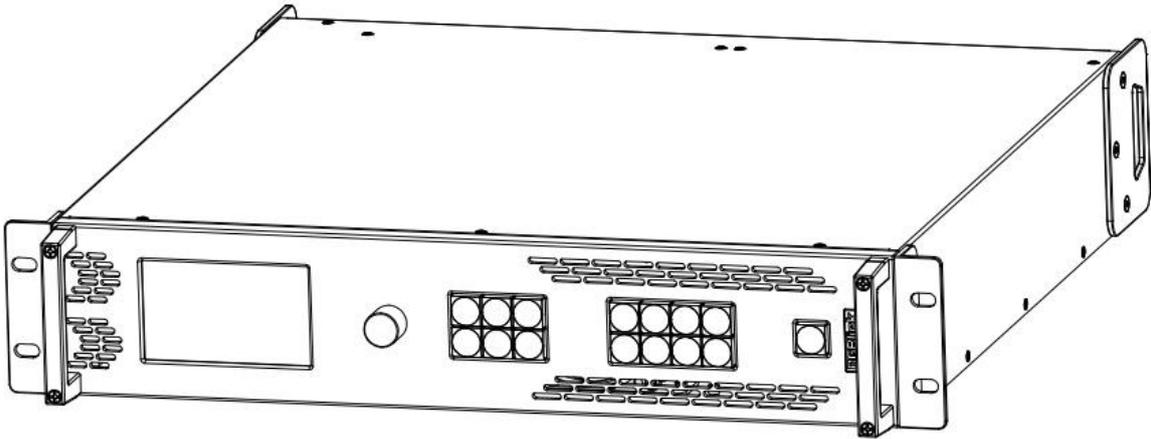
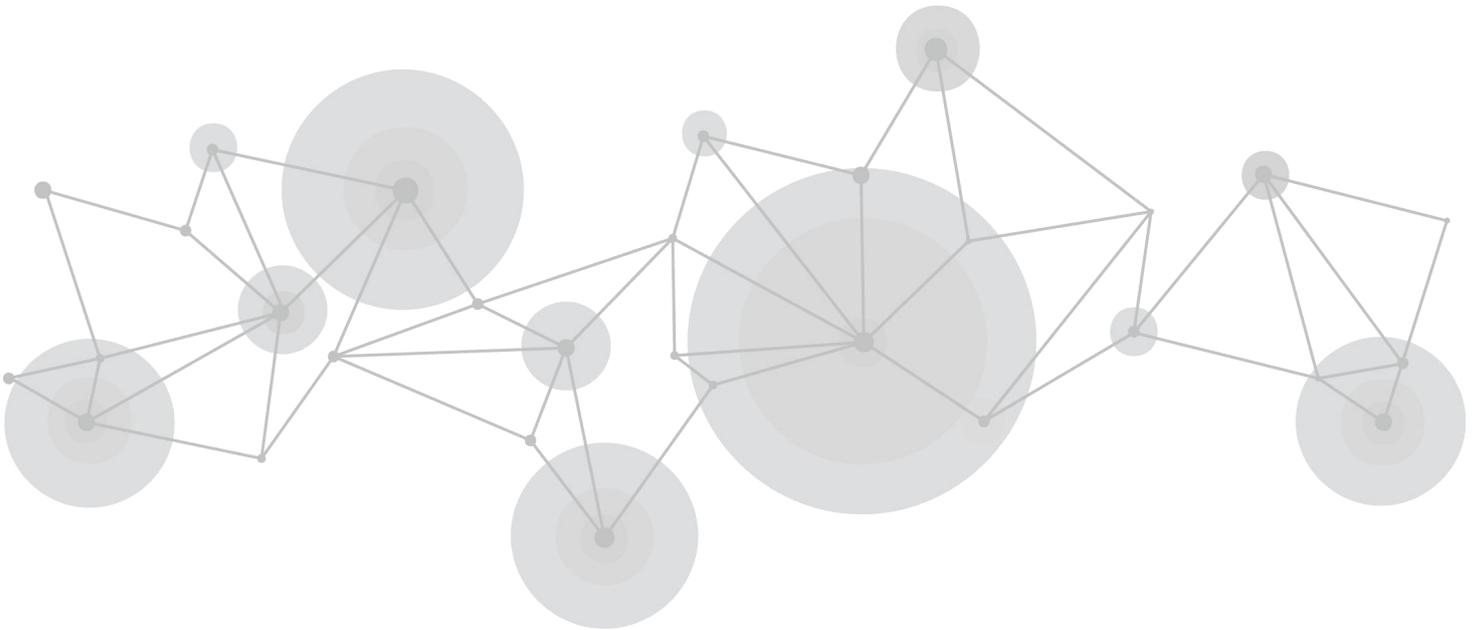

FLEX 4ml



USER MANUAL

RGBlink[®]



Article No: RGB-RD-UM-FLEX 4ml
E000
Revision No: V1.0

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Thank you for choosing our product!

This User Manual is designed to show you how to use this video processor quickly and make use of all the features. Please read all directions and instructions carefully before using this product.

Declarations

FCC/Warranty

Federal Communications Commission (FCC) Statement

This equipment has been tested and found to comply with the limits for a class A digital device, pursuant to Part 15 of the FCC rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area may cause harmful interference, in which case the user will be responsible for correcting any interference.

Guarantee and Compensation

RGBlink provides a guarantee relating to perfect manufacturing as part of the legally stipulated terms of guarantee. On receipt, the purchaser must immediately inspect all delivered goods for damage incurred during transport, as well as for material and manufacturing faults. RGBlink must be informed immediately in writing of any complains.

The period of guarantee begins on the date of transfer of risks, in the case of special systems and software on the date of commissioning, at latest 30 days after the transfer of risks. In the event of justified notice of compliant, RGBlink can repair the fault or provide a replacement at its own discretion within an appropriate period. If this measure proves to be impossible or unsuccessful, the purchaser can demand a reduction in the purchase price or cancellation of the contract. All other claims, in particular those relating to compensation for direct or indirect damage, and also damage attributed to the operation of software as well as to other service provided by RGBlink, being a component of the system or independent service, will be deemed invalid provided the damage is not proven to be attributed to the absence of properties guaranteed in writing or due to the intent or gross negligence or part of RGBlink.

If the purchaser or a third party carries out modifications or repairs on goods delivered by RGBlink, or if the goods are handled incorrectly, in particular if the systems are commissioned operated incorrectly or if, after the transfer of risks, the goods are subject to influences not agreed upon in the contract, all guarantee claims of the purchaser will be rendered invalid. Not included in the guarantee coverage are system failures which are attributed to programs or special electronic circuitry provided by the purchaser, e.g. interfaces. Normal wear as well as normal maintenance are not subject to the guarantee provided by RGBlink either.

The environmental conditions as well as the servicing and maintenance regulations specified in this manual must be complied with by the customer.

Operators Safety Summary

The general safety information in this summary is for operating personnel.

Do Not Remove Covers or Panels

There are no user-serviceable parts within the unit. Removal of the top cover will expose dangerous voltages. To avoid personal injury, do not remove the top cover. Do not operate the unit without the cover installed.

Power Source

This product is intended to operate from a power source that will not apply more than 230 volts rms between the supply conductors or between both supply conductor and ground. A protective ground connection by way of grounding conductor in the power cord is essential for safe operation.

Grounding the Product

This product is grounded through the grounding conductor of the power cord. To avoid electrical shock, plug the power cord into a properly wired receptacle before connecting to the product input or output terminals. A protective-ground connection by way of the grounding conductor in the power cord is essential for safe operation.

Use the Proper Power Cord

Use only the power cord and connector specified for your product. Use only a power cord that is in good condition. Refer cord and connector changes to qualified service personnel.

Use the Proper Fuse

To avoid fire hazard, use only the fuse having identical type, voltage rating, and current rating characteristics. Refer fuse replacement to qualified service personnel.

Do Not Operate in Explosive Atmospheres

To avoid explosion, do not operate this product in an explosive atmosphere.

Installation Safety Summary

Safety Precautions

For all FLEX 4ml installation procedures, please observe the following important safety and handling rules to avoid damage to yourself and the equipment.

To protect users from electric shock, ensure that the chassis connects to earth via the ground wire provided in the AC power Cord.

The AC Socket-outlet should be installed near the equipment and be easily accessible.

Please refer to and follow the instruction for the save device installation and connection of device.

Unpacking and Inspection

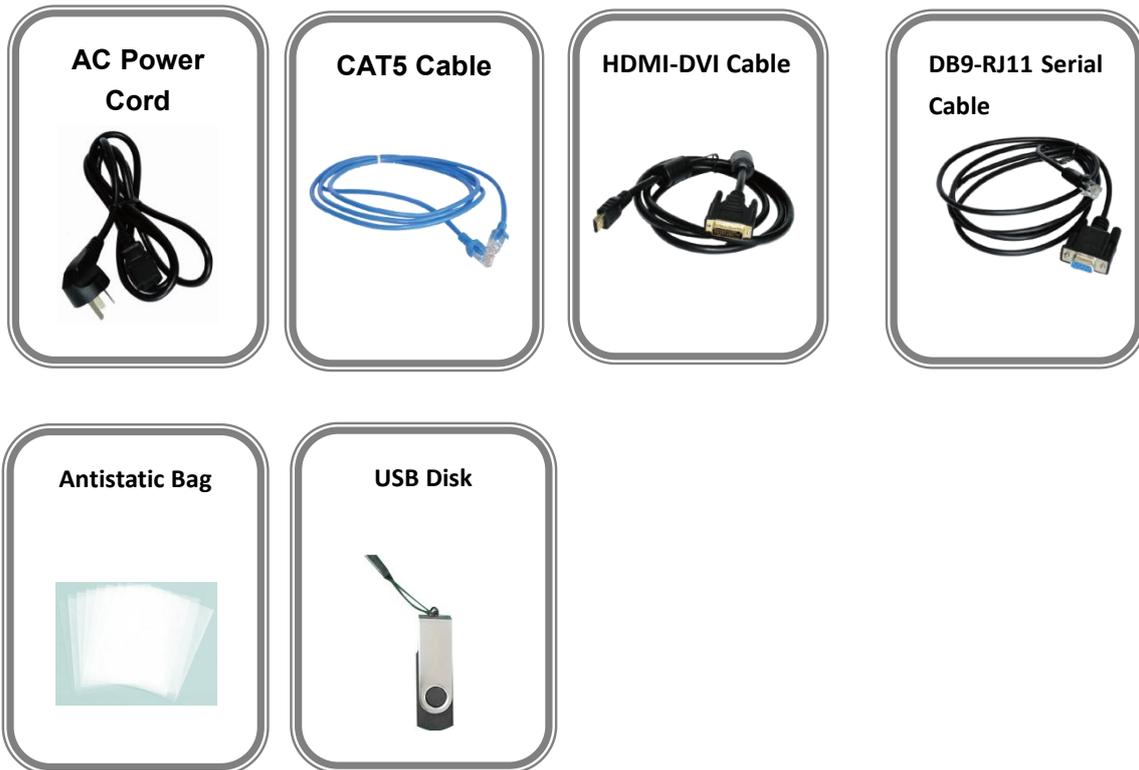
Before opening FLEX 4ml shipping box, inspect it for damage. If you find any damage, notify the shipping carrier immediately for all claims adjustments. As you open the box, compare its contents against the packing slip. If you find any shortages, contact your sales representative. Once you have removed all the components from their packaging and checked that all the listed components are present, visually inspect the system to ensure there was no damage during shipping. If there is damage, notify the shipping carrier immediately for all claims adjustments.

Site Preparation

The environment in which you install your FLEX 4ml should be clean, properly lit, free from static, and have adequate power, ventilation, and space for all components. The device should be far away from drips, so objects such as vases filled with liquid should not be placed on the device.

Chapter 1 Your Product

1.1 In the Box



Note:

AC Power Cable supplied as standard according to destination market.

1.2 Product Overview

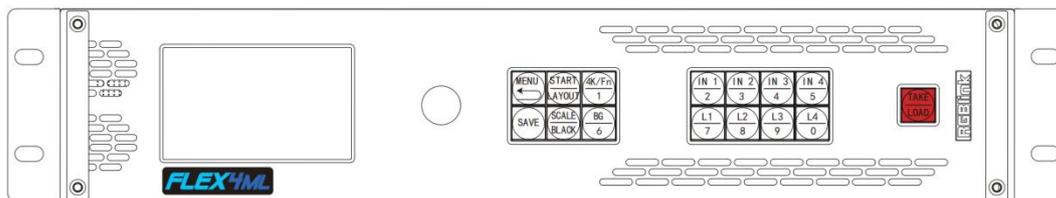
FLEX 4ml is multi-layer videowall splicing processor, standard with one 4K2K@60 digital input module which is formed by DUAL DVI, HDMI 1.4, HDMI 2.0 and DP 1.2 ports and four S-DVI (Sync) modules, supporting for 8 layers in total. The outstanding feature of FLEX 4ml is the built-in splicing and presentation mode patterns which help users to make quick splitting and presentation. Besides control on board, it also support for control via RGBlink XPOSE 2.0.

RGBlink video processing solutions provide a range of flexible configuration options for professional applications.



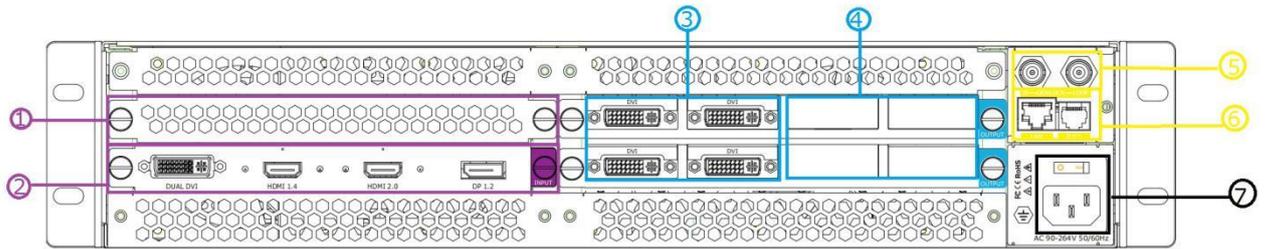
FLEX 4ml System Connection Diagram

1.2.1 Front Panel



Panel Instruction			
	MENU and EXIT		START and LAYOUT
	4K input source select, turn IN1-4 to IN5-8		SAVE SCENE
	SCALE and BLACK out		Background Layer selection
Number1~9	Numbers used in SCALE, CROP, CUSTOM, SAVE and LOAD		IN1/IN2/IN3/IN4 INPUT source selection
	Layer 1-4 selection		Load scene and TAKE to PGM
Knob	Confirm by pushing, selecting items by rotating	LCD panel	Displays current status of the product, and for feature selections, provides interactive choices in conjunction with buttons on the front panel.

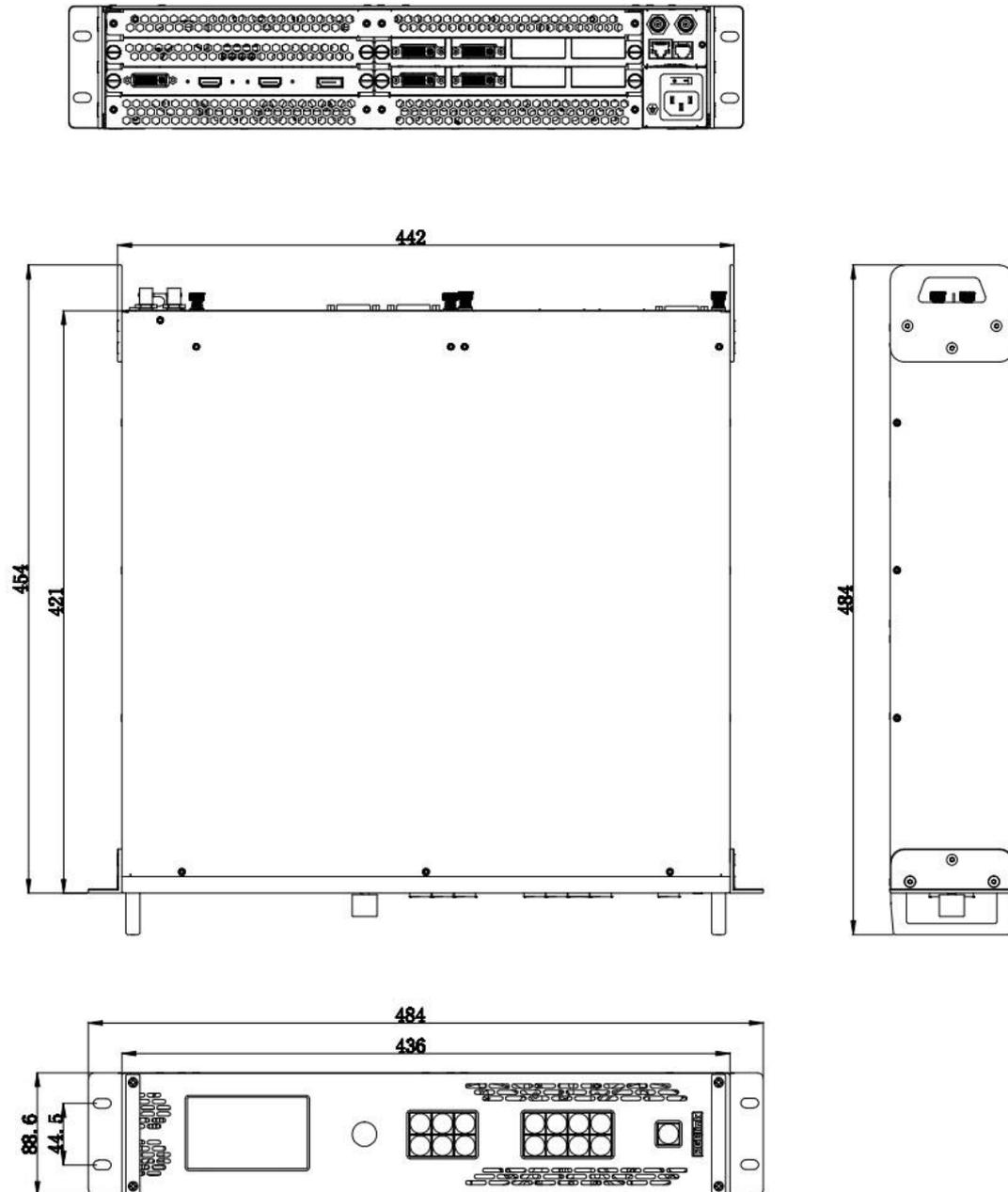
1.2.2 Back Panel



INPUT CONNECTORS		OUTPUT CONNECTORS	
1	Slot for optional inputs up to 4 inputs	3	4 DVI output as standard
2	1 slot for optional single input	4	Optional backup output slot
Communication			
6	Genlock In/Loop	6	LAN Port and RS232 port
POWER			
11	Power switch		
12	Power IEC-3		

1.2.3 Dimension

Following is the dimension of FLEX 4ml for your reference:



Chapter 2 Install Your Product

2.1 Plug in Signals

Connect signals to the product (ensure all devices are powered off first). Tighten connector screws/locks where provided.

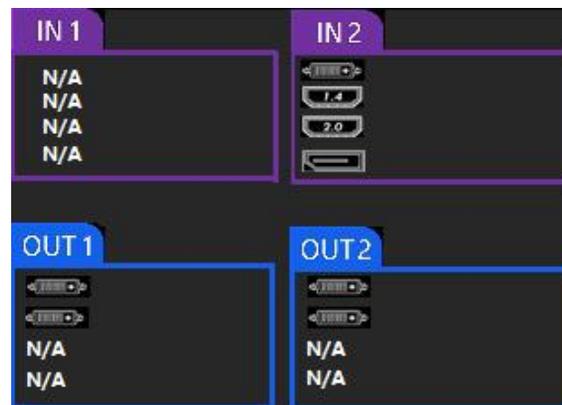
2.2 Plug in Main Power

Connect IEC cable to device and plug into wall socket. Turn on power at wall socket.

2.3 Turn on Your Product

Turn the power switch on the rear to ON position.

TST screen shows as below, meanwhile the device enter initializing state after that, the device will show its input and output and system state.



Chapter 3 Use Your Product

3.1 Use the MENU Button

Push **【MENU】** button to enter main menu.

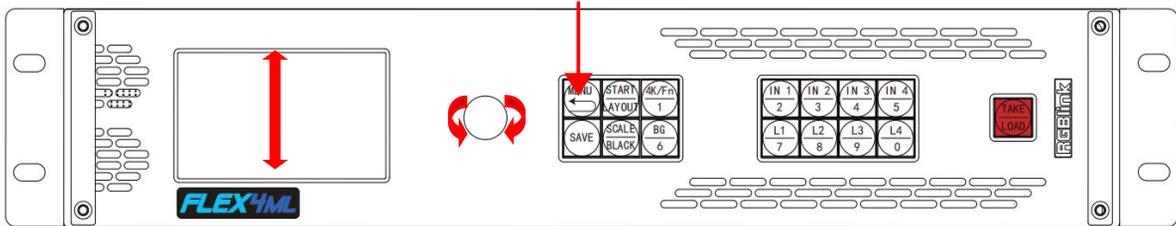
Turn the knob to select corresponding menu item.

The symbol > indicate that the item is selected.

Push the knob or **【OK】** button to confirm the operation.

The symbol * means the selected item is under editing state, ready to be set or checked

The operation diagram is as follows:



3.2 MENU Structure

The MENU structure is shown in the figure below:

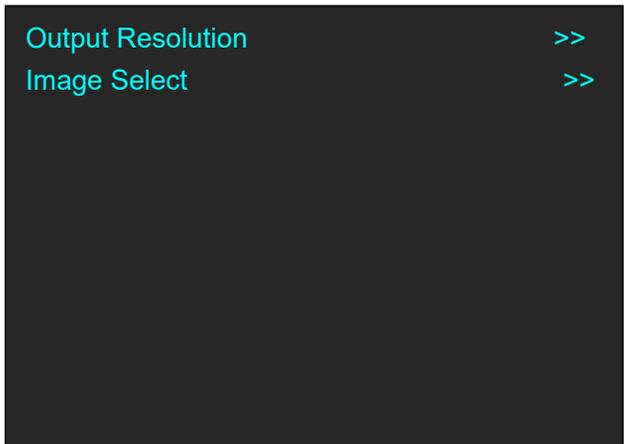
Presentation	Splitting	Advanced	Lanagugage	Factory Reset
Output Resolution	Output Resolution	4K Input Module Mode	English/中文	Factory Reset
Image Select	Image Select	EDID		
	Multi-Split	Input Adjustment		
		Test Pattern		
		Scene Management		
		System Setting		
		Synchronize		

3.3 Use the Menu

Use the menu system for convenient and intuitive operation. FLEX 4ml TST display shows the menu items. The TST display will show the default state when the menu is not in use, or the operation has timed out. Using the 【MENU】 button and rotary knob in the front panel, the TST display will show the corresponding menus according to user selections.

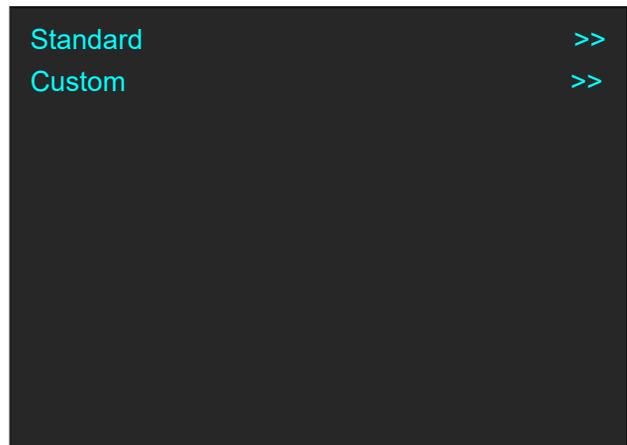
3.3.1 Presentation

After the device is boot up, push MENU, rotate the knob and select <Presentation>

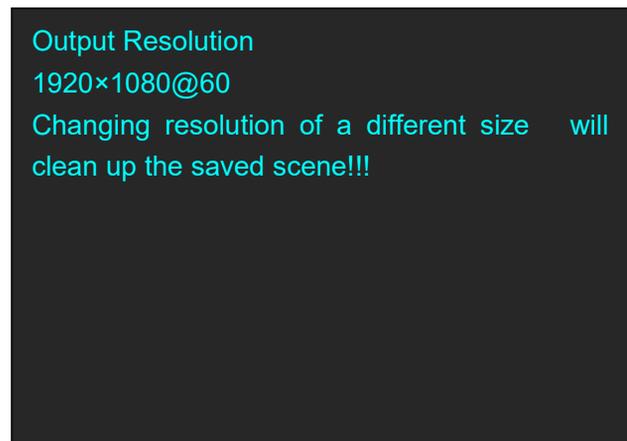


Output Resolution

Output Resolution: Choose Standard or Custom resolution



Standard: rotate the knob to select standard resolution.



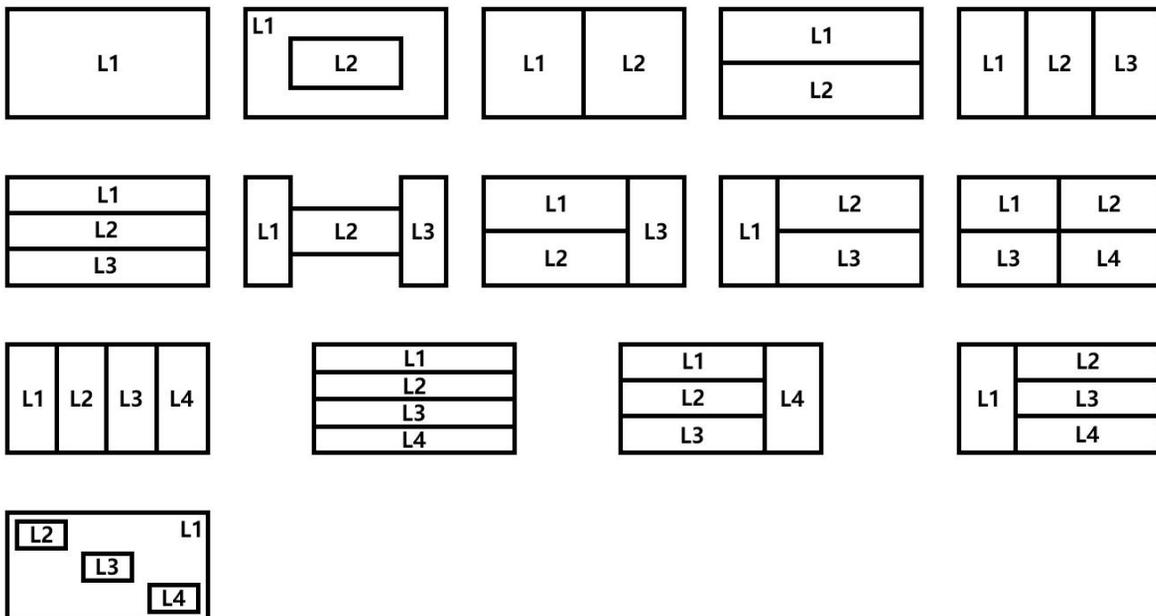
Custom:use 1~9 numbers to key in the width, height and frame rate.

Custom
1920×1080@60
Changing resolution of a different size will clean up the saved scene!!!

Image Select

Image Layout >>
L1 Source 1.No BOARD
Width 1920
Height 1080
H POS 0
V POS 0
Crop
Save Setting
Reset Parameters

Image Layout: Select the image layout for presentation mode. There are 15 layout patterns built-in as follows:

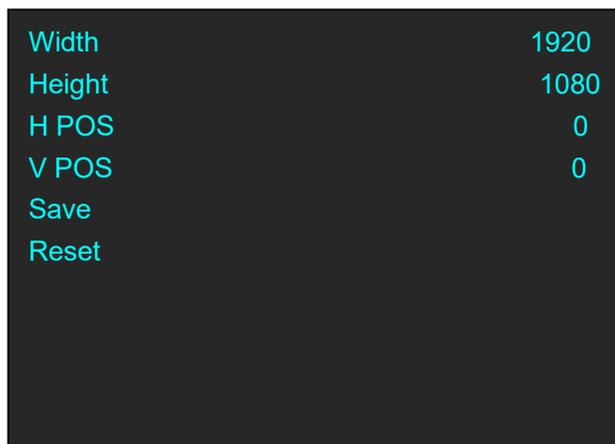


Change Layout will delete saved scene

L1~L4 Souce: After layout is selected, input source has be to be selected for each layer.
Input 1~4 is optional source, if there is no module installed, it will show :Index.NO BOARD
Input 5~8 is DUAL DVI, 6.HDMI 1.4, 7.HDMI 2.0, 8.DP 1.2 which locate on standard 4K@60 digital module.

Layer Adjustment : After layout selection,Width, Height, Horizontal Position, Vertical Position of each layer shall be set.

Crop: crop the source width and height for each layer.

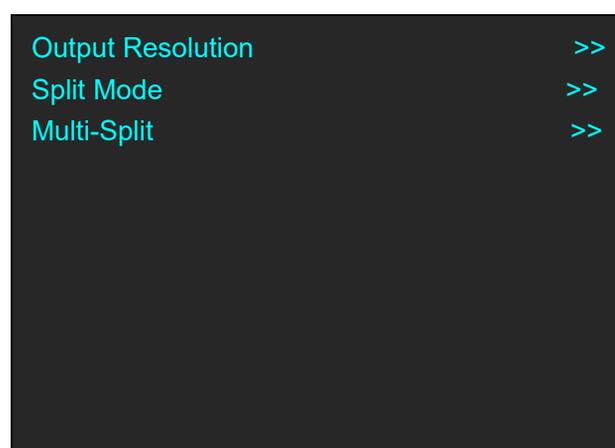


Save Setting: After layer adjustment and source crop is done, Save Setting to confirm the setting.

Reset Parameter: Cancel the above setting.

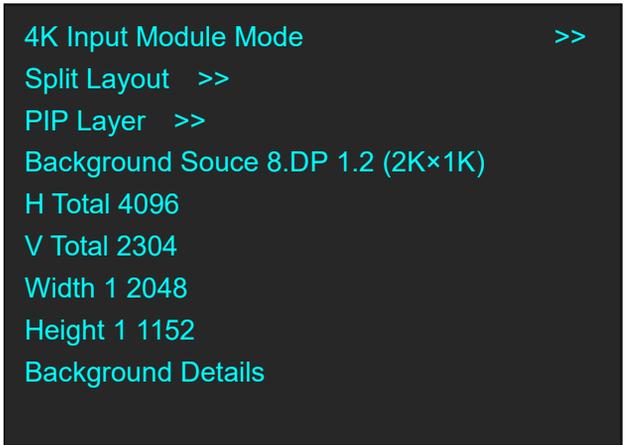
3.3.2 Split

Push MENU, rotate the knob and select <Split>



Output Resolution: the same as Output Resolution in Presentation Mode.

Split Mode



4K Input Module Mode

The available modes for 4K input module:

2Kx1K, 4Kx1K, 4Kx2K

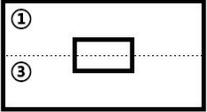
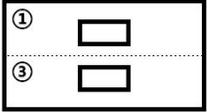
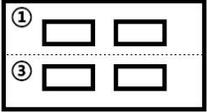
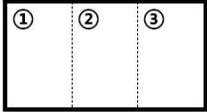
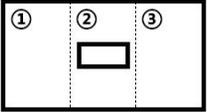
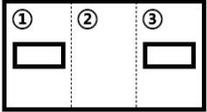
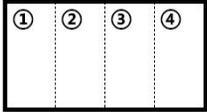
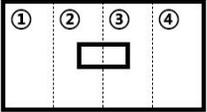
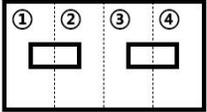
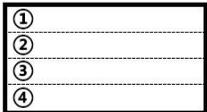
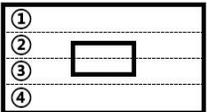
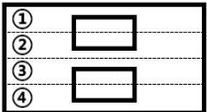
Save Setting to confirm.



Split Layout

There are 6 background split mode available and each basic split mode comes with useful multi-picture layout.

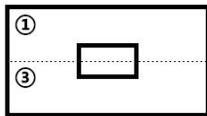
Split Mode	Background	Multi-Picture Layout
Cross		
H 1/2		

V 1/2				
H 1/3				
H 1/4				
V 1/4				

PIP

After the split mode is selected, PIP shall be set.

eg. Select split mode V 1/2 with 1 PIP layout



```

4K Input Module Mode      >>
Split Layout              >>
PIP Layer                 >>
Background Mode           V 1/2
Background Source         8.DP1 (2K×1K)
H Total                   2048
V Total                   2304
Height 1                  1152
Background Details        >>
Save Setting

```

PIP Layer MENU

PIP Source

Select source for each PIP layer
If the chosen layout contains more than 1 PIP, PIP Source 2 shall be set.

Width, Height, H Pos, V Pos

Set size and position for PIP

Save Setting

Save Setting to confirm above.

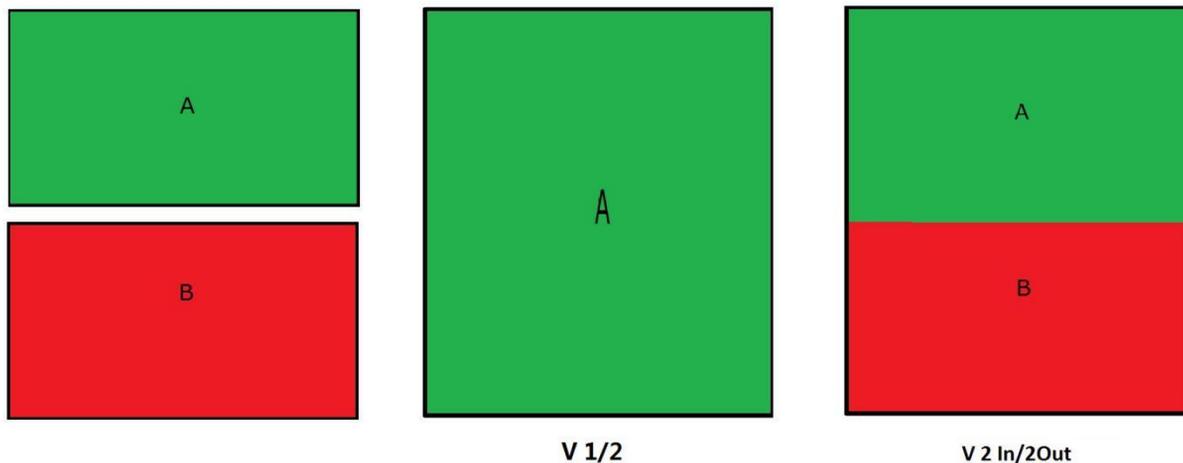
```

PIP Source 1              1.NO BOARD
Width                    1024
Height                   1152
H Pos                    512
V Pos                    576
Save Setting              >>
Reset Parameter

```

Background Mode

Under split mode V 1/2, there is subclassification V 2In/2 Out based on numbers of source.



Background Source

Select the source for background.

H Total, V total

Set total height and total width for the splicing output display.

Height 1

Set the height of the first output display.

FLEX 4ml show the parameters required based on the Split mode, for example, if the split mode is V 1/3. the Width 1 (width of first output display)and Width 2 (width of second output display) shall be set; if the split mode is Cross, Height 1 and Width 1 will be shown to set.

Background Details

To Scale and Crop the background.

Width	4096
height	2304
H POS	0
V POS	0
Save Setting	
Reset Parameters	

Save Setting

Save Setting to confirm above

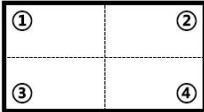
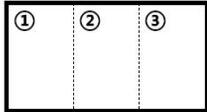
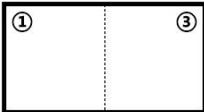
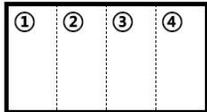
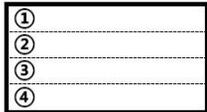
Reset Parameters

Cancel above setting.

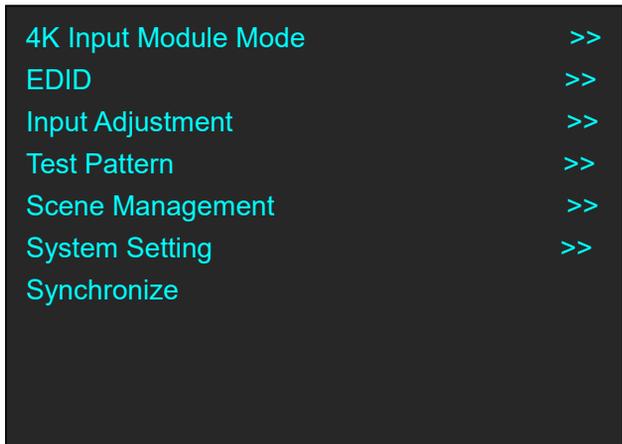
Multi Split Mode

```
EXT Input Genlock Format  1920×1080@60
Genlock Out Format        1920×1080@60
Sync                      ON
Split Mode                >>
```

Split Mode operation is the same as “Split Mode” in last section but there is no multi picture layout on each mode, only background split mode available in the Menu.

Split Mode	Background	Split Mode	Background
Cross		H 1/3	
H 1/2		H 1/4	
V 1/2		V 1/4	

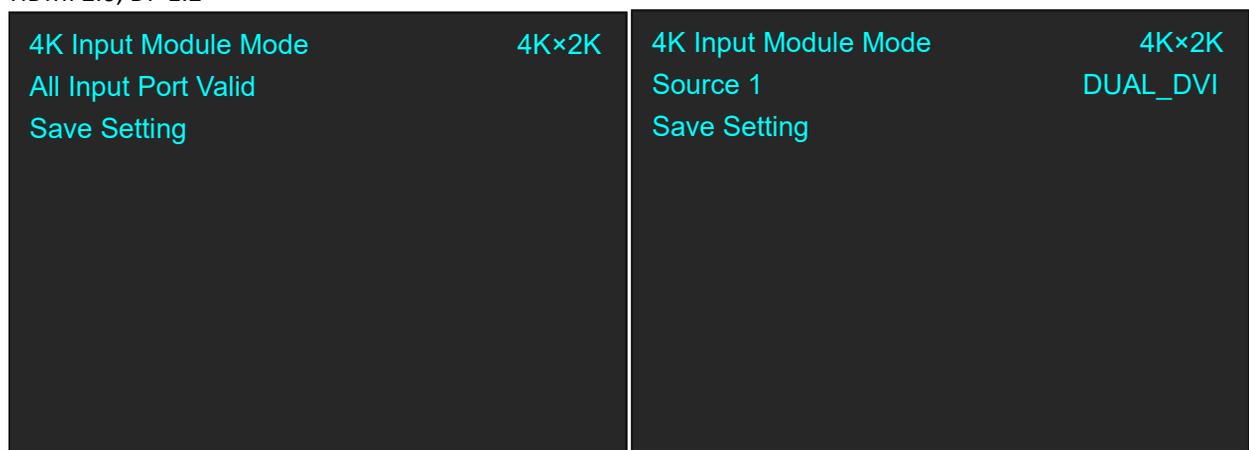
3.3.3 Advanced



4K Input Module Mode

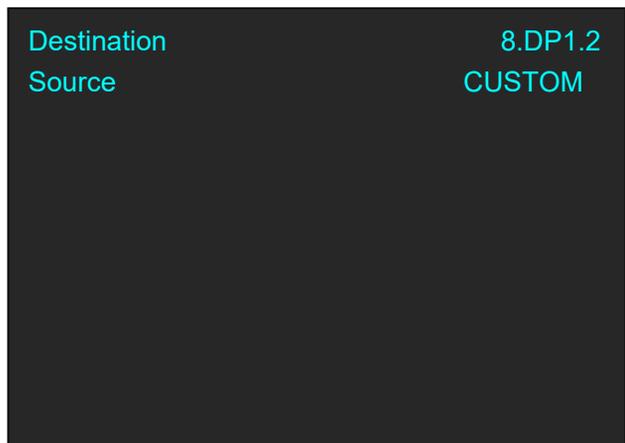
4K mode: 2K×1K, 4K×1K, 4K×2K,
The chosen mode is valid on all input port.

Push the mode to choose the
4K source: DUAL_DVI, HDMI 1.4
HDMI 2.0, DP 1.2



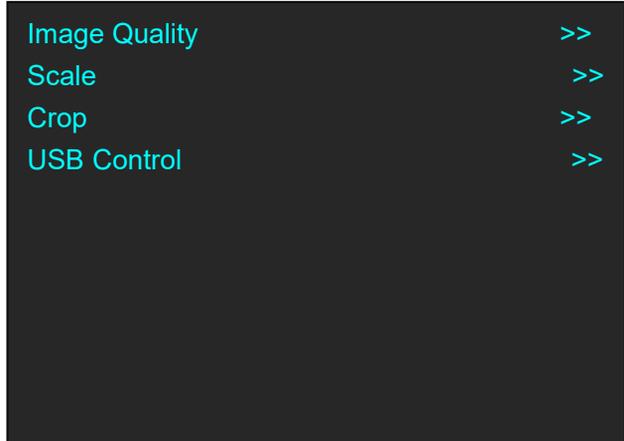
EDID

Destination: 1~8 Input Port
Source: CUSTOM or RESET
Choose CUSTOM to custome EDID
Choose RESET to reset EDID.

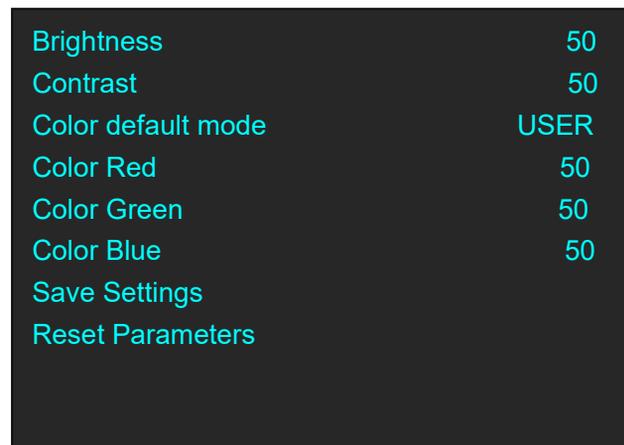


Input Adjust

Image Quality: Adjust brightness, contrast and color temperature of each input source port.



Brightness, Contrast,
Color Red, Green, Blue value:0-255
Color default mode:USER,sRGB,
5800, 6500,7500,9300

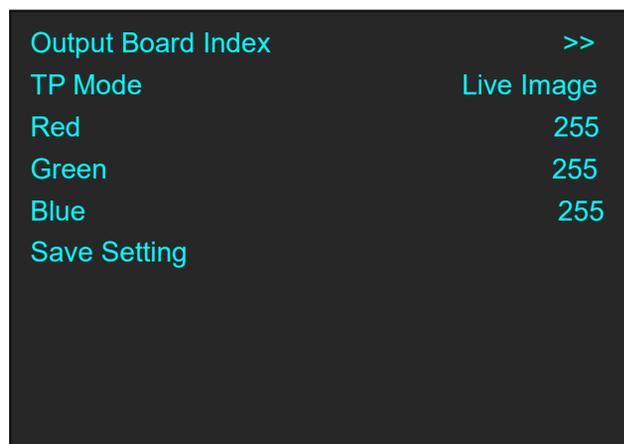


Scale: adjust each input source by scale
Crop:adjust each input source by crop

Test Pattern

Output Board Index:
Board in FLEX 4ml is EXT OS
Board 1: 1-2 output port
Board 2 : 3-4 output port

TP Mode: Live Image, Color Strip, Pure Color
Green, Red, Blue value range: 0~255

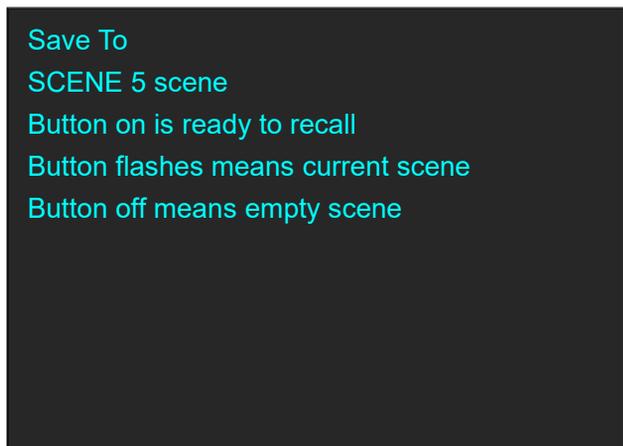


Scene Management

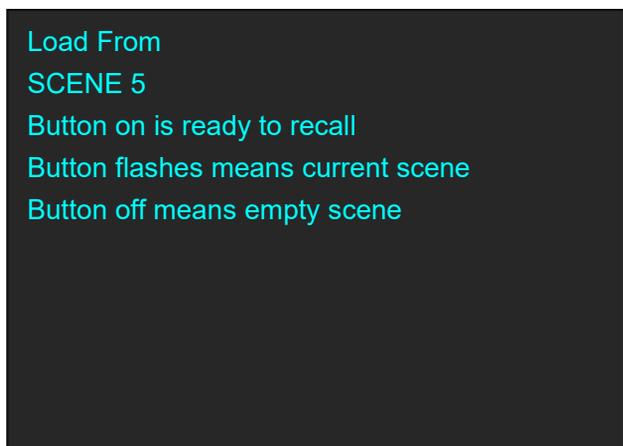
Fade In Fade Out time: 0.1S~10.0S
Set fade in fade out time for scene switching



Save To: Save the scene to SCENE 1-10

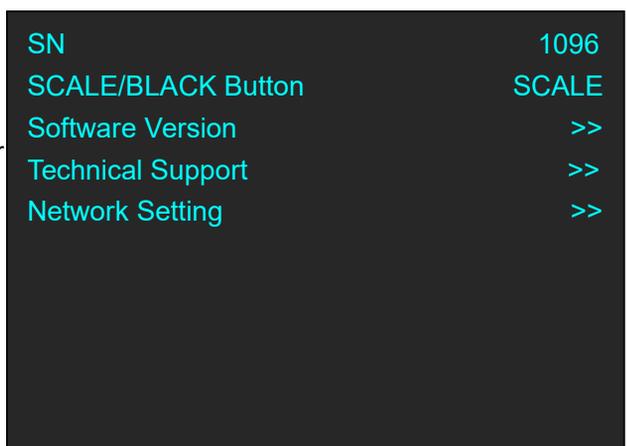


Load From: Load saved scene from SCENE 1-10.



Scene Management

SN: To check Serial number of the device
SCALE/BLACK Button: Choose the exact function for this composite button. If choose SCALE, pushing this button will open up SCALE menu.
If choose BLACK, pushing this button will black out selected layer.



Software Version: check comm board version,
input EXT, 4K input module, 4K FPGA, 4K Video,
output ext module 1and output ext module 2,
button module.

Technical Support: contact information of sales and
After sales service

Network setting: Mac address and
DHCP ON/OFF, IP Address, Subnet Mask,
Gateway setting take effect after the device is rebooted.

Synchronize

If the device is controlled by software (XPSE 2.0 or other OpenAPI), selecting Synchronize can sync the operation on software to the front panel of device.

3.3.4 Language

To switch language here. English or Chinese available.

3.3.5 Factory Reset

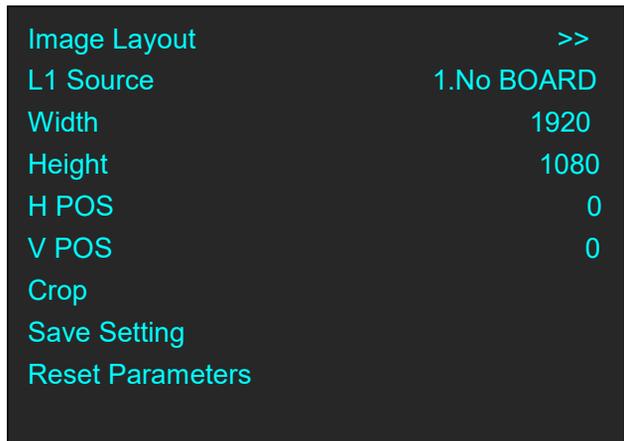
If Factory Reset is selected, the interface will show warning, confirm by pushing knob, cancel by push any other key.

3.4 Buttons

FLEX 4ml comes with shortcut buttons to enter the sub-menu of certain features. Here are details of some quick buttons.

START/LAYOUT

Short cut buttons to enter Split Mode menu when the device is used for the first time, If not, it will enter Presentation Mode



BG

On or Off background

When layout is selected, push BG button to select input source.

4K/FN

Push this button to choose 4K source as background. If there are two 4K2K@30 or 4K2K@60 input source, there will be more items offered to select.

Push this button again, IN 1~4 turn to IN 5~8.

L1/L2/L3/L4

Layer selection after background is set. When the layer is select the button will flash.

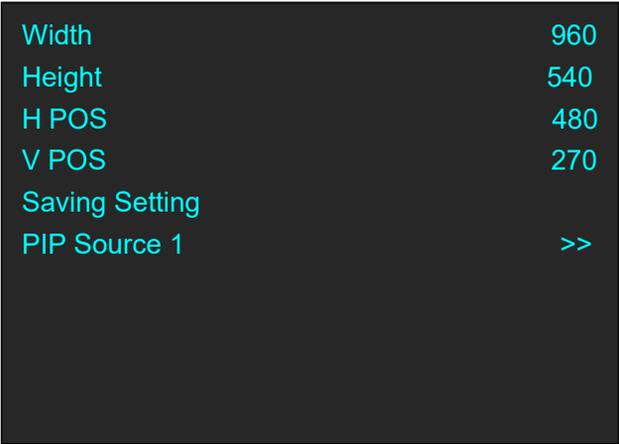
IN1/IN2/IN3/IN4

Select input source 1~4, when the source is selected, the button will flash.

SCALE/BLACK

Before using SCALE/BLACK button, the button function shall be set first. Under <Advanced>-<System Setting> menu, choose SCALE/BLACK as SACLE. After Layer is selected, pushing SCALE/BLACK button will open up SCALE menu as follow:

If button function set as BLACK, pushing this button will black out the selected layer.



Width	960
Height	540
H POS	480
V POS	270
Saving Setting	
PIP Source 1	>>

SAVE

Short cut button to SAVE scene to SECEN 1-10 by pushing number buttons

TAKE/LOAD

Short cut button to Load saved scene from SECEN 1-10 by pushing number buttons and Switch (TAKE) the scene to output display.

3.5 XPOSE 2.0 Control

Physically Connect Device to Computer

Use RJ11-DB9 serial cable to connect RS232 port of device and computer, or use CAT5/6 cable to connect LAN port of device and computer, or connect both device and computer to the same router.

XPOSE 2.0 Operation

Download XPOSE 2.0 software from RGBlink website.

<https://rgblink.com/software>

Please refer to user manual of XPOSE 2.0 for how to install and operate XPOSE 2.0

https://rgblink.com/en/products_detail.aspx?id=701

CHAPTER 4 ORDERING CODES

4.1 PRODUCT

710-0004-02-0 FLEX 4ml

4.2 OPTIONS

4.2.1 Input Options

190-0001-10-2 Single USB Input/Backup Module

190-0001-07-2 Single SDI Input/Loop Module

190-0001-06-4 Single HDMI Input Module

190-0001-04-2 Single DVI Input Module

190-0002-29-0 Single HDBaseT Input Module

190-0001-06-4 HDMI Input/ Module

4.2.2 Output Options

790-0004-21-0 Single S-DVI (Sync) Output Module

CHAPTER 5 Support

5.1 Contact Us

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Inquiries

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rgblink.com/contact-us

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Europe Regional Sales & Support

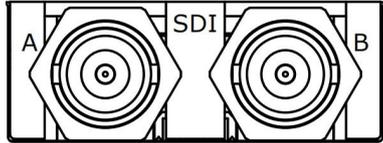
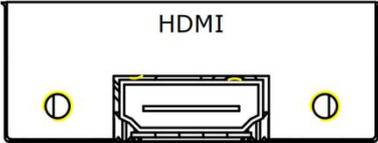
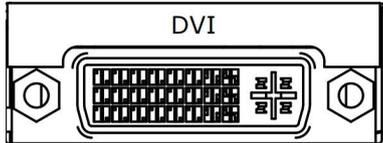
Eindhoven, Holland

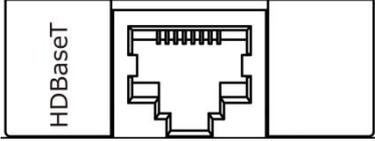
Flight Forum Eindhoven
5657 DW

+31 (040) 202 71 83

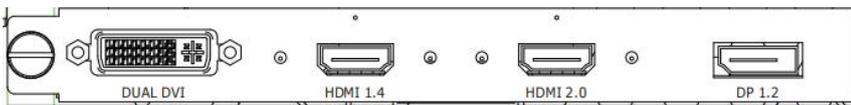
CHAPTER 6 APPENDIX

6.1 Specification

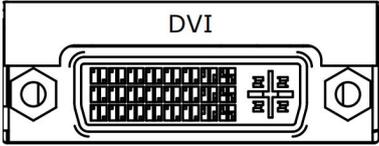
SDI Input/Loop Module (Optional)		
Connector Appearance		
Numbers of Connectors	2 (1 In/1Loop)	
Connectors	BNC	
Supported Standard	SMPTE 425M (Level A & B) SMPTE 424M SMPTE 292M SMPTE 259M-C DVB-ASI	
Input Resolutions	SMPTE 480i 576i 720p@50/59.94/60 1080i@50/59.94/60 1080p@23.98/24/25/29.97/30/50/59.94/60	
HDMI Input Module (Optional)		
Connector Appearance		
Numbers of Connectors	1	
Connectors	HDMI-A	
Supported Standard	HDMI 1.3	
Input Resolutions	SMPTE	480i 576i 720p@50/59.94/60 1080i@50/59.94/60 1080p@50/59.94/60
	VESA	800×600@60 1024×768@60 1280×720@50/59.94/60 1280×800@60 1280×960@60 1280×1024@60 1400×1050@60 1600×1200@60 1920×1080@23.98/24/25/29.97/30/50/59.94/60
DVI Composite Input Module (Optional)		
Connector Appearance		
Numbers of Connectors	1	
Connectors	DVI-I (Compatible with VGA, CVBS, YPbPr via Adapter)	
Supported Standard	DVI	1.0
	VGA	UXGA
Supported	SMPTE	480i 576i 720P@60 1080P@60

Resolutions	VESA	800×600@60 1024×768@60 1280×720@60 1280×800@60 1366×768@60 1400×1050@60 1600×1200@60 1920×1080@60			
HDBaseT Input Module (Optional)					
Connector Appearance					
Connectors	RJ45				
Numbers of Connectors	1				
Supported Standard	HDBaseT	1.0			
Input Resolution	SMPTE	720p@50/59.94/60 1080i@50/59.94/60 1080p@23.98/24/25/29.97/30/50/59.94/60			
	VESA	800×600@60/75/85 1024×768@60/75/85 1280×768@60 1280×800@60 1280×1024@60/75/85 1360×768@60 1366×768@60 1400×900@60 1600×1050@60 1600×1200@60 1680×1050@60 1920×1080@60 1920×1200@60 2048×1152@60 2560 ×816@60			
USB2.0 Input Module (Optional)					
Connector Appearance					
Connectors	USB-A				
Supported Standard	USB 2.0				
Media Types	Video Formats	MPEG1 MPEG2 MPEG4 H264 RM RMVB MOV MJPEG VC1 DIVX FLV			
	Image Formats	JPEG BMP PNG			
	Audio Formats	WMA MP3 M4A AAC			
Video Formats	File Type	File Extension	Encoding	Max Resolution	Max Bitrate
	MPEG1	.DAT .MPG .MPEG		1920×1080@ 30	20Mbps
	MPEG2	.MPG		1920×1080@ 30	20Mbps
	MPEG4	.AVI .MP4 .3GP .ASF	DVIX XVID	1920×1080@ 30	20Mbps
	RM RMVB	.RM .RMVB	RV8 RV9 RV10	1280×720@3 0	10Mbps
	H264	.MKV .MOV	H.264	1920×1080@	20Mbps

				30	
	MJPEG	.AVI		640×480@30	10Mbps
	DivX	.DIVX .AVI	MPEG DVIX H264	1920×1080@ 30	20Mbps
	VC1	.WMV .ASF	VC1	1920×1080@ 30	20Mbps
	FLV	.FLV	H264	1920×1080@ 30	20Mbps
Picture Formats	File Type	Max Resolution	Compression	Supported Resolution	
	JPEG	15360×8640	Progressive JPEG	Support 1024×768 only	
			Baseline(“Sta ndard”)	Full Range	
			Baseline Optimized	Full Range	
	BMP	9600×6400	Monochrome	Full Range	
			16-color	Full Range	
			256-color	Full Range	
			16 bit	Full Range	
			24 bit	Full Range	
			32 bit	Full Range	
		PNG	9600×6400	Non-interlace d	Full Range

4K@60Digital Module (Standard)		
Connector Appearance		
Numbers of Connectors	4	
Connectors	1×DVI-I 2×HDMI-A 1×DisplayPort	
Supported Standards	DVI	DUAL Link (Dual Link)
	HDMI	2.0
	DP	1.2
Input resolutions	SMPTE	720P@60 1080P@60 2160@60
	VESA	800×600@60 1024×768@60 1280×1024@60 1440×900@60 1600×1200@60 1920×1080@60 3840×2160@60 4096×2160@60

S-DVI (Sync) Output Module (Standard/Backup Optional)

Connector Appearance		
Numbers of Connectors	1	
Connectors	DVI-I	
Supported Standard	DVI	1.0
Output Resolution	SMPTE	720P@60 1080P@60
	VESA	800×600@60 1024×768@60 1280×720@60 1280×800@60 1366×768@60 1400×1050@60 1600×1200@60 1920×1080@60

Extras	
Communication	LAN RS232 1×RJ45 1×RJ11
Power Supply	AC 90-264V 50/60Hz 1.8A Max
Max Power	200W
Working Environment	0°C-45°C
Relativity Humidity	10% –85 % RH
Weight	9.5 kg
Dimensions	484mm×413mm×91mm
Product Warranty	3 years parts and labor warranty

6.2 Terms & Definitions

- **RCA:** Connector used primarily in consumer AV equipment for both audio and video. The RCA connector was developed by the Radio Corporation of America.
- **BNC:** Stands for Bayonet Neill-Concelman. A cable connector used extensively in television (named for its inventors). A cylindrical bayonet connector that operates with a twist-locking motion .
- **CVBS:** CVBS or Composite video, is an analog video signal without audio. Most commonly CVBS is used for transmission of standard definition signals. In consumer applications the connector is typically RCA type, while in professional applications the connector is BNC type.
- **YPbPr:** Used to describe the colour space for progressive-scan. Otherwise known as component video.
- **VGA:** Video Graphics Array. VGA is an analog signal typically used on earlier computers. The signal is non-interlaced in modes 1, 2, and 3 and interlaced when using in mode
- **DVI:** Digital Visual Interface. The digital video connectivity standard that was developed by DDWG (Digital Display Work Group). This connection standard offers two different connectors: one with 24 pins that handles digital video signals only, and one with 29 pins that handles both digital and analog video.
- **SDI:** Serial Digital Interface. Standard definition video is carried on this 270 Mbps data transfer rate. Video pixels are characterized with a 10-bit depth and 4:2:2 color quantization. Ancillary data is included on this interface and typically includes audio or other metadata. Up to sixteen audio channels can be transmitted. Audio is organised into blocks of 4 stereo pairs. Connector is BNC.
- **HD-SDI:** high-definition serial digital interface (HD-SDI), is standardized in SMPTE 292M this provides a nominal data rate of 1.485 Gbit/s.
- **3G-SDI:** standardized in SMPTE 424M, consists of a single 2.970 Gbit/s serial link that allows replacing dual link HD-SDI.
- **6G-SDI:** standardized in SMPTE ST-2081 released in 2015, 6Gbit/s bitrate and able to support 2160p@30.
- **12G-SDI:** standardized in SMPTE ST-2082 released in 2015, 12Gbit/s bitrate and able to support 2160p@60.
- **U-SDI:** Technology for transmitting large-volume 8K signals over a single cable. a signal interface called the ultra high definition signal/data interface (U-SDI) for transmitting 4K and 8K signals using a single optical cable. The interface was standardized as the SMPTE ST 2036-4.

-
- **HDMI** : High Definition Multimedia Interface: An interface used for the transmission of uncompressed high definition video, up to 8 channels of audio, and control signals, over a single cable.
 - **HDMI 1.3**: released on June 22 2006, and increased the maximum TMDS clock to 340 MHz (10.2 Gbit/s). Support resolution 1920 × 1080 at 120 Hz or 2560 × 1440 at 60 Hz). It added support for 10 bpc, 12 bpc, and 16 bpc color depth (30, 36, and 48 bit/px), called deep color.
 - **HDMI 1.4** : released on June 5, 2009, added support for 4096 × 2160 at 24 Hz, 3840 × 2160 at 24, 25, and 30 Hz, and 1920 × 1080 at 120 Hz. Compared to HDMI 1.3, 3 more features added which are HDMI Ethernet Channel (HEC) , audio return channel (ARC),3D Over HDMI, a new Micro HDMI Connector, an expanded set of color spaces.
 - **HDMI 2.0**, released on September 4, 2013 increases the maximum bandwidth to 18.0 Gbit/s. Other features of HDMI 2.0 include up to 32 audio channels, up to 1536 kHz audio sample frequency, the HE-AAC and DRA audio standards, improved 3D capability, and additional CEC functions.
 - **HDMI 2.0a**: was released on April 8, 2015, and added support for High Dynamic Range (HDR) video with static metadata.
 - **HDMI 2.0b**: was released March, 2016, support for HDR Video transport and extends the static metadata signaling to include Hybrid Log-Gamma (HLG).
 - **HDMI 2.1** : released on November 28, 2017. It adds support for higher resolutions and higher refresh rates, Dynamic HDR including 4K 120 Hz and 8K 120 Hz.

 - **DisplayPort**: A VESA standard interface primarily for video, but also for audio, USB and other data. DisplayPort (orDP) is backwards compatible with HDMI, DVI and VGA.

 - **DP 1.1**: was ratified on 2 April 2007, and version 1.1a was ratified on 11 January 2008. DisplayPort 1.1 allow a maximum bandwidth of 10.8 Gbit/s (8.64 Gbit/s data rate) over a standard 4-lane main link, enough to support 1920x1080@60Hz
 - **DP 1.2**: introduced on 7 January 2010, effective bandwidth to 17.28 Gbit/s support increased resolutions, higher refresh rates, and greater color depth, maximum resolution 3840 × 2160@60Hz
 - **DP 1.4**: publish on 1 Mar, 2016. overall transmission bandwidth 32.4 Gbit/s ,DisplayPort 1.4 adds support for Display Stream Compression 1.2 (DSC), DSC is a "visually lossless" encoding technique with up to a 3:1 compression ratio. Using DSC with HBR3 transmission rates, DisplayPort 1.4 can support 8K UHD (7680 × 4320) at 60 Hz or 4K UHD (3840 × 2160) at 120 Hz with 30 bit/px RGB color and HDR. 4K at 60 Hz 30 bit/px RGB/HDR can be achieved without the need for DSC.

● **Multi-mode Fiber:** Fibers that support many propagation paths or transverse modes are called multi-mode fibers, generally have a wider core diameter and are used for short-distance communication links and for applications where high power must be transmitted.

● **Single-mode Fiber:** Fiber that support a single mode are called single-mode fibers. Single-mode fibers are used for most communication links longer than 1,000 meters (3,300 ft).

● **SFP:** small form-factor pluggable, is a compact, hot-pluggable network interface module used for both telecommunication and data communications applications.

● **optical fiber connector:** terminates the end of an optical fiber, and enables quicker connection and disconnection than splicing. The connectors mechanically couple and align the cores of fibers so light can pass. 4 most common types of optical fiber connectors are SC, FC, LC, ST.

● **SC:** (Subscriber Connector), also known as the square connector was also created by the Japanese company – Nippon Telegraph and Telephone. SC is a push-pull coupling type of connector and has a 2.5mm diameter. Nowadays, it is used mostly in single mode fiber optic patch cords, analog, GBIC, and CATV. SC is one of the most popular options, as its simplicity in design comes along with great durability and affordable prices.

● **LC:** (Lucent Connector) is a small factor connector (uses only a 1.25mm ferrule diameter) that has a snap coupling mechanism. Because of its small dimensions, it is the perfect fit for high-density connections, XFP, SFP, and SFP+ transceivers.

● **FC:** (Ferrule Connector) is a screw type connector with a 2.5mm ferrule. FC is a round shaped threaded fiber optic connector, mostly used on Datacom, telecom, measurement equipment, single-mode laser.

● **ST:** (Straight Tip) was invented by AT&T and uses a bayonet mount along with a long spring-loaded ferrule to support the fiber.

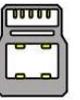
● **USB:** Universal Serial Bus is a standard that was developed in the mid-1990s that defines cables, connectors and communication protocols. This technology is designed to allow a connection, communication and power supply for peripheral devices and computers.

● **USB 1.1:** Full-Bandwidth USB, specification was the first release to be widely adopted by the consumer market. This specification allowed for a maximum bandwidth of 12Mbps.

● **USB 2.0:** or Hi-Speed USB, specification made many improvements over USB 1.1. The main improvement was an increase in bandwidth to a maximum of 480Mbps.

● **USB 3.2:** Super Speed USB with 3 varieties of 3.2 Gen 1 (original name USB 3.0), 3.2 Gen 2 (original name USB 3.1), 3.2 Gen 2x2 (original name USB 3.2) with speed up to 5Gbps, 10Gbps, 20Gbps respectively.

USB version and connectors figure:

	Type A	Type B	Mini A	Mini B	Micro-A	Micro-B	Type C
USB 2.0							
USB 3.0							
USB 3.1&3.2							

● **NTSC** : The colour video standard used in North America and some other parts of the world created by the National Television Standards Committee in the 1950s. NTSC utilizes an interlaced video signals.

● **PAL**: Phase Alternate Line. A television standard in which the phase of the colour carrier is alternated from line to line. It takes four full images (8 fields) for the colour-to-horizontal images (8 fields) for the colour-to-horizontal phase relationship to return to the reference point. This alternation helps cancel out phase errors. For this reason, the hue control is not needed on a PAL TV set. PAL, is widely used in needed on a PAL TV set. PAL, is widely used in Western Europe, Australia, Africa, the Middle East, and Micronesia. PAL uses 625-line, 50-field (25 fps) composite colour transmission system.

● **SMPTE**: Society of Motion image and Television Engineers. A global organization, based in the United States, that sets standards for baseband visual communications. This includes film as well as video and television standards.

● **VESA**: Video Electronics Standards Association. An organization facilitating computer graphics through standards.

● **HDCP**: High-bandwidth Digital Content Protection (HDCP) was developed by Intel Corporation and is in wide use for protection of video during transmission between devices.

● **HDBaseT**: A video standard for the transmission of uncompressed video (HDMI signals) and related features using Cat 5e/Cat6 cabling infrastructure.

● **ST2110**: A SMPTE developed standard, ST2110 describes how to send digital video over and IP networks. Video is transmitted uncompressed with audio and other data in a separate streams.

SMPTE2110 is intended principally for broadcast production and distribution facilities where quality and flexibility are more important.

●**SDVoE:** Software Defined Video over Ethernet (SDVoE) is a method for transmission, distribution and management AV signals using a TCP/IP Ethernet infrastructure for transport with low latency. SDVoE is commonly used in integration applications.

●**Dante AV:** The Dante protocol was developed for and widely adopted in audio systems for the transmission of uncompressed digital audio on IP based networks. The more recent Dante AV specification includes support for digital video.

●**NDI:** Network Device interface (NDI) is a software standard developed by NewTek to enable video-compatible products to communicate, deliver, and receive broadcast quality video in a high quality, low latency manner that is frame-accurate and suitable for switching in a live production environment over TCP (UDP) Ethernet based networks. NDI is commonly found in broadcast applications.

●**RTMP:** Real-Time Messaging Protocol (RTMP) was initially a proprietary protocol developed by Macromedia (now Adobe) for streaming audio, video and data over the Internet, between a Flash player and a server.

●**RTSP :** The Real Time Streaming Protocol (RTSP) is a network control protocol designed for use in entertainment and communications systems to control streaming media servers. The protocol is used for establishing and controlling media sessions between end points.

●**MPEG:** Moving Picture Experts Group is a working group formed from ISO and IEC developing standards that allow audio/video digital compression and Transmission.

●**H.264:** Also known as AVC (Advanced Video Coding) or MPEG-4i is a common video compression standard. H.264 was standardized by the ITU-T Video Coding Experts Group (VCEG) together with the ISO/IEC JTC1 Moving Picture Experts Group (MPEG).

●**H.265:** Also known as **HEVC** (High Efficiency Video Coding) H.265 is the successor to the widely used H.264/AVC digital video coding standard. Developed under the auspices of ITU, resolutions up to 8192x4320 may be compressed.

●**API:** An Application Programming Interface (API) provides a predefined function which allows access capabilities and features or routines via a software or hardware, without accessing source code or understanding the details of inner working mechanism. An API call may execute a function and/or provide data feedback/report.

●**DMX512:** The communication standard developed by USITT for entertainment and digital lighting systems. The wide adoption of the Digital Multiplex (DMX) protocol has seen the protocol used for a wide range of other devices including video controllers. DMX512 is delivered over cable of 2 twisted pairs with 5pin XLR cables for connection.

●**ArtNet:** An ethernet protocol based on TCP/IP protocol stack, mainly used in entertainment/events applications. Built on the DMX512 data format, ArtNet enables multiple “universes” of DMX512 to be transmitted using ethernet networks for transport.

●**MIDI:** MIDI is the abbreviation of Musical Instrument Digital Interface. As the name indicates the protocol was developed for communication between electronic musical instruments and latterly computers. MIDI instructions are triggers or commands sent over twisted pair cables, typically using 5pin DIN connectors.

●**OSC:** The principle of Open Sound Control (OSC) protocol is for networking sound synthesizers, computers, and multimedia devices for musical performance or show control. As with XML and JSON, the OSC protocol allows sharing data. OSC is transported via UDP packets between devices connected on an Ethernet.

●**Brightness:** Usually refers to the amount or intensity of video light produced on a screen without regard to colour. Sometimes called black level.

●**Contrast Ratio:** The ratio of the high light output level divided by the low light output level. In theory, the contrast ratio of the television system should be at least 100:1, if not 300:1. In reality, there are several limitations. Well-controlled viewing conditions should yield a practical contrast ratio of 30:1 to 50:1.

●**Colour Temperature:** The colour quality, expressed in degrees Kelvin (K), of a light source. The higher the colour temperature, the bluer the light. The lower the temperature, the redder the light. Benchmark colour temperature for the A/V industry include 5000°K, 6500°K, and 9000°K.

●**Saturation:** Chroma, Chroma gain. The intensity of the colour, or the extent to which a given colour in any image is free from white. The less white in a colour, the truer the colour or the greater its saturation. Saturation is the amount of pigment in a colour, and not the intensity.

●**Gamma:** The light output of a CRT is not linear with respect to the voltage input. The difference between what you should have and what is actually output is known as gamma.

●**Frame:** In interlaced video, a frame is one complete image. A video frame is made up of two fields, or two sets of interlaced lines. In a film, a frame is one still image of a series that makes up a motion image.

● **Genlock:** Allows synchronisation of otherwise video devices. A signal generator provides a signal pulses which connected devices can reference. Also see Black Burst and Color Burst.

● **Blackburst:** The video waveform without the video elements. It includes the vertical sync, horizontal sync, and the Chroma burst information. Blackburst is used to synchronize video equipment to align the video output.

● **Colour Burst:** In colour TV systems, a burst of subcarrier frequency located on the back part of the composite video signal. This serves as a colour synchronizing signal to establish a frequency and phase reference for the Chroma signal. Colour burst is 3.58 MHz for NTSC and 4.43 MHz for PAL.

● **Colour Bars:** A standard test pattern of several basic colours (white, yellow, cyan, green, magenta, red, blue, and black) as a reference for system alignment and testing. In NTSC video, the most commonly used colour bars are the SMPTE standard colour bars. In PAL video, the most commonly used colour bars are eight full field bars. On computer monitors the most commonly used colour bars are two rows of reversed colour bars

● **Seamless Switching:** A feature found on many video switchers. This feature causes the switcher to wait until the vertical interval to switch. This avoids a glitch (temporary scrambling) which often is seen when switching between sources.

● **Scaling:** A conversion of a video or computer graphic signal from a starting resolution to a new resolution. Scaling from one resolution to another is typically done to optimize the signal for input to an image processor, transmission path or to improve its quality when presented on a particular display.

● **PIP:** Picture-In-Picture. A small image within a larger image created by scaling down one of image to make it smaller. Other forms of PIP displays include Picture-By-Picture (PBP) and Picture- With-Picture (PWP), which are commonly used with 16:9 aspect display devices. PBP and PWP image formats require a separate scaler for each video window .

● **HDR:** is a high dynamic range (HDR) technique used in imaging and photography to reproduce a greater dynamic range of luminosity than what is possible with standard digital imaging or photographic techniques. The aim is to present a similar range of luminance to that experienced through the human visual system.

● **UHD:** Standing for Ultra High Definition and comprising 4K and 8K television standards with a 16:9 ratio, UHD follows the 2K HDTV standard. A UHD 4K display has a physical resolution of 3840x2160 which is four times the area and twice both the width and height of a HDTV/FullHD (1920x1080) video signal.

●**EDID:** Extended Display Identification Data. EDID is a data structure used to communicate video display information, including native resolution and vertical interval refresh rate requirements, to a source device. The source device will then output the provided EDID data, ensuring proper video image quality.

6.3 Revision History

The table below lists the changes to the Video Processor User Manual.

Version	Time	ECO#	Description	Editor
V1.0	20200422	0000	Release	Fanny