

**GENERIC SERVICE
VF-24XX
GEN 4
DISPLAY MANUAL**

26 April 2018
DD3875382
Rev 0



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1 Introduction

How to Use This Manual

This manual explains the installation, maintenance, and troubleshooting of VF-24X0 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 **DD3875382**.

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.26)** if any component needs replacement or repair.

Theory of Operation

Vanguard® Software

Daktronics Vanguard® software allows the DMS operator to check display status and to control messages. Refer to the **Vanguard® Software Help File [F1]** for information about operating Vanguard® software.

VFC-3000 Controller/Vanguard® Field Controller

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

The central controller creates messages and transmits them to the VFC-3000 controller/Vanguard® Field Controller for storage. Upon request from the central controller or the front panel interface, the VFC-3000 controller/Vanguard® Field 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/Vanguard® Field Controller also monitors local sensors (display-based sensors) like temperature, light level, and door detection. The VFC-3000 controller/Vanguard® Field Controller interprets sensor data for display control and diagnostic functions, such as adjusting the display's intensity for current lighting conditions.

Refer to the controller manual for configuration information.

Auxiliary Control Panel

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. The ACP may be located in the traffic cabinet or the display.

2 Components

Module

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.

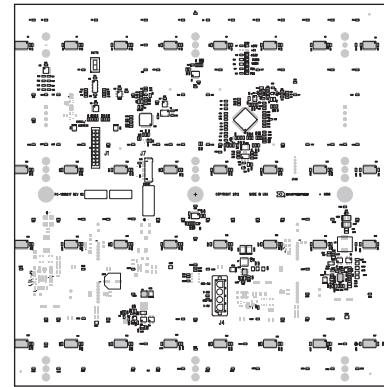


Figure 2: Module (Rear View)

Power Supplies

Power Supplies

The power supplies provide voltage to power the modules. Multiple power supplies provide power redundancy. If one power supply in the group fails, the other supports the full power load, preventing power failure to the modules. Power supplies are mounted to panels on the rear wall of the display.

Isolation Board

One isolation board mounts to each power supply. The isolation board provides input and output voltage to the power supply. **Figure 3** shows an isolation board. The isolation board receives 120 VAC input voltage from the distribution panel. Output from the power supply routes through the isolation board. From there, the 24 VDC output routes to the DC breaker rail.

Isolation board diagnostics include power supply data sent to the VFC-3000 controller/Vanguard® Field Controller about output voltage.

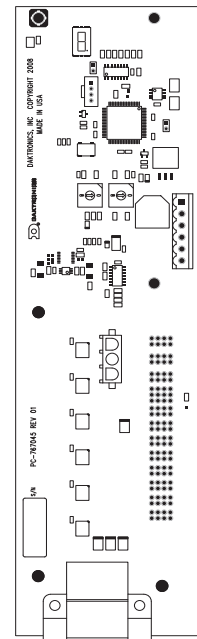


Figure 3: Isolation Board

Service Control Panel

The service control panel (SCP) is located on the right side of the display's back wall. The internal components of the SCP use information received from the VFC-3000 controller/Vanguard® Field Controller to control the display.

Vanguard® Control Board

The Vanguard® control board (VCB) receives high-speed serial data from the VFC-3000 controller/Vanguard® Field Controller through a fiber-optic or Cat-5 cable. It then distributes the signal to the appropriate modules and sensors. The VCB receives diagnostic data from the modules, temperature and light sensors, and isolation boards and transmits the data to the VFC-3000 controller/Vanguard® Field Controller. The VCB uses an I/O interface to control beacons. The VCB also monitors door sensors, ventilation fans, defog heaters, and power supplies.

The VCB 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.

Panelboard

The panelboard is a circuit breaker box that distributes incoming power to the display components that require AC power.

Surge Suppressor

The parallel surge suppressor protects the display from transient voltage 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, heater, or fan. Relays receive signal from the VCB.

DC Breaker Rail

The DC breaker rail receives incoming power from the power supplies and distributes power to the modules and the VCB.

Sensors Network

Rear Sensor

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

The light sensor transmits the ambient light level behind the display to the VCB. The VFC-3000 controller/Vanguard® Field Controller adjusts the display accordingly.

Internal Sensor

The internal temperature, humidity, 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 VCB, and the VFC-3000 controller/Vanguard® Field Controller adjusts LED intensity to protect the LEDs from overheating.

Bottom Sensor

The bottom light sensor is located on the bottom-right of the display. It detects the light intensity below the display.

Face Panel/Door Detection

The left-end sensor is located at the top of the door opening(s). The sensor detects whether the doors are open or shut, and it routes this information to the VCB, which monitors the status of the door sensors and reports it to the VFC-3000 controller/Vanguard® Field Controller.

Ventilation and Heater Systems

Intake Fans and Filters

Filtered intake fans mount to the top rear of the display. The VFC-3000 controller/Vanguard® Field Controller analyzes temperature readings from the temperature sensor network and adjusts fan usage. Additionally, an internal thermostat activates the fans if the internal temperature exceeds a set limit. A filter removes dust and debris from the incoming air to protect the internal display components.

Defog Heater Fans

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

Fan RPM Sensors

Each ventilation fan has an internal RPM sensor. The fans fail if they do not revolve at least 1,000 RPM. This information is then reported to and displayed on the VFC-3000 controller/Vanguard® Field Controller.

Lights

The display will have a light mounted behind every face panel. The lights turn on when any of the face panels are opened. Switches are located at the bottom of the face panel openings.

Beacon(s)

Beacons are turned on and off independently from the rest of the sign by the VCB. Beacons are at the customer's discretion.

UPS

A UPS contains batteries and an inverter. If the utility AC power fails, the UPS powers the controller and communication equipment for a limited amount of time. The UPS may be mounted in the traffic cabinet or in the display.

Traffic Cabinet

Cabinet Light

The traffic cabinet is equipped with a fluorescent light and sensor. The door sensor, located at the bottom of the traffic cabinet door opening, activates the light when the cabinet door opens.

Door Reporting

The door sensor, located at the bottom of the traffic cabinet door opening, reports 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 controller.

Pull-Out Drawers and Shelving

Traffic cabinets contain a pull-out drawer and several support shelves. The shelves hold components such as the 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 breakers 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 GFCI outlet is for service personnel only. Do not use the GFCI outlet for control equipment.

The outlet strip offers several outlets for plugging in control equipment.

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.

Intake Filters

The intake filters are located on the door. The filters remove dust and debris from the incoming air to protect the components.

Cabinet Heater

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.

Laptop Interface Enclosure

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 utility outlets provide a location within the LIE to plug in control equipment.

The GFCI outlet is for service personnel only. Do not use the GFCI outlet for control equipment.

3 Mechanical Installation

Lifting the Display

The top of the display is equipped with two $\frac{5}{8}$ " 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 4**. 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.

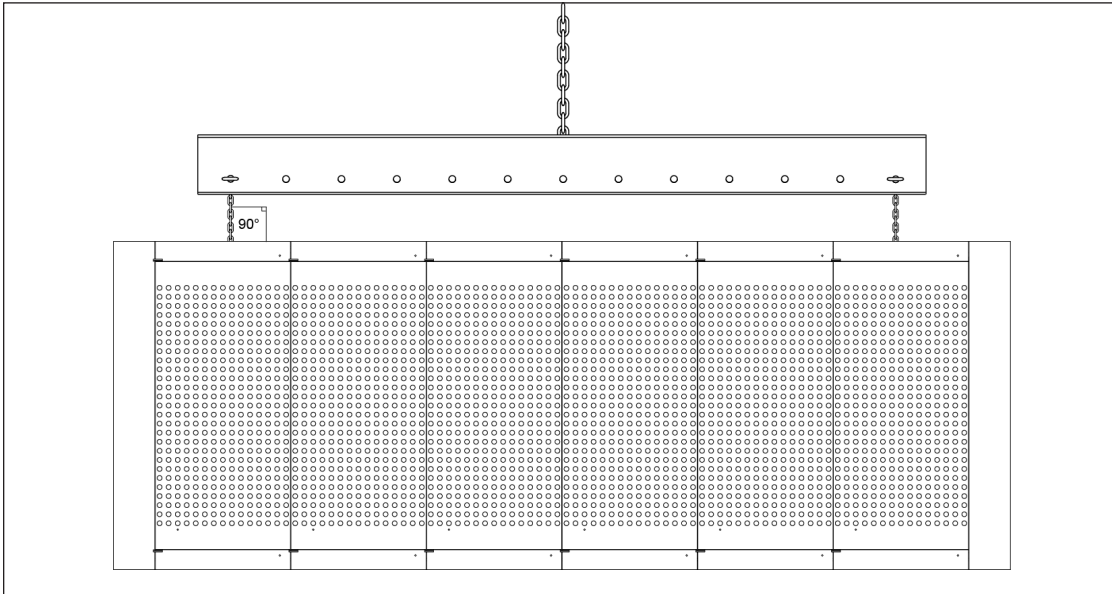


Figure 4: Correctly Lifting the Display

Uncrating the Display

The rear Z-bar attachment brackets and verticals may not be removed until uncrating. End sheets will remain for rigidity. Refer to **Figure 5**.

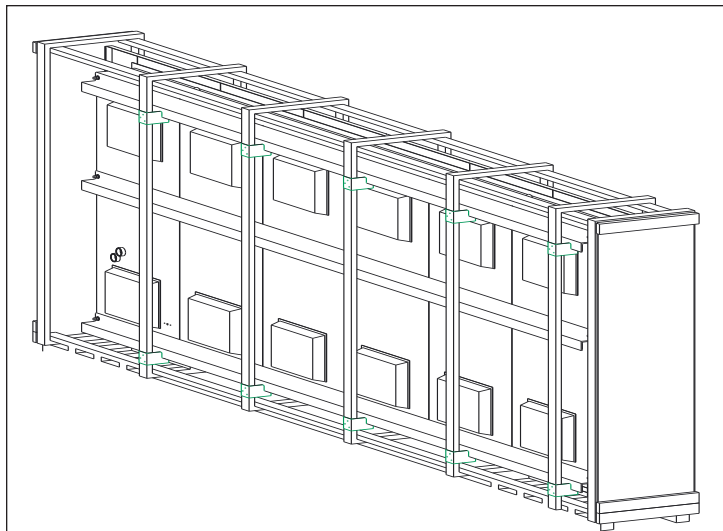


Figure 5: Rear View of Display with Z-bar Attachment Brackets

There are two lifting locations on the top of the display that are exposed for accessibility. The front crate verticals may be removed one at a time to access bays. Refer to **Figure 6**.

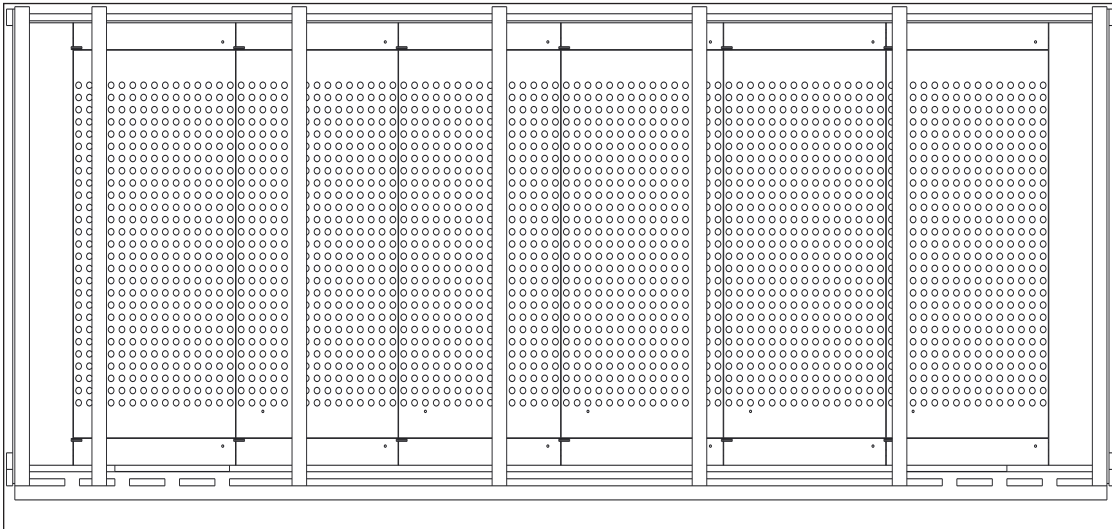


Figure 6: Front Crate Verticals

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 on 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 $\frac{5}{8}$ " 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 $\frac{3}{4}$ " 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.

Note: Power and signal must be run separately.

Pole Mounting

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

The conduit for power and signal may enter from the bottom or side of the cabinet.

Note: Power and signal must be run separately.

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.

Remove any fillings and 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

Getting Started

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.

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 or 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 national and local electrical 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 sign, 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 and one black wire. Power connections are completed at the factory.

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

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

Vanguard® Control Board Address Setting

The rotary switches set the sign address, which the software uses to identify the particular display. When replacing a VCB (refer to **Figure 7**), set the rotary switches on the new VCB to the same address configuration as the defective VCB. Each VCB in a network needs a unique address.

Set the switch by rotating it clockwise or counter-clockwise until the arrow points to the desired number; refer to **Figure 8**. Only 0 through 7 are viable addresses. To determine the number for each VCB.

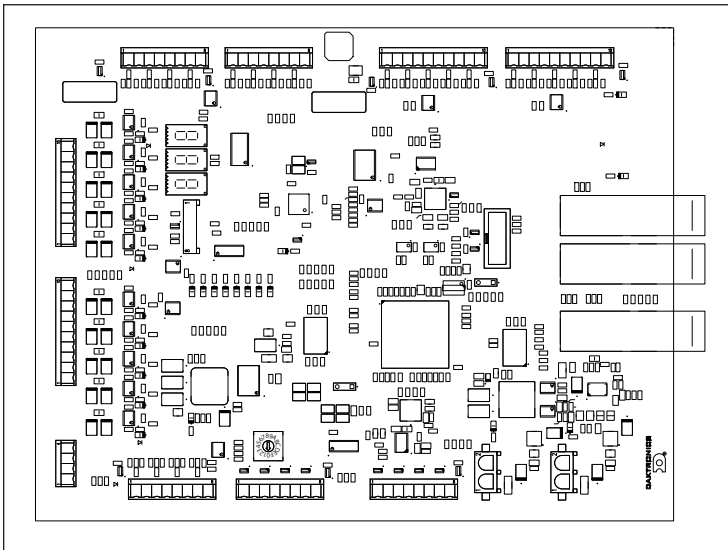


Figure 7: Vanguard® Control Board

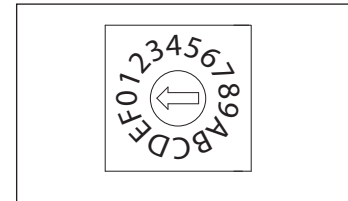


Figure 8: VCB Rotary Switch

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

Getting Started (With UPS)

1. Before performing any repair or maintenance to the displays:
 - a. Disconnect utility power.
 - b. Disable the display UPS system by shutting off the two switches on the UPS head unit face panel.
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.



Getting Started (Without UPS)

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-24X0 series DMS are front accessible — all internal components are accessible from within the display.

The following tools are required to service the display:

- Hex-head wrench ($\frac{5}{16}$ ")
- Stubby Phillips screwdriver
- Small Phillips screwdriver
- Small flat-head screwdriver
- Small pliers
- Medium Phillips screwdriver
- Medium flat-head screwdriver
- Nut driver ($\frac{3}{8}$ ")
- Cable ties
- Multimeter
- Clamp-on ground meter

Module Numbering System

Daktronics uses a module numbering system to help with troubleshooting; refer to **Figure 9**.

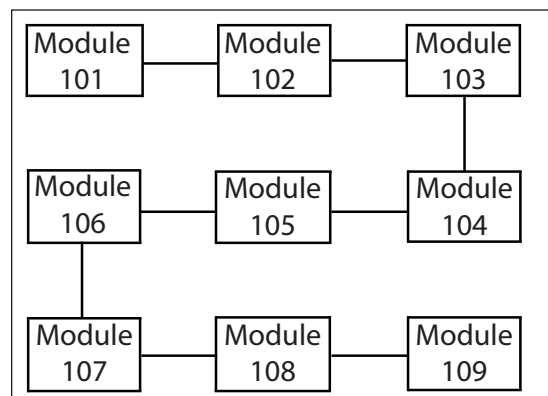


Figure 9: Module Numbering

7-Segment Error Codes (VFC-3000 Controller)

A 7-segment indicator appears on the following components; refer to **Figure 10**. 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 10: 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 (p.23) section.
3	Power Failure	Input Voltage has dropped below 20 VDC
8 (Solid)	Lost Packet	Diagnostic packet, FIFO full
8 (Looping)	No Error	

VCB

7- Segment Error Code	Error	Cause
1	Communications Lost	No fiber packets for 15 seconds
3	Power Failure	Board voltages below limit: V-In, 1 and 2 < 20 VDC 9 V < 8.52 VDC 3.3 V < 3 VDC 2.5 V < 2.37 VDC 1.2 V < 1.1 VDC
8 (Looping)	No error	

Isolation Board

7-Segment Error Code	Error	Cause
1	Communications Lost	No CAN packets for 10 seconds
2	Input power failure	V-In < 21 VDC
5	Output power failure	V-In < 21 VDC (with V-In OK)
8 (Looping)	No Error	

Vanguard Field® Controller

Three 7-segment indicators appear on the following component; refer to **Figure 11**. The 7-segment indicators provide codes to indicate normal running conditions as well as any present errors and their cause. When an error occurs, the 7-segment will flash the error codes individually in succession. If no errors are present, the 7-segment will continuously cycle normal running conditions.

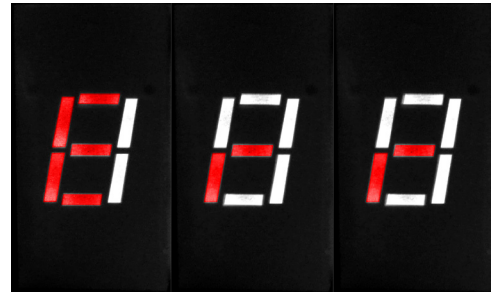


Figure 11: Three 7-Segment Indicators

VCB

7- Segment Error Code	Error	Cause
Err	Error	If an error condition exists, the VCB will display Err then the remaining error codes.
id	Hardware ID	Hardware ID (jumpers on the module) can't be read correctly (parity error), or have changed during runtime
Adr	Address	ProLink 6 address does not match rotary switch setting
hrd	Hardware	<ul style="list-style-type: none"> -Errors on PL6 link(s) -Error on sensor CAN port On board voltage error (measurement out of range) -Invalid or high VCB temperature reading -Error reading / writing to serial FLASH -Error with EPLD -7-segment display errors (bad segment) -Input voltage out of range
cod	Firmware	<ul style="list-style-type: none"> -Invalid interrupt occurred -Micro bootloader FW not found -Stack overflow -EEPROM write / erase error -No EPLD bootloader program found, or running EPLD bootload FW when it shouldn't be -Invalid PL6 modify packet
PL6	ProLink 6	Port A and Port B not in sync

A single 7-segment indicator appears on the following components; refer to **Figure 12**. 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 12:
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 (p.23) section.
3	Power Failure	Input Voltage has dropped below 20 VDC
8	Lost Packet	Diagnostic packet, FIFO full
8 (looping)	No Error	

Isolation Board

7-Segment Error Code	Error	Cause
1	Communications Lost	No CAN packets for 10 seconds
2	Input power failure	V-In < 21 VDC
5	Output power failure	V-In < 21 VDC (with V-In OK)
8 (looping)	No Error	

VFC-3000 Controller/Vanguard® Field Controller Replacement

1. Turn off the power switch on the VFC-3000 Controller/Vanguard® Field Controller face.
2. Label and remove all of the connections from the front and rear of the VFC-3000 controller/Vanguard® Field Controller.
3. Remove the screws securing the VFC-3000 controller/Vanguard® Field 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/Vanguard® Field 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/Vanguard® Field Controller.
8. Secure any retaining screws and prepare the VFC-3000 controller/Vanguard® Field Controller for operation.

Module Replacement (20mm)

1. Turn off power to the failed module by turning off the breakers for all power supplies.
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. Unlatch the 9 plastic hex nuts securing the module to the display.
4. Remove the module from the display face.
5. Align the new module with the 9 studs and replace the plastic hex nuts.
6. Replace the 9 plastic hex nuts removed in **Step 3**.

Note: If a hex nut is lost, replace it with only plastic hex nut. Do not use metal hex nuts.

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.

Environmental Sensors

Airflow Sensor

To remove the sensor:

1. Locate the failed sensor reported by the controller.
2. Turn off the intake fan breaker.
3. Loosen the $\frac{1}{4}$ -turn fasteners in the upper corners of the intake fan assembly panel and rotate the intake assembly forward.
4. Disconnect the Mate-n-Lok® connector.
5. Remove the nut and mechanical screw holding the sensor in place.

To replace the sensor, repeat the above steps in reverse order.

Light/Temperature/Humidity Sensor

To remove the sensor:

1. Locate the failed sensor reported by the controller.
2. Disconnect the terminal block from the sensor.
3. Remove the two Phillips screws fastening the sensor to the mounting plate.

To replace the sensor, repeat the above steps in reverse order.

Power Supply Assembly Replacement

Power supply assemblies are mounted on the rear interior of the display.

1. Turn off power to the power supply assembly by turning off the breaker in the distribution panel.
2. Locate the failed power supply assembly reported by the VFC-3000 controller/Vanguard® Field Controller.
3. Loosen the screws securing the power supply assembly to the backsheet, and gently lift the power supply assembly off the backsheet.

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

Vanguard® Control Board (VCB)

To replace the VCB (PC1):

1. Turn off the circuit breakers powering all power supplies.
2. Remove all connections to the VCB, including incoming signal from the VFC-3000 controller/Vanguard® Field Controller and outgoing signal to the modules and sensors.
3. Remove the screws holding the board in place, and carefully remove the failed VCB.
4. Position the new board in the enclosure and secure with 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.

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.

Filter Replacement

1. Turn off the intake fan breaker.
2. Loosen the $\frac{1}{4}$ -turn fasteners in the upper corners of the intake fan assembly panel.
3. Rotate the intake assembly forward and slide the filter out.
4. Slide a new filter into the panel. Ensure the filter is oriented in the same position as the filter being replaced.
5. Rotate the fan assembly back into its original position and tighten the $\frac{1}{4}$ -turn fasteners.

Fan Replacement

1. Unplug the fan cord and cut the cable ties.
2. Remove the hardware holding the fan and finger guard in place.
3. Remove the failed ventilation fan.

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

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 **Step 3**. Note the air flow orientation when attaching the new fan.
5. Reconnect power to the fan.
6. Adjust the thermostat to test the fan.

Traffic Cabinet Light Replacement

1. Turn off the circuit breaker that powers the light.
2. Remove the lamp cover and lamp.
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. Remove the lamp cover and lamp.
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 location-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: 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 air flow around the temperature 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/Vanguard® Field 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/Vanguard® Field 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. Turn off power to the DMS.
2. 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.
3. Dip the brush in the bucket of soapy water.
4. 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.

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

Pressure Wash Cleaning Method

Cleaning supplies:

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

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/Vanguard® Field 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 replace faulty modules.

Maintenance Checklist

Refer to the instructions in the **Display Maintenance (p.20)** section. One copy of the following service interval table may be filled out for each display.

Display Location:

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

Troubleshooting

For additional assistance, contact Daktronics Transportation Customer Service at the telephone number on the cover page. Replacement Parts and Exchange and Repair Programs

Problem Observed	Possible Cause	Solution
No LEDs light, and the VFC-3000 controller/Vanguard® Field Controller does not communicate with the central controller.	No power.	Check that the traffic cabinet has power.
	VFC-3000 controller/Vanguard® Field Controller or modem is bad.	Refer to the controller manual.
No LEDs light, but the VFC-3000 controller/Vanguard® Field Controller communicates with the central controller. All peripherals indicate Communication Error.	No power at the display.	Check that the circuit breakers in the traffic cabinet are on and not tripped.
	VFC-3000 controller/Vanguard® Field Controller is bad or is not connected to the display.	Refer to the controller manual.
	VCB is bad.	Replace VCB.
No LEDs light, but the peripherals pass and the VFC-3000 controller/Vanguard® Field Controller is communicating with the central controller.	VCB is bad.	Replace VCB.
	No power to power supply groups.	Check that the circuit breakers are on and are not tripped.
LEDs on the entire display are garbled, or wrong LEDs are on throughout the display.	Signal connections at the VCB are incorrect.	Check the signal wiring.
	VFC-3000 controller/Vanguard® Field Controller is bad.	Refer to the controller manual.
	VFC-3000 controller/Vanguard® Field Controller has the wrong display configuration.	Refer to the controller manual.
One line of modules does not respond properly. LEDs are garbled, do not change, are too bright or too dim, etc.	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/Vanguard® Field Controller, or control cable from display to Vanguard® Field Controller.	Repair wires as needed.
	Terminating resistor on the CAN bus for this line is bad.	Replace the terminating resistor.
	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.
	VCB is bad.	Replace VCB.

Problem Observed	Possible Cause	Solution
No LEDs on a module light.	Power connector unplugged at module.	Plug in connector.
	Address and signal connector unplugged at module.	Plug in connector.
	Power plug terminals are not properly seated, or the wire is bad.	Inspect all wires and terminals for power plug. Repair as needed.
	The module is bad.	Replace failed module.
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 module is bad.	Replace failed module.
One pixel does not turn off.	The module is bad.	Replace failed module.
One pixel does not light.	The module is bad.	Replace failed module.
One string (half the LEDs) in one pixel does not light.	The module is bad.	Replace failed module.
Electronically controlled fans or heaters are reported as on, but all are off.	Circuit breaker tripped.	Reset breaker.
	Relay is bad.	Replace relay.
	VCB is bad.	Replace failed VCB.
Ventilation fans do not run.	Circuit breaker tripped in traffic cabinet.	Reset the breaker.
	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.
	VCB is bad.	Replace failed VCB.
Ventilation fans run continuously.	Temperature inside the display exceeds the thermostat setting.	This is not a problem.
	The thermostat is stuck on or the wiring is shorted.	Replace the thermostat or repair wiring.
	VCB is bad.	Replace failed VCB.

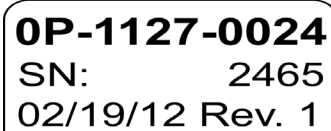
Problem Observed	Possible Cause	Solution
LED brightness is wrong—entire display is too bright or too dim.	Light sensor assembly is obstructed.	Clear obstruction.
	One or more wires or terminals in the light/temp control cable are misplaced, open or shorted to other wires or the frame in display, VFC-3000 controller/Vanguard® Field Controller, or control cable from display to VFC-3000 controller/Vanguard® Field Controller.	Repair as needed.
	Light sensor is not configured correctly.	Correct the settings. Refer to the controller manual.
	Light sensor printed circuit board (PCB) is bad.	Replace light sensor.
	VFC-3000 controller/Vanguard® Field Controller is bad.	Refer to the controller manual.
Pixel test shows all pixels on all display lines as bad. Display lines play messages correctly.	Fiber or RS422 display output RX not terminated properly (fiber or copper option).	Re-terminate display output RX connections (fiber or copper option).
	VFC-3000 controller/Vanguard® Field Controller is bad.	Refer to the controller manual.
One or more internal temperature sensors not reading.	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 VCB.	Repair wiring as needed.
	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.
	VCB is bad.	Replace VCB.
	Temperature sensor is not configured correctly.	Correct the settings. Refer to the controller manual.
One power supply indicates "bad" from the operator software or the VFC-3000 controller/Vanguard® Field Controller. All others indicate OK.	One isolation board is bad.	Replace isolation board.
	Bad power supply.	Replace power supply.
	Wiring for power supply in VCB is bad.	Repair as needed.

6 Replacement Parts and Repair and Exchange 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.
- “PR-____-____” denotes a specially ordered part.



OP-1127-0024
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Figure 13: Typical Label

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 13**. The part number is bolded.

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.

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

331 32nd Ave

Case# _____

Brookings, SD 57006

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.

Central Controller: Software system that can control displays remotely. This hardware device 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.

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

Isolation Board: Interface between the power supply and the redundant power bus. It provides isolation between the redundant power bus and a failed power supply.

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.

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

Module: Component containing an array of LED pixels and pixel driver circuitry. 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 Enclosure: 2–4 power supplies that provide redundant power to the display modules.

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 VCB, relays, surge suppressors, and the main power distribution panel.

Vanguard® Control Board (VCB): Internal display component that sends and receives signals to and from the VFC-3000 controller/Vanguard® Field Controller. It distributes the signals received from the VFC-3000 controller/Vanguard® Field Controller to modules throughout the display. All diagnostic data from the sensors and modules transmit through the VCB back to the VFC-3000 controller/Vanguard® Field Controller.

VFC-3000 Controller/Vanguard® Field 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/Vanguard® Field Controller also reads and analyzes the diagnostic data from a variety of sensors. It is located in the traffic cabinet or the display.