# Powerful advanced image processing

The C2-8000 & C2-7000 Series Video Processors are extremely flexible units and address a wide range of requirements. All products in these families are in reality multiple products in a single box and are at home in broadcast, display and live event environments.

Image Layer Processing

The C2-8000 & C2-7000 Series utilizes a multiple layer video display system allowing the stacking order of layers to be altered. For example, in the C2-7000 Series Dual PIP mode there are two image windows (A & B) that can be resized and positioned as desired, a lock source layer* (Z) which can be an active video source, two logo layers (a & b) and a color background. The foreground/background priority of each layer is user assignable over the color background layer. Windows A & B and layer Z can all be utilized as either a key source or background, and have fully adjustable levels of transparency through to opaque. In Independent Mode each scaler may use a different Z layer video source as a background or as a foreground key. In Switcher Mode video may be seamlessly transitioned over the Z layer video or under [behind] a Z layer key. In Dual PIP Mode the video layer priority and keying may be assigned independently for each output.
The C2-8000 Series can have three PIPs in Multi PIP mode.

(C2-7000 Series) only 2 x SDI inputs can be used at a time

Color background layer

Logo layer a

Logo layer b

Window A   Window B

Lock source layer Z
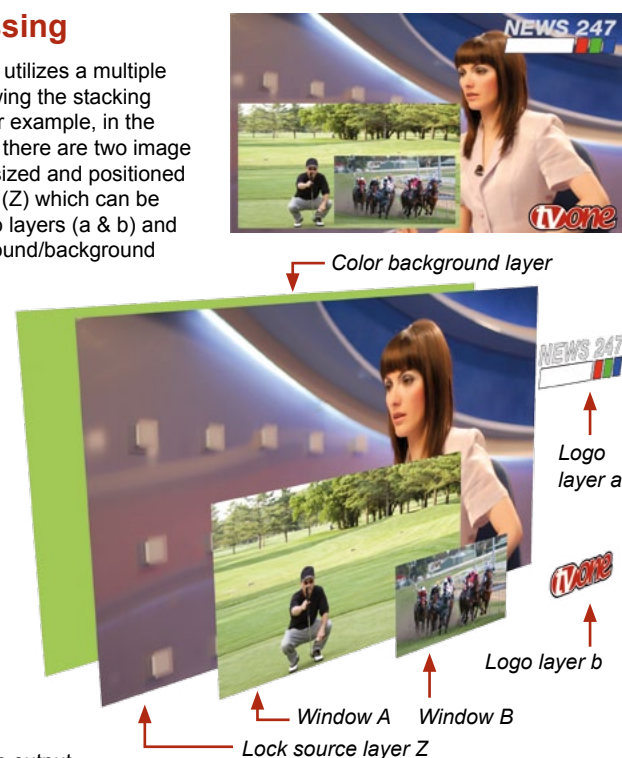
Image Keying

The Lock & Mix mode found on select CORIO® processors extends the capabilities of the Z layer to become an unscaled video source or a luminance/chroma key source. As a key source, the Z layer background information can be keyed out and utilizing the image layer processing capability, keyed over one or both windows depending on the mode. The transparency of the keyed Z layer video is fully adjustable. In Independent Mode, each scaler may use a different Z layer video source, in Switcher Mode, video may be seamlessly transitioned under a Z layer key and in PIP Mode the video layer priority may be assigned independently for each output.
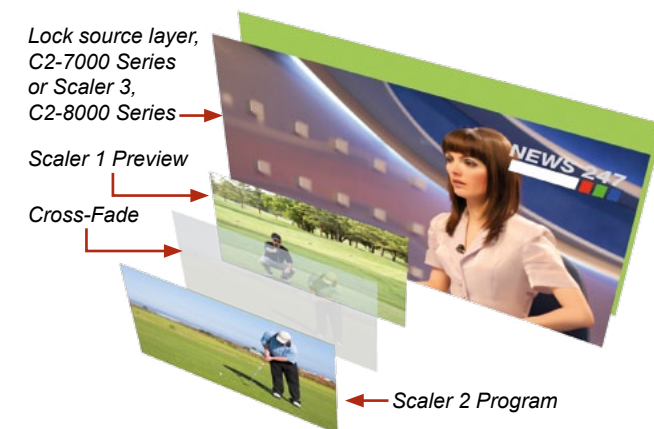
Color to be keyed

Layer Z
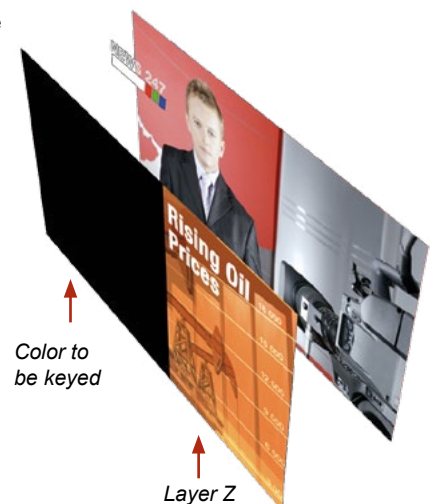
Keyed Output

Operational Modes

The C2-8000 & C2-7000 Series Video Processors can be operated in three different modes:

Switcher Mode

Provides equally powerful Program and Preview channels for live event switching. To achieve seamless switching, one scaler is reserved for Preview and a second for Program, enabling a true cross fade, cut, push or wipe transition between the two. In addition to previewing inputs before selection, complex functions, such as Chromakeys and Picture-In-Picture, can be previewed for setup totally independent of the Program channel output. Any signal format can be freely mixed with any other.

Lock source layer, C2-7000 Series or Scaler 3, C2-8000 Series →

Scaler 1 Preview

Cross-Fade

← Scaler 2 Program

Below, a simulation of a cross fade from Program (left), through transition (center), to the Preview source (right)

### Switching using the Still Image Store

The Still Image Store (SIS) can be used to store graphic elements that are used on a regular basis and can quickly be retrieved as a source. The SIS images can be positioned in Preview and a seamless transition to Program applied.

The C2-8000, the ideal Seamless Switcher for live events

The C2-8000's potential to have up to twelve universal inputs, makes it the ideal Seamless Switcher for live events, such as conferences for example. Due to the DVI-U connectors a multitude of different source formats (HD Video, SD Video, PC, DVD …) can be plugged directly into the C2-8000 Series unit, scaled and output to devices that have the same resolutions, i.e. a HD monitor, at 720p and a 720p projector.
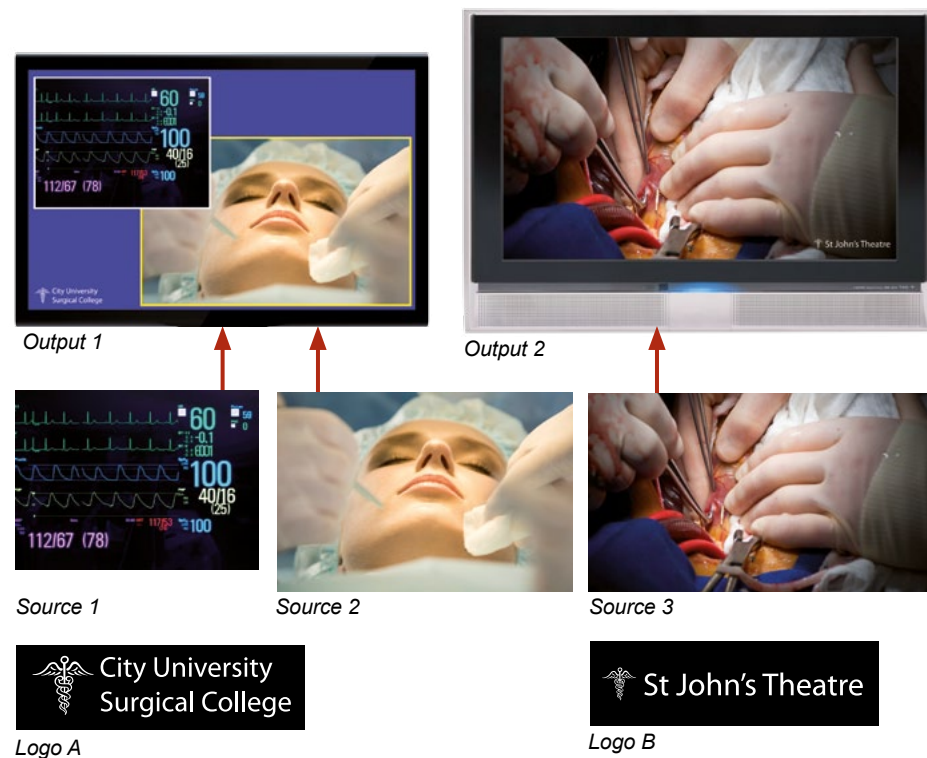
Program

Preview

Sources
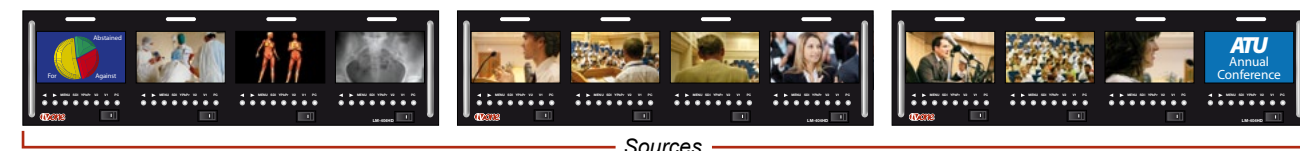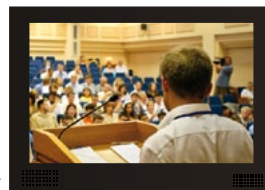
Independent Mode

Provides the power of two independently functioning products, performing different tasks in one box. Each output can deliver different formats and resolutions simultaneously. For example, a presentation being fed to a high resolution display on Output 1 via DVI can also be fed to a VCR for recording on Output 2 via Composite Video. Used for channel branding or digital signage applications user defined stored logos can be imposed on the outputs. Independent Mode in a Broadcast environment provides two completely independent Analog to HD-SDI Converters, each genlocked to a different reference and each with a different logo or ID keyed in.

Stored Logo A

R1
96.2FM

Source 1

Source 2

Stored Logo B

R2
102.8FM

The C2-8000, in Independent Mode, can seamlessly switch between any input (SD/HD/3G-SDI, HDMI, CV, YC, RGB, YPbPr) and output 2 different videos signals (SD/HD/3G, HDMI, CV, YC, RGB, YPbPr) of independent resolutions and frame-rate. One of the outputs may also have a PIP. Transitions available in Independent mode are Fade thru black, Push, Wipe and Cut.

Output 1

Output 2

Source 1   *Source 2*   *Source 3*

City University Surgical College

St John's Theatre

Logo A

Logo B

PIP Mode - Dual PIP (C2-7000 Series)

Any video input* can be placed into either of two windows of any size and positioned anywhere on the screen, even overlapping each other with user defined layer priority control. The windows can be placed over any other input as the background. The image in the window can then be switched to another input or a static image from the unit's memory and even zoomed in or out. Keying can be added independently to each window and the background.

*only 2 x SDI inputs can be used at a time

*PIP 1 : Keyed computer generated animation*

PIP 2 : Video with border added

Multi PIP (C2-8000 Series)

In Multi PIP mode both outputs have the same resolution or are referenced to a house source. Three PIPs can be layered on an unscaled lock source which determines the output resolution. Both Outputs 1 & 2 have identical sources, PIP size and positioning, but the layer order and borders of the PIPs can be different. Transitions available in Multi PIP mode are Fade thru black, Push, Wipe and Cut. A user defined logo can be overlayed.

Output 2   *Output 1*

Logo A

Sources
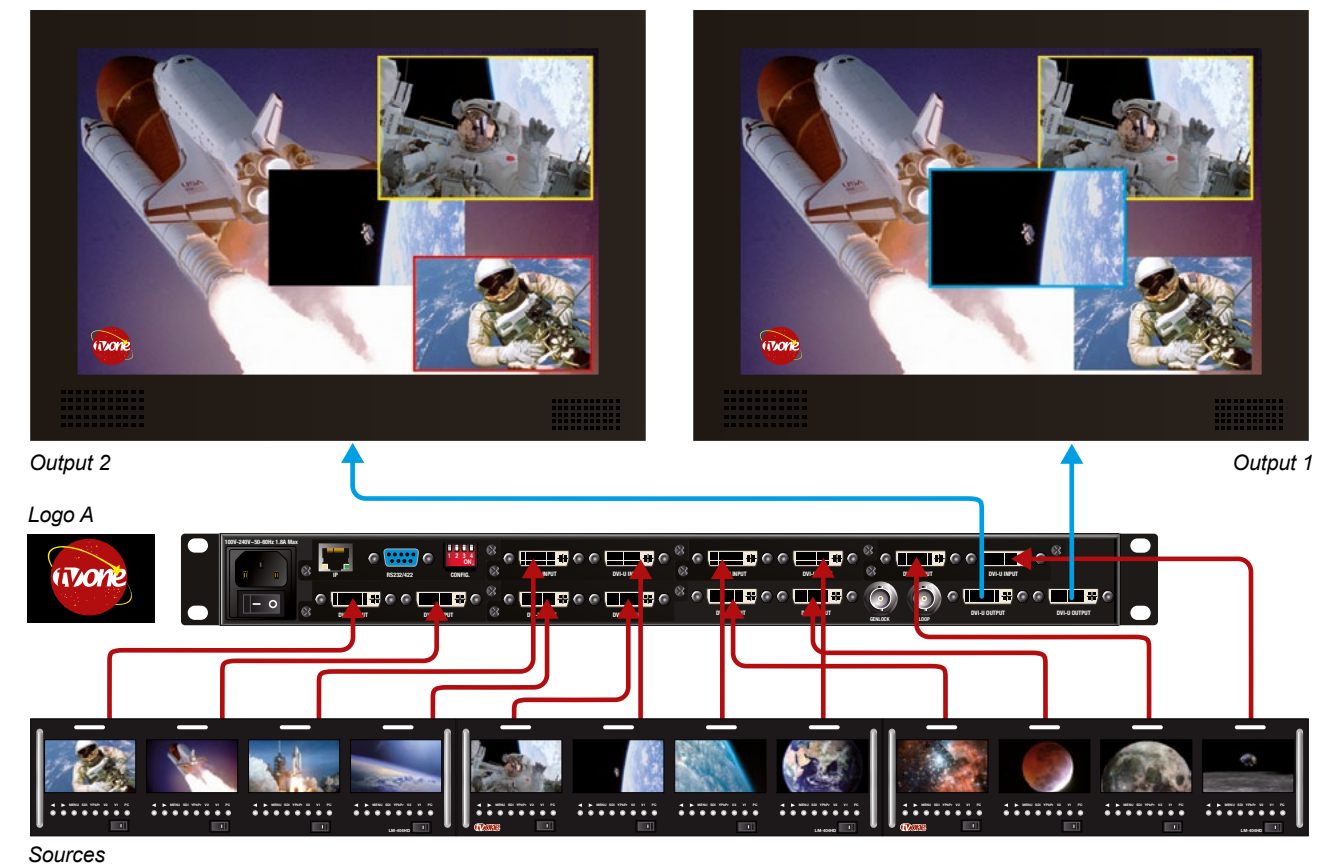
Automatic 3:2 Pulldown

Our exclusive CORIO®2 conversion technology employs advanced proprietary pixel adaptive motion compensation to smooth out fast moving images. The automatic 3:2 Pull-down efficiently de-interlaces NTSC video originating from 24 fps film. This enables original film footage to be incorporated into video without any loss in image quality.

Zoom and Shrink

Zooming into any area of the image, while maintaining high quality, is possible because of the unique CORIO®2 video sampling technology. Variable zoom can go up to 10x while Variable Shrink can go down to 10%, both adjustable in one pixel steps. Pixel level position controls allow accurate movement around any desired area and can be controlled from the front panel or the Windows Control Panel. Zooming can be independently applied to the images in the windows.

Shrink down to 10%

Zoom up to 10x
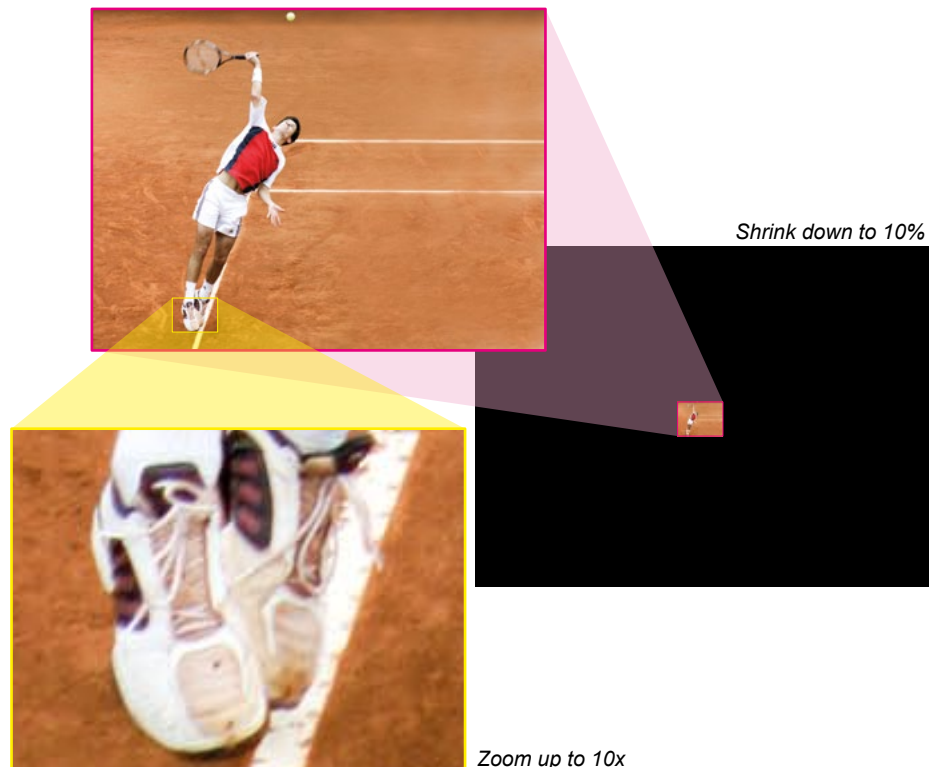
EDID Manager

An innovative new feature for CORIO®2 firmware is an EDID Manager. The EDID Manager allows the user to copy the EDID data from a display attached to the TV One unit's output and simulate its presence to a PC that is attached to its input, effectively giving transparent EDID operation. EDID is an information packet retrieved by a PC graphic card over a DVI link from a monitor which informs the graphic card the resolutions compatible with the display. The EDID manager on a CORIO®2 unit works by holding multiple copies of EDID data in non-volatile memory and allowing the user to select which one is shown to a PC on the DVI input.
As well as having pre-defined EDID data, this remarkable feature also allows the user to capture EDID information from any display attached to the DVI output of a CORIO®2 unit and store this in its non-volatile memory for recall at a later time. Up to six custom EDID settings can be stored in the CORIO®2 unit and will be retained even when power is switched off.
Designed to address commonplace problems that can occur as a result of EDID information transfer, the EDID Manager is now available on all new CORIO®2 video switcher/scalers, and can be added to existing units in the field by performing a free firmware upgrade from our website.

Frame Lock

The Frame Lock feature in CORIO®2 Technology is a useful tool that can be used to aid in the synchronization of an HD-SDI output to a composite video source, or for scaling one resolution to another whilst avoiding any potential frame-rate conversion artifacts. Available on all new CORIO®2 Video Switcher/Scalers, frame lock capability can also be added to existing units in the field by performing a free firmware upgrade from the TV One website.
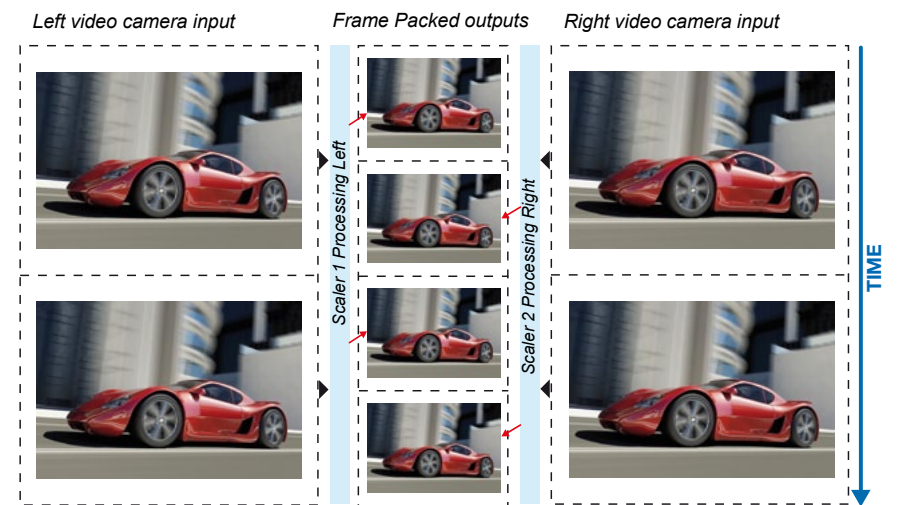Developed in response to the demand from the Broadcast Industry, this new frame lock feature enables the user to lock an output resolution frame rate to an input resolution frame rate (providing that both frame rates are identical) thus ensuring that the signals will remain aligned and not drift apart. For example, a 1280x720p @ 59.94Hz output could be frame-locked to a composite video NTSC @ 59.94Hz source, or a 1920x1080i @ 50Hz output could be frame-locked to a composite video PAL @ 50Hz source. In the C2-7000 Series, the non-scalable Z layer acts as a synchronization source. The C2-8000 Series differs by having a separate Genlock input with loop-through enabling inputs to be synchronized.

The image above simulates effect without Frame Lock, the image left, with Frame Lock

3D solutions

Due to the flexibility of CORIO® technology, TV One have been able to 3D Video support to the latest version of firmware, which will extend the ability of compatible products; for example the C2-8000 Series, C2-6204, C2-6104A and 1T-C2-750.
The firmware allows the EDID data for the source to be read and adds information to the HDMI signal sent to the display so that it recognizes the 3D signal. It also adds the extra 3D resolutions that supports the necessary Frame Packing. The processing of the left & right 3D images is handled by different scaling engines, allowing them to be either split from a single frame or merged into a single frame.

Left video camera input *Frame Packed outputs* *Right video camera input*

Scaler 1 Processing Left *Scaler 2 Processing Right* *TIME*

Frame packed 3D video resolutions

Frame packing is the simplest form of putting two images (left & right) into a single video resolution; effectively, the left image is sent first followed by the right image. Video bandwidth is doubled, which then means that the pixel rate is also doubled – and hence both left and right are sent together at the same individual frame rate. Because the video pixel rate has to be doubled in order to fit twice as many frames in during the same amount of time, only resolutions that are of low enough pixel rate can be doubled and still be within the DVI / HDMI pixel rate limit: 50, 59.94 & 60Hz for 720p, and 23.98, 24 & 25Hz for 1080p. As well as Frame Packing, left & right images can be transmitted 'Top-Bottom' or 'Side-by-Side'.

## 2x Camera inputs to 3D resolutions using two CORIO®2 scalers

By using 2 cameras and 2 scalers, the individual camera sources can be fed into each scaler, with the resulting windows output to a single 3D resolution – as per Frame packing mode. This then allows real-time conversion of camera sources to a 3D video signal. The same setup could be used to convert the 2 camera signals into a standard video resolution and sent over fiber, SDI, or recorded to Blu-ray. A separate unit could then scale that signal back to a standard 3D resolution for display.

3D Picture-in-Picture

A PIP can be added to a 3D resolution, with the PIP made to appear 'floating' out in front of the background video. This requires a unit with 2x scalers (and at least two inputs, one for Frame packed 3D, and one for the PC/Video PIP source), both taking the same PIP source and placing the PIP slightly offset in each Left & Right frame.
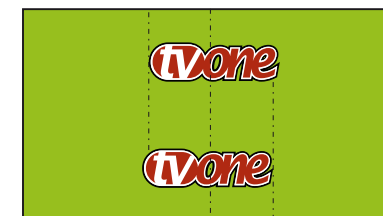
Off-setting a graphic (left & right Frame Pack) and keying the background produces a PIP that appears to be 'floating' in front of the video. Reversing the offset causes the PIP to appear to 'sink back' in the frame, however this is not recommended as it can break the 3D effect if an object in the background tries to go in front of it.
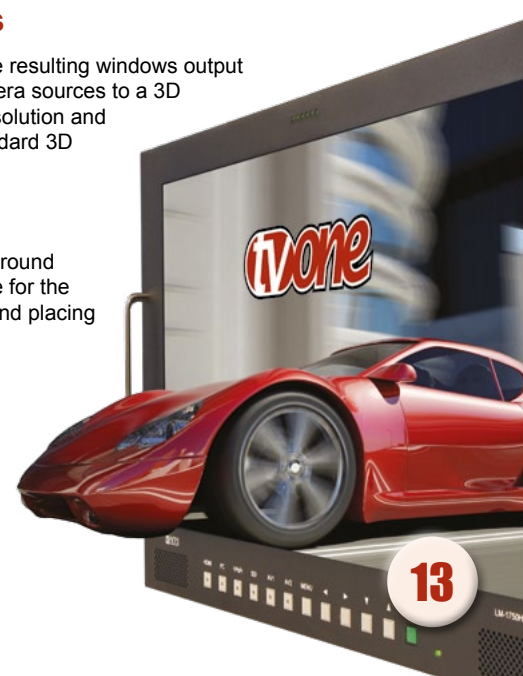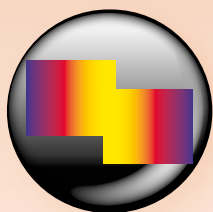
Edge Blending

Edge Blending is a method used to create a wider or taller video display. These displays are often seen in staging and live performance venues, churches, government and endless other unique applications requiring a larger video display. Two or more video/data projectors are used to create a single image. Edge Blending is applied to the edges of the images to insure they are merged seamlessly. This must be carefully handled to prevent image brightness problems in the overlapping areas.

Many TV One products contain Edge Blending as a standard feature including the C2-2450 dedicated Edge Blending unit that has been designed primarily for this function. The Edge Blending tool is a standard feature on the following products: C2-8000 Series*, C2-7000 Series*, C2-2450A, C2-2355A, C2-2350A, C2-2255A, C2-2250A, C2-2205A, C2-2200A, C2-1350, C2-1250, C2-260, 1T-C2-760.

* As the C2-8000 & C2-7000 Series include two processing engines, only one unit is required to blend two images.

Projector alignment

Projector alignment is simplified by using TV One's Edge Blend Tool. It provides a simple and quick way to configure an edge blending solution. The system can control multiple units simultaneously via multiple serial ports or ethernet, where available. The software allows any configuration of projectors, or screens for video wall applications, control of the blend size, crop, blend gamma and black level.

When the Edge Blending Tool is activated a series of assignable guidelines are projected to aid image alignment (see below). These lines show overlap areas - red lines indicating the edge of the image, and green lines the edge of the blending. When the right-hand red line overlaps the left-hand green line (and vice versa), and/or the top red overlaps the bottom green (and vice versa), the lines will become yellow indicating perfect alignment.

Aspect ratio adjustment

Since the original video source is probably 16:9 (or a similar aspect ratio), it will also be necessary to change the vertical zoom value differently to the horizontal one. This is best done after projector alignment and is easily achieved using the 'Aspect adjust' settings which allows the Horizontal and Vertical zoom values to be set independently. Once the output has been adjusted on one output channel, the same values must then be applied to the other(s).

Gamma Correction

Once the projectors have perfectly aligned there may be an overlap that is slightly brighter than the rest of the image. This is most probably due to the luminance of the projectors not being perfectly linear and it will therefore be necessary to apply 'gamma correction'. Gamma correction can be applied using the Video Processor, the correction value must be the same for each channel output, unless non-matching projectors are used.

Genlock/Frame Lock the output

Finally, if the source contains live (moving) video then it is worthwhile Genlocking or Frame Locking the channel's output to the source - this will eliminate any line or frame drift, which may cause frame-rate conversion problems.
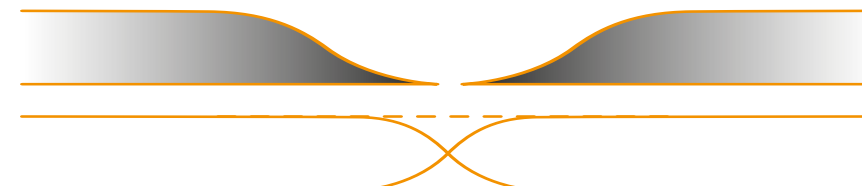
For more information on Edge Blending visit http://www.tvone.com/info_request.shtml and request a brochure.
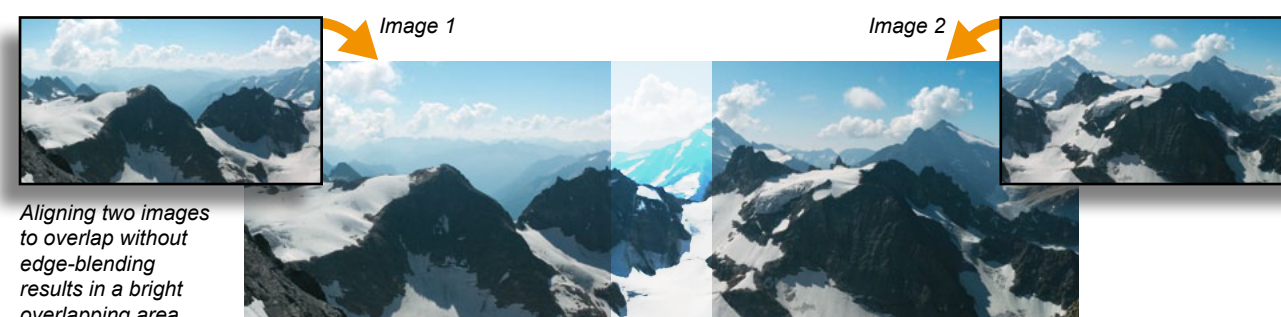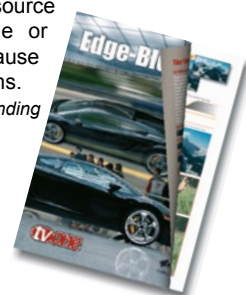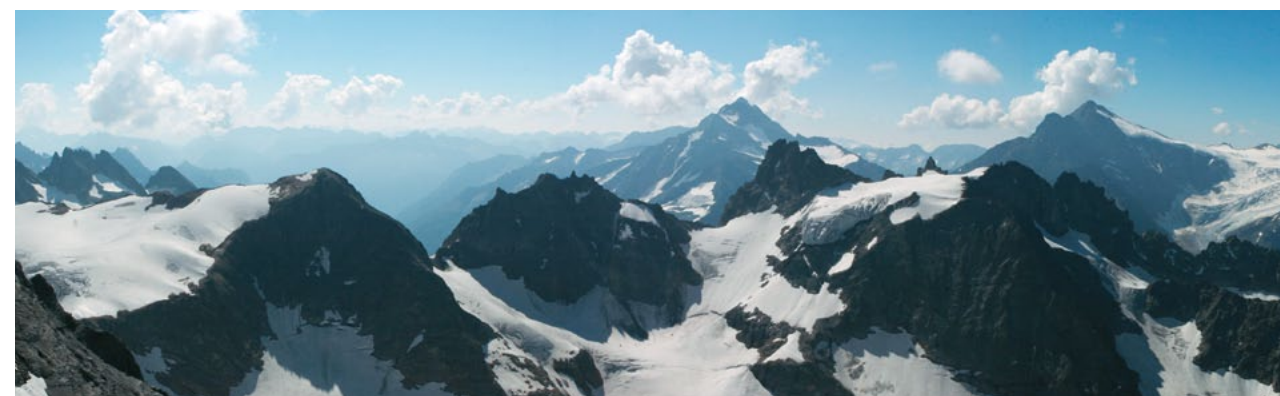

Aligning two images to overlap without edge-blending results in a bright overlapping area.

◄ *Edge blending gradually reduces the briightness of the projected image edge.*

▼ *When correctly aligned, this results in even illumination across the merged images.*

Edge Blending with the C2-8000 Series

The C2-8000 Series can produce an edge blend using two scaling engines, the video is prepared and output to two projectors and blended seamlessly together to create larger, brighter displays. Two user defined logos can be overlayed, one on each side of the image. The third scaler can be used to insert a PIP on the left side of the image. Set up is made simple with the freely available CORIOtools suite, which simplifies mapping, blending, gamma and picture adjustment.
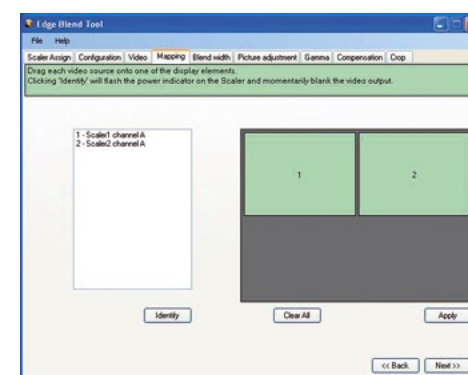
CORIOtools Suite integration FREE download

Logo A   Logo B

Source   Source