Supported RGB LED Panels

The current Pixblasters MS1 Video LED Controller supports LED panels built with addressable WS2812B RGB LEDs. Different WS2812B LED panels can be easily distinguished based on their horizontal and vertical resolutions. Most panels have three directly soldered cables: the data input (DIN) cable, the data output (DOUT) cable, and an optional power cable.

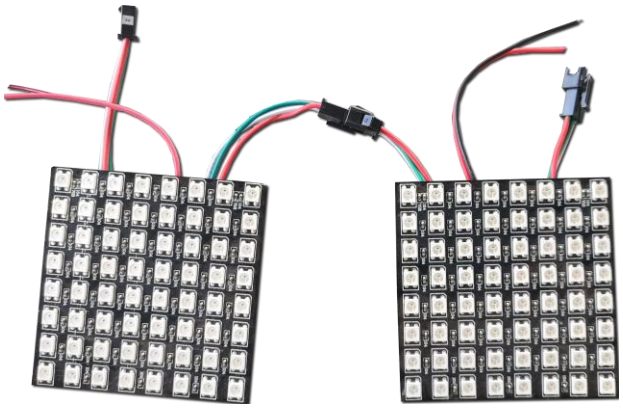

Figure 1: 8x8 LED Panels Connected in the LED Band (Front Side)

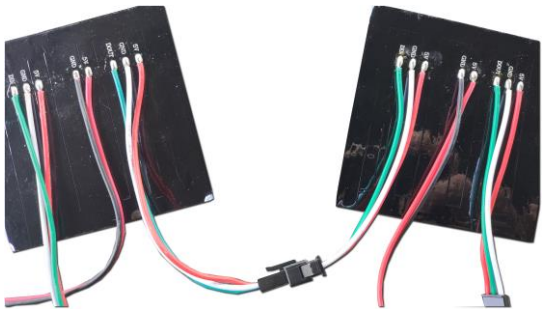

Figure 2: 8x8 LED Panels Connected in the LED Band (Back Side)

The DIN and DOUT cables come with standard LED connectors, facilitating straightforward connectivity—DIN fits only into DOUT, preventing incorrect connections. Both DIN and DOUT cables also distribute +5 VDC power. However, due to the cables' limited thickness, power distribution can become insufficient when connecting a larger number of LED panels. This condition can be identified by the "LED browning effect," where LEDs emit yellow-brownish tones instead of a pure white color. If this occurs, the optional power cable must be used to evenly distribute power to all LEDs. Before assembling larger LED video installations, Pixblasters recommends users unequivocally determine the LED input and fully understand the panel wiring.

Figure 3: Different WS2812B LED Panels

The Pixblasters MS1 Video LED Controller requires an additional initialization step for driving WS2812B compatible LED panels. LED panels are usually controlled by the FPGA configuration 5 and must be accompanied by the pixel mapping matrix that describes the structure of the LED panel. The pixel mapping matrices are provided by Pixblasters, as parts of the FPGA update package.

Depending on the attached LED panel, the user must select the correct .BIN file and program it to the dedicated Configuration 7 by following the steps described in the application note PAPP003 – Pixblasters MS1 Controller – FPGA Update Guide.

Each controller comes pre-initialized for use with 16x16 LED panels. Users who build video displays with 16x16 panels do not need to program the pixel mapping matrix, as it is already stored in the on-board memory.

LED Panel Type	Pixel Mapping Matrix File
8x8	p8x8_deg0.bin
16x16	p16x16_deg0.bin
32x8	p32x8_deg0.bin
22x22	p22x22_deg0.bin
44x11	p44x11_deg0.bin

Table 1: Examples of Pixel Mapping Matrix Files for Different LED Panels

Depending on the selected LED panel type, select the pixel mapping matrix file (**Table 1**) and program the .BIN file as described in the PAPP003 application note.

LED Panels Driving Capacity

LED Panel Resolution (H x V)	Supported LED panels per a single LED output	Supported LED panels per a single controller	Total LED driving capacity
8 x 8	8	256	16,384
16 x 16	2	64	16,384
32 x 8	2	64	16,384
22 x 22	1	32	15,488
44 x 11	1	32	15,488
7x7	8	256	12,544

Table 2: Number of Supported LED Panels Per a Single LED Output

The Pixblasters MS1 controller can drive up to 512 LEDs per output at the maximum refresh rate. This limit determines how many LED panels can be connected to a single output, depending on the panel type.

- **8x8 LED Panels**:
  - Each panel contains 64 LEDs.
  - Up to 8 panels can be connected serially.
  - Total LEDs for 8 panels: 8 x 64 = 512 LEDs.
- **16x16 and 32x8 LED Panels:**
  - Each panel contains 256 LEDs.
  - Up to 2 panels can be connected.
  - Total LEDs for 2 panels: 2 x 256 = 512 LEDs.
- **22x22 LED Panels:**
  - Each panel contains 484 LEDs.
  - Only 1 panel can be connected.
  - Total LEDs for 1 panel: 1 x 484 = 484 LEDs.

For optimal configuration and full use of the controller's LED driving capacity, the total number of LEDs (512) must be divisible by the number of LEDs in each panel type without a remainder. When the number of LEDs in a panel type does not evenly divide into 512, the number of supported panels will vary accordingly. For example, since 22x22 panels have 484 LEDs, only one such panel can be connected to a single LED output.

> By following these guidelines, you can ensure that your LED panels are correctly connected to the Pixblasters MS1 controller for optimal performance. Please note that the Pixblasters MS1 controller's maximum driving capacity is not fully utilized when fewer than 512 LEDs are connected per output.

Connecting LED Panels

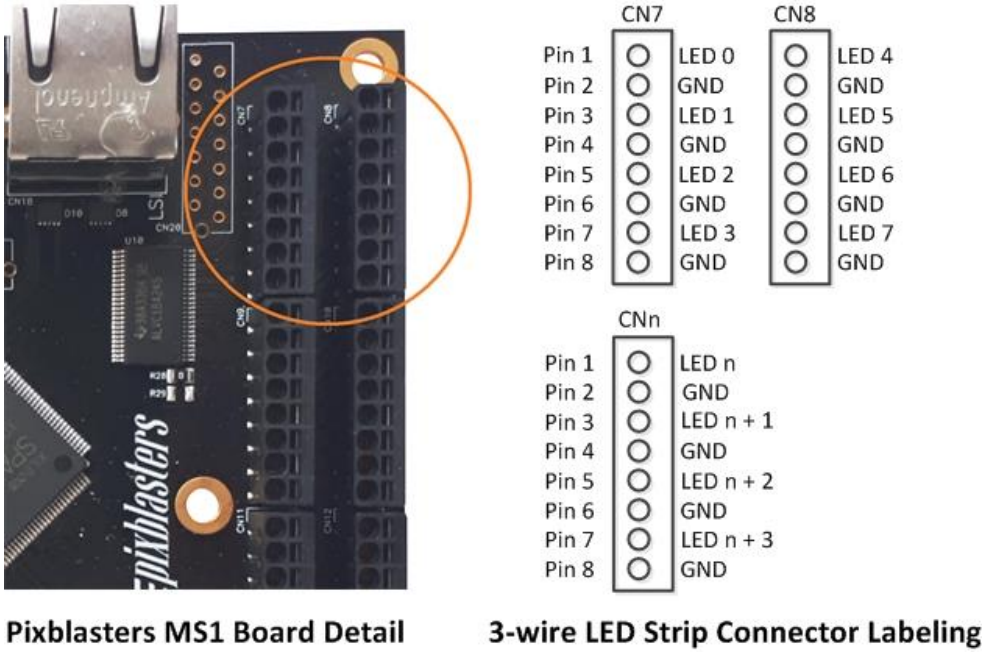

Figure 4: 3-wire WS2812-like LED Panels Connector Layout

The Pixblasters MS1 controller has 8 LED strip connectors CN7 – CN14. **Figure 4** shows LED connectors layout used for 3-wire RGB LED strips and LED panels. LED 0–31 are control data outputs that connect to LED panels' DIN data inputs.

Each "LED" and "GND" wire pair can control as many serially connected LED panels as it is listed in the **Table 2**. For, example it is possible to connect eight (8) 8x8 LED panels to LED 0 and GND control outputs.

Table 3: Pinout of LED Connectors – 3-WIRE Configuration

Connector	Pin	Description	Pin	Description
CN7	1	LED 0	2	GND
CN7	3	LED 1	4	GND
CN7	5	LED 2	6	GND
CN7	7	LED 3	8	GND
CN8	1	LED 4	2	GND
CN8	3	LED 5	4	GND
CN8	5	LED 6	6	GND
CN8	7	LED 7	8	GND
CN9	1	LED 8	2	GND
CN9	3	LED 9	4	GND
CN9	5	LED 10	6	GND
CN9	7	LED 11	8	GND
CN10	1	LED 12	2	GND
CN10	3	LED 13	4	GND
CN10	5	LED 14	6	GND
CN10	7	LED 15	8	GND
CN11	1	LED 16	2	GND
CN11	3	LED 17	4	GND
CN11	5	LED 18	6	GND
CN11	7	LED 19	8	GND
CN12	1	LED 20	2	GND
CN12	3	LED 21	4	GND
CN12	5	LED 22	6	GND
CN12	7	LED 23	8	GND
CN13	1	LED 24	2	GND
CN13	3	LED 25	4	GND
CN13	5	LED 26	6	GND
CN13	7	LED 27	8	GND
CN14	1	LED 28	2	GND
CN14	3	LED 29	4	GND
CN14	5	LED 30	6	GND
CN14	7	LED 31	8	GND

Power supply for LED panels is not routed through the Pixblasters controller board. Please read the Pixblasters User's Manual to understand LED video display power supply requirements.

The Pixblasters MS1 LED controller configured for 3-wire RGB LED strips and LED panels control provides 32 digital control data outputs. Each data output is capable to drive 512 RGB LEDs.

Twisting wires that connect LED panels to the Pixblasters MS1 is highly recommended. It removes the electromagnetic interference between the wires, assures more reliability and flicker-free LED display operation. Connecting all GND pins between the Pixblasters LED controller and LED strips is also highly recommended.

Assembling Video Display by LED Panels

Each LED output can control multiple LED panels connected in series. Consequently, a single LED output controls an LED band with a resolution (H x V) equal to:

(Number of panels per output * LED Panel Horizontal) * LED Panel Vertical

For example, when using an 8x8 LED panel, one output (controller 512px/output) controls an LED band resolution of:

(8 panels * 8 pixels Horizontal) * 8 pixels Vertical = 64 x 8 (H x V)

The horizontal resolution of the display can be expanded by using multiple adjacent LED outputs to drive the same LED band. For instance, in a video display made of 8x8 LED panels, to achieve a desired horizontal resolution of 256 pixels, you would need to use 4 LED outputs (controller 512px/output) to drive the LED band.

(4 outputs x (8 panels * 8 pixels Horizontal)) * 8 pixels Vertical = 256 x 8 (H x V)

In the same example, if you use 4 outputs for the horizontal LED band, you can have 8 such LED bands vertically because of the maximum number of LED outputs -> 32 / 4 = 8. The resolution of such a display would be:

8 * LED Band = 8 * (256 x 8) = 256 x 64 (H x V)

Video LED displays with higher resolutions can be supported by connecting multiple Pixblasters MS1 Video LED controllers together. For example, four Pixblasters controllers configured to drive 256x64 displays built with 8x8 LED panels can be easily combined to drive 1024x64, 512x128, or 256x256 video displays.

Figure 5 shows how to connect controller's LED outputs to LED panels in the described video display built of 8x8 LED panels. The internal register SEGMENTSNO defines the number of adjacent video outputs used for controlling the LED band. For the band built of 32 8x8 LED panels combined in a single horizontal LED band (256x8) the SEGMENTSNO = 4 (must be four) results in 4 adjacent LED outputs driving the horizontal LED band.

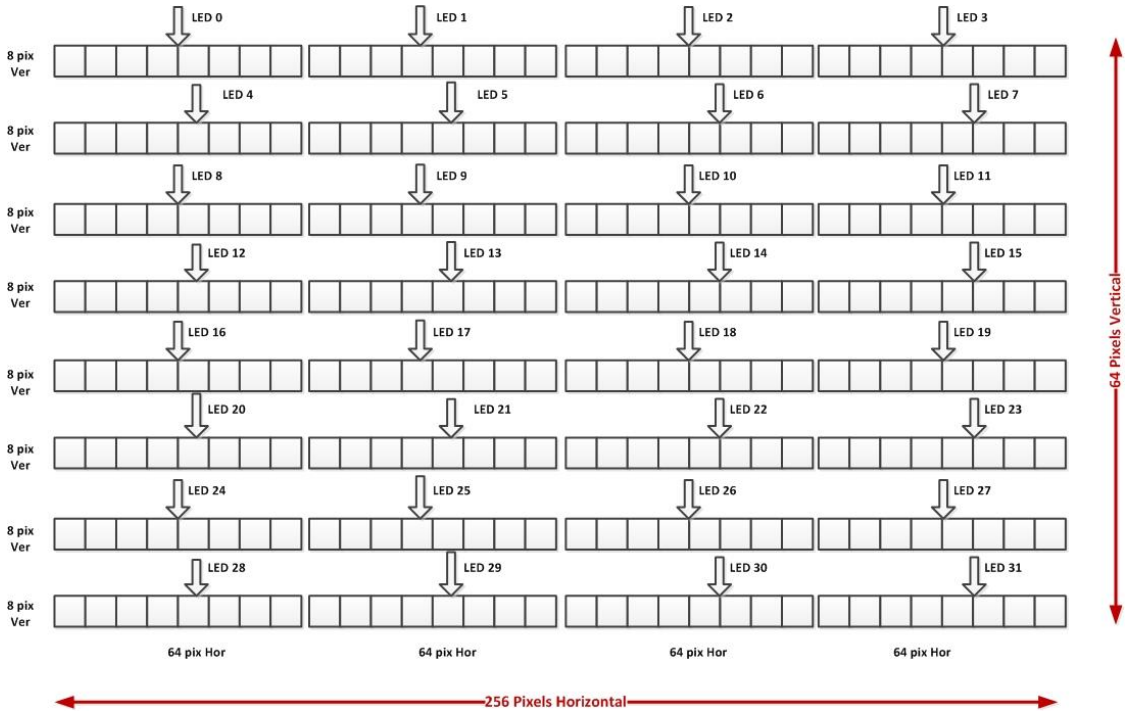

Figure 5: 256x64 LED Display Built by 8x8 LED Panels

Key Assembly Constraints for LED Panel Video Displays

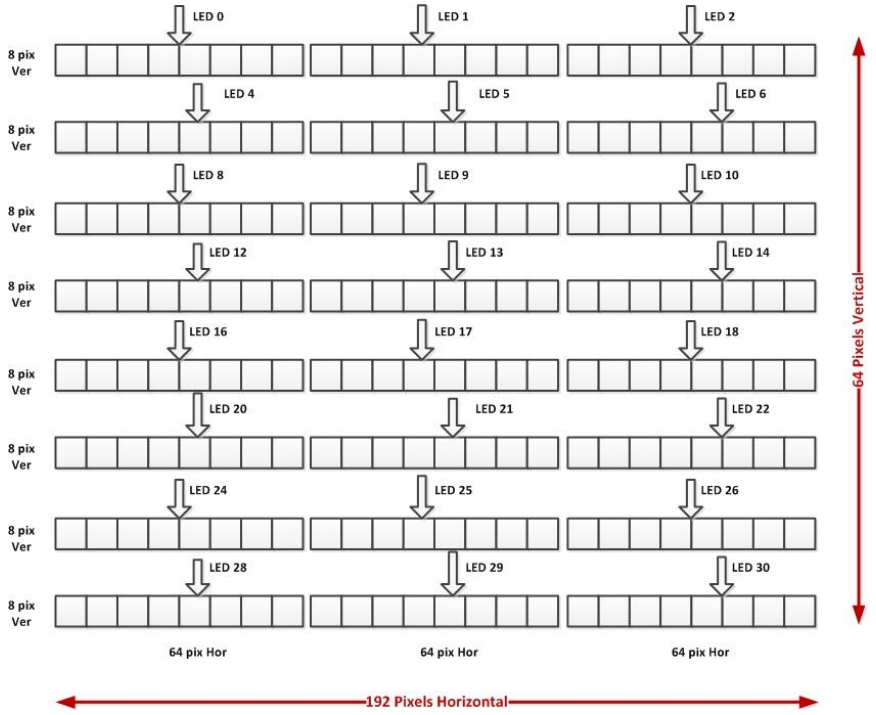

Figure 6: 192x64 LED Display Built by 8x8 LED Panels

The number of LED outputs (written in the SEGMENTSNO register) combined to drive the horizontal LED band must be divisible by two (2). The **Figure 6** explains the use of LED outputs when the horizontal resolution is lower than the maximum provided by the number of the LED outputs dedicated per LED band.

Horizontal resolution of 192 LEDs cannot be achieved by a single LED output driving serially connected 8x8 LED panels. Whenever is necessary to use more than a single LED output, the allowed number of combined outputs is 2, 4, 6,…,32.

The **Figure 6** shows that LED outputs number 3, 7, 11… cannot be used. It effectively decreases the LED driving capacity from the max. 16,384 LEDs to 12,288 LEDs. It represents the 25% decrease of the driving capacity.

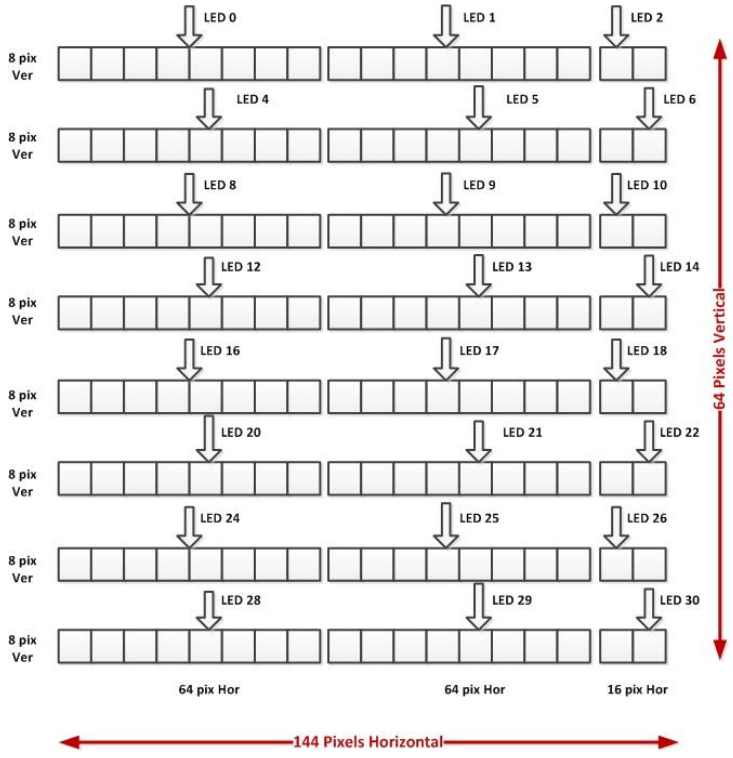

Figure 7: 144x64 LED Display Built by 8x8 LED Panels

The **Figure 7** display displays a very ineffective way of display assembly with 8x8 LED panels. Because of additional 2 LED panels at the end of the LED band controlled by a single LED output, the overall LED driving capacity would be decreased very much. Groups of 4 LED outputs would drive only 14 8x8 LED panels and the driving capacity would be decreased to 7,168 LEDs.

Example Video Display – 96x80 Built by 16x16 LED Panels

- LED material: 16x16 LED panels
- Video resolution 96 pixels horizontally and 80 pixels vertically (96x80)
- The display consists of a matrix of 6 LED panels horizontally, combined in 5 of such rows
- In total thirty (30) 16x16 LED panels
- The Figure 8 shows the display's setup
- The horizontal resolution is set to 128 pixels, though the targeted resolution is 96
- Pixblasters controller requires even number of outputs to be used horizontally, and due to this, the resolution must be set to 128 and the SEGMENTSNO register to 4

The following table shows the content of the Pixblasters controller's internal registers properly set up for the example 96x80 video LED display. Grayed rows can be configured differently, and white rows show must-have register values.

CONTROL	0x0141
CROPX	400
CROPY	400
STOREX	127
STOREY	79
STOREHRES	512
STOREPRESCAL	0
PROGLUTS	0x0000
SEGMENTSNO	4
CONTCFGLOADCNTRL	0x0000
AUX1	0x001F
AUX2	0
MAT_H	15
MAT_V	15
MAT_CFG	0x0011

Table 4: Internal Registers for the 96x80 Video LED Display Built by 16x16 LED Panels

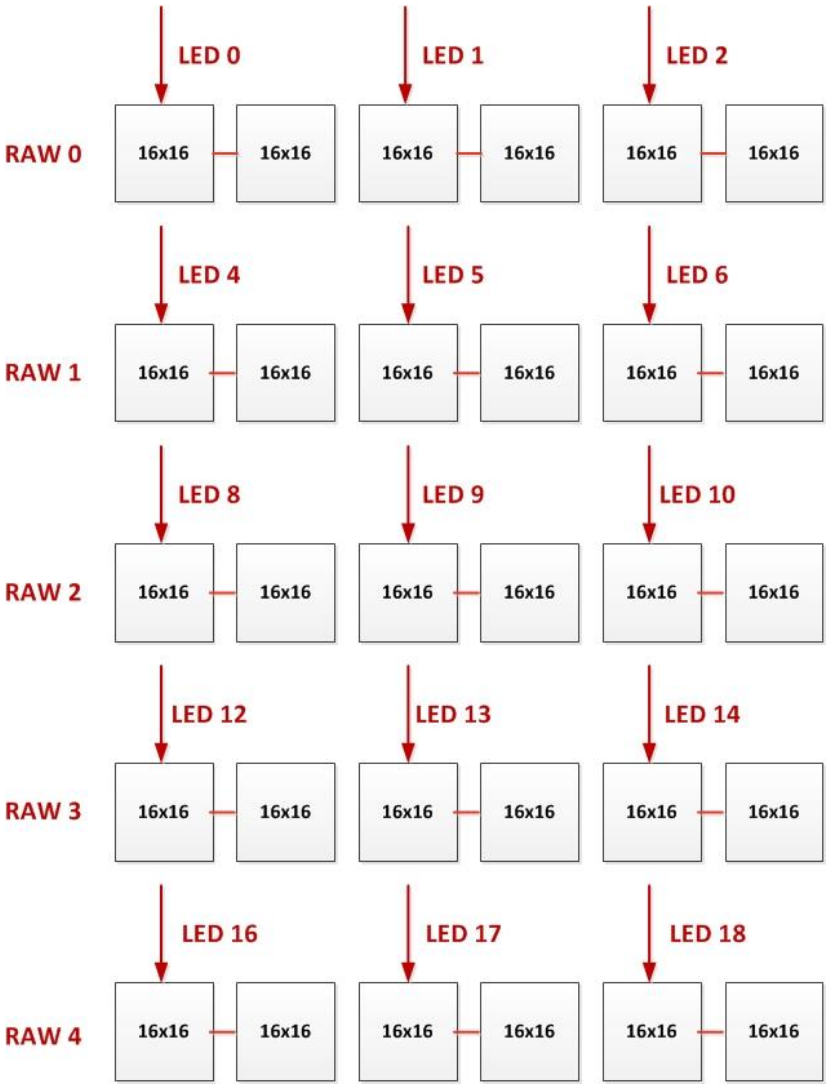

Figure 8: 96x80 Video Display Assembled with 16x16 LED Panels

Revision History

Version	Date	Description of Revisions
1.00	12.06.2024.	Initial public release.