GeoBox

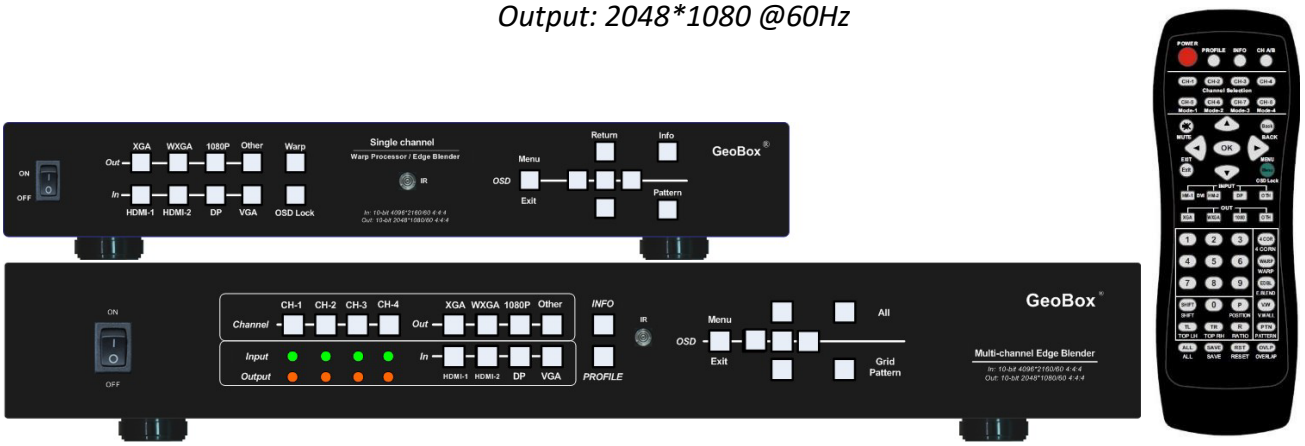
M800Ex 1-4 CH Projection Mapping Processor Datasheet

M801Ex (1 CH), M802Ex (2 CH), M803Ex (3 CH), M804Ex (4 CH)

*Input: up to 7680*2160 @30Hz, 7680*1200 @60Hz,*

*4096*2160 @60Hz 4:4:4 full color sampling*

*Output: 2048*1080 @60Hz*



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DCi/UHD 4k/60/4:4:4	HDMI 2.0 DisplayPort 1.2	HDCP 2.2/1.4	10-bit High-end scaler	Cadence Film 3:2 / 2:2	3D Motion De-interlace	Deep Color xvYCC/12-bit	Edge Blend RGB separate Gamma	Corner wall Geometry Alignment

Multi-Unit Cascade	Multi-View Discrete display	Flexible Aspect Ratio	Rotation Landscape Portrait	Control IR/USB/RS232 /Ethernet	Video wall Embedded	RoHS CE FCC

Table of Contents

Introduction… **3**
Specification. **5**
Function and Features **6**
Features illustration…….....……... **9**
Projection mapping…… **9**
Selectable Grid pattern for geometry alignment **12**
Selectable grid pattern size for geometry alignment **12**
8k/1k, 4k/60 daisy chain connection..... **13**
Image geometry alignment and warp..... **13**
Edge blending on flat and curved screen..... **14**
Corner wall alignment and display..... **14**
Linearity Grid Line Adjustment..... **16**
Immersive display..... **17**
Big scale display..... **17**
Flexible display..... **18**
Image flip and rotation..... **19**
Independent RGB Gamma correction..... **19**
White balance & Color correction..... **20**
Nine regions Black level uplift..... **20**
Edge Mask…… **21**
PIP/POP function…… **22**
Stretch image and change aspect ratio..... **23**
Digital Mapping **23**

Introduction

GeoBox can simplify projection mapping. Users can input patterns to create projection mapping without editing video content. M800Ex is a projection mapping processor that can provide multiple processing modules to control from 1 to 4 projectors. M801Ex is integrated with one processing module to control one projector, M802Ex for 2 projectors, M803Ex for 3 projectors, and M804Ex for 4 projectors. It was designed for projection mapping and sophisticated edge blending, image warping, and stacking. Multiple M800Ex can be cascaded for large-scale display.

M800Ex is derived from M800. It has all the functions of M800 plus the Digital Mapping function. Users can apply monochrome photos or patterns into M800Ex and decide to display signal source images in Black or White areas. Each Box can store up to 10 patterns and playback with preset time intervals. It masks the image from the output, and the user doesn't need to mask the source image for easy projection mapping.

4 input ports (2x HDMI, 1x DP, 1x VGA) and 1x HDMI outputs are designed in each processing module. Digital input supports up to 7680*2160 @30Hz (or 1k/8k) / 7680*1200 @60Hz with 4:4:4 full color sampling. Output supports up to 2048*1080 @60Hz. It is integrated with a 10-bit high-end processor, motion adaptive de-interlace, low angle smooth algorithm, 3:2/2:2 pull-down, and supports non-VESA standard input timing. Programmable EDID can optimize input timing to get the best video result.

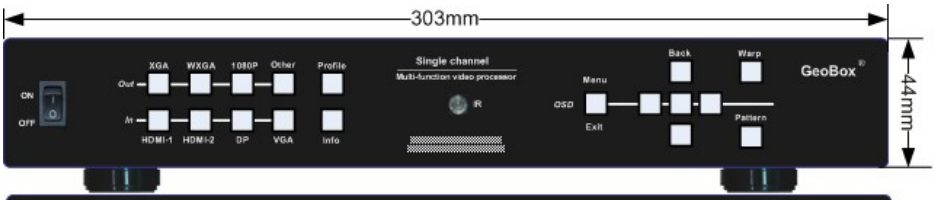
Advanced warp technology is embedded in M800Ex. Users can use an IR controller, USB, WebGui, and Ethernet to perform edge blending and sophisticated geometry alignment up to 17x17 control points. Linearity Grid Line Adjustment and Corner Wall image adjustment for mapping images at 90 degrees corners is a new function in geometry alignment. Separate R, G, and B gamma correction for edge blending region color fine-tuning, individual color correction for each output, and 9 regions black level uplift to compensate for projector light leakage are standard functions M800Ex. Users can see real-time geometry and color adjustment to get optimized results.

HDMI loop out supports daisy chain connection up to 8k/1k @30Hz / 4096x2160 @60Hz, allowing large displays with multiple units cascaded. The video wall function crops, allocate source images for each projector, and set overlap pixels for edge blending. Complete curved edge blending can be achieved through a remote controller and Ethernet without additional devices except for signal sources and projectors.

PIP (picture in picture) and POP (side by side) are standard functions. PIP image size is from 320*180 up to 1920*1200. In one M804, the user can display up to 8 input contents on the screen. Image 90/180/270 degrees rotation and flip in both primary and sub-image are embedded in M800Ex. It provides a more flexible system configuration.

M800Ex is an ideal solution for simulation. It can connect with inputs from multiple PCs and combine them into one seamless image. Unnecessary images can be masked out. It also provides flexible displays in an edge blending system. For a 3x projector edge blending system, the user can configure a 1+1+1 independent display, 1+2 (two projectors blended), and all-in-one (three projectors blended). Users can also execute edge blending with a projector at the portrait position without rotating the source image to increase image height. It is a good fit with a laser projector without limitation in installation angle.

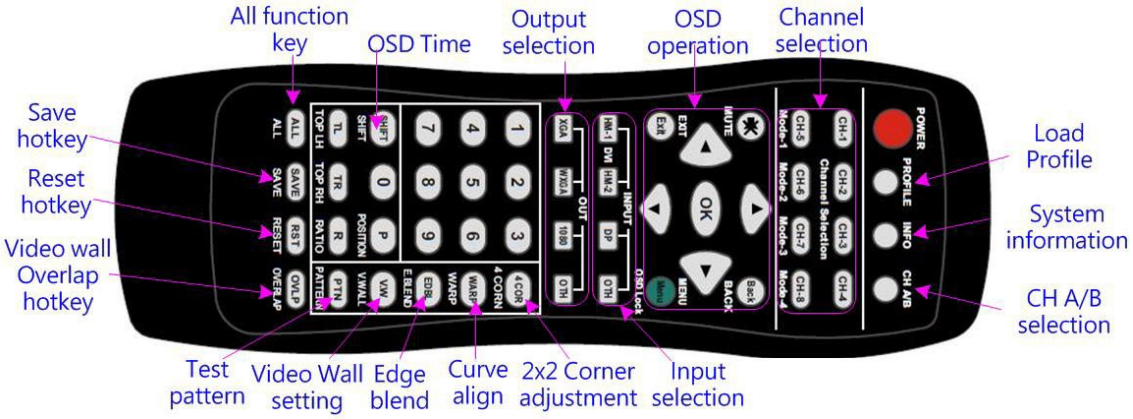
Using M800Ex, users can replace high-end projectors with low-cost projectors without lens shift, warp, and edge blending. It provides easy configuration, a low entry barrier, and cost-effective, reliable, and flexible solutions.



M801Ex (1 CH)

M802Ex (2 CH)
M803Ex (3 CH)
M804Ex (4 CH)

(This back panel shows 4 CH model—M804Ex)



Specification

- ✧ Each box has 1-4 processing modules.
  - M801Ex: Single module processor
  - M802Ex: Dual module processor
  - M803Ex: Triple module processor
  - M804Ex: Quad module processor
- ✧ Each processing module includes:
  - Input: 2x HDMI 2.0b, 1x DP1.2a and 1x VGA
  - Output: 1x HDMI 1.4
  - Loop output: 1x HDMI 2.0b for cascade.
- ✧ HDCP compliance: Input: HDMI: HDCP V2.2/V1.4, DP: HDCP: V1.3, Output: HDCP V1.4.
- ✧ Max. input resolution: 7680*2160/30 Hz, 7680*1200/60 Hz, 4096*2160/60 Hz
- ✧ Input supports progressive and interlaced RGB/YUV signal, 4:4:4 Chroma sampling, up to 30 Color bits.
- ✧ Support non-VESA standard input timings for easy connection with various signal sources.
- ✧ 15 selectable Outputs: HDMI 1.4 up to 2048*1080/60, progressive 4:4:4 RGB.
- ✧ 2 frames system latency: 33ms (@V=60Hz)
- ✧ New generation warp engine for geometry alignment up to 17x17 grid control points.
- ✧ Maximum geometry adjustment up to 1200 pixels in both H&V directions.
- ✧ Edge blending at 4 edges up to H=1920 pixels, V=1200 pixels with independent RGB gamma correction.
- ✧ 9 regions black level uplift to compensate light leakage from projector optical system.
- ✧ Edge Mask follows the result of geometry alignment up to 500 pixels.
- ✧ Edge Mask with 8 control points up to 900 pixels in H&V directions at each control point.
- ✧ Support Corner Wall adjustment in H&V at a flexible location.
- ✧ Support Linearity Grid Line adjustment for quick H&V line position alignment.
- ✧ Embedded video wall function for image split, cropping, and edge blend overlapped pixel settings.
- ✧ Selectable grid pattern size from 8-120 pixels in H&V direction. The default is 32*32 pixels.
- ✧ Selectable grid pattern color with optional transparency to see background image for external pattern.
- ✧ Flexible aspect ratio adjustment in each edge up to +_ 1800 pixels position shift.
- ✧ M800Ex is designed with a projection mapping function. Users can upload monochrome patterns into M800Ex and implement projection mapping. Each Box can store up to 10 different patterns.
- ✧ One 256-color pattern can be overlapped on the screen.
- ✧ 10-bit processor, 3:2/2:2 cadence, low angle smooth algorithm, high-quality scaling engine.
- ✧ 3D motion adaptive de-interlace.
- ✧ Frame lock function to get perfect synchronized outputs in all channels.
- ✧ Frame rate conversion and 50Hz in/out function to eliminate image frame drop or repeat.
- ✧ Free-run mode provides a continuous signal to the output, and no source searching is required in a projector when the input source changes.
- ✧ Support xvYCC & 8/10/12-bit deep color processing.
- ✧ Support HDR input signal but no HDR effect in the output.
- ✧ Individual color and white balance adjustment in each processing channel.
- ✧ Individual 90/180/270 rotation, flip, cropping, scaling & color adjustment in each channel up to 4k/60 input.
- ✧ PIP/POP function with PIP image size from 320*180 up to 1920*1200 resolution with flexible position and adjustable aspect ratio. This function is unavailable when the main image is 90/270 degrees in rotation.
- ✧ Selectable and programmable EDID in the range: H=1024-3840, V=720-2400.

- ✧ Users can save up to 5 settings and be recalled by remote controller, RS232, USB, or network.
- ✧ ESD Protection: ±8kV (Air-gap discharge), ±4kV (Contact discharge)
- ✧ Working environment: 45° C, 10-90% RH
- ✧ Control: keypads, IR, RS232, USB, Ethernet
- ✧ System settings can be stored and backup on a PC.
- ✧ Power supply: DC: 12V 3.3A
- ✧ Max. Power consumption:
  M801Ex: 8.4W, M802Ex: 14.4W, M803Ex: 21.6W, M804Ex: 28.8W
- ✧ Dimensions (Body only):
  Without protruding parts: M801Ex: 303mm*164mm*44mm, M802Ex-M804Ex: 440mm*190mm*58mm.
  With protruding parts: M801Ex: 303mm*175mm*55mm, M802Ex-M804Ex: 440mm*201mm*69mm
- ✧ Weight (Body only): M801Ex: 1.51kg, M802Ex: 2.47kg, M803Ex: 2.64kg, M804Ex: 2.81kg
- ✧ CE/FCC/RoHS Certified
- ✧ 30-month Warranty.

Function and features:

A. Structure

Each M800Ex consists of 1-4 processing modules. Each processing module can control one projector, and multiple processing modules can cascade to control a big-scale display system.

B. Each processing module includes below input and output ports

1. Input: 2x HDMI, 1xVGA, 1x DisplayPort。
   - HDMI & DisplayPort support 7680*2160 @30Hz, 7680*1200/4096*2160 @60Hz with 4:4:4 chroma sampling without compression. VGA supports up to WUXGA or 205MHz analog input signal.
   - Connect with various video sources and support non-VESA standard input resolution.
2. Output ports: 1x HDMI. Selectable output resolutions: XGA, WXGA,1280x720, 1280x1024, 1366x768, 1920x1080 (24/30/50/60Hz), 1920x1200 (30/60Hz), 2048x1080/60, 1024x768 @120Hz, 1280x720 @120Hz, 1280x800 @120Hz.
3. Loop out port: 1x HDMI 2.0b, same as source signal up to 8k/1k (1k/8k) @30Hz / 4096*2160 @60Hz.

C. Image warp, geometry alignment, and edge blending

1. Selectable grid pattern size for geometry alignment from 8-120 pixels in H&V. Default size is 32*32 pixels.
2. With full functions for quick 4 corner alignment, vertical and horizontal keystone correction, Pincushion & Barrel adjustment, image warp, and image 90/180/270 degrees rotation and flip.
3. Each channel controls one projector and can be cascaded to support unlimited projectors.
4. Integrated with full-function IR remote controller. Manual geometry alignment via Remote controller and WebGui up to 9*5 control points with H=+_ 1200 pixels and V=+_1200 adjustment range in total HD output (4 corners + warp adjustment).
5. Gwarp3 PC tool is available for warp and geometry alignment up to 17x17 control points with

H=+_1200 pixels and V=+_1200 pixels adjustment range in full HD output through USB or Ethernet. After geometry alignment is finished, the parameters can be stored inside PC or GeoBox; no more PC tool is needed.

6. Corner Wall geometry alignment at 90 degrees corner wall up to 900 pixels adjustment range in 4 corner position and H/V center point. The curvature point can be shifted up to +_900 points.
7. Four direction edge blending up to H=1920, V=1200 overlapped pixels for flat, curved & cylindrical screens.
8. Independent RGB gamma selection for edge blending color fine.
9. Precise black level uplift at multiple selected areas up to 9 regions to compensate for light leakage in the projector. A low native contrast ratio projector will be more severe in light leakage.
10. White balance and individual color correction for each projector.

D. High-end 10-bit video processor

1. 10-bit high-end processor with 3D motion adaptive de-interlace, low angle smooth algorithm, and 3:2/2:2 film mode detect and recovery function.
2. Complete color adjustment function, including brightness, contrast, hue, saturation, preset color mode, independent RGB gain adjustment, and white balance correction.

E. Edge mask

Image [Shift] to execute edge mask up to 500 pixels following the image profile after geometry adjustment and [Edge Mask] with 8 adjustment points to provide an irregular shape edge mask with random edge position up to 900 pixels in each control point. These two functions can be executed at the same time.

F. PIP/POP

1. PIP (picture in picture): with flexible PIP size (320*180 to 1920*1200), location, and aspect ratio.
2. POP (Picture outside picture): side by side or Top/Bottom images with full screen or maintain source signal aspect ratio.
3. The Overlap function can further adjust PIP sub-image size, cropping area, position, and aspect ratio.
4. Limitation:
   - When implementing PIP/POP function, the primary signal source can’t be rotated at 90/270 degrees
   - Source: only one HDMI source can be displayed on PIP/POP screen. Another source shall be DP or VGA.
   - PIP Overlap function is only available up to 4k/30 input resolution.

G. Video wall function

1. Image cropping and location assignment for each projector.
2. The image pixel cropping range is up to +_1800 pixels for image position shift, aspect ratio adjustment, bezel compensation, and creating overlap region for edge blending.
3. Connect with up to 8k/1k input signal and split the image for display devices without additional PC,

Image splitter or other devices.

4. Serve as video wall controller for irregular video wall display up to 15x15 matrix displays from the single signal source.

H. Image rotation and flip

1. Image 90/180/270 degrees rotation, flip, and mirror up to 4k/60Hz input resolution.
2. Image flip in Front/Rear, Left/Right, and Top/Bottom directions.
3. When executing 90/270 degrees image rotation, no PIP/POP function is available.
4. No 3D motion adaptive de-interlace function while the image is 90/270 degrees rotated. We propose to apply a progressive signal source to get the best video quality.

I. Projection Mapping

1. Projection mapping function is embedded in M800Ex models. Users can input up to 10 patterns (images) to M800Ex, then implement projection mapping. The pattern needs to be 2-bit monochrome in BMP file format. Users can use any signal source and select up to 4 display styles in each pattern. Users can use any signal source and content without needing to pre-mask the signal source.
2. One 256-color pattern can be overlapped on the screen.

J. System control and other features

1. Professional design and reliability for 7/24 working conditions.
2. Operation temperature: 0-45° C. Relative humidity: 10%-90% non-condensing.
3. Full-function OSD by front panel keypad, WebGui, IR, and Ethernet (Including through Wi-Fi by PC, Mobile, or iPad).
4. Firmware update via USB or Ethernet.
5. Gwarp3 PC tool can control multiple processors simultaneously through USB or Ethernet.
6. Internal grid pattern with selectable color and grid size for easy geometry alignment.
7. RS232 & Ethernet control system compatible with most control systems.
8. User can select blue or black background color when no input signal is detected.
9. Programmable EDID in the range of H=1024~3840, V=720~2400.
10. BOX ID and programmable IP address for convenient multiple unit control simultaneously.
11. Users can save up to 5 settings and be recalled by remote controller, RS232, USB, or network.
12. System settings can be backup to PC or USB device and copied to another unit.
13. Automatic power ON/OFF through input signal control. While no input signal is detected, it will shut down output automatically. Users can power ON/OFF the system through the control in the signal source.

Feature illustration

Projection mapping

The projection mapping function is embedded in M800Ex models. Users can input up to 10 patterns (images) to M800Ex, then implement projection mapping. The pattern needs to be 2-bit monochrome in BMP file format. Users can connect with any signal source and select up to 4 display styles in each pattern. There is no need to pre-mask in the signal source.

If the pattern resolution is less than the output resolution, the user has below display choices:

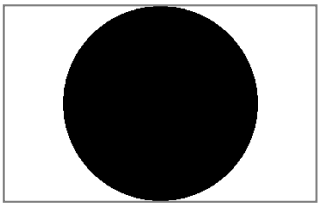
- Type 1: The content will display in the pattern's black area.
- Type 2: The content will display the white color area in the pattern.
- Type 3: Show the source image in the black pattern area and all areas outside the pattern.
- Type 4: Reverse display with Type 3.

Below are examples of circle pattern digital mapping.

--Pattern size: 1280*800

--Box output resolution: 1920*1080

Pattern: 1280*800

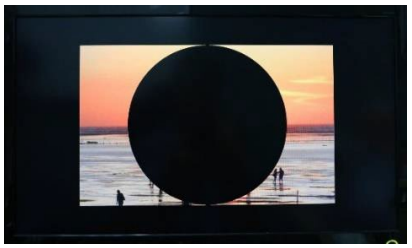


Type 1

Type 2

Type 3

Type 4

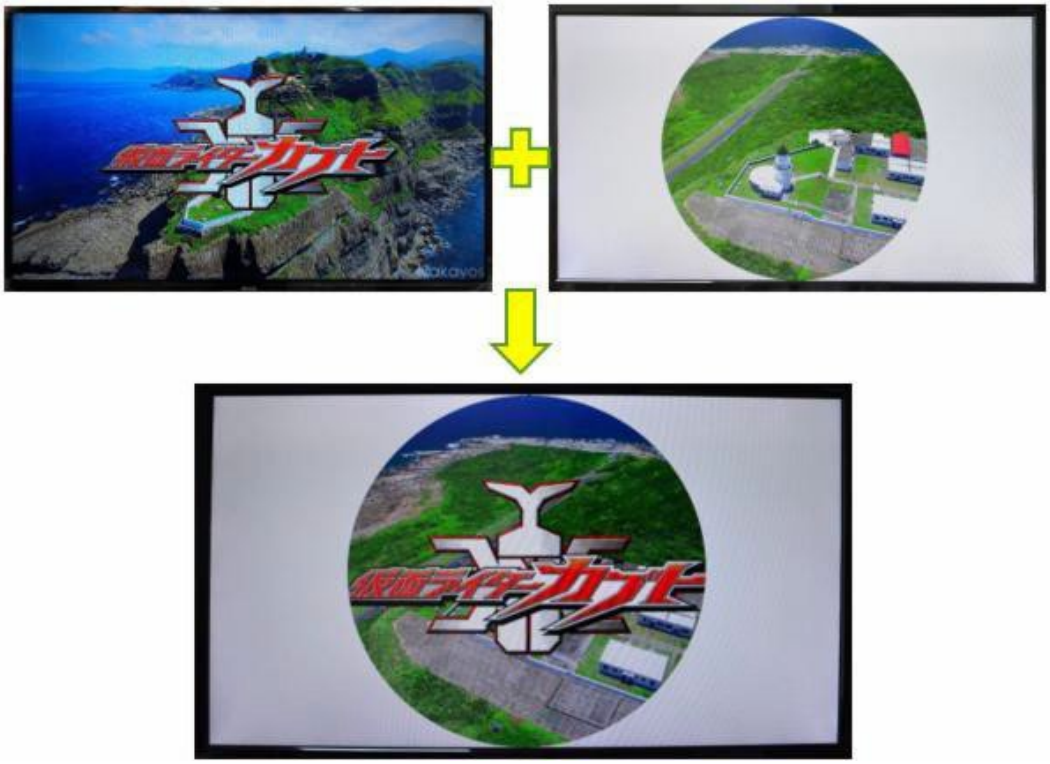


Color pattern overlap

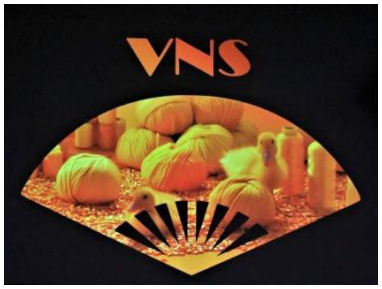
Different background color

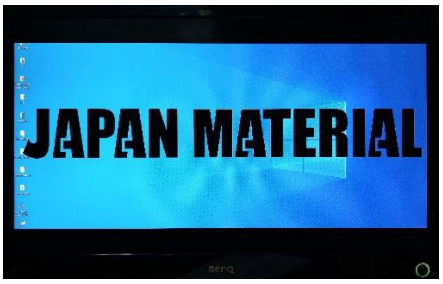
Color pattern overlap

Multiple-channel daisy chain

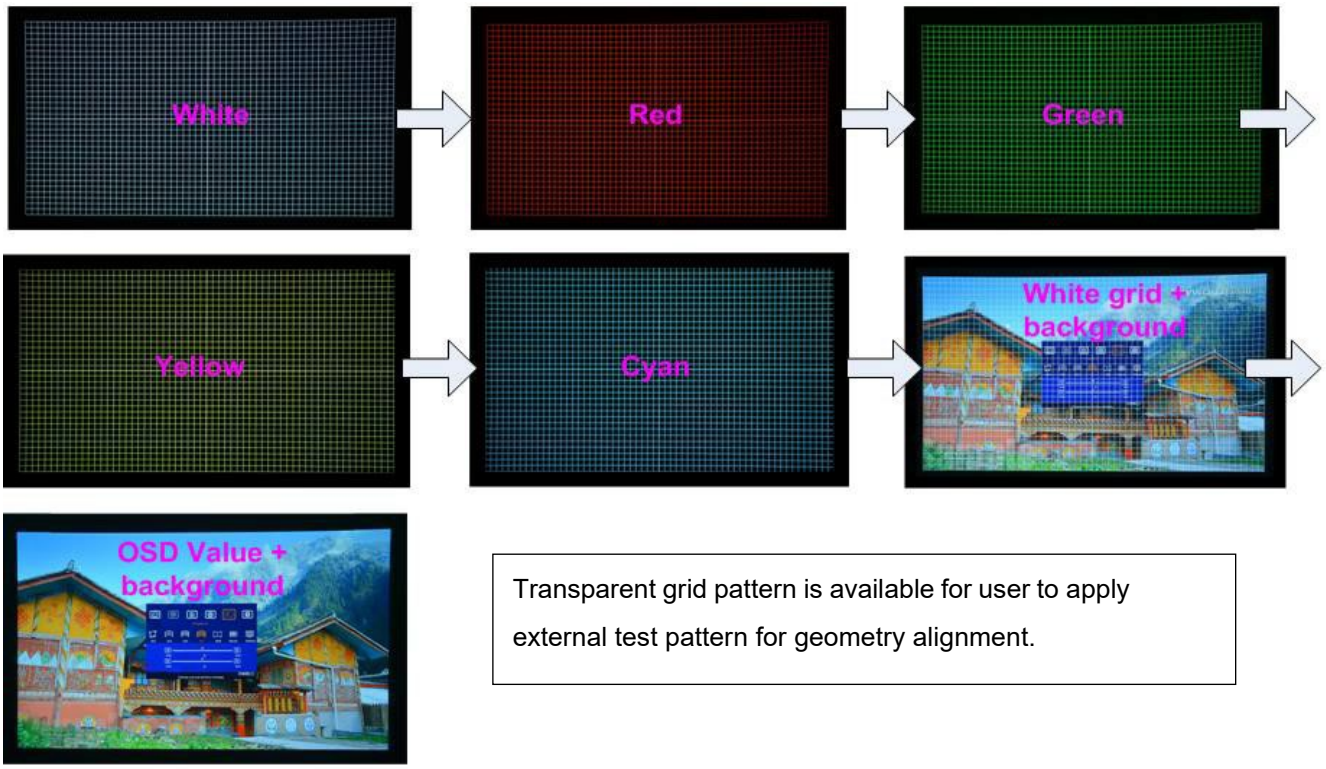


Other Application examples





Variable Grid Patterns for geometry alignment

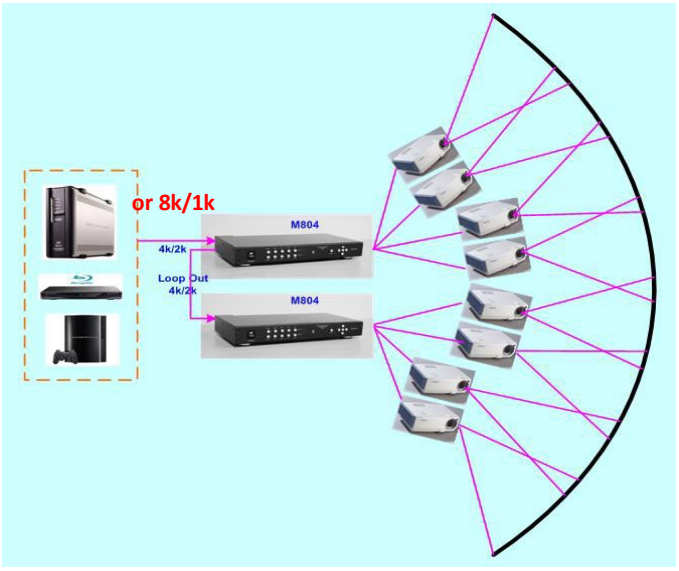


Transparent grid pattern is available for user to apply external test pattern for geometry alignment.

Selectable grid pattern size for geometry alignment

The pixel size in a grid pattern for geometry alignment is selectable to meet high-end simulation system geometry alignment requirements. The grid size in horizontal and vertical directions is adjustable from 8 to 120 pixels with a 1-pixel increment. H&V grid size will be the same. Users can select grid size under the [Edge Blend] menu.

8k/1k, 4K/60 daisy chain connection



No additional device is required.

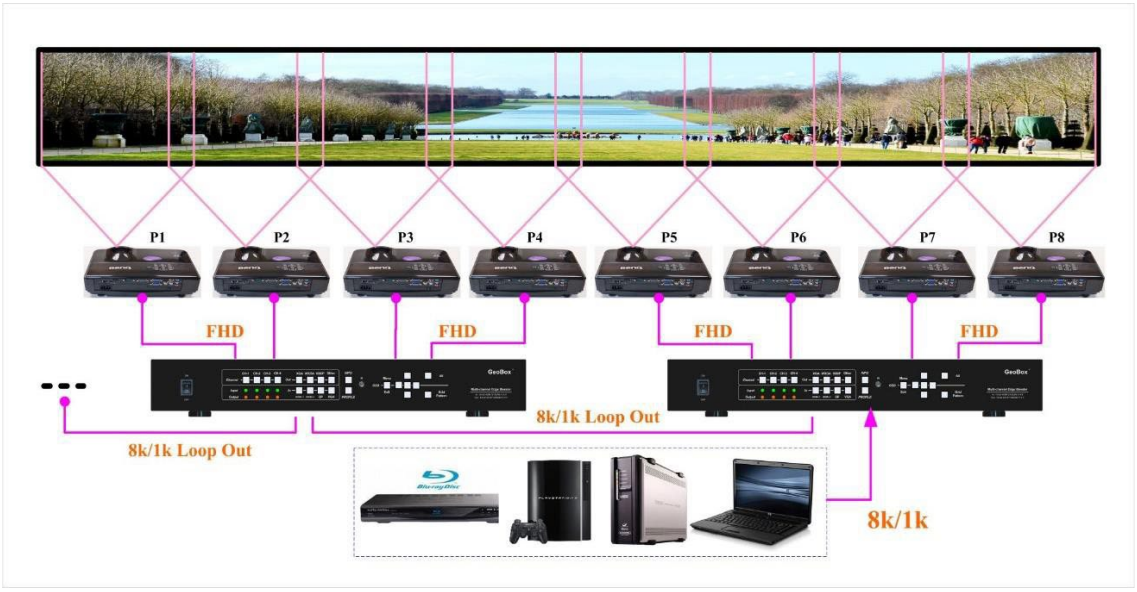
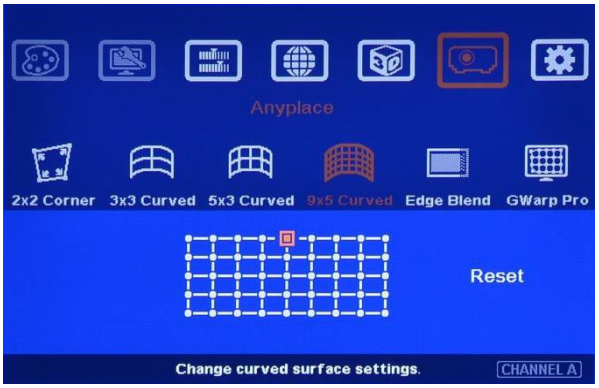
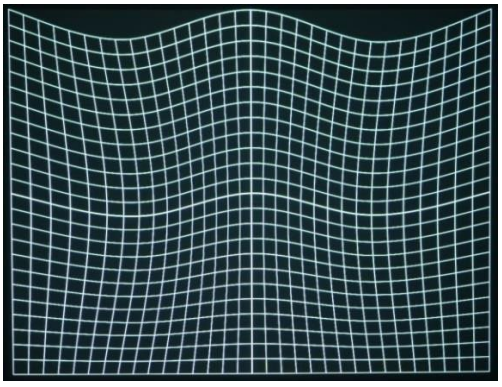


Image geometry alignment and warp





Edge blending on a flat and curved screen

Corner wall Alignment & Display

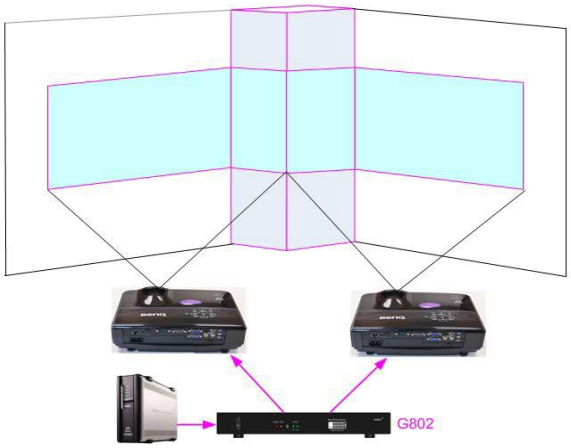
The Corner Wall alignment function is functional either in a horizontal or vertical direction. Corner Wall geometry alignment ranges up to 900 pixels in 4 corner positions and at the edge center in H&V directions. The curvature point position can be shifted +_ 900 pixels. Example for horizontal adjustment: the control point can be moved down to 900 pixels, and the curvature point can be +_900 pixels away from the center point

In a horizontal line. 4 Corner position alignment and Edge Blend function are still available with Corner Wall adjustment for easy image mapping and system setup.

In Horizontal and Vertical directions

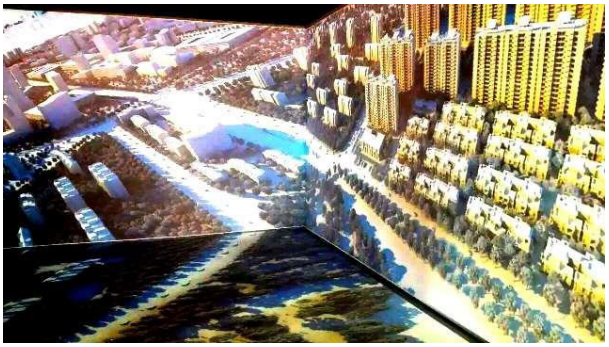
At any location but not only at the center

Two projector Corner Wall application



Three projector Corner Wall application

The other Corner Wall application examples

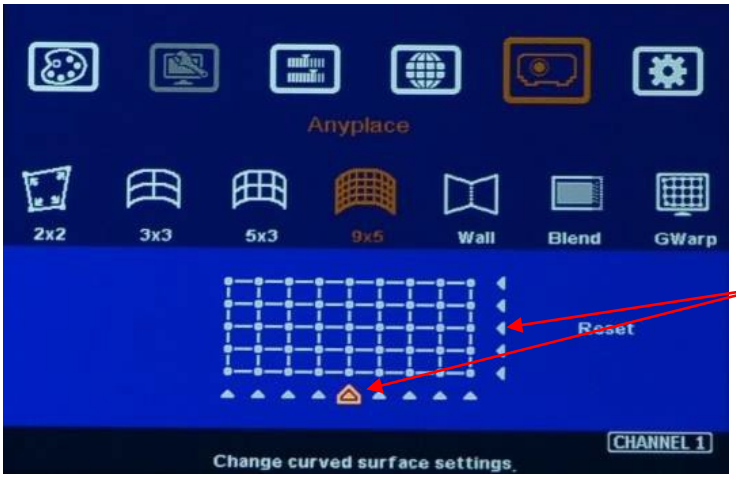


Single projector application

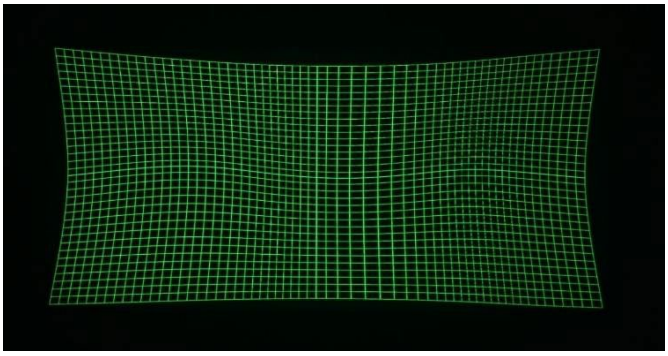
Linearity grid line adjustment

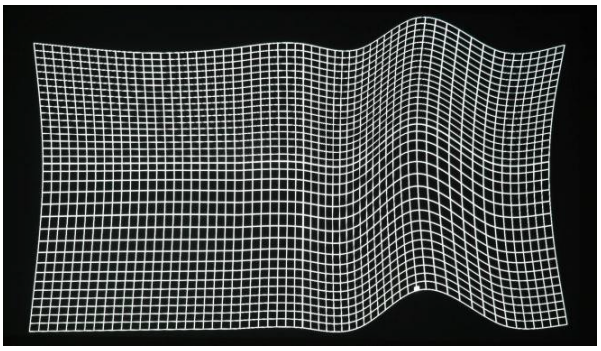
When the projector projects the image on a curved screen, the image will change the grid size gradually and cause different scaling factors on the center and both sides. Linearity grid line adjustment compensates for this effect and makes a complete image with the same scaling factor. Another application is to align images from adjacent projectors in the overlap region. This function can reduce the alignment time quite a lot.

1. This function can be executed only through a remote control.
2. It can be applied to both horizontal and vertical directions.
3. The operation OSD menu is under 3x3, 5x3 & 9x5 warp alignment menu. The result can be further adjusted by the Gwarp3 PC tool for detailed 17x17 image position fine-tuning.
4. Linearity grid line adjustment can be executed together with warp alignment & edge blending at the same time.



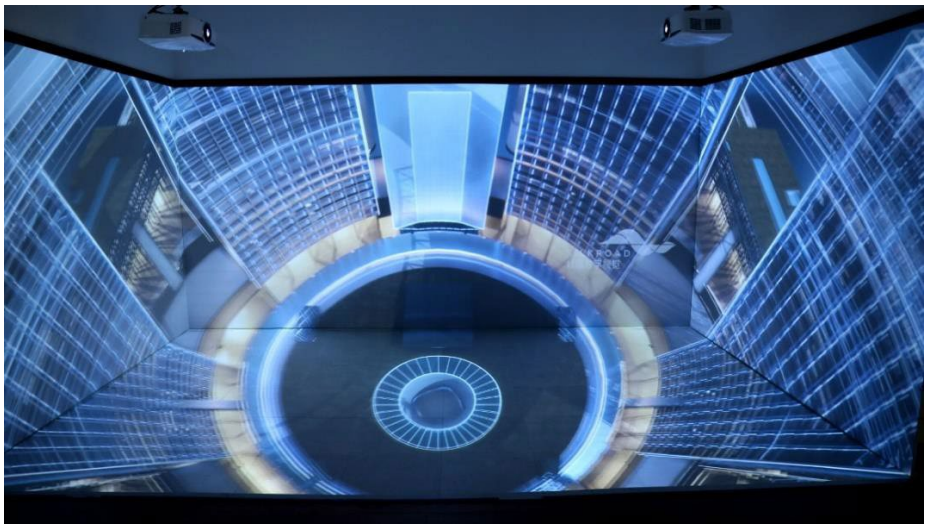
Control point for Linearity Grid Line Adjustment



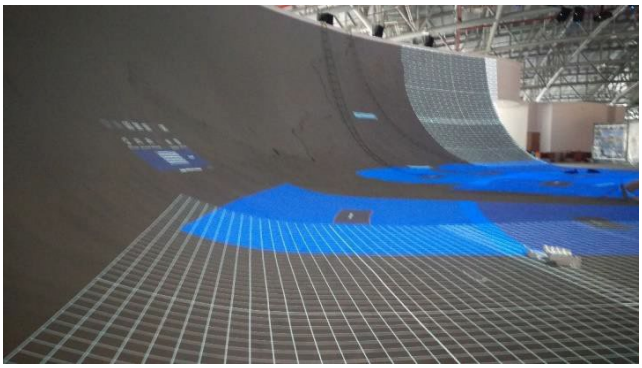


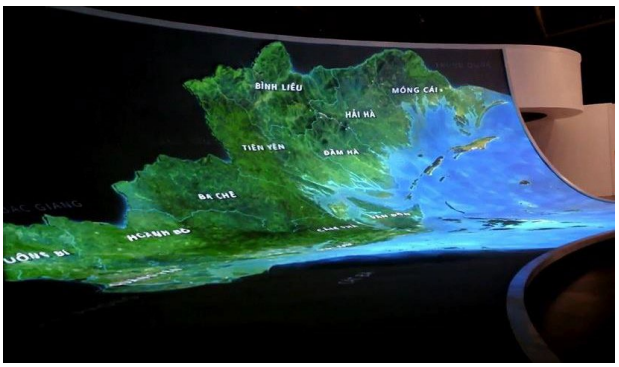
Immersive display

An immersive system with 4 walls + one floor



Big scale display





24 units of Christie projectors together with GeoBox for 35mx18m screen

Flexible display

One M800Ex has the below flexible display functions:

1. One immense content edge blending.
2. Independent content display from each projector.
3. 16:9 / 16:10 image at the center.
4. Edge Blending with a projector at the portrait to increase image height.
5. PIP/POP in each projector.

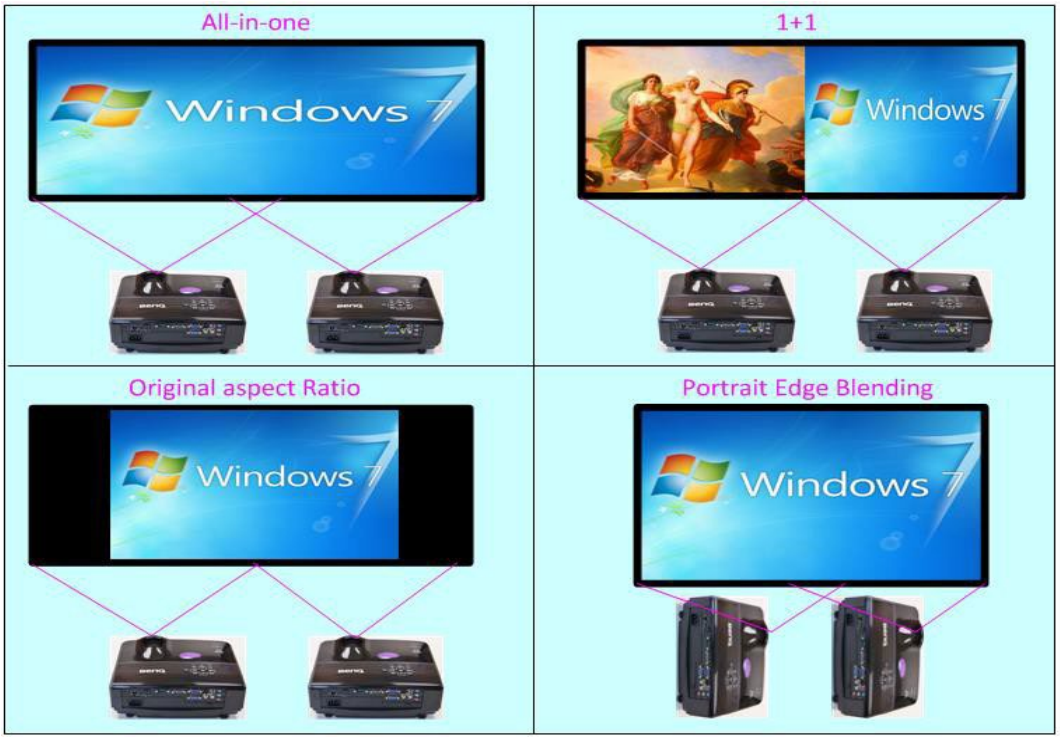
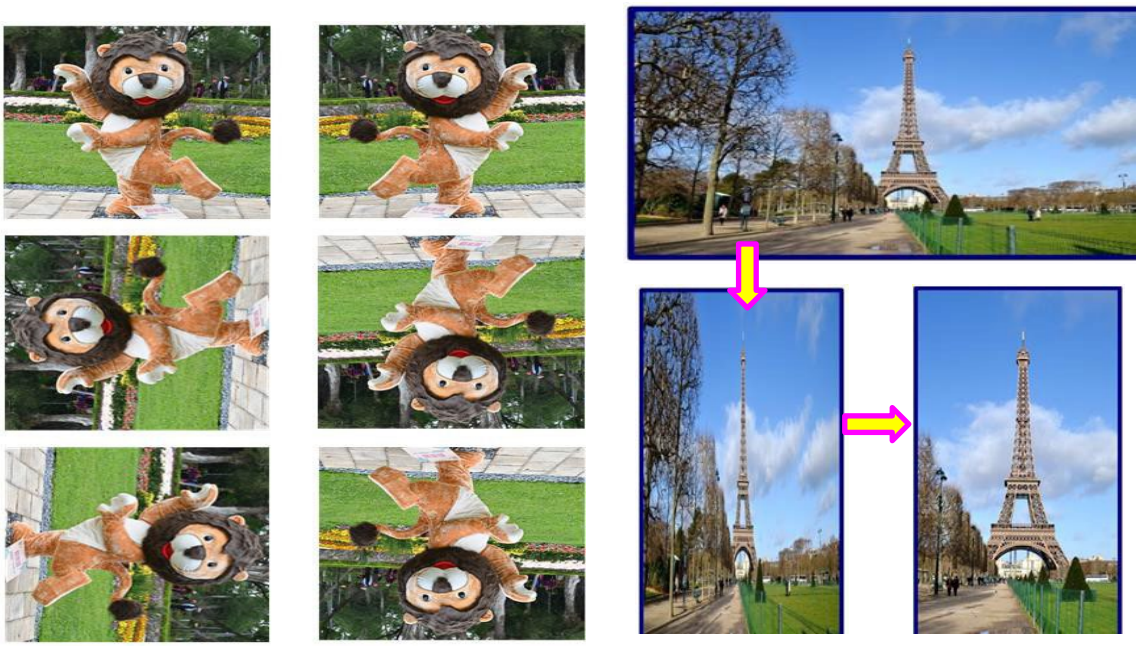


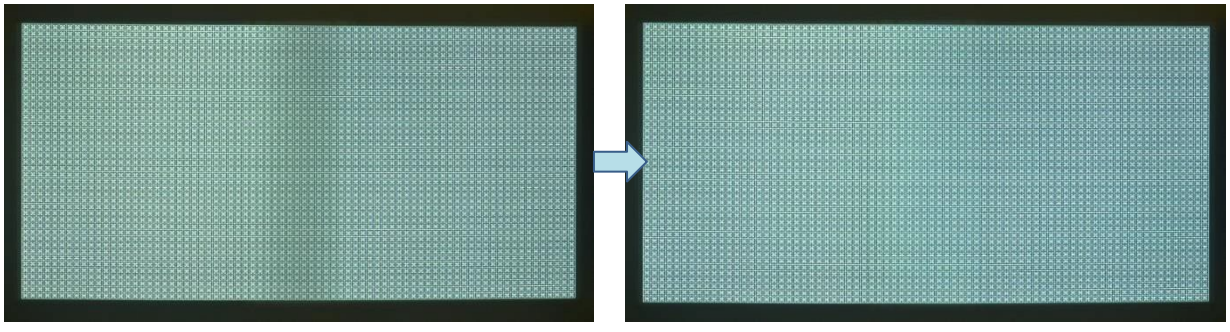
Image Flip & Rotation

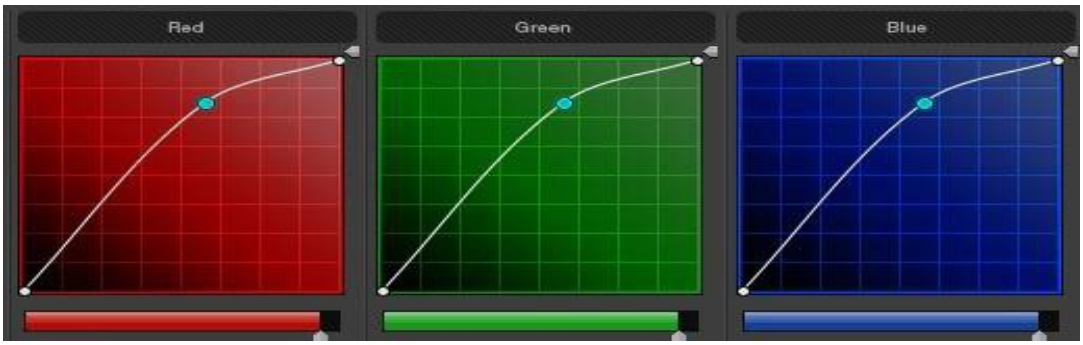
Image 90/180/270 degrees rotation and flip up to 4k/60Hz resolution. The user can adjust the aspect ratio after image rotation or flip.



Independent RGB gamma correction

Independent RGB gamma value adjustment in the Overlapped region allows more capacity to compensate for color banding in the overlapped region.



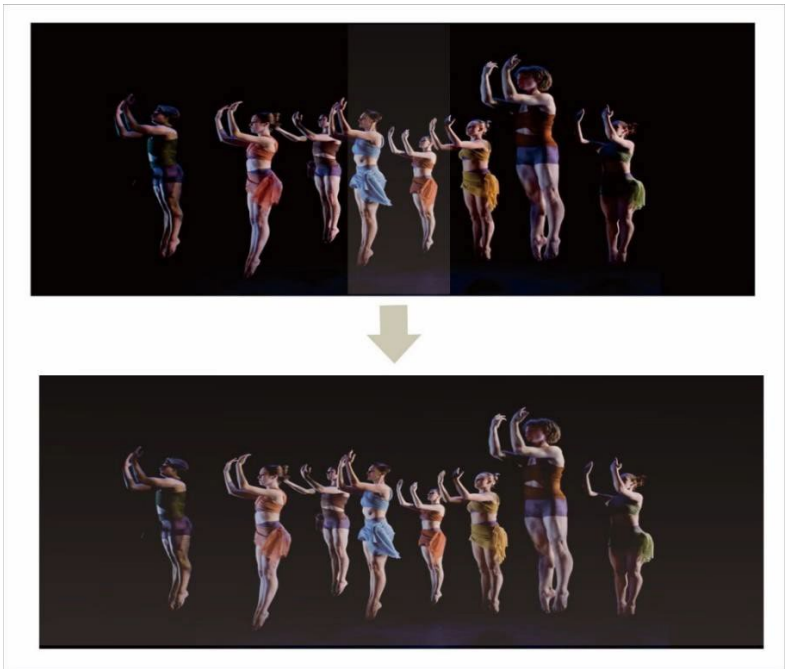


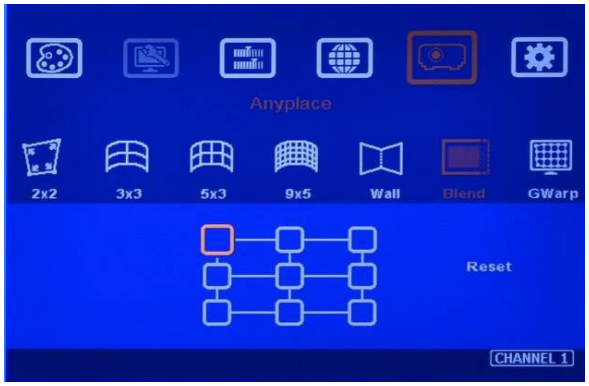
White balance & Color correction

Each channel can be adjusted separately through RGB Gain and Offset value.

Nine regions Black level uplift

It can compensate for the light leakage in the projectors, especially in low contrast ratio projectors under dark working environments. The native contrast ratio is related to projector light leakage and can't be reduced through signal processing. A higher native contrast ratio will have less light leakage. A laser projector will have a high contrast ratio and is the best choice for an edge blending system. Separate RGB, precise black level uplift, can be executed in multiple regions (up to 9) in each output channel at a selectable position. 2x2 edge blending system black level uplift can be implemented through 9 regions black level uplift.





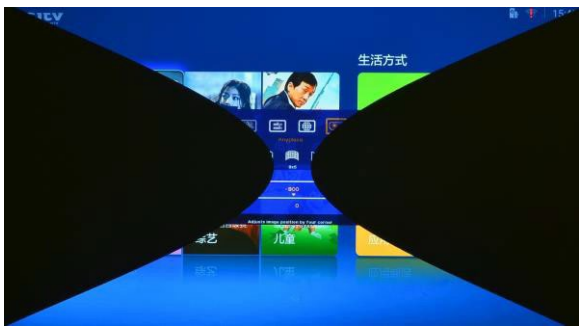
Nine regions black level uplift. Each region can set different RGB gain and offset.

Edge Mask

There are two edge mask functions in M800. One is the image [Shift], and the other is Edge [Mask] under the Edge blending menu.

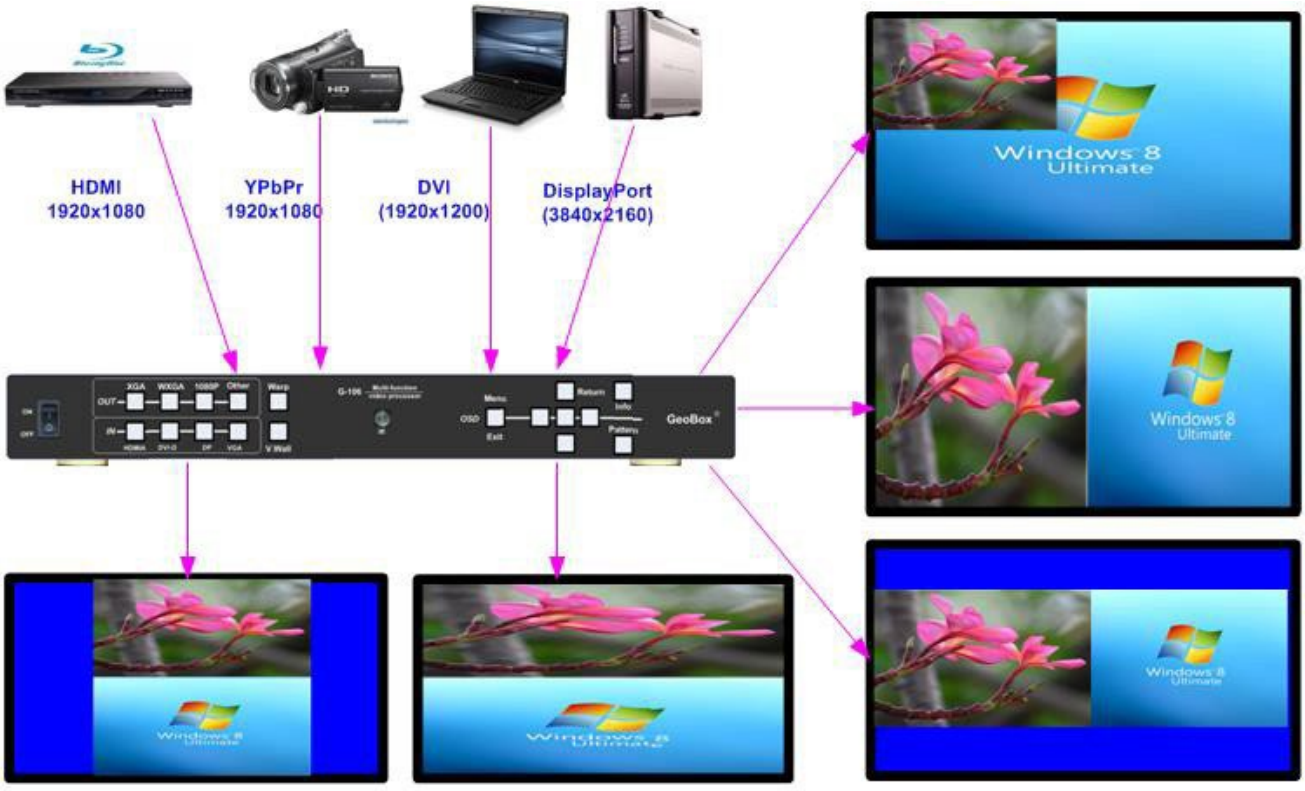
1. [Shift]: Able to do edge mask with black background in each edge up to 500 pixels. The image mask location will follow the image position after geometry alignment.
2. [Edge Mask]: There are 8 control points for the edge mask. When a user moves the position for each control The point, it will result in many kinds of edge mask patterns. The maximum position adjustment for each control point is +_ 900 pixels.
3. The adjusting range in [Shift] is based on the image position after geometry alignment, and the range in [Mask] is calculated from the original edge position before geometry or [Shift] adjustment. Both functions can be implemented at the same time.

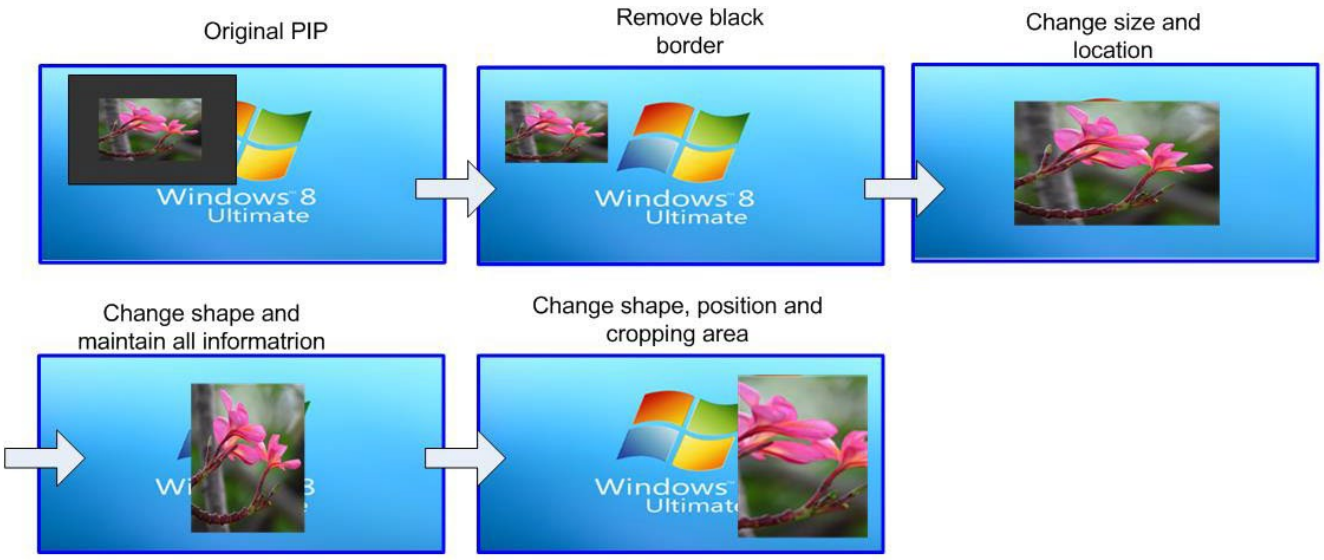
Example: Another Image [Mask]



PIP/POP function

M800Ex is designed with PIP/POP function in each processing module. Each processing module can display two contents in PIP (Picture in Picture) or POP (Picture outside picture) styles. Users can select two contents among HDMI, DP & VGA for PIP/POP display but can't choose simultaneously two HDMI input signals. The PIP image can be with variable sizes from 320*180 to 1920*1200 resolution. The location is flexible across the entire display zone in each projector. The POP images can be Side by Side or Top/Bottom position with full screen or keep the original aspect ratio.





Stretch the image and change the aspect ratio.

Geometry adjustment and Video wall cropping function can compensate for image size or change the aspect ratio. The adjusting range is up to 1800 pixels on each edge based on signal source resolution.