





Copyright © 2018

All rights reserved. While every precaution has been taken in the preparation of this manual, the publisher assumes no responsibility for errors or omissions. No part of this book covered by the copyrights hereon may be reproduced or copied in any form or by any means—graphic, electronic, or mechanical, including photocopying, taping, or information storage and retrieval systems—without written permission of the publisher.

Daktronics trademarks are property of Daktronics, Inc. All other trademarks are property of their respective companies.

Table of Contents

1	Introduction1		Laptop Interface Enclosure (Option	nal)7
	How to Use This Manual1		Light	7
	DMS Overview1		Fold-Down Shelf	7
	Theory of Operation1		Outlets	7
	Vanguard® Software1	3	Mechanical Installation	8
	VFC-3000 Controller1		Lifting the Display	8
	Auxiliary Control Panel (Optional)2		Display Mounting	8
	Display Peripherals2		Traffic Cabinet Mounting	9
2	Components3		Ground Mounting	9
	Modules3		Pole Mounting	9
	Power Supply Groups3		LIE Mounting	9
	Power Supplies3	4	Electrical Installation	10
	Low Voltage Distribution Board3		Power Installation	10
	Service Control Panel4		Grounding	10
	CAN Distribution Board4		Power	10
	CAN I/O Board4		Bonding Screw	10
	DC / DC Converter Board5		Power Connections	10
	Panelboard5		Display Termination	10
	Surge Suppressor5		Conduit Sealing	10
	Relays5		Module Connection	11
	Sensors Network5		Fans and Power Supplies Connect	tion 11
	External Sensor5		Traffic Cabinet (Optional)	11
	Internal Sensor5		First Time Fire Up	11
	Bottom Sensor5	5	Maintenance and Troubleshooti	ng 12
	Left-End Sensor (Optional)5		Service and Diagnostics	12
	Door Detection (Optional)5		Module Numbering System	12
	Ventilation and Heater Systems6		7-Segment Error Codes	13
	Intake Fans and Filters6		Modules	13
	Heater Fans (Optional)6		LVDB	13
	Fan RPM Sensors (Optional)6		Internal Component Access	14
	Beacon(s) (Optional)6		VFC-3000 Controller Replacement	14
	Traffic Cabinet (Optional)6		Module Replacement	14
	Cabinet Light6		Power Supply Replacement	15
	Door Reporting (Optional)6		LVDB Replacement	15
	Pull-Out Drawers and Shelving6		LVDB Fuse Replacement	16
	Panelboard6		SCP Maintenance	16
	Outlet Strip and Outlets7		DC / DC Converter Board (PC1)	
	Exhaust Fan Assembly7		Replacement	16
	Cabinet Heater (Optional)7		CAN Distribution Board (PC2) Replacement	1.4
	UPS (Optional)7		CAN I/O Board (PC3) Replacement	
			CAIT I/O BOUID (I CO) REPIDCEME	10

Table of Contents

	Ventilation Fan and Filter Maintenan	
	Filter Replacement	
	Fan Replacement	
	Traffic Cabinet Maintenance	
	Traffic Cabinet Fan and Thermostat Assembly Replacement	
	Traffic Cabinet Light Replacement	18
	LIE Maintenance	18
	Display Maintenance	18
	Structure	18
	Earth Ground Resistance	18
	Display Cabinet	19
	Temperature and Light Sensors	19
	Ventilation Fans	19
	Filters	19
	VFC-3000 Controller	19
	Face Panels	19
	Wet Outdoor Cleaning Method	19
	Pressure Wash Cleaning Method	20
	LEDs	20
	LED and Electronic Circuitry	20
	Maintenance Checklist	21
	Troubleshooting	22
6	Exchange and Repair Programs	25
	Daktronics Part Numbers	25
	Daktronics Exchange and Repair &	0.5
	Return Programs	
	Exchange Program	
	Repair & Return Program	
	Shipping Address	
	Email	
Glo	ossary	28

1 Introduction

How to Use This Manual

This manual explains the installation, maintenance, and troubleshooting of VF-2100 series Dynamic Message Signs (DMS). For information regarding the safety, installation, operation, or service of this system, refer to the telephone numbers 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 is referred to as **DD3940817**.

The serial and model numbers for the display are on the ID label attached to the display. This label looks similar to **Figure 1**. When calling Daktronics Customer Service, please have this information available to ensure timely response.



Figure 1: Display ID Label

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

DMS Overview

The VF-2100 series displays have rear access.

Theory of Operation

Vanguard® Software

Daktronics Vanguard® software allows the DMS operator to check display status and to control messages.

VFC-3000 Controller

The VFC-3000 controller is the communication hub for DMS management; it is located in the display or in the traffic cabinet.

The central controller creates messages and transmits them to the VFC-3000 controller for storage. Upon request from the central controller or the front panel interface, the VFC-3000 controller locates the message to display and sends it to the display's modules via the Vanguard® control board. The modules activate the appropriate pixels to form the message.

The VFC-3000 controller also monitors local sensors (display-based sensors) like temperature, light level, and door detection. The VFC-3000 controller interprets sensor data for display control and diagnostic functions, such as adjusting the display's intensity for current lighting conditions.

Auxiliary Control Panel (Optional)

The auxiliary control panel (ACP) complements the VFC-3000 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 VFC-3000 controller in another location. This improves safety and reduces maintenance time.

Display Peripherals

A peripheral is a display component configured through the VFC-3000 controller. Peripherals include sensors, power supplies, low voltage distribution boards (LVDBs), fans, and heaters.

2 Components

Modules

A module is a replaceable unit consisting of a display panel with clusters of LEDs, called pixels. The pixels display messages on the display. Refer to **Figure 2**.

Each module contains drive electronics that receive data packets from the Vanguard® control board and lights the appropriate pixels at the correct dimming level.

Power Supply Groups

Power Supplies

The power supplies mount to internal cabinet verticals.

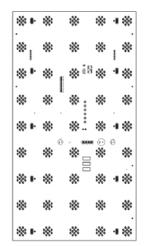


Figure 2: Module (Rear View)

Figure 3: LVDB

The power supplies provide power to the modules. Multiple power supplies provide power redundancy. Each power supply is paired with another power supply to make a power supply group. If one power supply in the group fails, the other supports the full power load, preventing power failure to the modules.

Low Voltage Distribution Board

One low voltage distribution board (LVDB) mounts to each power supply. The (LVDB) provides input and output voltage to the power supply. **Figure 3** shows an LVDB.

The LVDB receives 120 VAC input voltage from the distribution panel. Output from the power supply routes through the LVDB. Each output is fused at 15 A with automotive spade fuses. From there, the 24 VDC output routes to the modules.

LVDB diagnostics include power supply data sent to the VFC-3000 controller about output voltage and the passing or failing of each fuse.

Service Control Panel

The service control panel (SCP) is located on the left side of the display facing the rear. The internal components of the SCP use information received from the VFC-3000 controller to control the display. **Figure 4** shows the location of the SCP's internal components.

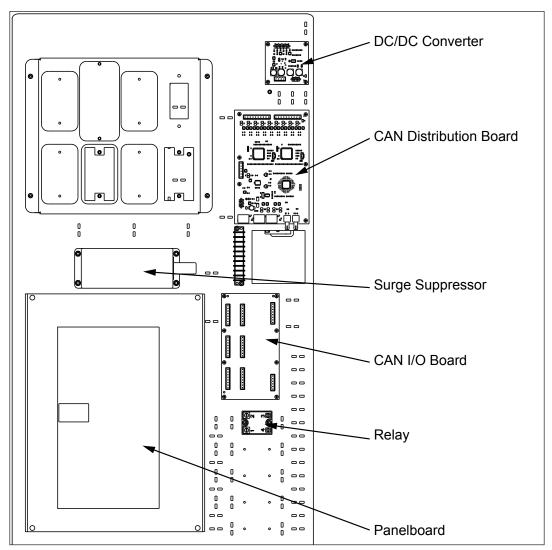


Figure 4: Service Control Panel

CAN Distribution Board

The CAN distribution board receives high-speed serial data from the VFC-3000 controller through a fiber-optic or Cat-5 cable. It then distributes the signal to the appropriate modules and sensors. The CAN distribution board receives diagnostic data from the modules, temperature sensors, light sensors, LVDBs, and CAN I/O board and transmits the data to the VFC-3000 controller.

The distribution board uses a protocol that routes signal to each horizontal line of the display. With this protocol, signal failure to one module in a horizontal line does not affect other LED modules in that line.

CAN I/O Board

The CAN I/O board is an input/output interface that also monitors the status of the power supplies, door open sensors, control beacons, fans, and heaters.

DC / DC Converter Board

The DC / DC converter board converts the 24 VDC output of the power supplies to 9 VDC. The power is then used by the light and temperature sensors, CAN distribution board, CAN I/O board, sensors, and LVDBs within the displays.

Panelboard

The panelboard is a circuit breaker box that distributes incoming power to the fans, DC / DC converter, and outlets.

Surge Suppressor

The parallel surge suppressor protects the display from current spikes.

Relays

Relays are solid-state switches in which the electrical current applied across one port or terminal controls electrical currents for another terminal, such as a beacon or fan. Relays receive signal from and transmit signal to the CAN I/O board, which communicates the relay's status to the CAN distribution board.

Sensors Network

External Sensor

The external temperature and rear light sensor consists of a small printed circuit board (PCB) mounted to the back of the display.

The temperature and light sensor transmits the external temperature and the ambient light level behind the display to the CAN distribution board, and the VFC-3000 controller adjusts the display accordingly.

Internal Sensor

The internal temperature, humidity (optional), and front light sensor measures the temperature near the LED pixels and the ambient light level in front of the display. The sensor transmits these measurements to the CAN distribution board, and the VFC-3000 controller adjusts LED intensity to protect the LEDs from overheating.

The internal sensor may also measure humidity within the display.

Bottom Sensor

The bottom light sensor is located on the bottom-left of the display when facing the rear. It detects the light intensity below the display.

Left-End Sensor (Optional)

The left-end sensor measures the internal temperature. The sensor transmits these measurements to the CAN distribution board, and the VFC-3000 controller adjusts LED intensity to protect the LEDs from overheating.

Door Detection (Optional)

The door sensors, if equipped, are located at the top of each door. The door sensors detect whether the doors are open or shut. This information routes to the mini CAN I/O board, which monitors the status of the door sensors and reports it to the VFC-3000 controller.

Ventilation and Heater Systems

Intake Fans and Filters

Filtered intake fans mount to the lower rear of the display. The VFC-3000 controller analyzes internal and external temperature readings from the temperature sensor network and adjusts fan usage. A filter removes dust and debris from the incoming air to protect the internal display components.

Heater Fans (Optional)

The heater fans mount to the bottom front of the display. The heater fans warm the front face to prevent fogging. The VFC-3000 controller analyzes internal temperature readings from the temperature sensor network and adjusts heater fan usage accordingly.

Fan RPM Sensors (Optional)

If your display has fan RPM sensors, a mini CAN I/O board for the RPM fans is installed on the front wall of the display.

With this option, each intake fan connects to an RPM sensor. The sensors monitor up to 2 fans for failure. The fans fail if they do not revolve at 1,000 RPM. This information is then reported to and displayed on the VFC-3000 Controller.

Beacon(s) (Optional)

Beacons are turned on and off independently from the rest of the sign by the VCB. A power supply and DC relays make up the Beacon controller and are located within the SCP.

Beacons are used at the customer's discretion.

Traffic Cabinet (Optional)

Cabinet Light

The traffic cabinet is equipped with an LED light and sensor. The light is located on the top rack of the traffic cabinet. The door sensor, located at the top of the traffic cabinet door opening, activates the light when the cabinet door opens.

Door Reporting (Optional)

The door sensor, located at the bottom of the traffic cabinet door opening, can report whether the door(s) are open or shut. This information routes to the mini CAN I/O board, which monitors the status of the door sensor(s) and reports the status to the VFC-3000 controller.

Pull-Out Drawers and Shelving

Traffic cabinets contain a pull-out drawer and several support shelves. The shelves hold components such as the VFC-3000 controller, the communication device, or a laptop computer.

The pull-out drawer is often used for storage of extra supplies such as screws, screwdrivers, or other hardware, and for the display and controller manuals. The pull-out drawer also can be used as a temporary location for a laptop computer.

Panelboard

The panelboard is equipped with switches that control power to lights, heat, and other power circuits.

Outlet Strip and Outlets

The GFCI and utility outlet are located next to the panelboard. The outlet strip offers several outlets for plugging in or charging electrical devices.

Exhaust Fan Assembly

The exhaust fan assembly is located at the top of the traffic cabinet and includes the exhaust fan and a thermostat. The fan and thermostat keep internal components and the interior of the traffic cabinet cool.

Cabinet Heater (Optional)

If equipped, the heater fan is located at the bottom of the traffic cabinet. The fan, thermostat, and heater regulate the temperature within the traffic cabinet, ensuring internal components operate at ideal temperatures.

UPS (Optional)

A UPS contains batteries and an inverter. If the utility AC power fails, the UPS powers the VFC-3000 controller and communication equipment for a limited amount of time. .

Laptop Interface Enclosure (Optional)

Light

The LIE is equipped with a fluorescent light and light switch, located at the top of the LIE.

Fold-Down Shelf

The LIE has a fold-down shelf that holds a laptop computer.

Outlets

The GFCI and utility outlets provide a location within the LIE to plug in electrical equipment.

3 Mechanical Installation

Lifting the Display

The top of the display is equipped with two $^{5}/_{8}$ " eyebolts for lifting the display. Lift the display using a lifting bar. Use both eyebolts, and maintain a 90° lifting angle as shown in **Figure 5**. The eyebolts may fail if this is not done.

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. Contact Daktronics with additional questions about display lifting.

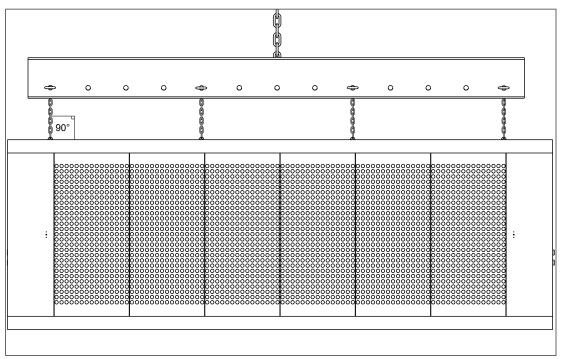


Figure 5: Correctly Lifting the Display

Display Mounting

Securely mount each display to a suitable mounting structure provided by others. Daktronics attached aluminum Z-extrusions to the back of the display for mounting. Use all Z-extrusions 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.

The eyebolts can either remain in the display or be removed without compromising the water tightness and weather resistance of the display cabinet. If removed, Daktronics recommends replacing eyebolts with $^{5}/_{8}$ " diameter stainless steel bolts to prevent debris from filling the threads of the permanent hardware.

Traffic Cabinet Mounting

Ground Mounting

Secure the traffic cabinet to a concrete pad using anchor bolts. Daktronics recommends using $^3/_4$ " stainless steel anchor bolts. When anchoring the traffic cabinet to the concrete pad, make sure the bottom of the cabinet allows for water drainage. Do not seal the cabinet to the concrete pad as this prevents water from draining properly.

The conduit for power and signal enter through the open area in the bottom of the cabinet.

Pole Mounting

Mount the cabinet using the pole-mount brackets. Make sure the brackets are secured at all locations.

LIE Mounting

LIEs are designed for pole-mounting. After installing the LIE, select power and signal entrances on the bottom, sides, or rear of the LIE. Prior to drilling, be aware of internal component locations to avoid damaging the components. Ensure the entrances will not obstruct the drain holes on the bottom of the LIE.

Seal any hole punched or drilled in the LIE with either a watertight plug or with a watertight conduit hub to prevent water from entering the LIE.

4 Electrical Installation

Power Installation

Qualified personnel must perform electrical installations to prevent injury to personnel and damage to the equipment.

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

For installation with ground and neutral conductors provided, the power cable must contain an isolated earth-ground conductor. Do not connect neutral to ground at the disconnect or at the display; this violates electrical codes and voids the warranty. Use a disconnect so all hot lines and neutral can be disconnected.

Bonding Screw

A bonding screw is included (not installed) with the panelboard. If the bonding screw is required, install it to avoid violation of local and national codes.

Power Connections

Each display operates on 120/240 VAC 3-wire plus ground, single-phase power. Power routes through the opening in the display rear and terminates at the panelboard.

Route power and signal cables to the display in conduit approved by local and national codes. Terminate all wires as labeled in the termination panels.

Display Termination

Power enters the display through the rear wall near the panelboard. To connect power to the display:

- 1. Locate the A41 panelboard inside the display.
- 2. Remove the panelboard cover to reveal the panelboard blocks.
- 3. Route the power cables through the 1 1/2" conduit hub, into the SCP, and into the A41 panelboard.
- 4. Terminate each wire at the appropriate terminal block and earth-ground lug.

Conduit Sealing

Fill the ends of conduits entering the display with duct seal.

Module Connection

4-pin connectors make the low voltage power connections within the display. Power for each module is provided with the use of one red, one orange, one blue, and one black wire. Power connections are completed at the factory.

The modules receive 24 VDC power from the power supply groups. Power redundancy is achieved with the 4-pin conductor and the 2 power supplies in the power supply groups. The primary power supply runs power through 2 pins in the 4-pin connector, and the backup connects to the remaining 2 pins.

Both lines are 24 VDC present at all times. The backup 24 VDC line only powers the module if the primary line fails. Primary and backup 24 VDC lines alternate between odd-and even-addressed driver modules in an effort to balance the load.

Fans and Power Supplies Connection

The fans and power supplies use 120 VAC from the panelboard. The surge suppressor in the panelboard protects the power supplies and modules from damaging power surges.

Traffic Cabinet (Optional)

Individually wire the following items directly to the earth-ground rod with an 8 AWG or larger wire according to local and national codes.

- Earth-ground lug mounted on the rear of the panelboard.
- Conduit grounding collars.
- Earth-ground connection inside the panelboard.

Earth-ground rods must be installed and connected per local and national codes.

- 1. Connect the auxiliary power connection to the panelboard.
- 2. Connect the neutral power wire to the neutral bus.
- 3. Connect the hot wires from the terminals to the panelboard lugs.

First Time Fire Up

After installing the display and DMS site equipment, test the site according to the field test procedure. This ensures all equipment is installed properly and is operational. If a field test procedure is not available, call Daktronics Transportation Customer Service to obtain a copy.

5 Maintenance and Troubleshooting

Important notes:

- 1. Disconnect power before performing any repair or maintenance to the displays.
- 2. Only qualified service personnel should access internal display electronics. Contact Daktronics Customer Service for training needs.
- 3. Daktronics engineering staff must approve changes made to the displays. If making modifications, submit detailed drawings to the Daktronics engineering staff for evaluation and approval or the warranty will be void.

Service and Diagnostics

The VF-2100 series DMS are rear accessible, meaning all internal components are accessible from the rear the display.

The following tools are required to service the display:

- Stubby Phillips screwdriver
- Small Phillips screwdriver
- Small flat-head screwdriver
- Small pliers
- Medium Phillips screwdriver
- Medium flat-head screwdriver
- Nut driver (3/8")
- Cable ties
- Ohmmeter
- Clamp-on ground meter

Module Numbering System

Daktronics uses a module numbering system to help with troubleshooting; refer to **Figure 6**.

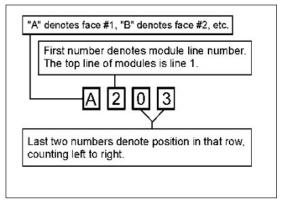


Figure 6: Module Numbering

7-Segment Error Codes

A 7-segment indicator appears on the following components; refer to **Figure 7**. The 7-segment indicator provides codes to indicate any present errors and their cause. When an error occurs, the 7-segment will flash the error code. If multiple errors are present, the 7-segment will flash the errors individually in succession. If no errors are present, the 7-segment will show a continuously looping figure-8.



Figure 7: 7-Segment

Modules

7-Segment Error Code	Error	Cause
1	Communications Lost	No CAN packets received for 10 seconds
2	Failed Pixel	Refer to the troubleshooting table in Troubleshooting (p.22).
3	Power Failure	Input Voltage has dropped below 20 VDC
4	Invalid address error	No valid address read from the address/signal harness
5	MDF error	Missing or corrupt module definition file in firmware
6	ORDF error	Missing or corrupt output routine definition file in firmware
7	LPF error	Missing or corrupt LED profile file in firmware
8 (solid)	White point error	Missing or corrupt LED currents or white point settings
8 (looping)	No Error	

LVDB

7-Segment Error Code	Error	Cause
1	Communications Lost	No CAN packets for 10 seconds
2	Input voltage error	V-In < 22 VDC
3	Single fuse error	One fuse is blown.
4	Multiple fuse error	Multiple fuses are blown.
8 (Looping)	No Error	

Internal Component Access

To access the internal components, open the service door.

- 1. Use the key provided by Daktronics to unlock the door.
- 2. Gently pull the door away from the display until the roller of the door is securely on the track groove. Two retainer bracets are located at the bottom of each service door to prevent the door from swinging freely while unlatched.
- 3. Roll the door right or left to access internal components.

To close a service door:

- 1. Roll the door back to its original position.
- 2. Gently push the door toward the display.
- 3. Use the key provided by Daktronics to lock the door.

VFC-3000 Controller Replacement

- 1. Turn off the power switch on the VFC-3000 controller face.
- 2. Label and remove all of the connections from the front and rear of the VFC-3000 controller.
- **3.** Remove the screws securing the VFC-3000 controller to the inside of the display or the traffic cabinet and remove the controller.
- **4.** Perform the needed maintenance.
- 5. When the VFC-3000 controller is ready for installation, slide it back into place.
- 6. Hold the controller in place and install the mounting screws.
- 7. Reconnect all connectors removed from the VFC-3000 controller.
- 8. Secure any retaining screws and prepare the VFC-3000 controller for operation.

Module Replacement

Note: Modules are not hot swap components. Always turn off power to the modules prior to servicing.

- 1. Turn off power to the failed module by turning off the breakers for both power supplies in the power supply group powering the modules.
- 2. Remove the wire connections:
 - **a.** Press the locking tabs of the 4-pin power connector and remove the connector.
 - **b.** Press the tabs of the 8-pin signal connector and remove the connector.
- **3.** If the display has 12" characters, unscrew the screws securing the module to the display with a Phillips screwdriver.
- **4.** If the display has 18" characters, turn the securing fastener at the top of the module $\frac{1}{4}$ -turn.
- 5. Pull the top of the module away from the display face at a 45° angle.

- 6. Align the new module and secure in place.
 - **a.** If the display has 12" characters, screw in the screws removed earlier.
 - **b.** If the display has 18" characters, secure the module by hooking the bottom tabs into the slots and turn the securing fastener at the top of the module \(^1/_4\)-turn.
- 7. Plug the 4-pin power connector and 8-pin signal connector into the new module.

Note: The connectors only fit together one way; do not force the connection.

- 8. Reapply power to the power supplies turned off in Step 1.
- 9. Test the modules:
 - **a.** Display the moving row, moving column, and all on/all off test messages. Run the test messages at both 10% and 100% brightness settings. Watch for proper operation of the LED module during each test message.
 - **b.** Perform a pixel test and check that all pixels operate correctly.

Power Supply Replacement

Power supplies are mounted on the rear interior of the display.

- 1. Turn off power to the power supply group by turning off the breaker in the panelboard.
- 2. Locate the failed power supply reported by the VFC-3000 controller. In the upper-left corner of each electrical bay is a white sticker labeled PSG1, PSG2, etc.
- 3. Note the location and orientation of the plugs going into the LVDB on the failed power supply. Disconnect the plugs going into the LVDB.
- **4.** Loosen the screws securing the power supply mounting plate to the metal truss, and gently lift the power supply and mounting plate off the truss.
- **5.** Loosen the screws securing the power supply to the plate, and gently lift the faulty power supply off the plate.
- 6. Remove the screws connecting the LVDB to the power supply.

To replace the new power supply, repeat the above steps in reverse order.

LVDB Replacement

- 1. Turn off power to the power supply containing the failed LVDB by turning off the appropriate breaker in the distribution panel.
- 2. Note the location and orientation of the plugs connected to the failed LVDB on the power supply. Remove the screws connecting the LVDB to the power supply.
- 3. Gently lift the LVDB off the power supply.

To replace the LVDB, follow the previous steps in reverse order.

LVDB Fuse Replacement

Note: Only replace fuses with fuses of the same type and rating.

- 1. Disable the circuit breakers that power the power supplies.
- 2. Locate the failed fuse by using a multimeter set to ohms to determine "OPEN" across the fuse. Using a small pliers or needle nose pliers, gently pull the failed fuse out of the LVDB.
- 3. Gently push the new fuse into the LVDB.

SCP Maintenance

When removing a component within the SCP, note the DIP switch and DIP jumper settings. After replacing a component, set the DIP switches and DIP jumpers on the replacement board to the previous setting.

DC / DC Converter Board (PC1) Replacement

- 1. Turn off the circuit breakers powering all power supplies.
- 2. Remove all connections to the DC / DC converter board.
- **3.** Remove the screws holding the board in place, and remove the failed DC / DC converter board.
- **4.** Position the new board in the enclosure and secure it using the screws removed in **Step 3**. Securely fasten the screws to ensure proper grounding.
- 5. Reconnect all connections removed in Step 2.
- **6.** Restore power.

CAN Distribution Board (PC2) Replacement

- 1. Turn off all the circuit breakers powering all power supplies.
- 2. Remove all connections to the distribution board, including incoming signal from the VFC-3000 controller and outgoing signal to the modules and sensors.
- 3. Remove the screws holding the board in place, and carefully remove the failed CAN distribution board.
- 4. Position the new board in the enclosure and secure with the screws removed in Step3. Securely fasten the screws to ensure proper grounding.
- 5. Reconnect all connections removed in Step 2.
- 6. Restore power.

CAN I/O Board (PC3) Replacement

- 1. Turn off the circuit breakers powering all power supplies.
- 2. Remove all connections to the CAN I/O board.
- 3. Remove the screws holding the board in place, and carefully remove the failed CAN I/O board.
- **4.** Position the new board in the enclosure and secure the board using the screws removed in **Step 3**. Securely fasten the screws to ensure proper grounding.

- 5. Reconnect all connections removed in Step 2.
- 6. Close the door and restore power.

Ventilation Fan and Filter Maintenance

Each time an intake fan assembly is opened, 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.

Filter Replacement

- 1. Turn off the intake fan breaker.
- **2.** Loosen the 1/4-turn fasteners in the upper corners of the intake fan assembly panel.
- 3. Rotate the fan and filter assembly forward.
- 4. Slide the filter out of the filter brackets.
- 5. Slide a new filter into the filter brackets.
- 6. Rotate the fan assembly back.
- 7. Tighten the 1/4-turn fasteners.

Fan Replacement

- 1. Open the service doors to the SCP and the failed ventilation fan.
- 2. Turn off the intake fan breaker and unplug any electrical connections.
- 3. Remove the screws securing the fan capacitor.
- **4.** Disconnect the fan cord from the fan capacitor.
- 5. Remove the screws connecting the fan bracket to the fan enclosure.
- 6. Lift the fan and fan bracket from the display.
- 7. Remove the screws connecting the fan to the fan bracket.
- 8. Remove the failed ventilation fan.

To replace the ventilation intake fan, follow the previous steps in reverse order.

Traffic Cabinet Maintenance

Traffic Cabinet Fan and Thermostat Assembly Replacement

- 1. Open the panelboard and turn off the circuit breaker supplying power to the fan and thermostat assembly.
- 2. Disconnect the fan's power cord.
- 3. Remove the hardware securing the finger guard and fan to the assembly bracket and remove the fan.
- 4. Attach the new fan to the bracket and secure it using the hardware removed in Step3. Note the airflow orientation when attaching the new fan.
- 5. Reconnect power to the fan.

Traffic Cabinet Light Replacement

- 1. Turn off the circuit breaker that powers the light.
- 2. Unclip the lamp assembly.
- 3. Insert a new lamp into the assembly and replace the cover.
- 4. Restore power and test the light.

LIE Maintenance

To replace an LIE light:

- 1. Turn off the circuit breaker that powers the light.
- 2. Unclip the lamp assembly.
- 3. Insert a new lamp into the assembly and replace the cover.
- 4. Restore power and test the light.

Display Maintenance

The following service intervals are recommendations. Contact Daktronics for recommendations based upon specific conditions.

Structure

At least once per year:

- Inspect the mounting structure for corrosion, loose bolts, and overall stability.
- Check the connections of the earth ground wires, if accessible.

Earth Ground Resistance

At least once per year ensure earth ground readings meet local and national codes.

Note: Note: Ground meters for this test are available for purchase from Daktronics.

Display Cabinet

At least once per year:

- Check for water stains and other signs of water intrusion in the display cabinet.
- Seal any leaks that have developed with a silicone sealant or another suitable sealer.
- Repair any door gaskets that have tears or missing pieces.
- Check the drainage holes in the bottom of the cabinet for obstructions.

Temperature and Light Sensors

At least once per year:

- Clear away any obstructions to airflow around the temperature sensors and light sensors.
- Clean the windows if they are dirty.

Ventilation Fans

At least once per year:

- Verify all fans work by pushing the test button until the fans turn on.
- Open the intake fan assembly and clean any dirt and debris off the fan blades.
 Spin the fan blades with a pen or pencil to ensure the bearings are free and the fan is balanced.

Filters

Check and clean the filters at least once per year. If the filter has an excess of dirt and dust, check the filters more frequently.

VFC-3000 Controller

At least once per year:

- Ensure all connectors are secure and the cables are not damaged in any way.
- Check the VFC-3000 controller operation.

Face Panels

Clean the face panels as needed, using one of the following methods.

Wet Outdoor Cleaning Method

Cleaning supplies:

- Water
- 5-gal bucket
- Automotive detergent
- 4' to 8' telescoping, soft automotive brush with bristles that are light to medium in rigidity
- Several soft terry cloth towels

Cleaning process:

- 1. Mix the automotive detergent and cold water in the 5-gal bucket at 1 oz detergent to 1 gal of cold water. Distilled water is preferred, but not required.
- 2. Dip the brush in the bucket of soapy water.
- **3.** Using brush strokes, wash the display from top to bottom.

Note: Using a soap-dispensing brush with a low soap-to-water ratio eliminates excess soap residue.

- **4.** Thoroughly rinse the display face with cold water under low pressure.
- 5. Use a soft, dry terry cloth to dry and remove any excess water.

Pressure Wash Cleaning Method

Cleaning supplies:

- Pressure washer
- 45° spray nozzle rated for 1,500 psi or less

Cleaning process:

- 1. Turn off power to the DMS.
- 2. Spray face and sides of the DMS. Keep the nozzle of the pressure washer at least 2' away from the display.

Note: Use caution along areas of the display that contain seams, weather stripping, or silicone. Ensure the pressure washer does not peel or rip any sealing material.

LEDs

When necessary, clean the LEDs with a damp cloth, a soft brush, a feather duster, or an anti-static, polycarbonate-type cleaner applied to a damp cloth. Do not spray the cleaner directly onto the LEDs.

LED and Electronic Circuitry

Test LED and electronic circuitry at intervals determined by customer requirements. Daktronics recommends performing the tests at least monthly. Perform tests on the DMS to check for hardware problems and incorrect variable settings.

Note: The following tests display functions, not other DMS equipment hardware.

- 1. Connect to the VFC-3000 controller and establish communication with the display.
- 2. Check that the temperature levels shown on the Sign Status screen of the Sign Control tab are the appropriate values for both internal and external temperature.
- **3.** Perform a Diagnostics test and check that all the power supplies and other configured peripherals pass.
- **4.** Make sure the photocell readings are appropriate for the current conditions.
- 5. Perform a pixel test and repair bad pixels.

Maintenance Checklist

Refer to the instructions in **Ventilation Fan and Filter Maintenance (p.17)** and **Traffic Cabinet Maintenance (p.18)**. One copy of the following table may be filled out for each display.

Display Location:

	Service Interval			Dates Performed and Initials		
Maintenance Item	Monthly Remote Diagnostics	1 yr.	As Needed			
Secure Connections		х				
Earth Ground Resistance		Х				
Display Cabinet		х				
Structural Inspection		х				
Light/Temp Sensors		х				
Face Panels			х			
LEDs			х			
Ventilation Fans Inspection		Х				
Internal Hardware		Х				
LED and Electronic Circuitry	Х					

Troubleshooting

For additional assistance, contact Daktronics Transportation Customer Service at the telephone number on the cover page.

Problem Observed	Possible Cause	Solution
No LEDs light, and the VFC- 3000 controller does not	No power.	Check that the traffic cabinet has power.
communicate with the central controller.	VFC-3000 controller or modem is bad.	Refer to the appropriate controller manual.
	No power at the display.	Check that the circuit breakers in the traffic cabinet are on and not tripped.
No LEDs light, but the VFC-3000 controller communicates with the central controller.	VFC-3000 controller is bad or is not connected to the display.	Refer to appropriate controller manual.
All peripherals indicate Communication Error.	CAN distribution board is bad.	Replace CAN distribution board.
	DC/DC converter board is bad.	Replace failed DC/DC converter board.
No LEDs light, but the peripherals pass and the	CAN distribution board is bad.	Replace CAN distribution board.
VFC-3000 controller is communicating with the central controller.	No power to power supply groups.	Check that the circuit breakers are on and are not tripped.
LEDs on the entire display are	Signal connections at the CAN distribution board are incorrect.	Check the signal wiring.
garbled, or wrong LEDs are on throughout the display.	VFC-3000 controller is bad.	Refer to appropriate controller manual.
	VFC-3000 controller has the wrong display configuration.	Refer to appropriate controller manual.
One line of modules does not	One or more wires or terminals in the signal cable (for this line) is misplaced, open or shorted to wires or frame, in display, VFC-3000 controller, or control cable from display to VFC-3000 controller.	Repair wires as needed.
respond properly. LEDs are garbled, do not change, are	Terminating resistor on the CAN bus for this line is bad.	Replace the terminating resistor.
too bright or too dim, etc.	One or more drivers in this line are bad.	Replace modules in the line one at a time and retest each time. Note: There may be more than one bad driver. Repair the failed driver.
	CAN distribution board is bad.	Replace CAN distribution board.

Problem Observed	Possible Cause	Solution
	Power connector unplugged at module.	Plug in connector.
No LEDo on a moodulo light	Address and signal connector unplugged at module.	Plug in connector.
No LEDs on a module light.	Power plug terminals are not properly seated, or the wire is bad.	Inspect all wires and terminals for power plug. Repair as needed.
	The driver is bad.	Replace failed driver.
One module is garbled, too bright or too dim, erratic, etc.	Signal plug terminals are not seated well at driver board, or wire is bad.	Inspect all wires and terminals for 8-pin plug. Repair as needed.
	The driver is bad.	Replace failed driver.
One pixel does not turn off.	The driver board is bad.	Replace failed driver board.
Office pixer does from form office.	The pixel board is bad.	Replace failed pixel board.
One pixel does not light.	The driver board is bad.	Replace failed driver board.
Office pixer does from light.	The pixel board is bad.	Replace failed pixel board.
One string (half the LEDs) in	The driver board is bad.	Replace failed driver board.
one pixel does not light.	The pixel board is bad.	Replace failed pixel board.
Electronically controlled fans or	Circuit breaker tripped.	Reset breaker.
heaters are reported as on, but all are off.	Relay is bad.	Replace relay.
all die on.	CAN I/O board is bad.	Replace failed CAN I/O board.
	Circuit breaker tripped in traffic cabinet.	Reset the breaker.
Cooling fans do not run.	Temperature inside the display is lower than the thermostat setting.	This is not a problem.
	The thermostat or its wiring is bad.	Repair as needed.
	CAN I/O board is bad.	Replace failed CAN I/O board.
	Temperature inside the display exceeds the thermostat setting.	This is not a problem.
Cooling fans run continuously.	The thermostat is stuck on or the wiring is shorted.	Replace the thermostat or repair wiring.
	CAN I/O board is bad.	Replace failed CAN I/O board.

Problem Observed	Possible Cause	Solution
	Light sensor assembly is obstructed.	Clear obstruction.
LED brightness is wrong—entire display is too bright or too dim.	One or more wires or terminals in the light/temp control cable are misplaced, open or shorted to other wires or the frame in display, VFC-3000 controller, or control cable from display to VFC-3000 controller.	Repair as needed.
	Light sensor is not configured correctly.	Correct the settings. Refer to the appropriate controller manual.
	Light sensor printed circuit board (PCB) is bad.	Replace light sensor.
	VFC-3000 controller is bad.	Refer to the appropriate controller manual
Pixel test shows all pixels on all display lines as bad. Display	Fiber or R\$422 display output RX not terminated properly (fiber or copper option).	Re-terminate display output RX connections (fiber or copper option).
lines play messages correctly.	VFC-3000 controller is bad.	Refer to the appropriate controller manual.
	Signal or power wiring is bad. One or more wires or terminals are misplaced, or are open or shorted to wires or the frame at one of the temperature sensors or the CAN I/O board.	Repair wiring as needed.
One or more internal temperature sensors not reading.	One or both of the temperature sensors is bad.	Remove connectors at the temperature sensor to test one sensor at a time. Replace any bad sensors.
	CAN I/O board is bad.	Replace CAN I/O board.
	Temperature sensor is not configured correctly.	Correct the settings. Refer to the appropriate controller manual.
One fuse indicates failure from the operator software or the VFC-3000 controller. All others indicate OK.	Fuse blown on reported LVDB.	Replace blown fuse.
One power supply indicates	One LVDB is bad.	Replace LVDB.
"bad" from the operator software or the VFC-3000	Bad power supply.	Replace power supply.
controller. All others indicate OK.	Wiring for power supply in CAN I/O board is bad.	Repair as needed.

6 Exchange and Repair Programs

Daktronics Part Numbers

All parts in Daktronics displays are assigned a part number. Daktronics part numbers are commonly found on drawings and are used when requesting replacement parts from Daktronics Customer Service. Take note of the following part number formats.

"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.

"W-___" denotes a wire or cable. Cables may also carry the assembly numbering format in certain circumstances. This is especially true of ribbon cables.

"PR-____" denotes a specially ordered part.

Most circuit boards and components within this display carry a label listing the part number of the unit. If a circuit board or assembly is not in the replacement parts list, use the label to order a replacement. A typical label is shown in **Figure 8**. The part number is bolded.

0P-1127-0024 SN: 2465 02/19/12 Rev. 1

Figure 8: 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):

Daktronics 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. 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 Case #____ Sioux Falls, SD 57104

Email

transportationhelp@daktronics.com

Glossary

Address: Identification number assigned to each sign in a network, set through the front panel interface. The central controller uses the address to differentiate between signs connected on the same network. Signs on the same network cannot have the same address.

CAN Distribution Board: Internal display component that sends and receives signals to and from the VFC-3000 controller. It distributes the signals received from the VFC-3000 controller to modules throughout the display. All diagnostic data from the sensors and modules transmit through the distribution board back to the VFC-3000 controller.

Central Controller: Software system that can control displays remotely. This software contains a message studio, schedule studio, a display manager, and other tools and options that are used to configure displays and networks for an Intelligent Transportation System.

Column: Vertical line of pixels.

Driver Board: Component on the back of each module that receives data packets from the VFC-3000 controller. The driver board turns the pixels on and off and controls their dimming. The driver board also contains circuitry to perform pixel diagnostics.

Dynamic Message Sign (DMS): An electronic message display used on roadways to give travelers information about traffic conditions. Such displays may inform of events like traffic congestion, accidents, incidents, or roadwork zones.

Eyebolt (Lifteye): Heavy steel bolt with a loop attached to the top of the display cabinet for lifting.

Light Emitting Diode (LED): Low-energy, high-intensity lighting units. Multiple, closely spaced LEDs form a pixel on the DMS display.

Line: Horizontal row of modules.

Low Voltage Distribution Board (LVDB): Distribution point for the DC power to the individual LED drivers on each module.

Matrix: Visible area on a display, measured in rows and columns of pixels.

Module: Component containing an array of LED pixels. Modules are placed next to each other to form the matrix of the display.

NTCIP: National Transportation Communication for ITS Protocol.

Panelboard: Circuit breaker box that distributes incoming power to the internal display components. A single panel unit may include buses, automatic overcurrent devices, and switches for light, heat, and power.

Pixel: A group of LEDs that turn on and off to form the characters and graphics making up the message content.

Power Supply: Unit that converts incoming AC power to DC power as required by several components within the display.

Power Supply Group: 2 power supplies that provide redundant power to multiple modules within its load capacity.

Relay: An electromechanical or semiconductor switch in which a current or voltage applied across one port or terminal controls electrical currents or voltages that appear across another terminal or terminals.

Row: Horizontal line of pixels.

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

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

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

Service Control Panel (SCP): Enclosure that serves as a central point for all data and power distribution. The SCP contains the CAN distribution board, CAN I/O board, DC / DC converter, relays, and the main power distribution panel.

VFC-3000 Controller: A component that receives signal information from the central controller, translates it, and activates the appropriate pixels on the display. It retains messages in its memory, determines the appropriate display brightness, and keeps the date and time through an internal clock/calendar. The VFC-3000 controller also reads and analyzes the diagnostic data from a variety of sensors. It is located in either the traffic cabinet or the display.