

**GENERIC SERVICE
VANGUARD®
VL-3500 20MM SERIES
DISPLAY MANUAL**

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1 Introduction

This manual provides installation, maintenance, and troubleshooting information for the Daktronics VL-35X0 displays. For information regarding the safety, installation, operation, or service of this system, please refer to the telephone numbers listed on the cover page of this manual.

Daktronics identifies manuals by the ED or DD number located on the cover page of each manual. For example, this manual would be referred to as **DD3934467**.

Daktronics builds displays for long life and little maintenance. However, from time to time, certain display components need replacing. Refer to the **Daktronics Exchange and Repair & Return Programs (p.25)** section if any component needs replacement or repair.

Display Overview

Daktronics outdoor Vanguard® LED displays are designed and manufactured for performance, reliability, ease of maintenance, and long life. The displays consist of an array of LED pixels. The configuration of the LED pixels depends on the model of LED displays.

A typical system consists of a central server computer and client computers running Vanguard® software and of one or more displays. Daktronics Vanguard® software package operates with Windows® XP, Windows® Vista®, Windows® 7, Windows® 8, Windows® Server 2003, Windows® Server 2008, Windows® Server 2012 systems on an IBM®-compatible computer.

The Vanguard® series VL-35X0 displays are matrix-based outdoor LED displays. The Vanguard® model numbers are described as follows:

VL-35XX-RRxCCC-20-Z-SF		
VL-35XX	=	Outdoor Vanguard® display
RR	=	Number of rows high (16, 32, or 48)
CCC	=	Number of columns wide (48, 64, 80, 96, 112, 128, 144, 160, 176, 192, 208, 224, 240, or 256)
20	=	Center-to-center pixel spacing
Z	=	Monochrome Amber (A), Red (R), or Full Color (RGB)

Network Concepts

Daktronics offers Ethernet and fiber-optic Ethernet network systems to interconnect and control displays. One display network can comprise up to 240 displays. Each Daktronics system is capable of performing multiple functions, including:

- Transferring messages.
- Programming messages to play on a display or group of displays in a network.
- Determining display statuses on a network.

The Daktronics VL-35X0 displays use one of the following communication methods. Refer to the **Signal Termination from Computer to Display (p.9)** section for more detailed information.

Ethernet

An Ethernet network is a standard communication method that allows one computer, or a number of computers, to connect to displays. Each display is identified by a unique address. This address allows the computer to communicate directly with each display. Refer to the **Signal Termination from Computer to Display (p.9)** section for more detailed information.

Fiber-optic Ethernet

A fiber-optic network is a standard communication method transmitting light (signal) through glass fibers. A signal converter is required to convert the computer's Ethernet interface to a light signal, and another to convert the light signal to Ethernet. The signal converter is either located in an external signal enclosure or within the display. Refer to the **Signal Termination from Computer to Display (p.9)** section for more detailed information.

Figure 1 shows a simplified diagram of basic display set-up.

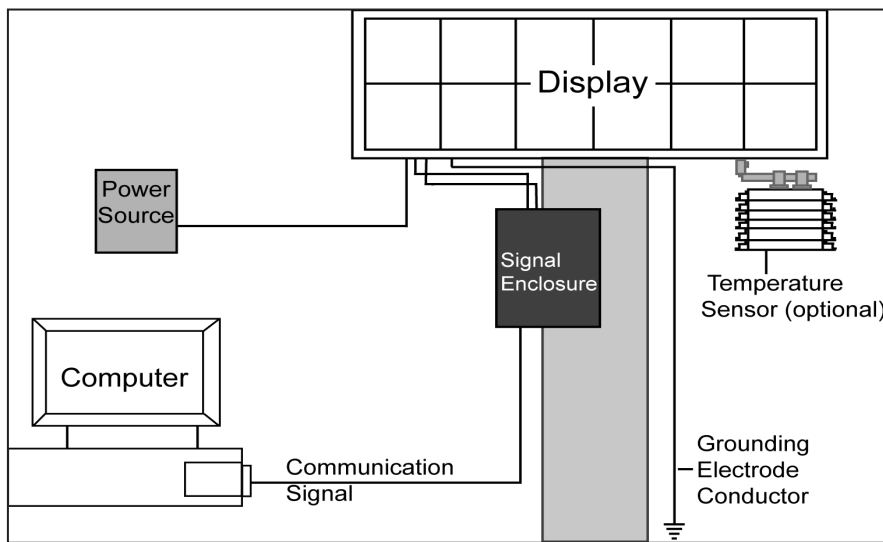


Figure 1: Basic Display Set-up

2 Mechanical Installation

Daktronics engineering staff must approve any changes made to the display. Before altering the display, submit detailed drawings for the proposed modifications to the Daktronics engineering staff for evaluation and approval, or the warranty will be void.

Daktronics is not responsible for the integrity of the mounting structure or any mounting hardware not provided by Daktronics. It is the customer's responsibility to ensure a qualified structural engineer has approved the structure and any additional hardware.

Pre-installation Checklist

Verify the following before installation:

- The display is in good condition after shipping and uncrating.
- A straight and square mounting frame is provided for the display.
- Height variation in any 4' (1.2 m) horizontal section must not exceed $\frac{1}{4}$ " (6.3 mm).
- Adequate support is provided for the display so that the structure will not yield at any unsupported points after mounting.
- Leave 4" (10.2 cm) of unobstructed space above the display so the eyebolt can be removed.

Note: No clearance is required once the eyebolt is removed.

- Maintain clearance around the display to allow unobstructed air flow through the vents and fans and to allow access to internal components.
- Assure the display cabinet has no holes (accidental or intentional) that could allow water to enter the display.
- Check that all display modules are fully latched into the display cabinet.

Support Structure Requirements

Support structure design depends on the mounting methods, display size, and weight. The structure design is critical and should be done only by a qualified individual. It is the customer's responsibility to ensure that the structure and mounting hardware are adequate.

Daktronics is not responsible for the installations or the structural integrity of support structures done by others.

Mounting plans need to take into account the ventilation system and face-mounted light sensor. In general, the entire front of all displays needs to be completely unobstructed to allow for air flow and internal access. Displays contain fans that pull air in from the lower vents and exhaust it out adjacent vents.

Keep in mind the location of mounting clips and the clearance needed for the power and signal terminations on the back of the display. Display height and wind loading are also critical factors to be considered.

Display Lifting

The top of the display is equipped with $\frac{1}{2}$ " eyebolts for lifting the display. Lift the display using a lifting bar. Use every eyebolt, and maintain a 90° lifting angle as shown in **Figure 2** to prevent eyebolt failure.

The eyebolts are designed to carry only the weight of the display cabinet. Do not lift the mounting structure or other additional weight. Do not permanently support the display with the eyebolts.

Note: Leave 4" (10 cm) of unobstructed space above the display so the eyebolt can be removed. No clearance is required once the eyebolt is removed.

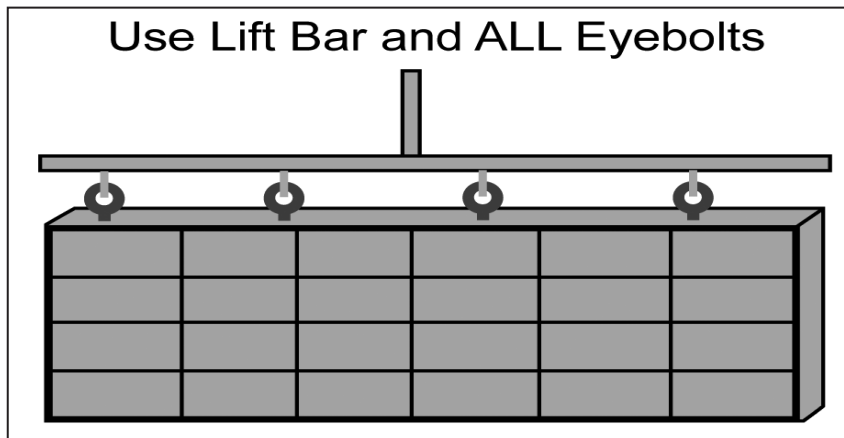


Figure 2: Correct Lifting Procedures

Display Mounting

Securely mount each display to a suitable mounting structure provided by others. Daktronics attached clip angles to the display for mounting. Use all clip angles when mounting the display.

Use appropriate hardware to support the weight of the display. Have a qualified engineer inspect the mounting structure.

Note: Daktronics is not responsible for mounting methods or the structural integrity of support structures provided by others.

After installing the display, inspect the top and sides of the display for any openings that may allow moisture to enter the display. Seal openings with silicone or another waterproof sealant. Not sealing openings may void the warranty.

3 Power Installation

Only qualified individuals should terminate power and signal cable within this Daktronics display.

Daktronics engineering staff must approve any changes made to the display. Before altering the display, submit detailed drawings for the proposed modifications to the Daktronics engineering staff for evaluation and approval, or the warranty will be void.

Note: Daktronics recommends that a separate circuit be run to the electronic display(s) to isolate it and prevent any issues that could be caused by line voltage fluctuations or high frequency noise on the power line caused by other types of equipment. A separate circuit also makes display maintenance and troubleshooting easier. Daktronics assumes no liability for any issues caused by line voltage fluctuations or other improper power conditions if these recommendations are not followed.

Conduit

Daktronics does not include conduit with the display. Separate conduit must be used to route the following:

- Power
- Signal IN wires
- Signal OUT wires (if signal is required for another display)

For power, displays are provided with either a J-box or a $\frac{3}{4}$ " conduit access hole located near the lower right on the back of the display.

Overview of Power/Signal Connection

1. Power to the display will be terminated externally in most cases. The **Power Connection (p.6)** section shows external wiring examples.
2. Possible methods for signal termination are shown in the various communication manuals.
3. Power is routed to the display through a fused disconnect switch capable of opening all ungrounded power conductors. Install the disconnect within the line of sight of any personnel performing maintenance on the display, unless it can be locked in the open position.

Note: Displays are equipped with circuit breakers that carry a **UL489** or **UL1077 (IEC 60947, VDE 660)** rating. These devices are intended only to protect the components within the display.

4. Power conductors from the disconnect to the display should be routed through conduit following local code specifications.
5. Display power will terminate either to the J-box or internally at the power termination panel.

6. Connect the grounding conductor to the grounding lug on the back of the display.
7. Signal cable is routed to the signal termination enclosure. Ground the enclosure to an isolated earth ground connector (when required).
8. Signal into the enclosure must be routed through conduit. The knockouts on the enclosure require the use of $\frac{3}{4}$ " conduit.

Power Requirements

Install this display in accordance with any applicable local and national electrical codes. This includes proper grounding and bonding of the display.

Do not connect the displays to any voltage other than that listed on the Daktronics product label.

Note: Conductors of circuits delivering power to a Daktronics display shall be sized in accordance with local and national electrical codes so that the power distribution system is capable of delivering full load power to the display while maintaining a voltage within five percent of the nominal utility voltage.

Displays use single-phase power. Proper power installation is imperative for display operation. Daktronics requires using a power disconnect switch with the display. Use a disconnect so that all ungrounded conductors can be disconnected near the point of power connection.

The disconnecting means must be either located in a direct line of sight from the display or capable of being locked in the open position. This ensures that power will not be reconnected while service personnel work on the display.

Grounding

All components of a display system—including but not limited to displays, control equipment, and connected peripheral equipment—must be electrically grounded. Only qualified individuals may perform electrical work, including verification of ground resistance. Daktronics is not responsible for improper grounding or damage incurred as a result of improper grounding.

Grounding methods must meet the provisions of all applicable local and national codes. Inspect and verify all grounding methods meet the provisions of all applicable local and national codes.

Proper grounding is necessary for reliable equipment operation and general electrical safety. Failure to properly ground the display system may void the warranty, disrupt operation, damage equipment, and cause bodily harm or death.

Power Connection

Power is most often terminated externally to the J-box on displays. However, larger displays require power to be terminated internally in the Power Termination Panel.

External Power Termination

Terminating hot, neutral, and ground wires at the J-box:

1. Route the power cable through conduit to the rear of the display and into the power termination J-box.
2. The J-box will contain two or three wires plus a ground coming from the interior of the display. These wires are pre-terminated to the power termination panel inside the display.
3. Inside the external J-box, connect the power wires to the wires coming from the display interior using wire nuts. Refer to **Figure 3** for 120 VAC and **Figure 4** for 120/240 VAC.

Note: The following colors are used for the pre-terminated wires.

120 VAC	120/240 VAC
Line 1 — Black	Line 1 — Black
	Line 2 — Red
Neutral — White	Neutral — White
Ground — Green/Yellow	Ground — Green/Yellow

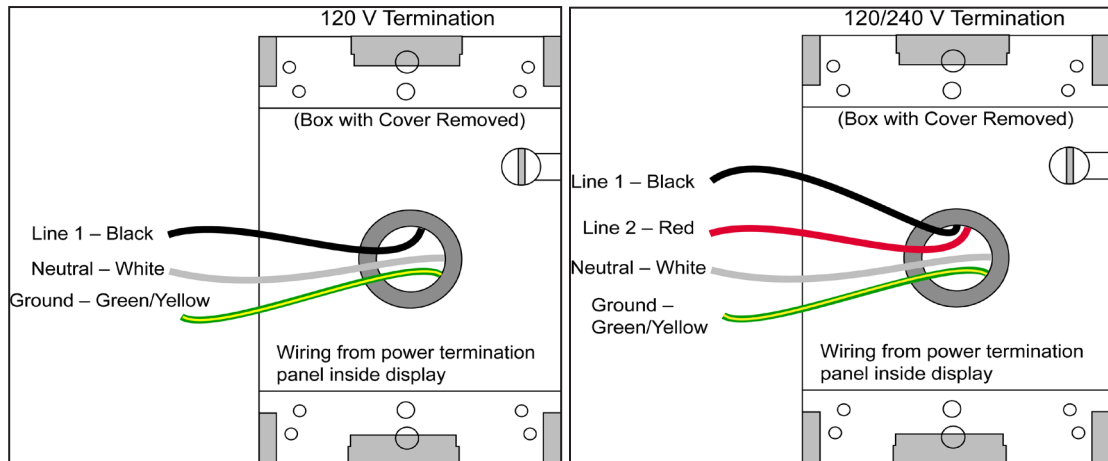


Figure 3: 120 V J-box Termination

Figure 4: 120/240 V J-Box Termination

Internal Power Termination

Terminating single-phase power to the internal power termination panel:

1. Open the display as explained in the **Accessing the Internal Components (p.11)** section and locate the power termination panel.
2. Route the cable through conduit to the back of the display. Use the $\frac{3}{4}$ " knockout for access, being careful not to damage internal components.
3. Connect the neutral wire to the neutral lug and the live wires to the Line 1 and Line 2 lugs.
4. The ground wire connects to the grounding bus bar. Refer to **Figure 5** for an example.

Power Routing in the Display

A general power routing, as shown in **Figure 6**, can be summarized as follows:

1. Power terminates internally to the power termination panel (either directly or via the rear-mounted J-box).
2. Power routes through the circuit breaker(s) in the power termination panel.
3. Power is routed through filters to the power supplies which provide power to the modules.
4. Power travels through the transformer which steps down power to the appropriate voltage for the controller (or MLC in a sectional display).
5. Power is also routed through a filter to the thermostat and the fans. The fans are activated by either the relay or thermostat.

Note: Power supplies are set to the proper voltage by the modules.

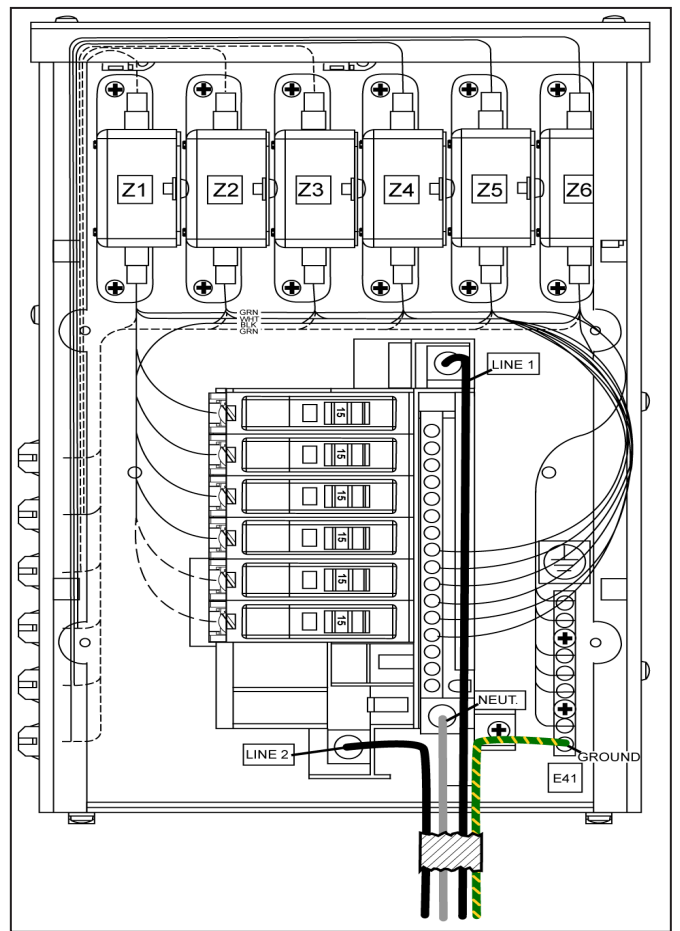


Figure 5: Single-phase 6-breaker Domestic Panel

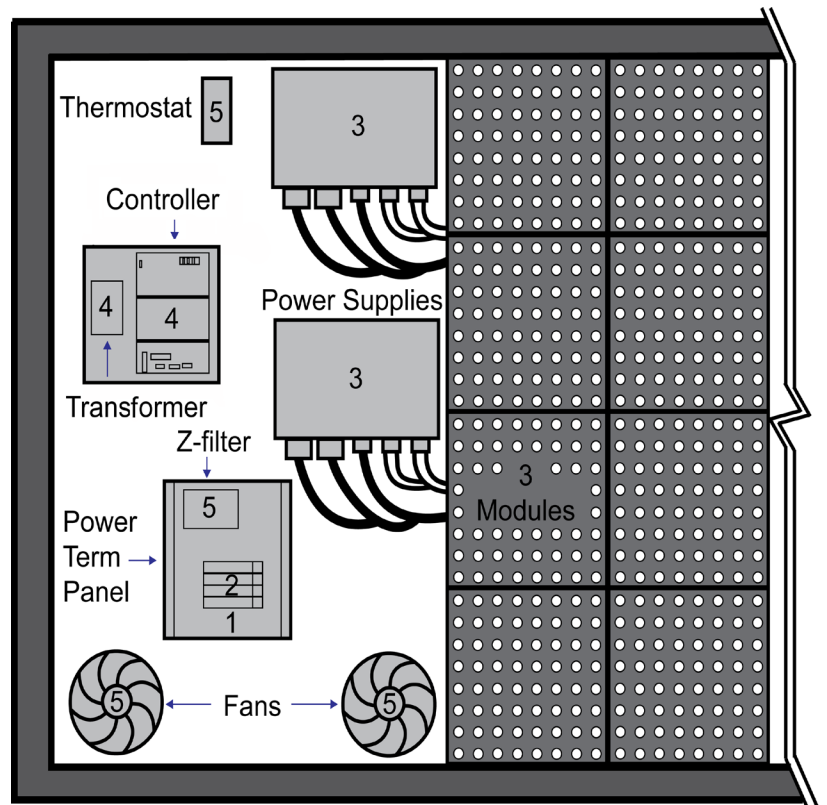


Figure 6: Power Flow Summary

Power Installation

Signal Termination from Computer to Display

Ethernet

An Ethernet network system requires a Cat-5 cable. Signal travels from the Local Area Network (LAN) to the Ethernet jack (J4) on the controller.

The signal cable terminates within the display at the controller. The opposite end terminates at the control computer.

Ethernet Surge Card (J2)	Ethernet In (J4)
Pin 1 (TX+)	Pin 1 (TX+)
Pin 2 (TX-)	Pin 2 (TX-)
Pin 3 (RX+)	Pin 3 (RX+)
Pin 4 (+VDC)	Pin 4 (CHGND)
Pin 5 (+VDC)	Pin 5 (CHGND)
Pin 6 (RX-)	Pin 6 (RX-)
Pin 7 (GND)	Pin 7 (CHGND)
Pin 8 (GND)	Pin 8 (CHGND)

Fiber-Optic Ethernet

A fiber-optic network requires a 4-fiber, fiber-optic cable. Two fibers are used, leaving the other two as spares. Either use direct burial or route the cable in conduit. Do not subject fiber-optic cable to mechanical flexing.

If the media converter is installed in the sign, the signal cable terminates at the fiber signal converter located either in an external signal enclosure or within the display.

4 Start-up Procedure

Start-up Checklist

Note: Before starting up the display, review this checklist to ensure that all parts are ready to operate correctly.

- Confirm that power is correctly connected to the display.
- Allow for sufficient power.
- Assure a main disconnect switch is used to control power.
- Inspect all circuit breakers (internal and external) for sufficient marking and size.
- Confirm that adequate grounding is installed. Each display face must have a separate earth-ground conductor.
- Assure the external communication equipment (signal enclosure, client radio, etc.) is properly installed.
- Inspect signal connections at the control computer.
- Inspect signal connections at the display and between displays when necessary.

Post Installation Checklist

Verify the following after starting the display:

- Ensure all ventilation fans are fully operational.
- Inspect all intake and exhaust vents for obstruction.
- Confirm proper communications from the control computer to the display(s).

5 Maintenance

Getting Started

1. Turn off the breaker before performing any repair or maintenance work on the displays. Disconnect power to the display if performing repair or maintenance.
2. Only qualified service personnel should access internal display electronics.
3. Daktronics engineering staff must approve any changes to the displays. If making modifications to the displays, submit detailed drawings to the Daktronics engineering staff for evaluation and approval or the warranty will be void.
4. VL-35X0 series displays are front accessible, meaning that access to the internal components is gained by removing the front modules of the display. **Figure 7** shows the approximate location of internal components.

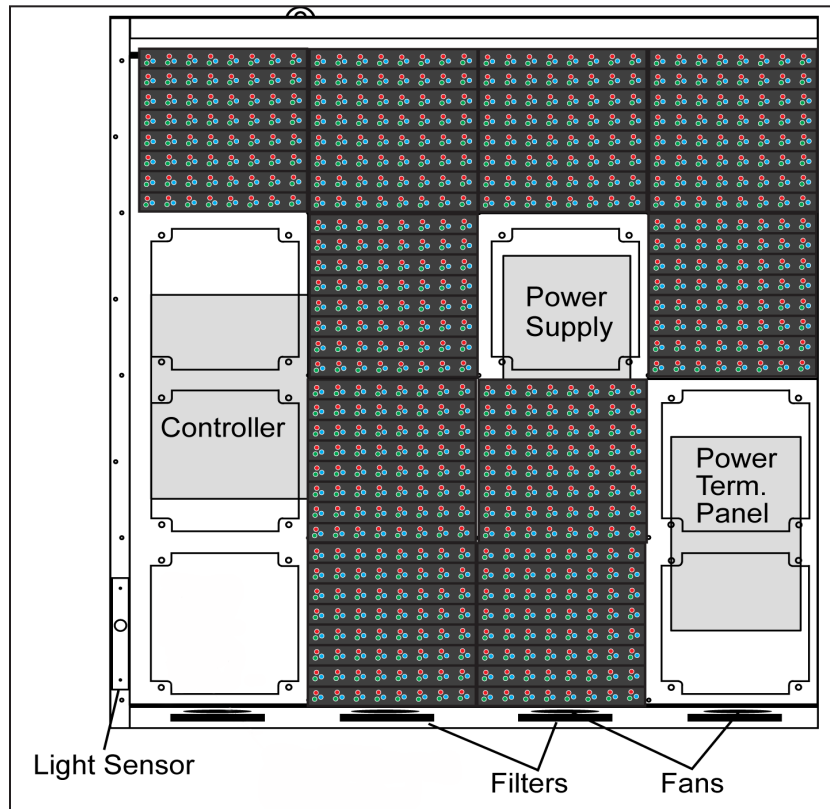


Figure 7: Internal Components

Accessing the Internal Components

Access the internal components by removing the front modules. The display may need to be opened to perform maintenance or for troubleshooting.

To access the interior of the display, perform the following steps:

1. Disconnect power to the display.
2. Locate the latch access fasteners on the module as shown in **Figure 8**. One is centered near the top and one is centered near the bottom.

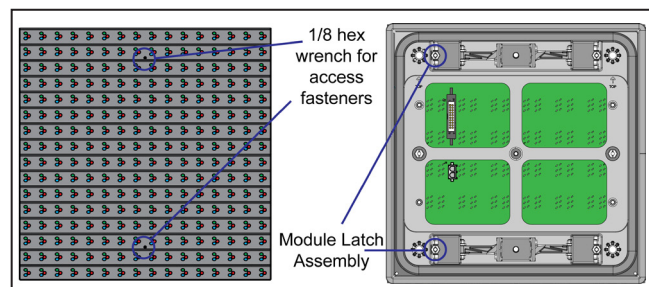


Figure 8: Module Latch Locations

3. With a $\frac{1}{8}$ " hex wrench, turn the latch access fasteners a quarter turn counter-clockwise. Gently pull the module far enough forward to reach behind the back and disconnect the power and ribbon cables.
4. Disconnect the two ribbon cables from the module by spreading the tabs on the sides and then lifting the cable head from the jack. Note the cable connections so they can later be reconnected correctly.
5. Unplug the power cables by squeezing the tabs on the sides of the plug head and pulling out.
6. When ready to reinstall the module, reconnect the cables to the module, making sure that the tabs are tightly pushed against the cable head. Carefully push the ribbon wires back into the cabinet so they are clear of the module edges.
7. Place the module into its proper location, checking that the weather stripping is in place. Latch the module at both the top and bottom locations by turning the hex wrench clockwise a quarter turn.

Note: The weather-stripping on the back edge of the module must be intact and in good condition to prevent water from entering the display.

The module latches must be fully engaged to create a watertight seal around the edge of the module. The module should be firmly seated against the display when the latches are fully engaged.

Ventilation System/Fans

VL-35X0 series displays are equipped with ventilation systems to help keep the internal electrical components at operable temperatures. Intake fans bring air into the display through vents situated on the bottom front. Exhaust then leaves the display through adjacent vents along the bottom front. **Figure 9** provides an example of the display's airflow.

Note: The air vents are located behind a false face and cannot be readily seen.

There is also a smaller fan located on the display controller enclosure cover which should always be running.

Frequency of Inspection

Fans should be checked every time the display is opened or at a minimum of once every three months. Check more often if the display is located in a dusty or harsh environment, such as along a gravel road.

The frequency of inspection will vary greatly from display to display as no two display setups are exactly the same. Therefore, Daktronics advises users and service technicians to use their own discretion when establishing an inspection schedule.

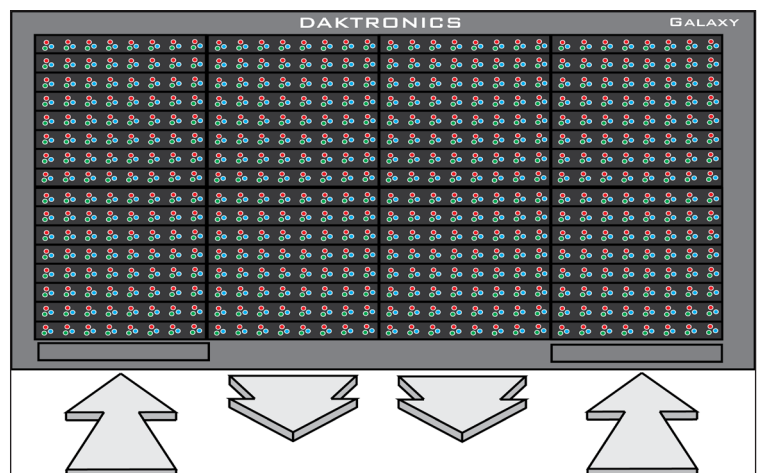


Figure 9: Ventilation Airflow

Fan Blades

Check the fan blades for dirt and debris, cleaning them and the inside of the display if necessary to maintain fan efficiency and to ensure proper cooling. Spin the fan blades with a pen or pencil to ensure that the bearings are free and that the fan is in balance.

Filters

Below each intake fan is a filter tray. Each time the fans are inspected, the filters must also be inspected; cleaning or replacing them when necessary.

To access the filter(s), press upward firmly on the tab located on the bottom front of the tray and pull outward.

The filters may be cleaned with water or compressed air (no greater than 60 psi and at least 6" away) blown through the filter in the opposite direction from which air normally flows. Allow filters to dry before returning them to their trays. Again, Daktronics encourages users and service technicians to use their own discretion when deciding whether to clean or replace the filters.

Note: Air is drawn upward through the filter. Be sure to check the bottom of the filter as this will be the side that requires cleaning.

Air Flow

Once the display's internal components reach a certain temperature, the fans are activated. If the fans are not operating, they may be checked by bypassing the temperature controls. To check the operation of the fans, open the display to expose the thermostat. Push and hold the bypass button on the thermostat to temporarily turn on the fans. If a fan does not rotate or does not operate smoothly, replace it.

Make sure that the intake vents and exhaust vents on the bottom front of the display are not blocked and are free of dust or other debris. Hold a piece of lightweight paper in front of the bottom edge (under the filter trays) of the display to detect air movement through the vents.

Note: When mounting the display, the entire front of the display must be exposed to allow for proper ventilation. Aesthetic shrouding (common in monument installations) is not advised.

Display Face Cleaning

Wet Cleaning Process

1. Turn off the power to the display.
2. Mix a mild, non-abrasive, non-petroleum-based detergent and cold water, one ounce of detergent to one gallon of cold water.
3. Saturate a light/medium duty cleaning brush with the soapy water.
4. Use horizontal brush strokes to loosen and remove dirt and grime, washing the display from top to bottom.

Note: Use light pressure so as not to damage the LEDs. Clean only an area that is safely within reach from a lift or stage, and then move on to the next section of modules.

5. Rinse the display face with generous amounts of cold water under low pressure. A spot-free rinse agent can be used to reduce water spots.
6. Use soft, dry terrycloth to dry and remove any excess water. Take care not to damage LEDs by catching the cloth on them.
7. Allow the display to completely air-dry for 12 hours before applying power to the display.

Dry Cleaning Process

1. Turn off power to the display.
2. Rub a dry, soft terrycloth towel horizontally across each row of LEDs.
3. Make four passes per row of LEDs before moving to the next row of LEDs. Work from top to bottom safely within reach from a lift or a stage. Take care not to damage LEDs or the plastic louvers by catching the cloth on them.

Annual Inspection

A yearly inspection of the display should be completed to maintain safe and dependable operation. The display will need to be opened to visually inspect the cabinet interior and the components. Refer to the **Accessing the Internal Components (p.11)** section for directions to access the interior.

- Tighten or replace any loose fasteners.
- Vacuum or carefully wipe away dust and debris around the fans and inside the cabinet.
- Check for water intrusion or stains and replace weather stripping, tighten module latches, place silicone sealant around areas where water might enter, and replace damaged electronic components as necessary.
- Check the paint for cracking and peeling and touch up with rust resistant enamel as necessary.
- Inspect the footings, tie points, and ground rods for corrosion and make sure the structural integrity and grounding connections are intact.

A log is provided after the glossary to track maintenance and help determine a maintenance schedule specific to the individual display.

6 Diagnostics and Troubleshooting

Note: Disconnect power when servicing the display. Only qualified service personnel should service internal electronic components.

Controller Diagnostics

The controller is the brains of the display, receiving communication from the computer and then sending information to the modules. The controller is located in the lower left area of displays as shown in **Figure 7**. LEDs on the controller show whether the power and communication signal are working properly.

To access the interior of the display, refer to the **Accessing the Internal Components (p.11)** section for instructions and illustrations. Remember to disconnect power to the display before accessing the interior. However, once the modules are removed and wires are found to be safe, power can be turned back on to view the diagnostic LEDs.

A controller is illustrated in **Figure 10** with essential diagnostic LEDs labeled:

- The DS2 RX1 LED displays the controller's receiving status. This LED will flash only when receiving information from the control computer.
- The DS3 TX1 LED signals the controller's transmission status. This LED will flash only when transmitting information to the modules.
- The RST DS3 LED signals the controller's reset status.
- The RUN DS4 LED signifies the controller's operational status. This LED will flash at a rate of about once per second to indicate that the controller is functioning properly.
- The LNK DS6 LED signals the controller's linking status.

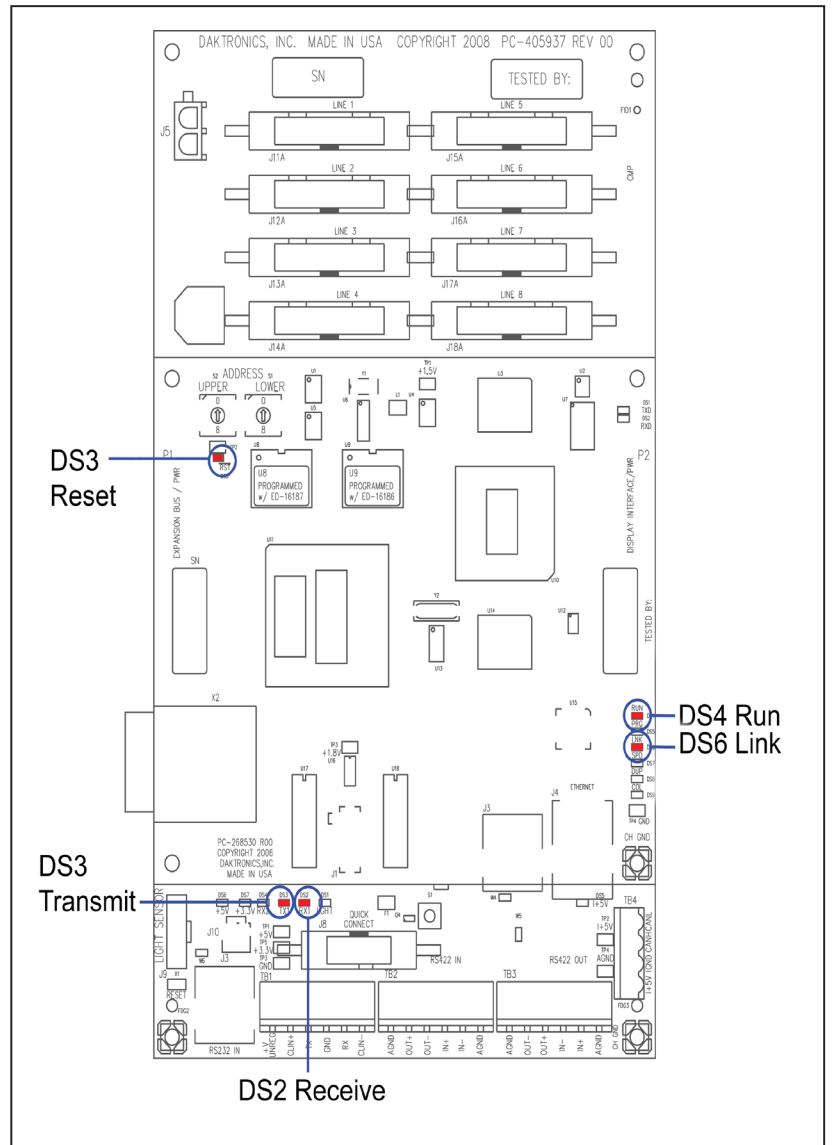


Figure 10: Controller Diagnostics

MLC (Optional)

The Multi-Line Controller (MLC) unit contains four red diagnostic LEDs. When properly connected to the primary display, the LED labeled DS23 (left side) will be off and the other LEDs will be on, as shown in **Figure 11**.

Troubleshooting Display Problems

This section contains some symptoms that may be encountered with the displays. This list does not include every possible symptom or solution but does represent common situations and simple steps to resolve them.

Troubleshooting may require removal and replacement of modules. Refer to the **Accessing the Internal Components (p.11)** section for more information. When replacing modules, make sure that the power and signal cables are reconnected correctly and the latches are tightly closed.

Before Calling for Help

Steps to take before calling Daktronics Customer Service:

1. Check the **Diagnostics and Troubleshooting (p.15)** section of this manual.
2. Call the service technician or Daktronics Customer Service at 800-833-3157.

Note: Sitting at the control computer while talking with the service technician will allow more efficient service.

Common Misconception

Blank display seen after boot-up.

A blank display is normal after the boot-up procedure. The display is then waiting for a message to be sent.

Module and LED problems

One or more LEDs are not lighting.

- Check/replace the ribbon cables on the module.
- If that does not help, the module may need to be replaced.

One or more LEDs on a single module will not turn off. **Figure 12: Modules Not Working**

- Check/replace the ribbon cables on the module.
- If that does not help, the module may need to be replaced.

A section of the display is not working.

- Check/replace ribbon cables from the last working module in the row to the first non-working module next to it. Refer to **Figure 12** for an example.
- Check the back of the modules to see that the power LEDs are on.
- Make sure the power cable to the module is connected.

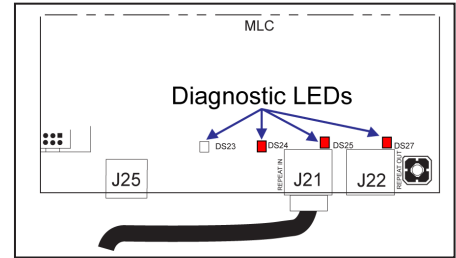


Figure 11: MLC Diagnostics

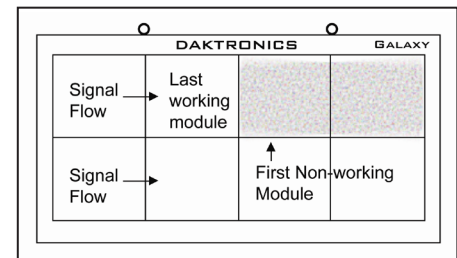


Figure 12: Modules Not Working

- Move or replace the first non-working module with the one on the left of the non-working section.
- Move or replace the first module to the left of the non-working modules.
- Check the translation table is correct.

One row of modules is not working or shows a distorted message.

- Check/replace the ribbon cables to and from the first non-working module.
- Check for bent pins on the jack going to a non-working module.
- Move or replace the modules that show distorted text.
- Move or replace the first module to the left of the non-working module.

A column of the display does not work.

- Check that the power cable is plugged into the first module in the column.
- While power is on, look at the back of the malfunctioning module(s) to see if the diagnostic LED is off, implying a power supply problem.
- Verify power to the power supply.

Entire display fails to work.

- Check the breakers in the building connected to main power source.
- Check the breakers in the power termination panel.
- Check the diagnostic LEDs on the controller for Power and Run. Refer to the **Controller Diagnostics (p.15)** section for more information.
- Check/replace the ribbon cable from the controller to the modules.
- Verify proper use of the software by checking the software manual.
- Check the translation table is correct.

Brightness problems

Display is stuck on bright or dim.

- Check the light sensor cable and wiring for secure connections.
- Check the light sensor lens for obstructions (lower left edge, front of cabinet).
- Replace the light sensor assembly.

Display is too bright at night.

Set the Dimming Schedule.

7 Parts Replacement

Module Replacement

If LEDs have failed, do not attempt to replace individual LEDs. Return a failed module to Daktronics for replacement and/or repair.

Each module can be removed separately without moving other components of the display.

1. Turn off power to the display.
2. Follow the instructions in the **Accessing the Internal Components (p.11)** section to release the module from the display cabinet.
3. Disconnect the two ribbon cables from the module, noting how they are connected to the back. Release ribbon cables by spreading the tabs on the sides and then lifting the cable head from the jack.
4. Unplug the power cables by squeezing the tabs on the sides of the plug head and pulling out.
5. Connect all three cables to the new module, making sure that the ribbon cable tabs are tightly pushed against the cable head. Carefully push the ribbon wires back into the cabinet so they are clear of the module edges.
6. Place the module into its proper location, checking that the weather stripping is in place. Latch the module tightly both top and bottom by turning the hex wrench a quarter turn clockwise.

Note: The weather-stripping on the back edge of the module must be in good condition and returned to its proper position in order to prevent water from entering the display.

The module latches must be fully engaged to create a watertight seal around the edge of the module. The module should be firmly seated against the display when the latches are fully engaged.

MLC Replacement (Optional)

Tools required: $\frac{1}{8}$ " hex wrench, $\frac{5}{16}$ " nut driver, and flathead screwdriver

The Multi-Line Controller (MLC) receives signal from the primary controller and distributes it to the modules. Ribbon cables run from the module connectors on the MLC to the first modules in each row via ribbon cables. The power supply nearest the MLC will provide its power via a transformer in the enclosure with the MLC.

1. Turn off power to the display.
2. Remove the module directly in front of the MLC. Refer to **Figure 7** for the approximate location.
3. Disconnect the input cables.
4. Remove all ribbon cables, labeling the module number as they are removed to ensure proper replacement.
5. Remove the six nuts holding the board in place using a $\frac{5}{16}$ " nut driver.
6. To install the new MLC, move the unit into place and replace the six nuts holding it to the display back. Reconnect input and ribbon cables. Turn on power, observing the boot-up sequence. Note that the LEDs to the right of the fiber jacks are on; DS23 to the left of the fiber cable should be off. Refer to **Figure 11** and **Figure 13** for more information.

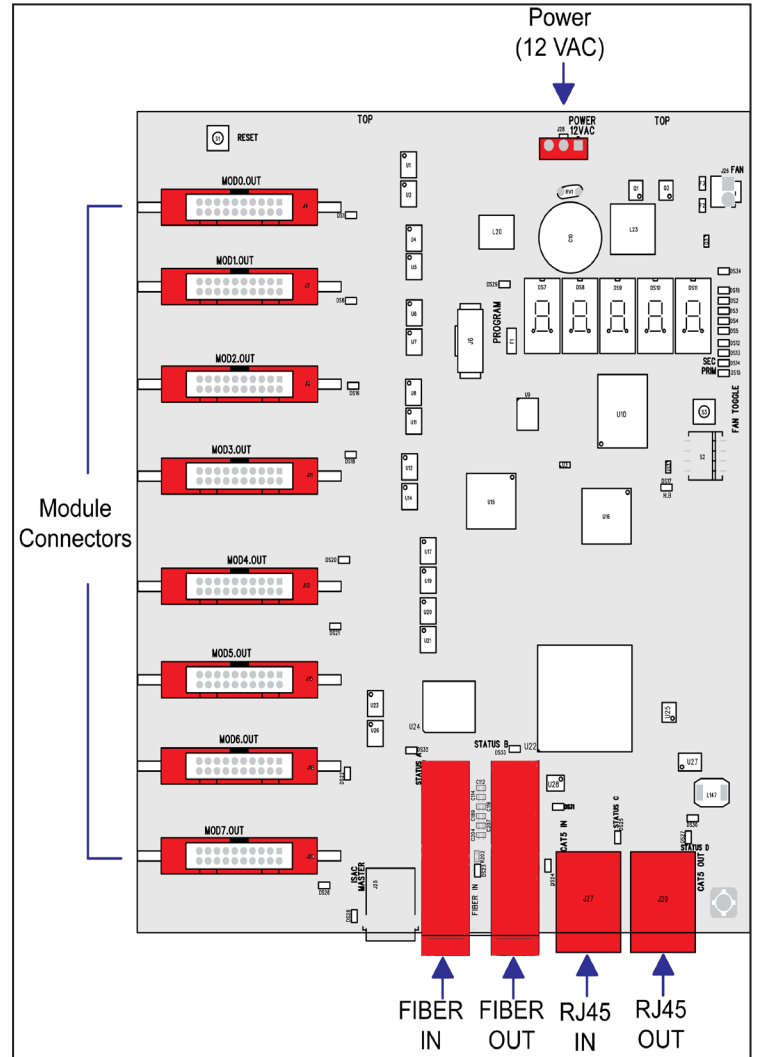


Figure 13: Multi-Line Controller (MLC)

Controller Replacement

Complete the following steps to replace a controller in the display:

1. Turn off power to the display.
2. Remove the module directly in front of the controller in the lower left area of the display. Refer to **Figure 7** for the location.
3. Loosen screws and remove the cover in front of the controller.
4. Disconnect the power input.
5. Remove all power and signal connections from the board. Label the cables as they are removed to ensure proper replacement.
6. Remove the six nuts holding the board in place using a $5/16$ " nut driver.
7. Take note of the rotary address on the controller to ensure the address on the replacement board is the same (see **Figure 14** and **Figure 15**).
8. To install the new controller, replace the six nuts holding it to the display back. Reconnect power and signal cables. Turn on power, observing the boot-up sequence, and then note that the pixel in the lower right corner shows power.

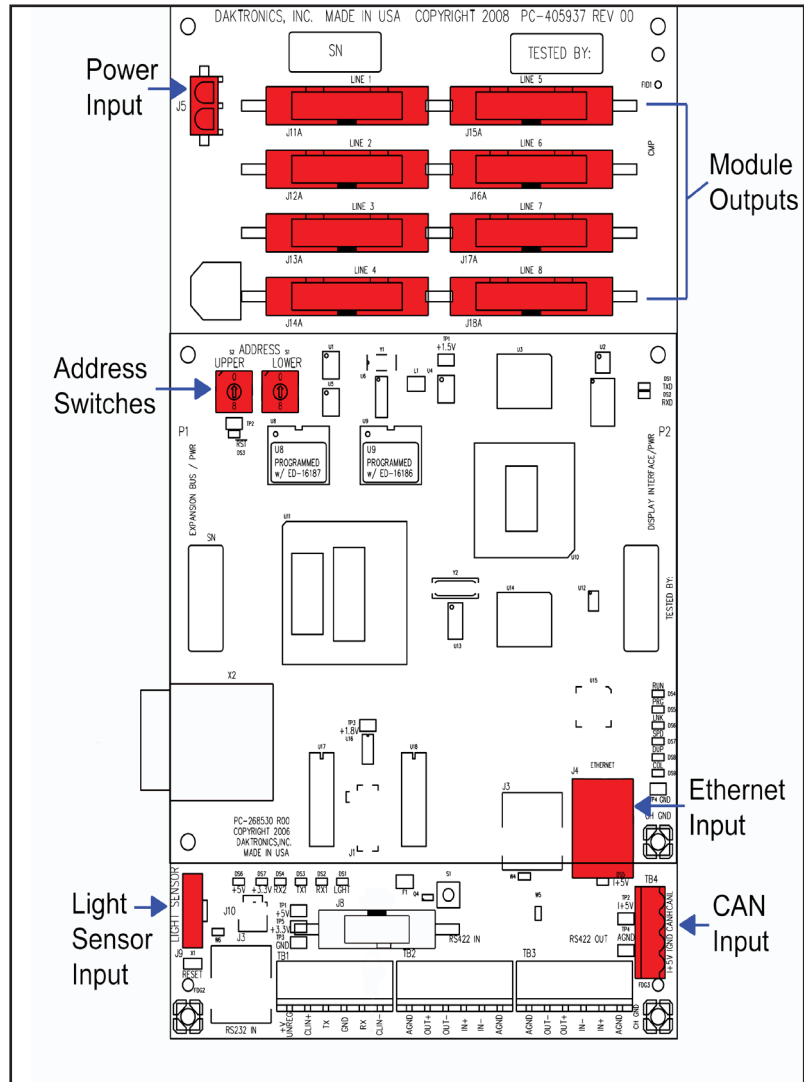


Figure 14: Display Controller

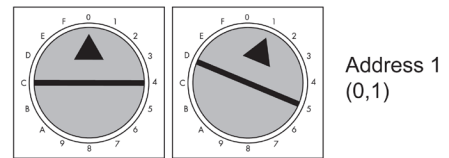


Figure 15: Rotary Address Switches

Controller Address Setting

The rotary switches set the hardware address which the software uses to identify each particular display. Each controller in a network needs a unique address.

To set the rotary address switches, rotate them until the arrow points to the desired number. The display's power must be turned off and then turned back on to activate the test mode or to change an address.

Note: Setting both rotary switches to address 0 will activate Test Mode. Turn the display's power off and back on to activate testing.

After testing, reset the rotary switches to an address other than 0/0 and repower the controller (the software will not recognize an address of 0).

Power Supply Replacement

VL-35X0 Series displays use 135-watt power supplies. Each module is connected to a wire harness on the power supply by a Mate-n-Lok® cable. Refer to **Figure 16** for an example.

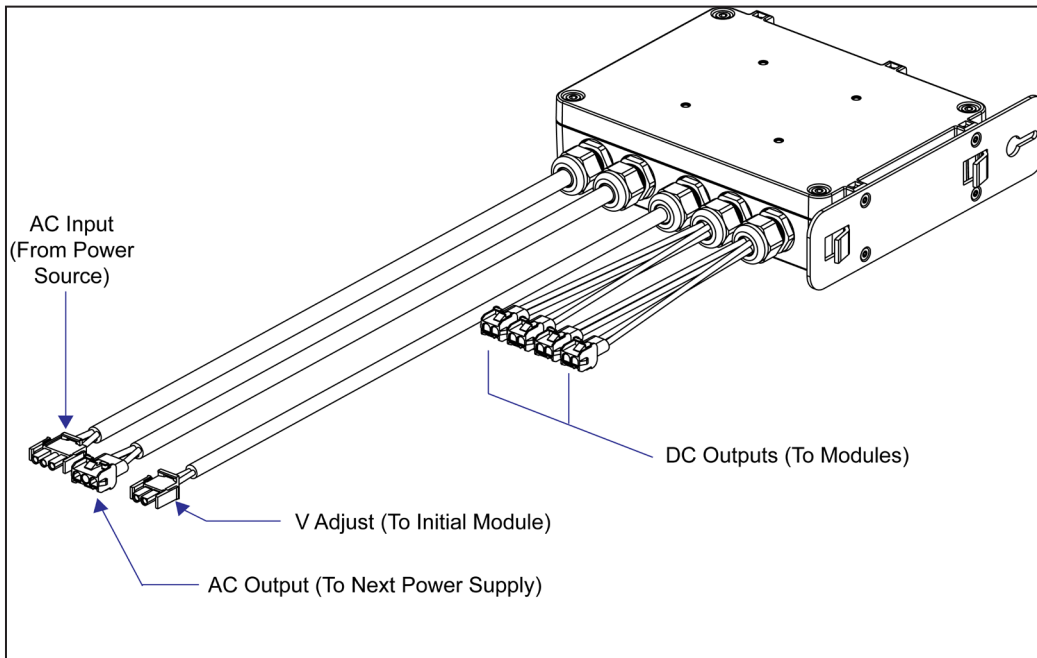


Figure 16: Power Supply

Complete the following steps to replace a power supply:

1. Turn off power to the display.
2. Remove the module directly in front of the appropriate power supply.
3. Disconnect the Mate-n-Lok® connectors from the power source as well as those going to the modules. Be sure to label each connector so that it can be properly reconnected.
4. Loosen the screw holding the power supply bracket to the cabinet upright and lift it off the hooks.
5. Carefully pull the power supply out of the cabinet.

6. Move the new power supply into place and tighten the screw on the support bracket.
7. Reconnect all the Mate-n-Lok® plugs so that each module will receive power.

Light Sensor Replacement

Tools required: $\frac{3}{16}$ " nut driver, $\frac{1}{8}$ " flat screwdriver, Phillips screwdriver

The light sensor assembly is mounted inside the bottom left edge of the cabinet. Refer to **Figure 7** for location.

If the light sensor fails, only the circuit board needs to be replaced. Remove the bottom left module on the display to access the light sensor. To replace a light sensor circuit board as shown in **Figure 17**, follow these steps:

1. Remove the screws that hold the light sensor to the cabinet.
2. Remove the #4-40 nuts securing the circuit board to the plate.
3. Remove the standoffs and attachment screws from the board.
4. Disconnect the four electrical wires on the sensor by unscrewing each screw that holds a wire in place. Note the order the wires are connected so they can be reconnected in the same locations on the replacement.
5. The light sensor plug on the controller does not need to be detached.
6. Reattach the new circuit board, following these steps in reverse.

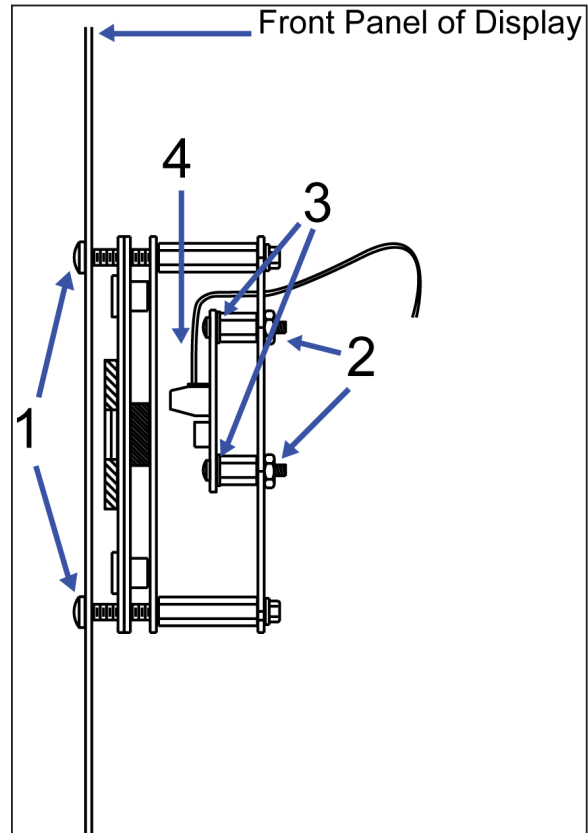


Figure 17: Light Sensor Assembly

Note: Align the new circuit board so that the lens lines up with the $\frac{1}{2}$ " circular opening in the bottom left edge of the display when the assembly is in place.

Auxiliary Control Panel (Optional)

The auxiliary control panel (ACP) complements the controller by providing a secondary control interface panel at the DMS site. The ACP allows a maintenance technician to perform diagnostics while working in one location without having to access the controller in another location. This improves safety and reduces maintenance time.

To replace the auxiliary control panel:

1. Turn off the power switch on the ACP face.
2. Label and remove all connections from the ACP.
3. Remove the screws securing the ACP to the inside of the display or equipment cabinet.

4. Remove the ACP.
5. Perform the needed maintenance.
6. When the ACP is ready for installation, slide it back into place.
7. Hold the ACP in place and install the mounting screws.
8. Reconnect all the connections removed from the ACP.
9. Secure any retaining screws and prepare the ACP for operation.

Fans and Filters

For preventative maintenance, perform the following:

- Check the fan blades for dirt and debris. Clean the fan blades to maintain the fan's efficiency and to ensure proper cooling. If the fan blades have a large accumulation of dirt and debris, change the filters more often.
- Spin the fan blades with a pen or pencil to ensure the bearings are free and the fan is balanced.
- Check the filters every year. Clean the filters with water and a mild detergent, such as dish soap.
- Compressed air can be used to clean the filter provided the nozzle is held at least 6" away from the filter, the pressure is no greater than 60 psi, and the air is blown through the filter opposite the airflow direction as indicated by the arrow stamped on the filter frame.

Fan Replacement

Note: Before removing the fan, take note of the orientation of the arrows on the side of the fan housing.

1. Disconnect the power cord from fan.
2. Unlock the fan/finger guard assembly by pushing down on the assembly and twisting counterclockwise. The leg on the finger guard will snap out of place.
3. Remove the fan assembly from the obround slot.
4. Detach the finger guard to the fan.

To replace the ventilation intake fan, follow the previous steps in reverse order. Ensure the fan is properly oriented.

Filter Replacement

To install a new filter:

1. Locate the plastic filter trays on the bottom of the display.
2. Press upward firmly on the tab located on the bottom front of the filter tray.
3. Pull the tray outward.
4. Remove the filter from the tray.

Replace the filter and slide the tray back into the display until the tab clicks in place.

Communication Accessories (Optional)

Ethernet Surge Card

An Ethernet surge card is an inline device that filters the Ethernet data line. It suppresses surges down to a low voltage in order to protect the display controller's Ethernet input. If a surge card is included with the display, it is located in the interior of the display. Refer to **Figure 18**.

To replace a surge card:

1. Disconnect the input and output signal connections.
2. Carefully remove the four screws holding the surge card in place using a $\frac{5}{16}$ " nut driver.
3. Install the new surge card and reconnect the signal cables.

Fiber/Ethernet Media Converter

The fiber media converter is located in the interior of the display or in an external signal enclosure. Complete the following steps to replace a media converter:

1. Disconnect the power and signal connections, referring to **Figure 19** for connector locations.
2. Remove the three corner nuts holding the fiber media converter.
3. Install the new fiber media converter.
4. Reconnect power and signal cables.

The fiber media converter contains the following input and output jacks:

- The fiber transmit and receive jacks are marked by arrows showing their function. The fiber cable from the first media converter connects to these jacks.
- The input/output Ethernet signal to/from the display routes through the breakout board to an RJ45 jack.
- The DC power input from the display to the media converter routes through the breakout board and into the power jack labeled "12 VDC Input".

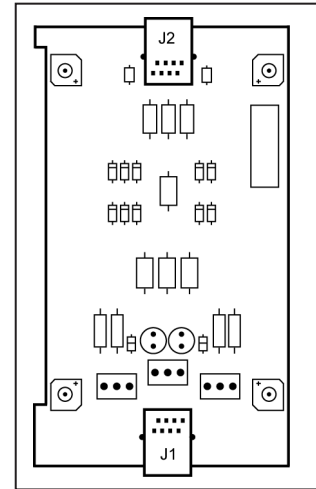


Figure 18: Ethernet Surge Card

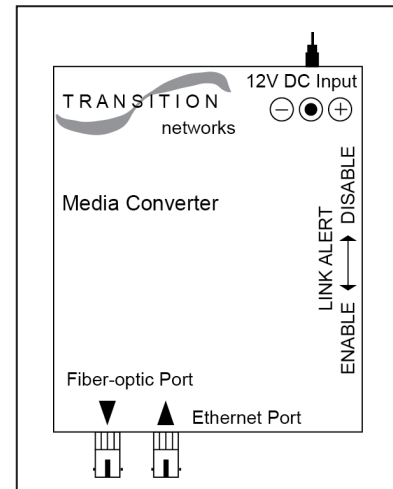


Figure 19: Fiber Media Converter

8 Exchange and Repair Programs

All parts in Daktronics displays are assigned a part number. Daktronics part numbers are commonly found on drawings. Those part numbers can be used when requesting replacement parts from Daktronics Customer Service. Take note of the following part number formats. (Not all possible formats are listed here.)

- “OP-____-____” denotes an individual circuit board.
- “OA-____-____” denotes an assembly. An assembly can be a single circuit board or a collection of components that function together, usually mounted on a single plate or in a single enclosure.
- “OZ-____-____” denotes an assembly.
- “PR-____-____” denotes a specially ordered part.

Most circuit boards and components within this display carry a label that lists the part number of the unit. If a circuit board or assembly is not listed in the replacement parts list, use the label to order a replacement. A typical label is shown in **Figure 20**. The part number is in bold.

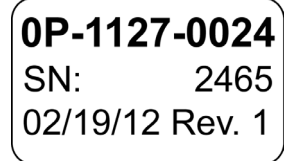


Figure 20: Typical Label

Daktronics Exchange and Repair & Return Programs

To serve customers' repair and maintenance needs, Daktronics offers both an Exchange Program and a Repair & Return Program.

Exchange Program

Daktronics offers a unique Exchange Program as a quick service for replacing key parts in need of repair. If a part requires repair or replacement, Daktronics sends the customer a replacement, and the customer sends the defective part to Daktronics. This decreases display downtime.

Before Contacting Daktronics

Identify these important part numbers:

- Display Serial Number:
- Display Model Number:
- Contract Number:
- Date Installed:
- Location of Display (Mile Marker Number):
- aktronics Customer ID Number:

To participate in the Exchange Program, follow these steps.

1. Call Daktronics Customer Service:

Market Description	Customer Service Number
Department of Transportation, mass transits, airports, parking facilities	800-833-3157

- 2. When the new exchange part is received, mail the old part to Daktronics.**

If the replacement part fixes the problem, send in the problem part which is being replaced.

 - a. Package the old part in the same shipping materials in which the replacement part arrived.
 - b. Fill out and attach the enclosed UPS shipping document.
 - c. Ship the part to Daktronics.
- 3. A charge is made for the replacement part immediately, unless a qualifying service agreement is in place.**

In most circumstances, the replacement parts are invoiced at the time they are shipped.
- 4. If the replacement part does not solve the problem, return the part within 30 working days or the full purchase price is charged.**

If, after the exchange is made the equipment is still defective, please contact customer service immediately. Daktronics expects immediate return of an exchange part if it does not solve the problem. The company also reserves the right to refuse parts that have been damaged due to acts of nature or causes other than normal wear and tear.

Repair & Return Program

For items not subject to exchange, Daktronics offers a Repair & Return Program. To send a part for repair, follow these steps:

- 1. Call or fax Daktronics Customer Service:**

Refer to the appropriate market number in the chart listed on the previous page.
Fax: 605-692-0145
- 2. Receive a case number before shipping.**

To receive a case number, contact a services coordinator via phone, email, or by creating a MySupport account on the Daktronics website. This expedites repair of the part.
- 3. Package and pad the item carefully to prevent damage during shipment.**

Electronic components, such as printed circuit boards, should be placed in an antistatic bag before boxing. Daktronics does not recommend using packing peanuts when shipping.
- 4. Enclose:**
 - your name
 - address
 - phone number
 - the case number
 - a clear description of symptoms

Shipping Address

Daktronics Customer Service
600 E 54th St N
RMA# _____
Sioux Falls, SD 57104

Email

transportationhelp@daktronics.com

Glossary

Cabinet: The metal frame of the display (back, sides, top, and bottom).

Column: Vertical line of pixels.

Controller: A component that controls data for the entire display. It is located behind the bottom-left module.

Display Address: Identification number assigned to each display in a network. It is set using the display's controller. The controller computer uses the address to differentiate between displays connected on the same network. Displays on the same network cannot have the same address.

Display Configuration: A display's model number, address, etc.

Ethernet: A local area network (LAN) protocol using a bus topology. The Ethernet network card uses the TCP/IP interface to communicate with the server via the LAN.

Ethernet Surge Card: An inline device that filters the Ethernet data line. It suppresses surges to a low voltage to protect the display controller's Ethernet input.

Face Panel: A latching door that hinges downward. The modules mount to the face panel.

Fiber Optic: Technology that uses light energy to transmit signal to displays via hair-thin optical fibers.

Fiber Media Converter: A hardware device that converts fiber media to Ethernet or vice versa.

LED (Light Emitting Diode): Low-energy, high-intensity lighting units. LED displays offer high resolution for distinct text. A cluster of LEDs form a pixel on the display.

Louver: Black plastic ledge positioned horizontally above each pixel row. The louvers block sunlight to increase the level of contrast on the display face.

Matrix: Area on a display that plays content, measured in rows and columns of pixels.

Module: A unit of the display that consists of LEDs, a display board, and a driver board. Modules are placed next to each other to form the matrix of the display. One driver board is located on the back of each module.

Multi-Line Controller: (MLC) receives signal from the controller and distributes it to the modules. Ribbon cables run from the module connectors on the MLC to the first modules in each row via ribbon cables. The power supply nearest the MLC will provide its power via a transformer in the enclosure with the MLC.

PCB: Printed Circuit Board.

Pixel: A group of LEDs that power on and off to form character and graphic content.

Pixel Pitch: The amount of space between the center of two pixels (20 mm). The pixel pitch is equidistant both vertically and horizontally.

Power Supply: Component that converts incoming alternating current (AC) power to direct current (DC) power, as required by several components within the display.

Row: Horizontal line of pixels.

RS232: Standard PC communication type with a maximum cable length of 25' (7.62 meters).

RS422: Standard differential communication type with a maximum cable length of 4,000' (1.2 kilometers).

RX LED: An LED on the signal converter that indicates the display is sending data back to the signal converter.

Serial Port: Connector on the back of the control computer. The serial port controls the display network through either a 9- or 25-pin serial connector.

Signal Converter: Component that converts data from RS232 to RS422 (wire converter) or from RS232 to light signals (fiber converter). The signal converter is used in RS422 or fiber systems.

Surge Suppressor: A device inserted in the signal line and to prevent damage to electronic equipment caused by voltage transients or spikes.

Translation Table: Custom memory map for the display.

TX LED: An LED on the signal converter that indicates the control computer is sending data to the display.

Vanguard® Software: Daktronics-designed, Windows®-based software that creates and edits messages on displays.

Maintenance Log

Inspection Item:	Date Performed						
General: Exterior Visual Inspection							
General: Interior Visual Inspection							
Modules: Weather Stripping							
Modules: Electrical Connections							
Modules: Latch Operation							
Ventilation System: Fans							
Ventilation System: Filters							
Hardware/Fasteners: Loose Bolts, nuts, screws, rivets, etc.							
Cabinet (Int. & Ext.): Paint cracking and peeling							
Cabinet (Int. & Ext.): Metal Corrosion							