

# GeoBox

## UD101 Lite UHD Warping Box Datasheet (Warping Box + Multiview)

Input: up to 7680\*2160 @30Hz, 7680\*1200 @60Hz, 4096\*2160 @60Hz

4:4:4 full color sampling

Output: up to 4096\*2160 @60Hz

- Image warp & geometry alignment
  - Edge mask
  - PIP/POP
- MultiViewer function
- Quick, seamless input swap



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## Introduction,

UD101 Lite (UD101L) is a multi-purpose warping box with multiple LED, LCD, and projector functions. Multi-units can be cascaded for large-scale display.

4 input ports (3x HDMI 2.0, 1x DP 1.4) and 1x HDMI outputs are designed in UD101L. The digital input supports up to 7680\*2160 @30hz and 7680\*1200 / 4096\*2160 @60Hz with 4:4:4 full-color sampling. Output supports up to 4096\*2160 @60Hz. It is integrated with a 10-bit high-end processor, motion adaptive de-interlace, low angle smooth algorithm, 3:2/2:2 pull-down, and supports non-VESA standard input timing. Programmable EDID can optimize input timing to get the best video result.

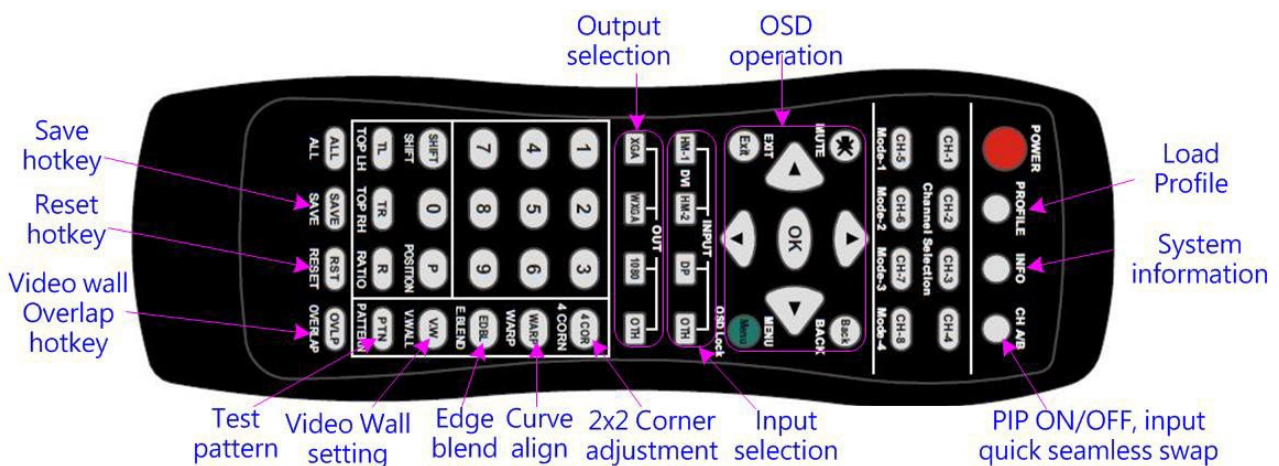
Advanced warp technology is embedded in UD101L. Users can use an IR controller, USB, WebGui, and Ethernet. Geometry alignment is up to 17x9 control points, and 128x68 grid pixel position fine-tuning is embedded. Linearity Grid Line Adjustment and Corner Wall image adjustment for mapping images at 90 degrees corners are integrated into UD101L. Users can see real-time geometry and color adjustment to get optimized results.

The video wall function is to split and allocate source images. The overlap function crops the image at the desired location, shifts the image position, and changes the aspect ratio.

HDMI loop out is designed for signal source monitoring and multi-unit daisy chain connection.

PIP (picture in picture) and POP (Picture outside Picture) are standard functions in UD101L. PIP image size is from 320\*180 to 1920\*1200 with flexible position and aspect ratio adjustment. Quick, seamless main/sub images swap. The overlap function allows different image sizes, aspect ratios, and cropping area adjustments in the PIP window.

UD101L is an ideal front-end processor for image stacking, geometry alignment, PIP, POP, image format conversion, de-interlacing, image rotation, and mobile mirror images displayed on portrait TV. It provides easy configuration, a low entry barrier, cost-effective, reliable, and flexible solution.



## **Specification**

- Input: 3x HDMI 2.0b, 1x DP1.4, Output: 1x HDMI 2.0, input seamless switcher function can be selected.
- 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, 4096\*2400 @50Hz, 4096\*2160 @60Hz. Max. Pixel clock: 600 MHz
- 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.
- 16 preset Outputs: up to 4096\*2160 @60Hz, progressive 4:4:4 RGB. Max. Pixel clock: 600 MHz
- 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-tuning is embedded. Each control point can be adjusted with 1/4 pixel/step and moved up to 12.5 pixels adjustment range. The 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 a 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 displays.
- 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, and aspect ratio adjustment.
- Selectable geometry alignment grid size from 8-120 pixels in H&V direction. The default is 32\*32 pixels.
- Selectable grid pattern color with optional transparency allows users to apply an external test pattern.
- Flexible aspect ratio adjustment in each edge up to +\_ 1800 pixels position shift.
- 3D format conversion: Convert 3D input signal into Side by Side, Top/Bottom, and frame sequential output format for passive 3D and active 3D displays.
- 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.
- Frame lock function to get perfect synchronized outputs in multi-unit applications.
- 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.
- 90/180/270 rotation, flip, cropping, scaling & color adjustment up to 4k/2k 60Hz input signal. Users can do more rotation angle fine-tuning 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 integrated.
- Quick, seamless swap between two input signals.
- Selectable and programmable EDID in the range: H=1024-4080, V=720-3840.
- Users can save up to 10 settings that can be stored and backup on a PC and recall at any time.
- ESD Protection: ±8kV (Air-gap discharge), ±4kV (Contact discharge)
- Working environment: 40°C, 10-90% RH
- Control: IR, RS232, USB, Ethernet
- CE/FCC/RoHS Certified
- Power supply: DC 12V 2A, Power consumption: DC 12V/1.1A (13.2W)
- Dimension and weight (Body Only): 303mm\*190mm\*40mm, 1.2Kg
- 30-Month Warranty

## **Functions and features**

### **A. Input / Output (the spec may be changed)**

- Input: 3x HDMI 2.0b (600 MHz), 1x DisplayPort 1.4 (1080 MHz).
  - Support 7680\*2160 @30Hz, 7680\*1200 @60Hz/4096\*2160 @60Hz with 4:4:4 chroma sampling without compression.
  - DisplayPort input supports up to 7680x4320 @30Hz input resolution.
  - Connect with various video sources and support non-VESA standard input resolution.
  - Support progressive and interleaved input signals.
  - Seamless switching function can be selected.
- Output ports: 1x HDMI2.0b. Preset output resolutions: 1024x768, 1280x720, 1280x800, 1280x1024, 1360x768, 1400x1050, 1600x1200, 1920x1080 (50/60Hz), 1920x1200 (30/60Hz), 3840x2160 (30/50/60Hz), 4096x2160 (50/60Hz).
  - 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 HDR-BT. 2020 input signal and processing with SDR full color 4:4:4 RGB output.

### **B. Image warp and geometry alignment**

- Test pattern grid size for geometry alignment is from 8-120 pixels in H&V. Default is 32\*32 pixels.
- With complete functions for quick 4 corner alignment, vertical and horizontal keystone correction, Pincushion & Barrel adjustment, image warp, and image 90/180/270 degrees rotation and flip.
- Each box controls one projector and can be cascaded to support unlimited projectors.
- Integrated with full-function IR remote controller. Manual geometry alignment via Remote controller up to 17x9 control points.
- 120x68 grid pixel position fine-tuning is embedded. Each control point can be adjusted with 1/4 pixel/step and moved up to 12.5 pixels adjustment range. The maximum adjusting points are 100 points.
- GCT PC tool is available for geometry alignment up to 17x9 control points through USB or Ethernet. After finishing the geometry alignment, store the parameters inside a PC or a GeoBox without needing the PC tool.
- Geometry alignment range:
  - Geometry alignment range is based on keystone angles in a 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 a more significant keystone angle. The adjustment range will still be

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 the user applies both H&V adjustments, 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 a user applies both H&V direction geometry alignments, the adjustment range may be reduced. Users will see abnormal displays (some noise or image crush). While the image is crushed, the user can return the adjustment value or adjust adjacent control points to return the image to normal.
  - The central geometry alignment should be done through 2x2 and 3x3. Other warp functions, such as 5x3, 9x5, 17x9, and 120x68 alignments, are for position fine-tuning purposes only. Geometry alignment shall follow 2x2→3x3→5x3→9x5→17x9→120x68 sequence. If the user executes 120x68 and returns to 9x5, only 9x5 warping data will be kept.
  - 2x2 is independent and it can combine warp results in 3x3, 5x3, 9x5, 17x9. However, it will reset 120x68 grid point warp result and only keep up to 17x9 warp result.
  - If the user executes geometry alignment to some extent with 2160P output resolution and switches back to 1080p output resolution, the image may crash due to a more significant geometry alignment angle. If you switch from low output to high input resolution, the image will not crash.
- W shape Corner Wall geometry alignment: up to 1200 pixels adjustment range in 12 control positions at H/V directions. The image distortion range at the wall corner depends on the projector's throw ratio. A longer throw ratio will have less image distortion and be easier for Corner Wall alignment. W shape corner adjustment can correct the image on both sides of the pillar at the wall corner.
  - Linearity grid line adjustment: The user can use this function to simultaneously move the position of a group of vertical lines or horizontal lines. The primary purpose is to move the full line position or smooth the gaps in the image horizontal or vertical lines in the curved screen display. Usually, users will see smaller grid line sizes on both sides of the curved screen. Users can use this function to leave all grid lines with the same gap quickly.
  - Embedded test pattern grid size is editable from 8-120 pixels in both H&V directions.
  - Different colors can be selected in the test pattern and applied to external test patterns from signal sources.

### C. 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 detect and recovery function.
- Complete color adjustment function, including brightness, contrast, hue, saturation, preset color temperature, and independent RGB gain adjustment.

### D. PIP/POP, MultiViewer

- [PIP]: Picture in Picture display with any two inputs.

- [SBS]: Side by Side display.
- [Top/Bottom]: Top/Bottom display.
- [SBS 2/1]: 2/3:1/3 side-by-side display with a monitor at landscape position
- [POP3]: One image on the LH side and two top/bottom images on the RH side in landscape monitor.
- [POP4]: One image at the Top and two at the bottom in the landscape monitor.
- [3X SBS]: Three split views of the landscape with the flexibility to adjust the center image size from 1/6 to 5/6 of horizontal size.
- [3X T/B]: Three split views at the 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 views with one image at the top and three small images at the bottom.
- PIP (picture in picture): with flexible PIP size (320\*180 to 1920\*1200), location, and aspect ratio.
- Except for [4x split] & [4x T/B] functions, all the other PIP/POP functions can support monitor at portrait and landscape positions. Sub-images also support rotation and flip up to 4k/2k 60Hz.
- The cropping function is available in PIP and POP images for different locations, sizes, and aspect ratio adjustments and for creating image borders with black or blue color.
- Primary and sub-image colors 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.

## **E. Quick PIP ON/OFF and two input seamless swap**

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

## **F. Video wall function**

- Image split, cropping, and location assignment for each projector.
- Video Wall overlap functions up to +\_1800 pixels in H&V direction in each edge:
  - Image position adjustment
  - Image cropping area adjustment.
  - Irregular video wall application
  - Aspect ratio adjustment.

## **G. Native 1:1 image display mode**

When single content is displayed on the screen, the 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 with what kind of aspect ratio.
- [Original AR]: to display content with original aspect ratio. If 4:3 input content is displayed on a 16:9 monitor, it will keep a 4:3 image aspect ratio with a full vertical screen.
- [1:1]: to display native pixel-to-pixel image at the center of the screen. When an XGA image is displayed on a 16:9 monitor, it will show up pixel to pixel XGA image at the center of the monitor without scaling to

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Keep original image quality.

- Further image cropping and aspect ratio adjustment are still available.

## H. 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 a progressive signal source to get the best video quality.

## I. Edge Mask

8 control points to define the area for edge mask up to 900 pixels in each point. It can work together with geometry alignment to get various edge mask effects. The edge mask will not change the image aspect ratio.

## J. 3D function

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

## K. Various color adjustment

- Independent R.G.B color gain adjustment.
- Preset color temperature: Standard, Reddish, Bluish
- Brightness, contrast, Hue, saturation, and sharpness adjustment.

## L. System control and other features

- Full-function OSD through 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.
- Standard RS232 & Ethernet control protocol compatible with most control systems.
- Users can select blue or black background color when no input signal is detected.
- Programmable EDID in the range of H=1024-4080, V=720-3840.
- BOX ID and programmable IP address for convenient multiple-unit control simultaneously.
- Users can save up to 10 settings and be recalled by remote controller, RS232, USB, or network.
- System settings can be backup to PC 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 the input signal again, it automatically outputs it to display devices. Users can power ON/OFF the system through the control in the signal source.



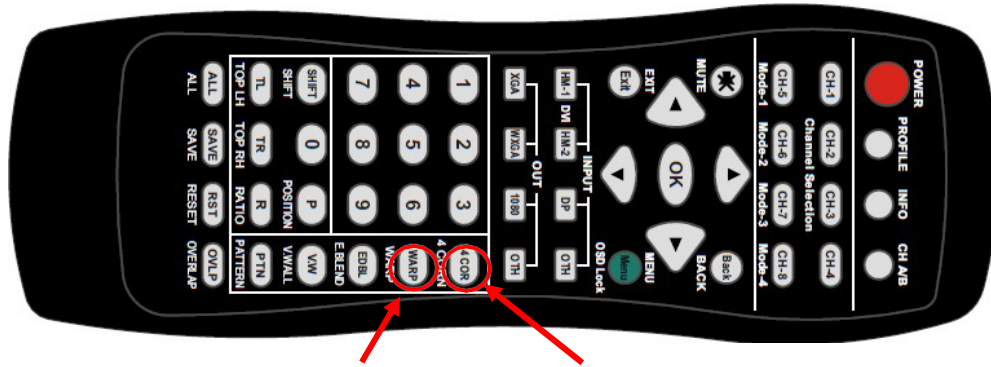
## Application

- 4K Projector display on a curved screen. It is suitable for golf simulation and big-screen game applications.
- Change the aspect ratio of the screen to meet the required screen size.
- The display mirror image of a mobile phone or iPad on a 4k portrait monitor for game or commercial applications.
- PIP/POP to add second video content on the screen with flexible image size, aspect ratio, and position adjustment.
- Quad split view multi-viewer to display 3/4 split view content in one 4k display.
- Crop any size and location of the image for the display.
- Image rotation for portrait display without rotating image source.
- Correct image distortion in ultra-short throw ratio projector application.
- Edge mask to remove the unnecessary image at the edge.
- Smooth display projection image on 90 degrees wall corner. ("V" type corner wall adjustment)
- Display the image on 90 degrees wall corner with a square pillar. ("W" type corner wall adjustment)
- Stacking multiple projectors to increase the brightness of the image.

## Feature illustration

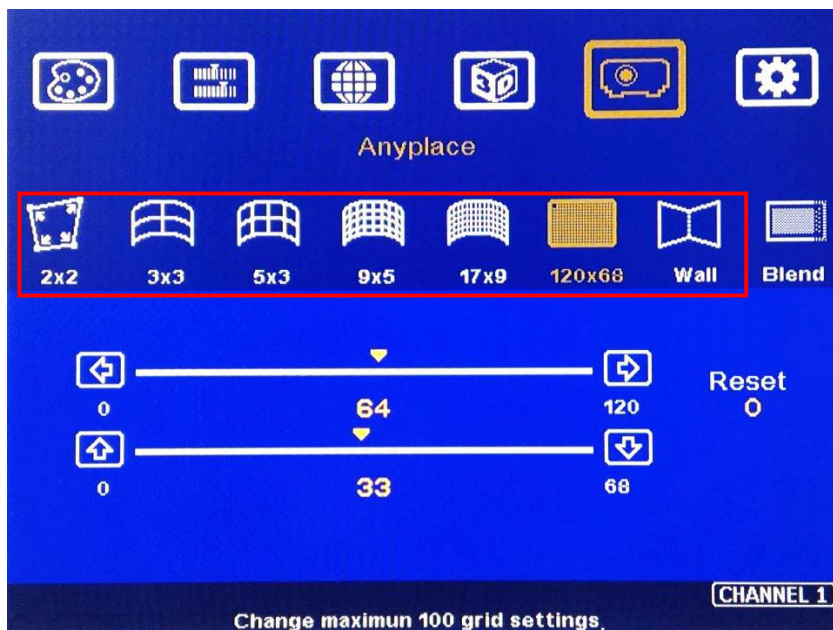
### A. Geometry alignment menu

- Users can execute geometry alignment through a remote controller, OSD, WebGui, or PC tool.
- The control point is 17x9 with a remote control & PC Tool.



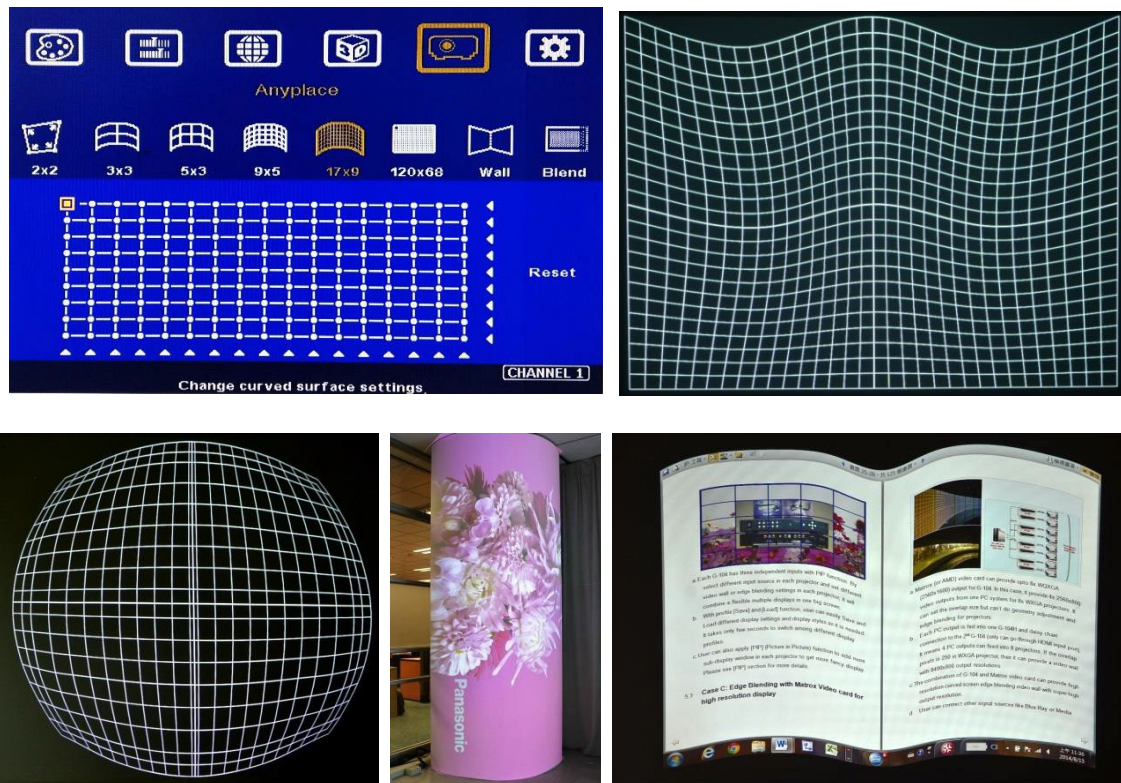
[3x3], [5x3], [9x5], [17x9] Warp

[2x2] 4 Corner alignment hotkey



## B. Image geometry alignment and warp

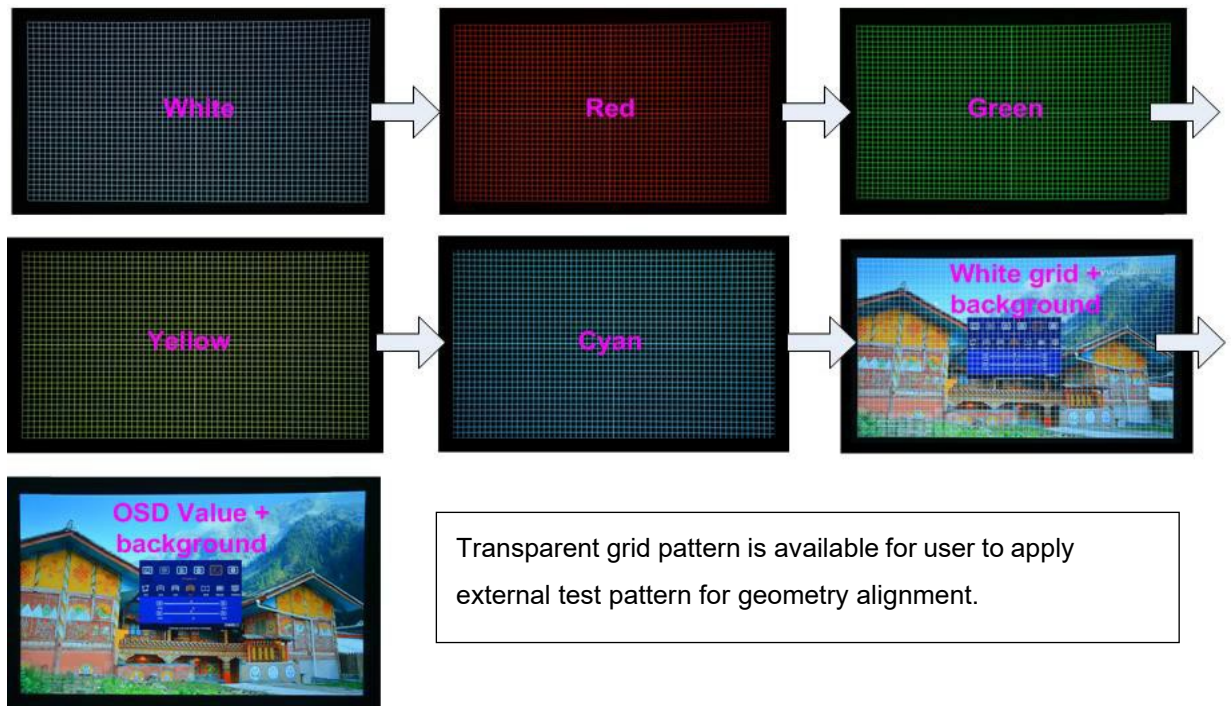
The user should follow the [2x2]→ [3x3]→ [5x3]→ [9x5]→ [17x9]→ [120x68] sequence to do geometry alignment to get smooth scaling factor in the image in all regions.



## C. Variable Grid Patterns for geometry alignment

A grid pattern is required for geometry alignment. Users can activate the test pattern through the [Pattern] hotkey in the remote control or through WebGui and GCT PC tools.

- The default grid size is 32\*32 pixels. Users can select different grid sizes from 8-120 pixels. Each channel can be set separately.
- There are 6 pattern styles for a user to select. When the user presses the [Pattern] key, it will circulate from [White]→ [Red]→ [Green]→ [Yellow]→ [Cyan]→ [White grid + background]→ [OSD menu + Background]
- If the user wants to apply his test pattern, please select the last transparent pattern mode to show the user pattern.
- Users can select different pattern colors for each projector while doing image geometry alignment.
- Users can see the geometry adjusting value when selecting [Background + OSD] display style.



#### D. Selectable grid pattern size for geometry alignment

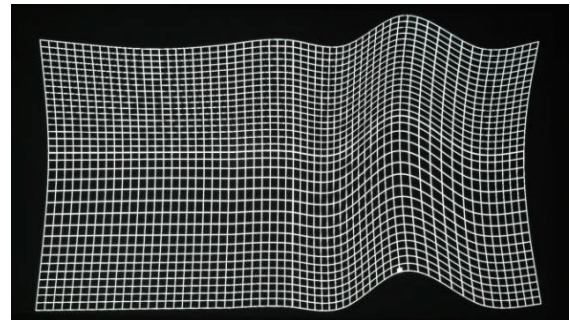
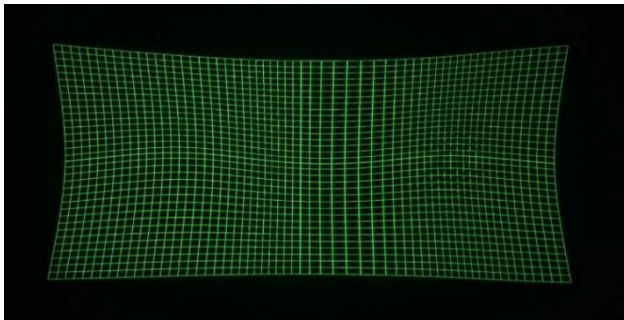
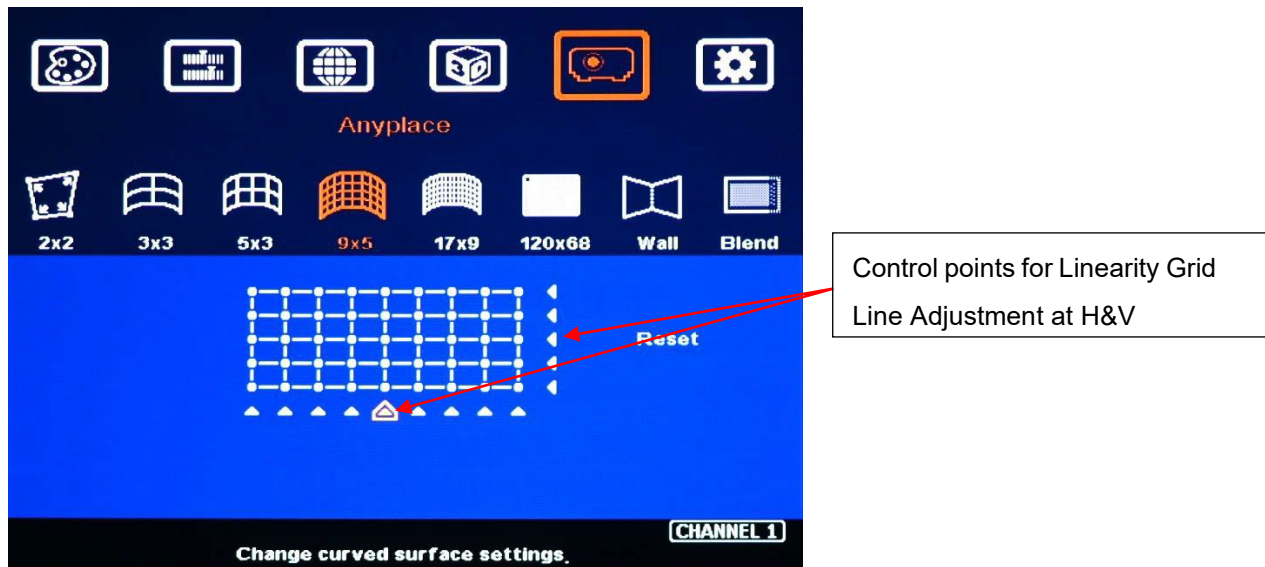
- The grid size in horizontal and vertical directions is from 8 to 120 pixels with a 1-pixel increment. H&V grid size will be the same.
- The default grid size for both H&V directions is 32x32.



#### E. Linearity grid line adjustment

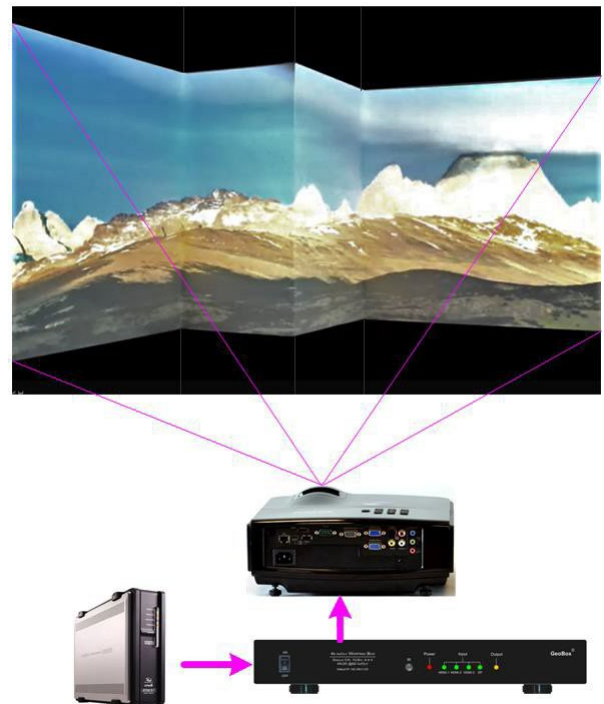
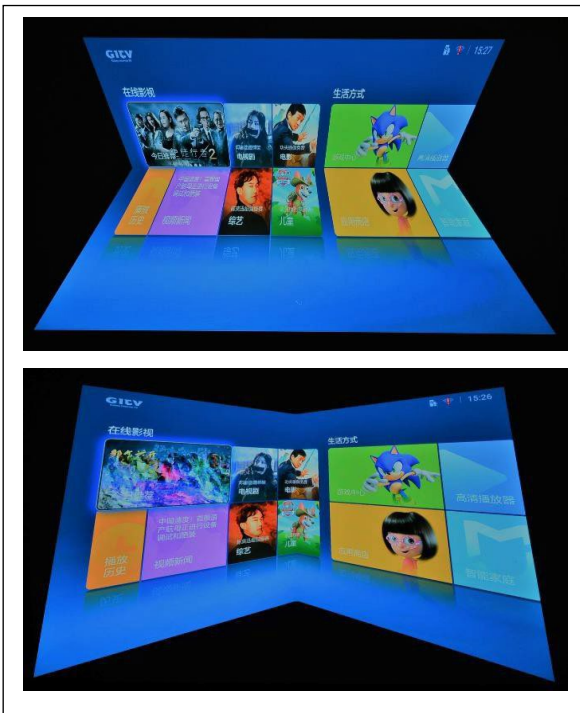
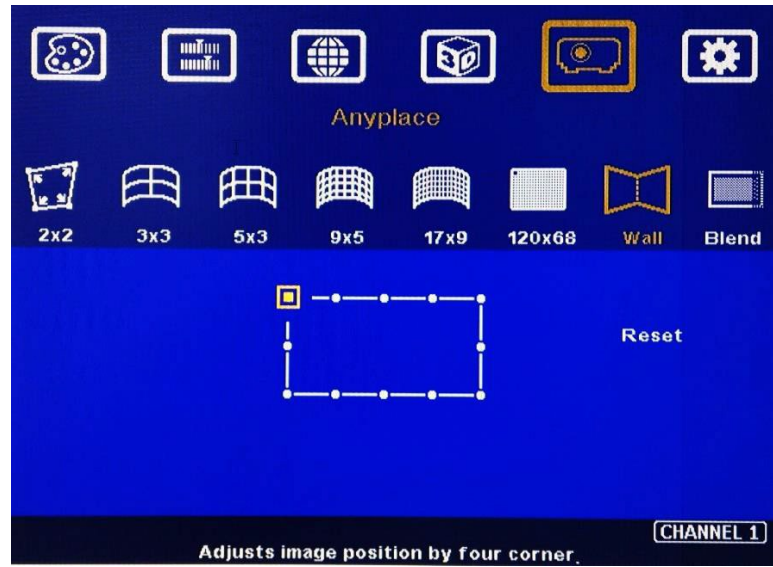
When the projector projects an image on a curved screen, the image will change the grid size gradually and cause different scaling factors on the center and both sides. Linearity grid line adjustment is to compensate for this kind of effect and make a complete image with the same scaling factor. This function can be executed only through OSD menu operation.

1. It can be applied to both horizontal and vertical directions.
2. The operation OSD menu is under 3x3, 5x3, 9x5 & 17x9 warp alignment menu. The result can be further adjusted by the PC tool for image position fine-tuning.
3. Linearity grid line adjustment can be executed with warp alignment simultaneously.



## F. “W” shape Corner wall Alignment

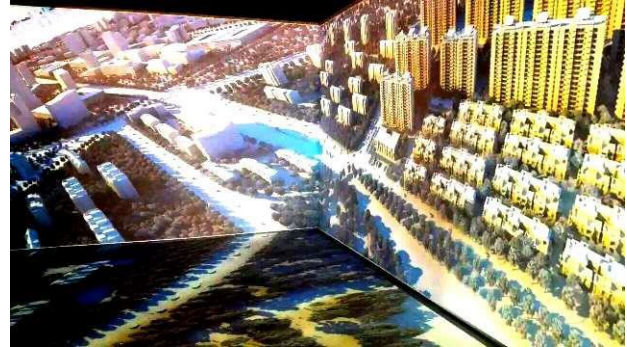
- The Corner Wall alignment function is functional either in the horizontal or vertical direction. 12 control points across entire edges are integrated. Corner Wall geometry alignment ranges up to +\_1200 pixels in each control point in H&V directions. 4 Corner position alignment is integrated into these 12 control points. The function is like 4 corner geometry alignment, letting the complete image shift position with the same scaling factor. The other 8 control points are for geometry alignment for the corner wall image. Edge Blend functions are still available when the user implements Corner Wall adjustment. Other geometry alignment and Warp functions will be disabled when Corner Wall alignment is enabled.
- W shape Corner Wall alignment can correct the image on both sides of the pillar at the wall corner.



Three projector Corner Wall application



### Other Corner Wall application examples



## **G. Edge Mask**

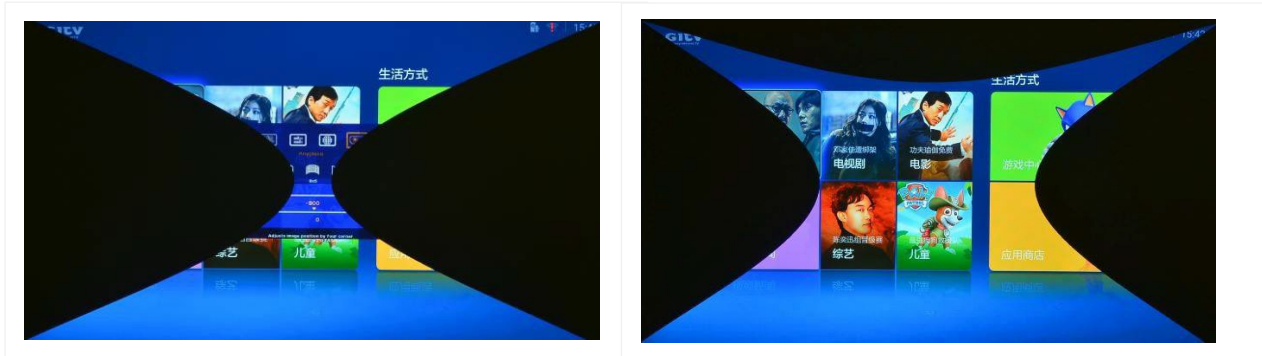
The edge mask function is integrated into UD101 Lite.

- [Edge Mask]: There are 8 control points for the edge mask. When the user moves the position for each control point, it will result in many edge mask patterns. The maximum position adjustment for each control point is +\_ 900 pixels.
- The adjusting range in [Mask] is calculated from the original edge position before geometry. Users can execute geometry alignment and Edge Mask to get various mask effects.





Example: Another Image [Mask]





## H. PIP/POP function

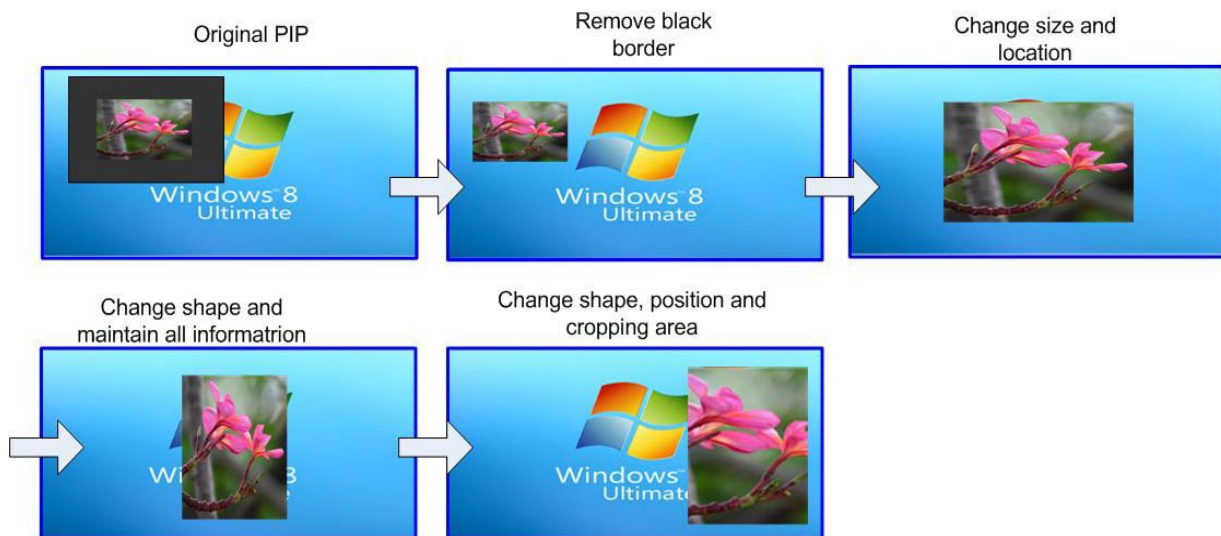
- [PIP]: Picture in Picture display with two inputs in each channel.
- [SBS]: Side-by-Side display.
- [Top/Bottom]: Top/Bottom display.
- [SBS 2/1]: 2/3:1/3 side-by-side display with a monitor at landscape position
- [POP3]: One image on the LH side and two top/bottom images on the RH side in landscape monitor.
- [POP4]: One image at the Top and two at the bottom in landscape monitor.
- [3X SBS]: Three split landscape views with the flexibility to adjust the center image size. The center image size can be up to 5/6 of the screen.
- [3X T/B]: Three split views at the 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 views with one image at the top and three small images at the bottom.
- PIP (picture in picture): with flexible PIP size (320\*180 to 1920\*1200), location, and aspect ratio.
- Except for [4x split] & [4x T/B] functions, all the other PIP/POP functions can support monitor at portrait and landscape positions. Sub-images also support rotation and flip up to 4k/2k 60Hz.
- The cropping function is available in PIP and POP images for different locations, sizes, and aspect ratio adjustments and for 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.



**All PIP/POP functions**

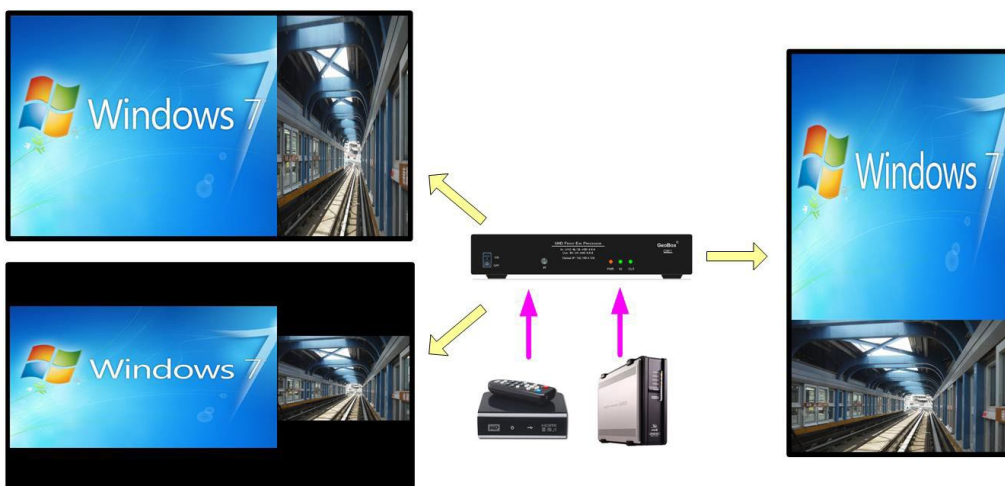


**Cropping function through Overlap adjustment**

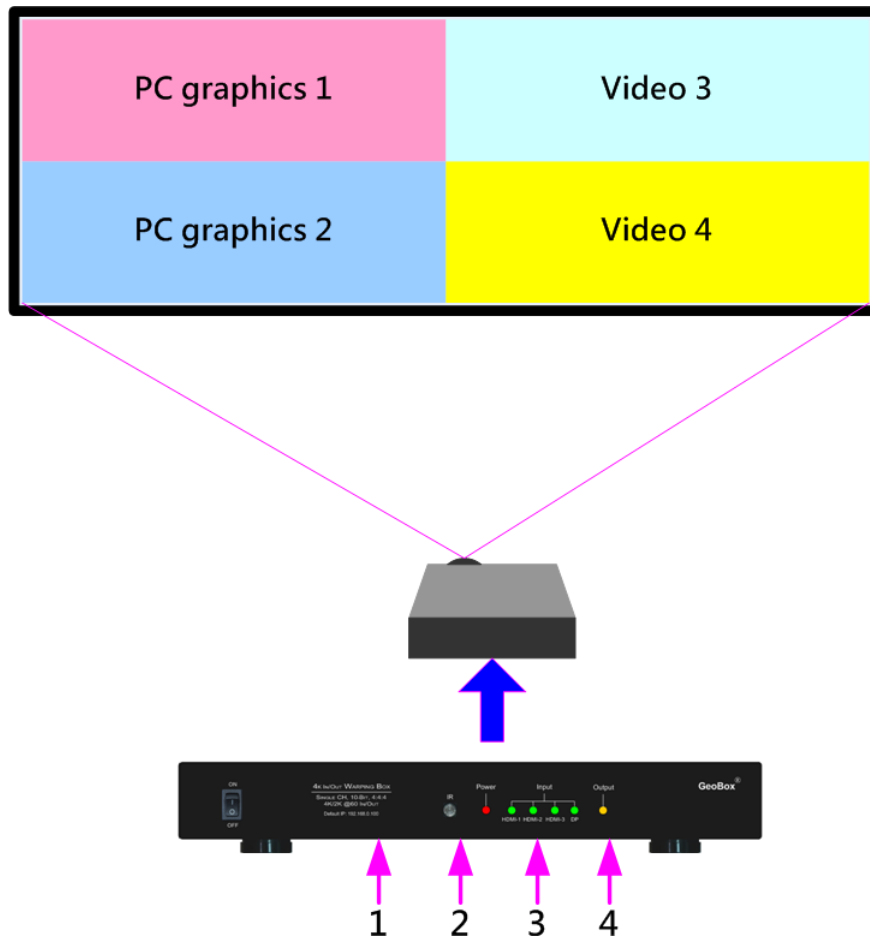


# I. MultiViewer function

## 3 split views

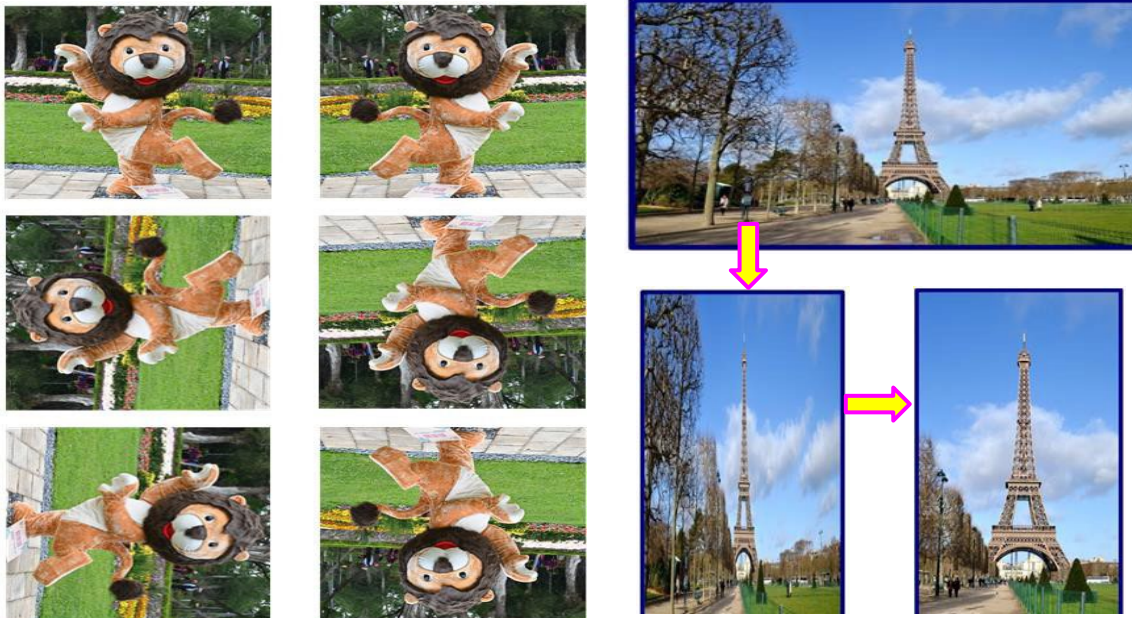


**4 split views** (One signal shall come from DisplayPort)



## J. Image Flip & Rotation in main and PIP/POP (Sub-images)

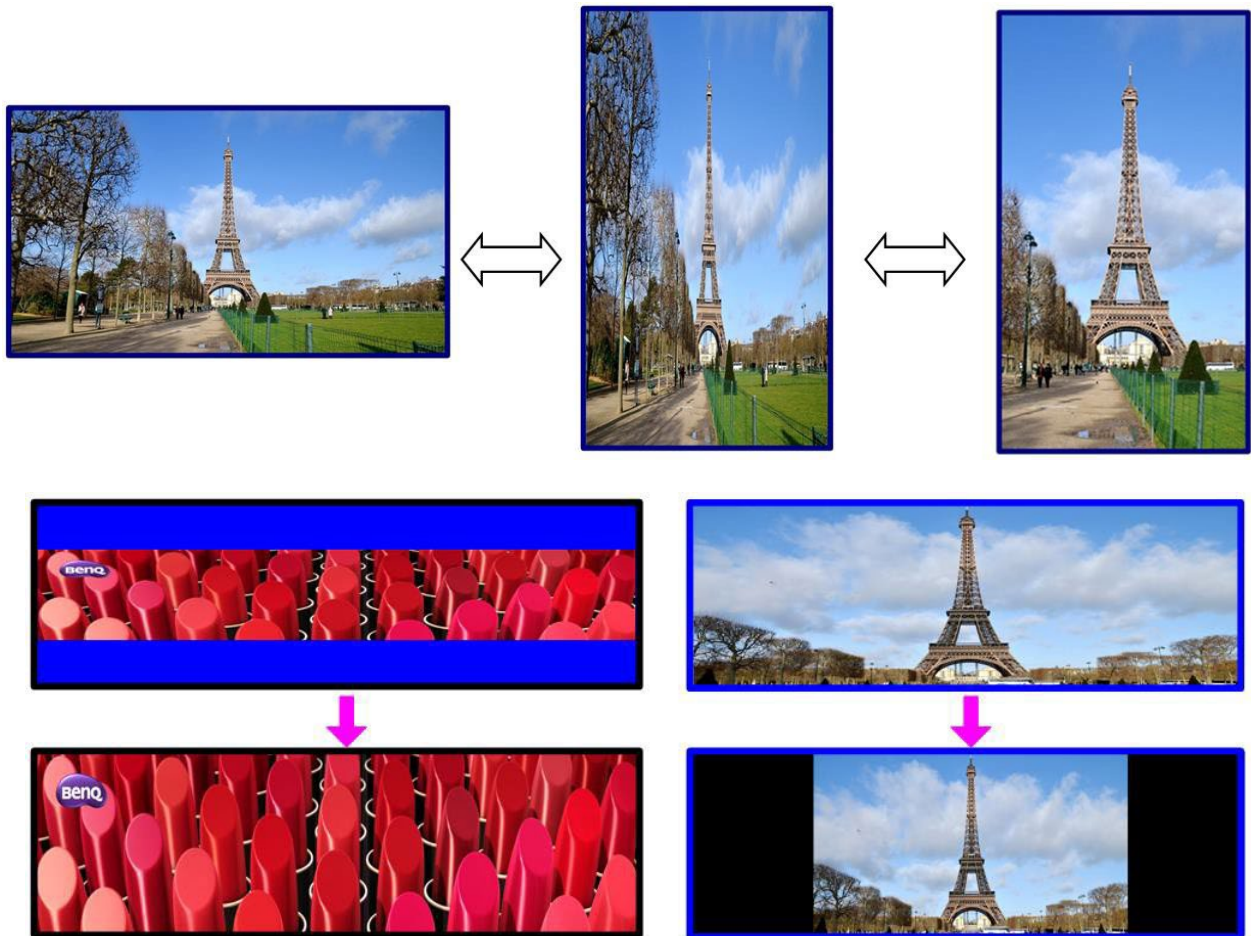
Image 90/180/270 degrees rotation and flip up to 4k/60Hz resolution independently in both primary and sub-image. After image rotation or flip, the user can adjust the aspect ratio and cropping area.



## K. Stretch the image, shift position, and change the aspect ratio.

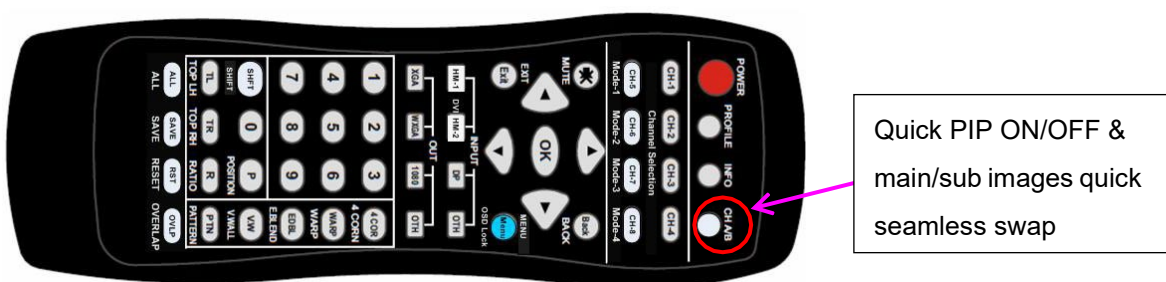
Geometry adjustment and Video wall cropping function can compensate for image size, position shift, or change in aspect ratio. The adjusting range is up to 1800 pixels on each edge based on the signal source.





## L. Quick PIP ON/OFF and two inputs quick, seamless swap

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



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



## M. 3D format conversion and Active 3D application

UD100 can convert Line interleaved and frame-packed 3D from Blue Ray DVD player into Side by Side, Top/Bottom, or Frame Sequential 3D format output signal for 3D display devices, including FHD 120Hz for 4K UHD projector active 3D display. When connected with two UD101L, the user can decode 3D signals into RH/LH discrete outputs for passive 3D display.

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