

# **BR860-1**

LED Display Control Board



## **Specifications**

## Change History

| Document Version | Release Date | Description                                         |
|------------------|--------------|-----------------------------------------------------|
| V1.0.1           | 2025-09-26   | Updated the power/temperature derating information. |
| V1.0.0           | 2025-08-29   | First release.                                      |

## Introduction

The BR860-1 is an LED display control board developed by NovaStar Tech Co., Ltd. (hereinafter referred to as NovaStar). It integrated a power module converts 90 Vac to 264 Vac into direct current, which directly powers the screen modules. Furthermore, the product offers functions such as undervoltage, overvoltage, overcurrent, overpower, and short-circuit protections, ensuring safety, high efficiency, and good reliability.

For PWM driver ICs, the maximum load capacity per card is:

- 512×384@60Hz (For 8bit video sources)
- 512×256@60Hz (For 10bit and 12bit video sources)

### Note

For PWM driver ICs, when working with COEX controllers and 10bit video sources, the maximum load capacity per card is 512×384@60Hz.

## Features

- Power Module and Receiving Card in One Package

The product supports input voltage of 90 Vac to 264 Vac and converts it to direct current to directly power the modules. Furthermore, the product offers functions such as undervoltage, overvoltage, overcurrent, overpower, and short-circuit protections.

- Color Management

Support standard (Rec.709 / DCI-P3 / Rec.2020) and custom color gamuts, enabling more precise colors on the screen.

- 18bit+

Improve the LED display grayscale by 4 times to avoid grayscale loss due to low brightness and allow for a smoother image.

- Pixel Level Brightness and Chroma Calibration

Work with NovaStar's calibration system to calibrate the brightness and chroma of each pixel, effectively eliminating differences and enabling high consistency for both brightness and chroma.

- Quick Adjustment of Dark or Bright Lines

The different brightness of seams caused by splicing of modules or cabinets can be corrected to improve the visual experience. The correction is easy and takes effect immediately.

- Multi-batch Adjustment

Adjust the brightness of cabinets or modules to minimize display discrepancies caused by variations in production batches.

- Low Latency

The latency of video source on the receiving card end can be reduced to 1 frame (only when using modules with driver IC with built-in RAM).

- 3D

Work with the controller that supports 3D function to enable 3D output.

- Individual Gamma Adjustment for RGB

Working with NovaLCT and the controller that supports this function, the receiving card supports individual adjustment to red gamma, green gamma and blue gamma, which can effectively control image non-uniformity at low grayscale conditions and white balance offset, allowing for a more realistic image.

- 90° Image Rotation

The display image can be rotated in multiples of 90° (0°/90°/180°/270°).

- Free Image Rotation

Support image rotation at any angle when using the dedicated MCTRL R5 controller and SmartLCT software.

- Smart Module (dedicated firmware required)

Work with the smart module to support module ID management, storage of calibration coefficients and module parameters, monitoring of module temperature, voltage and flat cable communication status, and LED error detection

- Calibration Coefficient Management

The calibration coefficients can be uploaded, read back, saved to hardware, and erased.

- Automatic Module Calibration

After a new module with flash memory is installed to replace the old one, the calibration coefficients stored in the flash memory can be automatically uploaded to the receiving card when it is powered on, which ensures unchanged uniform display brightness and chroma.

- Uploading Calibration Coefficients

Upload calibration coefficients to the receiving card quickly or in a stable manner, with acceleration support if needed.

- Module Flash Management

For modules with flash memory, the information stored can be managed, allowing for the storage and readback of calibration coefficients and module IDs.

- One-click to Apply Calibration Coefficients in Module Flash

For modules with flash memory, when the Ethernet cable is disconnected, users can hold down the self-test button on the cabinet to upload the calibration coefficients in the memory of the module to the receiving card.

- Mapping 1.1

The cabinet displays the Ethernet port, receiving card, and controller numbers in different colors, clearly showing the physical locations and connection topology of receiving cards.

- Settings of a Stored Image in the Receiving Card

The image displayed during startup, or displayed when the Ethernet cable is disconnected or there is no video signal can be customized.

- Temperature and Voltage Monitoring

Real-time monitoring of the temperature and voltage of the receiving card, without the need for other external devices.

- Cabinet LCD

The LCD module of the cabinet can display the temperature, voltage, single run time and total run time of the receiving card.

- Bit Error Detection

Real-time monitoring of the communication of the Ethernet port on the receiving card which helps users troubleshoot network communication problems.

- Detection of Ethernet Cable Disconnections

Monitors the number of times the Ethernet cable to the receiving card is disconnected, assisting in identifying potential communication link issues.

- Firmware Program Readback

The receiving card firmware program can be read back and saved to the local computer.

- Configuration Parameter Readback

The receiving card configuration parameters can be read back and saved to the local computer.

- Loop Backup

The receiving card and controller form a loop via the primary and backup line connections. When a fault occurs at a location of the lines, the screen can still display the image normally.

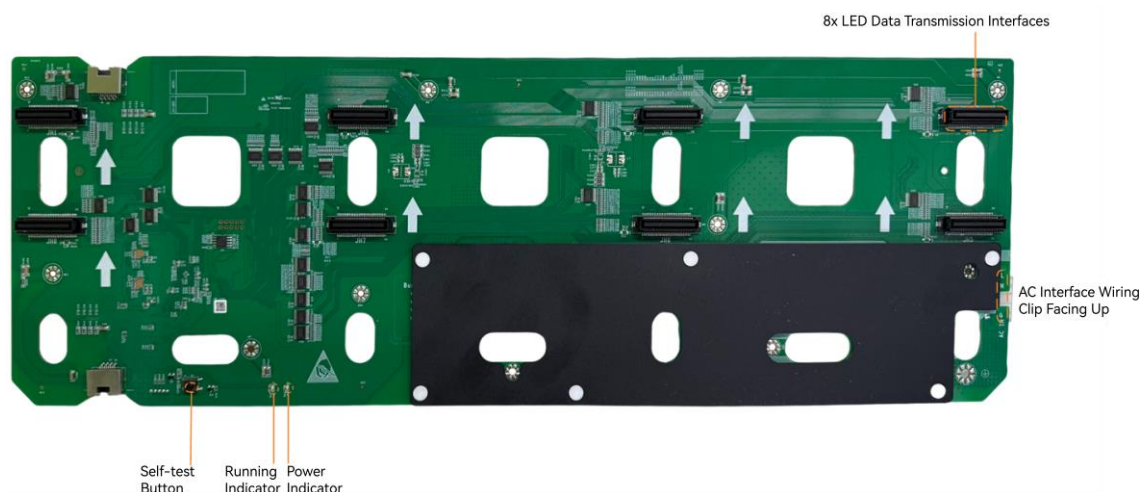
- Dual Backup of Configuration Parameters

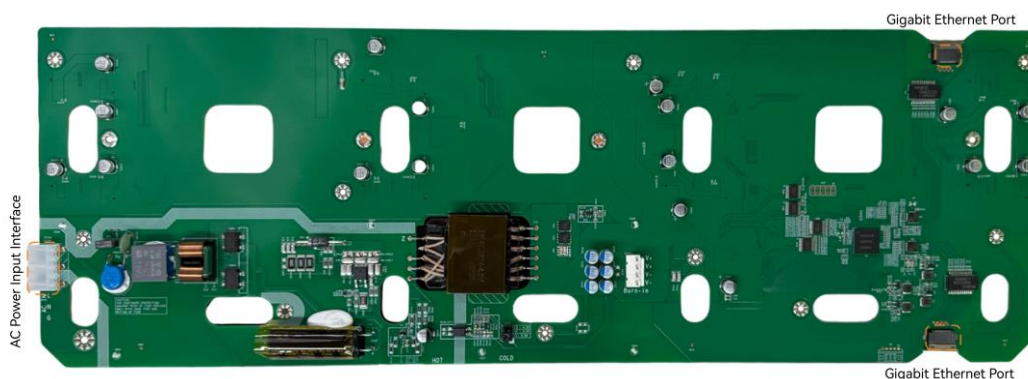
The receiving card configuration parameters are stored in the application area and factory area of the receiving card at the same time. Users usually use the configuration parameters in the application area. If necessary, users can restore the configuration parameters in the factory area to the application area.

- Dual Program Backup

Two copies of firmware program are stored in the receiving card at the factory to avoid the problem that the receiving card may get stuck abnormally during program update.

## Appearance





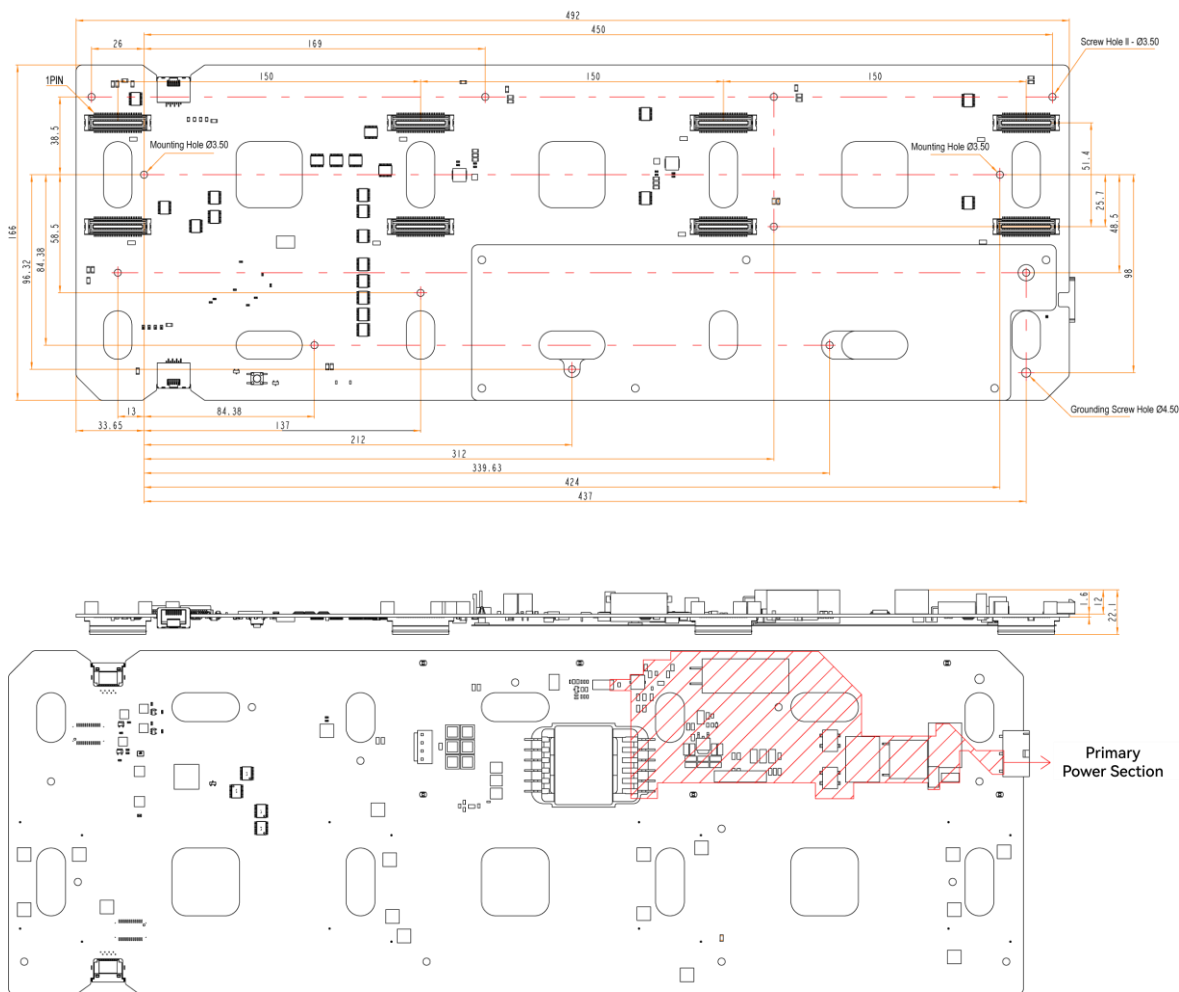
All product pictures shown in this document are for illustration purpose only. Actual product may vary.

## Indicator

| Indicators        | Color | Status                      | Description                                                                                                           |
|-------------------|-------|-----------------------------|-----------------------------------------------------------------------------------------------------------------------|
| Running indicator | Green | Flashing once every 1s      | The receiving card is functioning normally. Ethernet cable connection is normal, and video source input is available. |
|                   |       | Flashing once every 3s      | Ethernet cable connection is abnormal.                                                                                |
|                   |       | Flashing 3 times every 0.5s | Ethernet cable connection is normal, but video source input is unavailable.                                           |
|                   |       | Flashing once every 0.2s    | The receiving card failed to load the program in the application area and is now using the backup program.            |
|                   |       | Flashing 8 times every 0.5s | A redundancy switchover occurred on the Ethernet port and the loop backup has taken effect.                           |
| Power indicator   | Red   | Always on                   | The power input is normal.                                                                                            |

## Dimensions

The board thickness is not greater than 2.0 mm, and the total thickness (board thickness + thickness of components on the top and bottom sides) is not greater than 22.5 mm.

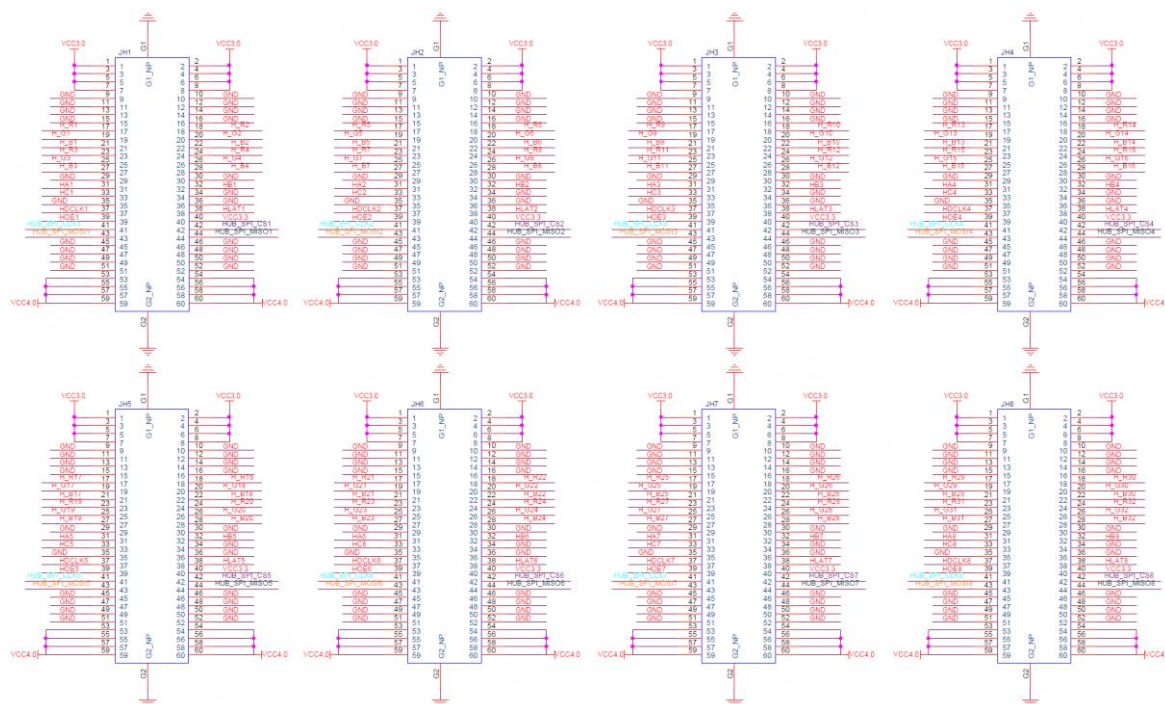


Tolerance:  $\pm 0.3$  Unit: mm

#### Note

- To make molds or trepan mounting holes, please contact NovaStar for a higher-precision structural drawing.
- The thermal conductive pad and silicone insulation pad are not included with the product. You will need to adhere them yourself according to the specified positions and sizes in the diagram. Attach the thermal conductive pad to the card, ensuring the thickness is appropriate for the available space in the cabinet and that it is compressed when in place. The silicone insulation pad should be adhered to the cabinet.
- The red shaded area in the diagram is the primary power section. Ensure a safety distance of at least 5mm between this area and the metal conductor of the cabinet. If this distance is not met, add a silicone insulation pad for additional insulation. Design the silicone pad to extend more than 5mm beyond the primary power section.
- For other areas, maintain a safety distance of at least 2mm from the cabinet.
- The silicone pad should be 0.23mm thick, with a voltage resistance of  $\geq AC/4KV$  and a thermal conductivity of  $\geq 1.6W/m.k$ .

## Pins



Pin Definitions (JH1 as an example)

|   |        |    |    |        |   |
|---|--------|----|----|--------|---|
| / | VCC3.0 | 1  | 2  | VCC3.0 | / |
| / | VCC3.0 | 3  | 4  | VCC3.0 | / |
| / | VCC3.0 | 5  | 6  | VCC3.0 | / |
| / | VCC3.0 | 7  | 8  | VCC3.0 | / |
| / | GND    | 9  | 10 | GND    | / |
| / | GND    | 11 | 12 | GND    | / |
| / | GND    | 13 | 14 | GND    | / |
| / | GND    | 15 | 16 | GND    | / |
| / | H_R1   | 17 | 18 | H_R2   | / |
| / | H_G1   | 19 | 20 | H_G2   | / |
| / | H_B1   | 21 | 22 | H_B2   | / |
| / | H_R3   | 23 | 24 | H_R4   | / |
| / | H_G3   | 25 | 26 | H_G4   | / |
| / | H_B3   | 27 | 28 | H_B4   | / |

| Pin Definitions (JH1 as an example) |               |    |    |               |                                  |
|-------------------------------------|---------------|----|----|---------------|----------------------------------|
| /                                   | GND           | 29 | 30 | GND           | /                                |
| Line decoding signal                | HA1           | 31 | 32 | HB1           | /                                |
| Line decoding signal                | HC1           | 33 | 34 | GND           | /                                |
| /                                   | GND           | 35 | 36 | GND           | /                                |
| Shift clock                         | HDCLK1        | 37 | 38 | HLAT1         | Latch signal                     |
| Display enable signal               | HOE1          | 39 | 40 | VCC3.3        | 3.3V module flash power supply   |
| Clock signal of serial pin          | HUB_SPI_CLK1  | 41 | 42 | HUB_SPI_CS1   | CS signal of serial pin          |
| Module flash data storage input     | HUB_SPI_MOSI1 | 43 | 44 | HUB_SPI_MISO1 | Module flash data storage output |
| /                                   | GND           | 45 | 46 | GND           | /                                |
| /                                   | GND           | 47 | 48 | GND           | /                                |
| /                                   | GND           | 49 | 50 | GND           | /                                |
| /                                   | GND           | 51 | 52 | GND           | /                                |
| /                                   | VCC4.0        | 53 | 54 | VCC4.0        | /                                |
| /                                   | VCC4.0        | 55 | 56 | VCC4.0        | /                                |
| /                                   | VCC4.0        | 57 | 58 | VCC4.0        | /                                |
| /                                   | VCC4.0        | 59 | 60 | VCC4.0        | /                                |

## Electrical Specifications

### Input Specifications

|                       |                    |
|-----------------------|--------------------|
| Input Voltage         | 90 Vac to 264 Vac  |
| Nominal Input         | 100 Vac to 240 Vac |
| Frequency Range       | 47Hz to 63Hz       |
| Starting Voltage      | > 70 Vac           |
| Maximum Input Current | 1.5A Max           |

|                           |                                               |
|---------------------------|-----------------------------------------------|
| Inrush Current            | Cold start: 100 A at 240 Vac, 50 A at 100 Vac |
| Power Factor              | /                                             |
| Current Harmonics         | /                                             |
| Standby Power Consumption | $\leq 4W$                                     |
| Input Fuse                | T3.15AL/250Vac                                |

## Output Specifications

|                          |                                                                                                                                                                                                                                                        |
|--------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Output Current           | 15.5A (Rated)<br><br>Note: The peak current is tested with a pulse width of less than 100ms and at an ambient temperature of 30°C.                                                                                                                     |
| Output Voltage           | Adjustable voltage: 3.8V/4V/4.2V<br><br>Low voltage: 3.0 V<br><br>Offers three adjustable settings, which can be changed by simply connecting a jumper cap.                                                                                            |
| Output Voltage Accuracy  | $\pm 2.0\%$                                                                                                                                                                                                                                            |
| Line Regulation          | $\pm 2.0\%$                                                                                                                                                                                                                                            |
| Load Regulation          | $\pm 2.0\%$                                                                                                                                                                                                                                            |
| Output Ripple Noise      | $\leq 200mV$<br><br>Note: In an environment of 25°C, the bandwidth is set to 20 MHz. A 0.1 $\mu F$ ceramic capacitor and a 10 $\mu F$ electrolytic capacitor are connected in parallel at the output for testing.                                      |
| Temperature Coefficient  | Pending                                                                                                                                                                                                                                                |
| Dynamic Load Performance | 0% to 50% load and 50% to 100% load, < 10%                                                                                                                                                                                                             |
| Efficiency               | @ 240 Vac, 84%, CH1 15.5A<br><br>@ 100 Vac, 82%, CH1 15.5A                                                                                                                                                                                             |
| Output Rise Time         | 30.0ms max<br><br>Note: Rise time is defined as the time it takes for the output voltage to increase from 10% to 90%. This is tested with a 0.1 $\mu F$ ceramic capacitor and a 10 $\mu F$ electrolytic capacitor connected in parallel at the output. |

|                              |                                                                                      |
|------------------------------|--------------------------------------------------------------------------------------|
| Start-up Delay Time          | Max 1s at 220 Vac                                                                    |
| Output Hold Time             | @ 240 Vac, 15ms<br>@ 100 Vac, 10ms                                                   |
| Output Voltage Overshoot     | 10% max<br>Note: All DC output currents should range from minimum to maximum values. |
| Capacitive Load              | 15500uF                                                                              |
| Ratio Radiation Emission     | Pending                                                                              |
| Switching Frequency          | Pending                                                                              |
| Power Temperature Derating   | -20°C to +70°C (Above 60°C, reduce load by 1.5% for every additional 1°C)            |
| Power Input Voltage Derating | 100% load at 90Vac to 264Vac with no derating                                        |
| MTBF                         | ≥ 100,000 hours at 25°C                                                              |

## Protection

|                                 |                                                |
|---------------------------------|------------------------------------------------|
| Input Undervoltage Protection   | Engages above 70 Vac, disengages below 65 Vac  |
| Output Overvoltage Protection   | < 6.5 V, self-recovery                         |
| Output Overcurrent Protection   | Triggered at 1.3 to 1.6 times of rated current |
| Output Overpower Protection     | Triggered at 1.3 to 1.6 times of rated current |
| Output Short-circuit Protection | Self-recovery                                  |

## Safety

|                       |                                                                                                                                                                            |
|-----------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Insulation Resistance | Input to output 500 Vdc, 100 MΩ min (at room temperature)<br>Input to FG 500Vdc, 100 MΩ min (at room temperature)<br>Output to FG 500Vdc, 100 MΩ min (at room temperature) |
|-----------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

|                              |                                                                                                                                                                                                                                                                                                     |
|------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Insulation Withstand Voltage | Input to output (I/P-O/P): 3.0 kVac / 10 mA<br>Input to case (I/P-CASE): 1.8 kVac / 10 mA<br>Output to case (O/P-CASE): 500 Vdc / 10 mA<br>Note: This refers to AC withstand voltage. The DC withstand voltage is 1.414 times the AC withstand voltage, while the leakage current remains the same. |
| Ground Resistance            | < 0.1 $\Omega$                                                                                                                                                                                                                                                                                      |

#### Note

If there are lightning protection components in the circuit, the following steps should be taken during the voltage withstand test after disconnecting the air gap tube:

- The input lines (L&N) need to be short-circuited together, and all the output lines need to be short-circuited together.
- Input to output: Input short-circuit line to output short-circuit line test.
- Input to FG: Input short-circuit line to FG.

## EMC

|                               |                                                                                         |
|-------------------------------|-----------------------------------------------------------------------------------------|
| Conducted Emission            | GB/T9254.1-2021/EN55032/FCC, Class A                                                    |
| Radiated Emission             | GB/T9254.1-2021/EN55032/FCC, Class A                                                    |
| Power Fluctuation and Flicker | Pending                                                                                 |
| Radiated Susceptibility       | EN55024; EN61000-4-2, 3, 4, 5, 6, 8, 11                                                 |
| Conducted Susceptibility      | EN55024; EN61000-4-2, 3, 4, 5, 6, 8, 11                                                 |
| Surge Susceptibility          | GB17626.5/IEC61000-4-5<br>Performance Criteria: B<br>DM: $\pm 2$ kV, CM: $\pm 4$ kV     |
| EFT Immunity                  | GB17626.4/IEC61000-4-4<br>Performance Criteria: B<br>$\pm 3$ kV                         |
| ESD Immunity                  | GB17626.2/IEC61000-4-2<br>Performance Criteria: B<br>Contact $\pm 4$ kV, Air $\pm 8$ kV |

|                                 |                                                       |
|---------------------------------|-------------------------------------------------------|
| Voltage Fluctuation and Flicker | Pending                                               |
| Voltage Drop                    | GB17626.11/IEC61000-4-11<br>Performance Criteria: B/C |

#### Voltage Drop Requirements:

| Voltage Drop | Duration | Performance Criteria |
|--------------|----------|----------------------|
| 0% Ut        | 10ms     | B                    |
| 70% Ut       | 500ms    | C                    |
| 40% Ut       | 200ms    | C                    |
| 0% Ut        | 5000ms   | C                    |



Caution

It is required to comply with the above-mentioned standards as a whole system.

If the product does not have the relevant certifications required by the countries or regions where it is to be sold, please contact NovaStar to confirm or address the problem. Otherwise, the customer shall be responsible for the legal risks caused or NovaStar has the right to claim compensation.

## Specifications

|                       |                                                                                                                                                                                                                  |                                                                                                                                   |
|-----------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------|
| Maximum Resolution    | For PWM driver ICs, the maximum load capacity per card is: <ul style="list-style-type: none"> <li>• 512×384@60Hz (For 8bit video sources)</li> <li>• 512×256@60Hz (For 10bit and 12bit video sources)</li> </ul> |                                                                                                                                   |
| Operating Environment | Temperature                                                                                                                                                                                                      | -20°C to +70°C (Above 60°C, reduce load by 1.5% for every additional 1°C)                                                         |
|                       | Humidity                                                                                                                                                                                                         | 10% RH to 90% RH, non-condensing                                                                                                  |
|                       | Altitude                                                                                                                                                                                                         | -60m to +5000m<br>Note: For every 100 meters above 2000 meters in altitude, the maximum operating temperature decreases by 0.5°C. |
| Storage Environment   | Temperature                                                                                                                                                                                                      | -40°C to +85°C                                                                                                                    |
|                       | Humidity                                                                                                                                                                                                         | 5% RH to 95% RH, non-condensing                                                                                                   |
|                       | Altitude                                                                                                                                                                                                         | < 5000 m                                                                                                                          |

|                         |             |                                                                                    |
|-------------------------|-------------|------------------------------------------------------------------------------------|
| Physical Specifications | Dimensions  | 492mm × 166mm × 22.1mm                                                             |
|                         | Net weight  | TBD<br>Note: It is the weight of a single receiving card only.                     |
| Packing Information     | Packaging   | An antistatic bag is provided for each board. Each packing box contains 14 boards. |
|                         | Packing box | 635.0mm × 595.0mm × 283.0mm                                                        |

## Copyright

**Copyright © 2025 Xi'an NovaStar Tech Co., Ltd. All Rights Reserved.**

No part of this document may be copied, reproduced, extracted or transmitted in any form or by any means without the prior written consent of Xi'an NovaStar Tech Co., Ltd.

### Trademark

 is a trademark of Xi'an NovaStar Tech Co., Ltd.

### Statement

Thank you for choosing NovaStar's product. This document is intended to help you understand and use the product. For accuracy and reliability, NovaStar may make improvements and/or changes to this document at any time and without notice. If you experience any problems in use or have any suggestions, please contact us via the contact information given in this document. We will do our best to solve any issues, as well as evaluate and implement any suggestions.

| [Official website](http://www.novastar.tech)  
| [www.novastar.tech](http://www.novastar.tech)

| [Technical support](mailto:support@novastar.tech)  
| [support@novastar.tech](mailto:support@novastar.tech)