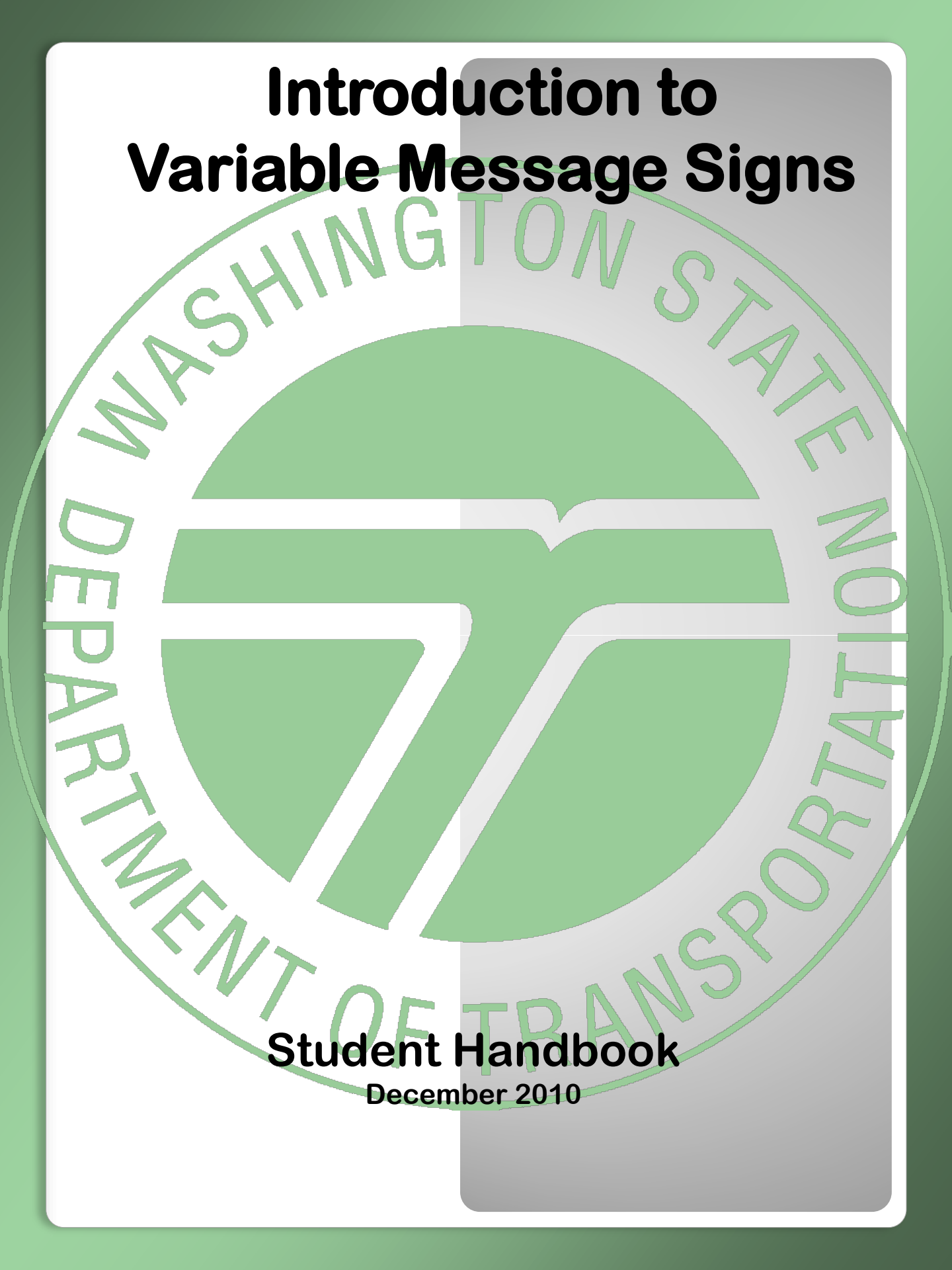
Introduction to Variable Message Signs



Student Handbook

December 2010

Table of Contents

Introduction to Variable Message Signs

Training Purpose

"To familiarize you with the overall operation of the VMS system, including software operation, troubleshooting/repair, and maintenance."

Topics Covered

1. **Different types of VMS technology and their usage.**
2. **Various VMS components and their functions within the sign system.**
3. **Common communication types involved in the sign system.**
4. **Basic software operations.**
5. **Basic procedures for troubleshooting, repair, and preventative maintenance of the VMS system.**

Topic 1

The different types of VMS technology and their usage

- VMS Introduction and Usage
- Types of VMS Technology
- Locations and Brands within Washington

VMS Introduction and Usage

Variable Message Signs (VMS) are traffic control devices used to provide motorist en-route traveler information. They are commonly installed on full-span overhead sign bridges, post-mounted on roadway shoulders, and overhead cantilever structures. The information is most often displayed in real-time and can be controlled either from remote centralized location or locally at the site. Traveler information displayed on VMS may be generated as a result of a planned or unplanned event, which is programmed or scheduled by operations personnel.

Traveler Information includes:

Construction Notices

Maintenance Operations

Special Event Notice and Motorist Instructions

Severe Weather Announcements

Traffic Congestion Conditions

Amber Alerts

Travel Times

Incident Notification

Other Roadway Information

The objective of the sign display is to allow the motorist time to avoid an incident, prepare for unavoidable conditions, or to give travel directions.

The goal is to have a positive impact on the motorist's travel time and ensure traveler's safety.

Types of VMS Technology and Their Usage

Types of Signs

Portable/Trailer – These are used for temporary setup and display of information at various locations. EX: Side of road for construction, disasters, detours, closures. Trailers can have solar panels, generators, or run on 120VAC.

SolarTech Display Control Panel

AES Stowed/Transport Position

AES Stowed with Solar Panel in Charging Position

AES Control/Power Panel

SolarTech Battery and Charging Equipment Compartment

Fixed Structure – Permanently mounted signs can be:

- Post mounted
- Bridge mounted

Sign structures have multiple access types:

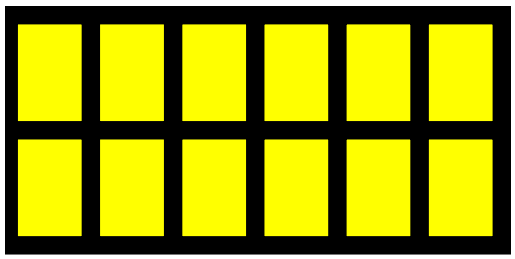
- Front access
- Rear access
- Walk-in

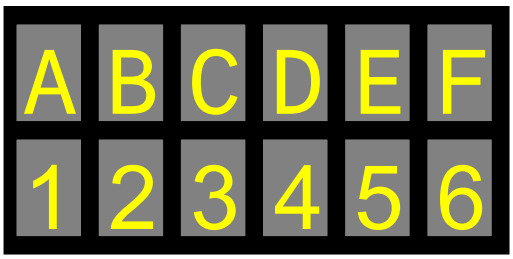
Daktronics “Walk In”

AES “Front Access”

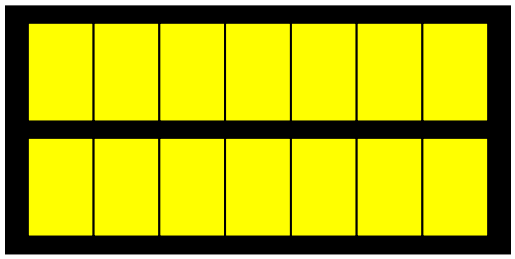
Matrix Display Types

Messages are limited by the types of VMS used and its display space configuration or matrix. There are three types of matrix displays: Character, Line, and Full.

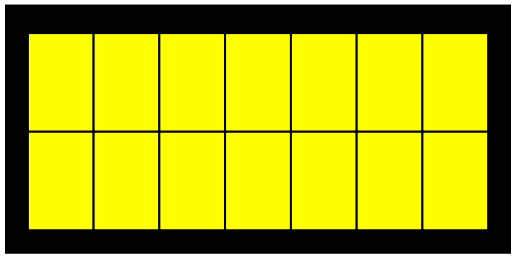




<u>Character Matrix</u> – Contains separate display space made available for each letter of the text message. A character matrix configuration of 6 horizontal and 2 vertical has only 12 character spaces available.



<u>Line Matrix</u> – Contains no physical separation between the charters in a single line of text. However, in a line matrix there still remains a horizontal separation between different lines of text.



<u>Full Matrix</u> – Contains no physical separations between individual characters or lines in the message. A message can be shown at any size and location as long as it is within the display space.

Types of VMS Display Technologies

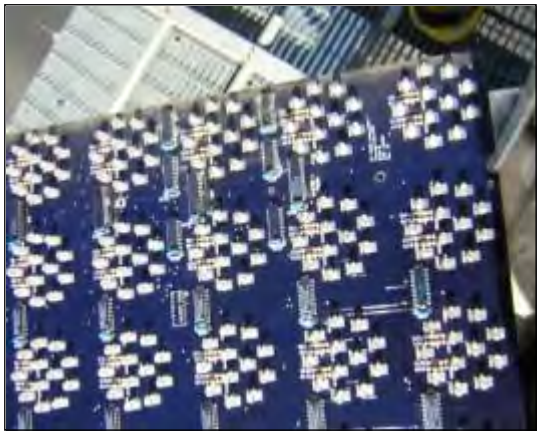
Flip disk – This technology utilizes a system of small circular, square, or rectangular disks; which individually rotate or flip to form characters on the VMS. Each disk has reflective material on one side, that when "flipped" is exposed to form the message.

AES Retro-reflective Flap

Telespot Flip Disc

Light Emitting Diode (LED) – LED technology utilizes clusters of solid-state diodes that form a single pixel. When voltage is applied, each diode cluster glows. By turning the voltage on or off, each pixel cluster is manipulated into forming the desired message.

Daktronics Pixel Array Behind Protective Face



Display Solutions LED Pixel Array

Fiber Optic – Fiber optic VMS technology utilizes bundles of fiber optic strands, which are strung to each pixel from a lamp source. A single lamp source will illuminate several pixels. To control which pixels are displayed, shutters are placed in front of each pixel. When a message is displayed, the magnetically controlled shutters open or remain closed to form a character or pattern.

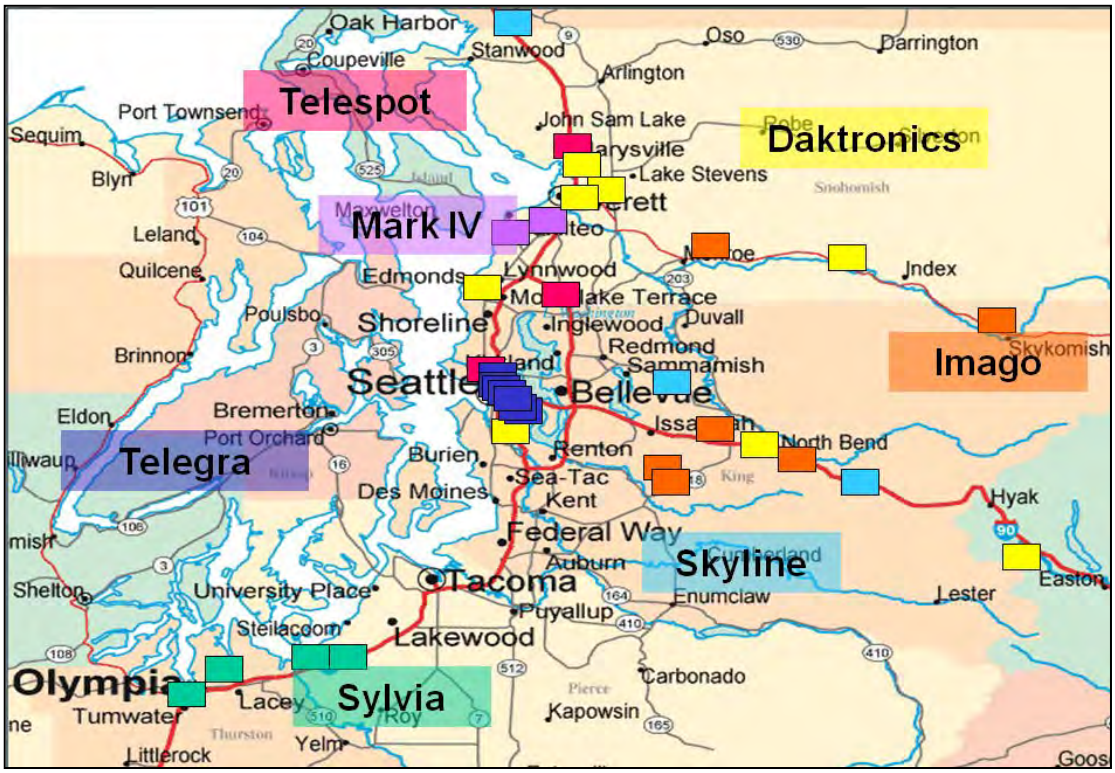
Telespot Halogen Back-lighting

Telespot Flip Disc with Fiber

Hybrid – A typical hybrid VMS utilizes both flip disk and either fiber optic or LED technology. Each flip disk has a hole in its center for light to pass through. A fiber optic bundle or an LED generates the light. When the pixel is activated, the disk is flipped. This allows light to pass through the hole while displaying the reflective side of the disk to traffic. When the pixel is off, its reflective surface is rotated, or flipped, blocking the light source.

Telespot Front Access

AES "T4" Trailer Module



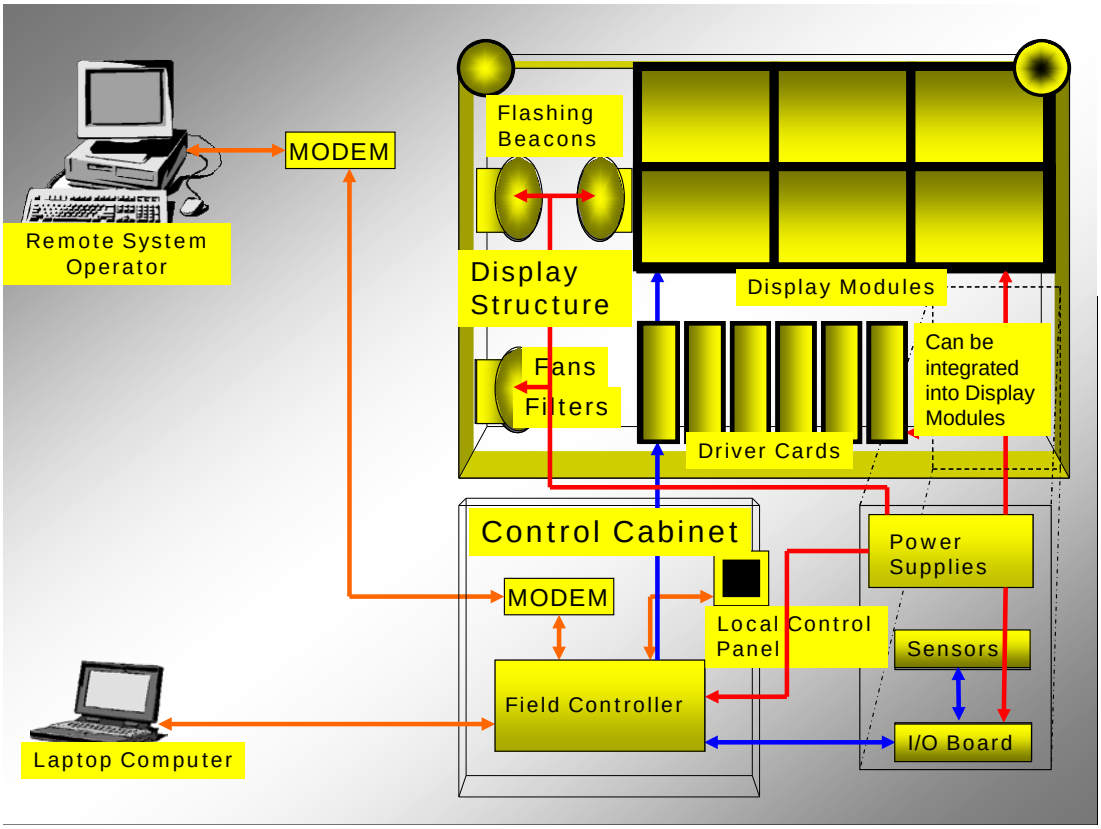
Locations and Brands within WA

- Approx. count *400*
- Suppliers
  - American Electronic Sign (Fixed and Trailers)
  - Sylvia
  - Daktronics
  - MarkIV
  - Telespot
  - AddCo (Trailers)
  - Skyline
  - Imago
  - Telegra
  - SolarTech

Topic 2

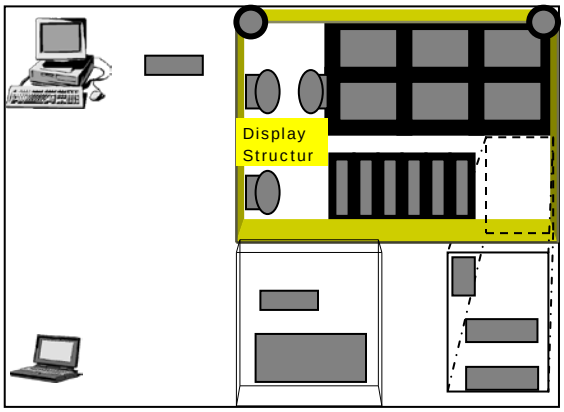
Various VMS components and the function of each within the sign system

- Functional description of components
- Relationship of components to each other.



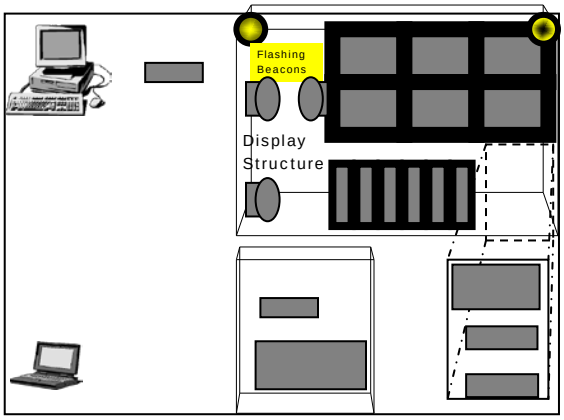
Display Structure

The sign structures are normally constructed of aluminum, with clear, anti-glare, Lexan facings. Some newer displays have exposed LEDs or lenses. The structures are designed to be resilient against temperature and other weather factors. Most of the major VMS components are contained within the display structure.



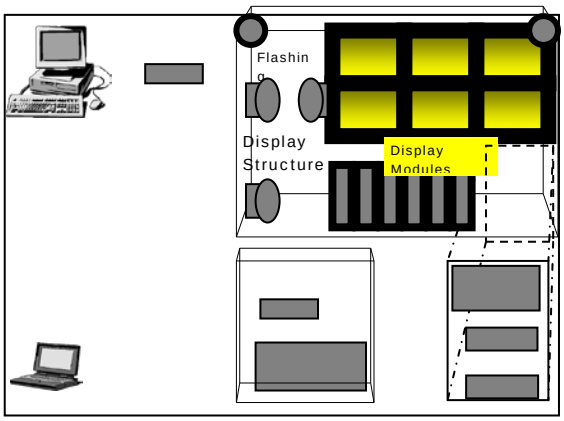
Beacons

Flashers, or beacons, are devices that are used to draw more attention to a sign when an important message is being displayed. They can be found within the sign face, mounted to the top of the sign structure, or on nearby poles. You should expect to find 2-3 flashing devices depending on the sign size.



Display Modules

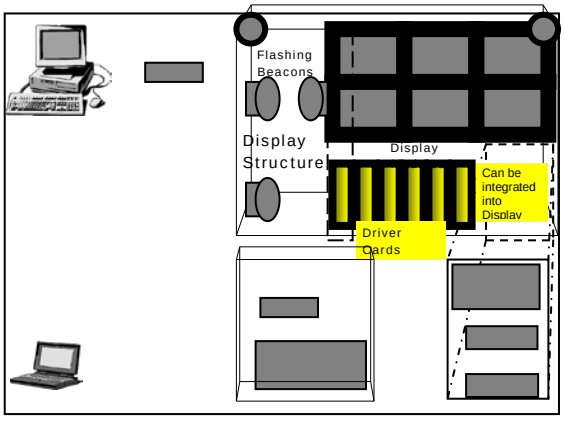
Display modules are contained within the sign structure and make up the display matrix. Each module consists of numerous pixels. The pixels are configured in columns and rows. When activated together, pixels form characters, numbers, and letters. With a group of multiple modules, messages can be displayed.

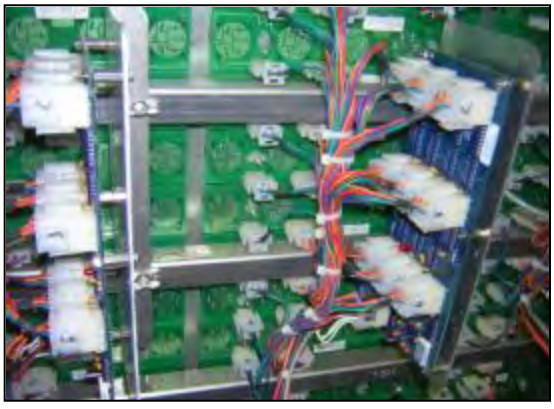


Display Drivers

Display drivers are circuitry that control the data output to the display modules. There is typically one driver per module, though some signs contain row and column drivers, or even one driver that controls multiple modules. Drivers are located on or near the display module they control. Newer displays are integrating the drivers onto the display module circuitry.

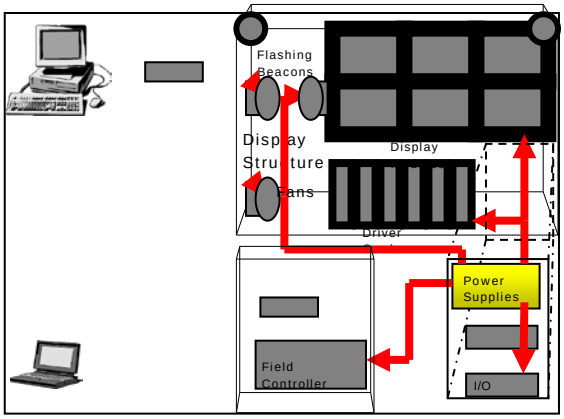
The display drivers are addressable and set per the module's location in the display matrix. This ensures the desired character will be displayed on the correct module.





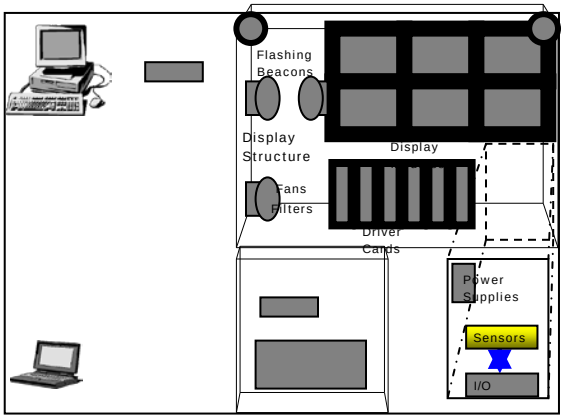
Power Supplies

Signs contain multiple DC power supplies that energize modules and other components. These power supplies can be redundant, meaning that if one fails, another will compensate. This allows for uninterrupted display operations.



Sensors

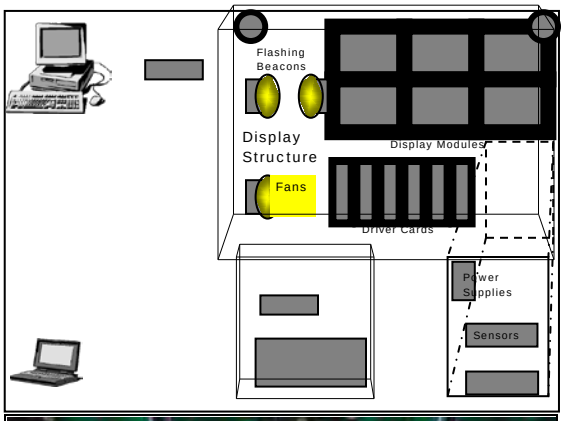
The sign contains multiple sensors that allow the field controller to adapt to environmental changes.

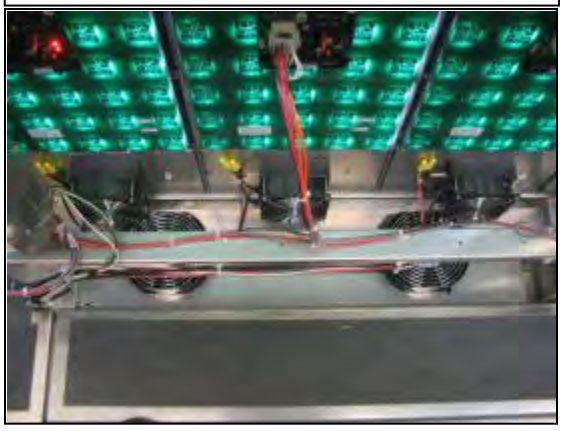


- **Temperature Sensors:** These sensors take internal and external temperature readings. The field controller reacts accordingly, to either heat or cool the VMS.
- **Light Sensors:** These sensors record external ambient light levels. The field controller changes the display intensity level to compensate for day and night conditions.

Fans

The fans, activated by the field controller, maintain proper operating temperatures and airflow within the display environment.

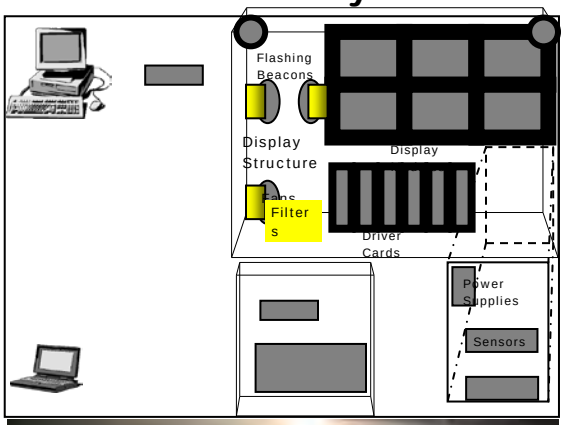




- **Intake Fans:** Pull in outdoor air into display
- **Exhaust Fans:** Blow air out of display
- **Pixel Fans:** - Heaters are paired with Pixel fans to blow warmed air across display face to heat or defog the display
  - Blow air across display back to cool display components

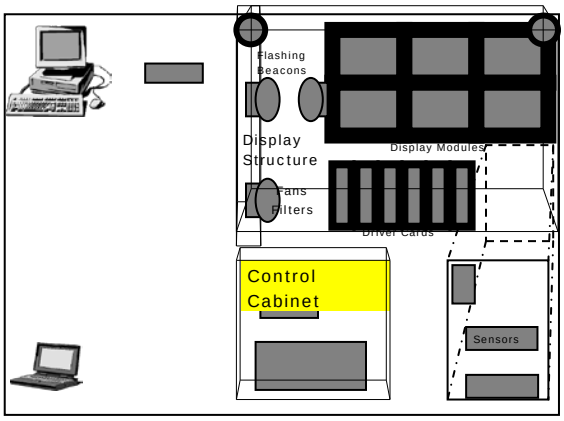
Filters

Filters are used to maintain a dust-free display system environment. Most displays contain intake and exhaust filters. Filter locations vary between manufacturers and sign models.



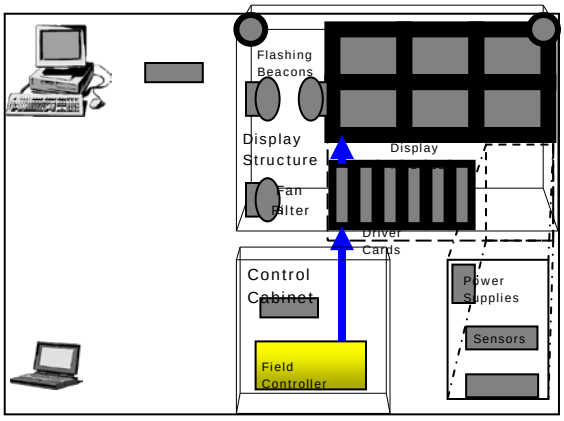
Control Cabinet

The cabinets are generally located near the sign structure. Depending on the manufacturer, the cabinet can house AC load centers, modems, fiber components, communication punch-down blocks, and field controllers.



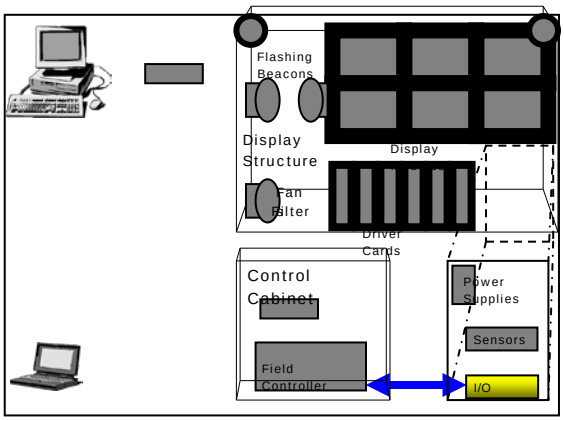
Field Controller

This is the central processor for the VMS. The field controller contains memory for message and schedule storage. It controls the display outputs and all peripherals within the sign. Communication with the controller can be locally or remotely via a computer.



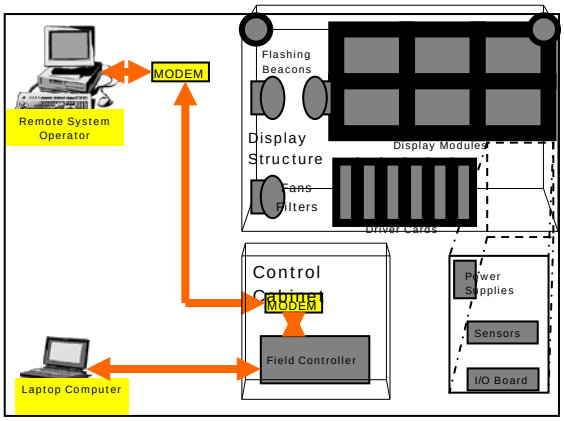
I/O Board

The input/output circuit board monitors all the sensor outputs. It also controls beacons and other relay controlled devices. The I/O board's output allows the field controller to respond to sensor changes as needed.



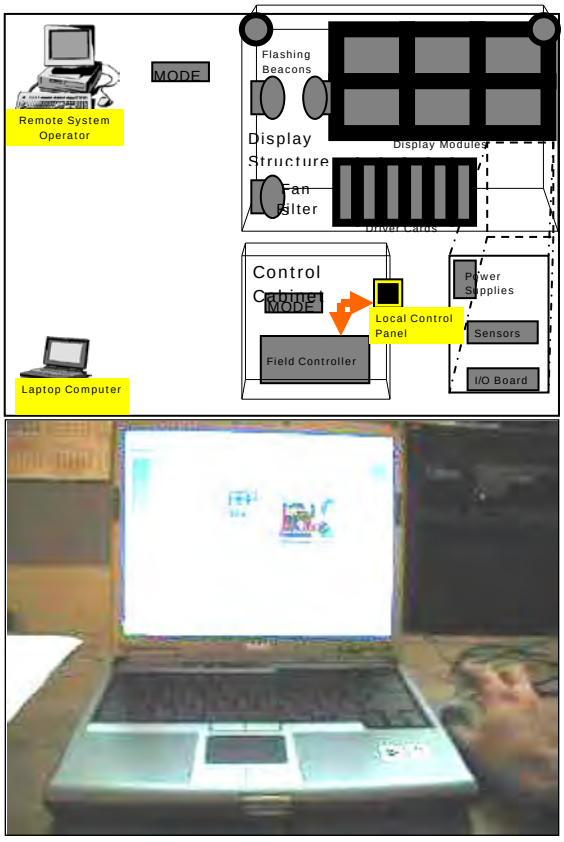
Modems

Modems are the devices that allow the operator to communicate to the field controller from a remote location. Remote Comms can be through copper or fiber runs.



Control Computers

Computers used to operate, repair, and maintain the VMS.

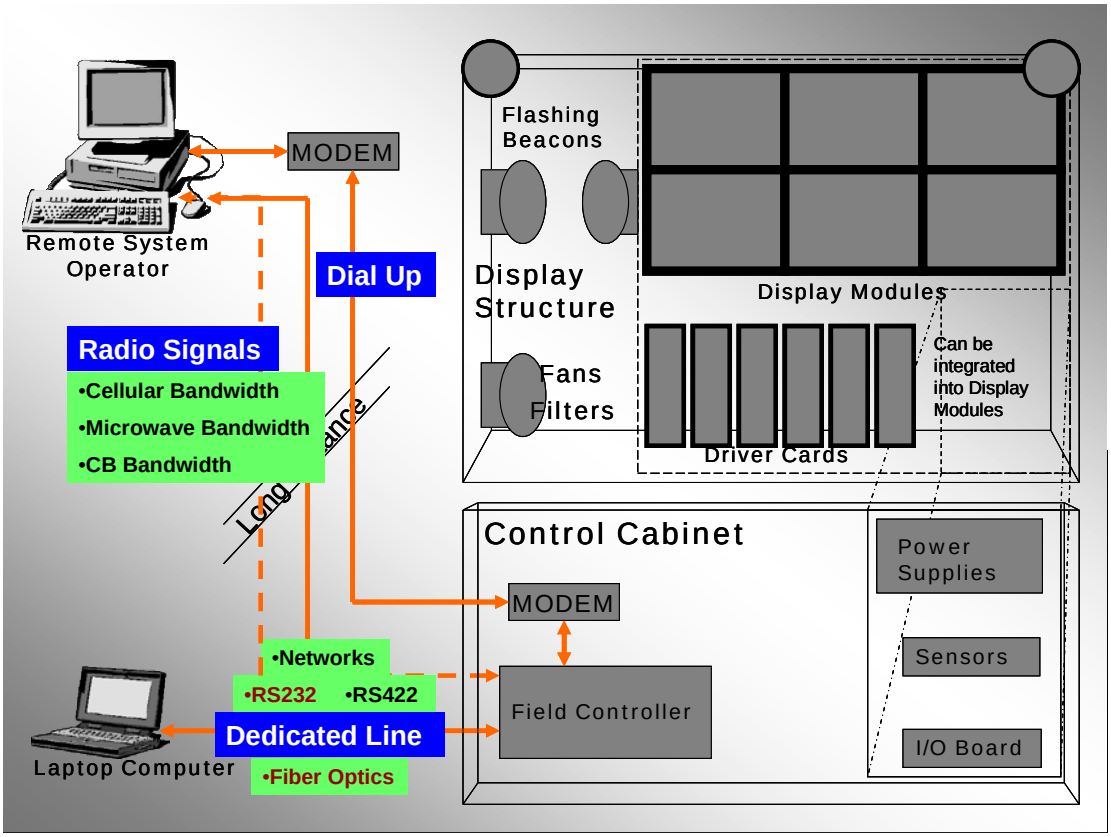


Local Computer: A local control system consists of a laptop with control software. This is used to aid a field technician with troubleshooting, diagnostics, and repair. The laptop connects directly to the field controller using RS-232 serial interface. Recent field controllers have a user interface, consisting of a display screen and input controls. This lessens the need for laptop and manufacturer software.

Remote Computer: A remote control system consists of a larger computer setup connected via a network. This allows operators and technicians to diagnose and control the VMS displays from afar. The Northwest Region's Regional Traffic Management Center at Dayton contains the remote system for our areas. Dayton utilizes a DOT engineered NTCIP software to control the region's VMSs. This software entails message control, but lacks means for any diagnostics.

Topic 3

The most common communication types involved in the sign system

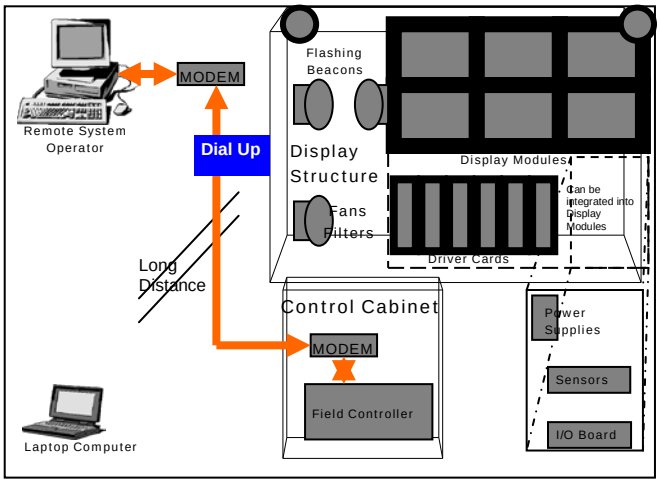


Types:

- Dial-up connection
- Dedicated line (point to point)
  - Copper
  - Fiber
- Radio connection

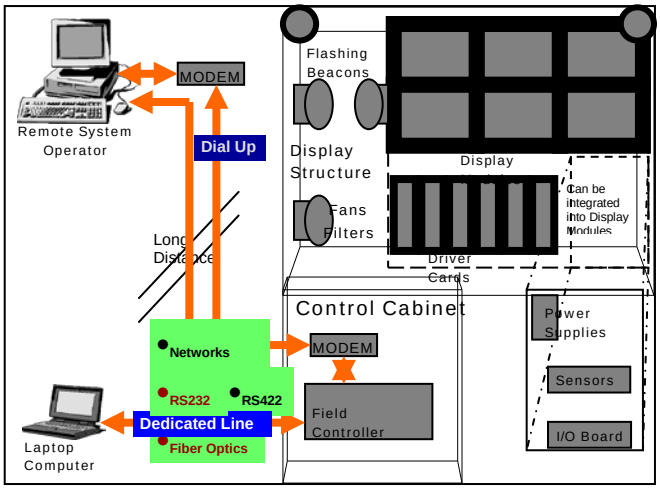
Type 1. Dial-up

Copper phone lines, along with modems, are utilized to make long distance connections with the signs. The signs have their own phone numbers used for access. The field controllers must be setup to accommodate this communication type. Modem handshaking, delay timing, and baud rates must be taken into consideration when configuring the controller.



Type 2. Dedicated line (point to point)

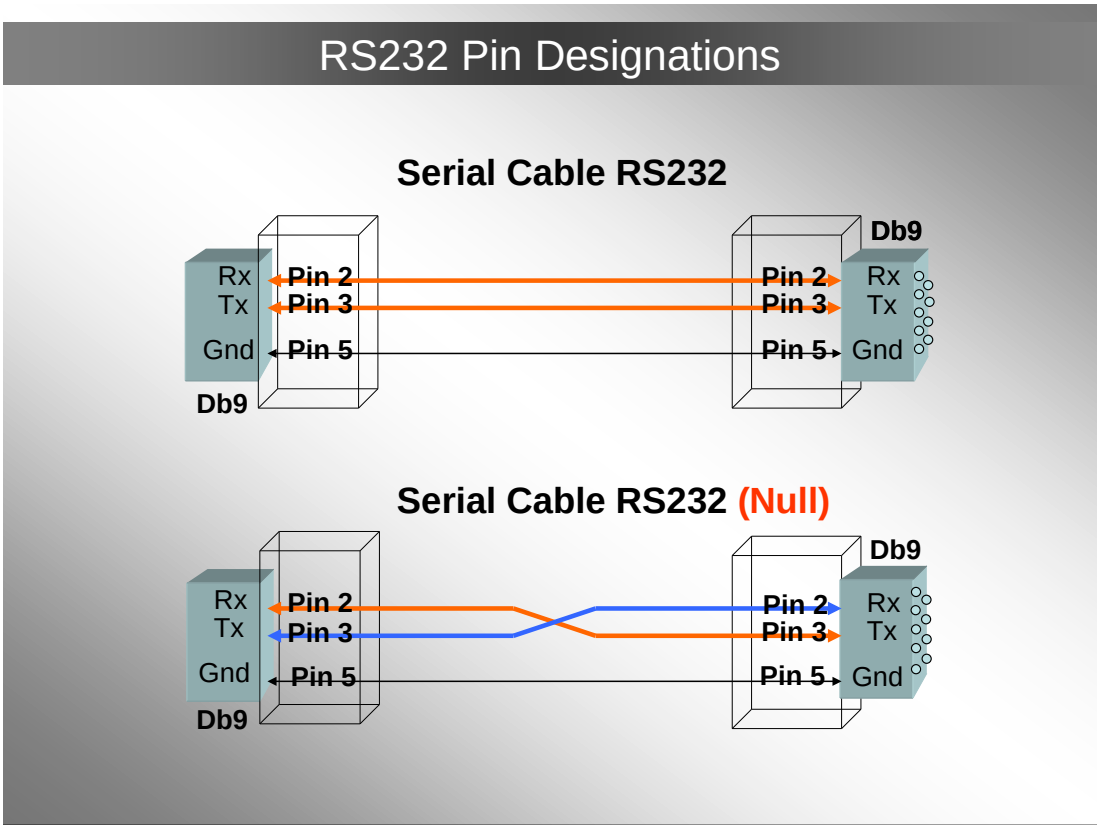
Point to point cabling can be used for local or remote access. Fiber or copper wiring is used to achieve these connections. A laptop requires a RS232 null connection to the sign controller. Remote connections require fiber or copper wiring and associated components. Controller configurations include baud rates, communication ports, and PTP/PTMP.



Four common types of serial connections used

- RS232

Consists of 3 wires: RX, TX, and a ground. RS232 has a length limitation of approx. 25ft. DB9 and USB are the most common connections used from the computer. Null modem cables are used when connecting locally to a controller.



RS422

Consists of 5-6 wires: RX+, RX-, TX+, TX-, and one or two ground wires. RS422 has a length limitation of approx. 4000ft. DB9 and USB connectors are also most commonly used.

Fiber Optics

Fiber optic cable is delicate glass cabling used to achieve long distance signal transfers. Single Mode and Multi Mode are the two fiber types used in the sign systems.

Networks
Some sign systems are connected through the user's network. This consists of RJ45 cabling and IP addressing.

Type 3. Radio signals
In remote locations, where direct cabling and phone lines are not available, radio signals can control a sign system. This system consists of extra equipment needed to translate the airwave signals for the sign.

The three common types of airwave signals used are:

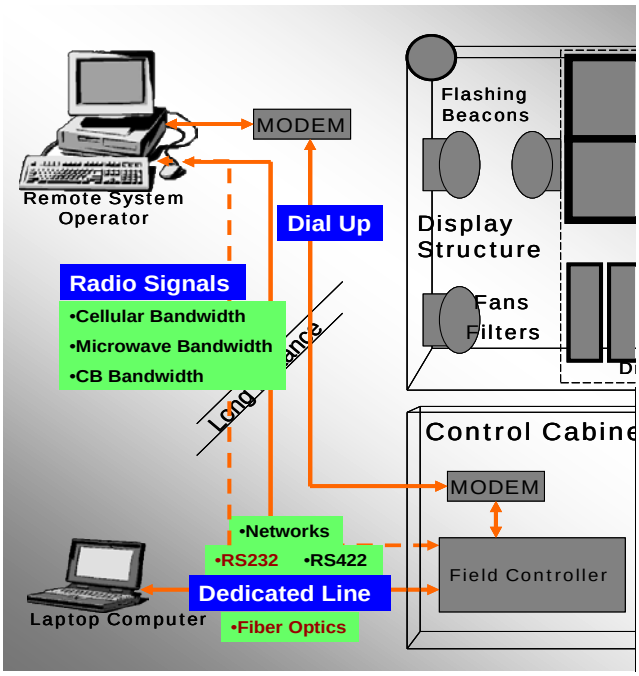
- **Cellular Bandwidth Signals:** Consists of a cellular modem and a cellular phone signal from a compatible phone service provider.

- **Microwave Bandwidth Signals:** Data is transferred through the microwave bandwidths of radio frequencies. This system utilizes a transmitter and receiver, which are locked on to a set frequency.

- **CB Bandwidth Signals:** Utilizes CB frequencies, involving CB radios and handhelds, which allow for sign functions.

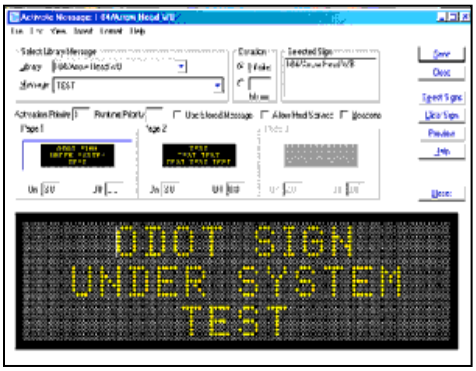
Usage and Location within the sign system

1. Remote to Sign - Dialup/Radio, Fiber/ Copper Networks
2. Local at Sign - Direct RS232, RS422
3. Controller within Sign- RS232, RS422, Fiber



Bonus Topic

Basic software operations, including maintenance tools used for troubleshooting



Skyline Software

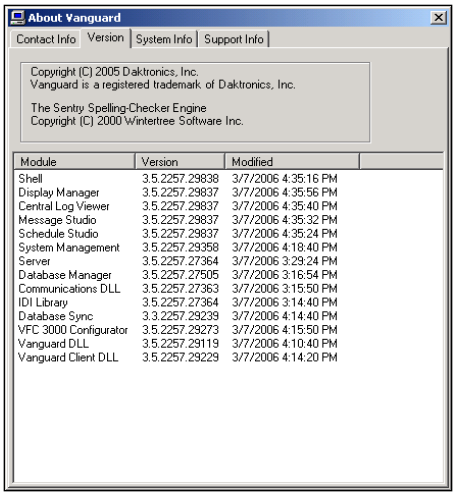
AES Software

There are several brands, makes, and versions of sign systems within the state. Several control software types are needed to service each region. All control software contains basic functions. These functions are described on the following pages. Your region should have contracts, manuals, and software for the VMS signs located in your area.

Intro:

System Requirements – Be sure to note the needed hardware requirements to run the control software. Most often this is found on the back of the software packaging or in the user manual.

Software Version – Most often manufacturers will change and upgrade sign hardware/firmware. Software compatibility becomes an issue. Be sure to note the software version installed on your laptop/PC. This information will become vital during troubleshooting steps.

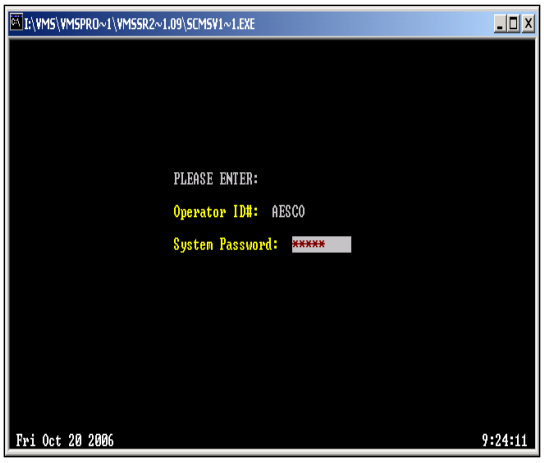


Daktronics Version Page

AES Version Page

Logging on – Like any other manufacturer's software, you will need a login name and password. Be sure you can properly open the software at the shop before venturing out to perform sign service. Certain user names yield certain user rights, and some software requires hardware "keys".

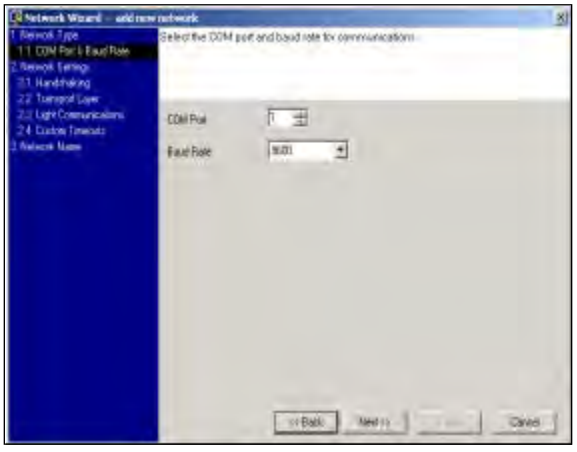
Daktronics Log-on Page



AES Log-on Page

Configurations:

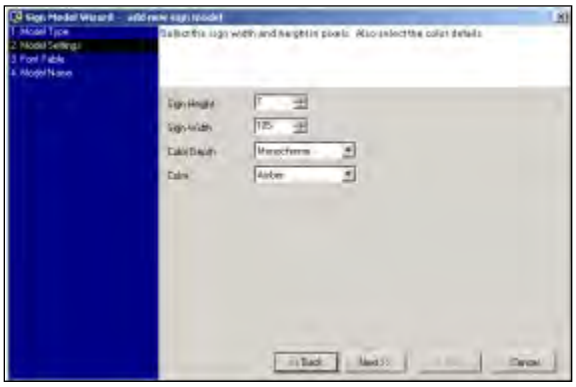
Communications – With numerous communication possibilities available, knowing the site specifications before attempting to communicate is required. All software protocols need to be set for the communication to operate 100%.



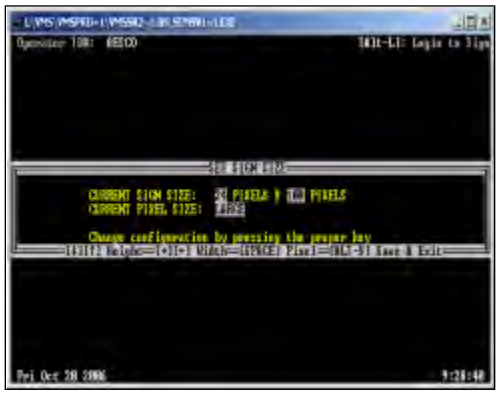
Daktronics Comm Settings Page

AES Comm Settings Page

Signs – There are various sign sizes in use. Familiarity with the sign size allows for messages to be created and displayed properly. Otherwise, messages can be cut off, or have lines missing without the operator's knowledge.

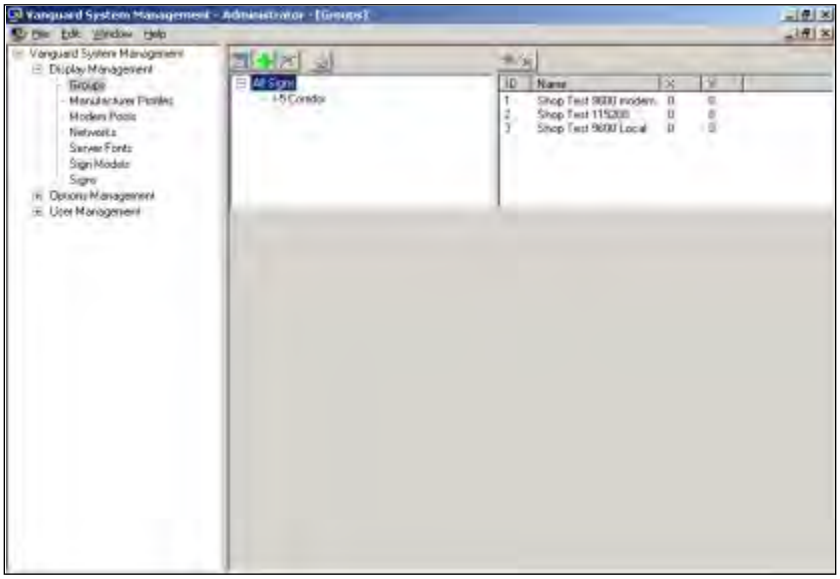


Daktronics Sign Size Page



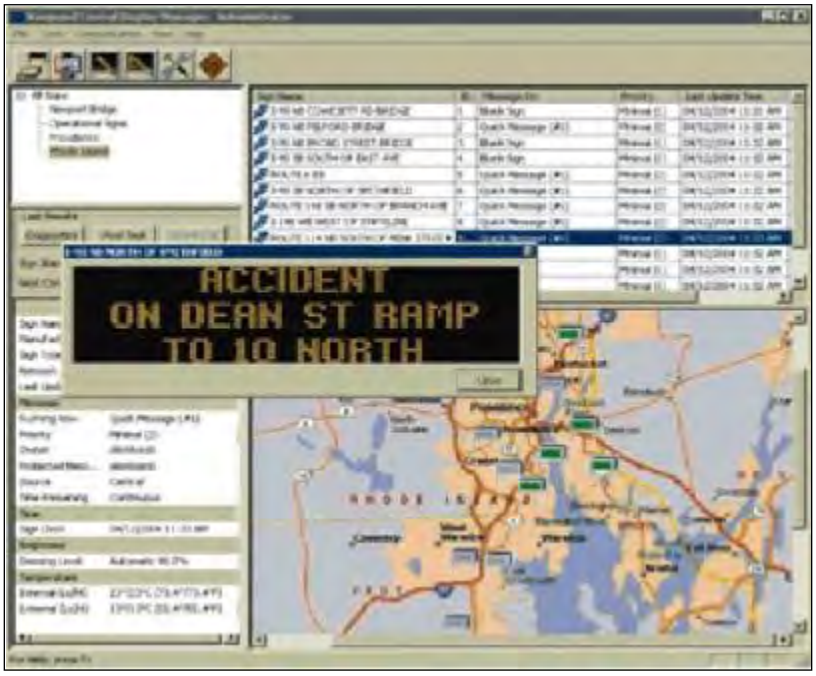
AES Sign Size Page

Groups – Signs can be configured in groups, to allow for ease of communication by the operator.



Daktronics Sign Groups Page

Sign Maps – Most manufacturers include a mapping tool to aid in sign control. By importing a map of your area, you are able to place markers of created signs at their site location.



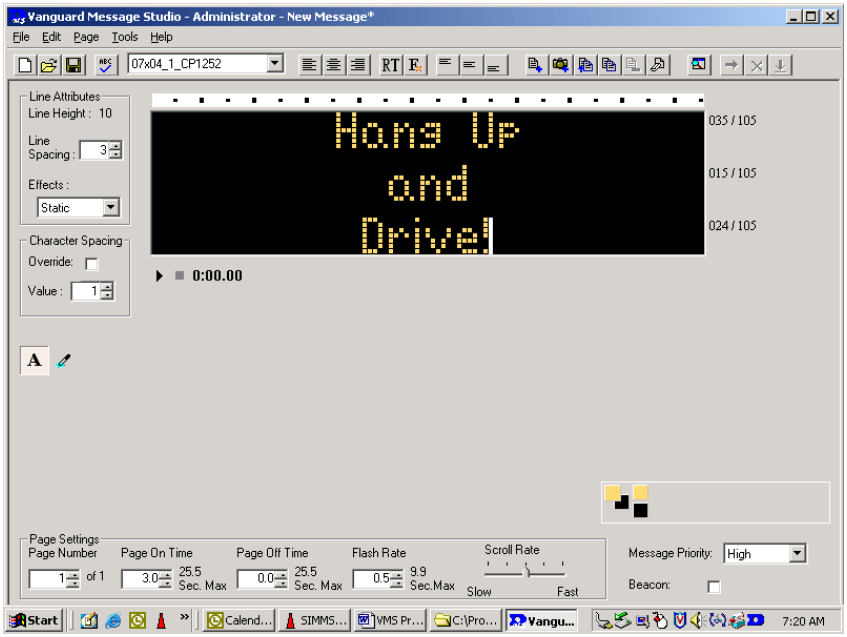
Daktronics Sign Map Page

Message Creation:

Basic Message – Messages can be static, flashing or alternating.

Creating messages that fit your sign and that conform to state regulations are necessary. Regulations include message length, hold times, content, and beacon use.

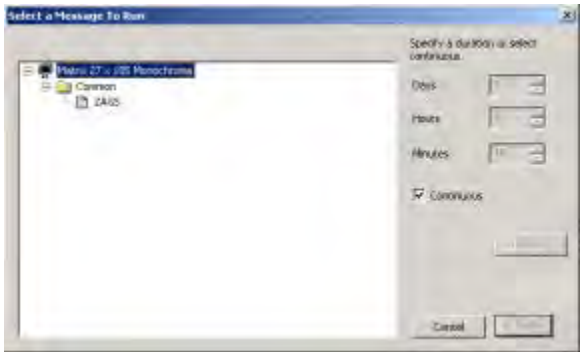
You will need to know the sign location and nearby road speeds to communicate a message properly. Font size, message content, message hold time, and priority should be determined and authorized before message creation begins. Test messages and previously created messages are stored in the controller library for fast and easy implementation.



Daktronics Message Creation Page

Message Display:

Sending a Message – Once a message has been created, it is stored in the laptop/PC, and needs to be sent to the VMS field controller. This is done by selecting the desired message, connecting to the VMS field controller, and transmitting the message to an open library slot.

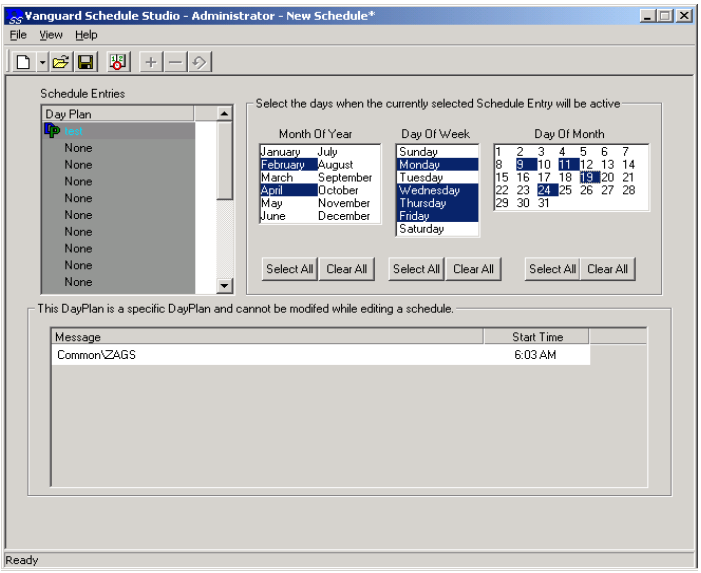


Daktronics Message Selection Page Page

AES Message Selection

Running a Message – Once a message has been stored properly in the field controller, it can be displayed on the sign. By selecting the message from the library, choosing the message duration, you can then display the message.

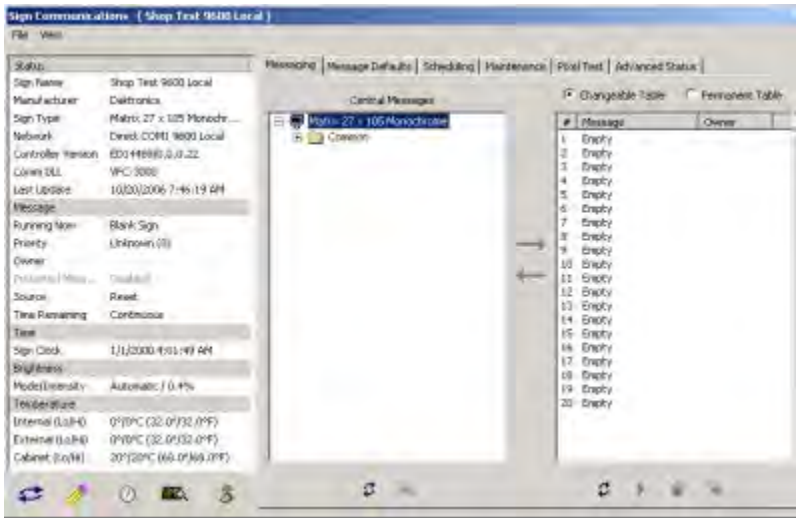
Scheduling a Message – If an event is known in advance, a message can be scheduled to run between a set time and date.



Daktronics Schedule Page

Operating the Sign:

Connecting to the Sign – Establishing communication to the sign is step one. Most signs will respond with a status report of some kind. This should include the controller's date and time, message status, and some sensor inputs. The controller firmware version and configurations can be shown as well. Once communication is established, all operations and maintenance tabs will become available.



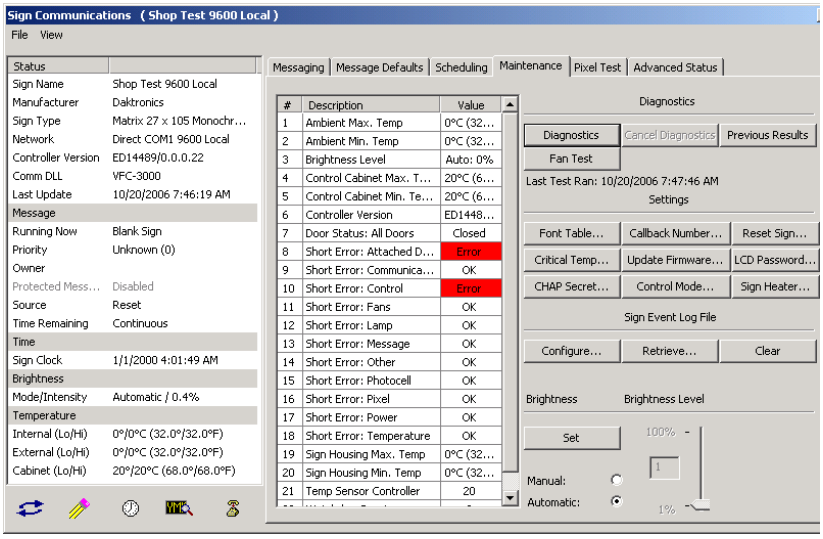
Daktronics Sign Communication Page

Other operations include:

- Schedule control stop/start/remove
- Message control stop/start/remove
- Unknown message retrieval
- Monitoring the sign
- Brightness adjustments
- Date/Time settings
- Log File use
- Default message settings

Diagnostics and Troubleshooting:

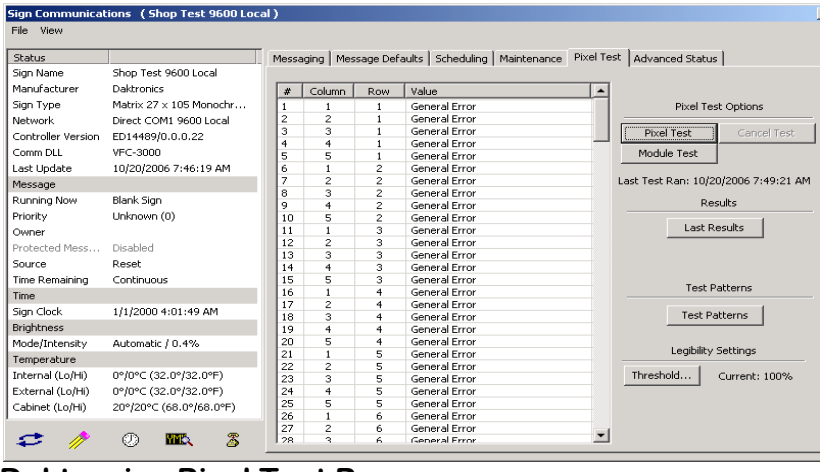
The software contains numerous maintenance tools used for troubleshooting sign failures.



Daktronics Maintenance Page

These include:

- **Light Sensor readings**
- **Temp Sensor readings**
- **Power Supply Pass/Fail readings**
- **Pixel/Lamp Tests**
- **Test Messages**
- **Comm. Failure messages**
- **Beacon Status**
- **Fan Status**



Daktronics Pixel Test Page

Topic 4

Procedures for troubleshooting, repair, and preventative maintenance of the VMS system

** Be sure to research technology and Brand before Service Trip **

Common Problems and Solutions

Module Failure – Ensure that all signal and power connections are secure. Check for proper operating voltage at the module. A troubleshooting tip is to swap the failed module with a known working module. If the problem moves, the module has failures and the original signal/power connections are ok. If a module is needed to be sent in for repair, move modules around to leave a blank spot in a less used area such as the lower corner.

Module/Driver Failure

Driver Failure – Check driver readout for failure code if applicable. Check driver source voltage for proper output. Check addressing and signal connections for loose pins or wires. Once power and signal are found to be ok, try swapping drivers with a known working driver. See if the problem moves, or stays at the original module location. Change out failed driver with spare, or leave "dead" module in a less used area of sign.

Driver/Module Failure

Power Supply Failure – Check the source voltage. Check all corresponding fuses. Double check that the other power supplies are not being overdriven, causing other power supplies to shut down. Be sure to follow proper replacement procedures when changing out power supplies. Most supplies will need to be adjusted to perform within thresholds to allow for proper operation and failure reporting.

Loss of Network Communications – Check punch-down or other communication wiring for loose or broken connections. Use a butt-set to check for transmit and receive tones if applicable. Check local communications with laptop to ensure that the sign is operating properly. Double check network settings to make sure nothing has been tampered with or reset. Also check the modem for proper operation. Be sure the comm. lights on the modem are activating, as they should. The field controller or modem may be locked up, and need to be reset.

Network/Controller Failure

Controller Failure – Since the field controller is simply a computer, they do have the capability to lock up. Simple resets will result in a repair, but be sure to note when the failure took place to track a reoccurring issue. A replacement field controller may be needed at that point. Power spikes and ground loops can cause the sensitive controllers to lock up or fail as well. Double-checking addressing and site settings will help determine if a controller is the issue or if it resides elsewhere.

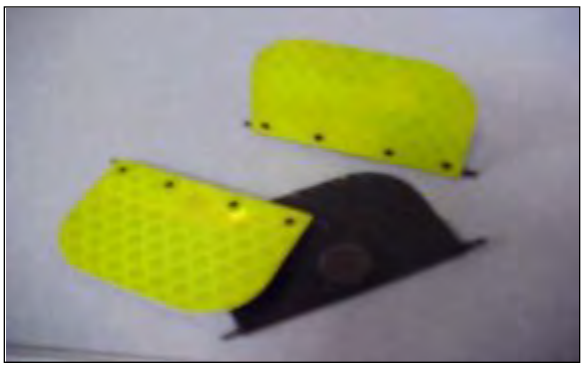
Message Display Failure – Check power and signal connections to controller, I/O boards and driver/modules. Display a factory test message to see if issue resides in the message trying to be displayed. Check to ensure message was created and stored properly. Make sure a schedule is not running. Be sure that light sensors are operating properly. Display may be on, but too dim to read properly.

Sensor Failures – Locate and check failed sensor connections. Light sensor failure will result in altered display intensities. Be sure to check that the sensor eye window is unobstructed and clean. Temp sensor failures will allow fans and heaters to not operate properly. They could overheat or overcool the sign components yielding further failures.

Water Intrusion – There should be weep holes in the bottom of the sign structure to allow for condensation release. There should not be water stains or corrosion on components or structure. Be sure to check the lift eye penetrations for water intrusions as well.

Backlighting Failure

Backlight Failure – Backlighting failures on flip disc signs can cause messages to be illegible. Checking fuses and power supplies for proper power is a good first step. Be sure that all the lamps are good. Swap lamp drivers, if need be, to see if problem moves as well.



Common Replacement Parts

- Field Controller
- Modules
- Drivers
- I/O boards
- Filters
- Sensors
- Modems
- Cabling
- Power Supplies
- Pixel Parts
- Fuses
- Lamps

Tools Used:

- Site Keys
- Basic Hand Tools
- Hardware Key if Applicable
- Spare Parts
- Harness
- PPE
- DMM/DVM
- Camera
- Note Pad
- Site manuals and PM Checklist
- Laptop with Proper Manufacturer and Version per job site


OPERATION AND MAINTENANCE MANUAL
HAWK N' INDUSTRIES LIMITED

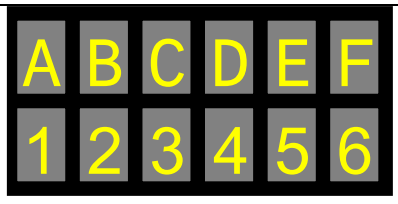
VMS Routine/Preventative Maintenance Checklist				
Maintenance Item	**6 Month**	**1 Year**	**As needed**	
				Sign# -
Sign Structure				Dates Performed
Pixel Test	X			
Power Supply Test	X			
Functionality Test	X			
Connections Secured	X			
Sign Enclosure Inspection		X		
Structural Inspection		X		
Light/Temp Sensor Inspection		X		
Internal Hardware Tight		X		
Face Panel Cleaning			X	
LED/Flip disc Cleaning			X	
Ventilation Fans Inspection			X	
Intake/Exhaust/Fan Filter Change			X	
Internal Lighting			X	
Vacuum Sign Interior			X	
Weather Resistance			X	
Traffic Cabinet				
Ventalation Fan	X			
Interior Lighting	X			
Heater Test	X			
Connections Secured	X			
Weather Resistance			X	
Exhaust Filter			X	

Notes

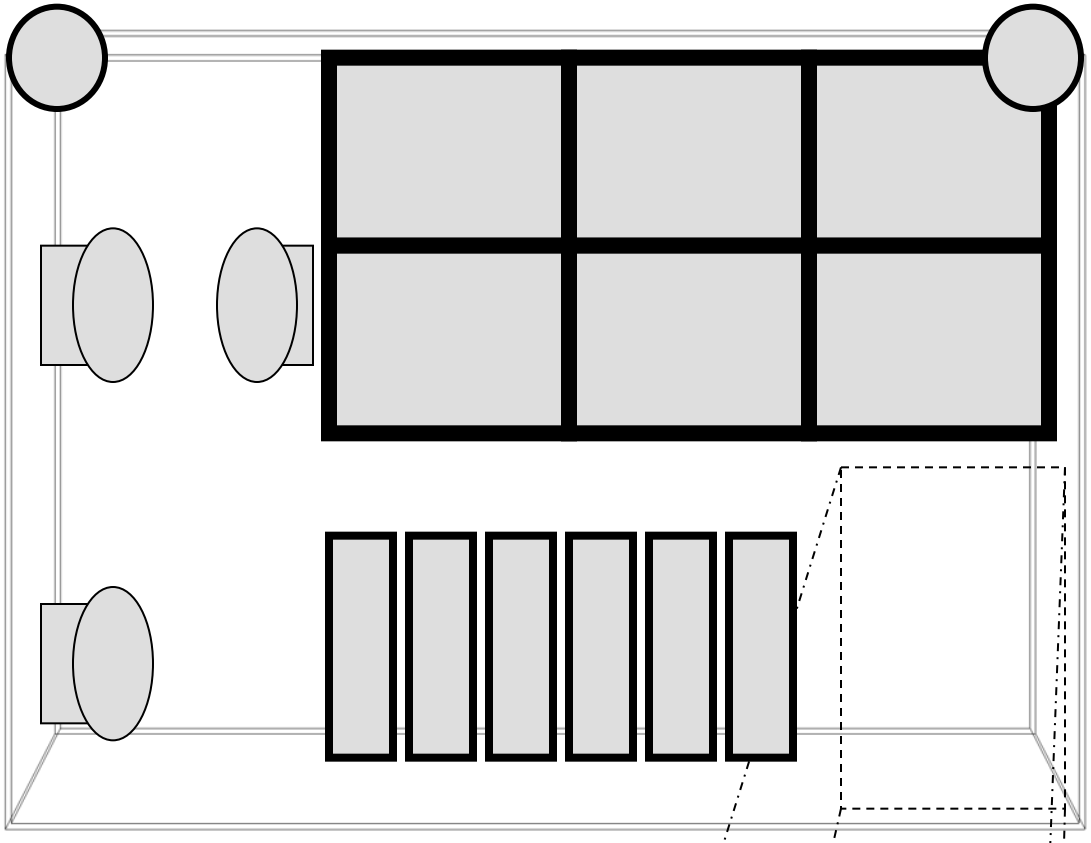
General -

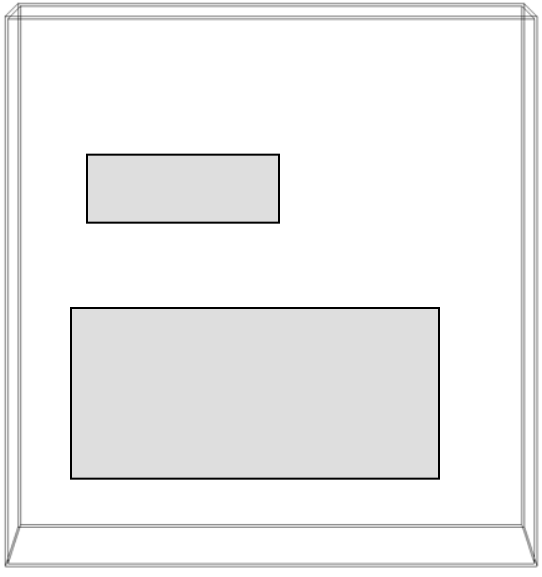
- Walk-in LED PM: 3 persons, TMA & Bucket truck, approx. 4-6 hrs
- Walk-in signs will have doors at either end of sign
- Non walk-in PM: 6-8 persons, 2-3 TMAs, 2 Bucket truck min., 8-10 hrs on weekend night
- Double check comms and sign operation before leaving sign site
- Be sure to vacuum Power Supply vents and fans

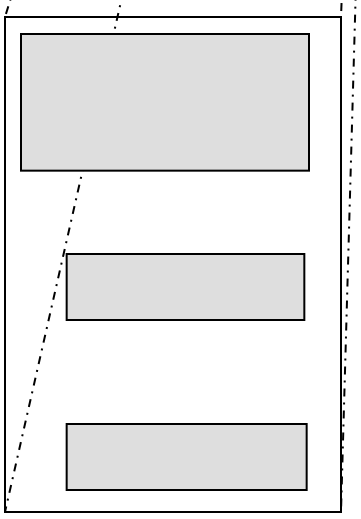
Matching Worksheet

1. Character Matrix	_____	
2. Fiber Optic	_____	
3. Full Matrix	_____	
4. LED	_____	
5. Flip Disc	_____	
6. Hybrid	_____	
7. Line Matrix	_____	

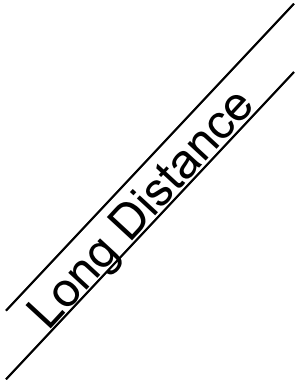
VMS Components
Block Diagram Worksheet

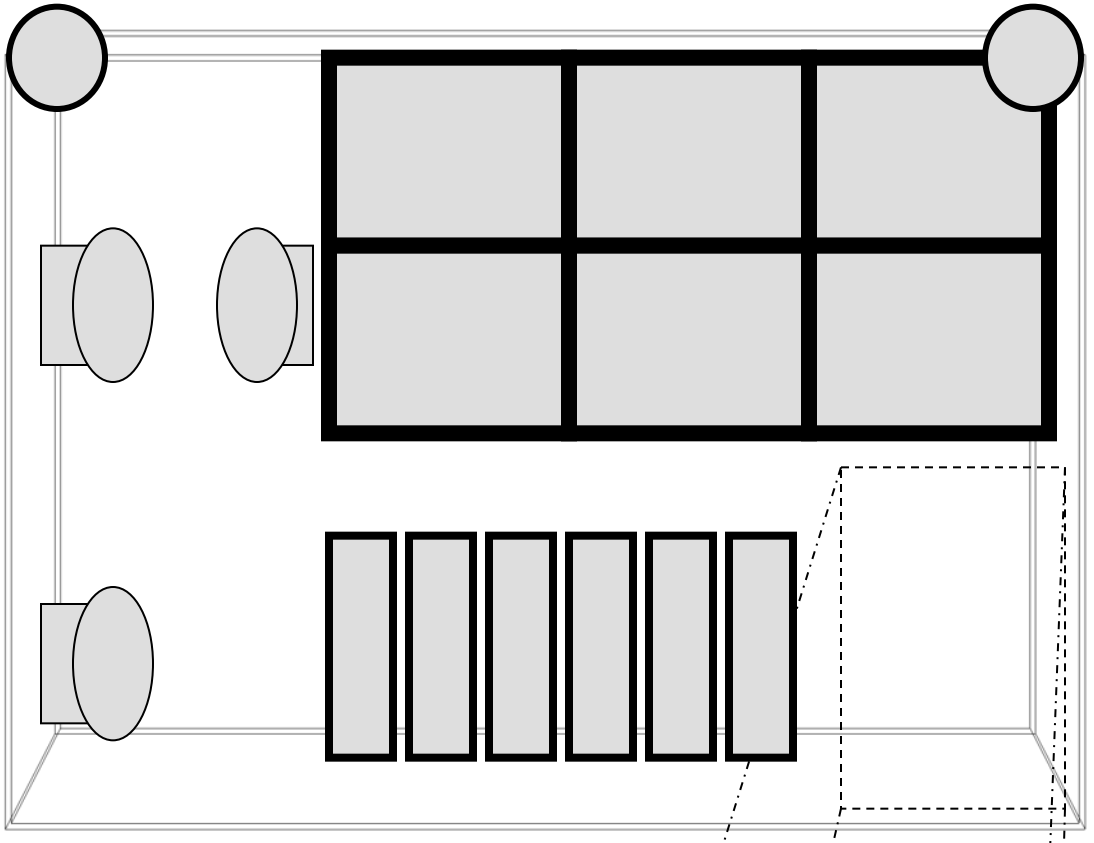


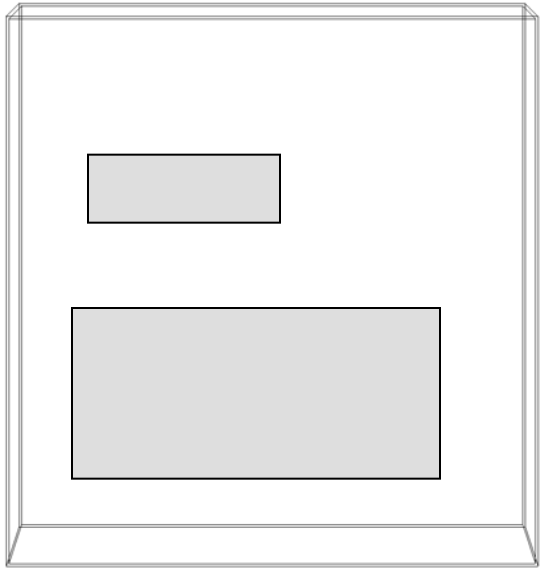


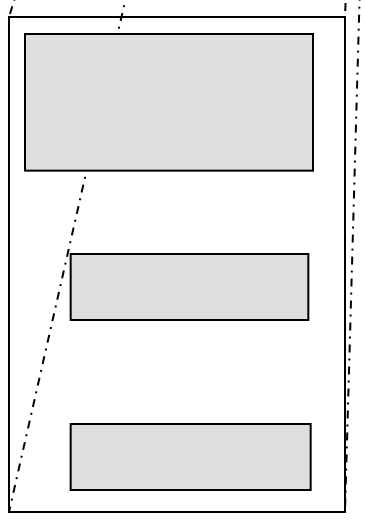


VMS Communication Types Block Diagram Worksheet









TST: Variable Message Signs

VMS TST Class

Should or Shouldn't

1. Leave the power ON when diagnosing power supply issues.
2. Test the sign once before leaving after a repair.
3. Check the Comm. Status before leaving the shop for sign service.
4. Bring all possible tools when servicing a sign. ie laptop, spare parts…
5. Trust the LED pixel test, as you cannot always see a failed pixel.
6. Manually move a stuck flip-disc.
7. Know that all the Comms. are working if your laptop connects.
8. Reset the field controller once before beginning troubleshooting.
9. Perform a PM only per the manufacturer's checklist.
10. Run the beacons during a test message.

VMS TST Class

True or False

1. **If the sign lights up 100%, all of the power supplies are good.**

2. **Sign operators are experts and give very accurate fail reports.**

3. **Display module boards can be moved from one location to the next.**

4. **Some newer signs do not need laptops to troubleshoot issues.**

5. **A clogged filter prevents debris from entering the sign, and does not cause harm to the sign.**

6. **Cleaning the light sensor covers helps to save energy.**

7. **A technician doesn't need to understand how to send and create messages, that is what the operators are for.**

8. **Signs are required to have exhaust, intake and pixel fans.**

9. **Construction and General maintenance keys are the only keys needed for sign and cabinet access.**

10. **Checking Power and Comm Status is a good place to start when troubleshooting a failed display.**

VMS Routine/Preventative Maintenance Checklist

Maintenance Item	6 Month	1 Year	As needed	
				Sign# -
Sign Structure				Dates Performed
Pixel Test	X			
Power Supply Test	X			
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LED/Flip disc Cleaning			X	
Ventilation Fans Inspection			X	
Intake/Exhaust/Fan Filter Change			X	
Internal Lighting			X	
Vacuum Sign Interior			X	
Weather Resistance			X	
Traffic Cabinet				
Ventalation Fan	X			
Interior Lighting	X			
Heater Test	X			
Connections Secured	X			
Weather Resistance			X	
Exhaust Filter			X	

Notes

General -

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- Be sure to vacuum Power Supply vents and fans

VMS Feedback

Positive:

"As a daily Seattle commuter, your overhead electronic travel time sign(s) is a great idea… Just returned from California; they need something like this on their overcrowded San Francisco Bay Area freeways… What is up with CALTRANS (California Department of Transportation)?"

"I like the information presented on these signs. It is nice to see the commute times even if I cannot avoid it – it helps to set expectations. I think the more information you can display on these signs the better"

"Thank you! I find the travel times a great feature. There is nothing more irritating than flipping on the radio to realize you just missed the traffic report and to make a blind decision as to which way to take to work."

"I love them! It is very, very useful! Thanks! My only "complaint" is if there is a different report, such as indicating an accident ahead, it seems to override the travel time estimates. It is in these situations that the travel time estimates are the most valuable."

Negative:

"What a waste of taxpayer money if you think this is more important than putting up information to help police catch a carjacker and murderer. I can hit a button on my cell phone and know exactly what the traffic is on all the major freeways in the area. It is much more important to me to know if one of the cars around me contains someone who just murdered somebody. I would like to be able to help the police get that person into custody. It is about time for somebody in this state to get at least one priority straight!"

"The reader boards over the highway are counterproductive. Drivers slow down to read these signs, causing more traffic. A big part of the problem is the poor choice of location for these signs."

"I believe the travel time display is not useful. By the time you see those as motorists, you have already chosen your route."

"In theory, I think this is a good idea, but in reality, it causes a slow down in the traffic while everyone tries to read the signs. You can listen to the radio and get pretty much the same information. Keep the traffic moving!"

Neutral:

"The travel times are ok. Perhaps you could use the reader boards to post signs like 'Turn On Headlights' when its raining, drizzling, etc. Or how about 'Use Your Blinker!'? I can think of other smarta$$ signs, but it would be inappropriate."

Acronym Glossary

AES – American Electronic Sign –

Sign Company providing trailers and fixed mounted signs to the State DOT. Company no longer exists.

CB – Citizen's Band –

CB is low-power (up to 4 Watts), public radio frequencies that does not require FCC approval.

CMS – Changeable Message Sign –

Electronic signage that involves a preset message library. The messages are called up by the end user from a memory list. The signs can encompass programmed electronics or simple lighting arrangements.

DB9 – 9 Pin Connector –

D style data connector containing 9 pins.

DMM – Digital Multimeter –

An electronic device used to measure voltage, resistance, current and other circuit characteristics. Readings are displayed on a digital LCD panel on the DMM.

DMS – Dynamic Message Sign –

A variable (also changeable, electronic, or dynamic) message sign, often abbreviated VMS or CMS, is an electronic traffic sign often used on roadways to give travelers information about special events.

I/O – Input Output –

I/O, pronounced "eye-oh", is the flow of data to and from the CPU. Also refers to the peripherals sending the data, and the pathways they use.

IP – Internet Protocol –

A packet-based protocol for delivering data across networks.

ITS – Intelligent Transportation Systems –

The ITS program is an initiative of the United States Department of Transportation to add information technology to transport infrastructure and vehicles. It aims to manage vehicles, loads, and routes to improve safety and reduce vehicle wear, transportation times and fuel costs.

Acronym Glossary

LED – Light Emitting Diode –

A light-emitting diode (LED) is a semiconductor device that emits incoherent narrow-spectrum light when electrically biased in the forward direction. This effect is a form of electroluminescence. The color of the emitted light depends on the chemical composition of the semiconducting material used, and can be near-ultraviolet, visible or infrared. Nick Holonyak Jr. (born 1928) of the University of Illinois at Urbana-Champaign developed the first practical visible-spectrum LED in 1962.

NTCIP – National Transportation Communications for ITS Protocol –

The NTCIP is a family of standards that provides both the rules for communicating (called protocols) and the vocabulary (called objects) necessary to allow electronic traffic control equipment from different manufacturers to operate with each other as a system.

PM – Preventative Maintenance –

Maintenance (including inspection, cleaning, and repair) of equipment on a regular basis that is sufficient to prevent unplanned failure.

PPE – Personal Protective Equipment –

Safety devices or safeguards worn by workers to protect against environmental hazards. PPE includes helmets, safety goggles, hearing protectors, face shields, respirators, arm guards, smocks, gloves, and safety boots.

PTP – Point to Point –

A protocol used in the communication of two computers through the use of a serial interface.

PTMP – Point to Multi-Point -

A protocol used in the communication of multiple computers through the use of a serial interface.

RJ45 – Registered Jack 45 –

An 8 pin connector used for data transmission over standard copper telephone cable.

RS 232 – Recommended Standard 232 –

This is the de facto standard for communication through PC serial ports. It can refer to cables and ports that support the RS232 standard.

Acronym Glossary

RS 422 – Recommended Standard 422 –

RS-422 is a serial data communication protocol which specifies 4 wire, full-duplex, differential line, multi-drop communications.

RX – Receive –

RX is the general abbreviation used in digital communications, representing a Receive signal. RX was the common telegraph abbreviation for receive. It should not be confused with the Rx used for medical prescriptions.

TX – Transmit –

TX is the general abbreviation used in digital communications, representing a Transmit signal. It should not be confused with the TX used for shorthand
medical script for 'treatment.'

USB – Universal Serial Bus –

An external bus standard that supports data transfer rates of 12 Mbps.

VMS – Variable Message Signs –

Electronic signage that employs ITS technology and centralized control systems to change messages in real time, providing motorists with timely and useful information.

Glossary

Amber Alert – In the USA and Canada, an AMBER Alert is a notification to the general public, by various media outlets, that a confirmed abduction of a child has happened. AMBER is an acronym for "America's Missing: Broadcast Emergency Response," and was named for 9-year-old Amber Hagerman, who was abducted and murdered in Arlington, Texas in 1996.

Bandwidth – A measure of the capacity of a communications channel. The higher a channel's bandwidth, the more information it can carry.

Baud Rate – The transmission rate at which data flows between computers. The baud rate is roughly equivalent to the number of bits per second (bps).

Cantilever – A structural member which projects beyond a supporting column or wall and is counterbalanced and/or supported at only one end.

Handshaking – The process by which two devices initiate communications. Handshaking begins when one device sends a message to another device indicating that it wants to establish a communications channel. The two devices then send several messages back and forth that enable them to agree on a communications protocol.

Lexan – Brand name of a polycarbonate sheet that is clear and high impact resistant. It comes with a 3-year warranty against breakage. It is used in commercial and residential glazing for its safety, security, and energy savings.

Modem – Short for modulator/demodulator. A communications device that converts one form of a signal to another that is suitable for transmission over communication circuits, typically from digital to analog and then from analog to digital.

Multi Mode Fiber – Type of fiber optic cable with a larger center core than single mode fiber. Multimode fiber is generally used over relatively short distances.

Glossary

Null Modem Cable – A specially designed cable that allows a user to connect two computers directly to each other via their communications ports (RS-232 ports). Null modems are particularly useful with portable computers because they enable the portable computer to exchange data with a larger system. Null modem cables have the TX (*transmit*) and RX (*Receive*) lines crossed over, thereby allowing data to be sent from one device to the other. They are similar to a crossover cable where it is the CTS (*clear to send*) and RTS (*ready to send*) lines are crossed over. Null-modem cables are used for serial port connections.

Peripheral – A peripheral is a type of computer hardware that is added to a host computer, in order to expand its abilities. More specifically the term is used to describe those devices that are optional in nature, as opposed to hardware that is either demanded, or always required in principle.

Serial – A telecom term that refers to "one after another." Data transmissions that are serial are ones that come in streams of data - one after another - one bit following the previous bit.

Single Mode Fiber – A fiber having a small core diameter and in which only one mode (the fundamental mode which may consist of two polarizations) will propagate at the wavelengths of interest.