

LED PROCESSORS

Introduction

The MX40 ROE is a flagship all-in-one LED display controller with 20 Ethernet ports. This controller integrates video processing and video control into one box and offers rich video input connectors (HDMI 2.0, DP 1.2 and 12G-SDI), 20x Ethernet output ports and 4x 10G optical ports (supports synchronous output). It can also work with the brand new software VMP (Vision Management Platform) to provide a better operation and control experience.

Features

Inputs and Outputs

- 3 types of inputs
 - 3x HDMI 2.0 (with loop through)
 - 1x DP 1.2
 - 1x 12G-SDI (with loop through)
- 12-bit, 10-bit and 8-bit video inputs
- 3 types of outputs
 - 20x Gigabit Ethernet ports, load capacity up to 9 million pixels
 - 4x 10G optical ports, supporting setting of output mode. Users may choose between
 20-port mode and 40-port mode.
 - 1x SPDIF digital audio port
- 3 types of controls
 - 1x Genlock signal input (with loop through)
 - 2x Ethernet control ports
 - 1x Auxiliary port

Advanced Features

- 4 independent layers
 - Support up to 4x 4K layers and layer priority adjustment in Z order.
- Image Scaling

Each layer supports 4 scaling mode: custom, pixel to pixel, snap to canvas, and fill screen.

Color Replacement

Replace any color in the image with another color without affecting other colors. It is recommended to choose color with higher saturation for replacement to achieve better outcome.

14Ch Color Correction

Supports precise adjustment to the hue, saturation, and brightness of black and white, and the 12 standard colors derived from the three primary colors (RGB).

Color Curves

Supports adjustment to the RGBW mapping curves of the screen.

3D LUT

Use the 3D LUT file (.cube) with an accuracy of 17×17×17 / 33×33×33 / 65×65×65 to adjust the colors of the video source.

Dynamic Booster

Real-time analysis and dynamic adjustment are made to each frame to significantly improve the display contrast and image details for better visual experience, and effectively control and lower the display power consumption, extending the service life of the LED screen.

Full-Grayscale Calibration

Work with high-precision calibration system CC3 along with the scientific-grade cameras CC60 and C3200 to generate unique calibration coefficients for each grayscale, ensuring uniformity of each grayscale and dramatically improving the image quality.

HDR

- Support HDR10 and comply with the SMPTE ST 2084 and SMPTE ST 2086 standards.
- Support HLG.

3D

Work with the 3D emitter and 3D glasses to bring a fascinating and immersive 3D viewing experience.

Latency

- Different screens can have different latency settings. The minimum processing latency
 of the LED display controller is reduced to 0-frame (less than 1 ms), achieving low
 latency without reducing the load.
- Supports additional latency. Users can choose to add zero to two frames of latency.

Preset

For optimal display in various scenarios, users can adjust display parameters such as layers, brightness, color temperature, and gamma ahead of time and save them as presets. Users can save up to 128 customizable presets which can be easily applied or switched with just one click.

• No rectangle restriction

No rectangle restriction for irregular screens. This means when calculating resolutions, blank pixels do not count towards the total capacity. The used load capacity of Ethernet ports is the sum of the resolutions of all cabinets with load.

Frame Rate Adaptive

Automatically adapt to video inputs with different frame rates ranging from 23.98 Hz to 480 Hz, and support the automatic calculation of optimal screen parameters based on the input source's frame rate. This ensures that the brightness deviation of the screen remains within 5% across different frame rates. It also supports precise frame rate adjustment in 0.01 Hz increments.

Shutter Fit

Automatically adjusts the driver IC parameters according to the camera shutter angle to fix problems of black lines, grayscale addition, and grayscale loss during camera shooting in xR scenarios.

Frame Multiplication

- Frame interpolation: Outputs images that are captured from multiple shooting angles with different backgrounds at the same time. Solid green backgrounds can also be inserted to allow for easy post-production adjustments.
- Frequency multiplication: Supports high frame rates of up to 480 Hz. This feature is to accommodate multi-angle camera shooting to improve the screen performance under the camera.

Device Controls

Web-based control

- Intuitive web interface with intelligent management.
- Real-time responsiveness over a 1000M/100M adaptive Ethernet interface, enabling concurrent multi-user access.
- Convenient firmware updates directly through the web interface.

• VMP software control

The device can be connected to the VMP software to provide easy and convenient operations and smart device management.

- Supports the SNMP and Art-Net protocols.
- Cascading control via Ethernet

The Gigabit Ethernet control ports support TCP/IP protocol and star topology. No switch or router is needed to deploy multiple devices on the same LAN via device cascading as the network switching function is already built in.

• Automated system monitoring and alarm

Hardware monitoring capabilities that encompass fan speed, module temperatures, voltage levels, and operational status. It automatically detects and reports any device faults or alarm information, ensuring real-time monitoring of the LED screen's operational status.

Table 4-1 Function Limitations

Function	Limitation
Frame Rate Adaptive	To use this function, it is required to pair with specific driver ICs. For detailed IC models, please contact the technical support.
Dynamic Booster	It is required to work with the A10s Pro receiving card or its derivatives. Users need to use a CA410-VP427, CA410-P427, or CA410-P427H colorimeter to perform the gamut and brightness correction.
3D	3D cannot be enabled simultaneously with Low Latency and Frame Multiplication. To use the 3D function, specified 3D glasses are needed. For details, please contact technical support.
HDR	Supports both automatic parsing and manual settings for HDR. When the input interfaces are HDMI 2.0, HDR10 and HLG are supported. For 12G-SDI, DP 1.2, and non-standard HDR sources, HDR attributes can only be manually overridden.
Low Latency	Low Latency cannot be enabled simultaneously with Genlock, 3D, and Frame Multiplication. Moreover, it is recommended to ensure all Ethernet ports load the cabinets vertically and share the same Y coordinate (all set to 0) when Low Latency is enabled.

Appearance

Front Panel



Name	Function
Running	Solid red: Standby.
indicator	Solid blue: The device is being powered on.
	Solid green: The device is running normally.
	Flashing red: The device is running abnormally.
Standby	Press the button to power on or power off the device.
button	Hold down the button for 5s to 10s to restart the device.
USB 2.0	Connect to a USB drive only to export the device diagnostic result.
	Only the NTFS and FAT32 file systems are supported. Others are not supported.
TFT Screen	A 3.5-inch screen to display the device status, menus, submenus and messages for parameter settings.
Knob	On the home screen, press the knob to enter the main menu screen.
	• On the main menu screen, rotate the knob to select a menu item or adjust the parameter value. Press the knob to confirm the operation.
	Hold down the knob and BACK button simultaneously for 5s or longer to lock or unlock the buttons and screen.
BACK	Go back to the previous menu or cancel the current operation.

Rear Panel



Inputs	Inputs						
Туре	Qty	Description					
HDMI 2.0-1 IN	1	Resolutions	Max resolution: 4096×2160@60Hz/8192×1080@60Hz (Forced) Min resolution: 800×600@60Hz				
		A					
		Max width/height (Forced)	Max width: 8192 pixels (8192×1080@60Hz) Max height: 8192 pixels (1080×8192@60Hz)				
		Frame rates	23.98/24/25/29.97/30/47.95/48/50/59.94/60/71.93/72/75 /100/119.88/120/143.86/144/240 Hz				
		HDR	Support HDR10 and comply with the SMPTE ST 2084 and SMPTE ST 2086 standards. Support HLG.				
		EDID management	Support standard resolutions, up to 3840×2160@60Hz. Support custom input resolutions.				
		HDCP	HDCP 2.2 compliant, backwards compatible with HDCP 1.4/HDCP 1.3.				
		Interlaced signal inputs	Not supported.				
HDMI 2.0-2 IN	1	Resolutions	Max resolution: 4096×2160@60Hz/8192×1080@60Hz (Forced)				
			Min resolution: 800×600@60Hz				
		Max width/height (Forced)	Max width: 8192 pixels (8192×1080@60Hz)				
			Max height: 7680 pixels (1080×7680@60Hz)				
		Frame rates	23.98/24/25/29.97/30/47.95/48/50/59.94/60/71.93/72/75 /100/119.88/120/143.86/144/240 Hz				
		HDR	Support HDR10 and comply with the SMPTE ST 2084 and SMPTE ST 2086 standards.				
			Support HLG.				
		EDID management	Support standard resolutions, up to 3840×2160@60Hz. Support custom input resolutions.				
		HDCP	HDCP 2.2 compliant, backwards compatible with HDCP 1.4/HDCP 1.3.				
		Interlaced signal inputs	Not supported.				
HDMI 2.0-3 IN	1	Resolutions	Max resolution: 4096×2160@60Hz/8192×1080@60Hz (Forced)				
			Min resolution: 800×600@60Hz				
		Max width/height (Forced)	Max width: 8192 pixels (8192×1080@60Hz)				
			Max height: 7680 pixels (1080×7680@60Hz)				

Inputs							
Туре	Qty	Description					
		Frame rates	23.98/24/25/29.97/30/47.95/48/50/59.94/60/71.93/72/75 /100/119.88/120/143.86/144/240 Hz				
		HDR	Support HDR10 and comply with the SMPTE ST 2084 and SMPTE ST 2086 standards. Support HLG.				
		EDID management	Support standard resolutions, up to 3840×2160@60Hz. Support custom input resolutions.				
		HDCP	HDCP 2.2 compliant, backwards compatible with HDCP 1.4/HDCP 1.3.				
		Interlaced signal inputs	Not supported.				
DP 1.2	1	Resolutions	Max resolution: 4096×2160@60Hz/8192×1080@60Hz (Forced)				
			Min resolution: 800×600@60Hz				
		Max width/height (Forced)	Max width: 8192 pixels (8192×1080@60Hz) Max height: 8192 pixels (1080×8192@60Hz)				
		Frame rates	23.98/24/25/29.97/30/47.95/48/50/59.94/60/71.93/72/75 /100/119.88/120/143.86/144/240 Hz				
		EDID management	Support standard resolutions, up to 3840×2160@60Hz. Support custom input resolutions.				
		HDCP	HDCP 1.3 compliant.				
		Interlaced signal inputs	Not supported.				
12G-SDI IN	1	Standards	Support ST-2082 (12G), ST-2081 (6G), ST-424 (3G) and ST-292 (HD) standard video inputs. Support 3G-Level A/Level B (DS mode).				
		Resolutions	Max resolution: 4096×2160@60Hz Min resolution: 720×480i@59.94Hz				
		Frame rates	23.98/24/25/29.97/30/47.95/48/50/59.94/60 Hz				
		Interlaced signal inputs	Support interlaced signal inputs, including 1080i/576i/480i.				
		Cables	Recommend using the CANARE-12G SDI coaxial cable. Cables up to 50 meters are supported.				
Outputs							
Туре	Qty	Description					
1-20	20	Gigabit Ethernet output ports. Support hot backup between Ethernet ports.					

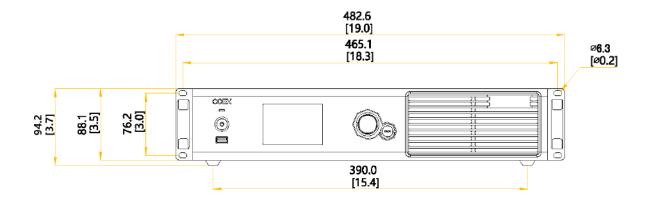
Inputs		
Туре	Qty	Description
		Max device load capacity: 9 million pixels
		Max output width/height: 16,384 pixels
		The maximum load capacity per Ethernet port is as follows. For details, refers to Ethernet Port Load Capacity.
		- 8bit@60Hz: 659,722 pixels
		- 10bit@60Hz: 494,791 pixels
		– 12bit@60Hz: 329,861 pixels
		Note
		The load capacity of a single Ethernet port can only achieve its maximum when the load width is 128 pixels or more. If the load width is less than that, the load capacity will be reduced accordingly, calculated as (128 - load width) × load height.
OPT 1-4	4	10G optical output ports
		Supports setting of output mode. Users may choose between 20-port mode and 40-port mode.
		• 20-port mode:
		 OPT 1 transmits the data of Ethernet ports 1 to 10. OPT 3 is the copy channel of OPT 1.
		 OPT 2 transmits the data of Ethernet ports 11 to 20. OPT 4 is the copy channel of OPT 2.
		 You can use the optical port alongside the physical Ethernet port, with priority given in the following order: OPT 1/2 > OPT 3/4 > Ethernet ports 1–20.
		• 40-port mode:
		OPT 1 transmits the data of Ethernet ports 1 to 10.
		 OPT 2 transmits the data of Ethernet ports 11 to 20.
		- OPT 3 transmits the data of Ethernet ports 21 to 30.
		- OPT 4 transmits the data of Ethernet ports 31 to 40.
		 You can use the optical port alongside the physical Ethernet port, with priority given in the following order: OPT 1/2 > Ethernet ports 1–20.
		Note
		 When both the optical and Ethernet ports are used simultaneously, please do NOT connect the controller's Ethernet port with the same number as the one of the optical port to the receiving card at the same time. If they are connected simultaneously, the display effect of the optical port will take precedence.
		• When Ethernet port backup is enabled in 40-port mode, the last 20 Ethernet ports are backed up by the first 20 Ethernet ports. When switching to the 20-port mode, please remember to remove the loop backup setup of the receiving card.
HDMI 2.0-1 LOOP	1	HDMI loop through. Up to 8 devices can be cabled in one loop.
HDMI 2.0-2	1	

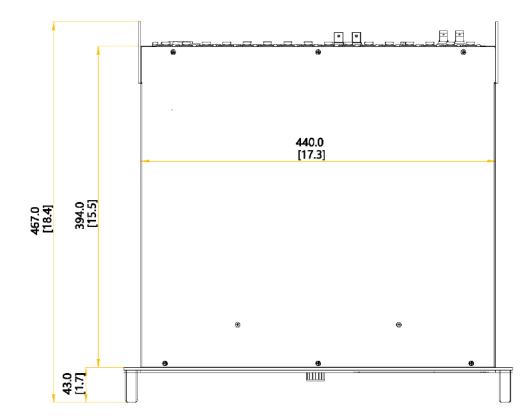
Inputs	Inputs						
Туре	Qty	Description					
LOOP							
HDMI 2.0-3 LOOP	1						
12G-SDI LOOP	1	SDI loop through. Up to 8 devices can be cabled in one loop.					
SPDIF OUT	1	A digital audio output. You can select one of the connected input sources (HDMI 2.0_2 or HDMI 2.0_3) for audio output.					
Controls							
Туре	Qty	Description					
ETHERNET	2	Gigabit Ethernet control ports. Support TCP/IP protocol and star connection. They have the same functions without priority and order, and can be connected to VMP software. No switch or router is needed to deploy multiple devices on the same LAN via device cascading as the network switching function is already built in. Up to 20 MX40 ROE can be cascaded.					
GENLOCK	1	A pair of Genlock signal connectors. Support Bi-Level, Tri-Level, and Blackburst. IN: Accept the sync signal LOOP: Loop the sync signal The Genlock input signal supports a frame rate range from 23.98 Hz to 60 Hz. For standard Genlock signal generators, up to 20 MX40 ROE can be cascaded.					
AUX	1	An auxiliary connector that connects to the central control device (RS232). (Reserved)					
Power							
100-240V~, 50/60Hz	1	An AC power input connector and switch					



The maximum input resolution and maximum width and height of HDMI and DP connectors must be obtained by setting the graphics card.

Dimensions





Tolerance: ±0.3 [±0.012] Unit: mm [inch]

Product Specifications

Electrical	Power input	100-240V~, 50/60Hz	
Specifications	Max power consumption	95 W	
Operating	Temperature	-20°C to +50°C	

Environment	Humidity	0% RH to 80% RH, non-condensing		
Storage	Temperature	-30°C to +80°C		
Environment	Humidity	0% RH to 95% RH, non-condensing		
Physical	Dimensions	482.6 mm × 94.2 mm × 467.0 mm (foot pad included)		
Specifications	Net weight	7.5 kg		
	Gross weight	10.5 kg		
		Note: It is the total weight of the product, accessories, and packing materials packed according to the packing specifications.		
Packing	Packing box	660.0 mm × 570.0 mm × 210.0 mm, kraft paper box		
Information	Accessory box	408.0 mm × 290.0 mm × 50.0 mm, white cardboard box		
	Accessories	 1x Power cord 1x Ethernet cable 1x HDMI cable 1x DP cable 4x Optical modules (single-mode) 1x Certificate of Approval 		
IP Rating		IP20 (Please prevent the product from water intrusion and do not wet or wash the product).		

The amount of power consumption may vary depending on various factors such as product settings, usage, and environment.

Video Source Specifications

Input	Resolution		Color Space	Sampling	Bit Depth	Integer Frame Rate (Hz)
HDMI	4K 4096×2160		RGB /	4:4:4	12bit	24/25/30
2.0		(Forced)	YCbCr		10bit	24/25/30/48/50
		3840×2160 RGB			8bit	24/25/30/48/50/60
			YCbCr	4:2:2	8/10/12bit	
				4:2:0	8/10/12bit	30/48/50/60 (All need to be forced except for 50/60 Hz)
	3840×2160		RGB / 4:4:4	12bit	24/25/30	
			YCbCr		10bit	24/25/30/48/50
					8bit	24/25/30/48/50/60

Input	Resolution		Color Space	Sampling	Bit Depth	Integer Frame Rate (Hz)
			YCbCr	4:2:2	8/10/12bit	
				4:2:0	8/10/12bit	48/50/60 (48 Hz needs to be forced)
	2K1K	2560×1440	RGB /	4:4:4	12bit	24/25/30/48/50/60/75
			YCbCr		10bit	24/25/30/48/50/60/75/100
					8bit	24/25/30/48/50/60/75/100/120
			YCbCr	4:2:2	8/10/12bit	
				4:2:0	8/10/12bit	75/100/120 (All need to be forced)
		1920×1080	RGB /	4:4:4	12bit	24/25/30/48/50/60/72/75/100/120/144
			YCbCr		10bit	
					8bit	24/25/30/48/50/60/72/75/100/120/144/240
			YCbCr	4:2:2	8/10/12bit	(240 Hz needs to be forced)
				4:2:0	8/10/12bit	120/144/240 (All need to be forced)
DP 1.2	4K	4096×2160 (Forced)	RGB /		12bit	24/25/30/48/50
			YCbCr		10bit	24/25/30/48/50/60
					8bit	24/25/30/48/50/60/75
			YCbCr	4:2:2	8/10/12bit	
		3840×2160	RGB / YCbCr	4:4:4	12bit	24/25/30/48/50
					10bit	24/25/30/48/50/60
					8bit	24/25/30/48/50/60/75
			YCbCr	4:2:2	8/10/12bit	(75 Hz needs to be forced)
	2K1K	K 2560×1440	RGB /	bCr 10k	12bit	24/25/30/48/50/60/75/100
			YCbCr		10bit	24/25/30/48/50/60/75/100/120
					8bit	24/25/30/48/50/60/75/100/120/144 (144
		YCbCr	4:2:2	8/10/12bit	Hz needs to be forced)	
		1920×1080	RGB / YCbCr	4:4:4	12bit	24/25/30/48/50/60/75/100/120/144 (144
					10bit	Hz needs to be forced)
					8bit	24/25/30/48/50/60/75/100/120/144/240
			YCbCr	4:2:2	8/10/12bit	(240 Hz needs to be forced)
12G-	4K	4096×2160	YCbCr	4:2:2	10bit	24/25/30/48/50/60

Input	Resolution		Color Space	Sampling	Bit Depth	Integer Frame Rate (Hz)
SDI		3840×2160				
	2K1K	2048×1080				
		1920×1080				



The table above only displays a selection of common resolutions and integer frame rates. Decimal frame rates are also supported, allowing for automatic frame rate adaptation from the highest frame rate of each resolution down to 23.98/29.97/47.95/59.94/71.93/119.88/143.86 Hz.

Ethernet Port Load Capacity

The formula of calculating the load capacity per Ethernet port and the detailed parameters are as follows.

- 8bit: Load capacity × 24 × Frame rate < 1000 × 1000 × 1000 × 0.95
- 10bit: Load capacity × 32 × Frame rate < 1000 × 1000 × 1000 × 0.95
- 12bit: Load capacity × 48 × Frame rate < 1000 × 1000 × 1000 × 0.95

Max Load Capacity per Ethernet Port (Pixels)						
Frame Rate / Bit Depth	8bit 10bit		12bit			
24 Hz	1,649,306	1,236,979	824,653			
25 Hz	1,583,333	1,187,500	791,667			
30 Hz	1,319,444	989,583	659,722			
50 Hz	791,667	593,750	395,833			
60 Hz	659,722	494,792	329,861			
120 Hz	329,861	247,396	164,931			
144 Hz	274,884	206,163	137,442			
240 Hz	164,931	123,698	82,465			

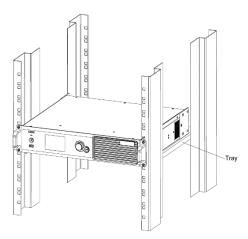
Notes and Cautions

Notes for Battery

- The battery is not intended to be replaced.
- Disposal of a battery into fire or a hot oven, or mechanically crushing or cutting of a battery can result in an explosion.
- Leaving a battery in an extremely high temperature surrounding environment can result in an explosion or the leakage of flammable liquid or gas.
- A battery subjected to extremely low air pressure may result in an explosion or the leakage of flammable liquid or gas.

Notes for Installation

When the product needs to be installed on the rack, 4 screws at least M5*12 should be used to fix it. The rack for installation shall bear at least 9kg weight.



- Elevated Operating Ambient If installed in a closed or multi-unit rack assembly, the
 operating ambient temperature of the rack environment may be greater than room ambient.
 Therefore, consideration should be given to installing the equipment in an environment
 compatible with the maximum ambient temperature (Tma) specified by the manufacturer.
- Reduced Air Flow Installation of the equipment in a rack should be such that the amount of air flow required for safe operation of the equipment is not compromised.
- Mechanical Loading Mounting of the equipment in the rack should be such that a hazardous condition is not achieved due to uneven mechanical loading.
- Circuit Overloading Consideration should be given to the connection of the equipment to the supply circuit and the effect that overloading of the circuits might have on overcurrent

- protection and supply wiring. Appropriate consideration of equipment nameplate ratings should be used when addressing this concern.
- Reliable Earthing Reliable earthing of rack-mounted equipment should be maintained.
 Particular attention should be given to supply connections other than direct connections to the branch circuit (e.g. use of power strips).

FCC Caution

- Any changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.
- This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.
- Note: 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 is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

Others

- This product can only be placed horizontally. Do not mount vertically or upside-down.
- This is Class A product. In a domestic environment, this product may cause radio interference in which case the user may be required to take adequate measures.

