



G406 Projector Application note

Do you have trouble in using projector internal warp and edge blending function?

- Inconvenient in multiple signal source connection
- System resolution is not enough after edge blending
- Big aspect ratio change and not easy to handle.
- Difficult to do portrait edge blending to increase image height.
- Difficult to assign image size for Corner Wall display based on different wall dimensions.
- Require all-in-one and discrete content display in each projector
- Require flexible aspect ratio adjustment after edge blending

G406 can solve the above problems and provide you superior image quality.

The applications under this document require Projector with geometry alignment or edge blending function. If low cost projector is used, please select G-602 or G-700 edge blending processor to execute precise geometry alignment and edge blending functions.



Table of Contents

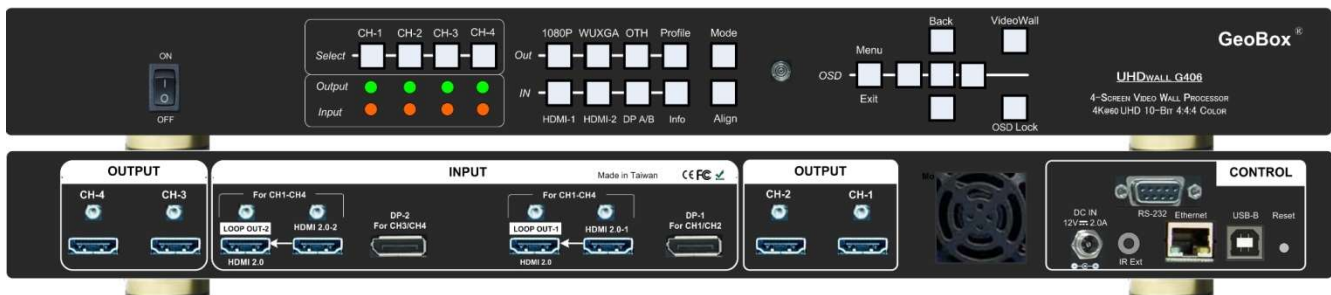
Introduction.....	2
Feature.....	2
G406 for Projector Application.....	3
1 Switcher and HDMI Splitter Function for Multiple Windows Display.....	3
2 Cropping Specific Region for Each projector and Set Overlap Value for Edge Blending.....	3
2.1 Typical Application: One 4k Signal for 3/4 Projector Edge Blending.....	4
2.2 Multiple Unit Cascaded.....	4
3 Cropping Image for Corner Wall & AR/VR Display.....	5
4 Increase System Resolution.....	5
4.1 Single G406 for 8k Signal Source.....	5
4.2 Multiple Units of G406 for High Resolution Display.....	6
5 Edge Blending with Projector at Portrait Position.....	6
6 Flexible Display with All-in-one and Multiple Windows.....	7
7 Adjust image aspect ratio.....	8
Basic Operation.....	9
1. Connecting the Inputs.....	9
2. Connecting the Outputs.....	9
3. HDMI Loop Out for Multiple Units Connection.....	10
4. Conventional Video Wall Settings.....	11
4.1 [Zoom] – Split Source Image.....	11
4.2 [Pan] – Assign Image Position.....	12
4.3 [Overlap] – Bezel Compensation and Position Alignment.....	12
4.4 Excel Spread Sheet for Overlap Value calculation.....	13
5. Save System Settings through OSD Menu.....	14
6. Load Profile Index through Front Panel hotkeys.....	14
7. Load Profile Index through Remote Controller.....	14
8. Easy Settings in Multiple Unit Application.....	15
8.1 Setup by Remote Controller.....	15
8.2 Setup by Ethernet.....	15
8.2.1 WebGui.....	15
8.2.2 UHDWall Manager PC tool.....	16
9. Limitations in Image Flip and Rotation.....	17
10. Warranty.....	17
Specifications.....	18

Introduction

GeoBox G406 is the state-of-the-art DCi/UHD 60fps four channel video processor to allow great freedom in projector applications. It incorporates two HDMI 2.0, two DisplayPort 1.2 inputs and two HDMI 2.0 loop-through ports with HDCP 2.2/1.4 as well as four synchronized Full HD outputs. Each output has independent image rotation/flip, scaling, cropping and color adjustment.

G406 is designed with matrix switcher function to display 1, 2, 3 or 4 independent contents on four projectors. Two HDMI 2.0 loop-through ports are designed for multiple unit cascade and allows user to select different contents for entire display.

It is pure hardware, standalone system with easy-of-use. All operations can be implemented through front panel keypads, IR remote controller, USB, RS232 or Ethernet. No additional PC, appropriate device or software tool is required, simple and more reliable. It can be connected with all kinds of signal sources such as PC, PS4, XBOX, Blue Ray player, media player and interactive system with low latency and quick response without the issues in system synchronization, virus and hacker.



Features

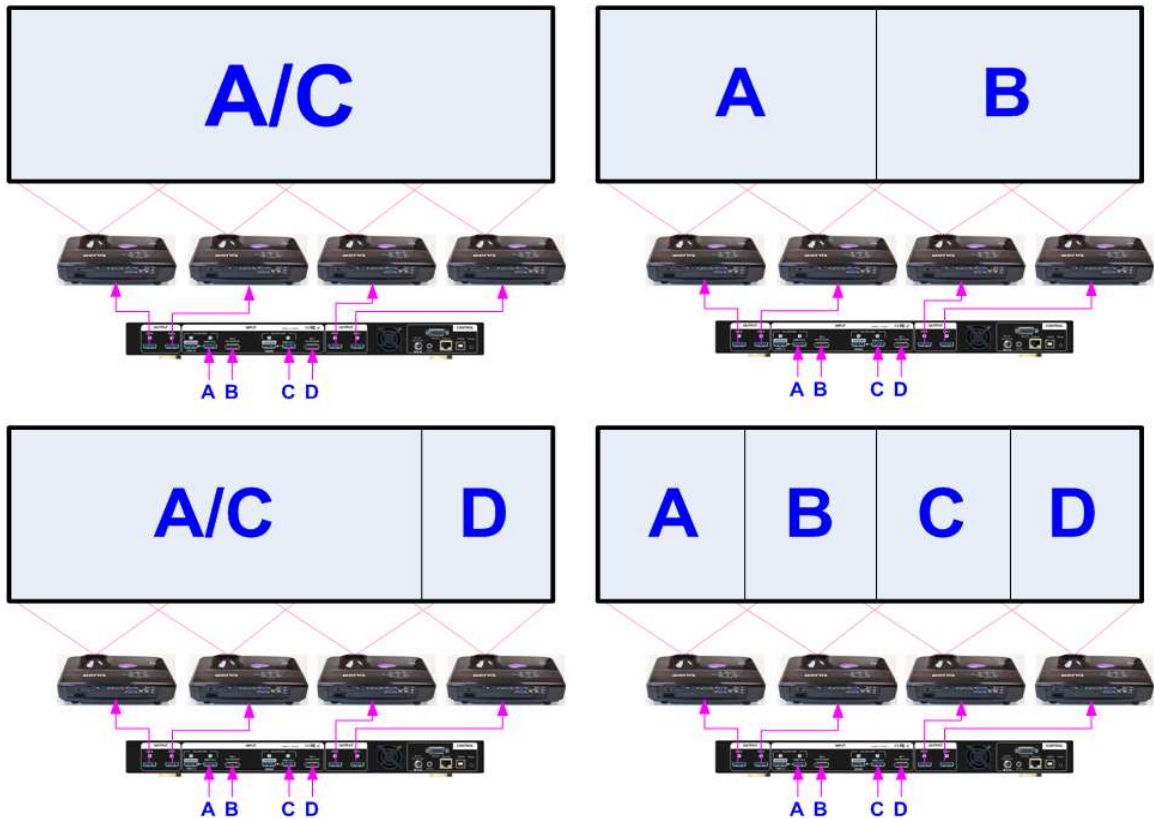
- ✧ 4x UHD/DCi 60fps inputs and 4x WUXGA/1080p outputs.
- ✧ Input ports: two HDMI 2.0 input ports for all channels. DP-1 for CH-1/CH-2 and DP-2 for CH-3/CH-4.
- ✧ Support up to 4096x2400@60Hz input through HDMI 2.0 & DisplayPort 1.2.
- ✧ HDCP compliant in all inputs and outputs (HDMI: HDCP 1.4/2.2, DP: HDMI 1.3)
- ✧ Matrix switch function to allow multiple window display, 1/2/3/4 contents on 4x outputs.
- ✧ Dual Loop-through ports for multiple units cascade in any scale display with selectable inputs.
- ✧ Pixel to pixel alignment up to +_ 900 pixels in H&V for flexible image capture, cropping & position alignment.
- ✧ Set output up to 900 overlapped pixels for projector edge blending application.
- ✧ Independent Image color adjustment, cropping, scaling, rotation and flip in each channel for variable applications
- ✧ Selectable output resolution and programmable EDID for optimized input to provide superior video quality.
- ✧ Frame-Lock function to get perfect synchronization among output channels.
- ✧ G406 can sever as one Quad channel processors or two independent dual channel processors to support up to 8k width input signal from one G406.
- ✧ Support HDR 10 high dynamic Range color input signal.
- ✧ Easy setup via IR, front panel Keypad, USB, RS232 & Ethernet. No PC or Zero client is required.
- ✧ Flexible RS232 + Ethernet simultaneous system control.
- ✧ Support super high resolution content (more than 8k/4k) through multiple 4k inputs.
- ✧ Ready for 24/7 working environment.

G406 for Projector application

Please note that G406 has no edge blending and geometry alignment functions. These two functions should be implemented from projector. Otherwise, please select G-602 or G-700 model to execute precise geometry alignment and edge blending functions.

1 Switcher and HDMI Splitter Function for Multiple Window Display

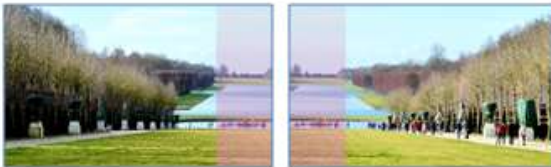
- 1.1 2x4, 2x8, 2x12, 2x16--- HDMI splitter and matrix switcher
- 1.2 Dual channels 1x2 DisplayPort to HDMI converter
- 1.3 Multi-window Applications



2 Cropping Specific Region for Each Projector and Set Overlap Pixel for Edge Blending

Two GeoBox outputs with redundant data in overlap region

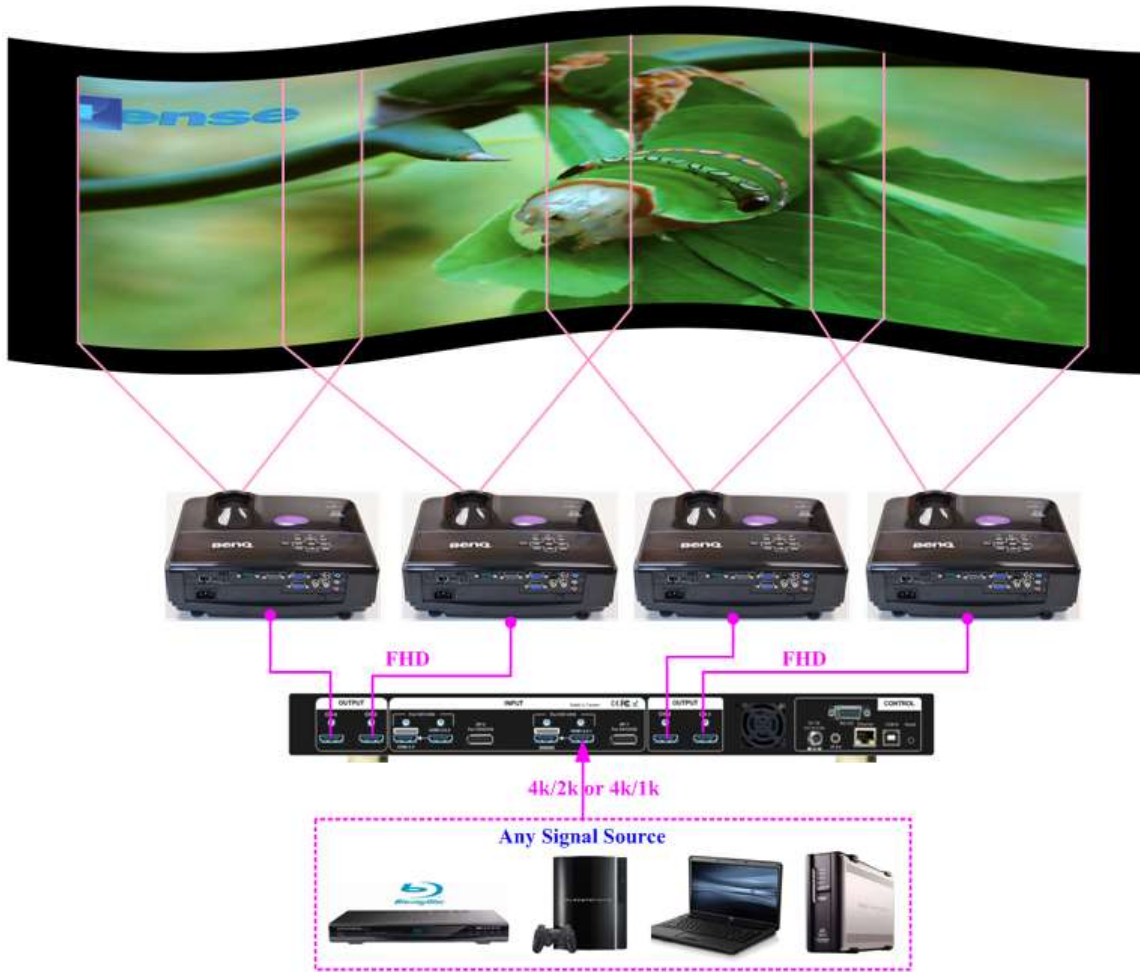
Projected image are overlapped and blended by projectors



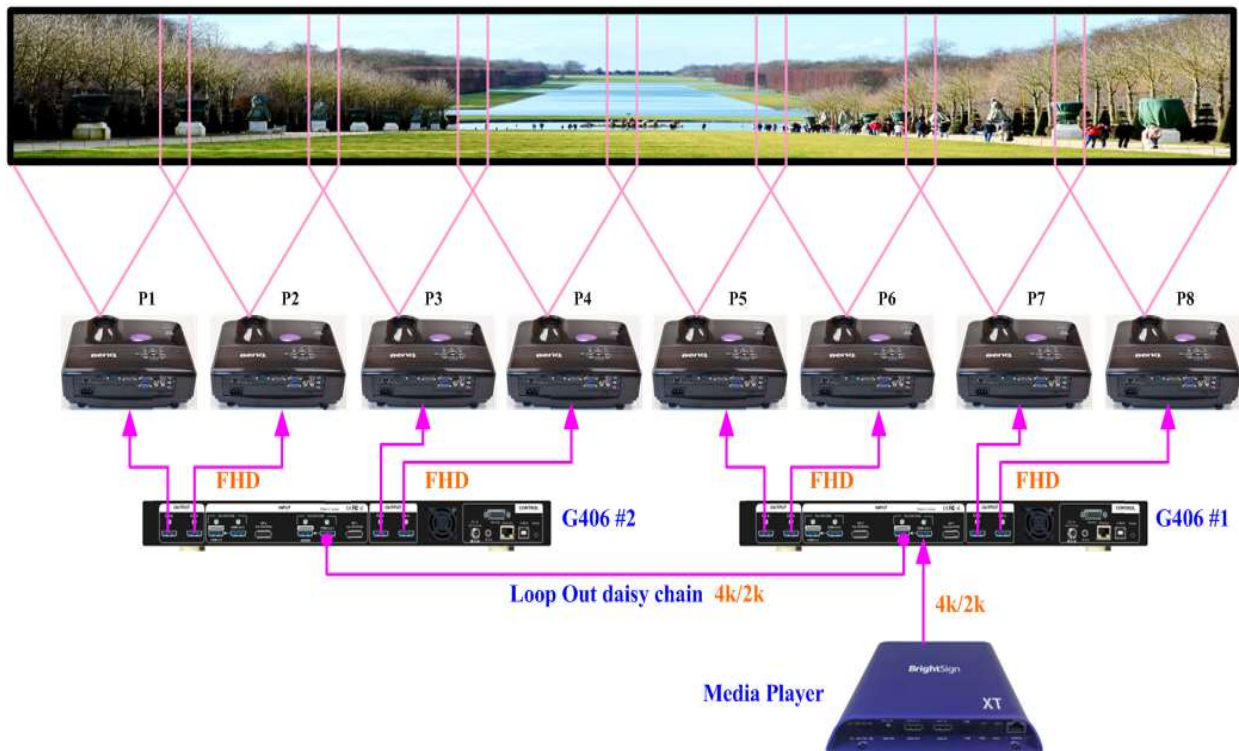
After projector edge blending, resulting seamless image



2.1 Typical Application: one 4k signal source for 4 projector edge blending



2.2 Multiple Units cascaded



3 Cropping Image for Corner Wall Display

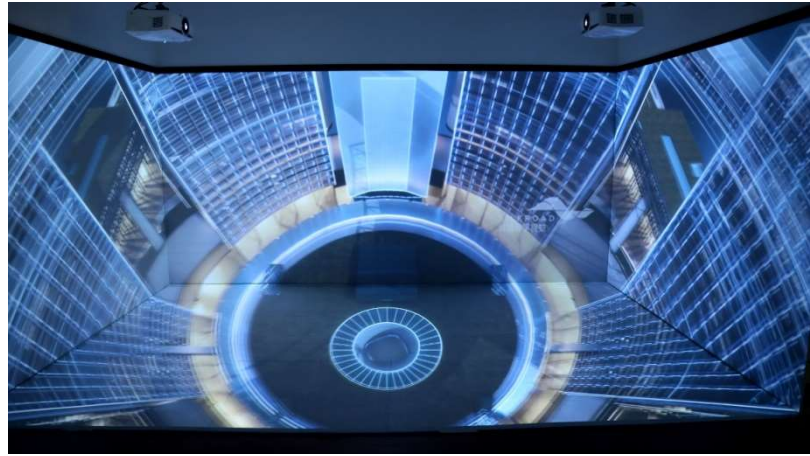
Two UST Projectors
at Portrait direction

(No edge blending required)



3 Walls plus one floor display: cropping the right region
to obtain uniform scaling factor for entire images

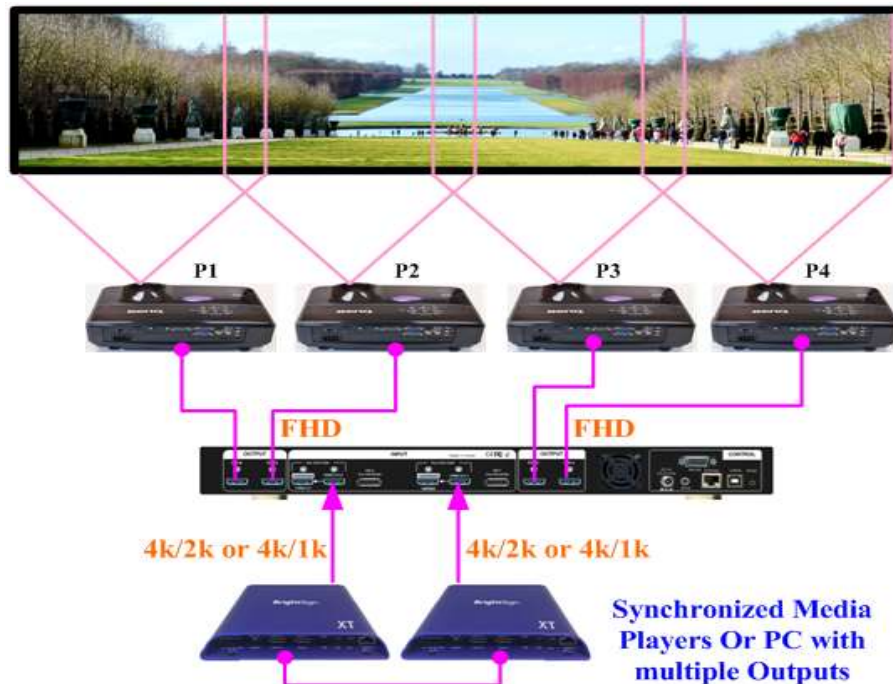
(Edge blending may be required depending on dimensions)



4 Increase System Resolution

4.1 Single G406 for 8K Signal Source

- ✧ Two 4k image for 4 projectors to achieve 8k width edge blending
- ✧ One G406 can be treated as two 4k/2k dual channel processor to split two 4k image for 4 FHD projectors.
- ✧ In below case, if the content is two 4k width (7680) and the Overlap pixels is 384 pixels (total 15% overlap region), the final total resolution of the projectors will be $7680 - 3 \times 384 = 6528$ pixels.
- ✧ If using 4x WUXGA 16:10 projectors and the screen width is 10m, the image height will be 1.84 m if overlap pixels is 384 (each projector image size is 294*184 cm, overlap 58.8 cm, 15%). The final image size is 10m * 1.84 m.
- ✧ If user wants to increase the image height to 2.0 m, to overlap 560 pixels is required (Each projector image size is 320*200 cm, overlap 93.3 cm, 22%). The final image size will be 10m * 2.0 m.
- ✧ More overlap pixels, the final image height will increase but the total illuminance will be less.

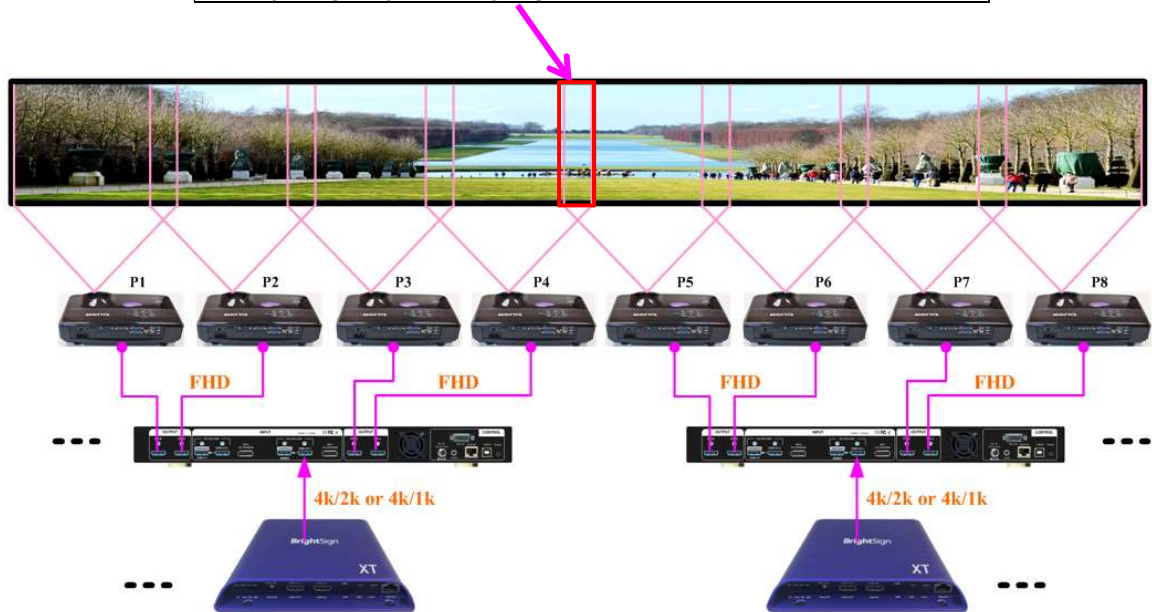


4.2 Multiple Units of G406 Cascade for High Resolution Display

Each G406 is served as one 4 channel processor. Unlimited signal sources can be cascaded.

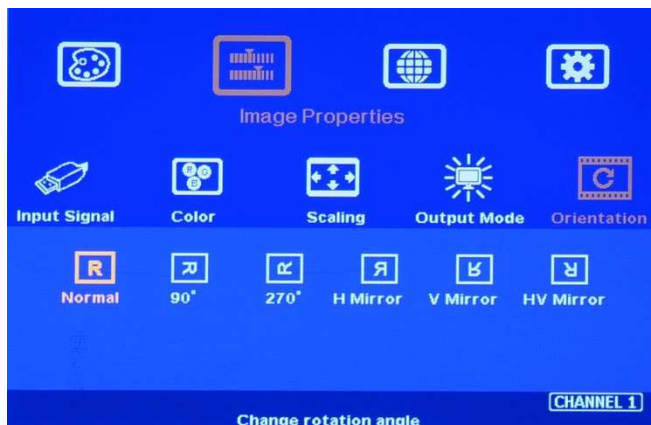
- ✧ The Overlap region between two signal sources should be pre-set by Display card or Media player. All the other overlapped area can be handles by G406.
- ✧ If display card and media player can't set Overlap region, User need to prepare the contents with required Overlap Pixels (same content) in each source for edge blending. This Overlap Region should be larger than the actual overlap pixels. G406 can adjust required pixels for edge blending based on the actual Overlap range in projector installation.

Overlap Region pre-set by signal source or reserved from Contents



5 Edge Blending with Projectors at Portrait Position

- ✧ Landscape edge blending will stretched the image. The purpose for Portrait edge blending is to increase the image height to get image close to 16:9 or 4:3 aspect ratio.
- ✧ Please select projector that is able to be installed at portrait position. User can rotate signal source by below OSD menu from GeoBox. It is not necessary to rotate image in advance.



- Open G406 [Orientation] OSD menu and select 90 or 270 degrees based on the projector installation direction.
- After image rotation, OSD menu will still follow original image direction before rotated.
- It is not necessary for user to rotate content image in advance.

Please execute [Video Wall] based on the final image direction after rotation, including [Zoom], [Pan] and [Overlap].



6 Flexible Display

Edge blending will stretch entire image. User can set different display Profiles and store in G406, then recall it by front panel keypads, remote controller, RS232 or Ethernet, The maximum display profiles can be set in G406 is five.

Case 1: All-In-One

Display one content

Case 2: 1+2

Two edge blended and one discrete

Case 3: 1+1+1

Three independent contents



Each display profile requires below settings in the system:

G406

- ✧ Input selection
- ✧ [Video Wall] setting: Zoom, Pan and Overlap

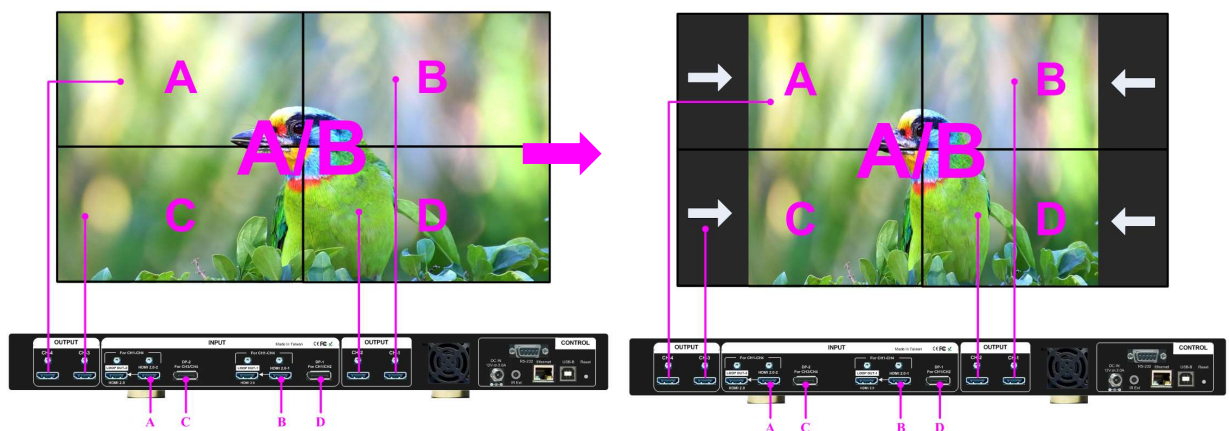
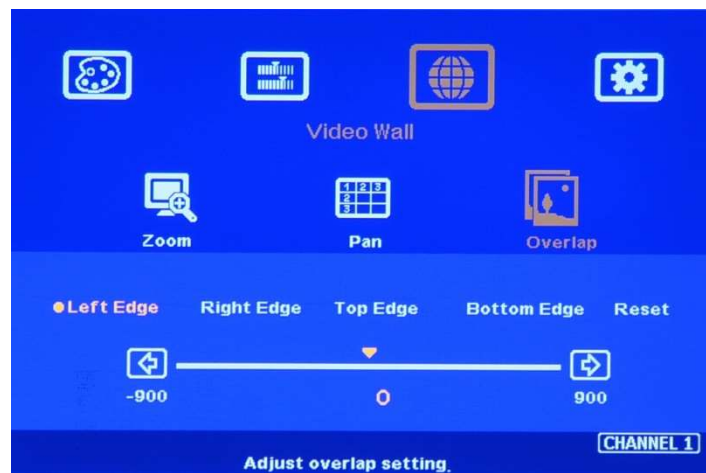
Projectors:

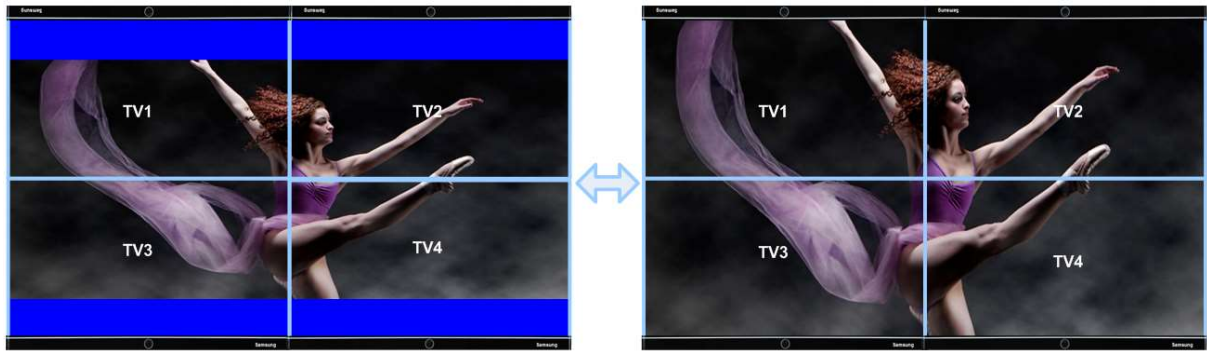
- ✧ Geometry alignment
- ✧ Edge Blending settings

7 Adjust image aspect ratio

G406 can adjust image aspect ratio through [Overlap] adjustment under [Video Wall] menu.

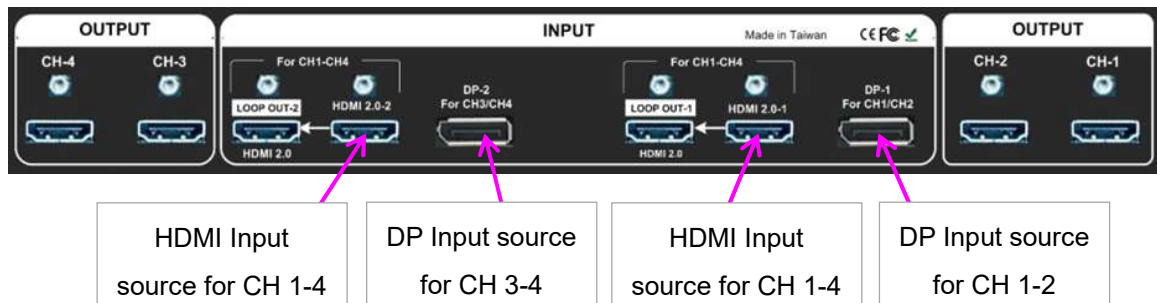
- ✧ To stretch image by reduce cropping area of the image through [Video Wall]→ [Overlap]→ select the edge and adjust overlap value. If the Overlap value is decreased, it will reduce cropping area of the display and cause [Zoom in] effect. The image will be stretched out and some area will be missing.
- ✧ If user increases the [Overlap] value, it will display more image area in the display. It will have [Zoom out] effect. The image will be shrunk. If the edge has no image to be drawn into center, it will cause a black border at that edge and user can see the aspect ratio change.





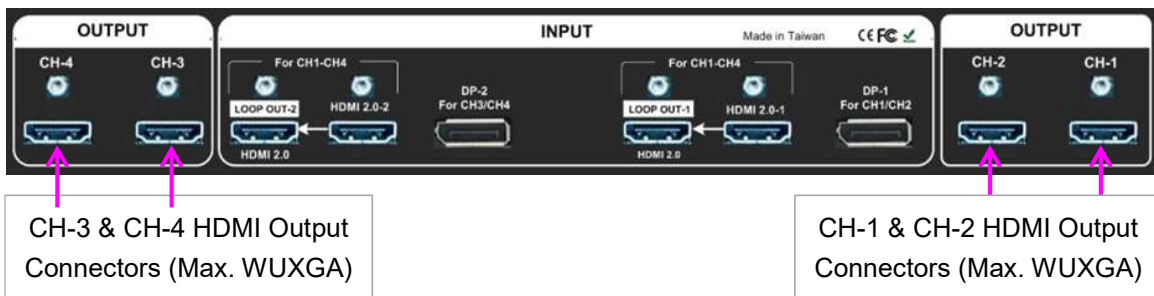
G 406 Basic Operation

1 Connecting The Inputs



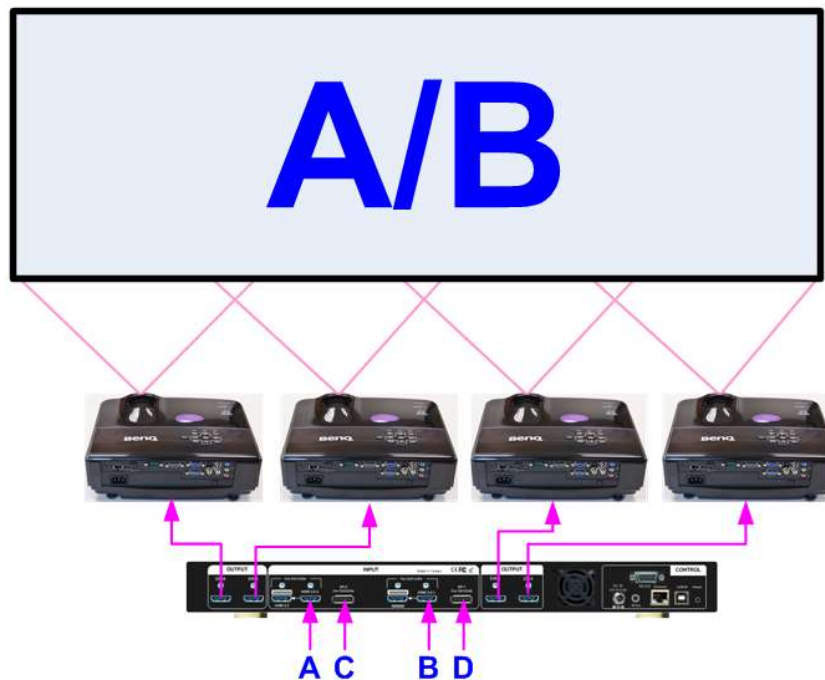
- 1.1 HDMI2.0-1 or HDMI2.0-2 input source can be displayed across entire display (all-in-one).
- 1.2 Each HDMI input source can be displayed in either CH 1/2 or CH 3/4 output freely to show two discrete contents on the video wall. It is one kind of matrix switch function.
- 1.3 CH 1/2 output is set as Group A and CH 3/4 is Group B. Each Group can only select one HDMI input source. While CH-1 selects HDMI2.0-1 as input source, if user selects HDMI2.0-2 for CH-2, then CH-1 input source will be also switched to HDMI2.0-2 at the same time. Group B (CH 3/4) will have the same limitation.
- 1.4 DP-1 input source can only be displayed in CH-1 or CH-2 output port. DP-2 input source can only be displayed in CH-3 or CH-4 output port.
- 1.5 When DP input source is selected for one output port, the other output port in the same Group still can select the source from the same DP input or any HDMI input source.
- 1.6 User can configure the input signal sources to display 1, 2, 3 or 4 contents across 4 output channels.

2 Connecting The Outputs

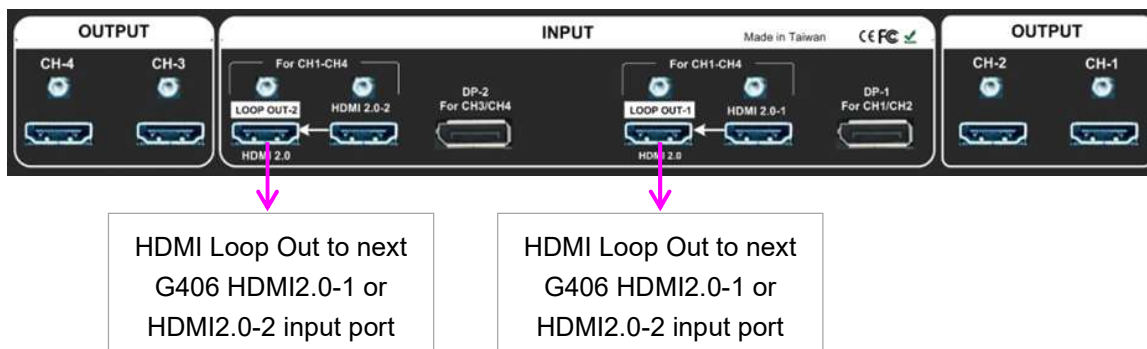


- 2.1 If user wants to display single content across entire video wall, user can connect any output to any projector. Only HDMI input source can be displayed across entire video wall.

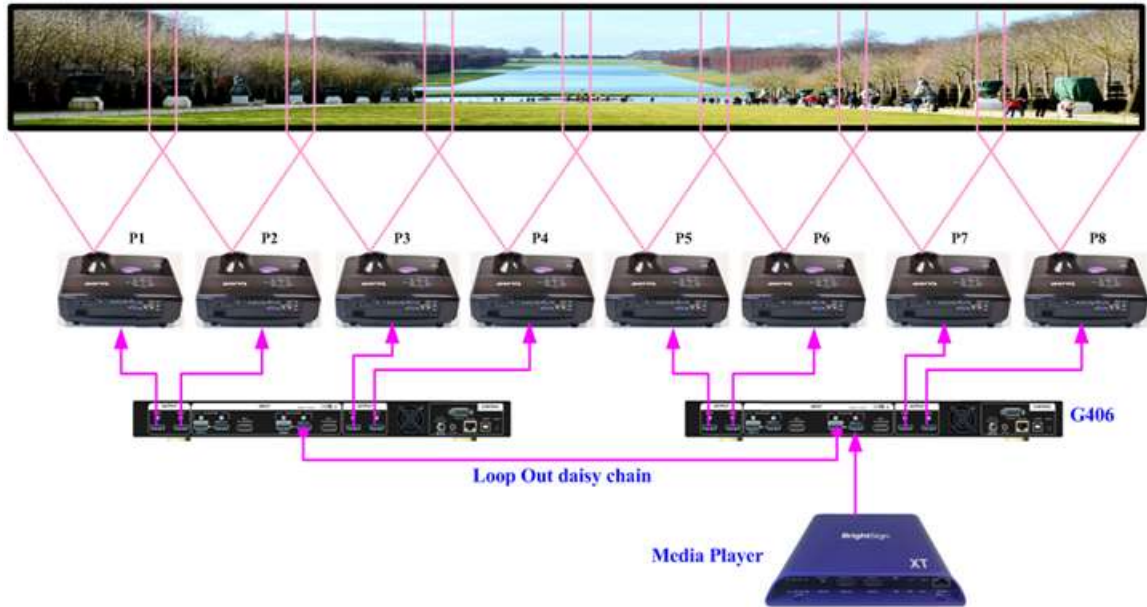
- 2.2 Pay attention that DP1 can only be displayed in CH1/2. DP2 can only be displayed in CH3/4.
- 2.3 User can display 1/2/3/4 content on 2*2 video wall based on the input/output connection configuration.



3 HDMI Loop Out for Multiple Unit Connection



- 3.1 Loop Out-1 provides the same raw source signal from HDMI2.0-1 input port. Loop Out-2 provides the same raw source signal from HDMI2.0-2 input port.
- 3.2 User can connect any Loop Out signal to any HDMI input port in the following G-406. No specific HDMI input port is assigned.
- 3.3 User can connect up to more than 10 units of G406 through daisy chain connection. The daisy chain connection number is related to the quality of HDMI connection cables—good cable can do more units in daisy chain connection.
- 3.4 When user connects two Loop Out ports through daisy chain connection, user can select any looping signal source to display across entire video wall. User can also display multi-windows through adding signal sources from DisplayPort input in each G406. Different settings can be stored in Profile Index and recall through front panel, IR remote controller or RS232/Ethernet control.

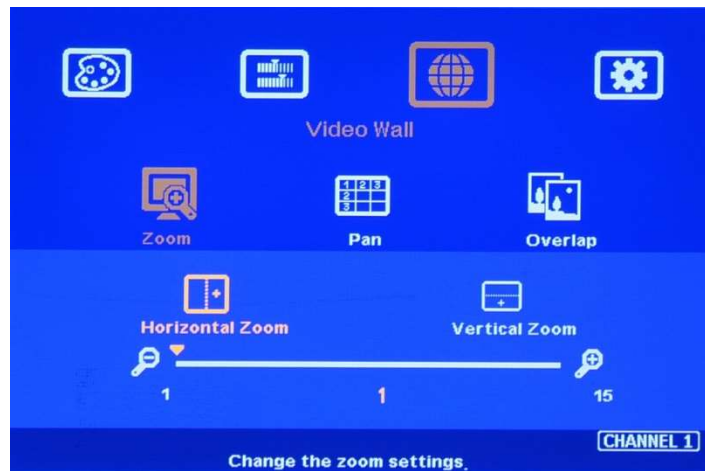


4 Conventional Video Wall Settings

- ✧ Video Wall settings is to crop the right region for each projector with Overlap pixels settings to let each projector display the right image with necessary Overlap Pixel settings to let adjacent image between two projectors 100% matched together.
- ✧ Press [Video Wall] hotkey on Front Panel or Remote Controller to activate [Video Wall] menu. WebGui and UHWall Manager PC tool are available for Ethernet configuration.

4.1 [Zoom]

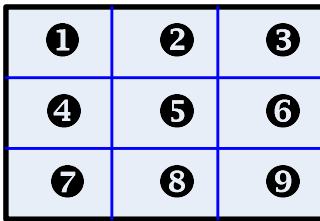
Use [Zoom] to split the display in horizontal and vertical directions. GeoBox will cut the image into different sections. Maximum split image is 15 in both horizontal and vertical directions.





For 3x1 displays

Horizontal Zoom= 3, Vertical Zoom = 1

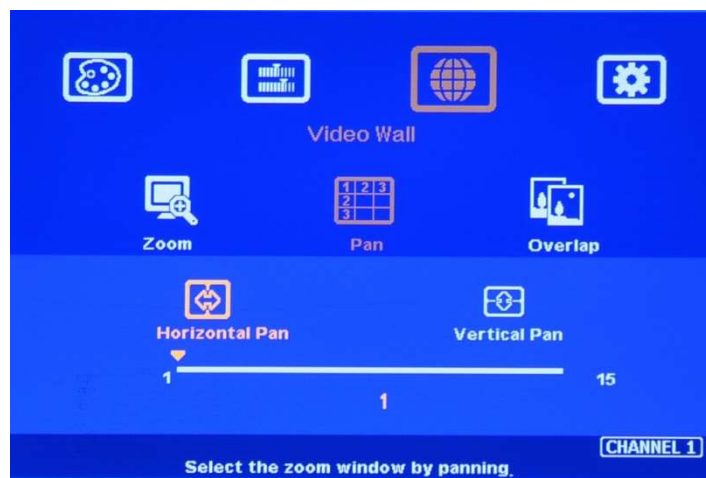


For 3x3 displays

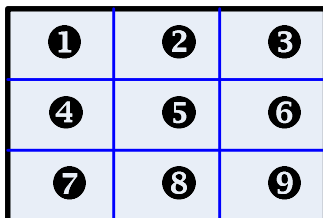
Horizontal Zoom = 3, Vertical Zoom =3

4.2 [Pan]

[Pan] will assign the location of each split image in the display in both horizontal and vertical directions. Horizontal direction is counted from Left to Right and Vertical direction is counted from Top to Bottom.



In the case of 3x3 display, Pan settings are as below:



For No. ③ monitor:

Horizontal Pan = 3

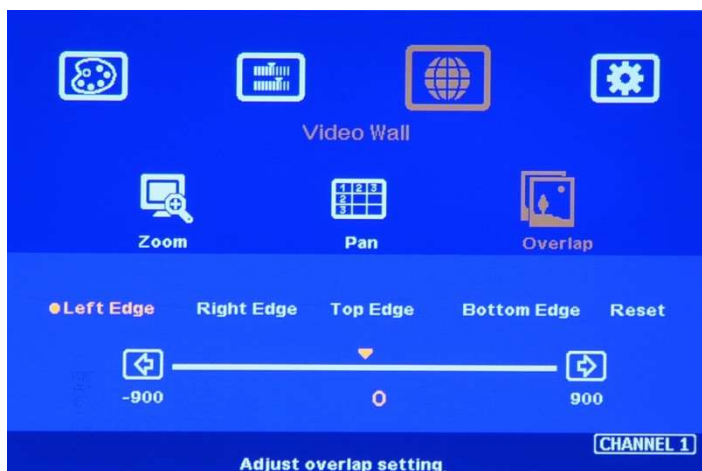
Vertical Pan = 1

For No. ⑥ monitor:

Horizontal Pan = 3

Vertical Pan = 2

4.3 [Overlap] – Image scaling factor and Position Alignment



When the source image is split by [Zoom] function, the actual split location doesn't consider the actual overlap among projectors. Overlap adjustment is to shift the image cropping area in each projector to match actual Overlap pixels between two adjacent projectors. Before Overlap setting in G406, user will see double image in overlapped area .

- Maximum [Overlap] adjustment value is +_900 pixels in each edge.

- Actual Overlap value setting is based on the source resolution (during setup), Output resolution in G406 (should be projector native resolution), Projector actual Overlap pixels (based on projector native resolution) and number of projectors in H&V direction. When image is 90/270 rotated, the Edge for Overlap setting is based on the direction after image rotation.

4.4 Excel Spread Sheet for Overlap Value Calculation

- User can download below Spread Sheet to calculation Overlap setting value at <http://www.vnstw.com/otherfile/6/file246-1-20180223162443-14.xls>
- Spread Sheet A: The overlap pixels among all projectors are all the same in H or V direction.
- Below is example based on 3840*2160 source input for XGA projector. Actual Overlap Pixels in the projector is H=250 pixels, V= 200 pixels (please check the value from Projector internal test pattern)

GeoBox Video Wall Overlap Value calculation sheet

Project basic data

Source resolution (H)	3840	Final output resolution	
Source resolution (V)	2160	Horizontal	4120
Projector resolution (H)	1024	Vertical	1336
Projector resolution (V)	768		
Overlap pixels (H)	250		
Overlap pixels (V)	200		
Qty of projector (H)	5		
Qty of projector (V)	2		

* Please Press [Info] key in remote controller or front panel to check Input/Output resolution. It should match the data in Spread Sheet. After finish settings, no limitation in input resolution.
 * After finishing setup, user can do minor Overlap value adjustment to get the clearest image.

Video wall setting value

Position of projector (H)	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
LH edge overlap value	0	47	93	140	186	x	x	x	x	x	x	x	x	x	x
RH edge overlap value	186	140	93	47	0	x	x	x	x	x	x	x	x	x	x

Position of projector (V)	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Top edge overlap value	0	162	x	x	x	x	x	x	x	x	x	x	x	x	x
Bottom edge overlap value	162	0	x	x	x	x	x	x	x	x	x	x	x	x	x

Example for video wall Overlap value settings in each projector

PJT 1	PJT 2	PJT 3	PJT 4	PJT 5
PJT 6	PJT 7	PJT 8	PJT 9	PJT 10

Projector #4: Take Overlap Value at H (Horizontal)= #4 +V (vertical)= #1 (LH=140, RH=47, Top: 0, Bottom: 162)
 Projector #6: Take Overlap Value at H (Horizontal)= #1 + V (vertical)= #2 (LH=1, RH=186, Top=162, Bottom: 0)

- Spread Sheet B: Overlap Pixels are not the same among projectors.

Video Wall Overlap Value Calculation Sheet (Irregular)

Project basic data

Source resolution (H)	3840
Source resolution (V)	1080
Projector resolution (H)	1280
Projector resolution (V)	800
Qty of projector (H)	5
Qty of projector (V)	2
Final output resolution	
Horizontal resolution	5350
Vertical resolution	1400

Please Press [Info] key in remote controller or front panel to check Input/Output resolution. It should match the data in Spread Sheet. After finish settings, no limitation in input resolution.

Overlap pixels

Overlap value (Horizontal)	250	300	350	250	250										
Overlap value (Vertical)	200	200	200	200	200										
	1~2	2~3	3~4	4~5	5~6	6~7	7~8	8~9	9~10	10~11	11~12	12~13	13~14	14~15	

Video wall setting value

Position of projector (H)	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
LH Overlap value	0	29	93	122	151	0	0	0	0	0	0	0	0	0	0
RH Overlap value	151	122	57	29	0	0	0	0	0	0	0	0	0	0	0

Position of projector (V)	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Top Overlap value	0	77	0	0	0	0	0	0	0	0	0	0	0	0	0
Bottom Overlap value	77	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Example for video wall Overlap value settings in each projector

PJT 1	PJT 2	PJT 3	PJT 4	PJT 5
PJT 6	PJT 7	PJT 8	PJT 9	PJT 10

Projector #4: Take Overlap Value at H (Horizontal)= #4 +V (vertical)= #1 (LH: 122, RH= 29, Top= 0, Bottom= 77)
 Projector #6: Take Overlap Value H (Horizontal)= #1 +V (vertical)= #2 (LH= 0, RH= 151, Top= 77, Bottom= 0)

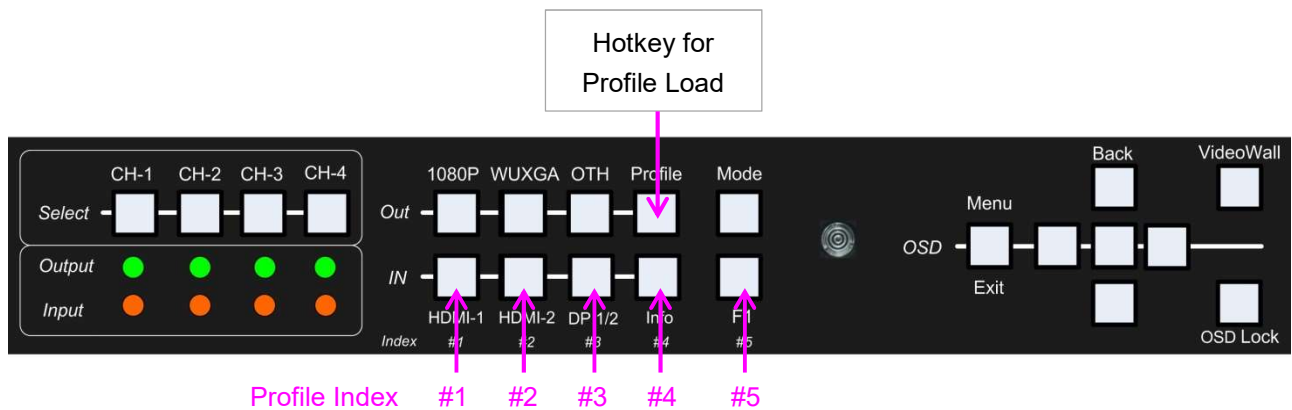
5 Save System Settings through OSD Menu

- After finishing system settings, user can save the setting by OSD menu through [Menu]→ [Options]→ [Setting]→ [Profile]→ [Save]→ [Index 1-5]. **[Save] Profile will take effect for two channels in the same display Group. User needs to Save CH1/2 & CH3/4 separately for one G-406.**
- User can recall the setting (Load) through IR remote controller or [Profile] hotkey on Front Panel.
- 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.



- When user power off the system, G406 will save user setting without loss even the setting is not saved into Profile Index, unless someone to change the setting.
- When system has been reset from OSD menu or update new Firmware, Profile data will still be kept inside G406.

6 Load Profile Index through Front Panel hotkeys



- Load Profile Index
Push [Profile key]→ Select Index # on Front Panel. No [Enter] is required.
- Index # keys on front panel
HDMI-1: Index 1, HDMI-2: Index 2, DP 1/2: Index 3, Info: Index 4, Align: Index 5
- No Profile [Save] shortcut key is available to avoid erasing by mistake.
- Profile Load will apply to all channels at the same time.

7 Load Profile Index through Remote controller

- Press [Profile] shortcut key→ Select number keys 1-5 to recall Index 1 – Index 5.
- Profile Load will apply to all channels at the same time.

8 Easy Setting In Multiple Unit Application

8.1 Setup by Remote Controller

8.1.1 If multiple units are used, user can set different [Box ID] (#1 - #99) to each Box in control system.

For IR control, the number range is #1 - #9.

8.1.2 User can control individual GeoBox through below method when all boxes or IR extender receivers are installed together.

- ✓ Press 851 number key on remote controller will lock all other G406 OSD menu except ID #1 G-406. User can see flashing LED on the Front Panel for the units with OSD locked.
- ✓ Press 853 will only unlock ID # 3 G406 for further OSD operation.
- ✓ Press 850 will unlock all G406 OSD menu. Remote controller can access to all box simultaneously.

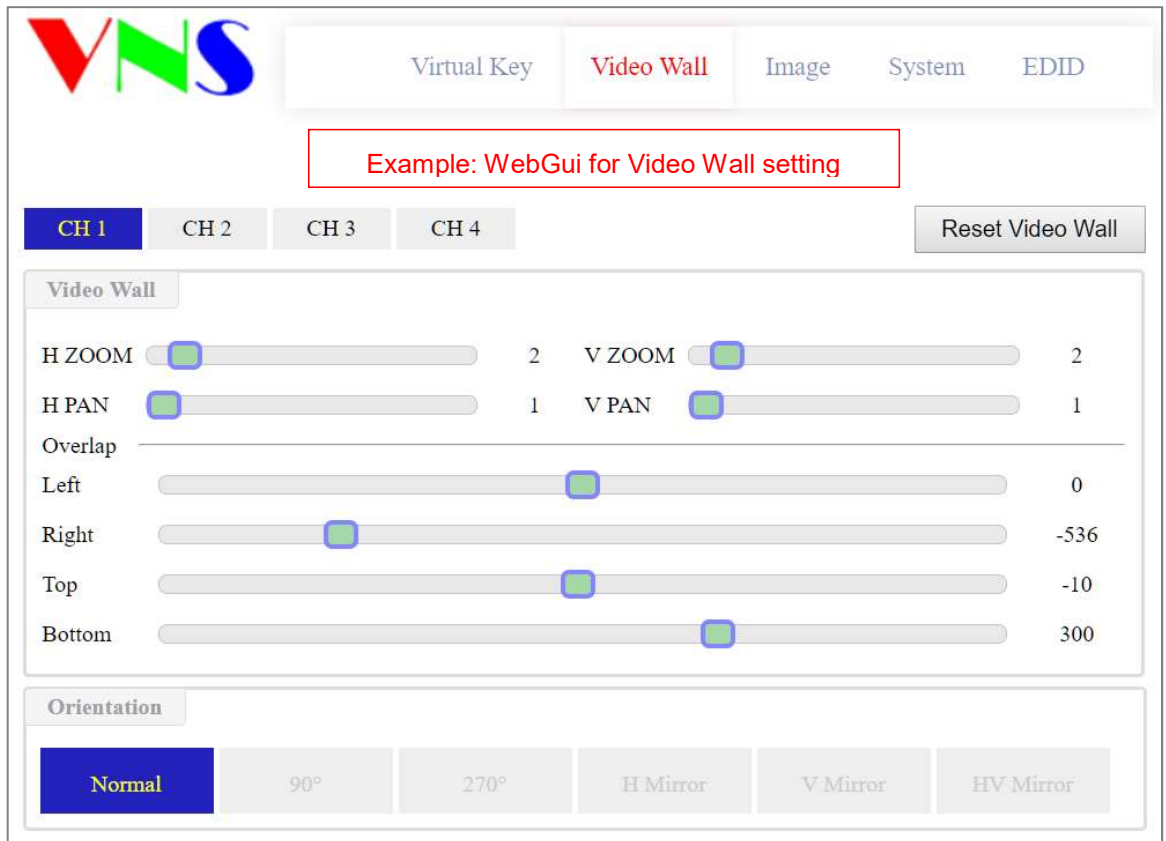
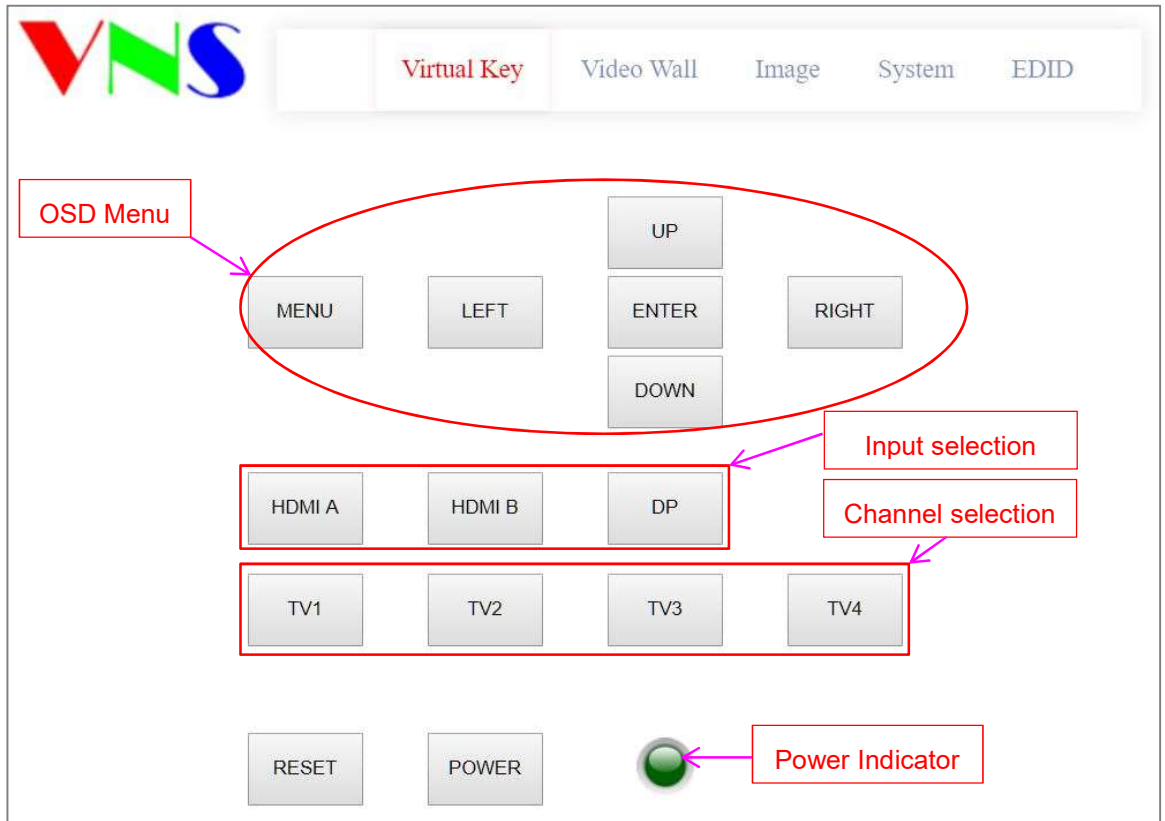
8.1.3 All the GeoBox (or IR extender receivers) should be installed together and can receive the same IR signal if user wants to implement above IR independent control.

8.2 Setup by Ethernet

User can connect all G406 in one Ethernet Router (switch hub) or same WiFi SSID and set **different Static IP address** for each Box, then user can use WebGui virtual keys or UHDWall Manager PC tool to control each G406 independently. User needs to set PC with the same Domain segment in Static IP for Ethernet connection.

8.2.1 WebGui

- ✧ WebGuis is embedded inside G406. Once user connects G406 with PC through Ethernet, user can access WebGui and execute all operation similar to OSD menu through Virtual Keys and OSD Menu. No PC tool is required.
- ✧ The connection can go through Ethernet router LAN port, WiFi Router or Cross Over Cab 5/6 cable. User can set each unit of G406 with different static IP address in the same domain, then open Google Chrome or Microsoft Explorer with IP address to access each unit of G406 for independent operation. There is no limitation in the number of G406 that can be controller at the same time.
- ✧ User can turn on/off the system through WebGui and see the status through power indicator.

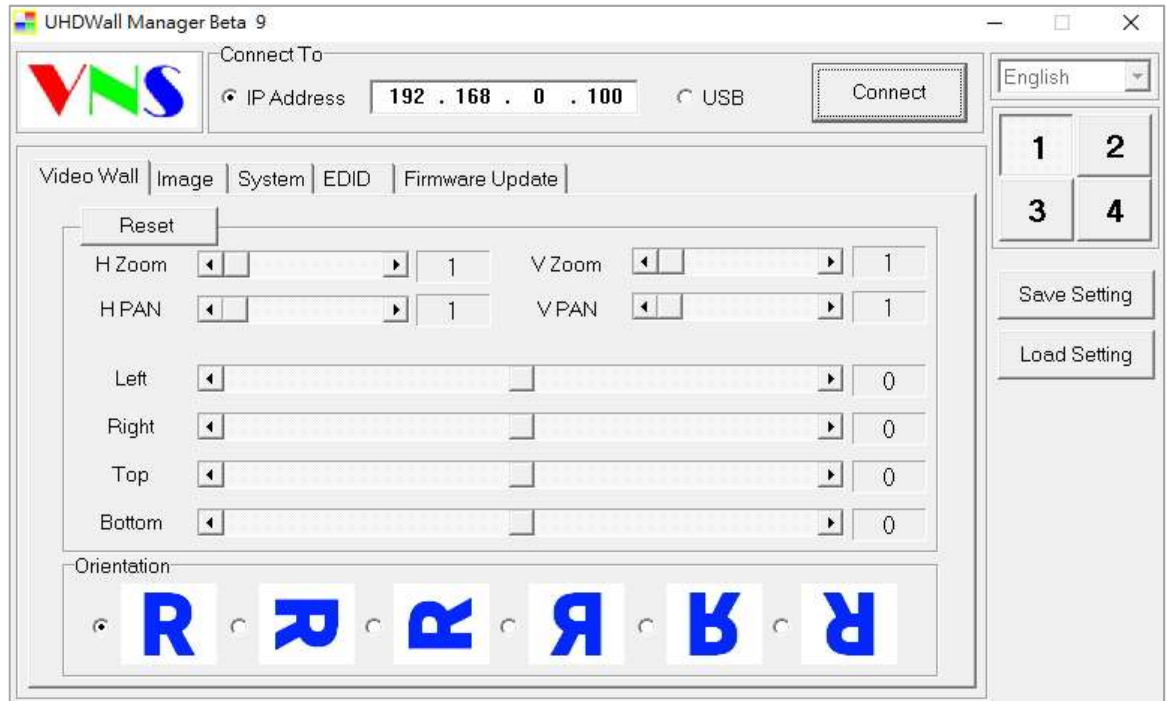


8.2.2 UHDWall Manager PC Tool

- ✧ UHDWall Manager is a PC tool executed through PC. User needs to download this tool from VNS website. Once user connects G406 with PC through Ethernet and open UHDWall Manager,

user can access UHDWall and execute all operation similar to OSD menu through PC keyboard and mouse.

- ✧ User can execute full operation functions and also update Firmware and MCU code through UHDWall. User can control multiple units at the same time through change IP address.



9 Limitations in Image Flip and Rotation

- Image 90/270 degrees rotation and image flips are only available in input resolution under 4k/2k @30Hz (included).
- If the image is RH/LH flip or Top/Bottom flip, the [Overlap] adjustment range under [Video Wall] menu may be only enough for bezel compensation. It will depend on the input/output timing and rotation/flip conditions.

10 Warranty

This device is designed and tested to the highest standards and backed by two years' parts and labor warranty. Warranties are effective upon the first delivery date to the end customer and are non-transferable. Warranty period extension is available up to 5 years through paying extra charges.

Specifications

- ✧ Input: 2x HDMI 2.0b for all channels, 1x DP1.2a for CH 1/2, 1x DP1.2a for CH 3/4
- ✧ Output: 4x HDMI up to 1080P & WUXGA
- ✧ 2x HDMI 2.0 loop out ports for multiple unit cascade & daisy chain connection
- ✧ HDMI: HDCP V2.2/V1.4, DP: HDCP: V1.3
- ✧ Max. input resolution: 4096x2400 @60Hz for both HDMI 2.0 & DP 1.2
- ✧ Support non-VESA STD input timings
- ✧ Support pixel to pixel 8k/4k display
- ✧ Selectable output up to 1920x1200 60Hz
- ✧ 10-bit processor, frame rate conversion
- ✧ 4:4:4 Chroma sampling, 30 Color bits, 12-bit RGB gamma CLUT
- ✧ Support sRGB & xvYCC color processing & 8/10/12-bit deep color
- ✧ 3:2/2:2 cadence, low angle smooth algorithm, high quality scaling engine
- ✧ Flexible aspect ratio adjustment in each edge up to +_ 900 pixels.
- ✧ 3D motion adaptive de-interlace
- ✧ Frame lock for synchronized outputs
- ✧ When the input is 50Hz signal, the output will also keep 50Hz to maintain the best video quality.
- ✧ High Dynamic Range (HDR) support: SMPTE ST-2084, SMPTE ST-2086
- ✧ Individual 90/180/270 rotation, flip, cropping, scaling & color adjustment in each channel
- ✧ Matrix switch for multi-window display
- ✧ Embedded HDMI/DP audio in each output
- ✧ Selectable and programmable EDID
- ✧ ESD Protection: ±8kV (Air-gap discharge), ±4kV (Contact discharge)
- ✧ DC 12V/1.1A, max. 13w, (100-240 VAC PSU)
- ✧ Working environment: 45° C, 10-90% RH
- ✧ Control: Front panel keypads, IR, RS232, USB, Ethernet
- ✧ Dimensions: 440mm*194mm*45mm, Weight: 2.2kg
- ✧ CE/FCC/RoHS/Green Certified