

Leyard TWA Series LED Video Wall Installation Guide



LEYARD

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Introduction

The Leyard® TWA Series is a line of fine pitch LED video walls available in 1.2 and 1.8 millimeters pitches. More pitches will be available in the future.

The Leyard TWA Series is architected to support the highest pixel density and delivers benefits unique to its “flat panel” design including a 16:9 form factor optimized for the most popular high resolution standards, ease of installation and service, and outstanding flatness and uniformity.

New Power-Efficient Model

The new Leyard TWA model incorporates power-efficiency with the industry-leading design of the Leyard TW® Series, resulting in an LED video wall display with reduced power utilization by as much 35%. The Leyard TWA provides additional image enhancements to further optimize visual experience through a wider color gamut and broader viewing angles.



Note: This manual is intended for use by qualified installation and service personnel experienced with direct view LED displays.

Safety Information

This display was designed with safety in mind. If you don't heed the safety warnings and cautions, you could be injured. There are safety warnings on stickers in various places in and on the display.



Important Safety Instructions

- 1 Read these instructions.
- 2 Keep these instructions.
- 3 Heed all warnings.
- 4 Follow all instructions.
- 5 Do not use the Leyard TWA Series outdoors or near water.
- 6 Do not install near any heat sources such as radiators, heat registers, stoves or other apparatus (including amplifiers) that produce heat.
- 7 Do not defeat the safety purpose of a polarized or grounding type plug. The polarized plug has two blades with one wider than the other. A grounding type plug has two blades and a third grounding prong. The wide blade or the third prong is provided for your safety. When the provided plug does not fit into your outlet, consult an electrician for the replacement of the obsolete outlet.
- 8 Protect the power cord(s) from foot traffic or kinks particularly at plugs, convenience receptacles and the point where they exit from any of the Leyard TWA Series products.
- 9 You should only use replacement parts, accessories and other components specified by Planar Systems.

- 10** Unplug all Leyard TWA Series products during lightning storms or when unused for long periods of time.
- 11** You must follow all National Electrical Code regulations. In addition, be aware of local codes and ordinances when installing your system.
- 12** Refer all servicing to qualified service personnel. Servicing is required when any Leyard TWA Series products have been damaged in any way, such as when the AC power cord or plug is damaged, liquid has been spilled or objects have fallen into a product, the products have been exposed to rain or moisture, or the products do not operate normally or have been dropped.
- 13** You should consider keeping the packing materials in case the equipment ever needs to be shipped.
- 14** The mounting structure must be secure. The wall and floor must be strong enough to hold all Leyard TWA Series cabinets, mounting structures, cables and accessories. Refer to the component weights and dimensions in the "Specifications" section on page 62. Seismic engineers should be consulted in areas prone to earthquakes.
- 15** The LEDs mounted on the front surface of the Leyard TWA Series can be damaged by contact with fingernails, rings and other hard items.

Recommended Usage

In order to get the most from your Leyard TWA Series, use the following recommended guidelines to optimize the display.

Note: The Leyard TWA Series is designed for fixed installation, indoor use only.

Normal use of the Leyard TWA Series is defined as operating in the open air to prevent heat buildup and without direct or indirect heat sources such as lighting fixtures, heating ducts, or direct sunlight that can cause the cabinets to experience high operating temperatures. Do not block ventilation openings. If the video wall will be installed in a recessed area with a surround trim or other enclosed system, ensure adequate openings are applied for proper air flow and ventilation. At sea level, the maximum ambient operating temperature for the Leyard TWA Series cannot be above 40° C nor below the minimum ambient operating temperature of -10° C (as measured ~ 2 feet (0.6m) in from of the screen). If one of these conditions is exceeded, it is up to the installer to ensure that cabinet placement is changed, thermal shielding is provided, and/or additional ventilation is provided to keep the system within its nominal operating parameters.

Cooling Requirements

For optimal performance, active cooling by the installer should be planned for when the ambient temperature of the video wall is predicted to be above the specified ambient temperature for the cabinet. Cooling may be done behind the cabinets depending on the video wall configuration.

System Architecture

The Leyard TWA Series LED video walls typically consist of a tiled array of multiple cabinets. These fanless design cabinets allow silent display operation and support rear service and rear access mounting. Optionally, the Leyard TWA Series may be equipped with a redundant AC power supply.

The terminology used in this document includes:

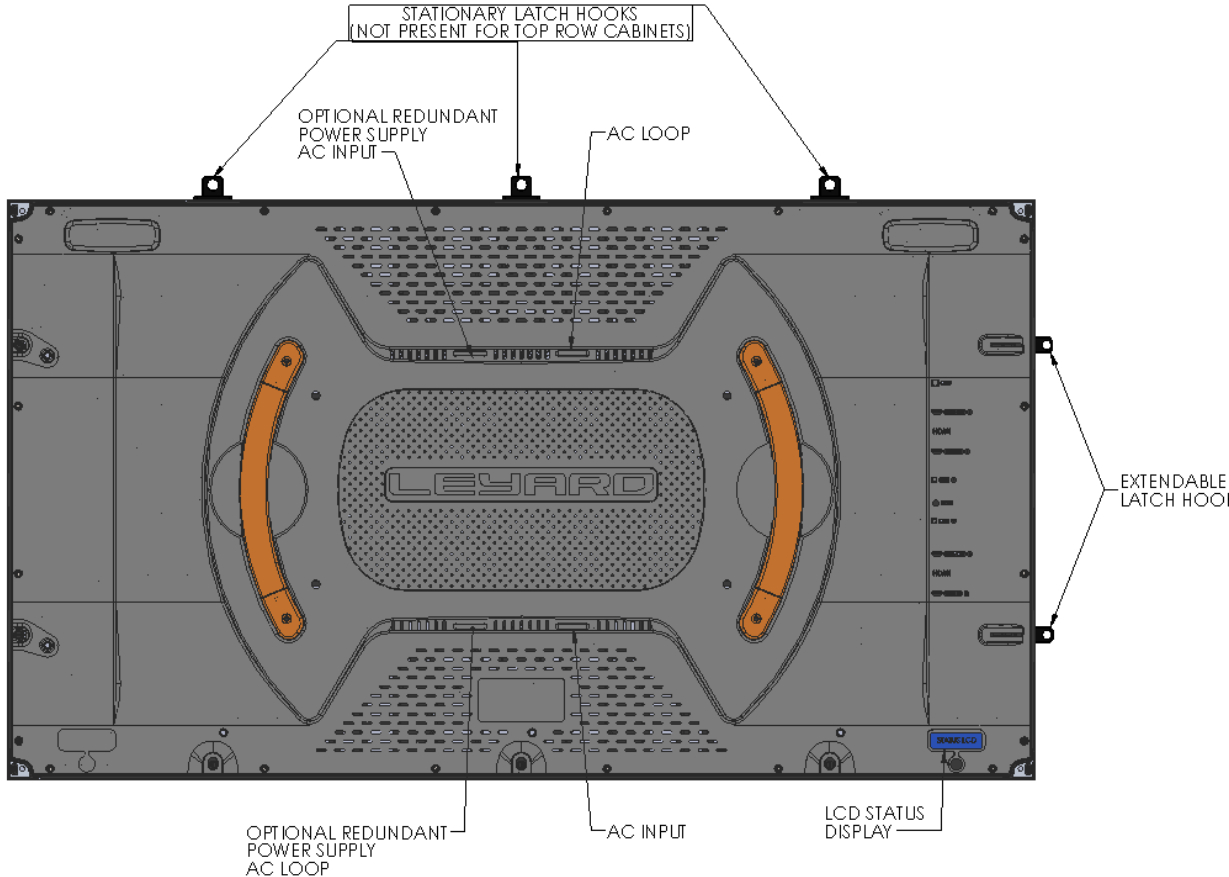
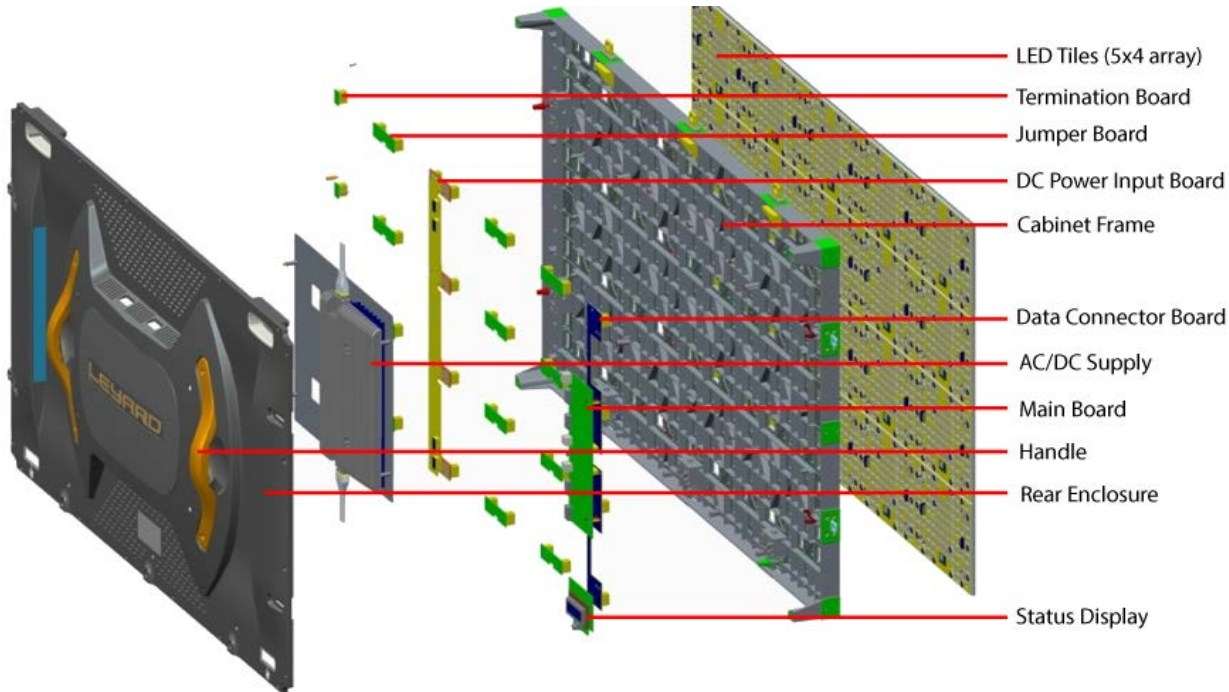
- **Video wall:** The array of Leyard TWA Series cabinets
- **Cabinet:** The overall Leyard TWA Series LED module
- **Tiles:** The individual LED tiles that comprise the Leyard TWA Series cabinet
- **Structure:** The assembly used to mount the Leyard TWA Series cabinet array

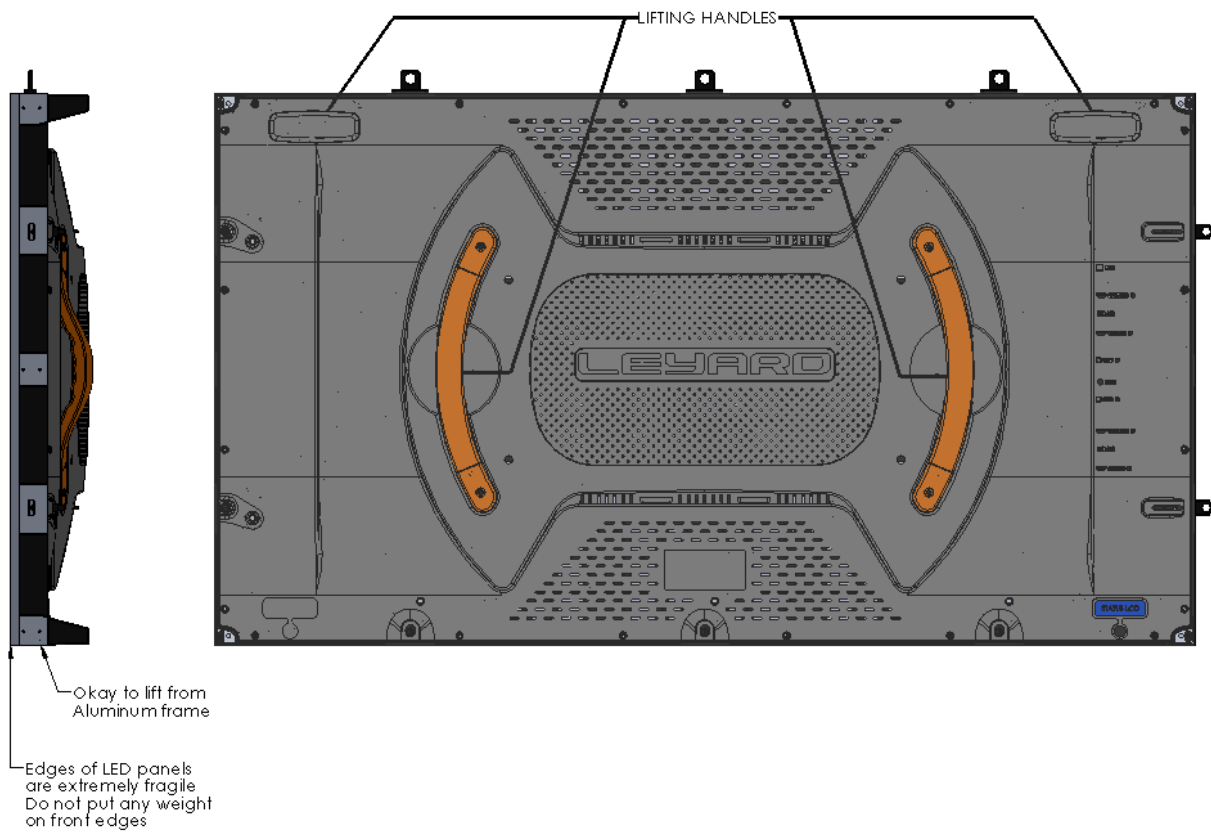
Primary Components

The primary components of a Leyard TWA Series cabinet are:

- LED tiles
 - LED tiles are placed together to create a cabinet
 - Contains the LEDs and LED driver ICs
 - Metal frame attaches the LED tile to the cabinet frame
- Main board
- I/O
 - Two HDMI inputs (a primary and a secondary input for redundancy)
 - Two HDMI outputs (for looping the HDMI to adjacent cabinets)
 - One LAN RJ45 input for control
 - Two RS232 RJ25 ports for control, loop in and loop out
- Status display
 - Rear-facing 3-inch diagonal LCD display
 - Provides continuously scrolling information in English (IP address, brightness setting, temperature reading from the main board sensor, and power supply good/bad status based on voltage measurements of power supply rails)
- AC power supply
 - AC power can be daisy-chained through the AC supply
- Cabinet frame and rear enclosure

Component View





Accessories

HDMI Splitter

- Used to create a redundant video path.

Specifications are located at <http://www.extron.com/product/product.aspx?id=hdmidaseries>.

Trim

There are two trim building blocks to be used to create a perimeter enclosure: top trim cover and left/right trim cover. Dimensioned drawings are provided in the "Drawings" section on page 71. Each trim piece covers one column or row of a Leyard TWA Series cabinet array. Note that bottom trim is not useable as the Leyard TWA Series cabinet must be supported from below.

Tool Kit

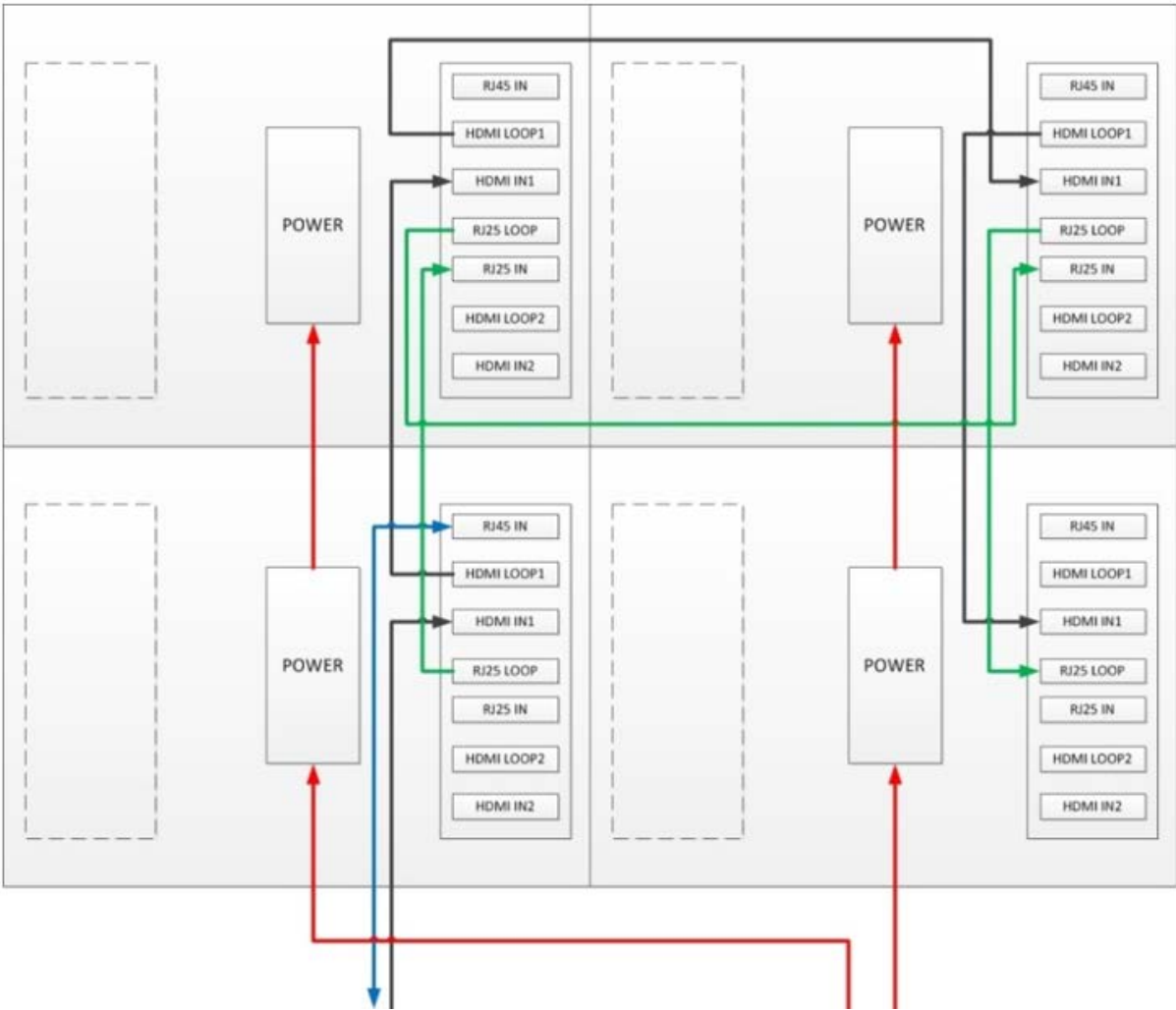
This includes a square drive 7mm L-Wrench tool for installation, maintenance and repair of a Leyard TWA Series LED video wall.

Accessory Kit

The accessory kit includes the Leyard TWA Series Control Software, Installation Guide, Z-Axis adjustment brackets and hardware, handling gloves and labeling materials.

Block Diagram

The block diagram below is a rear view of a 2 x 2 cabinet configuration showing typical connections, with the primary cabinet in the lower-left corner and three secondary cabinets.



Safe Handling

All Leyard TWA Series LED video wall components are susceptible to damage through improper handling. It is important to take great care in how the units are unpacked, staged and installed. The packaging has been specifically designed to protect the Leyard TWA Series parts during shipping, so the parts should be left in the package until it is time for their installation. Take care in unpacking and handling the Leyard TWA Series cabinets.

Great effort has been invested in providing defect-free cabinets for installation. As has been stated previously, the Leyard TWA Series cabinets are susceptible to damage from inadvertent contact. Here are some best practices for handling the Leyard TWA Series cabinets:

- Avoid contact with the front surface, edges and corners of the Leyard TWA Series cabinets with other materials, which can include:
 - Shipping containers, tabletops, and carts (any hard objects).
 - Personal jewelry. We recommend removing rings, watches, and so on before assembly.
 - Hard or loose objects, such as dangling video cables or tools. A swinging video cable or misdirected tool can damage the LEDs.
 - Inadvertent contact while carrying a Leyard TWA Series cabinet from its shipping container.
 - Unintended contact just prior to final placement of the Leyard TWA Series cabinet.
- If a Leyard TWA Series cabinet must be staged out of the shipping box, place it face up on a clean surface. Before placing the cabinet, check the surface for attached debris.
- Wearing soft cotton gloves may be useful while handling the Leyard TWA Series cabinets.

Before Installation

We **strongly** recommend you read this section **before** starting installation.

Special Notes on Mounting Structure Design

- Leyard TWA Series cabinets are heavy at approximately 66 lbs. per cabinet. Be sure the structure will support this weight.
- Keep in mind that small deflections in the mounting structure can cause misalignment and add significant time and difficulty to calibration, so rigidity is critical.
- Leyard TWA Series cabinets must be supported from the bottom. The lowest row will require a shelf or similar rest location capable of supporting the entire weight of the cabinets above. The support should not exceed the cabinet surface to ensure no contact with the LEDs will occur (see Figure 1).

Note: This shelf should be as rigid as is possible. Deflections in this shelf during installation will add substantially to calibration time.

- It is also critical that the mounting structure is designed so that the polymer back cover of the Leyard TWA Series cabinet can be removed for maintenance and repairs. The polymer back cover is shown in Figure 2 and highlighted in blue. If this cover is inaccessible, the cabinet and all cabinets above it must be removed for service or repair.

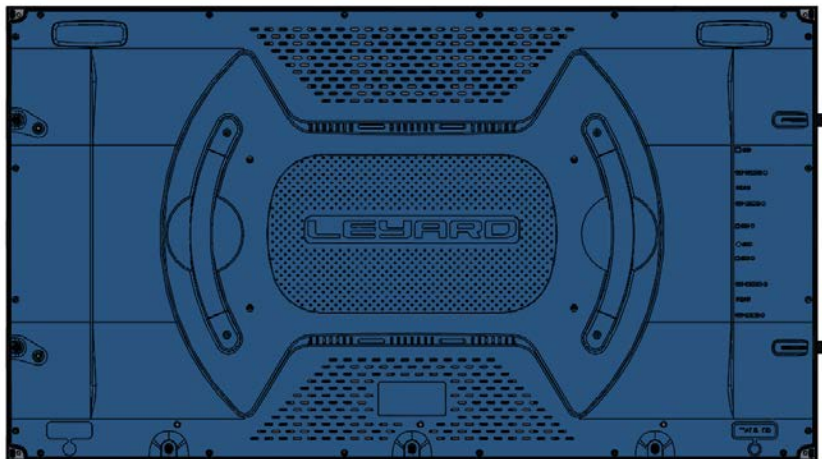


Figure 2. The blue area shows the polymer cover. When the video wall is assembled, ensure that this cover is removable for maintenance and repair.

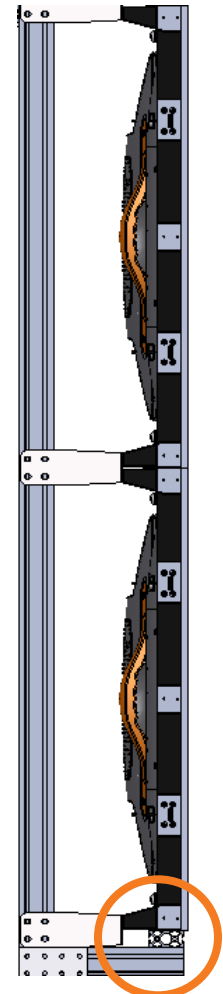


Figure 1. Leyard TWA Series cabinets must be supported from the bottom.

- Leyard TWA Series cabinets are intended for rear access installations. Ensure that the structure has enough space for one to two workers to move and work freely.
- The mount should be designed to allow for x, y, and z adjustability as the cabinets may not provide sufficient adjustability for ideal alignment.

Preparing the Mounting Structure

- On the mounting structure, the location where the cabinet mounting foot locations must be plumb and flat in relation to one another (feet are highlighted in Figure 3 in orange). Ensuring the flatness of the mounts will substantially speed up the adjustment process.
- Ensure that the crossbeam or shelf that the bottom row of the Leyard TWA Series cabinets will rest on is flat, level and rigid.
- For the far left column of Leyard TWA Series cabinets, ensure that there is a relief area to extend the mounting tabs. Mounting tabs must be extended in order to remove the back cover for maintenance. See Figure 3 below, where the mounting tabs are circled in blue.
- If side trim is in use, ensure that it can be removed easily after final installation as side trim will prevent the mounting tabs from extending.

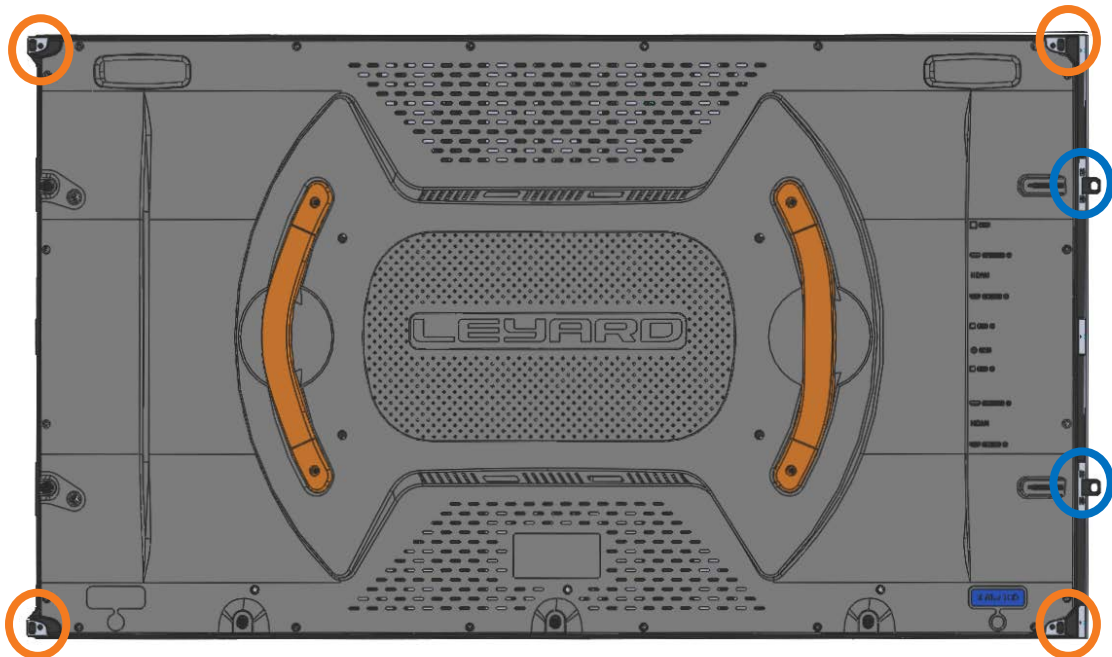


Figure 3. Side mounting tabs are circled in blue and mounting feet are circled in orange. Ensure that there is a relief for these to extend on the far left column to remove the polymer back cover.

Installing Your Leyard TWA Series LED Video Wall

Required Tools

Depending on your installation, you may need one or more of the following items:

- Metric hex key set
- Phillips #1 and flathead screwdrivers
- Minimum of three people capable of lifting and supporting Leyard TWA Series cabinets
- Ladder or lifts
- Back brace(s)
- Minimum 8 foot bubble level or laser level to check flatness

Recommended Tools

- Electric screwdriver
- Metric hex key bits
- Phillips #1 and flathead bits

Unpacking the Leyard TWA Series Cabinets

Note: Unpack cabinets only as they are required for installation. Leave cabinets in protective boxes until absolutely necessary.

- 1** Check the part number on your Leyard TWA Series cabinets. Part descriptions designated as "Top" must be used for the top row only. Set these units aside until it is time to assemble the top row.
- 2** Open the Leyard TWA Series cabinet boxes and carefully remove the three pieces of protective foam.
- 3** With two people, carefully lift the cabinet out of the box and remove the bottom three pieces of foam.
- 4** Once the cabinet is released from the protective foam, plug in each cabinet and turn on the power. Try red, green, blue, and white test patterns and look for any dead or damaged pixels. It is significantly easier to repair or replace LED tiles before the cabinet is assembled to the wall.

The protective metal covers will obscure the edge pixels. Either remove as stated in the next step or look behind the cover for defective pixels.

- 5 Use a 3mm hex key to remove the eight socket head cap screws securing the two side sheet metal protectors (see Figure 4).



Figure 4. A side sheet metal protective cover is shown. Bolts are circled in orange.

Note: Ensure that one person is holding the cabinet stable while these are removed. It may slip down slightly as the bolts are loosened.

- 7 Use a 5mm hex key to remove the four M6 socket head cap screws to release the top and bottom sheet metal protective covers (see Figure 5).



Figure 5. Top and bottom sheet metal protector bolts are circled in orange.

IMPORTANT! Ensure that the cabinet is stable during this operation. Make sure that the cabinet never leans forward as damage to the LEDs can occur.

- 8 Verify that the ½ turn fasteners on the cabinet are released. See Figure 6. If they are not released, use the square drive 7mm L-Wrench to turn them ½ turn and allow them to extend. Fasteners are spring loaded and should extend easily.

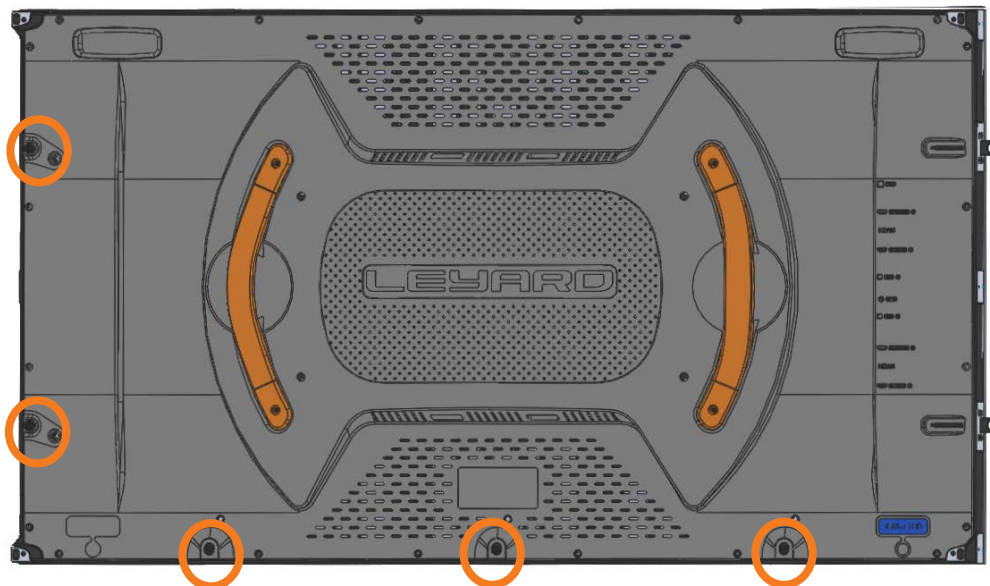


Figure 6. ½ turn fasteners are circled in orange.

Installing the First Cabinet

Before you begin, note the following:

- It is recommended to start from the center and work outwards until a full row is complete.
 - Follow the procedures outlined in “Unpacking the Leyard TWA Series Cabinets” on page 17 to carefully remove the cabinet from its packaging.
 - Be sure to test the cabinet prior to installation. It is substantially easier to make repairs or correct tile issues while the cabinet is not installed.
 - The first cabinet’s position is critical as all other cabinets will be referenced to the first cabinet.
- 1 With two people, carefully lift the cabinet. **Do not touch the LEDs** or place any weight on the LEDs. They are extremely fragile.
 - 2 Carefully set the cabinet in the center mounting location on the support beam.
 - 3 Loosely attach the screws to secure the cabinet.
 - 4 Level and plumb the cabinet using the machined surfaces as reference points. Tighten the 4x M6 bolts.
 - 5 After the bolts are tightened, verify that alignment has not changed.
 - 6 Turn the cabinet on again to verify that there are no damaged pixels or tiles. It is easier to repair damage without adjoining cabinets blocking access.

Installing Cabinets Horizontally (Left and Right)

Before you begin, note the following:

- Install cabinets from the first (center) cabinet and alternate right and left to fill out each row as shown in Figure 7.

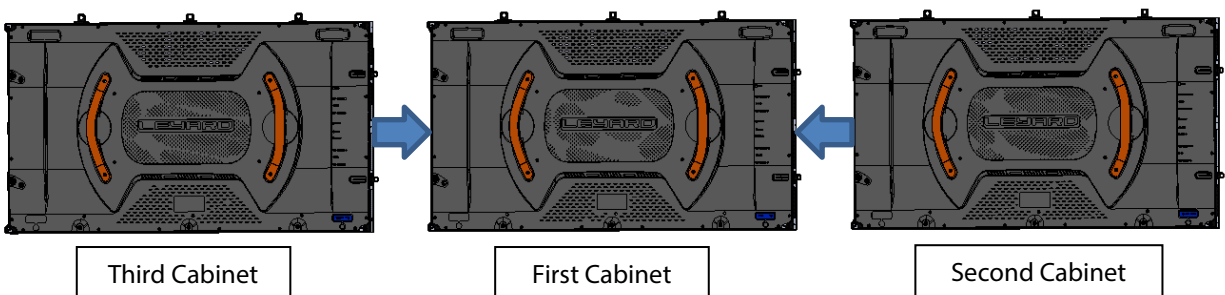


Figure 7. First install the center cabinet and then alternate installing additional cabinets right and left until the row is complete.

- Follow the procedures outlined in “Unpacking the Leyard TWA Series Cabinets” on page 17 to carefully remove the cabinets from their packaging.

- Be sure to test the cabinets prior to installation. It is easier to make repairs or correct tile issues while the cabinets are not installed.
 - Check that the ½ turn fasteners are released as shown in Figure 6.
- 1** With two people, carefully lift the cabinet. **Do not touch the LEDs** or place any weight on the LEDs. They are extremely fragile.
 - 2** Carefully set the cabinet on the base support. Be very careful not to impact the front face of either cabinet while placing the cabinet.
 - 3** Finger tighten the 4x M6 bolts to the mounting feet.
 - 4** Extend the latch hooks by pulling the levers up as shown in Figure 8 (circled in orange).
 - 5** On the right cabinet, press in the ½ turn fasteners, and then turn 180 degrees to secure them.
 - If the ½ turn fastener does not appear to fully seat or if you are unable to turn it ½ turn, you may need to loosen the hex socket using a 5mm hex key as shown in Figure 8 (circled in blue). Spin the hex key clockwise to move the ½ turn closer to the latch hook or counterclockwise to retract the ½ turn fastener.
 - Once the ½ turn fastener is seated, close the latch hook as shown in Figure 8 (circled in orange).
 - 6** Repeat steps 1 through 5 until the row is complete.

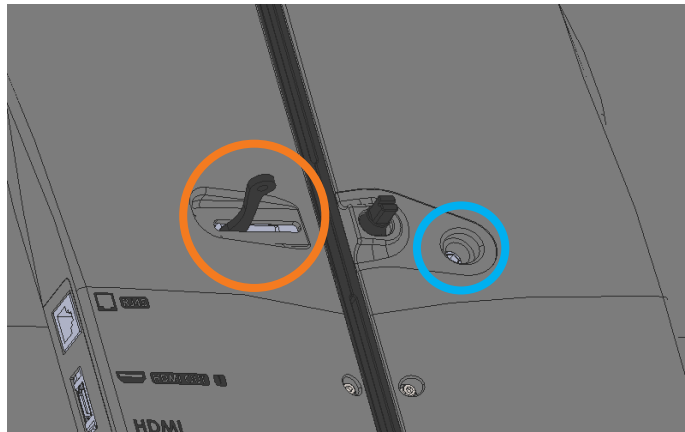


Figure 8. Extend the latch hooks by moving the lever circled in orange to the up position as shown; if the ½ turn fastener does not seat, use the hex socket circled in blue to adjust the position of the ½ turn fasteners.

Horizontal Tightening and Adjustment

This procedure may be completed after each cabinet is installed. However, it may be beneficial to install a complete first row prior to fully tightening and aligning cabinets, as the structure may deflect as the weight of new cabinets is added.

- 1 Check that the newly added cabinet(s) are level and aligned vertically.
- 2 If adjustment is required, do the following:

- a Carefully shim underneath the cabinet row until the vertical axis is aligned.
- b Use a 5mm hex key to tighten (turn clockwise) the two hex socket adjustment points circled in orange in Figure 9. These adjusters will secure the seam between the cabinets and tighten it to zero gap.

Notes:

- Use caution in tightening as the mechanism can be damaged from overtorque.
- Do not exceed 10 Nm (90 inlbf) of torque on any adjustment points. Exceeding this torque may result in an inability to adjust the seams.
- c Verify that the cabinets are now even and contacting between the machined surfaces.
- d If you are unable to get an even and contacting gap, recheck that the structure is level and plumb. As cabinets are added, the additional weight may cause deflection in the mounting structure, which may lead to misalignment of the cabinets.



Figure 9. Use a 5mm hex key to tighten the two adjustment points.

- 3 Tighten down the 4x M6 bolts completely and recheck the level and vertical alignment.
- 4 Repeat steps 1 through 3 to ensure that the entire row is fully tightened and aligned vertically.
 - Note that as more cabinets are added, the mount structure may deflect under the load. These steps may need to be repeated later in the process.
 - Adjustability of the mount structure may be required at this time to completely align the x and y axis.

Row Check

- 1 After completing each row, it is recommended to run the red, green, blue, and white test patterns on the cabinets to check for potential problems.
- 2 Check that there are no damaged tiles or defective LEDs.
- 3 Make any repairs as necessary before proceeding to the next vertical row.

Installing Cabinets Vertically

Before you begin, note the following:

- Just like the first row, install the cabinets from the center cabinet and alternate right and left to fill out each row as shown in Figure 10.

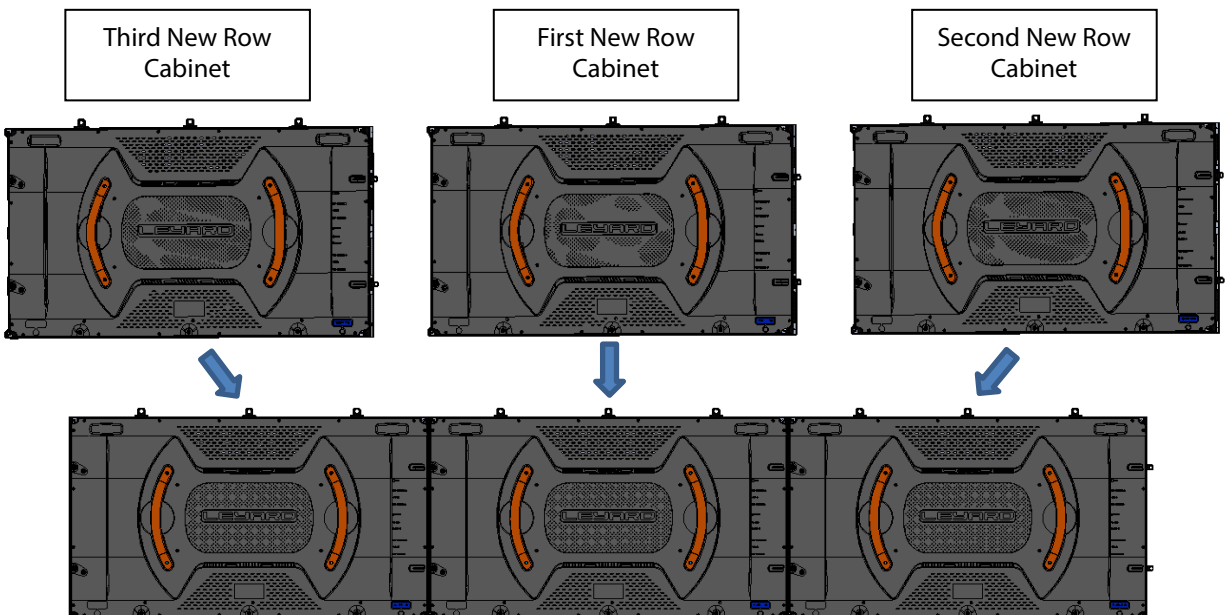


Figure 10. For additional rows, add the center cabinet first, and then build out the row of cabinets to the right and left from the center.

- Note that as additional rows of cabinets are installed, the added weight may cause deflection in the mount structure. This may require further adjustment of previously installed rows.
- Follow the procedures outlined in “Unpacking the Leyard TWA Series Cabinets” on page 17 to carefully remove the cabinets from their packaging.
- Be sure to test the cabinets prior to installation. It is easier to make repairs or correct tile issues while the cabinets are not installed.
- Check that the ½ turn fasteners are released as shown in Figure 6.

- 1 With two people, carefully lift the cabinet. **Do not touch the LEDs** or place any weight on the LEDs. They are extremely fragile.
- 2 Carefully set the cabinet on top of the last row of cabinets at the right-most available location. Be very careful not to impact the front face of either cabinet while placing the cabinet.

Note that the hooks have spring loaded dampers to prevent damage while setting the cabinet in place.

- 3 On the upper cabinet, press in the ½ turn fasteners, and then turn 180 degrees to secure them.

If the ½ turn fastener does not appear to fully seat or if you are unable to turn it ½ turn, you may need to loosen the hex socket using a 5mm hex key as shown in Figure 8 (circled in blue). Spin the hex key clockwise to move the ½ turn closer to the latch hook or counterclockwise to retract the ½ turn fastener.

- 4 Use a 5mm hex key to tighten the three hex socket adjustment points circled in orange in Figure 11. These adjusters close the gap between the two cabinets.

Do not fully tighten these points; tighten only enough to install the 4x M6 bolts to secure the cabinet. You will need some slack to adjust for any deflection in the structure when completing the row.

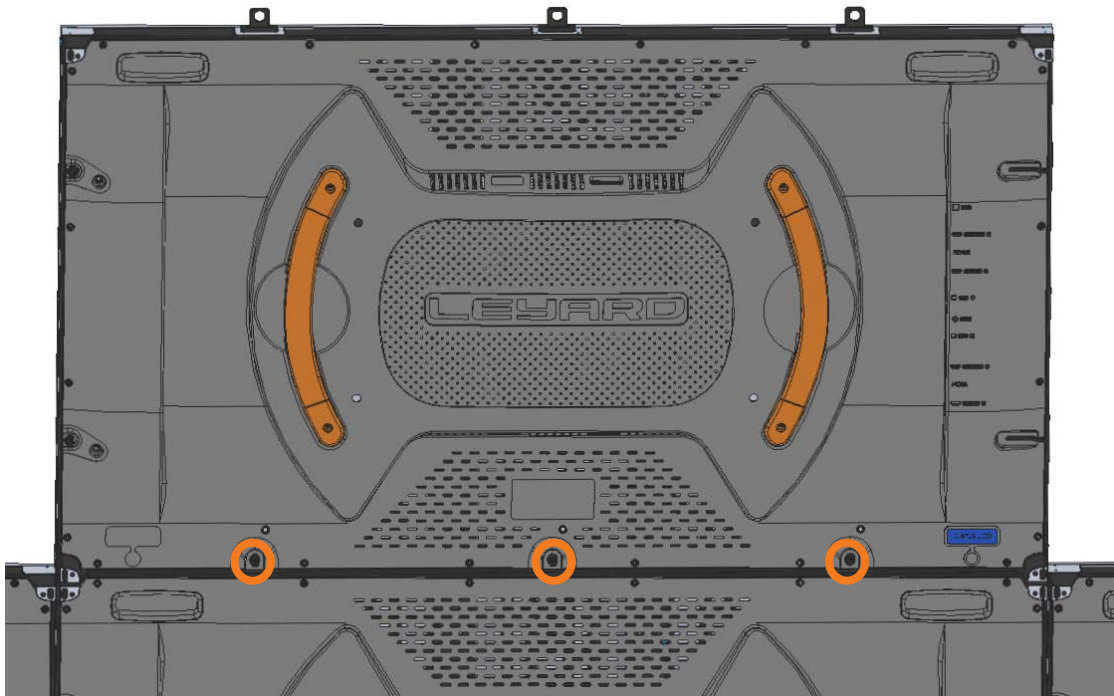


Figure 11. 5mm hex socket circled in orange. Use these to tighten cabinet down enough to secure the 4x M6 bolts. Do not fully tighten until the row is complete.

- 5 Finger tighten the 4x M6 bolts to the mounting feet.
- 6 Repeat steps 1 through 5 until the entire row is installed.

Row to Row Adjustment

- 1 Start from the center and work your way out during adjustment.
- 2 Check that the newly added cabinets are level and aligned horizontally. The cabinet seams should line up as closely as possible.

It may be helpful to have a person on each side of the cabinet array to adjust the cabinets right or left.

- 3 If adjustment is required, do the following:
 - a Use a 5mm hex key to tighten (turn clockwise) the three hex socket adjustment points circled in orange in Figure 11. These adjusters will secure the seam between the cabinets and tighten it to zero gap.

Notes:

- Use caution in tightening as the mechanism can be damaged from overtorque.
 - Do not exceed 10 Nm (90 inlbf) of torque on any adjustment points. Exceeding this torque may result in an inability to adjust the seams.
- b If you are unable to get an even and contacting gap, recheck that the structure is level and plumb. As cabinets are added, the additional weight may cause deflection in the mounting structure, which may lead to misalignment of the cabinets.
 - c You may need to make adjustments to the mount structure at this time to completely align the x and y axis.
- 4 Repeat step 3 for each cabinet in the row.
 - 5 Follow the procedures in “Horizontal Tightening and Adjustment” on page 22 and “Row Check” on page 23 to adjust the horizontal gap and position between cabinets, and complete a row check test. Due to deflection in the mounting structure, the rows below may need to be adjusted as well.

Note: Keep in mind that adjustment of the seams is an iterative process and is critical to function. Make sure to get the horizontal and vertical cabinet alignment as close as possible to zero. Additionally, note that as cabinets are added the increased weight may cause the structure to deflect and require readjustment.

- 6 Tighten down the 4x M6 bolts completely on each cabinet and recheck level and vertical alignment.
- 7 Repeat “Installing Cabinets Vertically” on page 23 and this procedure for additional rows.

Z-Axis Adjustment

Z-axis adjustment is an iterative process and may require several tries to complete this task.

Before you begin:

- Check that the mounting structure has not settled or shifted since the last row(s) have been added.
- Recheck that gaps are even and contacting for all cabinets.
- Recheck that the array is level and plumb and satisfactory in the x and y axis. It is critical to have the array as close as possible before starting the z-axis adjustment phase.

1 Locate the z-axis angled adjusters and z-axis straight adjusters as shown in Figure 12.

In Figure 13, the angled adjuster locations are circled in blue, and the straight adjuster locations are circled in red.

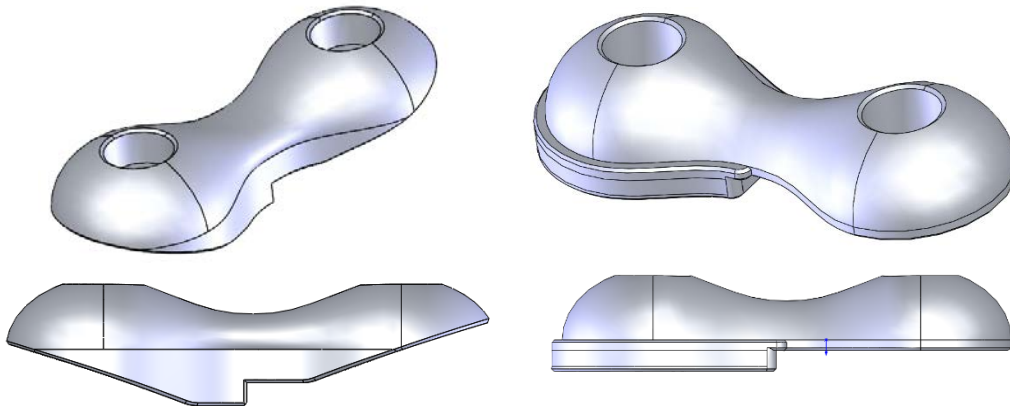


Figure 12. Shown on the left are angled adjusters. Shown on the right are straight adjusters.

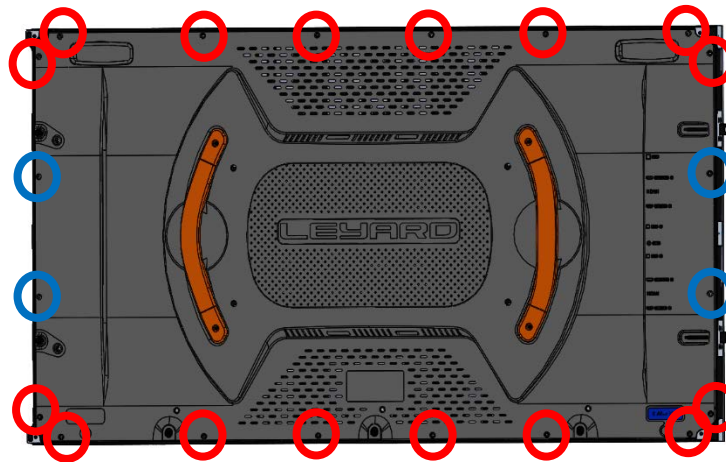


Figure 13. Four angled adjusters are used for locations circled in blue; 16 straight adjusters are used for locations circled in red.

- 2** To adjust the z axis, you'll need a person in front of the cabinets to feel for an offset between the two cabinets.

Note: The x, y adjustments may need to be loosened to allow the cabinets to move along the z-axis. Be sure to tighten again after z-axis adjustment if the x, y adjustments are loosened.

As with the assembly of the wall, begin with the bottom center cabinet and work your way out from there.

- As stated previously, z-axis adjustment is an iterative process and may require readjustment of previous cabinets as the structure is brought into alignment.
 - The two cabinets must be completely flush to the touch.
 - It is extremely important to get the offset as small as possible for the best visual results. Any offset will be visible by a black line as viewed from one side.
- 3** Check locations for offset along the seam between the two cabinets.
- a** Note which cabinet is protruding.
 - b** In the location where the offset is greatest, use a 2mm hex key and remove the nearest back cover screws from both cabinets.
 - c** Opposite the protruding cabinet, bolt the thicker side of the z-axis adjuster in place of the removed screw.
 - d** Slowly tighten the thinner side to the protruding cabinet as shown in Figure 14. This will pull the protruding cabinet to the same level. Do this slowly as it is easy to overshoot.
- If you overshoot, simply unbolt and flip the adjuster over.
- e** You may need to make adjustments to the mount structure at this time to completely align the z axis.

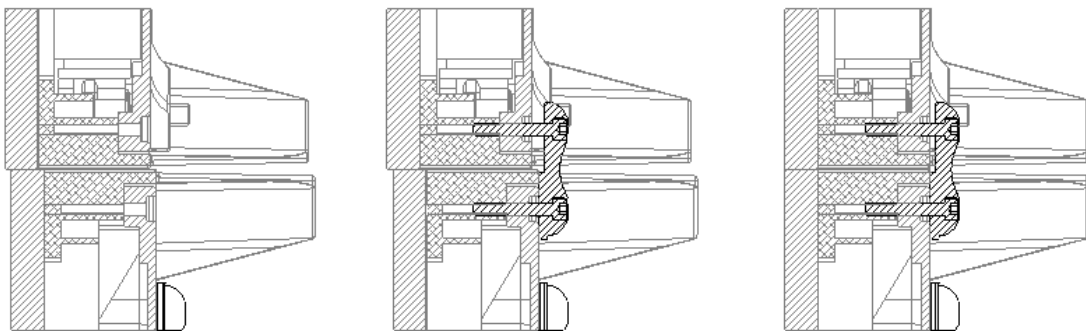


Figure 14. Where the protrusion is the greatest, bolt the z-axis adjuster's thick side down, and use the thin side of the z-axis adjuster to pull the protruding cabinet into alignment.

- 4** Continue to repeat steps 2 and 3, moving the adjusters as required to get a completely flush fit.
- 5** Check the seam between cabinets both right to left and bottom as applicable to ensure that the z axis has not shifted previously calibrated cabinets.

Software seam correction can help to minimize bright line seam differences between cabinets. For details, refer to “Step 5: Seam Correction” on page 34.

Configuring Your Leyard TWA Series LED Video Wall

Step 1: Install the Cabinet Cabling

After your cabinets are mechanically in place (see “Installing Your Leyard TWA Series LED Video Wall” on page 17), determine which cabinets will be the primary cabinets and which, if any, will be the secondary cabinets. Primary cabinets receive their HDMI and LAN/RS232 inputs from a host; secondary cabinets receive their HDMI and RS232 from another cabinet.

Determining the primary/secondary configuration depends on the host’s HDMI output resolution and the pixel pitch of the Leyard TWA Series. The maximum HDMI input resolution that can be handled by a Leyard TWA Series cabinet is 1920x1080, so typically the host will output a 1920x1080 HDMI format.

For example, consider a 1.2 mm pitch Leyard TWA Series in a 2 x 2 cabinet arrangement, which results in an overall pixel configuration of 1920x1080. For this example, it would be most convenient to use one HDMI 1920x1080 output and one LAN control from the host to drive one primary cabinet, which would then drive three secondary cabinets. However, if the host can provide only a 1280x720 HDMI output, then each of the 2 x 2 cabinets would need its own HDMI input and its own LAN control, and there would be four primary cabinets and no secondary cabinets.

Below is a rear view of the 2 x 2 connection scheme, assuming the host control is LAN.

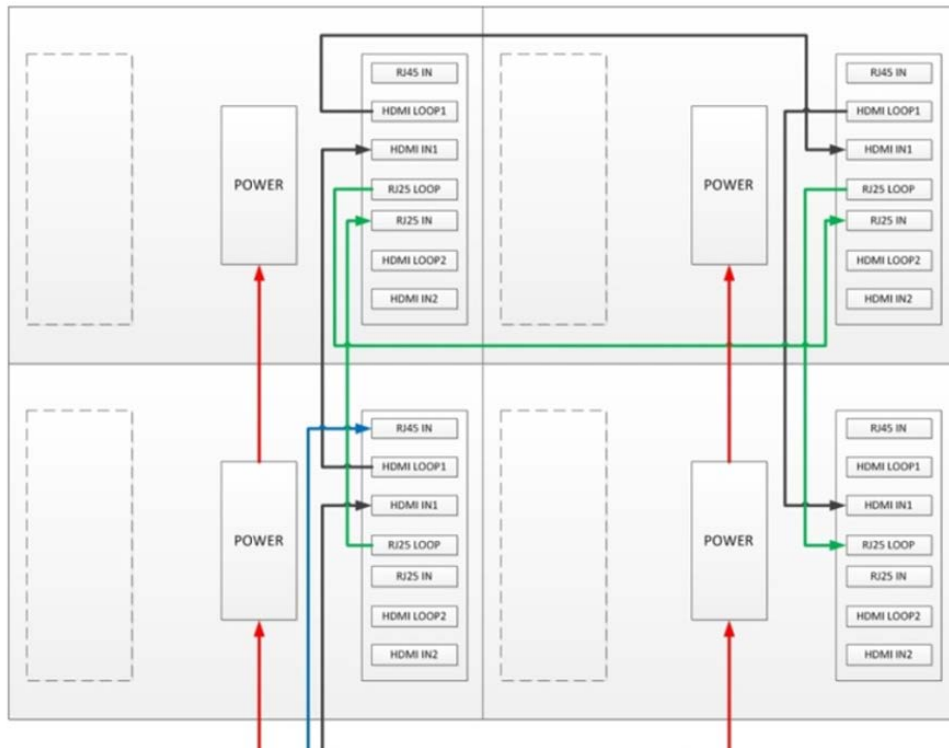
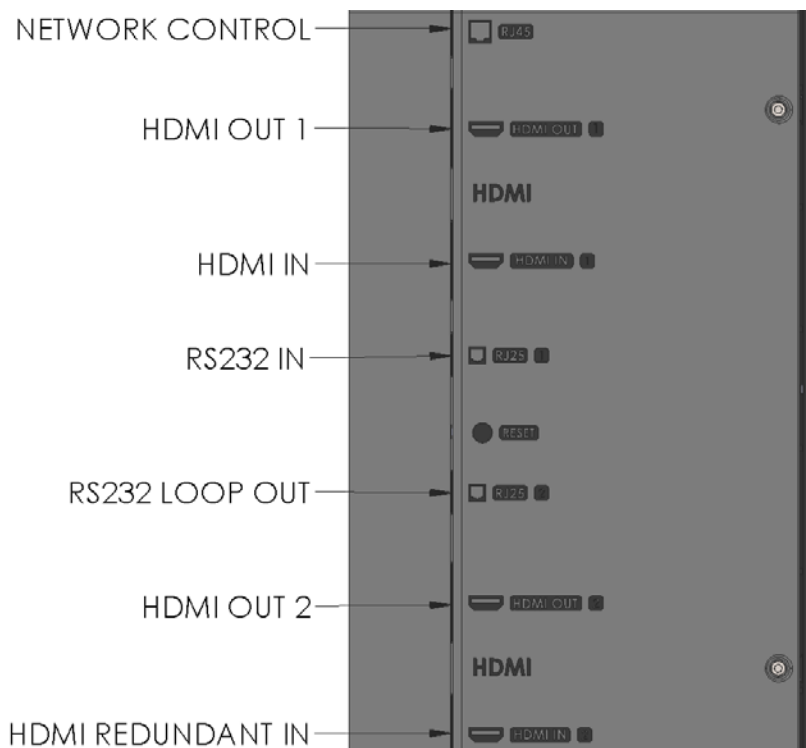


Figure 15. 2 x 2 Cabinet Arrangement

AC Power Connections (shown in red in Figure 15)

Custom AC power cables are provided with the product. Note that the power input connections route from the lowest cabinet up for primary power. If cabinets are configured with an optional redundant power supply, the redundant supply input power will input from the top and route down.

AC power can be looped between cabinets to reduce the number of AC circuits required. The number of cabinets allowed per AC circuit depends on the worst case cabinet power (100% brightness, full white pattern) and the current rating of the AC source. To allow sufficient margin for the 20A fuse on each cabinet's AC inlet, the recommended maximum number of cabinets per 110VAC circuit is three cabinets as shown in Figure 15. For 220VAC, up to six cabinets can be connected together, provided the AC source can handle the load. Refer to "Specifications" on page 62 for maximum power consumption per cabinet.



HDMI Connections (shown in gray in Figure 15)

Route the host's HDMI cable to HDMI IN on the primary cabinet using a standard HDMI cable. Then route the secondary paths using standard HDMI cables: from HDMI OUT 1 to HDMI IN on the secondary cabinets. Note that the sequence of the HDMI routing does not matter. As long as each cabinet receives an HDMI input, the image can be properly displayed.

For consistency, it is recommended that the conventions shown in Figure 15 are followed. Also note that the multiple HDMI inputs and outputs allow for redundant connections, which are typically not used.

Control Input (shown in blue in Figure 15)

The host can use either LAN, RS232, or LAN and RS232 for control. If using RS232, note that the pin assignment of the RS232 connector on the cabinet is custom. Refer to the RS232 pin assignments below if you are not using the cable provided with the product. If both RS232 and LAN connections are used, only one control method can be used at a time.

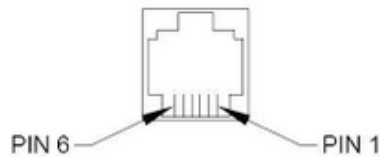
Control Looping (shown in green in Figure 15)

The looping of RS232 control between cabinets is accomplished using custom cabling. Refer to the RS232 pin assignments below if you are not using the cables provided with the product. The sequence of the control cabling connections is important because the sequence defines the cabinet addressing scheme. Follow the conventions shown in Figure 15 so that the function of the control software is consistent across all cabinets in the video wall.

Important: The control looping can be infinite, meaning that one primary cabinet could indirectly control as many cabinets as exist in the video wall. The only penalty is a slight delay in changes (such as a brightness change) that will be noticeable for seconds on long control loops.

RS232 Connector Pin Assignments

The RS232 connector consists of the following pin assignments (as viewed looking into the RS232 receptacle on the cabinet):



Pin	Name	Function
1	Rx	RS232 signal received by the cabinet
2	Tx	RS232 signal transmitted by the cabinet
3	NC	No connection
4	Reserved	Do not connect
5	GND	Ground
6	Reserved	Do not connect

Step 2: Set up Control of Multiple Primary Cabinets

Skip this step if you have just one primary cabinet in your video wall.

If multiple primary cabinets exist in the video wall (for example, there would typically be three primary cabinets in a 6 x 4 configuration of P1.2 cabinets), the host control will need to route to multiple cabinets.

RS232 control from the host could be used via an RS232 splitter, though with the following limitations: (1) no control of individual primary cabinets; (2) no functionality for Read commands; (3) no means of success/failure acknowledgement after a command is sent.

If more than one primary cabinet is desired, a better choice would be LAN control that operates through a network switch (not provided with the product). In that case, each of the primary cabinets would need separate IP addresses. The default cabinet IP address is 192.168.0.32, so all but one of the primary cabinets would need to have their IP address changed. For consistency, we recommend incrementing the addresses (for example, 192.168.0.33, 192.168.0.34, and so on). For instructions on how to change the IP address (IP Address Config) and how to control multiple primary cabinets (Multiple Mainboard Control), refer to “TWA54 Application Reference” on page 37.

Note that the IP addresses of the secondary cabinets do not matter and do not need to be changed. Also, each cabinet’s IP address can be visually read off of the small LCD display on the back of the cabinet. This avoids the problem of an unknown IP address.

Step 3: Define the Cabinet Addresses

The cabinet addresses (not IP addresses) must be defined for each primary-secondary group.

- 1 In the TWA54 application, in the Communication window, set the cabinet address for commands to 0, 0 (refer to “TWA54 Application Reference” on page 37). Note that 0, 0 is not a valid cabinet address; instead, 0, 0 indicates that subsequent commands will be issued to all cabinets.
- 2 On the TWA54_Tools tab, set **Cascade** to **ON** and click **Apply**.



- 3 Set **Assign Address** to **MCU** and click **Apply**. This option automatically assigns the cabinet addresses based on the order of the serial loop connections.

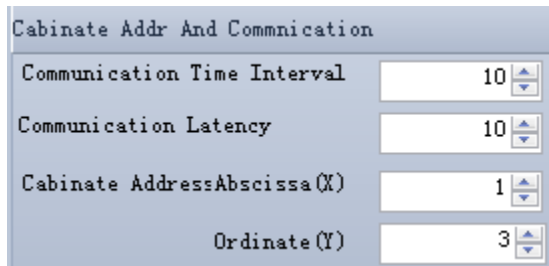


This procedure must be done for each primary cabinet that has secondary cabinets connected, typically by moving the LAN cable from primary to primary or by use of a network switch.

Step 4: Define the MB Origin Position for Each Cabinet

Each cabinet must know which portion of the HDMI input to display. This is accomplished by setting a cabinet parameter called MB Origin Position in the TWA54 Application. This parameter defines the pixel address of the HDMI content that will be displayed on the upper-left pixel of the cabinet.

- 1 For each primary-secondary group of cabinets, use the communication window to indicate which cabinet address to communicate with:



The screenshot shows a window titled "Cabinete Addr And Commnication" with the following settings:

- Communication Time Interval: 10
- Communication Latency: 10
- Cabinet Address: Abscissa (X): 1
- Ordinate (Y): 3

- 2 Set the MB Origin Position as desired (see page 41).
- 3 Repeat for each cabinet address in the primary-secondary group.
- 4 Repeat for all primary-secondary groups, either by moving the LAN cable or by changing to a different IP address if using a network switch.

For a P1.2 2 x 2 cabinet arrangement, the MB Origin Position values would be as follows:

Front view of a display:

MB Origin Position: 0, 0 (Secondary Cabinet; address 1, 3)	MB Origin Position: 960, 0 (Secondary Cabinet; address 1, 2)
MB Origin Position: 0, 540 (Secondary Cabinet; address 1, 4)	MB Origin Position: 960, 540 (Primary Cabinet; address 1, 1)

The HDMI input should be active with asymmetrical content during this step so that the results of the MB Origin Position setting changes can be visually confirmed.

In rare cases, image offsets may be desired to better position specific content. The MB Origin Position settings can be altered from those shown above to achieve a desired offset. For example, add 2 to all of the y values to move the displayed image down by two rows. In this case, the first two rows would always be black due to lack of content.

Step 5: Seam Correction

Careful mechanical assembly will minimize the gap variation between adjacent cabinet edges. However, visible seams may exist at the boundaries between cabinets, especially when solid patterns are viewed. After careful mechanical alignment, the control software can be used to slightly brighten or dim the visible seams as needed.

Seam correction can also be done to inner cabinet seams between tiles, though these inner seams are generally optimized at the factory. Refer to the “Edge Brightness Line Adjustment TabTWA54 Application Reference” on page 50. Note that because the seam correction process entails temporarily resetting the cabinet address and the MB Origin as well as switching the cabling around, it might be more efficient to perform seam correction as part of Step 1 (after connecting AC power and the HDMI cables), though the order is not critical.

Step 6: Display Adjustments

Finally, the display adjustments should be set as desired. Typically, this entails simply setting the brightness to the desired level. In other cases, a specific color temperature setting may be desired rather than the default 8500K. Note that the color temperature settings are approximate. See “Configuring the Color Temperature Settings” on page 45 if more accurate color temperature settings are required. If a 50 Hz HDMI input will be used, the Module frequency setting will need to be changed to 50 Hz.

For display adjustment details, refer to the appropriate section of the “TWA54 Application Reference” on page 37.

Installing the Leyard TWA Series Control Software

- 1 Locate the installation program on the USB drive provided with the product. The program is called *TWA54 xxxx Install*, where *xxxx* is the revision number.
- 2 Copy the installation program to the computer you want to use to control the display. If copied to the desktop, the program's icon will look like this:



- 3 Run the program (double-click the icon).
- 4 Follow the prompts to install the application. The process takes about a minute.

After the Leyard TWA Series Control Software is installed, there will be two application icons on the PC desktop:

- **TWA54:** The application that will typically be used to control the Leyard TWA Series LED video wall. For details, see “TWA54 Application Reference” on page 37.



- **TWA54 Engineer:** This application is essentially the same as the TWA54 application, and includes added functions and a password requirement. For details, see “TWA54 Engineer Application Reference” on page 54.



Note: Use caution in modifying values when using the software as they may result in visually undesirable results from which recovery is difficult.

Terminology

The nomenclature used in this software is different from what was used in some previous Planar LED products:

- LED tiles make up a cabinet; cabinets make up the LED video wall
- Each cabinet has a main board (MB), which is the cabinet controller embedded in the cabinet
- A cabinet connected directly to a host (computer) via LAN or RS232 is the primary cabinet or main cabinet
- Cabinets that connect via RS232 downstream from the primary cabinet are secondary cabinets

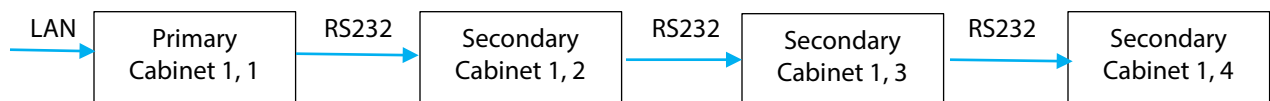
Addressing

The tile addressing within a cabinet, which is created automatically when you turn the cabinet on, is a simple row and column numbering scheme beginning with 1, 1 at the upper-left corner.

Below is an example as viewed from the front (P1.2 cabinet):

1, 1	1, 2	1, 3	1, 4	1, 5
2, 1	2, 2	2, 3	2, 4	2, 5
3, 1	3, 2	3, 3	3, 4	3, 5
4, 1	4, 2	4, 3	4, 4	4, 5

The cabinet addressing scheme, created during installation, is based on the order of the cabinet serial connections. The primary cabinet always has an address of $x = 1$ and $y = 1$, with only the y address incrementing on each secondary cabinet:



TWA54 Application Reference

The TWA54 application does not require a password and is meant to be used by the installer and the end customer. After opening the TWA54 application, follow the procedure below to set up communication settings.

The screenshot shows the 'Communication' window in the TWA54 application. It is divided into several sections:

- Communication:** Contains radio buttons for 'Serial' (selected) and 'Network'. Under 'Serial', there is a dropdown for 'COM1', a spin box for '115200', and a 'Refresh' button. Under 'Network', there is an 'IP' field with '192.168.0.32' and a 'Port' field with '8001'.
- Select Controller:** Contains a 'Controller Type' dropdown menu and an 'Output' dropdown menu.
- Cabinete Type:** Contains a 'Main Type' dropdown (set to 'TWA'), a 'Sub Type' dropdown (set to 'TWA1.2'), 'Module Count' (5x4), and 'Module Pixel' (192x135). There is an 'Advance' button below these fields.
- Cabinete Addr And Communication:** Contains four spin boxes: 'Communication Time Interval' (10), 'Communication Latency' (10), 'Cabinete Address Abscissa (X)' (0), and 'Ordinate (Y)' (0). At the bottom of this section are two buttons: 'Broadcast Address' and 'Single Cabinete'.

- 1 In the Communication window on the left of the application, do one of the following:
 - **If using serial control:** Click the **Serial** option, choose the appropriate COM port (click **Refresh** to see the available host COM ports), and set the baud rate to **115200**.
 - **If using LAN control:** Click the **Network** option, set the IP address of the primary cabinet (the IP address can be read from the small LCD on the rear of the cabinet), and keep the port set to **8001**.

The first three fields of the host's IP address must match those of the cabinet (192.168.0.xx, where xx is anything except 0, 1, or an address already used by a primary cabinet), with a mask value of **255.255.255.0**.

Note: To verify that LAN communication has been established, click the **P** button to ping the IP address. In the window that appears, if the response ends in “255”, the LAN connection is established and ready. You may need to unplug the LAN cable and plug it back in at the host to establish a connection.

- 2 Select **TWA** for **Main Type** and select the appropriate pixel pitch in **Sub Type**. Ignore the **Advance** button.
- 3 The **Communication Time Interval** and **Communication Latency** are set to **300** by default, which is appropriate for typical control.

Settings of **10** will speed up commands that take significant time, such as when downloading firmware or doing seam correction.

- 4 Specify the cabinet addresses:
 - **0, 0:** Communicate with both the primary and its secondary cabinets (assuming the cabinets have Cascade turned on, as explained in “Module Command Subtab” on page 46)
 - **1, 1:** Communicate with just the primary cabinet
 - **1, X:** (where X is 2, 3, and so on) Communicate with a specific secondary cabinet (again, assuming Cascade is on)
- 5 To control multiple primary cabinets, use either **Multiple Mainboard Control** or **Full Screen Control**, as explained in the “Mainboard Command Subtab” on page 40 and “TWA54 Engineer Full Screen Tab” on page 57.

Notes:

- When using **Full Screen Control**, the Communication window settings are ignored.
 - Both **Multiple Mainboard Control** and **Full Screen Control** are functional only via a LAN connection. If serial control of multiple primary cabinets is required without the need to communicate with individual cabinets, a third-party serial splitter could be used with the cabinet address set to 0, 0.
- 6 After the communication settings are set, select **TWA**, and then select the desired function.



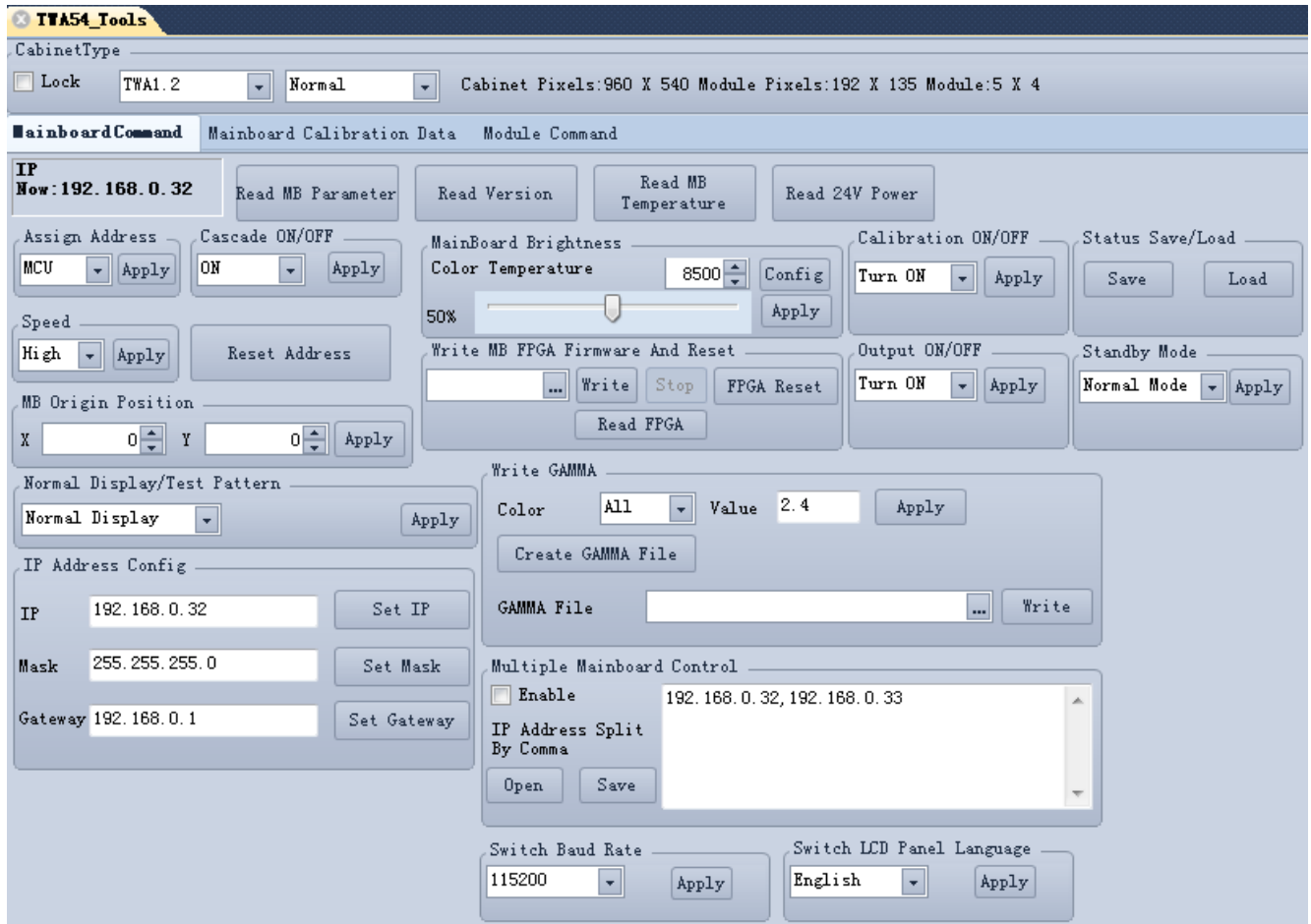
Each of these functions will be described next:

- “TWA54_Tools Tab” on page 39
- “Edge Brightness Line Adjustment Tab” on page 50

- “Full Screen Tab” on page 53

TWA54_Tools Tab

Most of the commonly used functions are on the TWA54_Tools tab:

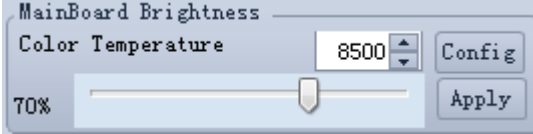
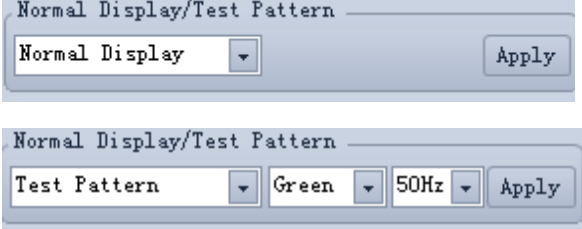




Select the desired cabinet type at the top of the TWA54 screen, such as TWA1.2. The field to the right of the cabinet type should be set to **Normal**. Note the cabinet and module resolutions are shown just to the right these fields. These resolutions can be helpful when defining the MB Origin Position during configuration (see “Step 4: Define the MB Origin Position for Each Cabinet” on page 33).

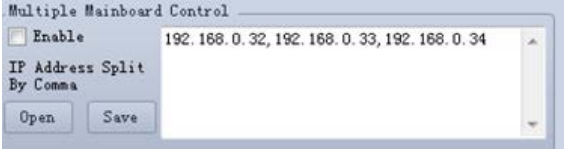
The TWA54_Tools tab contains three subtabs, with the most useful Mainboard Command subtab showing when the TWA54_Tools tab is first opened.

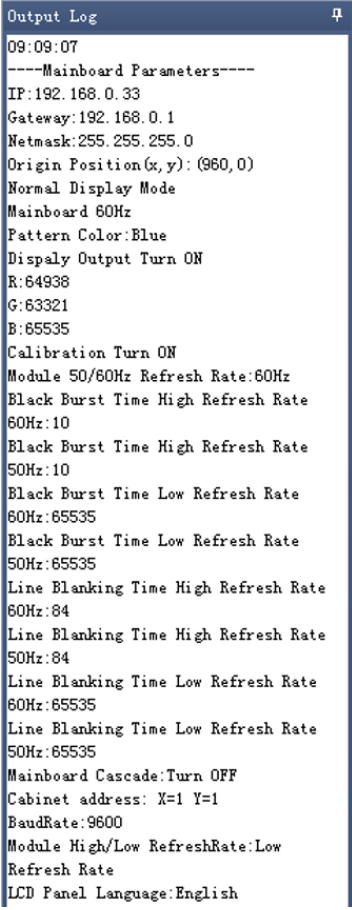
Mainboard Command Subtab


The fields are listed below in general order of importance.

Field	Description
<p>MainBoard Brightness Color Temperature</p>	<p>Set the brightness and color temperature and then click Apply.</p> 
<p>Normal Display/Test Pattern</p>	<p>Typically use Normal Display to display HDMI content. Selecting Test Pattern will override any active HDMI input and display the selected test pattern; a cabinet set to Normal Display without an HDMI input will display a black screen.</p> 

Field	Description
Assign Address and Cascade ON/OFF	<p>These fields are used during setup to automatically define the cabinet addresses and enable the serial looping where the primary cabinet (the cabinet connected to the host via LAN or RS232) can relay commands to the secondary cabinets. To do this:</p> <ol style="list-style-type: none"> 1 Make sure the cabinet serial cabling is in place. 2 In the Communication window, set x and y to 0 to broadcast commands to all cabinets. 3 Select ON for Cascade ON/OFF and click Apply to turn on the serial loop out on the cabinets. 4 Select MCU if it is not already selected and click Apply. The primary cabinet will be assigned an address of 1,1 and any secondary cabinets will be assigned, in the order in which they are connected by the serial loop, an address of 1, 2; 1, 3; 1, 4 and so on. Note that the x coordinate is always 1.  <p>Note: When a Cascade “off” command is sent, a side effect occurs: the cabinet connected by LAN to the host will automatically be given an address of 1, 1. Normally this is not an issue, but can be confusing if you temporarily connect a host to a secondary cabinet and send a Cascade “off” command.</p>
Reset Address	<p>If Cascade is set to on, this will set all cabinet addresses to 1,1. This field is typically not used.</p>
MB Origin Position	<p>This is used during setup to tell the panel which portion of the HDMI image to display. For example, to have the addressed cabinet display the upper-left section of the HDMI content, enter 0, 0 for MB Origin Position and click Apply. For a 2x2 arrangement of P1.2 cabinets, where each cabinet has a resolution of 960x540 (the cabinet resolution is provided at the top of the window, assuming the cabinet pitch is correctly selected), with the bottom-right cabinet addressed in the Communication window, enter 0, 540 for MB Origin Position and click Apply.</p> 

Field	Description								
<p>IP Address Config</p>	<p>Used to change the IP address of the primary cabinet. If the host PC is connected to multiple primary cabinets via a network switch, each primary cabinet must have a unique address (the IP address is displayed on the LCD display on the back of each cabinet). When the IP address of a TWA54 is changed, the display goes blank or blinks for about 30 seconds before normal operation resumes.</p>								
<p>Multiple Mainboard Control</p>	<p>Used to broadcast commands to various IP addresses (primary cabinets) via a network switch. This is very useful for changing parameters such as Brightness across an entire display composed of many primary cabinets. Click the Enable box and enter the desired IP addresses, and then change the desired parameter. The addressing in the Communication window must be set for a single cabinet (such as 1, 1) in order for the multiple control to function. Ignore the Open and Save buttons.</p> 								
<p>Output ON/OFF</p>	<p>When off, a sequence of test patterns is continuously displayed, so typically set this to on.</p>								
<p>Standby Mode</p>	<p>This will put the cabinet into sleep mode, where the display is black regardless of HDMI activity and the cabinet power consumption is lowered beyond that of a standard black pattern. It is the same as using the DC Power Off command on the Module Command subtab (see page 46). Typical cabinet power under the various black states is as follows:</p> <table border="1" data-bbox="690 1402 1421 1764"> <thead> <tr> <th>Condition</th> <th>Typical Cabinet AC input power</th> </tr> </thead> <tbody> <tr> <td>Black pattern applied via Test Pattern or HDMI content</td> <td>85W</td> </tr> <tr> <td>Standby Mode on, or DC Power turned off</td> <td>50W</td> </tr> <tr> <td>DC Power and RAM Power turned off (using TWA54 Engineer)</td> <td>42W</td> </tr> </tbody> </table>	Condition	Typical Cabinet AC input power	Black pattern applied via Test Pattern or HDMI content	85W	Standby Mode on, or DC Power turned off	50W	DC Power and RAM Power turned off (using TWA54 Engineer)	42W
Condition	Typical Cabinet AC input power								
Black pattern applied via Test Pattern or HDMI content	85W								
Standby Mode on, or DC Power turned off	50W								
DC Power and RAM Power turned off (using TWA54 Engineer)	42W								
<p>Write Gamma</p>	<p>Enter a gamma value and click Apply to define the brightness vs. gray level (ignore the file functions).</p>								

Field	Description
Config	Used to tune the accuracy of the color temperature settings, if desired. The color temperature settings are typically inaccurate for a given display, due to batch variation in the calibration factors. Refer to “Configuring the Color Temperature Settings” on page 45.
Read MB Parameters	<p>This provides the cabinet’s parameter settings (such as RGB brightness) in the Output Log window. For all read commands, the cabinet address in the Communication window must be a single address and not the global 0, 0. Below is a typical result of the Read MB Parameters operation.</p>  <pre> Output Log 09:09:07 ----Mainboard Parameters---- IP:192.168.0.33 Gateway:192.168.0.1 Netmask:255.255.255.0 Origin Position(x,y):(960,0) Normal Display Mode Mainboard 60Hz Pattern Color:Blue Display Output Turn ON R:64938 G:63321 B:65535 Calibration Turn ON Module 50/60Hz Refresh Rate:60Hz Black Burst Time High Refresh Rate 60Hz:10 Black Burst Time High Refresh Rate 50Hz:10 Black Burst Time Low Refresh Rate 60Hz:65535 Black Burst Time Low Refresh Rate 50Hz:65535 Line Blanking Time High Refresh Rate 60Hz:84 Line Blanking Time High Refresh Rate 50Hz:84 Line Blanking Time Low Refresh Rate 60Hz:65535 Line Blanking Time Low Refresh Rate 50Hz:65535 Mainboard Cascade:Turn OFF Cabinet address: X=1 Y=1 BaudRate:9600 Module High/Low RefreshRate:Low Refresh Rate LCD Panel Language:English </pre> <p>Note that the Black Burst and Line Blanking values are for just the tile at address 1, 1. There is no way to read the BB and LB values of the other 19 tiles in a cabinet, though it is likely they are the same as the tile at address 1, 1. An exception might be if one of the tiles was replaced in the field, because the BB and LB settings made at the factory can be dependent upon the LED batch.</p>

Field	Description
Read Version	Provides the main board FPGA and MCU version of the addressed cabinet in the Output Log window.
Read Power Status	Intended to provide voltage and current readings for various power supply rails, but is currently not functional.
Read MB Temperature	Provides the temperature as measured by a sensor on the main board of the addressed cabinet.
Read 24V	Provides the voltage reading of the 24V supply, which is an output of the AC supply. 21V is a typical reading.
Update MCU	Updates the main board microprocessor code. If clicked, will prompt for the location of the code to upload. Select the desired <i>.bin</i> file. This takes about 30 seconds to program, and then the display will go black for 30 seconds before recovering. Afterward, you may need to unplug and re-plug the LAN cable to restore LAN communication and/or cycle the AC power.
Write MB FPGA Firmware and Reset	Allows the FPGA firmware to be updated. Also can reset the FPGA, which causes the cabinet to go black for about 30 seconds before restarting. Refer to “Updating the Firmware” on page 45.
Status Save/Load	<p>Allows the presently-set mainboard parameters to be saved to a file for future recovery. The file resides on a PC or other media, not on the cabinet. Click Save to select the file name and path. Click Load to select the file to load.</p> 
Switch Baud Rate	Used to select the mainboard’s baud rate. The default is 115200 . 230400 and 9600 can also be selected. If the baud rate is changed and you are using serial control, the baud rate in the Communication window must be changed to match.
Speed	Currently not functional.

Configuring the Color Temperature Settings

To increase the accuracy of the color temperature settings, follow this procedure.

Notes:

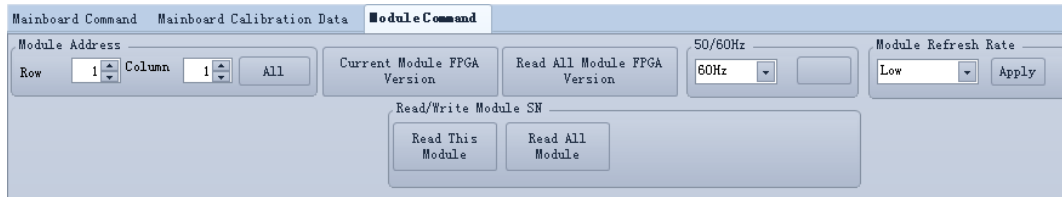
- An accurate spectrometer is required.
 - Depending on the color temperature setting, a side effect of this procedure is reducing luminance by up to 25%.
- 1 Run the TWA54 Engineer application (password required) to set R, G, and B to 65535 on the Full Screen tab (instead of selecting a specific color temperature).
 - 2 Allow the display to warm up for at least 10 minutes if not yet warm.
 - 3 Click **Config** to invoke the Config data input window.
 - 4 Apply a full red HDMI input to the display, and then use a chromaticity meter (such as I1D3) to measure luminance, x, and y. Enter the measured data into the appropriate fields in the Config window.
 - 5 Repeat the process for green and blue.
 - 6 In the Config window, click **Apply** to run the algorithm that computes the sub-pixel drive strengths required for accurate color temperature settings.
 - 7 Under **MB Brightness**, choose the desired color temperature and brightness for operation.

Updating the Firmware

To load new controller board FPGA firmware to the addressed cabinet, do the following:

- 1 In the Communication window, set the **Communication Latency** and **Communication Interval** settings to **10** (default settings of 300 work, but the process is much slower.) This implies a LAN connection; serial can also be used but is slow.
- 2 Click **...** to navigate to the desired *.rpd* file (usually the name includes the word "core", not "scanner").
- 3 Click **Write**. The process takes about 30 seconds.
- 4 Click **FPGA Reset**, which causes a black screen for one minute.
- 5 To restore the LAN connection, you may need to unplug and plug the LAN cable back in.
- 6 To restore operation, you may need to toggle the **Normal Display/Test Pattern** setting between **Test Pattern** and **Normal**.
- 7 If the display is white and does not show HDMI content, sometimes applying an **RGB Gamma** setting such as **2.4** will restore normal operation (even if gamma was already set to 2.4).

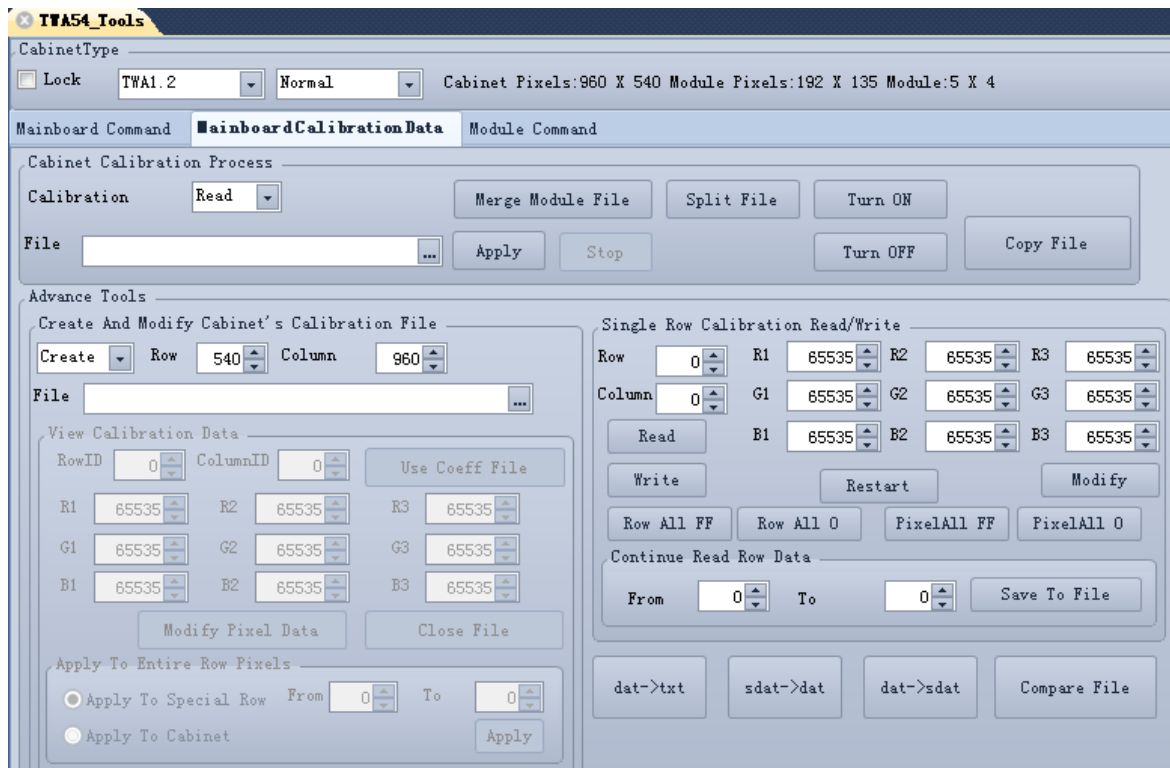
Module Command Subtab



Field	Description
Module Address	Used to select individual tiles within a cabinet if individual tile control is needed. This is typically not needed, so click All .
50/60 Hz	Must be set to match the frame rate of the HDMI input or the displayed image will flicker rapidly.
Current Module FPGA Version, Read All Module FPGA Version	In the Output Log window, provides the tile FPGA version for either the addressed tile or all tiles in the cabinet.
Read This Module, Read All Module	Provides the tile serial number, which is a time stamp assigned during manufacturing. It can also be used to determine the approximate build date.

MainboardCalibrationData Subtab

The MainboardCalibrationData tab, shown below, is for reading a cabinet's calibration data or for writing calibration data to the cabinet.




Field	Description
Calibration: Read	To read a cabinet's calibration data in file form (typically a factory operation), select Read under Cabinet Calibration Process , browse to a folder where you want the file to be stored, name the resulting file, and click Apply. It takes about 30 seconds to create the <i>sdat</i> file from a primary cabinet with Cascade turned off and the communication latency and interval set to 10.
Calibration: Write	To write a merged calibration file to a cabinet (typically a factory operation), select Write under Cabinet Calibration Process , use the file browser to select the file, and click Apply .
Split File	Used to split a cabinet <i>sdat</i> file into four tile <i>dat</i> files.
Turn On and Turn Off	Turn the calibration factors on or off so that the effects of calibration can be gauged. Note that

Field	Description
	extended run times with calibration turned off is not recommended, especially with white patterns and high brightness settings, due to increased power consumption and increased thermal conditions.
Advance Functions	Not used.


Creating a Cabinet *sdat* File

To create a cabinet *sdat* file (typically a factory operation), where the 20 tile calibrations *dat* files are merged into a single cabinet file, do the following:

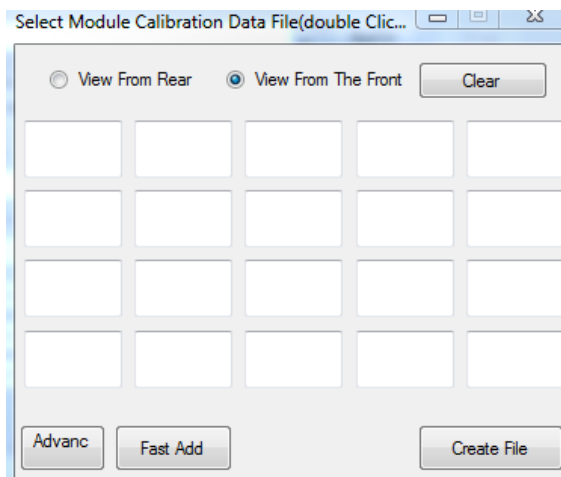
- 1 Click **Merge Module File**.
- 2 Confirm that the correct pitch is selected under **Cabinet Type** by clicking **Yes**.

 Please Confirm Type Is TWA1.2 Normal?

- 3 Typically, answer **No** to the Read Module Serial Number window. Click **Yes** if the *sdat* cal files for the tiles have been stored with the tile serial number used as the filename.

 Read Module Serial Number?

A window will appear with white rectangles for each of the tiles in the cabinet.

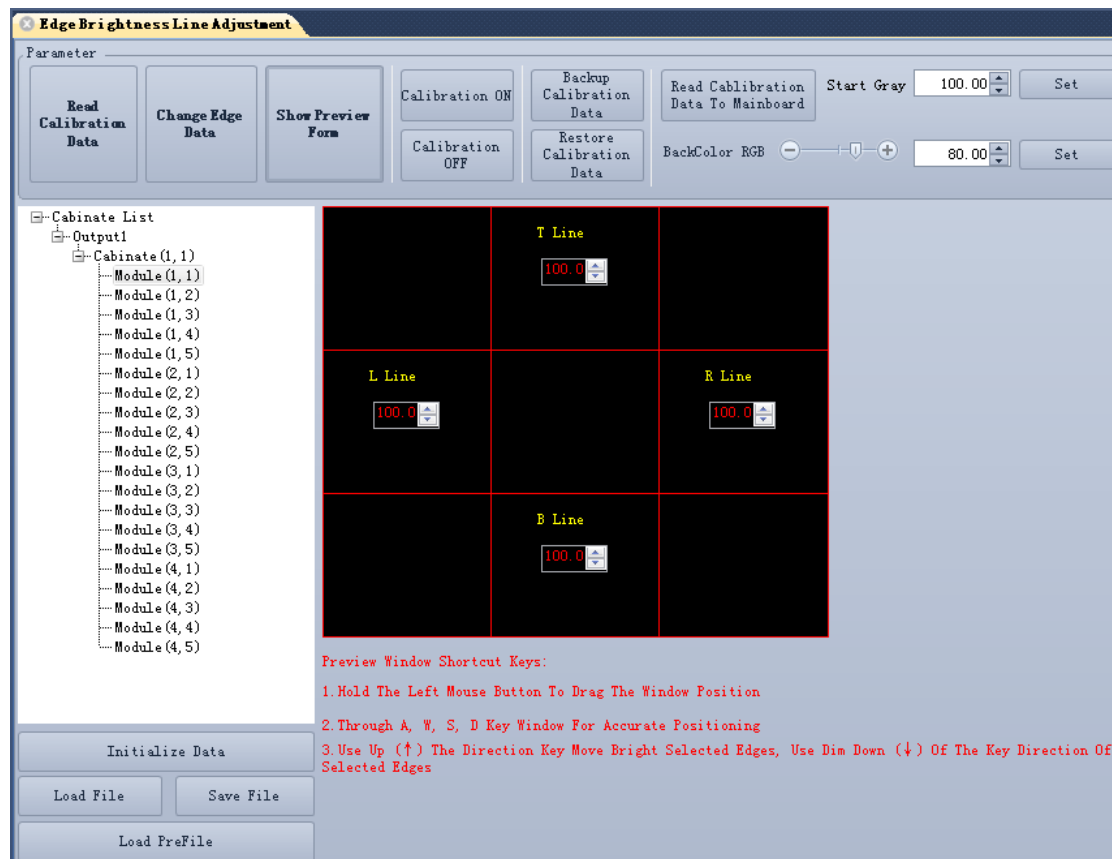


- 4 Double-click each white rectangle, one at a time, which will open a browser each time. Select the tile calibration *dat* file that corresponds to the selected tile. Do this for all tiles in the cabinet.
- 5 Once files have been selected for all 20 tiles, click **Create File**.
- 6 Use the browser to select the folder for the resulting merged file and click **Open**.
- 7 The file will then be saved to the designated folder. Use the procedure described above for **Calibration: Write** to write the merged file to the cabinet.

Note that there are additional calibration functions available on the Module Command subtab when the TWA54 Engineer application is run. Refer to “TWA54 Engineer Application Reference” on page 54.

Edge Brightness Line Adjustment Tab

This Edge Brightness Line Adjustment tab is used to perform seam correction. With seam correction, tile seams can be made either dimmer or brighter to help conceal slight mechanical misalignments.



The seam correction process modifies a cabinet's calibration file so that the calibration factors for pixels along a tile edge can be increased or decreased. The process can be time consuming, taking 5 to 30 minutes per cabinet.

Seams are corrected on a per tile basis. When adjusting tile edges that are internal to the cabinet, both of the tiles edges that form a seam can be adjusted simultaneously. When adjusting tile edges that form part of the cabinet perimeter, only one tile edge is adjusted at a time because corrections must be made one cabinet at a time.

Seams can be adjusted in two general ways: using a manual method where a tile edge is selected for adjustment and the results are seen once the corrected data is downloaded, or using a "preview" white screen that allows for mouse-based selection of seams to adjust with the results seen in real time. The latter method is preferred for speed and convenience.

To shorten the seam correction process, after some initial setup described below, each cabinet needing correction should have its communication path temporarily connected directly to the

host. This entails moving the LAN cable from cabinet to cabinet, doing the seam correction adjustments one cabinet at a time. It is also possible to leave the LAN connected to the primary cabinet and then adjust secondary cabinets one at a time using the proper cabinet address. However, the process time is much longer (it adds around two hours to the seam correction process of a 2x2 cabinet display) due to the communication time through the cabinets.

Here is the recommended seam correction process:

- 1** On the TWA54_Tools tab, with the cabinets connected normally (primary cabinet looping to the secondary cabinets):
 - a** Verify that the cabinet type is set correctly at the top of the TWA54_Tools tab.
 - b** For each cabinet that needs seam correction, set the **MB Origin Position** to 0, 0.
 - c** For each cabinet, turn the Cascade function off. This will speed up the data transfer process. Note that as a side effect of turning Cascade off, the cabinet addresses will be reset to 1, 1.
- 2** Connect the host's LAN cable to a cabinet that needs seam correction. This may entail moving the LAN connection from the primary cabinet temporarily to a secondary cabinet. If there is a serial loop-in connection at the cabinet, unplug the serial loop-in cable.
- 3** In the Communication window:
 - a** Set the IP address to match that of the cabinet.
 - b** Select the correct TWA pitch for the **Cabinet Type**. This will determine the size of the "preview" pattern.
 - c** Set the cabinet address to match that of the cabinet—usually 1, 1 due to the address reset of step 1c.
 - d** Set the **Latency** and **Time Interval** to **10** to speed up the process.
- 4** Optionally, set the **Brightness** to **50%** (other values will work as well).
- 5** If not already done, connect the PC's HDMI output to the cabinet. It can be either a direct connection or looped through other cabinets; the PC should be about to output 1920x1080. Note that the TWA54 must be designated the "main display" in the PC's display manager setup so that the preview pattern is positioned correctly.
- 6** Select the Edge Brightness Line Adjustment tab.
- 7** Click **Read Calibration Data** to get the calibration factors from the controller board so that they can be used as the starting point for the adjustment. This takes about 30 seconds.
- 8** Click **Backup Calibration Data** to save the factors from the previous step, and name the file something descriptive. This saved file is useful in the unlikely event that problems occur during seam correction and restoration is needed.

9 Click **Show Preview Form**, which opens up a window showing a white pattern for easy adjustment of the tile-to-tile seams, with two internal seams adjusted simultaneously. The size of the white pattern is a full cabinet size with a one tile-wide border around the perimeter that overlaps onto any adjacent cabinets. For a 960 x 540 P1.2 cabinet, which has 192 x 135 modules, the white pattern is 1344 x 810.

10 When **Show Preview Form** is clicked, the white pattern will be positioned for a cabinet with the **MB Origin Position** set to 0, 0 (upper-left portion of the HDMI content).

Important: Do not use the mouse or keyboard to move the white pattern, or any seam correction done may not have an effect once applied.

Because all cabinets were set to 0, 0, note that the same white pattern content will show on all cabinets.

11 Move the mouse to highlight the seam you want to adjust. When the mouse hovers over a seam, blue numbers will appear. By clicking on the blue numbers, the numbers will turn red and can then be adjusted using the up/down arrow keys of a keyboard. The effects (dimmer or brighter seams) will be shown on all cabinets, but the actual change will be applied only to the cabinet that has the LAN cable connected. When the first seam correction within a cabinet is completed, move to the next seam within the cabinet that needs correction.

12 Adjust all seams in the cabinet as required until the result is optimized. When the last adjustment is complete, click with the mouse somewhere on the white pattern so that last adjustment will be saved. Don't leave the pattern with red numbers showing.

13 Press the ESC key on the keyboard to close the preview screen.

14 Click **Change Edge Data** to write the new calibration data to the cabinet controller board and to the cabinet tiles.

a Answer **No** to the window that asks "Do you want to save the data values?" This is a reminder to save a *cal* data backup file, which was already done.

b Click **OK** to the next pop-up window and leave the value at 1.0.

c Wait for about two minutes for the write operation to execute.

When the process is complete, the cabinet will display self-test patterns, go momentarily black, and then begin normal operation.

15 Visually verify that the seam correction results on the cabinet just adjusted are acceptable. If further adjustment of the same cabinet is needed, click **Read Calibration Data** to read the new calibration data, because that will be the new starting point. Then click **Show Preview Form** and repeat the remainder of the seam correction process.

16 Repeat the seam correction process for any additional cabinets.

- 17 If at any time you need to return to the original calibration data, click **Restore Calibration Data**, navigate to the *sd* file you stored earlier, and click **Open**. Then wait two minutes for the calibration data to be restored.
- 18 When you are done with the seam correction on all cabinets:
 - a Re-connect the LAN cable to the primary cabinet.
 - b Re-connect all cabinet-to-cabinet serial cables.
 - c Set the IP address in the Communication window to match that of the primary cabinet.
 - d Set the cabinet address in the Communication window to global (0, 0).
 - e Set **Cascade** to on.
 - f Under **Assign Address**, click **Apply** to re-set all the cabinet addresses.
 - g Set the **MB Origin Position** of the cabinets back to their appropriate values.

Full Screen Tab

Do not use this tab when running the TWA54 application. Most of the functions on this tab are accessible or functional only when running the TWA54 Engineer application.

Troubleshooting Abnormal Display Behavior

At various times, especially during installation when settings and cable connections are being changed, it is possible that the cabinets will suddenly exhibit abnormal display behavior, such as displaying wrong content. In these situations, one or more of the following actions have been found to resolve this issue:

- 1 Cycle the AC power to the cabinet.
- 2 Set **Normal Display/Test Pattern** to **Test Pattern** and then back to **Normal Display**.
- 3 Unplug the HDMI cable and then plug it back in.
- 4 Send a **Gamma** command (select any value, such as 2.4, and click **Apply**).
- 5 Send a **Brightness/Color Temp** command (select any value and click **Apply**).

TWA54 Engineer Application Reference

The TWA54 Engineer application requires a valid user name and password. The user name is “admin” and the password is “123456”. When run, this application may at first look identical to the TWA54 application. But some functions that are grayed out in the TWA54 application are now active, some new functions appear, and the Full Screen tab contains more subtabs and is made functional.

Important: There are capabilities in TWA54 Engineer that can cause problems. If you have access to the password, change only settings you understand and do not attempt operation by trial and error.

These are the main uses for TWA54 Engineer:

- Adjusting the black burst settings, though they should be correctly set by the factory
- Adjusting the line blanking settings, though they should be correctly set by the factory
- Changing to the native color temperature by setting R-G-B to their maximum values of 65535 (possibly as part of the Config operation as described on page 45)
- Transferring calibration data between tiles and the main board if main board is replaced
- Loading new firmware into the tile FPGAs
- Getting the lowest power in sleep mode by turning off both DC and RAM tile power

The Mainboard Command subtab is the same as in the TWA54 application.

The Module Command subtab includes added functions, as shown below and described in the table following:



Field	Description
Black Time	Used to set the Black Burst values for each of the four possible operating states. Black Burst reduces the Refresh Rate , which can eliminate pixel artifacts (pixels slightly on that should be off) and vertical banding. Black Burst can also be used to minimize camera beat frequency effects seen in some broadcast studio situations. The Low 60 Hz value is meaningful only if operating at the default settings of low refresh rate and 60 Hz HDMI input. Generally avoid values above 400 as the display luminance will begin to decrease significantly at higher values.
HBlank Time	Used to set the Line Blanking values for each of the four possible operating states. Line Blanking adjusts the dead time between column writes and can be used to minimize pixel artifacts, although typically black burst is more likely to fix pixel artifacts.
Read/Write Module SN	Reads or writes the time-stamped ID number of the tile. Typically, there is no reason to use the write function, because then all traceability to factory records will be lost.
Read Module Data and Write to MB	The calibration factors reside on each tile, and all the tiles' calibration factors reside on the main board. The factors on the main board are the factors actually in use. Therefore, if a main board is replaced on a given set of tiles, or if new tiles are installed in a cabinet, the calibration factors will need to be uploaded from the tiles to the main board using the procedure "Reading Tile Data and Writing to MB" on page 56.
Cabinet File Write to All Module	Typically not used, this writes the calibration factors in the main board to the tiles. Use caution as this function can overwrite valid factors in the tiles.
Read Module Data	Used to read the calibration factors in the tile and store them in an external file. Turn Cascade off for faster process time. Use the file browser to designate the name and folder for the saved file. Afterward, the cabinet will display a blue screen. Set the Display Mode to Normal to restore normal operation.

Field	Description
Write One Module Data	Used to write a tile's calibration factors (if available in <i>dat</i> file form) to a tile. The cabinet and tile address must be set appropriately. Set Cascade to off to speed up the process (1 minute instead of about 4 minutes). Once completed, the cabinet will display a blue screen. Set the Display Mode to Normal to restore normal operation.
Write Calibration File to Module	For factory use, will read the addressed tile's ID and then search in a designated folder for a <i>dat</i> file with the same ID, which is then written to the tile.
Write FPGA	Used to update the tile FPGA firmware as described in "Writing FPGA" on page 57.
Read FPGA	Used to read the tile FPGA firmware and store it in a file.
Power Control	Used to turn off the power to the addressed tile or all tiles. Set both items to off and click Apply All to enter the lowest power black screen state. This is slightly lower power than standby mode in the TWA54 application.

Reading Tile Data and Writing to MB

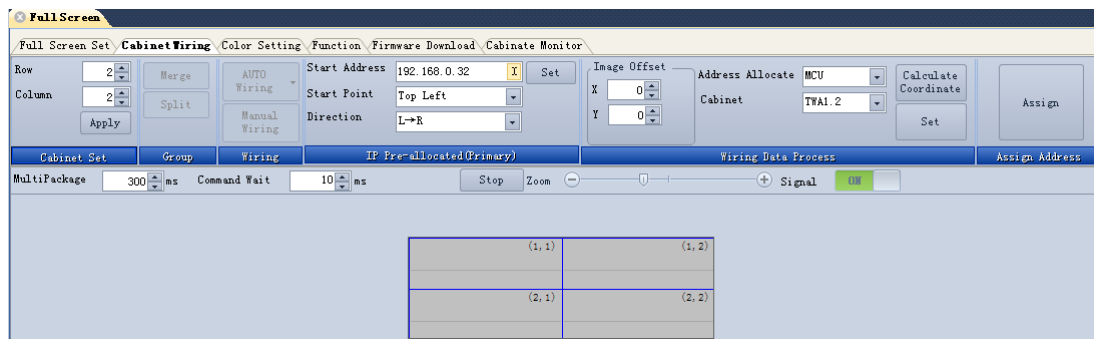
- 1 In the Communication window, set the **Cabinet Address** (usually 1,1) and set the **Time Interval** and **Latency** to **10**.
- 2 On the Mainboard Command subtab of the TWA54_Tools tab, set **Cascade** to **OFF**.
- 3 On the Module Command subtab, click **Read Module Calibration Data and Write to MB**.
- 4 Wait approximately five minutes for the processes to complete (20 tile reads and one cabinet write). Once complete, the cabinet will cycle through the turn on self-test patterns and then display a blue screen.
- 5 On the Mainboard Command subtab, change **Normal Display** to **Test Pattern** (any pattern is fine).
- 6 Change back to **Normal Display**. This executes a type of reset.
Normal operation should be restored, with the proper calibration factors in use.

Writing FPGA

- 1 In the Communication window, set the **Cabinet Address** (usually 1,1) and set the **Time Interval** and **Latency** to **10**.
- 2 Enter the tile address (row and column) or click **All** to program all modules in the cabinet.
- 3 Click **Write FPGA** and navigate to the desired *rpd* file (usually with a name including "scanner").
- 4 Select the *rpd* file and wait about one minute for the process to complete.
- 5 Follow the prompt to cycle the AC power off/on. You may need to cycle the LAN cable after cycling AC power.
- 6 You may need to toggle the **Normal Display/Test Pattern** setting between **Test Pattern** and **Normal** to restore operation.
- 7 If the display is white and does not show HDMI content, apply the **8 bit** or **10 bit Gamma** setting.

Ignore any functions not covered in this document.

TWA54 Engineer Full Screen Tab



Note the following when using the Full Screen tab:

- LAN control to the primary cabinet(s) is required to use Full Screen functions.
- Full Screen functions are largely redundant with little additional functionality beyond that of the TWA54_Tools tab, and less functionality in some cases.
- The Output Log window does not function when using the Full Screen tab. Instead, there are green success or red failure indicators on each primary cabinets' symbol at the bottom half of the Full Screen tab.
- Before using Full Screen to control secondary cabinets, the **Cascade** function must be on and the secondary cabinet addresses must be assigned. To do this, use the TWA54_Tools tab functions as described on page 39.

To use the Full Screen tab, the cabinets must first be initialized. There are two ways to do this, with the easiest method described first, and the method that may be quicker when dealing with a very larger number of cabinets described after.

Initializing the Cabinets

- 1 Enter the number of rows and columns of cabinets (1x1 for a single cabinet). This includes both primary and secondary cabinets.
- 2 Click on a primary cabinet. A green checkmark will appear.



- 3 Right-click in the yellow rectangle.
- 4 Click **Set Entrance**.
- 5 Right-click in the yellow rectangle again.
- 6 Click **Set IP** and enter the IP address for the cabinet in the window that appears.
- 7 Continue the process for each primary cabinet.

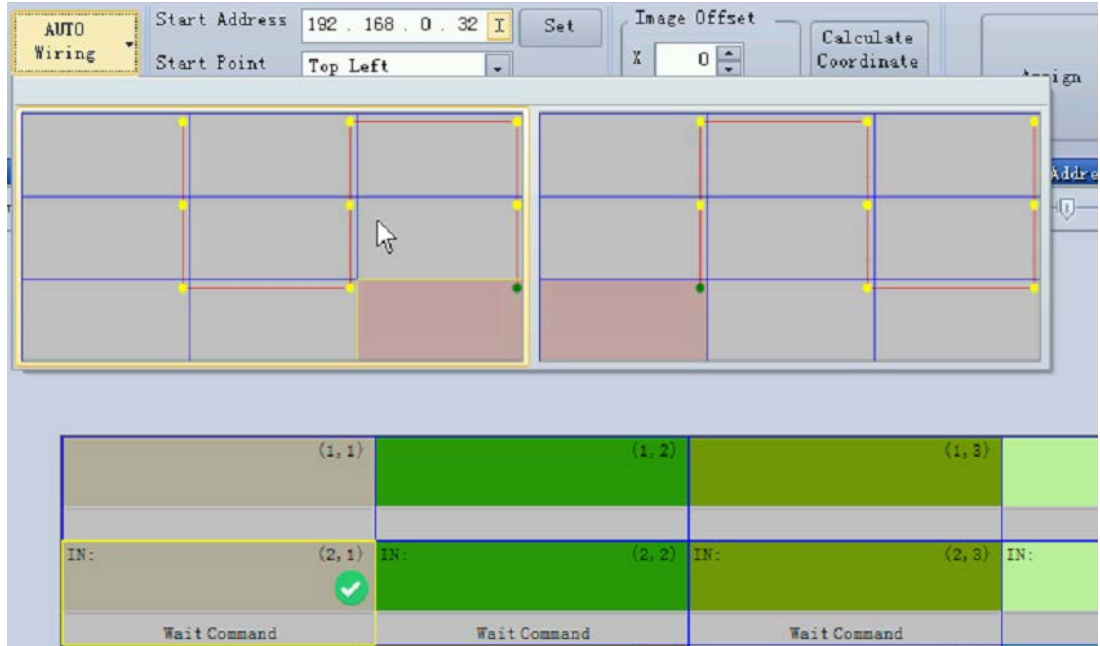
When using this method, ignore the **Start Address** setting and the **IP address** setting in the Communication window.

Now the functions under the Function subtab will be enabled. Typically, a network switch is used to map the host LAN control to all of the primary cabinets so that the entire display can be controlled. As previously discussed, this can also be done using **Multiple Mainboard Control** on the TWA54_Tools tab.

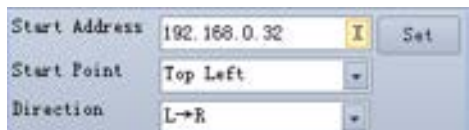
Initializing a Large Number of Cabinets

- 1 Enter the number of rows and columns of cabinets, including both primary and secondary cabinets.
- 2 For each primary cabinet, click on its symbol plus its secondary cabinets so that they all have green checkmarks.
- 3 Click **Merge** to group the secondary and primary cabinets.
- 4 Repeat steps 2 and 3 for each of the primary groups.
- 5 Right-click each primary cabinet and choose **Set Entrance**.

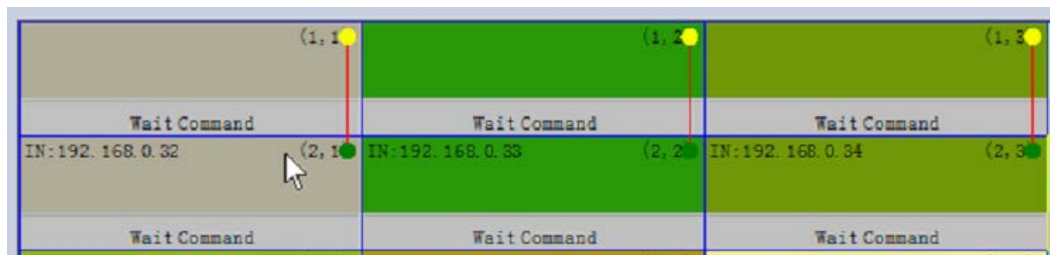
- 6 Click on a primary cabinet, click **Auto Wiring**, and then select the wiring scheme (usually the scheme shown on the left of the screenshot below, not the one on the right.) Repeat this step for each primary cabinet.



- 7 In **Start Address**, enter the address of the primary cabinet in the top-left group (usually 192.168.0.32), and make sure **Top Left** and **L→R** are selected. Click **Set**.



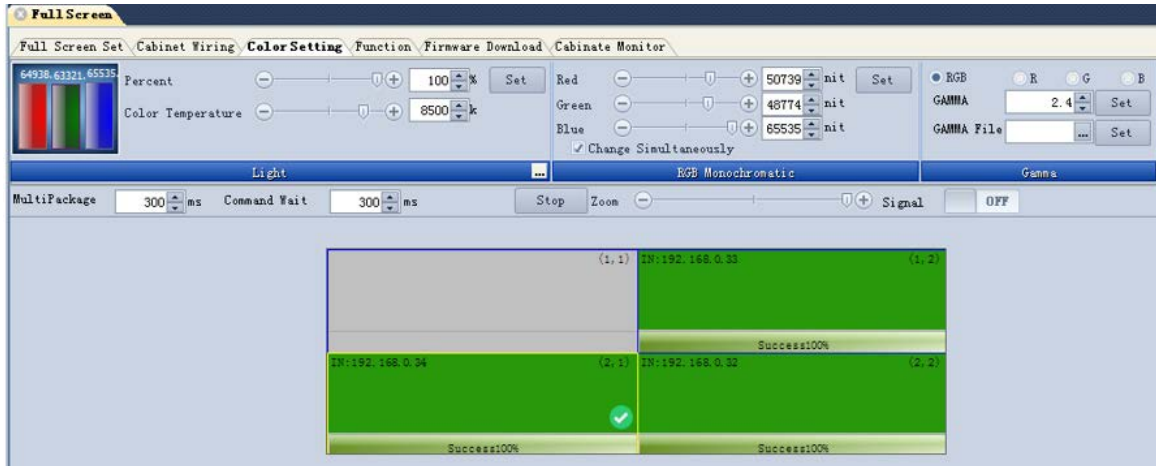
- 8 The IP addresses will now be shown on each primary cabinet's symbol:



- 9 Right-click on each primary cabinet and choose **Set Entrance**.

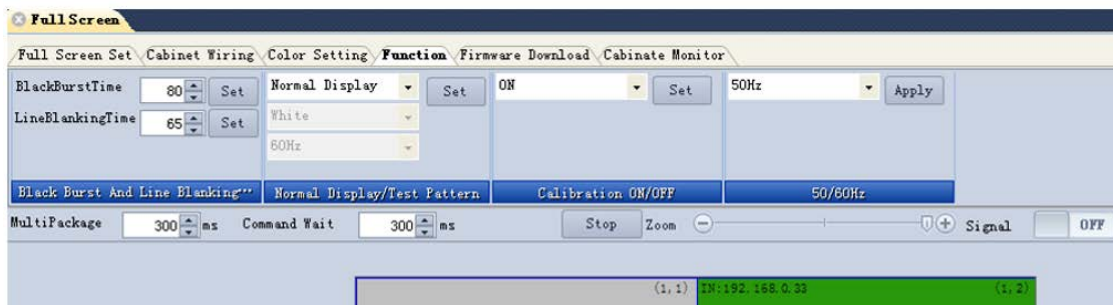
Color Settings Subtab

On the Color Settings subtab, shown below, you can change the brightness, color temperature, RGB settings (which is a combination of changing brightness and color temperature), and gamma.



Function Subtab

Under the Function subtab, shown below, you can change normal/test pattern settings, turn calibration on/off, set the frequency to 50/60 Hz to match the incoming HDMI frame rate, and change the Black Burst and Line Blanking settings.



Black Burst and Line Blanking Settings

The Full Screen Black Burst (BB) and Line Blanking (LB) settings apply to whatever refresh rate and frame rate were previously selected. There are separate BB and LB settings for each combination of refresh rate and frame rate. Also, the BB and LB settings apply uniformly to all tiles in a cabinet, with no capability to address individual tiles. This will be a problem if different tiles require different settings.

Therefore, it is generally bad practice to broadcast experimental black burst and line blanking changes to entire cabinets or video walls, because any uniquely optimal values would then be lost.

It is a better practice, if needed, to use the Black Burst and Line Blanking adjustments in the Engineer version of the Module Command subtab to make adjustments to single tiles only. That way, any negative effects of a bad adjustment can be limited to a single tile, which should be easier to correct. As a precaution, the existing BB and LB settings should first be read using the **Read MB Parameters** button and recorded in case they need to be restored later. Note that only the BB and LB settings of the tile at address 1, 1 can be read.

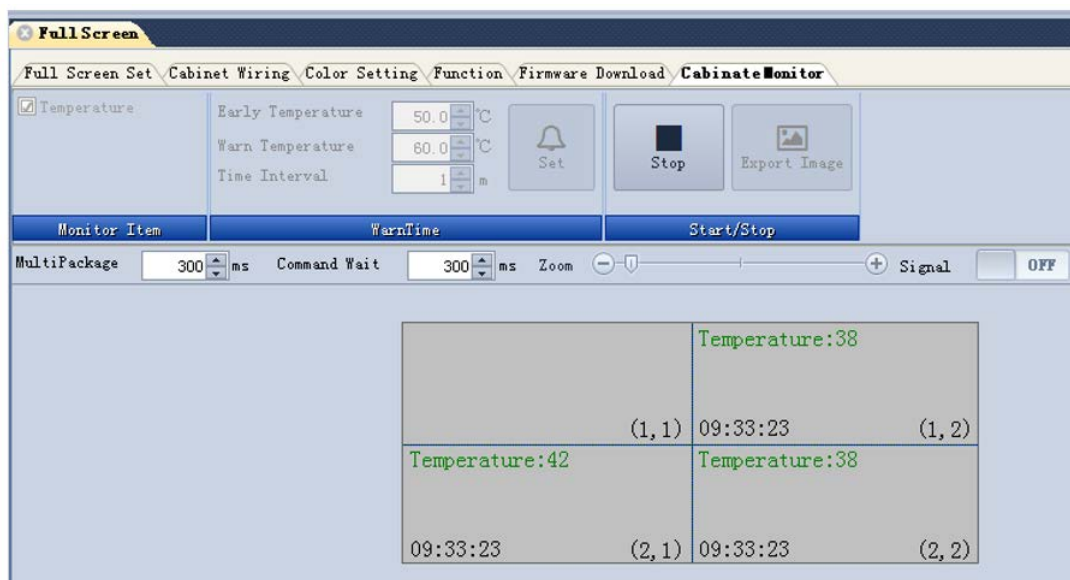
Firmware Download Subtab

The Firmware Download subtab is shown below:



Cabinet Monitor Subtab

The Cabinet Monitor subtab is shown below and allows simultaneous readings of the primary cabinet temperature as measured by a sensor on the main board. No data is recorded. If **Early Temperature** is exceeded, the temperature will be shown in yellow instead of green; if **Warn Temperature** is exceeded, the temperature will be shown in red. **Export Image** enables a *bmp* image of the present temperature readings to be stored on the host PC.



Appendix

Specifications

Dimensions and Weights

Parameter	Specification
LED Cabinet Dimensions	1200mm x 675mm x 100mm
Cabinet Weight	30kg

Cabinet Resolutions

Pixel Pitch	Actual Pixel Pitch	Tile Resolution	Tiles per Cabinet	TW54 Cabinet Resolution
1.2	1.25 mm	192 x 135	5 x 4	960 x 540
1.8	1.875 mm	128 x 90	5 x 4	640 x 360

Electrical Specifications

Input Voltage

Parameter	Specification
Low line voltage range	Nominal: 100-120V Worst Case: 90-132 V
High line voltage range	Nominal: 200-240V Worst Case: 180-264V
Line Frequency Range	49-61Hz
Maximum power: 100% brightness, white pattern, calibration on	350W max for 600 nit version product
Black pattern	85W typical
Sleep mode: module power turned off	50W typical
Module power and module memory off	42W typical

Optical Specifications

Parameter	Condition	Specification
Luminance	Center of cabinet, 100% brightness, white pattern, R-G-B all set to 65535, calibration turned on, thermally stable	600 nit version (early shipments only): 600 nits typical
Luminance Uniformity	100% brightness, white pattern, 3 x 3 array of measurements per cabinet, perimeter points one inch from edge, evenly distributed	$1 - (L_{\min} / L_{\max}) \geq 97\%$
Viewing Angle, Horizontal	White pattern, cabinet in landscape position	160°: $\leq 25\%$ luminance decrease typical from perpendicular to 80° off of perpendicular left or right
Viewing Angle, Vertical	White pattern, cabinet in landscape position	160°: $\leq 55\%$ luminance decrease typical from perpendicular to 80° off of perpendicular up or down
Chromaticity, x and y, CIE 1931	Center of cabinet, 100% brightness, white pattern, R-G-B all set to 65535, calibration turned on, thermally stable	Chromaticity will vary depending on LED batch and calibration. A possible chromaticity example is Red: 0.67, 0.31; Green: 0.21, 0.71; Blue: 0.14, 0.10; White: 0.31, 0.32
Color Gamut	100% brightness; red, green, and blue patterns	$\geq 97\%$ of NTSC
Chromaticity Uniformity	Center of cabinet, 100% brightness, white pattern; 3 x 3 array measurements per cabinet	White x, y coordinate variance < 0.005 between any of the nine points measured
Contrast	Dark room, white pattern and black pattern	$L_W / L_{Bk} > 5000:1$
LED Luminance Life (to 50% of initial luminance)	22C ambient	Continuous white, 100% brightness: $> 50k$ hrs 33% of pixels randomly lit white at 50% brightness: $> 100k$ hrs
LED, 1.2 pitch	RGB; 0808 size	
LED, 1.8 pitch	RGB; 1010 size	

EDID Information

The following is included in the EDID:

- Manufacturer ID: PNR
- Product ID: 62
- Monitor Name: Planar TWA54
- Physical Address: 1.0.0.0
- Maximum TMDS clock frequency: 225 MHz
- Deep Color support

Video Formats Supported and Listed in EDID

Resolution/Format	Frame Rate	Standard
640 x 480	60	VESA DMT
1024 x 768	60	VESA DMT
1280 x 960	60	VESA DMT
1280 x 1024	60	VESA DMT
720 x 480p/Format 3	60	CEA-861-F
720 x 576p/Format 18	50	CEA-861-F
1280 x 720p/Format 19	50	CEA-861-F
1280 x 720p/Format 4	60	CEA-861-F
1920 x 1080p/Format 31	50	CEA-861-F
1920 x 1080p/Format 16	60	CEA-861-F

Formats not listed above may be supported but are not guaranteed.

Environmental Specifications

The Leyard TWA Series is intended to be used in a standard indoor ambient environment.

Description	Specification
Operating Temperature	-10°C to 40°C
Non-Operating Temperature	20°C to 60°C
Altitude	10,000 ft max
Operating Humidity range	10 to 80% RH, non-condensing
Non-operating Humidity range	10 to 85% RH, non-condensing

Default Parameters

The cabinet and module parameters are defined as follows when shipped from the factory.

Parameter	Default Value	Description
IP address, gateway, and mask	192.168.0.32; 192.168.0.1; 255.255.255.0	Default network connection attributes
Cabinet address	1, 1	1,1 indicates the primary cabinet; used when sending commands
Red, Green, Blue	12987; 12664; 13107	Drive strength parameters that define brightness and non-primary color chromaticity; defaults correspond to 20% brightness and 8500K color temperature
RGB Gamma	2.4	Defines brightness for a given gray scale input
Origin	0, 0	Defines the portion of the HDMI content that will be displayed; 0, 0 is the upper left portion
Calibration	On	Calibration factors in use for best uniformity rather than off which increases power usage
Display Mode	Normal	HDMI content will be shown rather than a specified fixed test pattern
Cascade	On	Cabinets will forward any commands over the RS232 loop out port
Standby Mode	Normal	Sleep mode is off
Module DC Power	On	Modules are turned on
Module RAM Power	On	Module memory is in use
Output	On	Show HDMI content rather than test pattern sequence
Module Frame Rate	60 Hz	Set for an HDMI input of 60 Hz frame rate rather than 50 Hz
LCD Language	English	Rear LCD display will show information using English rather than Chinese
Black Burst, 60 Hz	100	BB value for low refresh rate, 60 Hz, P1.2 (values will vary for other pitches)
Black Burst, 50 Hz	100	BB value for low refresh rate, 60 Hz, P1.2 (values will vary for other pitches)
Line Blanking, 60 Hz	95 typical, varies with LED lot	Adjustment value for the dead time between module column writes
Line Blanking, 50 Hz	95 typical, varies with LED lot	Adjustment value for the dead time between module column writes

RS232 Commands

RS232 Command Protocol

RS232 host setting requirements:

- 115200 baud rate
- 8-N-1 (8 bits per byte, no parity, one stop bit)

The available commands are limited in number and are all Set commands, where the host forces a change. Get commands, where the host requests information, are not available.

Commands generally apply to all cabinets within the area controlled by the RS232 interface, which is typically a primary cabinet and its secondary cabinets. Use of third-party RS232 splitters can facilitate control of large displays consisting of multiple primary cabinets, though no responses are possible when splitters are used.

Commands can also apply to either a single tile or to a single cabinet (primary or secondary) by specifying the individual tile and/or cabinet addresses.

Each command requires two checksum bytes as explained below. There are many online tools that are useful for adding hex numbers to determine the checksum. One example of a hex calculator is available at <http://www.squarebox.com/legacy/hcalc.html>.

RS232 Command Structure

The following bytes are included in each command sent by the host. Bytes are listed in the order in which they appear in the command.

Item	Bytes	Hex Value	Description
Packet Header	1	65	Denotes start of the command packet
Command Length	2	XX YY	Total command length in bytes; typically the command length is 00 2D
Data Direction	1	0X	X = 0 is from PC to mainboard; X = 2 is from PC to tile
Reserved	1	01	Always value of 01
Cabinet Address	2	XX YY	00 00 for a broadcast command to all cabinets; 0x 01 for single cabinets where "x" is the cabinet's x address and must be 1 through 8
Reserved	7	00 00 00 00 00 00 00	Always all 00
Inner Region Header	1	55	Always 55
Inner Region Length	2	XX YY	Typically 00 1D; some commands are larger

Item	Bytes	Hex Value	Description
Module Address	2	XX YY	00 00 for a mainboard command; 0x 0y for single tile command where "x" is the tile's row and "y" is the tile's column
Command Code	6	XX XX XX XX XX XX	Defines the command, typically just the first 2 bytes, use 00 for each byte not used
Command Data	16	various	Data corresponding to the command
Inner Region Checksum	1	XX	Summation of bytes from Inner Region Length through Command Data. If the sum is more than two bytes, use the two least significant bits (for example, if the sum is AF3, use F3)
Inner Region Tail	1	AA	Denotes end of Inner Region
Packet Checksum	1	XX	Summation of bytes from Packet Length through Inner Region Tail. If the sum is more than two bytes, use the least significant bits (for example, if the sum is AF3, use F3)
Packet Tail	1	AA	Denotes end of command packet

Command List

Item	Command Description	Code	Data Bytes (16 bytes)	Notes
1	Set Luminance	00 02 00 00 00 00	UU VV WW XX YY ZZ followed by all 00	Can also be used to alter color temperature by changing individual R-G-B settings; UU VV is for Red (UU is msb); WW XX is Green; YY ZZ is Blue
2	Set Test Pattern Color	03 14 00 00 00 00	0X followed by all 00	1 for red pattern; 2 green; 3 blue; 4 white; 5 black
3	Set Display Mode to Normal or Test Pattern	02 11 00 00 00 00	0X followed by all 00	0 for Normal (show HDMI content); 1 for Test Pattern (show the set test pattern regardless of HDMI activity; if test pattern is set to black, then this command serves as a type of on/off command)

Item	Command Description	Code	Data Bytes (16 bytes)	Notes
4	Set Cabinet Origin Display Position	02 01 00 00 00 00	XX YY followed by all 00	XX is the x coordinate of the video content to be displayed at the upper left pixel of the cabinet; YY is the y coordinate

RS232 Command Examples

- 1 Set Luminance to 50% on the primary cabinet (and on any secondary cabinets if the primary cabinet has its Cascade function turned on):

```
65 00 2D 00 01 00 00 00 00 00 00 00 00 00 00 00 "55 00 1D 00 00 00 02 00 00 00 00 80 00 80 00 80
00 00 00 00 00 00 00 00 00 00 00 00 00 00 9F AA" CC F8
```

where the bytes highlighted in **red** are the command code, the **green** bytes are the command data, the **blue** bytes are the checksums, and with quotations enclosing the "inner region" bytes

IMPORTANT! The Set Luminance command also can impact color temperature. Once a Set Luminance command is issued, the proportion of Red-Green-Blue values should be kept the same on subsequent commands to avoid additional color temperature changes. Using the same value for R-G-B (as in the example above: 80 00, 80 00, 80 00) will give a color temperature of very roughly 8500K (the exact color temperature will vary with calibration and LED batch, unless the Config process is followed using the control software)

- 2 Set Luminance to 30% on the primary cabinet (and on any secondary cabinets if the primary cabinet has its Cascade function turned on):

```
65 00 2D 00 01 00 00 00 00 00 00 00 00 00 00 00 "55 00 1D 00 00 00 02 00 00 00 00 4E CD 4E CD
4E CD 00 00 00 00 00 00 00 00 00 00 00 00 70 AA" 9D F8
```

- 3 Set Luminance to 50% on just the tile with address 4,5 on the secondary cabinet with address 3, 1 (assumes the primary cabinet has its Cascade function turned on). Note that this command is of limited use but is described here to demonstrate control of a specific tile in a specific cabinet:

```
65 00 2D 00 02 01 03 01 00 00 00 00 00 00 00 00 "55 00 1D 04 05 00 02 00 00 00 00 80 00 80 00 80
00 00 00 00 00 00 00 00 00 00 00 00 00 A8 AA" DB F8
```

- 4 Set Display Mode to Test Pattern with Black Pattern on the primary cabinet (and on any secondary cabinets if the primary cabinet has its Cascade function turned on). This is essentially a "turn off" command:

```
65 00 2D 00 01 00 00 00 00 00 00 00 00 00 00 00 "55 00 1D 00 00 03 14 00 00 00 00 05 00 00 00 00
00 00 00 00 00 00 00 00 00 00 00 00 00 8E AA" F4 F8
```

- 5 Set Display Mode to Normal on the primary cabinet (and on any secondary cabinets if the primary cabinet has its Cascade function turned on). This is essentially a “turn on” command if test pattern mode has been previously invoked with a black pattern and assuming there is an active HDMI source:

```
65 00 2D 00 01 00 00 00 00 00 00 00 00 00 00 00 "55 00 1D 00 00 02 11 00 00 00 00 00 00 00 00 00
00 00 00 00 00 00 00 00 00 00 00 00 00 30 AA" 8D F8
```

Response Structure

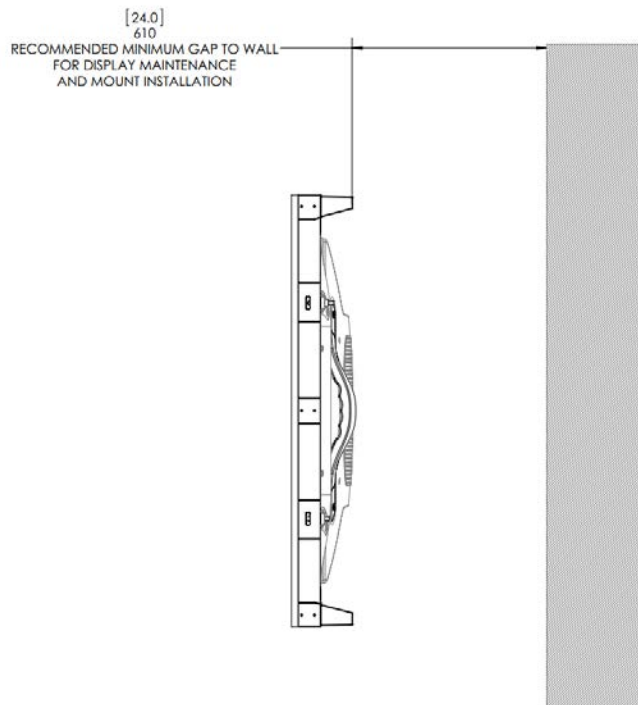
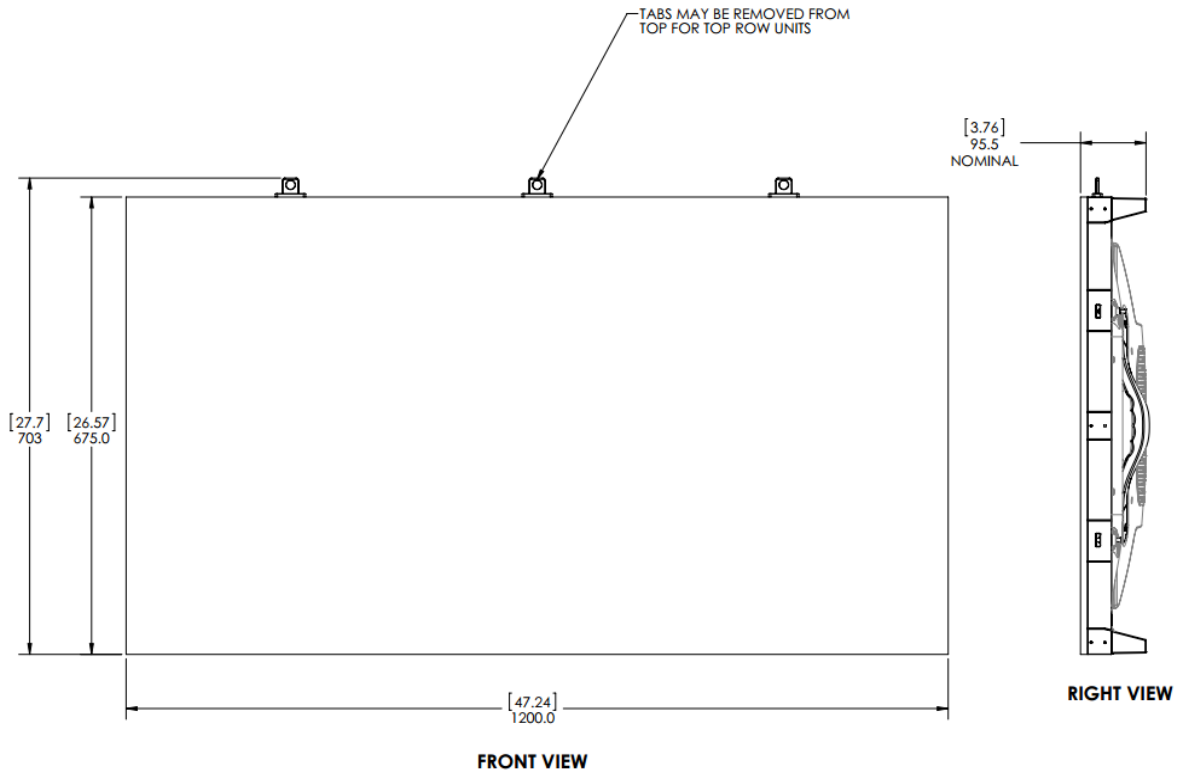
When the primary cabinet receives a command, it sends a response back to the host. The following bytes are included in each response sent by the cabinet to the host. Bytes are listed in the table below in the order in which they appear in the response.

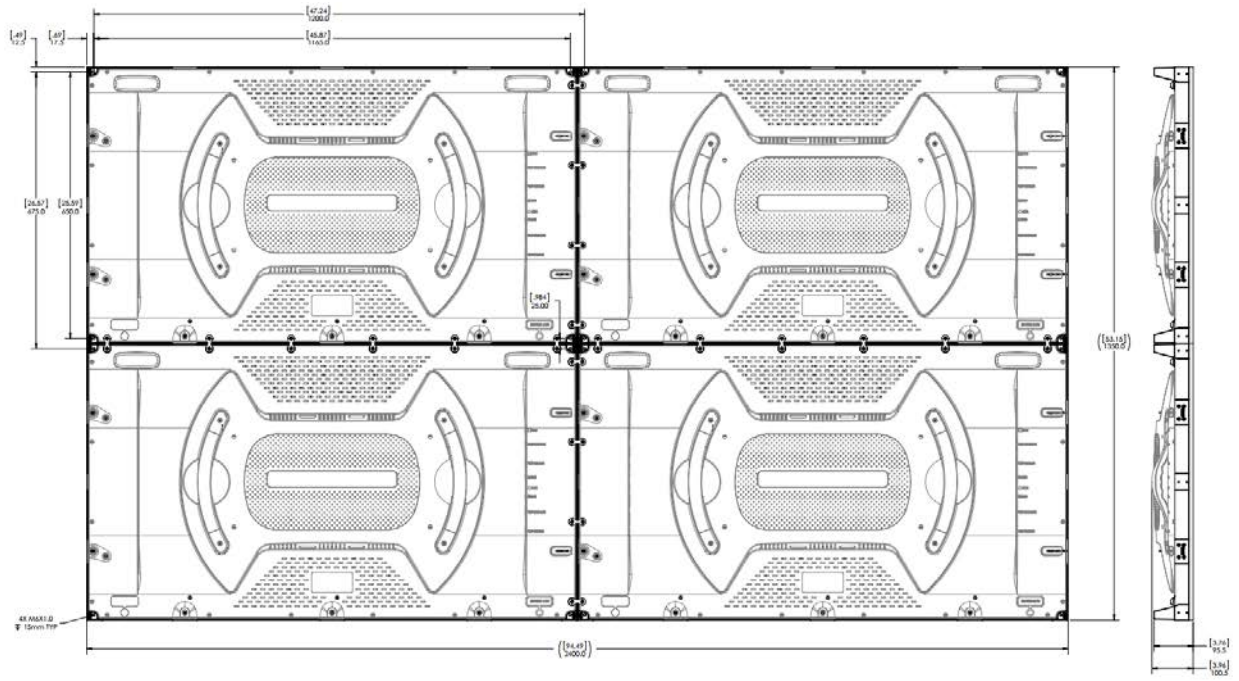
The response can be ignored by the host, or the host could verify that the command was successful by checking that the “command data” section of the response begins with “06”. However, a response of “06” indicates just that the primary cabinet’s main board has received the command successfully and does not indicate the success of any downstream commands to individual tiles within the primary cabinet or to secondary cabinets.

Item	Bytes	Hex Value	Description
Packet Header	1	65	Denotes start of the response packet
Packet Length	2	00 2D	Total response length in bytes
Data Direction	1	01	1 is mainboard to PC
Reserved	1	01	Always value of 01
Cabinet Address	2	XX YY	00 00 for a broadcast command to all cabinets; 0x 01 for single cabinets where “x” is the cabinet’s x address and must be 1 through 8
Reserved	7	00 00 00 00 00 00 00 00	Always all 00
Inner Region Header	1	55	Always 55
Inner Region Length	2	XX YY	Typically 00 1D; some commands are larger
Module Address	2	XX YY	00 00 if the command was a mainboard command; 0x 0y for single tile command where “x” is the tile’s row and “y” is the tile’s column
Command Code	6	XX XX XX XX XX XX	An echo of the command code

Item	Bytes	Hex Value	Description
Command Data	16	various	Result of the command: first byte is 06 if command was successful (if not 06, then the command was not successful)
Inner Region Checksum	1	XX	Summation of bytes 14 through 40 (Inner Region Header through Command Data)
Inner Region Tail	1	AA	Denotes end of Inner Region
Packet Checksum	1	XX	Summation of bytes 1 through 42 (Packet Length through Inner Region Tail)
Packet Tail	1	AA	Denotes end of command packet

Drawings





Support

Technical Support Website: <http://www.planar.com/support/>

- 1 Enter your login and password information.
- 2 Access downloadable utility software, new firmware, user manuals, and service manuals.

Downloading Utility Software

<http://www.planar.com/support/>

- 1 Enter your login and password information.
- 2 Navigate to the section that contains software updates and then look for Leyard TWA Series.
- 3 From the list of available software, click on the tool you need.