

Valo[®] Digital Billboard

Service and Maintenance Manual

DD1740664

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DAKTRONICS

DAKTRONICS, INC.

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Section 1: Introduction

This manual provides service and maintenance information for Valo® digital billboards. To ensure optimal display life, take time to read and understand the information in this manual.

1.1 About This Manual

This manual is divided into seven sections:

- **Introduction:** Explains basic information needed to use this manual.
- **Display Identification:** Explains differences between series displays.
- **Display Troubleshooting:** Explains basic troubleshooting steps.
- **Removing Modules from the Display:** Explains the various ways of removing modules from a display.
- **Replacing Display Components:** Explains how to replace display components.
- **Routine Maintenance:** Explains recommended guidelines for service calls and annual maintenance checks.
- **Power and Signal Testing:** Explains how to test power and signal.

At the end of this manual are a glossary and two appendices:

- **Glossary:** Defines various terms.
- **Appendix A: Supplementary Material:** Contains retrofit kit drawings, checklists, technical service bulletins, and quick guides referenced throughout the manual.
- **Appendix B: Daktronics Warranty and Limitation Liability:** Provides information on warranty and liability.

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

All references to drawing numbers, appendices, figures, or other manuals are presented in bold typeface, as shown above.

Section 2: Display Identification

Daktronics has shipped three major series of Valo® digital billboards. The 1000 series shipped from 2005 to 2008. The 2000 series shipped from October 2007 to November 2009. The 3000 series started shipping on December 2009. There are differences in the design and components in each series, and it is important to be able to identify the differences as service and maintenance requirements vary by series.

2.1 1000 Series Display

There were many variations within the 1000 series displays; however, the cabinet design remained consistent. The 1000 series displays are front access only. This is the easiest way to identify the series. Refer to **Figure 2**.



Figure 2: 1000 Series

2.2 2000 Series Display

The 2000 series displays have minor variations in the series. The cabinet and technologies remain similar. The 2000 series displays can be accessed from the rear as well as the front. To identify these displays, look for rear access doors on the back of the display. Refer to **Figure 3**.



Figure 3: 2000 Series

2.3 3000 Series Display

The 3000 series rear-mounted remote enclosure is standard for all shipments. The 3000 series displays can be accessed from the rear as well as the front. To identify these displays, look for rear access doors on the back of the display. Refer to **Figure 4**.



Figure 4: 3000 Series

Section 3: Display Troubleshooting

The following table lists some problems that may occur while operating a display. The left column contains a list of display problems. The right column contains a list of troubleshooting steps to help resolve the issue. While this table does not cover all possible problems that may occur, it does cover those that may occur most often. The first table covers troubleshooting issues for the 1000 series display, and the second table covers troubleshooting issues for the 2000 and 3000 series displays.

3.1 Troubleshooting

1000 Series Display Troubleshooting

1000 Series Display Problem	Troubleshooting Steps
Entire display is blank	<ul style="list-style-type: none"> • Check that the display is receiving power and that all breakers are on. • Verify power supply LEDs are on when power is applied to display (data distributor, multi-line controller, control cabinet, etc). • Check the status of the data distributor card to make sure it is not blank (signal locked, configured, etc). • Ensure fiber-optic signal cable is connected to the data distributor and the signal is locked. • Check that the V-Link[®] content output is on (not blank).
Blank section of display	<ul style="list-style-type: none"> • Ensure the power status LEDs on the modules, power supplies, and multi-line controllers in the blank section are all on. • Verify all RJ45 connections to the multi-line controllers are secure. Change the connections with one another to test. • Make sure all ribbon cable connections to the modules are secure.
Blank 5 high x 4 wide module section	<ul style="list-style-type: none"> • Check the power status LED on the multi-line controllers in the blank section. • Make sure the status indicator LCD on the multi-line controller is changing. • Verify all RJ45 connections to the multi-line controllers in the blank section are secure. Change the connections with one another to test.
Blank 5 high x 2 wide module section	<ul style="list-style-type: none"> • Check the power supply to the affected modules.
Blank row of modules	<ul style="list-style-type: none"> • Check the ribbon cable connections between the modules and multi-line controller in the blank section. From the front of the display, check the connection of the left-most module first. • Ensure the modules are receiving signal and power. Signal will not pass through a module that does not receive signal and power.
Blank 1 high x 10 wide module section	<ul style="list-style-type: none"> • Check the power supply to the modules.

Blank module	<ul style="list-style-type: none"> • Check the power status LEDs on all power supplies connected to the module. If a power indicator LED is off, check to make sure the fuse on the power supply output is intact and all power connections are securely fastened. • Check the ribbon cable input to the module and the output from the previous module or multi-line controller.
Blank half-module	<ul style="list-style-type: none"> • Check the ribbon cable of the module to the left of the blank module.
Garbled half-module	<ul style="list-style-type: none"> • Check the ribbon cable connections between modules and the multi-line controller in the garbled section. From the front of the display, check the connection of the left-most module first.
Garbled module	<ul style="list-style-type: none"> • Check the ribbon cable input to the module and the output from the module to its multi-line controller. • Ensure all connections on the module power supplies are tight. A garbled module can be an indicator of power supply failure. A module with no power will be blank and will not pass signal to the next module.
Garbled row	<ul style="list-style-type: none"> • Check the ribbon cable connections between the modules and the multi-line controller in the garbled section. From the front of the display, check the connection of the left-most module first.
Garbled or uncontrollable display	<ul style="list-style-type: none"> • Check the data distributor receiver board status LEDs to make sure it is receiving power. • Verify the V-Link configuration. • Ensure the fiber-optic signal cable is connected to the data distributor and the signal is locked and receiving configuration. • Verify all RJ45 connections and ribbon cables are connected to the correct locations.
Section of display is lighter than rest	<ul style="list-style-type: none"> • Test RJ45 cable input for the multi-line controller. • Test the power supply for the multi-line controller. • Replace the multi-line controller.
Discolored 1 high x 4 wide module section	<ul style="list-style-type: none"> • Check that RJ45 and power connections to the multi-line controllers are securely fastened. • Verify that calibration frame being used is correct, and re-send if required.
Discolored module	<ul style="list-style-type: none"> • Check all ribbon cables and make sure all power connections are securely fastened. • Verify the correct calibration frame is being used.
Hanging module	<ul style="list-style-type: none"> • Check the module to see if the module will reinsert and lock into the display. If it does not lock to the display, replace it with a spare module and send the old module to Daktronics for repair.

2000 and 3000 Series Display Troubleshooting

2000 and 3000 Series Display Problem	Troubleshooting Steps
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 all on. • Make sure fiber 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 fiber 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. From the front of the display, check the connection of the left-most module first. • Make sure that modules are receiving signal and power. Signal will not pass through a module that does not receive signal and 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 indicator LED is off, ensure 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. • 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. From the front of the display, check the connection of the left-most 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.
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Section 4: Removing Modules from the Display

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

Required tools:

- Phillips head screw driver or $5/16$ " nut driver
- $1/8$ " T-handle Allen wrench
- Allen wrench set
- Safety lanyard

4.1 Front Access

Most display components are rear accessible; occasionally, you may need to remove a display component from the front.

Note: 1000 series displays are front access only.

To remove a module from the front of the 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 5** for the approximate location of the holes.
3. Pull the module from the display just far enough to reach around to the back of the module. Attach one end of the safety lanyard to a lanyard attachment ring on the module. Attach the other end of the safety lanyard to a nearby upright or wire rod. Use the safety lanyard in this way to prevent module damage.

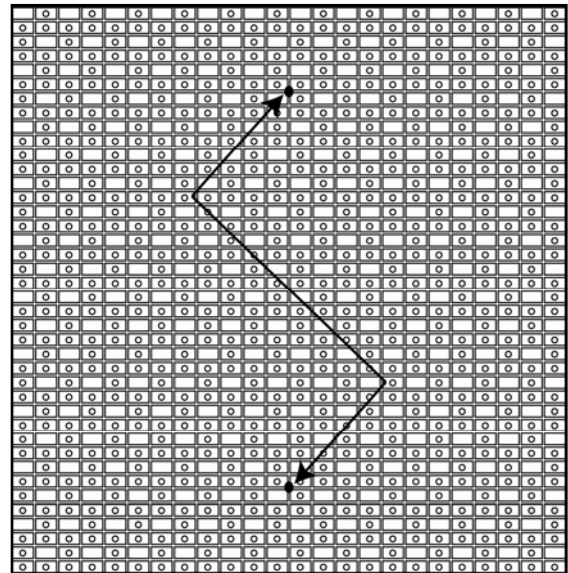


Figure 5: Module Face

4. Disconnect the power and signal cables from the rear of the module.
5. Reverse **Steps 1-4** to install a module in the display.

6. Gently pull the module to verify that it is properly seated.

4.2 Rear Access

Note: Depending on display configuration, you may need to remove a power supply and/or multi-line controller in order to access a module from the rear. These situations are covered throughout **Section 4**.

Note: If the access door has fans connected to it, disconnect display power before pulling the door away.

1. Lift the access door straight up.
2. Pull the bottom of the display door away from the back of the display.
3. Carefully place the access door out of the way.
4. Disconnect the power and signal cables from the rear of the module.
5. Attach one end of the safety lanyard to a lanyard attachment ring on the module. Attach the other end of the safety lanyard to a nearby upright or wire rod. Use the safety lanyard in this way to prevent module damage.
6. Disengage the upper and lower module latch release with a $1/8$ " Allen wrench and turn the release approximately $1/2$ turn clockwise. Refer to **Figure 6**.
7. Maintain a firm grip on the module, push it through the front of the display, and rotate the module in a manner that allows it to pull back through the frame opening.
8. Reverse the above steps to reinstall a module.

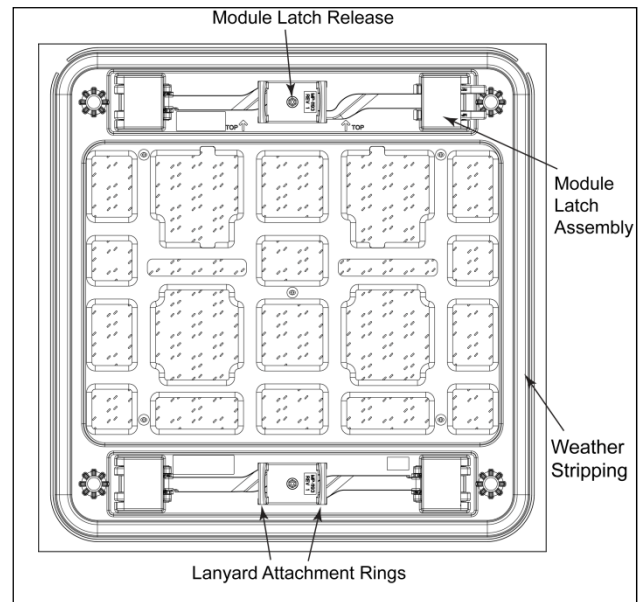


Figure 6: Module Rear

16 OT Module Removal

16 OT modules are rectangular. It is easiest to remove the module by pulling it lengthwise through the display face.

Unobstructed 16 OT Module Removal

1. Disconnect power and signal cables. Refer to **Figure 7**.
2. Attach one end of the safety lanyard to a lanyard attachment ring on the module. Attach the other end of the safety lanyard to a nearby upright or wire rod. Use the safety lanyard in this way to prevent module damage.

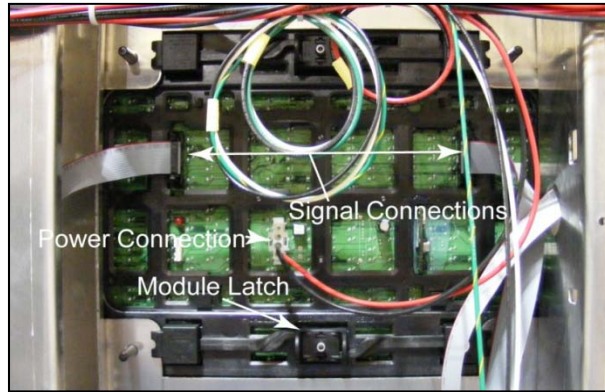


Figure 7: Module Connections

3. Use a T-handle Allen wrench to disengage module latches.
4. Carefully push the module out of the display face. Refer to **Figure 8**.

Note: Sometimes it may be necessary to remove the module beside, above, or below in order to access the target module.

5. Pivot the module to pull it through the back of the display.
6. Reverse **Steps 1-5** to reinstall the module.

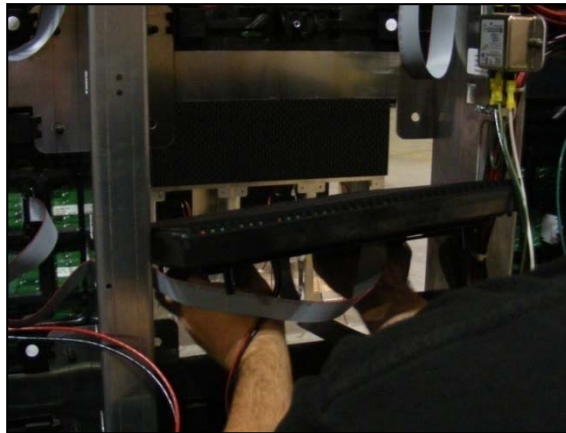


Figure 8: Pulling a Module through the rear of the Display

Removing a 16 OT Module behind a Power Supply

1. Remove the $\frac{5}{16}$ " TEK screw that holds the power supply bracket in place.
2. Pull the finger tab to disengage the power supply. Refer to **Figure 12** for an illustration of a power supply.
3. Lift the module power supply off the hook mount.
4. Gently set the power supply assembly down.

5. Disconnect power and signal cables from the module. Refer to **Figure 7**.
6. Attach one end of the safety lanyard to a lanyard attachment ring on the module. Attach the other end of the safety lanyard to a nearby upright or wire rod. Use the safety lanyard in this way to prevent module damage.
7. Use a T-handle Allen wrench to disengage module latches.
8. Carefully push the module out of the display face.
9. Pivot the module to pull it through the back of the display.
10. Reverse **Steps 1-8** to reinstall the module.



Figure 9: Removing Term Panel Support Screws

Removing a 16 OT Module Behind a Multi-Line Controller

1. Pull the finger tab to disengage the multi-line controller.
2. Lift the multi-line controller off the hook mount.
3. Gently set the multi-line controller assembly down.
4. Disconnect the module power and signal cables. Refer to **Figure 7**.
5. Attach one end of the safety lanyard to a lanyard attachment ring on the module. Attach the other end of the safety lanyard to a nearby upright or wire rod. Use the safety lanyard in this way to prevent module damage.
6. Use a T-handle Allen wrench to disengage the module latches.
7. Carefully push the module out of the display face.
8. Pivot the module to pull it through the back of the display. Refer to **Figure 8**.
9. Reverse **Steps 1-8** to reinstall the module.

Removing a 16 OT Module behind a Termination Panel

1. Remove the two support screws from the top of the termination panel.
2. Pull the finger tab to disengage the termination panel.
3. Lift the termination panel off the hook mount.
4. Gently set the termination panel assembly down.

5. Disconnect the module power and signal cables. Refer to **Figure 7**.
6. Attach one end of the safety lanyard to a lanyard attachment ring on the module. Attach the other end of the safety lanyard to a nearby upright or wire rod. Use the safety lanyard in this way to prevent module damage.
7. Use a T-handle Allen wrench to disengage module latches.
8. Carefully push the module out of the display face.
9. Pivot the module to pull it through the back of the display. Refer to **Figure 8**.
10. Reverse **Steps 1-9** to reinstall the module.

20 MT and 23 MT Module Removal

20 and 23 MT modules are square. Typically, modules should pull through the display face with the same ease no matter the direction.

Removing the Rear Access Display Door

1. Determine which door needs to be removed to best access the module.
2. Lift the access door straight up.
3. Pull the bottom of the display door away from the back of the display.
4. Carefully place the access door out of the way.

Unobstructed 20 MT or 23 MT Module Removal

1. Disconnect power and signal cables.
2. Attach one end of the safety lanyard to a lanyard attachment ring on the module. Attach the other end of the safety lanyard to a nearby upright or wire rod. Use the safety lanyard in this way to prevent module damage.
3. Use a T-handle Allen wrench to disengage module latches.
4. Carefully push the module out of the display face.
5. Pivot the module to pull it through the back of the display.

Note: Sometimes it may be necessary to remove the module beside, above, or below in order to access the target module.

Removing a 20 MT or 23 MT Module behind a Power Supply

1. Remove the $\frac{5}{16}$ " TEK screw that holds the power supply bracket in place.
2. Pull the finger tab to disengage the power supply. Refer to **Figure 12** for an illustration of the power supply.

3. Lift the module power supply off the hook mount.
4. Gently set the power supply assembly down.
5. Disconnect power and signal cables.
6. Attach one end of the safety lanyard to a lanyard attachment ring on the module. Attach the other end of the safety lanyard to a nearby upright or wire rod. Use the safety lanyard in this way to prevent module damage.
7. Use a T-handle Allen wrench to disengage module latches.
8. Carefully push the module out of the display face.
9. Pivot the module to pull it through the back of the display.
10. Reverse **Steps 1-8** to reinstall the module.

Removing a 20 MT or 23 MT Module Behind a Multi-Line Controller

1. Pull the finger tab to disengage the multi-line controller.
2. Lift the multi-line controller off the hook mount.
3. Gently set the multi-line controller assembly down.
4. Disconnect the module power and signal cables. Refer to **Figure 7**.
5. Attach one end of the safety lanyard to a lanyard attachment ring on the module. Attach the other end of the safety lanyard to a nearby upright or wire rod. Use the safety lanyard in this way to prevent module damage.
6. Use a T-handle Allen wrench to disengage module latches.
7. Carefully push the module out of the display face.
8. Pivot the module to pull it through the back of the display.
9. Reverse **Steps 1-8** to reinstall the module.

Removing a 20 MT or 23 MT Module behind a Termination Panel

1. Remove the two support screws from the top of the termination panel.
2. Pull the finger tab to disengage the termination panel.
3. Lift the termination panel off the hook mount.
4. Gently set the termination panel assembly down.
5. Disconnect the module power and signal cables. Refer to **Figure 7**.

6. Attach one end of the safety lanyard to a lanyard attachment ring on the module. Attach the other end of the safety lanyard to a nearby upright or wire rod. Use the safety lanyard in this way to prevent module damage.
7. Use a T-handle Allen wrench to disengage module latches.
8. Carefully push the module out of the display face.
9. Pivot the module to pull it through the back of the display.
10. Reverse **Steps 1-9** to reinstall the module.

Section 5: Replacing Display Components

5.1 1000 Series Specific Procedures

Note on Removing Modules

The 1000 series displays are front access only. Refer to **Section 4:** for instructions on removing a module from the front of the display.

Fine Mesh Screen

1. Cut out the existing fine mesh screen with a utility knife.
2. Align the rivet clearance holes on the grill cover (**OM-353962**) over the existing rivet heads.
3. Fasten the grill cover into place with #10 TEK screws.

Note: TEK screws go into the small holes. There are two holes on each end of the grill and two in the middle section.

Metal Frame Filter

Before May 2007, the 1000 series displays used metal frame filters. Release five of the 1000 series introduced the green filter, which is now a standard part on displays after May 2007. The green filter retrofit kit (**0A-1413-3900**) was introduced in April 2007 and should be used during routine filter service on 1000 series displays that still have metal frame filters.

To replace the metal frame filter, follow the steps below.

1. Remove the metal frame filter by lifting up and pulling out from the bottom of the filter.
2. Put the green filter in the filter holders.
3. Put the end of the filter bracket in the corner of the bottom holder, in between the filter and the outside flange of the bottom holder.
4. Rotate toward the center of the filter to get under and in front of the top holder.
5. Rotate the filter bracket up into a vertical position. Be sure not to rotate too far, or the channel will slip out.

Optional Thermostat Addition to Digital Billboard Fan Filter Displays

Daktronics recommends adding the thermostat to all 1000 series fan filter displays. Doing so may prolong fan life and reduce operation costs.

Use **Thermostat Addition Kit 0A-1413-3050**.

To install a thermostat, follow the steps below.

1. Turn off the breakers for the display fans in each display section. Refer to the block diagram and layout, and component drawings to determine breaker location.
2. Use the layout, component drawing to locate the first fan in each display section.
3. Remove the module that is in front of the first fan in each display section.
4. Disconnect the power quick-connect from the breaker to the first fan.
5. Plug the thermostat's power quick-connect into the breaker quick-connect and the fan quick-connect.
6. Using TEK screws, attach the thermostat to a display upright. Only screw through the mounting bracket.
7. Set the thermostat to 85° F.
8. Turn the fan breakers on.
9. Repeat **Steps 1-8** for each display section.

Reattaching Borders

On some 1000 series digital billboard displays, the border pieces may come loose.

Required tools:

- Cordless drill
- 1/4" Tapping screws
- 5/16" Drill bit
- 3/8" Driver

To reattach a border, follow the steps below.

1. Lift the bottom border tight against the bottom cabinet perimeter.
2. Drill a 5/16" pilot hole in the first extrusion where the self-tapping screws are to be mounted. Drill one pilot hole in the front and one in the rear. This will ensure that the self-tapping screws will pull the extrusion tight.
3. Install a 1/4" self-tapping screw in the pilot holes.

Module Gears

1. Remove the module from the display and place it face down on a flat, dry surface.
2. Completely extend the gear arms to relieve pressure on



Figure 10: Module Gear

the latch assembly.

3. Lift one side of the gear housing.
4. Place a flat head screwdriver into the middle pry slot.
5. Firmly pry with the handle of the screwdriver until gear housing comes loose.
6. Repeat Step 4 and Step 5 on the other side of the gear housing.
7. Lift the latch arms so they are no longer engaged with the module gear.
8. Lift the module gear out of the module housing.
9. Replace the existing module gear with a replacement module gear.
10. Press the latch arms down until they engage with the module gear teeth.
11. Ensure both clasps are in all the way or out all the way before replacing the module gear housing.
12. Place the gear housing over the module gear and latch arm assembly.
13. Place a large nut driver over the gear plug.
14. Strike the top of the nut drive with a hand to snap the gear housing into place.
15. Test the latch assembly to ensure it functions properly.

Legacy Cat-5 Cables

There have been numerous perceived failures of Cat-5 in the field. Cat-5 cables connected to the DD, MLC, and / or as a MLC to MLC link. Failures are visual and diagnostic.

Required tools:

- Soft bristle brush
- CRC Contact Cleaner
- CRC Di-Electrical Grease
- Module wrench
- Wire cutters

Follow these steps to determine the root cause:

1. Replace the MLC or DD where the problem starts. The DD could have a bad output or the MLC could have a bad input. Use the diagnostic codes/lights on the MLC or DD to troubleshoot the issue.

2. If there is still a problem, replace the MLC before the problem MLC. This will verify there is not a bad output on that MLC.
3. If the problem persists, inspect the cable link. Cut and remove the cable ties, as they may be too tight.
4. Inspect the RJ45 ends for poor crimping/latching or corrosion. If possible, use an Ethernet cable tester.
5. Inspect the RJ45 ends and CaiLube for dirt that would prevent the pins from making contact. If dirt is found:
 - a. Power down the equipment for cleaning.
 - b. Clean RJ45 ends with CRC contact cleaner and a soft bristle brush.
 - c. Clean inside of the jacks on the MLC and/or DD with contact cleaner.
 - d. Apply CRC electrical grease to the jacks on the MLC and/or DD and the ends of the RJ45 cable.
6. If the issue persists, replace the Cat-5 cable. If the cable fixes the issues, send the cable with a parts return tag that describes the issue and display location to:

Daktronics Inc.
ATTN: Billboard Electrical Engineers
201 Daktronics Dr. PO Box 5128
Brookings, SD 57006

5.2 2000 and 3000 Series Specific Procedures

Note on Removing Modules

Refer to **Section 4:** for removing modules from the display.

Replacing a Mobotix Webcam with a Panasonic Webcam

Required tools:

- Mobotix to Panasonic retrofit kit (0A-1413-3013)
- Drill
- 1/2" Drill bit
- Wire cutters
- 5/16" and/or 1/4" Nut driver bit
- Socket set

- Various wrenches
- UV Rated Cable Ties

In most instances, a bucket truck is required to replace a webcam. To replace a webcam:

1. Locate the webcam signal connections on the display.
2. Remove the webcam power cable from the termination plate.
3. Remove the Ethernet cable from the termination plate.
4. Drill a 1/2" hole for the new BNC coupler near the existing webcam signal cables.
5. Attach the BNC coupler to the display.
6. Remove the connection for the webcam power.
7. Replace the webcam power with the two-pin power connector.
8. Locate a half depth vertical location to mount the video server.
9. Hang the mounting plate on the half depth vertical with TEK screws.
10. Route the coaxial cable from the video server to the termination plate.
11. Connect Cable Input 1 on the video server to the new BNC coupler.
12. Connect the power cable to the adapter on the video server plate.
13. Connect the five-pin mate and lock end to the available five-pin jack on a power supply.
14. Remove the Cat-5e cable from the jack within the display cabinet on the signal termination plate.
15. Route and connect the Ethernet cable to the Ethernet input on the video server.
16. Locate and replace the existing transformer with the transformer located in the kit.
17. Reconnect the primary power to the transformer.
18. Route and connect the wire on the secondary side to the two-pin power connection.
19. Remove the old camera and existing camera cables.
20. Mount the Panasonic camera to the existing webcam arm.
21. Route the power and coaxial cables along the back of the display.
22. Connect the new power cable to the two-pin connector.

23. Connect the coaxial signal cable to the new BNC coupler.
24. Call Daktronics NOC at 1-877-DAK-HELP to verify that the camera is working and focused.

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 11**.
4. Remove the MLC assembly from the display cabinet.
5. Reverse **Steps 1-4** to replace the MLC.

Power Supplies

To remove a power supply from the display:

1. Access the interior of the display. Refer to **Section 5.2** for information on front and rear access.
2. Disconnect all power and signal connectors from the power supply.
3. Remove the $\frac{5}{16}$ " TEK screw holding the bracket in place.
4. Pull the finger tab and lift the power supply assembly. Refer to **Figure 12**.
5. Remove the power supply assembly from the display cabinet.
6. Reverse **Steps 1-4** to replace the power supply.

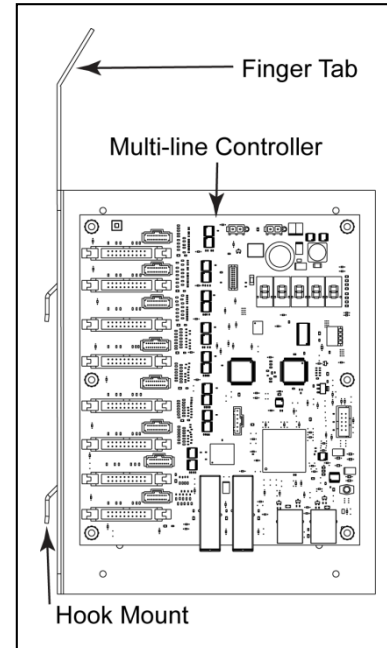


Figure 11: Multi-Line Controller

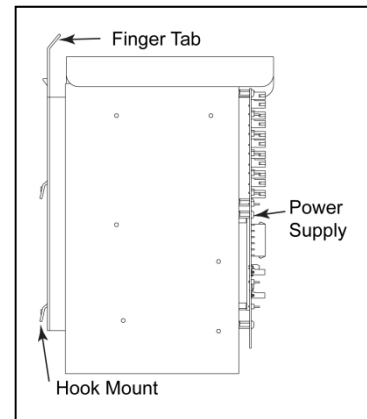


Figure 12: Power Supply

Filters

Filters should be checked yearly, except for sites that have been designated to be checked every six months.

To replace a filter in the display:

1. Depress the filter release. Refer to **Figure 13**.
2. Lower the filter door.
3. Remove the filter.
4. Reverse the above steps to replace a filter.

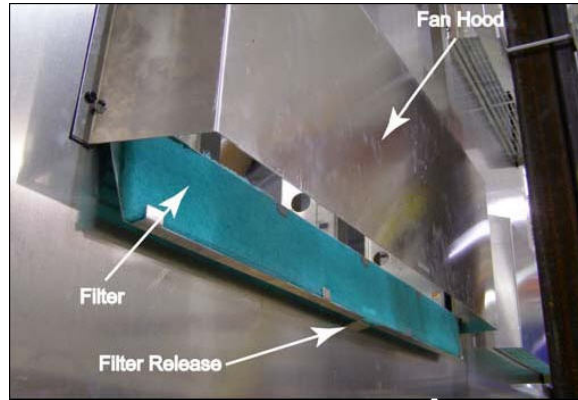


Figure 13: Filter Hood

Photo/Temp Cell

To remove a malfunctioning photocell:

1. Unplug the photocell cable from the back of the display.
2. Cut any cable ties that are holding the photocell cable in place.
3. Unscrew the TEK screws that hold the old photocell in place.
4. Using TEK screws, reattach the new photocell in the same location as the old photocell.

Note: If you are unable to use the same holes, fill the old holes with silicone to prevent water intrusion.

5. Route the photocell cable along the back of the display.
6. Plug the photocell cable to the photocell connect in the back of the display.

Section 6: Routine Maintenance

6.1 Inspecting a Display

When performing maintenance on a display, check for the following items:

- Inspect for modules protruding from the display face. If a module is protruding from the display, press the module in and tighten the module according to the steps in **Section 5.1**. If the module will still not latch, the latch may need replacement.
- Inspect for dirty filters in the display and the control enclosure. Refer to **Section 5:** for filter replacement steps.
- Inspect for water in the display. If water is found, attempt to locate the source of water intrusion.
- Ensure the cooling system and fans are working properly.
- For 1000 series displays, ensure the display border is secure. Refer to **Section 5.1** for steps on reattaching loose borders.
- Inspect the back sheets to ensure the silicone is in good condition and is sealing properly. Refer to **Section 6.3** for steps on reapplying silicone to the back sheets.
- Ensure there is not standing water in the spare parts box.
- Ensure the gasket is on the spare parts box. Refer to **Section 6.6** for the steps to reapply the gasket to the spare parts box.
- Call the NOC at 1-877-325-4357 if any of the issues are found.

6.2 Restarting a Display

Occasionally, it may be necessary to restart a display. To restart a display:

1. Shut down all control equipment in the remote enclosure.
2. Turn off the Uninterruptible Power Supply (UPS). Not turning off the UPS will delay sign restart.
3. Turn off all breakers in the main distribution panel inside the display. Refer to the display-specific system riser to locate the distribution panel. Typically, there is one breaker panel per display section.
4. Turn off site power.
5. Turn on site power.
6. Turn on all breakers in the main distribution panel inside the display.

7. Restart the UPS.
8. Restart all of the control equipment in the remote enclosure.

6.3 Applying Silicone to Display Back Sheets

1. Before applying silicone to display back sheets, remove the old silicone in the area that needs new silicone.
2. Use a clean cloth and water to clean the silicone path to remove dirt, dust, and debris from the path.
3. Allow the area to dry completely.
4. Evenly apply silicone over the area that needs silicone. Ensure all gaps are filled.

6.4 Cleaning a Webcam Lens

If a bucket truck is on site or the display has a retractable webcam arm, clean the camera lens on every visit. To clean a webcam lens:

1. Carefully clean the webcam lens with a lens-cleaning wipe or with a clean rag and a glass cleaner.

Note: If you think the lens may be out of focus after the cleaning, call 1-877-325-4357 and have the NOC ensure the webcam is focused and the image is clear.

6.5 Applying a Gasket to the Spare Parts Box

There should be a gasket around the lid lip. If there is not a gasket on the spare parts box:

1. Locate the gasket. Typically, it is stored in the spare parts box. If you cannot locate the gasket, call customer service to order a gasket.
2. Clean the gasket lip with a clean, damp cloth.
3. Allow the lip to dry completely.
4. Peel back a few inches of the tape on the back of the gasket.
5. Start applying the gasket at one corner of the spare parts box.
6. Continue applying the gasket while peeling the tape off the back of the gasket.

Note: On spare parts box corners, fold the tape at a 45° angle and press the tape firmly to make it as flush as possible.

7. After applying the gasket, cut off any excess gasket.

8. Press the gasket down and ensure it is flush along the lip.
9. Close the spare parts box lid to ensure the gasket does not inhibit the lid closing.

6.6 Fan Operation

1. Regularly check fan function. To do so, hold a hand or a piece of light paper above the fan to detect air movement.
2. Check that the thermostats are operational. If the thermostats are operational, but the fan is not operational, replace the fan. If a thermostat is not operational, replace it and check fans again.
3. If the fan does not turn or does not operate smoothly, replace it. After replacing 10 percent of the fans, Daktronics recommends replacing all cooling fans to reduce associated maintenance costs that may incur with increased heat buildup from fan failure.

6.7 Control Cabinet Heating Inspection

Issue

The heating and cooling systems for digital billboard controllers are not sufficiently heating or cooling some control cabinets. When the control cabinet is too hot or cold, display content may not display properly and have issues such as slow playback, flickering content, or playback failure. This could be caused by many things, including:

- the thermostats being set to the incorrect temperature
- the heating or cooling device not being connected
- the heating or cooling device not functioning properly.

Discovery and Repair

All controllers are shipped with heaters, but not all control cabinets are shipped with a/c units. Refer to the project BOM to determine if the control cabinet should have an a/c unit. The most likely cause of the control cabinet being over or under temperature is that the thermostat is not set to the correct temperature.

- For heating, thermostats should be set at 50° F
- For cooling, a/c thermostats should be set at 80° F

Sometimes the heating and cooling components malfunction, which may cause the control cabinet to overheat. To test the heating and cooling equipment, perform the following tests.

To test the heater, turn the thermostat to the highest setting, typically 90° F.

- If the heater does not turn on, inspect the wiring and ensure the heater is connected.
- If the heater is connected, but not functioning, call the NOC at 1-877-DAK-HELP (325-4357) to troubleshoot the issue or order a replacement heater.

To test the a/c unit, turn the thermostat to the lowest setting, typically 50° F.

- If the a/c does not turn on, inspect the wiring and ensure the a/c unit is connected.
- If the a/c unit is connected, but not functioning or cooling, call the NOC at 1-877-DAK-HELP (325-4357) to troubleshoot the issue or order a replacement a/c unit.

Sometimes the heater or a/c can become disconnected from the power source. If you notice this in a control cabinet, call the NOC at 1-877-DAK-HELP (325-4357) to help Daktronics track the issue. Refer to the control cabinet Riser Diagram attached to the display door to reconnect the heating and cooling equipment in the control cabinet.

6.8 Structural Inspection

Perform annual visual inspections of the display structure 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.
- 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.

6.9 Spare Parts

The following table is a generic list of spare parts. Spare parts requirements vary for each display. For a project-specific spare parts list, refer to the project Bill of Materials (BOM), or for newer displays refer to the spare parts list on the inside of the spare parts box lid.

Part Number	Description
0A-1393-3005	Module; HD-16M AF-2114-20X24-RGB-REQ; DS-1604
TH-1116	Tool Box, Better Built 48 X 24D X 25H
0A-1335-2506	Assembly; Secondary Harness, 48"
W-1677	Cable Assembly; 20POS, 36", 28 AWG
W-1676	Cable Assembly; 20 POS, 25", 28 AWG
0A-1413-0001	Assembly, Module PS, HK, Posi - Lock, A-2021R, 2 PIN
0P-1273-0039	MLC 4050' 8 Output, Coated
HS-1701	Padlock; Master Lock, Keyed Alike (11G043)
HS-1308	Weather-stripping, 1/16" T X 1" W, 50' ROLL

0A-1199-4913	16.75 X 15.75 X 4.13 Module Box
0A-1413-4100	T-Bolt, Border Attachment Hardware
0A-1413-4101	TEK Screw, Silver/Black, Border Attachment Hardware
W-1767	Cable; 3' Fiber Optic, Industrial LC-LC Duplex

6.10 Service Call

At every service call, perform the following service and maintenance checks. For a service call checklist, use **DD1372049** in **Appendix A**.

Required tools:

- Digital camera

Service Instructions

Contact the Network Operations Center (NOC) at 1-877-DAK-HELP (325-4357) before performing display service in order to provide a time stamp and get NOC assistance if needed.

Service Issue

1. Correct the service issue.

Structure

1. Inspect the structure, ladder, and catwalks for structural integrity.

Photocell

1. Test the photocell function. To do so, cover the photocell with an item that will block out all incoming light. The display content should dim within a couple of minutes.
2. If needed clean the photocell. For cleaning instructions, refer to **DD1509618** in **Appendix A**.

Webcam

1. If a lift truck is on site, clean the webcam lens. Refocus the camera as necessary.

Display Cabinet

Note: Some 1000 series displays use air conditioning (a/c) units.

1. Verify that the fans or a/c unit are operating properly. Check the condition of all filters and replace as needed.
2. Inspect the area where the a/c units interface with the display. Verify light is not visible around the edge of the display. Fill any leaks with polyurethane foam sealant.
3. Check the entire display cabinet for holes, missing nutserts, and other gaps. Fill any gaps/holes/gouges with silicone.
4. Ensure the back sheets and access panels are tight.

5. Verify the quality of the silicone where the fan hood meets the back sheet.
6. Inspect the silicone along the top shroud. Reapply silicone to any areas where the silicone is missing or peeling.
7. Check the fan hoods to ensure they have the grill covers at the fan hood opening. If the fan hoods have fine mesh screens, replace them with grill covers. Refer to the fine mesh screen replacement procedure in **Section 5.1**.

Water Intrusion Inspection

1. Check section splices for water trails. Follow the water trail to its source and silicone as needed.
2. Check the inside of the display at several locations for evidence of water intrusion, corrosion, or water stains. Include the cabinet, modules, power supplies, MLCs, and DDs in the inspection. Photograph any evidence of water intrusion.

Modules

1. Ensure all modules are seated properly. Work with the NOC to run a red test pattern then view the display from one end and look down the face of the display to inspect for modules that are sticking out.
2. Check for stuck pixels, bent LEDs, broken louvers, and other issues that may affect the display image quality.
3. Remove any loose modules and inspect them for stripped gears, broken latches, unlatched modules, etc. If the gears are plastic, replace them with metal gears.

Remote Enclosure

1. Inspect the remote enclosure for overall integrity.
2. Check the remote enclosure for signs of water intrusion, especially at entry locations.
3. Check the a/c filter in the remote enclosure. Wash the filter if it is dirty.
4. Visually inspect the electronics and cabling in the remote enclosure. Look for worn cables, connectors, dust in the computer or V-Link fans, corrosion, etc.
5. Verify that the key to the spare parts box is in the remote enclosure.

Spare Parts Box

1. Inspect the spare parts box for signs of water intrusion.
2. Inventory all spare parts in the box. Lock the spare parts box and place the keys in the remote enclosure.

Display Visual Inspection

1. Visually inspect the display from ground level for module discoloration or other visual issues. If you find any issues, contact a NOC technician to recalibrate the display remotely to restore uniformity.

Completing the Inspection

1. Call dispatch and give a time stamp.
2. Complete and return the Service Call Checklist to billboardfeedback@daktronics.com.
3. Call the Daktronics NOC to ensure diagnostics are clean.

6.11 Annual Maintenance Checks

For annual maintenance checks, perform the following service and maintenance procedures. For an annual maintenance checklist, use **DD1536475** in **Appendix A**.

Required tools:

- Digital camera
- Silicone approved for use on aluminum
- Utility knife
- Alcohol or Lens Cleaning wipes

Service Instructions

Before performing display service, contact the Network Operations Center (NOC) at 1-877-DAK-HELP (325-4357) to provide a time stamp and get NOC assistance if needed.

Structure

1. Inspect the structure, ladder, and catwalks for structural integrity.

Photocell

1. Inspect the photocell. If needed, clean the photocell. For cleaning instructions, refer to DD1509618 in Appendix A.
2. Test the photocell function. Cover the photocell with an item that will block out all incoming light. The display content should dim within approximately two minutes.

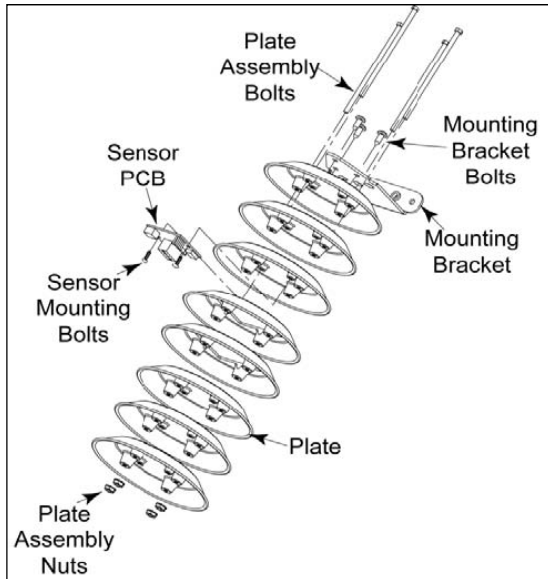


Figure 14: Photocell Assembly

Webcam

1. If a lift truck is on site, clean the webcam lens with alcohol or lens cleaning wipes. Refocus the camera as necessary.
2. Check the webcam connections for corrosion. Even if corrosion is not present, dip the webcam connectors in electrical grease.

Display Cabinet

Note: Some 1000 series displays use air conditioning (a/c) units.

1. Check the entire display cabinet for holes from missing nutserts, and other gaps on or along the edges of back sheets. Check the rear of the display for holes or gouges. Fill any gaps or holes with silicone. For gaps larger than 6", insert TEK screws into the display to shorten the gap length. Apply silicone along the seam and over the TEK screw heads.
2. Ensure the back sheets and access panels are tight.
3. Verify the silicone where the fan hood meets the back sheet is in good condition.
4. Check the fan hoods to ensure they have the grill covers at the fan hood opening. If not, replace the fine mesh screen with a grill cover (Daktronics part # 0M-353962).

5. Inspect the silicone along the top shroud. Reapply silicone in any areas where the silicone is missing or peeling.
6. Inspect the area where the a/c units interface with the display. Verify light is not visible around the edge of the display. Fill any leaks with polyurethane foam sealant.
7. Verify the a/c unit and/or fans are operating properly. Check the condition of all filters and replace as needed.

Water Intrusion Inspection

1. Check section splices for water trails. Follow the water trail and silicone as needed.
2. Check the inside of the display at several locations for evidence of water intrusion, corrosion, or water stains. Include the cabinet, modules, power supplies, MLCs, and DDs in the inspection. Photograph any evidence of water intrusion.

Thermostats

1. Ensure all thermostats in the display are set to 85° F. If thermostats are not set to 85°F, contact a Billboard Technician at 1-877-325-4357 to verify the display-specific thermostat settings.

Modules

1. Ensure all modules are seated properly. View the display from one end and look down the face of the display to inspect for modules that are sticking out.
2. Inspect the gaskets on the back of a few modules and ensure they are in good condition.
3. Check modules for pixels out, stuck pixels, bent LEDs, broken louvers, and other issues that may affect the display image quality.
4. Remove any loose modules and inspect them for stripped gears, broken latches, unlatched modules, etc. If the gears are plastic, replace them with metal gears. If a module has a broken module latch, replace the module and send the other module to Daktronics for repair.
5. Fill in weep holes in any 23 mm modules that were removed. Refer to **Figure 15**.



Figure 15: Fill in 23 mm Weep Holes

6. On 16 OT displays, work with a NOC technician to determine if the modules need gasket inspection. If so, check 10 -20 modules, take pictures, and contact the NOC to determine what to do with the information.

Remote Enclosure

1. Inspect the remote enclosure for overall integrity.
2. Check the remote enclosure for signs of water intrusion, especially at entry locations.
3. Check the a/c filter in the remote enclosure. Wash the filter if it is dirty. Allow it to dry before inserting it.
4. Visually inspect the electronics and cabling in the remote enclosure. Look for worn cables, connectors, dust in the computer or V-Link fans, corrosion, etc.
5. Check the battery level of the UPS in the remote enclosure.
6. Verify that the key to the spare parts box is in the remote enclosure.

Spare Parts Box

1. Inspect the spare parts box for signs of water intrusion.
2. Inventory all spare parts in the box. Use the chart in **DD1536475** in **Appendix A**.
3. Lock the spare parts box and place the keys in the remote enclosure.

Display Visual Inspection

1. Visually inspect the display from ground level for module discoloration or other visual issues. Contact a NOC technician to recalibrate the display remotely to restore uniformity.

Display Power

1. Verify the display is properly grounded. Measure the display grounding. It should measure 10 Ohms or less. If display grounding reads more than 10 Ohms, improve display grounding until it reads 10 Ohms or less.
2. Verify breaker panels, termination panels and cable connections are secure.
3. Verify the voltage on each leg. If the voltage reading is not equal to 120v \pm 5 on each leg, check the amperage in the displays breaker panels. Call a NOC technician to discuss potential actions or solutions.

Completing the Inspection

1. Upon completing the inspection, call 1-877-325-4357 to speak with a Billboard Technician who will request the findings, enter them into the system, and check for non-visual diagnostic errors that need resolution.

6.12 Cleaning a Display Face

Typically, it is not necessary to clean the display face. However, if the need arises, follow the steps below.

Required tools:

- Five-gallon bucket.
- Non-abrasive, non-petroleum based detergent.
- 4' – 8' telescoping, soft automotive brush. Daktronics recommends a 10" × 4" brush head and a brush of light to medium stiffness.
- Soft terry cloth towels.
- Cold water.

Wet Cleaning Instructions

1. Turn off power to the display.
2. Mix mild detergent and cold water in the five-gallon bucket at a ratio of one ounce of detergent to one gallon of cold water.
3. Clean only a section of modules that are safely within reach of the lift or stage, and then move to the next section of modules.
4. Working from top to bottom, use horizontal brush strokes to loosen dirt and grime. Use light pressure as not to damage LEDs. When finished washing the display face, rinse it with generous amounts of cold water under low pressure. A spot-free agent, such as Jet Dry[®], can be used to reduce water spots.
5. Use a soft, dry terry cloth to dry and remove any excess water. Take care not to damage LEDs by catching the cloth on them.
6. Allow the display to air-dry for one to two hours before applying power to the display.
7. Dispose of any leftover soapy water in an environmentally safe manner.

Dry Cleaning Instructions

1. Clean only a section of modules that are safely within reach of the lift or stage, and then move on to the next section of modules.
2. Working from top to bottom, rub a dry, soft terry cloth towel horizontally across each row of LEDs. Make four passes per row of LEDs before moving to the next row of LEDs.
3. Take care not to damage LEDs or the plastic louvers by catching them with the cloth.

Section 7: Power and Signal Testing

7.1 Testing the Display Ground

Testing with a Ground Meter

1. Remove any molding covering the ground connection and provide sufficient room for the jaws of the ground tester to close around the conductor.
2. Open the jaws of the ground tester and make certain that the jaws' mating surface is clean and free of dust, dirt, and other foreign matter.
3. Open and close the jaws a few times to allow the jaws to sit on the best mating position.
4. Set the rotary meter to Ω .
5. When powering on the ground tester, the tester will calibrate itself to ensure accuracy. Wait for the self-calibration to complete. During the process, the LCD will read, "CAL7, CAL6,..., CAL2, CAL1." Do not clamp to a conductor or open the jaws during calibration. The tester will beep when the calibration finishes and is ready for use.
6. Test resistance by clamping the meter on the testing strip provided in the ground meter kit. The testing strip simulates grounding rings and circuits. Once the reading is attained from the test strip, remove the meter.
7. Clamp the meter to the electrode or the ground rod-bonding conductor that you are measuring. Open and close the jaws a few times for better accuracy.
8. The LCD will read the ground resistance measurement. The meter will beep if the resistance is less than 40 Ω . The measurement should read under 25 Ω . Record the measurement.

Testing with a Multimeter

1. Remove any molding covering the ground conduction and provide sufficient surface to contact the probes on the multimeter.
2. Turn the dial on the multimeter to the Ω symbol.
3. Place the red positive probe of the multimeter on the ground wire in the term panel.
4. Place the black ground probe against the main distribution case.
5. The LCD will read the ground resistance measurement. The measurement should read under 25 Ω . Record the measurement.

Glossary

Data Distributor: device that routes signal to the display. Display data from the controller passes through the data distributor before routing to the multi-line controller (MLC) within the display. The data distributor mounts directly inside the display as a single card, or 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 louwer. 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, and 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.

Ribbon Cable: is a cable that runs many wires parallel to each other on a flat plane. These cables in various lengths are used throughout the display.

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: Supplementary Material

Appendix A contains drawings, checklists, technical service bulletins, and quick guides. These documents are referenced throughout the manual. The Daktronics drawing number is located in the bottom right corner of the drawings.

Grill Plate; Hood Ventilation; Retrofit	Drawing A-353962
Filter Replacement Assy; EN-2393 Retrofit.....	Drawing B-303734
Digital Billboard Service Call Checklist.....	DD1372049
Digital Billboard Annual Maintenance Checklist.....	DD1536475
Quick Guide: Valo Digital Billboard Photocell Cleaning Procedure.....	DD1509618

Appendix B: Daktronics Warranty and Limitation of Liability

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