

GeoBox

M800Ex Projection Mapping Box User Guide

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: up to 1920*1200 @60Hz, 2048*1080 @60Hz*

New generation Warp & Edge blending engine



Technical support:

Web site: www.VigilLink.com

E-mail: info@vigillink.com

Version: V1.01

Tel: +949-502-4484

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	Loop Out Daisy chain	Control IR/USB/RS232 /Ethernet	Video wall Embedded	RoHS CE FCC	

Table of Contents

Disclaimer/Copyright Statement.....	3
Warranty/RMA.....	3
FCC/CE Statement.....	3
Introduction.....	4
Functions and Features.....	6
1. Content in the packing box.....	9
2. Basic operation & settings	
2.1. Connecting the Inputs.....	9
2.2. Connecting the Outputs.....	9
2.3. Input / Output Selection & LED Indicators.....	10
2.4. System Connection and Power On.....	12
2.5. System Reset.....	14
2.6. HDMI Loop Out for daisy chain connection.....	14
2.7. System Settings: Box ID, RS232, Ethernet.....	14
2.8. How to use IR Remote Controller.....	16
2.9. Full screen and native aspect ratio.....	17
2.10. [Orientation] --Image rotation and flip.....	18
2.11. Color Adjustment.....	18
2.12. OSD Lock and unlock.....	19
2.13. System synchronization.....	20
2.14. PIP/POP—Dual window display.....	21
3. Projection mapping	
3.1. Introduction.....	24
3.2. Applicable models.....	24
3.3. Flexible display styles.....	24
3.4. Executive summary for projection mapping with Gwarp3 PC Tool.....	25
3.5. Time duration for Gwarp3 projection mapping operation.....	26
3.6. PC Tool for projection mapping—Gwarp3.....	27
3.7. How to prepare the pattern (image) for projection mapping.....	29
3.8. How to apply multiple mapping patterns in one project.....	31
3.9. Application examples.....	31
3.10. Limitation in projection mapping.....	33
3.11. Operation through remote controller.....	34
3.12. Image Shift, edge Mask vs. Projection Mapping.....	34
4. Project plan and preparation for edge blending	
4.1. Determine source signal resolution.....	34
4.2. Determine overlap region size and pixels.....	35
4.3. Relation between Overlap pixels and geometry alignment accuracy.....	35
4.4. Get installation data from GEOBOX Excel Spread Sheet.....	37
4.5. Apply Spread Sheet data for projector installation and GeoBox setting.....	39
4.6. Projector settings before edge blending.....	40
4.7. GeoBox settings before edge blending.....	40
5. Geometry Alignment	
5.1. Select the right Grid Pattern for geometry alignment.....	40
5.2. Grid pattern pixel size selection.....	41
5.3. Geometry alignment.....	42
5.3.1. Geometry alignment through remote controller.....	43
5.3.2. Activate grid pattern.....	43

5.3.3. [2x2] 4 corner geometry alignment	44
5.3.4. [3x3], [5x3], [9x5] warp alignment.....	44
5.3.5. Linearity grid line adjustment.....	46
5.3.6. Corner [Wall] geometry adjustment.....	47
5.4. [Gwarp3] PC Tool (more details in section 11.2).....	49
6. [Video Wall] Settings.....	50
6.1. [Zoom]: split the signal source.....	51
6.2. [Pan]: assign image location.....	52
6.3. [Overlap]: crop the right image for each projector.....	52
6.4. [Position]: shift image position without changing image size.....	53
7. [Edge Blend] settings.....	53
7.1. [Edge] Selection location and set edge blending value.....	54
7.2. [Shift]: shift image position and execute Edge Mask.....	55
7.3. [Gamma]: color correction in edge blending area.....	55
7.4. Black level uplift: [Offset] & [Corner] adjustment.....	57
7.5. [Color]: Individual projector white balance and color correction.....	59
7.6. Edge [Mask].....	60
7.7. [Grid] (Determine grid pattern size).....	61
7.8. Final image quality fine-tuning.....	62
8. Example for 3 projector edge blending	
8.1. Get detailed edge blending information through VIGILLINK Excel Spread Sheet.....	63
8.2. Mark the image location and install projector Tors.....	64
8.3. System connection.....	64
8.4. Projector settings.....	65
8.5. GeoBox settings.....	65
8.6. Geometry alignment.....	65
8.7. Video wall settings.....	67
8.8. Edge blending setting.....	68
8.9. Final image quality fine-tuning.....	69
9. Save/Load system settings.....	69
10. Multiple unit applications	
10.1. System connection in multiple unit edge blending.....	71
10.2. Content overlap setting issue.....	72
10.3. Convenient setting in multiple unit application.....	74
10.3.1. Setup by remote controller.....	74
10.3.2. Setup by Ethernet.....	74
11. WebGui and Gwarp3 PC tool.....	75
11.1. WebGui.....	75
11.2. Gwarp3 PC Tool.....	75
12. Advanced applications and settings	
12.1. Multiple Wall Immersive Display.....	78
12.2. Portrait edge blending.....	80
12.3. Flexible display.....	81
12.4. Discrete content displayed in each projector.....	82
12.5. Complete system aspect ratio adjustment.....	83
13. Miscellaneous setting	
13.1. Helpful Tips for edge blending.....	84
13.2. EDID settings.....	85
13.3. HDMI vs. DVI output signal.....	86

13.4.	System standby and automatically turn off output signal	87
13.5.	Change background color	87
13.6.	Turn off the Splash screen Logo	87
13.7.	Limitation in audio output	87
14.	Troubleshooting	
14.1.	Front panel LED indicators	88
14.2.	Intermittent or loss of input signal	88
14.3.	Video quality issues	88
14.4.	Image position shift after installation	89
14.5.	System crash and malfunction	89
14.6.	Slow response in pattern change in projection mapping	90
14.7.	Synchronization issue in the outputs	90
15.	Technical support	90
16.	Safety Precaution and Maintenance	91
	Specification	92
	Revision History	94

Disclaimer/Copyright Statement

Copyright 2020, VNS Inc.. All Rights Reserved

The information contained in this document is protected by copyright. VNS Inc. reserves all rights

VNS Inc.. Reserves the right to modify this document without any obligation to notify any person or entity of such revision. Copying, duplicating, selling, or otherwise distributing any part of this document without signing a non-disclosure agreement with an authorized representative of VNS Inc.. is prohibited. VNS Inc.. Makes no warranty for using its products and bears no responsibility for any error or omission that may appear in this document.

Product names mentioned herein are used for identification purposes only and may be trademarks of their respective companies.

Limited Warranty and RMA statement

This device is designed and tested to the highest standards and backed by thirty-month parts and labor warranty. Warranties are effective upon the first delivery date to the end customer and are non-transferable. Warranty-related repairs include parts and labor but do not include repair of faults resulting from user negligence, special modifications, abuse (mechanical damage), shipping damage, and/or other unusual damages. The customer shall pay shipping charges when the unit is returned for repair. Manufacturers will pay shipping charges for return shipments to customers.

The manufacturer does not assume responsibility for consequential damages, expenses or loss of revenue, inconvenience, or interruption in operation experienced by the customer. The warranty service shall not automatically extend the warranty period.

Please contact us for more information. When the product needs to be returned for repair, inform the manufacturer, and ask for a Return Material Authorization number.

FCC/CE statement

Note: This equipment has been tested and found to comply with the limits for a Class A digital device under Part 15 of FCC Rules. These limits are designed to protect reasonably against harmful interference in a residential installation. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. I Suppose this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on. In that case, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment to an outlet on a circuit different from the receivers.
- Consult the dealer or an experienced radio/TV technician for help.

Notice:

(1) An Unshielded-type power cord is required to meet FCC emission limits and prevent interference to the nearby radio and television reception. Only the supplied power cord must be used.

(2) Use belly shielded cables to connect I/O devices to this equipment.

(3) Changes or modifications not expressly approved by the party responsible for compliance could void the user’s authority to operate the equipment.

Introduction

M800Ex is a curved screen edge blending processor that can provide multiple processing modules to control from 1 to 4 projectors. M801Ex is designed 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 sophisticated edge blending, image warping, stacking, and projection mapping. One M804Ex can execute 4 projector digital projectors & edge blending without any additional equipment or splitter. More M800Ex can be cascaded for large-scale display.

4 input ports (2x HDMI, 1x DP, 1x VGA) and 1x HDMI outputs are designed in each processing module. The digital input supports up to 7680*2160 @30Hz, 7680*1200 @60Hz/4096*2160 @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 timings. 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 for complete line movement and Corner Wall image adjustment for mapping images at 90 degrees corners are new functions 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.

The digital mapping function is integrated into M800Ex. Users can upload patterns into M800Ex to perform the digital mapping. Each Box can store up to 10 different patterns for digital mapping. The digital mapping function can work with edge blending to perform large-scale digital mapping with multiple units of M800Ex.

Image 90/180/270 degrees rotation and flip with 4k/60 input from various input sources are embedded in M800Ex. It provides a more flexible system configuration ability.

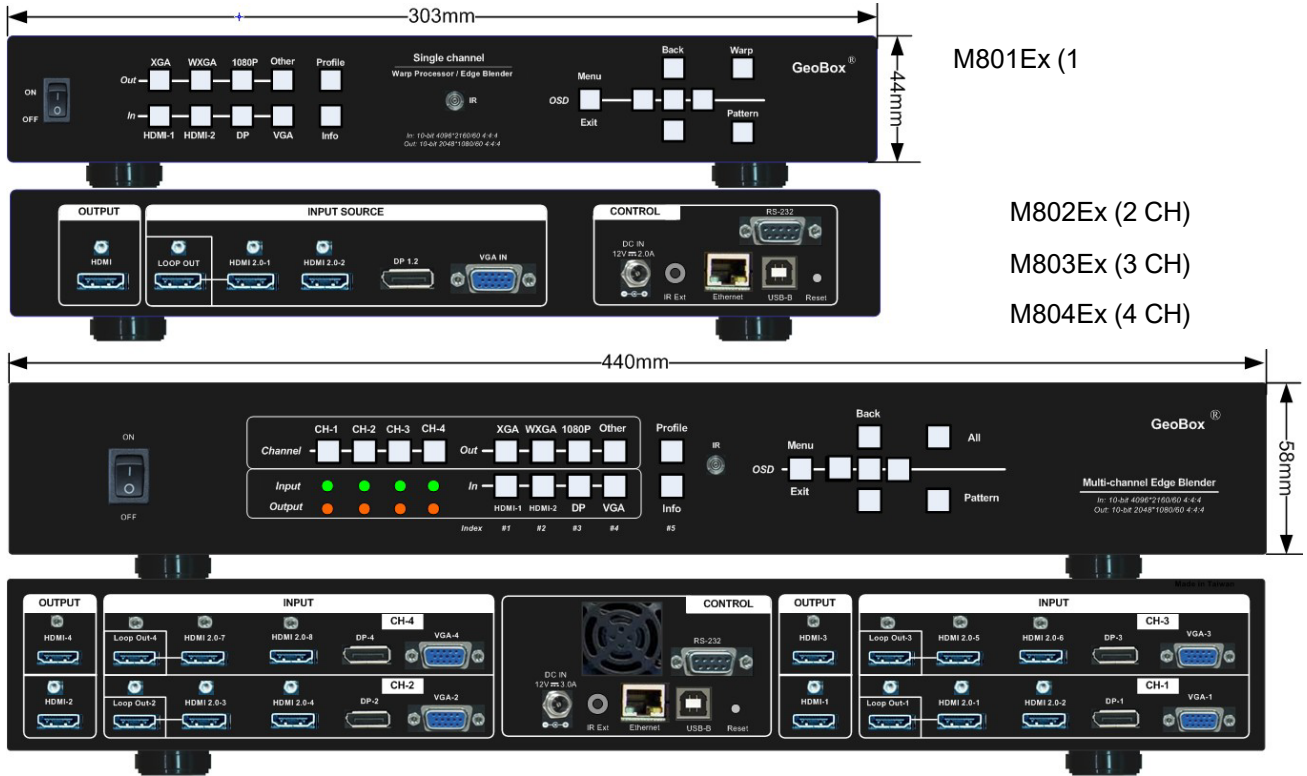
HDMI loop out supports daisy chain connection up to 8k/2k @30Hz / 4096x2160 @60Hz, allowing large displays with multiple units cascaded. The video wall function crops, allocates source images for each projector, and sets overlap pixels for edge blending. Complete curved edge blending can be achieved through the remote controller and Ethernet without additional devices except 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 M804Ex, the user can display up to 8 different 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.

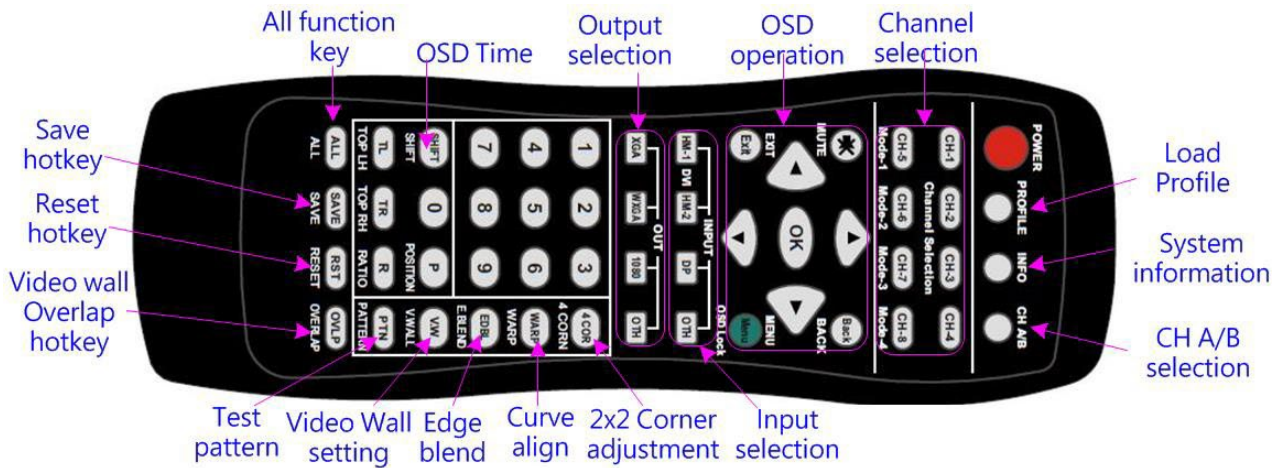
M800Ex can connect with inputs from multiple PCs and combine them into one seamless image. It also provides flexible displays in an edge blending system. For a 3x projector edge blending system, the user can configure a 1+1+1 independent display, 1+2 (two projectors blended), and all-in-one (three projectors 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.

Edge mask and digital mapping functions will provide more flexibility in large-scale edge blending and digital mapping applications without a PC or additional devices.

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.



(The back panel shows 4 CH model—M804Ex)



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 @60Hz/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/2k @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 full 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. Curvature points can be shifted up to +_900 points.
7. Linearity Grid Line adjustment function to move grid line position for quick geometry alignment.
8. Four direction edge blending up to H=1920, V=1200 overlapped pixels for flat, curved & cylindrical screens.
9. Independent RGB gamma selection for edge blending color fine.

D. Black level uplift

Precise black level uplift at multiple areas (up to 9) to compensate for light leakage in the projector optical system in a dark environment.

E. Background white balance

White balance and individual color correction for each output channel.

F. Digital mapping

1. Users can upload up to 10 patterns in each Box to implement digital mapping through Gwarp3 PC tool.
2. The pattern shall be in BMP format and monochrome 2-bit color.
3. Users can set different pattern content resolutions and decide to display either black or white areas in the pattern. There are 4 types of mapping displays for each pattern.
4. Each channel can have different digital mapping patterns and settings.

G. 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, 3 preset color temperatures, independent RGB gain adjustment, and white balance correction.

H. 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. The 8-point edge mask function can't work simultaneously with the projection mapping function.

I. 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. If the user wants to have a PIP image across the entire screen, the user needs to use one channel as front-end processor to achieve it. However, the max. System resolution is only up to 2048*1080. Users can easily add one G901 as front-end processor to get 4k/2k PIP/POP across the entire screen.
5. Limitation:
 - When implementing PIP/POP function, the main 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.

J. Video wall function

1. Image cropping and location assignment for each projector.
2. Image pixel cropping range is up to +_1800 pixels for image position shift, aspect ratio adjustment, bezel compensation, 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 single signal source.

K. 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 execute 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 progressive signal source to get the best video quality.

L. System control and other features

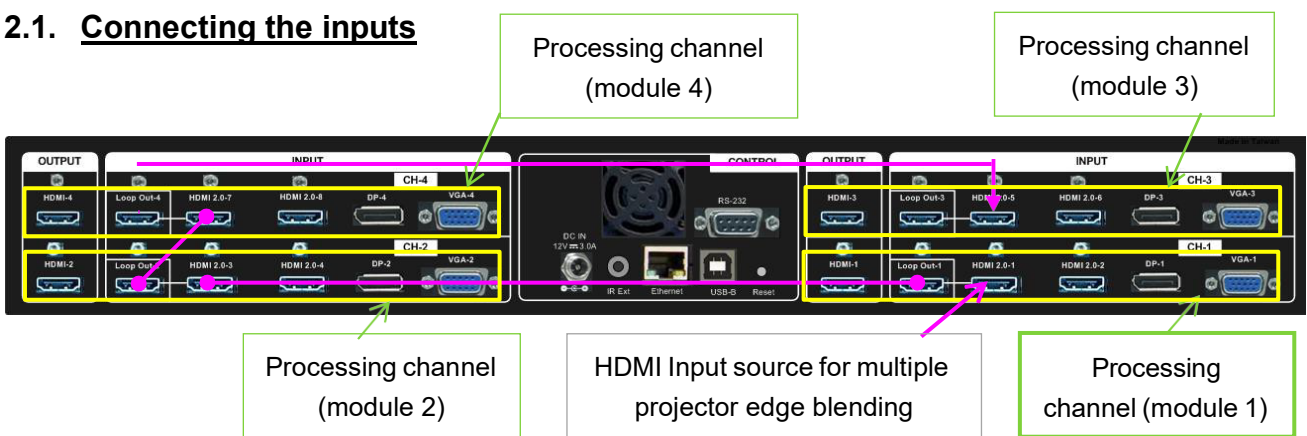
1. Professional design and reliable for 7/24 working condition.
2. Operation temperature: 0-45° C. Relative humidity: 10%-90% non-condensing.
3. System setup through front panel keypad, WebGui, IR and Ethernet (Including through WiFi by PC, Mobile or iPad).
4. Firmware update via USB or Ethernet.
5. 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. User can also apply external test pattern for geometry alignment.
7. RS232 & Ethernet control system compatible with most of control system.
8. User can select blue or black background color when no input signal is detected.
9. Programmable EDID in the range at H=1024~3840, V=720~2400. The signal source beyond these resolutions can be setup through display card.
10. BOX ID and programmable IP address for convenient multiple unit control at the same time.
11. User can save up to 5 settings and can be recalled by remote controller, RS232, USB or network.
12. System settings can be backup in PC, USB device and copied to other units.
13. Automatic power ON/OFF through input signal control. While no input signal is detected, it will shut down output automatically. User can power ON/OFF the system through the control in signal source.

1. Content in the packing box

- The M800Ex Quad Channel Video Wall Controller
- 1x RC-400 IR Remote Controller with two AAA battery
- 1x IR Extending Receiver with 1.8m cable
- 1x DC Power supply unit with power cord, In: AC 100V-240V, Out: DC 12V 3A
- Mounting bracket with screw (Option)
- Please download User Guide & Gwarp3 PC Tool at www.GeoBoxav.com.
- Curved screen edge blending Tutorial YouTube video is available at <https://youtu.be/pn6XQiNpdLc>

2. Basic operation & setting

2.1. Connecting the inputs

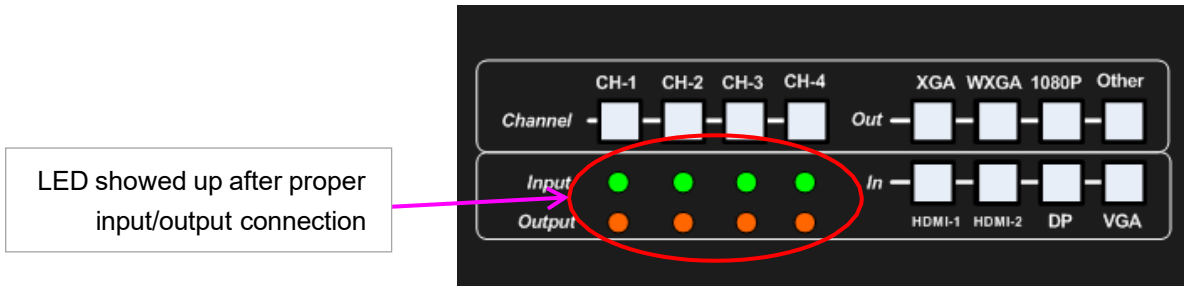


- Each processing channel (module) has four input ports: 2x HDMI, 1x DP, 1x VGA
- HDMI & DP input ports support up to 7680*1200 @30Hz, 4096x2160 @60 Hz.
- Only HDMI-1, HDMI-3, HDMI-5 & HDMI-7 input signals can be looped out. Loop out signal is unprocessed source signal.
- For edge blending application, user can connect signal source to any of above HDMI-1/3/5/7 input port and loop out to the second processing module HDMI input port. All processing channels (modules) shall be fed with the same signal. No specific connection sequence is required.
- User can reserve HDMI-1, HDMI-3, HDMI-5 & HDMI-7 for edge blending connection and the other input ports can be served as inputs for discrete display application.

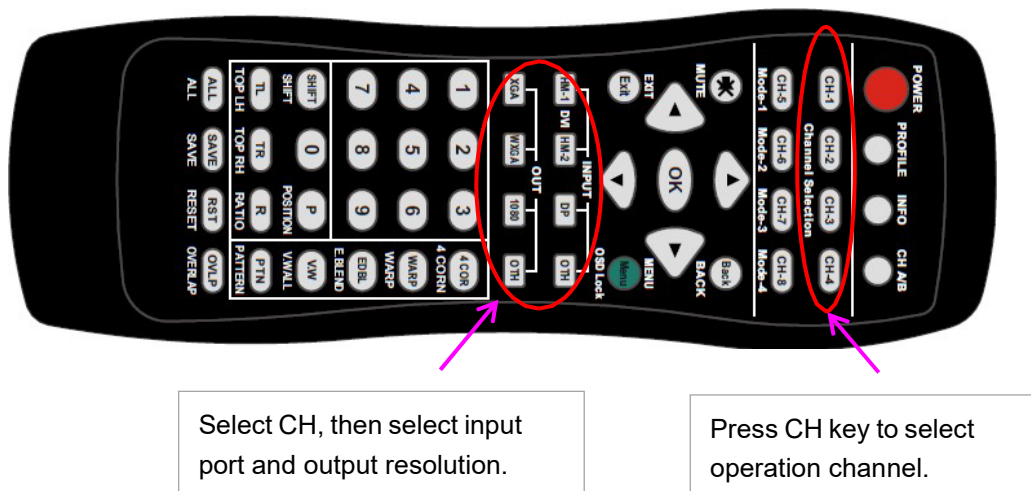
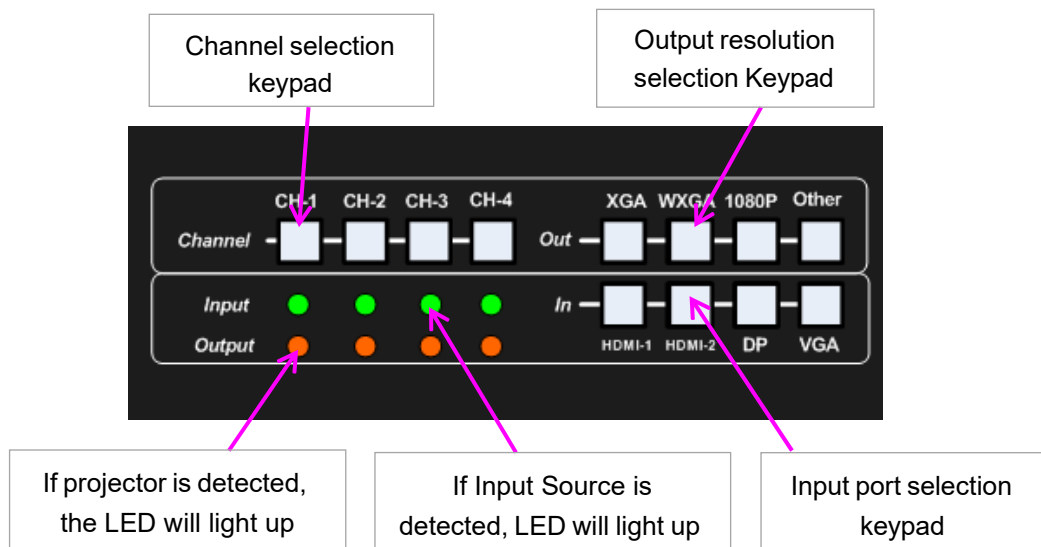
2.2. Connecting the outputs



- For 4 projectors edge blending application, user can connect any output to any projector and select projector location via [Video Wall] → [Pan] menu.
- If independent content display is required, user needs to arrange the input source and output connection and let input source be displayed at specific projector.
- Once input signal and output ports are properly connected, LED indicator on the front panel will show up. If any of the LED in CH-1 ~ CH-4 is not lighted up, please check the input/output connection and cable.



2.3. Input / Output selection & LED Indicators



2.3.1. Input source selection

- Default input port are HDMI-1/HDMI-3/HDMI-5/HDMI-7.
- User can press CH key, then select different input port for each channel.
- For one content edge blending display (all-in-one), user needs to input signal to HDMI-1 / HDMI-3 / HDMI-5 or HDMI-7, then loop out to next processing channel HDMI-1 / HDMI-3 / HDMI-5 or HDMI-7 input port to let all channels be fed with the same signal source.
- If user wants to select different input sources for different content edge blending, user needs to add one HDMI switcher at the front end to select different content for display.
- User can select different input port for each channel to display discrete content in each projector. Please see more details in flexible display section.
- PIP/POP is integrated in each processing channel. However, only one HDMI input signal can be selected in each processing channel in PIP/POP application. Please see more details in PIP/POP section.
- User can set EDID to let input source provide desired resolution. However, input resolution is controlled by signal source and may not output desired resolution. In this case, manual setting in signal source output resolution may be required. Some PC requires re-boot to get the right output resolution as EDID setting.
- M800Ex can support non-VESA standard input timing once signal source can provide, such as 7680*1200, 4096x2160, 3200x2400...

2.3.2. Output resolution selection

- User needs to select output resolution in each processing channel separately. The output resolution selection will apply to single channel. Default output resolution is 1080p.
- The output resolution should be the same as the projector native resolution. If user changes output resolution, geometry adjustment result will also be changed.
- User can select output resolution through remote controller, USB or Ethernet.
- Output resolution list: XGA, WXGA, 1280x720, 1280x1024, 1366x768, 1920x1080 (24/30/50/60Hz), 1920x1200 (30/60Hz), 2048x1080/60, 1024x768 @120Hz, 1280x720 @120Hz, 1280x800 @120Hz.
- User can access to [Image Properties] → [Output] OSD menu to select different output resolution.
- All output default resolution is 60Hz, RGB 4:4:4 and progressive.
- **If the output refresh rate is not the same as input refresh rate. The frame lock function will be disabled and it may cause not synchronization issue among output channels. If the input is 4k/30 with FHD/60 output, it will have no synchronization problem. If the input is 50Hz, please select 1080p 50 Hz output to avoid this issue.**
- When change output resolution, the projector may re-search signal source and take few seconds to finish the selection.
- User can click [Info] key to get system information and input / output signal resolution.

2.3.3. LED indicators

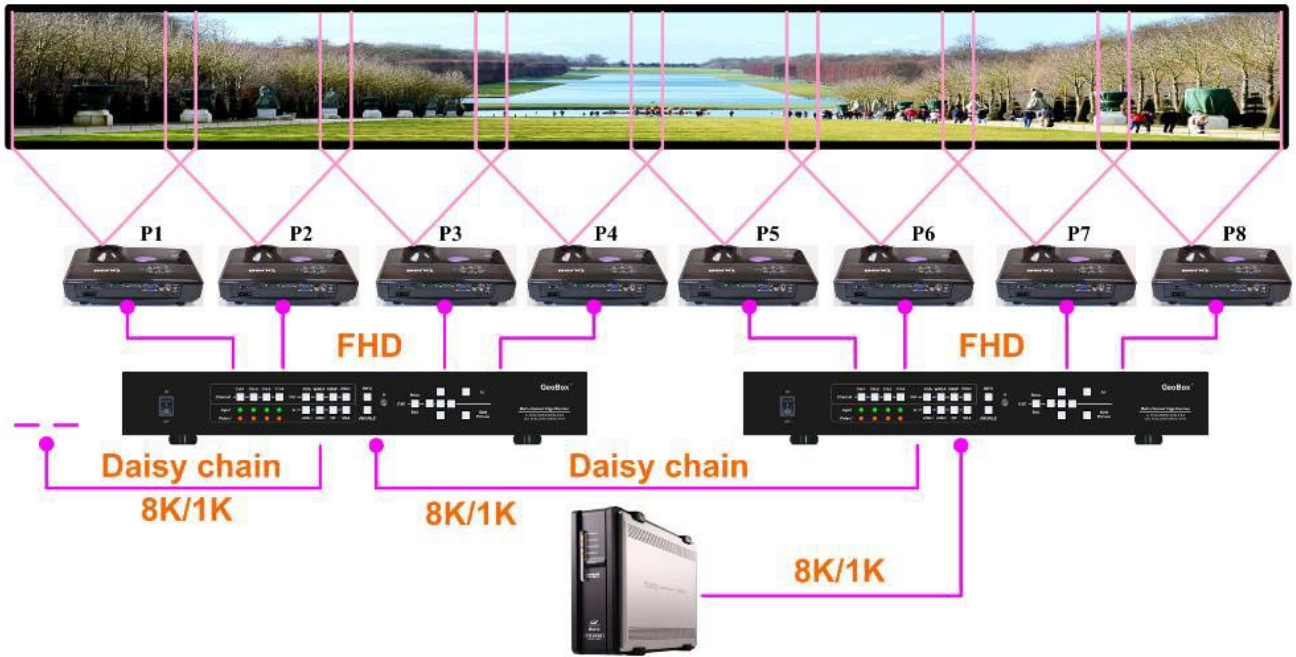
- LED indicators will show the input/output signal status.
- Green LED will show up when the input signal is detected.
- Orange LED will show up when the display device (projector) is connected.
- If user clicks Menu key for 5 seconds on the remote controller, GeoBox OSD menu will be locked and channel selection LED will be flashing. To press another 5 seconds, it will unlock OSD menu.

2.4. System connection and Power On

- Below is system connection for 4 projectors with M804Ex.



- Another system connection with multiple units of M800Ex.



- Poor quality HDMI cable and signal source will affect the connection distance and may cause signal noise or show intermittent image.
- To ensure all cables are connected correctly, it is recommended to use locking cables. We can provide T-Lock cable with certified quality.



- Complete edge blending system should be connected to one power Distribution Box with proper grounding. Power on the system after finishing all connections to avoid system damage by floating voltage among devices.
- When power is switched on, the booting time is about 19 seconds and the Input & Output LEDs on front panel will stay “Light-up” all the time for the channel with correct input source and output device connections.
- If continuous flashing in Channel selection LED with 1 second interval, it means the OSD function has been Locked. Please press [Menu] key for 5 seconds to disable [OSD Locked] function. If system lock is done by remote controller through [85x] operation, please press [850] to unlock system control.

2.5. System Reset

User can reset system through below method:

- User small pin to insert RESET hole at back panel for 5 seconds, user will see [Reset to Default] message. It will apply to all channels at the same time.
- Open OSD menu to reset the system. It will only be functional in one channel.
- User [Reset] hotkey on remote controller will reset one channel only.
- When operating through OSD or remote controller, user can select to reset [Reset All], reset [Video Wall setting] or reset [Anyplace] (geometry) setting.
- **Reset from OSD or remote controller will not delete Profile Index data. RESET from RESET Hole on back panel will delete Profile Index data.**

2.6. HDMI Loop Out for daisy chain connection



- HDMI Loop Out is for daisy chain connection. It is not an input port. Loop Out provides the same unprocessed source signal only from HDMI-1/HDMI-3/HDMI-5 or HDMI-7 inputs. All the other input signals will not be looped out. If user wants to execute edge blending through other input signal, please add video distributor and feed signal to all channels.
- User can connect any Loop Out signal to any HDMI input port in other channel or other GeoBox. No specific connection sequence is required. Once the signal can be fed to all channels, user can execute edge blending.
- Normally user can connect up to 10 projectors through daisy chain connection under 4k signal. The daisy chain connection number is related to the quality of HDMI cables and signal source resolution. Good cable or lower source resolution can connect more channels. User can also add HDMI splitter at the front end to increase the connection number for large scale video display.
- If loop out port is not connected, user can connect to a monitor for signal source monitoring purpose.

2.7. System settings: Box ID, RS232, Ethernet

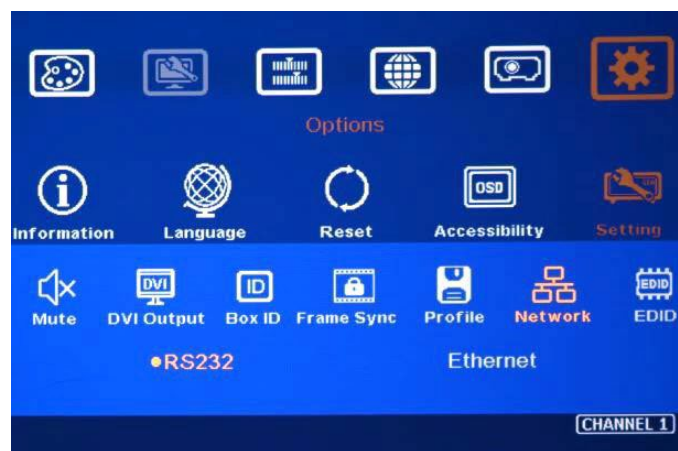
- **Box ID, RS232 and Ethernet settings can be executed through CH-1. The setting result will be applied to complete unit.**

- User can control or operate M800Ex settings through Ethernet. Default IP address is 192.168.0.100.
- When multiple units are used at the same time, user can set different IP address in each M800Ex so that each M800Ex can be controlled independently.

2.7.1. Box ID

- The range of Box ID is 0 ~ 99 for RS232 command.
- If user uses remote controller to execute system operation, the Box ID range is 0 ~ 9.

2.7.2. RS232 settings

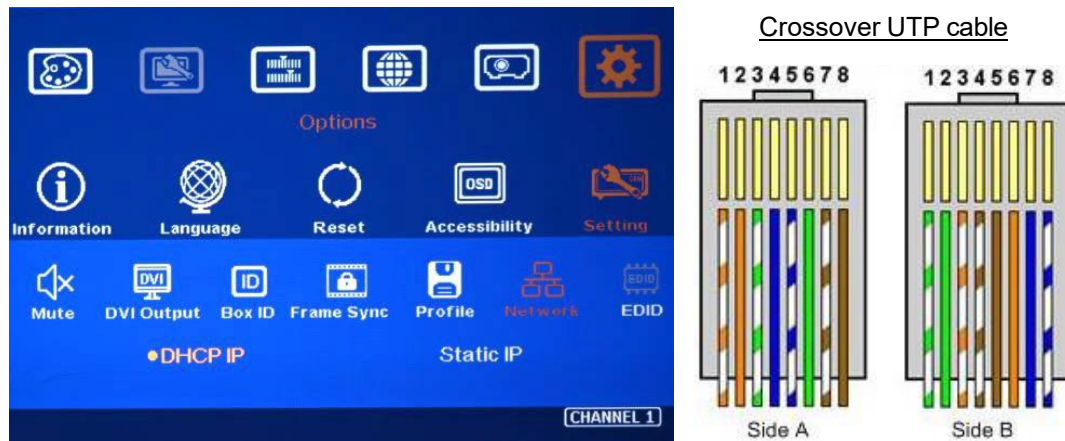


- RS232 is designed with DB-9 connector. User can select baud rate between 11520 and 9600.
- UART protocol for the control from RS-232 or Ethernet is available in the website.

2.7.3. Ethernet

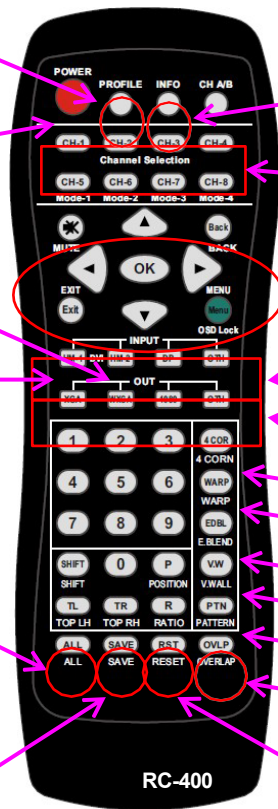
- User needs to connect GeoBox to WiFi Router or switch/hub through RJ45 to LAN port. Then user can control the system through Ethernet.
- Crossover UTP cable can be used for direct connection between PC and GeoBox. User needs to set PC TCP/IPv4 with the same domain segment as GeoBox (for instance, to set IP address at 192.168.0.105) and subnet mask at 255.255.255.0). In some PC, normal UTP cable can be used.
- Open web browser (Google Chrome or Internet Explorer) and input GeoBox IP address (default is 192.168.0.100), user can see GeoBox WebGui and menu with virtual keys similar to OSD for further system operation. There is no additional software is required.
- If user can't connect the network, please power off/on GeoBox again to let PC detect M800Ex network settings.
- User can set DHCP for the connection. If necessary, please [Renew] DHCP to get IP address before network connection.
- Gwarp3 PC Tool is another web tool for system setting and operation. It can also update Firmware or MCU code. Gwarp3 can be downloaded from GeoBox website.

- Each GeoBox can set different IP address for independent operation and control from the same PC.
- After get into Network setting OSD, please use < > OSD keys to select OSD menu items and use ^ v OSD keys to change IP address.
- If GeoBox is connected with WiFi Router (through LAN port), user can control GeoBox through WiFi via PC, iPad or mobile phone.
- Default TCP server port is 1266.



2.8. How to use IR Remote Controller

- IR remote controller has full functions for the operation of M800Ex.
- IR receiver is on Front Panel. One 3.5ø mm audio connector for IR extender is located at Back Panel of M800Ex. 1.8m IR extension cable is equipped in the packing. User can add audio cable to extend the distance up to more than 20 meters.
- IR remote control system is possible to be interfered and cause abnormal or discontinuous operation. Under this condition, Ethernet operation may be the best choice.



Setting [Load] shortcut key

Power on/off. If power off by remote controller, please power on by remote controller

HDMI-2/4/6/8 input port

HDMI-1/3/5/7 input port

Work with other function keys to execute function to all channels at the same time. Only some functions are available.

Setting [Save] menu (all channels)

System Information

Channel selection

OSD Menu operation keypads

Input source selection

Output resolution selection

[4 Corner] geometry alignment

[Warp] curve geometry alignment

[Edge Blend] menu

[Video Wall] Menu

Grid pattern for geometry alignment

Video Wall [Overlap]

System reset menu



Audio connector for IR extender

2.9. Full screen and native aspect ratio

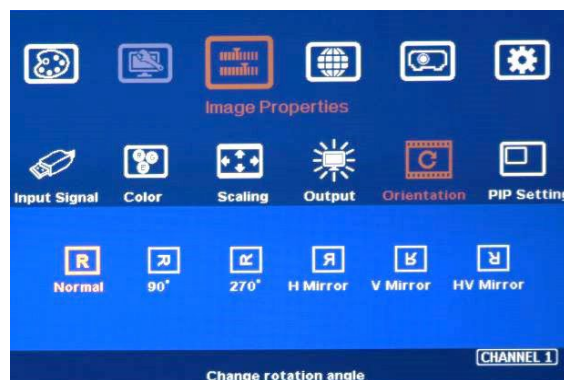
- [Scaling] under [Image Properties] menu is to select the display mode either following signal source original aspect ratio or full screen display
- For edge blending application, set to [Full Screen] mode is required. Otherwise, there will be abnormal display in some input timing.



- [Full Screen]: to display full screen image no matter the input source is in what kind of aspect ratio.
- [Original AR]: the output display will keep the same display aspect ratio as signal source. If the input is 4:3, then the output display will keep the same 4:3 aspect ratio with black borders at both sides.

2.10. Image rotation and flip

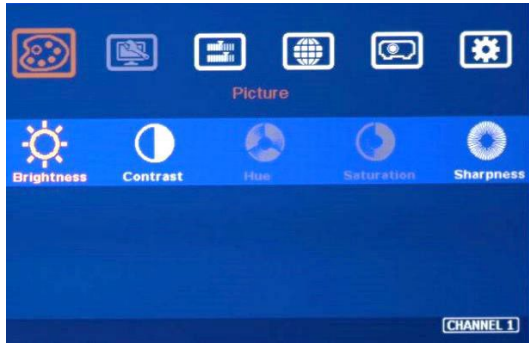
- This image orientation function will be applied to main image only. This function can support up to 4k/60Hz input signal.
- Image 90/270 degrees rotation is for edge blending with projectors at portrait position to increase image height. There is no need to rotation signal source.
- Image flip is for projector to project image from rear or top position.
- When the image is rotated or flipped, the OSD will still keep at original direction without change. Geometry alignment direction will follow OSD direction; i.e. OSD Top edge direction is geometry alignment Top edge. The direction for [Video Wall] settings will follow the image direction after rotated or flipped.
- User can see the direction of the TEXT “R” to do image flip and rotation.



2.11. Color Adjustment

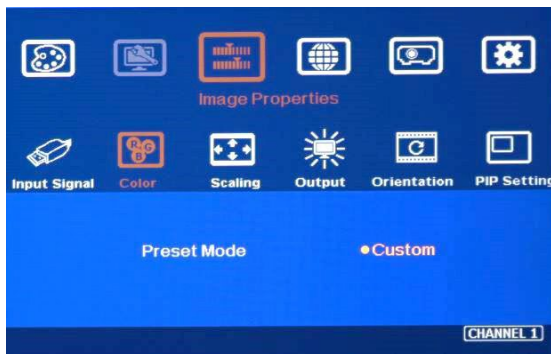
In edge blending application, color adjustment is important due to multiple units of projector images are combined together.

2.11.1. Global color adjustment: [Picture]



- [Picture] can execute below color adjustment for each processing channel.
- When input is YUV video: [Brightness], [Contrast], [Hue], [Saturation] & [Sharpness]
- When input is RGB 4:4:4: [Brightness], [Contrast] & [Sharpness]

2.11.2. Preset Color Temperature and independent RGB color adjustment



- [Color] under [Image Properties] menu can change preset color temperature and discrete [RGB] color in each channel.
- [Preset Mode]: [Neutral], [Reddish], [Bluish]
- [Custom]: discrete RGB color adjustment

2.11.3. Color adjustment function under [Edge Blend] menu



- Below adjustment will apply to each channel separately.
- [Gamma]: for color compensation in overlap region
 - [Offset]: for black level uplift in non-overlap region (limited adjustment range)
 - [Color]: for color white balance correction (limited adjustment range)

2.12. OSD Lock and unlock

- If multiple units of GeoBox is installed together or the IR receiver is put together, in order to avoid interference among multiple GeoBox during the installation, user can set different ID number for each GeoBox through [Options] Menu. Press number keys in Remote Controller to determine which GeoBox will be controlled.
 - 851: control GeoBox ID No. 1
 - 853: control GeoBox ID No. 3
 - 850: to unlock all units and user can control all GeoBox.

- If user press 851, only ID #1 GeoBox can be controller through OSD. The rest units of GeoBox will be locked and not respond to OSD operation.
- OSD Lock / Unlock: When continuously press [Menu] key in IR Remote Controller or front panel for 5 seconds, the OSD function will be locked and flashing LED on channel selection key will light up. To press [MENU] key for 5 seconds again, it will unlock OSD and user can manipulate the OSD again.

2.13. System synchronization

When the system uses multiple projectors, the image should be synchronized together. GeoBox uses [Frame Sync] to synchronize all outputs based on the input signal vertical sync. When [Frame Sync] is applied, it is possible to lose sync during system setup and cause projector to re-search the signal source. In order to provide smoother setup, GeoBox provides OSD for user to select different synchronization methods for easy setup.



- [Normal] (Frame Locked): We propose to set at [Normal] in most of the applications. When user reset system or adjust video wall settings, user will see projector re-searching the input source.
- [Fast]: time to sync the input source will be fast than [Normal]. During video wall settings, projector will reduce re-search behavior and will have smoother setup process.
- [Disable] (Free-Run mode): when GeoBox changes input source or timing, the output will still send out continuous output signal. The projector has lowest chance to re-search the input signal while system setup.
- If multiple unit application is required, please set it at [Normal] to let all output channels have synchronized image without frame tear or synchronization issue.
- If the output refresh rate is not the same as input refresh rate. The frame lock function will be disabled and it may lose synchronization among output channels. If the input is 4k/30 with FHD/60 output, it will have no synchronization problem. If the input is 50Hz, please select 1080p 50 Hz output to avoid frame repeat and system synchronization issues.

2.14. PIP/POP -- Dual window display



- ✓ PIP: Picture in Picture
- ✓ POP: Picture Outside Picture
- ✓ PIP sub-image maximum size: 1920*1200
- ✓ 90/270 image rotation is not available under PIP/POP function.
- ✓ Both main and sub-image will go through high end video with best video quality.

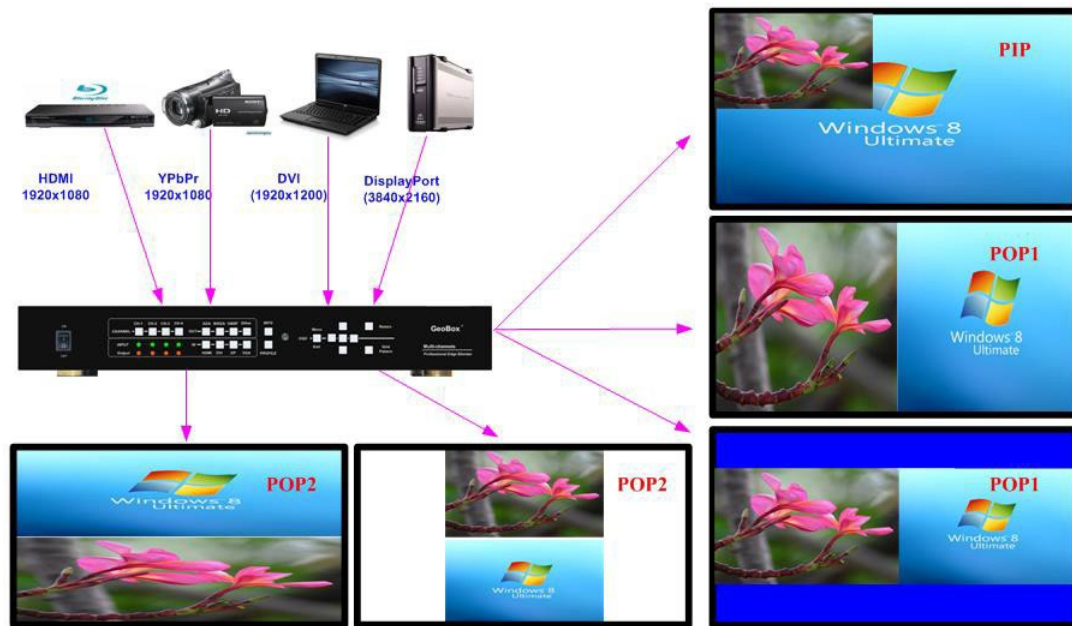
- Picture in Picture (PIP) function is to display up two images from one processing channel. The minimum size of sub-image is 320*180 Pixels and maximum size is 1920*1200 pixels.
- The location of the PIP image can be controlled by OSD menu at any location inside main image.
- The size of the PIP image is also flexible and can be controlled by OSD menu.
- User can display up to 8 contents in one M804Ex processor. Each sub-image can only be displayed inside the display range in each projector. When execute edge blending, please avoid to have sub-image in edge blending area.
- If PIP/POP image needs to be across entire screen, user needs to use the first processing channel as PIP/POP processor and output the image to HDMI port in next channel, then daisy chain connection to all processing channels. After edge blending, user can set PIP/POP across entire screen. Under this condition, the maximum system resolution will be limited to 2048x1080.
- If higher resolution in PIP/POP applications is required, user can install one G901 as front-end processor to provide 4k/2k output with PIP/POP functions across entire display system.



- Menus under [PIP setting]:
- Display: enable PIP or POP
 - Size: set PIP size
 - Position: set PIP position
 - Ratio: set PIP/POP display aspect ratio
 - Source: select input source for PIP/POP
 - Orientation: rotate sub-image direction
 - Overlap: adjust PIP image cropping area, position and aspect ratio.

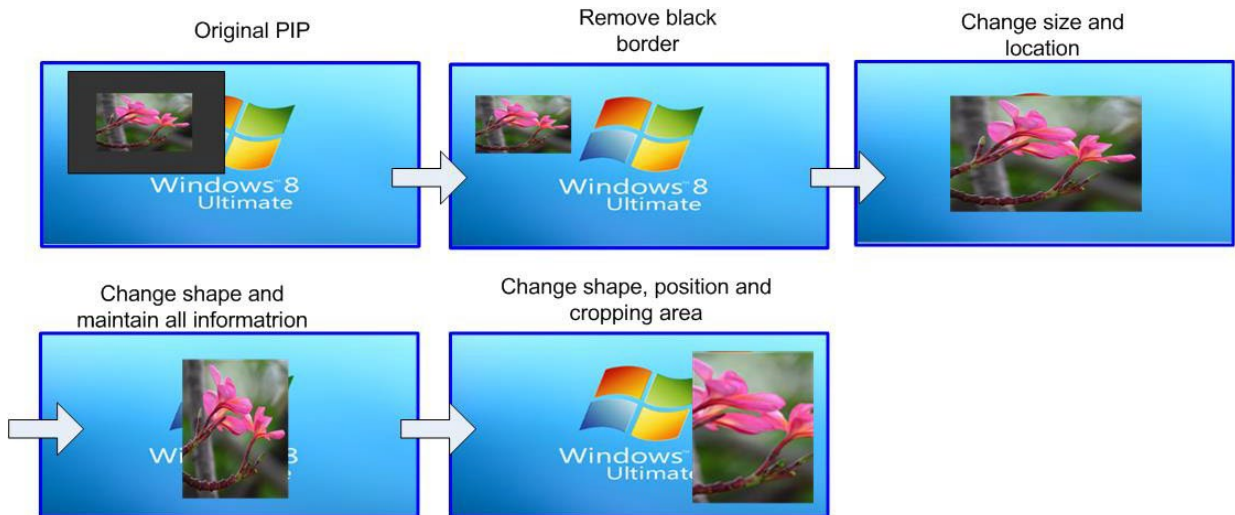
- **Display:** Under Display menu, there are four items:
 - ✓ Disable: disable PIP or POP function
 - ✓ PIP: select PIP (picture in picture) display function
 - ✓ POP1: POP mode at side by side display mode.

- ✓ POP2: POP mode at top/bottom display mode.



- Size: (Only apply to PIP function)
 - ✓ The size of the PIP image can be adjusted through [Size] OSD menu.
 - ✓ The minimum PIP size is 320*180 and maximum size of PIP image is 1920*1080 pixels.
 - ✓ PIP image can be displayed with full screen in the output. Further aspect ratio, image size or cropping area can be implemented through [Overlap] function under [PIP Settings] menu.
- Position: (only apply to PIP function)
 - ✓ The position of PIP image can be adjusted in H&V directions through Position OSD menu.
 - ✓ The PIP image will be maintained inside one projector and can't be outside main image.
 - ✓ Pixel by Pixel PIP image position adjustment.
 - ✓ Further position fine-tune can be executed from [Overlap] menu.
- Source:
 - ✓ The input source for PIP/POP is selectable. Main image can be selected from [Input Signal] under [Image Properties] menu or remote controller hot key. Sub-image shall be selected from [Source] under [PIP Setting] menu.
 - ✓ Only HDMI + DP, DP+VGA or HDMI+VGA can be selected as PIP/POP sources.
 - ✓ **No two HDMI input sources can be as main and sub-image sources at the same time unless user adds one HDMI to DP adapter to connect HDMI source from DP port.**
- **Ratio:** Set Aspect Ratio of sub-image in PIP/POP.
 - ✓ Full Screen: same aspect ratio as main image in PIP mode or full screen display in POP mode.
 - ✓ Original AR: the same aspect ratio as sub-image input source.
 - ✓ POP main image aspect ratio can be adjusted through [Scaling] under [Image Properties] OSD menu. Sub-image aspect ratio can be adjusted through [Ratio] menu under [PIP Setting] and [Overlap] function under [PIP Settings] menu.

- **Overlap:** adjust cropping area and aspect ratio of PIP image
 - ✓ User can execute further image cropping and aspect ratio change in PIP/POP image.
 - ✓ After further Overlap adjustment, user can further enlarge PIP image range from 180*90 pixels up to WUXGA resolution. User can also adjust image size in POP mode.



- **[Orientation] for PIP/POP**

- ✓ When PIP/POP is implemented, main image and sub-image can't be rotated at 90/270 degrees. Only 180 degrees rotation or RH/LH image flip and UP/Down flip function can be executed. Both main and PIP image will go through high end 3D motion de-interlacing.
- ✓ Main image rotation shall be executed from [Orientation] under [Image Properties] menu and Sub-image rotation shall be executed from [Orientation] under [PIP setting] menu.
- ✓ Main and sub-image can be rotated at different directions.
- ✓ When main image is 90/270 degrees rotated and user executes PIP/POP function, main image will be returned to normal display direction. Image 180 degrees rotation or flip can still be executed without change.

3. Projection mapping

3.1. Introduction

Projection mapping function is embedded in M800Ex models. User can input up to 10 patterns (images) to each M800Ex unit, then implement projection mapping. The pattern can be applied to all channels at the same time. Each channel can select different pattern to display separately. The pattern needs to be 2-bit monochrome or 256-color with BMP file format and uploaded by Gwarp3 PC tool. User can apply any signal source and select up to 4 display styles with editable background color for each pattern. User can use any signal source and content and no need to do pre-mask in signal source.

3.2. Applicable models

M801Ex (single channel), M802Ex (dual channels), M803Ex (3 channels), M804Ex (4 channels)

3.3. Flexible display styles

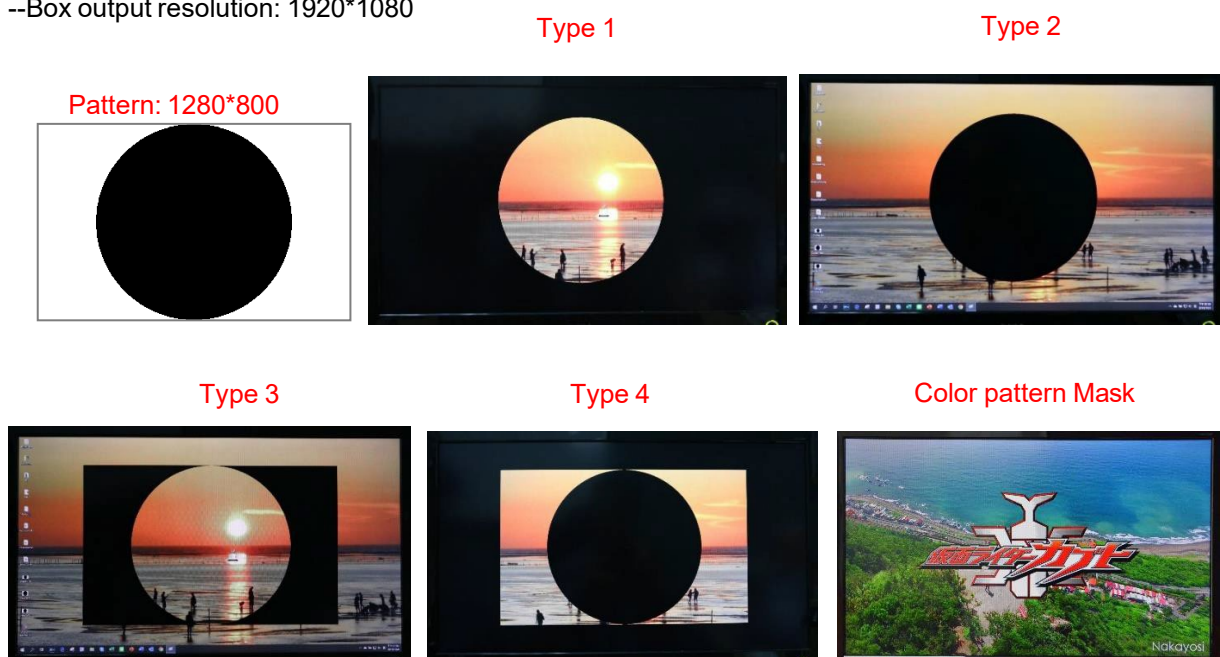
If the pattern resolution is less than output resolution, user has below display choices:

- Type 1: The content will display on black color area in the pattern.
- Type 2: The content will display on white color area in the pattern.
- Type 3: Show source image at black pattern area and all area outside the pattern.
- Type 4: Reverse display with Type 3.
- Type 5: The color in masked area can be changed to all kind of colors (RGB 256)
- Type 6: Color pattern Overlap. Only one 256-color pattern is allowed.

Below are examples for a circle pattern digital mapping.

--Pattern size: 1280*800

--Box output resolution: 1920*1080



3.4. Executive summary for projection mapping with Gwarp3 PC Tool

1. Load pattern from PC: click [Load Image]. It will be stored in warping processor
2. [Preview] is to combine all mapping settings (pattern + position + mask style + background color) together and store the mapping pattern to Gwarp3 and display mapping result on the screen.
3. Save pattern to Box: [Load Image]→ [Preview]→ select [Mode #] → click [Save]. [Preview] is a must process before SAVE to Box. Only 1x 256-color Pattern is allowed and must be SAVE to Mode #10.
4. Delete saved patterns from the Box: Select Mode # → click [Delete]
5. Recall pattern from Box: Select Mode # → [Read]. The pattern will show on [Preview Window] (17).
6. Assign SAVED pattern to each channel: select Channel→ Mode # →click [Set]. Only the patterns saved in the Box can be [Set] (assigned) to each channel.
7. Temporarily disable mapping result or Preview result from the screen: select Channel #→ Click [Clean]. [Clean] only temporarily clean the image on the screen. It will not change the pattern SET to each channel. When reboot the system, the mapping pattern SET to each channel will show up again.
8. If user wants to turn off mapping pattern in selected channel permanently, there are 3 ways to do it:
 - a. [Digi Mapping]→ Select Mode [Off] or select [Empty Mode #]→ click [SET].
 - b. Go to [Mask] tab in Gwarp3, select Mode [Off]→ click [Set]→ Done.
 - c. Open OSD menu. [Anyplace]→ [Mapping]→ [Off]
9. To SAVE mapping result in all channels: [System]→ [Save Profile]. Remote control [Save]→ #1-5.
10. To LOAD mapping result in all channels: [System]→ [Load Profile]. Remote control [Profile]→ #1-5.
11. [Save Setting] to PC:
 - a. it will save current Pattern (not all) & mapping result in selected channel while select file type as [Single channel setting]. The file extension name is SBF.
 - b. It will save all the Patterns saved in Mode # while select [Warp BOX setting]. The file extension name is WBF. User can copy mapping setting to other M800Ex.
12. Load Setting from PC: The time to load settings to PC is related to the pattern number and file size. It may take up to 3 minutes. After Load Back the settings from PC, PC tool will show up and locate at [Warp Adjust] tab. If user wants to see Projection Mapping result, user needs to click [Digi Mapping] tab again.
13. [All Reset] under [System] tab is the same function as OSD menu: [Options]→[Reset] →[Reset All] to reset the setting in each channel. It will not erase SAVED Patterns or Profile Index data in the Box.
14. [Do factory reset] under [System] tab is the same function as to insert pin into RESET hole on back panel for 5 seconds. It will erase Profile Index data and all the SAVED patterns. User needs to reconnect Gwarp3 for further operation.
15. Change mapping style, position and background color: User can change mapping style, position and color for any Pattern showed in [Preview Window] (17) after [Load Image] or [Read] back from SAVED patterns. After execute any change, user needs to click [Preview] before click [Save].
16. When Power Off/On Box, the mapping settings will remain the same but Preview pattern will be disabled. User will see the mapping result SET to each channel.

3.5. Time duration for Gwarp3 projection mapping operation

The operation time in Gwarp3 for color pattern is different from monochrome pattern. Below is the summary for the time during between monochrome pattern and 256-color pattern. The actual time will vary under different PC system, pattern number and file size. The time in below table is under below conditions:

- 5x monochrome pattern with resolution around 1280*800.
- 1x 256-color pattern with 1237*646 resolution, size: BMP 783kB (800KB after Gwarp3 compression)

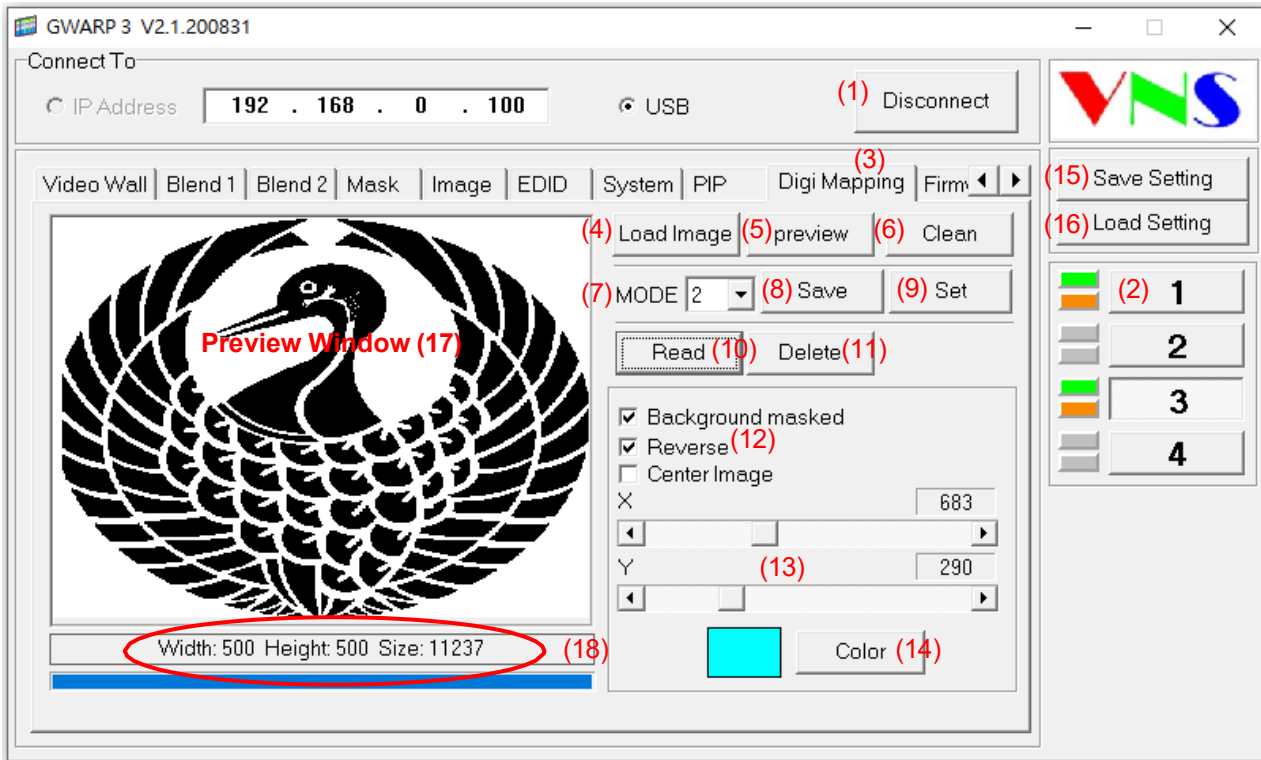
Functions	Only 5x monochrome pattern (Seconds)	With one more 256-color pattern (Seconds)
M804Ex MCU update	12"	12"
M804Ex FW update	175"	175"
Gwarp3 connection via USB	5"	40"
LOAD pattern	1-2"	1-2"
PREVIEW pattern	2-3"	22"
SAVE to Mode #	4"	47"
SET pattern to each channel	2"	17"
READ pattern from Mode #	1-2"	35"
SAVE SETTING to PC (WBF)	1-2"	1-2"
LOAD SETTING from PC (WBF)	2'11"	3'20"
All Reset	30"	62"
Select Mode # via OSD	2"	17"



This is the color pattern we used.
The green background color is deleted when it is loaded to Gwarp3. User can use Edge (<http://takabosoft.com/edge>) to do 256-color pattern editing and assign background color as "0" (not show).

3.6. PC Tool for Projection Mapping—Gwarp3

Gwarp3 is standard PC tool for edge blending processor as well as for Projection Mapping. It can be operated through USB or Ethernet. Please use Gwarp3 V2.1.200907 version or after to get full projection mapping function.



The item # in below represents the function # in Gwarp3 in above operation window.

- (1) Button to Connect Gwarp3 with Box. (please select connection type: USB or Ethernet)
- (2) After Gwarp3 connected with Box, user will see the status of system connection. [Green] represents output connection with projector and [Orange] represents input connection with signal source. Please select the channel that user plans to implement digital mapping.
- (3) [Digi Mapping]: This icon will show up if the Box can support Digital Mapping function. After click [Digi Mapping], user will see Digital Mapping operation window as above.
- (4) [Load Image]: To load the image (Pattern) from PC into Gwarp3. Select image File → Load the file → Image show up in Preview Window (17). It will also show the pattern resolution and file size after compression (18). The pattern file type shall be BMP. Maximum pattern resolution is limited to 2400x1200 and file size after compressed by Gwarp3 shall be less than 232k in monochrome pattern or 2M in 256-color pattern. This file size is not the same as actual file size in PC. It is related to the complexity of the image.
- (5) [Preview]: [Preview] will execute all the changes in (12) to (14) and preview the final result on the screen. **Click [Preview] is required before to save the pattern to selected Mode #.** The pattern showed

-
- in Preview Window (17) is stored in Gwarp3 temporarily. User can SAVE it into the Box through [Preview]→[Save]. When power off the Box, Preview pattern will be erase.
- (6) [Clean]: To turn off the mapping pattern on the display. It will not delete the patterns saved in the Box or turn off the pattern in “Preview Window”.
- (7) [Mode]: To select location for pattern storage. Color pattern can only be saved to Mode #10 and only one pattern is allowed. After click [Preview], user can select Mode # and click [Save] to store the pattern into selected Mode # inside the Box.
- (8) [Save]: Save pattern to select Mode #.
- The result will be saved to M800Ex in OSD [Anyplace]→[Mapping]→[Mode #] that can be applied to all channels.
 - If the pattern is 256-color pattern, it can only be saved to Mode #10.
 - Before click [Save], user needs to click Preview.**
- (9) [Set]: to upload select Mode # pattern to selected channel: [Select CH]→[Select Mode #]→[Set]
- It will upload the patten in selected Mode # but not the pattern in [Preview Window].
 - The pattern showed in “Preview Window” (17) can be further edited and [Save] to selected Mode # after execute [Preview] process. Then user can [Set] to each channel.
 - User can also Preview the Pattern under [Mask] tab and [Set] (assign) to each channel.
 - If user wants to turn off mapping pattern in selected channel permanently, there are three ways to do it:
 - [Digi Mapping]→ Select Mode [Off] or select [Empty Mode #]→ click SET.
 - Go to [Mask] tab in Gwarp3, select Mode [Off]→ click [Set]→ Done.
 - Open OSD menu. [Anyplace]→[Mapping]→[Off]
- (10) [Read]: to read back the pattern stored inside each Mode # so that user can see the actual pattern stored in each Mode #. After READ, user can select channel and click [Set] to assign the pattern to selected channel directly or click [Preview] to show the result on the screen. User can do further editing to the READ pattern, then click [Preview]→[Save] to store the result to selected Mode #.
- (11)[Delete]: To erase the saved pattern from select Mode #. The pattern is still kept by Gwarp3, if user can see it in [Preview Window]. User can SAVE it again through: [Preview]→[Select Mode #]→[Save]
- (12) Display type selection:
- [Background masked]: The background of the screen will be masked with selected color (14) and only source image showed on the black area of the pattern which user uploads.
 - [Reverse]: [V]: The source image will be showed on white color area of the pattern.

[]: The source image will be showed on black area of the pattern.
 - [Center Image]: to show the mapping pattern at the center of output image. If user CHECK [Center Image], then click [Preview], the pattern will show at the center of the screen. User can still do further position adjustment without closing CHECK in [Center Image].
 - The mapping pattern from both [Load Image] or [Read] which is showed in Preview Window (17) can be further edited.

-
- e. 256-color Pattern Position can be changed but the display styles and background color can't be edited.
- (13) Position setting: User can adjust mapping pattern position through slide bar in X&Y directions. If the pattern resolution is the same as GeoBox output resolution, the pattern position can't be changed. Position shift is not real time. User need to click [Preview] to see the result.
 - (14) [Color]: user can change the color of the masked area and background. User can combine [Display Type selection] to create different color effect on the mapping result. User can't change Color in 256-color pattern from Gwarp3.
 - (15) [Save Setting] to PC: it will save current Pattern & mapping result in selected channel while select file type as [Single channel setting]. The file extension name is SBF. It will save all the Patterns saved in Mode # while select [Warp BOX setting]. The file extension name is WBF. User can copy mapping setting to other M800Ex.
 - (16) [Load Setting] from PC: The time to save settings to PC is depended on the pattern number and file size. It many take to more than 3 minutes. After Load Back the settings from PC, Gwarp3 will show up at [Warp Adjust] tab. If user wants to see Projection Mapping result, user needs to click [Digi Mapping] tab again. When user uses [Warp Adjust] function, [Digital Mapping] function will be turned off to show up full OSD.
 - (17) [Preview Window]: This area will show up the pattern uploaded through [Load Image] or [Read] from the Box. User can click [Preview] to show mapping result on the screen. If user wants to save the pattern from [Preview Window], user needs to execute [Preview], then selects Mode # and click [Save] to save it into the Box. The pattern [Read] from the box can be [Set] (assigned) to selected channel directly without going through [Preview] process.

3.7. **How to prepare the pattern (image) for projection mapping**

a. **File resolution**

The maximum pattern (image) resolution should be under 2400x1200 or under GeoBox output resolution. Otherwise the location will be not correct. If image resolution is lower than output resolution, the image border will be inside the screen. User can create more display style on the screen.

b. **File size**

The file size in actual image in PC is not the same as the file size after compressed by Gwarp3. It will be related to the pattern complexity. Maximum file size after compressed by Gwarp3 shall be less than 232k in mono chrome pattern or 2M in 256-color pattern. User can check resolution and file size at the bottom of Digital Mapping operation Window (18).

The file upload time will vary based on the complexity of the file. It may take few minutes. When user switches to different mapping Mode, the switching time will also be different based on the file size and complexity.

c. **File format**

The file format must be BMP with monochrome 2-bit image or 256-color. User can convert the image format through Windows [Paint] PC software. 256-color is not the same as RGB 8-bit color.

d. PC Tool for file size / format conversion

Windows [Paint] can be a suitable software for projection mapping pattern editing. User can do editing, change file size and convert into monochrome BMP file. For 256-color overlapped pattern, user can use EDGE as editing tool: <http://takabosoft.com/edge>

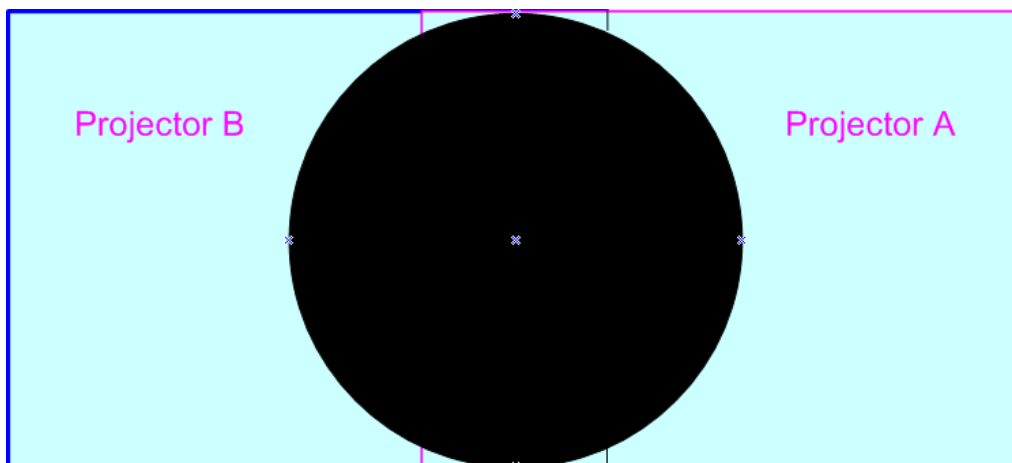
e. **Projection on object**

If user wants to project image on the surface of a building, user can stand at the point where the projector will be installed and takes monochrome photo, then crop the area for the projection and modify it into required pattern with necessary resolution.

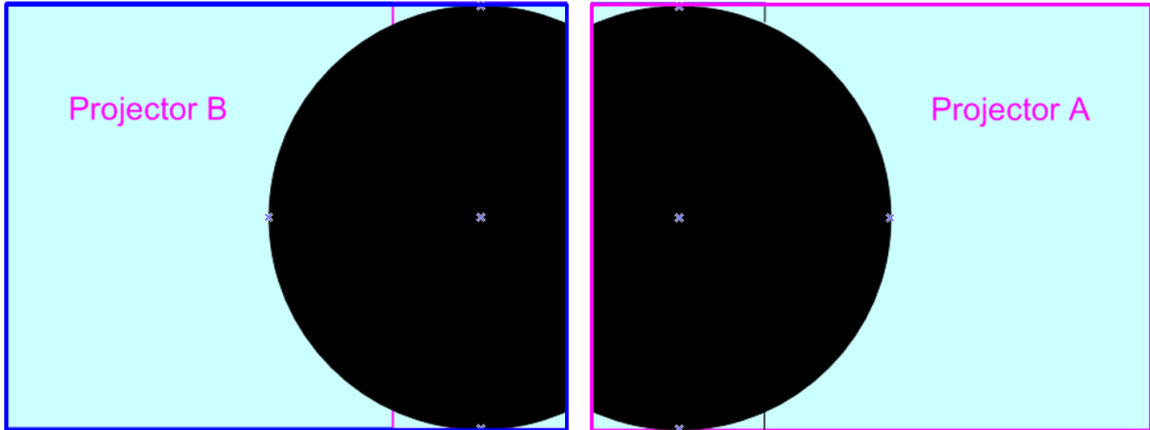
f. **Multiple unit cascade or edge blending application**

Digital mapping and edge blending or video wall setting are independent. If one project requires edge blending plus digital mapping, user can execute edge blending as normal operation, then apply mapping pattern to each projector.

- a. User needs to do projection mapping plan in advance. The pattern should cover the entire required display area. Based on the edge blending plan, each projector will cover some portion of the entire image and also some portion of the mapping pattern. User needs to create the mapping pattern for each projector separately, then fine-tune the pattern location through geometry alignment and Position shift (13) function. The position shift can be based on pixel by pixel and is not real time. User needs to click [Preview] to confirm the result on the screen.
- b. Below is example for dual projector edge blending system with round pattern at the center.
 - Requirement: two projector edge blending with one round pattern masked at the center.



- Cut the pattern into two portions based on the final location after edge blending



- To execute edge blending based on the planned location and fine-tune mapping pattern location will create perfect masked pattern at the center of the image.

3.8. How to apply multiple mapping patterns in one project

1. The patterns for projection mapping are switchable.

There are 10 patterns can be stored inside each M800Ex. User can seamlessly switch from one pattern to another pattern.

2. Method for the switching

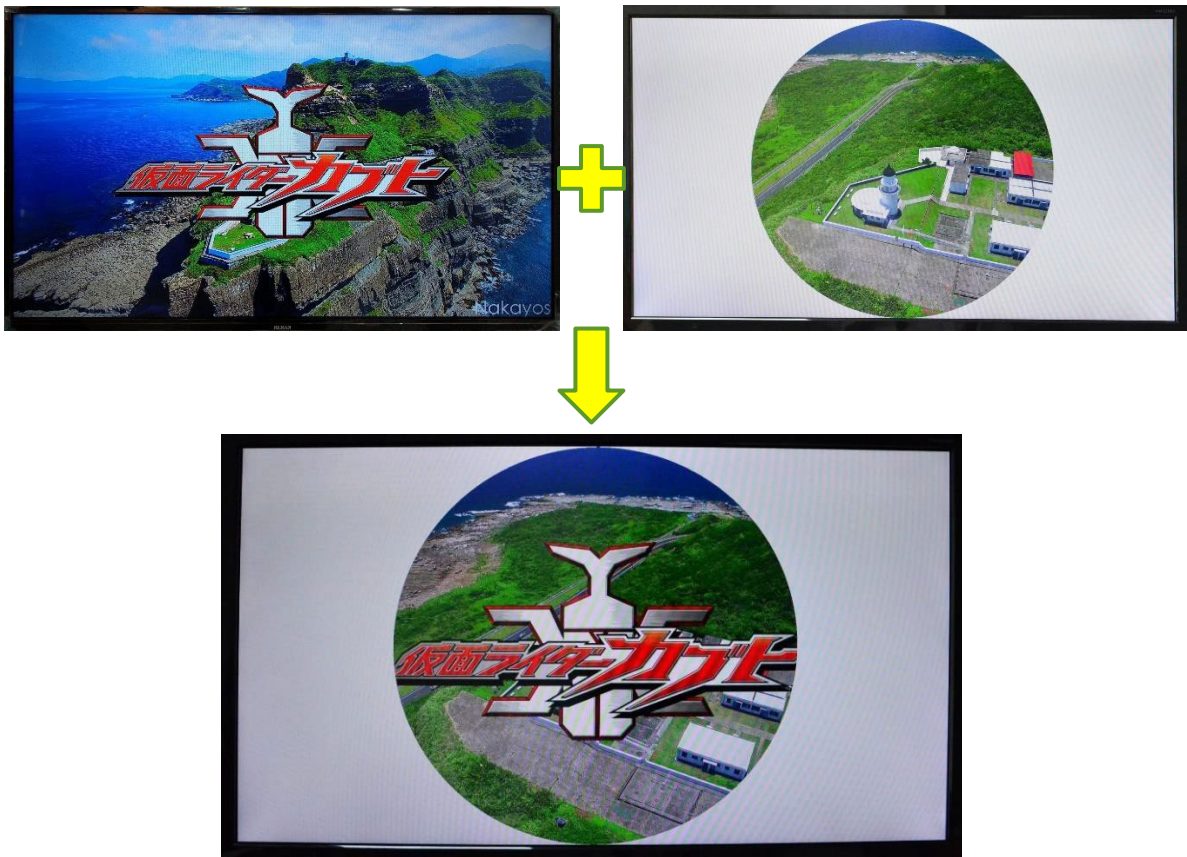
User can use Gwarp3 PC tool to switch among different patterns. RS232 command is available for the switching. User can preset the time interval among patterns and looping playback. Please pay attention to the switching time difference among different patterns. If the pattern file size is bigger or more complexity, the time will be longer. User needs to take this into calculation for switching time. 256-color pattern may take few minutes for the switching time.

3.9. Application examples

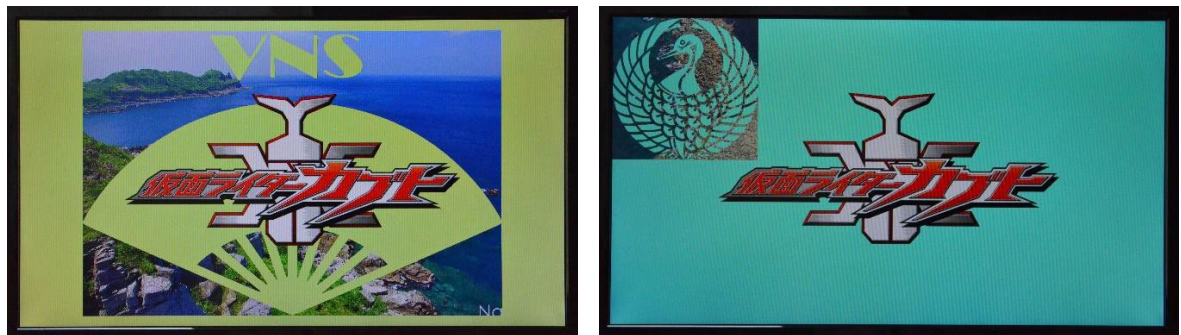
Different display styles



Combination from two channels



Another combination examples



Different background color



Other application examples



Reference YouTube video

https://youtu.be/19lUXV6_Zrw https://youtu.be/JnKbTVWu_8s

3.10. Limitations in projection mapping

1. When implement projection mapping function, Edge Mask function through 8 control points in M800Ex will be disabled. Mask and Mapping share the same image layer. User can only select one from [Mask] and [Mapping].
2. OSD will be blinded when the OSD is located at the same location as masked area. User needs to turn off projection mapping to get full OSD. Please see more details in Page 5, section (9)-d.
3. When user click [Warp Adjust] tag, mapping result will be temporarily disabled. Please click [Digi Mapping] again to show up mapping result.
4. When Load setting from PC, please click [Digi Mapping] tab or select [Mode #] through OSD menu to enable projection mapping display.

3.11. Operation through remote controller & OSD

- After upload the pattern from Gwarp3, user can save up to 10 patterns in each Box. It will be saved into Mode 1 to Mode 10. User can select display mode or turn off projection mapping by remote controller.
- The OSD will be under projection mapping and may not be seen. Under this case, user need to select display pattern through Gwarp3 PC tool.



3.12. Image [Shift], Edge [Mask] vs projection [Mapping]

- [Shift] can do edge mask following the curve of geometry alignment. Edge mask can only mask the area from the edge but projection mapping can mask every location inside the image.
- [Shift] function is independent function and is nothing to do with [Mask] and [Mapping].
- **User can only select either [Mask] or [Mapping] functions each time. The system will disable previous function automatically and only keep the later function that is in operation. Image [Shift] result is not affected.**

4. Projection plan and Preparation for Edge Blending

4.1. Determine source signal resolution

- The image size and watching distance are two major factors to determine source signal resolution and number of the projectors.
- If the screen size is 20m and the watching distance is 5m, the signal pixel pitch should be around 5mm (around 1mm for 1 meter watching distance). The system resolution is about $20\text{m}/5\text{mm}=4000$. It means the system resolution should be around 4000 pixels in width and the vertical resolution should follow the projector native resolution. If 1080p projector is used, the ideal system vertical resolution is 1080.

-
- After determine the system resolution, please make sure all the equipment in the signal pipe line should be able to support this resolution or higher. It includes signal source output, edge blending processor and the total resolution of the projectors after edge blending.
 - If user uses 8x XGA projector with 250 overlapped pixels, the total projector resolution after edge blending will be $1024*8-250*7=6442$ pixels. It means it is enough to use XGA resolution projectors in this 20m screen case. If user uses FHD or WUXGA high end projectors with watching distance at 5m, the final video quality will be very similar as XGA projector under 4k signal source at 5m watching distance but will be better at less than 5m watching distance.
 - We can provide free service to help customers to make project plan, including system configuration, type of projector, signal source and installation data.

4.2. Determine overlap region size and pixels

- During Excel Spread Sheet calculation, user has some flexibility to determine the overlap region size by different projector resolution, lumens, image size and number of projectors.
- The most common overlap region is about 20% to 40% based on single projector native resolution. For 1024*768 projector, the overlap range is $1024*20\%-1024*40\%=205\sim 409$ pixels. GeoBox test pattern default size is 32x32 pixels. Therefore, the final result will be around 7 grids (224 pixels) to 13 grids (416 pixels) for XGA projector and 12 grids (384 pixels) ~ 24 grids (768 pixels) for 1080p & WUXGA projectors. If the projector has accurate color and gamma curve, the overlapped pixel can be lower to 5 grids (160 pixels) in XGA projector. The actual pixel number should be determined based on the required screen size and the projector model used. Under the same screen width, if higher image is required, then the overlap region will be also increased.
- If the overlap pixels are increased, the image height will be also bigger. User can simulate with different overlap pixels (multiples of 32) to get a result that the image height is bigger than required image height with reasonable overlap region dimension between 50cm to 120cm in overlap region. Reasonable overlap region will be easier for overlap color control.
- GeoBox maximum edge blend range is H=1920 pixels, V=1200 pixels. The black level compensation range is 900 pixels. If user requires black level uplift compensation and the overlap region is more than 900 pixels, please select the outside black level Block to execute black level uplift. The pixel number is based on native projection area without any adjustment from either projector or GeoBox. If necessary, user can adjust the overlap size through geometry alignment to decrease overlap size without changing projector location.
- Please note that user can change the grid pattern size from 8 to 120 pixels but not only 32 pixels.

4.3. Relation between Overlap pixels and geometry alignment accuracy

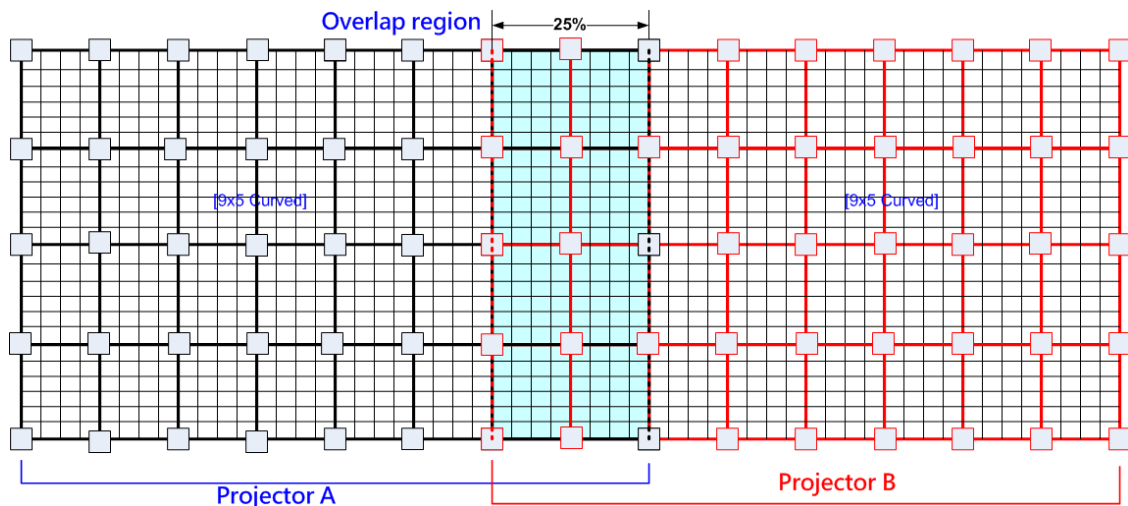
- Proper selection of Overlap pixels will affect the control points in geometry alignment. If the Overlap pixel is 25% of the projector native resolution (or GeoBox output resolution), it will have less geometry alignment points due to control points in adjacent projectors will be at the same

location. If the overlap pixel is not 25% of the projector native resolution, the control points will be at different positions. 37.5% overlap pixel will double the control points of the geometry alignment if compared with 25% overlap and have the best geometry alignment accuracy.

- [9x5 Curved] alignment will cut the horizontal image into 8 sections and the image in each section can be independently adjusted. In different output resolutions, there will be different pixel number in each section: XGA: $1024/8=128$, WXGA: $1280/8=160$, 1080p: $1920/8=240$. Usually, [9x5 Curved] alignment is enough for most of the curved screen edge blending.
- If the overlap area between two adjacent projectors has the same or multiple number as above, the geometry alignment control points in overlap region will be less. User can increase or decrease two or three grids (64 or 96 pixels) in overlap area to increase the control points in overlap region for more accurate alignment between adjacent projectors.
- Below figure is an example for [9x5 Curved] alignment in 1024 resolution:

✓ **25% overlap region:**

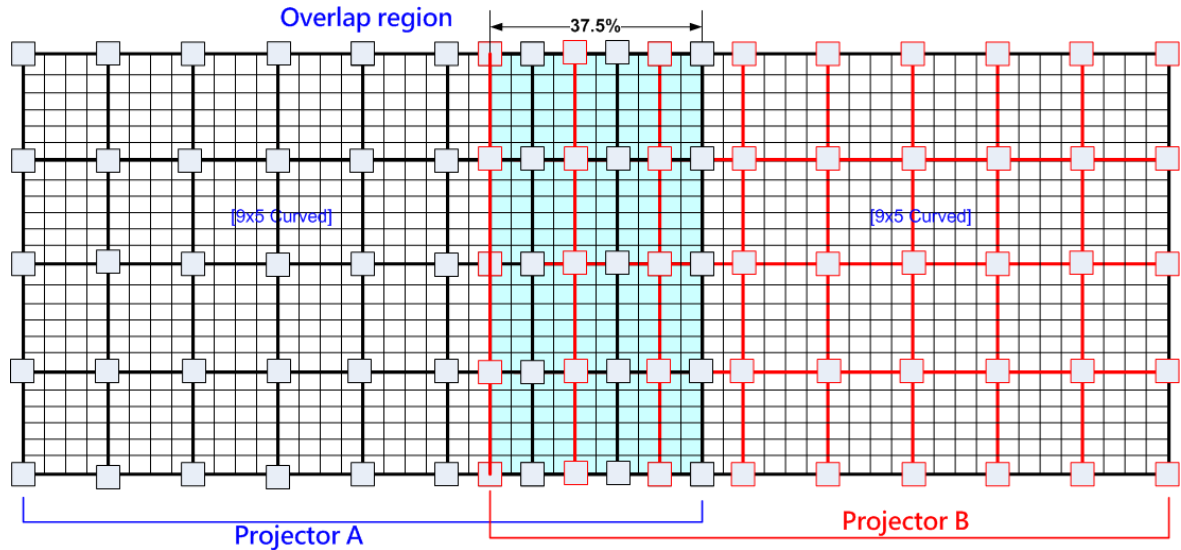
The adjusting points in projector A & B will be at the same position in overlap region



If the overlap is 256 pixels (25%) in XGA resolution, total adjusting points in overlap region are $3*5=15$. *The adjusting points in projector A & B will be at the same position in overlap region.* User will have less adjustment flexibility. If increasing two grids (64 pixels) to 320 overlap pixels, user can have 30 adjusting points to get more accurate geometry alignment. It can align the images from two projectors on curved screen with good quality by remote controller.

✓ **37.5% overlap region**

The adjusting points in projector A & B will be separated in 37.5% overlap region and increase geometry alignment accuracy.



✓ **Recommended overlap pixels in different output resolutions**

Below is the list for the accuracy of geometry adjustment in different overlap pixels:

GeoBox output resolution	1920*1080	1280*800	1024*768
Min. adjusting flexibility	256/480/704	320/480/640	256/384/512
Max. adjusting flexibility	352/608/832	224/256/384/416/544/576	192/320/448/576

4.4. Get installation data from GEOBOX Excel Spread Sheet

- GEOBOX can provide an Excel Spread Sheet for user to calculate necessary installation data for the project. It is important data for installation and setup.

Project basic data

Source resolution (H)	3840	Screen width	6.50 (m)
Source resolution (V)	800	Screen height	1.50 (m)
Projector resolu. (H)	1280	Projector lumen	3200 (Lum)
Projector resolu. (V)	800	Screen Aspect ratio	4.33 (required)

Overlap pixels (32 pixels per grid)	Overlap %	Recommended	
Overlap pixel (H)	256	20.0%	20%~40%
Overlap pixel (V)	0	0.0%	25%~40%

Recommended overlap region: Min. 50 cm width

Qty of projector (H)	3	Throw ratio (Min)	1.20
Qty of projector (V)	1	Throw ratio (Max)	1.70

Final output resolution

Horizontal resolution	3328
Vertical resolution	768
Extended pixel (H)	98
Extended pixel (V)	0

Video wall setting value

Position of projector (H)	1	2	3	4	5	6	7	8	9	10
LH edge overlap value	0	98	197	x	x	x	x	x	x	x
RH edge overlap value	197	98	0	x	x	x	x	x	x	x

Position of projector (V)	1	2	3	4	5	6	7	8	9	10
Top edge overlap value	0	x	x	x	x	x	x	x	x	x
BTM edge overlap value	0	x	x	x	x	x	x	x	x	x

Final result checking list (PJT: Projector)

Final Image size (meter)	Final Illuminance Lux (Lum/m ²)	Image size for each PJT			
Width	6.50	PJT lumen	3200	Width (m)	2.500
Height	1.56	Final Illumin	819	Height (m)	1.563

Overlap region size	Original aspect ratio	Projector throw distance			
Horiz. (m)	0.500	Projector	1.60	Min (m)	Max (m)
Vertic. (m)	0.000	Final result	4.16	3.00	4.25

* Final image height should be equal or larger than screen. User can shrink image to have the same image height as screen by GeoBox geometry adjustment.

* Standard luminance is 400-800 Lux for restaurant and big conference room, 1000-1500 Lux for trade show. 3D: 500 Lux (single projector)

- Below are assumptions for the above 3x projectors edge blending system Excel calculation.
 - ✓ Screen Size: 6.5m*1.5m with watching distance within 2m (pixel pitch less than 2mm)
 - ✓ Input signal resolution: 3840*800 (Pixel pitch is 6500mm/3840=1.7mm = 1.7m watching)

- distance, optimized vertical resolution is the same as projector native resolution: 800)
- ✓ Number of projectors: 3 projectors
 - ✓ Projector resolution and lumens. 1280*800 (native resolution), 3200 Lum
 - ✓ Overlap pixels and dimension. 8 grids=8*32= 256 pixels (50cm)
 - ✓ Projector throw ratio: 1.2-1.7 (based on projector spec)
- How to operate GEOBOX Excel Spread Sheet
- ✓ Input all the data in Yellow column, including Source Resolution, Projector Resolution (GeoBox output resolution), Screen size, Projector throw ratio, Projector Lumens, No. of projector and Overlap Pixels. User can try different configurations and select the most cost effective one with the image height a little higher than required.
 - ✓ User will get below data from the Spread Sheet.
 - Final image size for each projector is 250cm*1.56cm with Overlap region of 50cm in width.
 - The image height should be higher than the required one. User can shrink the vertical height to required dimensions through geometry alignment. The vertical adjustment range in each edge is 600 pixels.
 - Optimized content resolution: 3328*800 (This is the ideal resolution to set EDID). It is suggested to select the same vertical resolution (800) as projector native resolution to get the best result.
 - Installation distance: 3m-4.25m.
 - It is calculated from throw ratio and image wide for each projector. (2.5m*1.2=3m, 2.5m*1.7=4.25m)
 - The overlap value in Video Wall setting:
 - When user sets Video Wall Zoom, it will split the image equally for each projector. The projectors will be installed with some Overlap Pixels for edge blending. Therefore, Overlap Value is to crop more pixels for each section based on the Overlap size between two adjacent projectors.
 - LH Projector: select RH edge: +197 (to crop more 197 pixels for LH projector. These 197 pixels are based on source resolution.
 - Projector (Center): LH edge=+98, RH edge=+99 (total 197)
 - RH Projector: LH edge: +197
 - After finish setting, user can check the image, if some overlap area is blurred, user can increase or decrease Overlap Value with 1-2 pixels and select optimized one.
 - The final luminance is 819 Lux. It will be enough for inside room environment.
 - ✓ It is allowed to have different overlap pixel among projectors. "Irregular" Spread Sheet is required to calculate the data.
 - ✓ Please contact dealer or factory to get necessary assistance for the Spread Sheet.

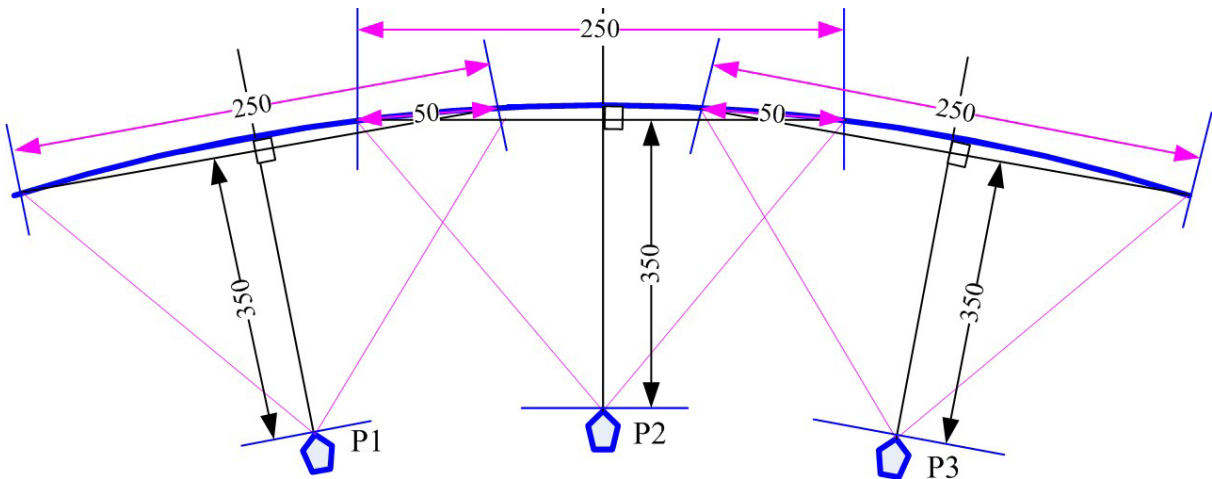
4.5. Apply Spread Sheet data for projector installation and GeoBox setting

4.5.1. Installation data from Spread Sheet from previous section:

- Image size for each projector: 250cm *156cm
- Overlap region: 50cm
- Installation distance based on throw ratio 1.1-1.7: between 300cm-425cm
- Installation height: install the projector at a position with minimum keystone at both vertical edges.

4.5.2. Mark projection region for each projector

- Based on the calculation data, user can easily determine the image location for each projector.
- Using laser Level tool and mark the locations for each projector with paper tape, including 4 borders and center line of the screen. The paper tape shall not damage the surface of the screen.



4.5.3. Installation the projector

- To install the projector at a location as showed above with the image just a little over required region at any point. Too large image will lose image resolution and brightness.
- Minimum keystone effect will optimize the image quality with less geometry alignment.
- The image height from the projector can be higher than required and user can draw down the image height through geometry alignment. The adjusting range is up to 1200 pixels in the top and bottom edges.



During the installation, Laser Level is a good tool to get correct horizontal and vertical line and make sure each projector can cover correct display

4.6. **Projector settings before edge blending**

- Please reset all projectors to factory default settings.
- Set to ceiling mount if necessary.
- Disable below items:
Auto keystone, auto aspect ratio, auto color compensation, auto source searching
- Select a display mode with gamma 2.2 or standard display mode. After edge blending, if user still sees some banding in overlap region, please select the best one from different display modes.
- If there is color deviation among projectors, please try to correct color difference through projector color adjusting function to let all color as close as possible.
- Enable [multiple projector display] mode if the projector has this setting.

4.7. **GeoBox settings before edge blending**

- Use small pin to insert into RESET hole on the back panel of GeoBox for 5 seconds to reset GeoBox to default setting. This [Reset] will apply to all channels at the same time.
- Select channel number, then select input port and output resolution in each channel separately.
- Set output resolution to be the same as projector native display resolution. Each channel shall set output resolution separately.
- Connect with a signal source to HDMI-1 in CH1, then connect loop out port to CH2 HDMI-3 via HDMI cable. If CH3 and CH4 are required, please connect the loop out port to HDMI-5 and HDMI-7 with HDMI cable to let all processing channel fed with the same signal source.
- The signal source for installation should be no less than 1080p.
- Check input/output LED indicators and make sure to have correct system connection.
- **User can set [Frame Sync] at [Disable] to eliminate [Source-Search] in projector during setup. After finish the setup, please set to [Normal] to get synchronization in all outputs.**

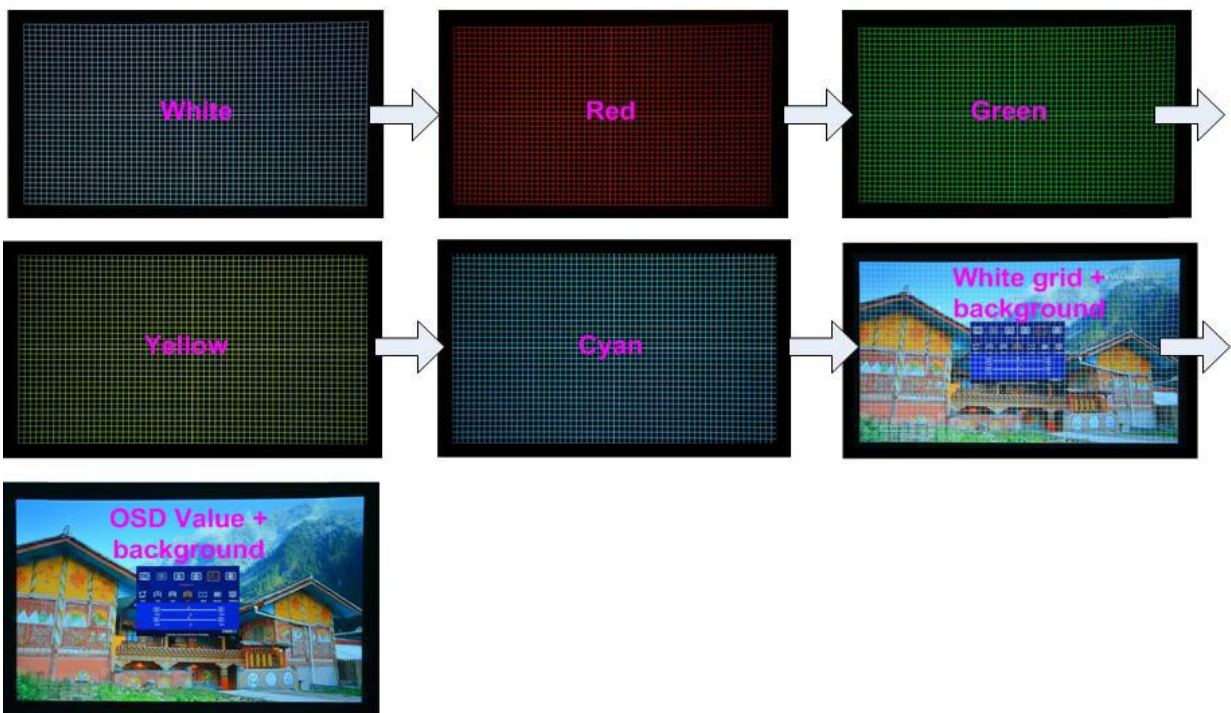
5. **Geometry alignment**

5.1. **Select Appropriate Grid Pattern for geometry alignment**

Grid pattern is required for geometry alignment. User can activate test pattern through [Pattern] hotkey in remote controller or through WebGui and Gwarp3 PC tool.

- The default grid size is 32*32 pixels. User can select different grid size from 8-120 pixels. Each channel can be set separately. In edge blending, the grid size in all channels shall be the same.
- The OSD show-up time can be determined by [Options]→ [Accessibility]→ [Menu Time Out]. If set at "0", the OSD will show up all the time unless input timing is changed or OSD [Exit].

- If user finds different grid size in different projectors, please check the grid pattern size, output timing setting and the aspect ratio settings in each projector. GeoBox needs to set at [Full Screen] display mode under [Image Properties]➔ [Scaling] menu.
- If user executes Geometry alignment, the pattern will appear automatically after select the adjusting point and press Enter.
- There are 6 pattern styles for user to select. When user presses [Pattern] key, it will circulate from [White]➔ [Red]➔ [Green]➔ [Yellow]➔ [Cyan]➔ [White grid + background]➔ [OSD menu + Background]
- If user wants to apply his own test pattern, please select the last transparent pattern mode to show up background user pattern.
- User can select different pattern color for each projector while doing edge blending setup.
- Note: some projector RGB pixels are not at the same location. It will cause position deviation. Please recheck with White grid pattern for final result.
- User can see geometry adjusting value when select [Background + OSD] display style.



5.2. Grid Pattern Pixel Size selection

- The pixel size in grid pattern for geometry alignment is selectable to meet special geometry alignment requirements. The grid size in both horizontal and vertical directions is from 8 to 120 pixels with 1-pixel increasement. H&V grid size will be the same. User can select grid size under [Edge Blend] menu.
- Default grid size for both H&V directions are 32x32.

- If 120 pixels grid size is selected, the grid pattern will be at the same position as 17x17 geometry adjustment control points. If 30/60 pixels grid size is selected, the grid pattern will also have some points that will match 17x17 control points. It will be convenient for some special application.
- In order to get optimized result in video wall [Overlap] value, user can use GEOBOX Excel Spread Sheet and apply an overlap pixel in the Spread Sheet to get a near integrate number in Video Wall [Overlap] value, then select the grid size to match this overlap pixel.
- In low resolution projector with low overlap grid number, user can select a grid size to maximized the overlap region to improve edge blending quality. For example, when the overlap pixel is only 186 pixels, if user selects 32x32 pixels as grid size, then user needs to reduce the grid size to only 160 pixels (5 grids) to let the grids from adjacent projector to stack together. If user selects a grid size of 31x31, then user can keep 186 pixels (6 grids) as overlap pixels.

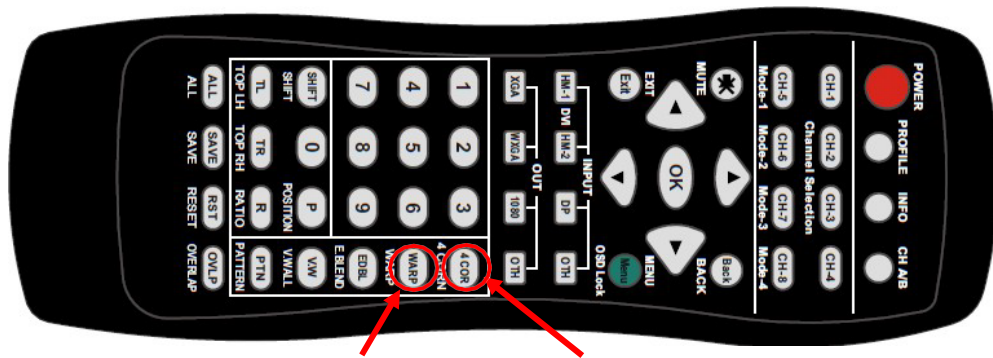


Below is the OSD menu for the selection of grid size.



5.3. Geometry alignment

Geometry alignment is to align the image position to let the projection image match the screen and also let image grids between two adjacent projectors be matched together. This step will take most of the time for edge blending. User can execute geometry alignment through remote controller, Gwarp3 PC tool or WebGui through Ethernet connection.



[3x3], [5x3], [9x5] Warp hotkey [2x2] Corner adjustment hotkey

5.3.1. Geometry alignment through remote controller

- Please be familiar with OSD operation from remote controller, including activating grid pattern, channel switching and hot keys for [4 Corner], [Warp], [Video Wall], [Edge Blend], [Pattern] and [INFO].
- [OSD Time Out] is default to "0". It will ensure the OSD and grid pattern will not be turned off automatically. Input timing change will disable OSD and exit from grid pattern.
- User can install IR extender receiver near screen for easy GeoBox operation (Please add audio extending cable to extend the distance up to 20 meters). If multiple units of GeoBox are used and IR receivers are put together, please set [Box ID] for each GeoBox so that user can control each GeoBox separately through [85x] command.
- Each channel should execute geometry, video wall setting and edge blending setting separately.

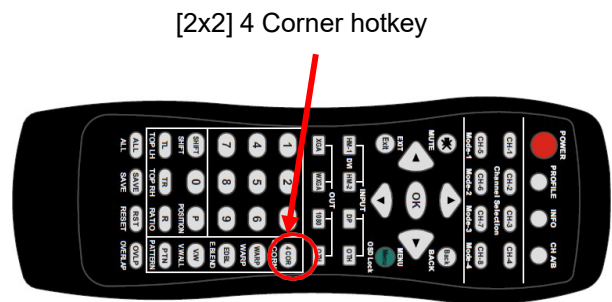
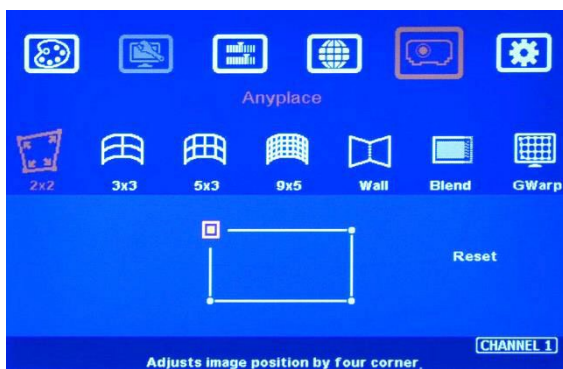
5.3.2. Activate Grid Pattern

- Use channel selection keys and [Pattern] hotkey to show grid patterns in all projectors. Press [Pattern] key again will change grid color. To set two different pattern colors in adjacent projectors will be more convenient during geometry alignment.
- If user finds the grid size between adjacent projectors is different. Some possibilities:

- The projection image sizes between two projectors are different (Zoom setting or projection distance is different).
 - Output resolution settings are not the same.
 - Projector aspect ratio setting is different.
 - GeoBox is set at [Original AR]. It shall be [Full Screen].
 - Set different grid pattern size in each channel.
- If user doesn't use GEOBOX Excel Spread Sheet to calculate the image size in each projector, please try to set the same projection height prior to geometry adjustment. In this case, the image width and overlap grid size for all projectors will be similar and is easy for geometry alignment.

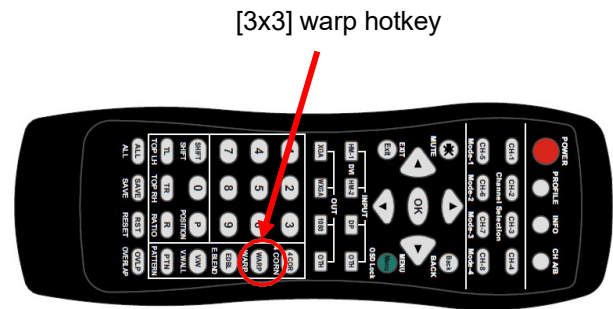
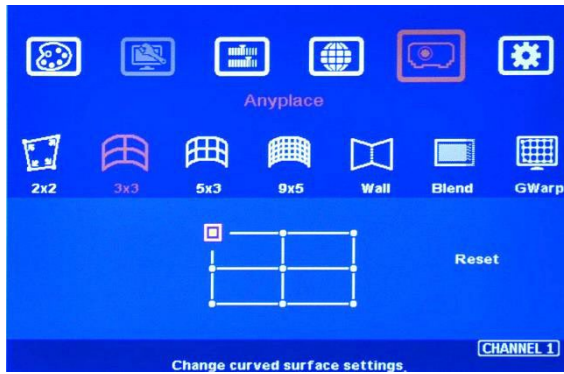
5.3.3. [2x2] 4 corner geometry alignment

- No need to do keystone correction in the projectors before geometry alignment unless the image has too big distortion and GeoBox can't cover the alignment range.
- [2x2] alignment will adjust whole image with the same scaling factor. [Warp] alignment will adjust only some portions of the image.
- Please follow the sequence [2x2]➔ [3x3]➔ [5x3]➔ [9x5] to do geometry alignment to ensure entire image will have uniform scaling factor.
- Apply [2X2] Corner geometry alignment and draw the corners to pre-marked locations.
- If no pre-marked location, please use [2x2] alignment to let the image in each projector with the same horizontal position and also let the vertical borders without keystone.
- Measure the image size in each projector, to reduce the size of the larger image and let adjacent projectors have similar grid size and grid number in overlap area.
- If the screen is curved, it is possible to have some image inside or outside the screen after 2x2 adjustment. However, it doesn't matter once the image covers entire screen before 4 corner adjustment. [Warp] alignment will adjust the image position back to required position.

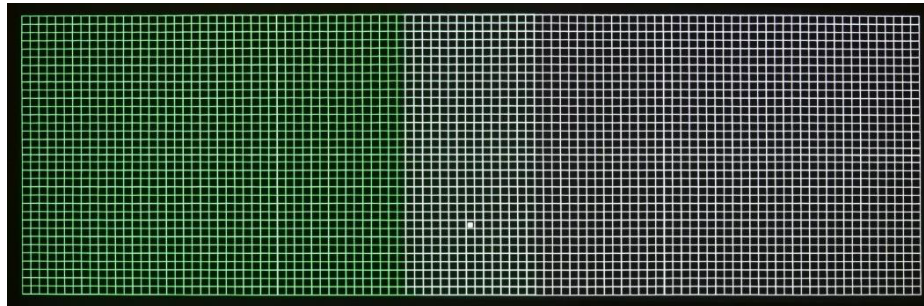


5.3.4. [3x3], [5x3], [9x5] Warp alignment

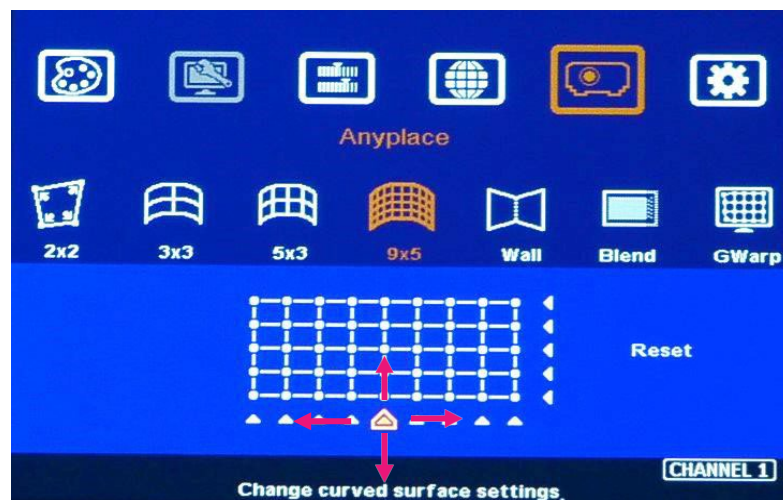
- After finish [2x2] corner alignment, apply [3x3 Curved] geometry alignment to let 9 adjusting points be located at the required position including four corners, edge center points and center line position.



- Please use [5X3] & [9x5] for further geometry alignment and let all the grids in overlap area with good grid stacking from two projectors.
- For curved screen, if there will be some difference in the grid size in adjacent projectors, user can use Linearity Grid Line adjustment (in next section) to adjust the grid size and finish the image position fine tune within shorter time.
- After finish Warp alignment, user can use [2x2] for complete image position fine tune without changing the Warp result. If user executes [3x3] alignment again after [9x5] alignment, [9x5] grid position will be reset and only keep [3x3] grid point information.
- In ideal condition, all grids in edge blending area between two adjacent projectors shall be aligned together. In some special case, the vertical lines in edge blending area have some gap and can't match 100%. Please try to align the grids near center of overlap region with good stacking. It allows small image shift in both sides of the overlap region because edge blending will reduce the effect of the mis-alignment in side borders. User can also adjust [Overlap] value in video wall settings to compensate this deviation and keep reasonable image quality.
- After the above processes, if the grid pattern in edge blending area still can't stack together, user can reduce one or two overlap grids from adjacent projectors to separate the adjusting points in each projector and get more accurate geometry alignment result. If the result is still not good, please use [Gwarp3] PC tool to apply 17x17 grid point adjustment. The adjusting result in remote controller can be further adjusted through Gwarp3 PC tool directly.
- Geometry alignment range from remote controller can be up to 600 pixels in [2x2] + 600 pixels more in [3x3] for one corner/edge.
- If geometry alignment range is too big, please adjust projector installation position or use projector geometry alignment function to cover some adjustment.
- Ultra-short throw ratio projector is not suitable for curved screen display due to big image distortion. Once user can execute geometry alignment to required position, the image quality will be reduced, especially in the Text mode.
- After geometry alignment, all the grid patterns in overlap region should be stacked together.

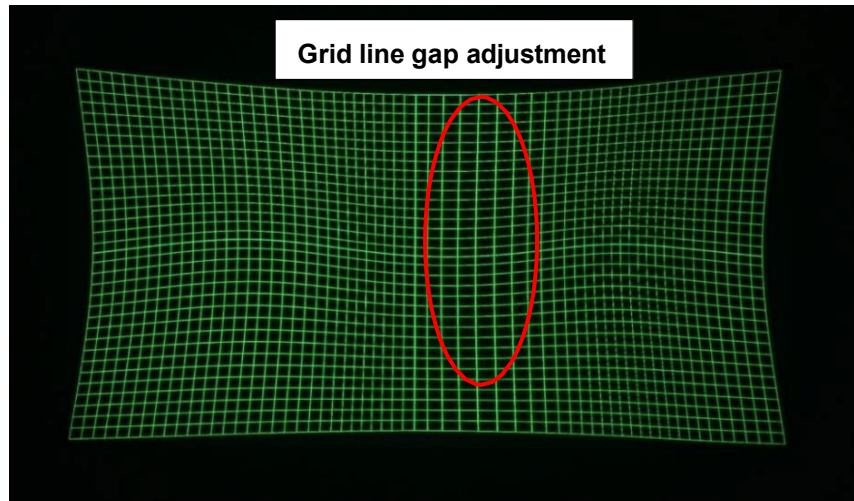


5.3.5. Linearity grid line adjustment



The control point can shift grid lines in both horizontal and vertical directions.

- Linearity grid line adjustment is under [3x3], [5x3] & [9x5] warp alignment menu. User can select the control point, then press ENTER to do grid line adjustment. Each control point can shift the image in both horizontal and vertical directions.
- When user projects the image to curved screen, the image grid size will continuously change—the grid size at the center will be bigger than both sides. Ultra-short throw projector will be more serious. Linearity grid line adjustment is designed to correct this kind of grid line gap difference.
- Linearity Grid Line adjustment can shift both horizontal and vertical grid lines. The maximum adjusting points in OSD menu is H=9, V=5. For [3x3], the adjusting range is +_600 pixels in each direction. This function is not available in Gwarp3 PC tool.
- This function can co-work with Warp and Edge Blending function.

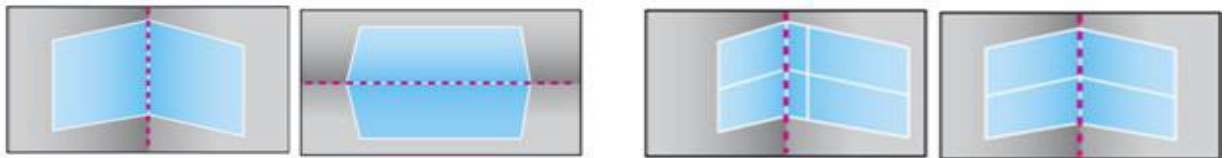


5.3.6. Corner Wall geometry adjustment

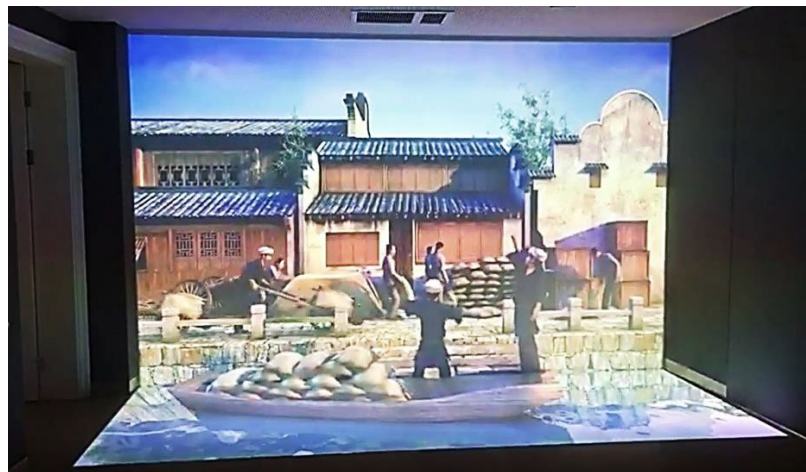
Important note: When apply Corner Wall function, all the other geomtry alignment function will be disabled. User can only execute geometry alignment through 8 points of Corner Wall adjustment. 4 corner control points can execute image 4 corner alignment same as [2x2] geometry alingment function. Edge Blend function will be still available.

Corner Wall alignment allows user to adjust the image at 90 degree corner wall. It can execute horizontal and vertical corner alignment. User can only select either horizontal or vertical alignment at one time. This function can co-exist with edge blending function but not warp function. The image position can be adjusted as below:

- 4 corner image positions
- The transition position of the image in horizontal or vertical direction
- The maximum Corner adjusting range is +_ 900 pixels and the curvature location adjusting range is +_900 pixels.
- User can't use ultra-short throw ratio projector for corner wall application. Otherwise, the image distortion will be too big to be adjusted and may also create focus issue.

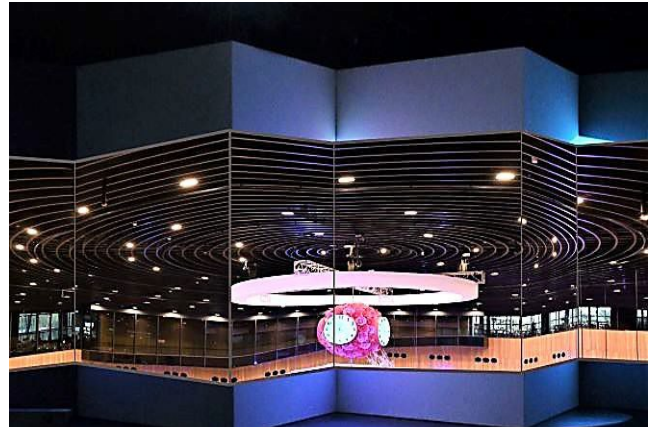
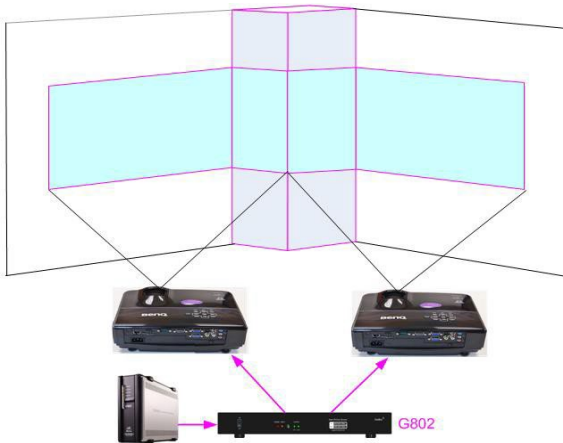


Example A: Single projector application



Example B: Dual projector application

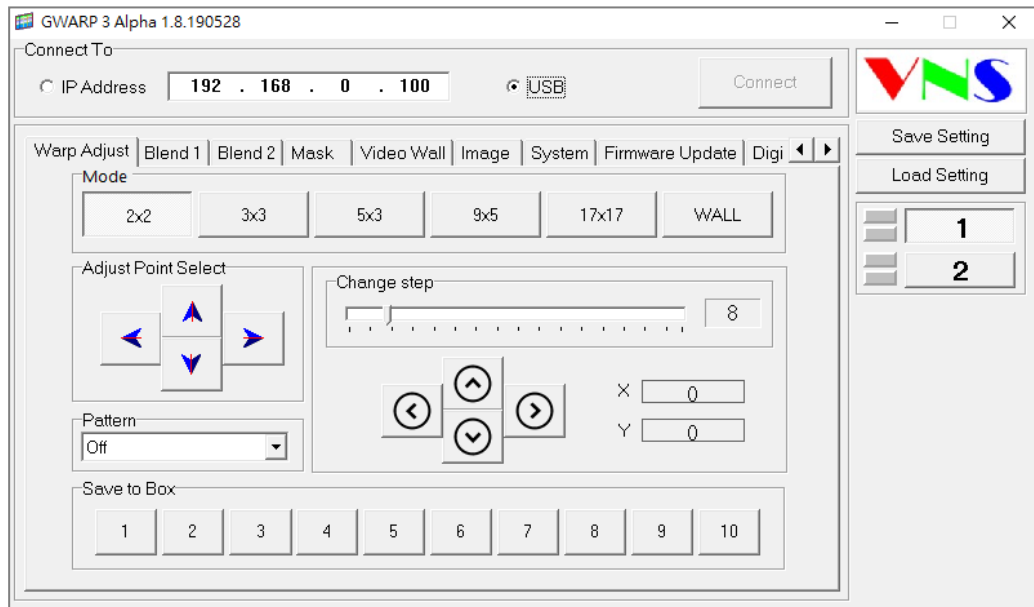
Example C: Three projector application



Corner wall application on curved screen

If user wants to implement Corner Wall function on curve screen, user can connect the signal to one channel in M800Ex to do warp alignment, then connect the output to the input port of the channel for Corner Wall alignment. Then user can execute curve alignment and Corner Wall adjustment at the same time.

5.4. Geometry alignment via Gwarp3 PC Tool



- Gwarp3 is a PC tool executed through PC. No software driver is required. Once user opens Gwarp3 and connects with PC through Ethernet or USB, user can execute edge blending settings through PC keyboard and mouse. After finish the setup, user can save the result to Box and no more PC is required.
- User can backup system settings in PC and copy to other units.

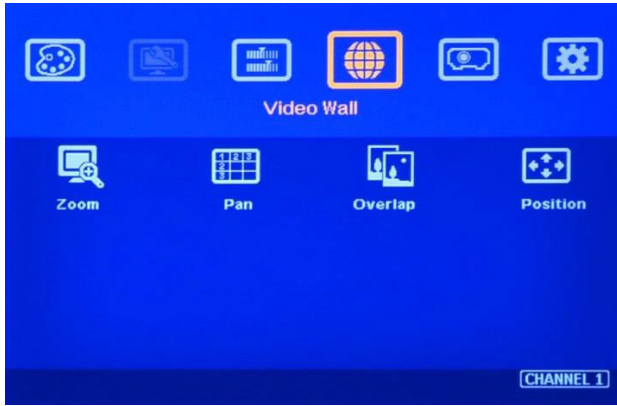
- Firmware and MCU code update can be executed through Gwarp3. User can control multiple units at the same time through different IP address.
- Please see more details in section 11.2 and download “Gwarp3 PC Tool Quick User Guide” from website to get more details.

5.4.1. Geometry alignment through [Warp Adjust]

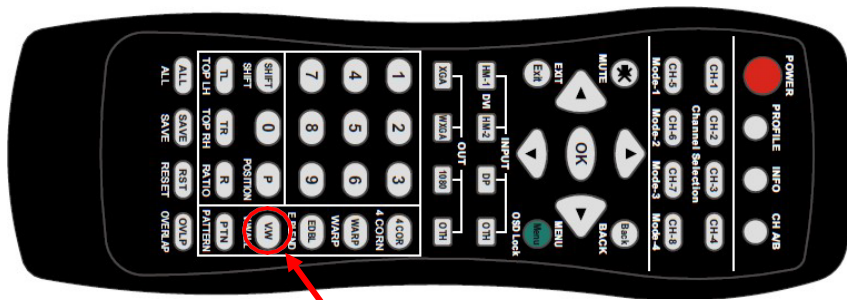
- **System Reset**
 - ✓ [CTRL + Shift + R]: Reset selected channel
 - ✓ [CTRL + Shift + A]: Reset all channels (from CH1-CH4)
 - ✓ Input / Output resolution and Profile Index settings will remain the same without reset.
- **[Warp Adjust]**
 - ✓ [P]: Enable grid pattern with different colors (R, G, B, C, M, W) & styles
 - ✓ [CTRL + P]: Disable grid pattern
 - ✓ Start from [2x2] alignment, then follow [3x3] → [5x3] → [9x5] → [17x17] sequence for geometry alignment. If go back to lower control point adjustment, it will reset higher control point adjustment. [2x2] alignment will not reset curve adjustment result.
 - ✓ [M]: Change Adjust mode from [2x2] → [3x3] → [5x3] → [9x5] → [17x17]
(PC language shall set to English, otherwise, some hotkey functions may not work)
 - ✓ Use [CTRL + Arrow] key to select control point.
 - ✓ Use [Arrow] key to adjust control point position with default step (8 pixels/step)
 - ✓ Use [Shift + Arrow] key to adjust control point position with 1 pixel/step.
- **Save settings**
 - ✓ Click # key under [Save to Box] to save the setting to Box. Each channel shall save separately but can save to the same # for convenient recall.
 - ✓ After finishing all channel geometry alignment and [Save to Box], click [System] to save all channel settings into [Profile Save].
 - ✓ Click [Save Setting] to save data into PC as backup or copy to another Box.

6. [Video Wall] setting

- The purpose for Video Wall Setting is to split the image and assign the right image to each projector. The overlap pixel for edge blending shall be accurately adjusted to avoid blurred image in overlap region. All of these functions are under [Video Wall] menu.
- Each channel shall execute [Video Wall] settings separately.



- Press Menu Keypad on Front Panel to enter [Video Wall] OSD menu.
- [Video Wall] hotkey on the bottom right position of the remote controller is available for quick access.
- Video wall function can crop image for edge blending and assign to projectors.



[Video Wall] menu hotkey

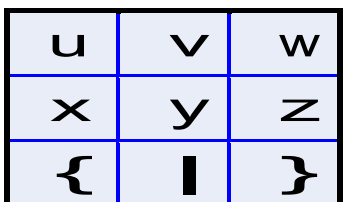
6.1. [Zoom]: split the signal source



Use [Zoom] to split input image in horizontal and vertical directions. Maximum split images are 15x15 in both horizontal and vertical directions from single input source.

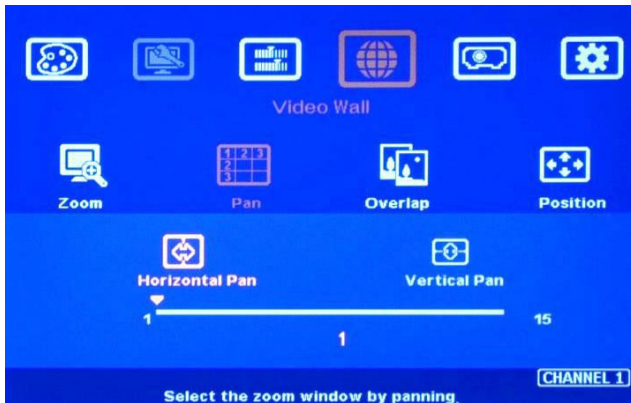


For 3 projectors at horizontal position, Horizontal Zoom=3, Vertical zoom=1



For 3x3 displays (9 projectors), Horizontal Zoom=3, Vertical Zoom=3

6.2. [Pan]: assign image location

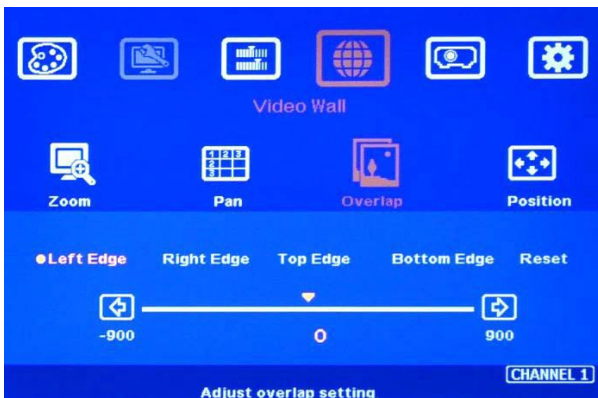


- Use [Pan] to determine the location of each split image in both horizontal and vertical directions.
- Default setting:
Horizontal Pan=1
Vertical Pan=1

U	V	W
X	Y	Z
{		}

For No. w projector: **For No. z projector:**
 Horizontal Pan = 3 Horizontal Pan = 3
 Vertical Pan = 1 Vertical Pan = 2

6.3. [Overlap]: crop correct image for each projector



- Use [Overlap] to adjust overlapped pixels between two adjacent projectors
- It can also change image aspect ratio.
- Max. Overlap range is +_1800 Pixels

- In multiple projector applications, the Overlap value can be determined by GEOBOX Excel Spread Sheet as showed in below chart with RED mark. User can follow this value to get the right overlap settings with clear image.
- This Overlap value will be calculated based on several factors—such as input resolution, projector resolution, quantity and overlap region size.
- If the overlap regions have different size due to installation position limitation, please use Irregular Excel Spread Sheet to calculate overlap value.
- User can use Video Wall overlap setting to fine-tune the image position in overlap region. It can compensate geometry mis-alignment and let image become much clearer.

Project basic data

Source resolution (H)	3840	Screen width	6.50 (m)
Source resolution (V)	800	Screen height	1.50 (m)
Projector resolu. (H)	1280	Projector lumen	3200 (Lum)
Projector resolu. (V)	800	Screen Aspect ratio	4.33 (required)
Overlap pixels (32 pixels per grid)		Overlap %	Recommended
Overlap pixel (H)	256	20.0%	20%~40%
Overlap pixel (V)	0	0.0%	25%~40%

Recommended overlap region: Min. 50 cm width

Qty of projector (H)	3	Throw ratio (Min)	1.20
Qty of projector (V)	1	Throw ratio (Max)	1.70

Final output resolution

Horizontal resolution	3328
Vertical resolution	768
Extended pixel (H)	98
Extended pixel (V)	0

Video wall setting value

Position of projector (H)	1	2	3	4	5	6	7	8	9	10
LH edge overlap value	0	98	197	x	x	x	x	x	x	x
RH edge overlap value	197	98	0	x	x	x	x	x	x	x

Position of projector (V)	1	2	3	4	5	6	7	8	9	10
Top edge overlap value	0	x	x	x	x	x	x	x	x	x
BTM edge overlap value	0	x	x	x	x	x	x	x	x	x

Final result checking list (PJT: Projector)

Final Image size (meter)		Final Illuminance Lux (Lum/m2)		Image size for each PJT	
Width	6.50	PJT lumen	3200	Width (m)	2.500
Height	1.56	Final Illumin	819	Height (m)	1.563

Overlap region size		Original aspect ratio		Projector throw distance	
Horiz. (m)	0.500	Projector	1.60	Min (m)	Max (m)
Vertic. (m)	0.000	Final result	4.16	3.00	4.25

* Final image height should be equal or larger than screen. User can shrink image to have the same image height as screen by GeoBox geometry adjustment.

* Standard luminance is 400-800 Lux for restaurant and big conference room, 1000-1500 Lux for trade show. 3D: 500 Lux (single projector)

6.4. [Position]: shift image position without changing image size

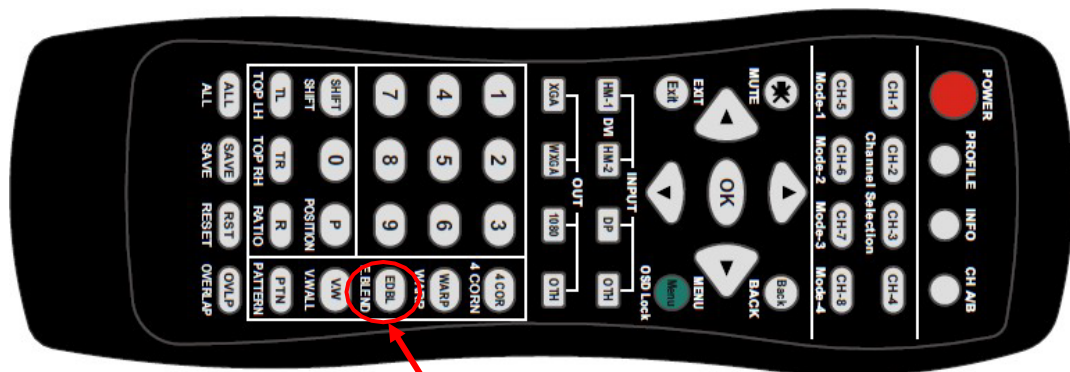
After cropping, user can shift image position at H&V directions without changing image size. Usually, it is for video wall application to fine tune image position. In projector edge blending application, user only changes Overlap value in one edge but not execute image shift.



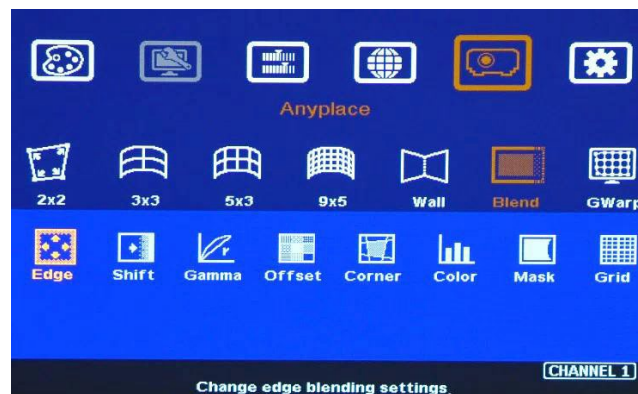
7. [Edge Blend] settings

- Edge Blend is to merge the images from multiple projectors to become one seamless image.
- The scaling factor between two adjacent images shall be the same. It means the image size under the same resolution should be the same.
- Geometry alignment is required before edge blending:
 - ✓ To let the image has the same grid size (same scaling factor in both horizontal and vertical directions)
 - ✓ To let images overlapped together in horizontal lines and vertical lines.
- Sub-menu under [Edge Blend] menu
 - ✓ [Edge]: select the right edge and set overlap pixels. The pixel no. is same as the overlap grid

- size multiple grid number. If overlap is 10 grids, the overlap pixel is 320 in default grid size.
- ✓ [Shift]: to shift image edge blending location and implement [Edge Mask] function for non-overlapped edges with black background.
- ✓ [Gamma]: adjust gamma value in [Transition] and [Gain] in each channel to improve banding effect in overlap region.
- ✓ [Offset]: to do black level uplift in non-overlapped area to compensate light leakage in projectors.
- ✓ [Corner]: to do precise [Offset] location alignment.
- ✓ [Color]: to do White Balance correction for individual projector.



[Edge Blend] hotkey



7.1. [Edge]: select location and set edge blending value

- [Edge] is to select the edge for edge blend and set overlapped pixel number.
- User can execute edge blending at any edge.
- Maximum edge blend pixels are H=1920, V=1200.
- Color indicating lines will appear when set edge blending pixels.
- User needs to adjust the color indicating lines to match together (green to green, red to red). The final overlap value is the same as actual overlap number (grid size * grid number).

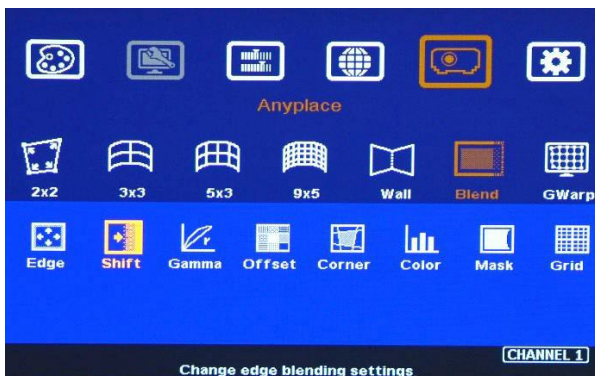


For 3 projector edge blending as example:

- To select [Right Edge] for LH projector
- To select both [Right Edge] & [Left Edge] for center projector.
- To select [Left Edge] for RH projector

7.2. **[Shift]: shift edge blending position and execute Edge Mask**

- [Shift] has two functions: one is to shift [Edge Blend] location and another function is to do [Edge Mask] in not [Edge Blend] borders.
- When user selects the edge in Edge Blending area, user can apply “+” value (0 to +500) to shift the whole [Edge Blend] position. If the value is “-“ (0 to -10), user can see color uplift in the edge of the Edge Blending area. The purpose is for user to do color fine tune in edge blending area.
- When user selects the edge without [Edge Blend], [Shift] will change image border location with black background without changing image size and location. It implements [Edge Mask] up to 500 pixels following the final result after geometry alignment.



- [Shift] is to shift [Edge Blend] location in [Edge Blend] edge. If the value is set to “-“, it will uplift the color in the border of edge blending area.
- It will execute [Edge Mask] on the edges in non-overlapped region.

7.3. **[Gamma]: Color correction in edge blending area**

- Different projectors may have different gamma curves. Different “Display mode” in the same projector will also have different gamma curves. These gamma curves will affect the color in edge blending area. The common issue is gray color banding effect. These issues are more significant in pure color or white back ground display.
- [Gamma] function is to adjust the gamma curve in edge blending area for each projector through independent RGB gamma curve adjustment.
- User needs to select right display mode (gamma curve 2.2 is the best gamma value in the projector setting) and fine tune the color difference among the projectors to minimize the possible banding effect in edge blending region.

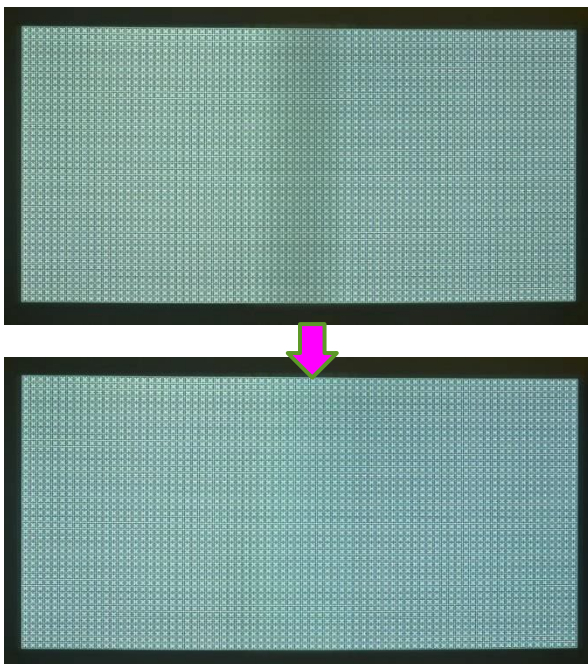


Three sub-menu under [Gamma] menu:

- [Transition]: To set edge blending area gamma value via discrete RGB gamma curve value adjustment.
- [Gain] gamma: To do gamma curve fine-tune in each projector. It can further improve edge blending result, especially while two adjacent projectors have different gamma curve.
- [Offset] gamma: It will apply to each projector separately and is only available when implement black level Offset adjustment. It determines the percentage of the Black Level [Offset] effect.

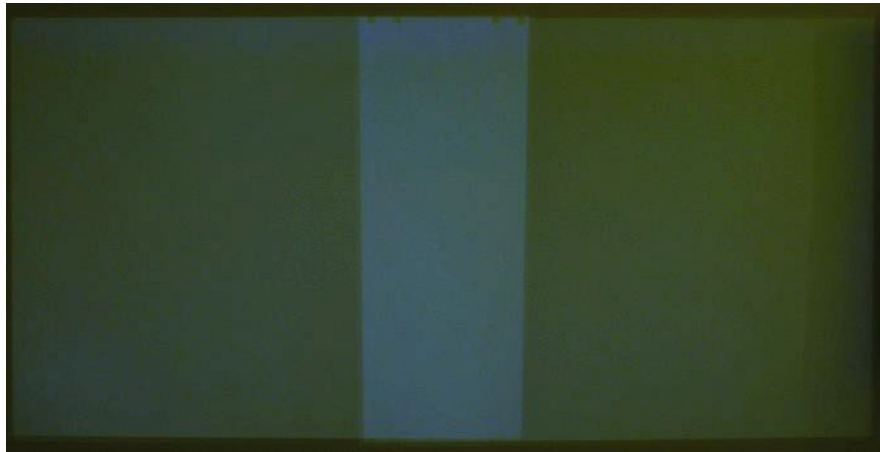
➤ Please note:

- ✓ The major reason for banding effect in edge blending area is related to projector color setting and gamma curve. All projectors shall have the same gamma setting and [Display Mode].
- ✓ Please disable [Dynamic] color function in the projectors. These functions may change gamma curve based on the content and affect final edge blending image quality.
- ✓ [Offset] gamma adjustment can be served as a tool to compensate the brightness difference between two projectors. It is only functional when user applies Black Level [Offset] function.



- Left picture is to show banding effect in edge blending area.
- This issue is related to many factors:
 - Screen: gain value under 1.0 is recommended
 - Projector: shall be the same model with the same gamma and Display Mode settings.
 - Usually Laser projector will get the best result due to accurate gamma and color.
 - Signal content: to avoid pure color or pure white color content. Multimedia is the best.
 - Overlap range: too small overlap range will cause banding effect. 20%-40% with more than 60 cm width is recommended.

7.4. Black level uplift: [Offset] & [Corner] adjustment



- If the ambient light is dark, audience will see grey region in Edge Blending area. It is due to light leakage from projector optical system and can't be fixed by signal processing. Low contrast ratio projector will be more serious. The only solution is to apply [Offset] function to uplift the color in non-transition area to compensate the visual color difference.
- Projector with higher native (not dynamic) contrast ratio will have less light leakage. Usually, DLP projector will have higher contrast ratio with better result. Laser projector has high contrast ratio with accurate color and gamma setting and is suitable for edge blending.
- [Corner] function is to do accurate position alignment.

7.4.1. [Offset]

- [Offset] is to set the level for color uplift. It should be determined based on the brightness level in overlap region.

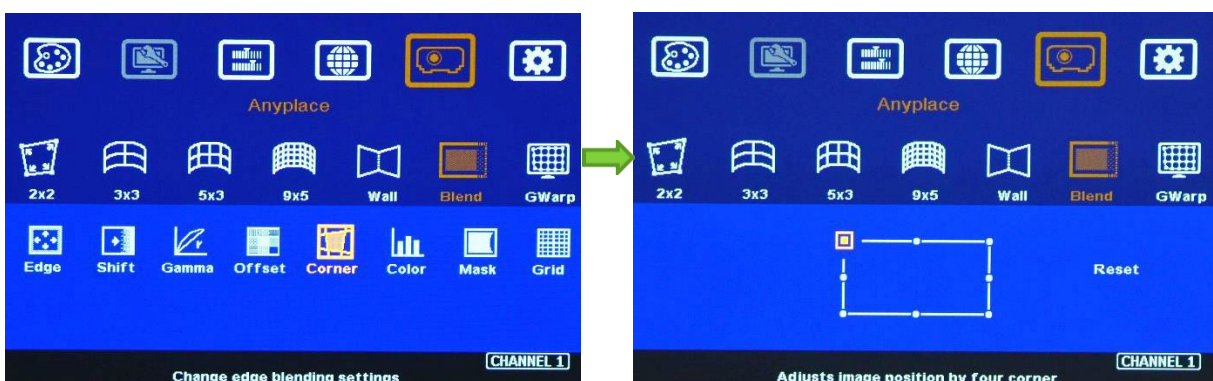




- For projector with horizontal edge blending, please select center region of the [Offset] block, then adjust RGB offset value to around 100 each.
- If user executes more complicated edge blending such as 4 projectors at 2x2 location. The maximum areas for black level uplift may increase up to 9 locations. Under this condition, user needs to select more areas for color compensation. Please select the region, to do RGB color adjustment, then back to [Corner] menu to adjust accurate location for color compensation. If RGB value is set to zero, the background color will remain the same as normal.

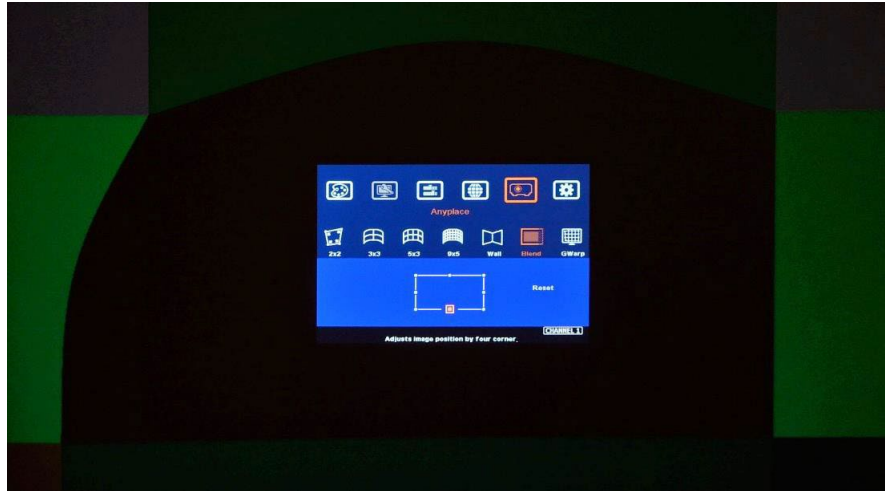
7.4.2. [Corner]

- Adjust the correct location for black level uplift by [Corner] menu.
- When user adjust the location of the control points, user will see the change of color uplift position. If the projector is at RH side, please adjust LH control points to RH side till to the edge of the light leakage region. This region starts from original projection area before geometry alignment. It is not the same as overlap area.
- The maximum adjustment range is +_900 pixels in vertical direction and +_1200 pixels in horizontal direction.
- After this step, user will see clearly the black level uplift region and back to Offset color settings to let the color in uplift region is similar to light leakage area.



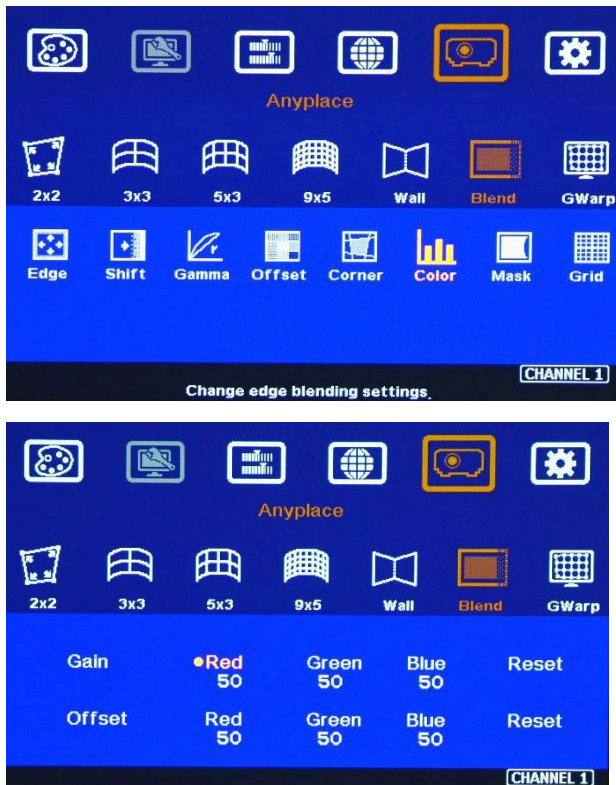
- Projector display imager, such as DMD, LCD and LCOS, will have some image borders due to active display window is not at full range of the imager. In dark environment, viewer may see a little light leakage in image borders. It is outside active display area and can't be fixed.

- If user finds some position deviation between Black Level uplift border and projector Light Leakage border during [Corner] adjustment, it is caused by poor geometry alignment between two adjacent projectors. Please make sure to have good image grid alignment in that area.
- Below is to show color adjustment in black level uplift areas through above method. It can show different colors with different shape of the borders. Maximum adjusting area is nine.



7.5. [Color]: Individual projector white balance and color correction

The [Color] function can be applied to individual projector for white balance and color difference correction through separate RGB Gain and Offset adjustment. It will be helpful to compensate projector color difference, lamp brightness decay and lamp replacement issue.



- Under [Color] menu, user can adjust separate RGB [Gain] and [Offset] value to change the color and white balance in each projector.
- [Gain] is to change the color slope and take more effect in brighter region.
- [Offset] is to add value in all level of brightness (0-225) and take more effect in darker region.
- When apply [Color] adjustment, it will affect entire color in the projector. Please check with different video contents and minimize the side effect.

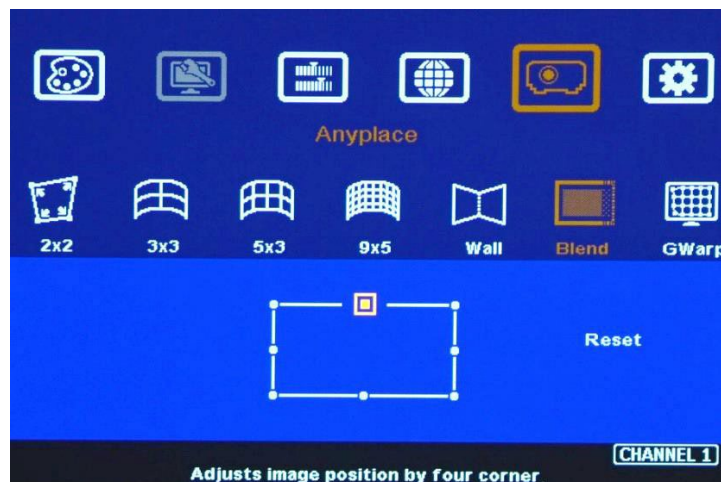
In edge blending procedures, user needs to adjust the color from projector first. If it is still not enough, user can use [Color] function to do further adjustment. Please note that, any color adjustment will reduce the color dynamic range. User needs to check the result with full range color image.

7.6. Edge [Mask]

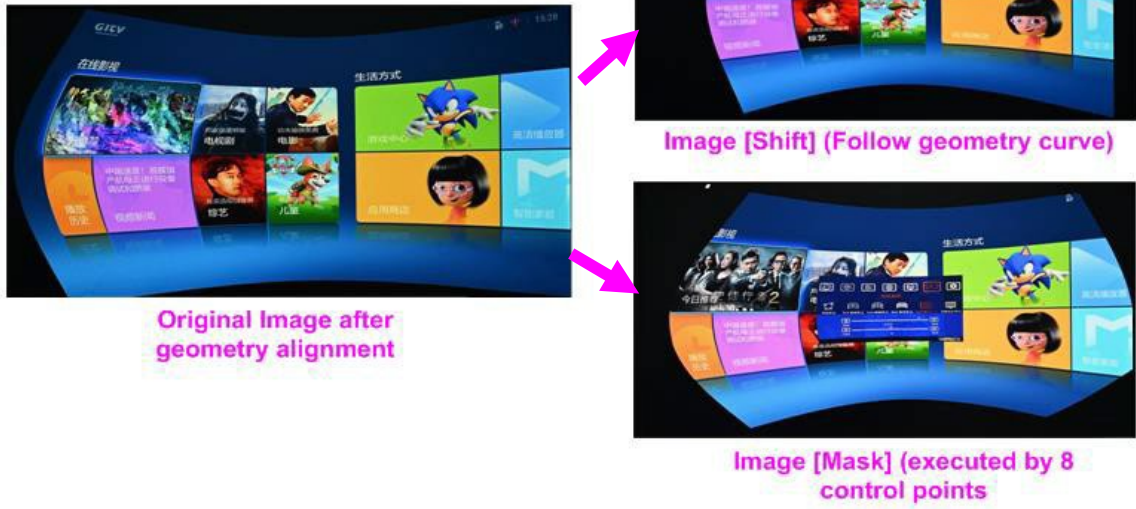
There are two edge mask functions in M800Ex. One is image [Shift] and another one is Edge [Mask] under Edge blending menu.



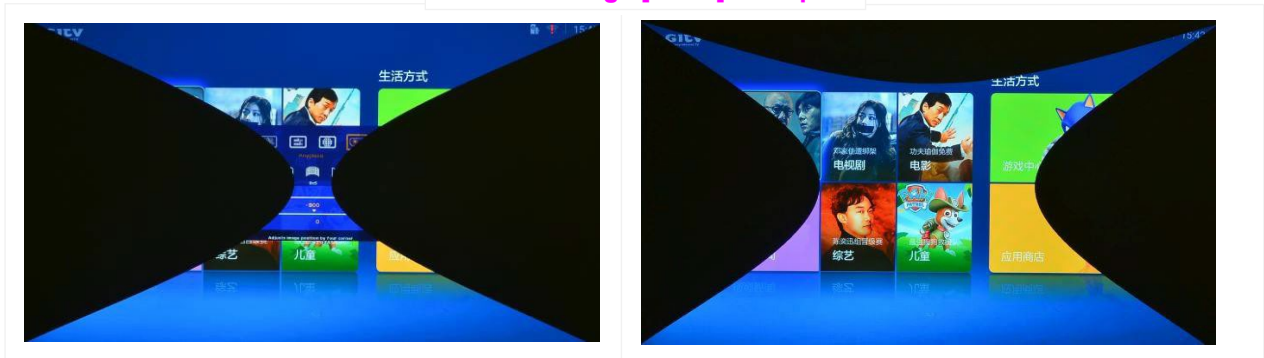
- [Shift]: Able to do edge mask with black background in each edge up to 500 pixels.
- [Edge Mask]: There are 8 control points for edge mask. When user moves the position for each control point, it will result various edge mask effect. The maximum position adjustment for each control point is ± 900 pixels in H&V directions.
- The starting point for [Shift] is based on the image position after geometry alignment and the starting point for [Mask] is calculated from the original edge position before geometry alignment and before [Shift] edge mask.



- **Please note that user can only select one functions between [Mask] and [Mapping] function. For instance, if you apply Mask in one projector and select Mapping in the same function again, it will disable Mask function automatically and only keep projection Mapping.**



Another Image [Mask] example



7.7. [Grid] (Determine grid pattern size)

The pixel size in grid pattern for geometry alignment is selectable. The grid size is from 8 to 120 pixels with 1-pixel increasement in both horizontal and vertical directions. H&V grid size will be the same. User can select grid size under [Edge Blend] menu. Default grid size for both H&V directions are 32x32.



7.8. Final image quality fine-tune

- The final performance will be a combination of many factors—projector characteristics, projector setting, screen, ambient light and GeoBox setting.
- Banding in overlap area under dark environment is caused by light leakage in the projector optic system. User needs to uplift the black level in none overlap area through [Offset] menu.
- GeoBox edge blending gamma setting range is from 0.9-3.0 and default setting is 2.2 gamma curve. To select projector display mode near 2.2 gamma setting will get the best result.
- The projector may retain light leakage near the border (about 20 pixels) of the imager (micro display—DMD or LCD). It is not possible to be fixed.
- The factors affect final image quality
 - ✓ GeoBox settings:
 - Edge Blending settings: Gamma (Transition, Gain), Shift (at “-“ value), Offset, Color.
 - Image Properties: To select Preset Mode to Neutral, sRGB or Bluish
 - Individual projector color adjustment by [Color] function under [Edge Blend] menu.
 - ✓ Projector:
 - Ultra-short throw ratio projector is not recommended for edge blending, especially in curved screen edge blending.
 - To reserve enough overlap area—0.6m-1.2m in width or 20%-40% (based on single projector native resolution) is recommended.
 - To adjust image position of the projector and reduce keystone angle.
 - Increase Overlap region & reduce off axis angle
 - To reset projectors with the same settings.
 - To select Display Mode. Usually Standard, sRGB/Neutral will get better result.
 - To disable projector Brilliant color adjustment or Dynamic color adjustment.
 - Try different color settings in the projectors.
 - ✓ Screen: To use lower gain value screen.
 - Short throw projectors with high gain screen may cause banding effect when watch from different viewing angles due to different reflection intensity.

8. Example for 3 projector edge blending

A Curved Screen Edge Blending tutorial video is available in the website at <https://youtu.be/pn6XQiNpdLc>. Please check.

8.1. Get detailed edge blending information through GEOBOX Excel Spread Sheet

8.1.1. Assumption

- Required image size (screen size): 6.5m*1.5m
- Input signal resolution: 3840*800 (Pixel pitch is 1.7mm, allow 1.7m watching distance, optimized vertical resolution is the same as projector native resolution: 800)
- Number of projectors: 3 projectors at 3x1 horizontal position
- Projector resolution and lumens. 1280*800 (native resolution), 3200 Lum
- Overlap pixels and dimension. 8 grids=8*32= 256 pixels
- Projector throw ratio: 1.2-1.7 (based on projector spec)

8.1.2. Excel calculation

Project basic data

Source resolution (H)	3840	Screen width	6.50	(m)
Source resolution (V)	800	Screen height	1.50	(m)
Projector resolu. (H)	1280	Projector lumen	3200	(Lum)
Projector resolu. (V)	800	Screen Aspect ratio	4.33	(required)
Overlap pixels (32 pixels per grid)		Overlap %	Recommended	
Overlap pixel (H)	256	20.0%	20%~40%	
Overlap pixel (V)	0	0.0%	25%~40%	

Recommended overlap region: Min. 50 cm width

Qty of projector (H)	3	Throw ratio (Min)	1.20
Qty of projector (V)	1	Throw ratio (Max)	1.70

Final output resolution

Horizontal resolution	3328
Vertical resolution	768
Extended pixel (H)	98
Extended pixel (V)	0

Video wall setting value

Position of projector (H)	1	2	3	4	5	6	7	8	9	10
LH edge overlap value	0	98	197	x	x	x	x	x	x	x
RH edge overlap value	197	98	0	x	x	x	x	x	x	x

Position of projector (V)	1	2	3	4	5	6	7	8	9	10
Top edge overlap value	0	x	x	x	x	x	x	x	x	x
BTM edge overlap value	0	x	x	x	x	x	x	x	x	x

Final result checking list (PJT: Projector)

Final Image size (meter)		Final Illuminance Lux (Lum/m2)		Image size for each PJT	
Width	6.50	PJT lumen	3200	Width (m)	2.500
Height	1.56	Final Illumin	819	Height (m)	1.563

Overlap region size		Original aspect ratio		Projector throw distance	
Horiz. (m)	0.500	Projector	1.60	Min (m)	Max (m)
Vertic. (m)	0.000	Final result	4.16	3.00	4.25

* Final image height should be equal or larger than screen. User can shrink image to have the same image height as screen by GeoBox geometry adjustment.

* Standard luminance is 400-800 Lux for restaurant and big conference room, 1000-1500 Lux for trade show. 3D: 500 Lux (single projector)

- Input the data in yellow column. User will get calculation result.
- Final image size for each projector: 2.500m*1.563m
- We reserve 6cm image height for geometry alignment and after service. User can use geometry alignment to draw the vertical height to the required dimension 1.5m.
- Optimized content resolution: 3328*800 (This is the ideal resolution for the content and EDID).
- Installation distance: 3m-4.25m (based on through ratio 1.2-1.7).
- The value in video wall Overlap setting:
 - #1 Projector: RH edge: +197
 - #2 Projector: LH edge=+98, RH edge=+98
 - #3 Projector: LH edge: +197

- The final luminance is 819 Lux. It will be enough for indoor environment.

8.2. Mark image location and install the projectors

- After Excel Spread Sheet calculation, user can understand the final image position for each projector based on the image size for each projector and the overlap region dimension. Please mark image position by paper adhesive tape on the screen. The positions should include 4 corners of the image for each projector and horizontal center line of the screen. Laser level is an ideal tool for marking center line, horizontal and vertical image positions.
- Please install the projector just enough to cover the required area with minimum keystone in both sides.

8.3. System connection



- Only the input signal from HDMI-1/HDMI-3/HDMI-5 input port can be looped out.
- Input signal can be connected to HDMI-1/HDMI-3/HDMI-5 input port and looped out to next processing module or unit.
- If setup by IR remote controller, please install IR extender near screen for easy access by remote controller. The maximum adjusting points is 9x5.
- User can setup GeoBox through Ethernet. Please use WebGui or Gwarp3 PC tool for the setup. Gwarp3 can implement up to 17x17 adjusting points.
- Select input port and set GeoBox output resolution to be the same as projector native resolution.

8.4. Projector settings

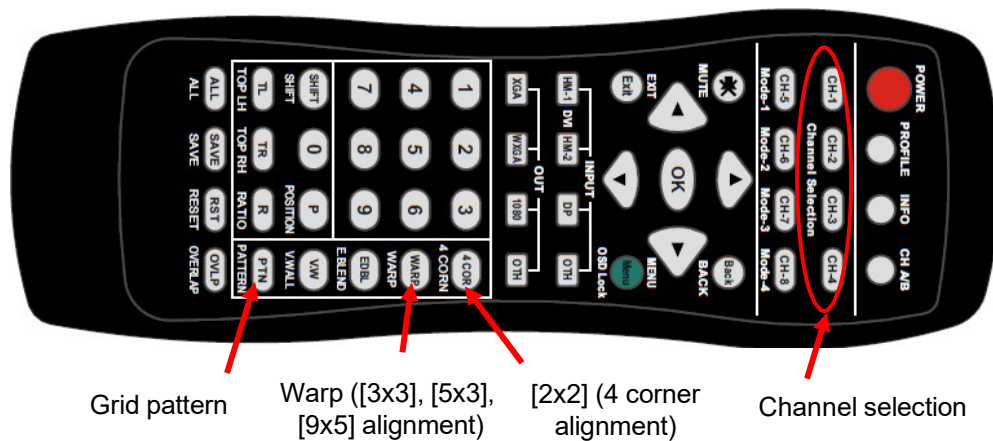
- Please reset projector to default setting.
- Disable dynamic color adjustment color adjustment.
- Disable Auto Keystone function.
- To select a Display Mode with 2.2 gamma curve will reduce the color difference in overlap area. If necessary, please choose a Display Mode with the best result.
- Use projector internal color adjusting function to adjustment the color variation among projectors before implement edge blending.
- Install projectors at a place with image size that can cover required image area and with minimized keystone to get the best video quality.

8.5. GeoBox Settings

- Reset GeoBox to default setting.
- Select input port.
- Select output resolution to be the same as projector native display resolution.
- Check input/output LED indicators and make sure to have correction system connection.
- Disable [Frame Sync] function to eliminate Source re-search in the projector while executing GeoBox system setup through [Options]→[Setting]→[Frame Sync]→[Disable]. Please return to [Normal] setting after edge blending.
- If setup via Ethernet, please connect GeoBox with Switch/Hub or WiFi router in LAN port.

8.6. Geometry alignment

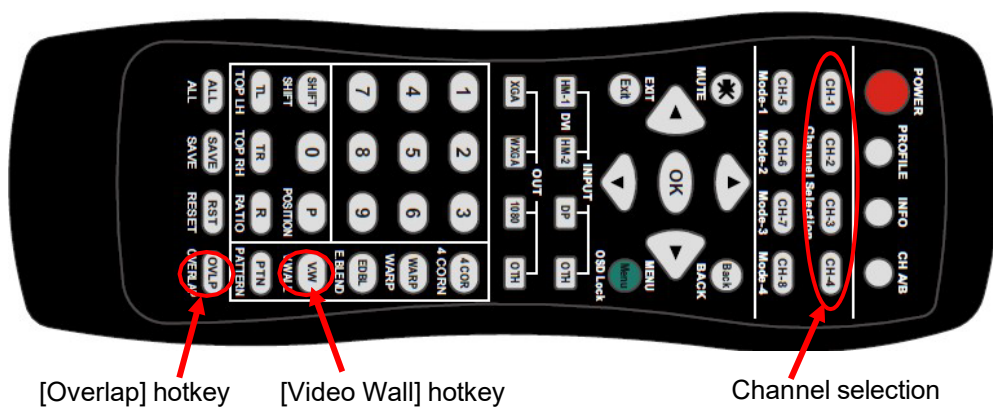
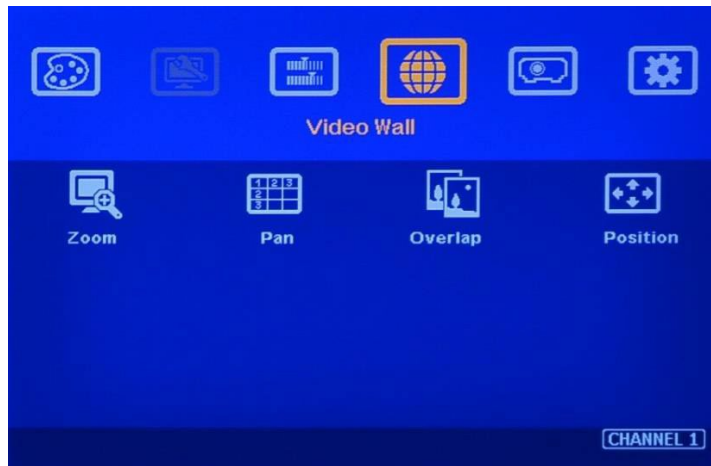




- User can install IR extender receiver near screen for easy GeoBox operation. IR receiver extender can be extended through audio cable.
- Click channel selection key and [Pattern] key to show grid patterns in all projectors. Press [Pattern] key again will change grid color. To set different pattern colors in adjacent projectors will be more convenient for geometry alignment.
- Please follow the sequence [2x2] → [3x3] → [5x3] → [9x5] to do geometry alignment to ensure entire image will have uniform scaling factor.
- Apply [2X2 Corner] geometry alignment and draw the corners to expected locations. It doesn't matter to have some image inside the screen once it covers entire screen before 4 corner adjustment. [Warp] alignment will adjust the image position back to the required position.
- If user doesn't execute GEOBOX Excel Spread Sheet calculation, please use [2x2] alignment and try to let all projectors have similar image size with the overlap area having the same grid number.
- Apply [3x3 Curved] geometry alignment to let 9 adjusting points be located at the required position including four corners, edge center points and center line position in each projector.
- Please use [5X3] & [9x5] for further geometry alignment and fine-tune. Linearity Grid Line adjustment function is convenient for complete grid line movement.
- After finish the alignment, user can use [2x2] for complete image position fine tune. If user executes [3x3] alignment again after [9x5] alignment, [9x5] grid position will be reset and only keep [3x3] grid point information.
- In ideal condition, all grids in edge blending area between two adjacent projectors should be aligned together.
- After the above processes, if the grid pattern in edge blending area still can't stack together, user can reduce or increase overlapped grids to change the control point positions in adjacent projectors and get more accurate geometry alignment result.
- [Gwarp3] PC tool can provide 17x17 grid point adjustment with quicker geometry alignment.
- After finish geometry alignment, all grids should be matched together.



8.7. Video Wall settings



- Click [INFO] key to check if correct input and output timing is in the system. User needs to apply the same input/output timing as GEOBOX Excel Spread Sheet calculation.
- Example for [Video wall] settings for 3 projectors horizontal edge blending with one M800Ex:
 - ✓ [Zoom]: set to H=3, V=1 in all channels. Each channel should be set separately.
 - ✓ [Pan]: LH projector (1st): H=1, Center projector (2nd): H=2, RH projector (3rd): H=3. All projector Vertical PAN is the same: V=1.

- ✓ [Overlap]: select the correct edge and apply the value calculated from GEOBOX Excel Spread Sheet: LH projector: RH edge, Center projector: both RH/LH edges, RH projector: LH edge
- ✓ Below is overlap value calculated from GEOBOX Excel under below condition: Input: 3840*800, Output: 1280*800, Overlap pixels: 256, Projectors: 3
Horizontal Overlap value: Projector 1 RH edge= 197, Projector 2 RH edge= 98, LH edge= 98, Projector 3 LH edge=197
Vertical values in all projectors are set with the same “V=0”.

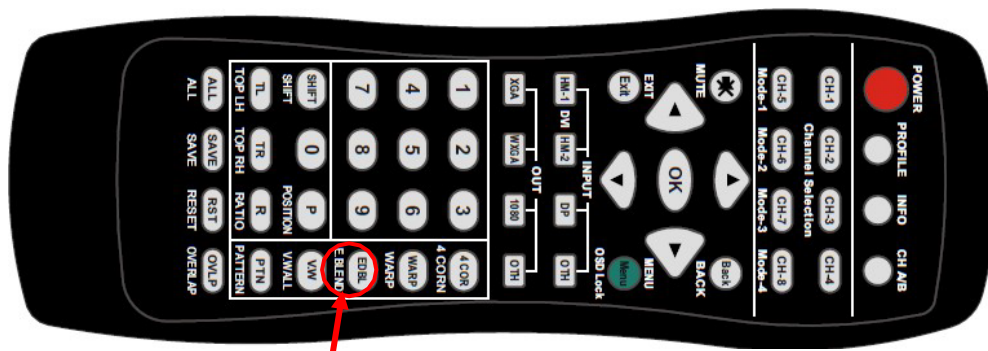
Video wall setting value

Position of projector (H)	1	2	3	4
LH edge overlap value	0.0	98	197	x
RH edge overlap value	197	98	0.0	x

Position of projector (V)	1	2	3	4
Top edge overlap value	0.0	x	x	x
BTM edge overlap value	0.0	x	x	x

- For dual projector edge blending, user can apply still image, select correct edges and adjust [Overlap] value simultaneously and let the image in edge blending area comes closer till without double image. Two projectors shall have the same value (same cropping range). The difference shall not be over 2 pixels.
- If user still sees some blurred image in edge blending area, please increase or decrease [Overlap] value in [Video Wall] setting to improve video quality.
- Please note that projector has Thermal Drift issue (position shift due to different temperature). The image position in power ON stage may be different from the position after 15-20 minutes when the position is stable. Don't adjust image position during this period until it is stable.

8.8. [Edge Blend] setting



[Edge Blend] hotkey

- Select correct Edge for the edge blending:
LH projector: RH edge, Center projector: RH & LH edge, RH projector: LH edge

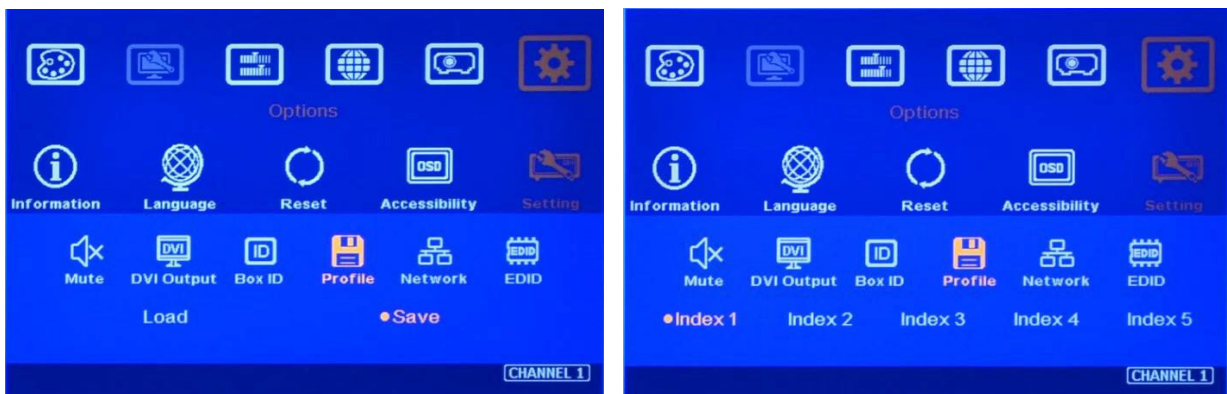
- RED and GREEN indicating lines will appear when increase edge blending pixels. The final overlap setting value will be the same as Overlap pixels (256) in this example case.
- User needs to adjust the color indicating lines to match together (green to green, red to red) and will see a smooth image.



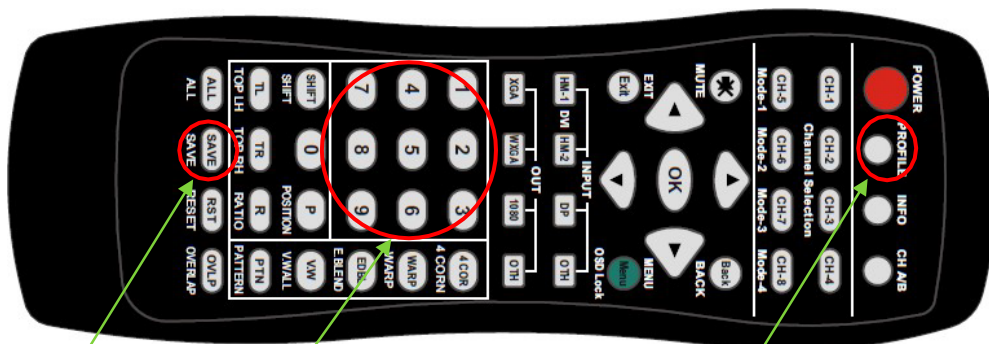
8.9. Final Image quality fine-tune

- If banding effect is visible in overlap area, please try below method:
 - ✓ GeoBox [Gamma]: Please try to adjust Gamma value in [Transition] & [Gain] menu and adjust [Shift] value to “ - “ to do color uplift in the edge of overlap region.
 - ✓ Projector: please try to change projector settings
 - All projector should have the same setting.
 - To select color profile with gamma 2.2 will get the best result.
 - Check Display Mode: Usually Standard, sRGB modes will get better result.
 - Disable projector Brilliant color or Dynamic color adjustment.
- The video quality in overlap region is related to many factors. Please see more details in other section related to [Final Image quality fine-tune] in this user guide.

9. Save/Load System Settings



- After finishing system settings, user can save the setting via OSD menu through [Menu]➔ [Options]➔ [Setting]➔ [Profile]➔ [Save]➔ [Index 1-5]. It will take effect for one channel only. User needs to save each channel separately.
- User can save the settings through [Save] hotkey on remote controller. It will take effect for all channels at the same time.
- [Save] function is also available in WebGui and Gwarp3. It will take effect for all channels.
- Please save all channels into the same Profile Index for easy Load back at the same time.
- Five different display settings can be saved to [Profile]. The data stored in Profile include EDID setting, input source, output resolution, color settings and all user customized settings.
- User can [Load] the settings through below methods:
 - ✓ OSD menu: [Menu]➔ [Options]➔ [Setting]➔ [Profile]➔ [Load]➔ [Index 1-5]. It will take effect for one channel only.
 - ✓ Remote controller [Profile] hotkey: Press [Profile] hotkey, then select number keys on the remote control (not through OSD direction keys) to [Load] user settings. It will Load the settings for all channels at the same time.
 - ✓ WebGui & Gwarp3: user can access [System]➔ [Load] menu to recall the settings for all channels through Ethernet or USB (Gwarp3 only).
- When user power off the system, M800Ex will save user setting without loss even the setting is not saved into Profile Index, unless someone to change it.
- Under below conditions, the settings data inside Profile Index will be kept without missing:
 - ✓ When system has been reset from OSD menu, it will take effect for one channel only and the Profile data will not be deleted.
 - ✓ Remote controller [Reset] hotkey will take effect for one channels and Profile data will be kept without delete.
 - ✓ When user update new Firmware, it will not affect Profile data.
 - ✓ Only Reset from reset hole on back panel will erase Profile Data.
- Hotkeys for Profile [Save] and [Load]



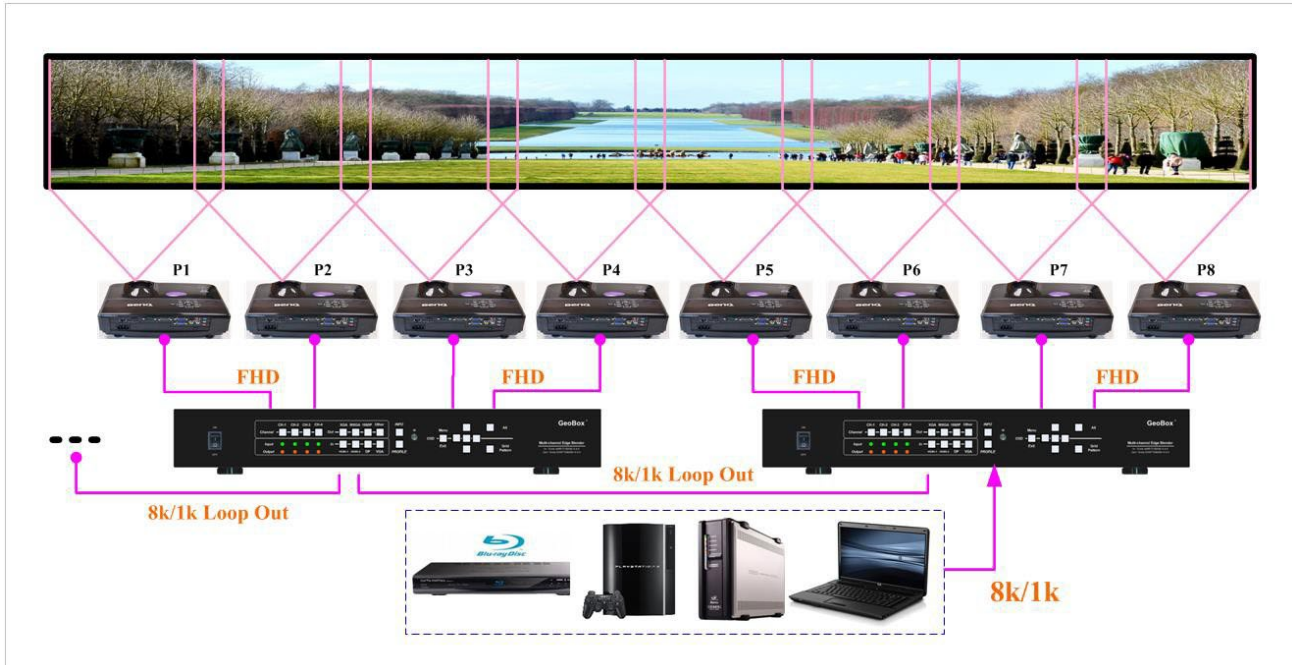
Press [Save], then select number key to save settings. The setting will apply to all channel at the same time.

Number keys (1-5) for Profile [Save] & [Load]

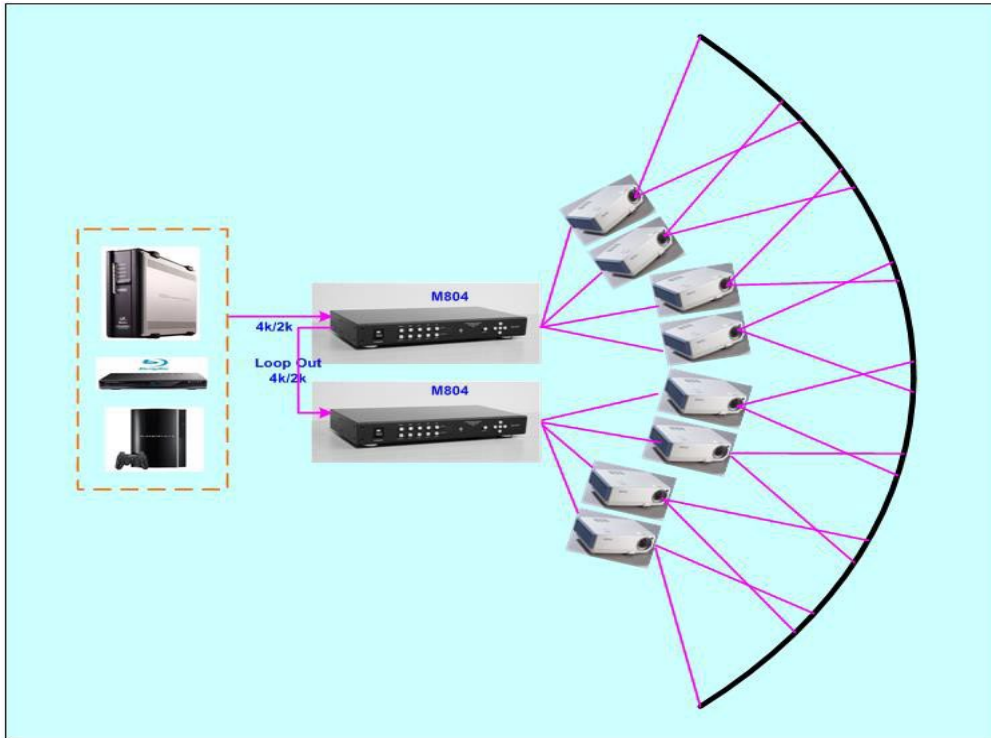
Press [Profile] hotkey, then select number keys (not through OSD direction keys) to [Load] user settings

10. Multiple unit applications

10.1. System connection in multiple unit edge blending



- Connect input signal to HDMI 1/3/5 or 7 input ports and loop out to next processing channel. The last loop out port needs to connect to next M800Ex. No special sequence is required.
- Usually, loop out signal can connect up to 10 processing channels. The maximum number is related to signal resolution and HDMI cable quality. If more channels are required, please add one HDMI splitter at the front end. It will extend to double or triple numbers of processing channels.
- In edge blending application, only HDMI-1/3/5/7 signal can be cascaded through internal HDMI splitter. If user wants to do edge blending with other input ports, please add video distributor at the front end and feeds the signal to all M800Ex processing modules. Each M800Ex has up to 4 processing modules.
- User can control M800Ex through Ethernet, USB or remote controller.
- IF GeoBox is installed in control room, Ethernet control through WiFi will be the most convenient. Notebook, mobile phone and Pad can execute GeoBox setup through WiFi.
- User can set individual Box ID and IP address for easy independent control in each GeoBox.
- Select input port and set GeoBox output resolution to be the same as projector native resolution.
- User needs to apply a signal source while executing video wall [Overlap] value setting. Signal source resolution should be the same as GEOBOX Excel Spread Sheet calculation. To apply 4K or higher signal resolution is recommended. After system setup, user can use any input resolution.
- Press [INFO] hotkey to check if the final in/out timings are the same as expected.



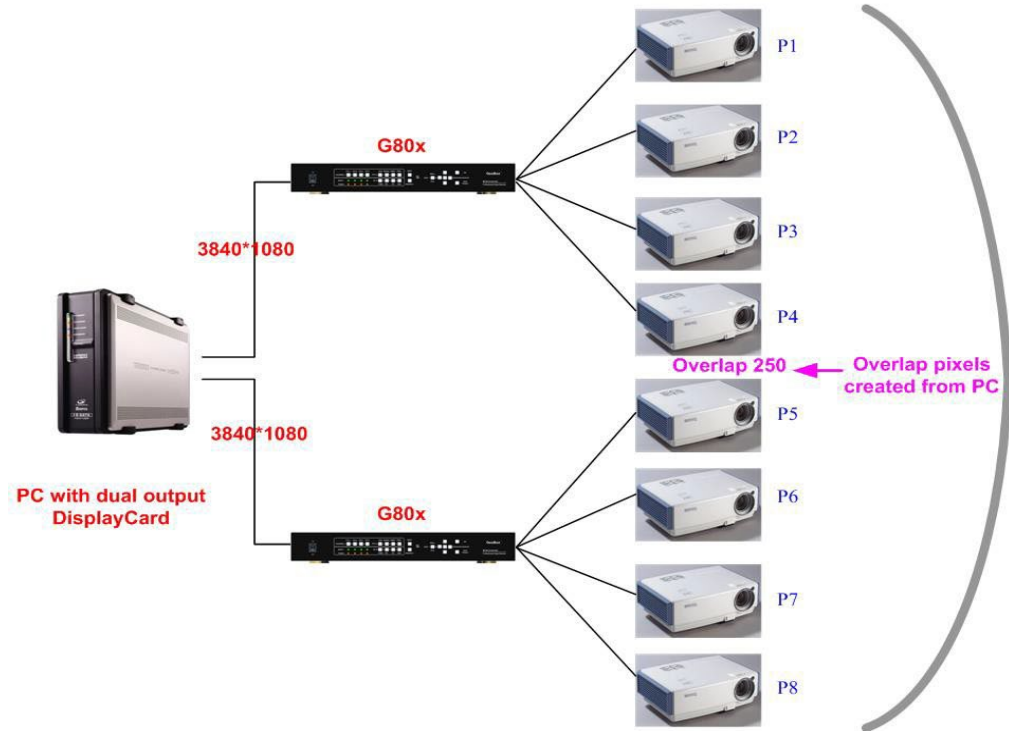
Usually, one 4k signal source can be applied for up to 20 meters screen through two M800Ex & 6-8 projectors. If bigger screen is required, user can apply multiple signal sources through multiple synchronized media player or multiple output display card to achieve higher system resolution.

10.2. Content overlap setting issue

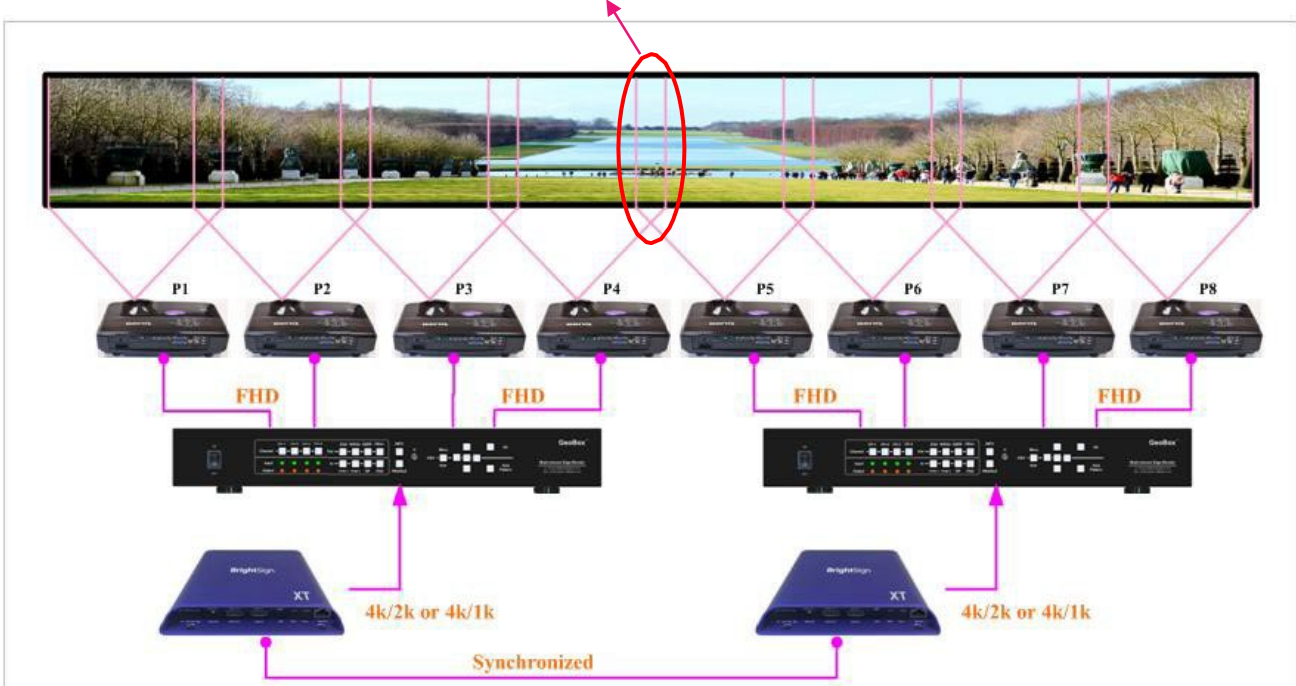
If the system is larger than 20m, usually, multiple 4k signal sources are required to get good enough video resolution. Below are some important points:

- User needs to split the content into different sections and each section is played back by one PC or media player.
- These PC or media player needs to be synchronized.
- GeoBox can crop the right overlap pixel inside one content for each projector but not for the pixel between two independent contents.
- The Overlap content between two independent signal sources shall be handles through below methods:
 - To set Overlap image through PC display card. In this case, the overlap cropping issue will be handled by PC.
 - To cut the content with same content in overlap section for edge blending. The pixel size shall be larger than Overlap region and GeoBox can crop the right pixel for edge blending. User can use synchronized media player (such as BrightSign) or low-cost multiple output display card from PC.
 - PC display card should be able to set overlap pixel up to 25% of the output resolution among the outputs. User can use similar function cards as Matrox TripleHead 2 Go, ATI

Display Group, NVidia SLI Surround or NVidia Mosaic mode.

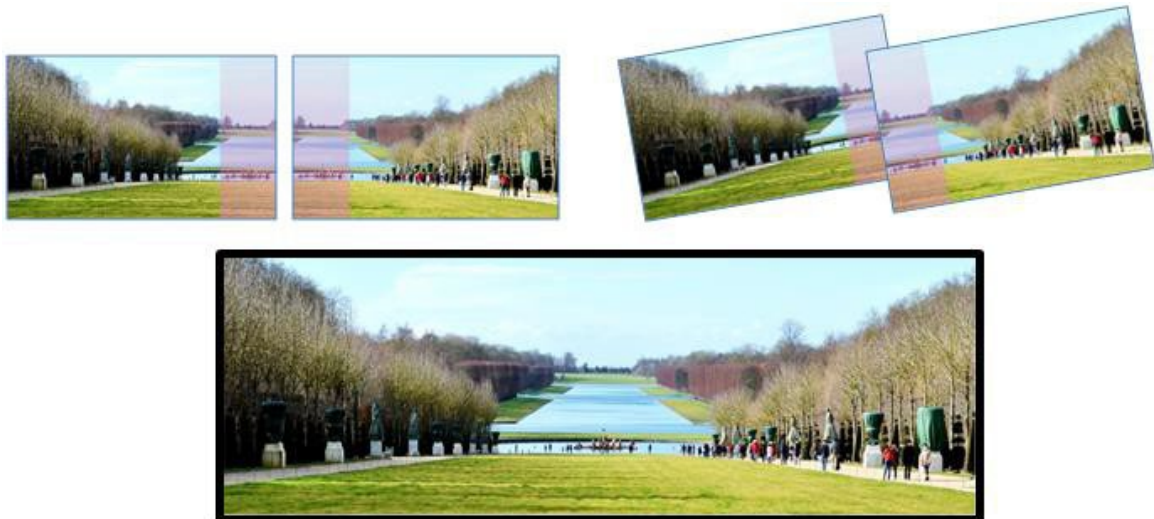


Overlap pixels for media player #1 & #2 in this region



Signal sources output two independent images with redundant data in overlap region

Projectors project the image with the same overlapped content



GeoBox executes Geometry alignment and crops the right pixel based on projector position to do edge blending

10.3. Convenient Setting and PC tools in multiple unit application

10.3.1. Setup by Remote Controller

- If multiple units are used, user can set different [Box ID] (#1 - #99) or IP address in each Box for individual control. For IR control, the [Box ID] number range is #1 - #9.
- When all M800Ex or IR extenders are installed together in the control range of single remote controller, user can do individual M800Ex control through below method.
 - Press [851] : all the box OSD will be locked except ID #1. Only ID #1 GeoBox can be operated through OSD menu.
 - Press [853] : all the box OSD will be locked except ID #3. Only ID #3 GeoBox can be operated through OSD menu.
 - Press [850] : all the box OSD will be unlocked and can be operated through remote controller at the same time.

10.3.2. Setup by Ethernet

User can connect all M800Ex in one Ethernet Router (WiFi Router or switch/hub) through LAN ports and set different Static IP address for each Box, then use WebGui virtual keys or Gwarp3 PC tool to control each M800Ex independently. Default IP address is 192.168.0.100. TCP Server port is 1266.

11. WebGui and Gwarp3 PC tool

- WebGui is embedded inside GeoBox. Once user connects GeoBox through Ethernet IP address, user can see virtual key for the operation.
- Gwarp3 is standalone PC tool that can be downloaded from GEOBOX Website. It is HID interface and can be controlled through USB or Ethernet. No software driver is required.

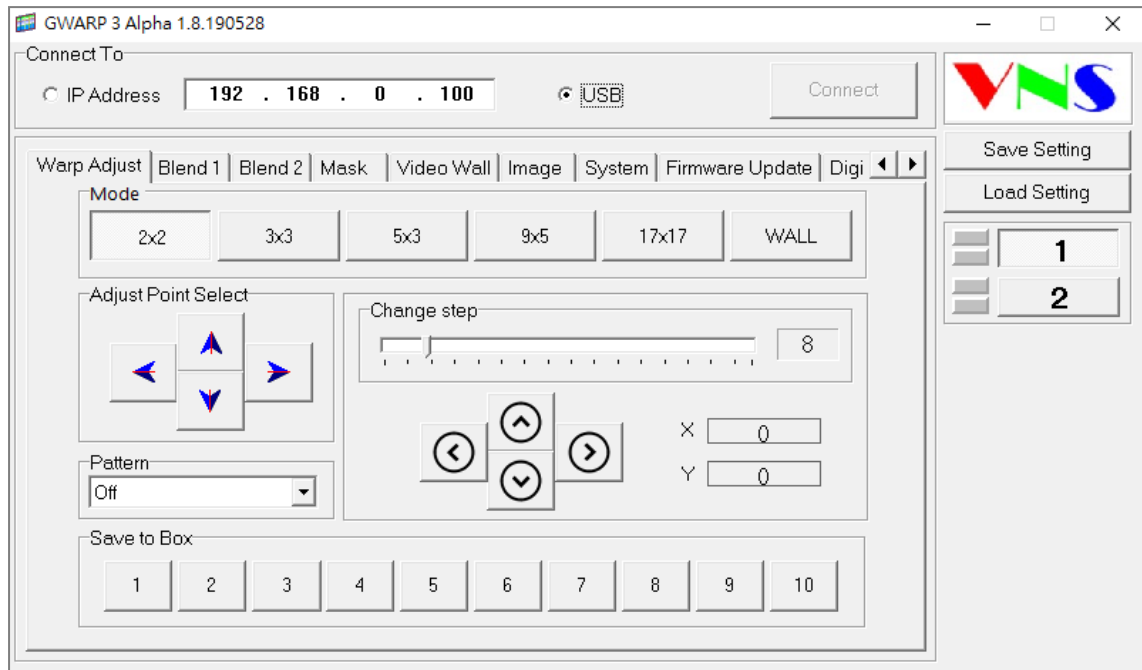
11.1. WebGui

- WebGui is embedded inside M800Ex. Once user connects M800Ex with PC through Ethernet, user can access WebGui and execute all operation similar to OSD menu through Virtual Keys and OSD Menu. No PC or appropriate software tool is required.
- The connection can go through Ethernet router LAN port, WiFi Router or Crossover Cat 5/6 cable. User can set each M800Ex with different static IP address in the same domain, then open Google Chrome or Microsoft Explorer browser with IP address to access each unit of M800Ex for independent operation. There is no limitation in the number of M800Ex that can be controller at the same time.
- User can turn on/off the system through WebGui and see the status through power indicator.



11.2. Gwarp3 PC Tool

(Please download Gwarp3 PC Tool and User Guide from website)



- Gwarp3 is a PC tool executed through PC. No software driver is required. Once user opens Gwarp3 and connects with PC through Ethernet or USB, user can execute edge blending settings through PC keyboard and mouse. After finish the setup, user can save the result to Box and no more PC is required.
- User can backup system setting in PC and copy to other units.
- Firmware and MCU code update can be executed through Gwarp3. User can control multiple units at the same time through different IP address.

11.2.1. Important concept

- Gwarp3 is a PC tool for convenient operation through USB or Ethernet connection.
- Geometry alignment in Gwarp3 is called [Warp Adjust]. OSD or Remote controller adjustment can only execute geometry alignment up to 9x5 control points but Gwarp3 can be up to 17x17.
- Under 9x5 control point, the geometry result in Gwarp3 will be executed to the Box in real time. It is the same result as OSD or remote controller operation. User can switch operation between remote controller and Gwarp3 at any time.
- 17x17 geometry alignment can't be executed in the Box in real time. User should execute [Save to Box] process to save the final data into Box and can find the result under [UserMap] menu.
- The data in [UserMap] is different format and can't recall for further modification.
- The data saved in Profile Index will save all user settings including UserMap. If the UserMap includes only up to 9x5 data, user can modify it. If it includes 17x17 data, user can't modify it and can only execute 2x2 corner finetune with +_50 pixels position shift in H&V directions.
- The data saved in Gwarp3 through [Save Setting] to PC can be as backup or copied to another unit. It is editable and user can execute further modification.

11.2.2. Steps for Edge blending setup through GWarp3 operation

- Set output with the same as projector native resolution.
- Connect GWarp3 → Select [Pattern] type → [Warp Adjust] → [2x2] → [3x3] → [5x3] → [9x5] → [17x17].
- After finish one channel geometry alignment, please select # and click [Save to Box] to save the settings into Box. The data saved in each channel is independent.
- Execute [Video Wall] settings. Can be executed in GWarp3 or OSD.
- Execute Edge [Blend] settings. Can be executed in GWarp3 or OSD.
- After finish all settings, go to [System] → [Profile Save] to save all settings into Box permanently.
- User can save the settings in PC through [Save Setting] as backup. The file name is WBF. User can load back WBF file from PC for further editing or copy to another unit of the same model GeoBox.
- When user copies PC file to another unit, please execute [Save to Box] in each channel, then save the final result into box by [Profile save]. Otherwise, 17x17 geometry result may be lost.

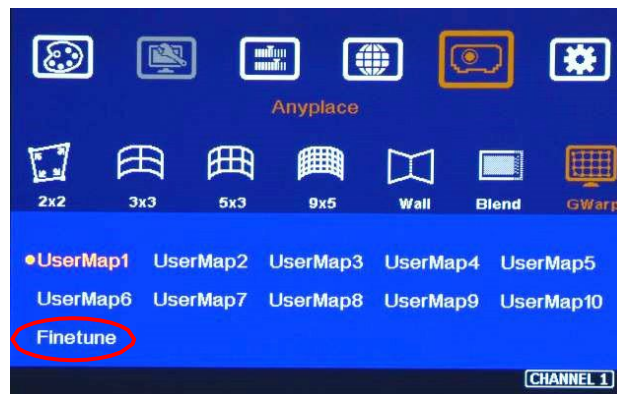
11.2.3. Geometry alignment through [Warp Adjust]

- **System Reset**
 - ✓ [CTRL + Shift + R]: Reset selected channel
 - ✓ [CTRL + Shift + A]: Reset all channels (from CH1-CH4)
 - ✓ Input / Output resolution and Profile Index settings will remain the same without reset.
- **[Warp Adjust]**
 - ✓ [P]: Enable grid pattern with different colors (R, G, B, C, M, W) & styles
 - ✓ [CTRL + P]: Disable grid pattern
 - ✓ Start from [2x2] alignment, then follow [3x3] → [5x3] → [9x5] → [17x17] sequence for geometry alignment. If go back to lower control point adjustment, it will reset higher control point adjustment. [2x2] alignment will not reset curve adjustment result.
 - ✓ [M]: Change Adjust mode from [2x2] → [3x3] → [5x3] → [9x5] → [17x17]
(PC language shall set to English, otherwise, some hotkey functions may not work)
 - ✓ Use [CTRL + Arrow] key to select control point.
 - ✓ Use [Arrow] key to adjust control point position with default step (8 pixels/step)
 - ✓ Use [Shift + Arrow] key to adjust control point position with 1 pixel/step.
- **Save settings**
 - ✓ Click # key under [Save to Box] to save the setting to Box. Each channel shall save separately but can save to the same # for convenient recall.
 - ✓ After finishing all channel geometry alignment and [Save to Box], click [System] to save all channel settings into [Profile Save].

- ✓ Click [Save Setting] to save data into PC as backup or copy to another Box.

11.2.4. Gwarp3 Image Position [Finetune] via remote controller

- While executing geometry alignment by Gwarp3, user still can execute geometry alignment through remote controller at the same time. The maximum grid pattern for remote controller is only up to 9x5. All the grid above 9x5 will be reset and only up to 9x5 grid will be kept.
- If the system is installed based on Gwarp3 geometry data (up to 17x17 grids) which is saved in UserMap, user still can execute small position modification through [Finetune] under [GWarp] menu via remote controller. User can only execute 2x2 fine-tune with a range of +-50 pixels for each corner.
- This function is important for after service and while changing lamp to return the image to original position.



12. Advanced applications and settings

12.1. Multiple Wall Immersive display

User can use multiple projectors to execute Multiple Wall display with the images from different projectors. Below is the example for a display with 3 walls and one floor to build one immersive display.

- Assumption
 - ✓ 3 walls display: W1=2m, W2=5m, W3=3m
 - ✓ Signal source: 3840x1080, GeoBox output resolution: 1920x1080
- Usually, 5000 Lum projector can cover 3-4 meters image width. Four projectors are required to cover entire screen.
 - ✓ W1: one projector is enough
 - ✓ W2: require two projectors with edge blending to cover the space
 - ✓ W3: one projector is enough
 - ✓ Floor: 2-3 projectors is required.



- To let all projectors with the same scaling factor to avoid image size difference among the walls. Total screen dimensions: $2.5+5+3=10.5\text{m}$
 - ✓ Total image width: 3840 pixels
 - ✓ Pixel density: $3840/10.5= 366\text{ pixels/m}$
 - ✓ Assign image resolution for each wall to get the same scaling factor.
 - W1 (PJ1) = $366*2.5= 914\text{ pixels}$ (Projector #1)
 - W2 (PJ2 & PJ3) = $366*5= 1829\text{ pixels}$ (Projector #2 & #3)
 - W3 (PJ4) = $384*3= 1097\text{ pixels}$ (Projector #4)
 - Based on the above data, if we express the image location by coordinate, W1 is from 0 to 914, W2 is from 914 to 2743 ($914+1829$), W3 is from 2743 to 3840.
- Video Wall settings:

User can set different Video Wall Zoom value for each projector separately. We assume to set Zoom at H=4, V=1 for all projectors.

 - ✓ W1: Zoom: H=4, V=1, Pan: H=1, V=1
Overlap: $3840/4=960$, $914-960= -46$ → Right Edge = -46, Other Edge=0
 - ✓ W3: Zoom: H=4, V=1, Pan: H=3, V=1,
Overlap: $3840/4=960$, $1097-960= +137$ → Left Edge = +137, Other Edge=0
 - ✓ W2: The image captured for W2 is 1829. User needs to calculate Video Wall Overlap Pixel based on this resolution. If we set 320 overlap pixels, the overlap value is 83 pixels.

Source resolution (H)	1829	Screen width	5 (m)
Source resolution (V)	1080	Screen height	1.50 (m)
Projector resolu. (H)	1920	Projector lumen	5000 (Lum)
Projector resolu. (V)	1080	Screen Aspect ratio	3.33 (required)
Overlap pixels (32 pixels per grid)		Overlap %	Recommended
Overlap pixel (H)	320	16.7%	20%~40%
Overlap pixel (V)	0	0.0%	25%~40%
Recommended overlap region: Min. 192 pixels or 50 cm width			
Qty of projector (H)	2	Throw ratio (Min)	0.8
Qty of projector (V)	1	Throw ratio (Max)	1.2
Final output resolution 1			
Horizontal resolution	3520	* Please apply Overlap pixels with 32x because internal grid size for geometry adjustment is based 32x32 for each grid.	
Vertical resolution	1056		
Extended pixel (H)	83		
Extended pixel (V)	0		

Video wall setting value

Position of projector (H)	1	2	3	4	5	6	7	8	9	10
LH edge overlap value	0	83	x	x	x	x	x	x	x	x
RH edge overlap value	83	0	x	x	x	x	x	x	x	x

Final Image size (meter)		Final Illuminance Lux (Lum/m2)		Image size for each PJT	
Width	5.00	PJT lumen	5000	Width (m)	2.727
Height	1.53	Final Illumin	1195	Height (m)	1.534

Overlap region size		Original aspect ratio		Projector throw distance	
Horiz. (m)	0.455	Projector	1.78	Min (m)	Max (m)
Vertic. (m)	0.000	Final result	3.26	2.18	3.27

* Final image height should be equal or larger than screen. User can shrink image to have the same image height as screen by GeoBox geometry adjustment.

* Standard luminance is 400-800 Lux for restaurant and big conference room, 1000-1500 Lux for trade show. 3D: 500 Lux (single projector)

* Theater: 172 Lux (16 foot-lamberts), SMTP display standard: 377 Lux

* Final brightness of the screen needs to multiple gain value of the screen.

* The actual installation image size should be equal or larger than expected size.

* The best content resolution is the same as Final output resolution in cell D15& D16.

* Illuminance: 1 Lux = 1 lumen/m2 = 0.0929 foot-candle

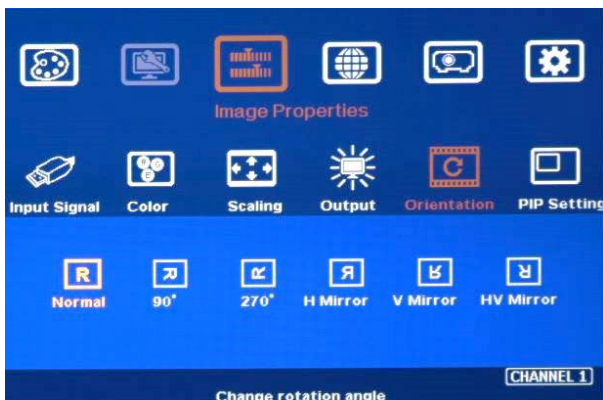
Luminance: 1 Lumen/m2/Steradian= 1Nit =0.29186 Foot-Lambert

Under this condition, the image cropped for PJ2 should be in the range from coordinate 914 to 1911.5 (914+1829/2+83). The image for PJ3 should be in the range from coordinate 1745.5 (914+1829/2-83) to 2743 (914+1829=2743).

- ✓ PJ2 Video wall setting: Zoom: H=4, V=1, Pan: H=2, V=1. The standard coordinate after Zoom setting will be from 960 (3840/4) to 1920 (960*2), Overlap value will be: Left Edge: 960-914= 46, Right Edge: 1911.5-1920= -8.5 (actual -8 or -9)
- ✓ PJ3 Video wall setting: Zoom: H=4, V=1, Pan: H=3, V=1. The standard coordinate after Zoom setting will be from 960*2=1920 to 960*3=2880, Overlap value will be: Left Edge: 1920-1745.5= 174.5 (actual 174 or 175), Right Edge: 2743-2880= -137
- ✓ After finishing video wall settings, user needs to set [Edge Blend] between PJ2 and PJ3 to finish complete system settings.

12.2. Portrait edge blending

When executing edge blending, the image will be stretched and the aspect ratio will be changed. In order to reduce aspect ratio change, user can execute portrait edge blending to increase image height. When execute image 90/270 degrees rotation, the input source resolution can be up to 4k/60Hz.





- Projector at portrait position to increase image height
- Source image is rotated by GeoBox at 90°
- Zoom: H=3, V=1 in all projectors
- PAN settings are showed in each image.
- Overlap settings: PJ1: Right Edge, PJ2: Left Edge & Right Edge, PJ3: Left Edge

- Some projectors are not suitable to be installed at portrait location. Laser projector has high contrast ratio, no limitation in installation angle and accurate color and gamma curve. It is the best choice for edge blending application.
- M800Ex can rotate source image before edge blending. It will be more convenient for user to connect with all kinds of conventional signals without the need to rotate the image in advance.
- When apply portrait edge blending, the GEOBOX Excel Spread Sheet calculation also needs to change the output resolution. If the projector is 1920x1200, then user needs to keyin Output Resolution (projector resolution) at 1200x1920.
- The OSD menu will not follow rotated image. Video Wall setting direction will follow actual rotated image direction but not OSD direction.
- All the function settings under [Anyplace] menu will follow OSD menu directions but not follow rotated image direction. The items include geometry alignment & edge blending.
- Except for the directions, all the rest settings will be the same as normal display.
- Image rotation menu is under [Image Properties]
- If using Fujifilm projectors with rotatable lens to project all-in-one image on Ceiling, wall and floor, the location setting (PAN) at 1st and 3rd projectors may be swapped. Please see the image after rotation and Left side projector PAN is H=1.

12.3. Flexible display

- When edge blending is implemented, the image aspect ratio will be changed.
- If the content has the same aspect ratio as the screen, the system can be setup to show no distortion image.
- In order to reserve flexibility for different user environments, GeoBox allows user to set different display modes. Below is the example for 3 projector edge blending system.
 - ✓ Case A: All-in-one: display one content across entire screen.
 - ✓ Case B: 2+1: two projectors edge blended and one independent content display.
 - ✓ Case C: 1+1+1: Each projector displays independent content.

- GeoBox setting for each case:
 - ✓ Case A: it is normal edge blending setting. Save the setting to Index 1 under [Profile].
 - ✓ Case B: user needs to reset all settings, select the input sources for discrete display and implement geometry alignment and edge blending only on two projectors with another one independently. Save the setting to Index 2.
 - ✓ Case C: user needs to reset all settings, select the input sources for discrete display and implement geometry alignment to separate the images among all projectors without overlap. Save the setting to Index 3
- User can store different settings into different profile Index and recall through remote controller, RS232 or Ethernet. No projector installation or settings is required.



12.4. Discrete content displayed in each projector

User can configure to show independent content in each projector. Below are the guidelines:

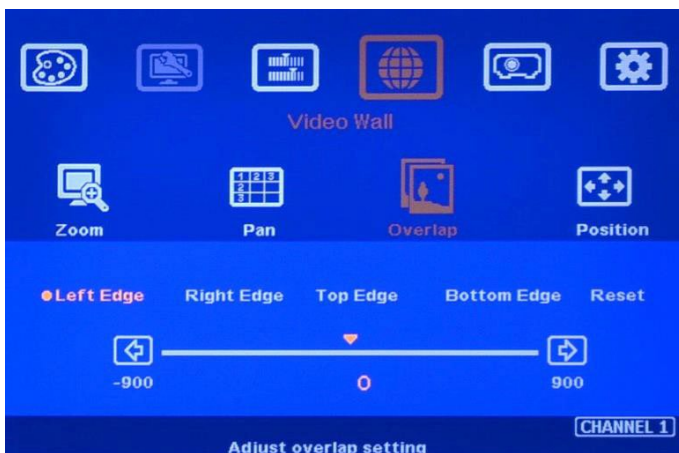
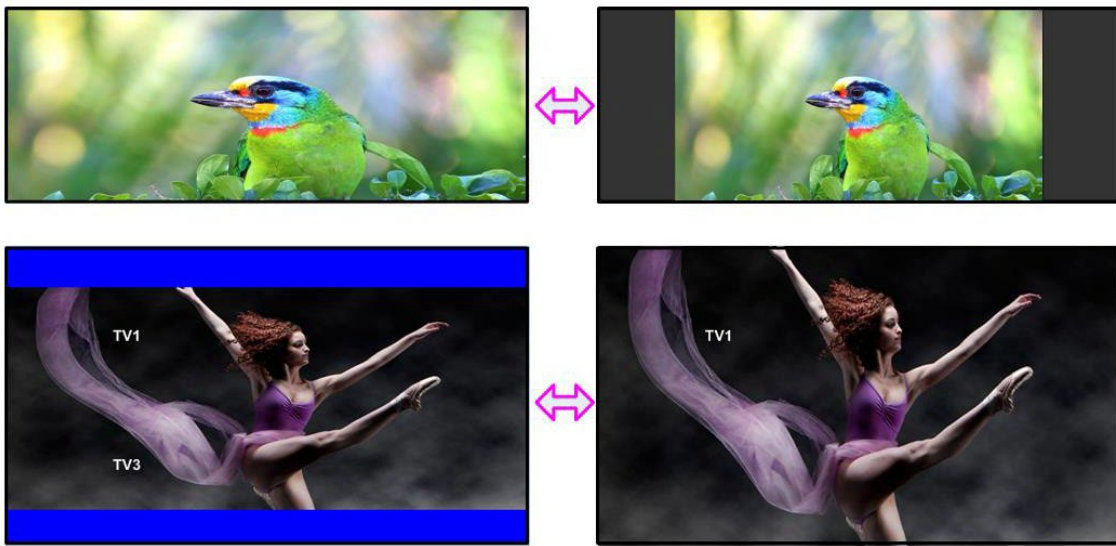
- Signal source selection: User can select HDMI-1/3/5/7 as the input ports for all-in-one edge blending and select HDMI-2/4/6/8 as the input source for four discrete displays.
- When execute discrete display, please reset [Video Wall] and Edge Blend] to default value.
- User need to use geometry alignment to let the images in projectors apart from each other.
- The Overlap region among adjacent projectors should not be too big. Otherwise, the final discrete image will have more aspect ratio change due to draw the image inward. If necessary, user can

draw back top/bottom image by Video Wall [Overlap] function to let final image has the same aspect ratio as original.

- Save the final result into the same Profile Index in all channels for easy recall.

12.5. Complete system aspect ratio adjustment

User can change the aspect ratio of the image with black borders or to stretch the image in specific direction to compensate the aspect ratio difference. The Maximum adjustment range is 1800 pixels in each edge. User can adjust [Overlap] value under [Video Wall] menu to change the cropping area and achieve aspect ratio change.



Activate [Overlap] under [Video Wall] menu

- User can select the channel and the edge required for edge shift, then adjust Overlap value to see aspect ratio change.
- The image position shift range is +_1800 pixels in each edge.

- If the Video Wall [Zoom] is set to H=1 & V=1, +-1800 pixels edge shift in RH and LH edges is only available under input signal up to 4k/2k @30Hz. Top Edge and Bottom edge are still functional when the input is 4k/60 with Zoom at H=1, V=1.
- If Video Wall [Zoom] is set to H=2 & V=2 or above, user can execute up to +_1800 pixels overlap adjustment in all edges up to 4k/60 input resolution.

- In multiple projector application, when user adjusts Top or Bottom Overlap value in one projector, user needs to adjust the same Overlap value in other projectors to let all projectors has the same scaling factor.
- In two projector edge blending, when user adjusts horizontal aspect ratio, user needs to change Video wall Overlap value with the same number in both projectors until getting clear overlap image. In GEOBOX Excel Spread Sheet calculation, if user calculates original Overlap value with 3840 input resolution, after increase 500 pixels in both outside edges in projector 1 (RH edge) and projector 2 (LH Edge), user can shrink the image width. However, the overlap region will become blurred. User needs to re-calculate Overlap value by new input resolution $3840+500*2=4840$ to get correct video wall Overlap value. User can also continuously increase overlap value in both projectors to a point that both images can match together.
- The adjustment range of 1800 pixels is calculated according to the signal source resolution. If the signal source is 4k/2k and the adjustment value is 1200 pixels, when switching to 1080p input signal, the adjustment value will be converted to 600 pixels automatically to maintain the same image position. If the input signal source is 1080p and the adjustment value is 1000 pixels, when switching to 4k/2k input signal, the adjustment value should be 2000 pixels. However due to the maximum adjustment value is only 1800 pixels, the final image will follow 1800 pixels but not 2000 pixels for 4k input. It means the image aspect ratio will not the same as 1080p input source.

13. Miscellaneous settings

13.1. Helpful tips for edge blending

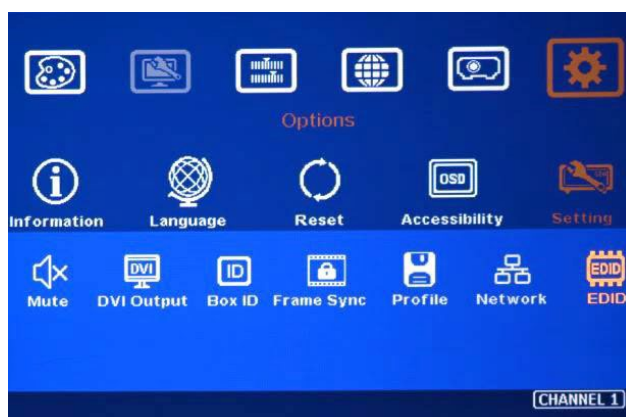
- Image distortion and aspect ratio issues
If the content aspect ratio is different from the screen, it will cause image distortion. User can adjust aspect ratio through [Overlap] settings. There are two choices:
 - ✓ Full screen display but some content will be drawn to outside border and missing.
 - ✓ Draw the image into screen and keep some blanking border at some borders.
- M800 can support interlaced signal source (i.e. 1080i). However, if user rotates or flips the image, there will be no 3D motion adaptive de-interlaced function. User may see some small flick image while the input is still image. We recommend applying progressive signal to avoid this kind of issue.
- In the application with short throw ratio projector on curved screen, there will be big image distortion. User needs to apply big geometry alignment and degrade the video quality.
- Image position drift will cause blurred image in overlapped region. For edge blending application, please select one projector with less Thermal drift. It can be judge through comparing image position shift between Power on and after 20 minutes running time.
- Mark the final image position. Once the position shift in the future, it can be recovered through [2x2 corner] adjustment via remote controller easily.

- Native contrast ratio is important in edge blending. The higher contrast ratio will have less light leakage with less banding in overlapped region under dark environment.
- Ultra-short throw projector is not suitable for edge blending due to big reflection angle and easy to cause color banding effect while watching from different viewing angle, especially under high gain screen.
- Select projector models for edge blending in advance will make sure to get the best final quality.
- Laser projector is recommended for edge blending due to accurate color calibration and high contrast ratio.

13.2. EDID Setting

Selective EDID setting for input source resolution is added into GeoBox. The settings will be applied to individual processing module on select input port. Each processing module needs to set EDID separately. For daisy chain connection, user only needs to set the EDID in the first input port connected with signal source. Below are some guideline for EDID setting:

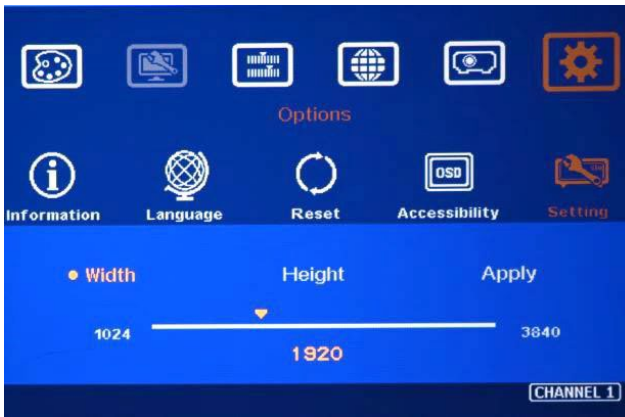
- GeoBox can support big range of input signal timing—from XGA up to 4k/2k @60Hz. In order to get the best video performance, user needs to select the best input signal resolution.
- Different display modes may show different final image aspect ratio. User can utilize different EDID setting to change signal source timing and get different output aspect ratio.
- User can select different EDID directly from OSD list or use [Customize] function to create Non-Vesa standard timing.
- If the signal is from PC, user can set customized EDID in GeoBox to let PC output expected output resolution. Some PC may not follow GeoBox EDID resolution setting and require customized output setting from display card or re-boot.
- The optimized EDID resolution should be the final resolution after edge blending. For instance, if user uses three WXGA projectors for edge blending with 320 overlapped pixels, then the best signal for this setup will be $1280*3-320*2=3200$.



- Activate EDID setting menu:
[Options] → [Setting] → [EDID]
- Use IR remote controller to select desired EDID.
- After select EDID, signal source will auto-change the output timing setting.
- Press [INFO] key to check if the input and output timing are set correctly.

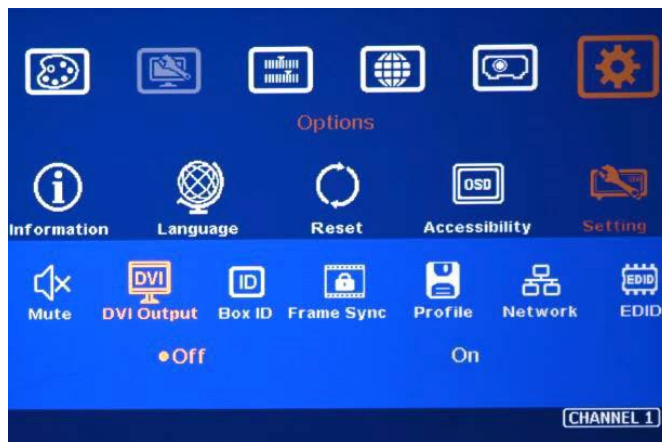


- User can also set EDID manually. The range for customized EDID will be from 1024x768 to 3840x2400.
- Horizontal resolution is in a step of 8 pixels and vertical resolution is in 1-pixel.
- After creating the EDID, PC or laptop may not output required timings due to hardware limitation or driver issue. User may need to do custom setting inside PC and re-boot to get desired output.



13.3. HDMI vs. DVI Output Signal

- HDMI digital signal is compatible with DVI signal. Most of display devices can support both digital signals. However, some old equipment may have less flexibility in signal compatibility. In this case, user may need to select DVI output format to get normal display in some devices.
- HDMI signal embeds more signal information, such as audio and HDCP. Once some information is missing, it will also affect the display. It may cause intermittent or loss of image. Under this condition, user can try to set DVI output. The connection doesn't need to change.

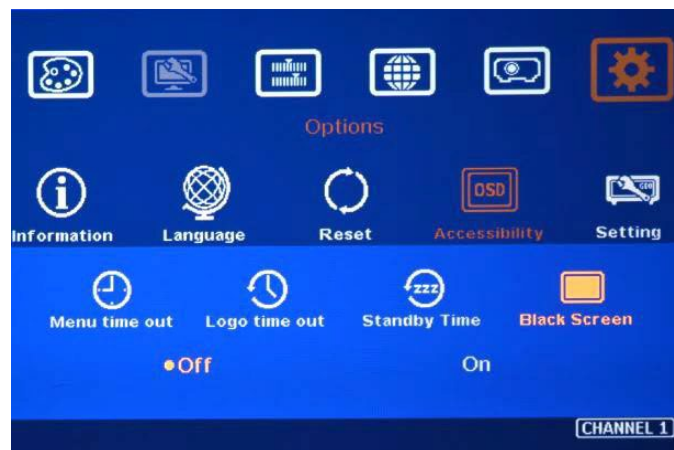


13.4. System Standby and Automatically Turn Off Output Signal

- [Options]→ [Accessibility]→[Standby Time]
- If set [Standby Time] at 60, the system will get into Standby Mode after 60 seconds when no input signal is detected. The output signals from M800Ex will also be terminated at the same time. If M800Ex detects input signal again, it will automatically turn on the system.
- If the projector can automatically turn off/on by detecting input signal, user can control signal source to execute entire system on/off control.

13.5. Change Background Color

When no signal input, the system will show blue color background with [Power Saving Mode] message on the screen. User can change background color to black on the screen with no text message on it through [Options]→ [Accessibility]→ Black Screen]→ [On]



13.6. Turn off splash screen Logo

- User can turn off splash screen Logo through [Options]→ [Accessibility]→ [Logo Time Out] and set the value at "0". Default setting is 10 seconds.
- It will reduce the boot up time.

13.7. Limitation in Audio Output

If both HDMI and DP input are selected, only HDMI audio will be selected as audio output.

14. **Trouble Shooting**

14.1. **Front Panel LED indicators**

- User should see Input / Output LED lights in each channel. If no light illuminated in specific channel, please check Input / Output connecting cables, signal source & projector in that channel.
- If user sees continuous flashing in some channel LED, it means OSD may be locked. Please press [Menu] key for 5 seconds or press 850 number keys in remote controller to disable [OSD locked].

14.2. **Intermittent or Loss of Input Signal**

- Check the HDMI cable quality and make sure all cables are fitted correctly. 4k/60 signal requires high speed certified cables.
- Cable length: Connecting cable length should be as short as possible. Replace a short cable to verify the possible root cause.
- HDCP compliant issues: If the input source or the monitors are not HDCP compliant, it is possible to stop M800Ex from negotiating HDCP link and show intermittent, abnormal or no image. Please check HDCP condition in signal source or display device.
- Resolution issues: check if signal source and connecting cables can provide source signal supported by M800Ex.
- DVI/HDMI signal compatibility: some display devices may only support HDMI or DVI video signal and execute wrong signal format detecting. The default output is HDMI. User can change output with DVI format through [Options]→ [Setting]→ [DVI]→ [On].
- Usually, to swap with different cable, output channel, signal source and projector can verify the root cause for the failure.
- When it is possible to have signal compatibility issue, user can add one HDMI splitter/switcher in the middle to change signal impedance. It may fix the issue.
- During system settings, the output signal may be temporarily lost and cause projector re-searching input signal and the image disappears shortly. User can disable [Frame Sync] function to avoid this kind of effect . After finishing system setup, user need to set [Frame Sync] at [Normal] position to get perfect synchronization in all output channels.

14.3. **Video quality issues**

- Use the highest resolution and number of color bits (RGB 4:4:4) images allowed by M800Ex to be used as a signal source whenever possible. Please click INFO key to verify input/output resolution.
- There are a number of lower-quality AV players, the specification and actual output are

difference, or because of the use of lower color sampling bits or poor image compression technology, resulting in lower quality or image is not smooth (LAG).

- If the use of H.264/H.265 compressed files, please select a player with hardware decoding to get smooth video quality.
- If the input signal is interlaced signal (interlaced-1080i), and the image is rotated, then the channel will have no [3D Motion adaptive de-interlaced] processing function. If user applies static image source, the output video will have a slight jitter phenomenon. The processing channel quality will be reduced. Use a progressive signal source setting (1080p/2160p) whenever possible.
- Please press [INFO] shortcut key to check the input/output signal settings.

14.4. Image position shift after installation

The position shift in the projector will be enlarged to more than 10x due to projection distance. One mm image shift inside projector may appear 1cm image shift on the screen. User will clearly see blurred effect on overlap region in edge blending setup.

- There will be some image position shift after system setup. The main reasons are as follows:
 - Thermal drift due to projector internal temperature change. When power on the projector, the temperature is lower. After 20-30 minutes, the image position shift may be up to 5-10mm. It will be more obvious in overlap region. Different projector will have different thermal drift range.
 - Stability of mounting system.
 - Projector structure change after installation due to weight and thermal effect.
 - Cable connection and cause weight balance issue.
 - Change lamp
 - Earth quake or caused by human reasons.
- The first projector image position calibration should be done within one month after installation. The second calibration may be required after 3 months, then every 6 months or once a year.
- If user finds big position shift and doesn't know the real issue. Please follow below procedures to confirm the issue is from GeoBox or not.
 - Turn off GeoBox and open projector internal test pattern.
 - Mark the corner positions of the projector image.
 - Check projector image shift condition after some time with GeoBox in OFF condition.
 - User will clearly identify that the position shift is from GeoBox or not after this procedure.
 - GeoBox is digital processor and will not change image position only for few pixels.

14.5. System crash and malfunction

- After FW update, please reset the system through a pin inserting to reset hole on the back panel for 5 seconds to avoid abnormal settings inside the system.

- When the input source is 4:4:4 PC graphics signal, only [Brightness], [Contrast] and [Sharpness] three items under [Picture] menu can be executed. If the input is 4:2:2 video source, all the items are functional.
- When implement [Corner Wall] alignment, other geometry functions will be not functional.
- Remote controller may be interfered by environment and can't be smoothly operation.

14.6. Slow response in pattern change in projection mapping

- If the pattern for projection mapping is too complicated, it may take long time to render the mapping image. It only affects switching time but not affect image quality or performance.

14.7. Synchronization issue in the outputs

- The input refresh rate should be the same as output refresh rate so that the system can implement Frame Lock to synchronize all the outputs. If the input source is 50Hz with 60Hz output, it is possible to see some lag or frame tear in the display.
- Please make sure to set [Frame Sync] at [Normal] in all channel to ensure all outputs will be synchronized.



15. Technical support

- User can send e-mail to sales@vigillink.com together with as much information as possible.
- The following information is required for a swift response.
 - Sink device (projector): type and model number
 - Screen details or specific application details.
 - GeoBox model No. and series No.
 - Details of the signal source and the resolution.
 - Press [Info] key to get System Information and send the data to us, including input/output timing and F/W version.
 - The exact nature of the problem. Please be as detailed as possible.
 - If possible, please attach the Pictures of the issue.

- Usually we will response within 24 hours (excluding weekends)
- Please note that if the machine is sent back for repair, user needs to pay for the delivery cost.

16. Safety Precaution and Maintenance

16.1. Power Supply

Please connect electric power for all devices in the system from the same Power Distribution Box with correct grounding. Open the power after finishing system connection to reduce the risk for system damage from high floating voltage.

16.2. Working Environment

Please locate M800Ex in an environment free from dust, moisture and high temperature with good ventilation.

16.3. Warranty

This device is designed and tested to the highest standards and backed by thirty-month's parts and labor warranty. Warranties are effective upon the first delivery date to the end customer and are non-transferable.

16.4. Maintenance and Repair

Apart from what is detailed in User Guide, maintenance should be carried out by competent technician assigned by GEOBOX. If M800Ex is physically damaged, it should be returned for repair using VIGILLINK RMA procedures. If the unit is opened by user, it will lose the right for warranty protection.

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 30Hz, 7680*1200 @60Hz, 4096*2160 60Hz
- 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)
- Provide projection mapping function through input monochrome pattern. User can apply any content and doesn't need to do image mask in the content in advance. Up to 10 different patterns can be stored inside each Box.
- 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 following 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 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 setting.
- Selectable grid pattern size from 8-120 pixels in H&V direction. 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.
- 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 continuous signal to output, no source searching required in projector when input source change.

-
- Support xvYCC & 8/10/12-bit deep color processing.
 - Support High Dynamic Range (HDR) input signal: SMPTE ST-2084, SMPTE ST-2086
 - 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 not available when the main image is 90/270 degrees rotation.
 - Selectable and programmable EDID in the range: H=1024-3840, V=720-2400.
 - User can save up to 5 settings and can 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 in 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 months Warranty.

Revision History

Revision	Date	Originator	Comments
V1.0	2019-05-13	Steve Wang	First version
V1.1	2019-05-19	Steve Wang	Fixed typo
V1.2	2019-06-18	Steve Wang	Fixed typo
V1.3	2019-10-16	Steve Wang	Support 8k/1k input
V1.4	2019-11-19	Steve Wang	Fixed Profile Save/Load
V2.0	2020-05-19	Steve Wang	New revision
V2.01	2020-06-05	Steve Wang	Add system connection information
V2.02	2020-10-18	Steve Wang	Add projection mapping information