining functions are achieved via flexible area-of-interest and windowing control. The SP4 is configured with the SP4 Configuration utility that sends commands to the unit through the RS-232, USB, or optional Ethernet. Appropriate parameters are stored in non-volatile memory to retain desired settings.

Low Latency Plane Input

The SP4 has an HDMI 2.0 input for low latency video combining. If the low latency input is utilized, it forms the Low Latency Plane, and is the basis for the output timing. No re-sizing or re-timing is supported on the low latency input.

Scaler Planes

Scaler Plane #1 is populated from 1 to 4 SDI inputs. Robust windowing and area-of-interest controls allow video content to be placed in programmable locations with variable sizes. The "Windowing Applications" section shows some of the possibilities.

Scaler Plane #2 is rarely used. It is available for applications requiring keying on an SDI input to combine with another SDI input (keyed video combining), such as RGB keying.

Scaler Plane Segments

The scaler planes are divided into segments for processing. Segments are vertical slices of the overall output resolution. The number (1, 2 or 4) and size of segments depends on the output resolution and timing. The configuration application shows the segment boundaries within the output resolution. If 2 scaler planes are required, then each scaler plane must have the same resolution and timing, and each scaler plane has 1 segment or each scaler plane has 2 segments. Examples include:

Resolution/Timing	# of segments	Segment size	2nd scaler plane possible?
3840x2160 /60Hz	4	960x2160	No
3840x2160 /30Hz	2	1920x2160	Yes
2560x1440/60Hz	2	1280x1440	Yes
1920x1080/60Hz	1	1920x1080	Yes

Note. In cases where the low latency input is NOT used but keying is still required, a 2nd scaler plane must be defined.

Input Mode Detection and Scaler Plane Windows

Each 3G-SDI video input port (1-4) can be pre-configured with multiple input modes defining timing, resolution, etc. The built-in Mode Handler Control function is programmed to monitor the port for the pre-configured timing modes.

Up to 4 windows can be defined within the output active area. ***See additional window sections for limitations***. Each window is assigned to an input port. Input modes defined for that input port are mapped to the window according to the window's mode-dependent and mode-independent parameters, such as window size, location, input area-of-interest, flip (vertical or horizontal), and rotate (90/180/270).

If a pre-defined timing mode is not detected for an input port, then windows assigned to that input are programmed to either display a specific RGB color or disappear.

Scaler Plane Methodology and Limitations

Windowing within the scalar plane is accomplished by Independent Windowing (IW).

Independent Windowing (IW): With this mode, up to 4 windows can be placed in a scaler plane. The following constraint (IWC#1) is enforced by the configuration application:

$$\sum_{n=1}^{\#\ of\ windows} (segments\ utilized\ by\ window\ n) <= 4$$

IW allows each window to have independent horizontal and vertical scaling. Windows can be placed anywhere in the output resolution, tempered by IWC#1. IW supports rotation in 90 degree increments. IW also supports robust background fill colors. **In most use models, Westar recommends Independent windowing.**

Tactical Commands for Independent Windowing

"Tactical" commands allow real-time update of a window's source, that source's area-of-interest, window size, location, rotation, and color adjustments. These commands are particularly useful for tactical displays requiring dynamic windowing. Tactical commands are defined in the SP4 Command Line Description. Please contact the factory for more information.

Windows for display resolutions up to WUXGA

The SP4 offers robust windowing for display resolutions with pixel clock frequencies <= 165 MPixels/sec (eg 1080P and WUGA @ 60Hz). Up to 4 windows may be sized and placed anywhere in the output active area. Window techniques include PIP, side-by-side, and other window configurations.

Windows for display resolutions beyond WUXGA

The Dual DVI and HDMI outputs both support pixel rates beyond 165 MP/sec (> WUXGA/60Hz). The SP4 supports these displays with some limitations. If the pixel rate exceeds 165 MP/sec, then the output active area is divided into segments. Two (2) segments are required for displays between 165 MP/sec and 330MP/sec; Four (4) segments are required for displays between 330 MP/sec and 660 MP/sec. The # of windows, window sizes, and window locations are limited per the previous Independent Windowing (IW) and Regional Windowing (RW) sections.

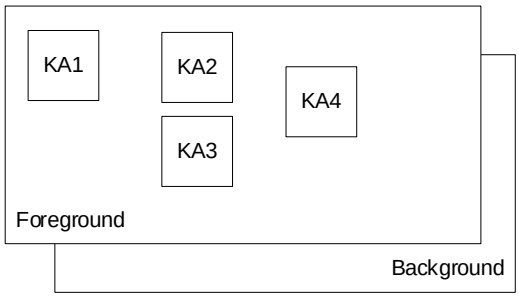
Video Combining (Standard)

- PIP is performed by assigning windows in a layer.
- Programmable alphas in a layer support z-order priority and alpha blending per window overlap area.

Keying

Keying requires both the foreground and background layer to form a display plane.

Up to (4) rectangular key areas (KA1 – KA4) may be defined (with any size and any location) and placed in the foreground plane, as shown below.



Each key area uses one of the (4) video combining definitions. Alpha blend is standard. RGB, Luma, or HSV Keying requires optional :Key. :Key supports calculations on foreground pixels that are "inside" the key area(s). Foreground and background alpha values are applied based on the key calculation result (Key = True or Key = False)

A foreground and background alpha value is also defined for any area outside the defined key areas.

Every outgoing pixel is calculated as:

*PixelOut = foreground alpha*foreground pixel +*

*background alpha*background pixel*

Notes:

1. *If a key area overlaps with another key area, then the lower number key area has priority (eg KA1 has priority over KA2).*
2. *The SP4 configuration application allows a key area to be defined by a corresponding window (eg See Application #2 on Page 8). Alternatively, a key area may be defined completely independent of a window location.*

Programmable

- Remote interface for both initial configuration and, if required, dynamic operational control. (2) RS-232 ports and USB are standard. Ethernet is optional.

- Commands are defined in the Command Line Description.

User Programmable Inputs / Outputs

- Each SDI input supports many standard timings. Typical resolutions are 1920x1080, 1280x720, or 720x480.
- The HDMI input supports many HDMI formats, including 1080P, 2560x1440, and 3840x2160.
- Similar resolutions are supported on the output. The supported output types are SDI (up to 3G-SDI) and HDMI 2.0. (1080P and above)
- If the Low Latency (LL) HDMI input is used, then the output timing is identical to the low latency input timing. In cases not using the LL input, output timing is either free-running or gen-locked to a SDI input. *Gen-locking for output resolutions/timings up to 1080P/60Hz only.*

Gamma Adjustments

The SP4 supports overall panel gamma correction to account for the characteristics of a particular panel. The VP17 supports mode dependent reverse gamma correction to reverse prior gamma correction on a particular input video source.

The SP4 gamma LUTs are 1024 element tables (curves) used to re-shape 10bit video luminance profile. Individual R, G and B LUT's are supported. The panel gamma LUT is typically profiled to the inverse characteristic of the panel. The reverse gamma LUT is typically used to reverse a prior gamma profile adjustment on a particular input video source.

The LUT's default to "bypassed" mode. For applications that require gamma adjustments the tables can be incorporated into the downloadable configuration file using the SP4 Configuration application. A spreadsheet is available from Westar that supports creation of the .csv files that are compatible with the SP4 Configuration application.

LUT table entries are constructed as follows:

- Panel Gamma (10.2) correction values are 12bit with 10bits integer and two bits fractional (0000-0fff).
- Reverse Gamma (10.5) correction values are 15bit with 10bits integer and 5bits fractional (range 0000-7fff).

Test Pattern / Messaging

- Test Patterns include: flood fields, color wedges, checkerboards, and color wedges; each highly programmable.
- Test pattern overlays include outline, lines, and pixel.
- Up to 8 on-screen messages using built-in 8x10 pixel character generator based on ASCII character set. Each message has:
    - up to 64 characters
    - 1x, 2x, 4x, 8x character size multiplier
    - programmable location in x and y

Ordering Configurations

The standard SP4 can be ordered with optional Keying as

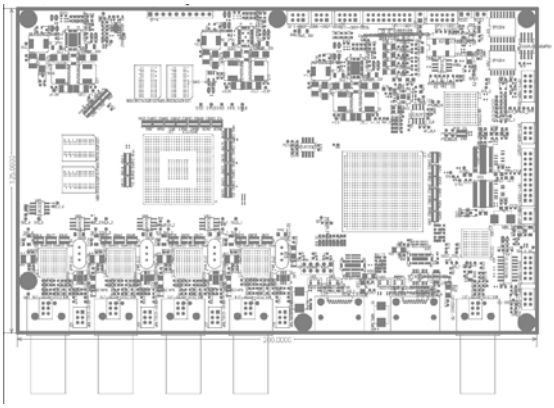
SP4 :Key

SP4 Operation: Typically, the SP4 operates as follows:

1. Upon power up, the SP4 configures itself based on its internal BIOS. The BIOS includes various input definitions and an output definition (timing, electrical format, video combining definition, etc.)
2. If valid video is detected, the SP4 populates windows with that video per the mode definition. If valid video is not detected, the SP4 populates window(s) with a pre-defined color (blue-screen), or some other function as defined in the BIOS created with the configuration utility. In all cases, the SP4 output timing and formats are per the output definition.

Dimensions	1U 19” Rackmount ,19” x 1.75” x8” Deep
Temperature Range	Operating: 0°C to +70°C (additional data available) Storage: -40°C to +100°C
Video Input	SDIx4 (each with loop-thru), HDMI 2.0 (1080P to 4K)
Video Output	SDI, HDMI 2.0 (1080P to 4K)
Synchronization	When Low Latency (LL) input is used, the output timing is identical to the LL input timing. In cases not using the LL input, output timing is either free-running or gen-locked to a SDI input. Gen-locking only functions for output resolutions/timings up to 1080P/60Hz.
Input Power	IEC Connector, 100-240 VAC, 47-63 Hz, less than 60 Watts
Weight	Less than 4 lbs
Control Interface	RS-232, USB, Ethernet

SP4 Specifications



For applications requiring a single board to be embedded in the customer’s own enclosure, we offer the SP4 as shown below:

Ordering configurations include:

SP4 /NE ; board only
SP4 /NE /Key board only, with Keying

Optional Ethernet is available via a cable assembly with built-in Ethernet port.

Physical Dimensions	200mm x 125mm x 12mm
Temperature Range	Operating: 0°C to +70°C (additional data available) Storage: -40°C to +100°C
Video Input	SDIx4, HDMI 2.0 (1080P or greater)
Video Output	SDI, HDMI 2.0 (1080P or greater)
Input Power	+12 VDC, 10 Watts
Control Interface	RS-232, USB, Ethernet (optional)

SP4 /NE Specifications

Support Documentation/Applications

To help with your integration, the SP4 is supported by the following:

- SP4 Configuration Utility and Manual
- SP4 Installation Manual (/NE version)
- SP4 Command Line Description

Contact Us

Call us for additional product info and pricing.

+1 (636) 300-5164
www.westardisplaytechnologies.com

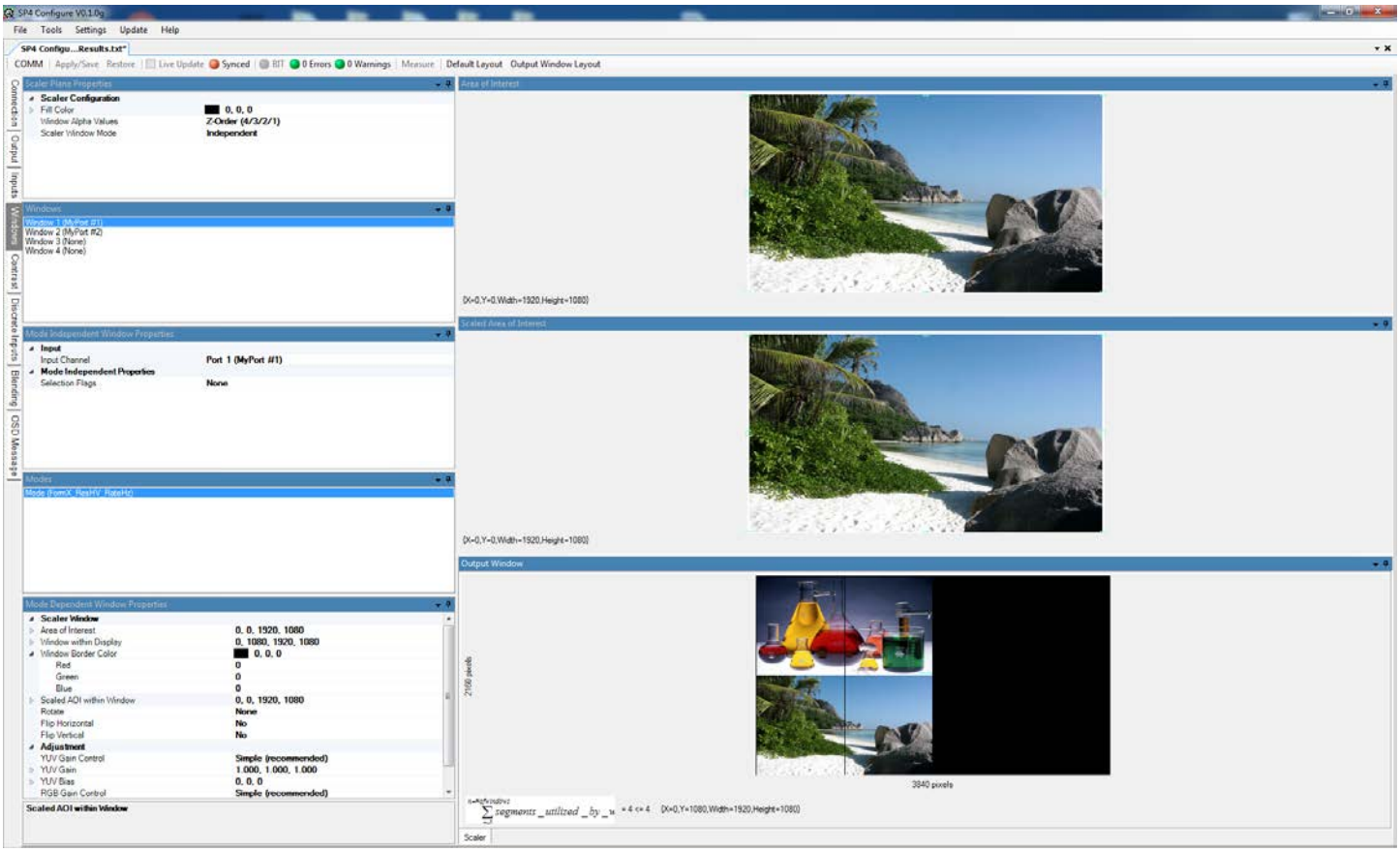
Connector	Type	Description	**Connector**	Type	Description
J1	10 pin header	Factory Use Only	**J15**	BNC	CH2 – 3G-SDI Video Input
J2	DF11-10DP	Factory Use Only	**J16**	DF11-6DP	CH1 – 3G-SDI Loop-Through Out
J3	2 position jumper	Board Reset	**J17**	DF11-6DP	CH2 – 3G-SDI Loop-Through Out
J4	DF11-6DP	USB Interface	**J18**	BNC	CH4 - 3G-SDI Video Input
J5	DF11-18DP	Discrete I/O	**J19**	BNC	CH3 – 3G-SDI Video Input
J6	DF11-6DP	Future Ethernet	**J20**	DF11-6DP	CH3 – 3G-SDI Loop-Through Out
J7	2 position jumper	Boot Jumper	**J21**	DF11-6DP	CH4 – 3G-SDI Loop-Through Out
J8	DF11-10DP	Factory Use Only			
J9	DF11-10DP	RS-232 Interface	**J23**	BNC	3G-SDI Video Output
J10	DF11-8DP	LED Interface	**J24**	DF11-4DP	EDID TX Interface
J11	10 pin header	Factory Use Only	**J25**	HDMI	HDMI Video Output
J12	DF11-6DP	Aux Fan Power	**J26**	HDMI	HDMI Video Input
J13	DF11-6DP	Power Input	**J27**	2 position jumper	Factory Use Only
J14	BNC	CH1 – 3G-SDI Video Input			

SP4 /NE Connector Table

SP4 Configuration Application

The SP4 is configured using the **SP4 Configuration** application. This PC-based application is used to set up all the input modes, windows, and output timing. Commands can also be dynamically sent to the SP4 for real-time operation. The **SP4 Configuration** application also supports in-the-field firmware and FPGA updates.

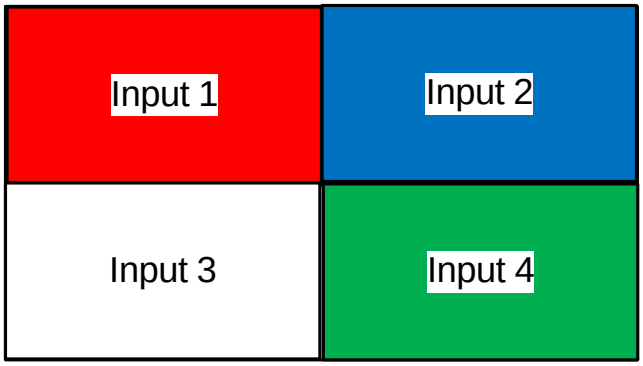
In the figure below, 2 1080P inputs are captured and placed in the upper left and lower left portion of a 3840x2160 output window. The black area would be filled by the low latency HDMI input.



SP4 Windowing Applications

Please see Application #1 (Page 7) for typical windowing in 1080P (or less) output resolutions.

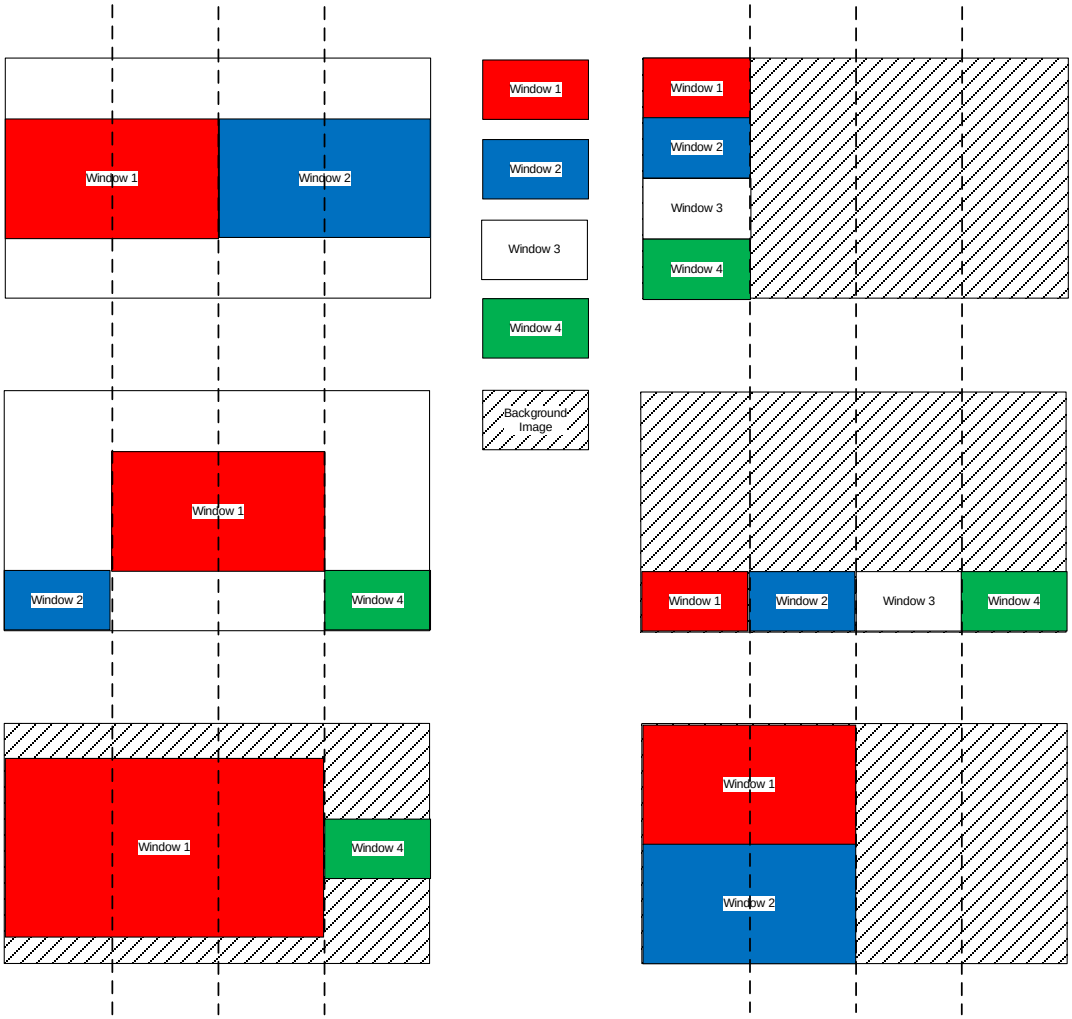
Using regional windowing, the QuadView shown below is possible for 3840x2160/60 Hz applications.



Using independent windowing, the following windows are possible for 3840x2160 / 60Hz.

Notes:

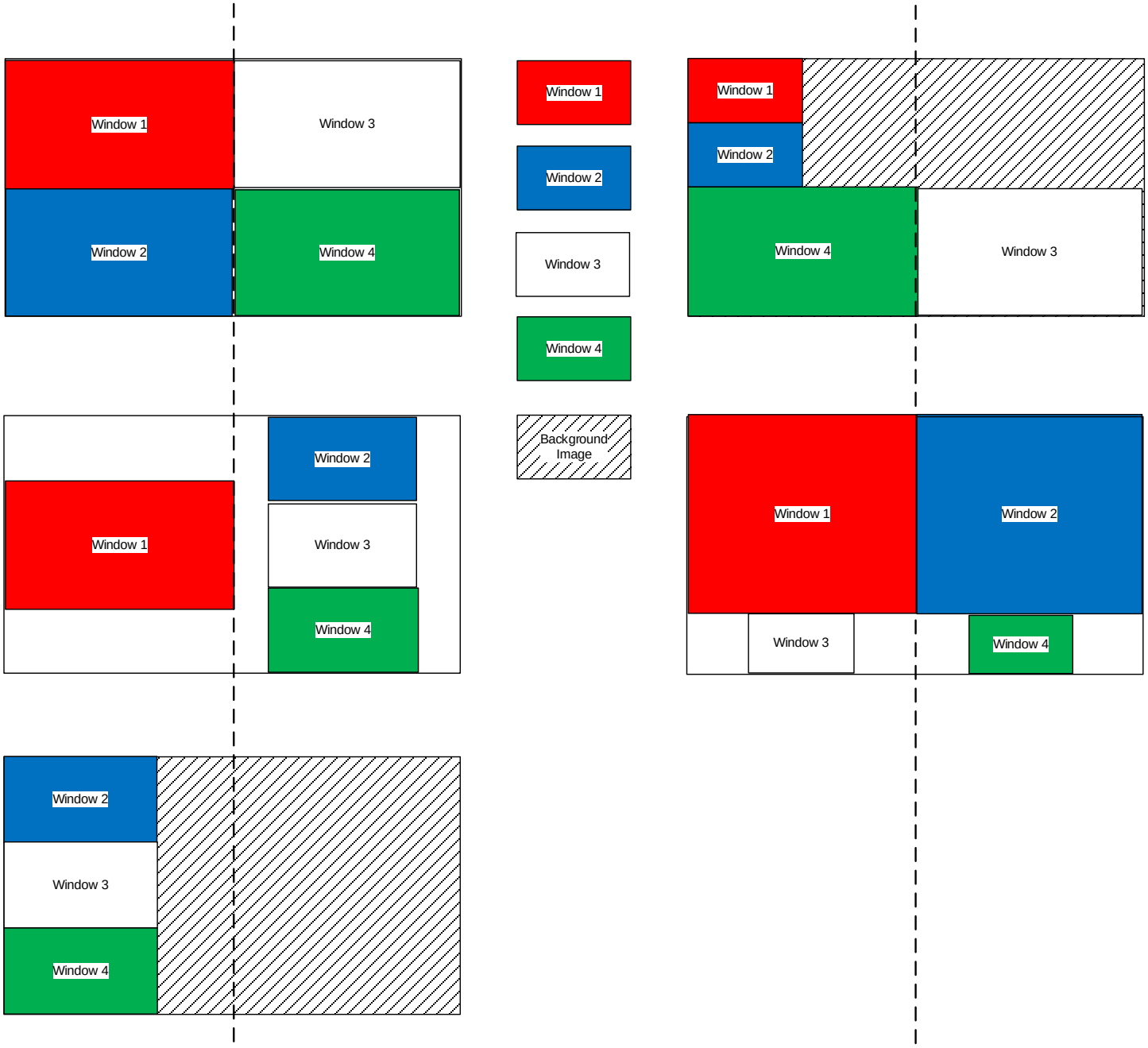
- Background image is assumed to be HDMI 2.0 input.
- Dotted lines represent segment boundaries.



Using Independent windowing, the following windows are possible for 3840x2160 / 30 Hz

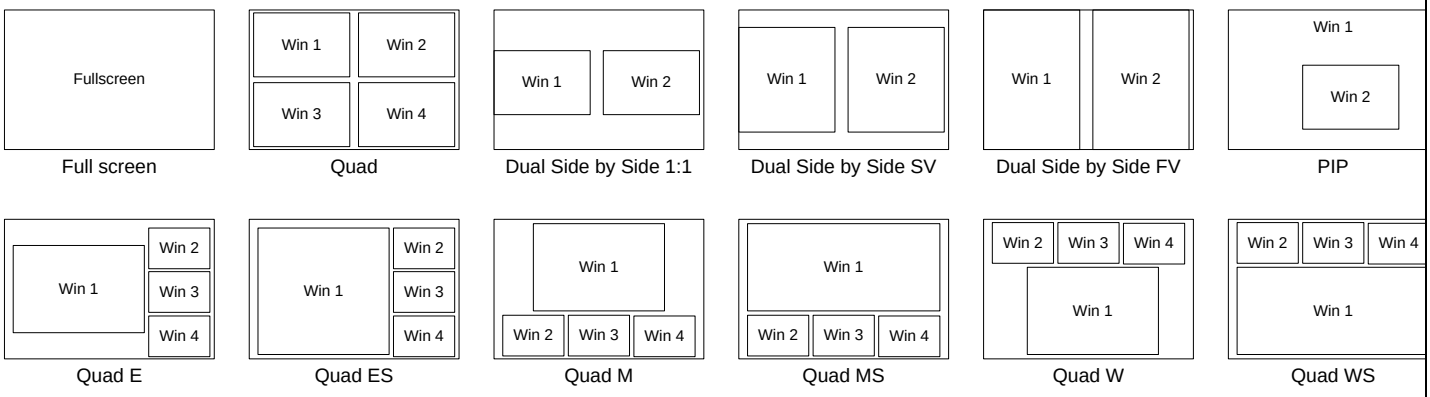
Notes:

- Background image is assumed to be HDMI 2.0 input.
- Dotted lines represent segment boundaries.



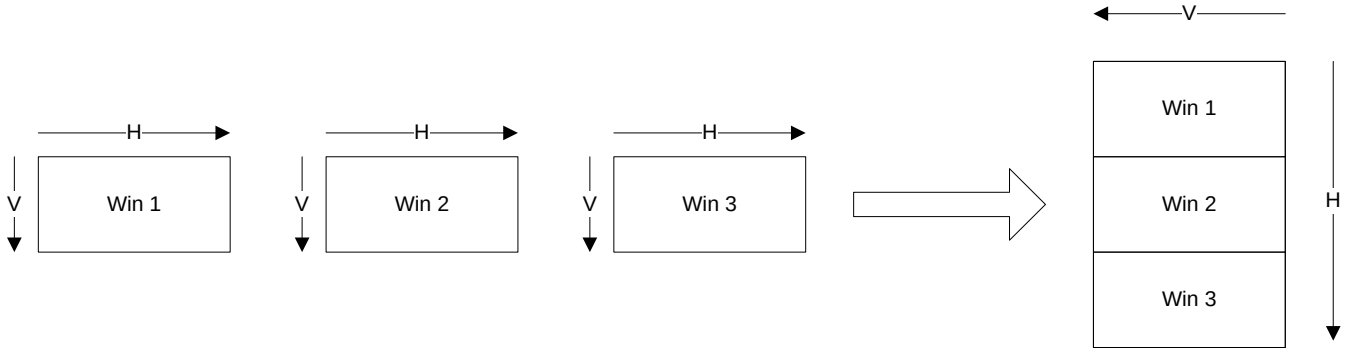
Applications

Application #1 Landscape Video Combining



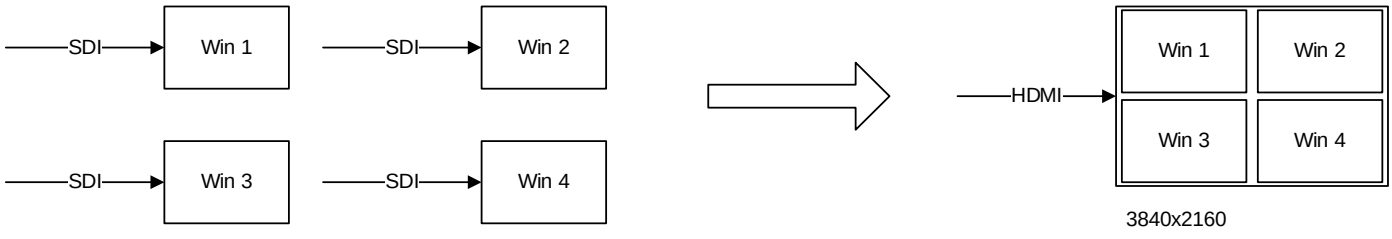
In Application #1 above, a SP4 is used to combine 4 different video feeds (inputs 1-4) into a single HDMI, SDI, or DVI 1080P image. Each layout is easily configured by a hotkey command, making SP4 ideal for viewing multiple SDI video sources, in both a rack-mount or embedded scenario.

Application #2 using standard display for Portrait Video Combining



In Application #2 above, a SP4 is used to capture 3 different SDI video feeds, then rotate and combine to allow a normal landscape 1080P HDMI display to be used as a portrait display.

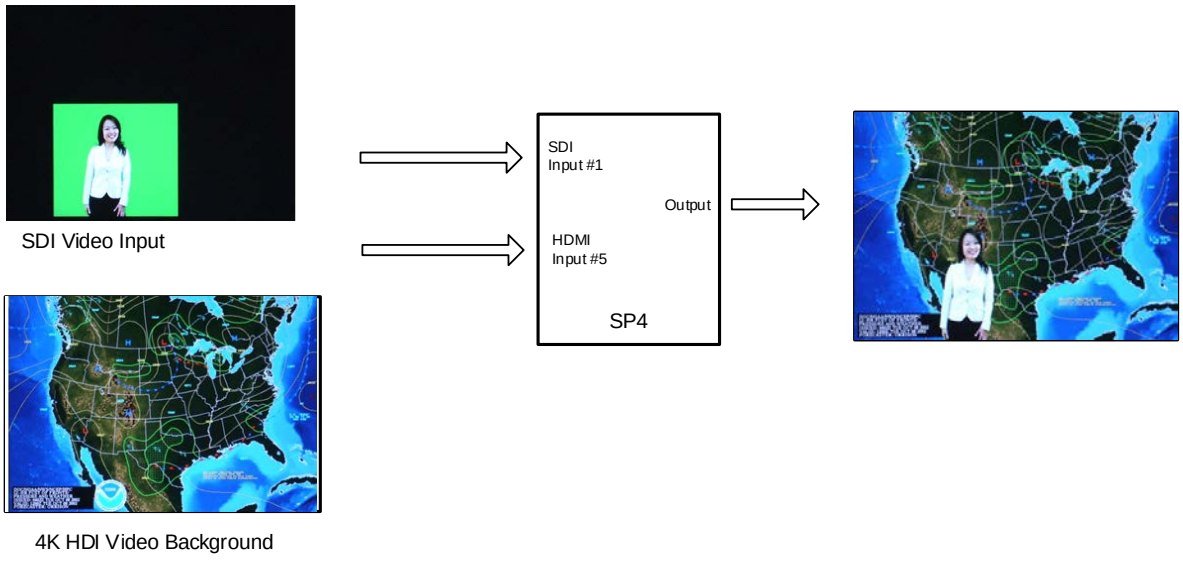
Application #3 Converting 4xSDI to 4K/30 Hz HDMI Display



In Application #3 above, a SP4 is used to capture 4 different SDI video sources and combine to drive a 3840x2160 / 30Hz HDMI TV.

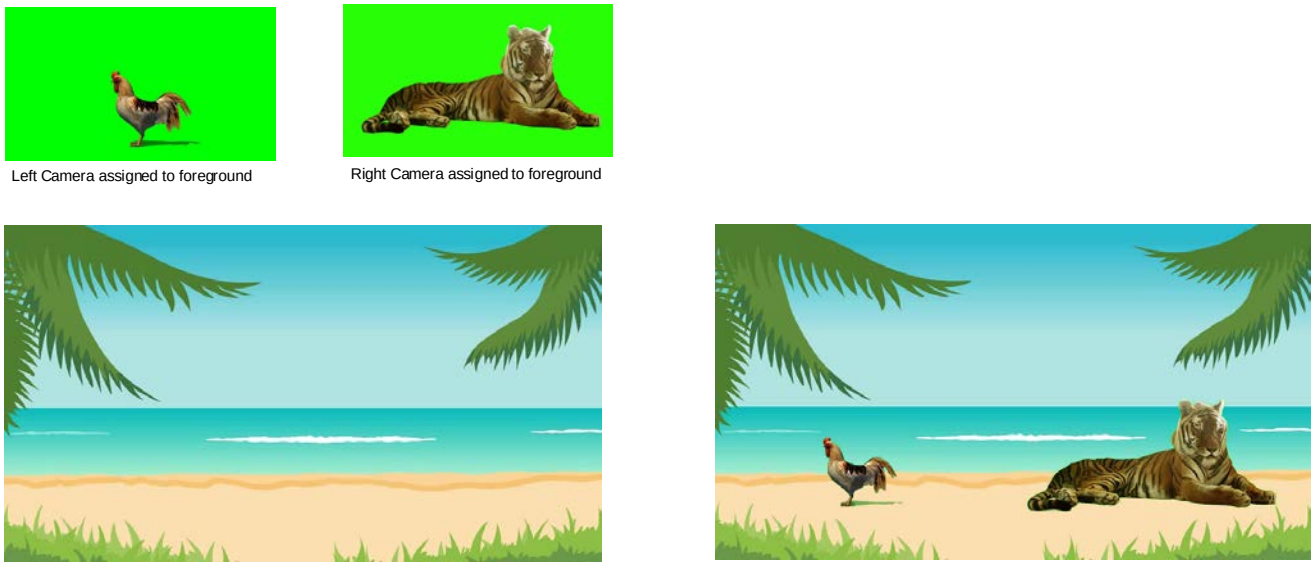
Applications (Cont.)

Application #4 Keying on a SDI video input to combine with a HDMI background



In Application #4 above, a SP4 :Key is used to key a live video feed (in the foreground) over the map graphic (in the background). Using HSV keying, the greenish area (as well as the black, non-active area) becomes transparent, thereby passing the background..

Application #5 Keying on a (2) SDI camera inputs to combine with a HDMI background



In Application #5 above, a SP4 :Key is used to key (2) live video feeds (3G-SDI) in the foreground over the 3840x2160 Out-The-Window scenery in the background. Using HSV keying, the greenish areas become transparent, thereby passing the background.