



The absolute opposite of ordinary

UHD Edge Blending Processor

UD100 User Guide

UD101 (1 CH), UD102 (2 CH), UD103 (3 CH), UD104 (4 CH)

The World's first UHD Edge Blender with MultiViewer function

*Input: up to 7680*2160 @30Hz, 4096*2160 @60Hz, 4:4:4 full color sampling*

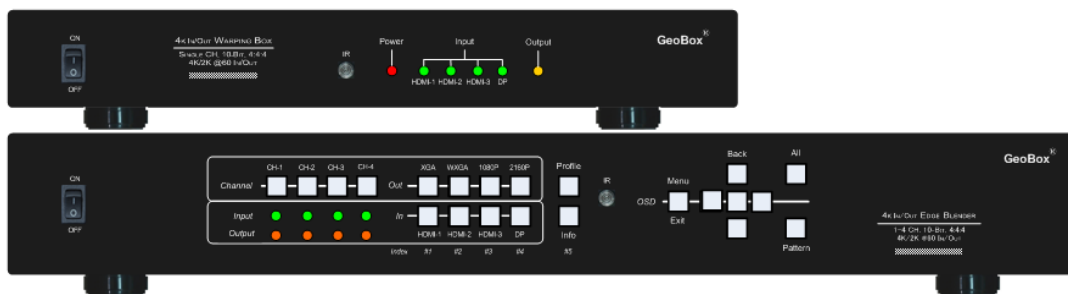
*Output: up to 4096*2160 @60Hz*

New generation 4K Warp & Edge blending engine

Quick seamless input swap

Full functions for edge blending. No PC or splitter is required.

Full functions in one box, simple, easy-of-use



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Introduction

UD100 is designed for 4k projector warp, stacking and curved screen edge blending with the flexibility to provide multiple processing modules to control from 1 to 4 projectors. UD101 is integrated with one processing module to control one projector, UD102 for 2 projectors, UD103 for 3 projectors and UD104 for 4 projectors. One UD104 can execute 4 UHD projector edge blending with projectors, HDMI cables and signal source without any additional equipment or splitter. Multiple UD100 can be cascaded for large scale display.

Each processing channel (processing module) has 4 input ports, one HDMI 2.0 output and one HDMI 2.0 Loop through port. All inputs support up to 7680*2160 @30Hz, 7680*1200 @60Hz input resolution with 4:4:4 full color sampling. DisplayPort input can support up to 7680*4320 @30Hz. Output supports up to 4096*2160 @60Hz. It is integrated with 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 UD100. User can use front panel keypads, IR controller, USB, WebGui and Ethernet to perform edge blending and sophisticated geometry alignment up to 17x9 control points with 120x68 grid pixel position fine-tune. Linearity Grid Line Adjustment for complete line movement and Corner Wall image adjustment for mapping image at 90 degrees corner are integrated. Separate R, G, B gamma correction for edge blending region color fine-tune, individual color correction for each output and 9 regions black level uplift to compensate light leakage in the projector are also standard functions in UD100. Users can see real time geometry and color adjustment to get optimized result.

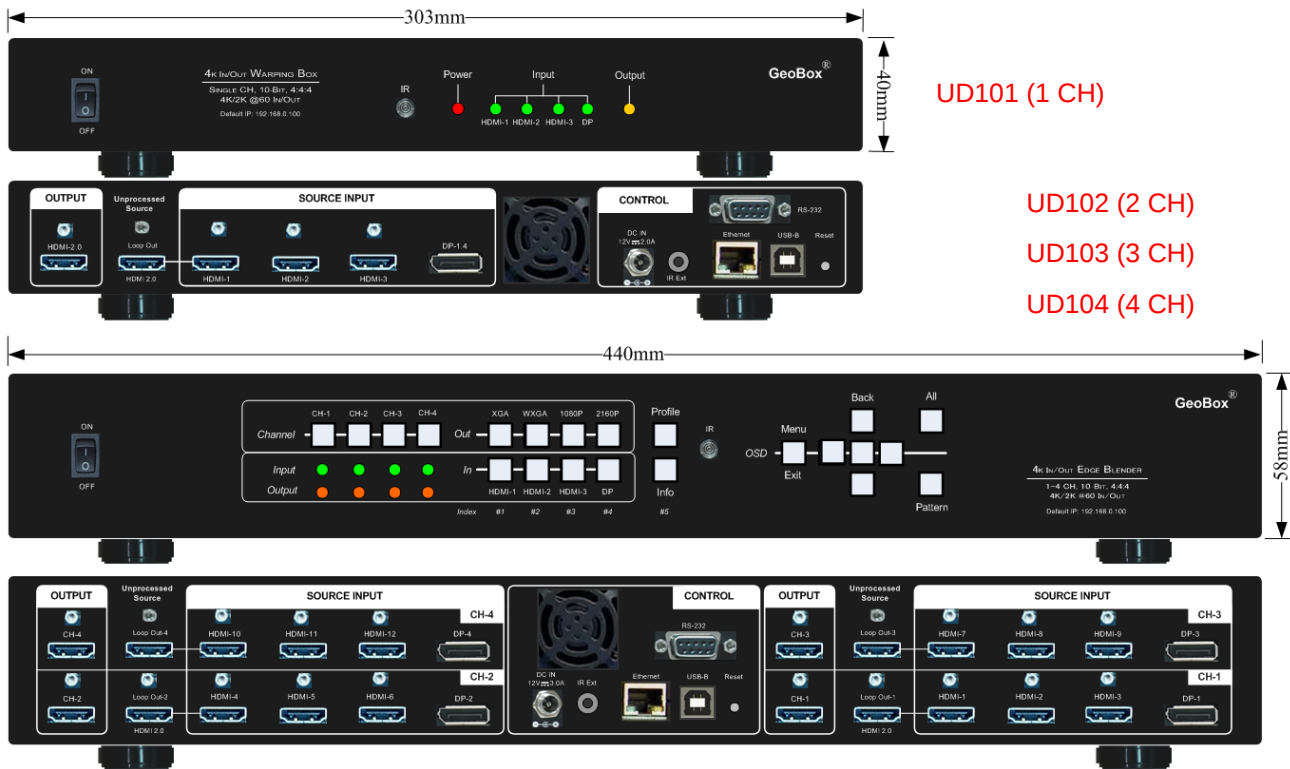
HDMI loop out supports daisy chain connection with the same input resolution and allows large display with multiple units cascaded. Video wall function is to crop and allocate source image for each projector and set overlap pixels for edge blending. Complete curved edge blending can be achieved through front panel keypad, remote controller, USB and Ethernet.

PIP (picture in picture), POP (side by side) and 3/4 split view MultiViewer functions are built-in. PIP image size is from 320*180 up to 1920*1200. Quick seamless main/sub images swap. In one UD104, user can display multiple windows (up to 16 different input contents) on the screen from one UD104. Image 90/180/270 degrees rotation and flip are embedded in UD100. It provides flexible system configuration.

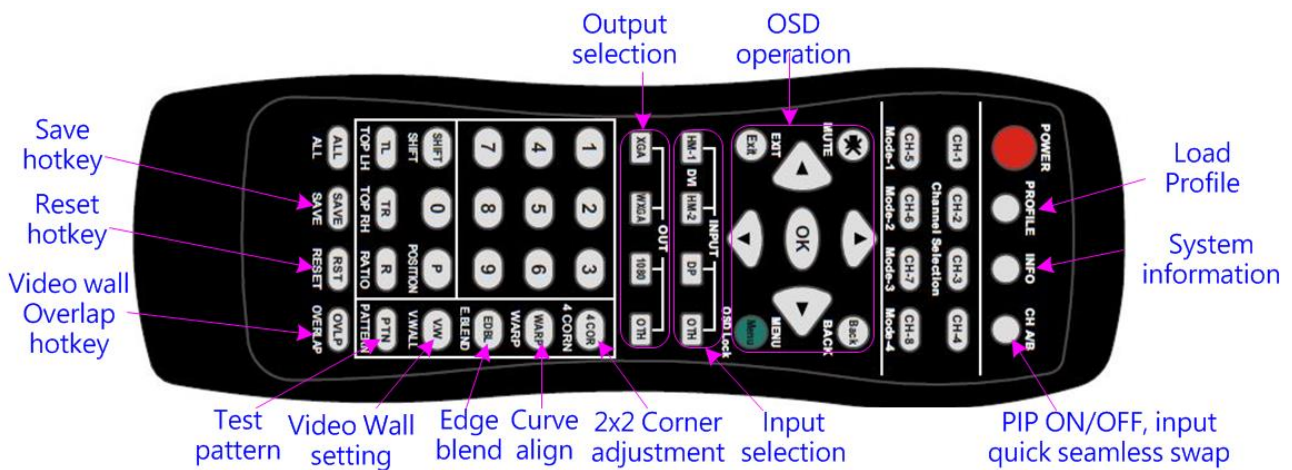
UD100 is an ideal solution for simulation. It can connect with inputs from multiple PCs and combine them into one seamless image. Unnecessary image can be masked out. It also provides flexible displays in edge blending system. For a 3x projector edge blending system, user can configure as 1+1+1 independent display, 1+2 (two projectors blended) and all-in-one (three projectors blended). User can also execute edge blending with projector at portrait position without rotating source image to increase image height. It is a good fit with laser projector without the limitation in installation angle.

Using UD100, users can replace high end projector with low-cost projector without lens shift, warp and edge blending. It provides easy configuration, low entry barrier, cost effective, reliable and flexible solution.

Outlook



(This back panel shows 4 CH model—UD104)



Function and features

A. Structure

Each UD100 consists of 1-4 processing modules. UD101 is integrated with one processing module to control one projector, UD102 for 2 projectors, UD103 for 3 projectors and UD104 for 4 projectors.

Multiple UD100 can be cascaded to control big scale display system.

B. Input and output

Each processing module has below Input/Output ports:

- Input: 3x HDMI 2.0b, 1x DisplayPort 1.4.
 - Support 7680*2160 @30Hz, 7680*1200 @60Hz/4096*2160 @60Hz with 4:4:4 chroma sampling.
 - DisplayPort input supports up to 7680x4320 @30Hz input resolution.
 - Connect with various video sources and support none VESA standard input resolution.
 - Support progressive and interleaved input signals.
- Output ports: 1x HDMI2.0b (Max. 600 MHz). Preset output resolutions: 1024x768, 1280x720, 1280x800, 1280x1024, 1360x768, 1400x1050, 1600x1200, 1920x1080 (50/60Hz), 1920x1200 (24/30/60/120/240Hz), 3840x2160 (24/25/30/50/60Hz), 4096x2160 (50/60Hz), 3840x2400 60Hz, 1152x576 60Hz.
 - Loop out port: 1x HDMI 2.0b, same as source signal from nearby HDMI input port up to 8k/2k (2k/8k) @30Hz / 4096*2160 @60Hz.
 - All outputs are RGB 4:4:4 progressive signals.
 - Selectable 8-bit/10-bit Deep Color mode for each output port.
 - Automatically detect and process HDR BT. 2020 input signal and output with full color 4:4:4 RGB SDR signal.

C. Image geometry alignment and warp

- Test pattern grid size for geometry alignment is from 8-120 pixels in H&V. Default is 32*32 pixels.
- With full functions for quick 4 corner alignment, vertical and horizontal keystone correction, Pincushion & Barrel adjustment, image warp and 90/180/270 degrees rotation and flip.
- Each channel controls one projector and can be cascaded to support unlimited number of projectors.
- Integrated with full function IR remote controller. Manual geometry alignment via Remote controller and WebGui up to 17*9 control points.
- 120x68 grid pixel position fine-tune is embedded. Each control point can be adjusted with 1/4 pixel/step and moved up to 12.5 pixels adjustment range. Maximum adjusting points are 100 points.
- GCT PC tool is available for warp and geometry alignment up to 17x9 control points & 120x68 pixel position fine-tune through USB or Ethernet. After finishing geometry alignment, the parameters can be stored inside PC or GeoBox. No more PC tool is needed.
- Geometry adjustment range:
 - Geometry alignment range is based on keystone angle in horizontal and vertical direction. The

maximum geometry alignment range is about 40° horizontal keystone and 35° vertical keystone in combination of all geometry alignment, including 2x2 and warp alignment.

- 2x2: each control point (4 corners) can be moved up to H=+_600 pixels and V=+_600 pixels. It is about H=600/3840 and V= 600/2160 position shift when the output is 4k/2k output resolution. If the output resolution is 1920*1080, it will have bigger keystone angle. The adjustment range will be still about H=+_600 pixels and V=+_600 pixels before image crush. It is about H=600/1920 and V= 600/1080 position shift.
- 3x3: each control point (total 9 control points) can be moved up to H=+_600, V=+_600 pixels. If user applies both H&V adjustment, the range will be lower.
- 2x2 and 3x3 can be executed at the same time but the combination of the geometry alignment will be limited to H=+_1200 pixels and V=+_1200 pixels for each control point.
- When user applies both H&V direction geometry alignment, the adjustment range may be reduced. User will see abnormal display (some noise or image crush). While the image is crushed, user can return the adjustment value or adjust adjacent control points to let the image back to normal.
- The major geometry alignment should be done through 2x2 and 3x3. Other warp function such as 5x3, 9x5 and 17x9 alignments are for position fine-tune purpose only. Geometry alignment shall follow 2x2, 3x3, 5x3, 9x5, 17x9, 120x68 sequence. If user executes 17x9 and back to 9x5, only 9x5 warping data will be kept. 2x2 is independent and will not affect warp adjustment result.
- If user executes geometry alignment to some extend with 2160P output resolution and switch back to 1080p output resolution, the image may crush due to bigger geometry alignment angle. If switch from low output resolution to high input resolution, the image will not crush.
- W shape Corner Wall geometry alignment: up to 1200 pixels adjustment range in 10 control positions at H/V directions. The image distortion range at wall corner depends on the throw ratio of the projector. Longer throw ratio will have less image distortion and easier for Corner Wall alignment. W shape corner adjustment can correct the images in both sides of the pillar at wall corner.
- Linearity grid line adjustment: User can use this function to move the position of a group of vertical lines or horizontal lines simultaneously. The major purpose is to move complete line position or smooth the gaps in image horizontal or vertical lines in curved screen display. Usually, user will see smaller grid line size at both sides of the curved screen. User can use this function to let all grid lines with the same gap quickly.
- Embedded test pattern grid size is editable from 8-120 pixels in both H&V directions.
- User can select different color in the test pattern and can also apply external test pattern from signal source.

D. Edge blending

- Four direction edge blending up to H=1920, V=1200 overlapped pixels for flat, curved & cylindrical screens.
- Independent RGB gamma selection for edge blending color fine.

E. Black level uplift

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

F. White balance

White balance and individual color correction for each output channel.

G. High end 10-bit video processing

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

H. PIP/POP, MultiViewer

- [PIP]: Picture in Picture display with any two inputs in each channel.
- [SBS]: Side by Side display.
- [Top/Bottom]: Top/Bottom display.
- [SBS 2/1]: 2/3:1/3 side by side display with monitor at landscape position
- [POP3]: One image at LH side and two top/bottom images at RH side in landscape monitor.
- [POP4]: One image at Top and two images at bottom in landscape monitor.
- [3X SBS]: Three split views at landscape with the flexibility to adjust center image size.
- [3X T/B]: Three split views at portrait with full screen or original aspect ratio selection.
- [4x Split]: Four split view multi-viewer. (Monitor at landscape only)
- [4x T/B]: Four split view with one image at top and three small images at bottom.
- PIP (picture in picture): with flexible PIP size (320*180 to 1920*1200), location and aspect ratio.
- Except [4x split] & [4x T/B] functions, all the other PIP/POP functions can support monitor at portrait and landscape position. Sub- images also support rotation and flip up to 4k/2k 60Hz.
- Cropping function is available in PIP and POP image for further location, size and aspect ratio adjustment as well as creating image borders with black or blue color.
- Main and sub-image color can be further adjusted to get optimized video quality.
- All the inputs for main and sub-images can be up to 4k/2k 60Hz 4:4:4 signals.

I. Native 1:1 image display mode

When single content is displayed on the screen, user has below choices for the display:

- [Full screen]: to display the content with full screen. The image will be scaled to full screen no matter the input is with what kind of aspect ratio.
- [Original AR]: to display content with original aspect ratio. If 4:3 input content is displayed on 16:9 monitor, it will keep 4:3 image aspect ratio with vertical full screen on the monitor.

- [1:1]: to display native pixel to pixel image at the center of the screen. When XGA image is displayed on 16:9 monitor, it will show up pixel to pixel XGA image at the center of the monitor without scaling to keep original image quality.
- Further image cropping and aspect ratio adjustment is still available.

J. Quick PIP ON/OFF and two input seamless swap

- User can use remote controller [CH A/B] hotkey to turn ON/OFF PIP image.
- If the output resolution is set to FHD or 1920x1200, user can assign one input signal to main and another signal to PIP channel and execute quick input seamless swap through this function.

K. Video wall function

- Image cropping, split and location assignment for each projector.
- Video Wall overlap functions up to +_1800 pixels in H&V direction in each edge for below functions:
 - Image cropping and position adjustment.
 - Set overlap pixel for edge blending.
- Aspect ratio adjustment: to stretch 2.35:1 movie to full screen display on 16:9 screen or shrink 16:9 image on 2.35:1 screen without changing aspect ratio.

L. Image rotation and flip

- Image 90/180/270 degrees rotation, flip and mirror up to 4k/60Hz input resolution.
- Image flip in Front/Rear, Left/Right and Top/Bottom directions.
- No 3D motion adaptive de-interlace function while the image is 90/270 degrees rotated. Please apply progressive signal to get the best video quality.

M. 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 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.

N. 3D functions

- Passive 3D: Decode 3D input signal into RH/LH eye frame output for passive 3D display.
- 3D format conversion: Convert 3D input signal into Side by Side, Top/Bottom and frame sequential output signal for passive 3D and active 3D displays.

O. Various color adjustment

- Independent R.G.B color gain adjustment.
- Preset color temperature: Standard, Reddish, Bluish
- Brightness, contrast, Hue, saturation and sharpness adjustment.
- Under Edge blending, user can execute separate RGB white balance adjustment.

P. System control and other features

- Professional design and reliable for 7/24 working condition.
- Full function OSD through front panel keypads, WebGui or IR.
- Firmware update via USB or Ethernet.
- GCT PC tool can control multiple processors simultaneously through USB or Ethernet.
- Internal grid pattern with selectable color and grid size for easy geometry alignment.
- RS232 & Ethernet control system compatible with most of control system.
- User can select blue or black background color when no input signal is detected.
- Programmable EDID in the range at H=1024-4080, V=720-3840.
- BOX ID and programmable IP address for convenient multiple unit control at the same time.
- User can save up to 10 settings and can be recalled by remote controller, RS232, USB or network.
- System settings can be backup in PC, USB device and copied to another unit.
- Automatic power ON/OFF through input signal control. While no input signal is detected, it will shut down output automatically. If it detects input signal again, it will automatically output signal to display devices. User can power ON/OFF the system through the control in signal source.

User Guide

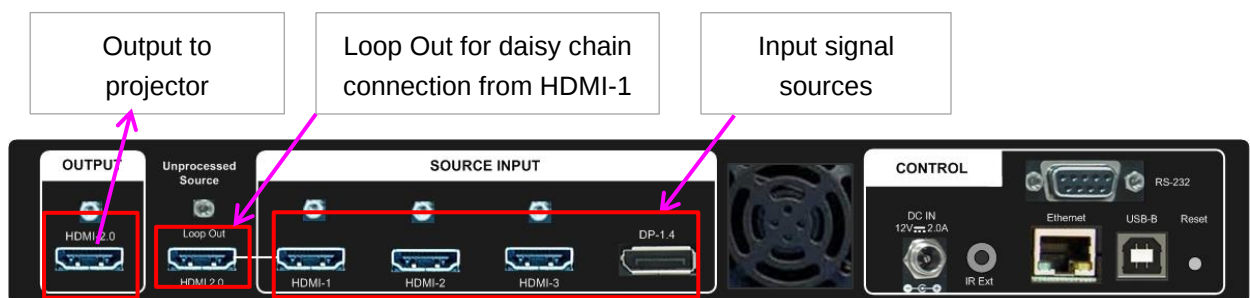
1. Content in the packing box

- One UD100 4K projector edge blending processor
- 1x RC-400 IR Remote Controller (without battery)
- 1x IR Extending Receiver with 1.8m cable
- 1x DC Power supply unit with power cord, In: AC 100V-240V, out: DC 12V 2-5A
- Mounting bracket with screw (Option)
- Please download User Guide & GCT PC Tool at www.vnstw.com.

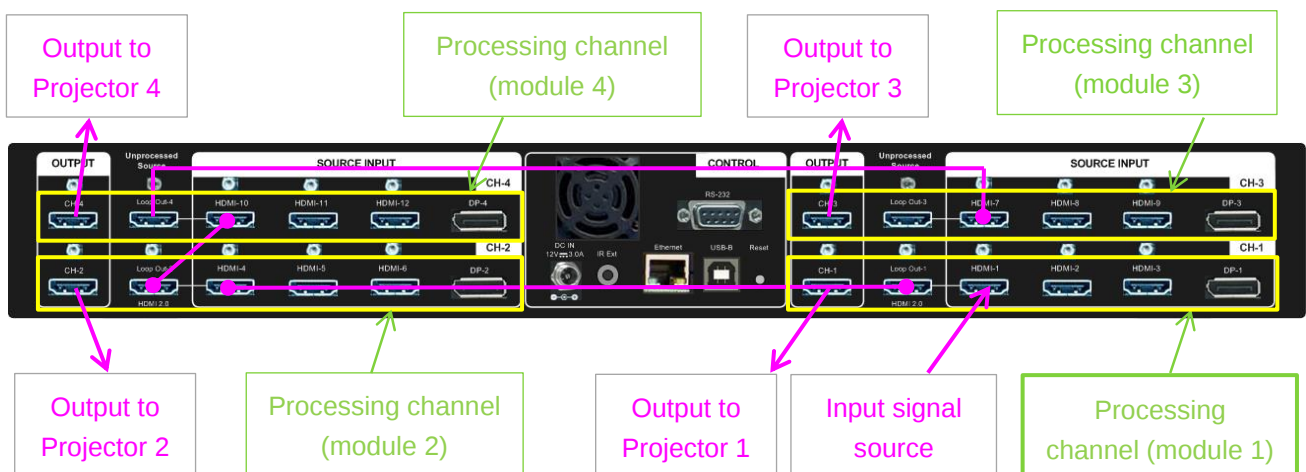
2. Basic operation & setting

2.1. Connecting the input and output

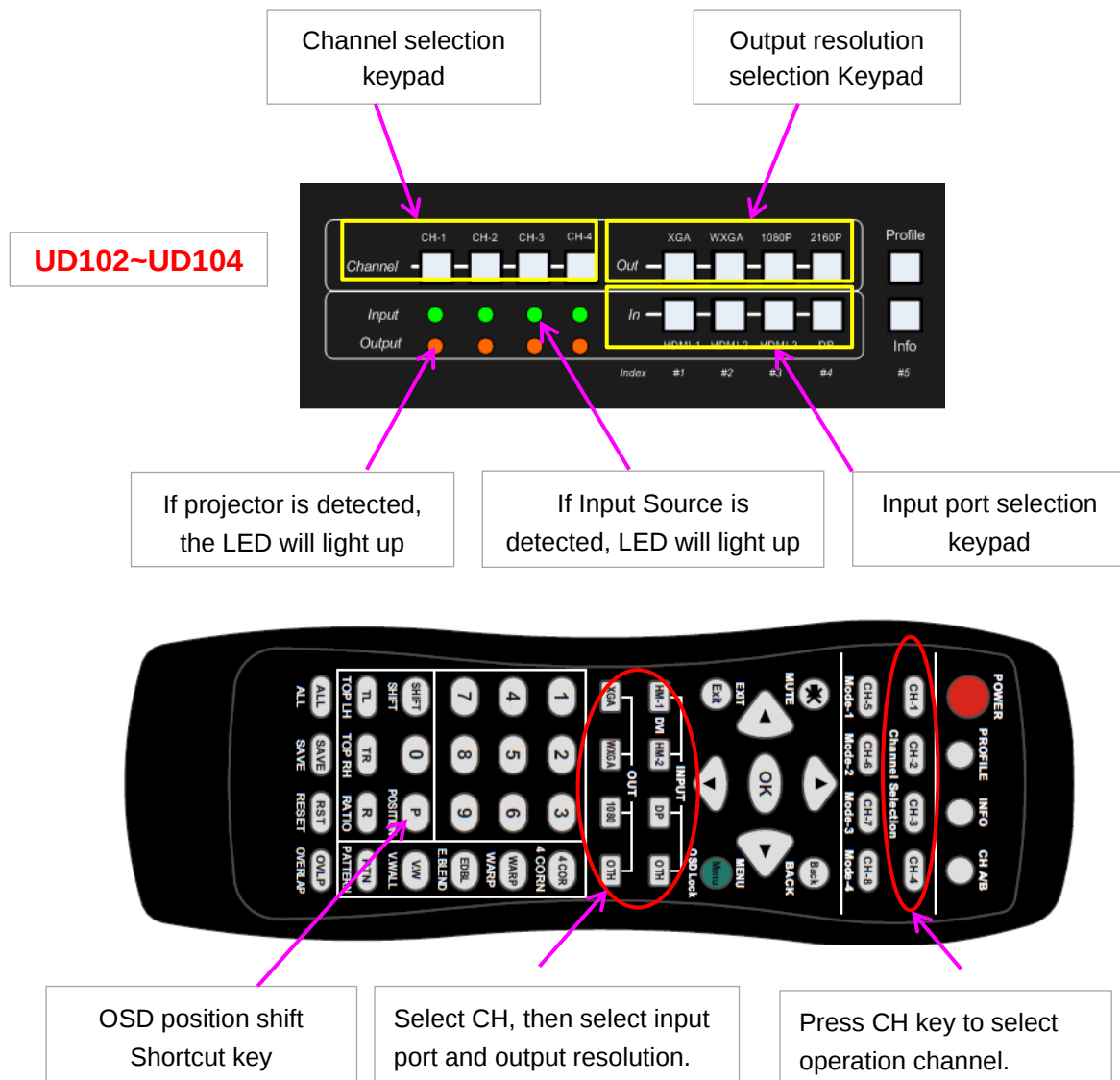
UD101



UD104 (for 4 projector edge blending)



2.2. Input / Output selection & LED Indicator



PS.

- [OTH] key in output selection will show output timing at 3840*2160 60Hz.
- User can click [Info] key in remote controller to get system information and input / output signal resolution.

2.2.1. Input source selection

- Each UD100 has four input ports: 3x HDMI, 1x DP. User can select input port from remote controller or front panel keypad.
- HDMI & DP input ports support up to 4096x2160 @60 Hz, 4096x2400 @50Hz, 8k/2k @30 Hz.
- Default input port are HDMI-1/HDMI-4/HDMI-7/HDMI-10.
- User can press CH key, then select different input port for each channel.

- UD100 can support non-VESA standard input timing once signal source can provide, such as 4096x1200, 3200x3200...
- Only HDMI-1, HDMI-4, HDMI-7 & HDMI-10 input signals can be looped out. Loop out signal is unprocessed source signal.
- For one content edge blending display (all-in-one), user needs to input signal to HDMI-1 / HDMI-4 / HDMI-7 or HDMI-10, then loop out to next processing channel HDMI-1 / HDMI-4 / HDMI-7 or HDMI-10 input port to let all channels be fed with the same signal source.
- User can reserve HDMI-1, HDMI-4, HDMI-7 & HDMI-10 for edge blending connection and the other input ports can be served as inputs for discrete display, PIP/POP or MultiViewer applications.
- If user wants to select different input sources for edge blending with different content, user can add one G901 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.
- PIP/POP and MultiViewer function are integrated in each processing channel. User can select any input signal in the same processing module as signal source. This function can only be executed inside one channel unless user connects output signal among different channels.

2.2.2. Output resolution selection

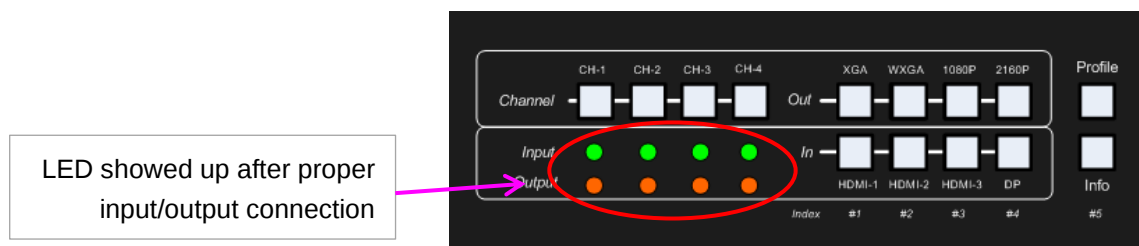
- Output resolution should be set at the same native resolution of the projector to get the best video quality. If user changes output resolution, geometry adjustment result will also be changed.
- User needs to select output resolution in each processing channel separately. The output resolution selection will apply to single channel.
- Output resolution supports up to 4096*2160/60Hz. User can select output resolution from remote controller, front panel, WebGui or PC tool.
- Preset output resolutions: 1024x768, 1280x720, 1280x800, 1280x1024, 1360x768, 1400x1050, 1600x1200, 1920x1080 (50/60Hz), 1920x1200 (24/30/60/120/240Hz), 3840x2160 (24/25/30/50/60Hz), 4096x2160 (50/60Hz), 3840x2400 60Hz, 1152x576 60Hz.
- All outputs default resolution is 60Hz, RGB 4:4:4 and progressive.
- No specific connection sequence is required. The location for each projector can be determined through Video Wall settings.
- User can select output resolution through remote controller, USB or Ethernet.
- User can access to [Image Properties]→ [Output] OSD menu to select all preset output resolution and select 8/10 bits deep color output.
- 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 synchronization issue among output channels. If the input is 30Hz

with 60Hz output, it will have no synchronization problem. If the input is 50Hz, please select 50 Hz output to avoid this issue.

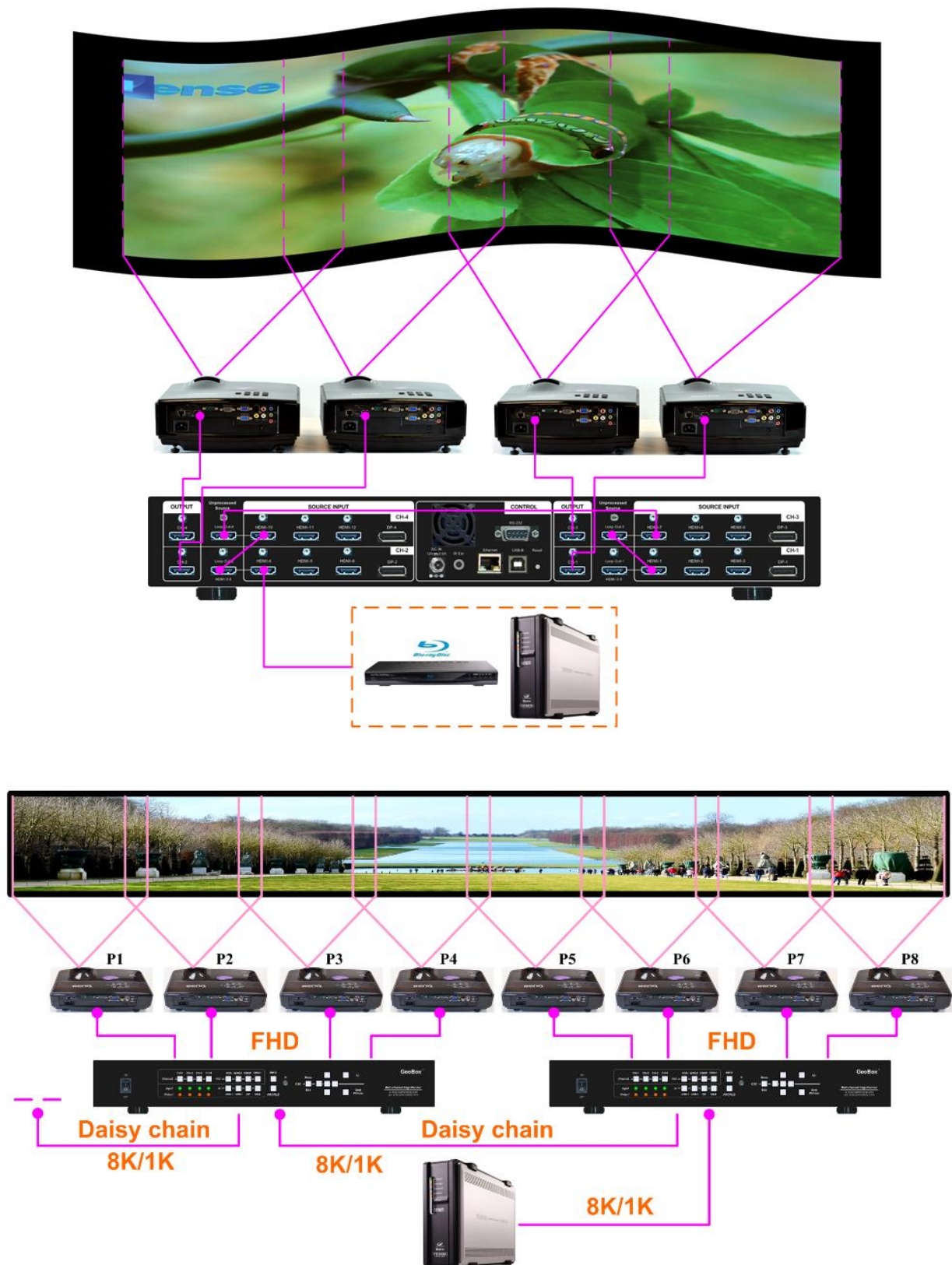
- When change output resolution, the projector may re-search signal source and take few seconds to finish the selection.

2.2.3. LED indicator

- 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.
- 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 presses Menu key for 5 seconds on the remote controller, GeoBox OSD menu will be locked and the channel LED will be flashing. To press another 5 seconds, it will unlock OSD menu.
- If multiple units are used in the system, user can set different ID and use remote controller [85x] key to execute independent control. Press [851] following other OSD keys, the remote controller can only show Box ID #1 OSD and channel LED on front panel in other units will be flashing. User can disable OSD LOCK with [850] command via IR controller.



2.3. System connection and Power On



- Poor quality HDMI cable and signal source will affect the connection distance and may cause signal noise or show intermittent image. 4k signal requires 4k certificated HDMI cable.
- To ensure all cables are connected correctly, it is recommended to use locking cables.



- 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 20 seconds (different input source and HDCP may have different booting time) 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 power LED, 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.

2.4. 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 apply to one channel only.
- Use [Reset] hotkey on remote controller will go to Reset OSD menu and apply to one channel only.
- When operating through OSD or remote controller, user can select to reset [Reset All], [Video Wall setting] or [Anyplace] (geometry) setting.
- When update FW and MCU, Profile Index data will be kept without change unless user executes RESET from reset hole on the back panel.
- **Reset from OSD or remote controller will not delete Profile Index data. RESET from RESET Hole on back panel will delete Profile Index data.**

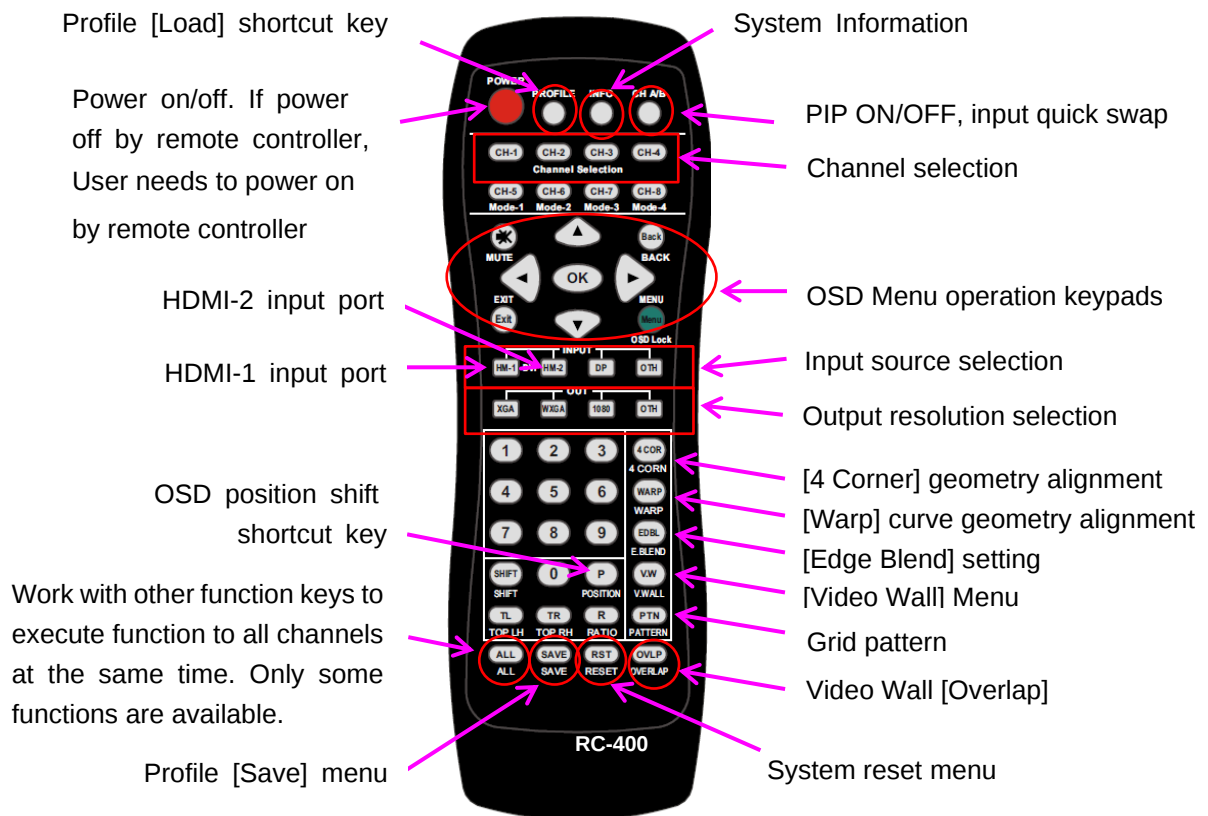
2.5. HDMI Loop Out for daisy chain connection



- HDMI Loop Out is for daisy chain connection. It is not an input port. Loop Out provides the same unprocessed source signal from HDMI-1/HDMI-4/HDMI-7 or HDMI-10 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 steps 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 use multiple outputs PC or HDMI splitter at the front end to increase system resolution or the connection number for large scale display.
- If user wants to control more than 10 projectors, user can add one HDMI splitter with multiple outputs for multiple groups of GeoBox. It will support 2x, 3x... number of projectors.
- If loop out port is not connected, user can connect to a monitor for signal source monitoring purpose.

2.6. How to use IR Remote Controller

- IR remote controller has full functions for the operation of UD100.
- IR receiver is on Front Panel. One 3.5mm audio connector for IR extender is located at Back Panel of UD100. 1.8m IR extension cable is equipped in the packing. User can add audio cable to extend the distance up to 20 meters.
- IR remote control system is possible to be interfered by the environment and cause abnormal or discontinuous operation. Under this condition, Ethernet operation may be the best choice.



1.8m IR extender



Audio connector for IR extender

2.7. System settings: Box ID, RS232, Ethernet

- Box ID, RS232 and Ethernet settings shall be executed through CH-1. The setting result will be applied to complete unit. It can be changed through OSD menu, WebGui or PC Tool.
- 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 UD100 so that each UD100 can be controlled independently.
- For multiple channel operation, user can select channel directly for further operation. It is nothing to do with Box ID and IP address.

2.7.1. Box ID

- The range of Box ID is 0 ~ 99 for RS232 command.
- If user uses remote controller to execute individual box 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.

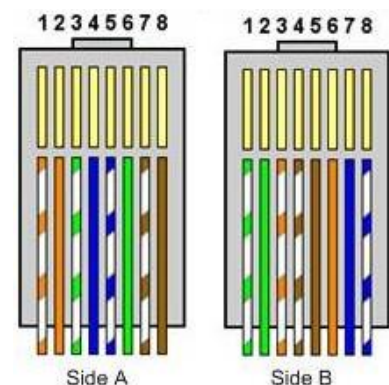
2.7.3. Ethernet

- 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, Microsoft Edge) 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 has difficult to link with Microsoft Edge, please key-in below IP: http://192.168.0.100/.
- If user can't connect the network, please power off/on GeoBox again to let PC detect UD100 network settings. If necessary, please also check [Ethernet]→[Static IP] menu to see if IP address is correct or not. User can reset GeoBox through reset hole to get 192.168.0.100 default setting.
- User can set DHCP for the connection. If necessary, please [Renew] DHCP to get IP address before network connection.
- GCT PC Tool is another web tool for system setting and operation. It can also update Firmware or MCU code. It can be downloaded from VNS 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. Long press direction key will increase the adjusting speed.
- 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. Please download Telnet Application Note at <https://www.vnstw.com/supp.php?catid=98>



Crossover UTP cable



2.8. Full screen and native aspect ratio in main input

- [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 timings.



- [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.

2.9. Color Adjustment

2.9.1. 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]

2.9.2. Preset Color Temperature and independent RGB color adjustment



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

2.9.3. 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)

2.10. 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 under [Options] Menu. Press number keys in Remote Controller to determine which GeoBox can 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 presses 851, only ID #1 GeoBox can be controller through OSD. The rest units of GeoBox will be locked. The channel key LED will show flashing light with 1.0 second interval.
- 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 channel key LED on will light up with 0.5 second interval. To press [MENU] key for 5 seconds will unlock OSD Lock.

2.11. System Power on sequence

In most of application, it is not necessary to have different power on sequence in the system. In some special case, if the signal source can't send out signal based on EDID requested resolution, please power on GeoBox 30 seconds before power on signal source. It will make sure signal source can detect correct EDID.

2.12. System synchronization

GeoBox uses [Frame Locked] to synchronize all outputs based on the input signal vertical sync. When [Frame Locked] is applied, it is possible to lose some frames during system setup and cause projector

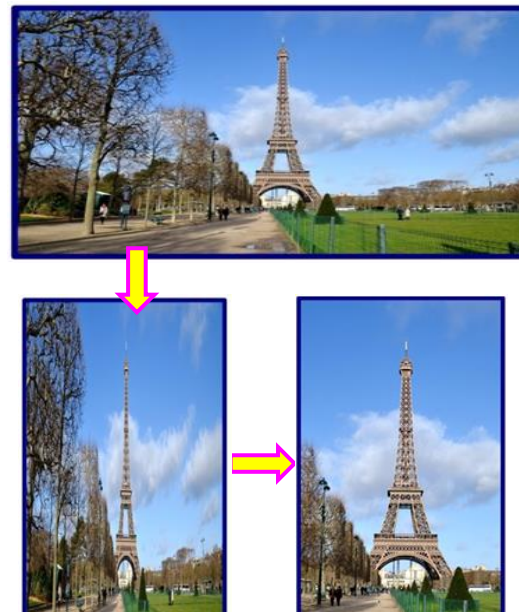
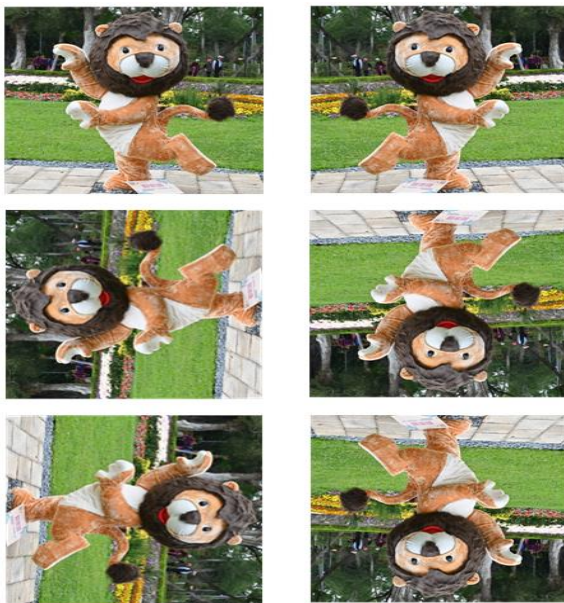
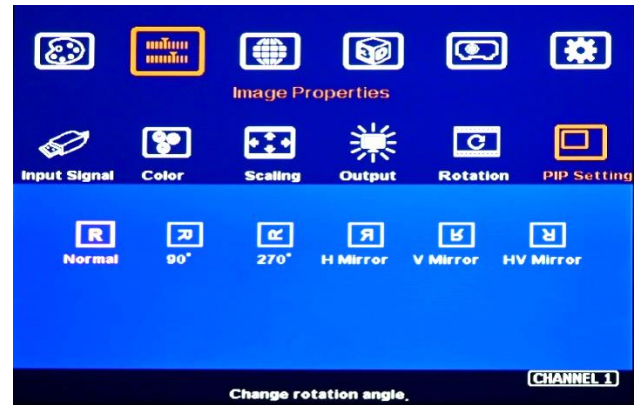
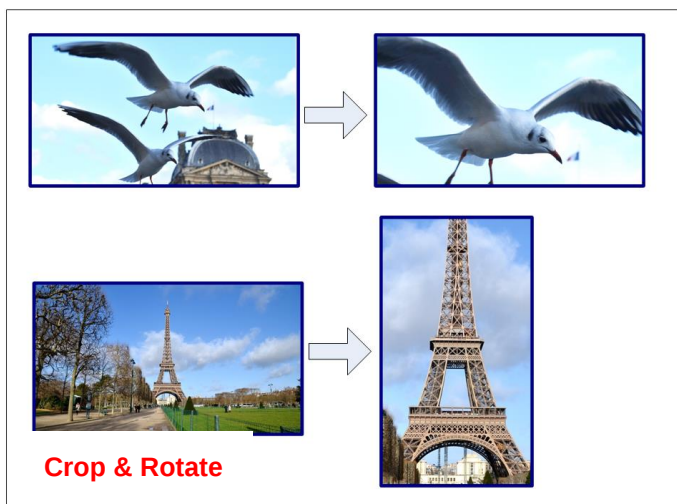
to re-search the signal source. In order to get smoother setup, GeoBox provides OSD for user to select different synchronization methods for easy setup.



- [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 system setup, projector will reduce re-search behavior in some settings.
- [Disable] (Free-Run mode): when GeoBox changes input source, timing or video wall settings, the output will still send out continuous output signal. Most of the projector will not re-search the input signal while system setup.
- After finish the setup, 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 30Hz with 60Hz output, it will have no synchronization problem. If the input is 50Hz, please select 50 Hz output to avoid frame repeat and system synchronization issues.

2.13. Image rotation and flip

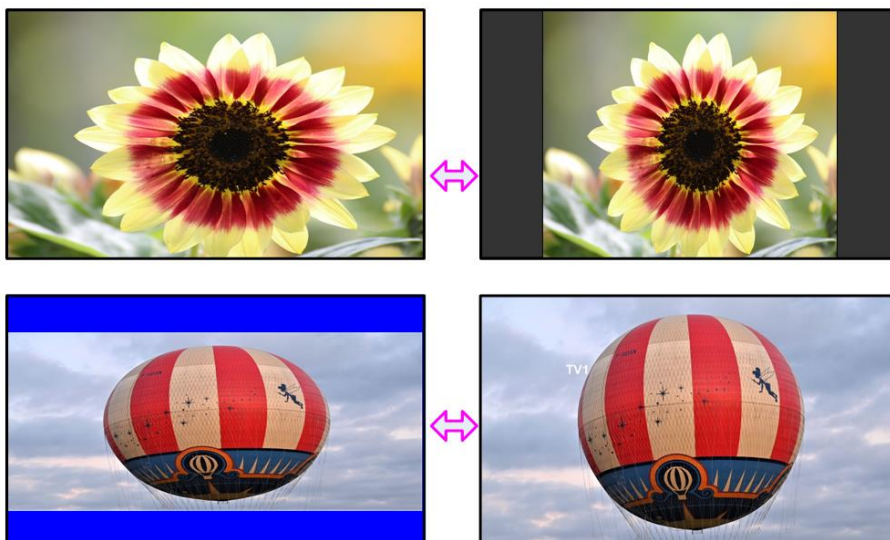
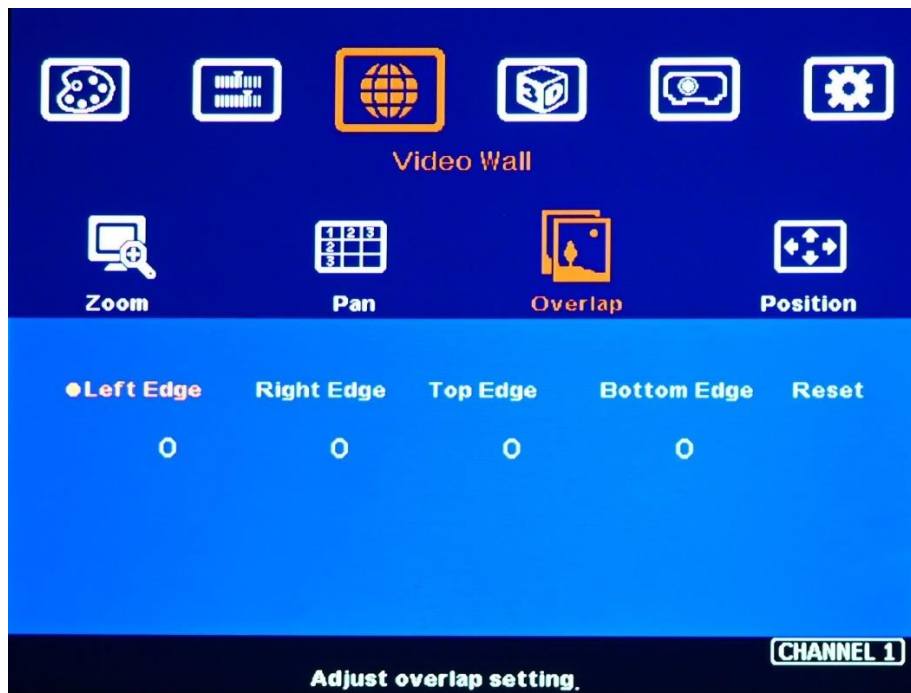
- This image orientation function will be applied to both main and sub-image image. This function can support up to 4k/60Hz input signal.
- Image 90/270 degrees rotation is for edge blending with projectors at portrait position to increase image height. There is no need to rotation signal source.
- Image flip is for projector to project image from rear or top position.
- When the image is rotated or flipped, the OSD direction may be changed. 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.

OSD for main image rotationOSD for sub-image rotation**2.14. Image Cropping in main and Sub-images**

- Image cropping at any location in both main and PIP/POP (sub-image) independently.
- Image cropping function can co-exist with image rotation and flip functions.
- This function is also available when implement MultiViewer function.

2.15. Flexible Aspect Ratio Adjustment

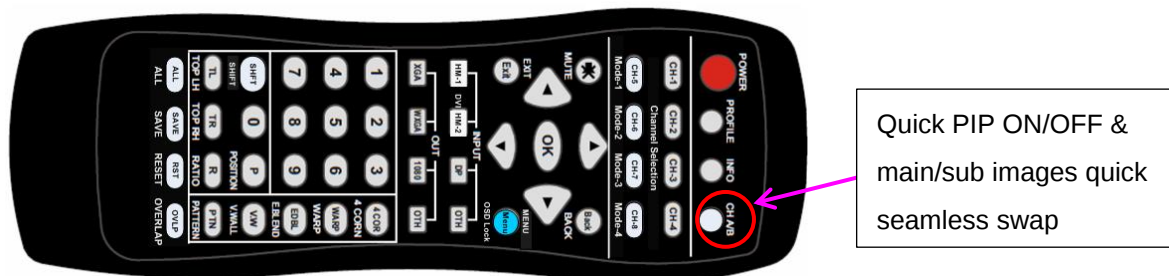
User can use Video Wall [Overlap] function to change the aspect ratio of the image with black or blue borders through [Options]→ [Accessibility]→ [Black Screen]. The Maximum adjustment range is 1800 pixels in each edge.



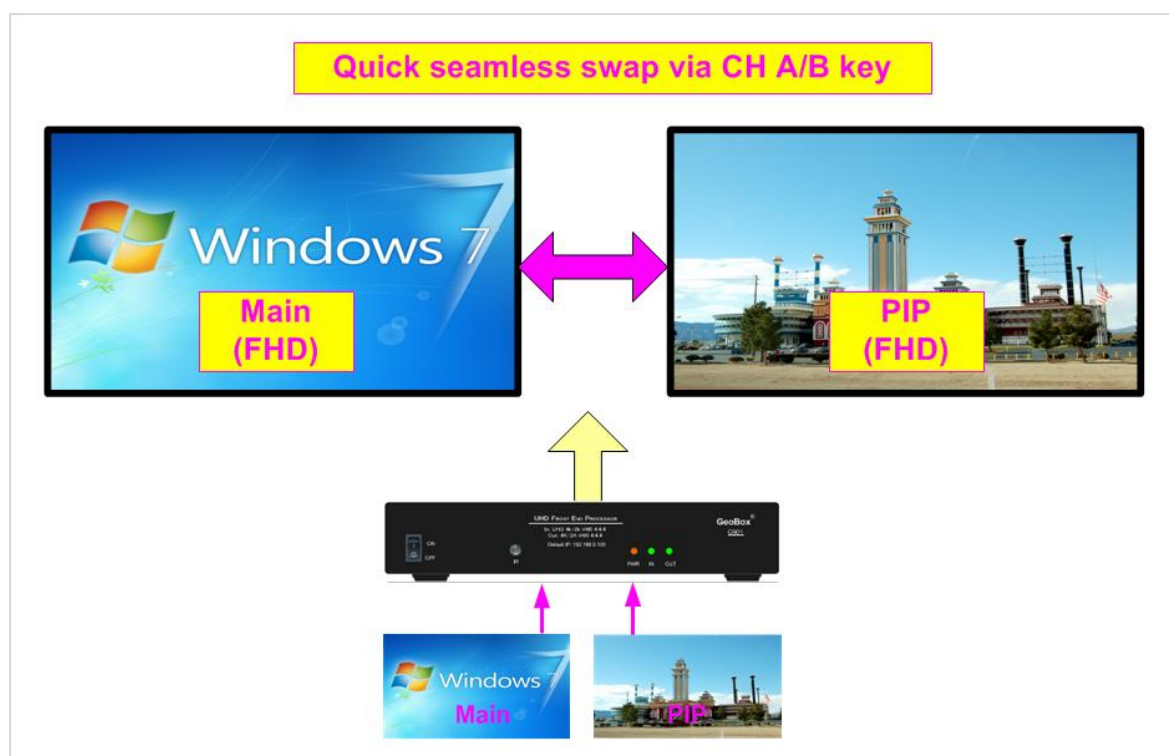
Background color can be black or Blue.

2.16. Quick PIP ON/OFF and two inputs quick seamless swap

- CH A/B key in remote controller can execute quick PIP image on/off in each channel.



- When the output resolution is set to 1920x1200 or 1920x1080, user can add full screen PIP image on top of main image. User can click [CH A/B] key to turn on/off PIP image to swap main/sub-images seamlessly.
- This image swap can be applied to any two inputs in each channel. Please select channel selection key and assign one input to main image and another input to PIP image, then click [CH A/B] key to execute seamless quick swap between these two inputs.



3. PIP/POP/MultiViewer display

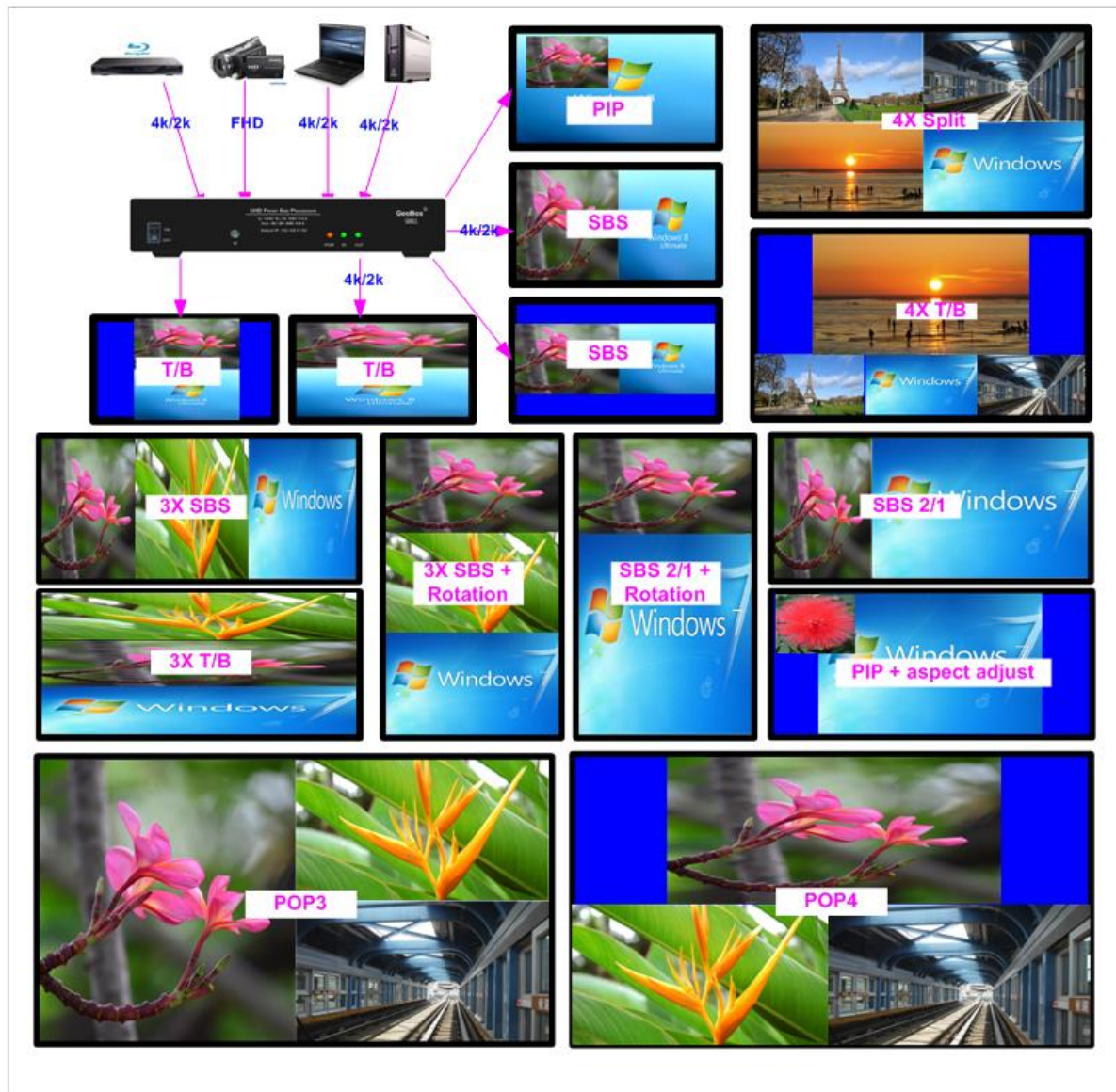
- UD100 is designed with PIP/POP and MultiViewer function. One UD104 can display up to 16 contents across 4 projectors.
- Each sub-image can only be displayed inside the display range in each projector. When execute edge blending, please avoid sub-image in edge blending area.
- If PIP/POP/MultiViewer image needs to be across entire screen, user needs to use one processing channel as front-end processor to implement PIP/POP/MultiViewer and output the image as signal source. Under this condition, the maximum system resolution will be limited to 4096*2160/60Hz.
- User can also add one G901 as front-end processor to get PIP/POP and MultiViewer functions across entire display system.

3.1. PIP/POP main menu



3.1.1. [Display]





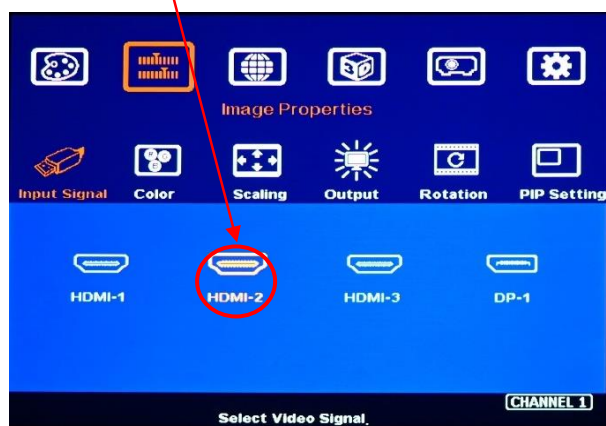
- [PIP]: Picture in Picture display with any two inputs in each channel.
- [SBS]: Side by Side display.
- [Top/Bottom]: Top/Bottom display.
- [SBS 2/1]: 2/3:1/3 side by side display with monitor at landscape position
- [POP3]: One image at LH side and two top/bottom images at RH side in landscape monitor.
- [POP4]: One image at Top and two images at bottom in landscape monitor.
- [3X SBS]: Three split views at landscape with the flexibility to adjust center image size.
- [3X T/B]: Three split views at portrait with full screen or original aspect ratio selection.
- [4x Split]: Four split view multi-viewer. (Monitor at landscape only)
- [4x T/B]: Four split view with one image at top and three small images at bottom.
- PIP (picture in picture): with flexible PIP size (320*180 to 1920*1200), location and aspect ratio.
- Except [4x split] & [4x T/B] functions, all the other PIP/POP functions can support monitor at portrait and landscape position. Sub- images also support rotation and flip up to 4k/2k 60Hz.

- Cropping function is available in PIP and POP image for further location, size and aspect ratio adjustment as well as creating image borders with black or blue color.
- All the inputs for main and sub-images can be up to 4k/2k 60Hz 4:4:4 signals.

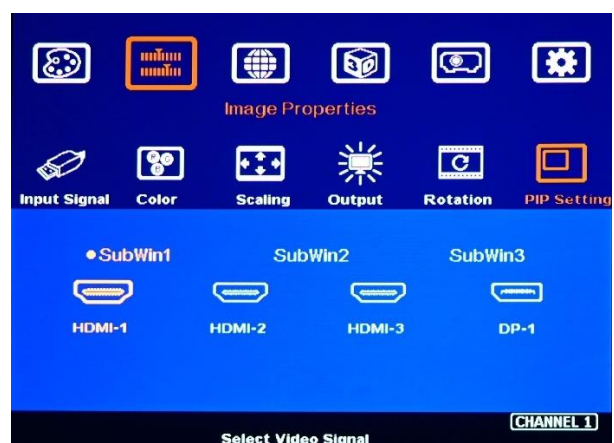
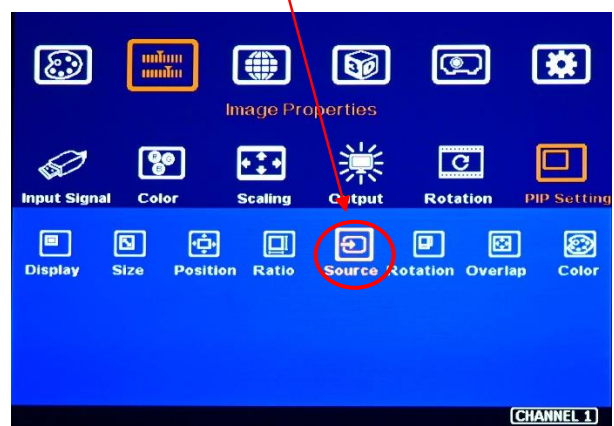
3.1.2. PIP/POP source selection

- The input source for main and sub-images can be selected separately without limitation.
- Any signal from input ports can be displayed on PIP/POP screen up to 4k/2k 60Hz.
- User can swap the position in Main and sub-image--to select main image from [Image Properties]→ [Input Signal] Menu and select PIP image from [Image Properties]→ [PIP Setting]→ [Source]→ [SubWin1-3].
- User can save different settings into [Profile] under [Options] menu and recall at any time.
- Any input port can be selected as main or sub-image input source.

Main image source selection

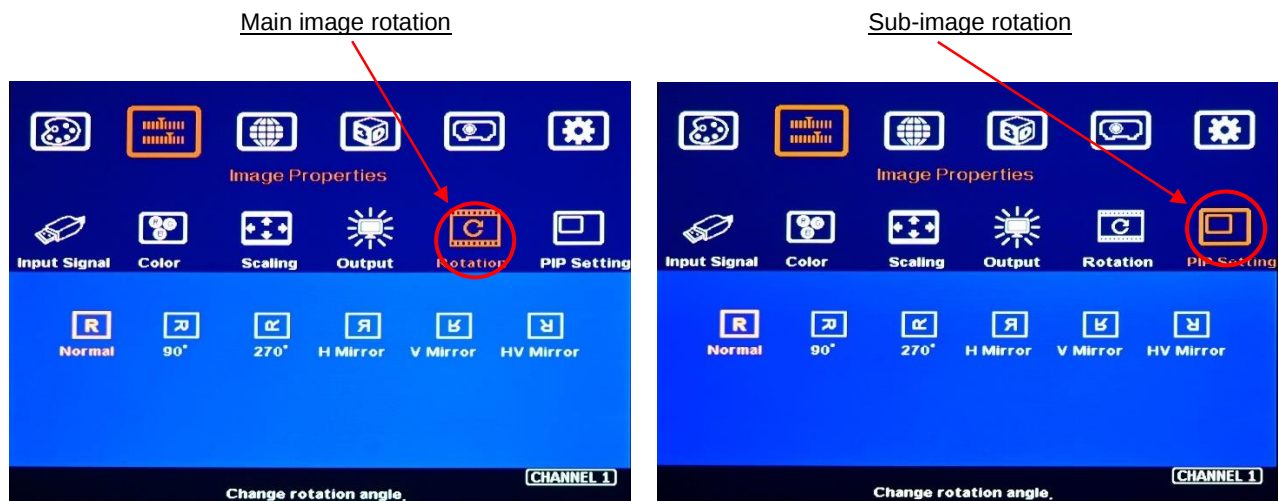


Sub-image source selection



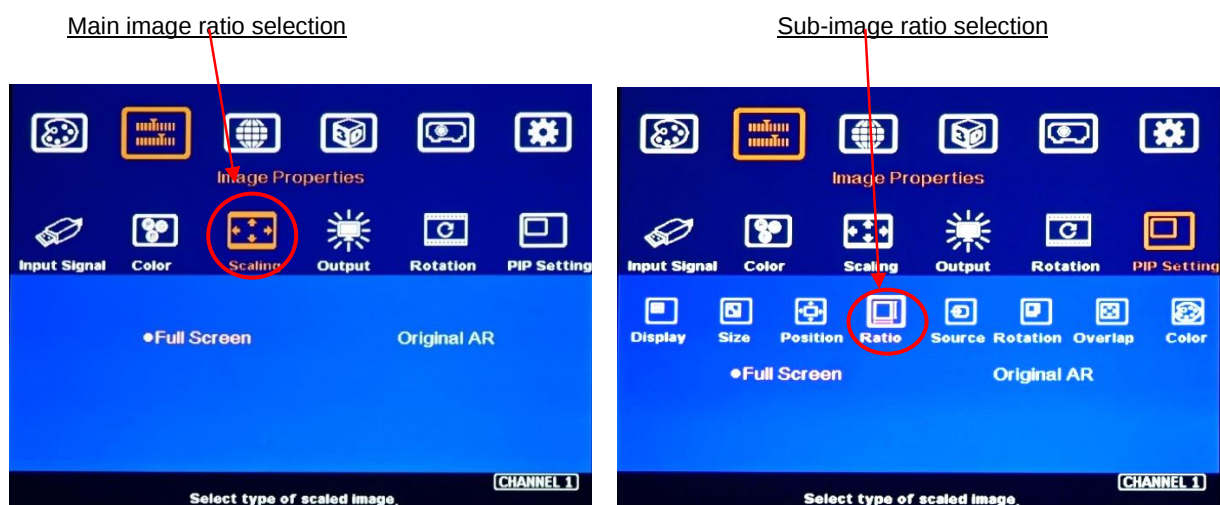
3.1.3. Multiple window image rotation (not available in 4 split views)

- Main and sub-images can be rotated separately at 90/180/270 degrees based on the installation direction of the projector.
- Main image rotation shall be selected from [Orientation] under [Image Properties] OSD menu.
- Sub-image rotation must be operated through [Orientation] under [PIP Setting] OSD menu.



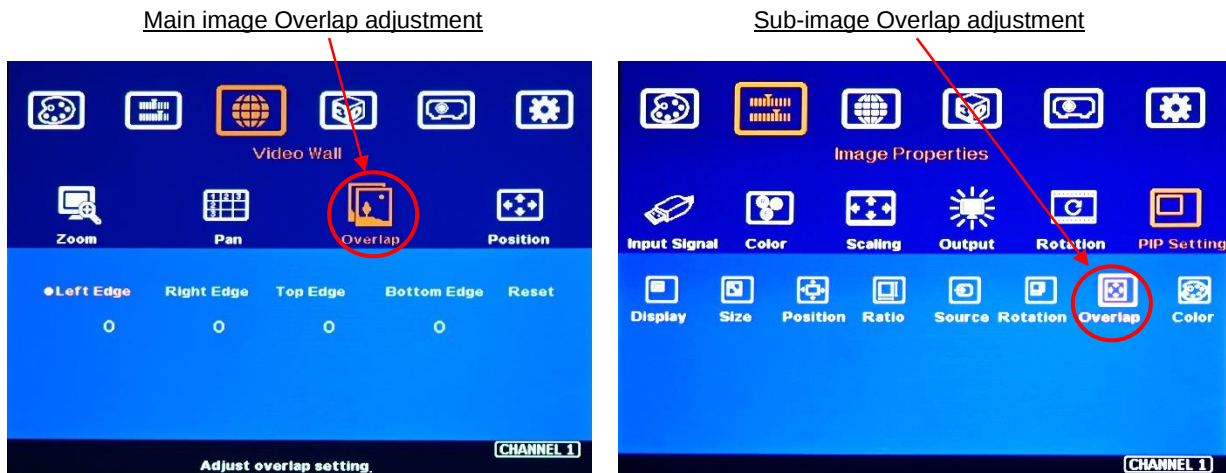
3.1.4. Maintain original aspect ratio or follow output aspect ratio (in multiple window display)

- Main Image: can be selected through [Scaling] OSD menu under [Image Properties].
- Sub-Image: Select [Source] → [Ratio] OSD menu under [PIP Settings].
- Under aspect ratio menu, there are two selections: [Full Screen] & [Original AR]
 - Full Screen: to display full screen image in PIP or POP.
 - Original AR: keep aspect ratio same as signal source in PIP and POP.



3.1.5. Adjust aspect ratio or cropping area in main and sub-image

- User can change the cropping area and aspect ratio in main and sub-image through Overlap OSD menu. Each image edge can adjust the overlap up to +_1800 pixels.
- When Overlap value is decreased, the image cropping area will be reduced and cause the image have Zoom-In effect (enlarged). If the Overlap value is increased, the image cropping area will increase and cause the image to have Zoom-out effect (shrunk).



3.2. PIP (Picture in Picture)

- Main & PIP input source is swappable.
- PIP image in each channel is independent. It is only inside one display but not across multiple displays.
- PIP and main images can be rotated at 90/180/270 degrees independently to build different display styles.
- If one PIP image across multiple projectors is required, user can use one channel as front end to implement PIP function, then connect the output to the input port in edge blending channel to get it.

3.2.1. PIP [Size] and [Position]

- PIP image size is from 320*180 to 1920*1200.
- It can be further adjusted through Overlap function to get about 160*90 image size.
- User can replace main image with sub-image on entire display under FHD output resolution.
- The PIP image position can be further adjusted through [Overlap] function.

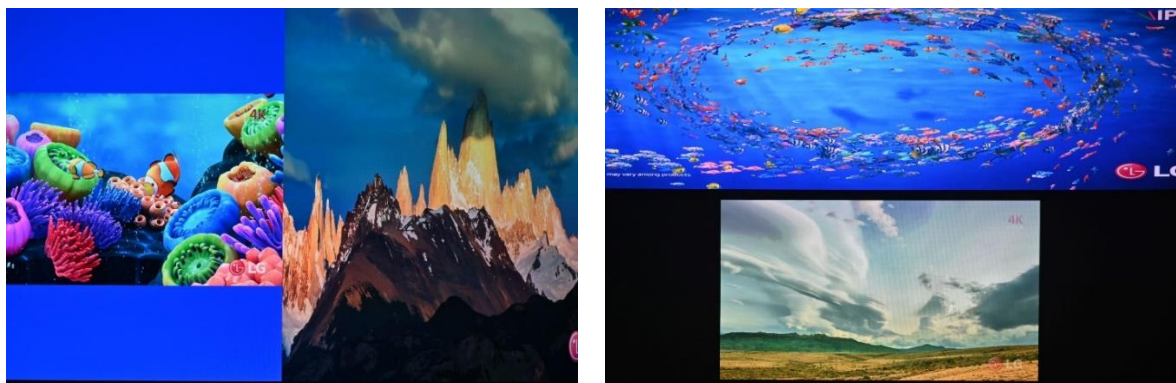
3.3. **POP and 3 split view / 4 split view MultiViewer function**

- [SBS]: Side by Side 2 split display.
- [Top/Bottom]: Top/Bottom 2 split display.
- [SBS 2/1]: 2/3:1/3 side by side display.
- [POP3]: One image at LH side and top/bottom two images at RH side.
- [POP4]: One image at Top and two images at bottom.
- [3X SBS]: Three split views at landscape. The center image size is from 1/6 to 5/6 of the screen.
- [3X T/B]: Three split views at portrait direction.
- [4x Split]: Four split view multi-viewer. (Monitor at landscape only)
- [4x T/B]: Display 4 split views with one image at the top and 3 images at the bottom. Below 3 windows keep 16:9 aspect ratio. Main image can keep full screen or original aspect ratio.
- Except [4x split] and [4x T/B] functions, all the other multiple window functions can support monitor at portrait and landscape position. Both main image and the sub-image support 90/180/270 degrees rotation and flip and keep [Full Screen] or [Original AR] aspect ratio.
- In all multiple window functions, cropping function (Overlap setting function) is available in Main image and all sub-images for further location, size and aspect ratio adjustment as well as creating image borders with black or blue color.
- All the inputs for main and sub-images can be up to 4k/2k 60Hz 4:4:4 signals.
- POP function is independent in each channel.
- One UD104 can display 16 contents in four 4k projectors.

3.4. **Example for Aspect ratio adjustment**

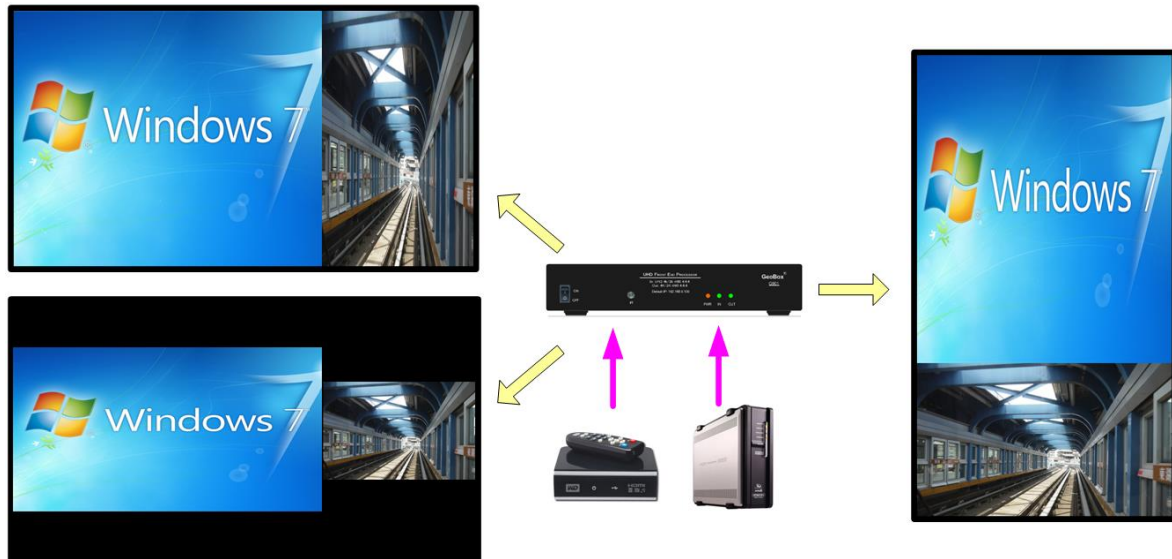
- POP image aspect ratio selection:
 - ✓ Main Image: can be selected through [Scaling] under [Image Properties].
 - ✓ Sub-Image: can be selected through [Ratio] menu under [PIP Settings].
- Further aspect ratio adjustment can be executed through Overlap function under [Video Wall] menu (for main image) and under [PIP Setting] menu (for sub-image).

Independent aspect ratio in main and sub-images



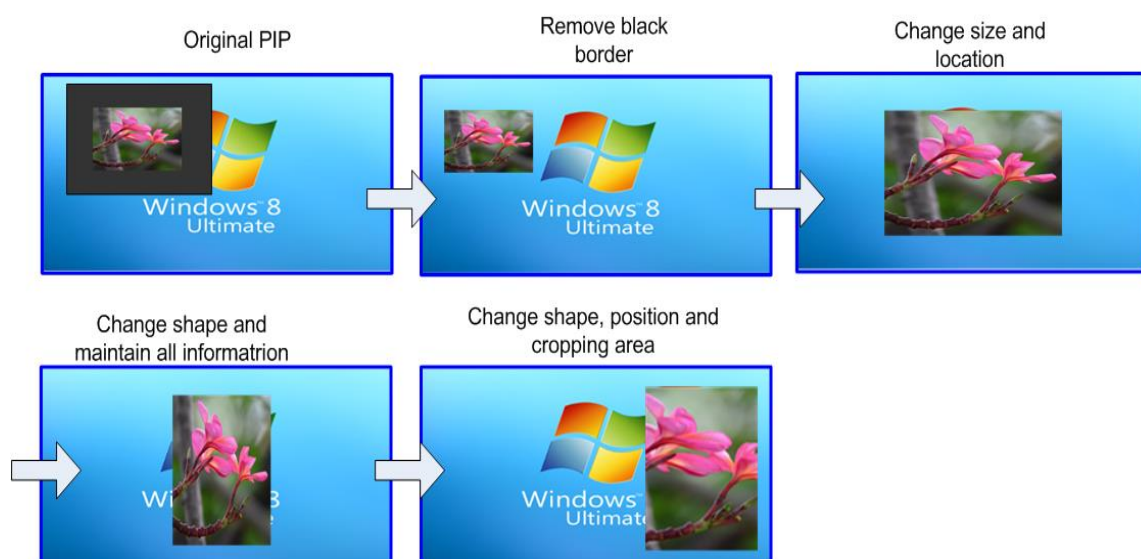
3.5. Example for [Orientation]

- Image rotation in main and sub-image can be executed separately.
- Image rotation can be executed together with image cropping and aspect ratio adjustment functions to create more display styles.



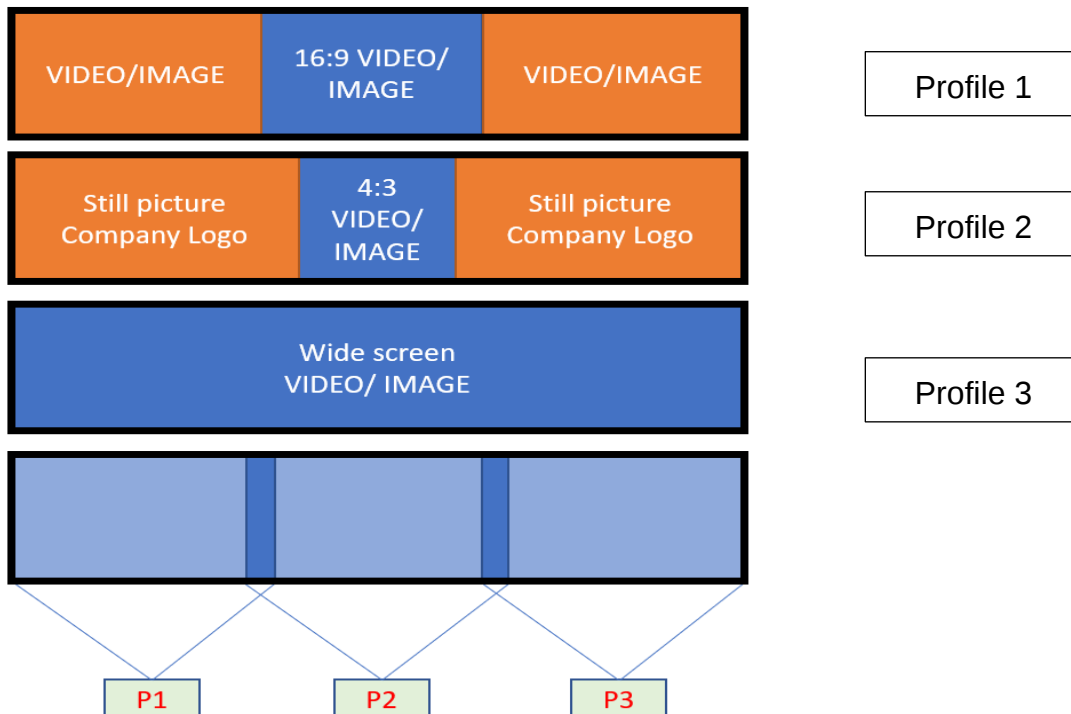
3.6. Example for [Overlap] adjustment in PIP

- Through Overlap function, main image and 1st sub-image can be displayed with various size and aspect ratio as show below.
- It is available in all sub-images.



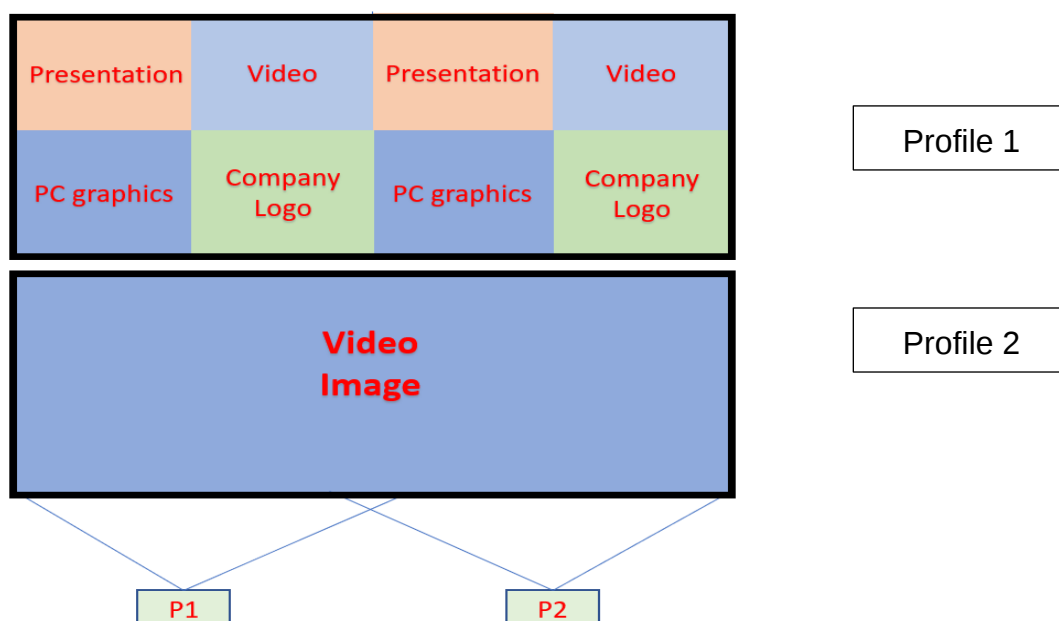
3.7. Example for flexible 3 split view configuration in one UD104

One channel of UD104 implement flexible 3 split view, then output to next channel as signal source. User can implement 3 split views in one projector through one UD101 as well.



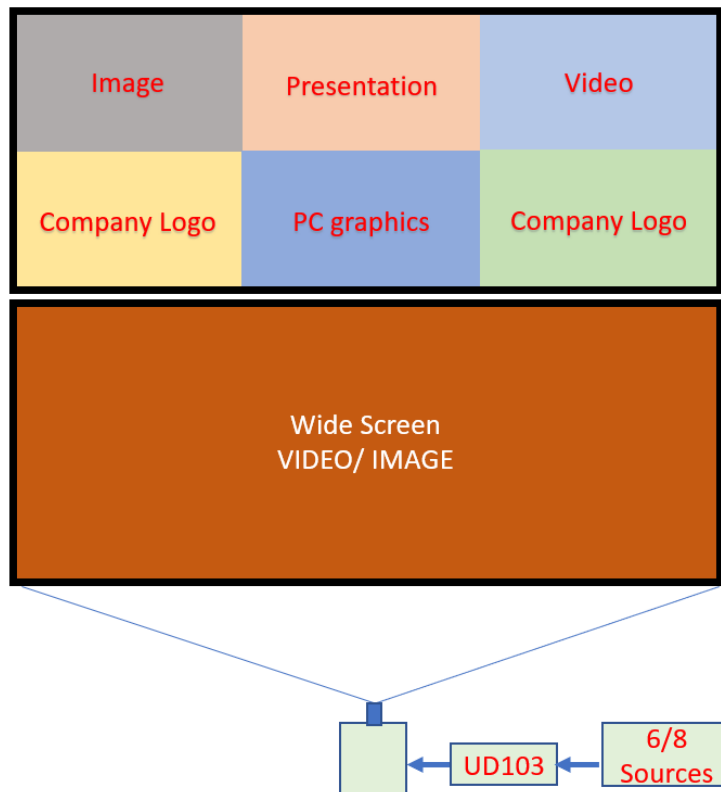
3.8. 6/8 split view from one UD102 with two projectors

Each channel can implement 4 split view windows and combine them side by side will create Profile 1 image. If two projector edge blending is required, user needs to feed the same source signal to HDMI-1 and HDMI-4 at the same time.



3.9. Example for 6/8 split view configuration in one UD103

One channel can implement maximum up to 4 split views. Multiple channels can be cascaded for more display windows. Below 6 or 8 split views can be implemented through one UD103. First two channels to execute two 3 or 4 split views, then output to the 3rd channels to execute POP (Side by Side) or Top/Bottom function to combine them into 6/8 split views and output to the projector.



4. **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 WUXGA projector is used, the ideal system vertical resolution is 1200.
- 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, edge blending processor and the total resolution of the projectors after edge blending.
- If user uses 8 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.
- 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**

- VNS provides an Excel Spread Sheet in the website for user to do edge blending plan.
- Using Excel Spread Sheet calculation, user can 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 $1024*20\%\sim 1024*40\%=205\sim 409$ 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.
- User can simulate with different overlap pixels to get reasonable overlap region dimension between 50cm to 120cm. Wider overlap region will be easier for overlap color control.

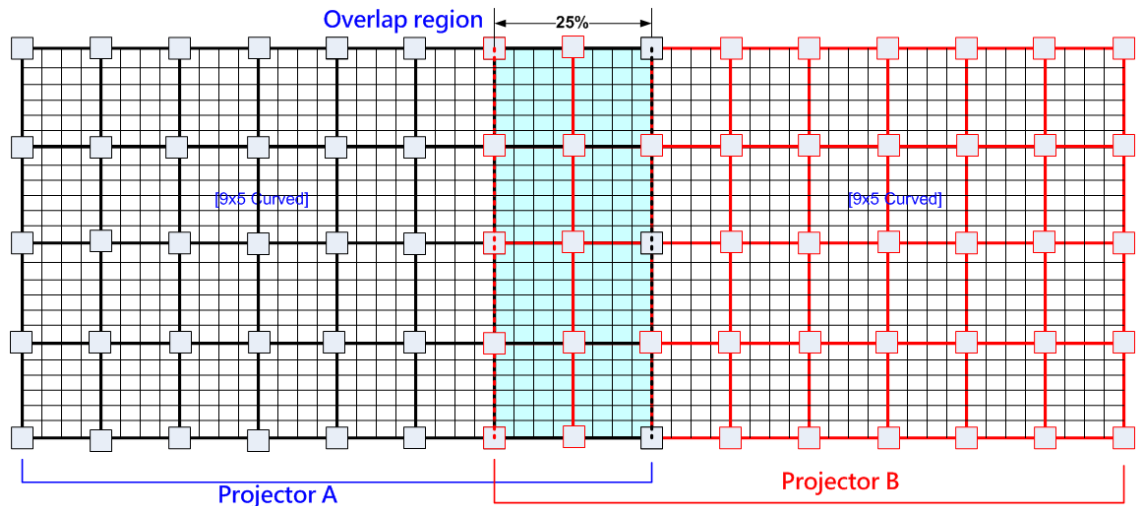
- GeoBox maximum edge blend range is H=1920 pixels, V=1200 pixels. If the overlap region is larger than above limits, user can reduce overlap pixel by geometry alignment and let overlap pixels within the limits. Another way is to set projector display mode with 4:3 aspect ratio. In Excel Spreadsheet calculation, user needs to change the projector resolution into 4:3 resolution, such as 2880x2160 for UHD projector or 1600x1200 for WUXGA projector to get actual image size. However, the Video Wall Overlap setting value should be calculated by GeoBox input and output resolutions. Projector aspect ratio change is one kind of geometry alignment but not resolution change.
- The black level compensation range is 900 pixels. If user requires black level uplift compensation and the overlap region is more than 1000 pixels, please try the outside black level Block to execute black level uplift. The pixel number is based on native projection area before any adjustment from either projector or GeoBox. If necessary, user can decrease the overlap size through geometry alignment without changing projector location but the black level compensation region will be still the same.
- Please note that user can change the grid pattern size from 8 to 120 pixels in H&V.

4.3. **Relation between Overlap pixels and geometry alignment accuracy**

- Overlap pixels will affect the control points in geometry alignment. If the Overlap pixel is 25% of the 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 GeoBox output 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] alignment will cut the horizontal image into 8 sections. In different output resolutions, there will be different pixel number in each section: XGA: $1024/8=128$, WXGA: $1280/8=160$, 1080p: $1920/8=240$.
- If the overlap area size 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) by geometry alignment in overlap area to increase the control points in overlap region for more accurate alignment between adjacent projectors.
- Usually, [9x5 Curved] alignment is enough for most of the curved screen edge blending. [17x9] alignment by remote controller is integrated in UD100. It can achieve more complicated applications.
- Below figure is an example for [9x5] alignment in projector with 1024x768 native resolution:

✓ **25% overlap region:**

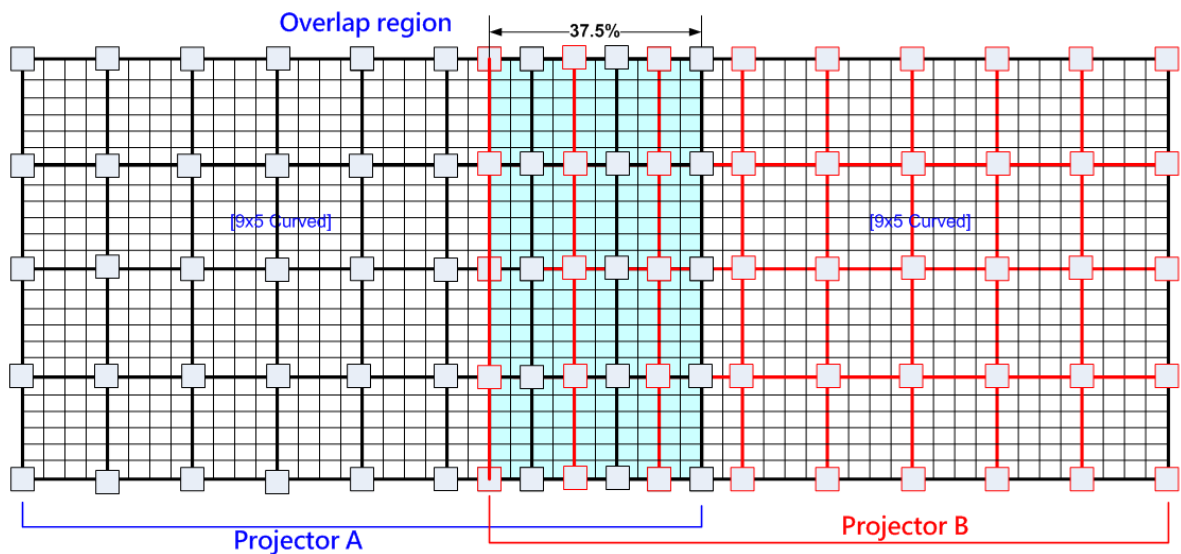
The adjusting points in projector A & B will be at the same position in overlap region



If the overlap is 256 pixels (25%) in XGA resolution, total adjusting points in overlap region are $3 \times 5 = 15$. 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.

✓ 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*1200	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	192/320/448/576

4.4. Get installation data from VNS Excel Spread Sheet

- VNS 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/m2)	Image size for each PJT
Width	6.50	PJT lumen
Height	1.56	Final Illumin

Overlap region size	Original aspect ratio	Projector throw distance
Horiz. (m)	0.500	Projector
Vertic. (m)	0.000	Final result

* Final mage 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 VNS 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 equal or higher than the required one. User can shrink the vertical height to required dimensions through geometry alignment. The maximum vertical adjustment range in each edge is 1200 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. ($2.5\text{m} \times 1.2 = 3\text{m}$, $2.5\text{m} \times 1.7 = 4.25\text{m}$)
- The final illuminance is 819 Lux. It will be enough for inside room environment.
- The overlap value in Video Wall setting (please see more details in Video Wall section):
 - 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
 - If the input source resolution while video wall setting is different from the calculation, the result will be wrong.
- ✓ If overlap pixels among projectors are different, "Irregular" Spread Sheet is required to calculate the data.
- ✓ Please contact dealer or factory to get necessary assistance for the Spread Sheet.

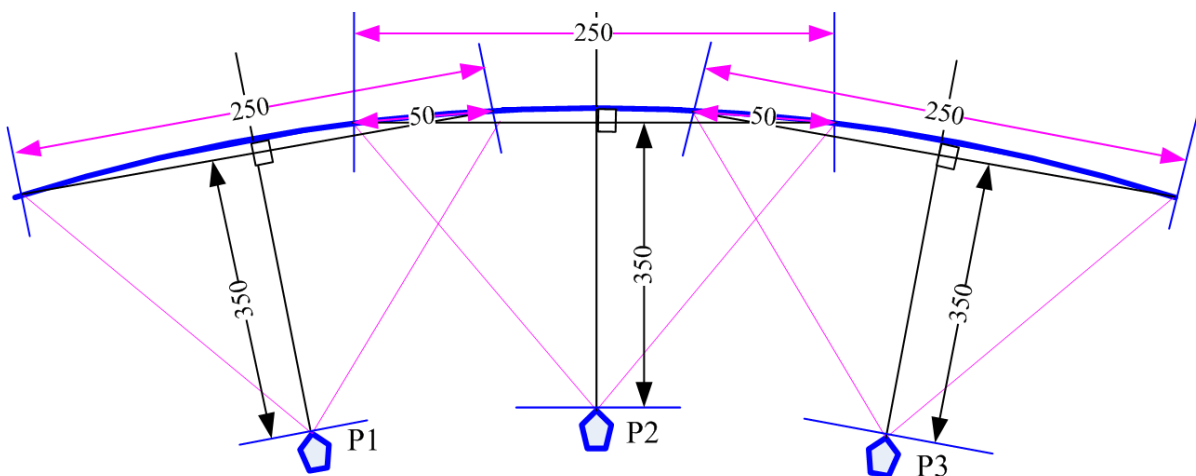
4.5. **Apply Spread Sheet data for projector installation and GeoBox setting**

4.5.1. Installation data from Spread Sheet

- 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 area.

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
- 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. [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-4 via HDMI cable. If CH3 and CH4 are required, please connect the loop out port to HDMI-7 and HDMI-10 with HDMI cable to let all processing channel fed with the same signal source.
- Ideal signal source for installation should be 4k/2k.

- 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.

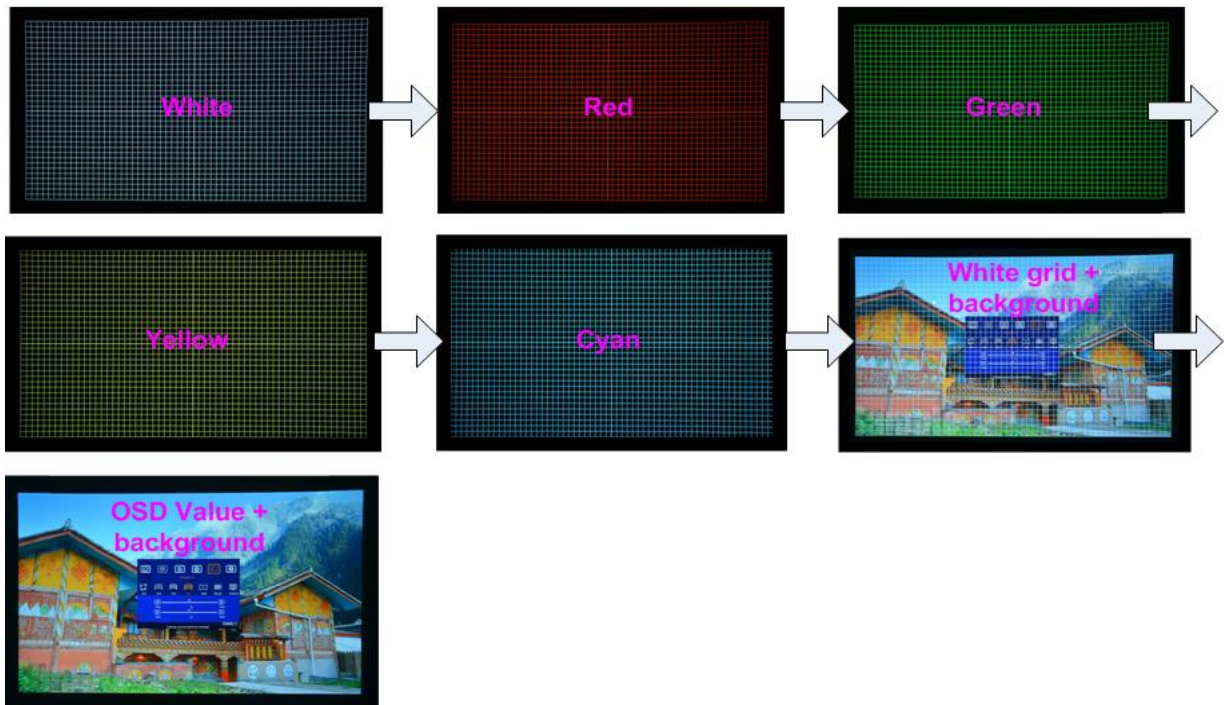
5. **Geometry alignment**

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

Grid pattern is required for geometry alignment. The area of grid pattern is the display area of the source image. User can activate test pattern through [Pattern] hotkey in remote controller or through WebGui and 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 [OK].
- There are 6 pattern modes 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 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 re-check with White grid pattern for final result.
- User can see geometry adjusting value when select [Background + OSD] display style.

PS. User can select the last pattern mode [OSD Value + background] and apply external test pattern for geometry alignment.



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 [Blend] menu.
- Default grid size for both H&V directions are 32x32 pixels.
- If 120 pixels grid size is selected, the horizontal grid pattern will be at the same position as 17x9 geometry adjustment control points. If 30/60 pixels grid size is selected, the grid pattern will also

have some horizontal grid points that will match 17x9 control points. It will be convenient for some applications.

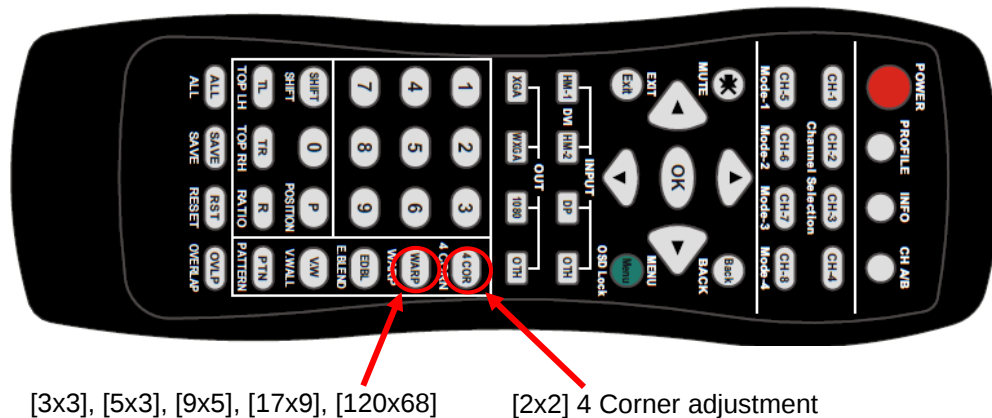
- In order to get optimized result in video wall [Overlap] value, user can use VNS Excel Spread Sheet and apply an overlap pixel in the Spread Sheet to get a near integrate number in Video Wall [Overlap] value, then select the grid size to match this overlap pixel.
- In low resolution projector with 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.



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 front panel keypad, remote controller, PC tool or WebGui through Ethernet connection.





5.3.1. Geometry alignment through remote controller

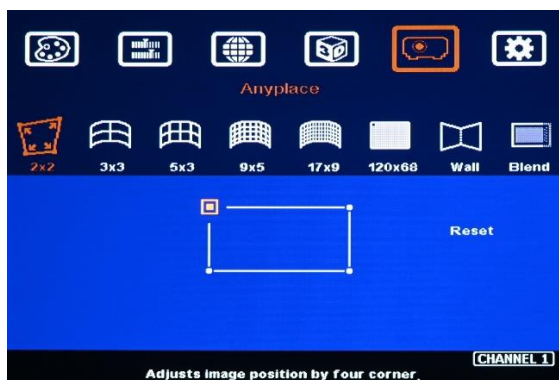
- Please be familiar with OSD operation from remote controller, including activating grid pattern, channel selection and hot keys for [4 Corner], [Warp], [Video Wall], [Edge Blend], [Pattern] and [INFO].
- Grid pattern will not be turned off until input timing change or press OSD Exit.
- User can install IR extender receiver near screen for easy GeoBox operation (User can 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

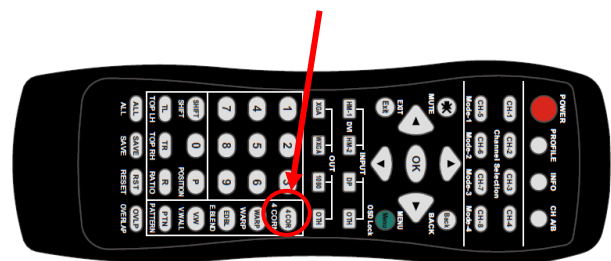
- Use channel selection keys and [Pattern] hotkey to show grid patterns in all projectors. Press [Pattern] key again will change grid color. To set two different pattern colors in adjacent projectors will be more convenient during geometry alignment.
- If user finds the grid size between adjacent projectors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

- In most of applications, no need to do keystone correction in the projector before geometry alignment.
- If using short throw ratio projector in curved screen display, the image will have big distortion. Please use projector to do geometry alignment before GeoBox.
- [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]→ [17x9]→ [120x68] 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 lines without keystone effect.
- 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 adjustments. [Warp] alignment can adjust the image position back to required position.



[2x2] 4 Corner hotkey

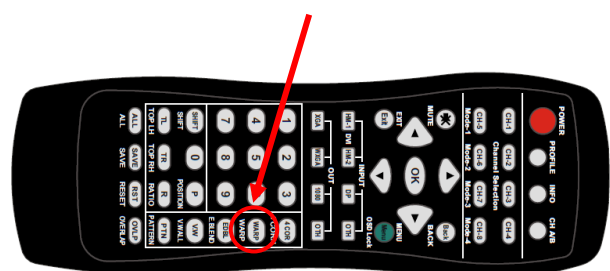


5.3.4. [3x3], [5x3], [9x5], [17x9], [120x68] Warp alignment

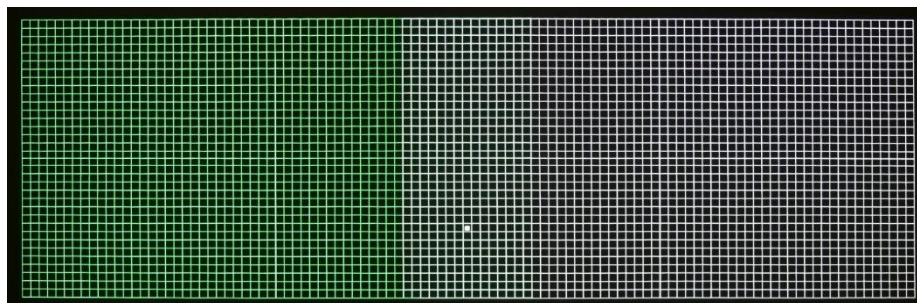
- After finish [2x2] corner alignment, apply [3x3] geometry alignment to let 9 adjusting points be located at the required positions including 4 corners, edge center points and center line.



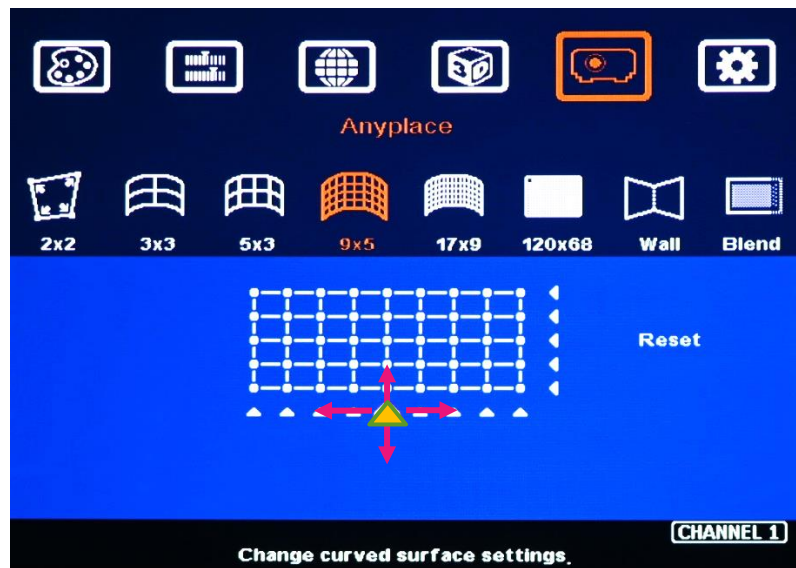
[3x3] warp hotkey



-
- Please follow the sequence [2x2]→ [3x3]→ [5x3]→ [9x5]→ [17x9]→ [120x68] to do alignment.
 - 120x68 grid pixel position fine-tune: Each control point can be adjusted with 1/4 pixel/step and moved up to 12.5 pixels adjustment range. Maximum adjusting points are 100 points.
 - 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 line gap 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 [9x5] alignment again after [17x9] alignment, [17x9] grid position will be reset and only keep [9x5] 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 adjust [Overlap] value in video wall settings to compensate the stacking 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.
 - Geometry alignment keystone angle is about $H=40^\circ \cdot V=35^\circ$. The range can be up to 600 pixels in [2x2] + 600 pixels more in [3x3] for one corner/edge. It also depends on the output resolution. Lower output resolution will have less geometry alignment pixels.
 - If the adjustment range is too big, it is possible to get crashed image, please take below actions to improve the situation:
 - Use projector geometry alignment function to cover some adjustment.
 - Apply longer ZOOM ratio in the projector (to increase projector installation distance).
 - Adjust projector installation position.
 - Exchange with longer throw ratio projector to reduce image distortion.
 - 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.



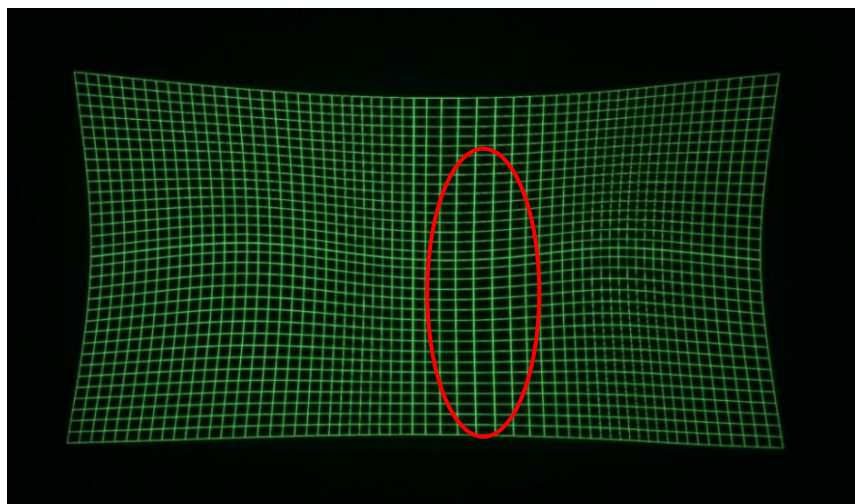
5.3.5. Linearity grid line adjustment



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

- Linearity grid line adjustment is under [3x3], [5x3], [9x5] & [17x9] warp alignment OSD menu. User can select the control point, then press ENTER to do grid line adjustment. Each control point can shift multiple grid lines 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=17, V=9. For [3x3], the adjusting range is +_600 pixels in each direction. This function is not available in PC tool.
- This function can co-work with Warp and Edge Blending function.

Grid line gap adjustment

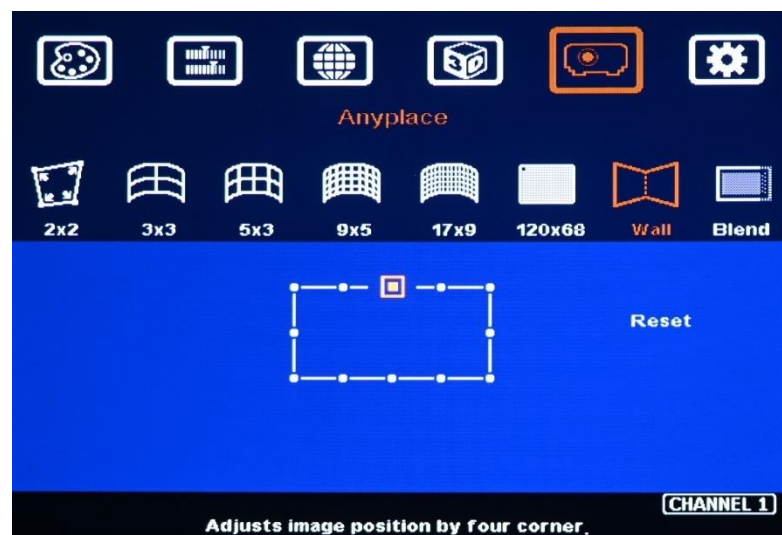


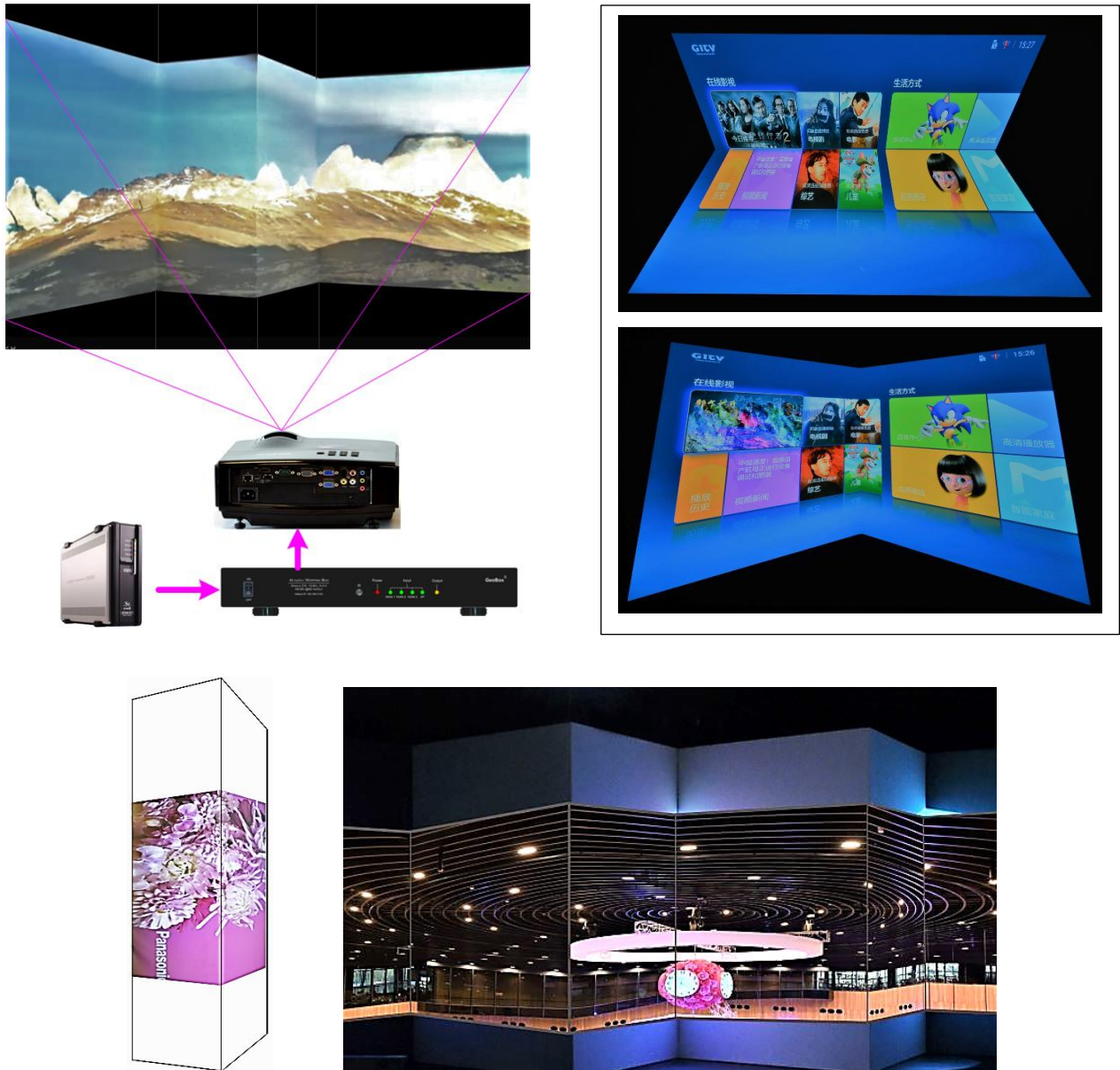
5.3.6. W shape Corner Wall geometry adjustment

Important note: When apply Corner Wall function, all the other geomtry alignment function will be disabled. User can only execute geometry alignment through 10 points of Corner Wall adjustment. 4 corner control points can execute 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 or images at two sides of the pillar at wall corner through 10 control points across the edge of the image. It can execute horizontal and vertical corner wall 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 positions of the image. The whole image position will be shifted the with same scaling factor. The adjustment range is 1200 pixels in both H&V directions.
- The rest 6 control points can correct the image position at wall corner or the images at two sides of the pillar at corner wall. It can shift the image positions in horizontal and vertical direction with the control range up to +_1200 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. The ideal projector throw ratio should be larger than 1.0:1 if the output resolution is UHD.





Corner wall application on curved screen

If user wants to implement Corner Wall function on curved screen, user can connect the signal to another UD100L to do warp alignment, then connect the output to the input port in another unit for Corner Wall alignment. Then user can execute curve alignment and Corner Wall adjustment at the same time.

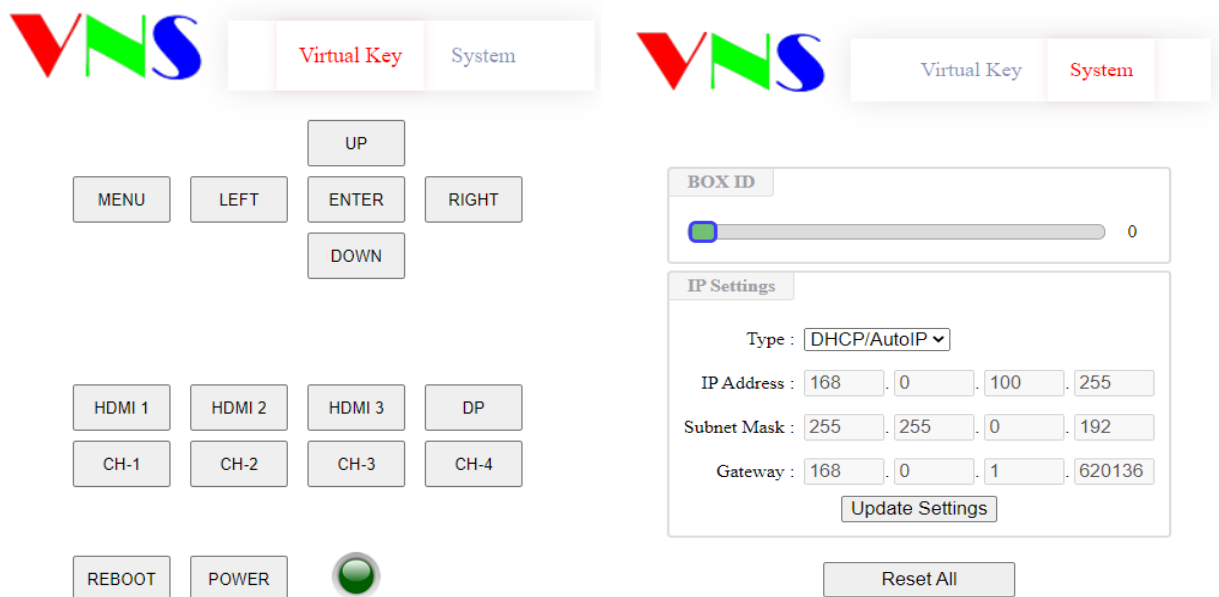
Important notice on curved screen application

The image quality in Corner wall adjustment will be degraded due to big geometry alignment. It is recommended to apply only multimedia content in this kind of applications. User can display the images at different side walls with different projectors to get the best video quality. GeoBox can crop correct image to get the right scaling factor based on the wall dimensions.

6. Geometry alignment via WebGui and PC Tool

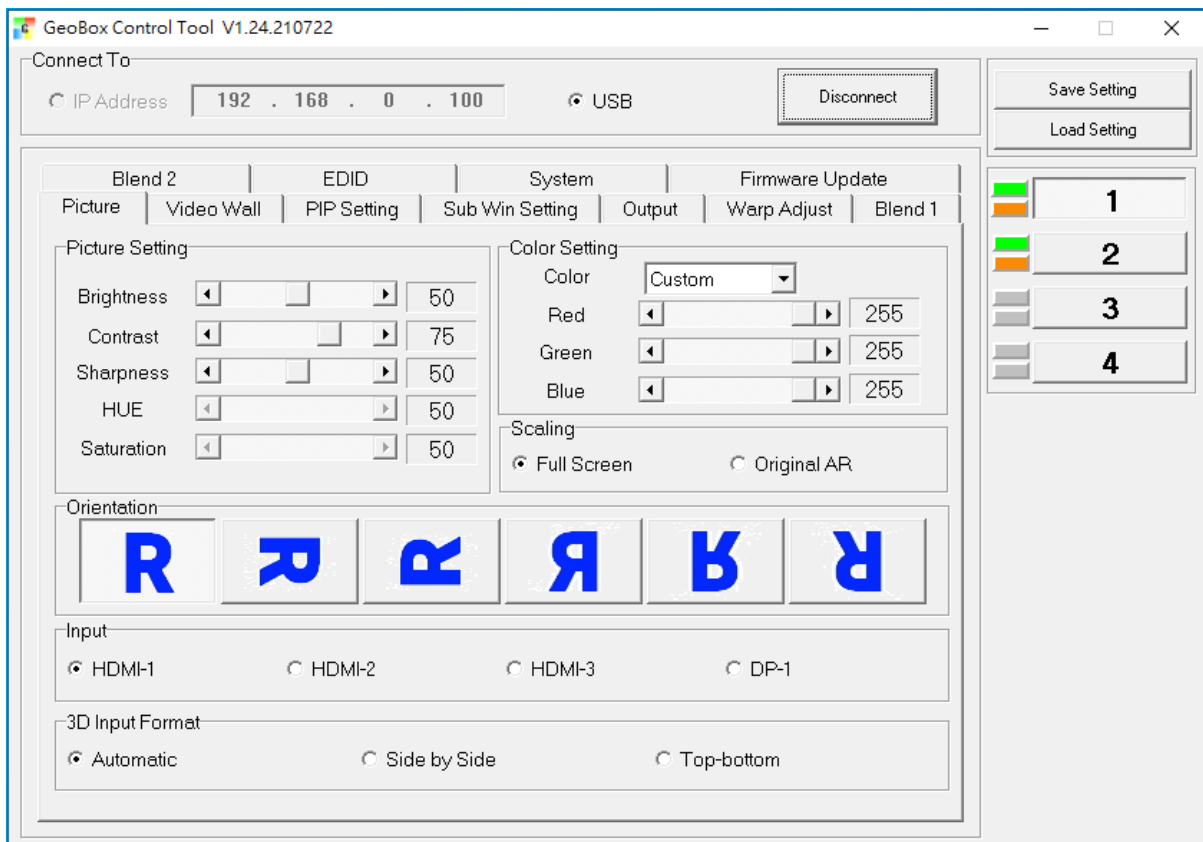
6.1. WebGui

- User can connect GeoBox through web browser like Microsoft Edge or Google Chrome through input the IP address <http://192.168.0.100/>. User needs to set PC at the same IP segment such as 192.168.0.105.
- After connection, user will see WebGui as below:



- Use Mouse to click the button to do the operation. User will see OSD menu on the screen for further operation. It will be the same as control through IR keypads.
- When user wants to adjust geometry position with big value, please quickly click with the mouse at virtual key and it will increase the adjusting speed to get to the value needed.
- User can Power ON/OFF the system or reboot the system through Buttons. The Power indicator will change color to Red if the system is power off. User can also turn on the power through WebGui.
- User can set different IP address and save final settings into Profile Index through OSD menu.
- The maximum geometry control point in WebGui is 17x9, same as Remote controller or GCT operation.
- If user uses mobile phone for the operation, it may have different behavior in different OS. If meet trouble, please double check with different brand mobile phone.

6.2. GCT PC tool



- GeoBox Control Tool (GCT) can be executed through PC. No software driver is required. Once user opens PC Tool and connects with PC through Ethernet, WiFi or USB, user can execute edge blending settings through PC keyboard and mouse remotely.
- The settings from GCT will be updated to the Box at real time. User can switch the operation between OSD menu and GCT seamlessly.
- User can backup system settings in PC and copy to other units.
- Firmware and MCU code update can be executed through PC Tool. User can control multiple units at the same time through different IP address.
- Different PC tool version requires correspondance MCU code and firmware version. Otherwise, it may not work. Please contact us if you have any trouble.

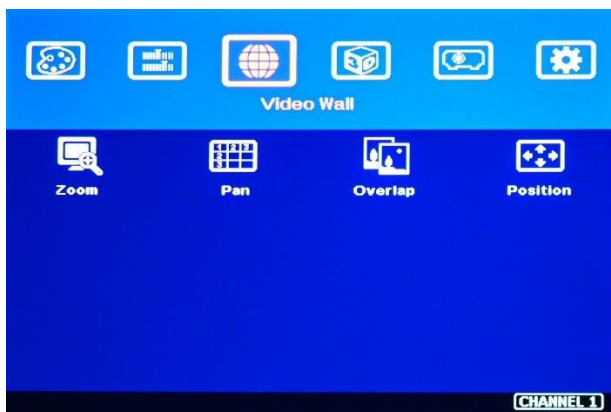
6.3. Steps for Edge blending setup through GCT operation

- Set output with the same resolution as projector native resolution through remote controller, front panel keypad, OSD or GCT PC tool under [Output] menu.
- Connect GCT→ Select [Pattern] color→ [Warp Adjust]→ [2x2]→ [3x3]→ [5x3]→ [9x5]→ [17x9]— [120x68].

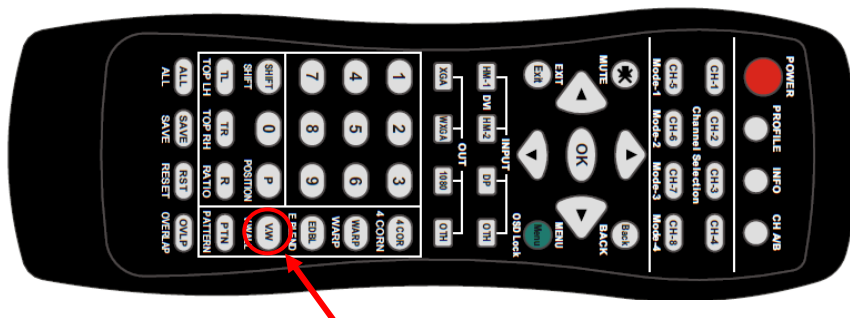
- User can save the final warp result into [System]→ [Save Profile].
- Execute [Video Wall] settings by GCT or OSD.
- Execute Edge Blend settings by GCT or OSD.
- After finish all settings, go to [System] → [Save Profile] to save all settings into Box permanently.
- User can save the settings into PC through [Save Setting] as backup. The file name is BSF. It includes all the GCT settings for all channels and the data in all Profile Indexes. User can load back BSF file from PC for further editing or copy to another GeoBox of the same model.

7. [Video Wall] setting

- The purpose for Video Wall Setting is to split the image and assign specific image to each projector. The overlap pixel setting is to change the cropping area for each projector based on the overlap size. Overlap value 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.

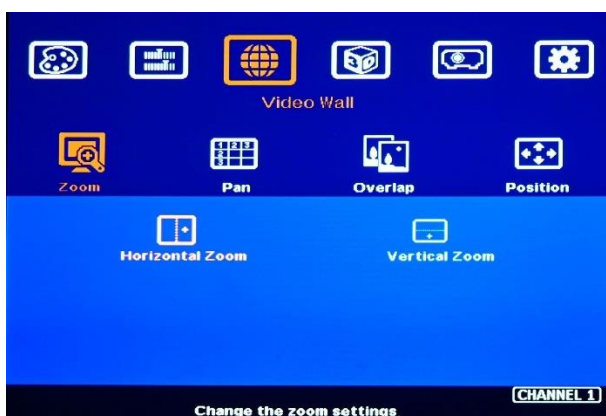


- Press Menu Keypad on Front Panel to enter [Video Wall] OSD menu.
- [Video Wall] hotkey is available in the remote controller for quick access.



[Video Wall] menu hotkey

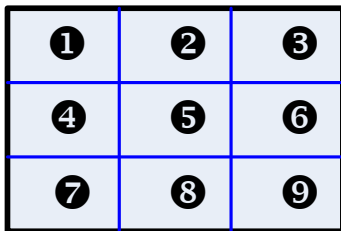
7.1. [Zoom]: split the signal source



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

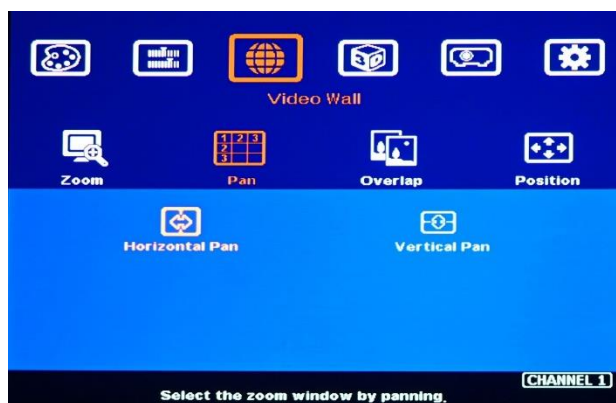


For 3 projectors at horizontal position, Horizontal Zoom=3, Vertical zoom=1



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

7.2. [Pan]: assign image location



- [Pan] is to determine the location of each split image in both horizontal and vertical directions up to 15x15.
- Default setting:
Horizontal Pan=1
Vertical Pan=1



For No. ③ projector:

Horizontal Pan = 3

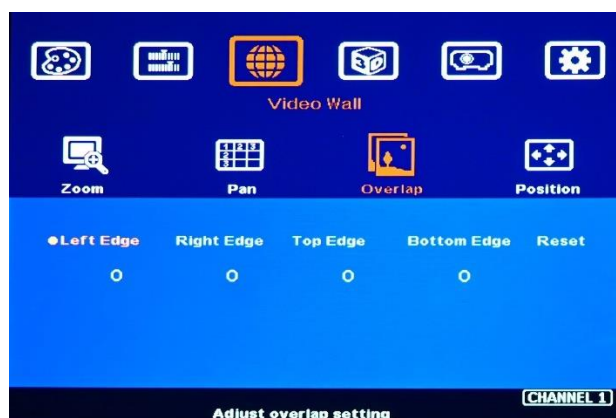
Vertical Pan = 1

For No. ⑥ projector:

Horizontal Pan = 3

Vertical Pan = 2

7.3. [Overlap]: crop the right image for each projector



- [Overlap] is to set correct cropping pixels for each projector based on the overlap condition.
- It can also change image aspect ratio.
- Max. Overlap range is +_1800 Pixels in both horizontal and vertical directions.

- In multiple projector applications, the Overlap value can be determined by VNS 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 native resolution (GeoBox output 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%
Overlap pixel (V)	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
Height	1.56	Final Illumin

Overlap region size	Original aspect ratio	Projector throw distance
Horiz. (m)	0.500	Projector
Vertic. (m)	0.000	Final result

* 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)

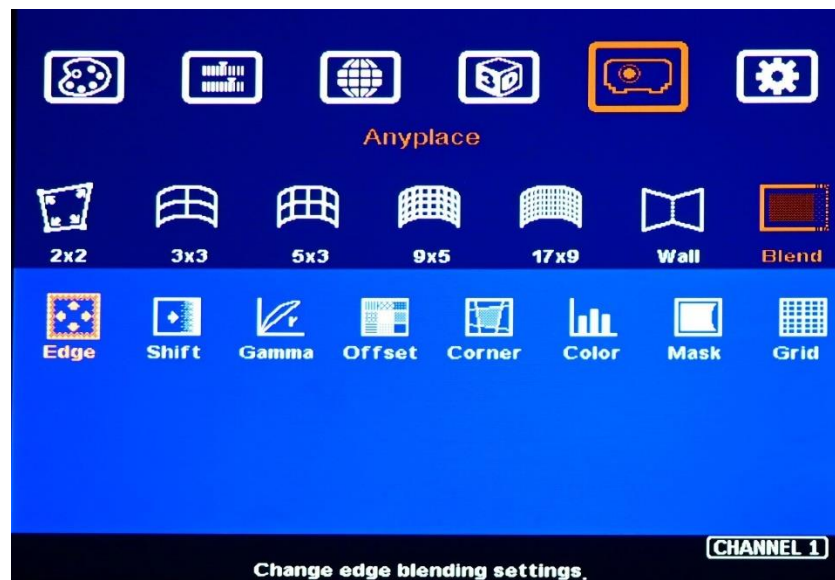
7.4. [Position]: shift image position without changing image size

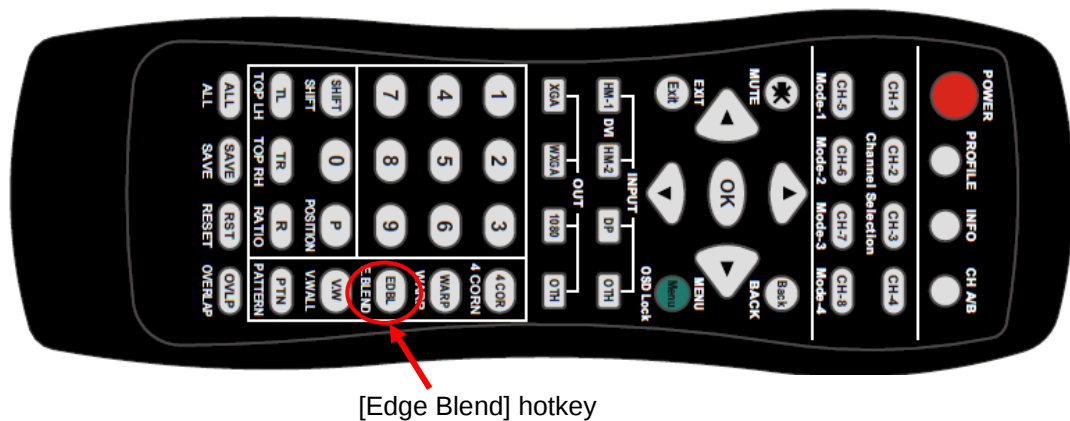
After cropping, user can shift image position at H&V directions without changing image size. Usually, it is for video wall application to fine tune image position. In projector edge blending application, user only changes Overlap value in one edge but not execute image position shift.



8. Edge [Blend] settings

- [Blend] menu is to merge the images from multiple projectors to become one seamless image.
- The scaling factor between two adjacent projectors 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 H&V)
 - To let images from two adjacent projectors be stacked together in grid lines.
- Sub-menu under [Edge Blend] menu:
 - [Edge]: select the overlap edge and apply overlap pixels. The pixel no. is same as the overlap grid size multiple grid number. If overlap is 10 grids (under 32 grid size), the overlap pixel is 320.
 - [Shift]: shift edge blending location under the same overlap size 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]: execute black level uplift in non-overlapped area to compensate light leakage in the projector.
 - [Corner]: Execute precise [Offset] (Black Level Uplift) location alignment.
 - [Color]: Execute White Balance correction for individual projector.
 - [Mask]: Mask out unnecessary image in the image edge.
 - [Grid]: set grid pattern size for Horizontal and Vertical directions.





8.1. [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. Max. edge blending edge is four.
- Maximum edge blend pixel in each edge is: H=1920, V=1200. If the overlap value is larger than above limits, user can set projector with 4:3 aspect ratio display mode or reduce the overlap by geometry alignment. The Video Wall Overlap value will be the same based on the input/output resolution in GeoBox but not display mode in the projector.
- Red & Green Color indicating lines will appear when set edge blending pixels.
- User needs to adjust the color indicating lines to stack together (green to green, red to red). The final overlap value is the same as actual overlap number (grid size x grid number).



For 3 projector edge blending as example:

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

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

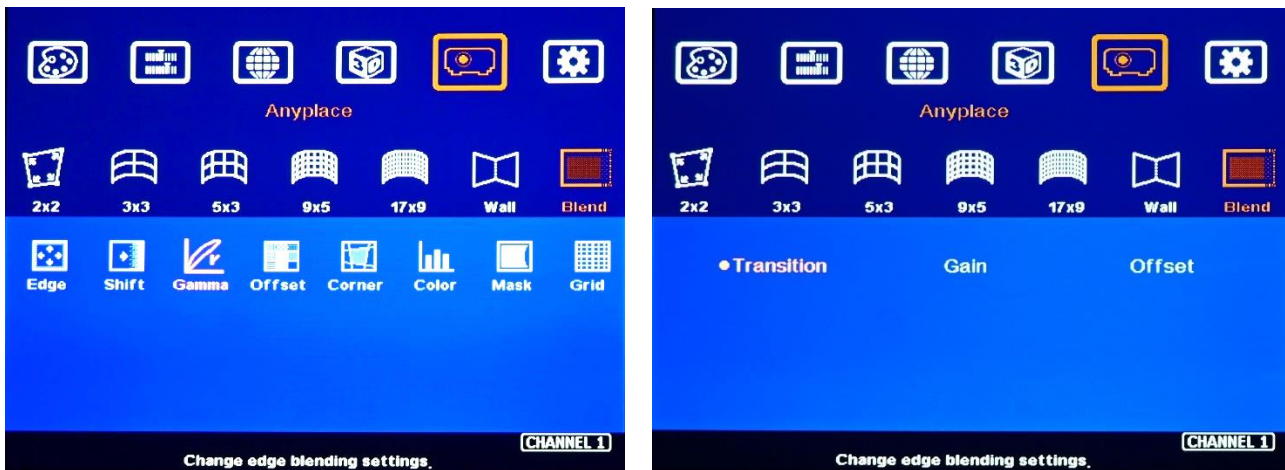
- [Shift] has two functions: one is to shift [Edge Blend] location and another function is to do [Edge Mask] in not [Edge Blend] borders.

- 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 border.
- 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 outline after geometry alignment.



8.3. [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. Edge blending default gamma curve is 2.2. 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.
- 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].
 - 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 before edge blending to minimize the possible banding effect in edge blending region.
 - Some projectors have [Multiple unit application] menu item for user to choose while executing edge blending function.
 - 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.



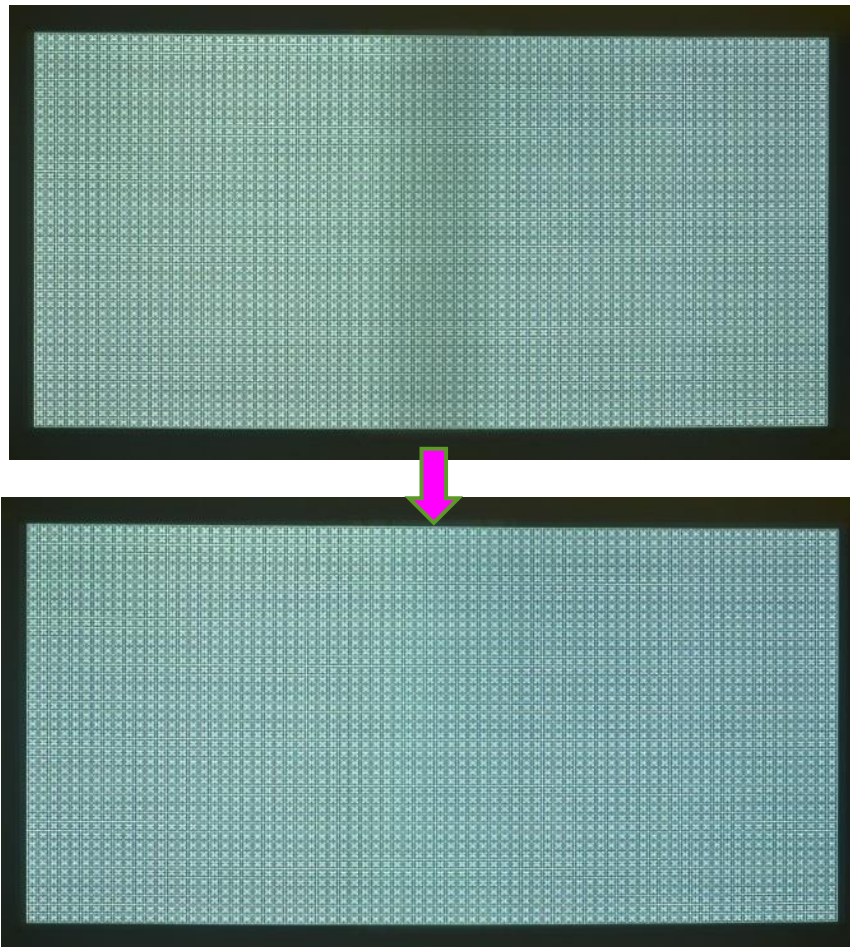
Three sub-menus under [Gamma] menu:

- [Transition] Gamma:
 - ✓ To set edge blending area gamma value via discrete RGB gamma curve value adjustment. The gamma value range for each RGB color is from 0.9-3.0.
 - ✓ When overlap region is brighter, user can decrease the gamma value and if overlap area is too dark, user can increase the gamma value to improve video quality.
 - ✓ User can apply pure color RGB and adjust R.G.B. value separately to see the difference.
 - ✓ Transition gamma adjustment may not solve color banding issue once the projectors gamma curves are not the same, smooth or have variation among projectors.
- [Gain] gamma:
 - ✓ This function can change the gamma curve in each projector separately.
 - ✓ It can further improve edge blending result, especially while two adjacent projectors have different gamma curve.
 - ✓ User can start with one projector in one color first and see the color change in overlap area. Then adjust other colors to match required color.
 - ✓ Usually, when user adjusts Gain Gamma in the first projector, it will affect the color in one side of the overlap region. User can adjust another projector to compensate another side. The adjusting value for adjacent projector can be different.
- [Offset] gamma:
 - ✓ [Offset] gamma will change RGB gamma at the same time.
 - ✓ This function is only available when user implements [Offset] function for black level uplift. After user implements [Offset] setting for black level uplift, user can adjust [Offset] gamma to change the gamma curve for black level uplift.
 - ✓ User can use this function to fine-tune the brightness level between overlap region and non-overlap region in edge blending application.

Below picture shows banding effect in edge blending area

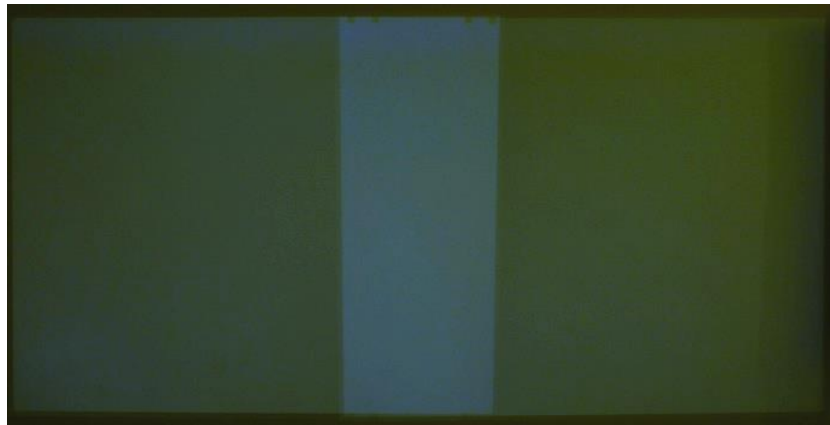
This issue is related to many factors:

- 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 can get good 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.



PS. User can shift OSD position to avoid interrupt overlap region color adjustment or black level uplift border position fine-tune. Please press [Position] key on remote controller to shift OSD position.

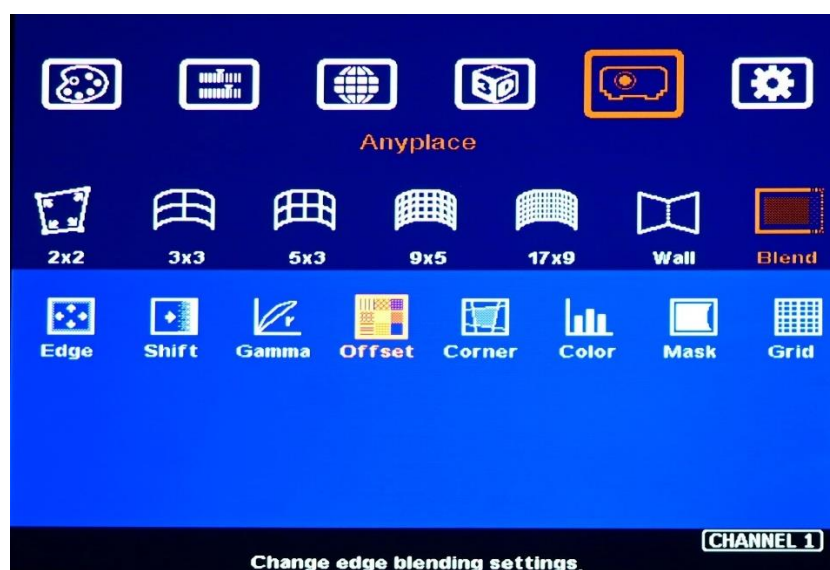
8.4. **Black level uplift: [Offset] & [Corner] adjustment**

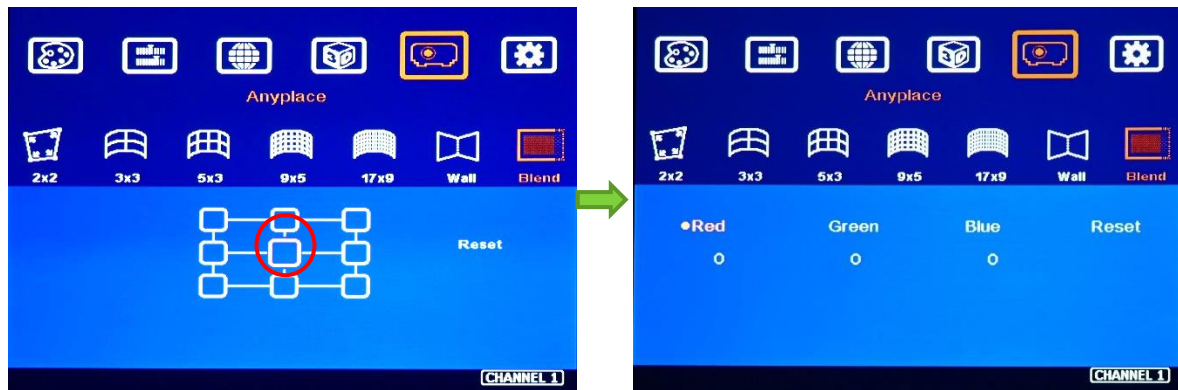


- If the ambient light is dark, audience will see grey region in Edge Blending area. It is due to light leakage from projector optical system and can't be fixed by signal processing. Low contrast ratio projector will be more serious. The only solution is to apply [Offset] function to uplift the color 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. Laser projector has high native contrast ratio with accurate color and gamma setting and is suitable for edge blending.
- [Offset] function is to uplift the color in non-overlap region and [Corner] function is to do accurate position alignment.

8.4.1. [Offset]

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

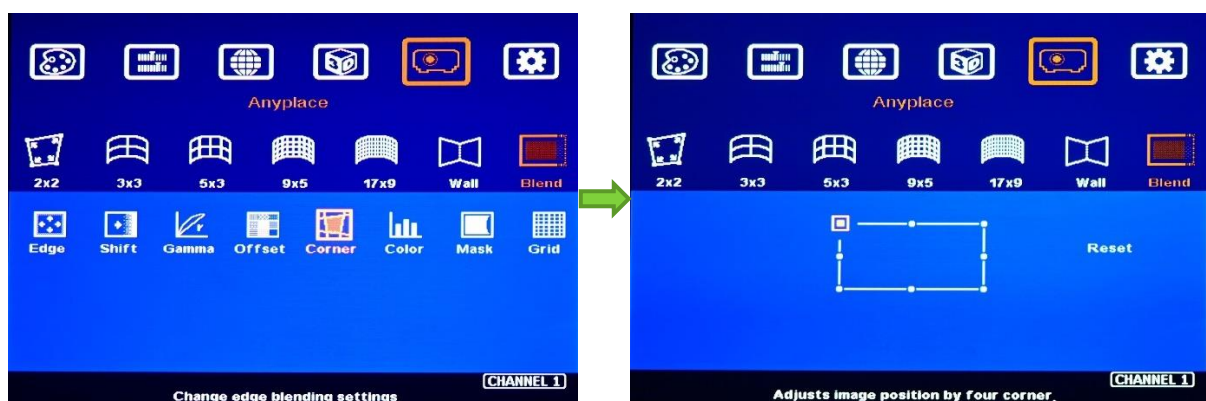




- User can select the region for black level uplift and apply the offset value in R.G.B. color to compensate the color difference between overlap region and non-overlap region.
- If user executes more complicated edge blending such as 4 projectors at 2x2 location. The maximum areas for black level uplift may increase up to 9 locations. Each location can have different [Offset] setting.
- RGB color adjustment range is from 0-255. For DLP projector, the adjusting value is near 60-90. For LCD projector, the adjusting value is near 80-120. RGB is independent.

8.4.2. [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. 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.



- 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.

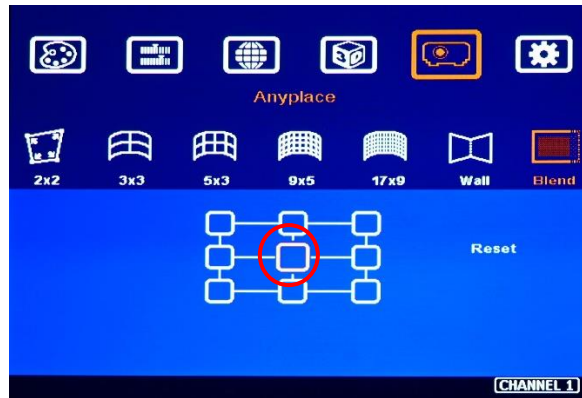
- If user finds some position deviation between Black Level uplift border and projector Light Leakage border, it can be fine-tune by geometry alignment between two adjacent projectors. Please make sure to have good image grid alignment in the border of overlap area.
- **User can shift OSD position to avoid interruption in the border position adjustment while black level uplift. Please press [Position] key on remote controller to shift OSD position.**
- 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.



8.4.3. Procedures for black level uplift

Two projector horizontal edge blending as example.

- Turn off ambient light and apply a black background content on the screen. If no black background content, user can disconnect input signal to get black image.
- Projector may have dynamic color adjustment function. In ideal case, please apply the actual display content and select the location that will show clear light leakage image. It can make sure to get the best result.
- Below is the procedure for black level uplift in two projector edge blending:
 - Select CH-1 (LH projector), select center block as showed in red circle.
 - Press [OK] and adjust RED color to 150. User will see red color enhancement.
 - [Back] to [Corner] menu.
 - Start from [Right Edge] (Top, Middle, Bottom) and adjust uplift location to match light leakage. (if necessary, please shift OSD location by press [Position] hotkey in remote controller).
 - [Back] to [Offset]→ Select center block→ RED→ adjust the value to 70
 - Fine-tune R.G.B color to let LH projector have similar color in overlap and non-overlap area.
 - Select CH-2 (RH projector), execute the same procedures as CH-1 to finish black level uplift procedures.



8.5. [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. It can't compensate the color banding in edge blending region. Edge blending color banding is mainly caused by gamma curve setting in the projectors.



- 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.



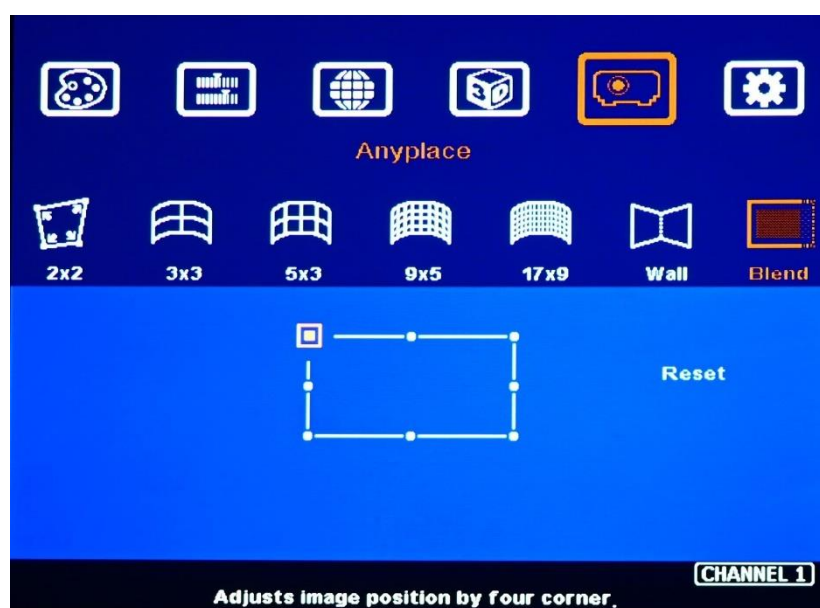
In edge blending procedures, user needs to adjust the color from projector first. If it is still not enough, user can use [Color] function to do further adjustment. Please note that, any color adjustment will reduce the color dynamic range. User needs to check the result with full range color image.

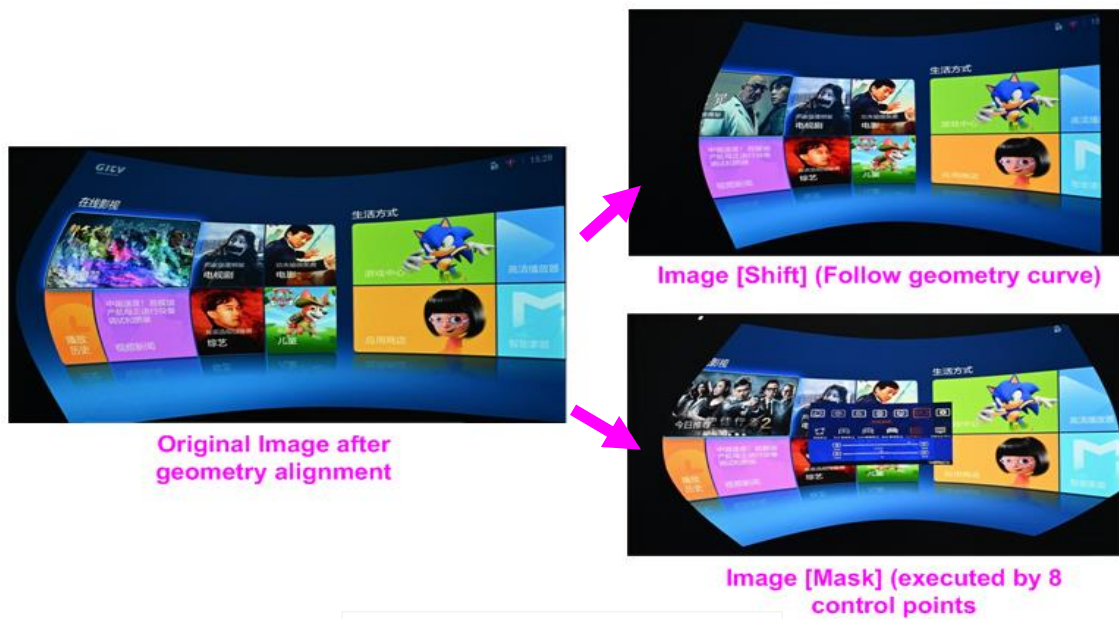
8.6. Edge [Mask]

There are two edge mask functions in UD100. One is image [Shift] and another one is Edge [Mask] under Edge [Blend] menu.

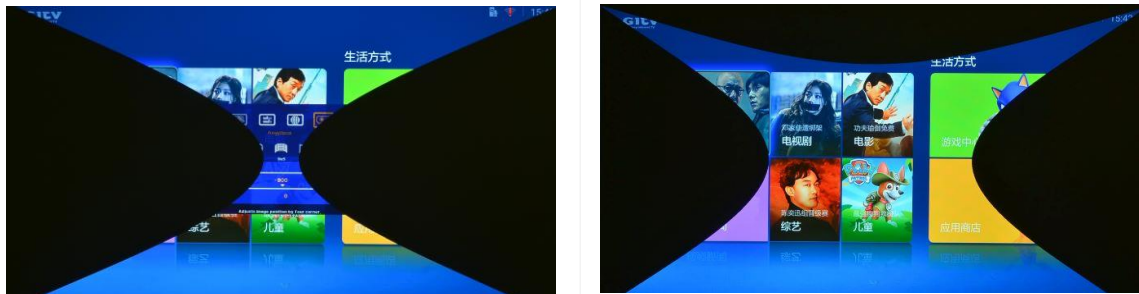


- [Shift]: Able to do edge mask with black background in each edge up to 500 pixels.
- [Edge Mask]: There are 8 control points for edge mask. When user moves the position for each control point, it will result various edge mask effect. The maximum position adjustment for each control point is ± 900 pixels 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 [Shift] edge mask.
- User can apply both [Shift] and [Mask] function at the same time to get various edge mask effect.





Another Image [Mask] example



8.7. [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.



8.8. 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.
- The projector may retain light leakage near the border (about 20 pixels) of the imager (micro display—DMD, LCOS or LCD). It is not possible to be fixed.
- The factors affect final image quality
 - ✓ Projector:
 - To select projector display mode near 2.2 gamma setting will get the best result.
 - Ultra-short throw ratio projector is not recommended for edge blending, especially in curved screen edge blending.
 - When using ultra-short throw projectors, the reflection angle in overlap area will be very big. Viewer will see different color banding when watch the image from different viewing angle especially the screen gain value is more than 1.0.
 - 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 Auto/Dynamic color adjustment.
 - Try different color settings in the projectors.
 - ✓ GeoBox settings:
 - Edge Blending Gamma settings:
 - i. To execute [Transition] Gamma adjustment: start from one color in one channel first. After see some difference, then adjust other two colors. Try to do the same in the second channel.
 - ii. [Gain] Gamma adjustment: if Transition Gamma adjustment still can't fix the issue, try to adjust Gain Gamma. It will change gamma curve in each projector separately. Starting from one channel in one color first, then to do other two colors adjustment.
 - iii. [Offset] gamma: When implement black level uplift, [Offset] gamma can change the brightness in overlap region borders if some brightness gap happens between overlap and non-overlap areas.
 - [Shift] adjustment: If user sees dark line at the edge of the overlap region, to adjust few pixels (1-10) at “-“ value will change the color at the border.
 - [Color] under [Blend] menu: If user sees background color difference when apply pure

white image, user can apply [Color] to balance background color difference.

- Image Properties: To select Preset Mode to Neutral or Bluish may improve banding condition but it will change whole image color temperature.
- ✓ Screen: To use lower gain value screen.
 - Low gain value screen will improve banding effect in overlap region but will reduce total image brightness.
 - Short throw projectors with high gain screen may cause banding effect when watch from different viewing angles due to different reflection intensity.
 - User needs to carefully select the transparent screen for projection from rear when using ultra-short throw ratio projector. Due to big reflection angle, the transparent screen should be test before installation.

9. **Example for 3 projector edge blending**

A Curved Screen Edge Blending tutorial video is available in the website at <https://youtu.be/pn6XQiNpdLc>. It can be applied to UD100 model °

9.1. **Get detailed edge blending information through VNS Excel Spread Sheet**

9.1.1. Assumption

- Required image size (screen size): 6.5m*1.5m
- Watch distance: 2m (pixel pitch should be less than 2mm)
- Input signal resolution:
 - Horizontal resolution: $6.5\text{m} / 2\text{mm} = 3250$. It means minimum input resolution shall be $H > 3250$. 3250 is not VESA standard resolution. Therefore, we select 3840 as horizontal resolution. The ideal vertical resolution is based on screen aspect ratio: $6.5/1.5 = 4.33:1$. $3840/4.33 = 886$. It means 3840*886 is the resolution without image distortion.
 - In actual application, user can select 3840*886 from PC signal source. The media player and other display playback devices may have no 3840*886 output. User can select 3840*800 (same as projector vertical resolution) or 3840*1080 (or 3840*2160). Once user creates a content with 3840*886 resolution and set a full screen display in the complete system, user still can see no distortion image.
 - User can also prepare any content with 4.33:1 aspect ratio to get no distortion image.
- Number of projectors: 3 projectors at horizontal position
- Projector resolution and lumens. 1280*800 (native resolution), 3200 Lum. GeoBox output resolution shall be the same as projector native resolution to get the best video quality.
- Overlap pixels and dimension. 8 grids= $8*32 = 256$ pixels (based on Excel Spread Sheet calculation)
- Projector throw ratio: 1.2-1.7 (based on projector spec)

9.1.2. 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 image position fine-tune. User can use geometry alignment to draw the vertical height to the required dimension 1.5m. The maximum image height adjustment can be up to 30% to 50% (depending on output resolution).
- Optimized content resolution: 3840*886 (4.33:1).
- Installation distance: 3m-4.25m (based on throw ratio 1.2-1.7).
- The value in video wall Overlap setting (under 3840 input resolution):
 - #1 Projector: RH edge: +197
 - #2 Projector: LH edge=+98, RH edge=+98
 - #3 Projector: LH edge: +197
- The final luminance is 819 Lux (Lum/M2). It will be enough for indoor environment.

9.2. Mark image location and install the projectors

- After VNS 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.

9.3. System connection



- Only the input signal from HDMI-1/4/7/10 input port can be looped out.
- Input signal can be connected to HDMI-1/4/7/10 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 17x9.
- User can setup GeoBox through Ethernet. Please use WebGui or PC tool for the setup.
- Blue Tooth keyboard and mouse can also extend the distance for remote setup.
- Select input port and set GeoBox output resolution to be the same as projector native resolution.

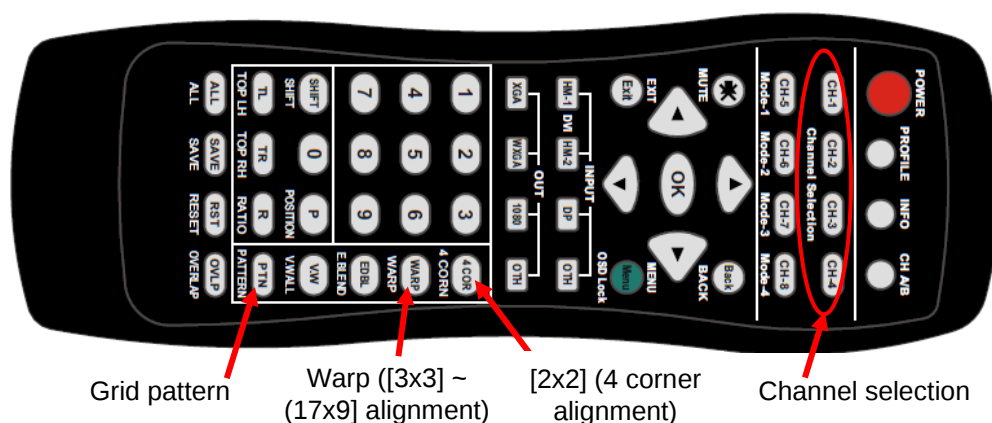
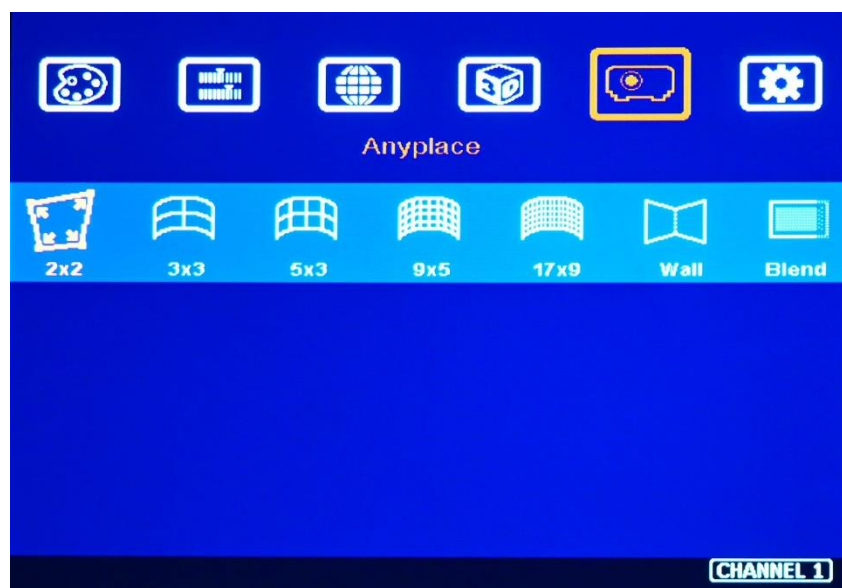
9.4. Projector settings

- Please reset projector to default setting.
- Disable dynamic color and brilliant 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 adjust 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.

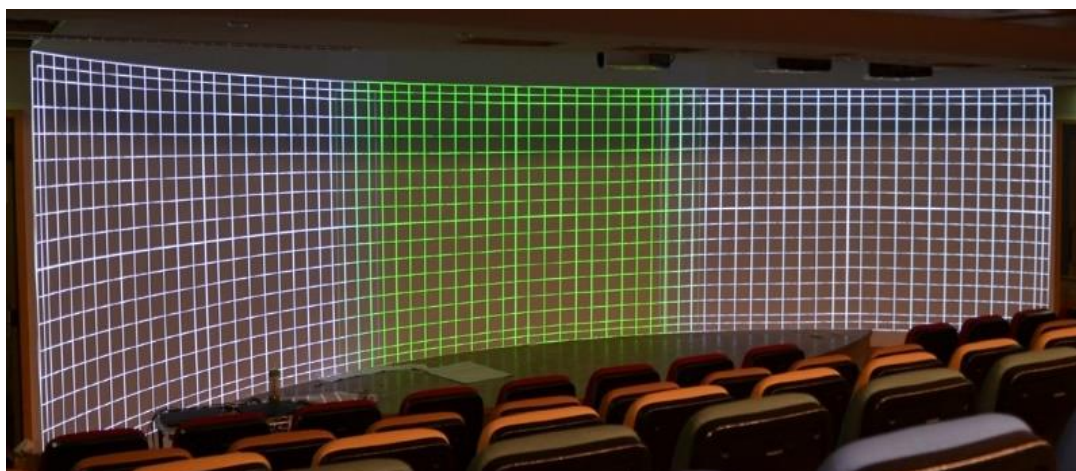
9.5. GeoBox Settings

- 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]. It will reduce re-search input source in the projector. Please return to [Normal] setting after edge blending settings to make sure all channels can be synchronized.
- If setup via Ethernet, please connect GeoBox with Switch/Hub or WiFi router by LAN port.

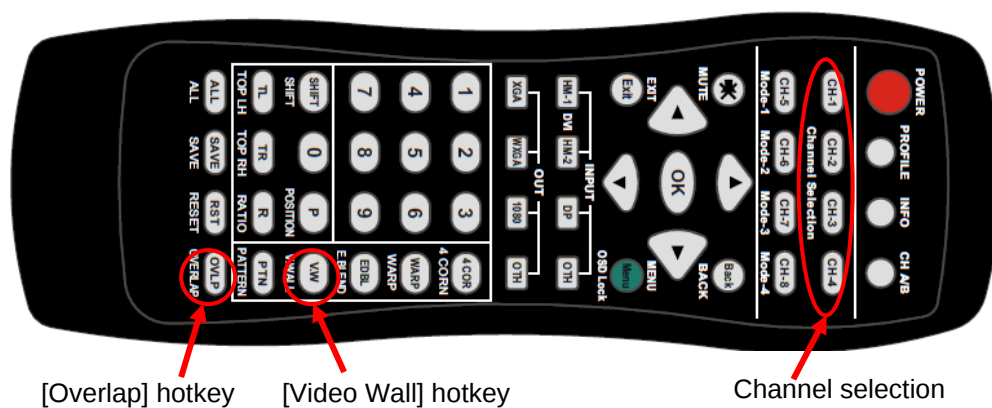
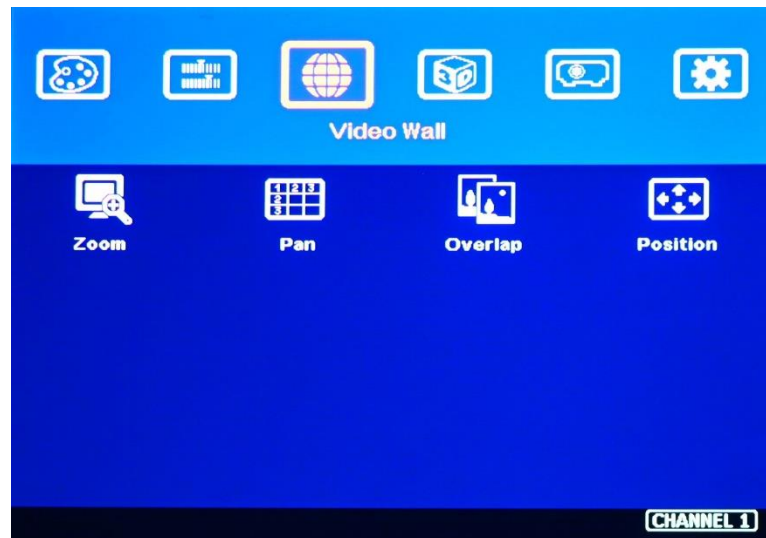
9.6. Geometry alignment



- User can install IR extender receiver near screen for easy GeoBox operation. IR receiver extender can be extended through audio cable up to 20 meters.
- Click channel selection key and [Pattern] key to show grid patterns in each channel. 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]→ [17x9] to do geometry alignment to ensure entire image will have uniform scaling factor.
- Apply [2X2] geometry alignment and draw the corners to expected locations. It doesn't matter to have some image inside or outside 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 VNS Excel Spread Sheet calculation, please use [2x2] alignment and 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] & [17x9] for further geometry alignment and fine-tune. Linearity Grid Line adjustment function is convenient for line gap alignment.
- After finish the alignment, user can use [2x2] for complete image position fine tune. If user executes [9x5] alignment again after [17x9] alignment, [17x9] grid position will be reset and only keep [9x5] grid point information.
- In ideal condition, all grids in edge blending area between two adjacent projectors should be stacked together.
- After the above processes, if the grid pattern in edge blending area still can't stack together, user can reduce 1-2 overlapped grids to change the control point positions in overlapped area and get more accurate geometry alignment result.
- PC tool can provide quicker geometry alignment remotely.
- After finish geometry alignment, all grids should be stacked together.



9.7. Video Wall settings



- Click [INFO] key to check if correct input and output timing are in the system. User needs to apply the same input/output timing as VNS Excel Spread Sheet calculation.
- Example for [Video wall] settings for 3 projectors horizontal edge blending with one UD103:
 - ✓ [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 VNS Excel Spread Sheet: LH projector: RH edge, Center projector: both RH/LH edges, RH projector: LH edge
 - ✓ Below is overlap value calculated from VNS 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".

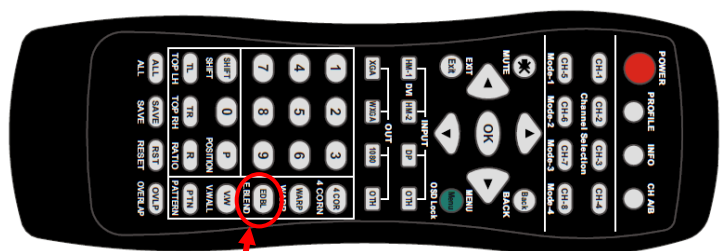
Video wall setting value

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 in two channels and let the image in edge blending area come closer till without double image. Two projectors shall have the same value (same cropping range). The difference shall not be over 2 pixels.
- If no Excel is available for overlap calculation, user can apply VNS Video Wall test pattern on the screen, then adjust the complete pattern to let entire pattern match together by overlap adjustment.
- If user still sees some blurred image in edge blending area, please fine-tune [Overlap] value and check whether geometry alignment is correct or not to improve video quality.
- Please note that projector has Thermal Drift issue (position shift due to different temperature). The image position in the beginning of Power ON may be different from the position after 15-20 minutes. Don't fine-tune image position during this period until it is stable.

9.8. [Edge Blend] setting



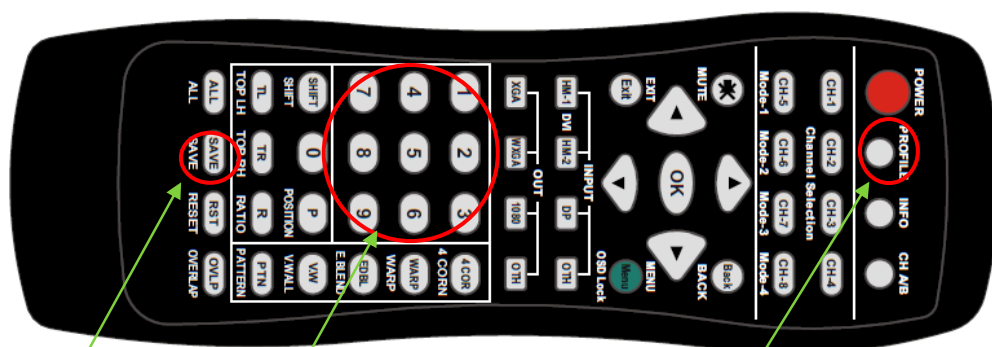
[Edge Blend] hotkey

- 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 spread sheet.
- Please adjust the color indicator lines to match together (green to green, red to red) and will see a smooth image.

9.9. Final Image quality fine-tune

- If banding effect is visible in overlap area, please try below method:
 - ✓ GeoBox [Gamma]: to adjust Gamma value under [Transition] & [Gain] menu.
 - ✓ Projector: please try different 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 Auto/Dynamic color adjustment.
- The video quality in overlap region is related to many factors. Please see more details in Edge Blend section in this user guide.

10. Save/Load System Settings

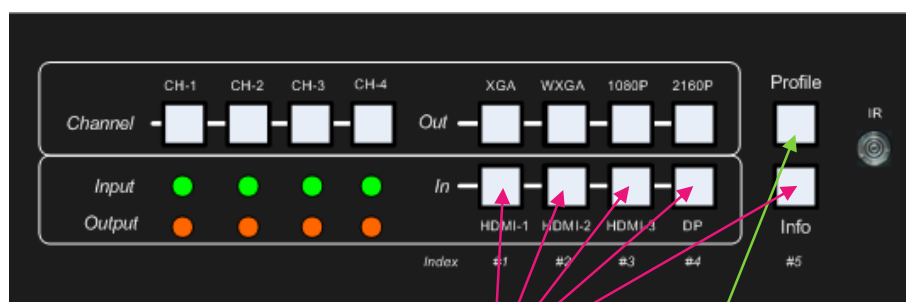


Press [Save], then select number key (1-9) to save settings. The setting will apply to all channels at the same time.

Number keys (1-9) for Profile [Save] & [Load]

Press [Profile], then select number keys to [Load] user settings. It will apply to all channels at the same time.

- After finishing system settings, user can save the setting via OSD menu through [Menu]→ [Options]→ [Setting]→ [Profile]→ [Save]→ [Index 1-10]. 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. Maximum Index number is 1- 9 only.
- [Save Profile] function is also available in WebGui and PC Tool. It will take effect for all channels up to 10 indexes.
- Please save all channels into the same Profile Index for easy Load back at the same time.
- Max. 10 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 1-10]. It will take effect for one channel only.
 - Remote controller [Profile] hotkey: Press [Profile] hotkey, then select number keys (Index 1-9) on the remote control to [Load] user settings. It will Load the settings for all channels at the same time.
 - WebGui & PC Tool: user can access [System]→ [Load Profile] menu to recall the settings for all channels through Ethernet or USB.
- When user power off the system, UD100 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 channel 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 [Load] from front panel keypad.

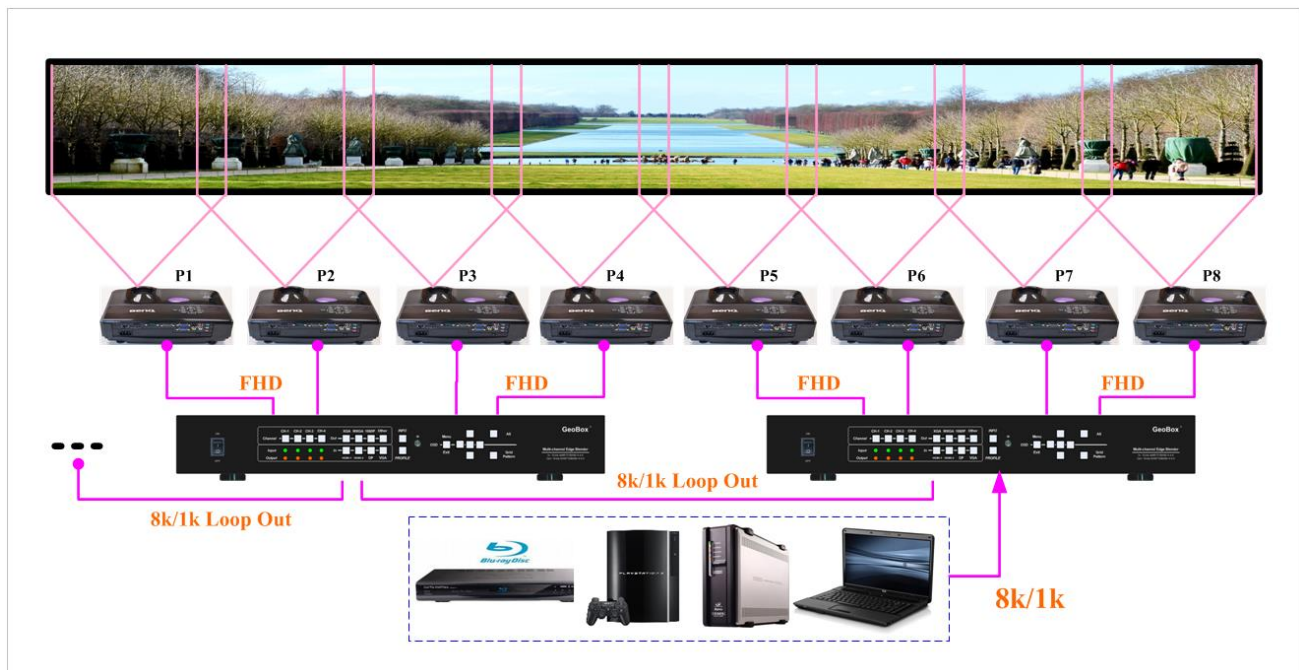


Index # keys (1-5)
for Profile [Load]

Press [Profile], then select [Index #] to
[Load] user settings. It will apply to all
channels at the same time.

11. Multiple unit applications

11.1. System connection in multiple unit edge blending



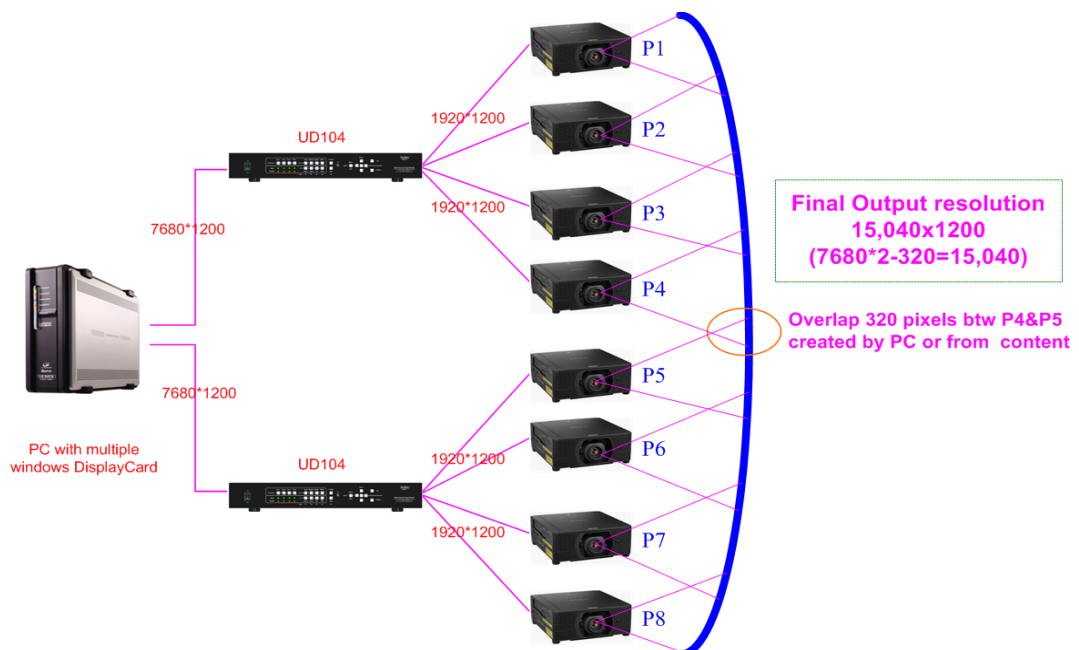
- Connect input signal to HDMI 1/4/7/10 input ports and loop out to next processing channel input port. The last loop out port can be connected to next UD100. No special sequence is required.
- Usually, loop out signal can connect up to 10 processing channels. The maximum number is related to signal 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-1/4/7/10 signal can be cascaded through internal HDMI splitter. If user wants to do edge blending with other input signal, please add video switcher at the front end to select different input source.
- User can control UD100 through Ethernet, USB or remote controller.
- IF GeoBox is installed in control room, Ethernet control will be the most convenient. Notebook, mobile phone and Pad can execute GeoBox setup through Ethernet or WiFi. Blue Tooth keyboard and mouse can also be used in remote setup.
- 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 VNS 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 UD104 & 6-8 projectors. If bigger screen is required, user can apply one 8K/2K or multiple signal sources through multiple synchronized media player or multiple output display card to achieve higher system resolution.

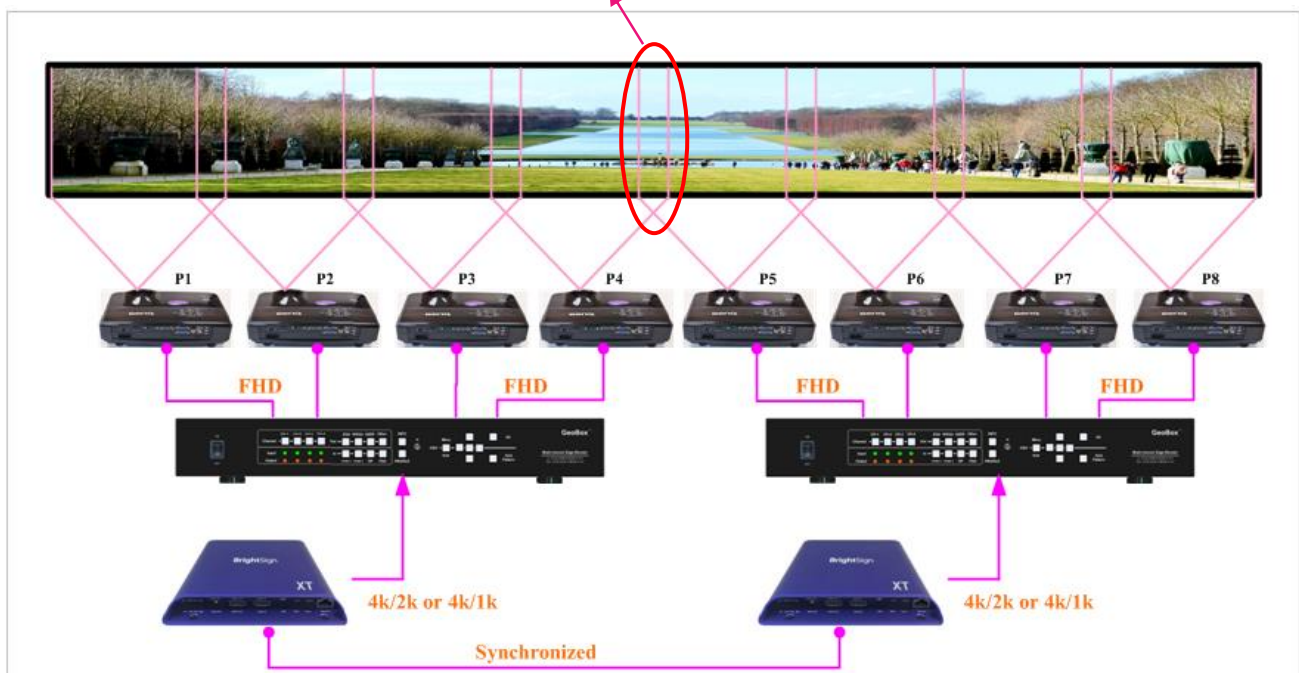
11.2. Content overlap setting issue

If multiple 4k/60 signal sources are required to get better 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 players need 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 handled through below methods:
 - To set Overlap image through PC display card. In this case, the overlap cropping issue will be handled by 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 such as Matrox TripleHead 2 Go, ATI Display Group, NVidia SLI Surround or NVidia Mosaic mode.
 - To cut the content with redundant data 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.

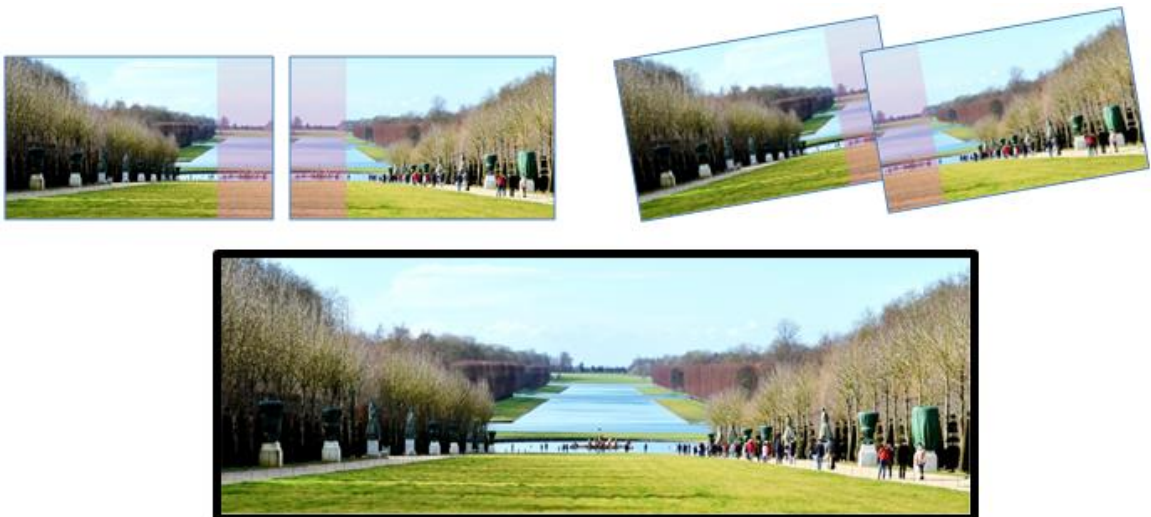


Overlap pixels from media
player #1 & #2 in this region



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 correct
pixel based on projector position to do edge blending

11.3. Convenient Setting in multiple unit application

11.3.1. 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 UD100 or IR extenders are installed together in the control scope of single remote controller, user can do individual UD100 control through below method.
 - Press [851] : Only ID #1 GeoBox can be operated through OSD menu.
 - Press [853] : 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.
- The channel key on the front panel of the unit that is locked through 85x will show flashing light with 1.0 second interval.

11.3.2. Setup by Ethernet

User can connect all UD100 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 PC tool to control each UD100 independently. Default IP address is 192.168.0.100. TCP Server port is 1266.

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.



- a. Assumption
 - ✓ 3 walls display: W1=2m, W2=5m, W3=3m
 - ✓ Signal source: 3840x1200, GeoBox output resolution: 1920x1200
- b. Usually, 5000 Lum projector can cover 3-4 meters image width. Four projectors are required to cover entire screen.
- c. The dimension of W1 and W2 is only 2.5-3.0 m. User can use one projector for W1 and W2 separately. It is possible to use one projector across two walls. Due to big geometry alignment and off axle projection, the video quality will be lower. We suggest to stitch the image edge at wall corner to get the best video quality.
- d. In ideal condition, each projector should have the same projection size to get equal brightness. For 2.5m image height, the image width should be 4m (16:10 aspect ratio).
 - ✓ W1: one projector is enough
 - ✓ W2: require two projectors with edge blending to cover the space
 - ✓ W3: one projector is enough
 - ✓ Floor: 1-2 projectors is required. (If use one projector, the image size is 5.0mx3.1m, the brightness and resolution will be a little lower. The installation distance should be also considered. Bigger image requires bigger installation distance.
 - ✓ The image in each wall should have the same scaling factor.

- ✓ Total screen dimensions: $2.5+5+3=10.5\text{m}$
- ✓ Total image width: 3840 pixels
- ✓ Pixel density: $3840/10.5= 365.7$ pixels/m
- ✓ Assign image resolution for each wall to get the same scaling factor.
 - W1 (PJ1) $=365.7*2.5= 914$ pixels (Projector #1)
 - W2 (PJ2 & PJ3) $=365.7*5= 1829$ pixels (Projector #2 & #3)
 - W3 (PJ4) $=365.7*3= 1097$ 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.
- e. Geometry alignment: user has two ways to handle the image size in W1 & W3.
 - ✓ To use geometry alignment to squeeze W1 to 2.5m width & W3 to 3.0m. If geometry range is not enough from GeoBox, please apply projector geometry alignment at the same time.
 - ✓ User can also maintain the image size larger than 2.5m/3.0m and increase [Overlap] value at outside edge to draw the image back to 2.5m/3.0m.
- f. 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: $3840/4=960$, $914-960= -46 \rightarrow$ Right Edge = -46. If image size is adjusted to 2.5m by geometry alignment. Left Edge=0. If the image size is larger than 2.5m width, user can increase Left Edge overlap value to shift the image back to 2.5m)
- ✓ W3: Zoom: H=4, V=1, Pan: H=3, V=1,
 Overlap: $3840/4=960$, $1097-960= +137 \rightarrow$ 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 want to get 2.5m image height, we need to have 1440 overlap pixels, the overlap value is 549 pixels.

Source resolution (H)	1829	Screen width	5.00 (m)
Source resolution (V)	1200	Screen height	2.50 (m)
Projector resolu. (H)	1920	Projector lumen	6000 (Lum)
Projector resolu. (V)	1200	Screen Aspect ratio	2.00 (required)
Overlap pixels (32 pixels per grid)			
Overlap pixel (H)	1440	Overlap %	75.0%
Overlap pixel (V)	0	Recommended	20%~40%
Recommended overlap region: Min. 50 cm width			
Qty of projector (H)	2	Throw ratio (Min)	0.50
Qty of projector (V)	1	Throw ratio (Max)	0.80
Final output resolution			
Horizontal resolution	2400	* Please apply Overlap pixels with 32x adjustment is based 32x32 for each grid.	
Vertical resolution	1200	*User can change grid size via OSD to any grid size between 8-120 pixels.	
Extended pixel (H)	549		
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	549	x	x	x	x	x	x	x	x
RH edge overlap value	549	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	6000	Width (m)	4.000
Height	2.50	Final Illumin	600	Height (m)	2.500

Overlap region size		Original aspect ratio		Projector throw distance	
Horiz. (m)	3.000	Projector	1.60	Min (m)	Max (m)
Vertic. (m)	0.000	Final result	2.00	2.00	3.20

* 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), SMPA 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.

- ✓ Under this condition, the image cropped for PJ2 should be in the range from coordinate 914 to 2377.5 ($914+1829/2+549$). The image for PJ3 should be in the range from coordinate 1279.5($914+1829/2-549$) 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: $2377.5-1920= 457.5$ (actual 457 or 458)
- ✓ 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: $1920-1279.5= 640.5$ (actual 640 or 641), Right Edge: $2743-2880= -137$
- ✓ After Zoom and Pan settings, user can also apply external Video wall test pattern and align the image together through Overlap adjustment. Once the pattern can match together, the Overlap settings should be correct. When apply external test pattern, user needs to continuously press [Pattern] key to see the external pattern from outside source.
- ✓ 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.



Original image at landscape



- 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 native contrast ratio, no limitation in installation angle and accurate color and gamma curve. It is the best choice for edge blending application.
 - UD100 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 VNS Excel Spread Sheet calculation also needs to change the output resolution. If the projector is 1920x1200, then user needs to key-in Output Resolution (projector resolution) at 1200x1920.
 - The OSD menu will follow original image direction. Video Wall setting direction will follow 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]

PS1. 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.

PS2. When apply portrait edge blending, the installation location of the projector will be near the middle height of the screen. If the projector has lens shift function, projector can have higher location.

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 projector, execute geometry alignment and edge blending on two projectors with another projector to show discrete content. 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.

Note: please save the setting through Remote controller "SAVE" hotkey or PC tool so that all channels can be saved into the same Profile Index for easy recall. User can recall through remote controller, RS232 or Ethernet. No projector installation or setting change is required.



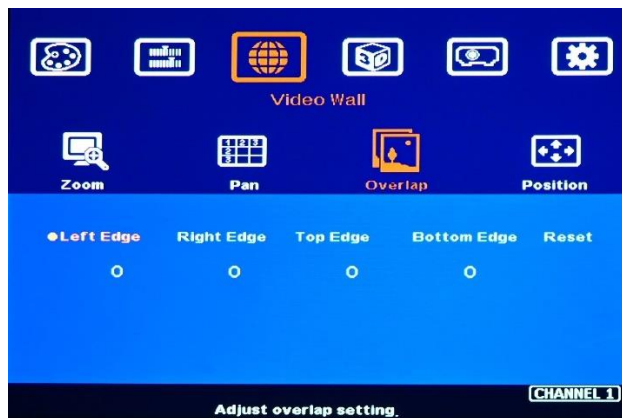
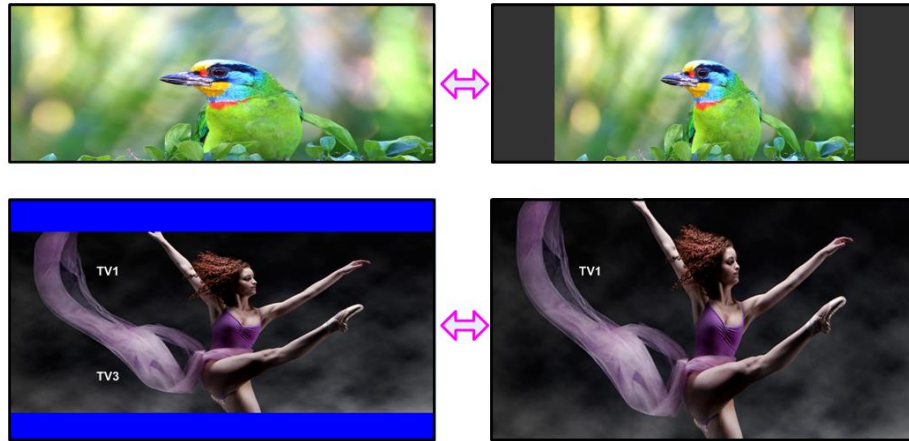
12.4. Discrete content displayed in each projector

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

- Signal source selection: User can select HDMI-1/4/7/10 as the input ports for all-in-one edge blending and select HDMI-2/5/8/11 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 edges by increasing 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. Image 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.
- [Overlap] hotkey is available in remote controller at bottom left corner.

- In multiple projector application, user only needs to adjust the overlap value in top/bottom edges to do vertical aspect ratio change. All the projectors need to have the same Overlap values to get the same image height. No horizontal overlap value adjustment is required.
- For horizontal aspect ratio adjustment, the process will be much more complicated because any horizontal overlap adjustment to change the aspect ratio will change image scaling factor and affect edge blending image stacking.
- For two projector edge blending, user can have one 16:9/16:10 image at screen center. For more than 2 projectors, we suggest to turn off some projector and only set one or two projectors to display one 16:9/16:10 image.
- In two projector edge blending, if user wants to change image aspect ratio and display it in the center of the screen, user can measure the dimensions and put marks on the screen as final image positions, then increase the same Overlap value in both outside edges (LH edge in projector-1, RH in projector-2) to shift the image to the marked locations.
- After this process, user still needs to increase the same Overlap Value in the Overlap setting until see clear image. User can use VNS Excel Spread Sheet calculation to get Overlap setting value. If user calculates original Overlap value with 3840 input resolution, after increase 500 pixels in both outside edges in projector 1 (LH edge) and projector 2 (RH Edge) as example, user can shrink the image width. However, the overlap region will become blurred. User needs to re-calculate Overlap

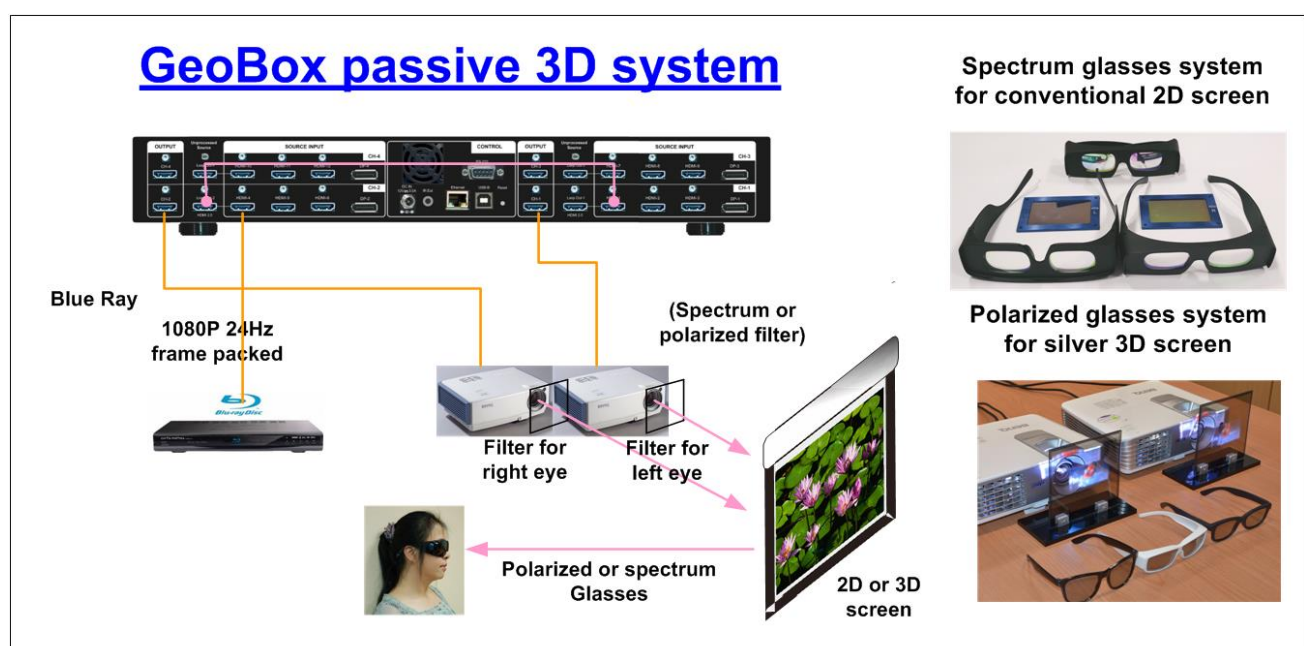
value by new input resolution $3840+500*2=4840$ to get correct video wall Overlap value. User can also continuously increase overlap value in both projectors to a point that can get clear image.

- 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.

12.6. Passive 3D application and 3D format conversion

12.6.1. Passive 3D System Configuration

UD100 will decode 3D format from all kinds of 3D video sources, including Blue Ray DVD, STB, Media player, Game console and PC... 3D signal will be decoded by GeoBox into signals for Right/Left eyes for passive 3D display or convert into specific 3D format for 3D display devices. The signal for passive 3D display needs to be displayed through two projectors. Two projector images need to be stacked on the screen through UD100 geometry alignment. Each projector will display signal only for one eye. User needs to install a polarized filter in front of the projector and also wears polarized glasses. The glasses need to match the polarized filter in front of the projectors so that the right eye can only see the scene for right eye and the left eye can only see the scene for left eye. Silver 3D screen is required to preserve the polarization of the light for 3D display. It is possible to use optic spectrum method from Infitec or Encircle Inc. to allow 3D displayed on conventional 2D screen.

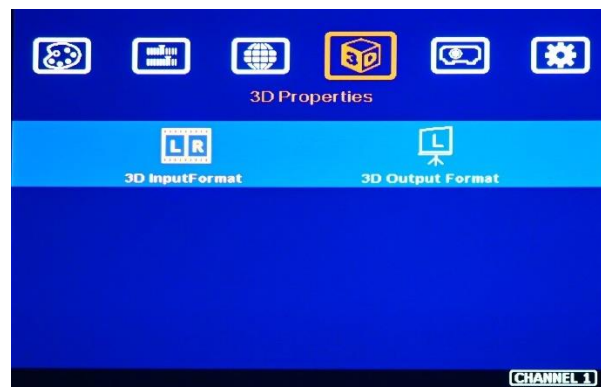


12.6.2. Passive 3D System installation and setup

- GeoBox should not be installed at side of the projector where the ventilation hot air comes out.
- Two projectors can be put side by side or top/bottom. Closer lens position will reduce geometry adjustment range and reduce the loss of the image resolution and brightness. Please make sure hot ventilation air will not affect the other projectors.
- Set output resolutions from 3D signal source as high as possible and connect to HDMI input of GeoBox, then daisy chain connection to another channel.
- GeoBox will decode and distribute RH/LH eye signals for two projectors.
- Install polarized filter at some distance from projector lens to avoid thermal damage (at least 5-10 cm depending on projector lumens). The polarized filter only allows up to 70°C temperature.
- Setup the polarized filter and glasses so that right/left eye can only see the scene for one eye.
- Use GeoBox geometry alignment function to align the images from two projectors completely stacking together. Please place the polarized filter in front of the projector before geometry alignment because polarized filter will affect the light path from projectors. Some deviation is allowed for 3D display but will affect the performance in 2D display.

12.6.3. GeoBox 3D settings

Two sub-menus under [3D properties] menu.



1) Input Format]

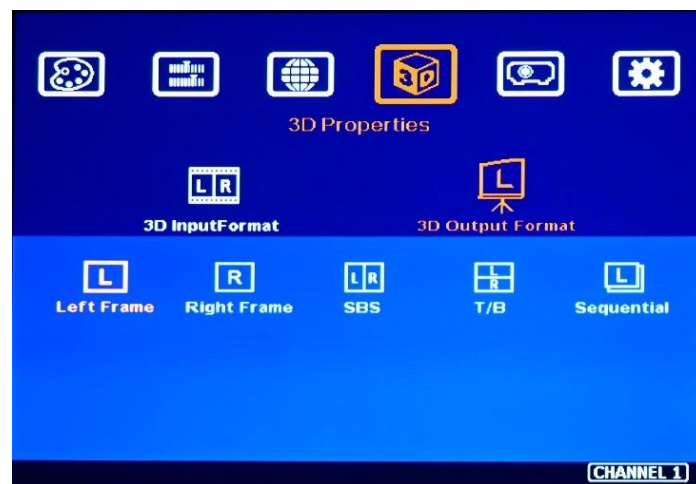
- Select [Automatic] if the 3D signal is standard 3D formats from Blue Ray player or sources with 3D INFO inside the signal.
- Select [Side by Side] or [Top-Bottom] based on 3D input format.



PS. User can apply dual camera RH/LH images as 3D signal source. In this case, please feed each camera output to one channel of UD100 to implement passive 3D. User can also execute POP function in one channel to output side by side 3D format for 3D display devices

2) [Output Format]

- Passive 3D application: To set [Right Eye Frame] for RH eye projector and [Left Eye Frame] for LH eye projector. It should match the RH/LH polarized filter location.
- SBS, T/B and Sequential outputs are for 3D format conversion. Some 3D display devices can only support specific 3D format. User can select the right format for 3D display device. Sequential output has not yet been varified yet.



12.6.4. 3D format conversion

UD100 can convert 3D formats into Side by Side and Top/Bottom outputs for passive 3D or active 3D display devices. Some 3D display devices have some limitation in supporting 3D input format. UD100 can convert 3D formats into popular 3D format output for these 3D display devices, including frame sequential output.

Miscellaneous settings

13.1. Helpful tips for edge blending

- UD100 can support interlaced signal source (i.e. 1080i/2160i). 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 may be big image distortion and beyond geometry alignment range. The video quality will be degraded due to big distortion adjustment.
- 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 native contrast ratio.
- 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.

13.2. Image distortion

- If the content aspect ratio is different from the screen aspect ratio, it will cause image distortion. User has below alternatives:
 - 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 edges.
 - User can adjust aspect ratio through video wall [Overlap] settings.
- If the content aspect ratio is the same as screen aspect ratio, user can take below actions to get no distortion full screen display through below actions:
 - PC signal source: To set EDID resolution with the same aspect ratio as the screen.

- If the signal source output resolution is not the same aspect ratio as the screen, user needs to set signal playback with full screen display without any border in the image.
- In PC display card settings, user needs to select [Full screen] display but not [Keep original aspect ratio]. GeoBox will expand the image to full screen automatically.

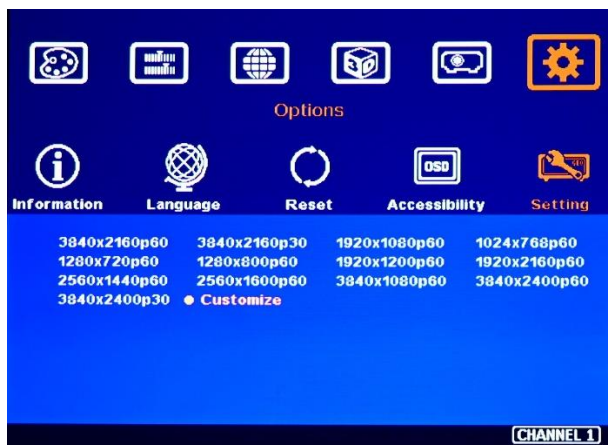
13.3. EDID Setting

Selectable EDID setting for input source resolution is added into GeoBox. The settings will be applied to individual processing module on selected input port. Each processing module needs to set EDID separately. Below are some guideline for EDID setting:

- GeoBox can support big range of input signal timing—from XGA up to 8k/2k @30Hz. In order to get the best video performance, user needs to select the best input signal resolution.
- Different source resolution 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. The range is H=1024-4080, V= 720-3840.
- If the signal is from PC, user can set customized EDID in GeoBox to let PC output expected resolution. Some PC may not follow GeoBox EDID resolution setting and require customized output setting from display card or re-boot.
- User can create some timings that is outside VESA standard, such as 7680x2160/30Hz.
- 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.
- 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.
- PC may memory the first EDID when it is connected with GeoBox at the first time and may not follow new EDID setting. Below are some suggestions that may fix this kind of issue.
 - Power ON GeoBox first and set EDID before connected with signal source. It will make sure PC can catch correct EDID information.
 - To switch to other Preset mode, then return to the required one. If Preset EDID modes still can't get satisfied result, user can try Customized setting. It may get different result.
 - If Preset modes and Customize EDID setting still can't get required result, please insert small pin into Reset Hole on the back panel for 5 seconds to reset the system. It will reset the system to factory default and get different result. Please note that reset from Reset Hole will erase customer settings saved in Profile Index.
- User can check the input/output resolution from INFO key on remote controller.



- Activate EDID setting menu:
[Options]→ [Setting]→ [EDID]
- Select desired EDID.
- If necessary, select Customize EDID in the range: H=1024-4080, V=720-3840
- 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.



13.4. HDMI vs. DVI Output Signal

- HDMI digital signal is compatible with DVI signal. Most of display devices can support both digital signals. However, some 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.
- Some HDMI optical fiber cable requires DVI output to get smooth signal transmission.

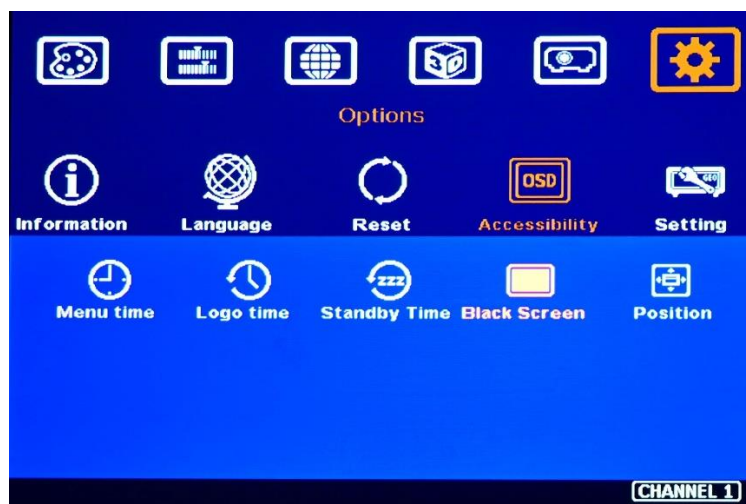


13.5. System Standby and Automatically Turn Off Output Signal

- [Options]→ [Accessibility]→[Standby Time]. Each channel is set separately.
- 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 UD100 will also be terminated at the same time. If UD100 detects input signal again (hot plug signal), it will automatically output the signal.
- If the projectors can automatically turn off/on by detecting input signal, user can control signal source to execute entire system on/off control.

13.6. 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 with no text message on it through [Options]→ [Accessibility]→ [Black Screen]→ [On]. Back ground color setting will be applied to not full screen display, such as aspect ratio change or PIP/POP display.



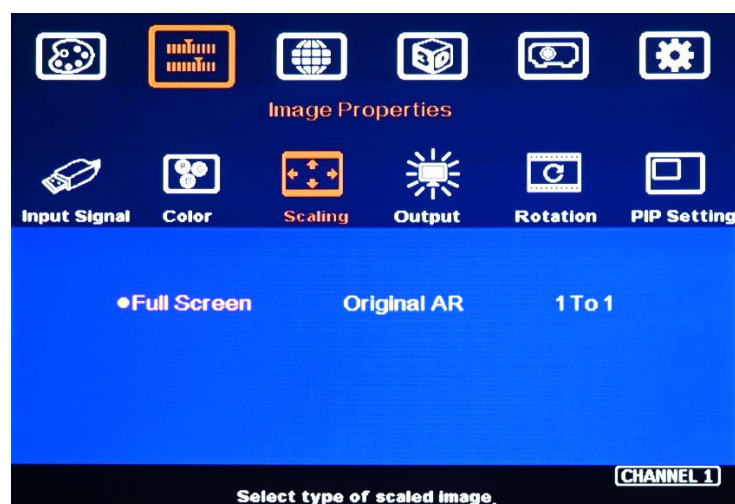
13.7. Turn off splash screen Logo

- 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 some boot up time.

13.8. Audio Output setting

If user executes PIP/POP function, user can select the audio source between main and sub-image. Mute function is available. The output sound is embedded inside HDMI output signal. It is only stereo audio. Please access [Option]→ [Setting]→ [Audio Mute] to do audio setting.

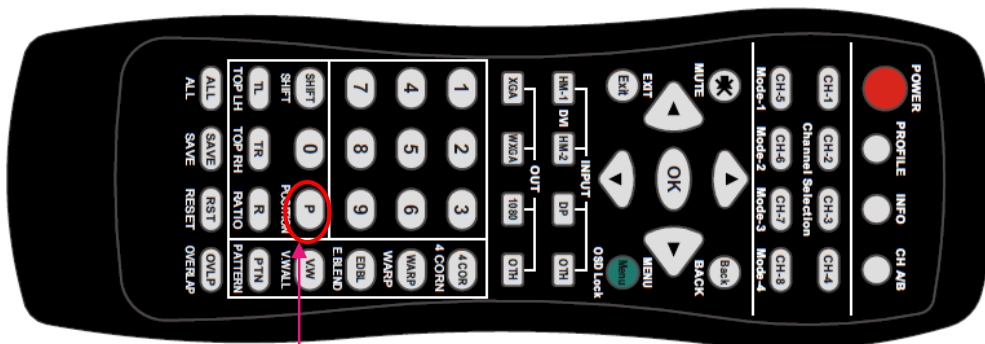
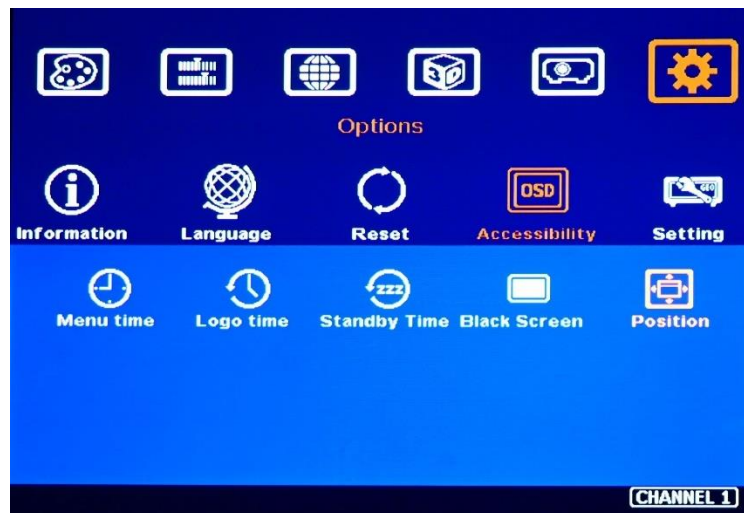
13.9. Native 1:1 pixel to pixel display mode



When single content is displayed on the screen, user has below choices for the display:

- [Full screen]: to display the content with full screen. The image will be scaled to full screen no matter the input is with what kind of aspect ratio.
- [Original AR]: to display content with original aspect ratio. If 4:3 input content is displayed on 16:9 monitor, it will keep 4:3 image aspect ratio with vertical full screen on the monitor.
- [1:1]: to display native pixel to pixel image at the center of the screen. When XGA image is displayed on 16:9 monitor, it will show up pixel to pixel XGA image at the center of the monitor without scaling to keep original image quality.
- Further image cropping and aspect ratio adjustment is still available.

13.10. Change OSD location



Please click [Position] hotkey to activate OSD position shift menu, then use Direction key to shift OSD position to desire location.

13.11. HDCP control



Three sub-menu under [Image Properties]→ [Output]→ [HDCP Output] settings:

- [HDCP Input Only]: Encrypts HDCP only if the input signal has HDCP.
- [HDCP Enable]: Always output HDCP
- [HDCP Disable]: Does not encrypt HDCP. Only non-HDCP compliant input signal can be 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 (0.5 or 1.0 second interval) 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].
- If user sees flashing LED on Input/Output LED indicators at the same time with 1 second interval, it means the system gets wrong FW/MCU code or HW failure. User can turn off/on the system again to see if it can solve the issue or not. User can also update the MCU code and FW PC tool again. If the issue is still existing, then user needs to apply RMA and send back the unit to factory for checking.

14.2. No image in the projector

- If UD100 output resolution is 4k/2k/60Hz and the projector can't support 4k input, user will see no display image in the projector.
- Please use remote controller or front panel output selection keys to select [1080] or lower output resolution to let display device be able to support it.
- Please check input/output LED indicators and make sure all the signals are correctly connected.
- If user still can't see the image, please click [Menu] key to activate OSD. If user can see normal OSD, the system should be normal. Please click [INFO] key to check input and output timings.
- If user still can't see the image, please change signal source, HDMI cable or display device to find the root cause of the failure.
- HDCP may be the reason for no image. Please make sure display device is HDCP compliant.
- Many HDMI extenders can only support up to 4k/2k @30Hz. Please select correct HDMI extender based on your requirements.

14.3. Intermittent or Loss of Input Signal

- Check the HDMI cable quality and make sure all cables are fitted correctly. 4k/60 signal requires 4k/2k certified cables.
- Cable length: Connecting cable length should be as short as possible. Replace a short cable to verify the possible root cause. Usually, the longest standard 4k/2k HDMI cable is only up to 10m.

- HDCP compliant issues: If the input source or the projectors are not HDCP compliant, it is possible to stop UD100 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 UD100.
- DVI/HDMI signal compatibility: some display devices may only support DVI video signal. The default output is HDMI. User can change output with DVI format through [Options]→ [Setting]→ [DVI]→ [On] to test it.
- Usually, to swap with different cable, output channel, signal source and projector can verify the root cause for the failure.
- 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.
- We propose to use signal enhanced cable, HDBaseT or Optical Fiber cable for long distance connection. Conventional 4k/60 HDMI cable can't support more than 10 meters. If using optical fiber cable, user may need to set DVI output to get smooth transmission.
- User can connect a monitor at the end of the Loop out port to check signal source stability.

14.4. Video quality issues

- Try to use the highest signal resolution and number of color bits (RGB 4:4:4) allowed by UD100. 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. These media player may be designed with lower color sampling bits or poor image compression technology, resulting lower image quality or lagged image.
- If 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 may have slight jitter phenomenon. The processing channel quality will be reduced. Use a progressive signal source setting (1080p/2160p) whenever it is possible.
- Please press [INFO] shortcut key to check the input/output signal settings.
- User can select [Image Properties]→ [Output]→ [Deep Color] to set 10-bit signal output. It will smooth the gradient color when the input signal is also 10-bit. Please note that HDMI 2.0 can only support 4k/2k 60Hz 8-bit signal only.
- If possible, please apply 60Hz signal source. User can see smoother image while image is panning or in fast motion. User may see jitter image in 24/30Hz input source.

14.5. Image position shift after installation

The position shift in the projector will be enlarged to more than 10x due to projection distance. 1 mm position shift in the projector may appear 1 cm 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. The image position in projector power on stage and after 20-30 minutes may have big difference. Different projector will have different thermal drift range.
 - Stability of rack mounting system.
 - Projector structure change after installation due to weight and thermal effect.
 - Cable connection may 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 and overlap region borders.
 - Check projector image shift condition after some time with GeoBox in OFF condition.
 - User will clearly identify that the position shift is from projector or not after this procedure.
 - GeoBox is digital processor and will not change image position only for few pixels.
- Please open test patterns in GeoBox before edge blending and put marks on 4 corners of each projector as reference for future image position recovery by [2x2] alignment.

14.6. 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. It will erase Profile settings.
- If only one channel is abnormal, please reset this channel through remote controller. It will not affect other channels.
- When the input source is PC graphics, only [Brightness], [Contrast] and [Sharpness] 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.
- When geometry alignment is over the maximum adjusting range, the image may crash. It can be recovered by system reset or reducing adjusting value. Maximum adjustment range is about

H=40°, V=35°, +_1200 pixels in each corner under 4k/2k output resolution, less adjusting range under multiple point adjusting condition.

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 Locked 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.
- 30Hz input with 60Hz output will be OK.
- Please make sure to set [Frame Sync] at [Normal] in all channels to ensure all outputs will be synchronized.

15. Technical support

- User can send e-mail to sales@vnstw.com together with necessary information.
- 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 take a picture to send to us.
 - The exact nature of the problem. Please be as detailed as possible.
 - If possible, please attach the Pictures of the issue.
- Generally, 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 UD100 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 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.

16.4. Maintenance and Repair

Apart from what is detailed in User Guide, maintenance should be carried out by competent technician assigned by VNS. If UD100 is physically damaged, it should be returned for repair using VNS RMA procedures. If the unit is opened by user, it will lose the right for warranty protection.

Specification

- Each model has 1-4 processing modules.
 - UD101: single processing module
 - UD102: dual processing modules
 - UD103: 3 processing modules
 - UD104: 4 processing modules
- Each processing module includes:
 - Input: 3x HDMI 2.0b, 1x DP1.4
 - Output: 1x HDMI 2.0
 - Loop output: 1x HDMI 2.0b for audio and daisy chain connection.
- HDCP compliance: Input: HDMI: HDCP V2.2/V1.4, DP: HDCP: V1.3, Output: HDCP V2.0/V1.4.
- Max. input resolution: DisplayPort: 7680*4320 @30Hz, HDMI: 7680*2160 @30Hz, 7680*1200 @60Hz, 3840*2400 @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.
- 24 preset Outputs: up to 4096*2160 @60Hz, progressive 4:4:4 RGB. Max. pixel clock: 600MHz.
- 1:1 pixel to pixel native image display with original quality.
- 2 frames system latency: 33ms (@V=60Hz)
- Warp engine for geometry alignment up to 17x9 control points.
- 120x68 grid pixel position fine-tune is embedded. Each control point can be adjusted with 1/4 pixel/step and moved up to 12.5 pixels adjustment range. Maximum adjusting points are 100 points.
- Maximum geometry adjustment up to 1200 pixels in both H&V directions for each corner.
- Support W shape Corner Wall adjustment in H&V at flexible location.
- Support Linearity Grid Line adjustment for quick H&V line position alignment. It is good for the line gap adjustment on curved screen display.
- 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 at each control point in H&V directions.
- Embedded video wall function for image split, cropping, edge blending overlap pixel setting and aspect ratio adjustment.
- Selectable geometry alignment grid size from 8-120 pixels in H&V direction. Default is 32*32 pixels.
- Selectable grid pattern color with optional transparency to allow user to apply external test pattern.
- Flexible aspect ratio adjustment in each edge up to +_ 1800 pixels position shift.
- OSD menu location is adjustable.
- 10-bit processor, 3:2:2:2 cadence, low angle smooth algorithm, high quality scaling engine.
- 3D motion adaptive de-interlace.
- Passive 3D: Decode 3D input signal into RH/LH eye frame output for passive 3D display.
- 3D format conversion: Convert 3D input signal into Side by Side, Top/Bottom and frame sequential output signal for passive 3D and active 3D displays.
- Frame lock function to get perfect synchronized outputs in multi-unit application.
- Frame rate conversion and 50Hz in/out function to eliminate image frame drop or repeat.
- Support xvYCC & 8/10/12-bit deep color processing.
- Automatically support HDR 10 input signal processing with SDR full color RGB 4:4:4 output.
- Individual color and white balance adjustment in each processing channel.

- 90/180/270 rotation, flip, cropping, scaling & color adjustment up to 4k/2k 60Hz input signal. User can do more rotation angle fine-tune through geometry alignment.
- PIP/POP function with PIP image size from 320*180 up to 1920*1200 resolution with flexible position and adjustable aspect ratio. 2/3/4 split view POP is available in each channel.
- Quick seamless swap between two input signals in each channel.
- Selectable and programmable EDID in the range: H=1024-4080, V=720-3840.
- User can save up to 10 settings that can be recalled by front panel keypads, remote controller, RS232, USB or network.
- ESD Protection: ±8kV (Air-gap discharge), ±4kV (Contact discharge)
- Working environment: 40 ° C, 10-90% RH
- Control: keypads, IR, RS232, USB, Ethernet
- System settings can be stored and backup in PC.
- CE/FCC/RoHS Certified
- Power supply: DC 12V 2A-5A
- 2 Year Warranty, paid extension available up to 5 years.
- Max. Power consumption: UD101: DC 12V/1.1A, 13.2W, UD102: 12V/2.1A, 25.2W, UD103: 12V/3.1A: 37.2W UD104: 12V/4.1A, 49.2W
- Dimensions and weight (Body only):
Without protruding parts: UD101: 303mm*190mm*40mm, 1.2kg
UD102-104: 440mm*190mm*58mm, UD102: 2.5kg, UD103: 2.7kg, UD104: 2.9 kg

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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 two years' 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. Manufacturer will pay shipping charges for return shipments to customers.

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

User can pay extension fee to extend the warranty period. Please contact us for more details. In the event that a product needs to be returned for repair, inform 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, pursuant to Part 15 of FCC Rules. These limits are designed to provide reasonable protection 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. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, 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 into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

Notice:

- (1) An Unshielded-type power cord is required in order to meet FCC emission limits and also to prevent interference to the nearby radio and television reception. It is essential that only the supplied power cord be used.
- (2) Use only 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.

Revision History

Revision	Date	Originator	Comments
V1.0	2021-0617	Steve Wang	First version
V1.02	2021-0705	Steve Wang	Add GCT PC tool
V1.03	2021-0705	Steve Wang	Add 3D function
V1.04	2021-0720	Steve Wang	Modify 3D function, seamless input swap
V1.05	2021-0816	Steve Wang	Add W shape Corner Wall adjustment
V1.06	2022-1115	Steve Wang	Add native 1:1 display mode
V1.07	2024-0103	Steve Wang	Add explanation for overlap pixel over 1920 pixels