Curved screen edge blending using G-104

1 Outlook and Function

- Power Switch
- Warp Hot key
- Input selection
- IR Receiver
- OSD Menu
- OSD keys
- Pattern Hot key
- Output selection
- Hot Keys
- SPDIF OUT
- HDMI Loop Out
- IR Extender
- DC 12V/2A
- Ethernet
- HDMI OUT VGA OUT DP IN HDMI IN DVI-I IN RS-232

2 Features

1. Input: 1x DVI-I (support VGA, DVI, HDMI), 1x DisplayPort, 1x HDMI
2. Video Output: 1x HDMI, 1x VGA
3. HDMI raw signal loop back output
4. Audio out: 1x SPDIF RCA output
5. Full HD input and output, DisplayPort supports up to 2560x1600 input resolution
6. Patented warp technology for precise geometry alignment & edge blending
7. Designed with dual warp engines for independent warp/geometry adjustment and edge blending
8. Input image can be edge-blended before geometry adjustment to make sure the blending area always compliant with warping area to get the best edge blending result.
9. The most convenient curved screen edge blender without the need for PC or software tool.
10. Reliable and durable design for long term industrial and commercial applications
11. Designed with internal grid pattern for easy geometry adjustment
12. Support 360° cylindrical screen edge blending
13. 10-bit processor high end scaler with 3D motion adaptive de-interface, low angle algorithm and 3:2/2:3 movie mode processing
14. With Picture-in-Picture function (PIP) at any location of the image up to XGA resolution
15. Video wall function to split, crop and magnify the image with pixel based overlap region adjustment.

16. De-multiplexing 3D formats from Blue Ray, Set Top Box, PC… for dual projector passive 3D
17. Frame lock 1080P@24Hz output for passive 3D RH/LH eye projector synchronization
18. Edge mask for easy system installation
19. Full function front panel OSD keypads and IR remote control. No PC is required.
20. IR extender, RS-232 and optional Ethernet control
21. Dimension: 303x45x160mm, 1.6KG
3 Helpful Tips

3.1 In order to avoid interference among multiple GeoBox during the installation, user can set ID number for each GeoBox through Options in OSD Menu. Press number keys in Remote Controller for the control of multiple GeoBox:

- 850: simultaneous control for all GeoBox
- 851: control GeoBox ID No. 1
- 852: control GeoBox ID No. 2

3.2 OSD Lock / Unlock: When continuously press [MENU] key in Front Panel or IR Remote Controller for 12 seconds, the OSD function will be locked to prevent from the changes of the settings by other people. To press MENU key for 12 seconds again, it will unlock OSD and user can manipulate the OSD again.

3.3 Picture menu in the OSD can only be activated while the input signal is not in color [Preset Mode]. To select [Image Properties] → [Custom] → [Save], then user can activate [Picture] menu again.

3.4 [Image Setup] menu will not be activated if the input source is not from VGA.

3.5 Procedures to do system Reset: OSD Menu [Options] → [Reset] → [Reset All]

3.6 To set [Menu Time Out] to “0”, the OSD will appear till the OSD Menu has been turned off manually.

3.7 To set [Logo Time Out] to “0”, the splash screen will not show the splash screen Logo while GeoBox is powered on.

3.8 Please select digital signals output to projector (HDMI or DVI) to avoid image position shift. If VGA output should be selected, please set projector without implementing Auto-Adjustment in VGA input.

3.9 Each Internal Test Pattern Grid represents 50x50 pixels no matter which input resolution is selected.

3.10 Continuously press PATTERN button, internal test pattern will show different colors for easy installation:

White—Red—Green—Blue—Blank

4 Applications Example

4.1 Case A: Simple curved screen edge blending

- No PC or special tool required
- One HDMI loop out connector for HDMI daisy chain connection. No video splitter required.
4.2 Case B:

Edge Blending with 50% Matrox Video card for high resolution display

a. The overlap settings will come from both G-104 and Matrox display card (3 from Matrox card and 4 from G-104) and G-104 executes both geometry adjustment and edge blending.

b. This system requires only 50% of Matrox video card and PC processing power. It will provide more smooth system operation with less limitation.

c. The output signal from PC can be at the highest output resolution from Matrox video card, i.e. 2560*1600 through DisplayPort output. G-104 DisplayPort can capture this output signal and crop necessary output resolution for the projector. The maximum output resolution can be up to 1920x1200 (or full HD).

5 General rules for Edge Blending setup

5.1 Excel Spread Sheet is available to calculate the number of projectors and overlap pixels between projectors. Make sure enough brightness on the screen with aspect ratio matching the content.

5.2 Placement of Projectors:

a. Select projectors with higher contrast ratio (above 3000:1 is recommended) and set projectors at reasonable distance from the screen with 200-500 overlap pixels between two projectors.

b. Use removable tape as temporary marks to indicate the display ranges for each projector. Each
projector should have the same display size. Otherwise the grid size in each projector will be different and the blending image will become blurred.

c. To project each projector a little over the display range for further geometry adjustment.
d. Using keystone function in the projectors to set parallel vertical or horizontal overlap edges between 2 adjacent projectors will get better video quality in Edge Blending image.

5.3 Projector setting:

a. Reset projector to default setting
b. Disable Auto Keystone function and set new keystone value to let vertical edges in adjunction images in parallel vertically.
c. Select sRGB Display Mode will reduce the color difference in overlap area.
d. Use projector internal color adjusting function to adjustment the color variation among projectors.

5.4 G-104 Setting

a. Reset GeoBox to default setting.
b. Select the input source and best output resolution to match projector native display resolution.
c. Set [OSD Time Out] to [OFF] to maintain the display of OSD and Grid Test Pattern during the installation period.
d. To set Color in [sRGB] or [Neutral], Preset Mode will create better Edge Blending result. (OSD menu [Image Properties]→[Color]→[Preset Mode]→[sRGB/Neutral])

5.5 Four Corner geometry and curve adjustment

To adjust the corner positions in each projector to match preset marks in the screen. After all projectors are projecting at the right preset positions, then accurate position fine-tune and curve adjustment is required to let all the grids in overlap area able to align perfectly. To use projector keystone to get vertical edges in center projector will be easier to get better blending result.

5.6 Video Wall setting (Image split and allocation)

After [4 Corner] adjustment, video wall setting is required. The functions of video wall are as follows:

a. Split the image for different projectors
b. Determine the location of the image for each projector
c. To set proper overlap region in the edge between projectors
d. Video Wall [Overlap] setting is to decide the cropping area for each projector so that two projector overlap regions can match together with the right position and scaling ratio. It is not real overlap pixel # between adjacent projectors.

5.7 User will see double brightness in overlap region before further [Edge Blending] setting. Edge Blending setting is to let two images in overlap region merged gradually in different directions to become one seamless image. The setting value is based on the actual overlap pixel number. For instance, if the overlap is 6 grids, then the setting value is 6x50=300 pixels because each grid is 50x50 pixels in internal test pattern.

5.8 Image quality fine tuning

a. The final performance will be a combination of many factors—projector characteristics, projector
setting, screen, ambient light, GeoBox setting.

b. Banding in overlap area under dark environment is caused by low contrast ratio projectors due to light leakage in the projector optic system. Some DLP projector may retain light leakage near the border of the image and affect the performance of the result. It can be compensated by applying [Offset] function under [Edge Blend] menu (Black Level setting in non-transition area) but is difficult to be fixed completely.

c. The factors affect final image quality

   i. GeoBox settings:
      - Edge Blending: Gamma, Shift, Offset, Gain
      - Image Properties: To select Preset Mode to sRGB, Neutral or Bluish

   ii. Projector:
      - To adjust installation position of the projector and deduce keystone angle.
      - Increase Overlap region & Reduce off axis angle
      - To change Display Mode, usually sRGB/Neutral will get the best result.
      - Try different color settings. If necessary to use 3D color adjustment in the projector.
      - To implement internal color adjustment.

   iii. Screen: To use lower gain value screen.

6. Procedures for dual projector Curved Screen Edge Blending

6.1 Locations of the projectors

   The best location for the projectors will be at the center of the circle of the curved screen so that all grids pattern will have the same grid size. If it is not possible, it should be near the vertical line perpendicular to the chord of the circle. The projectors should have the same zoom ratio and settings.

6.2 Reasonable overlap region is required

   In XGA projector, we recommend to overlap at least 250 pixels for easy quality fine-tune. It means the overlap region is about 13.9% in the complete image \( \frac{250}{1024^2-250} = 13.9\% \). In the case of full HD projector, the overlap region is about 300~600 pixel (8.5%~18.5%).

6.3 The images from two projectors must have the same grid size

   Helpful tips to let all grids with the same size:

   6.3.1 To calculate the necessary size of the images from two projectors. The image size from two projectors must be the same. To put temporary marks on the screen to indicate the final location of the images and align the images to meet the required size. (An Excel Spread Sheet can be provided for the calculation of the system configuration)

   6.3.2 The second way is to mark the center line of the screen and let CH-RH & CH-LH has the same grids over the center line, then start geometry adjustment.

6.4 Geometry alignment procedures for dual projector curved screen edge blending

   6.4.1 Mark the center points of the screen. Install projector to project image a little over the screen with recommended overlap area.

   6.4.2 Reset GeoBox, set [Menu Time Out] to “0”.

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6.4.3 Activate [Pattern] menu to show internal grid pattern with different colors.

6.4.4 Use [Shift] menu under [Warp] to do 4 corners adjustment in the first channel and draw the images into screen borders with rectangular

6.4.5 Activate [Edge] menu under [Warp] to draw the edge of the image into screen border.

6.4.6 Activate [Center] menu under [Warp] to align the center line of the image into horizontal straight line.

6.4.7 Fine-tune the positions of the corners, edges and the center of the image.

6.4.8 Swap to another channel in another G-104 with the same procedures as above.

6.4.9 Fine-tune the grid in overlap region and let the grid pattern in CH-RH & CH-LH overlap together at the overlap region. If it is not possible due to screen curve or installation conditions, then at least the grids at 4 corners of overlap region should be overlapped together between CH-RH & CH-LH. We can adjust the cropping pixels in video wall function to reduce the image blur in overlap region.

6.4.10 After finish geometry adjustment, then go to next step—video wall setting.

6.5 Video wall setting: Extend the image for two projectors and assign the location

6.5.1 Follow the instruction of [Video Wall] settings in section 11 to extend the image into two projectors and assign the location in each projector.

CH-RH: [Horizontal] zoom = 2, [Horizontal] pan = 2, [Vertical] in zoom and pan = default = 1
CH-LH: [Horizontal] zoom = 2, [Horizontal] Pan = 1, [Vertical] in zoom and pan = default = 1

6.5.2 To set correct [Overlap] value to eliminate the double image at the overlap region. In multiple projector edge blending, user needs to calculate the overlap value between projectors. An Excel spreadsheet can be provided for the calculation.

6.6 Set pixel number for Edge Blending

6.6.1 Pixel number in edge blending is calculated based on the grids number in overlap region.

6.6.2 Each grid pattern represents 50x50 pixels in size. If the overlap is 6 grids, then the [Edge Blend] value should be 6x50= 300 pixels

6.6.3 CH-RH is located at the right hand side. Therefore the [Edge Blend] is at [Left Edge] and CH-LH should be at [Right Edge]. The value for both GeoBox shall be the same: 300

6.7 Image fine tune through [Overlap] menu under [Video Wall]

6.7.1 If the grid pattern in overlap area is not perfectly aligned together, viewer will see blurred image in overlap area. In this case, after the above procedures, user needs to adjust the [Overlap] value in both CH-RH & CH-LH to get the best overlap image in overlap region. This [Overlap] value both channels should be the same or only minor difference.

6.7.2 It is possible to have some banding effect in overlap region due to many factors. Image fine-tune is required.

6.8 Image fine tuning

The final performance will be a combination of many factors—projector characteristics, projector setting, screen, ambient light, GeoBox setting. The follows are the functions that should be tried during the final fine-tune stage.

6.8.1 GeoBox:

   d. Edge Blending: Gamma, Shift, Offset, Gain
e. Image Properties: To select Preset Mode to sRGB or Bluish

6.8.2 Projector:

f. To adjust installation position of the projector:
   i. Increase Overlap region
   ii. Reduce off axis angle

g. To change Display Mode and try different color settings.
h. To implement 3D color adjustment.

6.8.3 To use lower gain value screen.

7. Example for two projector curved screen edge blending

During the complete geometry adjustment procedures, it is not necessary for user to connect video source to GeoBox. GeoBox will output Blue background to the projectors. It will be convenient through the complete geometry adjustment procedures. External Grid pattern can also be applied if necessary.

7.1 To install projectors with image a little over the screen and 250-400 pixels between overlap region

1. LH is in Green and RH is in White color.
2. The color of grid pattern can be selected through [Pattern] key

7.2 To adjust corner positions of left channel (CH-LH) through [Shift] menu under [Warp]

2. Start Corner adjustment in the image from LH GeoBox (projector).

2. Using direction keys to move [Top Left] corner into screen boarder.
7.3 To adjust curve at top edge of CH-LH through [Edge] menu under [Warp]

1. Activate [Warp] menu under [Anyplace] and select [Edge] for further adjustment
2. Select [Top Edge] to draw Top Edge of the image into screen border

Left figure shows Top Edge had been moved into screen border.

7.4 To fine tune the position of top two corners and top edge in CH-LH via [Shift] & [Edge] menu

1. The image corner locations (Top Left and Top Right) will have some change after Top Edge adjustment.
2. Fine tune the positions of these two top corners.
7.5 To adjust image center line in CH-LH through [Center] menu under [Warp]

1. The horizontal line in LH image is still not straight enough and need to be adjusted.
2. Activate [Center] menu under [Warp] and draw down the position of Center image.
3. The value of the adjustment is about 50% of the value in Top Edge adjustment.

1. Left figure shows that the [Center] of the image had been adjusted with horizontal line at image center.
2. The top edge and two upper corners need to be fine tune again because [Center] adjustment will affect these positions.

7.6 To adjust corner positions of right channel (CH-RH) through [Shift] menu under [Warp]

Activate [Shift] menu in RH channel and start the adjustment in 4 corners of RH channel.

1. Select [Top Left] corner and start the adjustment.
2. Follow the same process as LH channel to adjust all 4 corners into screen borders.

1. Left figure shows all 4 corner of RH channel had been moved into screen borders.
2. Top edge still locates outside the screen and the center line is not horizontal.
7.7 To adjust curve at top edge of CH-RH through [Edge] menu under [Warp]

1. Activate [Edge] menu under [Warp].
2. Select [Top Edge] and move Top Edge into the screen border

1. Left figure shows Top Edge had been moved into screen border.
2. To activate [Shift] menu and fine-tune the positions of two top corners.
3. The center line of RH image is still not horizontal and straight.

7.8 To adjust image center line in CH-RH through [Center] menu under [Warp]

1. To activate [Center] menu under [Warp]
2. To adjust the center position of RH channel and let it become straight horizontal line.

1. Left figure shows the center line of RH channel becomes straight horizontal line.
2. Center line adjustment will also affect the positions of the edges and corners. User may need to fine tune the positions for several times before it becomes perfect.

7.9 To align the grid pattern in overlap region between CH-LH & CH-RH

To activate [Shift] menu in both CH-RH & CH-LH as showed in left figure with Green and White Marks. (Top Left corner in CH-RH & Top Right corner in CH-LH)
It may be necessary to do more fine-tune to align grid pattern in overlap region as close as possible. User needs to try all the function under [Warp] menu to reduce the gap in the grids between CH-RH & CH-LH to the best condition. It doesn’t matter if some gaps still exist. We can fine-tune overlap quality in [Video Wall] settings.

7.10 To extend the image into two projectors through [Video Wall] settings

To activate [Video Wall] menu to split the image for two projectors (Zoom), assign display location in each projector (Pan) and adjust the image capture range (Overlap)
1. To activate [Zoom] menu under [Video Wall] to split the image for two projectors.
2. To set [Horizontal] Zoom value at “2” at both channels due to the image is split for two projectors. The [Vertical] Zoom value is “1” as default setting without change.

1. To activate [Pan] menu under [Video Wall] to assign the location to each projector.
2. To set [Horizontal] Pan value at “1” for CH-LH and “2” for CH-RH as showed in left. The [Vertical] Pan value is “1” as default setting without change.

1. To apply external test pattern with vertical and horizontal lines as showed in left.
2. The image is split into LH/RH portions from the center line before [Overlap] adjustment. Viewer will see double image in overlap area.

1. To activate [Overlap] menu under [Video Wall] to adjust the cropping area to eliminate double image in overlap region.
2. To select [Right Edge] in CH-LH and [Left Edge] in CH-RH and start overlap adjustment.
3. To increase [Overlap] value will reduce the gap between LH/RH images.

1. After set correct [Overlap] value, viewer will see clear image at the center of overlap region.
2. It is still possible for viewer to see minor blurred image at both sides of overlap region. This issue will be minimized after set [Edge Blend] value under [Anyplace] menu.
7.11 To execute [Edge Blend] setting in both LH/RH channels under [Anyplace] menu

2. To select the correct edge in LH/RH channels—[Right Edge] in CH-LH & [Left Edge] in CH-RH to set [Edge Blend] value

After above step, if viewer still sees some blurred image in overlap area, please return to [Overlap] menu under [Video Wall] in both channels to adjust the [Overlap] value to get the best image quality. [Overlap] value can be minor difference (Left figure shows “201” in CH-LH and “200” in CH-RH)

1. Left figure shows the final result.
2. Image fine-tune through GeoBox, Projectors and installation may be required if poor image quality is found. Please see more details in section 17.8.
Below is the final result of Curved Screen Edge Blending