Ultimems HD309D1-C1 Scanning Projection Module

Ultimems HD309D1-C1 Scanning Projection Module User Manual

Contents

Ultimems HD309D1-C1 Scanning Projection Module

HD309D1-C1 MEMS Scanning Projection Module
Specifications:

- MEMS Mirror
- Drive Force Resolution
- Projected FOV
- Contrast
- Focus
- Brightness (Lumen)
- Color Gamut
- Throw Ratio
- Cable Requirement
- Power Input
- Video Input Interface
- Power Consumption
- Safety of Laser Product
- Size
- Module Weight
- Operation Environment
- Storage Environment

Product Usage Instructions

Installation:

1. Place the module in a suitable location for projection.
2. Connect the power input to a compatible power source.
3. Connect the video input interface to the desired video source.

4. Ensure proper ventilation around the module for cooling.

Operation:

1. Power on the module using the designated power button.
2. Adjust the focus and brightness settings as needed for optimal projection quality.
3. Select the desired input source using the control interface.
4. Control the projected image by adjusting the throw ratio and color settings.

Maintenance:
Regularly clean the MEMS mirror and ensure there is no obstruction affecting the projection quality. Avoid exposing the module to extreme environmental conditions.

FAQ:

- **Q: How do I adjust the focus of the projection?**
  A: Use the focus adjustment controls provided on the module to sharpen or soften the projected image.
- **Q: Can I use this module outdoors?**
  A: It is recommended to use the module in indoor environments to protect it from environmental factors that can affect performance.
- **Q: What is the recommended cable requirement for this module?**
  A: Use high-quality cables compatible with the video input interface to ensure optimal signal transmission and performance.

HD309D1-C1
MEMS Scanning Projection Module <User manual>
Preliminary version

Jan 04, 2023 Version 1.0

Revision History

Version	Date	Description	Originator
1.0	2023.01.04	Initial Release	MiguelWang

Specifications

MEMS Mirror / Drive Force	2D single mirror / Electrostatics
Resolution	720P / 60 frames per second (Input Source)
Projected FOV	X axis:39°; Y axis:23° (ref.)
Contrast	10,000: 1 <FOFO test>
Focus	Free Focus
Brightness (Lumen)	34 ± 3lm (measured at 400mm from MEMS Mirror)
Color Gamut	>150%
Throw Ratio	<1.3
Cable requirement	• USB Full-Featured Type-C to Type-C cable • Digital video interface cable
Power Input	• DC 4.75V ~ 5.5V via USB Type-C • **(Note:** Exceeding this value may result in damage to critical components.)
Video input interface	• USB Type-C receptacle; DisplayPort Alternate Mode (DP. Alt. Mode) • Digital video interface receptacle
Power Consumption	Peak 6.5W; Normal operation<5.5W
Safety of Laser product	Class 1 (IEC 60825-1:2014 + IEC62471-5)
Size	Please refer to ”Mechanical drawing”
Module Weight	35± 3 grams
Operation environment	0°~35°C ; 40~60%
Storage environment	0°~60°C

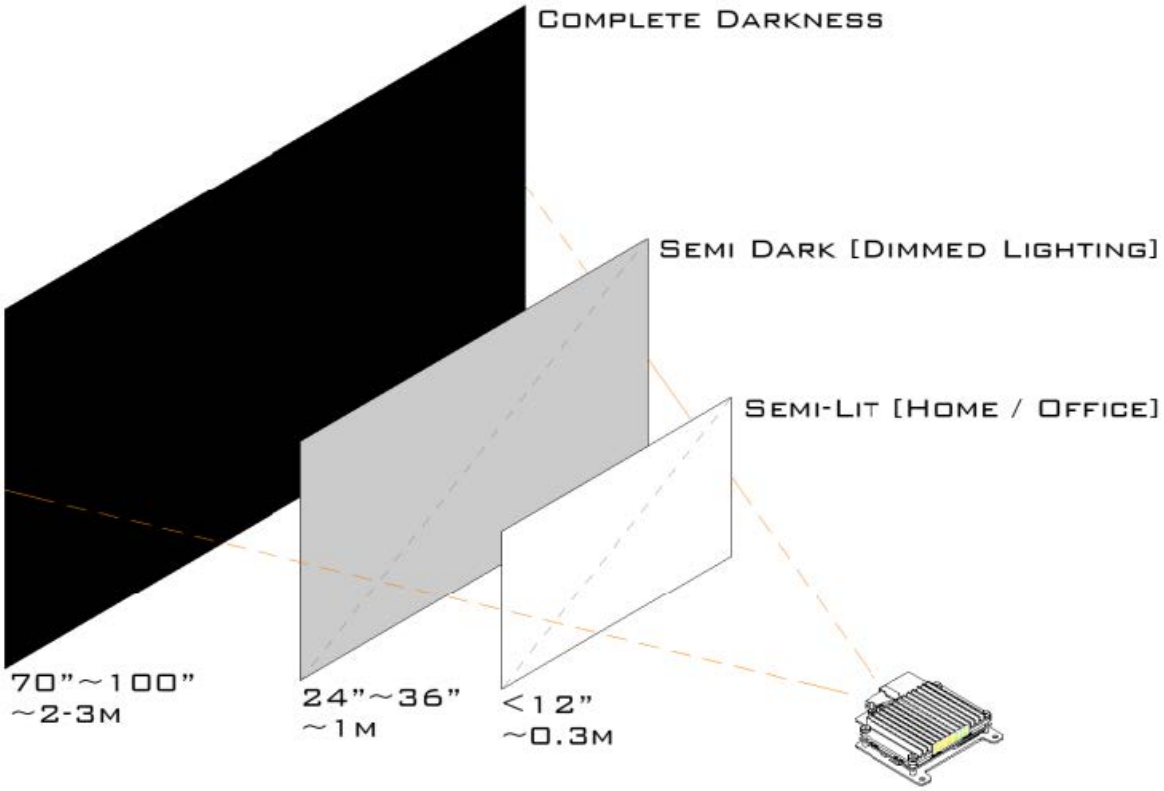
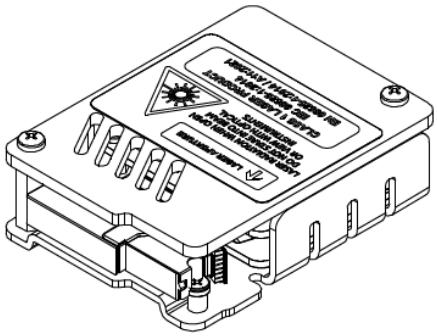


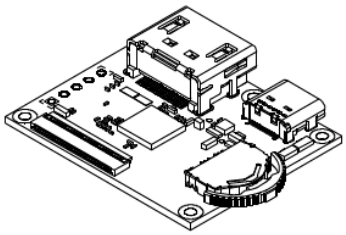
Fig.1 HD309D1-C1 projection area size

Contents

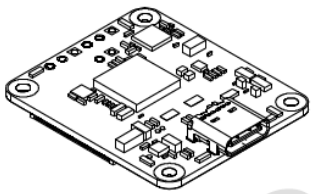
1. Components inside the package



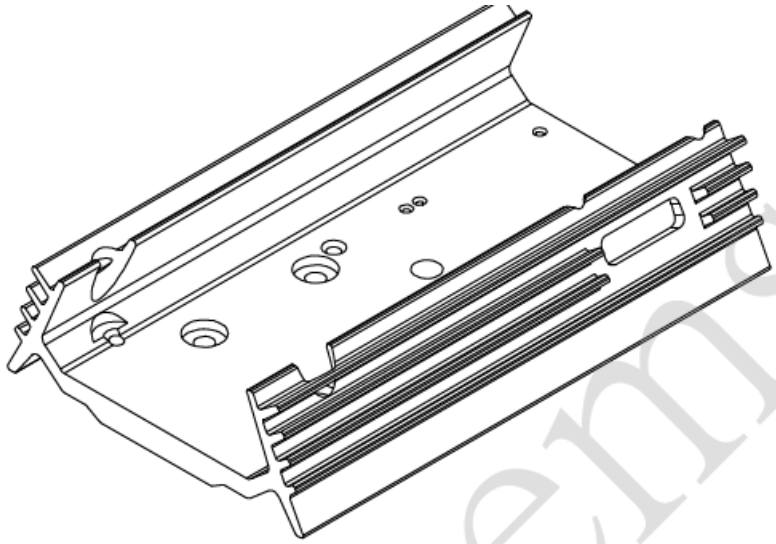
LSP Module (HD309U2)



Digital Video Interface Converter Board

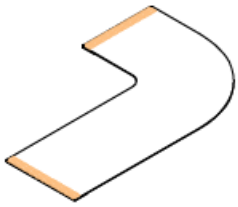


Type-C Converter Board



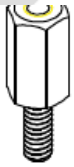
Metal Base

FPC
(Type A)



FPC
(Type B)

Machine Screw
M3.0x6.0L
[3 pcs]



Spacer
M1.6x6.0L
[6 pcs]

Machine Screw
M1.60x3.5L
[6 pcs]

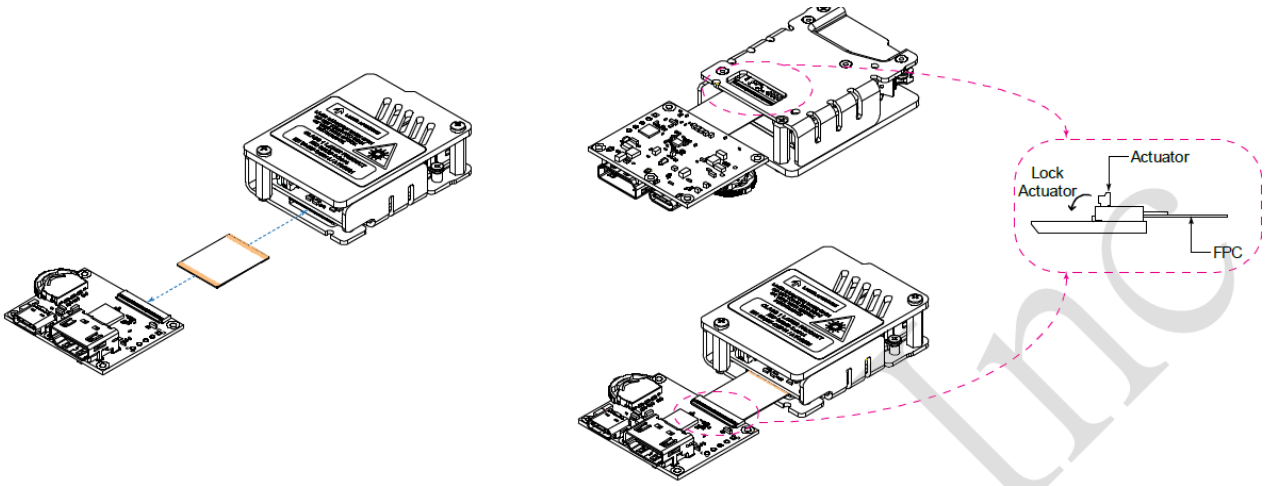
2. Others

   OSD SW tool QR code when converter board is Type C version

Assembly

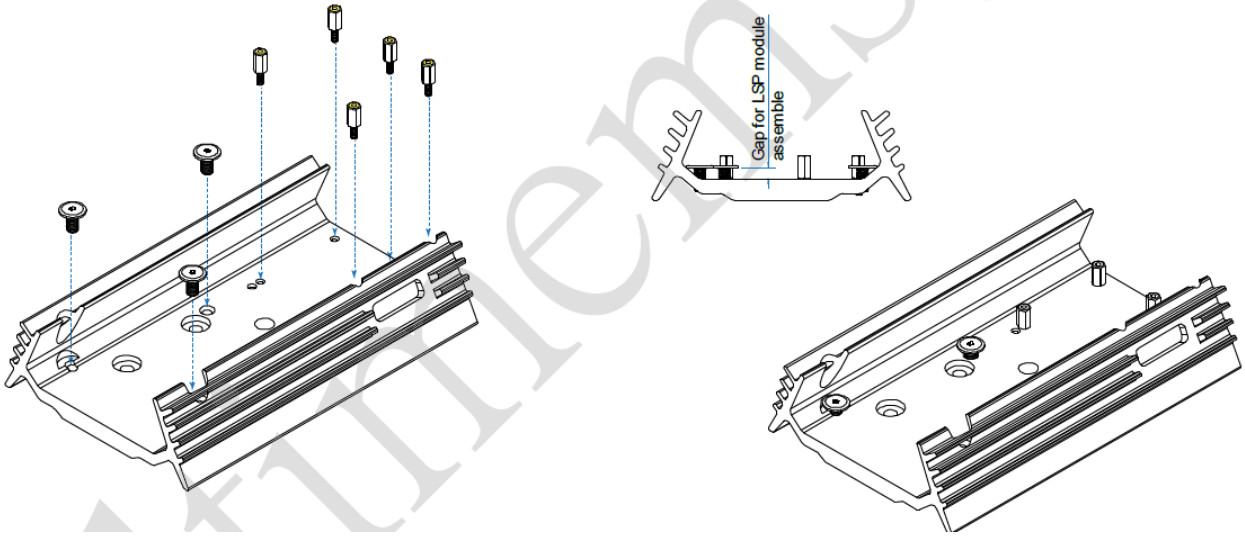
1. When converter board is Digital video interface version
   - **Step 1:**

     Insert FPC to LSP module and converter board connector ,then lock the actuator respectively.

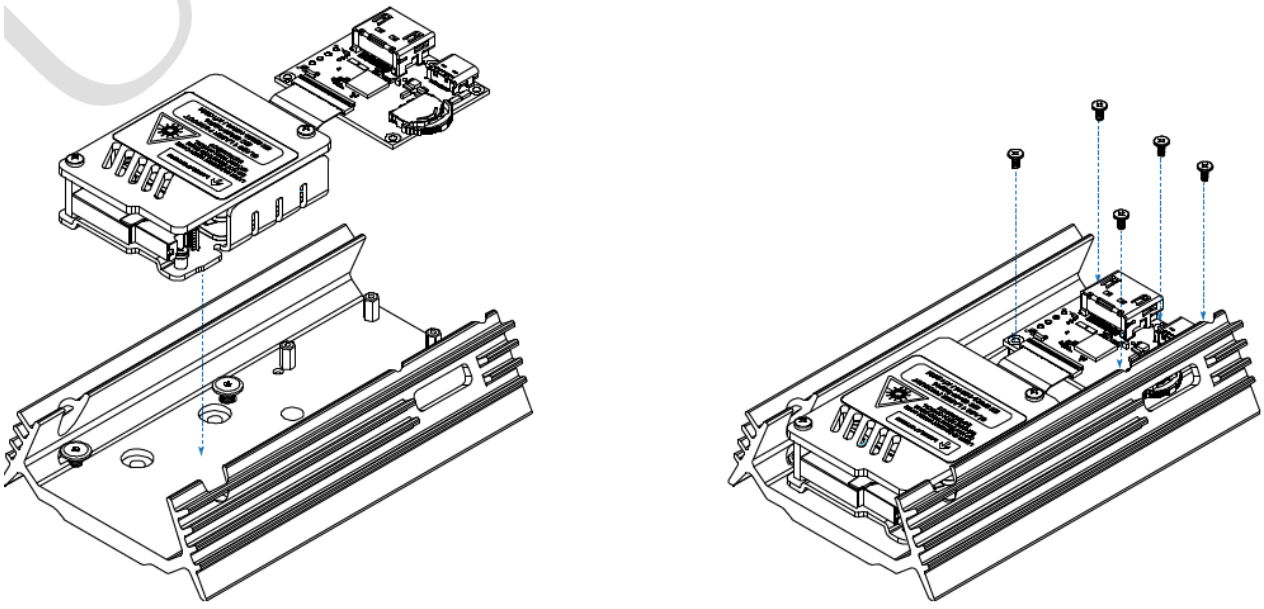


- Step 2:

  Pre-assemble M3.0 machine screw and spacer to metal base.

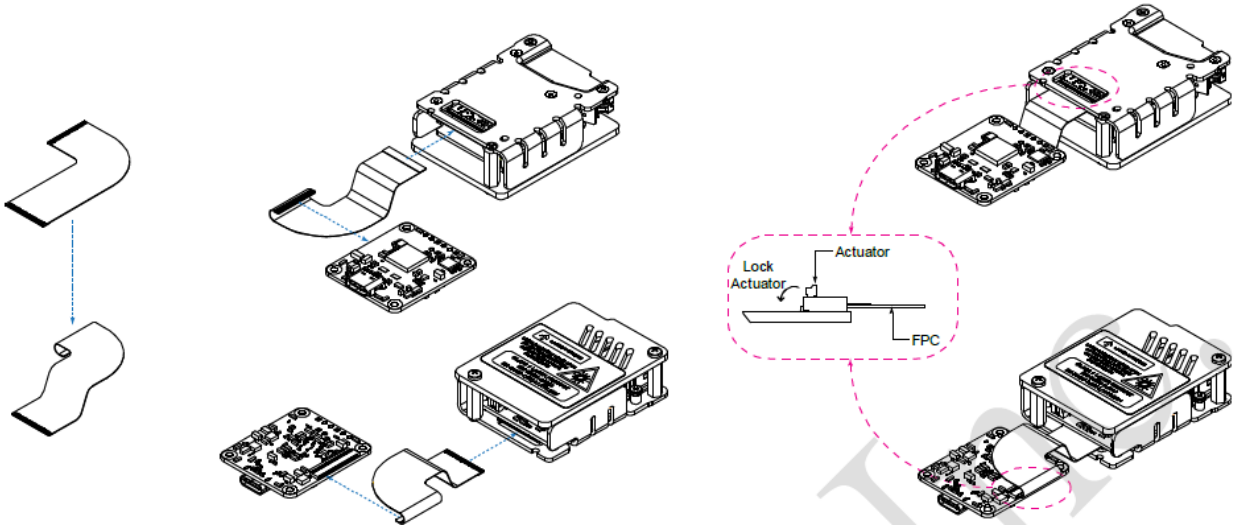


- Step 3:
- Fixed LSPmodule to metal base, fasten M3.0 machine screw.
- Fixed converter board by using M1.6 machine screw.

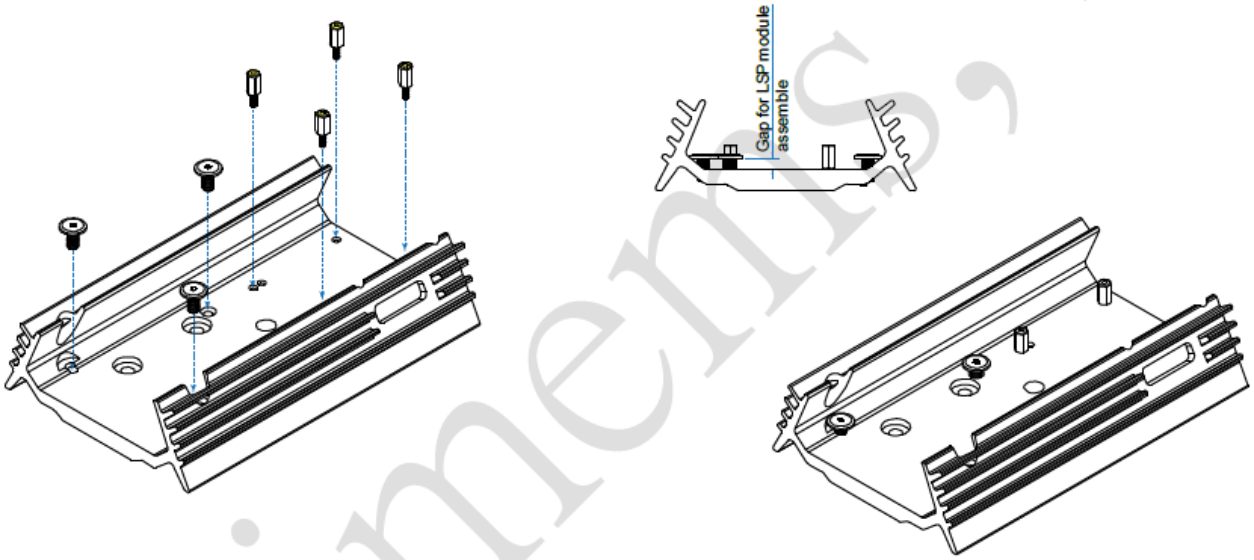


2. When converter board is Type C version
   - Step 1:
   - Pre-bending FPC(Type-B).

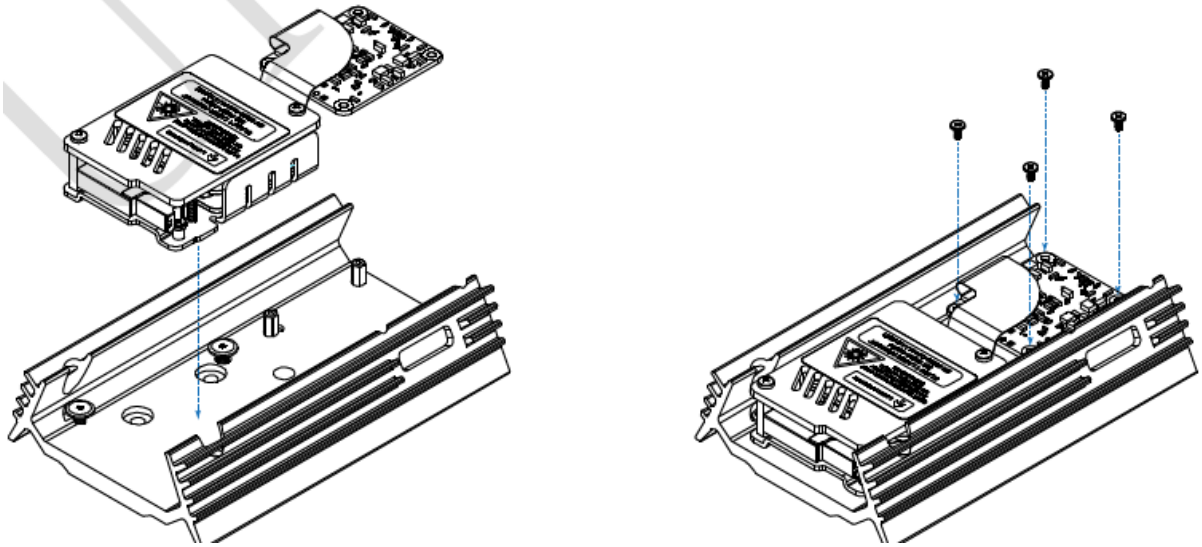
- Insert FPCto LSPmodule and converter board connector, then lock the actuator respectively.



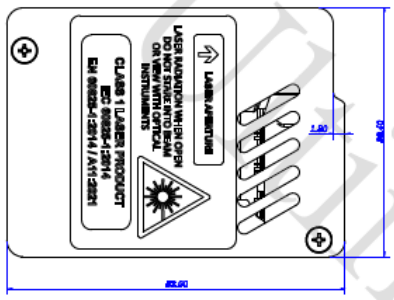
- Step 2:
- Pre-assemble M3.0 machine screw and spacer to metal base.

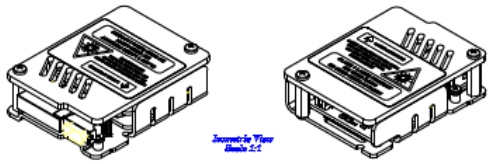


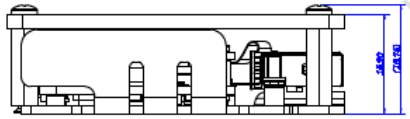
- Step 3:
- Fixed LSPmodule to metal base, fasten M3.0 machine screw.
- Fixed converter board by using M1.6 machine screw.

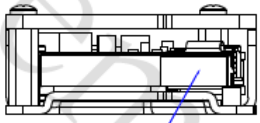


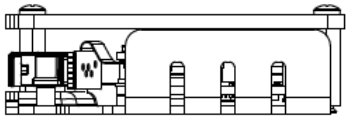
Mechanical drawing

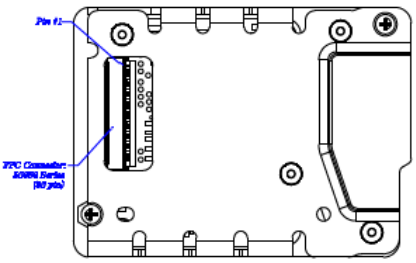


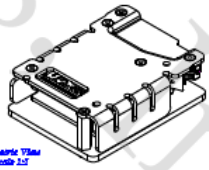










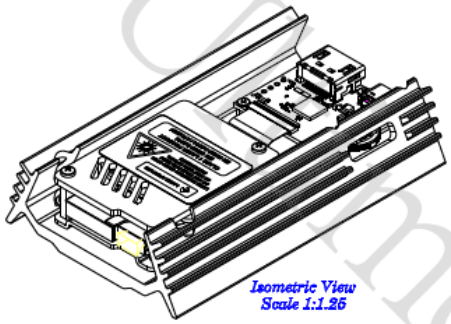


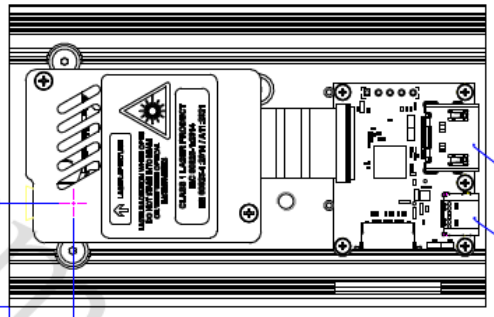
Dimension	Tolerance
x<=18	±0.10
18<x<=250	±0.20
250<x<=500	±0.30
500<x<=1000	±0.50
x>1000	±0.80

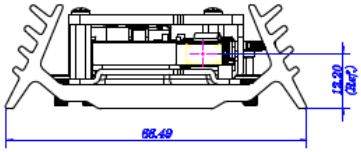
Sym.	Date	Description of revision	Drawn	Aprd.
(0)	22.Sep.'22	Initial Release	Eddie	

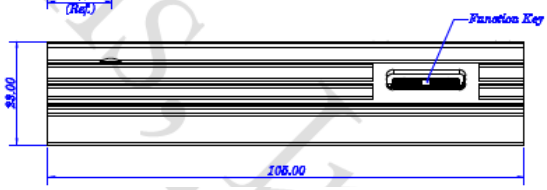
History

Scale		Size	A3	Ultimems, Inc. 及至微機電股份有限公司
Projection		Sheet No.	1/1	
Unit	mm	Date	22.Sep.'22	
Approved		Material		Part Name: HD309D1-C1 Outline
Checked		Weight		
Designer	Eddie Ching	Dwg. No.		Part Number:
Drawn	Eddie Ching	Version	00	





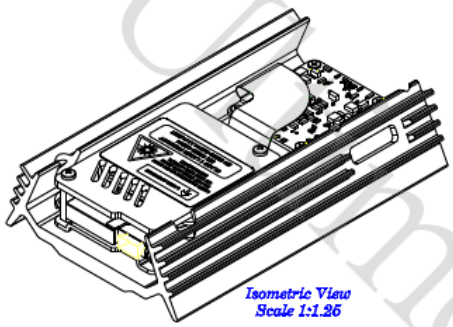




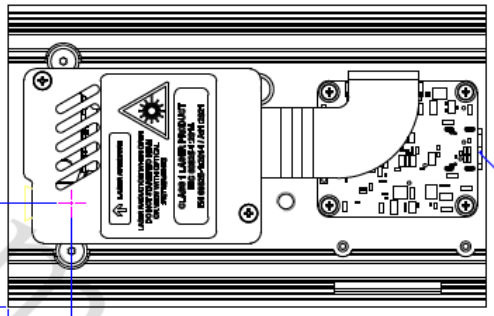
Scale	1:1	Size	A4	Ultimems, Inc. 及至微機電股份有限公司
Projection		Sheet No.	1/1	
Unit	mm	Date	22.Sep.'22	
Approved		Material		Part Name: HD309D1-C1 w/ Digital Video Interface Converter Board
Checked		Weight		
Designer	Eddie Ching	Dwg. No.		Part Number:
Drawn	Eddie Ching	Version	00	

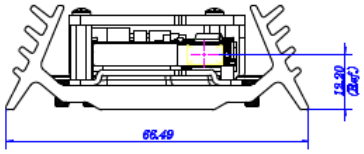
Sym.	Date	Description of revision	Drawn	Aprd.
04				
03				
02				
01				
00	22.Sep.'23	Initial Release	Eddie	

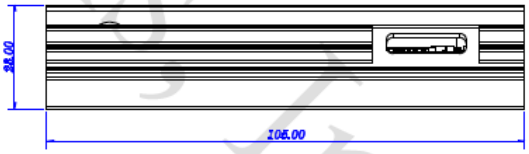
History



Isometric View
Scale 1:1.25



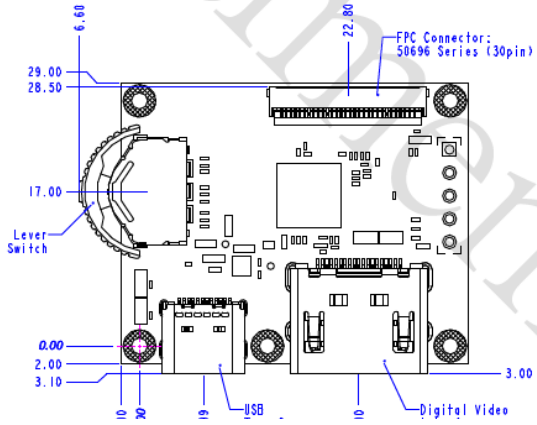


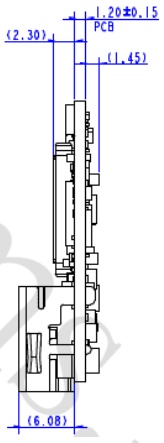


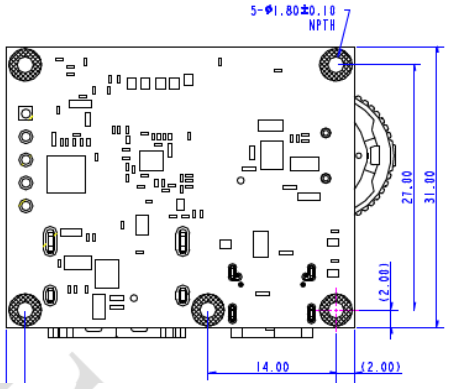
Scale	1:1	Size	A4	Ultimems, Inc. 及至微機電股份有限公司	
Projection		Sheet No.	1/1		
Unit	mm	Date	22.Sep.'23		
Approved		Material		Part Name	HID809D1-C1 w/ Type-C Converter Board
Checked		Weight			
Designer	Eddie Ching	Dwg. No.		Part Number	
Drawn	Eddie Ching	Version	00		

Sym.	Date	Description of revision	Drawn	Aprd.
04				
03				
02				
01				
00	04.Aug.'23	Initial Release	Eddie	

History





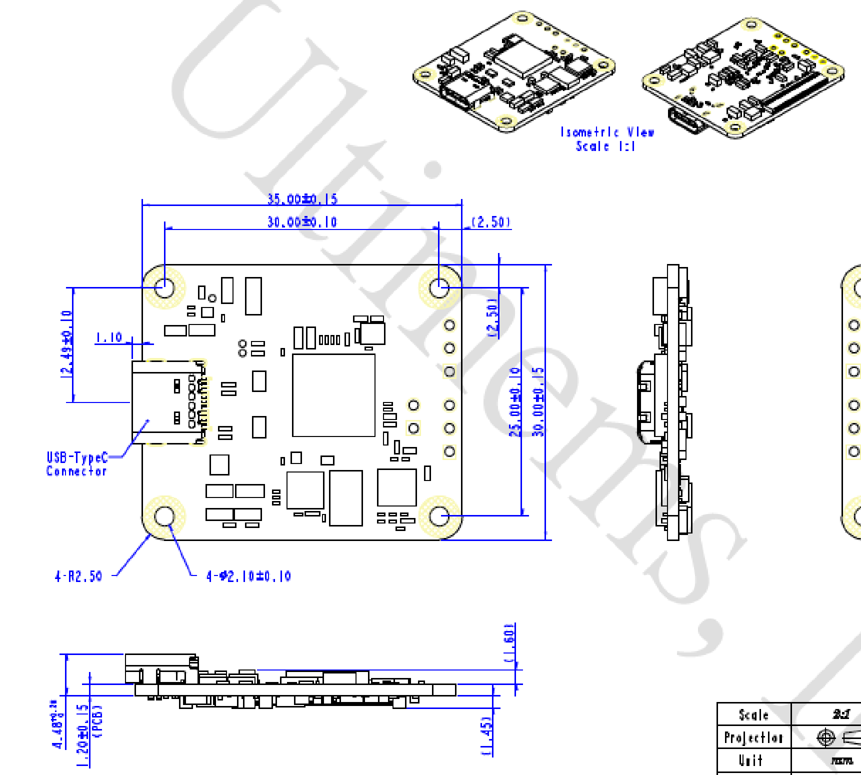


Copper Area

Don't Place Any Component

Note:
1. ⓒ: Critical Dimension.
2. Unspecified Dimension Tolerance Refer To Tolerance Table.
3. ( ) is Reference Dimension.

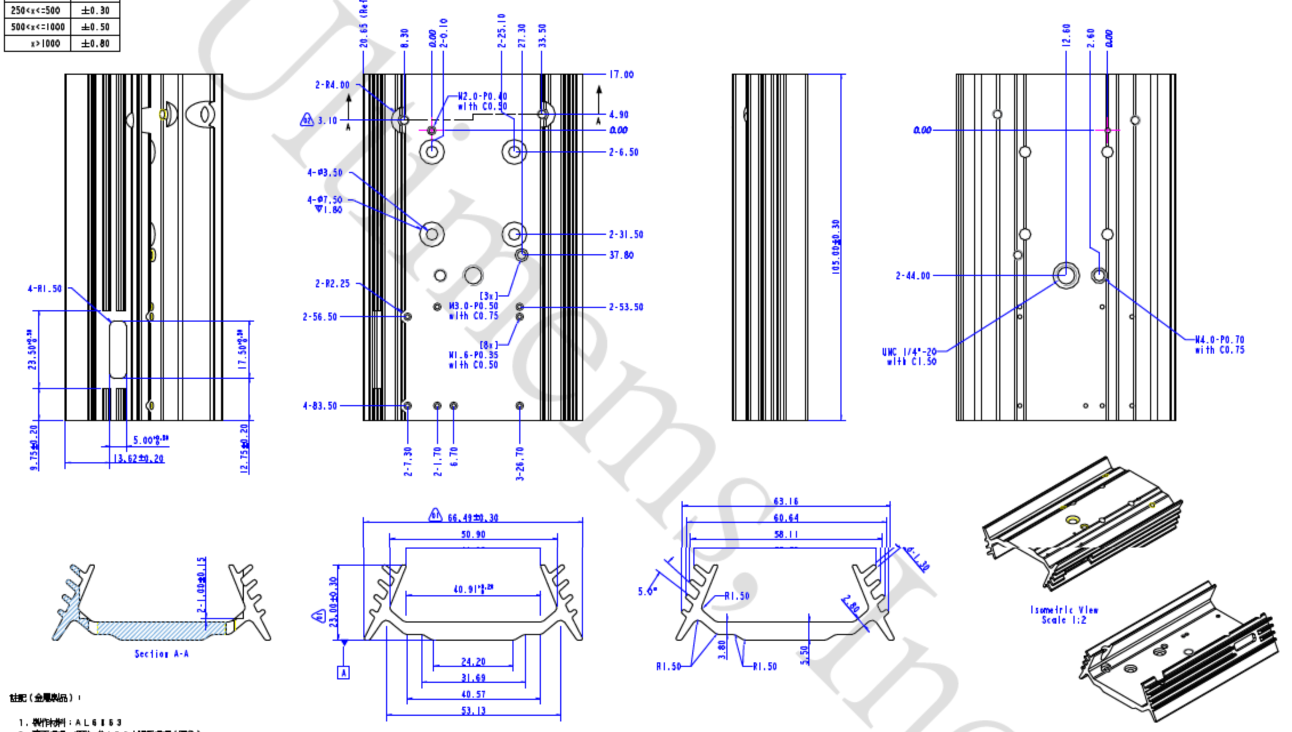
Scale	2:1	Size	A4	Ultimems, Inc. 及至微機電股份有限公司	
Projection		Sheet No.	1/1		
Unit	mm	Date	04.Aug.'23		
Approved		Material		Part Name	81E09-PCB-COD-A01
Checked		Weight			
Designer	Eddie Ching	Dwg. No.		Part Number	
Drawn	Eddie Ching	Version	00		



04				
03				
02				
01				
00	10.Nov.'21	Initial Release	Eddie	
Sym.	Date	Description of revision	Drawn	Aprd.
History				

Scale	2:1	Size	A4	Ultimems, Inc. 及至微機電股份有限公司	
Projection		Sheet No.	1/1		
Unit	mm	Date	10.Nov.'21		
Approved		Material		Part Name	31E04-PCB-COD-A01 USB-C Adaptor Board
Checked		Weight			
Designer	Eddie Ching	Dwg. No.		Part Number	
Drawn	Eddie Ching	Version	00		

Dimension	Tolerance
x<=10	±0.10
10<x<=250	±0.20
250<x<=500	±0.30
500<x<=1000	±0.50
x>1000	±0.80

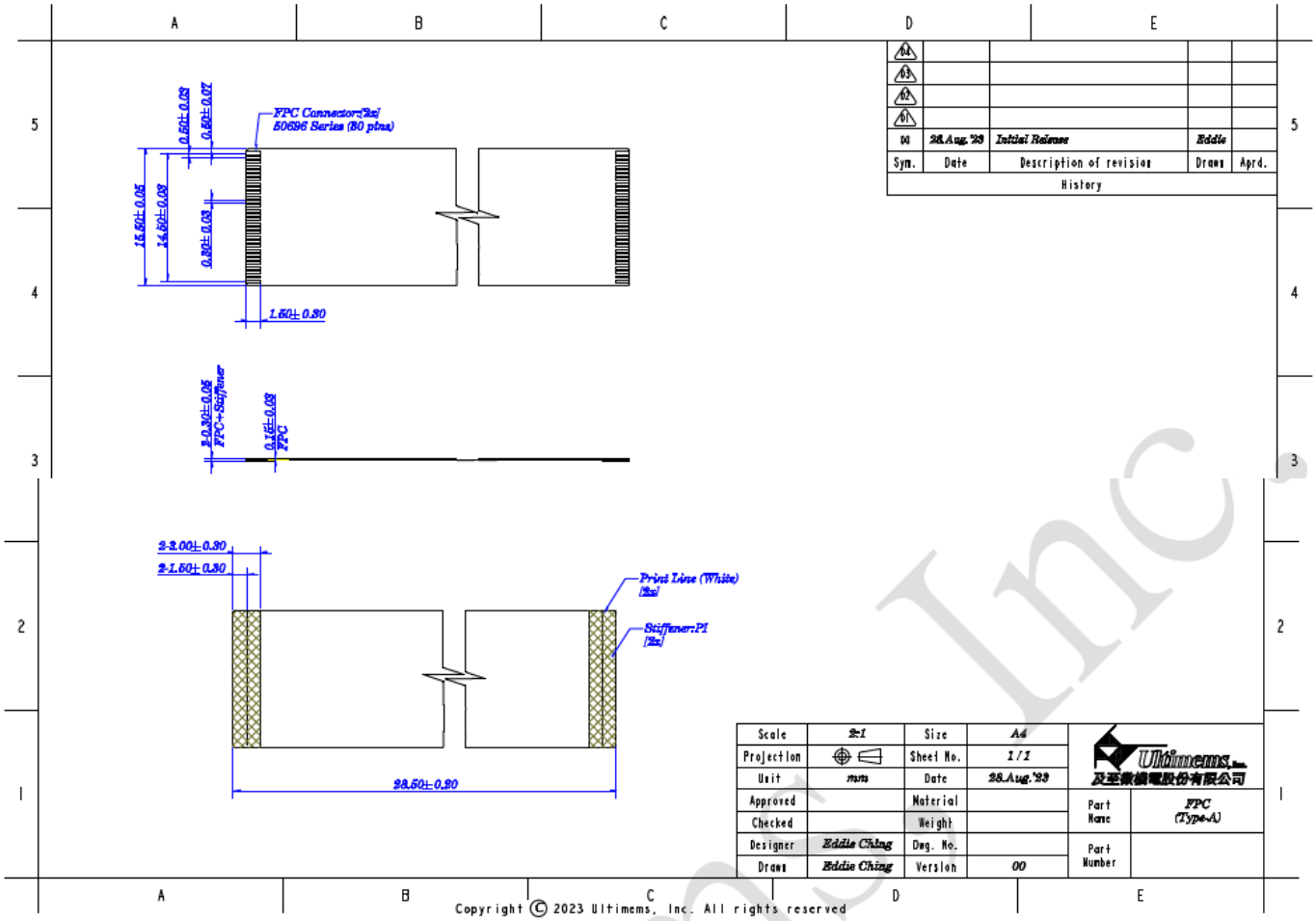


註記（金屬製品）：

1. 製作材料：AL6063
2. 表面處理：噴砂 #150+陽極處理（原色）
3. 拍牙處理：無
4. 鉚釘處理：無
5. 毛邊方向：如圖面標示，毛邊高度需小於料厚 5%
6. 外觀要求：不可有銳角、油污、明顯氧化及刮傷等情形
7. 圖面未標示之尺寸請參照 3D or 2D CAD，未標示之圓角為 R=1.50mm，未標示公差尺寸請依公差表進行製作
8. 球標尺寸為重要管制尺寸，供應商必須有專程管制計劃
9. 部品量產前需經過樣承認程序，由及至微工程人員承認
10. 送貨需附部品相關檢驗報告（重點尺寸量測報告及其他指定證明文件）

04				
03				
02	08.Dec.'22	Basic Dim. Marking	Eddie	
01	18.Oct.'22	Release P/N & Defined Outline Tol.	Eddie	
00	31.Aug.'22	Initial Release	Eddie	
Sym.	Date	Description of revision	Drawn	Aprd.
History				

Scale	1:1	Size	A3	Ultimems, Inc. 及至微機電股份有限公司	
Projection		Sheet No.	1/1		
Unit	mm	Date	08.Dec.'22		
Approved		Material	AL-6063	Part Name	Base
Checked		Weight			
Designer	Eddie Ching	Dwg. No.		Part Number	5-MM00078
Drawn	Eddie Ching	Version	02		



Sym.	Date	Description of revision	Drawn	Aprd.
00	28.Aug.'23	Initial Release	Eddie	

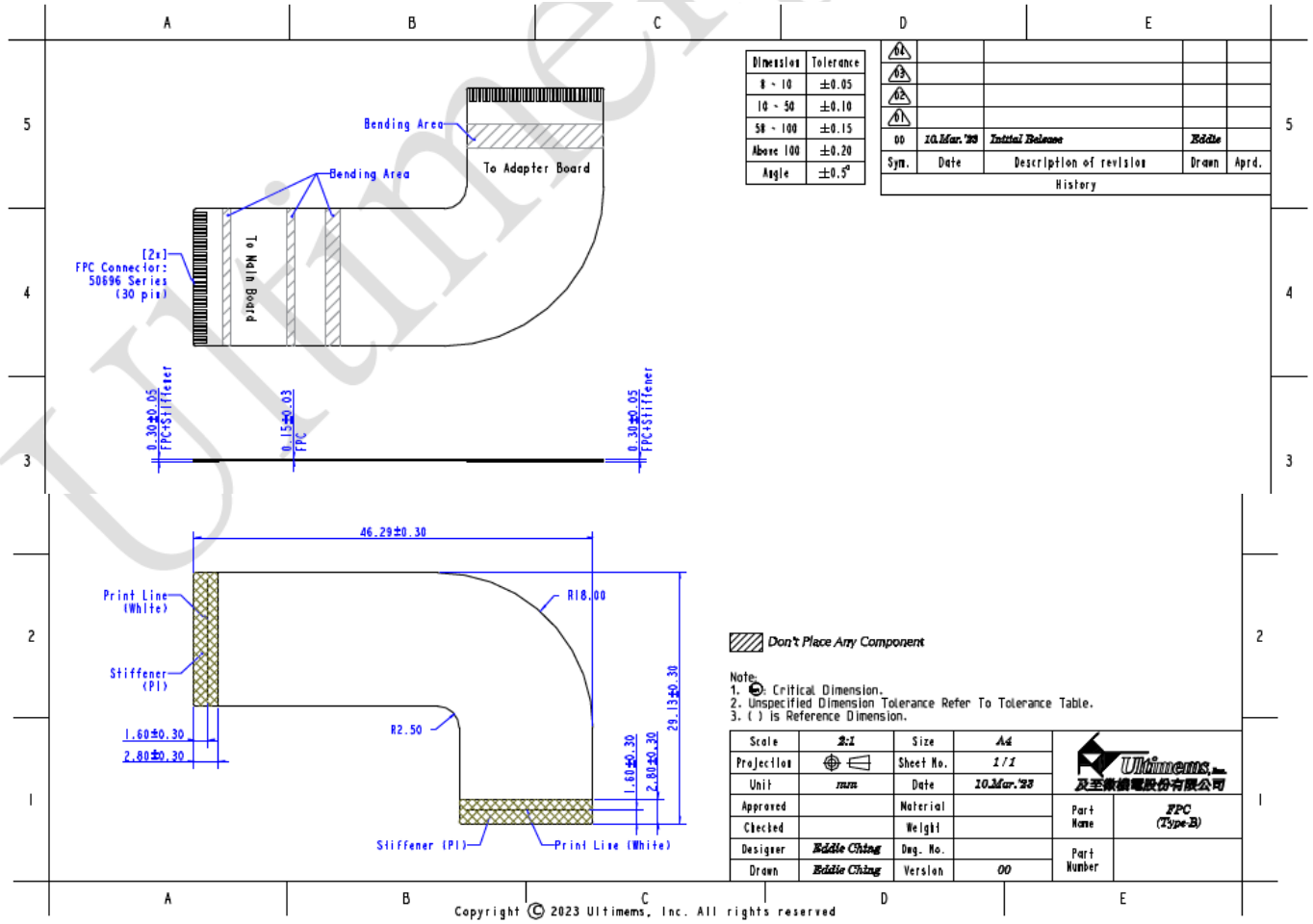
History

Scale	2:1	Size	A4
Projection		Sheet No.	1/1
Unit	mm	Date	28.Aug.'23
Approved		Material	
Checked		Weight	
Designer	Eddie Ching	Dwg. No.	
Drawn	Eddie Ching	Version	00

Ultimems, Inc. 及至微機電股份有限公司

Part Name: FPC (Type-A)

Part Number:



Dimension	Tolerance
0 ~ 10	±0.05
10 ~ 50	±0.10
50 ~ 100	±0.15
Above 100	±0.20
Angle	±0.5°

Sym.	Date	Description of revision	Drawn	Aprd.
00	10.Mar.'23	Initial Release	Eddie	

History

Don't Place Any Component

Note:
1. ◎: Critical Dimension.
2. Unspecified Dimension Tolerance Refer To Tolerance Table.
3. ( ) is Reference Dimension.

Scale	2:1	Size	A4
Projection		Sheet No.	1/1
Unit	mm	Date	10.Mar.'23
Approved		Material	
Checked		Weight	
Designer	Eddie Ching	Dwg. No.	
Drawn	Eddie Ching	Version	00

Ultimems, Inc. 及至微機電股份有限公司

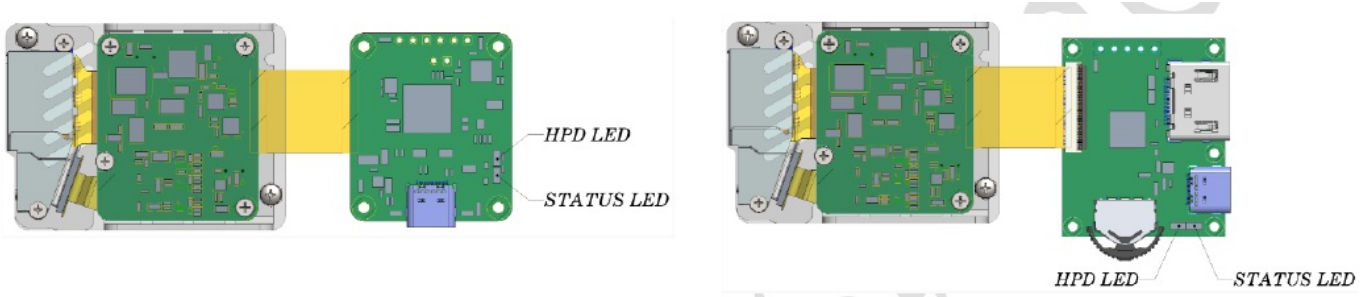
Part Name: FPC (Type-B)

Part Number:

Troubleshooting

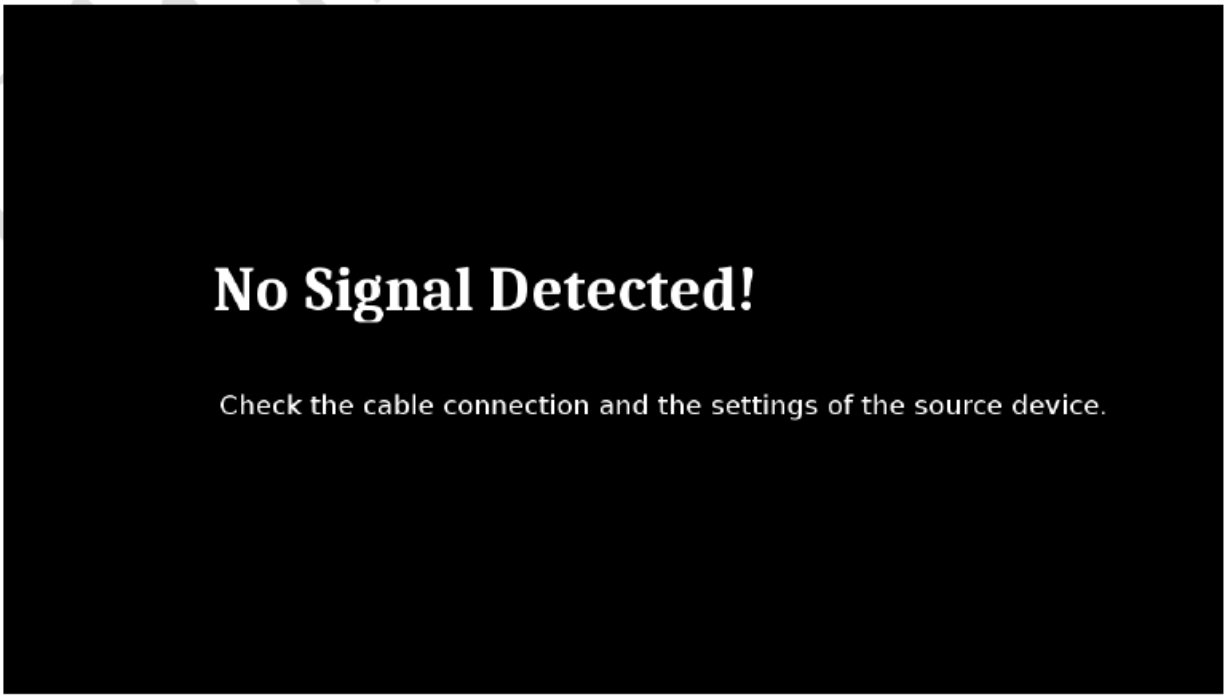
STATUS and/or HPD LEDs do not light up or fast-blinking.

- Step 1: Make sure your DRP/DRD*(e.g. PCs, smartphones, etc.) and cable support Type-C DP* Alt.* mode when using the Type-C converter board.
- Step 2: Make sure cable, FPC, Digital video interface source or DRP/DRD, and the HD309D1-C1 are securely connected.
- Step 3: Make sure that the HD309D1-C1 operates over a specified temperature range.
- Step 4: Unplug the cable from the HD309D1-C1 and plug it back in.



No image from the projector.

- Step 1: Make sure your DRP/DRD (e.g. PCs, smartphones, etc.) and cable support Type-C DP Alt. mode when using the Type-C converter board.
- Step 2: Make sure cable, FPC, Digital video interface source or DRP/DRD, and the HD309D1-C1 are securely connected.
- Step 3: Make sure that the HD309D1-C1 operates over a specified temperature range.
- Step 4: Unplug the cable from the HD309D1-C1 and plug it back in



The projected image color is not correct (e.g. reddish) or distorted.

- Step 1: Take a cleanroom wiper to wipe away any particles from the lens. Step 2: Make sure your DRP/DRD (e.g. PCs, smartphones, etc.) and cable support Type-C DP Alt. mode when using the Type-C converter board.

- Step 3: Make sure cable, FPC, Digital video interface source or DRP/DRD, and the HD309D1-C1 are securely connected.
- Step 4: Make sure that the HD309D1-C1 operates over a specified temperature range.
- Step 5: Unplug the cable from the HD309D1-C1 and plug it back in.
- Step 6: Check the projection surface/screen color.

The projected image is jumping or shaking.

- Step 1: Make sure your DRP/DRD (e.g. PCs, smartphones, etc.) and cable support Type-C DP Alt. mode when using the Type-C converter board.
- Step 2: Make sure cable, FPC, Digital video interface source or DRP/DRD, and the HD309D1-C1 are securely connected.
- Step 3: Make sure that the HD309D1-C1 operates over a specified temperature range.
- Step 4: Check whether there are any sources of vibration (e.g. speaker.) close to the HD309D1-C1.
- Step 5: Check whether there are any sources of magnetic field (e.g. magnet.) close to the HD309D1-C1.
- Step 6: Unplug the cable from the HD309D1-C1 and plug it back in.
- Step 7: Keep the magnetic field away from the projection module.

The projected images flicker, or blurry is displayed.

- Step 1: Make sure the HD309D1-C1 isn't projected onto a non-planar screen.
  It is recommended that you project onto a smooth and flat surface. Step 2: Entering OSD* menu via OSD SW tool or the function key.
- Step 3: Select [Sharpness] to adjust.

Color convergence problem (the alignment of the green and blue colors)

- Step 1: Make sure the projection surface should not be colored or textured. Step 2: Entering OSD menu via OSD SW tool or the function key.
- Step 3: Select [Green/ Blue Alignment] to adjust.

The projected image is distorted.

- Step 1: Make sure the HD309D1-C1 isn't projected onto a non-planar screen. It is recommended that you project onto a smooth and flat surface.
- Step 2: Make sure your DRP/DRD (e.g. PCs, smartphones, etc.) and cable support Type-C DP Alt. mode when using the Type-C converter board.
- Step 3: Make sure cable, FPC, Digital video interface source or DRP/DRD, and the HD309D1-C1 are securely connected.
- Step 4: Make sure that the HD309D1-C1 operates over a specified temperature range.
- Step 5: Unplug the cable from the HD309D1-C1and plug it back in.

***Abbreviate**

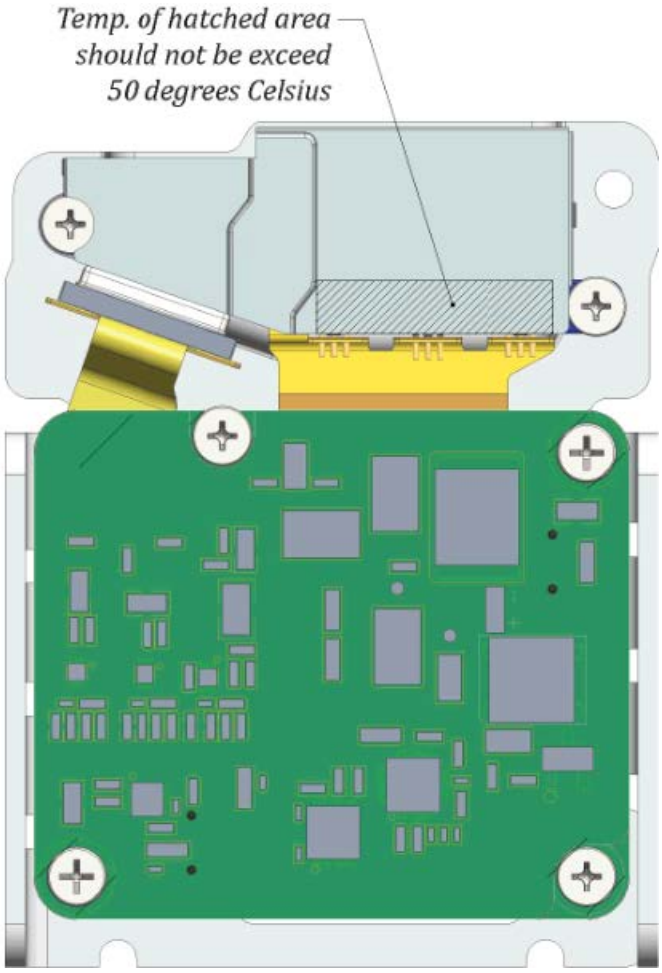
- HDP: Hot plug detect
- DRP: Dual-role power
- DRD: Dual-role data
- Alt: Alternate
- DP: DisplayPort
- OSD: On-screen display

Note:

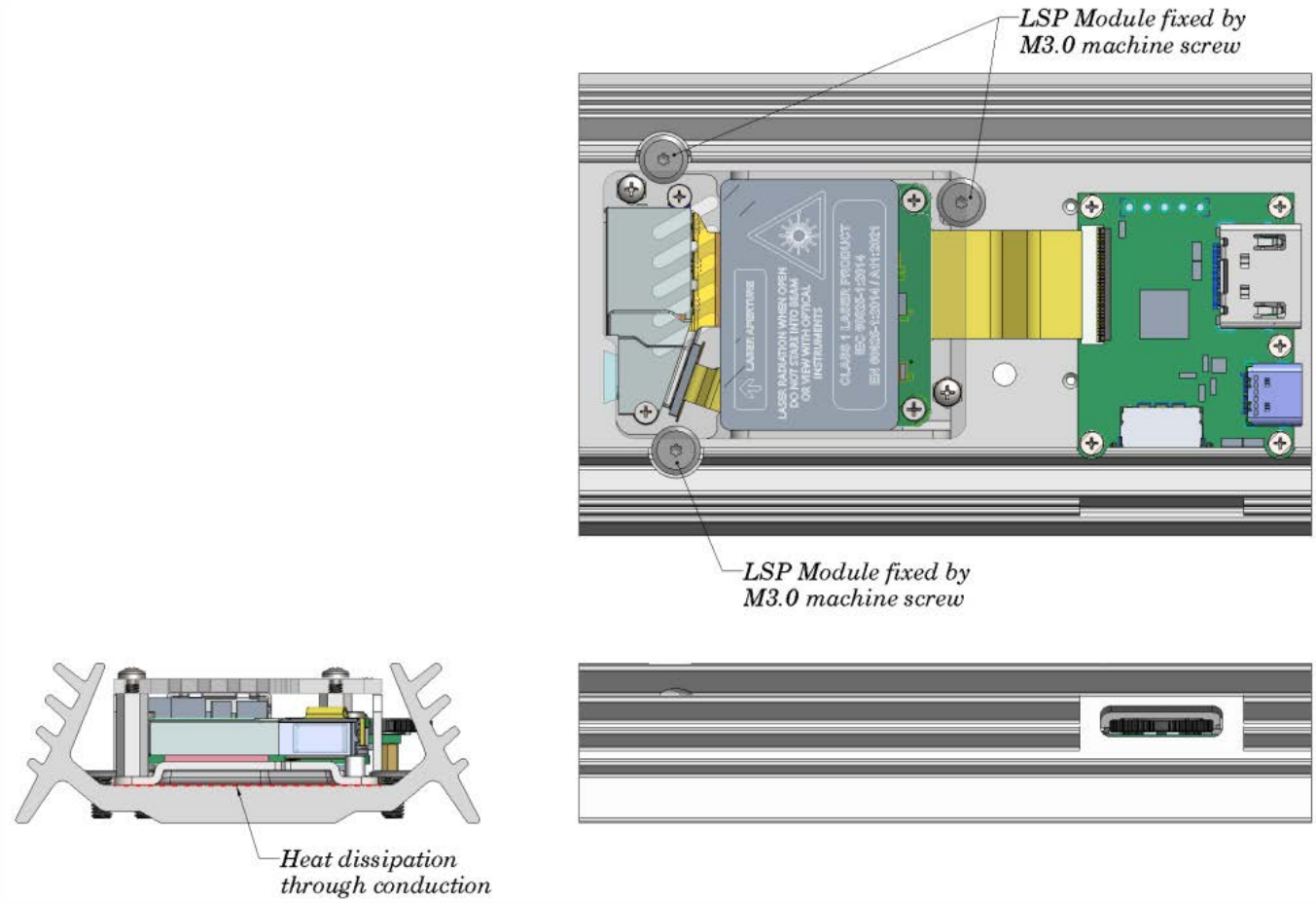
- Some DRP/DRD is designed to enter protection mode when an over-current event is occurring. In protection mode, the DRP/DRD may turn off DP Alt. mode function to protect itself for system stability. This may lead to abnormal behavior of the HD309D1-C1.
- Please contact your local reseller for technical support if you still cannot solve your problems with the suggested methods.

Thermal requirement

The thermal design is expected to make the temperatures of the specified top cover area never exceed 50°C as shown in attached figure. If the specified area temperature over 50°C, the laser diodes could be damaged or degraded due to the high temperature, the liability for damages will be excluded.



The recommended thermal solution is as shown in attached figure, a metal base is needed to place under the MEMS scanning projection module. The minimum metal base size is 105.0 x 66.5 x 23.0 mm, and the drawing of reference design is as page



OSD Manual

Operation Method if converted board is “ Type C type”

- Step 1: Create a directory named “OSD-BUTTON” in the personal computer (PC).
- Step 2: Scanning the QR code card inside the box (please refer to page 5). And download compressed app zip file into the “OSD-BUTTON”.
- Step 3: Un-compress app zip file in “OSD-BUTTON”
- Step 4: Connect HD309D1-C1 and PC and wait for desktop of PC display projecting through HD309D1-C1.
- Step5: Double click icon as right side to launch OSD SW tool  app
- Step6: OSD SW tool and the image of main screen / button function description as below in the PC display

Main screen

Button function

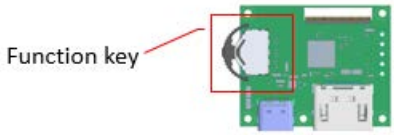
-  Exit app
-  Move focus up
-  Enter focus setting
-  Move focus down

Step7: There are two ways to tap the icon of OSD SW tool as above. If you use the keyboard, the keystroke function is as below.

-  Exit app
-  Enter focus setting
-  Toggle OSD menu (Test connection)
-  Move focus up / down / backward / forward

Operation Method if converted board is “Digital video interface type”

- Step 1: Press and hold Function key [Enter] for 3 to 5 seconds, you will see a “On-Screen Display” (OSD) menu.
- Step 2: When the OSD menu is activated, these keys are used as directional arrows to select the desired menu items and to make adjustments. Select the operation menu and select an item (press Function key) Step 3: Adjust the parameters according to the displayed adjustment items
- Step 4: Select “Save” and save the setting.
- Step5: Press and hold Function key [Enter] for 3 to 5 seconds to return display mode



OSD menu and setting

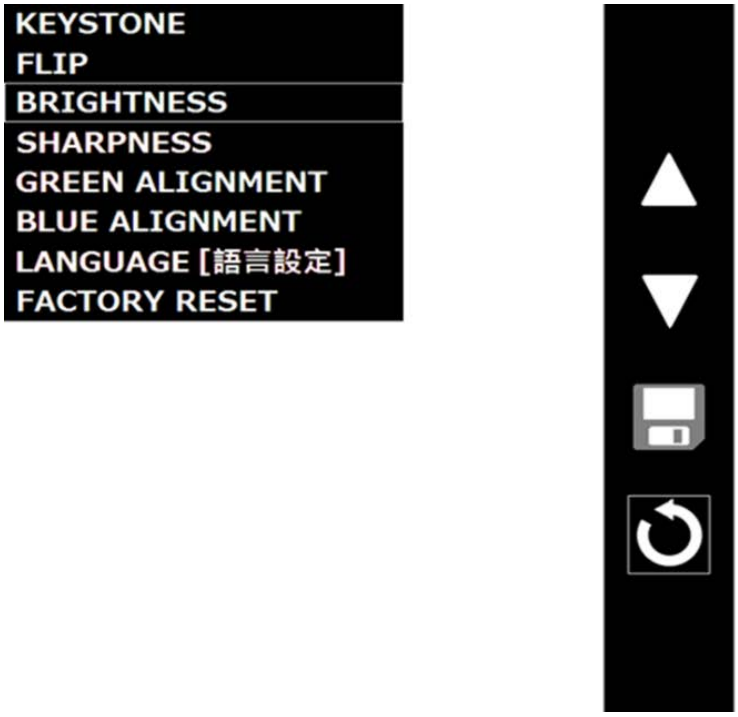
Note: It also can enter this menu via the function key when using the Digital video interface converter board)

1. **Language**

   There are four languages for your selection.(Traditional Chinese) , (Simplified Chinese) , English , (Japanese)

2. BRIGHTNESS

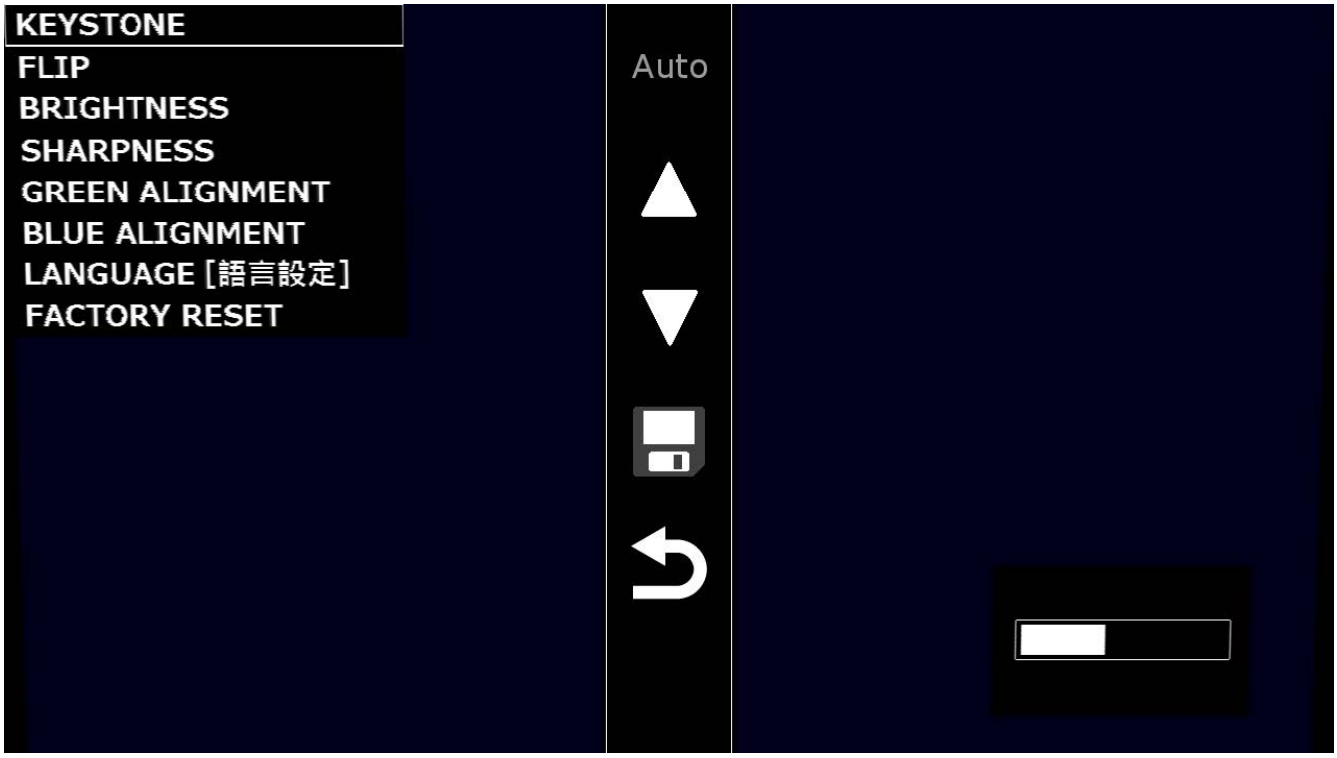
   Adjust the screen brightness



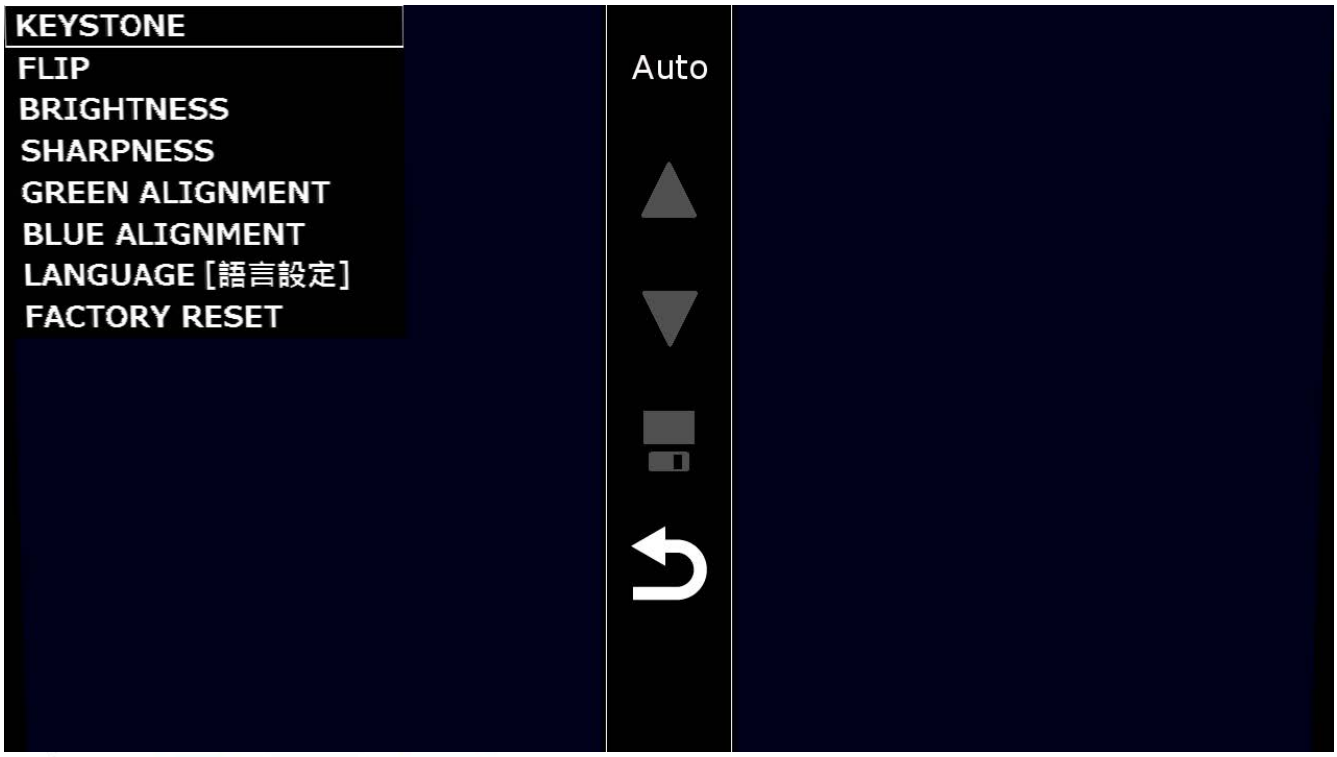
3. KEYSTONE: Vertical directional distortion correction

   Corrects trapezoidal distortion that occurs when the projector is tilted up and down.

   <Auto keystone off>



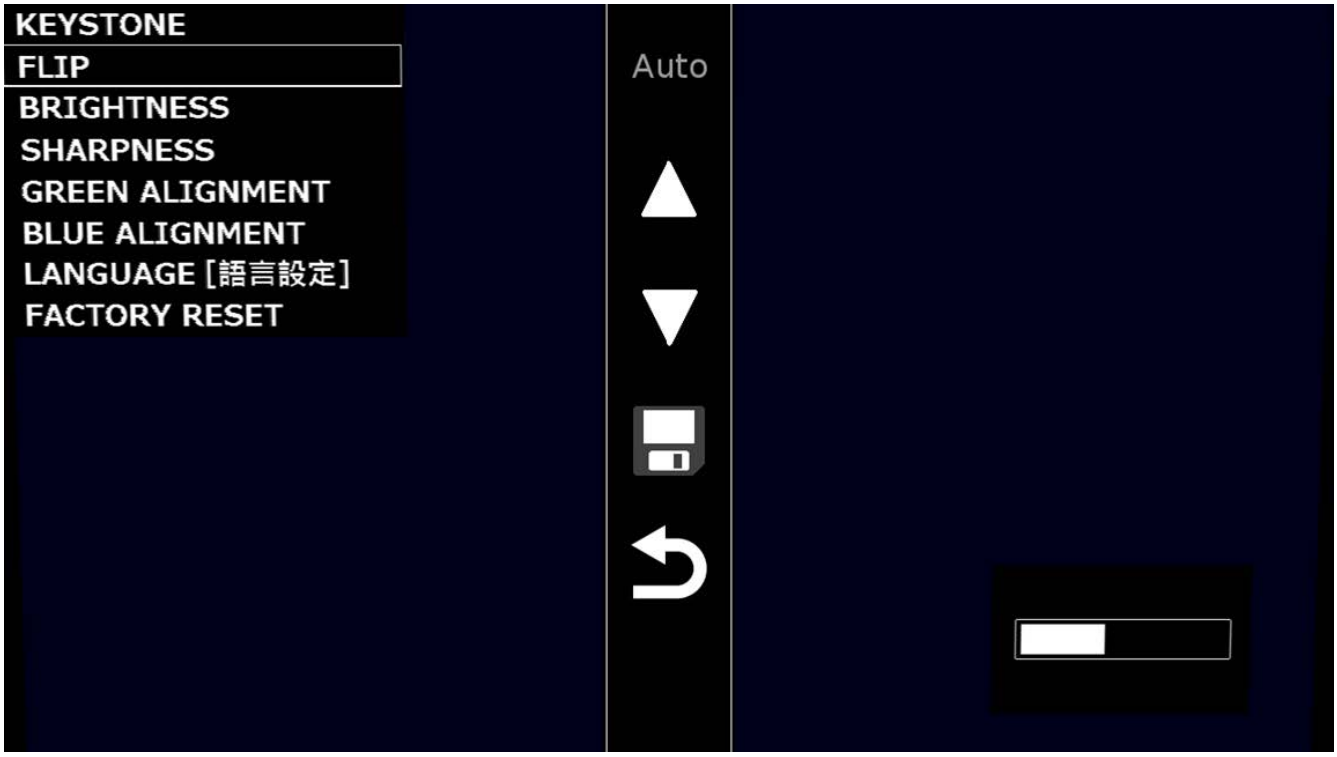
   <Auto keystone on>



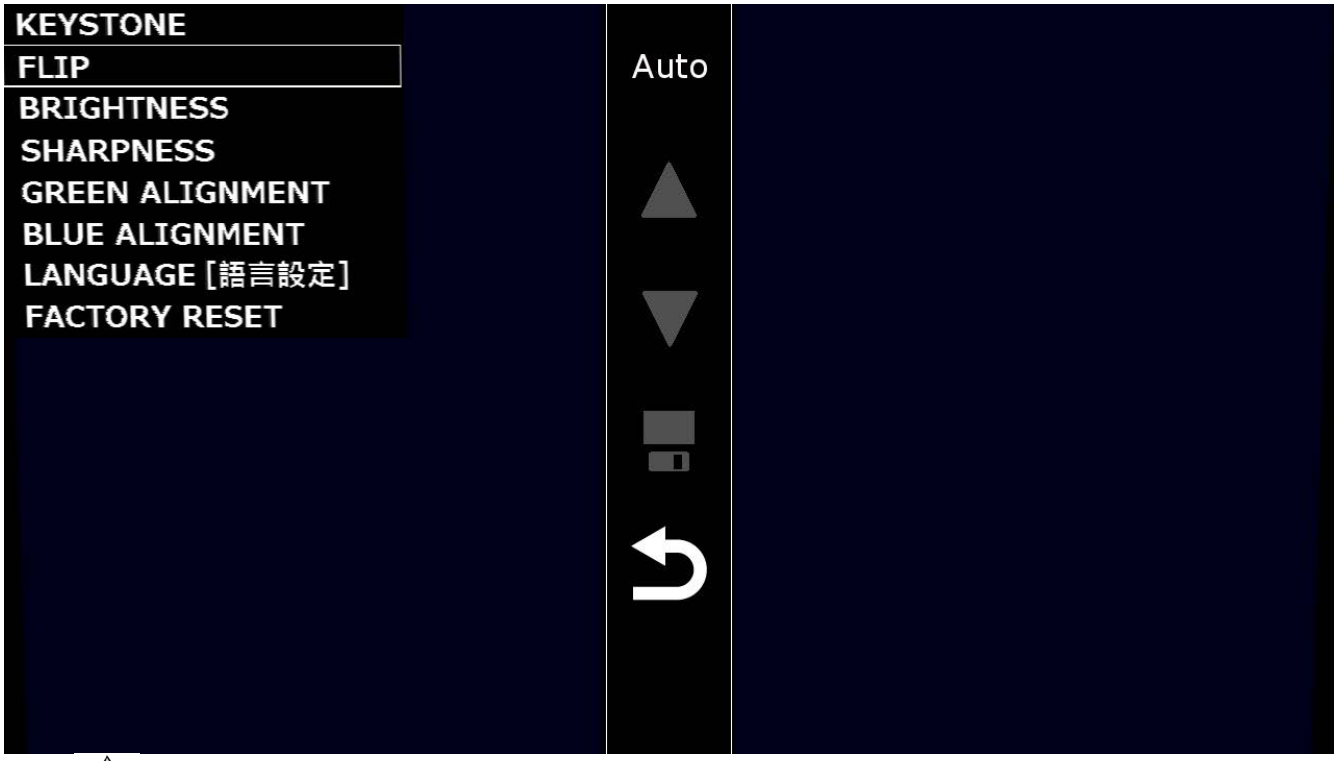
Auto : Auto vertical keystone (±29 degrees)

4. FLIP: Image flip

You can flip the display image vertically and horizontally <Auto flip off>



<Auto flip on>



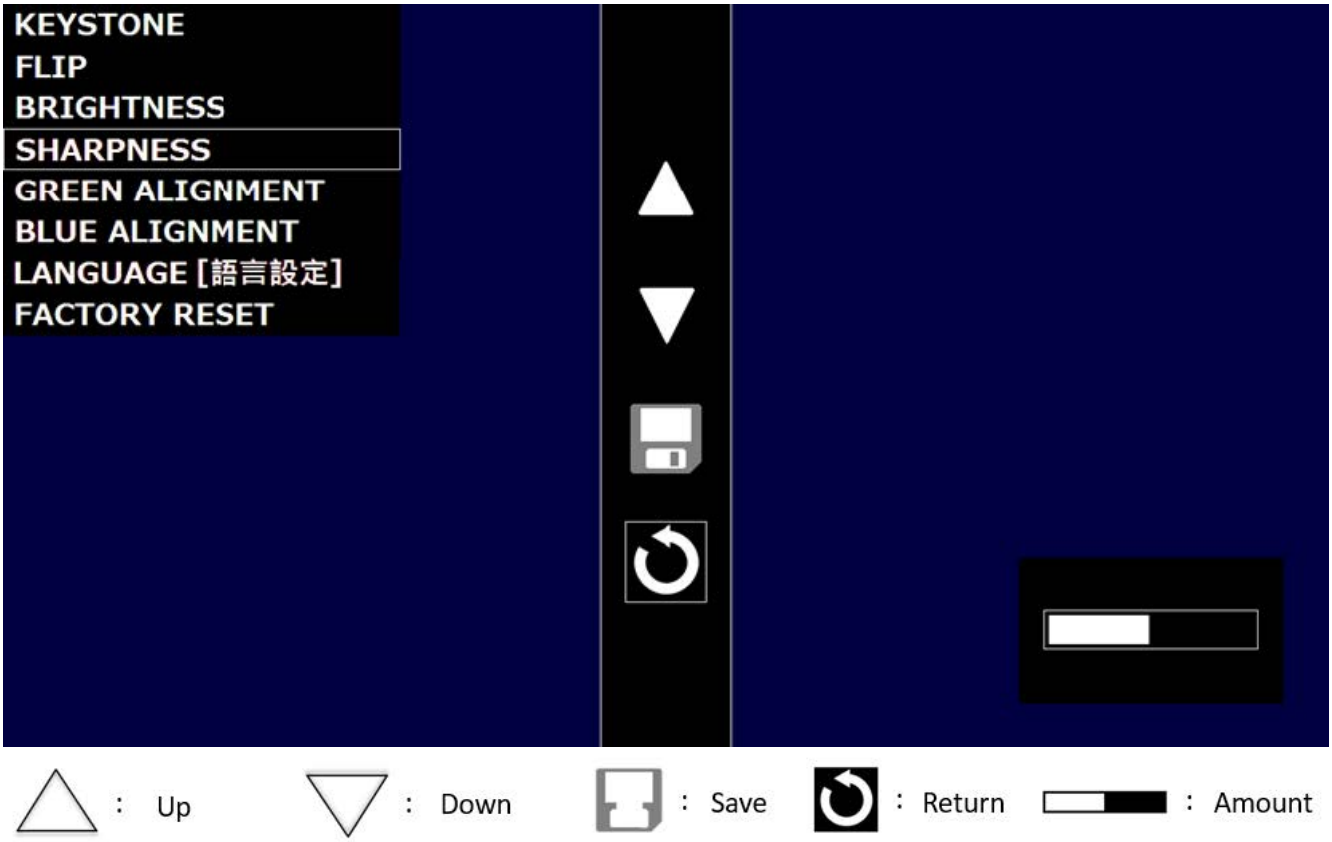
-  Upper left -> Upper right -> Lower left -> Lower right -> Return
-  Lower right -> Lower left -> Upper right ->Upper left – Return
- 

Flip is adjusted automatically
-  Save
-  Return

- Amount

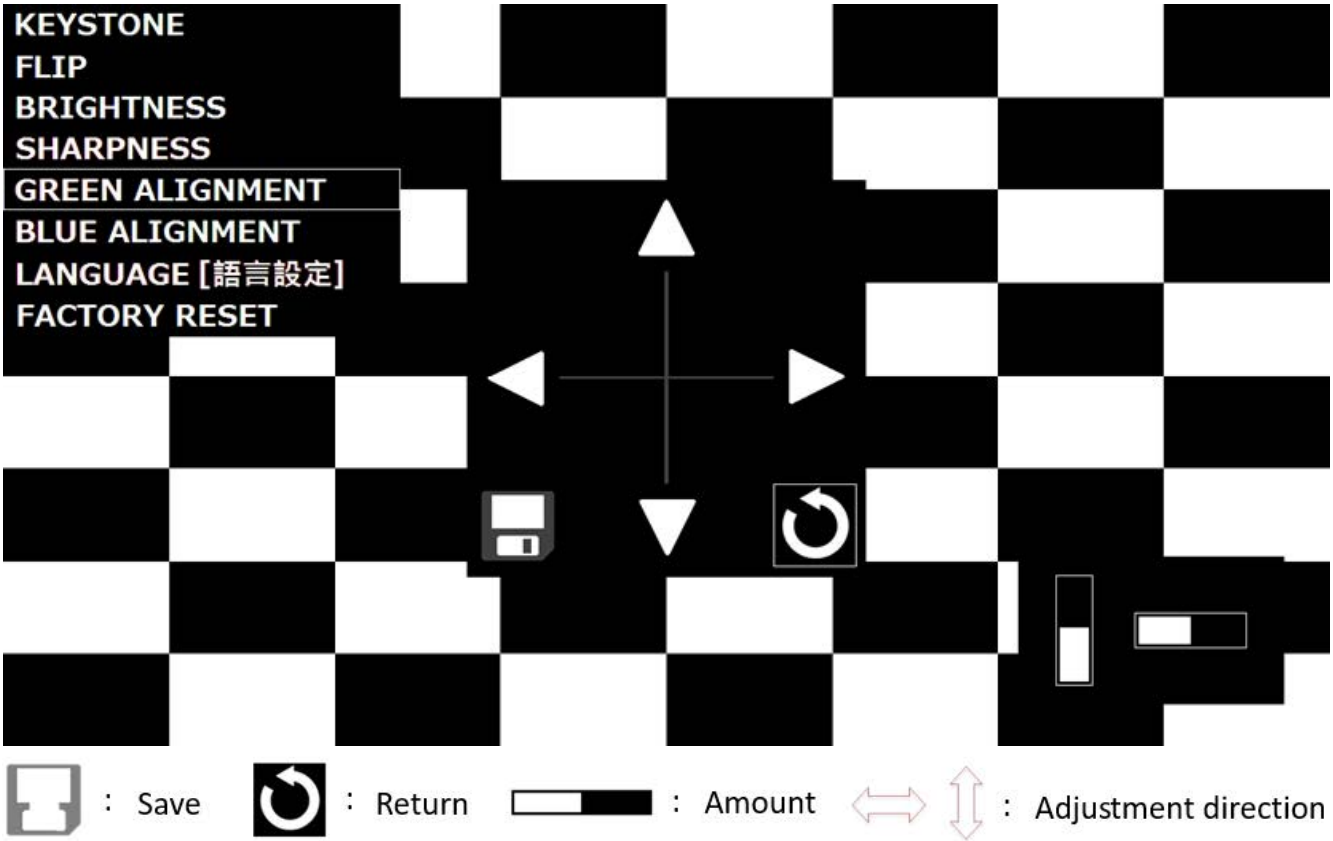
5. SHARPNESS: Fine adjustment for misalignment

   Adjust the vertical double line at the center of the screen to one.



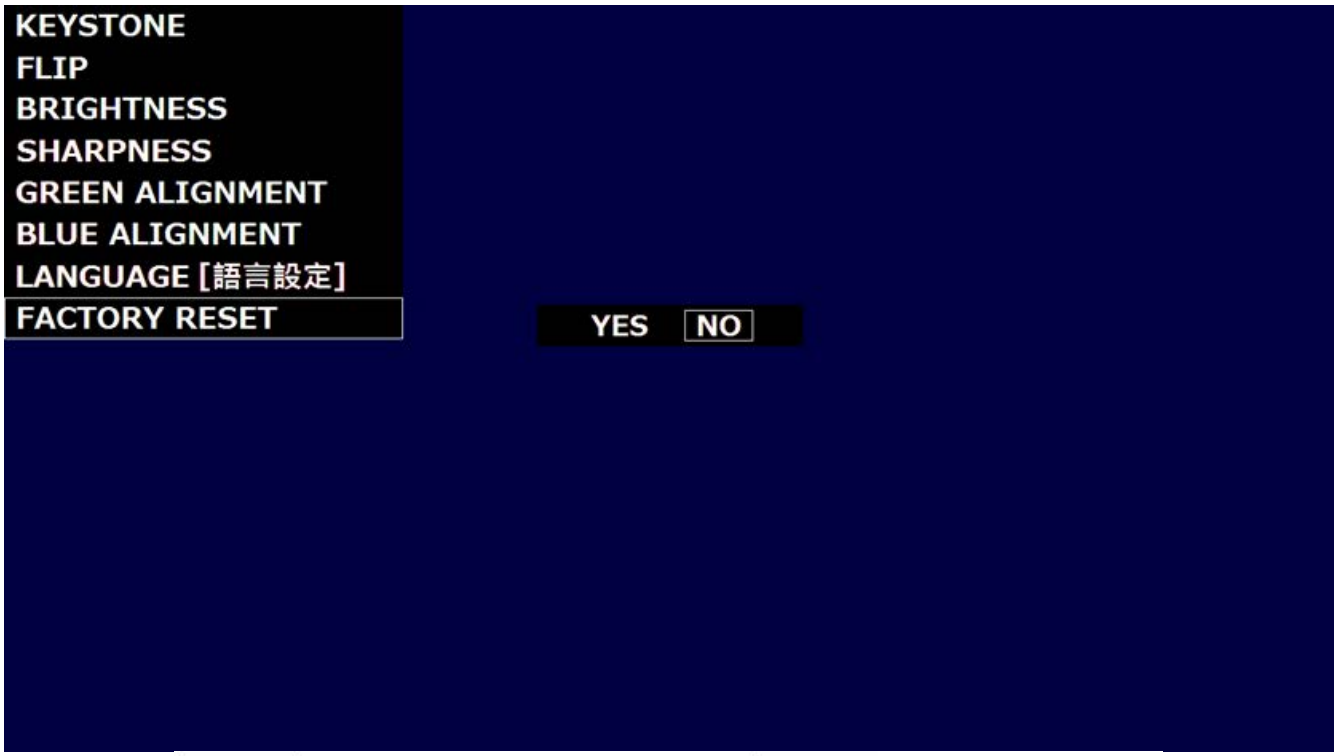
6. GREEN/BLUE ALIGNMENT: Color shift adjustment

   The color shift (RGB) adjustment of this machine is adjusted by finely adjusting the positions of green and blue colors.



7. FACTORY RESET: Reset (return to initial settings)

   Reset all settings items to default value



Yes : Restore default settings No : Keep settings

Precautions of use

- Do not point the laser light at a mirror, etc. as the reflected laser light may be harmful to eyes.
- Don’t remove the black tape on the module
- Magnetic or electric noise may cause HD309D1-C1 abnormal or the noise from HD309D1-C1
- Children should only use HD309D1-C1 under adult supervision. Keep the HD309D1-C1 out of reach of infants.
- Do not short-circuit HD309D1-C1. Do not allow metal objects such as hairpins to come into contact with HD309D1-C1 or its terminals.
- Do not disassemble or modify HD309D1-C1
- Do not place HD309D1-C1 in fire nor heat it in a microwave oven or oven.
- Do not allow HD309D1-C1 to get wet with fresh water, sea water, milk, soft drinks or soap water. Do not use HD309D1-C1 while wet.
- Do not use or store HD309D1-C1 in a place where temperature is extremely high, such as near a fire, under direct sunlight, near a heater or in a car parked in the sun. Do not use HD309D1-C1 in a place with poor ventilation, such as while wrapped in a quilt/ blanket or in a bag.
- Do not apply a strong impact to HD309D1-C1. Avoid hitting it with a hammer, putting any heavy object on top, stepping on it or dropping it.
- Avoid continuous contact between your skin and HD309D1-C1 while in use. Doing so may cause low-temperature burns. Be careful of heat transmitted through clothes as it may also cause low temperature burns.
- Do not touch or stick your finger into the connection parts.
- Ulitmems, Inc. is not liable for damage or loss resulting from the use of HD309D1-C1, or for any claim from a third party.
- Ulitmems, Inc. is not liable for problems with your PC, cell phone or other hardware arising from the use of HD309D1-C1; the suitability of the product for specific hardware, software, or peripherals; operating conflicts

with other installed software; data loss; or other accidental or unavoidable damages.

- If a malfunction occurs, stop use and contact KSY.
- Use HD309D1-C1 in a place where there is no dust or cigarette smoke because HD309D1-C1 is a precision apparatus.
- Use on a stable or flat surface when using HD309D1-C1
- Do not place HD309D1-C1 close to credit and other cards. Doing so may result in the loss of recorded data.
- Ulitmems, Inc. is not responsible for, and the Limited Warranty does not cover, any damage arising from a failure to operate the product within its intended uses, or otherwise follow the user's manual and safety instructions relating to the product's use and installation
- The Limited Warranty does not cover products purchased from sources other than Ulitmems, Inc. or a Ulitmems, Inc. authorized dealer (including non-authorized online auctions), or issues due to: (i) outdoor exposure and other acts of nature; (ii) power surges; (iii) accidental damage; (iv) abuse; (v) limitations of technology; (vi) cosmetic damage; (vii) contact with liquid, heat, humidity or perspiration, sand, smoke, or foreign materials; (viii) use of parts or supplies not sold or authorized by Ultimems, Inc. ; (ix) servicing not authorized or performed by Ultimems, Inc. or a Ultimems, Inc. authorized service center; (x) computer or internet viruses, bugs, worms, or Trojan Horses; (xi) malfunctions due to peripherals/accessories; (xii) modifications of or to any part of the product, including "rooting" or other modifications to control the behavior of the product or any factory installed operating system; (xiii) consumable parts such as batteries, cable; or (xiv) any product where the factory-applied serial number has been altered or removed from the product.

Eye safety precautions

1. The HD309 is a certified Class 1 Laser Product (IEC 60825-1:2014 + IEC62471-5)
2. Beware the eyes injured that caused by laser beam, so please do not look at laser beam directly.

Laser Color	**Green**	**Red**	**Blue**
Part No.	OSRAM PLT3 520D	USHIO HL63653TG	OSRAM PLT3 450GB
Wavelength(min/max)	515nm/530nm	635nm/645nm	440nm/460nm

Recommend resolution setting of Raspberry Pi

When using "Digital video interface converter board" connecting to Raspberry Pi, recommend resolution setting: Setting the values of "hdmi_group" and "hdmi_mode" in the config file and steps/example are showed as below

1. Uncomment (remove # symbol) "hdmi_group" and "hdmi_mode".
2. Change the value of "hdmi_group" to "2" and "hdmi_mode" to "85".
3. Force the Raspberry Pi to use HDMI mode.
   Edit /boot/config.txt and uncomment hdmi_force_hotplug as shown below hdmi_force_hotplug=1
4. Reboot Raspberry Pi: sudo reboot
    - Example as below

- # uncomment if you get no picture on HDMI for a default “safe” mode
- #hdmi_safe=1
- # uncomment this if your display has a black border of unused pixels visible # and your display can output without overscan
- #disable_overscan=1
- # uncomment the following to adjust overscan. Use positive numbers if console # goes off screen, and negative if there is too much border
- #overscan_left=16
- #overscan_right=16
- #overscan_top=16
- #overscan_bottom=16
- # uncomment to force a console size. By default it will be display’s size minus # overscan.
- #framebuffer_width=1280
- #framebuffer_height=720
- # uncomment if hdmi display is not detected and composite is being output
- #hdmi_force_hotplug=1
- # uncomment to force a specific HDMI mode (this will force VGA)
- hdmi_group=2
- hdmi_mode=85
- HD309D1-C1 Ver. 1.0
- MEMS Scanning Projection Module
- # uncomment to force a HDMI mode rather than DVI. This can make audio work in # DMT (computer monitor) modes #hdmi_drive=2 # uncomment to increase signal to HDMI, if you have interference, blanking, or # no display #config_hdmi_boost=4 # uncomment for composite PAL #sdtv_mode=2 #uncomment to overclock the arm. 700 MHz is the default. arm_freq=900 # for more options see **http://elinux.org/RPi_config.txtcore_freq=250sdram_freq=45over_voltage=2**

Documents / Resources

	**Ultimems HD309D1-C1 Scanning Projection Module** [pdf] User Manual HD309D1-C1 Scanning Projection Module, HD309D1-C1, Scanning Projection Module, Projection Module, Module

References

- **RPiconfig - eLinux.org**
- **User Manual**