FUJIFILM

Warping and Blending Tool for FP-ZUH series

FUJIFILM

PROJECTOR

FUJIFILM Corporation

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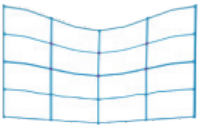
Introduction

Projector projection allows you to create spaces with various effects and benefits by integrating images from multiple projectors into one large, seamless image. When the projection screen is not perfectly flat or is angled, the shape of the projected image must be adjusted to fit the uneven projection surface. The Warping and Blending Tool for FP-ZUH Series is an application that can adjust images from multiple projectors through image processing. This enables the creation of a unified single image, regardless of size or shape.

Warping

Projecting images onto curved or distorted surfaces results in distorted images. Using the Geometric Distortion Correction function allows you to accurately correct the projected image to match the curvature of the display surface.

Distorted image



Grid Point Adjustment

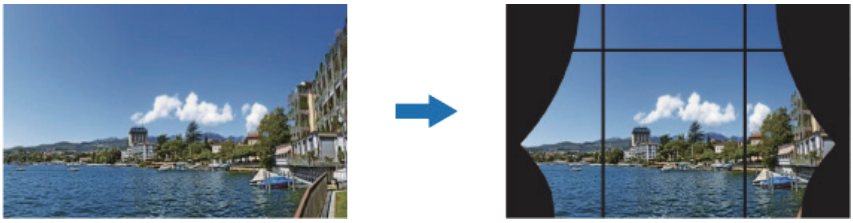
Blending

When projecting images onto large, irregularly shaped surfaces like building walls, hemispherical domes, or cylindrical surfaces, multiple projectors are required. The blending function allows you to combine images from multiple projectors into one large image. It is also possible to project two or more identical images onto the screen simultaneously to create a single brighter image (stacked projection).

Two-Surface Blending

Masking

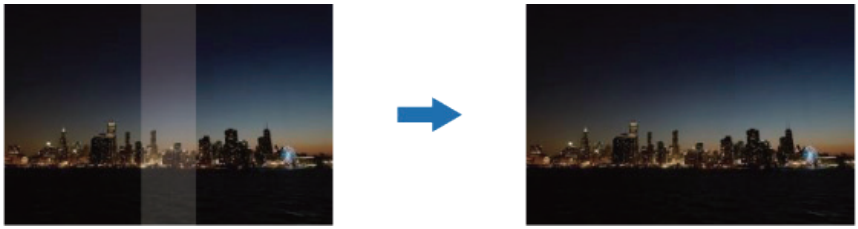
Use the mask function to avoid projecting onto specific objects or areas, such as audience members, speakers, or stage set designs. Additionally, masks can be used to cover specific parts of the image, creating an effect as if the image is being viewed through a window or balcony.



Mask Image

Black Level

When blending, overlapping areas may appear brighter than the rest of the image. This occurs because twice the light hits the overlapping region. The Black Level Correction feature adjusts the brightness of non-overlapping areas to match the brightness of overlapping areas, enhancing screen uniformity in dark scenes.



Black Level Correction

System Requirements

To use the Warping and Blending Tool for FP-ZUH Series FP-ZUH, you need to prepare the computer for installation, the video input source, and a HUB•LAN cable for LAN connection.

Please ensure your device meets the minimum requirements.

PC

- 220 MB or more of free disk space.
- LAN port.
- Computer running Microsoft Windows 11 (excluding Arm architecture)

Input source

When using two or more projectors (excluding stacking,) the device used as the input source must support the ability to split a single video feed across multiple screens. This requires a video processing device or a computer equipped with a high-performance graphics card.

Caution

- This application is exclusively for the Fujifilm Projector FP-ZUH Series.
- Before beginning adjustments, allow the projector to warm up for at least 30 minutes to stabilize image projection variations caused by temperature.
- Use the latest firmware version for the FP-ZUH projector.
- Depending on the amount of geometric distortion correction applied, noise may appear on the screen.

Installation and Setup

Install the application and set up the network and projector.

Application Installation

Download and install the Warping and Blending Tool for FP-ZUH Series on your computer.

Download the application.

The installation program can be downloaded from the Fujifilm website (www.fujifilm.com). For the latest version compatible with your projector, please contact your dealer.

Install the application.

Double-click the installation program to open the setup wizard. Follow the on-screen instructions to install the application.

Setting Up the Network

The Warping and Blending Tool for FP-ZUH Series controls the projector via LAN. You can connect the projector and computer to an existing network or connect the devices directly using a network hub or similar device.

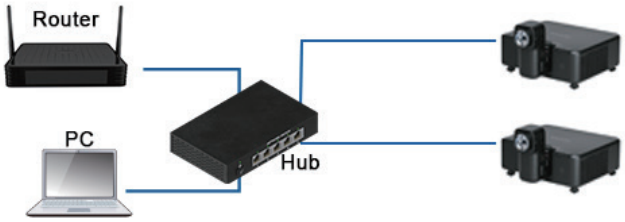
TIPS The OSD menu used in this section may be different on your projector. Please check the user manual for more information.

Connecting the Projectors and the Computer

To set up a direct connection between the projector and computer, follow these steps:

This example explains the case when using a Wi-Fi router.

1. Connect your computer to a router or network hub using Wi-Fi or a LAN cable.
2. Connect the projector to the network hub using a LAN cable.
3. Configure the IP addresses for the projector and computer. Ensure that each device within the network has a unique IP address assigned to it.



Network Connection Examples

a. Select "System Settings: Advanced" > "LAN Settings" > "IPv4 Settings" from the menu screen.
b. Turn off DHCP and manually set the projector's IP address.
c. Set the computers IP address to match the first three digits of the projectors IP address. For example, if the projectors IP address is 192.168.1.100, set the computers IP address to 192.168.1.xxx (where xxx is any number other than 100).
   This IP address is used by the application to identify the projector.
d. Select "Apply" and press the Enter key. Select "Yes" on the confirmation screen.

Using an Existing Network

If a network is available, connect the projector and computer to the same network. (This explanation assumes a network using DHCP. For details, contact your network administrator.)

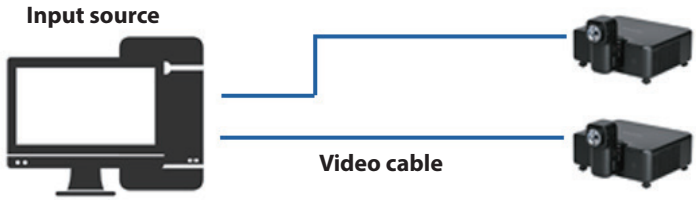
1. Select "System Settings: Advanced" > "LAN Settings" > "IPv4 Settings" from the menu screen.
2. Please enable DHCP so that the projector can automatically obtain an IP address.
3. Select "Apply" and press the Enter key. Select "Yes" on the confirmation screen.
4. Check the IP address from the "Status" > "Communication" menu.
   The IP address is used by the application to identify the projector.

Setting Up the Projectors

Connect the projector to the same input source using a video cable and set up the projection system.To achieve a more uniform image, adjust the projector's output level and image color so that the projected images look as similar as possible.

Connecting the Projectors to the Input Source

Use a video cable to connect the projector to the same input source. To split one image across multiple screens, you must configure the video settings on the input device. For example, if using a computer with a high-performance graphics card, you must configure the graphics card settings for image splitting and layering. For details, refer to the input device's user manual or contact your dealer.



Connect the projector to the input source.

Adjusting the Projectors

After connecting the projector to the same input source, adjust the projector's brightness and image color settings to ensure the projected images are consistent..

TIPS	The following adjustments are made using the remote control or the projector's control panel via the main menu. Some settings can also be adjusted via web control. See the projector's user manual for details. Allow the projector to warm up for at least 30 minutes before making adjustments.

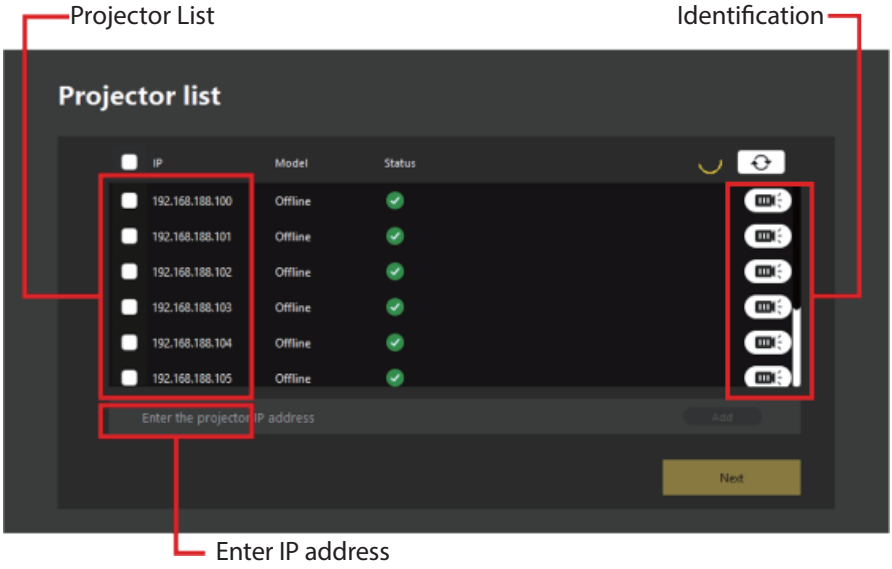
1. Adjust the image size and projection position according to the layout of the projection screen and projector.
   - Adjust the projector's zoom to change the image size.
   - Adjust the projector's lens shift to change the position of the image.
2. Set the brightness and color of the image on the projector and adjust each projector so that the images match.
   - Reset all image settings for each projector.
   - Set the projector's picture mode to the optimal mode for the image.
   - Adjust the projector's color settings to match the colors across all projectors.

How to Use the Application

Project Creation Start Page

This is the start page for creating a blending project. Select the projector(s) for the project from the projector list.

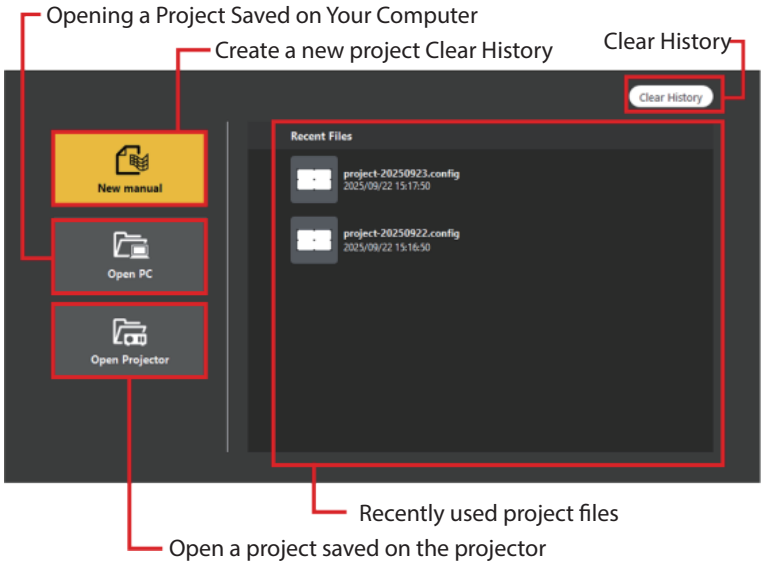
Projector Selection



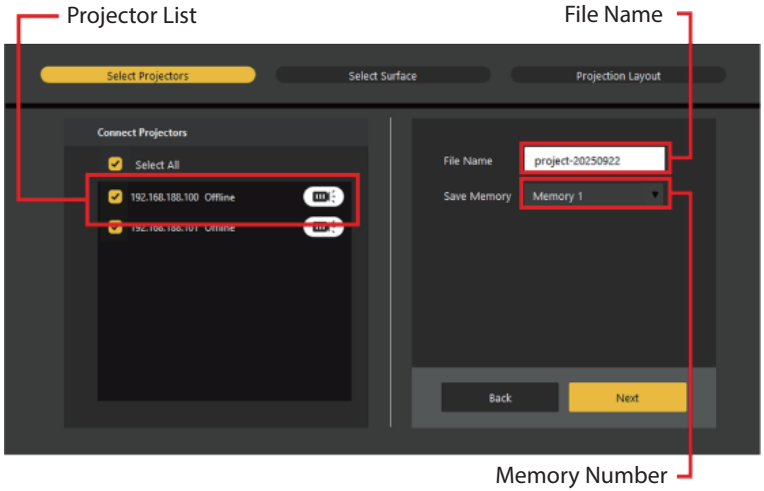
1. Select the target projector from the projector list.
2. he Warping and Blending Tool for FP-ZUH Series automatically searches for projectors on the same network. This process may take several seconds.
3. To manually add a projector, enter its IP address in the input field and click "Add".
4. To confirm which projector is selected, click the button to project a white test pattern. Click the button again to remove the test pattern.
5. Click "Next" to proceed to the project file settings.

How to Use the Application

After the start page, a page appears for creating a new project or opening a previous project file from your computer or projector.



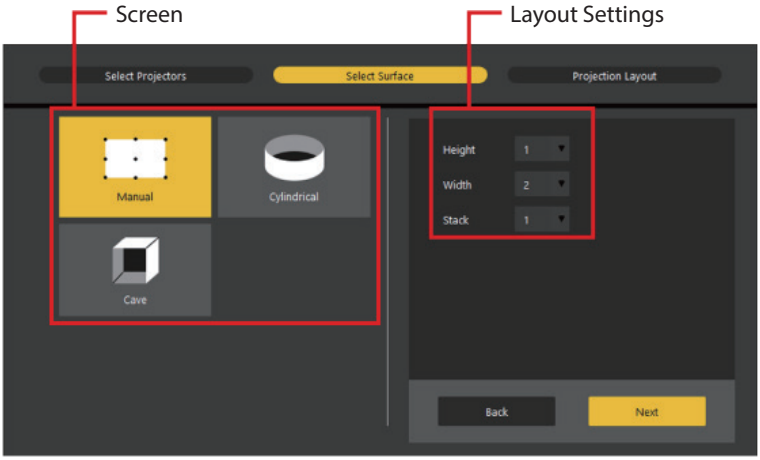
Projector Settings



Projector Settings

1. Please double-check that the selected projector is correct.
2. Enter the file name in the "File Name" field.
3. In the "Save Memory" field, select the memory to store the geometric raw data.
4. The memory destination corresponds to the "Memory Number" in the projector's "Warping & Blending" settings. The stored content will be overwritten when the project is saved.
5. Click "Next" to proceed to the projector placement settings.

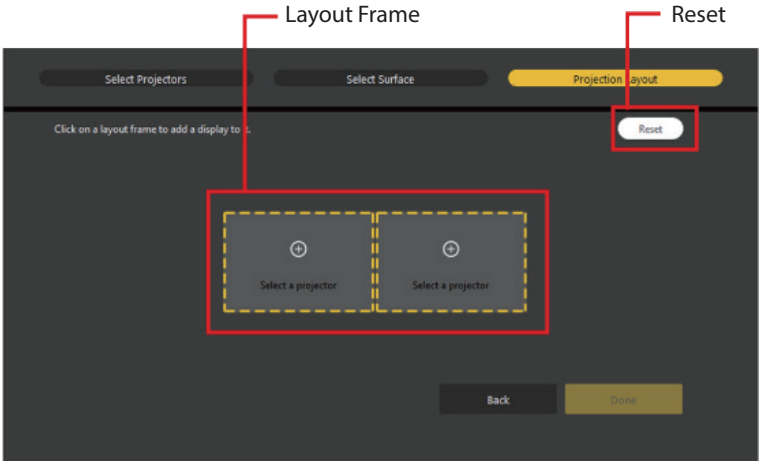
Screen Selection



Screen Selection

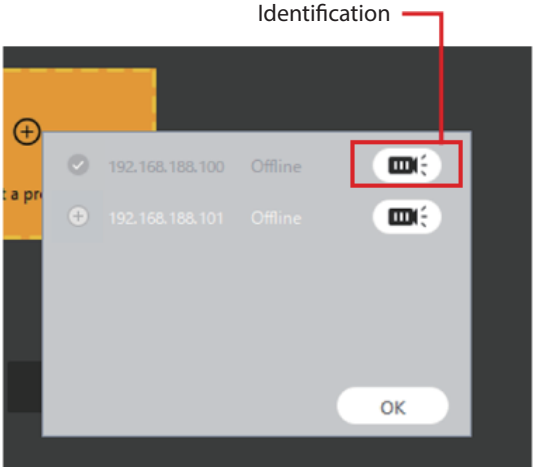
1. Select a screen that suits your projection purpose.
2. In Layout Settings, configure the projector placement. Enter the number of units for height (vertical), width (horizontal), or stacking (projecting in layers). The total number of units must match the total number of selected projectors. In the "Save to Memory" field, select where to save the settings.
3. Click "Next" to proceed to the projection layout settings.

Projection Layout Settings



Projection Layout Settings

1. Clicking the layout frame will pop up the projector list dialog.



2. Select the projector you want to project from and click "OK".
3. To verify the projector, click the button to project a white pattern across the entire screen. Click the button again to remove the pattern.

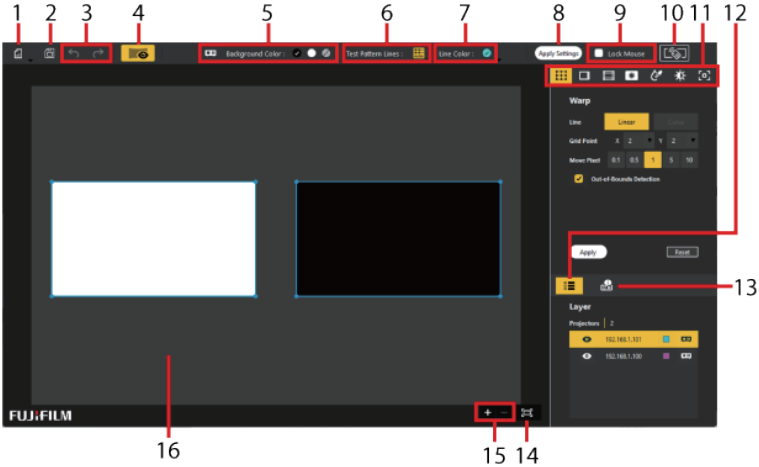
4. Repeat steps 1 and 2 to select all projectors. Ensure the projector placement matches the actual installation location.
5. To reset the selected projectors, click "Reset".
6. Click "Finish" to complete the projector placement.
7. After this step, you will no longer be able to change the projector layout settings.

Workspace Description

This section describes the main workspace and shortcuts for the Warping and Blending Tool for FP-ZUH Series.

Main Workspace

The Warping and Blending Tool for FP-ZUH Series enables geometric distortion correction and edge blending for projected images.



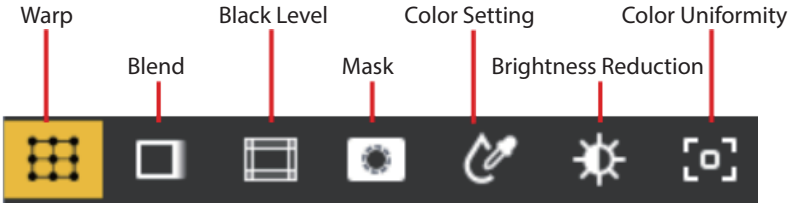
Main Workspace

No.	Function	Description
1	Menu	The menu contains commands for file operations.
	New Project	Create a new project.
	Open from PC	Loads a saved project or configuration file from your computer.
	Open from projector	Load a project from the projector.
	Projector Memory	Select the memory number to save the correction information.
	Save	Save the project.
	Reset All	Reset all settings.
	Language	Select the display language. English / Simplified Chinese / Traditional Chinese / Japanese.
	Log File	Save log files.
	Help	Display version information and license agreement.
	Quit	Exits the application.
2	Save	Saves the project.
3	Undo/Redo	Undoes the most recent operation. Redoes the undone operation. *Only valid for worping function.
3	Preview	Projects the input video with the current adjustments applied.
4	Background Color	Set the screen background to black, white, or the input video.
5	Test Pattern Lines	Sets the test pattern lines. Selecting "0" hides the cross pattern. Sets cross patterns to "5x5", "10x10", or "20x20". Selecting "ALIGN" reflects the number of points set in "Grid Points". "Contour" displays only the outline lines.
6	Line Color	Select the color for the test pattern.

7	Apply Settings	Enable/disable adjustment functions and set whether to automatically apply and display settings on the image. Applies to all connected projectors. Warp Blend Black Level Mask Color Setting Brightness Reduction Color Uniformity
8	Lock Mouse	Disables mouse adjustment operations. (Selection only)
9	Projector Control	Displays the remote control screen for operating certain functions of the projector unit. Display the remote control screen.
10	Function Tab	Select adjustments such as warping and blending.
11	Layer	Displays a list of projectors being adjusted and selects the projector to operate.
12	Information	Displays the projector's output resolution.
13	Fit	Click the button to adjust the canvas to the optimal size.
14	Zoom In / Zoom Out	Click "+" to enlarge the canvas and "-" to shrink it.
15	Canvas	This is the editing area for adjusting video. Clicking any layout frame or selecting a projector in the layers will turn the frame white.

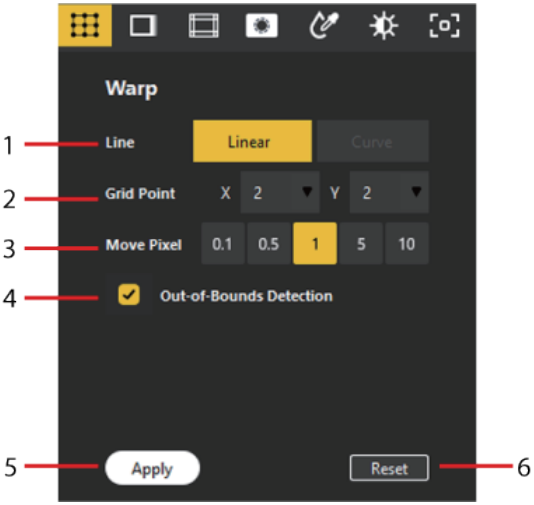
Adjusting the Images

This tool allows you to adjust video in multiple ways, including geometric distortion correction, blending, black level, masking, color adjustment, brightness correction, and uniformity. To switch functions, select from the function tabs in the upper right corner of the main workspace.



Warping the Images

Warping is a technology that allows you to change the shape of the projected image so that it looks visually correct when projected onto an uneven screen.

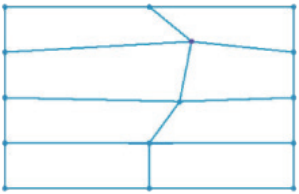


Function Tab - Warp

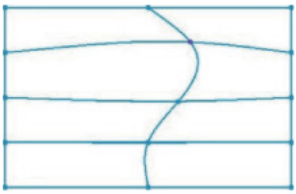
No.	Function	Description
1	Line	Set the line warping style.
	Linear	Moving grid points will correct the line shape linearly.
	Curve	When moving grid points, the line shape is corrected non-linearly. Curve correction is not possible with 2 × 2 grid points.
2	Grid Point	Sets the number of grid points on the screen. (Supports up to 65 *× 33) *Supports up to 33 × 33 for 120/240Hz video input.
3	Move Pixel	Set the pixel movement of the control point.
4	Out-of-Bounds Detection	Prevents point movement from becoming excessively extreme.
5	Apply	Apply the warping adjustment.
6	Reset	Clear the warp settings.

Warping an Image

1. Choose a projector by clicking on its layout frame or choose it from the Layer tab.
2. In the "Test Pattern Lines" toolbar, select the pattern to display on the projection screen.
3. In "Line," select either "Linear" or "Curve" correction type depending on the screen type.



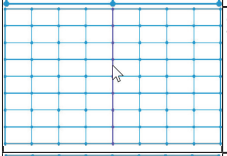
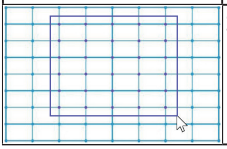
Linear Adjustment



Curve Adjustment

4. Select the number of grid points on the screen using the "Grid Points" option. When beginning adjustments, start with the minimum number (2 × 2) and gradually increase the grid points to refine details. Reducing the number of grid points during adjustments will erase settings for some points.
5. Click the ALIGN button in the toolbar to align the test pattern lines with the grid points.
6. Set the grid point movement amount in pixel increments using "Move Pixel".

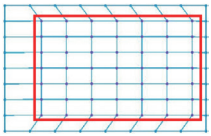
7. Select the grid point you want to move. The selected point will change color. (Example: purple).

	Please select a single point. Click the point or use the W, A, S, D keys on your keyboard to select the point
	Select all points on a straight line. Click anywhere on the line, or click a point and press Ctrl + V to select a vertical line, or press Ctrl + H to select the horizontal line.
	Select all points within the region. Drag the mouse to select an area, selecting all points within it.

8. To correct the image, click and drag a grid point to move it, or use the keyboard arrow keys to move it.

TIPS

When correcting an image, start with the outer areas and then adjust the central area. As shown in the image on the right, first adjust the points outside the red frame, then adjust the points inside the red frame.



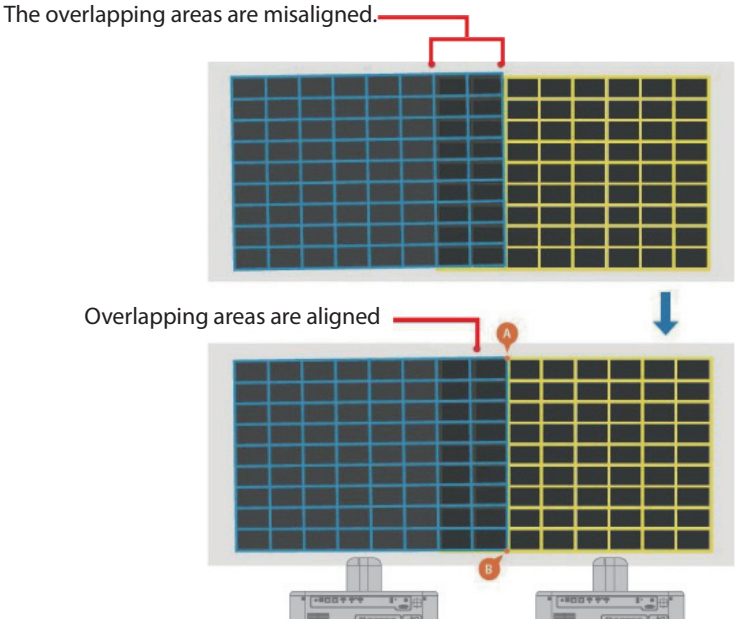
9. Click "Preview " to project the input image and check for screen distortion.
10. To clear the warp settings, at the function tab, click Reset.

Warping for Edge Blending

When edge blending two adjacent videos, warping can be used to adjust the shape of the overlapping area to more accurately align the two overlapping videos.

To manually adjust with greater precision, use two test patterns with the same number of grid lines but different grid line colors.

1. Adjust the geometric distortion correction grid points to correctly align the grid lines in the overlapping area.
2. Move point A of the left projection downward to align it with the top grid line of the right projection, and move point B of the right projection downward to align it with the bottom grid line of the left projection.

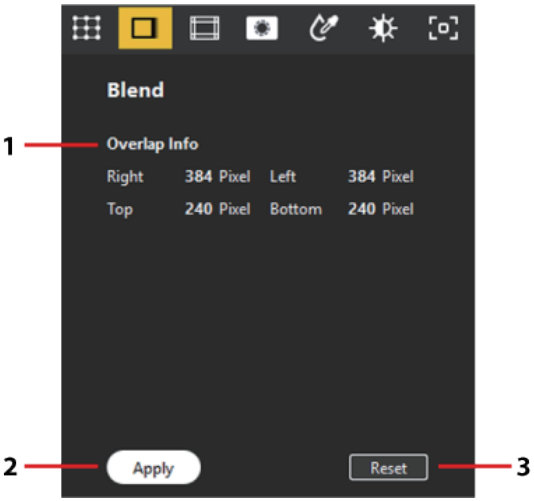


Warp for Edge Blending

TIPS	For optimal correction, apply the correction to the slightly larger image. Also, adjust from the outer points and then move to the inner points.

Edge Blending

Edge blending is an image processing technique that combines two or more split images into a single complete image. Use the blending settings to blend overlapping images.



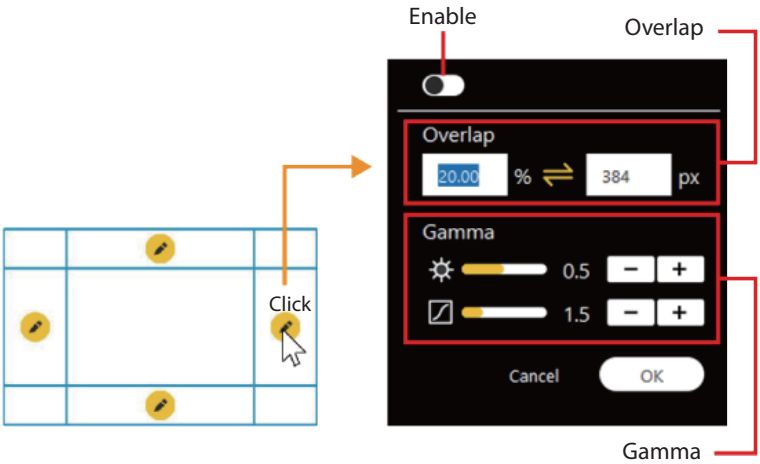
Function Tab - Blend

No.	Function	Description
1	Overlap Information.	The blend width for overlapping overlaps on top/bottom/left/right.
2	Apply	Enables blend data.
3	Reset	Resets the blend width to the default setting.

Follow these steps to blend two adjacent images.

1. Click the layout frame or select the projector from the Layers tab. When selected, the projector frame turns light blue.
2. At the Test Pattern toolbar, set up the grid test patterns for the projectors. It's suggested setting the two test pattern with the same number of lines, but different line color.

3. Select a projector, and click on the overlapped edge.

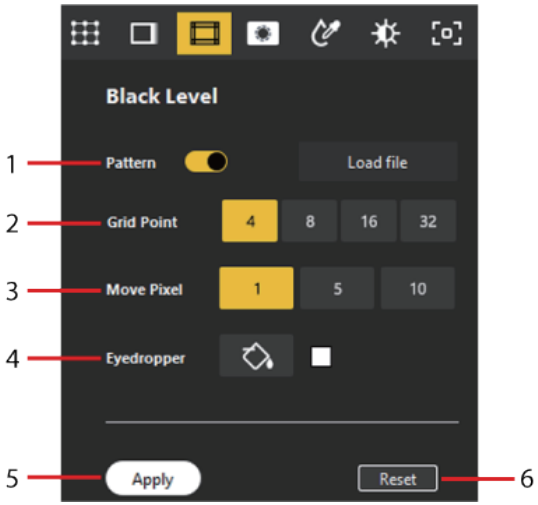


Setup the Blend Edge

4. Configure edge blending in the pop-up dialog.
   a. Switch the "Enable" toggle button to on to activate the blending effect.
   b. Set the blend overlap width in the overlapping area using either a percentage or pixel value of the image. The percentage and pixel value are based on the displayed resolution.
   c. Adjust the gamma settings to modify the inflection point and slope of the gamma curve.
   d. Click "OK" to apply the blend settings to the edges.
5. Enabling the blending effect applies a gradient effect to the selected overlap area.
6. Click "Preview" to check the current adjustment results.
   Click "Preview " at the top of the toolbar to project the input image. Click "Preview" again to return to the test pattern.
7. Repeat steps 3 through 6 on the other projector to adjust and set the overlapping area between the projectors.
8. To clear the blending settings for the selected projector, click "Reset" in the function tab.

Black Level

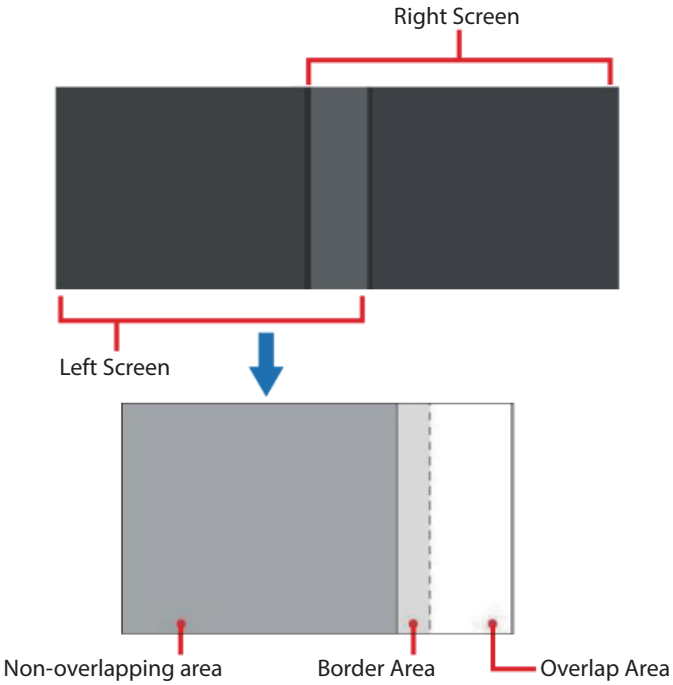
After blending two images, when projecting a dark image, the overlapping area may appear brighter than the rest of the image.



Function Tab – Black Level

No.	Function	Description
1	Pattern	Enables the black level effect.
2	Grid Point	Adjusts the black level area to improve the display of overlapping region boundaries. Each black level area can be set to a maximum of 32 points.
3	Move Pixel	Set the pixel movement of control point.
4	Eyedropper	Eyedropper mode to pick up the black level color.
5	Apply	Enable and apply black level data.
6	Reset	Reset the black level settings.

To ensure uniform color reproduction, adjust the "non-overlapping areas" and "black border color" so they appear consistent with overlapping areas.

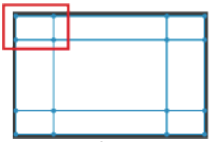


Black Level Areas

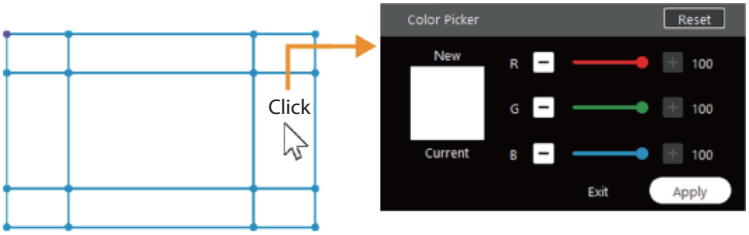
TIPS To properly adjust black level fluctuations, perform this in a dark environment whenever possible.

1. Switch to the Black Level function tab. The cross pattern display will automatically switch to a black background.
2. Click the layout frame or select the projector you want to adjust from the Layer tab. When selected, the projector frame turns light blue.
3. Select "Pixel Movement". This value determines the number of pixels the control point moves when using the keyboard arrow keys.

4. Select the grid point value. Grid points adjust the black level area for edge correction with adjacent overlapping regions. Up to 32 points can be adjusted per black level area.

> **TIPS**
>
> Start adjustments with 4 grid points Start with a few and gradually increase the number of points.
>
> 
> 4 control points per region

5. Set the amount of movement for control points using pixel movement.
6. Use control points to select adjustment areas. You can select two areas: one is the nonoverlapping area, and the other is the black border.
   a. Click the point you want to move.
   b. Drag the selected point on the canvas to change its position, or use the arrow keys on your keyboard.
7. To adjust the black level color of the selected adjustment area, click one of the areas. The color picker screen will appear.



Color Picker

8. Enter RGB values or drag the sliders to adjust the color of the selected area.
9. Click "Apply" in the color picker dialog to apply the values to the selected area.
10. Repeat steps 7 through 9 until the color of the adjustment area matches the overlapping area.

11. To adjust the black level color of the selected adjustment area, click the white square next to the Eyedropper and adjust the color in the color palette on the "Select Color" screen.

Select Color

12. Adjust the color of the selected area by entering the RGB values from Step 7 or selecting a color from the color palette in Step 11.
13. Click "OK" in the "Select Color" dialog to apply the values to the selected area.
14. Repeat steps 7 through 13 until the color in the adjustment area matches the overlapping area.

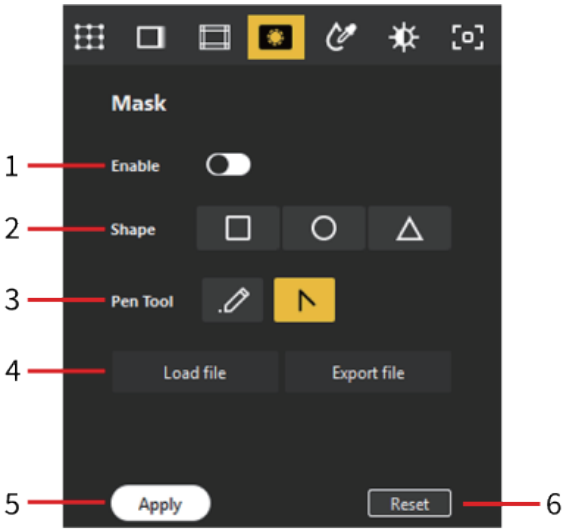
Black Level Adjustment

15. To reset the black level settings, click "Reset" in the Function tab.

Masking

The mask function allows you to create an image with a portion of the screen masked. You can create a mask using a preset pattern or by using an image file for the mask.

> **TIPS** Mask images must be in BMP/JPEG/PNG format, with a grayscale color level of 0 (black) or 25 (white).

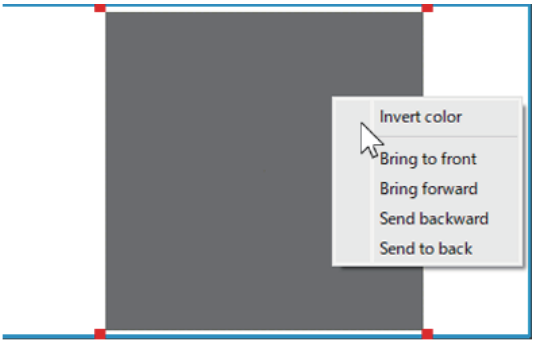


Function Tab - Mask

No.	Function	Description
1	Enable Mask	Enables or disables the mask function.
2	Shape	Select a preset mask shape pattern. (Square, Circle, Triangle)
3	Pen Tool	Use the Pen Tool to draw the mask.
4	Load/Export	Loads a mask image from a file and saves the current mask to a file.
5	Apply	Applies the mask.
6	Reset	Clears the mask on the screen.

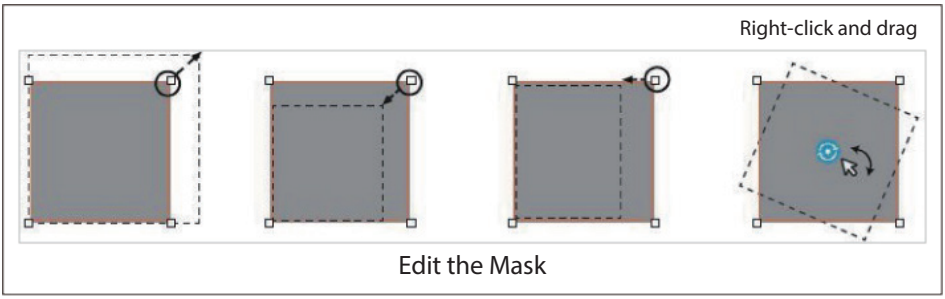
Create New Mask

1. To use the mask function, enable the "Enable/Disable"button .
2. In the "Shape" field, select a mask shape from the preset patterns
3. Right-click the created mask to display layer settings. You can change the mask layer's opacity or invert the mask color.



Invert the Mask and the Layer Setting

4. To move the mask on the screen, drag it to change its position.



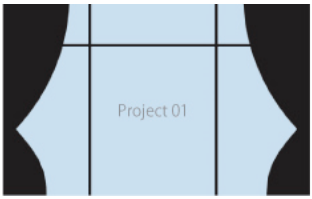
Edit the Mask

5. Click "Preview " to check the mask effect.
6. To clear the mask, click "Reset" in the Features tab.

Loading a mask

Load the image file to apply the mask.

1. Verify the image used for the mask is in BMP/JPEG/PNG format with a 2-tone color scale 0 (black) or 255 (white).
2. Select the projector and click "Load File".
3. From the dialog box that appears, select and open the file from your computer.
4. Click "Preview " to check the mask effect during projection.



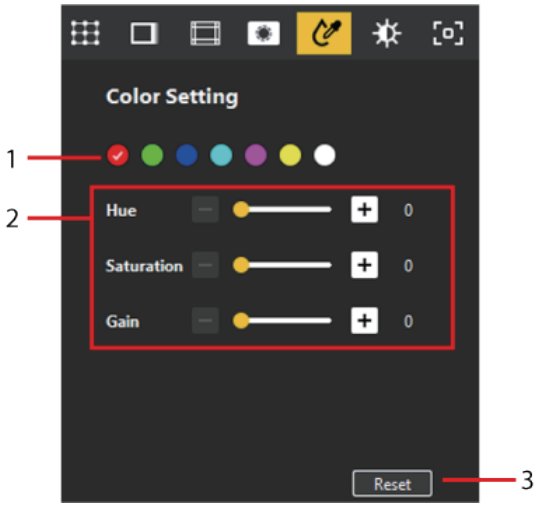
Load a Mask Pattern

Preview a Mask

TIPS Loaded mask images cannot be edited, such as moving, resizing, or rotating.

Projector Color Setting

You can configure the "7 Color Adjustment" setting within the projector's display settings menu from the application. Select a color and adjust its hue, saturation, and gain value.

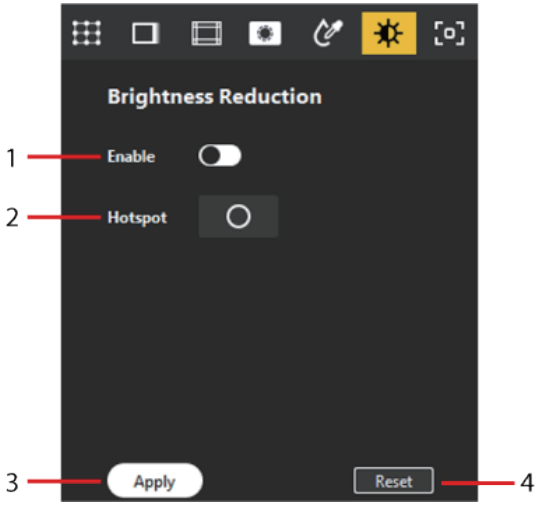


Function Tab - Color Setting

No.	Function	Description
1	Base Color	Pick up a base color to adjust the color parameters.
2	Hue / Saturation /Gain	Adjust the Hue / Saturation / Gain values.
3	Reset	Click to reset the HSG value to default setting.

Brightness

When there is a hotspot area in the projected image, you can use this function to reduce the brightness of the area to improve the overall brightness uniformity of the image.

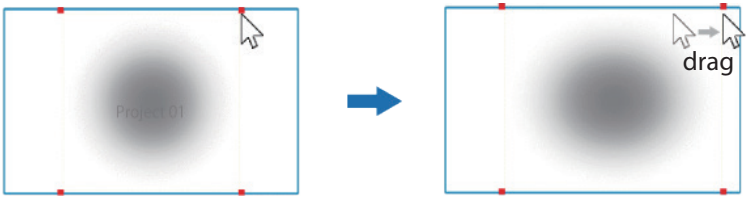


Function Tab - Brightness

No.	Function	Description
1	Enable	Enables/disables the hotspot reduction effect.
2	Brightness Point	Add hotspots you wish to correct.
3	Apply	Apply the hotspot correction.
4	Reset	Clears all hotspot settings.

Enable luminance correction using the steps below.

1. Click on the white circle next to Hotspot to add the brightness effect on projection.
2. Adjust the area of brightness effect by dragging the corner control point as below.

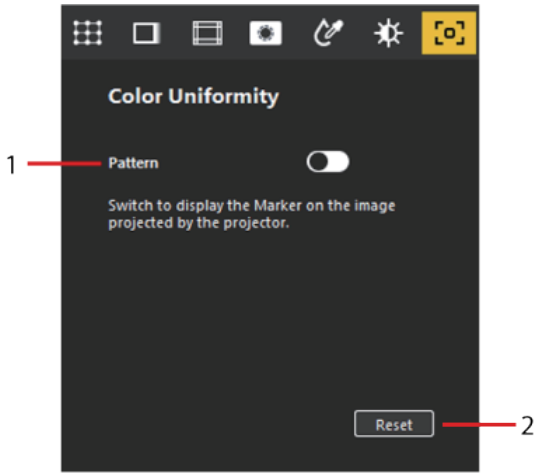


Adjust the Hotspot Area

3. Click "Preview " to check the brightness correction effect during projection.
4. To clear the hotspot points on the screen, click "Reset" in the Function tab.

Color Uniformity

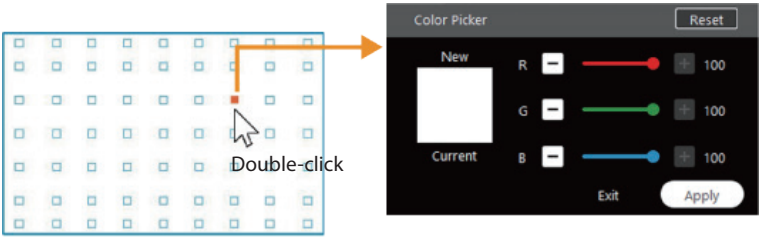
A function for fine-tuning the color uniformity of projected images.



Function Tab - Color Uniformity

No.	Function	Description
1	Pattern	Displays a 63-point (9 × 7) uniformity control marker.
2	Reset	Clears all uniformity settings.

1. Switch to the Uniformity Function tab. The image automatically switches to the uniformity control points.
2. Select one of the 263 (9 × 7) control points and double-click it to display the color picker screen for setting the color.

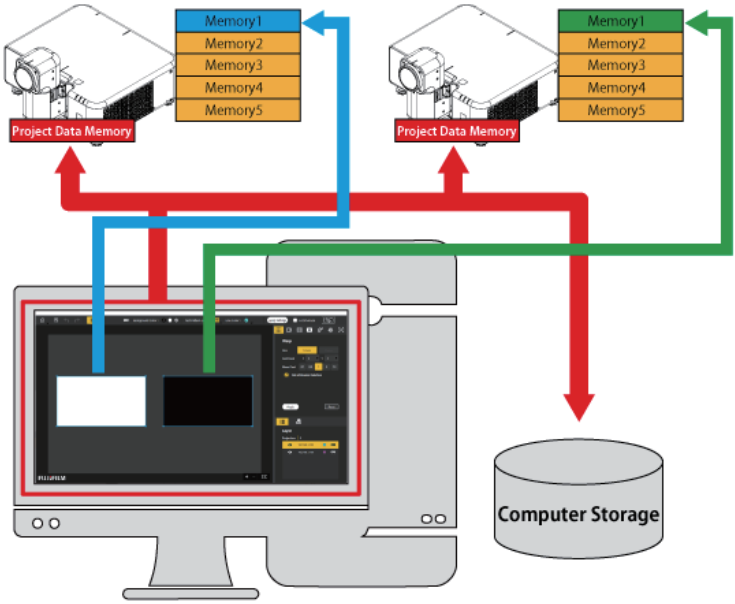


Color Picker

3. Set the color of the selected area by entering RGB values or dragging the sliders.
4. Click "Apply" in the color picker dialog to apply the values to the selected area.
5. To clear the uniformity settings, click "Reset" in the Features tab.

Saving the Project

To save the project, click "Save " in the top toolbar.When saving, the data will be saved as shown below.

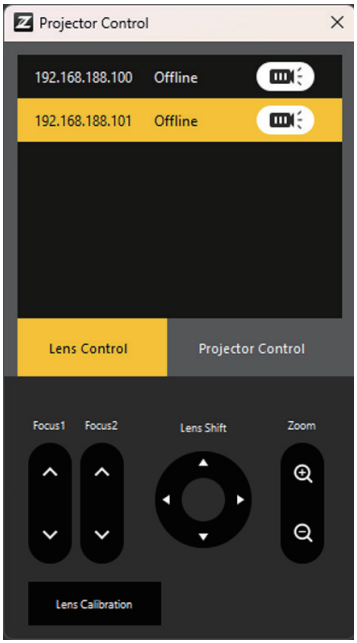


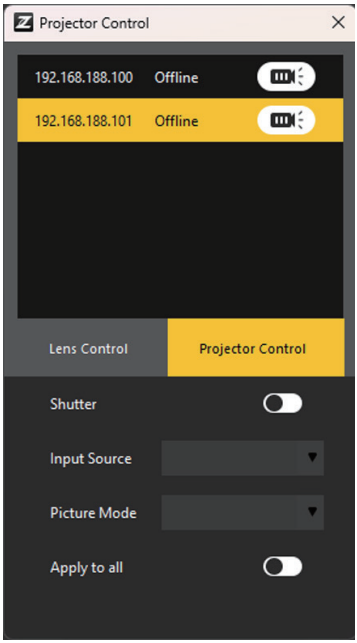
	Data contents	Save location
→	Project Data	The dedicated project memory for each projector and the following folders on the computer. C:\Users\USER NAME\.Warping and Blending Tool for ZUH series\Config
→	Left projector geometric raw data	Memory slots 1–5 for Warping & Blending Menu. (Saved to the number specified when creating the project.)
→	Right projector geometric raw data	Memory slots 1–5 for Warping & Blending Menu. (Saved to the number specified when creating the project.)

TIPS Project- dedicated memory is used only within the application and cannot be accessed from the main unit's menu.

Projector Control

The Warping and Blending Tool for FP-ZUH Series allows you to operate some functions of the projector itself, such as lens adjustment (shift, zoom, focus 1 • 2), shutter, input source selection, and image mode. Click "P r o j e c t o r C o n t r o l" on the top toolbar to display the operation screen.





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