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# The Leading LED Display Service Provider 2019

The logo for NOVA STAR, featuring the word "NOVA" in blue and "STAR" in black, with a green swoosh underlining "NOVA".

**NOVA STAR**



# About Us



Every NovaStar product is designed and built with six main principles in mind: innovation, stability, security, power, ease of use, and customer service. This is why NovaStar products are used all around the world, and trusted for huge events such as the 2008 Beijing Olympic Games, the World Cup, and WWE. From the smallest event to the world's greatest stages, NovaStar's LED display control systems set the industry standard for excellence.

When founded in 2008, NovaStar was nothing but the unlikely dream of a few university students. Working in two alternating shifts around the clock to try and create their first product, missing holidays and balancing schoolwork, ever focused on the goal of one day becoming one of the premier tech companies in the world. That same year, NovaStar was chosen to provide LED display technology for the 2008 Beijing Olympic Games, beginning a journey that is still going strong.

Today, NovaStar is one of the leading LED display solution providers in the world. Still headquartered in their original hometown of Xi'an China, Nova now has 44 branches located around the world, serving more than 10,000 customers. NovaStar also has over 500 proprietary intellectual property patents for products in LED display control, cloud computing, and other fields, leading to the receipt of numerous design and innovation awards.

Nova's many products include LED display synchronous

and asynchronous control systems, calibration systems, cloud-based content publishing and management systems, and more. These products are all designed to integrate easily, forming a complete ecosystem for the setup, operation, and maintenance of LED displays.

We believe that the key to success is innovation. Not only technological innovation, but also the finding of new ways to communicate and interact with customers. Innovative ways to increase the functionality of products, while making them even easier to use. How to increase power and speed while not sacrificing stability or security. These are the questions and goals that so many years later continue to keep our engineers up at night.

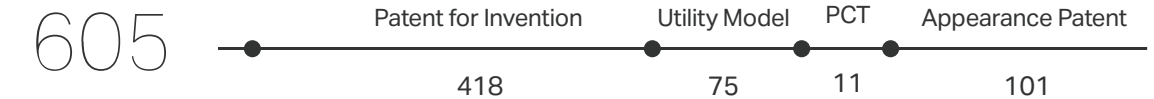
A Nova is one of the brightest astral bodies in the night sky. At NovaStar, we spend every day trying to live up to that name. From day one, becoming the brightest star in the LED display control industry has been the vision of our founder and the entire Nova team. With NovaStar products now trusted all over the world for huge events from the Rio Games to the World Cup to WWE, the unlikely dream has now become a reality.

NovaStory

## Innovation pushes industry and drives future

Patents related to NovaStar in field account for 90% and are growing at an annual pace of 30%.

### Patents (up to 2018)



### Intellectual Property Rights (up to 2018)





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Always on the leading edge of LED technology, NovaStar controllers are fast, sleek, and powerful.

## Controller

### ■ All-in-1 Controller

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# NovaPro UHD



## Features

NovaPro UHD is a new all in controller developed by novastar, by integrated video processor, Switcher, 4k sending card and control software, this product is capable of receiving various video signals, processing and sending images of the resolution up to ultra HD 4Kx2K@60Hz.

NovaPro UHD is equipped with the mainstream 4K connectors in the market, and has been added some new functions, such as video transition effects. With the SMART LCT +VCAN +PLAYER, NovaPro UHD supports layer creation, property setting and screen configuration by simple mouse, keyboard or monitor operations. Wherever a mobile phone or PAD device is available, everything is under control.

NovaPro UHD supports sending the processed video to LED display through Neutrik Ethernet port, fiber optical connector or SDI connector. With powerful video processing and sending abilities, NovaPro UHD is well suited for high-end rental applications, stage control systems and small pitch LED displays.

- Supports various input connectors, including 4 × 12G-SDI connectors with loop output functions, 1 × HDMI2.0 with loop output functions, 1 × DP1.2, connector, and 1 × USB playback port.
- Supports 1 × replaceable input card with four connectors. The input card can be DVI, HDMI or VGA.
- Supports 8 x layers, 1 x OSD and 1 x LOGO, and the BKG is settable.
- Supports up to 2 x layers with the resolution of 4K x 2K@60HZ and 6 x layers with the resolution of 1920x1080P@60HZ.
- OSD supports 4Kx2K, cropping, transparency adjustment, dynamic and static images and texts, and can be placed at any position.
- Layers support transparency adjustment, irregular layers, layer mask, brightness and color keying, and layer overlapping and flipping.
- The maximum supported display width or height of a single device is up to 8K.
- Supports playing the solutions stored in USB drive.
- Supports MultiViewer monitoring settings, including preview of input sources, PVW, PGM, or mixed preview.
- Supports sending the preview content to PC for display support web control via PC, pad, phone through a wireless or wired network.
- Supports 16 × Neutrik Ethernet outputs, 4 × 10G fiber optical outputs with copy and redundancy modes.
- With the built-in smart platform Master VI, layer and screen configurations can be easily performed by using an external mouse, keyboard and monitor.

## Rear Panel

Connector	Quantity	Description
12G-SDI	4	Supports input resolution up to 4Kx2K@60Hz and downward compatibility. Supports 12G-SDI Loop output.
DP1.2	1	Supports input resolution up to 4Kx2K@60Hz and downward compatibility. Supports HDCP1.3.
HDMI2.0	1	Supports input resolution up to 4Kx2K@60Hz and downward compatibility. Supports HDCP1.4 and HDCP2.2. Supports HDMI2.0 Loop output.
DVI	4	Four DVI connectors adopt plug-in design for connecting different input cards according to users' needs. HDMI input cards, Dual-link DVI input cards are supported. The default option is DVI input card.
USB	1	Supports USB playback.



## Output

Connector	Quantity	Description
Neutrik Ethernet port	16	Supports 16xNeutrik Ethernet output ports.
Fiber optical connector	4	Supports 4 × 10G fiber optical output connectors with backup and redundancy modes <ul style="list-style-type: none"> <li>• OPT1 transmits data of Ethernet port 1-8.</li> <li>• OPT2 transmits data of Ethernet port 9-16.</li> <li>• OPT3 is the backup/redundant channel for OPT1 or Ethernet port 1-8.</li> <li>• OPT4 is the backup/redundant channel for OPT2 or Ethernet port 9-16.</li> </ul>
HDMI	1	MVR is used as the monitoring connector of MultiViewer to preview input source, PVM, PGM or perform mixed preview.
AUX	1	AUX is used as an auxiliary output for connecting devices such as a prompter.

## Control

Connector	Quantity	Description
Ethernet	1	Connects to the PC for communication, or to the network.
USB (Type-B)	1	<ul style="list-style-type: none"> <li>• Connects to the PC for device control.</li> <li>• It can be used as the input for cascading devices.</li> </ul>
USB (Type-A)	1	It can be used as the output for cascading devices.
Genlock IN	1	It is used for Genlock signal input.
Genlock LOOP	1	It is used for Genlock signal loop output.
USB (Type-A)	1	<ul style="list-style-type: none"> <li>• Connects a USB drive to play the solutions or perform system upgrade.</li> <li>• Connects a mouse or keyboard.</li> </ul>
GUI	1	Connects to a monitor for human-machine interaction.

# NovaPro HD



The NovaPro HD is a professional LED display controller. Besides the function of display control, it also features in powerful front end processing, so an external scalar is no longer needed. With professional interfaces integrated, NovaPro HD meets the requirements of broadcast industry, in image quality and in control.

## Features

- The inputs of the NovaPro HD include CVBS, VGA, SDI, DVI, HDMI and DP. They support input resolution up to 1080p@60Hz. Highest pixel clock is 165MHz. Output bandwidth is up to 4Gbit. Advanced de-interlacing motion adaptive processing technology is adopted so that images are clear and fine. And with HDMI, the gray scale depth can be up to 12bits.
- Each input can be fully configured with contrast, brightness, hue, saturation, and RGB gain. Inputs can be scaled up or down to fit the LED display resolution.
- Computer software for system configuration is not necessary. The system can be configured using one wheel and one button. All can be done just by fingers. That's what we called Touch Track! You can also configure the system with browsers. This gives you the option of using a remote PC (Windows or Mac or Linux), a pad or even a smart phone to do the configuration. Real-time previews assist with system set-up and confirm source status.
- The NovaPro HD has DMX512 and GenLock interface. Professional control and synchronization are ready to go. Optical fiber outputs enable the confident long-distance data transmission.
- The NovaPro HD is the flagship product of our new generation controllers, powerful in processing, professional in control, and friendly in user-interface. Having a display to work has never been as easier and more enjoyable as with NovaPro HD.



## Rear Panel

Ethernet: Internet port, Can be connected with PC for communication through standard TCP/IP.

<b>USB Control</b>	IN: Connected with PC for communication.
	OUT: Cascaded with the next NovaPro HD.
DMX Control: Connect all consoles that support DMX512 interface protocol.	
<b>Input</b>	Audio input: Audio.
	Video input: DP/HDMI/VGA/DVI/ CVBS /SDI.
<b>SDI LOOP</b>	SDI input signal looping out port.
<b>Genlock</b>	IN: Genlock synchronizing signal guarantees display picture on big screen is synchronous with external Genlock source.
	LOOP: Looping out port of Genlock.
<b>DVI LOOP</b>	DVI input signal looping out port.
<b>Montior</b>	DVI output, monitor can be connected for monitoring.
	HDMI output , monitor can be connected for monitoring.
LED Output: 4-way Internet port output	
OPT Output: 4-way optical fiber output.	
AC Power: AC power interface.	



## Specifications

### Input index

Port	Amount	Resolution specification
<b>CVBS</b>	1	PAL/NTSC
<b>VGA</b>	1	VESA standard
<b>DVI</b>	1	VESA standard (support 1080i input) and support HDCP
<b>HDMI</b>	1	EIA/CEA-861 standard, conforming to HDMI-1.3 standard and supporting HDCP
<b>DP</b>	1	VESA standard
<b>3G-SDI</b>	1	480i, 576i, 720p, 1080i/p (3G SDI)

### Output index

Port	Amount	Resolution specification
<b>DVI input looping out (DVILOOP)</b>	1	Consistent with DVI input Support HDCP looping out
<b>DVI</b>	2	1280×1024/60Hz 1440×900/60Hz 1680×1050/60Hz 1600×1200/60Hz 1600×1200/60Hz – Reduced 1920×1080/60Hz/50Hz 2560×816/60Hz 2048×640/60Hz 1920×1200/60Hz 2304×1152/60Hz 2048×1152/60Hz 1024×1280/60Hz 1536×1536/60Hz User-defined output resolution (bandwidth optimization) Horizontal resolution: maximum 3840 pixels Vertical resolution: maximum 1920 pixels
<b>HDMI</b>	1	
<b>SDI input looping out (SDILOOP)</b>	1	480i, 576i, 720p, 1080i/p (3G SDI)

# VX6s



The VX6s is an all-in-one video controller that integrates sending card functions with video processing. Designed with powerful video processing capability, it supports 10 video inputs and 6 Gigabit Ethernet outputs.

Based on the powerful FPGA processing platform, the VX6s supports multiple transition effects, such as quick seamless switching and fade, providing flexible display controlling and outstanding video presentations.



## Features

- Features 7 input connectors: 2 × 3G-SDI, 2 × HDMI 1.3, 2 × DVI and 1.3, 2 × DVI and 1 × USB playback.
- Supports 3 × window and 1 × OSD.
- Supports quick and advanced screen configurations.
- Switches the PVW to PGM by pressing only the TAKE button in the switcher
- Supports adjustment of input resolutions.
- Supports device redundancy settings.
- The maximum loading capacity of video output is 3.9 million pixels. Multiple VX6s units can be cascaded.
- Supports auto fit function of windows.
- The maximum video output width is 4096 pixels.
- A total of 16 user presets can be created and saved as templates. The templates can be used directly and conveniently.
- Any HDMI or DVI input source can be used as the synchronization signal to achieve vertical synchronization of output.
- Features an intuitive OLED screen and clear button indicator prompt in the front panel, simplifying system control and operation.

## Rear Panel

### Input

Connector	Qty	Description
3G-SDI	2	Supports input resolutions up to 1920×1080@60Hz and downward compatibility.
USB	2	Connects to a USB flash drive to play video or picture files stored in the drive. Connects to a mouse.
DVI	2	VESA standard Supports input resolutions up to 1920×1200@60Hz and downward compatibility. Supports HDCP.
DVI LOOP	1	DVI loop output connector.
HDMI	2	Supports input resolutions up to 1920×1200@60Hz and downward compatibility. Supports HDCP.

### Output

Connector	Qty	Description
Ethernet	6	6 Ethernet outputs

### Control

Connector	Qty	Description
Ethernet	1	Connects to the PC for communication, or to the network.
USB (Type-B)	1	Connects to the PC for device control. Used as the input connector for cascading devices
USB (Type-A)	1	Used as the output connector for cascading devices

CE RoHS FCC



# VX4U



VX4U is a professional LED display controller of NovaStar. Besides having all the functions of an LED display controller, it also features powerful front end video processing. With high image quality and flexible image control, VX4U is able to meet the demands of media industry.



## Features

- The inputs of the VX4U include CVBS×2, VGA×2, DVI×1, HDMI×1, DP×1 and USB×1. The supported input resolution is up to 1920×1200@60Hz. The input images of VX4U can be zoomed point-to-point according to the resolution of LED display.
- With seamless quick switching and fade-in/out effects to enhance and present pictures of professional quality.
- The location and size of PIP (Picture in Picture) are adjustable, which can be controlled at will.
- Adopts NovaStar G4 engine. The screen is stable and flicker free without scanning lines. Images are exquisite and have a good sense of depth.
- Able to perform white balance calibration and color gamut mapping based on the different features of LEDs used by screens to ensure reproduction of true colors.
- HDMI/external independent audio input.
- Supports high-bit video input, 10bit/8bit.
- Loading capacity of video output: 2.3 million pixels.
- Supports multiple controller montage for loading huge screen;
- Supports NovaStar's new-generation pixel-by-pixel calibration technology and the calibration is fast and efficient.
- Adopts an innovative design to enable smart configuration. Screen settings can be completed within several minutes, which has greatly shortened the preparation time.
- With an intuitive LCD interface and clear button indicator lights to simplify the control of the system.

## Rear Panel

Inputs	
Audio	Audio Input
DP	DP Input
HDMI	HDMI Input
USB	USB Input
DVI	DVI Input
VGA1~VGA2	2-Channel VGA Inputs
CVBS1~CVBS2	PAL/NTSC System Composite Video Input
Outputs	
DVI LOOP	DVI Loop Output
Monitor -DVI OUT1	VGA Monitoring Interface1
Monitor -DVI OUT2	DVI Monitoring Interface2
LED Out 1, 2, 3, 4	4-Channel Ethernet outputs
Control	
ETHERNET	Ethernet Control (Connect PC for communication or access network)
Type B USB	USB Control (Connect PC for communication or USB cascade input)
Type A USB	USB cascade output
Power	
AC 100-240V ~ 50/60HZ	AC power interface

## Specifications

### Input index

Port	Qty	Resolution specification
CVBS	2	PAL/NTSC
VGA	2	VESA Standard, support max. 1920×1200@60Hz input
DVI	1	VESA Standard (support 1080i input), support HDCP
USB	1	Multimedia file formats: avi, mp4, mpg, mkv, mov, vob
		Multimedia coding formats: MJPEG, MPEG-1, MPEG-2, MPEG-4, DivX, H.264, Xvid
HDMI	1	EIA/CEA-861 standard, in accordance with HDMI-1.3 standard, support HDCP
DP	1	VESA Standard

### Output index

Port	Qty	Resolution specification
DVI LOOP	1	Consistent with DVI input
VGA	1	Max. output 1280×1024@60Hz (2.3 million pixels) Self-defined output resolution (Bandwidth optimization)
DVI	1	Max. horizontal resolution up to 3840 pixels Max. vertical resolution up to 1920 pixels



# VX4S



The VX4S is a professional LED display controller. Besides the function of display control, it also features in powerful front-end video processing. With high image quality and flexible image control, VX4S is able to meet the demands of media industry.



## Features

- The inputs of the VX4S include CVBS×2, VGA×2, DVI×1, HDMI×1, DP×1 and SDI×1. They support input resolution up to 1920×1200@60Hz; the input images of VX4S can be zoomed point-to-point according to the screen resolution.
- Provide seamless high-speed switching and fade-in/ fade-out effect so as to strengthen and display picture demonstration of professional quality.
- The location and size of PIP can both be adjusted, which can be controlled at will.
- Adopt the NovaStar G4 engine; the screen is stable and flicker free without scanning lines; the images are exquisite and have a good sense of depth.
- Can implement white balance calibration and color gamut mapping based on different features of LEDs used by screens to ensure reproduction of true colors.
- HDMI/external audio input.
- 10bit / 8bit HD video source;
- The loading capacity: 2.3 million pixels.
- Support multiple controller montage for loading huge screen.
- Support NovaStar's new-generation point-by-point calibration technology; the calibration is fast and efficient.
- Computer software for system configuration is not necessary. The system can be configured using one knob and one button. All operations can be done in a few steps. That's what we call Easy Screen Configuration!
- Adopt an innovative architecture to implement smart configuration; the screen debugging can be completed within several minutes; greatly shorten the preparation time on the stage.
- An intuitive LCD display interface and clear button light hint simplify the control of the system.

## Rear Panel

Input Source	
Audio	Audio Input
DP	DP Input
HDMI	HDMI Input
SDI IN	SDI Input
DVI	DVI Input
VGA1~VGA2	2-Channel VGA Inputs
CVBS1~CVBS2	PAL/NTSC composite video Input
Output Interface	
DVI LOOP	DVI Loop Output
SDI LOOP	SDI LOOP Output
Monitor -DVI OUT 1	DVI Monitoring Interface 1
Monitor -DVI OUT 2	DVI Monitoring Interface 2
LED Out 1, 2, 3, 4	4-Channel Ethernet outputs
Controlling Interface	
ETHERNET	Network Control (Communication with PC, or Access Network)
Type B, female USB	USB Control (Communication with PC, or Cascade Input)
Type A, female USB	USB Cascade Output
Power	
AC 100-240V~50/60HZ	AC power interface



## Specifications

Input index		
Port	Number	Resolution specification
CVBS	2	PAL/NTSC
VGA	2	VESA Standard, support max. 1920×1200@60Hz input
DVI	1	VESA Standard (support 1080i input), support HDCP
SDI	1	480i, 576i, 720P, 1080i/P
HDMI	1	EIA/CEA-861 standard, in accordance with HDMI-1.3 standard, support HDCP
DP	1	VESA Standard
Output index		
Port	Number	Resolution specification
DVI LOOP	1	Consistent with DVI input
VGA	1	1280×1024@60Hz 1440×900@60Hz 1280×1024@60Hz 1440×900@60Hz 1680×1050@60Hz 1600×1200@60Hz 1600×1200@60Hz – Reduced 1920×1080@60Hz 2560×816@60Hz 2048×640@60Hz 1920×1200@60Hz 2304×1152@60Hz 2048×1152@60Hz 1024×1280@60Hz 1536×1536@60Hz Self-defined output resolution (Bandwidth optimization) Horizontal resolution maximum 3840 pixels Vertical resolution maximum 1920 pixels
DVI	1	1280×1024@60Hz 1440×900@60Hz 1680×1050@60Hz 1600×1200@60Hz 1600×1200@60Hz – Reduced 1920×1080@60Hz 2560×816@60Hz 2048×640@60Hz 1920×1200@60Hz 2304×1152@60Hz 2048×1152@60Hz 1024×1280@60Hz 1536×1536@60Hz Self-defined output resolution (Bandwidth optimization) Horizontal resolution maximum 3840 pixels Vertical resolution maximum 1920 pixels
SDI LOOP	1	480i, 576i, 720p, 1080i/p Consistent with SDI input

# MCTRL4K



MCTRL4K is an independent master controller developed by NovaStar with an epoch-making significance. The loading capacity of a single unit is up to 4096×2160@60Hz, which is able to meet the on-site requirements of oversized LED displays. MCTRL4K makes it easier to create stunning visual effects for users.

MCTRL4K also can be used as two independent master controllers, which makes it more flexible to load LED displays.

The design of MCTRL4K is innovative. It allows to configure a display at any time without PC.

Various video inputs such as DP, HDMI, dual-link DVI etc. and outputs of 16-channel Neutrik Gigabit Ethernet ports as well as 4-channel optical fiber ports are supported.



## Features

- HDR 10 (High Dynamic Range)**  
 The MCTRL4K controller with A8s or A10s receiving cards offers an excellent solution to precisely parse HDR video sources.
- HLG**  
 HLG is a standard for HDR(High Dynamic Range) , which can capture high dynamic range images directly , making the images have more overall detail, a wider range of colors, and look more similar to what is seen by the human eyes. And no metadata is required for real-time transmission.
- 3D (Three Dimensional)**  
 MCTRL4K can support 3D function just by adding one NOVA 3D External Emitter EMT200 and updating the program.
- HDR offers viewers increased contrast and luminance ranges, a broader and richer color gamut and an immersive viewing experience.
- Complete video input interfaces: DP1.2 ×1, HDMI2.0×1, dual-link DVI×2;
- Supports 16-channel Neutrik Gigabit Ethernet outputs and 4-channel optical fiber outputs and maximum loading capacity of a single unit up to 4096×2160 @ 60Hz maximum width or height up to 7680
- Supports two operating modes during dual-link DVI input: mosaic and multi-card;
- Innovative design to enable smart configuration without PC which has greatly shortened the time for stage preparation;
- Supports NovaStar's latest pixel-by-pixel calibration technology, the process of which is fast and efficient;
- Enables white balance calibration and color gamut mapping based on the different features of LEDs on the display to ensure the real restoration of color;
- Manual adjustment of screen brightness, which makes it much easier and quicker;
- Multiple controllers are able to be cascaded for uniform control.
- Support SNMP function, to monitor the status of devices in real time with SNMP converter; mass data is instantly acquired, state is fully controlled, and equipment is zero-fault.
- Support low latency

## Rear Panel

### Inputs

<b>DP 1.2</b>	DP 1.2 connector
<b>HDMI 2.0</b>	HDMI 2.0 connector
<b>DUAL DVI-D1/D2</b>	Dual-link DVI interface

### Outputs

<b>1~16</b>	16-channel Neutrik Gigabit Ethernet outputs
<b>OPT1~4</b>	4-channel optical fiber outputs

### Control

<b>ETHERNET</b>	Control interface
<b>USB</b>	IN: cascade input or connecting to PC for communication OUT: cascading next unit

### GenLock

<b>IN</b>	Genlock type: Blackburst Genlock synchronous signal, making sure the pictures on LED display are synchronous with external Genlock source.
<b>LOOP</b>	Genlock loop output

### Power supply

<b>AC 100-240V ~50/60HZ</b>	AC power interface
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## Specifications

**Input index** Supports special frame rate and achieves (23.98/29.97/47.95/59.94/71.93/119.88) Hz automatic frame rate adaptation.

Port	Qty	Resolution specification
<b>DP</b>	1	DP 1.2 standard Max. supported resolution:3840×2160@60Hz or 7680×1080@60Hz (downward compatibility)
<b>HDMI</b>	1	HDMI 2.0 standard Max. supported resolution:3840×2160@60Hz or 7680×1080@60Hz (downward compatibility)
<b>Dual-link DVI</b>	2	VESA standard, max. supported resolution: 3840x1080@60Hz (downward compatibility)

### Output index

Port	Qty	Resolution specification
<b>RJ45</b>	16	Neutrik Gigabit Ethernet port
<b>OPT</b>	4	Optical fiber port, single mode and double fiber, LC port, 1310nm OPT1 is used for transferring the data of port 1-8 OPT2 is used for transferring the data of port 9-16 OPT3 is the backup channel of OPT1 OPT4 is the backup channel of OPT2 Either Gigabit Ethernet port or optical fiber port can be used at the same time. Two types of ports cannot be used to connect devices simultaneously.

# MCTRLR5



MCTRLR5 is an independent master controller developed by NovaStar with an epoch-making significance. Its flexible rotation function allows users to make their LED displays more creative. The loading capacity of a single unit is up to 3840×1080@60Hz. MCTRLR5 can meet the on-site requirements of oversized LED displays. With a unique innovative design, it enables screen configuration any time without the need for a computer. Various video inputs such as HDMI, dual-link DVI, SDI and outputs of 8-channel Neutrik Gigabit Ethernet as well as 2-channel optical fiber are supported. MCTRLR5 also can serve as two independent controllers, which makes it more flexible to load LED displays and creates a stunning experience for users.

## Features



- Complete video inputs: 6G-SDI, HDMI 1.4×1, dual-link DVI×1.
- Support simultaneous output of 8-way Neutrik Gigabit Ethernet port and 2-way fiber port with single-device load up to 3840×1080@60Hz.
- Images can be rotated with any angle at any area on the screen. Cabinet, port and screen rotation operation become much easier.
- Innovative design enabling smart configuration and greatly shortening the preparation time.
- Supports NovaStar's G4 engine to create stable and flicker-free pictures without scanning lines, and present smooth images with a good sense of layering.
- Supports NovaStar's latest pixel level calibration technology with a fast and efficient process.
- Enables white balance calibration and color gamut mapping based on the different features of LEDs on the display to ensure colors are faithfully reproduced.
- Screen configuration can be done at any time without the need for a computer.
- Manual adjustment of screen brightness with convenience and efficiency.
- USB port of the front panel can be used for firmware upgrade.
- Status display showing cabinet status in a more intuitive way.
- Multiple MCTRLR5 units can be cascaded for uniform control.



## Specifications

Inputs		
Port	Qty	Resolution specifications
6G-SDI	1	SMPTE ST2081 standard Maximum supported resolution: 3840×2160@30Hz (downward compatibility).
HDMI	1	HDMI 1.4 standard Maximum supported resolution: 3840×2160@30Hz (downward compatibility).
Dual-link DVI	1	VESA standard Maximum supported resolution: 3840×1080@60Hz and 3840×2160@30Hz (downward compatibility).
Outputs		
Port	Qty	Resolution specifications
RJ45	8	Neutrik Gigabit Ethernet port
OPT	2	Optical fiber port, single mode and double fiber, LC port, 1310nm OPT1 is used for transferring the data of port 1-8 OPT2 is the backup channel of OPT1 Both Gigabit Ethernet port and fiber port can be connected to the device simultaneously in one operation.
Control		
Port	Qty	Description
ETHERNET	1	Control interface
USB	2	Control interface of upper computer and cascading interface
GenLock		
IN		Genlock type: Blackburst Genlock synchronizing signal keeping pictures being displayed on the screen in sync with external Genlock source.
LOOP		Genlock loop out



# MCTRL660 PRO



The MCTRL660 PRO is a professional controller developed by NovaStar. A single MCTRL660 PRO has a loading capacity of up to 1920×1200@60Hz. It allows users to customize resolutions to configure ultra-large screens with ultra-width or ultra-height.

The MCTRL660 PRO is mainly used for the rental and fixed fields, such as concerts, live events, security monitoring centers, Olympic Games and various sports centers.



## Features

- Input connectors: 1×3G-SDI, 1×HDMI 1.4a, 1×single-link DVI.
- Output connectors: 6×Gigabit Ethernet port, 2×10G optical port.
- Loop output connectors: 1×3G-SDI LOOP, 1×HDMI LOOP, 1×DVI LOOP
- Input of ultra-high color depths, such as 10-bit/12-bit 4:4:4, with input resolutions up to 1920×1080@60Hz, increasing color expression capabilities by 4096 times compared to 8-bit inputs, and presenting images with rich and delicate colors, smoother transitions, as well as clearer details.
- Independent Gamma adjustment of RGB, effectively controlling image non-uniformity under low grayscale and white balance offset to improve image quality.
- Support low latency
- Dual working modes: working as sending card and fiber converter.
- One-click backup and recovery, quickly recovering previous screen configurations to deal with sudden on-site failure.
- Image flipping, making stage effect more cool and dazzling.

## Rear Panel

	Connector	Description
Input	DVI IN	Single-link DVI connector Custom resolutions supported: <ul style="list-style-type: none"> <li>▪ Maximum horizontal resolution: 3840×600@60Hz</li> <li>▪ Maximum vertical resolution: 600×3840@60Hz</li> </ul> Supported standard resolutions (See the device menu)
	DVI LOOP	DVI loop out
	HDMI IN	HDMI 1.4a compliant HDCP 1.4 compliant Custom resolutions supported: <ul style="list-style-type: none"> <li>▪ Maximum horizontal resolution: 3840×600@60Hz</li> <li>▪ Maximum vertical resolution: 600×3840@60Hz</li> </ul> Supported standard resolutions (See the device menu)
	HDMI LOOP	HDMI loop output
	3G-SDI IN	SMPTE ST 425-1 Level A & B, SMPTE ST 274, ST 296, ST 295 compliant Supported input resolutions: 1920×1080@60Hz, 1280×720@60Hz Note: Do not support setting the resolutions for 3G-SDI input sources.
	3G-SDI LOOP	SDI loop output

	Connector	Description
Output	RJ45×6	Maximum loading capacity of a single output: 650 000 pixels. Support redundancy between Ethernet ports.
	OPT1 OPT2	10G optical ports. The loading capacity of a single optical port equals to that of all the 6 Ethernet ports. 2 OPT inputs/outputs: <ul style="list-style-type: none"> <li>▪ The OPT1 works as the primary input or output port, and the 6 Gigabit Ethernet ports work as the corresponding output or input ports.</li> <li>▪ The OPT2 works as the backup input or output port.</li> </ul> In the sending card mode, both OPT ports and 6 Gigabit Ethernet ports work as output ports to output the same image. In the fiber converter mode, when the OPT ports work as the input ports, the 6 Gigabit Ethernet ports work as output ports. Or, when the 6 Gigabit Ethernet ports work as input ports, the OPT port works as output port.
	MONITOR	HDMI Connects to a monitor to monitor the inputs. The output resolution is 1920×1080@60Hz.
Control	GENLOCK IN	Genlock type: Blackburst Genlock sync signal: Used to ensure synchronization between the LED screen display and external Genlock source
	GENLOCK LOOP	Up to 8 MCTRL660 PRO units can be cascaded.
	ETHERNET	connects to PC and supports TCP/IP
	USB IN	Input port for cascading devices, or connecting to PC
	USB OUT	Output port for cascading devices. Up to 8 MCTRL660 PRO units can be cascaded.
Power	100 V –240 V AC	



# S1



With multiple I/O and coaxial interfaces, controller S1 is ideal for different applications. It has higher data transmission bandwidth. One S1 controller can support 3840×1080@60Hz making the LED display connection simpler. Benefiting from the SerDes technology, controller S1 has zero latency and is especially designed for high-end LED display applications.

## Features



- The inputs of the S1 includes 3G-SDI×1, HDMI×1, DVI×1 and support input resolutions up to 3840×1080@60Hz.
- The outputs of the S1 includes BNC×2 pairs.
- Zero latency feature, the whole system includes S1 and TR100 only 1 frame.
- Support pixel-level calibration technology.
- Support Mapping.
- Support the hardware backup solution.
- The system can be configured with a knob and a button on the front panel. Computer software for system configuration is not necessary.
- The OLED display makes operations much easier.



## Rear Panel

	Interface	Resolution specification
Input	DVI×1	Single-link DVI User-defined resolution settings Horizontal resolution up to 3840 pixels Vertical resolution up to 3840 pixels
	HDMI×1	Supports 3840×2160@30Hz, 3840×1080@60Hz, etc.
	SDI×1	Supports 3G-SDI SDI Loop
Output	BNC×4	2-channel outputs and 2-channel inputs, with each pair channel supports bandwidth up to 3.25G and can load 1080p led screen. Zero-latency. The maximum transmission distance of the coaxial cable is 100 meters.
GenLock	IN×1	GenLock synchronizing signal keeping pictures being displayed on the screen in sync with external GenLock source.
	LOOP×1	GenLock loop out
Control	RS232(Baud rate 115200Bps)/ USB(cascading) / RJ45 (TCP/IP).	
Switch	100~240VAC @50/60Hz	AC power interface.



Power, stability, and easy integration. You really can have it all.

# Video Processor

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J6	29
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# J6



Developed by NovaStar, J6 is the latest high-performance multi-screen splicing processor featuring enhanced image processing. Based on a powerful FPGA processing platform, J6 supports quick seamless switch of any input source and supports transition effects such as fade, etc., allowing you to experience more flexible screen layouts.

In addition, J6 can work with the new smart management software V-Can to enable more screen splicing effects and better satisfy your needs.



## Features

- Supports a wide range of video inputs divided into 4 groups with 8 interfaces, including 1×CVBS/VGA/HDMI/DVI (allowing you to choose any one of these 4 interfaces), 1×DualLink DVI/HDMI 1.4/DP1.1(allowing you to choose any one of these three interfaces).
  - resolution of each window is up to 7680×1080@60Hz.
  - Window position, size, etc. are adjustable allowing to add borders to the windows and set border width, color, etc.
  - Capable of creating 10 presets which are saved as templates and can be used directly and easily.
  - Provides dozens of input source transition effects to enhance and present demo images with professional quality.
  - An intuitive color LCD on the front panel and clear button indicator lights simplify the system control operations.
  - Supports Genlock synchronization, allowing you to choose any input source or external synchronous signal to achieve frame lock output.
- Input resolution of Input A supports 4K×2K@30Hz. Other inputs support 1920×1080@60Hz which are downward compatible.
- Supports 5 output channels, including 4 groups with 8 interfaces of DVI splicing output and one HDMI preview output.
- The preview interface supports preview of 8 video input signals, and supports overlapping display of information like input resolution, frame rate, etc.
- Output resolution can be set. Splicing width of 4 channels can be up to 15360×600.
- Capable of displaying 6 windows simultaneously at most and the maximum



## Specifications

Inputs		
Port	Qty	Specifications
DualLinkDVI/HDMI1.4/DP1.1 (Choose one from these inputs)	1	Supports 4K×2K@30Hz, 2560×1600@60Hz (downward compatible)
DVI(DVI-D)	4	VESA standard 1920×1080@60Hz(downward compatible)
CVBS(BNC)/VGA(DB25)/HDMI/DVI(DVI-D) (Choose one from these inputs)	1	VESA standard 1920×1080@60Hz(downward compatible)
SDI(BNC)	2	720p, 1080p
Outputs		
Port	Qty	Specifications
DVI(DVI-D)	4 groups (8 channels)	Maximum supported resolution of each interface: 1080p (DualLink output is available for DVI1and DVI3DualLink.)
SDI Loop(BNC)	2	480i, 576i, 720p, 1080i/p (3G SDI), same as SDI input
HDMI(Type A)	1	Supported output resolution: 1920×1080@60Hz
Control		
Port	Qty	Specifications
ETHERNET(RJ45)	1	Control interface
USB(Type-B)	1	Control interface for connecting upper computer
USB(Type-A)	1	Interface for cascading more J6 units





# C1



C1, a console specially designed for NovaStar's terminal video processing products, such as J series, is mainly used for live stage control.

The C1 is designed with two LCD screens. One is used for previewing input sources. The other, together with buttons on the panel, is used to configure the layer size, layer position, input source, output resolution, layer border and input source cropping under each preset.

The C1 is also designed with a joystick and T-Bar. The joystick is used to precisely adjust the size and position of layers. The T-Bar supports adjustment of 1024 levels of layer transparency, finely controlling the transition effects of presets and PVW,PGM for switching.

Thanks to the cool lighted buttons, highly sensitive joystick and T-Bar, plus the two LCD screens, the C1 is extremely easy to operate, making live stage control most convenient.



## Features

- Support two LCD screens ,one for monitoring the other touch screen for operating. During operating, users can view on one of the LCD screens the input source status, preview status and status of output on LED display, so that the overall situation is under control.
- Supports control of up to 16 terminal devices.
- C1 support J6,N9.
- Supports screen mosaic, easy mosaic, output image quality adjustment, BKG settings, EDID settings, test patterns, and switching from normal display to blackout with one button press.
- Supports up to 32 presets.
- Supports preset copying, use of preset templates, preset customizing, saving of custom presets, preset data cleanup, lockup of preset area on C1 operation panel.
- Supports up to 8 x layers, 1xOSD, 1xBKG, and 1xLOGO.
- Supports configurations of shape layers and layer mask.
- Supports layer adding with one button press, layer cleanup with one button press, and moving a layer to the front or back with one button press.
- Supports layer editing, layer image quality adjustment, layer border settings, and layer freezing.
- Supports settings of the layer size and position through the joystick and buttons.
- Supports Aux configuration.
- Supports input source cropping.
- Supports 13 transition effects and settings of transition duration.
- Supports adjustment of the joystick's sensitivity.
- Supports manual adjustment of the fade transition effect of layers by using the T-Bar.
- Supports remote or live control of terminal video processors through RJ45.



## Specifications

Port and Button	Quantity	Description
Ethernet (RJ45)	1	A port to remotely control the terminal through network
USB	1	Used to update program, or connect to the upper computer
U-DISK	1	Connects to a USB drive to import USB files
Monitor	1	IN: An HDMI preview connector that connects to the HDMI preview connector of a terminal LOOP: An HDMI loop output connector which can display the preview display of a terminal on other display devices
RS232	1	A control connector that connects to the upper computer
Reset button	1	A pinhole reset button used to reset and restart the C1



# N9



## Features

N9 is a high-performance multi-screen video switcher independently developed by NovaStar. Using high-performance video processing technologies, the N9 is capable of processing and outputting ultra-high quality images. The N9 also features powerful video signal receiving capability. It can support 9 inputs and 4 DVI outputs at the same time. A single N9 can load up to an 8KK screen, and multiple N9 units can be cascaded for output.

The N9 can work with NovaStar's Event console C1 and make the operation of N9 on stage more convenient.

What's more, it can work with the new smart management software V-Can to enable more screen mosaic effects and better satisfy your needs.

Thanks to the powerful capabilities of receiving and processing a variety of video signals, the N9 can be widely applied in various scenarios, such as intermediate and high-end rental, stage control, media centers, big conference sites, exhibition sites and concert control centers.

- Supports 9 inputs: 1×DP1.2 with the resolution up to 3840×2160@60Hz, 1×SDI with the resolution up to 1920×1080@60Hz, 1×dual link input of Dual link DVI, DP1.1 or HDMI1.4 input card with the resolution up to 3840×1080@60Hz, and 6 inputs with the resolution up to 1920×1080@60Hz.
- Supports 4 DVI mosaic outputs, 4 DVI backup outputs, 1 HDMI preview output, and 2 Aux outputs.
- Supports up to 7 layers. The maximum resolution of each year can reach 3840×2160, 7680×1080, or 1920×4320.
- Supports BKG settings. The BKG can be uploaded from the upper computer, or from the display screenshots.
- Supports quick and custom mosaic.
- The output resolution can be set. The mosaic width of 4 outputs can be up to 15360×600.
- Supports 2 Aux outputs.
- The preview connector supports previewing of inputs, PVW and PGM.
- A total of 32 user presets can be created and saved as templates. The templates can be used directly and conveniently. Provides various transition effects .
- Features an intuitive LCD screen and clear button indicator prompt on the front panel, simplifying system control and operation.
- Supports Genlock synchronization and synchronization with any input source.

## Rear Panel

Inputs	
INPUT-1	DP1.1, 3840×1080@60Hz and downward compatible This connector can be replaced with an HDMI1.4, DP1.1 or Duallink DVI connector based on user requirement.
INPUT-2	HDMI1.3, 1920×1080@60Hz and downward compatible These connectors can be replaced with DVI, VGA or CVBS connectors based on user requirement to accept different video sources.
INPUT-3	
INPUT-4	DVI1, VESA standard compliant, 1920×1080@60Hz and downward compatible.
INPUT-5	DVI2, VESA standard compliant, 1920×1080@60Hz and downward compatible.
INPUT-6	DVI3, VESA standard compliant, 1920×1080@60Hz and downward compatible.
INPUT-7	DVI4, VESA standard compliant, 1920×1080@60Hz and downward compatible.
INPUT-8	DP1.2, 3840×2160@60Hz and downward compatible.
	DP1.2 LOOP
INPUT-9	SDI, 1920×1080@60Hz and downward compatible
	SDI LOOP

Outputs	
HDMI	MVR output, capable of previewing of 9 input sources, PVW and PGM
DVI1	DVI1 output If the output mode is set to Duallink, this connector is DuallinkOut1.
DVI2	DVI2 output If the output mode is set to Duallink, this connector is invalid.
DVI3	DVI3 output If the output mode is set to Duallink, this connector is DuallinkOut2.
DVI4	DVI4 output If the output mode is set to Duallink, this connector is invalid.
HDMI1/HDMI2	2 Aux outputs
Control	
ETHERNET (RJ45)	A control connector.
USB (Type-B)	Connects to the upper computer.
USB (Type-A)	Cascades N9 units.
Genlock-Loop	Connects to a synchronization signal to synchronize cascaded units.





Rethinking what one little card can do.

# Receiving Cards

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ARMOR	37
TR100	41

# ARMOR



## Armor Series Receiving Cards

Highly improving the image quality on the display

The high-end and small-size receiving cards of Armor series developed by NovaStar uses multiple unique LED display image processing technologies, such as 18bit+ and ClearView, to greatly improve the display image quality, make the image attractive and vivid, and the display value more visible.



## Features



- **HDR 10**  
The high-end and small-size receiving cards of Armor series developed by NovaStar uses multiple unique LED display image processing technologies, such as 18bit+ and ClearView, to greatly improve the display image quality, make the image attractive and vivid, and the display value more visible.  
(A8s, A10s)
- **HLG**  
HLG is a standard for HDR(High Dynamic Range) , which can capture high dynamic range images directly , making the images have more overall detail, a wider range of colors, and look more similar to what is seen by the human eyes. And no metadata is required for real-time transmission.  
(A8s, A10s)
- **18bit+**  
Effectively avoid grayscale loss caused by brightness reduction and improve the grayscale performance under low brightness, displaying more exquisite and expressive images.  
(A8s, A10s)
- **ClearView**  
Adjust the texture, size and contrast in different areas of images based on characteristics of the human visual system to make the image details more vivid and realistic.  
(A8s, A10s)
- **Low Latency**  
Reduce the frame latency of the video source on the receiving card end to 1 frame (for the module that the RAM is built within the driver IC).  
(A8s, A10s, Supported by dedicated firmware)
- **LVDS Transmission**  
Use the transmission mode of low-voltage differential signaling (LVDS), realizing less data cables between the receiving card's HUB board and module, longer transmission distance, higher signal transmission quality, better EMC effect and more stable image output.  
(A4s, A5s, A7s, A8s, A9s, A10s, Supported by dedicated firmware)
- **Mapping**  
Display the receiving card ID and Ethernet port information on the cabinet. The user could get the receiving card's location and wiring route, which makes debugging extremely convenient.  
(A5s, A7s, A8s, A9s, A10s)
- **Free Screen Rotation**  
Working with the MCTRL R5, the receiving cards support screen rotation at any angles, displaying plentiful and more creative images.  
(A8s, A10s)
- **Automatic Calibration**  
After a module has been replaced, the receiving card can automatically read the new module ID and calibration coefficients, and save them to the Flash of the receiving card.  
(A5s, A7s, A8s, A9s, A10s)

CE (Class B) RoHS

(For detailed function comparison, please see next page.)

# ARMOR



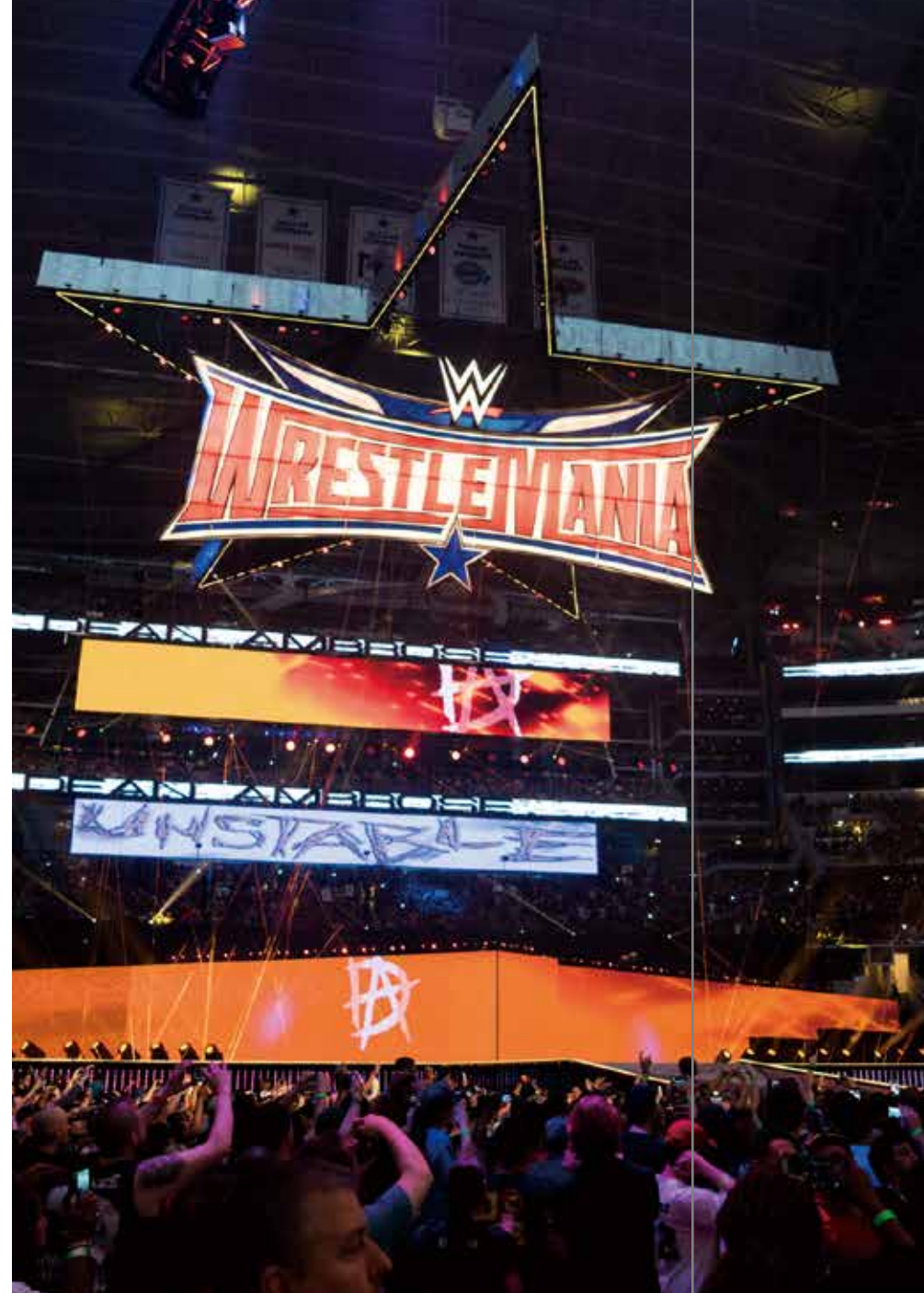
Product Model	A4s	A5s	A7s	A8s	A9s	A10s
Resolution (PWM IC)	256×256	320×256	512×256	512×256	512×512	512×512
RGB Parallel Data Group	24	32	32	32	32	32
Serial Data Group	64	64	64	64	64	64
MOM (Memory on module)	✓	✓	✓	✓	✓	✓
Smart Module	✓	✓	✓	✓	✓	✓
Receiving Card Backup		✓	✓	✓	✓	✓
Power Supply Backup	✓	✓	✓	✓	✓	✓
Loop Backup	✓	✓	✓	✓	✓	✓
Cabinet Monitoring LCD	✓	✓	✓	✓	✓	✓
Temperature Monitoring	✓	✓	✓	✓	✓	✓
Power Supply Monitoring	✓	✓	✓	✓	✓	✓
Monitoring of Ethernet cable communication status (Supported by dedicated firmware)	✓	✓	✓	✓	✓	✓
CE-EMC Class B	✓	✓	✓	✓	✓	✓
RoHs	✓	✓	✓	✓	✓	✓

Product Model	A4s	A5s	A7s	A8s	A9s	A10s
<b>Maintenance Function</b>						
Firmware Copy	✓	✓	✓	✓	✓	✓
RCFG Restore and Read	✓	✓	✓	✓	✓	✓
<b>Calibration Function</b>						
Pixel level color and brightness calibration	✓	✓	✓	✓	✓	✓
Quick seam correction	✓	✓	✓	✓	✓	✓
One-Click Apply Calibration Coefficient in MOM	✓	✓	✓	✓	✓	✓
Calibration Coefficient Backup		✓	✓	✓	✓	✓
Auto Calibration		✓	✓	✓	✓	✓
<b>Performance Enhancements</b>						
Prestored Picture	✓	✓	✓	✓	✓	✓
Rotation per 90°	✓	✓	✓	✓	✓	✓
EMC Optimizing	✓	✓	✓	✓	✓	✓
LVDS Transmission	✓	✓	✓	✓	✓	✓
3D function	✓	✓	✓	✓	✓	✓
Mapping		✓	✓	✓	✓	✓
18bit+				✓		✓
ClearView				✓		✓
Free Rotation (with R5)				✓		✓
Low Latency				✓		✓
HDR				✓		✓

# TR100



TR100, a new generation of receiving card with coaxial connectors as the transmission media, features higher pixels drive capacity up to 384×384, and supports 1.0/2.3 connector which ensures more reliable system connection and data transmission. Benefiting from the SerDes technology, TR100 has the lower latency feature (1 frame).



## Features

- Support 32-group of RGB data output per single card.
- Support 384×384 resolution per single card.
- Support configuration file reading back.
- Support smart module with the functions of storing and managing information like calibration coefficients, module information, module parameters etc. as well as flat cable detection and LED pixel-by-pixel error detection without monitoring card.
- Support module Flash management and allows for storage of calibration coefficients and module information.
- Support various hot backups such as hardware backup, dual card backup, dual power backup etc. and seamless switching.
- Support low latency feature.
- Support voltage and temperature detection.
- Support 18bit+ grey-level output.
- Support pixel-level calibration.
- Support pre-store picture setting for the receiving card.
- Support dual backup of display parameters.
- Able to apply module Flash calibration coefficients through one click.
- Support LCD Human-Computer Interaction (HCI).
- Support Mapping which will display the serial number and port number of the current cabinet
- Support dual backup of calibration coefficients.
- Support backup and read back of the firmware program.
- With specific EMC design to effectively reduce electromagnetic radiation.

CE RoHS



Sometimes even the best products need a helping hand.  
NovaStar's accessories are designed to work seamlessly with our products.

## Accessories

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Fiber Converter CVT310 / CVT320	45
Fiber Converter CVT4K-S / CVT 4K-M	45
Ambient Brightness Sensor NS060	46
Multifunction Card MFN300	46
Fiber Converter CVT-Rack310 / CVT-Rack320	47
Ambient Temperature Sensor MTH310	48
Monitoring Card MON300	48



### Fiber Converter CVT310 / CVT320

- 1 optic fiber interface.
- 1 RJ45.
- Power supply: 100 ~ 240V AC 50/60Hz.
- No need to install the drivers.
- CVT310: Transmission distance up to 300m, by using multi-mode dual-core optic fiber with LC interface.
- CVT320: Transmission distance up to 15km, by using single-mode dual-core optic fiber with LC interface.
- Certification: CE、RoHS、 FCC、 EAC



### Fiber Converter CVT4K-S / CVT 4K-M

- Supports 16-channel Neutrik Ethernet outputs.
- Supports 4-channel optical fiber interfaces(10G fiber adapter). Two of them are master input/output channels and the other two are backups.
- Supports two types of power interfaces (3-pin power socket and PowerCON) with dual-power redundancy backup.
- With various indicator lights on the front panel, each status can be showed clearly.
- AC 100-240V ~ 50/60HZ.
- No need to install the drivers.
- Transmission distance of CVT 4K-S is 10km  
Transmission distance of CVT 4K-M is 300m
- Certification: EMC、 LVD、 RoHS、 FCC、 UL/CUL、 CB、 EAC、 IC.



### Ambient Brightness Sensor NS060

- Ambient brightness detect, 256 levels of auto brightness adjustment.
- Sending card (MSD300, MCTRL300, MCTRL600), PSD100 or multi-function card (MFN300) supported.
- 5m standard cable, 100 meters extend.
- With protection from dust ingress and water jet, it can be used in an outside setting.
- Certification: CE, RoHS



### Multifunction Card MFN300

- 8 power switch management.
- 4 light sensor/ambient temperature sensor interface.
- Auto power control of fan/air condition/LED display based temperature.
- Audio output integrated.
- Certification: CE、 RoHS





### Fiber Converter CVT-Rack310 / CVT-Rack320

- 16 optic fiber interface.
- 16 RJ45.
- Power supply: 100 ~ 240V AC 50/60Hz.
- No need to install the drivers.
- CVT-Rack310: Transmission distance up to 300m, by using multi-mode dual-core optic fiber with LC interface.
- CVT-Rack320: Transmission distance up to 15km, by using single-mode dual-core optic fiber with LC interface.
- Certification: CE、FCC、RoHS、IC



### Ambient Temperature Sensor MTH310

- Detect ambient temperature.
- Multi-function card supported.
- 5m standard cable, 100 meters extend.
- Waterproof.
- Certification: CE、RoHS、FCC



### Monitoring Card MON300

- Cabinet temperature, humidity and smoke monitoring.
- 8 power supply voltage monitoring.
- Ribbon cable status monitoring.
- Cabinet door open/close status monitoring.
- 4 fan speed monitoring.
- LED error status monitoring.
- Certification: CE、RoHS

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