

2000 Series Digital Billboard

Installation Manual

ED-18399

Rev 7—29 July 2009

DAKTRONICS

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Section 1: Introduction

This manual guides Project Managers (PM) and Authorized Service Contractors (ASC) in the installation of 2000 Series Valo® Digital Billboard displays, and display components. Before performing any work, read and understand all of the steps in this manual.

1.1 Using this Manual

Important Safeguards:

- Read and understand installation instructions before beginning the installation process.
- Turn off display power before servicing.

This manual is divided into five sections:

1. **Introduction:** explains the basic information needed to use this manual. Take time to read the entire introduction as it explains concepts used throughout this manual.
2. **Display Installation:** covers required tools, site preparation, display assembly, and display hanging.
3. **Spare Parts Box Installation:** covers spare parts box installation information.
4. **First-time Power Up:** covers display startup procedure as well as display troubleshooting. It also covers test patterns, diagnostics, and calibration.
5. **Display Service & Troubleshooting:** covers removal MLCs, power supplies, and modules as well as display troubleshooting.

At the end of this manual are a glossary and three appendices: **Appendix A: Drawings**, **Appendix B: Supplementary Manuals**, and **Appendix C: Daktronics Warranty and Limitation of Liability**. The Glossary defines terms used in this manual. **Appendix A** contains drawings specific to your digital billboard. **Appendix B** contains manuals that contain useful information about installing your display and connecting the controller to the internet. **Appendix C** explains Daktronics standard warranty and liability limitations.

Figure 1 illustrates a Daktronics drawing label. The drawing number is located in the lower right-corner of a drawing. This manual refers to drawings by listing the last set of digits and the letter preceding them. In the example, the drawing would be referred to as **Drawing A-69945**.

DAKTRONICS, INC. BROOKINGS, SD 57006		
PROJ: BASKETBALL		
TITLE: SEGMENTATION, 7 SEG BAR DIGIT		
DES. BY: BPETERSON	DRAWN BY: TNELSON	DATE: 8 JUL 01
APPR. BY: AVB	7087-PO8A-69945	
SCALE: 1 = 4		

Figure 1: Daktronics Drawing Label

It is important to note the drawing title since this manual may refer to drawings in an appendix by title rather than drawing number. All references to drawing numbers, appendices, figures, or other manuals are presented in bold typeface, as shown above.

1.2 Installation Component Overview

Figure 2 shows typical installation component locations for a Valo® 2000 series billboard.

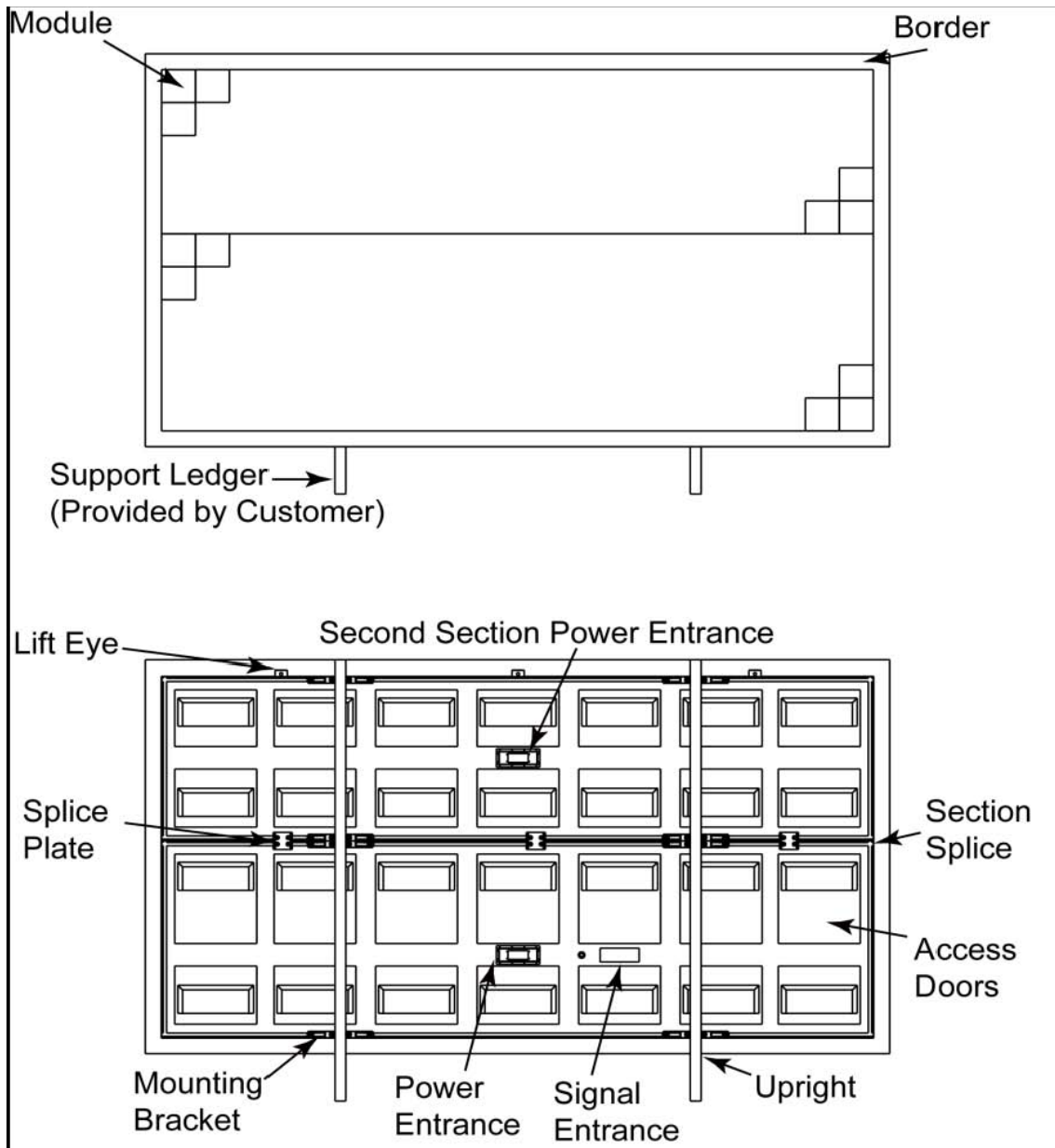


Figure 2: Installation Component Overview

Section 2: Display Installation

2.1 Before Starting

- Review all drawings in **Appendix A**.
- Review the **System Riser** in **Appendix A** with the electrician.
- Review the **Daktronics Warranty and Limitation of Liability** in **Appendix C**.
- Review installation plans with the installer.

2.2 Required Tools

The following bullets list the minimum tool requirements Daktronics recommends having on-site for each installation. The customer is responsible for providing these tools.

- Allen wrenches: Various sizes, including $\frac{3}{16}$ "
- Bucket truck (customer must supply until the final proof and performance from the Daktronics NOC)
- Caulk gun
- Crane
- Cordless drill
- Drill bits
- Hammers
- Ladders: 6', 8', or 10' (step or A-frame)
- Laptop computer
- Pry bar
- Ratchet tie-downs/come along
- Screw drivers: Phillips and flat head
- Socket and open end wrench: $\frac{11}{16}$ "
- Socket extension: 3"
- Socket set, $\frac{1}{2}$ " drive ($\frac{3}{4}$ " socket head)
- Splice Wrench: Refer to **DD1473819** in **Appendix B** for directions on using the splice wrench.
- T-handle wrench: $\frac{1}{8}$ "
- Tape measure
- Torque Allen wrench: $\frac{3}{16}$ "
- Torque stick: 75 ft-lb (shipped in the spare parts box): Refer to **DD1473819** in **Appendix B** for directions on using the torque stick.
- Utility knife

2.3 Site Preparation

1. Inspect the work area for potential hazards and installation issues.

2. Verify that the catwalks were mounted in the proper location. Refer to the pixel pitch specific bracing and catwalk drawing in **Appendix A** or the **Shop Drawing in Appendix A** for catwalk mounting locations. Once the truck arrives, remove all tarp and wood shipping material from the trailer.
3. Inspect the display for damage. Photograph any damage and send the images to the Project Manager.
4. Ensure all the following parts are with the display. If missing display parts call the Project Manager or the Project Materials Manager immediately to verify the parts were shipped with the display.
 - Attachment clamps
 - Hardware for section splice (if applicable)
 - Photo sensor
 - Remote enclosure
 - Spare parts box
 - Square C-channel splice plates (if applicable)
 - Trim and Border T-bolts
 - Webcam
 - Webcam arm
5. If the display requires a splice, ensure splice key is installed before lifting the display.
6. Remove bracing between display sections.

2.4 Before Display Installation

Before the display arrives on site for installation:

- Verify the ledger brackets are mounted to the structure. These display must rest on these once installed.
- Verify the electrician has installed power according to the requirements outlined in the **System Riser in Appendix A**.
- Verify there is internet service to the site. Display start up and running content on the display is expedited through the use of the internet.

2.5 Display Installation

1. Identify and separate all of the border pieces. Refer to ED-18429 in Appendix B for generic border installation instructions and illustrations.

Upper Border Installation

2. Place the top border to the display top section. Refer to Drawing B-317987 in Appendix A.
3. Push the border T-bolts through the border T-bolt notch. Turn the bolt 90° to lock the bolt into the channel. Refer to Figure 3.

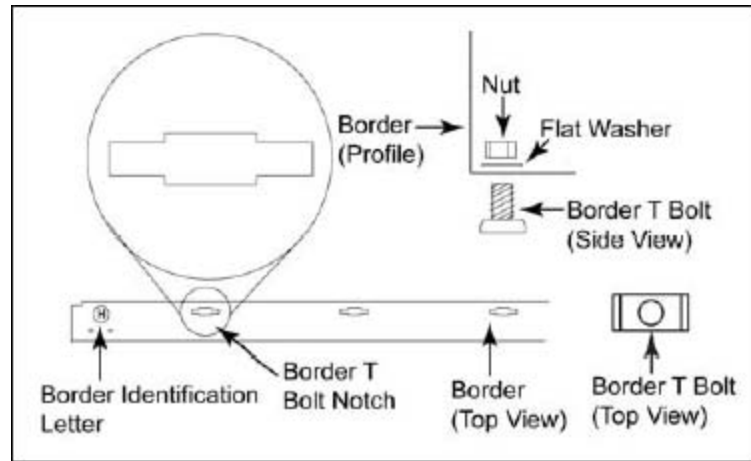


Figure 3: Border Assembly

4. Slide the border bolt to one of the narrow ends of the border bolt notch.
5. Attach a 1/2" flat washer and 1/2" nut on the border bolt.
6. Ensure the bottom of the border aligns with bottom of the display.
7. Tighten the border T-bolts. Refer to Figure 3.
8. Install the side borders on the display top section before lifting the display.
 - a. Place the side borders on the side of the display top section.
9. Push the border bolts through the border bolt notch.
10. Turn the bolt 90° to lock the bolt into the channel.
11. Slide the border bolt to one of the narrow ends of the border bolt notch.
12. Place a 1/2" flat washer and 1/2" nut on the border bolt.
13. Ensure the bottom of the border aligns with bottom of the display.
14. Tighten the border T-bolts.

Align Lift Eyes

15. Align the lift eyes in the display according the spacing requirements shown on the Shop Drawing in Appendix B.

16. Ensure lift eyes are secure by tightening the $\frac{3}{16}$ " Lift Eye Set Screws. Refer to **Figure 4**.

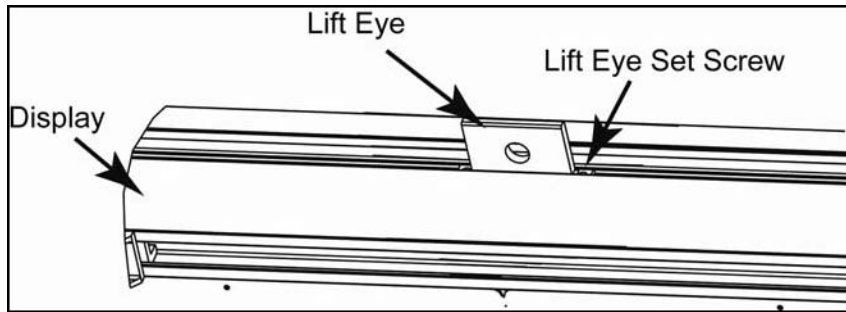


Figure 4: Installed Lift Eye

Removing the Display from Truck

17. Attach a spreader beam to the lift eyes. Refer to **ED-16454** in **Appendix B** for spreader beam specifications.
18. Lift the display enough to apply tension.
19. Unbolt the display from the shipping braces.

Note: Some displays do not require section splice on-site. If a section splice is not required proceed to **Step 28**. If a splice is required, leave the lower section end shipping braces bolted to the truck. Refer to **ED-18400** in **Appendix B**.

Display Splicing

20. Ensure the channel key is in the splice channel.
21. Lift the display top section off the truck.
22. Guide and align the sections together the top section is resting on the bottom section. Refer to **Drawing B-308718** in **Appendix A** for more vertical section splice details.
23. Ensure the U-channel brackets in the display sections align with the slots in the Valo®Mount bracket.
24. Ensure the display sections align in all directions. Refer to the **ED-18400** in **Appendix B**.

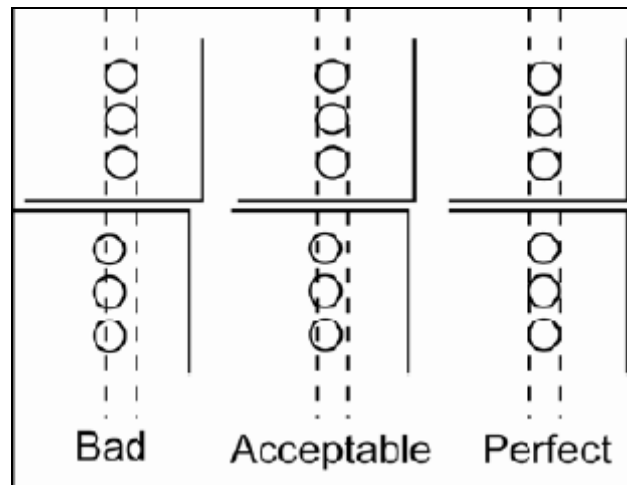


Figure 5: LED Alignment

25. Verify the LEDs on the display face are aligned. Refer to **Figure 5**.

26. Slide the U-channel into the Valo®Mount channel on the display back.

27. Attach and secure all mounting plates along the section splice. Refer to **Figure 6**.

Note: Use the Splice Wrench in the spare parts box to align the display sections.

Lower Border Installation

28. Place the lower vertical borders against the side of the display.

29. Push the border bolt through the lower border bolt notch.

30. Turn the bolt 90° to lock the bolt into the channel.

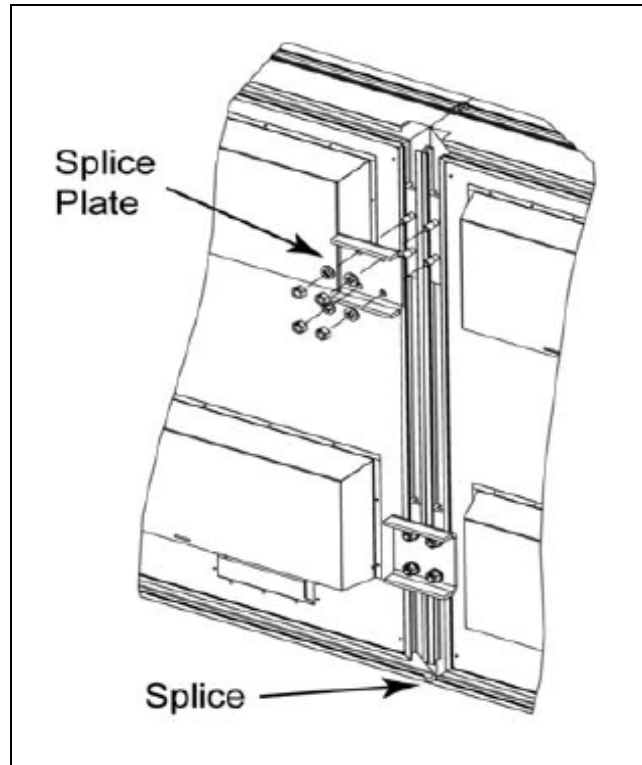


Figure 6: Section Splice

31. Slide the border bolt to one of the narrow ends of the border bolt notch.

32. Place a 1/2" flat washer and 1/2" nut on the border bolt.

33. Ensure the bottom of the border aligns with bottom of the display.

34. Tighten nuts on the border T-bolts.

35. Insert and fasten border T-bolts in the remaining bolt notch locations.

36. If applicable, attach the second vertical border. Ensure the top of the second vertical border is flush with the top of the display.

37. Splice the vertical border sections together with border splice plates. Splice plates attach to the rear of the border with four Tek screws from the front of the border.

- Do not drill holes out to make the border fit.
- Adjust the border if needed.

38. Repeat **Steps 28-37** to attach the vertical border on the other end of the display.

39. Place the corner splice plate behind the vertical and horizontal borders.

40. Place the front corner splice plate over the corner splice plate, vertical, and horizontal borders.
41. Attach the front corner splice to the vertical and horizontal borders and the corner splice plate.
42. Repeat **Steps 4-5** for the bottom borders.

Aligning Mounting Brackets

43. Measure out the mounting bracket location based on the structure upright spacing. Position the brackets in these locations.

Webcam Arm Installation

44. Use the steps in **DD1463448** in **Appendix B** for webcam arm installation instructions.

Photocell Installation

45. Attach the photocell to the display. To do so:
 - a. Locate the photocell.
 - b. Find a location on the display that will have sufficient ambient light.
 - c. Attach the photocell with the $\frac{1}{2}$ " shroud bolts. Refer to **Figure 7**.

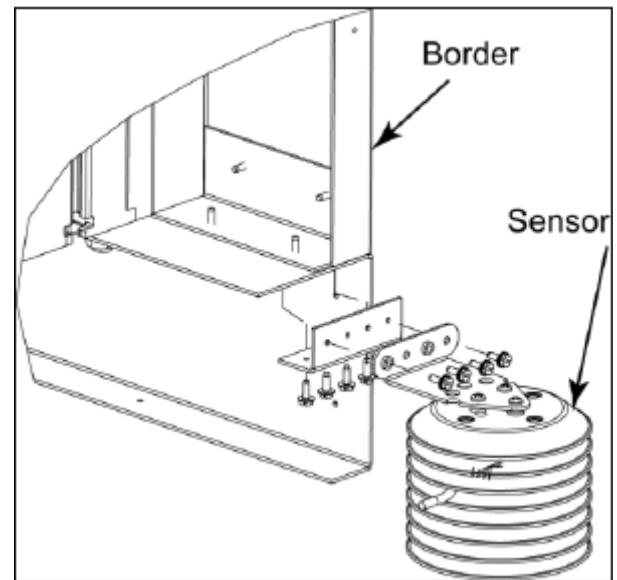


Figure 7: Photocell Installation

Note: Photocells are typically attached before flying the display. Ensure the sensor location allows the cable to connect easily to the Photocell connection location. Refer to the **System Riser** in **Appendix A** for the Photocell connection location.

- d. After hanging the display, plug photocell cable to the connection location shown on the **System Riser** in **Appendix A**.
- e. Neatly cable-tie excess cable with UV resistant cable ties so it does not hang below the bottom of the display.

Removing Display from Truck

46. Remove the shipping braces from the bottom display section.
47. Tie tag lines to mounting brackets on each bottom corner of the display. Ensure the tag lines do not prevent the upright from sliding into the mounting bracket.
48. Lift the display off the truck.

Hanging the Display

49. Slowly lift the display to the structure while guiding the display into place with tag lines.
Refer to ED-18487 in **Appendix B** for further installation instructions and illustrations.

50. Align the Offset Extrusion with the Uprights. Refer to **Figure 8**.

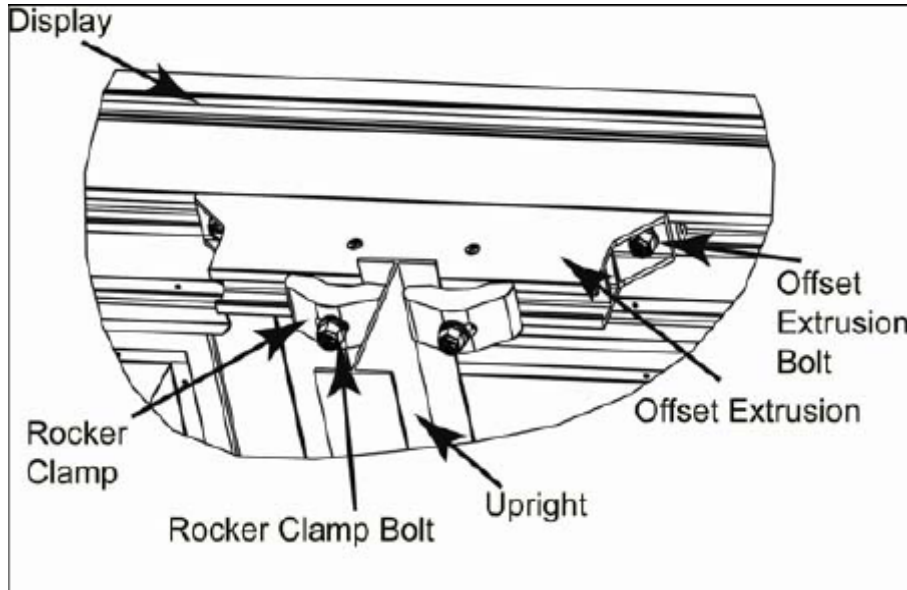


Figure 8: Mounting Assembly

51. Lower the display along the upright until it rests on the support ledger. The support ledger is provided by the customer. Verify the display is resting on all support ledgers before continuing.
52. On each end of the display, slide the pre-assembled Offset Extrusion and the Rocker Clamps over until they engage the Upright flanges. Refer to **Figure 8**.
53. Tighten the nut on the Rocker Clamp Bolt to 75 ft-lb with the torque stick. This will pull the display firmly against the upright.
54. Slide the right side Rocker Mount in the end of the Intermediate Extrusion. Refer to **Figure 8**.
55. Tighten the nut on the Rocker Clamp Bolt to 75 ft-lb with the torque stick. This will pull the display firmly against the upright.
56. Tighten all of the nuts on the Offset Extrusion Bolts to 75 ft-lb with the torque stick.
57. Remove crane support.
58. Remove the tag lines.
59. Secure all remaining mounting assemblies.

Power and Signal Connection

60. If applicable, connect signal cables between display sections.
 - a. Connect the Signal Out to Signal In quick connects provided on the display back.
61. Run signal cables to the display. Refer to the **System Riser** drawing in **Appendix A** for signal cable specifications and connection locations.
62. Locate display power entrances. These are located in the middle of the lower and upper halves of the display.
63. Run power from the junction box to each display section. Refer to the **System Riser** in **Appendix A** for electrical requirements.
64. Test the display ground. It must be at least 10 Ohms before powering up the display.
65. Strip $\frac{1}{2}$ " of each the insulation off each power wire.
66. Insert the power and ground wires into the multi-tap connector according to the **System Riser** in **Appendix A**.
67. Tighten all set screws.

Note: Ensure all set screws that hold the wires into place are tight. If they are not tight, the connection will loosen over time and cause the display to malfunction.
68. Set wire and multi-tap connector inside the display.
69. Replace the power entrance door.

Section 3: Spare Parts Box Installation

3.1 Spare Parts Box Installation

To properly install a spare parts box, ensure the lid is on top, the latch is easily accessible, and the lid opens completely. If possible, mount the spare parts box by welding or bolting the spare parts box feet to a catwalk. Do not mount the box in a location that inhibits maintenance personnel from accessing the display. Refer to **Figure 9**. Always lock the spare parts box when leaving the display site.

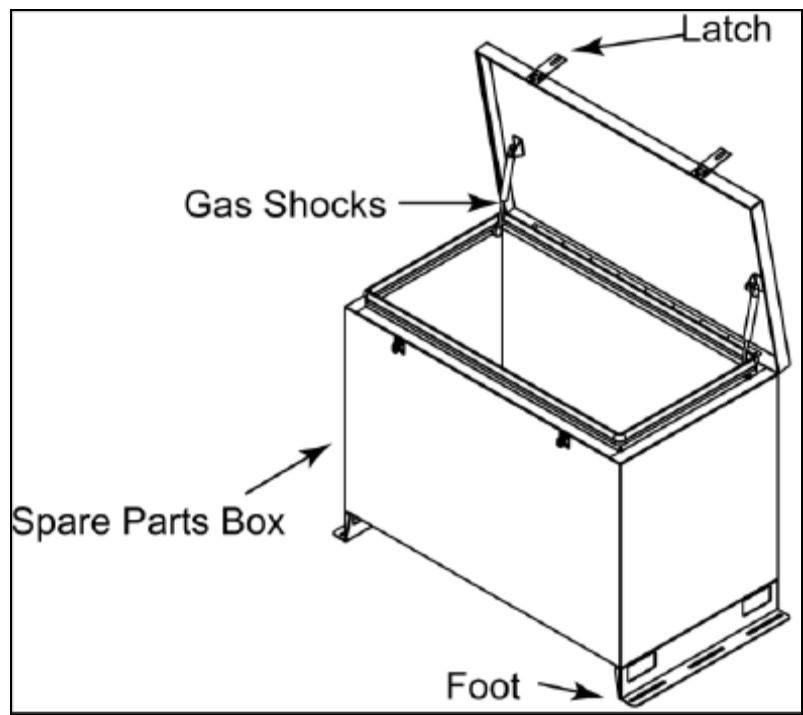


Figure 9: Spare Parts Box

Section 4: First-Time Power Up

4.1 First-time Power Up

1. Install the iBoot and router according to the **System Riser** in **Appendix A**.
2. Turn on the Uninterruptible Power Supply (UPS). Ensure the equipment in the remote enclosure powers up properly. Make sure the connections did not loosen during shipping.
3. After a successful boot, ensure the V-Link® 1500 starts.
4. Run a test sequence from the display unit. Use V-Link® 1500 Management Utility to activate test patterns.
5. With a test pattern running to the display, troubleshoot the display and control equipment until 100% operational. Refer to **ED-18425** in **Appendix B** for troubleshooting tips.
6. Ensure that the dimming is set to automatic and in functioning properly.
 - Verify the display brightens during the day and dims at night.
 - Cover the photocell for ten minutes and ensure it dims to zero.
7. Call the NOC at 1-877-DAK-HELP for assistance with the remaining steps.
8. Verify internet connectivity.
9. Have Daktronics NOC verify communication and that all controller functions work.

4.2 Connecting to the Display

1. Click **Network > Configure Connection**.
2. In the **Connection Configuration** window select **Direct Connection**. Set the appropriate **COM port** and set the baud rate to **115200 bps**.
3. Under **TCP/IP Connection**, set the **IP address** and **Socket**.

Note: Default Socket is 3001.

4. After completing the **Connection Configuration**, click **Network > Connect**. A communication status bar shows the download status.
5. After a successful connection, information such as the **IP address**, **Display Size**, **Driver Version**, **Firmware Version**, as well as **V-Link® Processor** displays.

Running Test Patterns

1. In the V-Link® Connection page, click **Connect > Tools**.
2. Locate the drop-down box with **Test Patterns**.
3. Choose either the **Module ID** or **Cycle All** test patterns.
4. Click **Start Test**.
5. When finished, click **Stop Test**.

4.3 Diagnostics

1. Click **Diagnostics**.
2. Click **Refresh**.
3. Ensure the time is close to the time on the computer task bar.
 - If the times do not match, communication does not exist between the computer and controller. If this happens attempt to reestablish communication by repeating the steps in **Section 4.2**.

Section 5: Display Service and Troubleshooting

5.1 Replacing Modules

Rear-Access

To remove a module from a rear-access display, complete the following steps:

Note: Depending on display configuration, you may need to remove internal display components to remove modules from the rear.

1. Open the display door to access the module.
2. Disconnect the power and signal cables from the rear of the module.
3. Attach a safety lanyard to the rings on the module.
4. Note: A safety lanyard secured to another area of the display guarantees that the module will not fall if dropped.
5. Disengage the module upper and lower latch release with a $1/8$ " Allen wrench and turning the release approximately $1/2$ turn clockwise. Refer to **Figure 10**.

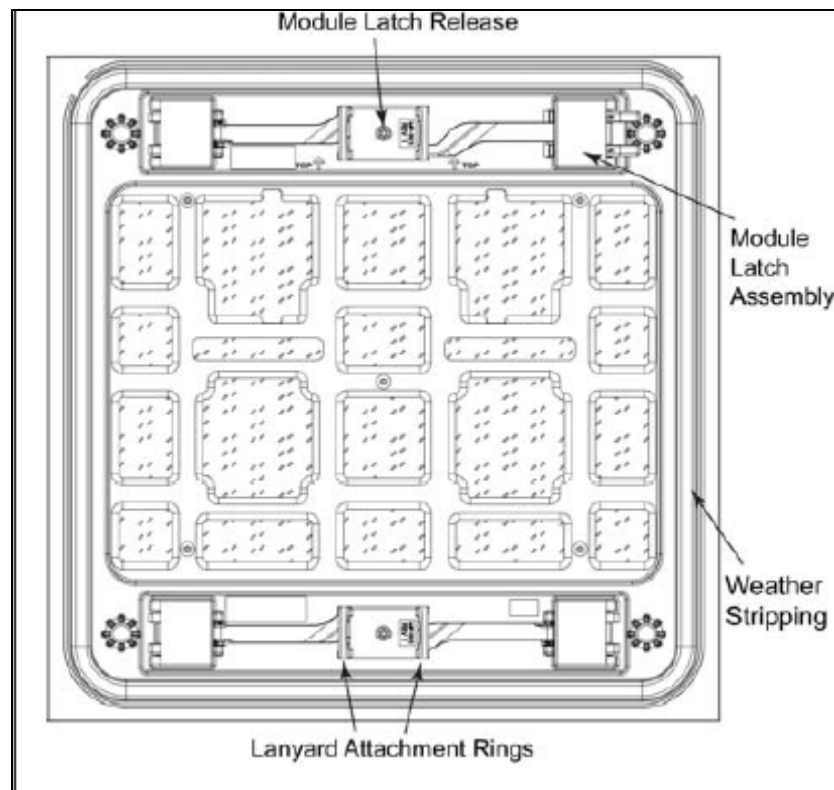


Figure 10: Module Rear

Note: With the releases disengaged the module is free to fall from the display face so maintain a firm grip on the module and use a safety lanyard.

6. Maintain a firm grip on the module, push it through the front of the display, and rotate it in a manner that allows it to pull back through the frame opening.

Reverse the above steps to reinstall a module.

After removing a module from the display, take a moment to inspect the weather stripping on the rear of the module. When the module is properly secured to the display frame, this weather stripping prevents moisture from seeping into the display. Deteriorated weather stripping may lead to water-related display damage.

Front-Access

Most display components can be accessed from the rear. Occasionally a display component may need to be removed from the front. To remove a module from a front-access display:

1. Disconnect display power.
2. With a $1/8$ " hex head driver, turn the top and bottom latch releases approximately $1/2$ turn counter-clockwise. Refer to **Figure 11**.

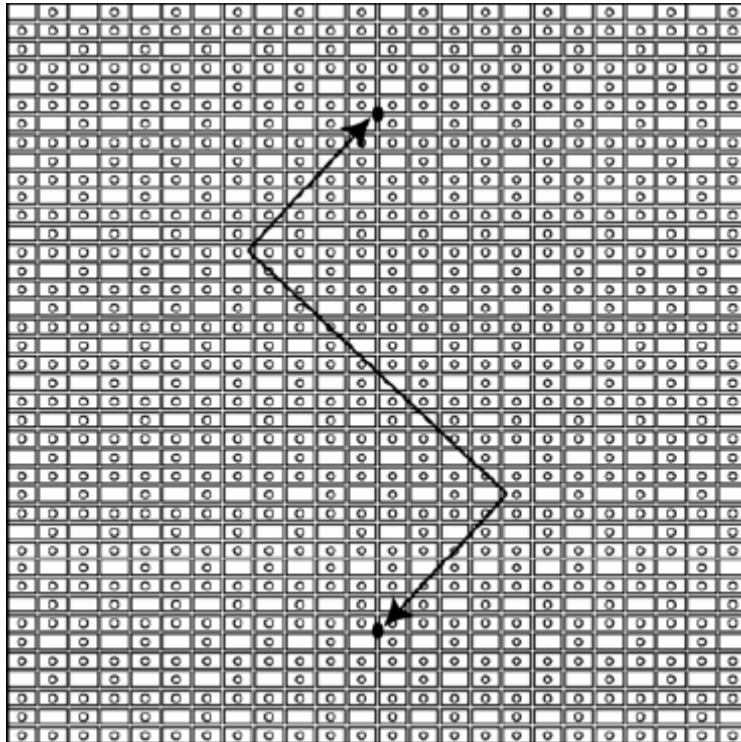


Figure 11: Latch Release

3. Pull the module from the display just far enough to reach around to the back of the module. Attach the safety lanyard to the rings on the module.

Note: A safety lanyard secured to another area of the display guarantees that the module will not fall if dropped.

4. Disconnect the power and signal cables from the rear of the module.

Reverse the above steps to install a module in the display. Give the module a light pull to ensure it is properly seated.

5.2 Replacing Multi-line Controllers (MLC)

To remove a MLC from the display:

1. Access the interior of the display.
2. Disconnect all power and signal connectors from the MLC.
3. Pull the finger tab and lift the MLC assembly. Refer to **Figure 12**.

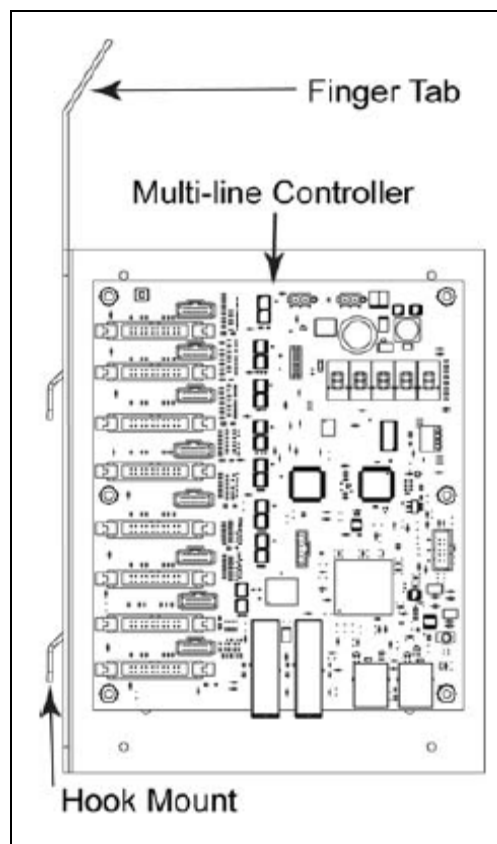


Figure 12: MLC Assembly

4. Remove the MLC assembly from the display cabinet.

Reverse the above steps to replace the MLC.

5.3 Replacing Power Supplies

To remove a power supply from the display:

1. Access the interior of the display.
2. Disconnect all power and signal connectors from the power supply.
3. Pull the finger tab and lift the power supply assembly. Refer to **Figure 13**.

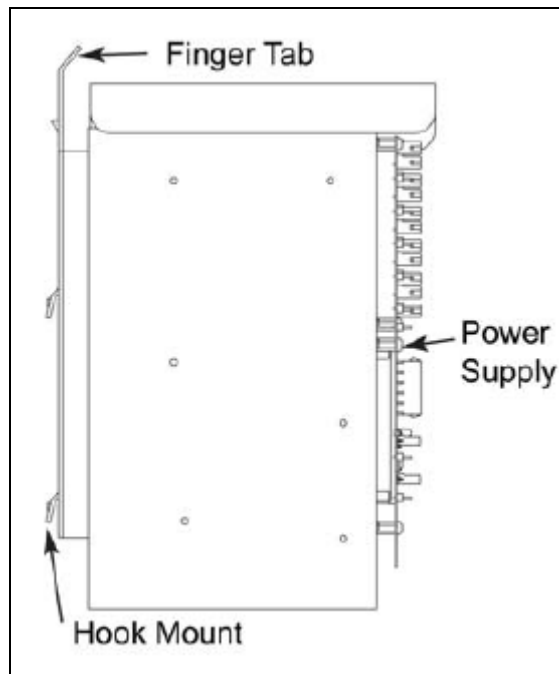


Figure 13: Power Supply Assembly

4. Remove the power supply assembly from the display cabinet.

Reverse the above steps to replace the power supply.

5.4 Replacing Filters

To replace a filter in the display:

1. Depress the filter release. Refer to **Figure 14**.

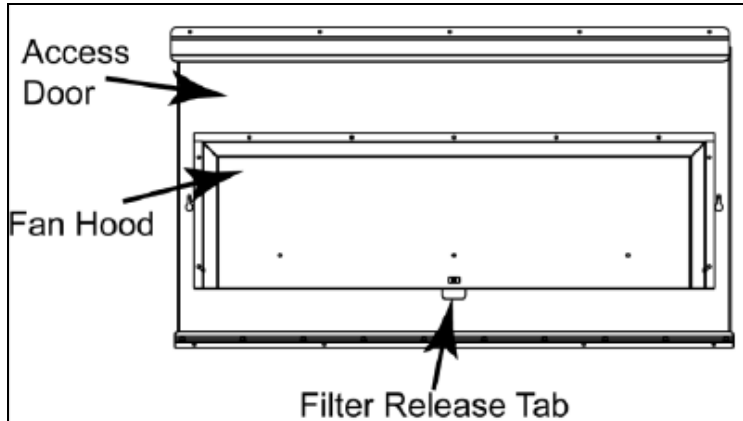


Figure 14: Filter Hood

2. Lower the filter door.
3. Remove the old filter.

Reverse the above steps to replace a filter.

To check fan operation, hold a hand or a piece of light paper above the fan to detect air movement. If the operation of the fan is questionable, a fan-testing power cord is available to check it. Plug the test cord into the fan and plug the other end into a 120-volt outlet. If the fan does not turn or does not operate smoothly, replace the fan.

After replacing 10 percent of the fans, Daktronics recommends replacing all cooling fans to reduce associated maintenance costs that incur with increased heat buildup from fan failures.

5.5 Structural Inspection

Perform annual visual inspections of the display to facilitate repair and lengthen display life.

- Check for possible corrosion, especially at structural tie points and ground rods.
- Check, tighten, and replace fasteners as required.
- Check electronic components for corrosion. Repair and replace as needed.
- At least once a year check the inside of the display for signs of water intrusion. Water can enter the display where weather stripping has deteriorated or where fasteners have loosened.

5.6 Troubleshooting

This table lists some problems that may be encountered while operating the display. Next to each problem are steps that may help resolve it. While this list does not cover all possible problems that may occur, it does not cover those that occur most often.

Display Problem	Solution
Entire display is blank	<ul style="list-style-type: none"> • Check that the display is receiving power and all breakers are turned on. When power is applied to the display, power supply LEDs should turn on. • Check the data distributor LCD status to make sure the input signal is locked and the output is not blank. • Make sure the fiber-optic signal cable connects to the data distributor. The input signal should be locked.
Section of display is blank	<ul style="list-style-type: none"> • Make sure the power status LEDs on the modules, power supplies, and in the blank section are on. • Make sure RJ45 connections to the multi-line controllers in the blank section are secure. Change the connections with one another to test.
16-48 high section of display is blank	<ul style="list-style-type: none"> • Check the power status LED on the multi-line controller in the blank section. • Verify the status indicator digit on the multi-line controller. • Make sure RJ45 connections to the multi-line controllers in the blank section are secure. Change the connections with one another to test.
16 high section of display is blank	<ul style="list-style-type: none"> • Check the ribbon cable connections between modules and the multi-line controller in the blank section. Check the connection to the leftmost module first (from the front of display). • Make sure that modules are receiving logic power. Signal will not pass through a module that does not receive logic power.
Module is blank	<ul style="list-style-type: none"> • Check the power status LEDs on all power supplies connected to the module. If a power supply LED is off, make sure the fuse on the power supply output is intact. • Check the ribbon cable input to the module and the output from the previous module.

Entire display is garbled or uncontrollable	<ul style="list-style-type: none"> • Check the data distributor receiver board status LEDs to make sure the data distributor is receiving power. • Check the Venus 7000 configuration and restart sign service. • Ensure the fiber-optic signal cable is connected to the data distributor. The input signal should be locked. If the input signal is not locked, check the fiber connections.
8 high section of the display is garbled	<ul style="list-style-type: none"> • Check the ribbon cable connections between modules in the garbled section. Check the connection to the leftmost (from display front) module first.
Single module is garbled	<ul style="list-style-type: none"> • Check the ribbon cable input to the module and the output to the previous module. • Make sure all connections on the module power supplies are tight. A garbled module could indicate power supply failure. A module with no power is blank and does not pass signal to the next module.

Glossary

Data Distributor: device that routes signal to the display. Display data from the controller passes through the data distributor before routing to the modules within the display. The data distributor may mount directly inside the display as a single card or may be housed in a separate enclosure with other parts.

Lanyard Attachment Ring: a ring found on the back of each module near the latch release on the back of the module. The lanyard attaches to the ring and prevents the module from falling.

Latch Release: device that holds the module firmly to the display frame. There are two per module, one on the top and one on the bottom.

Light Emitting Diode (LED): low energy, high intensity lighting unit.

Line Filter: device that removes electromagnetic noise that might interfere with local communication channels from the power system. Line filters sometimes mount on brackets with power supplies. Other times they are mounted alone.

Louwer: a black plastic shade positioned horizontally above each pixel row. Louvers increase the contrast level on the display face and direct LED light for easier viewing.

Module: consists of a display board with LEDs, a driver board or logic card, a black plastic housing, a module latch assembly, and a louver. Each module is individually removable from either the front or back of the display.

Module Latch: an assembly using a rotating retainer bar to hold the module firmly to the display frame. There are two per module, one near the top and one near the bottom.

Multi-Line Controller (MLC): a circuit board that passes display data that can be turned on and off. For LED displays, a pixel is the smallest block of LEDs that can generate all available colors.

Power Supply: device that converts AC line voltage from the panel board to low DC voltage for driver boards. One power supply may power multiple modules.

Termination Block: an electrical connection point, usually used to connect internal power and signal wires to wires of the same type coming into the display from an external source.

Appendix A: Reference Drawings

Appendix A contains drawings that are not project specific. Refer to the Project Installation Packet for project-specific drawings. Any project specific drawings take precedence over the drawings listed in Appendix A. The Daktronics drawing number is located in the bottom right corner of the drawings. Refer to Section 1.1 for information regarding how to read the drawing number. The drawings in Appendix are listed in alpha-numeric order.

Vertical Section Splice Assembly; Billboard	Drawing A-308718
Can Temperature/Photo Sensor with Mount; Valo	Drawing A-319764
Generic Border Cover Attachment: Billboard	Drawing A-323761
Horizontal Splice and Mounting Bracket Attachment.....	Drawing B-308570
Generic Border Attachment; Billboards	Drawing B-317987
Bracing/Catwalk Dwg; DB-2110 16 OT Displays	Drawing B-329379
Bracing/Catwalk Dwg; DB-2110 20 OT Displays	Drawing B-351539
Bracing/Catwalk/Ledger Dwg; 12OT Displays	Drawing B-631137
Block Diagram; Power	Project Specific
Block Diagram; Signal	Project Specific
Layout, Component and Power	Project Specific
Shop Drawing	Project Specific
System Riser	Project Specific

Appendix B: Supplementary Manuals

The Daktronics manual number is located on the front of the manual, or in the lower left corner of the sheets.

Quick Guide: Valo [®] Digital Billboard Retractable Webcam Arm Mounting and Use.....	DD1463448
Quick Guide: Valo [®] Digital Billboard Installation Tool Use	DD1473819
Quick Guide: Valo [®] Digital Billboard Catwalk Mounted Webcam Arm Installation	DD1583763
Quick Guide: Billboard Installation: Spreader Beam Specifications	ED-16454
Quick Guide: 2008 Series Digital Billboard Section Splice	ED-18400
Quick Guide: 2008 Series, Digital Billboard Troubleshooting and Service	ED-18425
Quick Guide: 2008 Series Digital Billboard Border Installation	ED-18429
Checklist: 2008 Series Digital Billboard Installation	ED-18430
Quick Guide: 2008 Series Digital Billboard Display Mounting	ED-18487

Appendix C: Daktronics Warranty and Limitation of Liability

Daktronics Warranty and Limitation of Liability **SL-02374**