

1600 Series, 2.5 Inch Small Matrix Displays

(120V – Front Access)

Installation, Maintenance & Troubleshooting Manual

ED11944

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Display Serial # _____

Display Model # _____

Date Installed _____



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Section 1: Introduction

1.1 How to Use This Manual

This manual explains the installation, maintenance and troubleshooting for the Daktronics 1600 series Incandescent, 2.5-inch small matrix display system. For additional questions regarding the safety, installation, operation or service of this system, please refer to the telephone numbers listed on the cover page of this manual.

The manual is divided into four sections: Introduction, Mechanical Installation, Electrical Installation and Maintenance & Troubleshooting.

- **Introduction** covers the basic information needed to make the most of the rest of this manual. Take time to read the entire introduction as it defines terms and explains concepts used throughout the manual.
- **Mechanical Installation** provides general guidance on display mounting.
- **Electrical Installation** provides general guidance on terminating power and signal cable at the display.
- **Maintenance & Troubleshooting** addresses such things as removing basic display components, troubleshooting the display, performing general maintenance and exchanging display components.

At the end of this manual are three appendices: **Appendix A: Reference Drawings**, **Appendix B: Forms & Reports** and **Appendix C: Forms and Reports**. Drawings are in alphanumeric order unless otherwise specified.

- **Appendix A** contains any drawings referenced throughout this manual that are general to all 1600 series Incandescent 2.5Odisplays. In addition, this appendix contains any drawings specific to this display. **These drawings always supersede any similar drawings found in this manual.**
- **Appendix B** contains any checklists or general information relevant to this display.
- **Appendix C** contains any forms and reports that are relevant to this display.

Listed below are a number of drawing types commonly used by Daktronics, along with the information that each is likely to provide.

- **System Riser Diagrams:** overall system layout from control room to display, power and phase requirements.
- **Shop Drawings:** fan locations, transformer locations, mounting information, power and signal entrance points and access method (front or rear).
- **Schematics:** power wiring, signal wiring, panelboard or power termination panel assignments, signal termination panel assignments and transformer assignments.

The box on the next page, **Figure 1**, illustrates a Daktronics drawing label. The drawing number is located in the lower-right corner of the drawing. This manual refers to drawings by listing the last set of digits and the letter preceding them. In the example below, the manual refers to the drawing as **Drawing A-114667**.

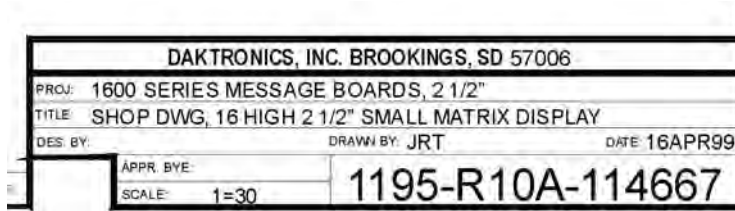


Figure 1: Drawing Label

All references to drawing numbers, appendices, figures or other manuals use in **bold** typeface, as shown below.

“Refer to **Drawing A-114667** in **Section 3** for the location of the Venus 1500 controller.”

In addition, any drawings referenced within a particular sub-section are listed at the beginning of that sub-section in the following manner:

Reference Drawing:

Shop Drawing, 16 High 2 ½” Small Matrix **Drawing A-114667**

Appendix A contains all referenced drawings.

Daktronics identifies manuals by the ED number located on the cover page of each manual. For example, Daktronics refers to this manual as **ED11944**.

Please list the model number, display serial number and the date this display became operational in the blanks provided on the front page of this manual. The ID label, located on the front of the display on the right end, contains the serial and model numbers. This label will look similar to the one shown in **Figure 2**. When calling Daktronics Customer Service, please have this information available to ensure that we service your request as quickly as possible.

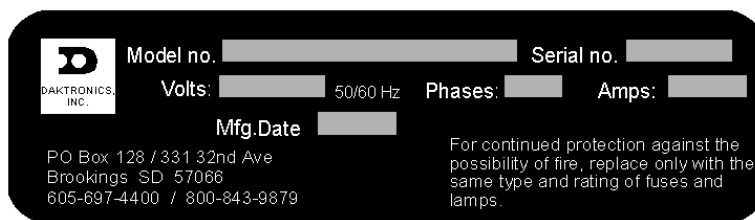


Figure 2: Display ID Label

Daktronics builds displays for long life and require little maintenance. However, from time to time, certain display components will need replacing. The **Replacement Parts List** in **Section 4.15** provides the names and part numbers of components that may need to be ordered during the life of this display.

Following the **Replacement Parts List** in **Section 4.15** is the **Exchange/Replacement Procedure** in **Section 4.16**. Refer to these instructions if any display component needs repair or replacement.

1.2 Display Configurations

Daktronics offers 1600 series small matrix displays as monochrome units. The displays are configured in one of two ways: with Venus[®] 1500 software that sends data to a Venus 1500 controller within the display or with Venus 4600 software that sends data to a serial line interface within the display. In addition, the Venus 1500-controlled display offers a number of different computer-to-sign communication methods.

Figure 3 illustrates the possible signal configurations for a small matrix display. Notice that a Venus 1500-controlled display (monochrome) can configure for RS/232, RS/422, modem or fiber optic communication. The Venus 4600-controlled display has only one standard configuration – fiber optic.

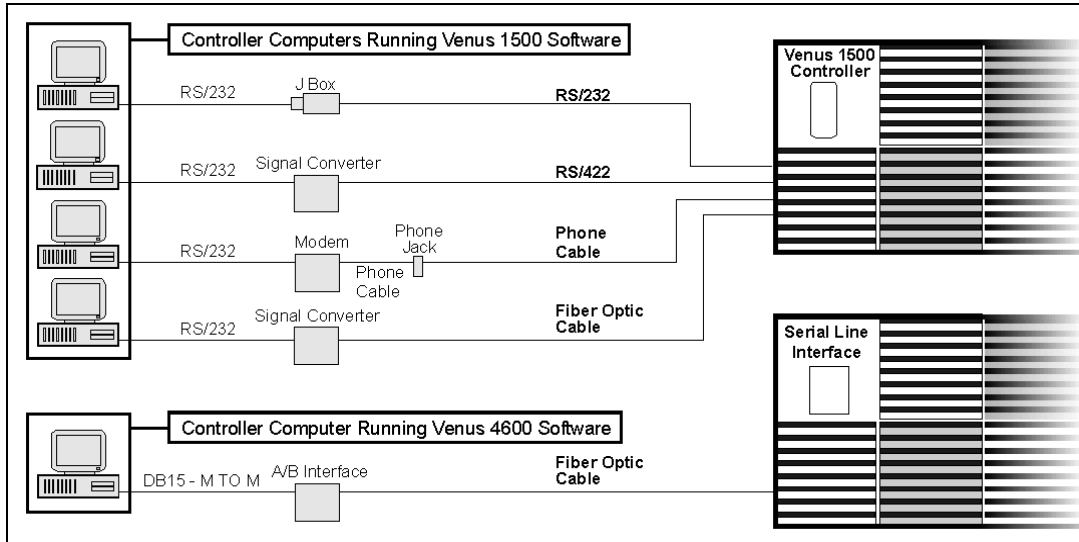


Figure 3: Possible Signal Configurations

Daktronics builds and ships small matrix displays as self-enclosed units that require only mounting and power/signal hookup. **Figure 4** illustrates some common cabinet configurations.

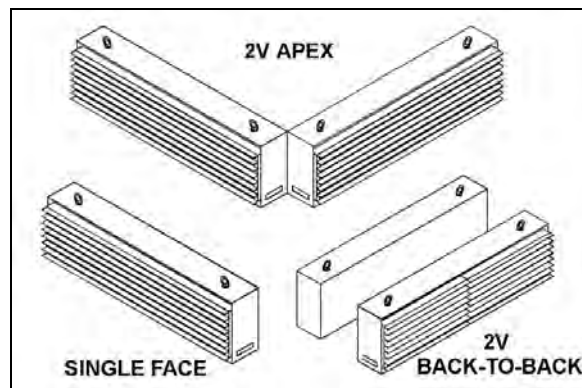


Figure 4: Possible Cabinet Configurations

Single face displays are single-sided, stand-alone units. They do not have the ability to drive an echo display.

2V displays consist of two single-face units; one master and one echo, with an interconnect harness between cabinets. All incoming power and signal cables connect within the cabinet of the master display.

1.3 Display Definitions

Button Thermostats: Small, round, nickel-size thermostats mounted within the display on the transformers. The master-echo board within the fan controller enclosure monitors these thermostats. **Figure 5** shows a button thermostat.

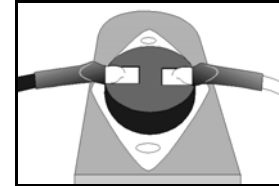


Figure 5: Button Thermostat

Controller Computer: The computer used to program the display. This display will use either Venus 1500 or Venus 4600 software.

Display Controller: A general term used to describe the device housed within the display cabinet that receives signal from the controller computer. This display will use as a controller either 1) a Venus 1500 controller or 2) a serial line interface.

Fan Controller Enclosure: Assembly found within the display that serves as a junction point for the button thermostats. Venus 1500 systems will also have a master-echo board within the enclosure. Venus 4600 systems have no master-echo board within the fan controller enclosure, but instead route the thermostat status back to the serial line interface board. **Figure 6** shows the fan controller enclosure, both with and without the enclosure cover. The master-echo board is on the right. The Venus 4600 fan control enclosure looks similar, but lacks the master/echo board.

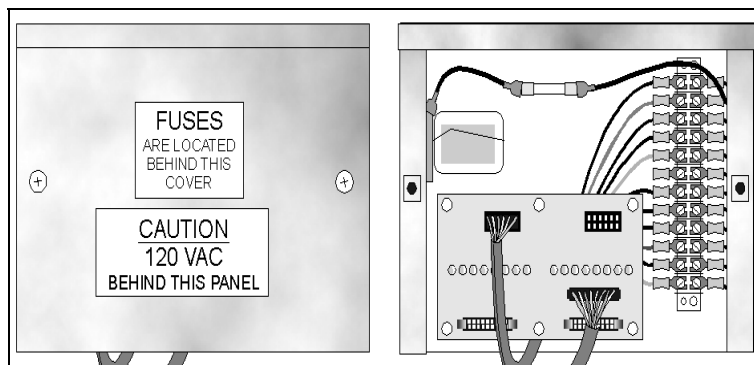


Figure 6: Fan Controller Enclosure

Fiber Optic: A standard communication method using light (signal) transmitted through a glass fiber. Fiber optic cable cannot exceed 1,200 feet. A signal converter may be required for fiber optic and RS/232 configuration. This communication method is an option in both Venus 1500 and Venus 4600 Systems.

Junction Box: Small enclosure in which display data traveling on serial cable from the computer is transferred to RS/232 cable. The junction box must be located within 25 feet of the display. Only Venus 1500 systems using the RS/232 communication option utilize this junction box. **Figure 7** illustrates a junction box.

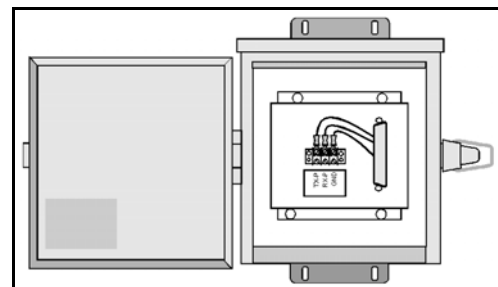


Figure 7: Junction Box

Lampbank: A circuit board consisting of an array of lamps 8 pixels high by 4 pixels wide. **Figure 8** shows a single lampbank, front and back. Two lampbanks mount to the rear of each lens/reflector assembly as seen in **Figure 9**. If necessary, a lampbank can be easily removed from the lens/reflector assembly.

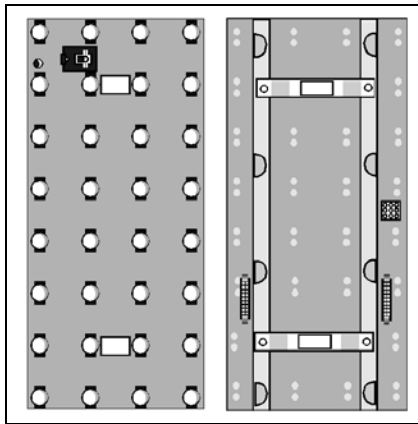


Figure 8: Lampbank (Lamp Side)

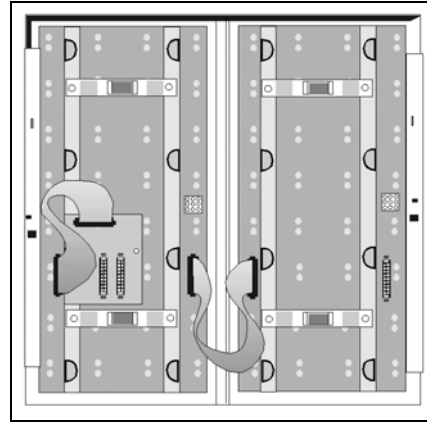


Figure 9: Two Lampbanks on Lens / Reflector Assembly (Solder Side)

Lens/Reflector Assembly: Consists of reflectors, lenses and louvers. It is eight lenses high by eight lenses wide. A lens/reflector assembly is easily removable for maintenance. **Figure 10** illustrates the front and back of a lens/reflector assembly. Two lampbanks mount on the rear of this assembly, as seen in **Figure 9**.

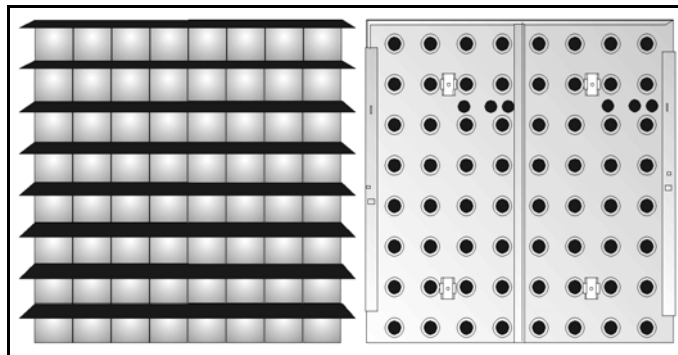


Figure 10: Lens/Reflector Assembly

Light Detector: An optional device that senses ambient light levels. The light detector and the controller operate together to dim the display when maximum lamp brightness is not required. This saves energy and extends lamp life. **Figure 11** shows the light detector for the Venus 1500 systems.

Louver: A piece of aluminum, eight pixels long, positioned above each row of lamps to provide contrast and help direct light.

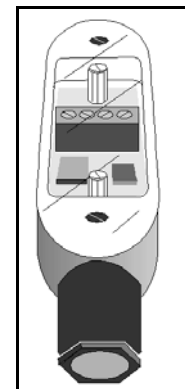


Figure 11: Light Detector

Module: Consists of four lampbanks mounted to the backs of two lens assemblies. A module, **Figure 12**, is eight pixels high by 16 pixels wide. One transformer can power two modules (256 lamps).

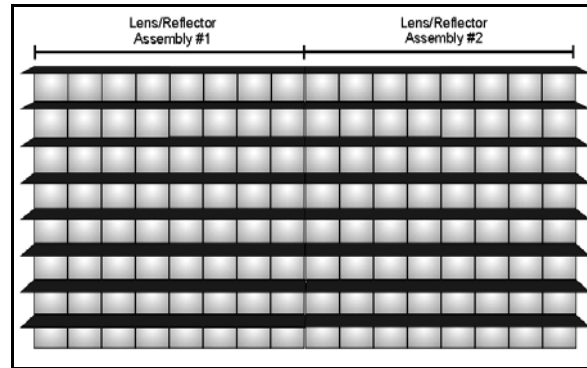


Figure 12: Module

Modem: A standard communication method that utilizes standard phone transmission lines, and is an option with the Venus 1500 System.

Pixel: Daktronics describes a pixel as being the point of light created by a single lamp behind a single lens.

Power Termination Panel: Assembly in which incoming power connects to the display. It mounts to the cabinet on the left end (front view). **Figure 13** shows the power termination panel enclosure, both with the cover on the enclosure and with it removed.

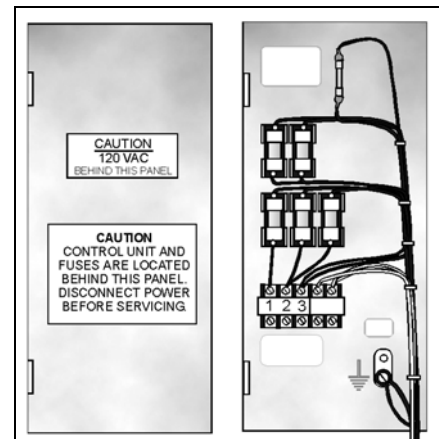


Figure 13: Power Termination Panel

Quarter-Turn Fasteners: A type of latching mechanism found on many Daktronics assembly enclosures. Using a Phillips screwdriver, turn the fastener one-quarter-turn counter-clockwise to release the latch and one-quarter-turn clockwise to secure the latch.

RS/232: A standard PC communication type with a maximum cable length of 25 feet (8 meters).

RS/422: A standard differential communication type with a maximum cable length of 4,000 feet (1.2 kilometers).

Serial Line Interface (SLI): The controller board used in Venus 4600 display systems. The serial line interface (also called a line receiver) receives signal from the controller computer via fiber optic cable and routes it to the display. **Figure 14** illustrates the metal enclosure that houses the serial line interface, both with the enclosure cover in place and with the enclosure cover removed. The serial line interface board is seen on the right.

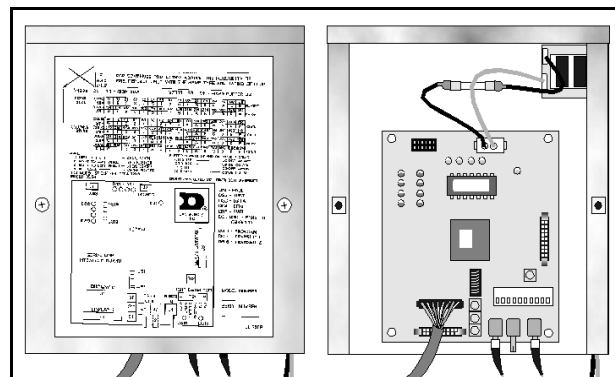


Figure 14: Serial Line Interface

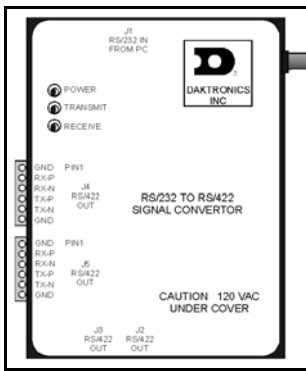


Figure 15: Signal Converter

Sign Address: An identification number assigned to each sign of a network. The control software uses the address to locate and communicate with each display. Displays on the same network cannot have the same address.

Signal Converter: A Daktronics-supplied unit that converts the data from RS/232 to RS/422. The signal converter is used in Venus 1500 RS/422 systems. **Figure 15** shows the converter.

SunSpot®: SunSpot displays, also called monochrome displays, use only one color lens - usually white. “SunSpot” is a registered trademark of Daktronics, Inc.

Temperature Sensor: The temperature sensor is an optional device that monitors temperature outside the display. The temperature sensor can be used to offer “time and temperature” updates. **Figure 16** shows a common temperature sensor. Daktronics offers many enclosure styles.

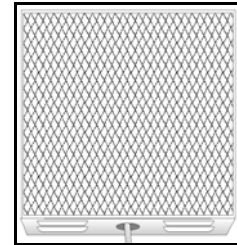


Figure 16: Temp Sensor



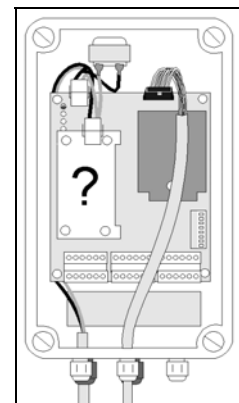
Figure 17: Transformer

Transformer: The device that transforms incoming AC voltage to the operational AC voltage required by the display electronics. **Figure 17** illustrates a transformer.

Venus 1500 Controller: The type of controller used in Venus 1500 display systems. It consists of a controller board, MDC (multipurpose display controller) board, address board, and possibly a fiber optic or modem board, depending on display configuration. The controller receives data from the controller computer via RS/232 cable, RS/422 cable, fiber optic cable or modem/phone cable. The data then routes to the rest of the display. **Figure 18** illustrates the Venus 1500 controller in its enclosure. The ‘?’ indicates the position of a fiber optic or modem board, if used.

Venus 1500 System: A display configuration that uses a controller computer running Venus 1500 software to control a display housing a Venus 1500 controller. Venus 1500 systems can use any one of four methods to transmit data from the controller computer to the display: RS/232, RS/422, fiber optic or modem/phone cable. This display is set up for one of these methods.

Venus 4600 System: A display configuration that uses a controller computer running Venus 4600 software to control a display housing a serial line interface. Venus 4600 systems transmit data from the controller computer to the display over fiber optic cable.



Venus A/B Transmitter Interface: A Daktronics-supplied unit used to convert RS/232 signal to fiber optic signal. Venus 4600 Systems uses this. **Figure 19** shows the transmitter interface.

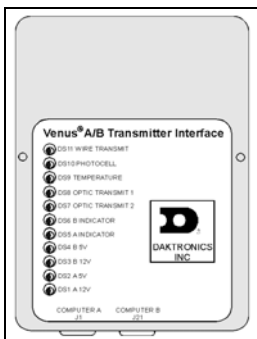


Figure 19: Venus A/B Transmit I/F

Vertical Shift Board (VSB): Circuit board mounted to the back of the left-most (front view) lampbank in each row of modules. It routes data from the controller both down the row and to the VSB below it. **Figure 20** shows the VSB. **Figure 9** shows the VSB on a lampbank. The vertical shift board is also known as a vertical shift register

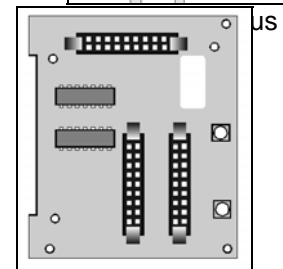


Figure 20: Vertical Shift Board

(VSR).

1.4 Daktronics Nomenclature

The Daktronics module numbering system assigns numbers to modules to aid in wiring and troubleshooting. Remember, a module is two, side-by-side lens/reflector assemblies. **Figure 21** illustrates the numbering on a typical 16x80 pixel small matrix display. **Figure 22** explains the meaning of the module numbering.

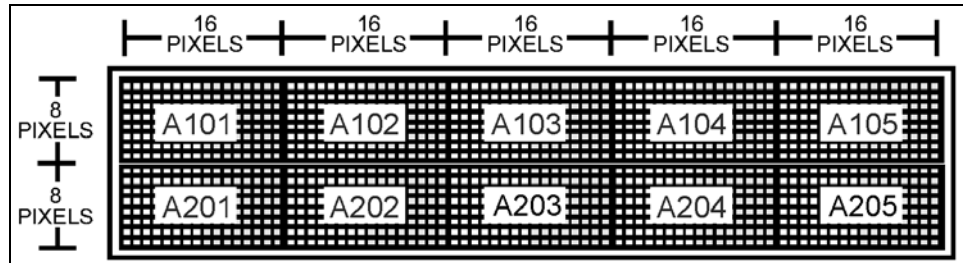


Figure 21: Module Numbering (16x80 Display) – Front View

In addition, lampbanks also have a numbering system. There are two lampbanks mounted on the back of each lens/reflector assembly. Therefore, there are four lampbanks per module. **Figure 23** illustrates this lampbank numbering. It uses the same first four digits as the module numbering system, but with an A, B, C or D at the end to indicate whether it is the first, second, third or four lampbank on that module.

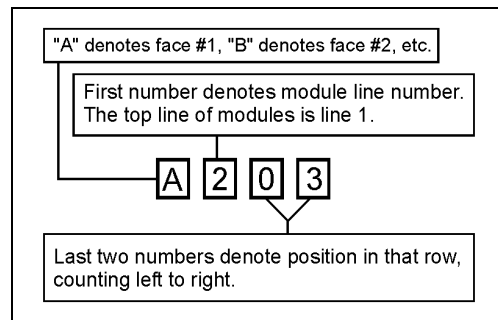


Figure 22: Module Numbering Detail

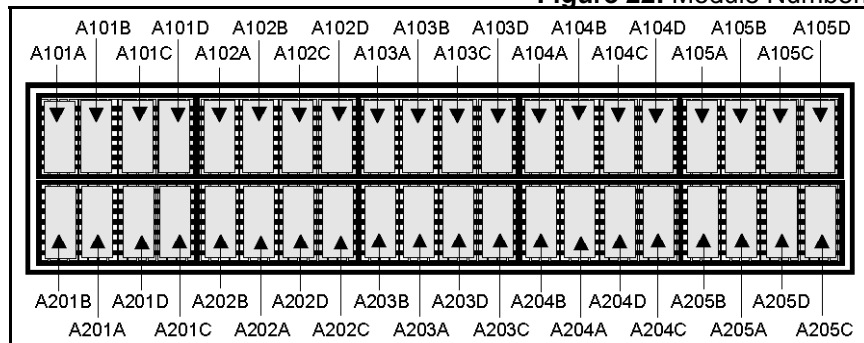


Figure 23: Lampbank Numbering (16x80) - Front View

In addition, when using Daktronics drawings it may also be helpful to know the following.

- “F” denotes a fuse (F1, F2, F3...)
- “T” denotes a transformer (T1, T2, T3)
- “TB” denotes a termination block – power or signal.
- “A” denotes an assembly. These are divided according to power or signal.
Power assemblies consist of a number of power components, usually within a common enclosure. For instance, a power termination block (TB41) may be located within a power termination panel enclosure (A41). A second power termination panel has the label A42, a third A43, etc.
Signal assemblies consist of a number of signal routing or transmission components, usually within a common enclosure. For instance, the enclosure housing the Venus 1500 controller or serial line interface for this display is A31.

Section 2: Mechanical Installation

The Daktronics engineering staff must approve any changes that may affect the weather tightness or cooling ability of this display. This includes, but is not limited to:

- **Border shrouding**
- **Back sheets**
- **Cooling fans**
- **Fan filters**
- **Filler panels**

Submit detailed drawings of the proposed changes to our engineering staff for evaluation and approval or the warranty will be null and void.

Appendix B contains two copies of the Installation Quality Checklist. It covers both mechanical and electrical installation. This form is intended to assist in display installation and assure its dependable operation. Make sure to act upon each item of the checklist. Following installation, return one copy to Daktronics Customer Service to receive a free set of replacement air filters. Contact Daktronics Customer Service if any product quality questions or concerns should arise.

2.1 Support Column Selection

Support column size is dependent on the height and total wind loading of the display and any other signage attached, such as advertising panels.

Column selection is critical; only a qualified individual should do this.

It is the installer's responsibility to specify the exact type of column and number of columns used. Using more columns generally allows smaller columns.

2.2 Lifting the Display

The top of the display (or display sections) will be equipped with eyebolts to lift the unit. Take special care not to exceed the rated load of the eyebolts. Refer to the information in **Appendix B** labeled **Eye Bolts** to determine the allowable load of the eyebolts shipped with the display.

Figure 24 illustrates both the correct (left example) and the incorrect (right example) method of lifting a display. Lift the display as shown on the left, with the lifting bar.

Stress on the eyebolts increase as the angle between the cable and the display top decreases.

Use every lifting point provided!

Do not attempt to permanently support the display by the eyebolts.

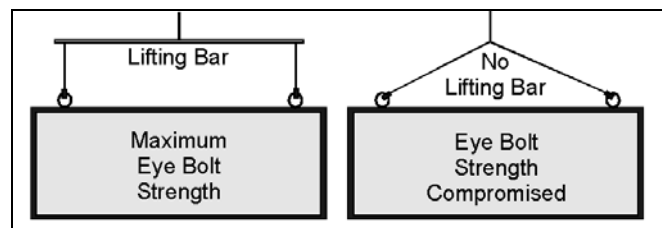


Figure 24: Display Lifting

If mounting this display outside, make sure water or moisture doesn't get into the display.

1. Inspect the top and sides of the display for any holes that may allow moisture to enter the display. If the eyebolts were removed, plug the holes with bolts and the rubber sealing washer that came with the eyebolt.
2. Plug and seal the eyebolt holes and any other openings that may allow water to enter the display with silicone or another waterproof sealant.

CAUTION: Fully attach backsheets to the display cabinet with all of the screws prior to lifting the display with the eye bolts. The backsheets provide structural support to the cabinet. Lifting the display with the backsheets removed may cause the cabinet members to twist, compromising the structural integrity and/or squareness of the display frame. If the display frame is not square, normal waterproofing measures may prove inadequate, leading to moisture related problems for the electronics.

2.3 Cabinet Mounting

Reference Drawing:

Mounting Example, 2½" Small Matrix**Drawing A-114676**

The method used to mount displays can vary greatly from location to location. For this reason, this manual only addresses general mounting topics. If this display was part of a custom contract, consult the shop drawing in **Appendix A** for mounting information.

Before beginning the installation process, verify the following:

- The mounting structure will provide a straight and square frame for mounting the display.
- The mounting structure will not give way at any unsupported points after mounting the display.

Correct any deficiencies before beginning the installation process.

It is the responsibility of the installer to ensure the installation will agree with local codes. The mounting hardware is also the responsibility of the installer.

The 9 x 1¾ x 1¾ channel used in this display requires supporting the display every eight feet with a maximum overhang of three feet on each end of the display. The distribution of these supports is to be symmetrical. This requires a minimum of two supports.

Drawing A-114676 illustrates one of the many ways a small matrix display may be mounted. To mount a display as seen in the drawing complete the following steps:

1. Remove the four pieces of bar stock from the display. These flat pieces of metal reinforce the display cabinet at the mounting points.
2. Since bolts or rods will be run on each side of each column, it will be necessary to drill two holes in both the bar stock and the cabinet frame at the support points. Refer to **Figure 25**.
3. Drill holes in the bar stock and through the cabinet frame. Run bolts to the angles on the opposite side of the columns.
4. Secure the display firmly in place.

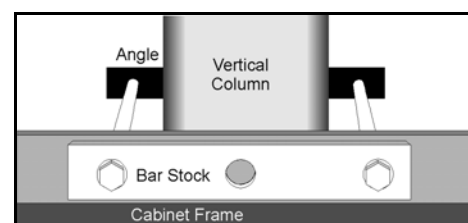


Figure 25: Possible Mounting Method

When mounting the display take note of the following:

- Keep ½-inch clearance below the drain holes in the bottom of the display.
- Do not obstruct airflow to the display fans. Refer to **Drawing A-114676**.
- Power and signal terminations require access to the inside of the display. Avoid mounting the display in a manner that hinders access to the display face.
- The Daktronics engineering staff must first approve any modifications to the display ventilation system.

You must properly seal the eyebolt holes on top of the display cabinet to prevent water from entering the unit and damaging the electrical components.

Complete the following steps if leaving the eyebolts in the display.

1. Verify the eyebolts are firmly in place. From time to time eyebolts will loosen slightly from shipping vibration.
2. If the eye bolts need tightening, keep in mind they need only be snug. Over-tightening will crush the rubber sealing washers, rendering them ineffective.
3. Apply silicone sealant around the base of the eyebolts on top of the cabinet.

Complete the following steps if removing the eyebolts from the display.

1. Remove and discard the eyebolts, **but keep the rubber sealing washers**.
2. To plug the eyebolt holes, insert half-inch bolts through the rubber sealing washers and into the eyebolt holes from the top of the display cabinet.
3. Tighten the bolt only as much as is needed to hold the bolt snugly in place. Over-tightening will crush the rubber sealing washers, rendering them ineffective.
4. On the top of the cabinet, apply silicone sealant around the head of each bolt.

Inspect the entire display for any holes or gaps that may allow water to enter the display. Use silicone sealant to close any such openings.

The filters of 1600 series small matrix display are located on the bottom exterior of the display cabinet. If mounting an advertising panel or other structure beneath this display, 2.5 inches of clearance must be present in order to remove the filters. Refer to **Figure 26**.

The amount of clearance between the display and the ad panel or structure can also affect display ventilation. Refer to **Section 2.5** to calculate the amount of clearance required for adequate display cooling.

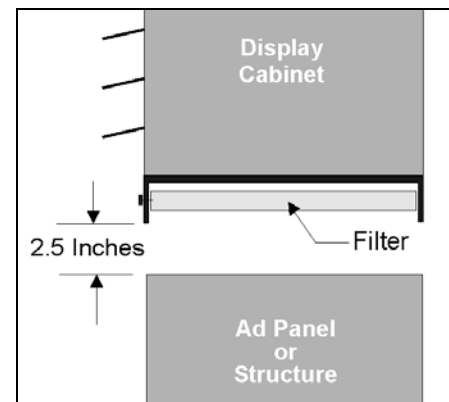


Figure 26: Bottom Clearance

Filter removal is addressed in **Section 4.3, Filters**.

2.4 Light Detector and Temperature Sensor Installation

Refer to **ED9490** in **Appendix C** for light detector installation and **ED9489** in **Appendix C** for temperature sensor installation information.

2.5 Display Ventilation Requirements

Reference Drawings:

Mounting Example, Small Line Displays **Drawing A-101424**

Label, Filter Clearance **Drawing A-141064**

Daktronics small matrix displays use fans to prevent overheating. The fans bring air into the cabinet from the bottom of the display, creating positive pressure within the display. The fans then force out the warm air within the display through small gaps above each of the lenses, cooling the lamps and lowering the internal temperature of the cabinet. This continuous cycle of airflow extends the life of the lamps and decreases the maintenance costs associated with overheating.

If mounting another sign or structure on top of one another, maintain a minimum of 2 1/2" This is to ensure proper airflow through the sign and to allow easier access for filter removal. Refer to **Figure 27** and **Drawings A-101424** and **A-141064**.

In some circumstances it may be necessary, or desirable, to mount a small matrix display within another structure or to "skin over" one or more displays. If enclosing a display in this nature, adequate openings must exist in the outer structure for air intake.

If enclosing a small matrix display within another structure or "skinned over," observe the following specifications to prevent display damage and premature lamp failure:

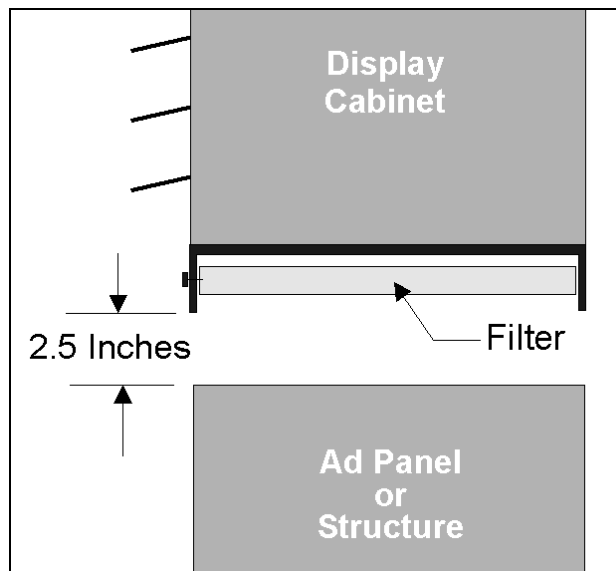


Figure 27: Minimum Clearance for Sign Bottom

- Provide twelve square inches of unobstructed opening per module for adequate display cooling. Make allowances to compensate for the percentage of screen in the material covering the openings in the enclosed structure.
- If forcing air into the enclosed area, it should run at 110 cubic feet per module (one module = 20" x 40" display active area or eight rows x 16 columns of lamps).

For example, a 16x80 double-face, small matrix display inside an enclosed structure would require 240 square inches, or 1.7 feet, of unobstructed opening in the bottom of the center cabinet.

$$\begin{aligned} (2 \text{ displays (16x80 pixel size)})/128 \text{ pixels per module} &= 20 \text{ modules} \\ (2(1280))/128 &= 20 \text{ modules} \\ 2560/128 &= 20 \text{ modules} \end{aligned}$$

$$20 \text{ modules} \times 12 \text{ square inches} = 240 \text{ square inches or } 1.7 \text{ square feet}$$

Also, if forcing air into an enclosed display, adhere to the following filter specifications:

- The effective filter area is to be no less than 2.3 square feet per 1.0 square feet of filter face area.
- The filter media is to have an average arrestance (resistance to debris) of 90-92%.
- Initial resistance should not exceed 0.48 w.g. (water gauge) at 500 fpm (feet per meter).

Submit any plans for filtering air in an enclosed display to the Daktronics engineering staff for evaluation and approval or the warranty will be null and void.

2.6 Verifying Correct Lens and Module Position

The final steps of mechanical installation involve verifying the proper positioning of all lenses upon their respective lens/reflector assemblies and that all modules engage fully into the cabinet.

Look down the rows of louvers from either end of the display and secure all lenses properly. Lenses not secured properly are easily noticeable as the lens removal tab, or the lens itself, will not be in alignment with the other lenses or lens removal tabs of that row.

Refer to **Figure 28** and the following steps to return a lens to its correct position.

1. First, insert the bottom indexing tabs into the slots. There is one indexing tab on each bottom corner of the lens.
2. While gently pushing the above louver upward, grab the lens tab and push the top of the lens behind and under the louver offset. Only push the louver upward enough to allow the lens to snap into position behind the offset.
3. Release the louver and verify the lens aligns with others in the row.

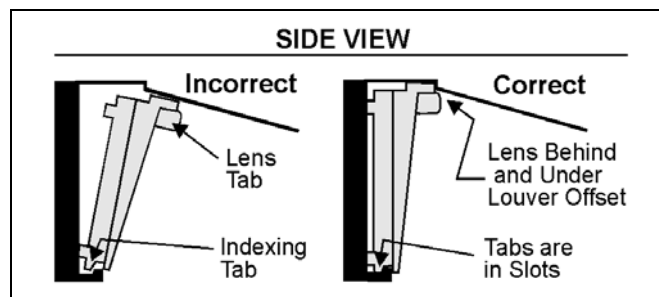


Figure 28: Correct Lens Position

Also, ensure that the rows of louvers are in proper alignment. If any rows seem out of position, this may indicate the one, or both, sides of the lens/reflector assembly do not engage fully into the cabinet. If this is the case, a firm push to both sides of the module at the same time should snap the module into place.

Section 3: Electrical Installation

Appendix B contains two copies of the Installation Quality Checklist. It covers both mechanical and electrical installation. This form assists in display installation and assures its dependable operation. Address each item on the checklist. Following installation, return one copy to Daktronics Customer Service to receive a free set of replacement air filters. Contact Daktronics Customer Service if any product quality questions or concerns should arise.

3.1 Common Connectors

This display uses many different types of connectors for power and signal termination. Take special care when disengaging any connector so as not to damage the connector, the cable or the circuit board.

When pulling a connector plug from a jack, do not pull on the wire or cable; pull on the jack itself. Pulling on the wires may damage the connector.

The following information presents some common connectors encountered during display maintenance. These include ribbon cable connectors, Mate-n-Lok connectors, Phoenix-style connectors, fiber optic connectors, termination panels and termination blocks, and tab connectors. Some displays do not use all of these connectors.

1. Ribbon Cable Connectors:

Daktronics uses a variety of ribbon cables and ribbon cable connectors. **Figure 29** and **Figure 30** show two of the most common ribbon cable connectors. To disconnect ribbon cable connector #1, squeeze the metal locking clips inward and pull the plug out of the jack. To disconnect ribbon cable connector #2, pull each of the plastic locking arms outward and remove the plug.

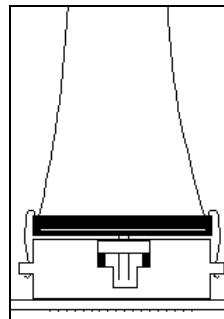


Figure 29: Ribbon Cable Connector 1

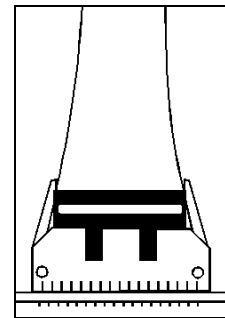


Figure 30: Ribbon Cable Connector 2

Before replacing a ribbon cable connector, spray it with DeoxIT™ contact cleaner to remove any foreign matter that may cause signal problems. In addition, apply a generous amount of CaiLube™ protector paste to the plug before inserting it into the jack. This paste will protect both the plug and the jack from corrosion. Both the DeoxIT and the CaiLube are in the tool kit accessories package included with this display. Refer to the replacement parts list in **Section 4.15** if additional supplies of either are needed.

2. Fiber Optic Connectors:

At each end of a fiber optic cable is a “twist-on” connector. To remove the fiber plug from its jack, push it toward the jack and twist it counter-clockwise until the plug can pull free. **Figure 31** shows a common type of fiber optic connector.

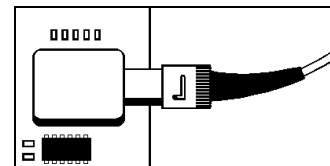


Figure 31: Fiber Optic Connector

3. Termination Panels & Termination Blocks:

Termination panels and termination blocks connect internal power and signal wires to wires of the same type coming into the display from an external source. Most signal wire comes with forked connectors crimped to the ends of the wire. Power wires need to have one-half inch of insulation stripped from the end of the wire prior to termination. Tighten all screws firmly to ensure a good electrical connection. Refer to **Figure 32**.

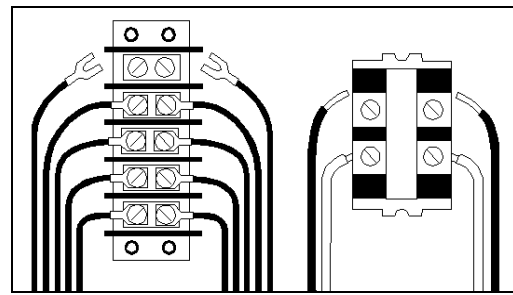


Figure 32: Termination Panel (Left) and Termination Block (Right)

4. Phoenix-Style Connectors:

Phoenix-style connectors, which are usually green, terminate signal on circuit boards. Refer to **Figure 33**. Strip one-quarter inch of insulation from the wire prior to termination. To remove a wire, turn the above screw counter-clockwise to loose the connectors grip on the wire. To insert a wire, push the bare wire into the connector and turn the above screw clockwise to lock the wire into place.

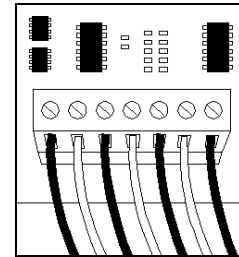


Figure 33: Phoenix Connector

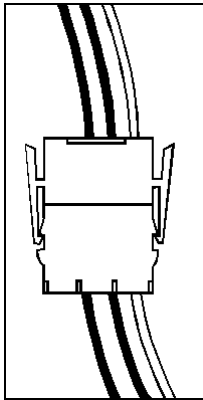


Figure 34: Mate-n-Lok Connector

5. Mate-n-Lok™ Connectors:

The Mate-n-Lok connectors found in this display are white and come in a variety of sizes. **Figure 34** illustrates a four-pin Mate-n-Lok connector. To remove the plug from the jack, squeeze the plastics locking clasps of the side of the plug and pull it from the jack.

4. Tab Connectors:

The tab connector, illustrated in **Figure 35**, is in most Daktronics displays. Grab the connector on the plastic terminal cover when removing. Do NOT pull it off the tab by pulling on the wire.

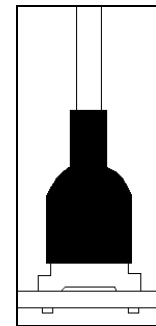


Figure 35: Tab Connector

3.2 Display Power Requirements

The following table summarizes the power requirements for the various 1600 series, 2.5-inch small matrix displays. **Power stated is per display face.**

Display Size	120/208 3 Phase 4 Wire Plus Ground (In Amps)	120/240 Single Phase 3 Wire Plus Ground (In Amps)	Total Watts
8 x 48	8	16	2938
8 x 64	16	16	3917
8 x 80	16	24	4896
8 x 96	16	24	5875
16 x 48	16	24	5875
16 x 64	24	33	7834
16 x 80	33	41	9792
16 x 96	33	49	11750
24 x 48	24	41	8813
24 x 64	33	49	11750
24 x 80	41	65	14688
24 x 96	49	73	17626

3.3 Checking Line Voltage & 24-Hour Voltage Monitoring

Prior to display installation, perform a two-part voltage check. This is a necessary step taken to maximize lamp life. By looking-up the line voltage on the table in this sub-section, you can calculate the estimated lamp life and, if necessary, take steps to extend it.

Appendix C has two forms titled “Display Power Report.” This form records three different voltage readings.

1. Line voltage, addressed in this sub-section.
2. 24-hour monitoring, which also addressed in this sub-section
3. Lamp voltage, checked after the display is powered-up for the first time.

When complete, send one of the “Display Power Report” forms to Daktronics Customer Service. The other form is for the customer’s records.

To complete the line voltage check, take a line reading of each phase and record the results on each of the power reports in **Appendix A**. Then place a voltage monitor on the phase with the highest reading for 24 hours. Also, write down the maximum and minimum voltages recorded on each of the power reports.

If lacking the proper equipment to accurately monitor line voltage, consider the following options.

- Have the local power company take the readings.
- Rent the equipment from a local service company.
- Have Daktronics Customer Service recommend the proper equipment.
- Rent the equipment from Daktronics.

If there is any reason to suspect large voltage fluctuations, place a recorder on the line for at least one phase of the power for one week while the display operates normally. Contact Daktronics Customer Service with respect to this recording.

Display brightness and lamp life are generally determined assuming an average incoming line voltage of 120 volts AC at 60 hertz. If the line voltage varies from that value, it will affect both lamp life and brightness. Lamp life results will also vary with programming style and use of dimming mode.

⌚ *Lamp life predictions are for lamps operating in a laboratory with continuous operation in a stable temperature and mechanical environment. Actual values will differ from predicted life because of switched operation, varying temperature, mechanical vibrations due to wind, traffic and sign service and actual hours of operation. Data is that of the manufacturer.*

Lamp Voltage/Lamp Life with 23 VAC Secondary (T-1109 XFMR)									
	120 V Only			5 V Buck			5 V Boost		
Line Volts	Lamp Volts	Candle Power	Lamp Life Hours	Lamp Volts	Candle Power	Lamp Life Hours	Lamp Volts	Candle Power	Lamp Life Hours
18.90	19.72	3.42	35022	18.90	2.95	59271	20.60	3.98	20250
108	20.10	3.66	27530	19.27	3.16	46578	21.00	4.26	15923
110	20.48	3.91	21740	19.64	3.37	36770	21.40	4.55	12577
112	20.87	4.17	17242	20.01	3.60	29155	21.80	4.86	9978
113	21.06	4.30	15380	20.19	3.71	16003	22.00	5.01	8902
114	21.25	4.44	13733	20.38	3.83	23215	22.20	5.18	7950
115	21.44	4.58	12275	20.56	3.96	20748	22.40	5.34	7107
116	21.63	4.73	10983	20.74	4.08	18561	22.60	5.51	6359
117	21.83	4.88	9836	20.93	4.21	16621	22.80	5.68	5696
118	22.02	5.03	8818	21.11	4.34	14899	23.00	5.86	5107
119	22.21	5.18	7912	21.30	4.48	13367	23.20	6.04	4583
120	22.40	5.34	7107	21.48	4.61	12004	23.40	6.22	4117
121	22.59	5.50	6389	21.66	4.75	10790	23.60	6.41	3701
122	22.78	5.67	5748	21.85	4.89	9708	23.80	6.60	3331
123	22.98	5.84	5177	22.03	5.04	8742	24.00	6.80	3000
124	23.17	6.01	4666	22.22	5.19	7878	24.20	7.00	2704
125	23.36	6.18	4210	22.40	5.34	7107	24.40	7.20	2440
126	23.55	6.36	3801	22.58	5.50	6416	24.60	7.41	2203
127	23.74	6.55	3435	22.77	5.65	5797	24.80	7.63	1991
128	23.93	6.73	3106	22.95	5.82	5242	25.00	7.84	1801
129	24.13	6.92	2811	23.14	5.98	4744	25.20	8.07	1630
130	24.32	7.12	2547	23.32	6.15	4297	25.40	8.29	1477

If the line voltage is near or above 125 volts or a longer lamp life is desired, contact Daktronics for transformer adjustment.

Contact a local electrician or the local power company if line voltage is substantially above or below normal.

3.4 Preparing the Display for Power & Signal Connection

Reference Drawings:

- Shop Drawing, 7 or 8 High, 2 ½ "Drawing A-114666
- Shop Drawing, 16 High, 2 ½ "Drawing A-114667
- Shop Drawing, 24 High, 2 ½ "Drawing A-114668

When connecting power and signal to this display it is necessary to access the following items.

- Power termination panel.
- Display controller (Venus 1500 controller or serial line interface)
- Fan control enclosure – *Venus 1500, 2V cabinet configurations only.*

The shop drawings illustrate the locations of the above-listed items at the end of this section. However, only one of the drawings is appropriate for this display. Use the following table to choose the correct shop drawing.

If the display being installed is...	Consult shop drawing...
7 or 8 high display (all lengths)	Drawing A-114666
16 high display (all lengths)	Drawing A-114667
24 high display (all lengths)	Drawing A-114668

After locating the power termination panel and display controller on the shop drawing, complete the following steps to ready the display for power and signal hook-up.

1. Remove the necessary lens/reflector assemblies to gain access to the termination panel and display controller. Lens/reflector removal is addressed in *Lens/Reflector Assemblies* in **Section 4.3**. Venus 1500 systems need only access the fan control enclosure if installing two displays together in a 2V cabinet configuration. Venus 4600 systems do not need access to the fan control enclosure regardless of cabinet configuration.
2. Remove the covers from the power termination panel, the display controller and, if needed, the fan control enclosure.

Daktronics completes all internal power and signal wire routing and connecting prior to shipment.

3.5 Bringing Power to the Display

Reference Drawing:

- Assy, Term Panel..... Drawing A-113974

Only qualified individuals should perform power routing and termination to the display. It is the responsibility of the installer to ensure the installation will adequately meet local codes and standards.

- ▶ **Run power** from the power distribution point to the termination panel of each display face.
- ▶ **Run power** separately to each display face.
- ▶ **This power** is run through conduit according to national and local electrical codes.
- ▶ **Use the knockouts** in the back sheet located near the termination panel for the conduit entrance point. This area is marked with a label (“Recommended Pwr & Sig Entrance Location”).
- ▶ **Power cannot** route through the display. Do not use the support conduit, located inside the display, for power routing.

The following subsections address the routing of incoming power through a power disconnect switch and the termination of incoming power at the display's power termination panel. Daktronics completes all power routing and connection within the display past the power termination panel prior to shipment.

When terminating the incoming power to the term panel, balance the individual power phases as evenly as possible. Current draw per line, as noted on the sales literature or schematic, is the **high** leg current draw.

For a 2V display, bring power into both faces. The termination panel for the echo face is located in the right end of the display. Connect power as stated above.

Power Disconnect Switch

Route power to the display through a fused disconnect switch capable of opening all ungrounded power conductors. Locate this disconnect within the line of sight of any personnel performing maintenance on the display. If locating the disconnect out of sight of the display, it must be able to lock in the open position.

Due to the inrush current (momentary surge) created by the display on start-up, Daktronics recommends using oversized current devices, high magnetic breakers or time delay fuses to handle the momentary surge.

The Over Current Protection Device needs to match the fault current available in the power delivery circuit. To determine the available fault current of circuit, have qualified personnel perform an onsite fault current survey at the site.

The National Electrical Code requires the Amp Inrush Current (AIC) rating of the electrical equipment in a circuit match the available fault current in the electrical circuit.

Because each installation is unique, Daktronics offers these instructions as guidelines only. Daktronics assumes no liability if installation steps have been omitted or other necessary procedures are not included in this manual.

Daktronics is not responsible for the quality of the power delivery system to the display. It is the customer's responsibility to ensure the undertaking of proper safety measures. Power and signal wiring in the display must comply with local, state and national electrical codes, with the correct cabling procedures for the installation determined and followed.

Power Termination at the Display


Incoming power connects to the power termination panel located within the left end of display. **Drawing A-113974** shows an example of a power termination layout. The appearance of other termination panels will vary by sign size.

Complete the following steps to connect power to the termination panel.

1. Pull the power cable from the conduit to the termination panel.
2. Connect the white neutral wire (or wires) to the position labeled NEUT on TB41.
3. If terminating 120/240 single-phase power, connect the hot wires to the positions labeled L1 and L2 on TB41. If terminating 120/208 three-phase power, connect the hot wires to L1, L2 and L3 on TB41.
4. Apply a silicone sealant around the conduit where it meets the cabinet to prevent water/moisture from entering the display.

5. Refer to the following section, **Section 3.5**, for important information regarding display grounding.

Grounding

 Displays *MUST* be grounded according to the provisions outlined in Article 250 of the National Electrical Code®. Daktronics recommends a resistance to ground of 10 ohms or less. Verification of ground resistance can be performed by the electrical contractor who is performing the electrical installation. This service can also be performed by Scoreboard Sales and Service personnel

The display system *must* be connected to earth-ground. Proper grounding is necessary for reliable equipment operation. It also protects the equipment from damaging electrical disturbances and lightning. **The display must be properly grounded or the warranty will be void.**

The material of an earth-ground electrode differs from region to region and from conditions present at the site. Consult the National Electrical Code and any local electrical codes that may apply. The support structure of the display cannot be used as an earth-ground electrode. The support is generally embedded in concrete, and if in earth, the steel is either primed or it corrodes, making it a poor ground.

Power Installation

There are two considerations for power installation; installation with ground and neutral conductors provided and installation with only a neutral conductor provided. These two power installations differ slightly, as described in the following paragraphs:

Installation with Ground and Neutral Conductors Provided

For this type of installation, the power cable *must* contain an isolated earth-ground conductor. Under this circumstance, *do not* connect neutral to ground at the disconnect or at the display. This would violate electrical codes and void the warranty. Use a disconnect so that all hot lines and neutral can be disconnected. Refer to **Figure 36** for installation details. The National Electrical Code requires the use of a lockable power disconnect within sight of or at the display.

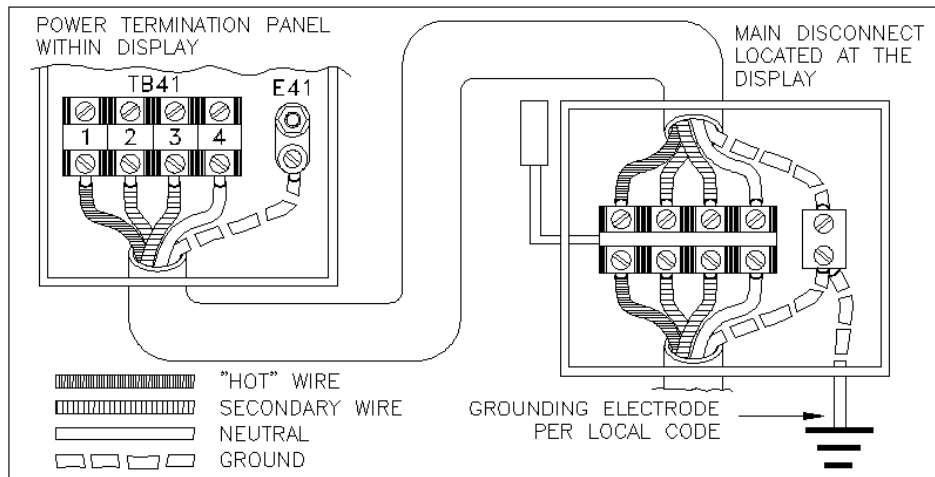


Figure 36: Installation with Ground and Neutral Conductor Provided

Installation with Only a Neutral Conductor Provided

Installations where no grounding conductor is provided must comply with article 250-32 of the National Electrical Code. If the installation in question meets all of the requirements of article 250-32, the following guidelines must be observed:

- Connect the grounding electrode cable at the local disconnect, never at the display power termination panel.
- A disconnect that opens all of the ungrounded phase conductors should be used.
- The neutral and the ground conductors should be bonded in the display power termination panel.

Refer to **Figure 37** for installation details.

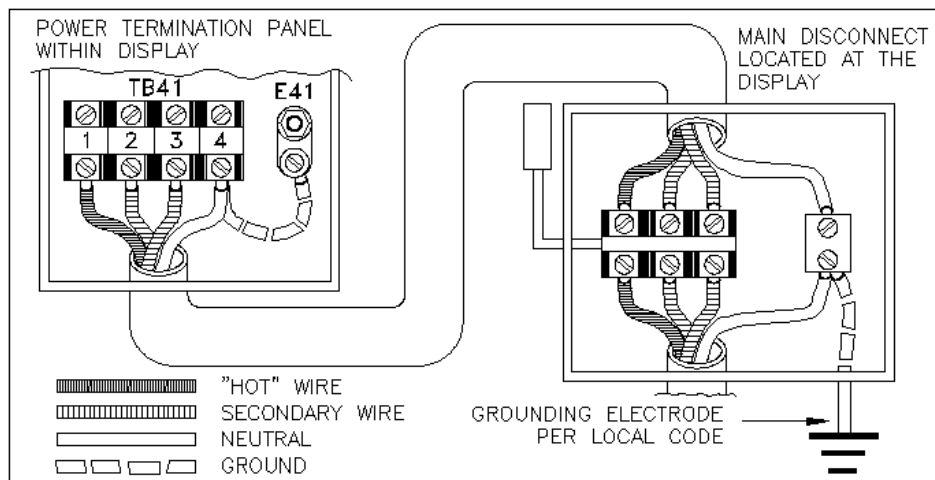


Figure 37: Installation with only Neutral Conductor provided

3.6 Bringing Signal to the Display

Reference Drawings:

V1500 Signal Termination.....	Drawing A-103727
Serial Line IF Signal Terms.....	Drawing A-103740

System Riser Diagram (Serial Line IF).....	Drawing A-107196
System Riser Diagram (RS/422).....	Drawing A-148859
System Riser Diagram (RS/232).....	Drawing A-148870
System Riser Diagram (Fiber Optic).....	Drawing A-148878
System Riser Diagram (Modem).....	Drawing A-148884

The method used to route and terminate signal cable at the display differs according to the type of signal cable used. This is especially true for the Venus 1500 systems, which are available in the following configurations.

- Venus 1500 system using RS/232 signal
- Venus 1500 system using RS/422 signal
- Venus 1500 system using modem/telephone cable
- Venus 1500 system using fiber optic signal

Venus 4600 systems use only one type of signal – fiber optic. Daktronics completes all internal signal wiring prior to shipment.

The following sub-sections address signal cable connection for each of the previously listed signal cable configurations. Refer to the information appropriate for this particular display.

Signal interconnect between displays in a 2V configuration is covered in **Section 3.7**.

Venus 1500 System Using RS/232 Signal

RS/232 systems use a two-conductor, shielded cable to transmit the RS/232 signal from the junction box to the display controller. The cable is assigned the Daktronics part number W-1117. Keep the following in mind when working with W-1117 cable.

- W-1117 cable should not be subjected to mechanical flexing after installation.
- It is not for direct burial.
- It should only be routed in a dedicated, grounded metallic conduit.
- It has a maximum length of 25 feet.

Complete the followings steps to connect signal to a Venus 1500 system using RS/232 cable.

1. Mount the junction box with 25 feet of the base of the display.
2. Route conduit and W-1117 cable from the junction box to the knockouts on the right side (rear view) of the display – or master display if a 2V configuration is being installed.
3. Continue cable into the Venus 1500 controller enclosure fitting labeled “Signal In.”
4. Use the table within this sub-section titled “Venus 1500 RS/232 Signal Connection” to terminate the W-1117 cable at the Venus 1500 controller and at the junction box.
 - The connector labeled “RS/232 In” (TB1) is a six-position, Phoenix-style connector found on the Venus 1500 controller board. Refer to **Drawings A-103727** and **A-148870** at the end of this section.
 - TB41 is the only termination panel within the junction box.

Venus 1500 RS/232 Signal Connection		
J-Box	Cabling	RS/232 In (TB1)
		Pin 1 (N.C)
		Pin 2 (N.C.)
TB41-2 (RX-P)	Clear	Pin 3 (TX-P)
TB41-3 (GND)	Shield	Pin 4 (GND)

TB41-1 (TX-P)	Black	Pin 5 (RX-P)
		Pin 6 (N.C)

- The controller computer connects to the 25-position connector (DB25) within the junction box. Refer to **Drawing A-148870** at the end of this section.
- Apply silicone sealant around the signal conduit where it meets the display cabinet to prevent water/moisture from entering the display.

Refer to **Light Detector Installation - Venus 1500 Systems** in **Section 3.8** for instructions on installing the light detector for this display. If ordering a temperature sensor, refer to **Section 3.9** for temp sensor installation instructions.

If this display is one face of a two-face, 2V cabinet display configuration, refer to **Section 3.7** for instructions on running signal from the master to the echo unit.

Venus 1500 System Using RS/422 Signal

RS/422 systems use a six-conductor, unshielded cable to transmit the RS/422 signal from the signal converter to the display controller. This cable consists of paired wires. It is Daktronics part number W-1210. Keep the following in mind when working with W-1210 cable.

- Do not subject W-1210 cable to mechanical flexing after installation.
- It is not for direct burial.
- Only route it in a dedicated, grounded metallic conduit.
- It has a maximum length of 4,000 feet.

Complete the following steps to connect signal to a Venus 1500 system using RS/422 cable.

- Route conduit and W-1210 cable from the control room to the knockouts on the right side (rear view) of the display – or master display if installing a 2V configuration.
- Continue cable into the Venus 1500 controller enclosure fitting labeled “Signal In.”
- Use the table within this sub-section titled “Venus 1500 RS/422 Signal Connection” to terminate the W-1210 cable at the Venus 1500 controller and at the signal converter.
 - The connector labeled “RS/422 In” (TB2) is a six-position, Phoenix-style connector found on the product board of the Venus 1500 controller. Refer to **Drawings A-103727** and **A-148859**.
 - “J6” is one of two six-position, Phoenix-style connectors found on the side of the signal converter. Each is clearly labeled.

Venus 1500 RS/422 Signal Connection		
Sig. Conv. (J6)	Cabling	RS/422 In (TB2)
Pin 1 (GND)	Red	Pin 1 (GND)
Pin 2 (TX-P)	Black	Pin 2 (RX-P)
Pin 3 (TX-N)	Brown	Pin 3 (RX-N)
Pin 4 (RX-P)	White	Pin 4 (TX-P)
Pin 5 (RX-N)	Blue	Pin 5 (TX-N)
Pin 6 (GND)	Green	Pin 6 (GND)

- The controller computer connects to the 25-position connector (DB25) on the signal converter labeled “J1.” Refer to **Drawing A-148859**

Refer to *Light Detector Installation - Venus 1500 Systems* in **Section 3.8** for instructions on installing the light detector for this display. If ordering a temperature sensor, refer to **Section 3.9** for temp sensor installation instructions.

If this display is one face of a two-face, 2V cabinet display configuration, refer to **Section 3.7** for instructions on running signal from the master to the echo unit.

Venus 1500 System Using Modem/Telephone Cable

Modem systems use standard telephone cable routed through conduit to send data from the controller computer modem to the display controller. The local telephone company must assist in this installation. Ask a representative of the phone company which colors the TIP and the RING for signal connection use.

The telephone lines must be standard, direct dial lines not run through a switchboard/communications system.

Refer to **Section 4.5** for an FCC notice regarding modem use.

Complete the following steps to connect signal to a Venus 1500 system using a modem and telephone cable.

1. Route conduit and telephone cable to the knockouts on the right side (rear view) of the display – or master display if installing a 2V configuration.
2. Continue cable into the Venus 1500 controller enclosure fitting labeled “Signal In.”
3. Remove the telephone terminal block cover and connect incoming wires using standard telephone wire colors.
4. Replace the telephone terminal block cover.
5. One short RJ11 telephone cable plugs into the telephone terminal block and the jack labeled “Phone” (J1) on the Venus 1500 controller modem board. The other short RJ11 cable plugs into the jack labeled “RS/232 Out” (J2) on the Venus 1500 controller modem board and the RJ11 jack on the Venus 1500 controller product board. Refer to **Drawings A-103727** and **A-148884**.

Refer to **Section 3.8** for instructions on installing the light detector for this display. If ordering a temperature sensor, refer to **Section 3.9** for temp sensor installation instructions.

If this display is one face of a two-face, 2V cabinet display configuration, refer to **Section 3.7** for instructions on running signal from the master to the echo unit.

Venus 1500 System Using Fiber Optic Signal

Venus 1500 fiber optic systems use a four-fiber cable to transmit data from a signal converter in the control room to the display controller. The cable is Daktronics part number W-1376. Keep the following in mind when working with W-1376 cable.

- Do not subject W-1376 cable should to mechanical flexing after installation.
- It is suitable for direct burial or routing in conduit.
- It has a maximum length of 1,500 feet.

Complete the following steps to connect signal to a Venus 1500 system using fiber optic cable.

1. Route conduit (if needed) and W-1376 cable from the control room to the knockouts on the right side (rear view) of the display – or master display if installing a 2V configuration.
2. Continue cable into the Venus 1500 controller enclosure fitting labeled “Signal In.”

3. Use the table within this sub-section titled “Venus 1500 Fiber Optic Connection” to connect fiber optic cable at the signal converter and the Venus 1500 controller fiber optic board.
 - The Venus 1500 fiber optic board mounts on the Venus 1500 controller board within the Venus 1500 enclosure. Refer to **Drawings A-103727** and **A-148878**.
 - The fiber optic connectors on the side of the signal converter are clearly labeled.

Venus 1500 Fiber Optic Signal Connection		
Signal Converter	Cabling	Venus 1500 Fiber Board
RX-Out (J3)	-----	TX-In (J4)
TX-Out (J2)	-----	RX-In (J5)

4. The controller computer connects to the nine-position connector (DB9) on the signal converter labeled “J1.” Refer to **Drawing A-148878** found at the end of this section.

Refer to *Light Detector Installation - Venus 1500 Systems* in **Section 3.8** for instructions on installing the light detector for this display. If ordering a temperature sensor, refer to **Section 3.9** for temp sensor installation instructions.

If this display is one face of a two-face, 2V cabinet display configuration, refer to **Section 3.7** for instructions on running signal from the master to the echo unit.

Venus 4600 System Using Fiber Optic Signal

Venus 4600 fiber optic systems use a two-fiber cable to transmit data from an A/B interface in the control room to the serial line interface within the display. The cable is Daktronics part number W-1242. Keep the following in mind when working with W-1242 cable.

- Do not subject W-1242 cable to mechanical flexing after installation.
- It is suitable for direct burial or routing in conduit.
- It has a maximum length of 1,500 feet.

Complete the following steps to connect signal to a Venus 4600 system using fiber optic cable.

1. Route conduit (if needed) and W-1242 cable from the control room to the knockouts on the right side (rear view) of the display – or master display if installing a 2V configuration.
2. Pull fiber optic cable to the bottom of the serial line interface board.
3. Connect fiber cable to J8, fiber optic input, on the serial line interface board and to J8 (RX) on the A/B interface. Refer to **Drawings A-107196** and **A-103740**.
4. The controller computer connects to the 15-position connector (DB15) on the A/B interface. Refer to **Drawing A-107196**.

If the optional photo/temp sensor was ordered with this display refer to *Optional Photo/Temp Sensor Installation - Venus 4600 Systems* in **Section 3.8**.

If this display is one face of a two-face, 2V cabinet display configuration, refer to **Section 3.7** for instructions on running signal from the master to the echo unit.

If this display does not have a photo/temp sensor and is not one face of a two-face, 2V cabinet configuration, refer to **Section 3.10**.

If this display is one face of a two-face, 2V cabinet display configuration, refer to **Section 3.7** for instructions on running signal from the master to the echo unit.

3.7 Interconnect of 2V Displays

Reference Drawing:

Interconnect, 2V	Drawing A-104023
Shop Drawing, 7 or 8 High, 2 ½ "	Drawing A-114666
Shop Drawing, 16 High, 2 ½ "	Drawing A-114667
Shop Drawing, 24 High, 2 ½ "	Drawing A-114668

The procedure for interconnecting 2V displays differs for Venus 1500 and Venus 4600 systems. **Drawing A-104023** provides a general idea how signal cable routes between display faces in both Venus 1500 and Venus 4600 systems.

In order to provide a signal interconnect between two (or more) Venus 1500 system displays the lens/reflector assemblies must be removed from in front of both the Venus 1500 display controller and the fan control enclosure. Venus 4600 systems do not have a fan control enclosure. Therefore, remove only the lens/reflector assemblies in front of the serial line interface.

The shop drawing for this display shows the locations of the display controller (Venus 1500 controller or serial line interface) and the fan control enclosure (Venus 1500 only). The following table explains which shop drawing is used for which display.

If the display being installed is...	Consult shop drawing...
7 or 8 high display (all lengths)	Drawing A-114666
16 high display (all lengths)	Drawing A-114667
24 high display (all lengths)	Drawing A-114668

Refer to *Lens/Reflector Assemblies* in **Section 4.3** for instructions on removing lens/reflector assemblies.

Having removed the needed lens/reflector assemblies, proceed to the appropriate sub-section for this display.

Venus 1500 Systems

On all Venus 1500 systems, signal comes from the controller computer to the Venus 1500 controller in the independent (master) display. That signal then relays to the echo display over two 25-foot-long cables: one being 12-pin and the other being 20-pin.

The two 25-foot cables ship in the echo display. The location of the cables within the display is labeled on the back sheet.

When placed back-to-back, the displays can have a maximum separation of five feet if the display is 144 pixels long. For every 16 pixels less in length, the displays can be two feet farther apart.

Complete the following steps to interconnect signal between the master and echo displays.

1. Route two-inch conduit and both the 12 and 20-pin cables between the displays. Daktronics provides knockouts on the rear of the displays for attaching conduit.
2. Within the echo display, the 20-pin connector plugs into the "Input" jack of the vertical shift board located at the upper-left end (front view) of the display. The vertical shift board attaches to the back of the lampbank of the rear of the lens/reflector assembly. Eight-pixel-high displays only have one lens/reflector assembly on the left end of the display.
3. Still within the echo display, the 12-wire cable routes from TB31 into the 12-position jack of

the fan control enclosure of the master display.

4. In the master display, plug the 20-pin connector into the output jack (J5) of the master/echo board in the fan controller enclosure.
5. Still in the master display fan control enclosure, plug the other end of the 12-pin connector into the output (J3) of the master/echo board.
6. Replace all covers and lens/reflector assemblies.
7. Apply silicone sealant around conduit attachment points to prevent moisture/water from entering the display.

Refer to *Light Detector Installation - Venus 1500 Systems* in **Section 3.8** for instructions on installing the light detector for this display. If ordering a temperature sensor, refer to **Section 3.9** for temp sensor installation instructions.

If the light detector and temperature sensor come installed, refer to **Section 3.10**

Venus 4600 Systems

On all Venus 4600 systems, signal comes from the controller computer to a serial line interface board in either display. The master display houses the serial line interface that receives signal directly from the controller computer. The serial line interface of the remaining display, considered the echo display, receives signal over fiber optic cable from the serial line interface in the master display.

Fifty feet of fiber optic cable ships in the echo display. The location on the cable within the display is labeled on the back sheet.

When placed back-to-back, the displays can have a maximum separation of 25 feet if the display is 96 pixels long. For every 16 pixels less in length, the displays can be three feet farther apart.

Complete the following steps to interconnect signal between the master and echo displays.

1. Route conduit and fiber optic cable between the displays. Daktronics provides knockouts on the rear of the displays for attaching conduit.
2. Within the echo display, connect the fiber optic cable to the J8 (RX) plug of the serial line interface.
3. Within the master display, connect the fiber optic cable to the J6 or J7 (TX) plug of the serial line interface.
4. Replace all covers and lens/reflector assemblies.
5. Apply silicone sealant around conduit attachment points to prevent moisture/water from entering the display.

If the optional photo/temp sensor came with this display refer to *Light Detector Installation - Venus 1500 Systems* in **Section 3.8**.

If the optional photo/temp sensor comes already installed, proceed to **Section 3.10**.

3.8 Controlling Display Brightness

Daktronics 1600 series small matrix displays have the ability to alter the brightness of the lamps via the controller software. This feature increases the impact of the display and extends the life of the lamps. During the day, lamps need to be brighter to compete with sunlight. During the night, lamps can be dimmer because they are not competing with sunlight and because lamps tend to glare at night if too bright.

Lamp brightness levels are set using the Venus software running on the controller computer. Control brightness by either manually configuring a bright/dim schedule or by letting the optional light detector adjust lamp brightness as needed.

Following are the optional light detector installation instructions for both Venus 1500 and Venus 4600 systems.

ED9067 and **ED4602** contain operation instructions for the Venus 1500 and Venus 4600 software, respectively. Use the appropriate software manual to configure the display for a light detector if using one.

Light Detector Installation - Venus 1500 Systems

Instructions for mounting and connecting signal wire to the light detector are located with the light detector in its box.

A light detector can easily connect to the Venus 1500 display controller as follows.

1. Route the light detector cable (Daktronics part number W-1234) through conduit and into the display.
2. Continue the cable into the controller box fitting labeled “LIGHT.”
3. Strip the insulation and terminate wires to TB7 as shown below. TB7 is near the lower-right corner of the Venus 1500 controller product board, as seen in **Figure 38**.

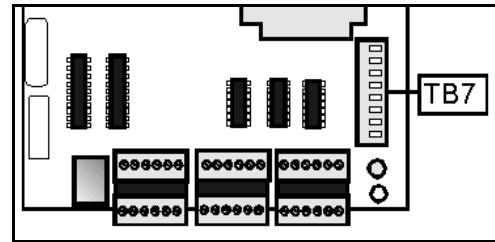


Figure 38: TB7 on Venus 1500 controller

Light Detector	Field Cabling	Venus 1500 Controller Term Block (TB7)
+V	Red	Pin 1 (+5V)
GND	Black	Pin 2 (GND)
P	Green	Pin 3 (Light - P)
N	White	Pin 4 (Light - N)

If a temperature sensor was ordered with this display, refer to *Optional Temp Sensor Installation - Venus 1500 Systems* in **Section 3.9** for installation instructions.

Proceed to **Section 3.10** if all the following statements are true.

- Signal from the controller computer routes and connects to the Venus 1500 controller within the display.
- The light detector connects to the Venus 1500 controller.
- A temperature sensor was not ordered with this display or is already installed.
- If this is a 2V, multi-face display, signal interconnects between the displays.

Optional Photo/Temp Sensor Installation - Venus 4600 Systems

Instructions for mounting and connecting signal wire to the light detector are located with the light detector in its box.

Venus 4600 systems usually have a combination light and temperature sensor. The two devices integrate into a common circuit board. There is also a photocell-only option available. The only

difference between the two options is the number of wires running from the sensor to the Venus A/B transmitter interface, where the sensor connects.

Complete the following steps to connect the photo/temp sensor to the Venus A/B transmitter interface.

1. Remove the cover from the Venus A/B transmitter interface. Removing each of the two screws on the face of the enclosure and lifting the cover away accomplishes this.
2. Route cable and conduit from the sensor to the A/B interface.
3. Strip the wire insulation and terminate to TB1 in the A/B interface as shown in the table below. **Figure 39** illustrates the location of TB1 on the A/B interface circuit.

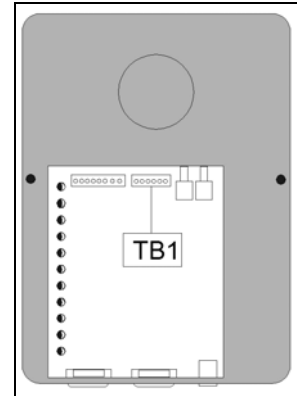


Figure 39: TB1 on A/B Interface

The wire colors correspond to the wire colors leaving the sensor.

Wire Color	TB1 On A/B Interface Circuit Board
White	Pin 1 (Photo-P)
Black	Pin 2 (GND-N)
Red	Pin 3 (TMPV-P)
Brown	Pin 4 (GND-N)
Green	Pin 5 (TMPIN-P)
Shield	Pin 6 (GND-N)

Not all wires above will be present if the temperature sensor is not included. If this is the case, simply connect the wires that are present according to the above table.

Proceed to **Section 3.10** if all the following statements are true.

- Signal from the controller computer routes and connects to the serial line interface within the display.
- The photo/temp sensor ordered with the display has connected to the A/B transmitter interface.
- If this is a 2V, multi-face display, signal has interconnected between the displays.

3.9 Optional External Temperature Sensor

Both Venus 1500 and Venus 4600 systems offer an optional external temperature sensor. This sensor relays temperature information to the Venus software, which can then display the temperature data on the display. This can be combined with the time to create a “time and temp” service.

Operation instructions for the Venus 1500 and Venus 4600 software are in **ED9067** and **ED4602**, respectively. Use the appropriate software manual to configure the display if using a temperature sensor.

Optional Temp Sensor Installation - Venus 1500 Systems

Instructions for mounting and connecting signal wire to the temperature sensor are located with the temp sensor in its box.

Connect the temp sensor to the Venus 1500 display controller as follows.

1. Route the temp sensor cable (Daktronics part number W-1234) through conduit and into the display.
2. Continue the cable into the controller box fitting labeled “TEMP.”
3. Strip the insulation and terminate wires to TB7 as shown below. TB7 is found near the lower-right corner of the Venus 1500 controller product board, as seen in **Figure 35** in *Light Detector Installation - Venus 1500 Systems* in **Section 3.8**.

Temp Detector	Field Cabling	Venus 1500 Controller Term Block (TB7)
P	Green	Pin 5 (Temp - P)
N	White	Pin 6 (Temp - N)
+V	Red	Pin 7 (+5V)
GND	Black	Pin 8 (GND)

Proceed to **Section 3.10** if all the following statements are true.

- Signal from the controller computer has routed and connected to the Venus 1500 controller within the display.
- The light detector and/or temp sensor ordered with the display have connected to the Venus 1500 controller.
- If this is a 2V, multi-face display, signal has interconnected between the displays.

Optional Photo/Temp Sensor Installation - Venus 4600 Systems

Instructions for mounting and connecting signal wire to the light detector are located with the light detector in its box.

Venus 4600 systems usually have a combination light and temperature sensor. The two devices integrate into a common circuit board. There is also a photocell-only option available. The only difference between the two options is the number of wires running from the sensor to the Venus A/B transmitter interface, where the sensor connects.

Refer to *Optional Temp Sensor Installation - Venus 1500 Systems* in **Section 3.9** for photo/temp sensor installation instructions.

3.10 First Time Power-Up

Having completed all power and signal connections, the display is now ready to power up for the first time.

Before powering-up the display replace all enclosure covers within the display and put the lens/reflector assemblies back into the cabinet. If additional instructions are needed refer to *Signal Summary* in **Section 4.2** for a general overview of signal connection within the display and *Lens/Reflector Assemblies* in **Section 4.3** for instructions on removing and replacing a lens/reflector assembly.

Having re-assembled the display, turn the display ON at the main disconnect and verify the following occurs on the display.

Venus 1500 Systems

1. Output Test (DDDs)
2. Product Name (Galaxy)
3. Display Size (Row x Column)
4. Firmware Number (ED10134)
5. Firmware Revision (Rev X.XX)
6. COM1 Configuration (C1: V15/RTD)
7. COM2 Configuration (C2: None)
8. Line Frequency (60 Hz)
9. Hardware Address (HW: XX)
10. Software Address (SW: XX)
11. Display Name
12. Modem if present (Modem)

Venus 4600 Systems

The display will blank until a sequence is run on the controller. Refer to **ED4602** for instructions on running a sequence.

After completing the test patterns, the Venus 1500 controller will run messages stored in the battery backup memory. These messages will continue to run until the power disconnects or the messages change using the controller computer.

If the display is operating as expected, proceed to the final step of small matrix display installation – the lamp voltage check.

If the display is not operating correctly, double check all signal and power connections and refer to **Section 4.6** for troubleshooting guidance. If unable to resolve the problem contact Daktronics Customer Service.

3.11 Lamp Voltage Check

The final step in display installation is checking lamp voltages. Excessive voltage to the lamps causes premature burnout while insufficient voltage hinders the display's effectiveness.

Although Daktronics performs a line voltage check prior to installation, perform the lamp voltage test. This test will bring to light any internal problems, such as a transformer damaged during shipping that could result in sending excessive voltage to the lamps.

Complete the following steps to test lamp voltages.

1. Turn on the power to the display and configure the display to have 50% of the lamps on per module. This can be done by either:
 - creating a static sequence with alternate columns on, or
 - selecting the sequence from the appropriate controller manual under the diagnostics section. Refer to the Venus 1500 Operator's Manual (**ED9067**) or the Venus 4600 Operator's Manual (**ED4602**) for more information on setting up and running sequences.
2. Locate two modules powered by the same transformer.
3. Remove a lens and an ON lamp from any column from one of the above modules. Refer to **Section 4.3 Lenses** to address lens removal and replacement. **Figure 40** illustrates the use of the lamp removal tool.
4. Insert the lamp voltage tester into the empty lamp socket.
5. Place the probes of the voltage tester leads into the holes of the lamp voltage tester (**Figure 41**). Record the lamp voltage reading on each of the "1600 Series Display Power Report" forms found in **Appendix C**. The table in **Section 3.4** lists expected lamp life based on line and lamp voltages.

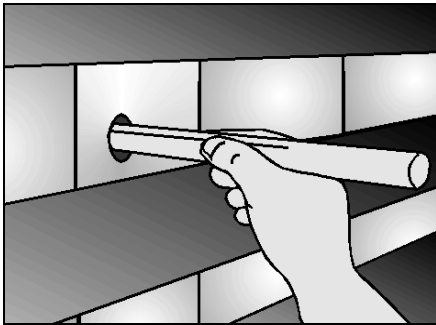


Figure 40: Removing an ON Lamp

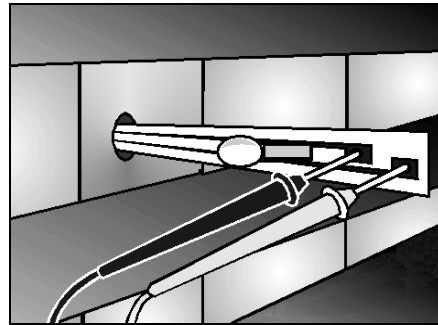


Figure 41: Lamp Voltage Tester

USE EXTREME CAUTION!

Do not short across the terminals of the voltage tester. Doing so will damage the module electronics.

6. Repeat the above steps for at least two more modules.
7. Carefully replace the lamps and lenses.

Remember to record the lamp voltage readings on the each “Display Power Report” found in Appendix B. Return one of the forms to Daktronics Customer Service.

Section 4: Maintenance & Troubleshooting



IMPORTANT NOTES:

1. **Turn off power before performing any repair or maintenance work on the display!**
2. **Only qualified service personnel may access internal display electronics.**
3. **Do not operate the display with the back sheets removed!** The cabinet is positively pressurized, directing adequate airflow around the lamps and out through the lenses. Display operation without the back sheets in place and fans running could cause damage to the display and will void the warranty. *Fasten the back sheets securely into place.*
4. **Dirt and contaminants may enter the display if it operates without the fan filters in place or with dirty fan filters.** These contaminants may cause premature failure of the electronic components. *Operating the display with dirty fan filters or without fan filters voids the warranty.*
5. **The Daktronics product managers engineering staff must approve any changes that may affect the weather-tightness of the display.** This is to include, but is not limited to, border shrouding, back sheets, cooling fans, fan filters and filler panels. *Before making ANY modifications to the weather tightness of the display, submit detailed drawings to our engineering staff for evaluation and approval or the warranty will be null and void.*

4.1 Maintenance & Troubleshooting Overview

Small matrix displays are front accessible units, meaning access to the internal components is only from the front of the display.

This list provides an overview of information found within each group.

- **Operational Summary:** outlines the power and signal routing of the display, as well as operation of the ventilation system.
- **Servicing of Display Components:** explains how to remove various display components and provides operational and diagnostic information on each item.
- **Maintenance:** addresses the steps that must be taken to keep the display in safe, operational condition.
- **Troubleshooting:** lists the causes of a number of possible display malfunctions.
- **Replacement Parts List:** provides the descriptions and part numbers of selected display components.
- **Exchange/Replacement Procedure:** explains the process for returning a display component to Daktronics for repair or replacement.

4.2 Operational Summary

Reference Drawings:

Schematic, 16 High, 48 to 96	Drawing B-112311
Schematic, 7 or 8 High, 48 to 96.....	Drawing B-112505
Schematic, 24 High, 48 to 96	Drawing B-113973
Shop Dwg, 7 or 8 High, 2 ½"	Drawing A-114666
Shop Dwg, 16 High, 2 ½".....	Drawing A-114667
Shop Dwg, 24 High, 2 ½".....	Drawing A-114668

This overview summarizes the power and signal functioning of the typical 1600 series, 2.5-inch small matrix display. Refer to the display schematics at the end of this section or any project specific drawings included in **Appendix A** for detailed power and signal information.

There are a number of schematics at the end of this section. Use the following table as a guide in choosing the one appropriate for this display.

If the display being installed is...	Consult schematic...
7 or 8x48 pixels to 7 or 8x144 pixels	Drawing B-112505
16x48 pixels to 16x64 pixels	Drawing B-112311
24x48 pixels to 24x96 pixels	Drawing B-113973

In addition, the shop drawings in **Appendix A** show the locations of the power termination panel, display controller and fan control enclosure.

Use the following table to choose the correct shop drawing.

If the display being installed is...	Consult Section 3 shop drawing...
7 or 8 high display (all lengths)	Drawing A-114666
16 high display (all lengths)	Drawing A-114667
24 high display (all lengths)	Drawing A-114668

Power Summary

As addressed in **Section 3.5, Power Termination at the Display**, incoming power terminates at TB41 on the power termination panel within the display. Display grounding is the responsibility of the installer must comply with both Article 250 of the National Electrical Code and all local codes and standards.

From the power termination panel, power routes to the transformers; the display size determines the exact number of transformers. Each transformer fuses on the primary side. These fuses are located above TB41 on the power termination panel. **Use only FLNR20, 250 V slow blow fuses.** Refer to the replacement parts list in **Section 4.15**.

From the transformers, power routes to the individual lampbanks on the backsides of the lens/reflector assemblies. Each transformer is capable of powering a maximum of two modules (eight lampbanks).

In addition, the power termination panel also houses the fuse for the display controller (Venus 1500 controller or serial line interface). This is the top-most fuse on the panel. **Replace this fuse with only another AGC-2 ½, 2 ½ A, 250 V fuse.**

An individual fuse is also located within the fan control enclosure. Power to the fans routes through this fuse and then through a relay. If the display is blank for 30 minutes, the display

controller can flip the relay, turning off the fans and extending the life of both the fans and the filters. **Replace this fuse only with an AGC-7 1/2, 7 1/2 A, 250V fuse.**

Figure 42 provides a general summary of the power routing of the 1600 series small matrix displays. Neutral and ground wires are not illustrated. The illustration is for conceptual purposes only.

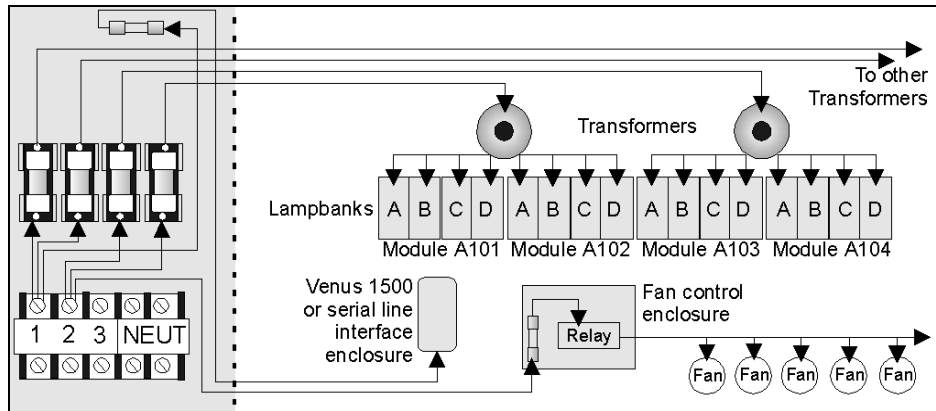


Figure 42: Power Routing Example

For detailed power and signal information, refer to the appropriate general schematic at the end of this section, or the project specific schematic in **Appendix A**, if one was included. Refer to **Section 4.2** if unsure which schematic to use.

Signal Summary

Because they use different display controllers, Venus 1500 and Venus 4600 systems differ significantly in terms of signal routing. For this reason, the signal routing of each is addressed separately within this sub-section.

Venus 1500 Signal Summary

Venus 1500 systems are comprised of a computer running Venus 1500 software that sends data to a Venus 1500 display controller within the display. The controller computer can send data to the display controller in any of the following signal formats.

- RS/232
- RS/422
- Modem
- Fiber Optic

Each of the previously listed signal formats requires slightly different cable and controller equipment. **Figure 3** in **Section 1.2** illustrates the various Venus 1500 system configurations.

For more detailed information regarding controller computer to display controller connection, refer to the schematic appropriate for this display (**Section 4.2**) and the **Section 3** instructions for bringing signal to the display.

After receiving data from the controller computer, the Venus 1500 controller then relays the display information to the master-echo board within the fan controller enclosure. A 20-pin cable connects J3 on the Venus 1500 controller to J1 (Controller Input) on the master-echo board.

From the master-echo board, display information goes to the vertical shift board located behind the upper-left-most lampbank (front view). A 20-pin ribbon cable connects J4 (Master Output) on the master-echo board to J2 (Input) on the vertical shift board. If an echo display is present, data is sent to the same vertical shift board on that display via J5 (Echo Output) on the master-echo board.

The vertical shift board then sends the display information to the lampbank on which it is mounted. A 20-pin ribbon cable connects J1 (Data Out) on the vertical shift board to J2 (Input) on the lampbank. On 16 and 24-high displays, J3 (Output) on each vertical shift board connects to J2 (Input) on the vertical shift board below it. Each display row has one vertical shift board behind the left-most lampbank (front view).

The display data then cascades down the row as it is passed from J3 (Output) on each lampbank to J2 (Input) on the next lampbank over 20-pin ribbon cable.

The button thermostats in this display connect to a junction panel within the fan controller enclosure before routing to J2 (Master Fans) on the master-echo board. If an echo display is present, the button thermostats in that display connect to a junction panel in that display's fan control enclosure. However, only the master display has a master-echo board, so the thermostat harness from the echo display routes to J3 (Echo Fans) on the master display's master-echo board.

The light detector and the optional temp sensor connect to the Venus 1500 controller board at TB7.

Figure 43 illustrates the signal routing for a Venus 1500, 16-high display. The illustration is for conceptual purposes only. The display cabinet houses all components except the controller computer and the light detector.

For detailed power and signal information, refer to the appropriate general schematic at the end of this section, or the project specific schematic in **Appendix A**, if one was included. Refer to **Section 4.2** if unsure which schematic to use.

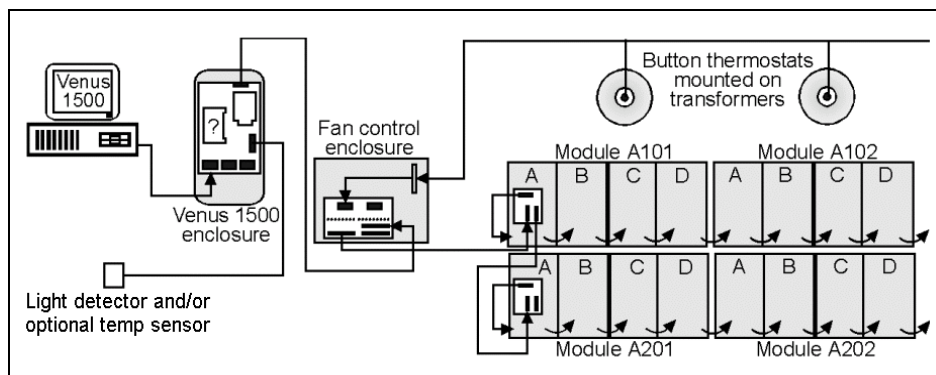


Figure 43: Signal Routing for Venus 1500, 16-High Display

Venus 4600 Signal Summary

Signal routing for Venus 4600 systems starts at the controller computer. This computer, running Venus 4600 software, sends data to the Venus A/B transmitter interface over serial cable. The DB15 male-to-male cable connects to the A/B transmitter at J1.

The data then goes to the serial line interface board within the display over fiber optic cable. The cable runs from the J5 fiber transmit jack within the A/B interface to the J6 fiber input

jack on the serial line interface board. If an echo display is present, the data is shared with the displays by running a fiber optic cable between J6 or J7 (TX) on the master display's serial line interface to J8 (RX) on the echo display's serial line interface.

From the serial line interface board, display information routes to the vertical shift board behind the upper-left-most lampbank (front view). A 20-pin ribbon cable connects J4 on the serial line interface to J2 (Input) on the vertical shift board.

The vertical shift board then sends the display information to the lampbank on which it is mounted. A 20-pin ribbon cable connects J1 (Data Out) on the vertical shift board to J2 (Input) on the lampbank. On 16 and 24-high displays, J3 (Output) on each vertical shift board connects to J2 (Input) on the vertical shift board below it. Each display row has one vertical shift board behind the left-most lampbank (front view).

The display data then cascades down the row as it passes from J3 (Output) on each lampbank to J2 (Input) on the next lampbank over 20-pin ribbon cable.

The button thermostats in this display connect to a junction panel within the fan controller enclosure. A wire harness runs from this panel to J1 (Fans) on the serial line interface board. The thermostats in the echo display, if there is one, run to that display's junction panel and then to that display's serial line interface.

The photocell, if ordered with the display, connects to the Venus A/B transmitter interface at TB1 inside the transmitter case.

Figure 44 illustrates the signal routing for a Venus 4600, 16-high display. The illustration is for conceptual purposes only. The display cabinet houses all components except the controller computer, light detector (photocell) and the Venus A/B transmitter interface.

For detailed power and signal information, refer to the appropriate general schematic at the end of this section or the project specific schematic in **Appendix A**, if one was included. Refer to **Section 4.2** if unsure which schematic to use.

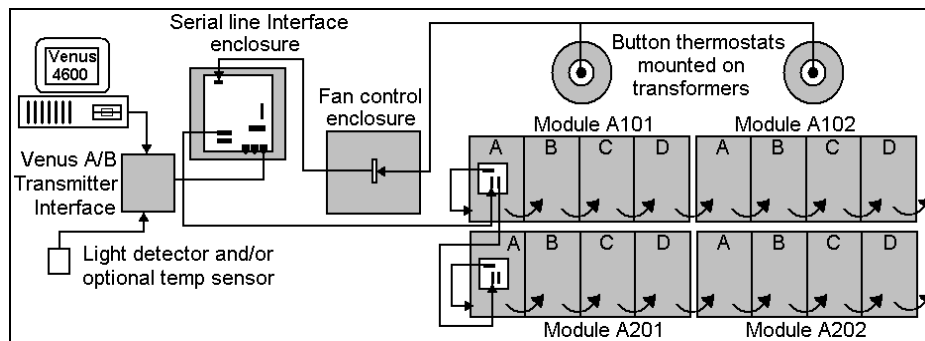


Figure 44: Signal Routing for Venus 4600, 16-High Display

Ventilation & Temperature Sensing Summary

Daktronics 1600 series small matrix displays depend on a ventilation system and internal temperature sensing equipment to prevent and monitor heat buildup within the cabinet. Excessive heat shortens the life of all electrical components, including lamps.

The three critical parts of the ventilation system are the filters, the fans and the lenses. On the bottom of the cabinet are a number of air filters, and above each air filter, within the cabinet, is a fan. The fans draw cooler air from outside the display through the filters and into the display. This incoming air forces warm air, already in the cabinet, out through the lenses on the face of the display. Each lens has an exhaust port near the top to allow for airflow. Before the air exists through the lenses, it passes past the lamps, cooling them in the process. This maximizes the life of the lamps. **Figure 45** illustrates this ventilation process.

To protect this display from heat-related damage, numerous button thermostats are in the cabinet, usually mounted on the transformer mounting bolts. There is one thermostat for each fan in the display. When the internal cabinet temperature climbs too high, one or more thermostats will open. What happens next depends on whether this display is a Venus 1500 or Venus 4600 system.

If this is a Venus 1500 system, the master-echo board in the fan control enclosure of the master

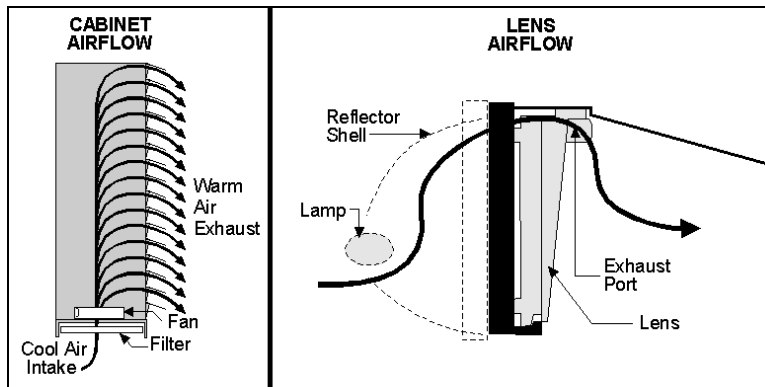


Figure 45: Cabinet and Lens Airflow

display will sense the open thermostat. It will then send an alert to the Venus 1500 controller, which will blank the display.

When the internal cabinet temperature drops to acceptable levels, the affected thermostats will close and the display controller (serial line interface or Venus 1500 controller) will return the display to operational status.

When the internal cabinet temperature drops to acceptable levels, the display controller (serial line interface or Venus 1500 controller) will return the display to operational status.

The master-echo board, used on Venus 1500 systems, and the serial line interface board, used on Venus 4600 systems, have LEDs on them to indicate which thermostats are closed. This is useful information when troubleshooting. Refer to *Master-Echo Board* for master-echo board information and *Additional Venus 4600 System Components (Serial Line Interface)* for serial line interface board information.

In addition, the display controllers in 1600 series small matrix displays will turn off power to the fans if they sense the display has been blank for 30 minutes. This action is completed through the relay in the fan control enclosure. This extends the life of both the fans and the filters. The display controller will start the fans automatically when the display is in use.

4.3 Servicing of Display Components

Reference Drawings:

Line Receiver Settings	Drawing A-110966
Line Receiver Settings	Drawing A-117756

This sub-section explains the functions of the various display components and the procedures for removing and replacing them. It also addressed the meaning of any diagnostic LEDs found on the circuit boards.

Access to lamps in this display can be made by either removing the lampbank to which the lamps attach or by removing the lens in front of the lamp. If needing to replace only a few lamps, it is easier to remove the lenses in front of them. If there are many lamps requiring replacement on a lampbank (five or more), it is easier to remove the lampbank from the lens assembly. This sub-section addresses both methods of lamp removal and replacement.

Lenses

A lens is positioned in front of each lamp in each lens/reflector assembly. The lenses, along with the reflectors, direct the light from the display. Sixty-four lenses are found on each lens/reflector assembly.

Complete the following steps to remove a lens from a lens/reflector assembly.

- Carefully pry out the lens tab using the lens/lamp extractor found in the tool kit. The lens tab is located at the top center of the lens. Refer to **Figure 46**. If necessary, gently press up on the louver above the lens to aid in removal. Applying excessive force to the louver may cause it to become deformed.

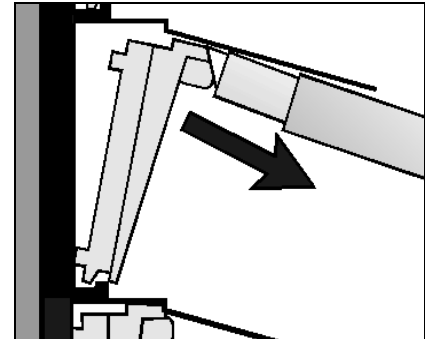


Figure 46: Removing a Lens

Complete the following steps and refer to **Figure 47** to insert a lens into the lens/reflector assembly.

1. Insert the lens' indexing tabs into their respective slots on the lens/reflector assembly. There is one indexing tab on the bottom-left and bottom-right corners of the lens.
2. Push the lens into position behind the louver offset. If necessary, gently press up on the louver above the lens to aid in insertion. Applying excessive force to the louver may cause it to become deformed.
3. Verify that the lens position and placement is consistent with others in that row. If a lens looks out of position it is likely an indexing tab is not in its slot.

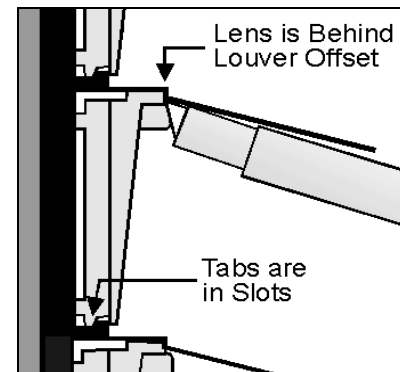


Figure 47: Replacing a Lens

Lamps

There are 64 lamps per lens/reflector assembly (or 32 lamps per lampbank). Each lamp rests in a socket on the lampbank. As illustrated in **Figure 48**, when the lampbank is mounted on the back of the lens/reflector assembly the lamps extend into the reflector shells of the assembly.

The life rating of a lamp is defined as the average number of hours within which 50 percent of a test quantity is expected **not** to fail **and** within 70 percent of that rated life, 90 percent are expected **not** to fail. The 7.5-watt lamps used in the 1600 series, 2.5-inch display have a rated lamp life of 12,004 hours when operated at 21.48 volts.

Typically, lamp failures for the 12,004-hour, 21.48-volt lamp may be expected as follows.

- Three percent of the lamps normally fail upon reaching 35 percent of the rated life. Thirty-five percent of 12,004 hours is 4,201 hours.
- Ten percent of the lamps normally fail upon reaching 70 percent of the rated life. Seventy percent of 12,004 hours is 8,402 hours.
- Fifty percent of the lamps normally fail upon reaching 100 percent of the rated life. The remainder of the lamps lasted longer than the rated lamp life of 12,004 hours.

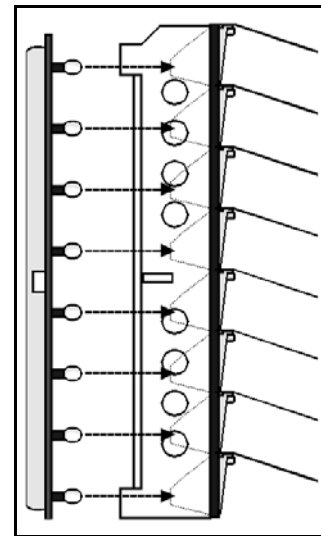


Figure 48: Lampbank and Lens/Reflector Assy.

The table below presents this information in another way. It shows the predicted lamp failure rates for various sizes of small matrix displays based on a lamp voltage of 21.48 volts and assuming the display is operated 18 hours per day. *The figures are based on the manufacturer's test data and laboratory conditions.*

Failure Percentage	Hours of Operation	Days in Service	Predicted Number of Lamp Failures For Various Display Sizes					
			8x48 384 Lamps	8x64 512 Lamps	8x80 640 Lamps	8x96 768 Lamps	8x112 896 Lamps	16x112 1792 Lamps
3	4,201	233	12	16	20	24	27	54
10	8,402	466	38	51	64	76	89	179
50	12,004	666	192	256	320	384	448	896

⌚ *Lamp life predictions are for lamps operating in a laboratory with continuous operation in a stable temperature and mechanical environment. Actual values will differ from predicted life because of switched operation, varying temperature, mechanical vibrations due to wind, traffic and sign service and actual hours of operation. Data is that of the manufacturer.*

Lamps in this display are accessed either by removing the lampbank to which the lamps are attached or by removing the lens in front to the lamp. If just a few lamps here and there need replacing it is easier to remove the lenses in front of them. If there are many lamps that need replacing on a single lampbank (five or more) it is easier to remove the lampbank from the lens assembly. Both methods of lamp removal/lamp replacement are addressed in this sub-section.

Complete the following steps to access and service lamps by removing a lampbank.

1. In order to access the lampbank, pull the lens/reflector assembly from the display. Refer to **Lens/Reflector Assemblies** in **Section 4.3** for instructions on removing this assembly.

2. After removing the lens/reflector assembly from the display, remove the lampbank from the assembly. Refer to **Lampbanks** in **Section 4.3** for instructions on removing the lampbank.
3. Replace the necessary lamps. Use the lens/lamp extractor if the lamps are hot. **Use only Daktronics-approved lamps of the same wattage.**
4. Remount the lampbank to the back of the lens/reflector assembly as explained in **Lampbanks** in **Section 4.3**.
5. Insert the lens/reflector assembly back into the display cabinet as explained in **Lens/Reflector Assemblies** in **Section 4.3**.

Complete the following steps to access and service lamps by removing a lens.

1. Remove the necessary lenses as explained in **Lens/Reflector Assemblies** in **Section 4.3**.
2. As illustrated in **Figure 49**, remove the bad lamps with the lens/lamp extractor tool found in the tool kit.
3. Replace the necessary lamps. Use the lens/lamp extractor if the lamps are hot. **Use only Daktronics-approved lamps of the same wattage.**
4. Replace the lenses as explained in **Lenses** in **Section 4.3**.

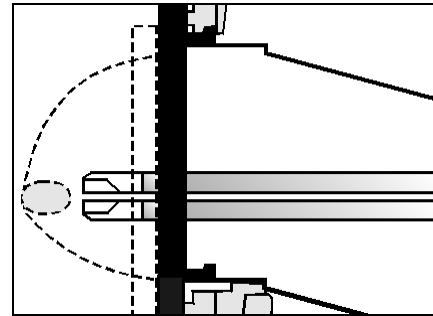


Figure 49: Lamp Removal

Lens/Reflector Assemblies

The lens/reflector assembly is an eight pixel by eight pixel unit consisting of a frame on which louvers, lenses and reflectors are mounted. Each lens/reflector assembly can be easily removed from the display for servicing. If a lens/reflector ever becomes damaged, refer to **Section 4.15** for a replacement part number and to **Section 4.16** for exchange/replacement information. An 8x16 module consists of two side-by-side lens/reflector assemblies and the lampbanks (four in all) on the back.

Complete the following steps to remove a lens/reflector assembly from the cabinet.

1. Remove the lens from row four, column one, and the lens from row four, column eight, of the lens/reflector assembly as illustrated in **Figure 50**. *Lenses* in **Section 4.3** addresses lens removal.
2. In the outer corner of each of the two reflector shells is an access hole. Slide the 10-inch flat head screwdriver into one of these holes. Keep the screwdriver edge vertical and push it into the hole, sliding it along the frame until it stops.
3. Use the handle of the screwdriver as a lever to disengage the latching mechanism on this side of the assembly. Pushing the screwdriver handle sideways, away from the assembly, will free this side of the assembly. **Figure 51** illustrates this procedure.

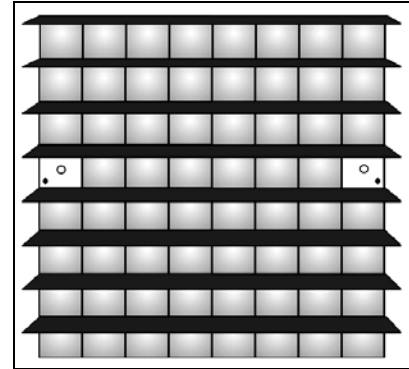


Figure 50: Assembly with Lenses Removed

Note: It takes only mild pressure on the screwdriver handle to free each side of the lens/reflector assembly. Excessive

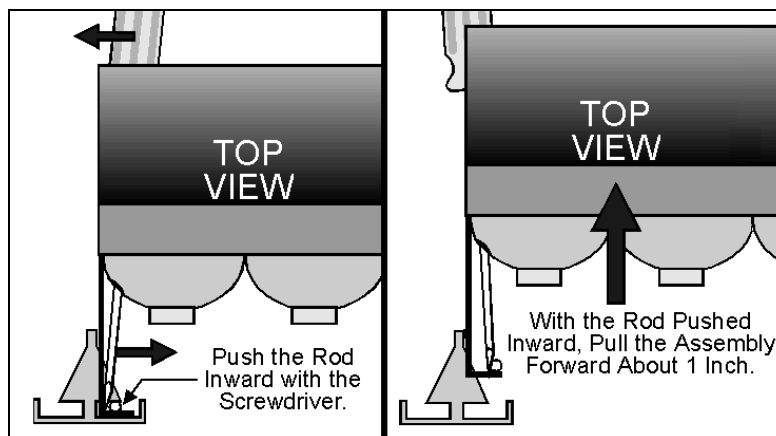


Figure 51: Assembly Removal

force can bend the rod.

4. While holding the screwdriver handle to the side, pull this side of the assembly out about an inch. This will pull it free of the latch and prevent it from snapping back into a locked position.
5. Perform steps 2-4 to free the opposite the opposite side of the assembly.

CAUTION: The lens/reflector assembly is now held in place by only a few ribbon cables. Do not let the assembly fall from the cabinet.

6. Pull the assembly out of the display far enough to disconnect all ribbon cables and power connectors from the lampbanks mounted on the assembly's backside. The assembly is now completely free of the cabinet.

Complete the following steps to install a lens/reflector assembly in a cabinet.

1. Reconnect all ribbon cables and power connectors to the lampbanks on the back of the assembly. If this is the left-most assembly in a row (front view), ribbon cables will also need to be reconnected to the vertical shift board. Refer to *Venus 1500 Signal Summary* or *Venus 4600 Signal Summary* in **Section 4.2** if unsure which ribbon cables go where.

- Slide the lens/reflector assembly back into position in the cabinet. A firm push should be all that is needed to lock the assembly into position. Give a tug to the assembly to verify that it is firmly locked in place.
- If necessary, replace any lenses as explained in *Lenses* in **Section 4.3**.

If one or both sides of the lens/reflector assembly fail to lock into position after repeated attempts take the following steps.

- Hold a section of 2x4 board vertically against the louvers on the stubborn side of the assembly.
- With the heel of the other hand strike the board
- Give a tug to the assembly to verify the assembly is locked in place.

Do not pound on the board with a hammer or similar device. This is likely to damage the louvers.

Lampbanks

A lampbank is a circuit board consisting of an array of lamps eight pixels high by four pixels wide. There are two lampbanks mounted on the rear of each lens assembly. When a lampbank is placed on the back of the lens/reflector assembly, the lamps extend into holes in the back of the reflector shells, allowing the reflectors and louvers to direct the light. **Section 4.3, Figure 48** illustrates this.

A single lampbank, front and back, is shown in **Figure 52**. The functions of the labeled components are explained in the following table.

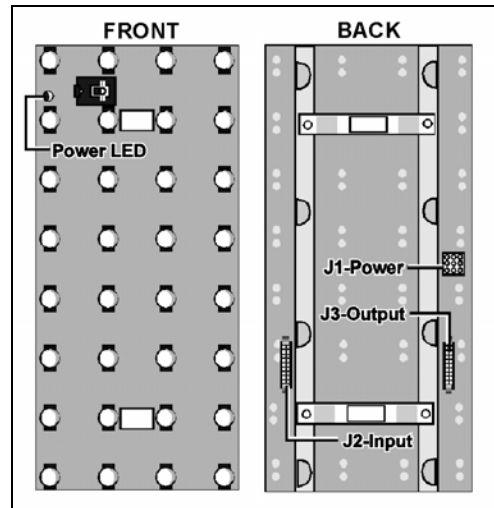


Figure 52: Lampbank Components

Component	Function
Power LED	A lit LED indicates the lampbank is receiving its operational voltage of 5 VDC.
J1-Power	Power from a transformer enters the lampbank at this connector.
J2-Input	Signal enters the lampbank at this connector from any of the following sources: <ul style="list-style-type: none"> From a vertical shift board if it is the left-most lampbank in any row (front view). From the previous lampbank in that row.
J3-Output	Signal exits the lampbank at this connector and is passed to the next lampbank in that row. This connector is not used on the last lampbank in any row.

Complete the following steps to remove a lampbank from a lens/reflector assembly.

- Remove the appropriate lens/reflector assembly as explained in *Lens/Reflector Assemblies* in **Section 4.3**.
- Disconnect the ribbon cable connecting the two lampbanks.
- Each lampbank is held to the lens/reflector assembly by two plastic latches. One latch at a time, squeeze the latch arms together and pull that end of the lampbank up past the latch. Refer to **Figure 53**.

4. Pull the lampbank from the lens/reflector assembly.

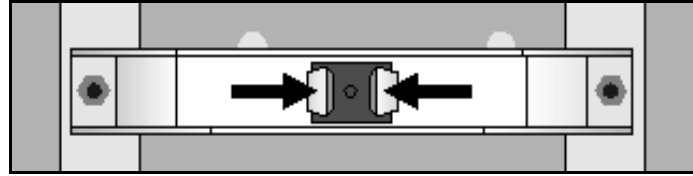


Figure 53: Lampbank Latch

Complete the following steps to replace a lampbank.

1. Place the lampbank on the lens/reflector assembly. The white power connector (J1) should be to the right side (rear view).
2. Press down upon each latch bracket until both the latch arms on each latch snap into position.
3. Reconnect the two lampbanks on the lens/reflector assembly with the ribbon cable.
4. Put the lens/reflector back into the display cabinet as explained in *Lens/Reflector Assemblies* in **Section 4.3**.

In the event a lamp socket needs to be replaced on a lampbank, complete the following steps in a static-free environment.

1. Unsolder the two contacts of the socket.
2. Carefully pull the socket from the lampbank. Take care not to damage the pad or lift the trace.
3. Insert the new socket and solder in place.
4. Clean the area of solder residue and apply conformal coating to the circuit board to protect against moisture damage. Use PC-101 protective coating for circuit boards (or equivalent). SE-1003 is the Daktronics part number for such coating.

Vertical Shift Boards

A vertical shift board (VSB) is found on the back on the left-most lampbank in each row. It routes incoming data down each row of lampbanks. The top VSB within a display receives data from one of two locations.

- If *Venus 1500* controlled, data comes from the master/echo board in the fan control enclosure of the master display.
- If *Venus 4600* controlled, data comes from the serial line interface board in that display.

All other VSBs receive data from the VSB above it.

Figure 54 illustrates a vertical shift board. The table lists the function of each of the labeled components.

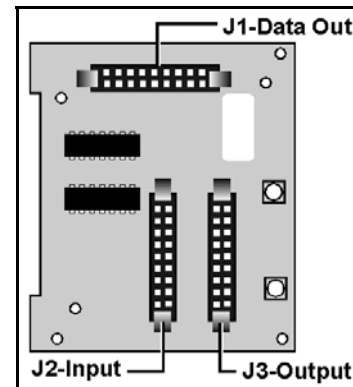


Figure 54: VSB Components

Component	Function
J1-Data Out	Signal is sent through this connector to the J2 (Input) connector on the underlying lampbank.
J2-Input	On <i>Venus 1500</i> systems, signal reaches this connector from either of the following sources: <ul style="list-style-type: none"> • The master-echo board within the fan control enclosure of the master display. • The J3 (Output) connector of the VSB above it. On <i>Venus 4600</i> systems, signal reaches this connector from either of the following sources: <ul style="list-style-type: none"> • The serial line interface board within that display. • The J3 (Output) connector of the VSB above it.
J3-Output	Through this connector, signal is passed to the J2 (Input) connector of the VSB below.

Complete the following steps to remove a vertical shift board.

1. Remove the appropriate lens/reflector assembly as explained in *Lens/Reflector Assemblies* in **Section 4.3**.
2. Disconnect any remaining signal cables from the vertical shift board.
3. Remove the nut holding the board in place.
4. Remove the board from the lampbank.

Complete the following steps to replace a vertical shift board.

1. Remount the vertical shift board to the lampbank and secure it with the nut.
2. Reattach the signal cable running between J1 (Data Out) and J2 (Input) on the underlying lampbank.
3. Reinstall the lens/reflector assembly as explained in *Lens/Reflector Assemblies* in **Section 4.3**.

Fans

Fans are critical components of this display system. Generally, there is one fan for every three modules. Do not run this display if even one fan is inoperable.

After replacing 10 percent of the fans, Daktronics recommends replacing all the fans to reduce additional maintenance costs resulting from inefficient fan operation.

Refer to **Section 4.8** for fan maintenance information and to **Section 4.15** for the part number of the fans used in this display.

Complete the following steps to remove a fan from the display.

1. Remove the appropriate lens/reflector assembly as explained in *Lens/Reflector Assemblies* in **Section 4.3**.
2. Remove the filter beneath the bad fan as explained in *Filters* in **Section 4.3**.
3. Disconnect the power cord from the fan.
4. On the underside of the cabinet, remove each of the two nuts holding the fan in place. Refer to **Figure 55**.
5. Lift the fan from the bottom of the cabinet.



Figure 55: Typical Fan

Simply reverse the above steps to install a fan. Remember to connect the power cord.

Note: An arrow on the side of the fan indicates the direction of airflow through the fan. Be sure the fans bring air into, and not out of, the display.

When the display is not in operation, turn off the power to conserve energy and to extend the life of both the fans and the electronic components.

Filters

The filters are found on the underside of the display cabinet. Above each filter, within the display, is a fan. The filters prevent dirt and debris from entering the display and interfering with display ventilation.

Complete the following steps and refer to **Figure 56** to remove a filter assembly from the underside of the cabinet.

1. First, flip the power disconnect to the OFF position.
2. With a Phillips screwdriver, remove the screw(s) from the front of the cabinet holding the filter assembly in place.
3. Swing the front of the assembly downward.
4. Pull the assembly out from under the cabinet.

Reverse the above steps to replace the filter assembly.

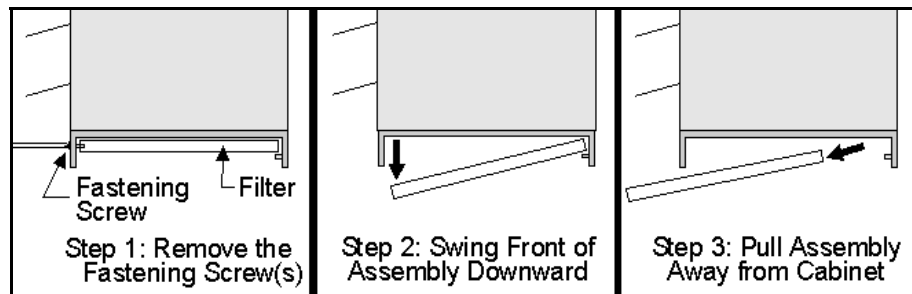


Figure 56: Removing a Filter Assembly

When replacing the assembly, the “wire side” of the actual filter material must face up.

Complete the following steps to remove and replace the filter within the assembly. Refer to **Figure 57** for guidance.

1. Remove side screws.
2. Remove inner filter frame.
3. Remove corner screw from the filter frame.
4. Swing up the upper frame arm and remove filter.
5. Replace filter.
6. Assemble frame and place back on the display.

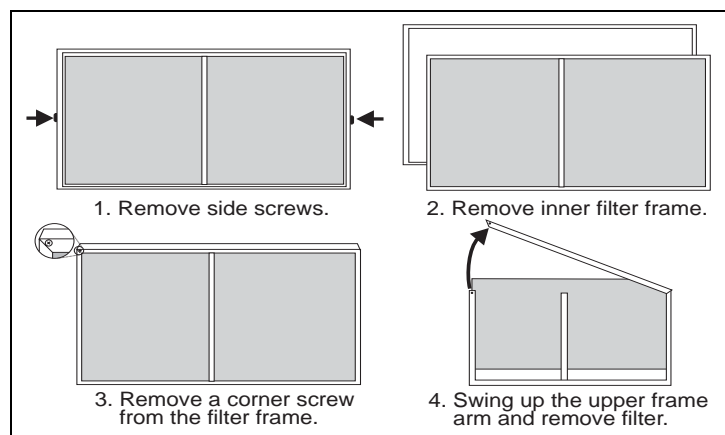


Figure 57: Removing a Filter from a Filter Assembly

Refer to the previous set of instructions to replace the filter assembly beneath the cabinet.

Transformers

The Daktronics T-1109 transformer delivers 21.48 volts to the lamp from the 5V Buck winding when supplied with 120 volts. As shown in the table in **Section 3.3**, expected lamp life decreases dramatically as the voltage to the lamp increases. Lamp life is approximately 12,004 hours using the T-1109 transformer as stated above.

The transformer is capable of adjustment if the line voltage varies enough to significantly reduce expected lamp life.

Contact Daktronics customer service if adjustment is required.

Additional Venus 1500 System Components

The circuit boards addressed in this sub-section only apply to Venus 1500 systems.

The Venus 1500 controller is comprised of a controller board (also called a control board) and an MDC board in a common enclosure. These circuit boards are part of every Venus 1500 control system. In addition, a fiber optic board or a modem board might also be found within the enclosure.

The following table explains which circuit boards are found in RS/232, RS/422, fiber optic and modem systems.

Format	Circuit Boards Present
RS/232	Controller board and MDC Board
RS/422	Controller board and MDC Board
Fiber Optic	Fiber Optic Board, Controller board and MDC Board
Modem	Modem Board, Controller board and MDC Board

The following information addresses 1) the product and MDC boards, 2) the modem board, 3) the fiber optic board and 4) the master-echo board found within the fan control enclosure in the master Venus 1500 display.

Controller Board and MDC Board

Figure 58 illustrates the controller board with the attached MDC board. If a fiber optic or modem board is in use, it will mount to the controller board at the location indicated.

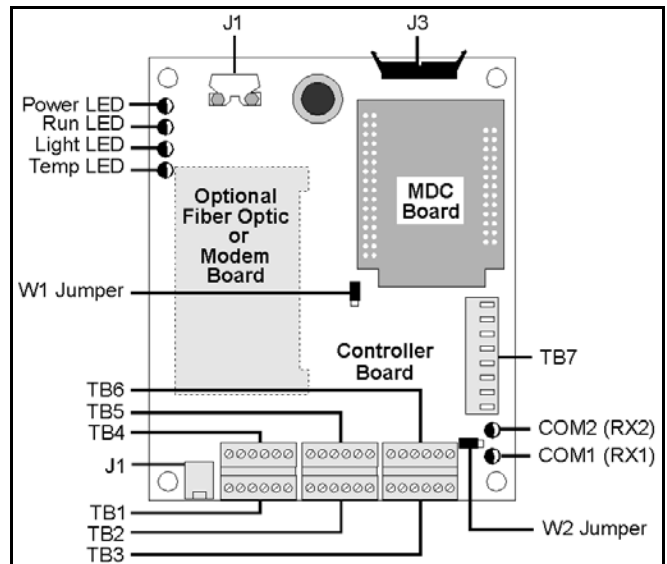


Figure 58: Venus 1500 Controller Board & MDC Board

The table to the right lists the functions of the connectors found on the controller board.

Connector	Function
J1	RS/232 In – COM1
TB1	RS/232 In – COM1
TB2	RS/422 In – COM1
TB3	RS/422 Out – COM1
TB4	RS/232 In – COM2
TB5	RS/422 In – Com2
TB6	RS/422 Out – Com 2
J2	10 VAC Input
J3	Signal Out

On the controller board are a number of diagnostic LEDs. The following table lists the LEDs and their respective functions and operations.

LED Name	Function	Operation
PWR	Controller has power	Always On
RUN	Controller is running	Flashes
LGHT	Light Detector Input	Light Level=Flash Rate
TEMP	Temp Sensor Input	Temperature=Flash Rate
RX2	Data In – COM1	On while Communicating
RX2	Data In – COM2	On while Communicating

The W1 and W2 jumpers on the controller board must be ON for modem communication and OFF for all others: RS/232, RS/422 and fiber optic.

Before this display can run in a sign network, it must have an address. Set the display address by using the DIP switches on the MDC board. The switches are on the underside of the MDC board near TB7 of the controller board. The following table lists the switch setting for various addresses.

Address	Switch 1	Switch 2	Switch 3	Switch 4	Switch 5	Switch 6	Switch 7	Switch 8
1	ON	OFF	OFF	OFF	OFF	OFF	OFF	OFF
2	OFF	ON	OFF	OFF	OFF	OFF	OFF	OFF
3	ON	ON	OFF	OFF	OFF	OFF	OFF	OFF
4	OFF	OFF	ON	OFF	OFF	OFF	OFF	OFF
5	ON	OFF	ON	OFF	OFF	OFF	OFF	OFF
6	OFF	ON	ON	OFF	OFF	OFF	OFF	OFF
7	ON	ON	ON	OFF	OFF	OFF	OFF	OFF
8	OFF	OFF	OFF	ON	OFF	OFF	OFF	OFF
9	ON	OFF	OFF	ON	OFF	OFF	OFF	OFF
10	OFF	ON	OFF	ON	OFF	OFF	OFF	OFF
11	ON	ON	OFF	ON	OFF	OFF	OFF	OFF
...
127	ON	ON	ON	ON	ON	ON	ON	OFF

If the need arises to replace the Venus 1500 display controller, set the DIP switches on the MDC for the same address as the old controller.

The controller board and the MDC board are one functional unit; replace it as a single device.

Complete the following steps to remove the Venus 1500 controller.

1. Flip the main disconnect to the OFF position.
2. Disconnect all power and signal connections from the controller board.
3. Remove the nuts holding the controller board in the enclosure.
4. Write down the MDC switch settings.
5. If this display uses fiber optic or modem communication, remove the fiber optic or modem board from the controller board by removing the nuts.
6. If sending the controller (controller board and MDC board) back to Daktronics, keep the modem or fiber board (if present) and all mounting hardware.

When installing a new display controller, verify the MDC DIP switch is set correctly.

Optional Modem Board

The modem board has two LED's. A lit Power LED indicates the modem board is receiving power. The Active LED will light when the modem initialized and when it is in the process of communicating. The modem phone input connects to the telephone terminal block with a small, straight RJ11 cable. The modem RS/232 Out connects to the controller board J1 RS232 In with a small, straight RJ11 cable.

A modem system requires jumpers to be set on the modem board. Refer to **Controller Board and MDC Board** in **Section 4.3** for jumper settings.

Complete the following steps to replace a modem:

1. Turn off display power at power disconnect.
2. Disconnect the power and signal connections. **Figure 59** illustrates the modem board connectors.
3. Remove the four nuts on top of the modem board.
4. Insert the new modem, replace the screws, reconnect the power, and signal connections.

Optional Fiber Optic Board

The fiber optic board has LEDs. A lit Power LED indicates the modem board is receiving power. The Receive LED (DS2) will light when the fiber optic board is accepting signal from the controller computer. The Transmit LED (DS3) will light when the display fiber optic board is sending signal to the computer fiber optic board. In addition, the fiber module has two incoming fiber connectors and two outgoing fiber connectors. The fiber optic board connects to the controller board with a small flipped PC connector cable (DB9F to RJ11 - RS/232 Out).

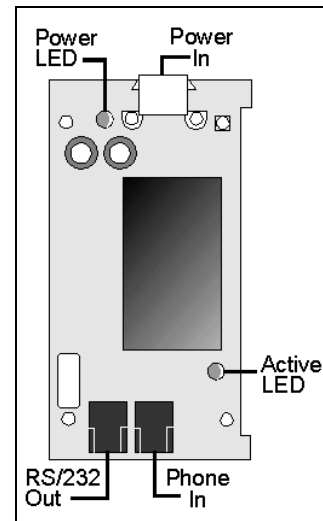


Figure 59: Optional Modem Board

Complete the following steps to replace a fiber optic board:

1. Turn off display power at the power disconnect.
2. Disconnect the power and signal connections. **Figure 60** illustrates the fiber optic board connectors.
3. Carefully remove the four nuts holding the fiber optic board in place.
4. Install the new fiber optic board, replace the nuts and reconnect power and signal cables.

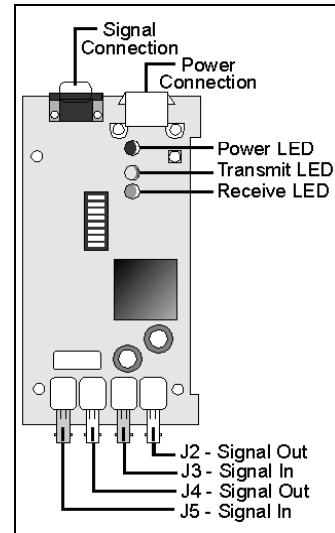


Figure 60: Optional Fiber Optic Board

Master-Echo Board

Inside the fan controller enclosure of the Venus 1500 display is the master-echo board, illustrated in **Figure 61**. This circuit board serves as a relay. It receives display data from the Venus 1500 controller and routes it to the vertical shift boards of both the master and, if present, the echo display. The master-echo board is only in the master display fan controller enclosure.

In addition to routing display signal, the master-echo board also monitors the button thermostats of both the master and, if present, the echo display. If internal cabinet temperatures climb too high, one or more thermostats will open. The master-echo board will sense this and send an alert to the Venus 1500 controller, which will blank the display.

When the internal cabinet temperature drops to acceptable levels, the thermostats will close, the master-echo board will alert the Venus 1500 controller of the change and will restore normal display operation.

The master-echo board has 16 LEDs to indicate thermostat status – eight for the master face and eight for the echo face. Each of these groups of LEDs are numbered 1 – 8, right to left. These LEDs correspond to button thermostats with the display cabinet, which number 1 – 8, left to right, when viewed from the front.

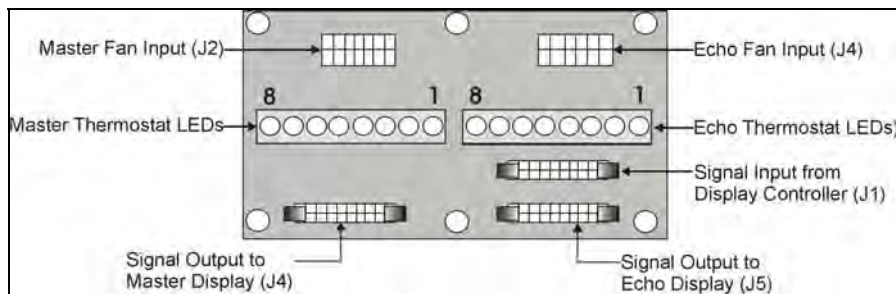


Figure 61: Master-Echo Board Components

Complete the following steps to remove a master-echo board from its enclosure.

1. To access the fan control enclosure housing the master-echo board, remove the necessary lens/reflector assemblies as explained in *Lens/Reflector Assemblies* in **Section 4.3**. Refer to the shop drawing listed in **Section 4.2** if unsure of the location of the controller on this display.
2. Remove the cover from the enclosure.
3. Disconnect all signal cables from the circuit board. It may be helpful to label the connectors to ensure correct placement when installing another master-echo board.
4. Remove the nuts holding the board in place and remove the board from the enclosure.

Additional Venus 4600 System Components (Serial Line Interface)

The only component unique to Venus 4600 systems is the serial line interface board (SLI). The SLI receives data from the display controller and passes that signal to the vertical shift boards. The SLI also monitors the status of the display thermostats. The serial line interface board is illustrated in **Figure 62**. It is in the serial line interface enclosure in the display.

The functions for the diagnostic LEDs found on the serial line interface board are as follows:

DS1 - Line Fault (red): This indicates if the controller and data cable connect correctly. With the controller turned on, and a good fiber optic connection, it should be OFF (it may flash ON occasionally). If DS1 stays ON there is probably a break in the fiber optic cable, a bad termination or something wrong with the controller computer.

DS2 - Test Mode (red): This indicates when the serial line interface is in test mode. If it is ON, a test pattern will appear on the display.

DS3 - Data (amber): This indicates when the serial line interface is receiving data from the controller. It will flash ON when receiving data.

DS4 - Bright (red): This indicator will be ON when the photocell is detecting a full bright light level and OFF for other light levels. If no photocell is connected to the serial line interface, it will flash.

DS5 - Power (green): This indicates when the power on the serial line interface is working. It should ALWAYS be ON.

DS6 - DS13 - Thermostat Inputs (all red): These indicate proper cooling of the display. These should ALL be ON. An OFF LED indicates a thermostat has opened due to excessive heat buildup within the display cabinet, possibly due to a failed fan or a dirty filter. When this occurs, the serial line interface will automatically blank the display to prevent heat damage to the electrical components.

DS6 corresponds to thermostat 1 in the cabinet and DS13 corresponds to thermostat 8 in the cabinet. The thermostats are numbers from left to right when the display is viewed from the front. The thermostats are located on the mounting bolts for the transformer. For 16' or 24' high displays, the thermostats are on the upper most transformer only. Refer to appropriate shop drawing.

When the internal cabinet temperature drops to acceptable levels, the thermostats will close. The serial line interface will sense this and restore the display to normal operation.

DS14 - Program (red): This indicates the serial line interface powered-up OK. It should be ON.

DS15 and/or DS16 - Transmit (both red): Indicate(s) signal transmission out of the fiber optic transmitter(s) (to the echo face).

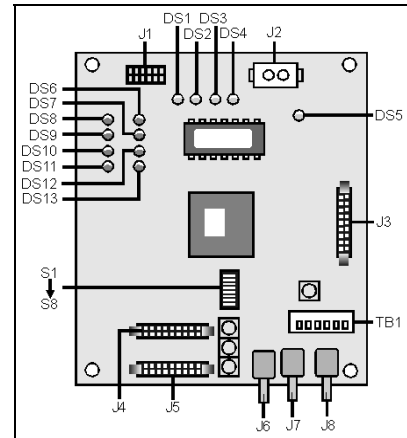


Figure 62: Serial Line Interface Detail

Daktronics configures the switch settings (S1-S12). If the need arises to verify switch settings, use the label on the cover of the serial line interface as a guide. Refer to **Drawings A-117756** and **A-110966**.

Complete the following steps to remove a serial line interface board from its enclosure.

1. To access the enclosure housing the serial line interface, remove the necessary lens/reflector assemblies as explained in *Lens/Reflector Assemblies* in **Section 4.3**. Refer to the shop drawing listed in **Section 4.2** if unsure of the location of the serial line interface on this display.
2. Remove the cover from the enclosure.
3. Disconnect all signal cables from the circuit board. It may be helpful to label the cables to ensure correct placement when installing another serial line interface board.
4. Remove the nuts holding the board in place and remove the board from the enclosure.

4.4 Display Maintenance

The maintenance steps provided within the following sub-sections are vital to ensuring satisfactory display operation. Lack of maintenance can shorten display life and lead to unexpected repair costs.

Ten Maintenance Checklists are in **Appendix B** to serve as a guide during the maintenance process and to provide a record of the maintenance completed. The checklists are for the customer's benefit; do not return them to Daktronics.

4.5 Lamp Testing & Maintenance

Replace failed lamps as soon as possible (or prior to scheduled events) to maximize the effectiveness of the display. Lens removal is addressed in *Lenses* in **Section 4.3**. Lamp removal is covered in *Lamps* in **Section 4.3**.

Always use Daktronics-supplied lamps in this display. Lamps purchased through Daktronics have specifications that are superior to similar lamps built in standard production. The recommended lamps provide the ideal intensity and beam spread for this display design. Lamps not provided by Daktronics will decrease the display's effectiveness. Refer to the Replacement Parts List in **Section 4.15** when additional replacement lamps are required.

Spotting failed lamps in large displays can sometimes be difficult. For this reason, both Venus 1500 and Venus 4600 systems have the ability to run lamp tests. Lamps turn on and off in patterns that make it easier to spot failed lamps.

Venus 1500 Lamp Test:

To run a lamp test on a Venus 1500, start the display in test mode. To start the display in test mode complete the following steps:

1. Turn off display power at power disconnect.
2. Access the Venus 1500 display controller.
3. **Write down the current settings of the DIP switch on the underside of the MDC board.** Refer to *Controller Board and MDC Board* in **Section 4.3** for the location of the MDC board.
4. Set the DIP switches on the MDC board on the display controller to address zero (flip all the switches toward the numbers on the circuit board).
5. Restore power and observe the lamp test.

To exit test mode complete the following steps:

1. Turn off display power.
2. Set address back to original setting.
3. Restore power to display.

Venus 4600 Lamp Test:

The Venus 4600 software provides two lamps tests: the *Pattern Test* and the *Pixel Locator* method. The **Diagnostics** section of the **Venus 4600 Operator's Manual, ED4602** explains both sections.

Use the Pattern Test if the controller computer is out of sight from the display. Use the Pixel Locator method if the display is visible from the controller computer.

Refer to **ED4602** for instructions on running either of the above tests.

Appendix B provides a lamp test form for recording the locations of failed lamps. Each time you plan a lamp test, make a copy of the form and use it to mark the locations of the bad lamps.

Optional Lampbank Test Table:

A lampbank test table is an optional device often ordered with the small matrix displays. The table allows a lampbank to be removed from the display and tested for failed lamps. Either can be purchased through Daktronics Customer Service.

Complete the following steps to test a lampbank using either of the above testers:

1. Remove the lampbank from the lens/reflector assy or from the display.
2. Plug test table into a standard 120-volt outlet. Make sure the **power switch is OFF**.
3. Place the 4-pin jumper plug into **J1** for the 2-1/2" 1/4" module lampbank. **CAUTION: Never insert jumpers into both J1 and J2 at the same time.**
4. Attach power cable from **J44** to the power plug of the lampbank.
5. Attach signal cables to the lampbank. The cable from **J35** will attach to the input jack of the lampbank and the cable from **J42** will be attached to the output jack of the lampbank. For lampbanks with piggyback boards, connect the signal wire from the test fixture directly to the lampbank input.
6. Turn power switch ON and mark all bad lamps with a piece of masking tape. **NOTE: Do not remove or replace the lamps without disconnecting the power. Otherwise, this may damage the lampbank.**
7. Turn fixture power OFF.
8. Replace all lamps with Daktronics approved lamps of the same wattage.
9. Turn test fixture power on and check if all lamps light up. If lamps don't light properly, check the troubleshooting section of the maintenance manual.
10. Test the lampbank output.
11. Unplug the lampbank and return it to the display.

4.6 Lens/Reflector Assembly Maintenance

The lens/reflector assemblies are maintenance free; however, each time an assembly is removed from the display the pile weather stripping should be checked for signs of deterioration. The weather stripping runs along the top and sides of each lens/reflector assembly. In addition, over time, the louvers on the front of lens/reflector assembly may become damaged and need replacing. Weather stripping and louver replacement are addressed in the next two sub-sections.

Weather Stripping Maintenance

Often, difficulty in sliding a lens/reflector assembly back into the cabinet can be attributed to worn or deteriorating weather stripping. If this is the case, the adhesive on the underside of the tape has likely failed, causing the weather stripping to buckle when pushed into the cabinet.

Weather stripping is essential for keeping moisture out of the display and for maintaining proper display ventilation. Replace bad weather stripping immediately.

Take note of the following before attempting to replace the pile weather stripping on a lens/reflector assembly:

- After peeling away the old weather stripping, clean the lens/reflector assembly with an adhesive remover so the new weather stripping will adhere better.
- Precut the necessary amount of weather stripping needed to wrap up one side, across the top and down the other side of the lens/reflector assembly (plus a little extra).
- Only peel enough protective paper off the weather stripping to do one side at a time. After removing the protective tape, do not let anything, especially hands, touch the adhesive side of the weather stripping
- During the entire application process, keep the weather stripping taut. Even the slightest buckle or wrinkle will cause problems when trying to put the assembly back into the display cabinet.
- Take note of the critical areas shown in **Figure 63**. Stretch the weather stripping tighter in these areas to prevent buckling.

Having read the previously listed notes, complete the following steps to replace bad weather stripping:

1. Starting at the bottom of one side, apply the weather stripping up the side of the assembly as close to the front edge of the metal side plate as possible.
2. Continue the weather stripping onto the top of the assembly. Pull the weather stripping firmly to produce a tight corner and then, while still pulling it tightly, apply it around the raised curve on the top of the louver. Stay on the raised portion of the louver, but stay as close as possible to the ledge.
3. Apply the weather stripping across the top of the assembly (across the top of the louver) and again pull it firmly to follow the raised curve of the louver and to wrap it over the corner of the assembly.
4. Continue the application down the side of the metal side plate as done in **Step 1**.
5. Clip the weather stripping flush at the bottom of both sides of the assembly.
6. After putting the lens/reflector assembly back into the cabinet, check the spacing between this assembly and the assemblies and/or display cabinet around it with the .032-inch feeler gauge found in the tool kit. The feeler gauge should not move freely. There should be some resistance along the entire length of all sides of the assembly. Refer to **Figure 64**.

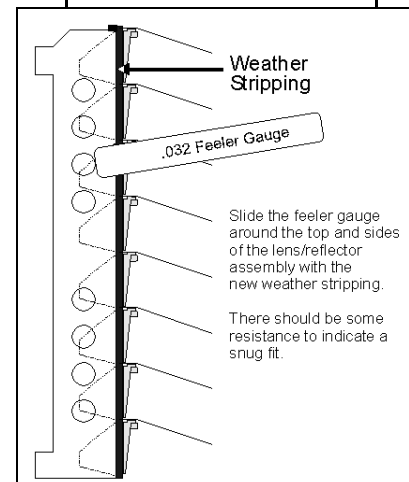
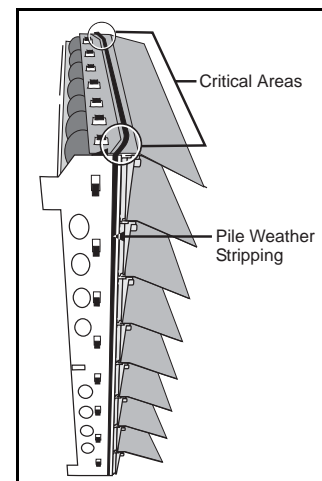


Figure 64: Checking Weather Stripping

Louver Maintenance

The louvers play an important role in making this small matrix display an effective communication device. The louvers cast a dark shadow on the display face, which contrasts

sharply with the brightly lit pixels. The louvers also help direct light from the pixels.

The louvers require no maintenance. However, replace severely bent or damaged louvers to maximize display effectiveness.

Note: As noted on the replacement parts list in **Section 4.15**, the top louver of a lens/reflector assembly has a different part number than the other 6 or 7 (depending on display model) louvers below it. Take care to order the correct louver.

Refer to **Figure 65** and complete the following steps to replace a louver.

1. Remove the lens/reflector assembly from the cabinet as explained in *Lens/Reflector Assemblies* in Section 4.3.
2. Remove both the lampbanks from the back of the lens/reflector assembly as explained in *Lampbanks* in Section 4.3.
3. Remove the lampbank latches by removing the single screw that holds each one in place.
4. Remove the vertical bracket by removing the 7 or 8 screws (depending on display model) that hold it in place.
5. The metal rain shield is now free to be slid upward and off from the lens/reflector assembly.
6. On both top corners of the assembly is a retaining tab bent over the top louver. With pliers, bend each of these tabs back in alignment with the metal side plates. **Figure 66** shows the method used to position the side plates for louver replacement.
7. Push each metal side plate downward until it is free to pull away from the assembly.

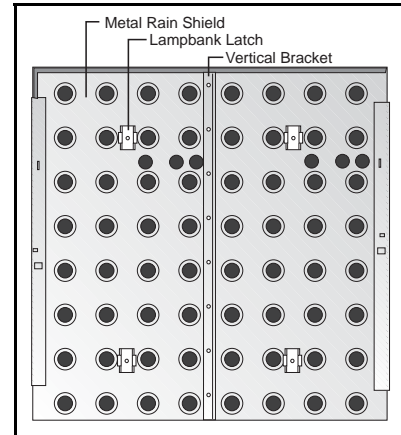


Figure 65: Lens Assembly Components

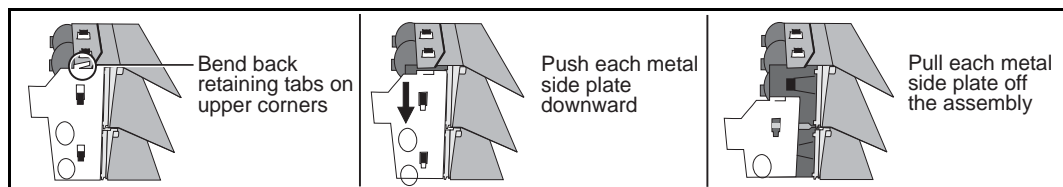


Figure 66: Removing a Metal Side Plate

Replacing only the top louver does not require the removal of the side metal plates.

8. Having removed the side plates, the only thing holding the rows of louvers/reflector together is the tape weather stripping between them. Access the damaged louver by pulling the rows above this louver off in an intact group, as **Figure 67** illustrates. There are now two groups of row/reflector assemblies.
9. In the same manner as done with the metal side brackets, slide the damaged louver to the side and remove it from the row of reflectors beneath it. Discard it returning it to Daktronics.
10. Place the new louver onto the reflector row and slide it to the side until it secures in place beneath the top reflector tabs.
11. Remove the protective tape from the tape weather stripping to expose the adhesive surface. Nothing, especially hands, should touch the exposed adhesive surface of the weather stripping. The top louver of an assembly does not have tape weather stripping.

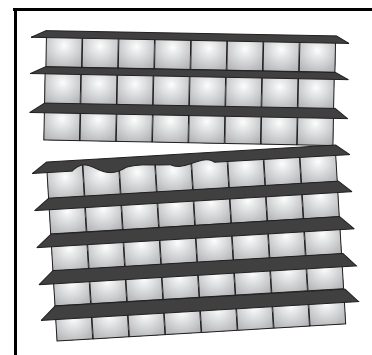


Figure 67: Separating Rows above Damaged Louver

12. With both groups of reflector rows lying on their backsides, carefully join them together by pressing the adhesive face of the tape against the underside of the above reflector row. Line up the reflector rows as accurately as possible. Leave the reflector/louvers laying down for the next step.
13. Place the metal side plates on each side of the reflector/louver rows and slide them into position beneath the side reflector tabs.
14. With pliers, bend the two top retainer tabs back over the upper louver.
15. Slide the rain shield back into position on the rear of the lens/reflector assembly then reattach the vertical bracket and the lampbank latches. Use the longer screws for the latches. The top edge of the rain shield should not extend beyond the top of the assembly.
16. Apply new weather stripping to lens/reflector assembly as explained in *Weather Stripping Maintenance* in **Section 4.6**.
17. Reattach both the lampbanks to the back of the lens/reflector assembly as explained in *Lampbanks* in **Section 4.3**.
18. Remount the lens/reflector assembly in the cabinet as explained in *Lens/Reflector Assemblies* in Section 4.3.

4.7 Filter Maintenance

Check the filters after the display has been in operation for 1,500 hours – and every 1,500 hours after that – to ensure they are allowing air to enter the cabinet. Air cannot pass through a filter packed with dirt and dust.

Check filters more often if the display is in a dusty or harsh weather environment. Displays located along gravel roads will likely require filter checks more often than every 1,500 hours. In addition, monitor the filters if any area construction projects are throwing dust and/or dirt into the air.

1,500 hours is equivalent to 83 days if the display is operated for 18 hours a day and the power to the display is turned off when not in use to ensure that the fans are not operating when the display is not running. 1,500 hours is equivalent to 62 days if the display is on running non-stop, 24 hours a day.

Daktronics recommends keeping spare filters on hand at all times. Ideally, filters require replacement during routine maintenance. If a filter media shows evidence of damage or wear, replace the filter with a Daktronics filter (Part Number L-98614).

If a filter other than the Daktronics standard filter is used, follow these criteria:

- Effective filter area is to be no less than 2.3 square feet per 1.0 square feet of face area and
- Filter media is to have an average arrestance of 90-92%.

Filters in **Section 4.3** addresses filter removal.

Filter and fan maintenance take place at the same intervals – 1,500 hours. Refer to **Section 4.8** for fan maintenance information before replacing the filters.

4.8 Fan Maintenance

Above each filter, within the cabinet, is a fan. Check fans after the display has been in operation for 1,500 hours – and every 1,500 hours after that – to ensure the display cools properly. Check fans more often if the display is located in a dusty or harsh weather environment. Displays located along gravel roads will likely require fan checks more often than every 1,500 hours. In addition, monitor the fans if any area construction projects throw dust and/or dirt into the air.

1,500 hours is equivalent to 83 days if the display is operated for 18 hours a day and the power to the display is turned off when not in use to ensure that the fans are not operating when the display is not running. 1,500 hours is equivalent to 62 days if the display is on running non-stop, 24 hours a day.

In addition to 1,500-hour maintenance, take a minute to inspect the fans after removing a lens/reflector assembly.

1. Check the fan blades for dirt and debris. If the fan blades have a large accumulation of dirt and debris, this indicates that the filters need more frequent changing. Keep fan blades clean to maintain fan efficiency and ensure proper cooling.
2. Spin the fan blades with a pen or pencil to ensure that the bearings are free and the fan is still in balance.

After replacing 10% of the fans, Daktronics recommends replacing all fans to avoid the increased maintenance costs associated with inefficient fan operation.

A fan testing power cord is available for checking fan operation. Plug the test cord into the questionable fan and plug the other end into a 110-volt outlet. If the fan does not turn or does not operate smoothly, replace it.

➔ **Use extreme caution during this testing! The fan blades are exposed!**

Fan and filter maintenance take place at the same intervals – 1,500 hours.

Fans in **Section 4.3** addresses fan removal and replacement.

⌞ **Note:** If the display is not in operation, turn power off to conserve energy and extend the life of both the fans and electronic components.

4.9 Interior Maintenance

Do not allow dust and/or dirt to accumulate within the display cabinet. The fans can pick up debris deposit it behind the lenses. This may restrict airflow out of the display and cause overheating problems. Use an air hose and vacuum to keep the inside of the cabinet clean.

Occasionally, it is a good idea to check the airflow through the lenses using the “smoke test.” This is especially true if the display controller is blanking the display but the cause of overheating is not apparent.

Perform the smoke test in the following manner.

1. Light a smoke ball or similar smoke-producing device beneath a fan inlet.
2. Observe where the smoke exits the display. It should only exit through the lens exhaust ports. If smoke exits from between two or more lens/reflector assemblies the weather stripping likely needs replacing.
3. If smoke does not exit a particular group of lenses, remove the lenses to clean out any debris, replace the lenses and retest. A failed fan may create an effect similar to that of clogged lens exhaust ports.

4.10 Structural Maintenance & Inspection

Complete a yearly inspection to maintain safe and dependable display operation. This inspection should address the following issues.

- **Corrosion**
Check the paint and look for corrosion, especially at footing, structural tie points and ground rods.
- **Loosened Hardware**
Verify fasteners, such as bolts and rivets, have not come loose. Check, tighten, or replace fasteners as required.
- **Water Stains**
Check the inside of the cabinet for any signs of water intrusion. Pay special attention to the area around the lift eyebolt holes
- **Electrical Components**
Check all electrical components closely for signs of corrosion.

If any of the above conditions exist, take action to correct the situation.

4.11 Periodic Line and Lamp Voltage Checks

Perform line and lamp voltage checks every six months or whenever an event occurs that might affect line voltage in the area. Such an event might include a large business or factory opening or closing in the area.

Section 3.3 addresses the checking of line voltage. **Section 3.11** addresses the checking of lamp voltage.

4.12 Cleaning the Signal Connectors

If it becomes necessary to remove or replace a signal cable, clean the plugs and the circuit board jacks with DeoxIT (Daktronics part number CH-1015). Inspect and clean the jacks and plugs thoroughly to ensure the absence of foreign matter. The presence of dirt or water may cause signal interconnect problems.

After cleaning the parts, push the plug into a jar of CaiLube (Daktronics part number CH-1019), ensuring the paste wets the plug to a depth of at least 1/8" on all four sides. Also, check to make sure all the pinholes of the plug fill with paste and that sufficient paste is present to form a "V" on the end of the plug. There should be enough paste on the end of the plug to form a weatherproof seal (from paste pushed out around the jack) when inserting the plug into the circuit board jack.

DeoxIT is the electrical contact cleaner in an aerosol can and CaiLube is the electrical contact lubricant and protector paste in a 1 oz. jar. Both are in the *Tool Kit Accessories* package. CaiLube also comes in an 8 oz. jar (Daktronics part number CH-1021). If requiring additional supplies, contact Customer Service for ordering information.

4.13 FCC Modem Notice

The optional modem on the Venus 1500 controller complies with Part 68 of the FCC rules and regulations. With each device shipped, a label contains, among other information, the FCC Registration number and Ringer Equivalence Number (REN) for this product. The customer must, upon request, provide this information to the telephone company.

The REN is useful to determine the number of devices that may connect to a telephone line and still have these devices ring when the number is called. In most, but not all areas, the sum of the RENs of all of these devices connected to one line should not exceed five. To be certain of the number of devices that may connect to the line, as determined by the REN, the customer should contact the local telephone company to determine the maximum REN for the calling area.

If the system causes harm to the telephone network, the telephone company may discontinue service temporarily. If possible, they will notify the customer in advance. If advance notification is not practical, the company will notify the customer as soon as possible. The telephone company may make changes in its facilities, equipment, operations or procedures that could affect proper functioning of the equipment. If this is done, the customer will be notified in advance to give ample opportunity to maintain uninterrupted telephone service.

If modem problems occur, please contact Daktronics customer service for information on obtaining service or repairs. The telephone company may request the device be disconnected until the problem has been corrected or until it is certain that the device is not malfunctioning.

4.14 Troubleshooting

The following table lists some possible operational problems that you could encounter in a 1600 series small matrix display. The problems are under “Symptoms/Conditions” and the possible causes are under “Possible Cause/Remedy.” This table does not include every possible problem, but does represent those most likely to occur.

Symptoms/Conditions	Possible Cause/Remedy
One or more lamps will not light.	<ul style="list-style-type: none"> • Replace the lamp. • Replace the socket. • Replace the lampbank.
One or more lamps will not turn off.	<ul style="list-style-type: none"> • Check for metallic foreign objects on the lampbank causing a short. • Replace the lampbank.
None of one row of modules or part of one row of modules is working. A row can be 7 or 8 pixels high, depending on lens/reflector assembly model.	<ul style="list-style-type: none"> • Check for a bad vertical shift board (VSB) by swapping in a known good vertical shift board. • Replace the ribbon cable from the VSB to the underlying lampbank. • Check appropriate fuse on power termination panel. • Check for 120 VAC incoming display power. • Replace the last working lampbank in that row.
Garbled display or shifted sequence.	<ul style="list-style-type: none"> • Set computer and serial line interface to high line feed. • Double check serial line interface is set for correct display size. • Replace serial line interface. • Replace the control computer's Venus transmitter card.
Group of 2 modules does not work.	<ul style="list-style-type: none"> • Check appropriate fuse on power termination panel. • Check transformer for correct output (24 VAC).
Entire display does not work	<ul style="list-style-type: none"> • Check for 120 VAC incoming display power. • Check fuse in fan control enclosure. • Check all signal connections. • Verify the serial line interface is receiving data. • Power down/up the display to verify Venus 1500 controller boot-up. • Check the controller LEDs.
Single module does not work	<ul style="list-style-type: none"> • Check signal connection. • Check power connections. • Check appropriate fuse on transformer termination panel. • Replace lampbank.
Display works for a short time and then blanks.	<ul style="list-style-type: none"> • Check fans, filters and fuses.

Cannot communicate with display (Venus 1500 controlled)	<ul style="list-style-type: none"> • Verify Venus 1500 sign setup communication settings. • Verify signal converter (RS422, modem, fiber) is working (TX LED). • Verify controller is receiving communication commands (RX LED). • Verify address of display and Venus 1500 sign.
Master/Echo board or Serial Line Interface has fan LED(s) off.	<ul style="list-style-type: none"> • Determine LED number. • Ensure cable is in place on fan inputs (J2/J3). • Check corresponding fan (LED 1=Fan 1, LED 8=Fans 8 & 9).

4.15 Replacement Parts List

Part Description	Daktronics Part Number
Conformal Coating (PC 101)	SE-1003
Controller Board, Venus 1500 Based	0A-1146-0007
Flipped PC Connector, DB9F/RJ11F	0A-1146-0029
Electrical Contact Lubricant & Protector, 8 oz. Jar	CH-1021
Filter	0L-98614
Filter with Aluminum Frame	0A-1176-0017
Fan Finger Guard	HS-1289
Fan Power Cord, 24"	W-1396
Fan, 120 Volt	B-1019
Fuse, AGC, 2.5 A, 250 V (Termination Panel)	F-1001
Fuse, Serial Line Interface, MDL- 2 ½, 2 ½ A	F-1002
Fuse, FLNR20, 9/16 x 2, 250 V, Slow Blow	F-1037
Fuse, Fan Control, AGC-7 ½, 7 ½ A	F-1005
Lamp, 24V, T-3 ¼, Wedge Base	DS-1388
Lampbank, 7 x 4 Pixels	0P-1195-0002
Lampbank, 8 x 4 Pixels	0P-1195-0001
Lampbank Latch, Arms	MP-1085
Lens, Mono, White	DS-1288
Lens/Reflector Assembly, 7 x 8	0A-1195-1001
Lens/Reflector Assembly, 8 x 8	0A-1195-1007
Louver, Top, No Tape	0M-124912
Louver, All Rows But Top, With Tape	0M-124913
Master/Echo Board, Fan Control Enclosure (Master)	0P-1146-0018
Optional Modem Board; Venus 1500 Based Controller	0P-1146-0003
Optional Fiber Optic Board; Venus 1500 Based Controller	0P-1127-0024
RS232 Interface	0A-1103-0010
PC Signal Converter; Fiber	0A-1127-0239
PC Signal Converter; RS422	0A-1127-0237
Desktop Test Fixture	0A-1176-0007
Power Cord, Fan Testing	0A-1089-0192
Serial Line Interface (SLI) Board	0P-1176-0008
Socket, Mini-Wedge Base	X-1209
Transformer; Marquee Application, 120 V, T-1109	0A-1195-0023

Weather Stripping, Pile	HS-1149
Vertical Shift Board	OP-1176-0009
Thermostat Assy.	OA-1176-0024
Tool Kit (includes the following items)	OA-1195-0037
Screwdriver	TH-1050
Lamp Voltage Tester	OP-1195-0003
Lamp/Lens Extractor	OA-1195-0038
Electrical Contact Cleaner & Lubricant, 8 oz. Jar	CH-1019
Electrical Contact Cleaner, Spray Can	CH-1015
0.032 Feeler Gauge	OM-69133
2-foot, 20-position cable (from VSR to VSR)	OA-1000-0016
3-foot, 20-position cable (from LR to VSR)	OA-1000-0018
5-inch, 20-position cable (module to VSR)	W-1356
12-inch, 20-position cable (8x4 module to 8x4 module)	W-1357
18-inch, 20-position cable (8x8 to 8x8 and 8x16 to 8x16)	W-1387

4.16 Daktronics Exchange/Repair & Return Programs

To serve customers' repair and maintenance needs, Daktronics offers both an exchange and a repair and return program. The exchange program reduces down time by providing timely replacement of key components. Daktronics provides this service to qualified customers who follow the program guidelines explained below. It is our pleasure to provide this service to ensure you get the most from your Daktronics products. Please call our Help Desk (1-877 / 605-1114) if you have any questions regarding the exchange program or any other Daktronics service.

When you call the Daktronics Help Desk, a trained service technician will work with you to solve the equipment problem. You will work together to diagnose the problem and determine which exchange replacement part to ship. If, after you make the exchange, the equipment still causes problems, please contact our Help Desk immediately.

If the replacement part fixes the problem, package the defective part in the same packaging the replacement part arrived in, fill out and attach the enclosed UPS shipping document and **RETURN THE PART TO DAKTRONICS**. (You may use the same box and packing the exchange part was sent in.) This will speed up the transaction and alleviate confusion when the failed component arrives at Daktronics. (Daktronics expects immediate return of the exchange part if it does not solve the problem.) For most equipment, you will be invoiced for the replacement part at the time it is shipped. This invoice is due when you receive it.

Daktronics reserves the right to refuse equipment that has been damaged due to acts of nature or causes other than normal wear and tear.

If the defective equipment is not shipped to Daktronics within 30 working days from the invoice date, it is assumed you are purchasing the replacement part and you will be invoiced for it. This second invoice represents the difference between the exchange price and the purchase price of the equipment. This amount is due when you receive the second invoice. If you return the exchange equipment after 30 working days from invoice date, you will be credited for the amount on the second invoice minus a restocking fee.

To avoid a restocking charge, please return the defective equipment within 30 days from the invoice date.

Daktronics also offers a Repair and Return program for items not subject to exchange.

Where to Send: To return parts for service, contact your local representative prior to shipment to acquire a Return Material Authorization Number (RMA#). If you have no local representative, call the Daktronics Help Desk for the RMA#. This will expedite the receiving process.

Packaging for Return: Package and pad the item well so that it will not be damaged in shipment. Either install electronic components such as printed circuit boards in an enclosure, or put them in an anti-static bag before boxing. Please enclose your name, address, phone number and a clear description of symptoms.

Mail: Daktronics, Inc., Customer Service
PO Box 5128
331 32nd Avenue
Brookings, SD 57006

Phone: Daktronics Help Desk: 1-877 / 605-1114
or 1-605 / 697-4035

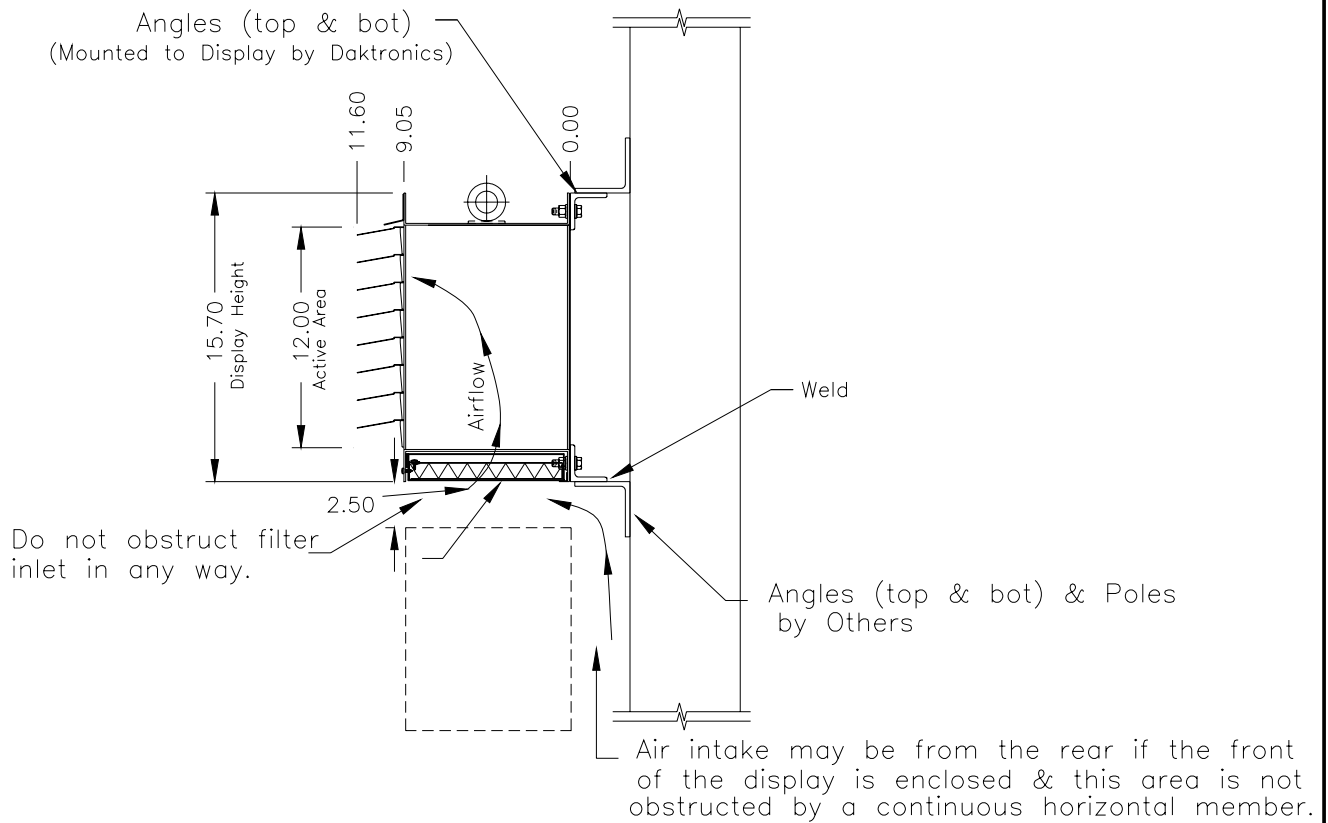
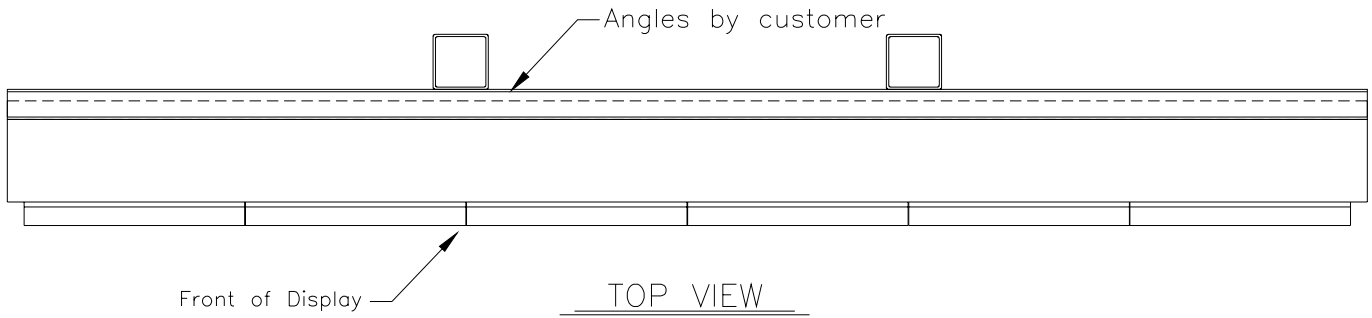
Customer Service Fax: 1-605 / 697-4444

E-mail: helpdesk@daktronics.com

Appendix A: Project Specific Drawings

Appendix B: General Drawings

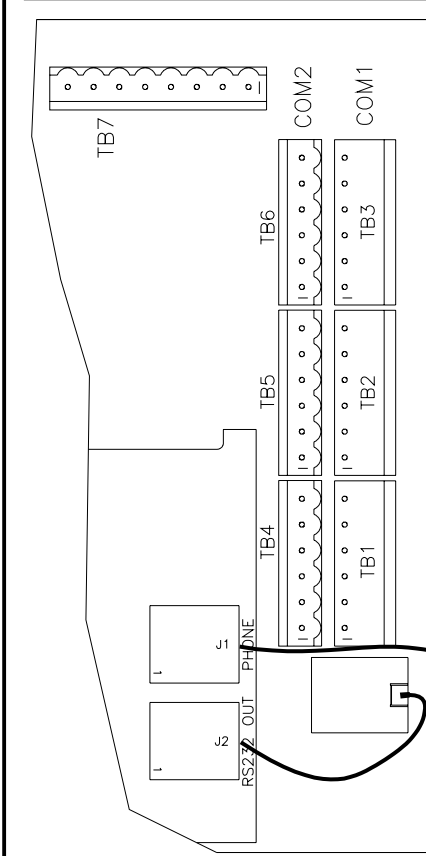
Mounting Example, Small Line Displays	Drawing A-101424
V1500 Signal Termination.....	Drawing A-103727
Serial Line IF Signal Terms.....	Drawing A-103740
Interconnect, 2V.....	Drawing A-104023
System Riser Diagram (Serial Line IF).....	Drawing A-107196
Line Receiver Settings	Drawing A-110966
Assy, Term Panel.....	Drawing A-113974
Shop Drawing, 7 or 8 High, 2 ½".....	Drawing A-114666
Shop Drawing, 16 High, 2 ½".....	Drawing A-114667
Shop Drawing, 24 High, 2 ½".....	Drawing A-114668
Mounting Example, 2 ½ " Small Matrix.....	Drawing A-114676
Line Receiver Settings	Drawing A-117756
Label, Filter Clearance.....	Drawing A-141064
System Riser Diagram (RS/422).....	Drawing A-148859
System Riser Diagram (RS/232).....	Drawing A-148870
System Riser Diagram (Fiber Optic).....	Drawing A-148878
System Riser Diagram (Modem).....	Drawing A-148884
Schematic, 16 High, 48 to 96.....	Drawing B-112311
Schematic, 7 or 8 High, 48 to 96.....	Drawing B-112505
Schematic, 24 High, 48 to 96.....	Drawing B-113973



Notes:

1. 2 1/2" of clearance between the bottom of the display & any other display/obstruction below is required for filter access & air intake.
2. The gap between displays may be shrouded if air is allowed to enter from the rear.
3. Filter can be accessed only from the front of the display.

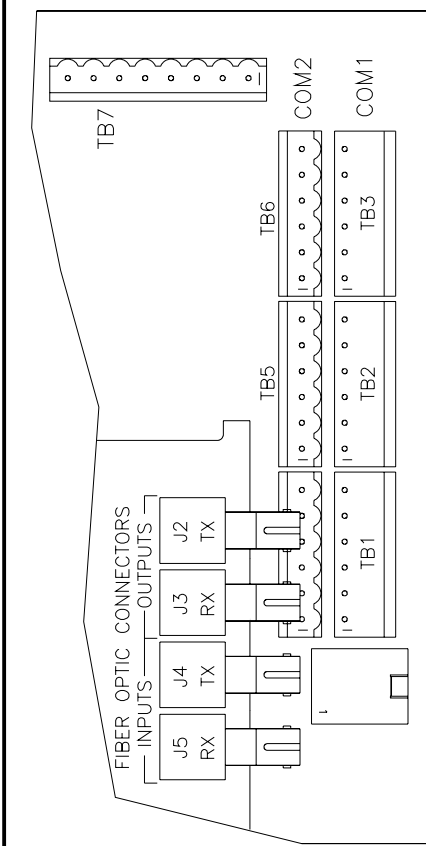
3	29SEP99	CORRECTED 2.25 TO 2.50 FILTER CLEARANCE.	JRT		DAKTRONICS, INC. BROOKINGS, SD 57006	
2	27Jul98	ADDED NOTES.	JRT		PROJ: 1600 SERIES MESSAGE BOARDS, 1 1/2"	
1	15APR98	ADD ACTIVE AREA & DISPLAY HEIGHT	JRT		TITLE: MOUNTING EXAMPLE, SMALL LINE DISPLAYS	
REV.	DATE	DESCRIPTION	BY	APPR.	DES. BY:	DRAWN BY: JRT DATE: 9APR98
					REVISION	APPR. BY: SCALE: 1=20
						1176-R10A-101424



SEE RS/232 AND RS/422 BELOW FOR
TEMP AND RS/422 TERMINATIONS

MODEM

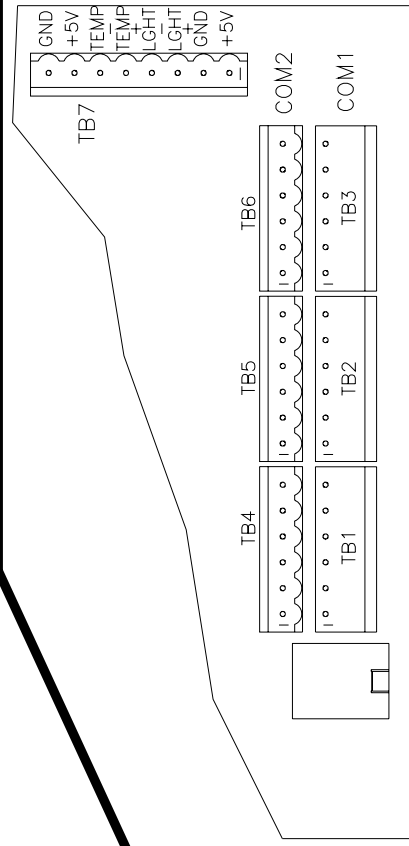
STANDARD PHONE
TERMINATIONS (TIP & RING)
MATCH COLORS



CONNECT "RX" FROM COMPUTER TO J4 (TX)
CONNECT "TX" FROM COMPUTER TO J5 (RX)
CONNECT "RX" (J3) TO DISPLAY 2 "TX" (J4)
CONNECT "TX" (J2) TO DISPLAY 2 "RX" (J5)

FIBER OPTIC

SEE RS/232 AND RS/422 BELOW FOR
TEMP AND RS/422 TERMINATIONS



IN / OUT WIRE
COLOR CODES

BLK	TEMP
RED	SENSOR
WHT	(W-1234)
GRN	WHT
WHT	GRN
GRN	LIGHT
BLK	DETECTOR
RED	(W-1234)

IN	OUT
CLR	RS/232 IN (W-1117)
SHLD	
BLK	
GRN	RS/422 IN (W-1210)
BLU	
WHT	
BRN	
BLK	
RED	
GRN	RS/422 OUT (W-1210)
BLU	
WHT	
BRN	
BLK	
RED	

RS/232 IN	RS/422 IN	RS/422 OUT
PIN 1 (N.C.)	PIN 1 (GND)	PIN 1 (GND)
PIN 2 (N.C.)	PIN 2 (TX-N)	PIN 2 (DATA TX-N)
PIN 3 (TX-P)	PIN 3 (TX-N)	PIN 2 (DATA TX-P)
PIN 4 (GND)	PIN 4 (RX-P)	PIN 4 (DATA RX-N)
PIN 5 (RX-P)	PIN 5 (RX-N)	PIN 5 (DATA RX-P)
PIN 6 (N.C.)	PIN 6 (GND)	PIN 6 (GND)

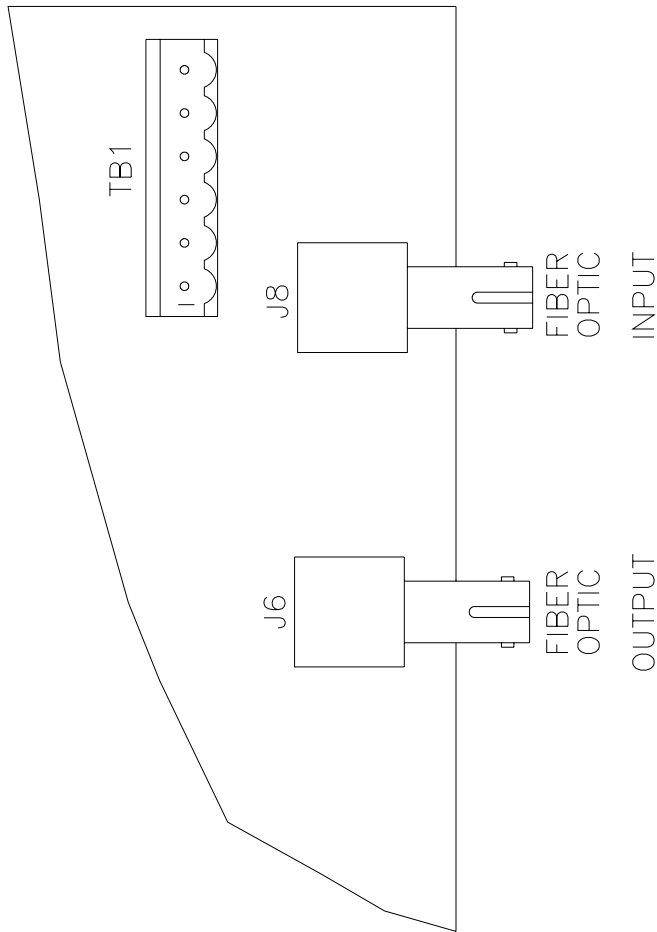
IN / OUT WIRE
COLOR CODES

RS/232 AND RS/422

1	28AUG98	ADDED LIGHT DETECTOR WIRING CORRECTED RS/232 COLOR CODES ENLARGED TEXT TITLES	TGW	
REV.	DATE	DESCRIPTION	BY	APPR.

DAKTRONICS, INC. BROOKINGS, SD 57006			
PROJ: 1600 SERIES			
TITLE: V1500 SIGNAL TERMINATIONS			
DES. BY:	DRAWN BY: TWOODARD	DATE: 10JUN98	
REVISION	APPR. BY:	1176-R01A-103727	
	SCALE: NONE		

TB1	
PIN	FUNCTION
1	+5V-P
2	GND-N
3	PHOTO-P
4	PHOTO-N
5	N.C.
6	N.C.

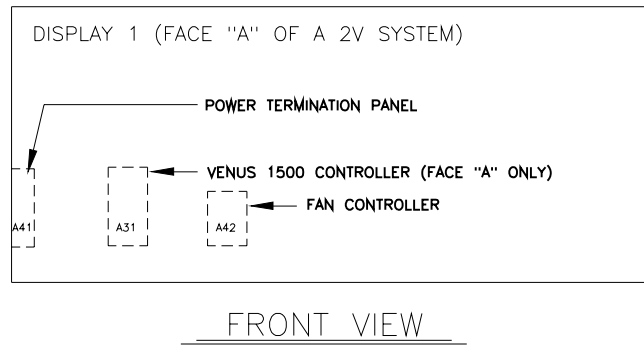
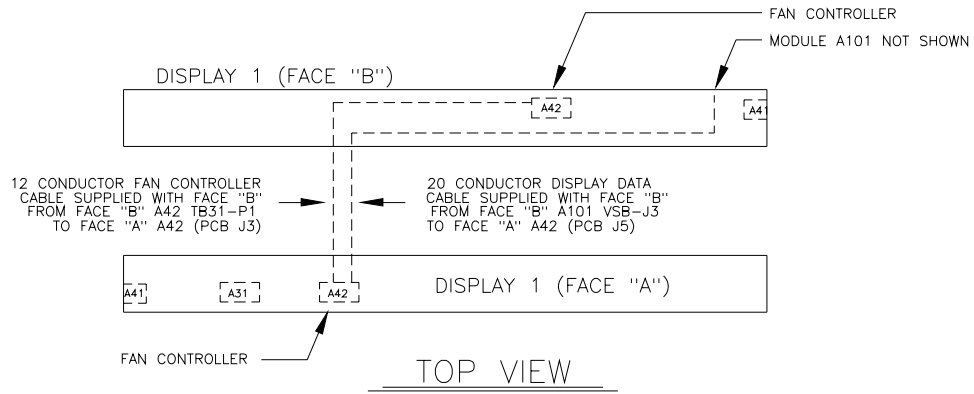


0A-1176-0023, SERIAL LINE INTERFACE ENCL 120V (COMPLETE ASSEMBLY)
 0P-1176-0008, SERIAL LINE INTERFACE, S1600 (PCB ASSEMBLY ONLY)

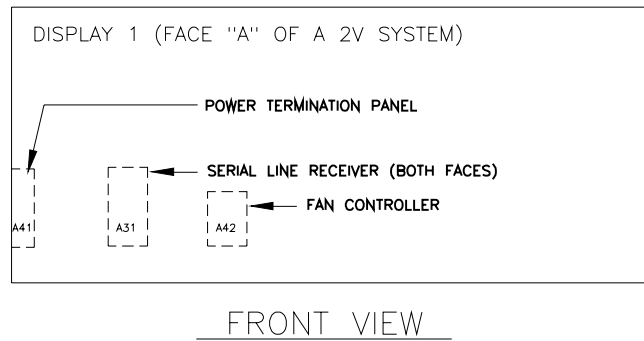
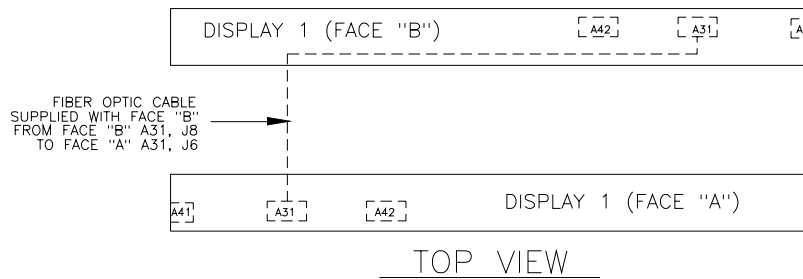
REV.	DATE	DESCRIPTION	BY	APPR.

DAKTRONICS, INC. BROOKINGS, SD 57006	
PROJ:	1600 SERIES
TITLE:	SERIAL LINE INTERFACE SIGNAL TERMINATIONS
DES. BY:	TWOODARD
DRAWN BY:	RLONG
DATE:	10JUN98
REVISION	
APPR. BY:	
SCALE:	NONE
1176-R01A-103740	

VENUS 1500



VENUS 4600



DAKTRONICS, INC. BROOKINGS, SD 57006

PROJ: 1600 SERIES

TITLE: INTERCONNECT, 2V WIRING

DES. BY: TWOODARD

DRAWN BY: TWOODARD

DATE: 10JUN98

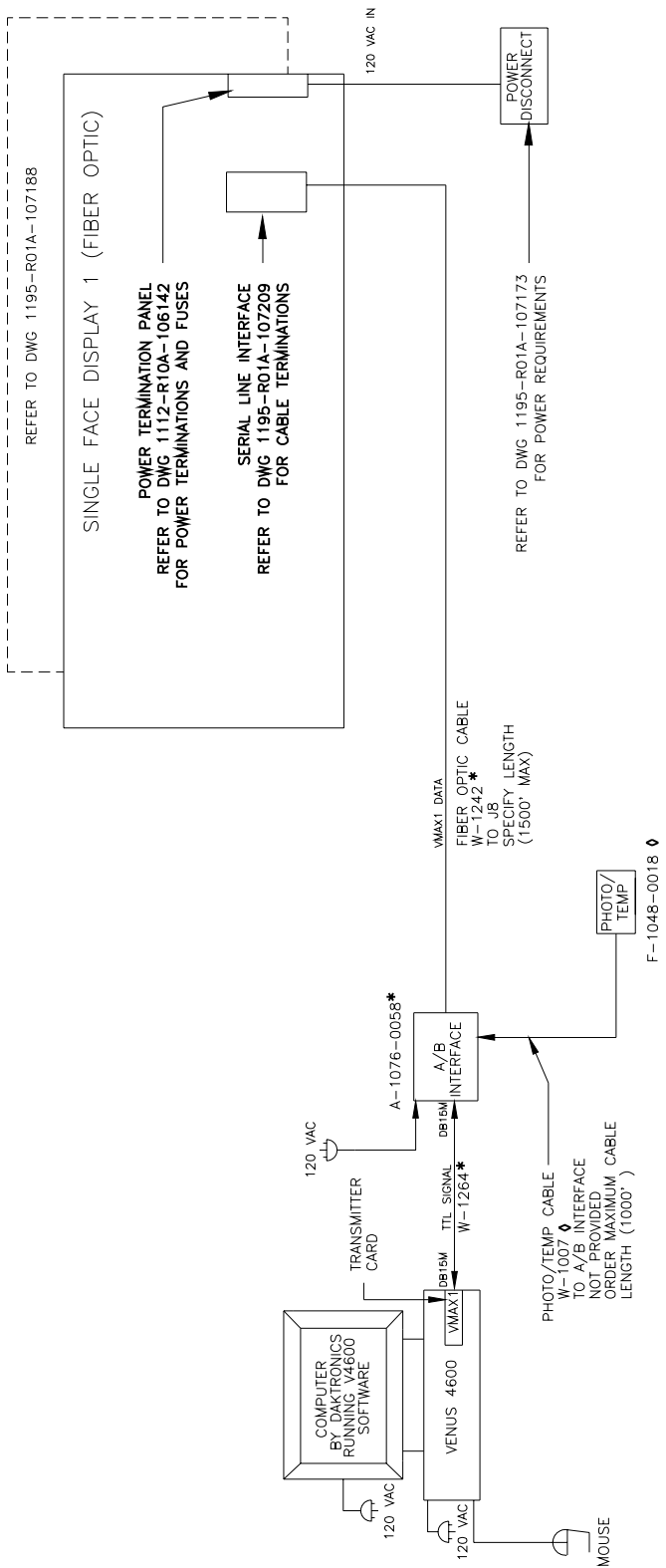
REV.	DATE	DESCRIPTION	BY	APPR.
1	28AUG98	ADDED TB31 TO 12 CONDUCTOR FAN NOTE ENLARGED VENUS 1500 & 4600 TITLES	TGW	

REVISION

APPR. BY:

SCALE: 1=1

1176-R01A-104023



* REQUIRED PART
 ◊ OPTIONAL PART

DAKTRONICS PART NO.	DESCRIPTION
1. F-1048-0018	TSI-EM EAVE MOUNT PHOTO/TEMP SENSOR
2. A-1127-0237	A/B TRANSMITTER INTERFACE
3. W-1264	CABLE; DB15MF TO DB15M
4. W-1242	CABLE; 2 FIBER, FIBER OPTIC
5. W-1007	CABLE 5 COND. 18 AWG, PHOTO/TEMP SENSOR

NOTES:

- TEMPERATURE SENSOR PHOTO/TEMP CABLE (W-1007 NOT INCLUDED) MAY BE ORDERED FROM DAKTRONICS, PLEASE SPECIFY AT TIME OF ORDER.
 - MAXIMUM LENGTH OF 1000'
- FIBER OPTIC CABLE (W-1242) MAY BE ORDERED FROM DAKTRONICS, PLEASE SPECIFY AT TIME OF ORDER.
- FOR OUTDOOR USE, ALL CABLES MUST BE ROUTED IN A GROUNDED CONDUIT.

DAKTRONICS, INC. BROOKINGS, SD 57006			
PROJ: 1600 SERIES 2 1/2"			
TITLE: SYSTEM RISER DIAGRAM; SERIAL LINE INTERFACE			
DES. BY: TWOODARD		DRAWN BY: TWOODARD	
DATE: 02SEP98			
REVISION	APPR. BY:	1195-R01A-107196	
	SCALE: 1 = 1		

REV.	DATE	DESCRIPTION	BY	APPR.

16 HIGH

1648 SWITCH SETTINGS	
DIP S1	ON
DIP S2	OFF
DIP S3 N.U.	OFF
DIP S4 N.U.	OFF
DIP S5	ON
DIP S6	ON
DIP S7	OFF
DIP S8	OFF
ROTARY S9	1
ROTARY S10	0
ROTARY S11	2

1664 SWITCH SETTINGS	
DIP S1	ON
DIP S2	OFF
DIP S3 N.U.	OFF
DIP S4 N.U.	OFF
DIP S5	ON
DIP S6	ON
DIP S7	OFF
DIP S8	OFF
ROTARY S9	1
ROTARY S10	0
ROTARY S11	3

1680 SWITCH SETTINGS	
DIP S1	ON
DIP S2	OFF
DIP S3 N.U.	OFF
DIP S4 N.U.	OFF
DIP S5	ON
DIP S6	ON
DIP S7	OFF
DIP S8	OFF
ROTARY S9	1
ROTARY S10	0
ROTARY S11	4

1696 SWITCH SETTINGS	
DIP S1	ON
DIP S2	OFF
DIP S3 N.U.	OFF
DIP S4 N.U.	OFF
DIP S5	ON
DIP S6	ON
DIP S7	OFF
DIP S8	OFF
ROTARY S9	1
ROTARY S10	0
ROTARY S11	5

16112 SWITCH SETTINGS	
DIP S1	ON
DIP S2	OFF
DIP S3 N.U.	OFF
DIP S4 N.U.	OFF
DIP S5	ON
DIP S6	ON
DIP S7	OFF
DIP S8	OFF
ROTARY S9	1
ROTARY S10	0
ROTARY S11	6

16128 SWITCH SETTINGS	
DIP S1	ON
DIP S2	OFF
DIP S3 N.U.	OFF
DIP S4 N.U.	OFF
DIP S5	ON
DIP S6	ON
DIP S7	OFF
DIP S8	OFF
ROTARY S9	1
ROTARY S10	0
ROTARY S11	7

16144 SWITCH SETTINGS	
DIP S1	ON
DIP S2	OFF
DIP S3 N.U.	OFF
DIP S4 N.U.	OFF
DIP S5	ON
DIP S6	ON
DIP S7	OFF
DIP S8	OFF
ROTARY S9	1
ROTARY S10	0
ROTARY S11	8

16160 SWITCH SETTINGS	
DIP S1	ON
DIP S2	OFF
DIP S3 N.U.	OFF
DIP S4 N.U.	OFF
DIP S5	ON
DIP S6	ON
DIP S7	OFF
DIP S8	OFF
ROTARY S9	1
ROTARY S10	0
ROTARY S11	9

16176 SWITCH SETTINGS	
DIP S1	ON
DIP S2	OFF
DIP S3 N.U.	OFF
DIP S4 N.U.	OFF
DIP S5	ON
DIP S6	ON
DIP S7	OFF
DIP S8	OFF
ROTARY S9	1
ROTARY S10	0
ROTARY S11	A

16192 SWITCH SETTINGS	
DIP S1	ON
DIP S2	OFF
DIP S3 N.U.	OFF
DIP S4 N.U.	OFF
DIP S5	ON
DIP S6	ON
DIP S7	OFF
DIP S8	OFF
ROTARY S9	1
ROTARY S10	0
ROTARY S11	B

24 HIGH

2448 SWITCH SETTINGS	
DIP S1	ON
DIP S2	OFF
DIP S3	OFF
DIP S4	N.U.
DIP S5	ON
DIP S6	OFF
DIP S7	N.U.
DIP S8	OFF
ROTARY S9	2
ROTARY S10	0
ROTARY S11	2

2464 SWITCH SETTINGS	
DIP S1	ON
DIP S2	OFF
DIP S3	OFF
DIP S4	N.U.
DIP S5	ON
DIP S6	OFF
DIP S7	N.U.
DIP S8	OFF
ROTARY S9	2
ROTARY S10	0
ROTARY S11	3

2480 SWITCH SETTINGS	
DIP S1	ON
DIP S2	OFF
DIP S3	OFF
DIP S4	N.U.
DIP S5	ON
DIP S6	OFF
DIP S7	N.U.
DIP S8	OFF
ROTARY S9	2
ROTARY S10	0
ROTARY S11	4

2496 SWITCH SETTINGS	
DIP S1	ON
DIP S2	OFF
DIP S3	OFF
DIP S4	N.U.
DIP S5	ON
DIP S6	OFF
DIP S7	N.U.
DIP S8	OFF
ROTARY S9	2
ROTARY S10	0
ROTARY S11	5

24112 SWITCH SETTINGS	
DIP S1	ON
DIP S2	OFF
DIP S3	OFF
DIP S4	N.U.
DIP S5	ON
DIP S6	OFF
DIP S7	N.U.
DIP S8	OFF
ROTARY S9	2
ROTARY S10	0
ROTARY S11	6

24128 SWITCH SETTINGS	
DIP S1	ON
DIP S2	OFF
DIP S3	OFF
DIP S4	N.U.
DIP S5	ON
DIP S6	OFF
DIP S7	N.U.
DIP S8	OFF
ROTARY S9	2
ROTARY S10	0
ROTARY S11	7

24144 SWITCH SETTINGS	
DIP S1	ON
DIP S2	OFF
DIP S3	OFF
DIP S4	N.U.
DIP S5	ON
DIP S6	OFF
DIP S7	N.U.
DIP S8	OFF
ROTARY S9	2
ROTARY S10	0
ROTARY S11	8

24160 SWITCH SETTINGS	
DIP S1	ON
DIP S2	OFF
DIP S3	OFF
DIP S4	N.U.
DIP S5	ON
DIP S6	OFF
DIP S7	N.U.
DIP S8	OFF
ROTARY S9	2
ROTARY S10	0
ROTARY S11	9

24176 SWITCH SETTINGS	
DIP S1	ON
DIP S2	OFF
DIP S3	OFF
DIP S4	N.U.
DIP S5	ON
DIP S6	OFF
DIP S7	N.U.
DIP S8	OFF
ROTARY S9	2
ROTARY S10	0
ROTARY S11	A

24192 SWITCH SETTINGS	
DIP S1	ON
DIP S2	OFF
DIP S3	OFF
DIP S4	N.U.
DIP S5	ON
DIP S6	OFF
DIP S7	N.U.
DIP S8	OFF
ROTARY S9	2
ROTARY S10	0
ROTARY S11	B

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DAKTRONICS, INC. BROOKINGS, SD 57006

PROJ: 1600 SERIES MESSAGE BOARD

TITLE: LINE RECEIVER SETTINGS, 1648-16192, 2448-24192

DES. BY: TWOODARD

DRAWN BY: RLONG

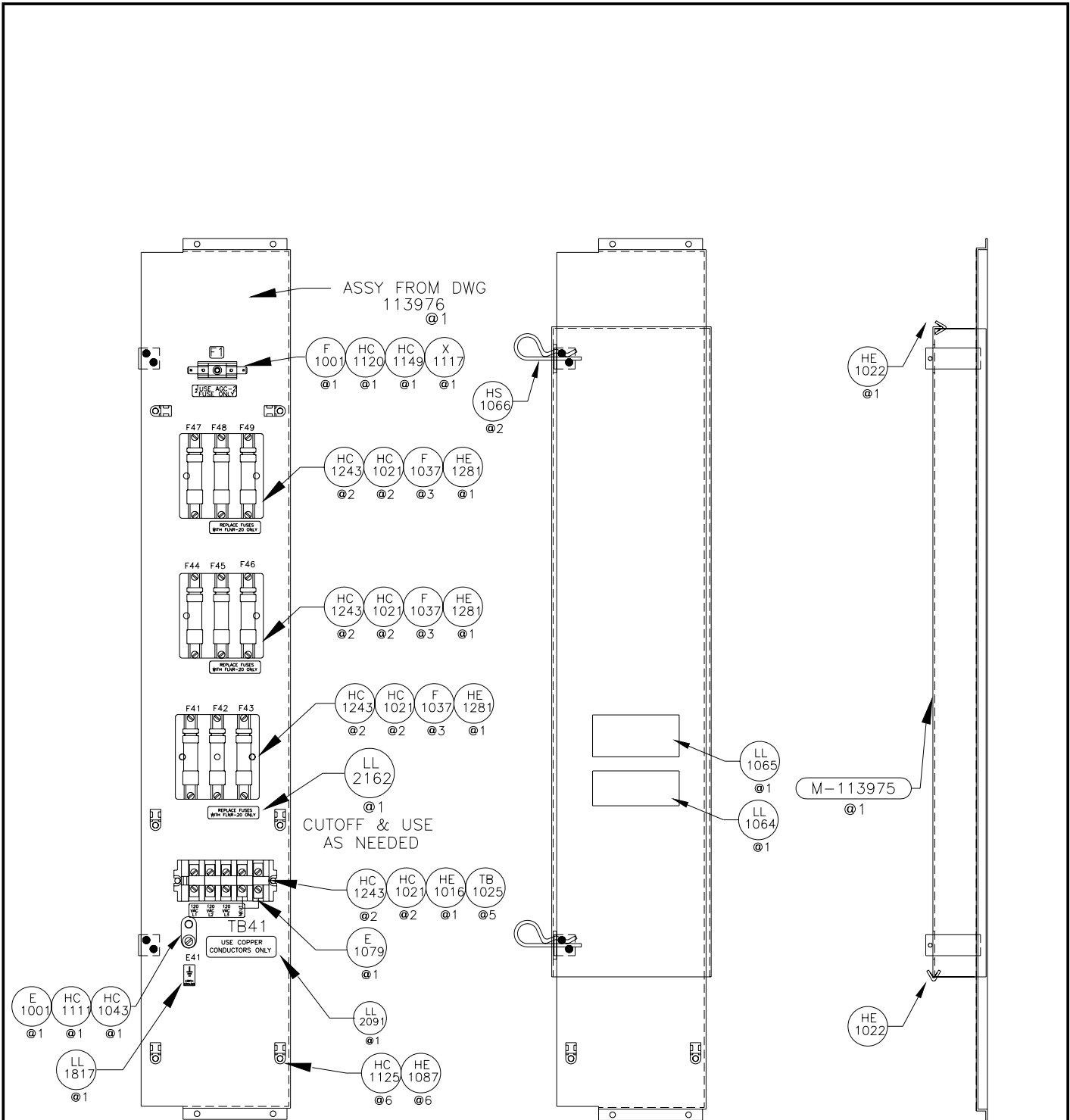
DATE: 14JAN99

REV.	DATE	DESCRIPTION	BY	APPR.
1	29DEC99	ADDED 1648 & 2448 SETTINGS, CHANGED S3, S4 & S7.	RLONG	

REVISION
01

APPR. BY: _____
SCALE: 1=1

1176-R01A-110966



FRONT VIEW

FRONT VIEW

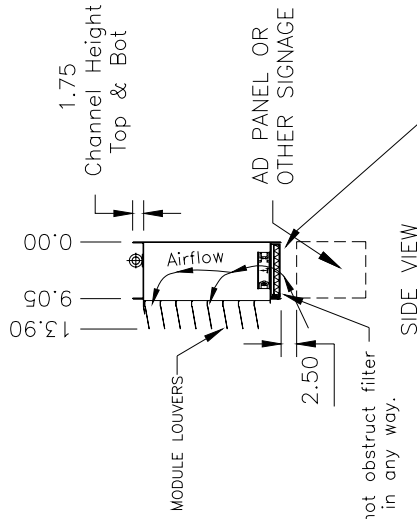
SHOWN WITH COVER

RIGHT SIDE

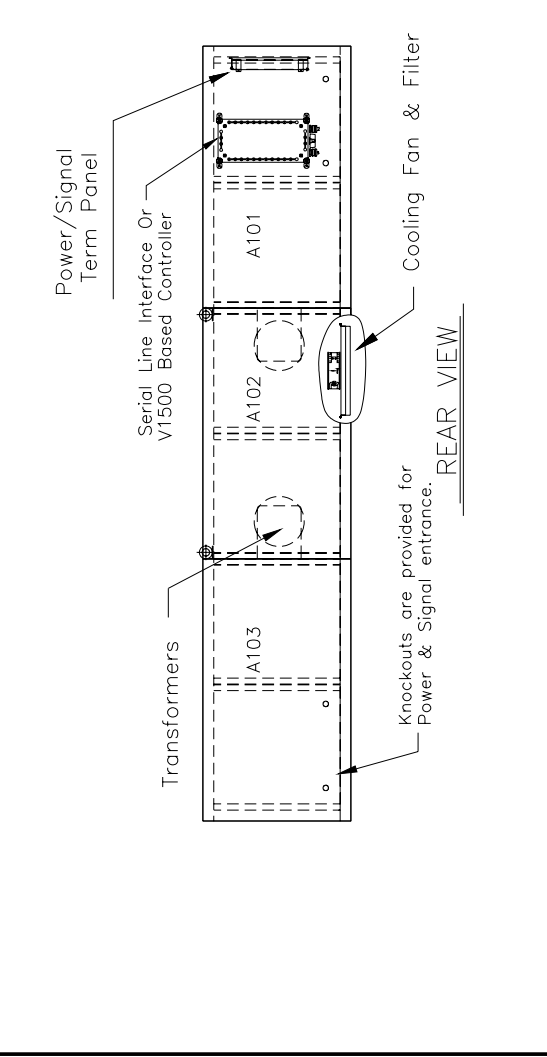
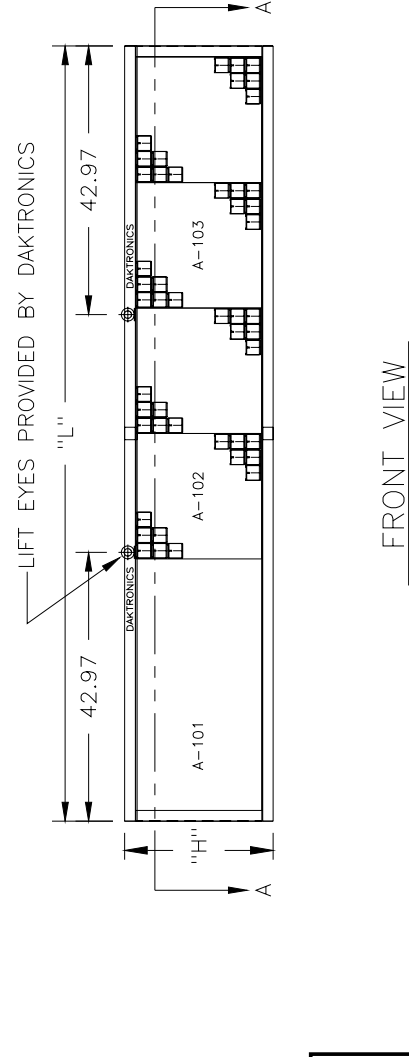
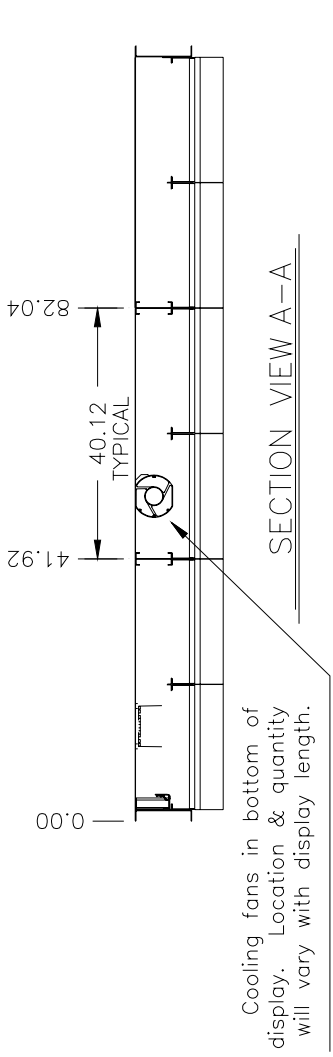
REV.	DATE	DESCRIPTION	BY	APPR.
3	22 APRIL 02	CHANGED HC-1132 TO HC-1125	BSCH	
2	10JUL00	MOVED TB41 LABELING SO L1 IN UNDER FIRST TERM BLOCK ON LEFT. MOVED E-1079 TO 4 & 5 TERM BLOCK FOR NEUTRAL. MIRRORRED THE LABEL BLOCKS	RLONG	
1	9 JUNE 99		VPV	

DAKTRONICS, INC. BROOKINGS, SD 57006	
PROJ:	1600 SERIES MESSAGE BOARDS, 2 1/2 IN
TITLE:	ASSY, TERM PANEL, 2480 and 2496-18
DES. BY:	DRAWN BY: VERN V DATE: 26 MAR99
REVISION	APPR. BY:
SCALE: 1=5	1195-E10A-113974

MODEL	DIM "L"	DIM "H"	NO OF MODULES	WEIGHT (SF)
748	123.96 IN	21.22 IN	3	195
764	164.08 IN	21.22 IN	4	260
780	204.20 IN	21.22 IN	5	325
796	244.32 IN	21.22 IN	6	390
848	123.96 IN	23.72 IN	3	195
864	164.08 IN	23.72 IN	4	260
880	204.20 IN	23.72 IN	5	325
896	244.32 IN	23.72 IN	6	390



- NOTES:
1. Display is front access for maintenance.
 2. Mounting method must meet local codes. Display should be mounted solid to the structure and not hung on chain or cable.
 3. Top surface of display available for mounting as required, but display must remain as airtight & water resistant as possible.
 4. Customer is responsible for the structural integrity of structure that display is mounted to.
 5. All dimensions are in inches.
 6. Display is all aluminum construction.
 7. Reference Dwg 1195-R10A-113898 for power requirements.
 8. Main disconnect by customer.
 9. 2 1/2" of clearance between the bottom of the display & any other display/obstruction below is required for filter access & air intake.
 10. The gap between displays may be shrouded if air is allowed to enter from the rear.
 11. Filter can be accessed only from the front of the display.



VENTILATION NOTE: IN ENCLOSED STRUCTURE SITUATIONS, TWELVE SQUARE INCHES OF UNOBSTRUCTED OPENING PER MODULE MUST BE PROVIDED TO INSURE ADEQUATE DISPLAY COOLING. ALLOWANCES MUST BE MADE TO COMPENSATE FOR THE PERCENTAGE OF SCREEN IN THE MATERIAL COVERING THE OPENINGS IN THE STRUCTURE. IF AIR MUST BE FORCED INTO THE ENCLOSED STRUCTURE, 110 CUBIC FEET PER MINUTE MUST BE PROVIDED PER MODULE.

DAKTRONICS, INC. BROOKINGS, SD 57006

PROJ: 1600 SERIES MESSAGE BOARDS, 2 1/2"

TITLE: SHOP DWG, 7 & 8 HIGH 2 1/2" SMALL MATRIX DISPLAY

DES. BY: _____ DRAWN BY: JRT DATE: 15APR99

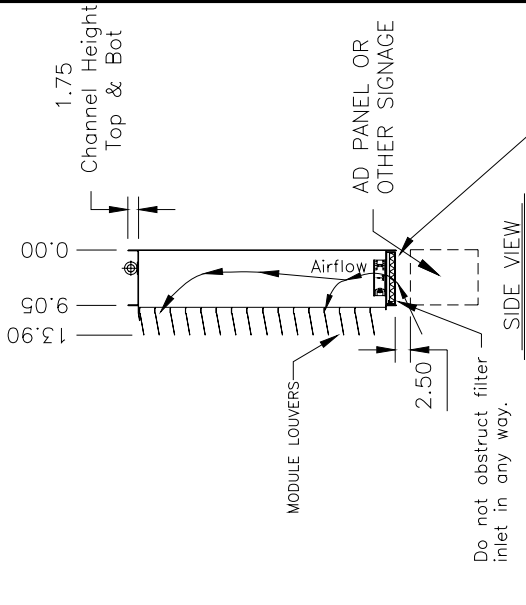
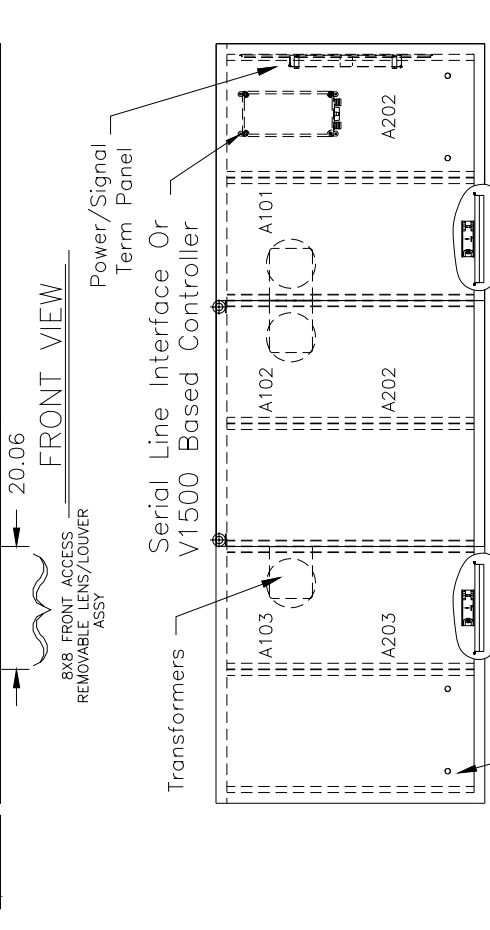
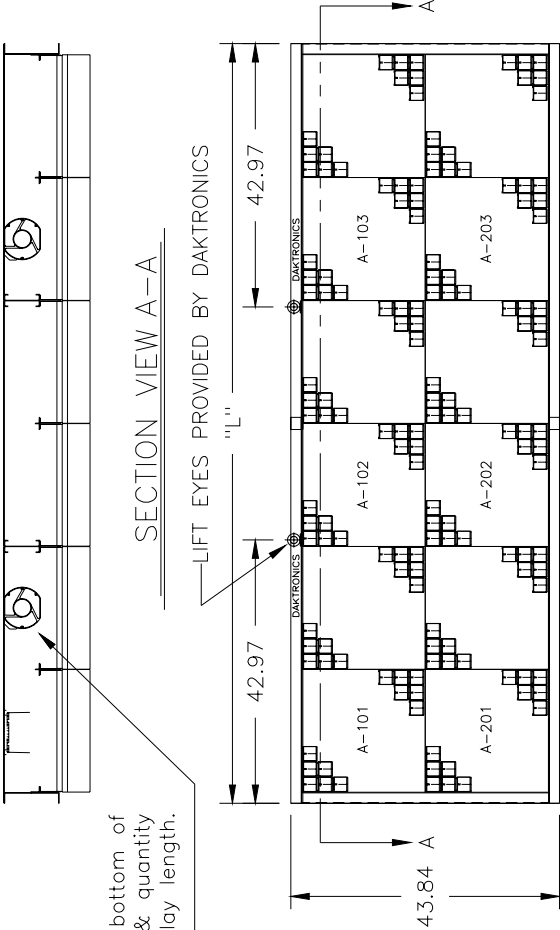
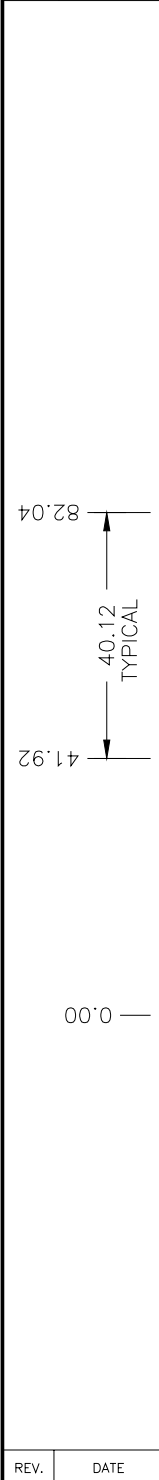
REVISION _____ APPR. BY: _____

SCALE: 1=30

1195-R10A-114666

REV.	DATE	DESCRIPTION	BY	APPR.

MODEL	DIM "L"	NO OF MODULES	WEIGHT (SF)
1648	123.96 IN	6	390
1664	164.08 IN	8	520
1680	204.20 IN	10	650
1696	244.32 IN	12	780



Air intake may be from the rear if the front of the display is enclosed & this area is not obstructed by a continuous horizontal member.

NOTES:

1. Display is front access for maintenance.
2. Mounting method must meet local codes. Display should be mounted solid to the structure and not hung on chain or cable.
3. Top surface of display available for mounting as required, but display must remain as airtight & water resistant as possible.
4. Customer is responsible for the structural integrity of structure that display is mounted to.
5. All dimensions are in inches.
6. Display is all aluminum construction.
7. Reference Dwg 1195-R10A-113898 for power requirements.
8. Main disconnect by customer.
9. 2 1/2" of clearance between the bottom of the display & any other display/obstruction below is required for filter access & air intake.
10. The gap between displays may be shrouded if air is allowed to enter from the rear.
11. Filter can be accessed only from the front of the display.

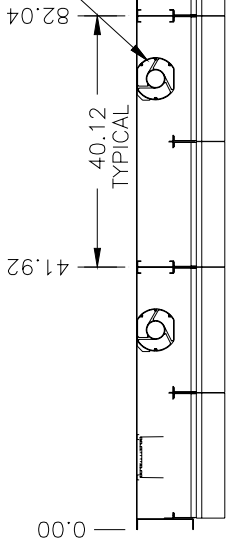
VENTILATION NOTE: IN ENCLOSED STRUCTURE SITUATIONS, TWELVE SQUARE INCHES OF UNOBSTRUCTED OPENING PER MODULE MUST BE PROVIDED TO INSURE ADEQUATE DISPLAY COOLING. ALLOWANCES MUST BE MADE TO COMPENSATE FOR THE PERCENTAGE OF SCREEN COVERING THE OPENINGS IN THE STRUCTURE. IF AIR MUST BE FORCED INTO THE ENCLOSED STRUCTURE, 110 CUBIC FEET PER MINUTE MUST BE PROVIDED PER MODULE.

DAKTRONICS, INC. BROOKINGS, SD 57006			
PROJ: 1600 SERIES MESSAGE BOARDS, 2 1/2"			
TITLE: SHOP DWG, 16 HIGH 2 1/2" SMALL MATRIX DISPLAY			
DES. BY:	DRAWN BY: JRT	DATE: 16APLR99	
REVISION	APPR. BY:	1195-R10A-114667	
	SCALE: 1=30		

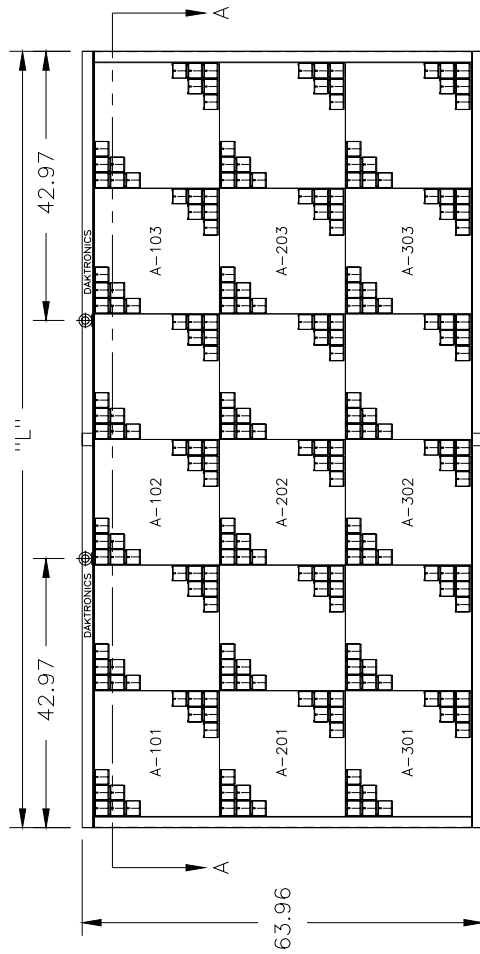
REV.	DATE	DESCRIPTION	BY	APPR.

MODEL	DIM "L"	NO OF MODULES	WEIGHT (SF)
2448	123.96 IN	9	585
2464	164.08 IN	12	780
2480	204.20 IN	15	975
2496	244.32 IN	18	1170

Cooling fans in bottom of display.



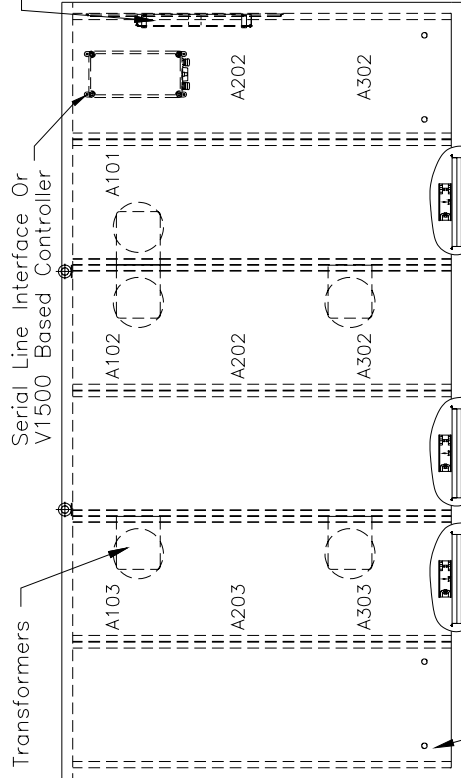
SECTION VIEW A-A



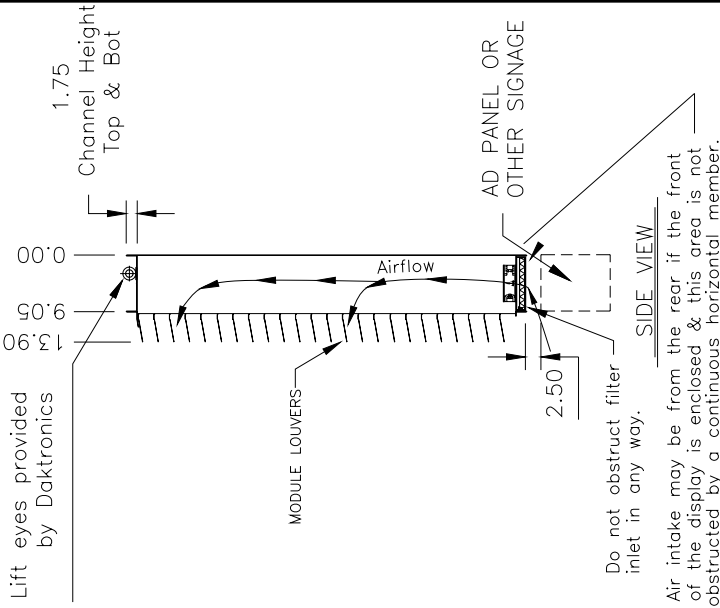
FRONT VIEW

8X8 Front Access Removable Lens/Louver Assy

Power/Signal Term Panel



REAR VIEW



Lift eyes provided by Daktronics

Channel Height Top & Bot

MODULE LOUVERS

Airflow

AD PANEL OR OTHER SIGNAGE

SIDE VIEW

Do not obstruct filter inlet in any way.

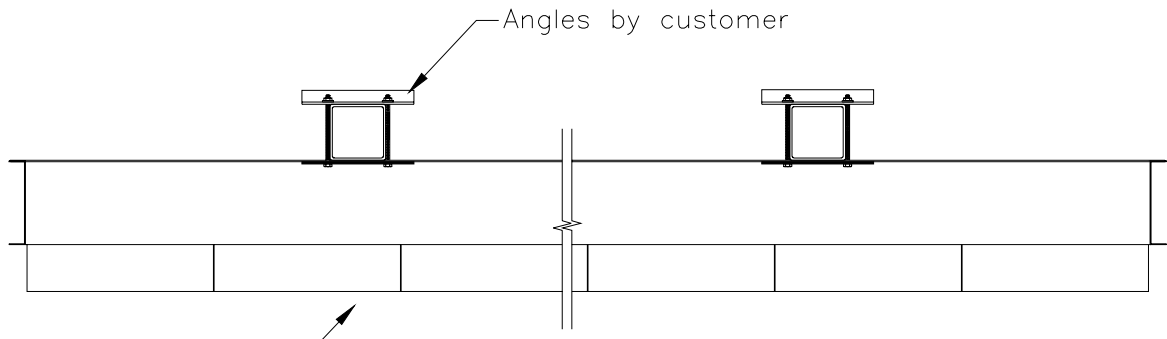
Air intake may be from the rear if the front of the display is enclosed & this area is not obstructed by a continuous horizontal member.

NOTES:

1. Display is front access for maintenance.
2. Mounting method must meet local codes. Display should be mounted solid to the structure and not hung on chain or cable.
3. Top surface of display available for mounting as required, but display must remain as airtight & water resistant as possible.
4. Customer is responsible for the structural integrity of structure that display is mounted to.
5. All dimensions are in inches.
6. Display is all aluminum construction.
7. Reference Dwg 1195-R10A-113898 for power requirements.
8. Main disconnect by customer.
9. 2 1/2" of clearance between the bottom of the display & any other display/obstruction below is required for filter access & air intake.
10. The gap between displays may be shrouded if air is allowed to enter from the rear.
11. Filter can be accessed only from the front of the display.
12. Ventilation note: In enclosed structure situations, twelve square inches of unobstructed opening per module must be provided to insure adequate display cooling. Allowances must be made to compensate for the percentage of screen in the material covering the openings in the structure. If air must be forced into the enclosed structure, 110 cubic feet per minute must be provided per module.

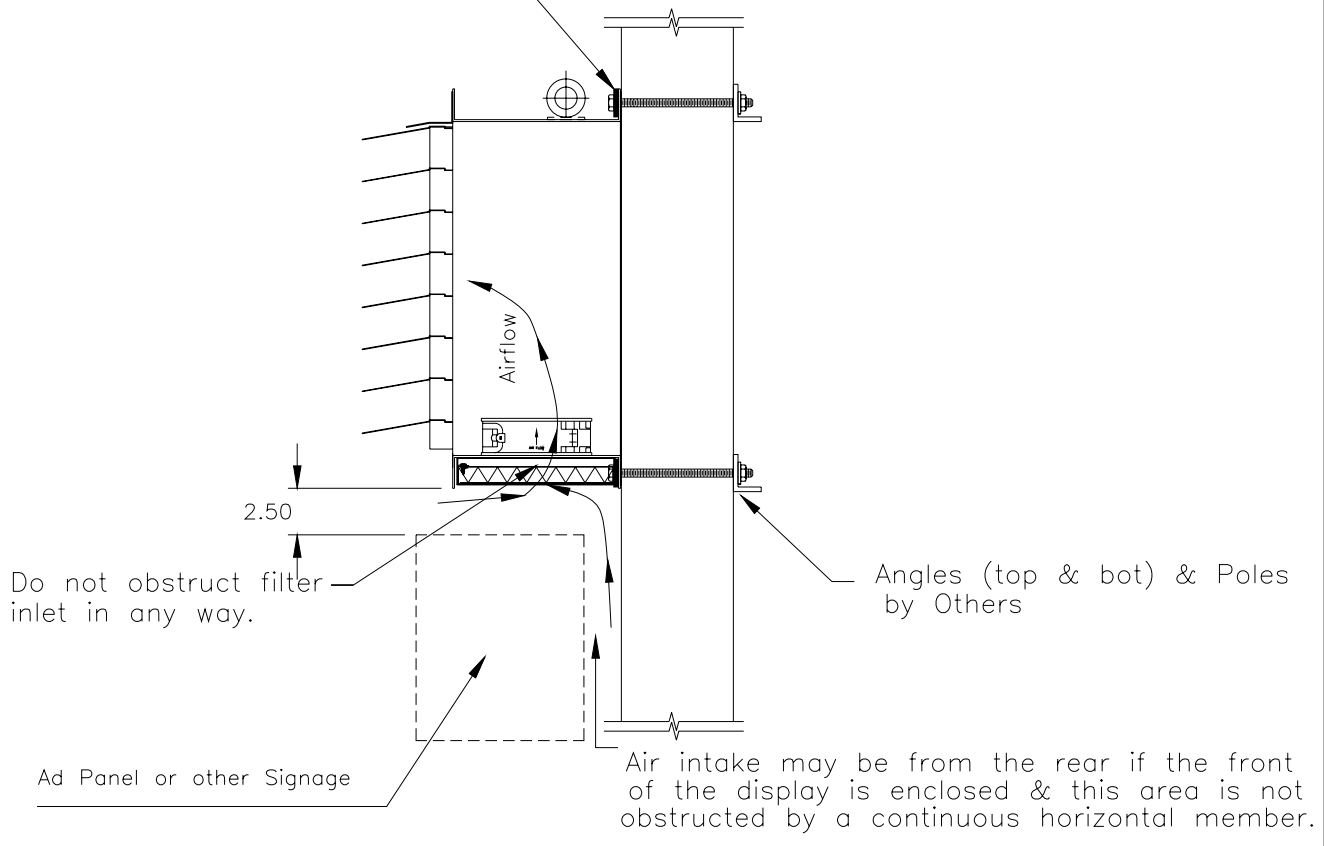
REV.	DATE	DESCRIPTION	BY	APPR.

DAKTRONICS, INC. BROOKINGS, SD 57006	
PROJ:	1600 SERIES MESSAGE BOARDS, 2 1/2"
TITLE:	SHOP DWG, 24 HIGH 2 1/2" SMALL MATRIX DISPLAY
DES. BY:	DRAWN BY: JRT
DATE:	16APR99
REVISION	APPR. BY:
SCALE:	1 = 30
1195-R10A-114668	



TOP VIEW

Front of Display
Bar Stock to Reinforce Cabinet Channel by Daktronics



SIDE VIEW

Scale: 1=10

Notes:

1. 2 1/2" of clearance between the bottom of the display & any other display/obstruction below is required for air intake.
2. The gap between displays may be shrouded if air is allowed to enter from the rear.
3. Filter can be accessed only from the front of the display.

REV.	DATE	DESCRIPTION	BY	APPR.

DAKTRONICS, INC. BROOKINGS, SD 57006			
PROJ: 1600 SERIES MESSAGE BOARDS, 2 1/2"			
TITLE: MOUNTING EXAMPLE, 2 1/2" SMALL MATRIX DISPLAYS			
DES. BY:	DRAWN BY: JRT	DATE: 16APR99	
REVISION	APPR. BY:	1195-R10A-114676	
	SCALE: 1=20		

V7000

ALL SIZES SWITCH SETTINGS	
DIP S1	ON
DIP S2	ON
DIP S3 N.U.	OFF
DIP S4 N.U.	OFF
DIP S5	ON
DIP S6	OFF
DIP S7	OFF
DIP S8	OFF
ROTARY S9	F
ROTARY S10	0
ROTARY S11	F

V4600

SWITCH SETTINGS	
DIP S1	ON
DIP S2	ON
DIP S3 N.U.	OFF
DIP S4 N.U.	OFF
DIP S5	OFF
DIP S6	OFF
DIP S7	OFF
DIP S8	OFF
ROTARY S10	0

ABOVE SWITCH SETTINGS
ARE THE SAME SEE SIZE
FOR ROTARY S9 DETAIL "A"
FOR ROTARY S11 DETAIL "B"

ROTARY S9

7/848 - 192	0
1648 - 192	1
2448 - 192	2
3248 - 192	3
4048 - 192	4
4848 - 192	5
5648 - 192	6
6448 - 192	7
7248 - 192	8
8048 - 192	9
8848 - 192	10

DETAIL: "A"

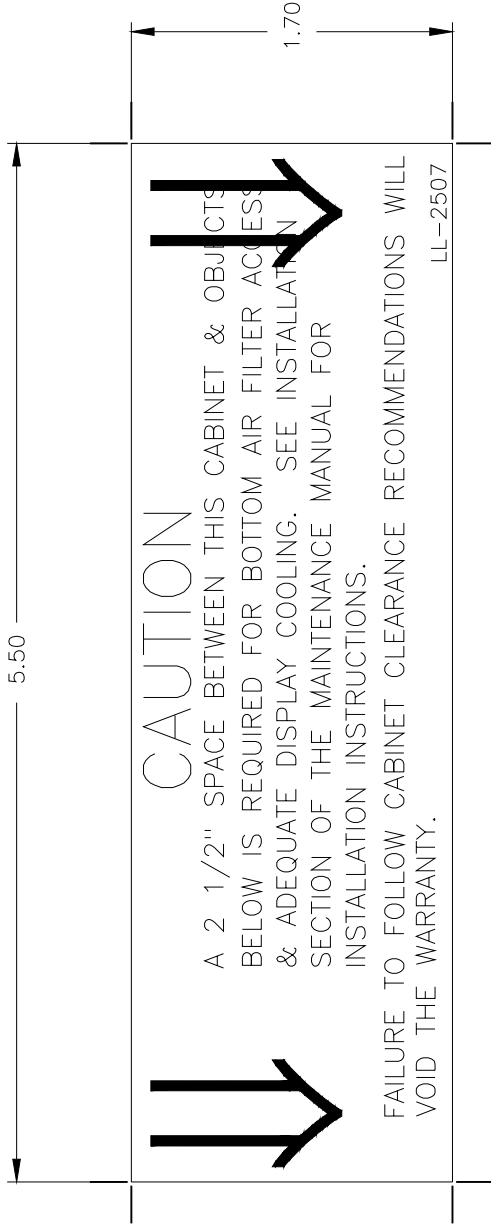
ROTARY S11

7 - 8848	2
7 - 8864	3
7 - 8880	4
7 - 8896	5
7 - 88112	6
7 - 88128	7
7 - 88144	8
7 - 88160	9
7 - 88176	A
7 - 88192	B

DETAIL: "B"

REV.	DATE	DESCRIPTION	BY	APPR.
3	25JAN00	CHANGED V4600 ALL S2'S TO ON AND S5 & S6 TO OFF; ADDED V7000 SETTINGS MOVED ALL SIZES TO THIS ONE DRAWING	RLONG	
2	28DEC99	CHANGED S3, S4, & S7. ADDED 7/864 SETTINGS	RLONG	
1	7JUL99	CORRECT HEADING FOR 7/8176	JRT	

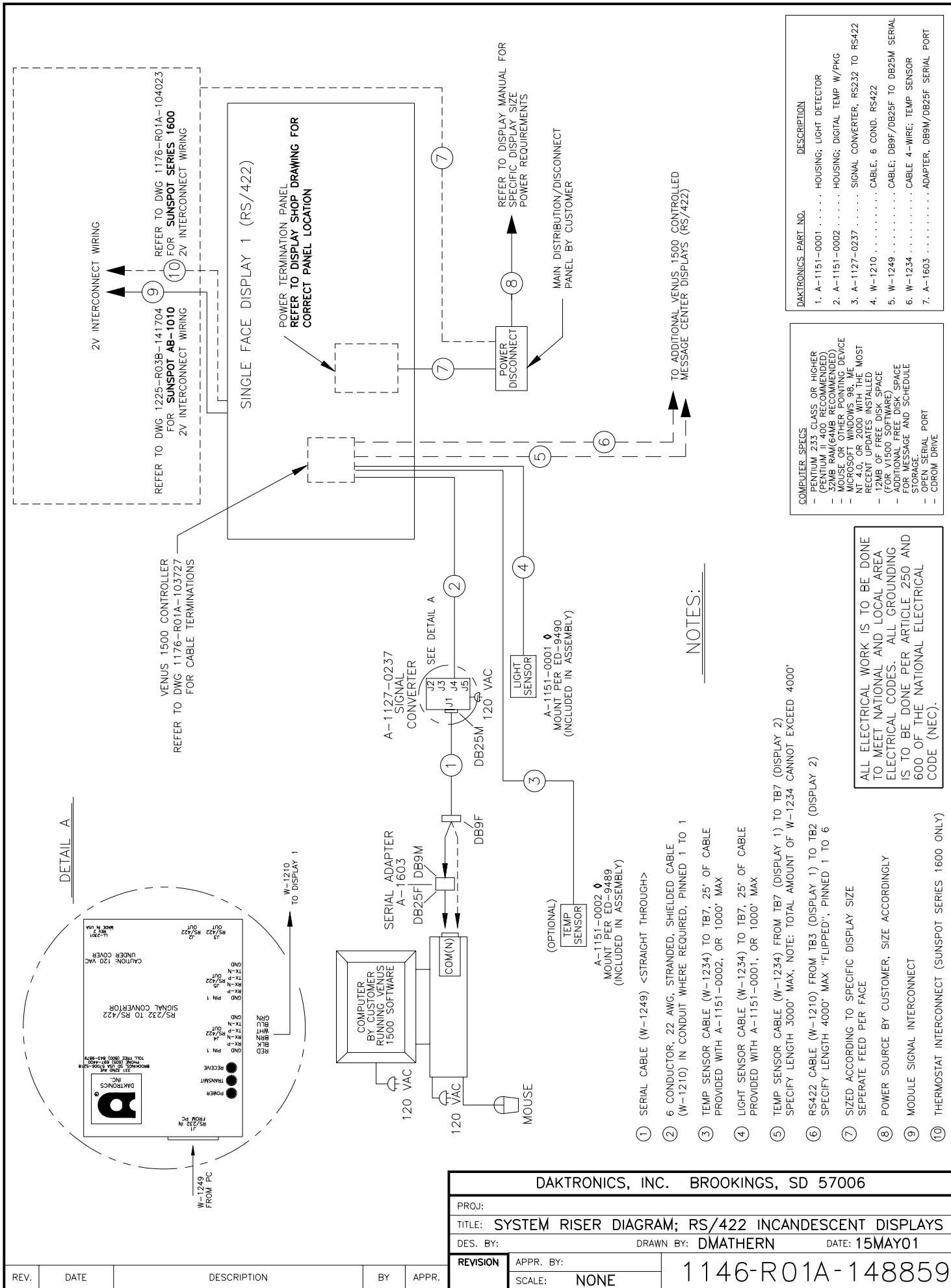
DAKTRONICS, INC. BROOKINGS, SD 57006	
PROJ:	1600 SERIES MESSAGE BOARD
TITLE:	LINE RECEIVER SETTINGS, 7-88, X 48-192
DES. BY:	TWOODARD
DRAWN BY:	RLONG
DATE:	28JUN99
REVISION	APPR. BY:
	SCALE: 1=1
1176-R01A-117756	



- SPECIFICATIONS:
1. DAKTRONICS PART NUMBER IS LL-2507.
 2. MATERIAL IS ALUMINUM FOIL WITH ACRYLIC ADHESIVE.
 3. COPY IS RIGHT READING ON BLACK BACKGROUND
 4. TEXT IS SILVER.
 5. PAPER BACKING TO BE SPLIT TO FACILITATE REMOVAL.
 6. LABEL TO BE CUT PER DIMENSIONS.

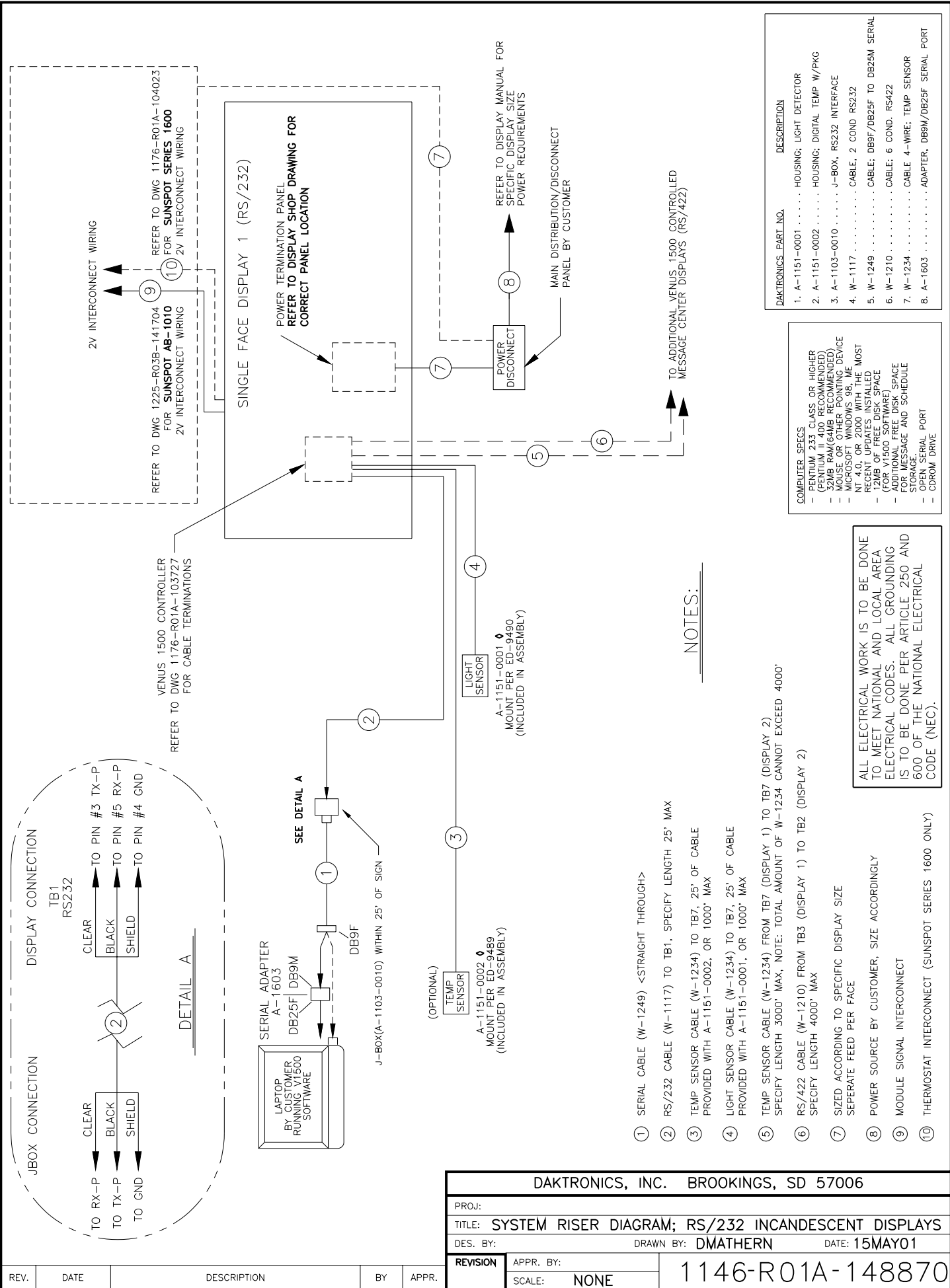
DAKTRONICS, INC. BROOKINGS, SD 57006	
PROJ: 1600 SERIES MESSAGE BOARDS	
TITLE: LABEL, FILTER CLEARANCE	
DES. BY:	DATE: 13NOV00
REVISION	DRAWN BY: JRT
APPR. BY:	1195-V08A-141064
SCALE: 1=1	

REV.	DATE	DESCRIPTION	BY	APPR.



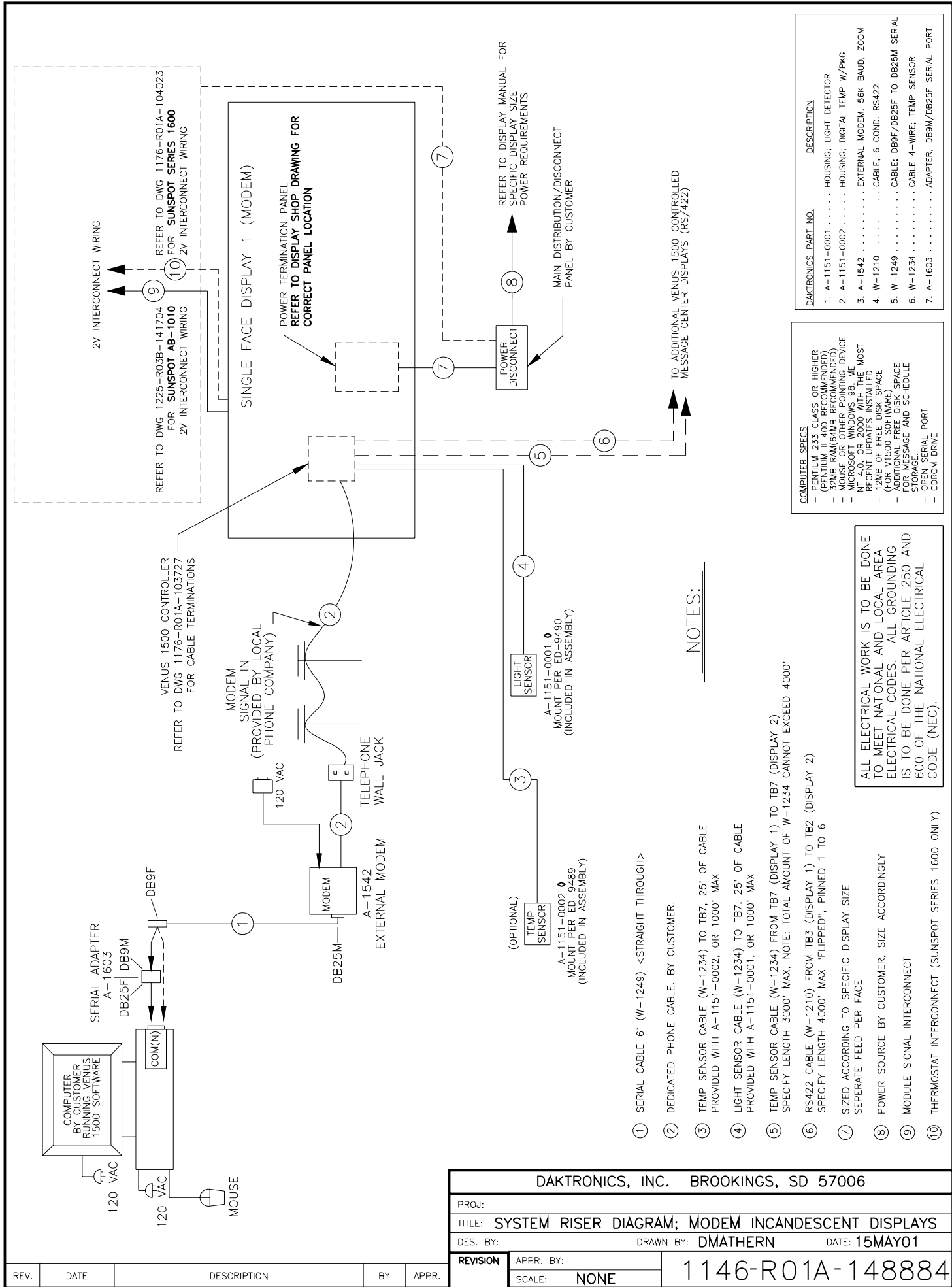
REV.	DATE	DESCRIPTION	BY	APPR.

DAKTRONICS, INC. BROOKINGS, SD 57006	
PROJ:	
TITLE:	SYSTEM RISER DIAGRAM; RS/422 INCANDESCENT DISPLAYS
DES. BY:	D MATHERN
DATE:	15MAY01
REVISION	
APPR. BY:	
SCALE:	NONE
1146-R01A-148859	



REV.	DATE	DESCRIPTION	BY	APPR.

DAKTRONICS, INC. BROOKINGS, SD 57006	
PROJ:	
TITLE:	SYSTEM RISER DIAGRAM; RS/232 INCANDESCENT DISPLAYS
DES. BY:	DRAWN BY: DMATHERN DATE: 15MAY01
REVISION	APPR. BY:
SCALE: NONE	1146-R01A-148870



DAKTRONICS PART NO.	DESCRIPTION
1. A-1151-0001	HOUSING; LIGHT DETECTOR
2. A-1151-0002	HOUSING; DIGITAL TEMP W/PKG
3. A-1542	EXTERNAL MODEM, 56K BAUD, ZOOM
4. W-1210	CABLE, 6 COND. RS422
5. W-1249	CABLE; DB9F/DB25F TO DB25M SERIAL
6. W-1234	CABLE 4-WIRE; TEMP SENSOR
7. A-1603	ADAPTER, DB9M/DB25F SERIAL PORT

- COMPUTER SPECS**
- PENTIUM 233 CLASS OR HIGHER (PENTIUM II 400 RECOMMENDED)
 - 32MB RAM (64MB RECOMMENDED)
 - MOUSE OR OTHER POINTING DEVICE
 - MICROSOFT WINDOWS 98, MS RECEIVE, UPDATER, INSTALLER, MOST
 - 12MB OF FREE DISK SPACE (FOR V1500 SOFTWARE)
 - ADDITIONAL FREE DISK SPACE FOR MESSAGE AND SCHEDULE STORAGE.
 - OPEN SERIAL PORT
 - CDROM DRIVE

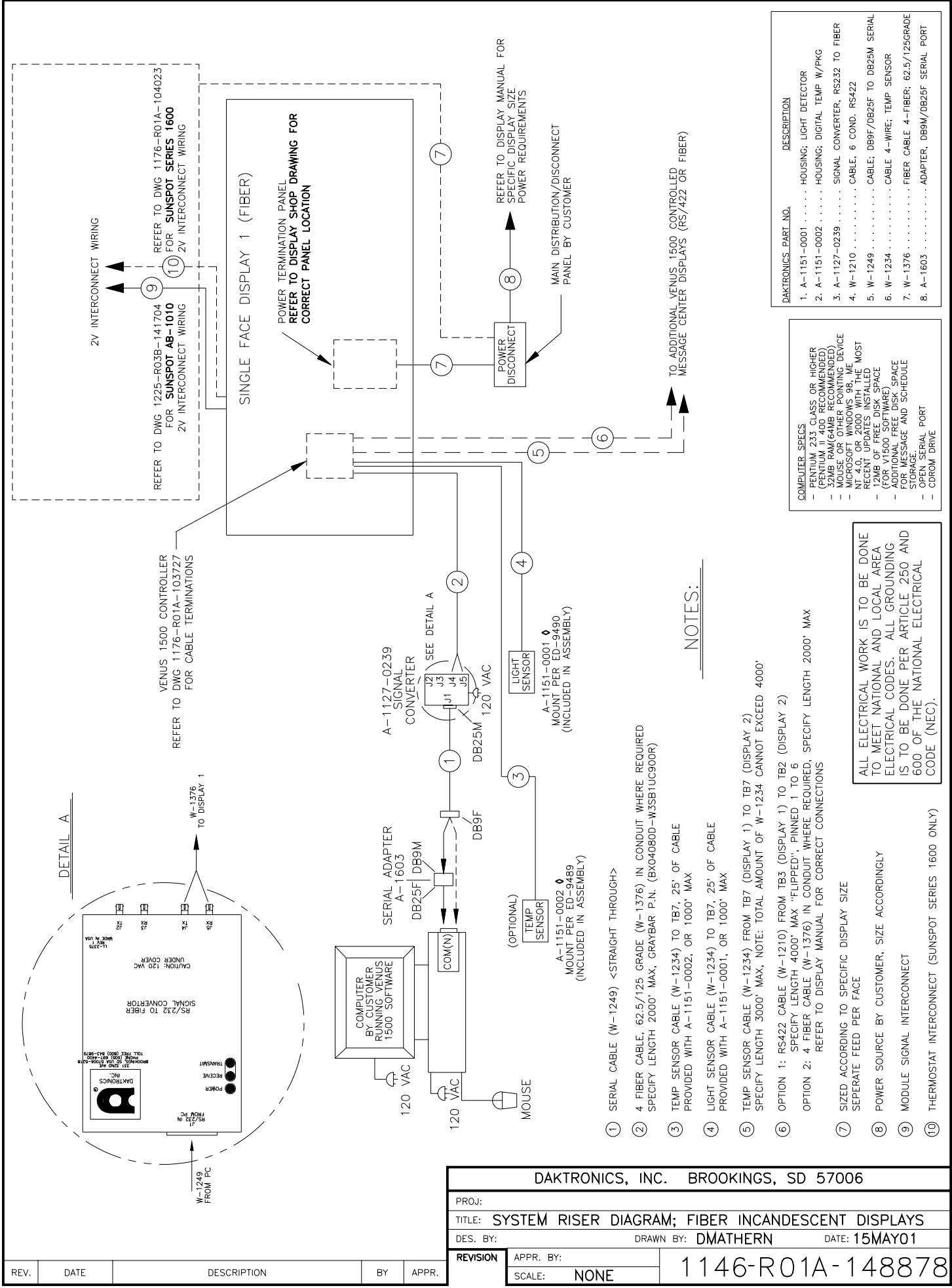
ALL ELECTRICAL WORK IS TO BE DONE TO MEET NATIONAL AND LOCAL AREA ELECTRICAL CODES. ALL GROUNDING IS TO BE DONE PER ARTICLE 250 AND 600 OF THE NATIONAL ELECTRICAL CODE (NEC).

NOTES:

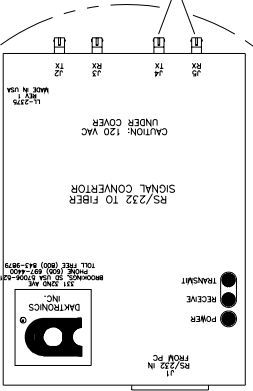
- SERIAL CABLE 6' (W-1249) <STRAIGHT THROUGH>
- DEDICATED PHONE CABLE. BY CUSTOMER.
- TEMP SENSOR CABLE (W-1234) TO TB7, 25' OF CABLE PROVIDED WITH A-1151-0002, OR 1000' MAX
- LIGHT SENSOR CABLE (W-1234) TO TB7, 25' OF CABLE PROVIDED WITH A-1151-0001, OR 1000' MAX
- TEMP SENSOR CABLE (W-1234) FROM TB7 (DISPLAY 1) TO TB7 (DISPLAY 2) SPECIFY LENGTH 3000' MAX; NOTE: TOTAL AMOUNT OF W-1234 CANNOT EXCEED 4000'
- RS422 CABLE (W-1210) FROM TB3 (DISPLAY 1) TO TB2 (DISPLAY 2) SPECIFY LENGTH 4000' MAX "FLIPPED", PINNED 1 TO 6
- SIZED ACCORDING TO SPECIFIC DISPLAY SIZE SEPARATE FEED PER FACE
- POWER SOURCE BY CUSTOMER, SIZE ACCORDINGLY
- MODULE SIGNAL INTERCONNECT
- THERMOSTAT INTERCONNECT (SUNSPOT SERIES 1600 ONLY)

DAKTRONICS, INC. BROOKINGS, SD 57006	
PROJ:	
TITLE:	SYSTEM RISER DIAGRAM; MODEM INCANDESCENT DISPLAYS
DES. BY:	DRAWN BY: DMATERN DATE: 15MAY01
REVISION	APPR. BY:
SCALE: NONE	
1146-R01A-148884	

REV.	DATE	DESCRIPTION	BY	APPR.



DETAIL A



DAKTRONICS, INC. BROOKINGS, SD 57006	
PROJ:	
TITLE:	SYSTEM RISER DIAGRAM; FIBER INCANDESCENT DISPLAYS
DES. BY:	DRAWN BY: DMATHERN DATE: 15MAY01
REVISION	APPR. BY:
	SCALE: NONE
1146-R01A-148878	

NOTES:

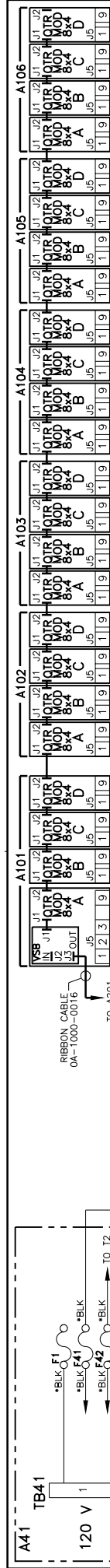
- 1 SERIAL CABLE (W-1249) <STRAIGHT THROUGH>
- 2 4 FIBER CABLE, 62.5/125 GRADE (W-1376) IN CONDUIT WHERE REQUIRED SPECIFY LENGTH 2000' MAX, GRAY/BAR P.N. (BX04080D-W3SB1UC900R)
- 3 TEMP SENSOR CABLE (W-1234) TO TB7, 25' OF CABLE PROVIDED WITH A-1151-0002, OR 1000' MAX
- 4 LIGHT SENSOR CABLE (W-1234) TO TB7, 25' OF CABLE PROVIDED WITH A-1151-0001, OR 1000' MAX
- 5 TEMP SENSOR CABLE (W-1234) FROM TB7 (DISPLAY 1) TO TB7 (DISPLAY 2) SPECIFY LENGTH 3000' MAX, NOTE: TOTAL AMOUNT OF W-1234 CANNOT EXCEED 4000'
- 6 OPTION 1: RS422 CABLE (W-1210) FROM TB3 (DISPLAY 1) TO TB2 (DISPLAY 2) SPECIFY LENGTH 4000' MAX "FLIPPED", PINNED 1 TO 6
OPTION 2: 4 FIBER CABLE (W-1376) IN CONDUIT WHERE REQUIRED, SPECIFY LENGTH 2000' MAX REFER TO DISPLAY MANUAL FOR CORRECT CONNECTIONS
- 7 SIZED ACCORDING TO SPECIFIC DISPLAY SIZE SEPARATE FEED PER FACE
- 8 POWER SOURCE BY CUSTOMER, SIZE ACCORDINGLY
- 9 MODULE SIGNAL INTERCONNECT
- 10 THERMOSTAT INTERCONNECT (SUNSPOT SERIES 1600 ONLY)

DAKTRONICS PART NO.	DESCRIPTION
1. A-1151-0001	HOUSING; LIGHT DETECTOR
2. A-1151-0002	HOUSING; DIGITAL TEMP W/PKG
3. A-1127-0239	SIGNAL CONVERTER, RS232 TO FIBER
4. W-1210	CABLE, 6 COND. RS422
5. W-1249	CABLE; DB9F/DB25F TO DB25M SERIAL
6. W-1234	CABLE 4-WIRE; TEMP SENSOR
7. W-1376	FIBER CABLE 4-FIBER; 62.5/125GRADE
8. A-1603	ADAPTER, DB9M/DB25F SERIAL PORT

- COMPUTER SPECS**
- PENTIUM CLASS OR HIGHER
 - 233MHz OR HIGHER
 - 32MB RAM (64MB RECOMMENDED)
 - MOUSE OR OTHER POINTING DEVICE
 - MICROSOFT WINDOWS 98, ME
 - NT 4.0, OR 2000 WITH THE MOST RECENT UPDATES INSTALLED
 - 12MB OF FREE DISK SPACE
 - ADDITIONAL FREE DISK SPACE FOR MESSAGE AND SCHEDULE STORAGE.
 - OPEN SERIAL PORT
 - CDROM DRIVE

ALL ELECTRICAL WORK IS TO BE DONE TO MEET NATIONAL AND LOCAL AREA ELECTRICAL CODES. ALL GROUNDING IS TO BE DONE PER ARTICLE 250 AND 600 OF THE NATIONAL ELECTRICAL CODE (NEC).

REV.	DATE	DESCRIPTION	BY	APPR.



MODULES A101 THRU A106 (ROW 1 OF 3) SHOWN ABOVE. MODULE ROW 2 OR 3 NOT SHOWN

- NOTES:
- 2448 USES MODULES THROUGH A103, A203, A303
 - 2464 USES MODULES THROUGH A104, A204, A304
 - 2480 USES MODULES THROUGH A105, A205, A305
 - 2496 USES MODULES THROUGH A106, A206, A306
2. ALL WIRING IS 18 AWG EXCEPT • IS 12 AWG
3. 2448 USES TERM PANEL OA-1195-0036
 2464 USES TERM PANEL OA-1195-0037
 2480 USES TERM PANEL OA-1195-0038
 2496 USES TERM PANEL OA-1195-0039

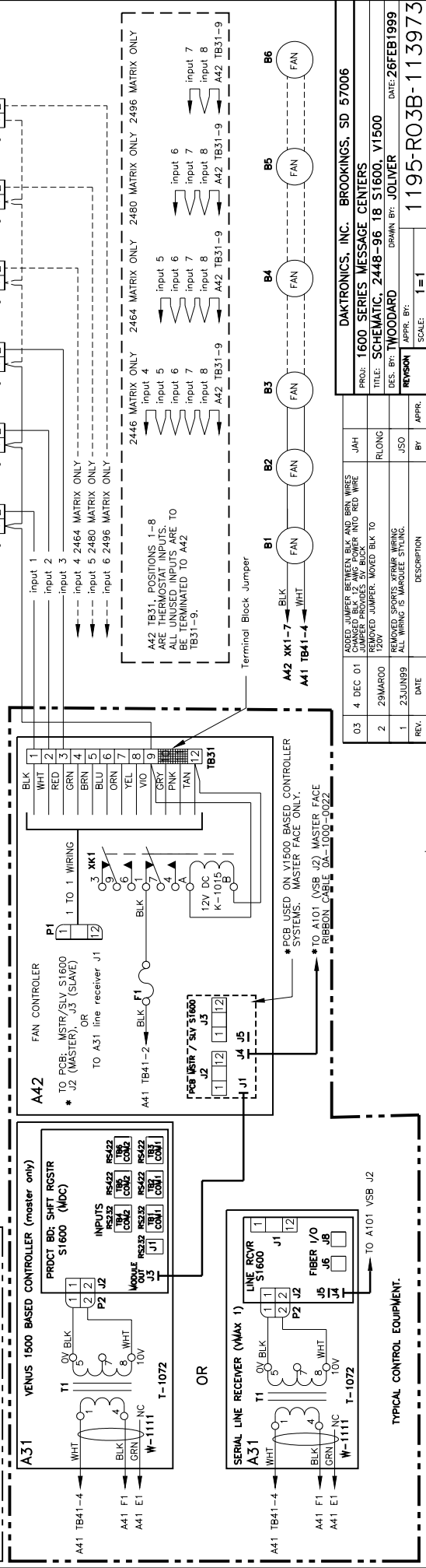
4. TRANSFORMER TO FUSE HARNESS LENGTHS

F41-T1	F42-T2	F43-T3	F44-T4	F45-T5	F46-T6	F47-T7	F48-T8	F49-T9
70R8 48	10'	10'	10'	10'	N/A	N/A	N/A	N/A
70R8 64	10'	10'	10'	15'	10'	15'	20'	N/A
70R8 80	10'	10'	10'	15'	20'	10'	15'	20'
70R8 96	10'	10'	10'	15'	20'	10'	15'	20'

TYPICAL TRANSFORMER WIRING. EACH TRANSFORMER PROVIDES POWER TO TWO BX16 MODULES.

FUSE 120/208 3ø 120/240 SINGL ø
F41 TB41-1 TB41-1
F42 TB41-2 TB41-2
F43 TB41-3 TB41-3
F44 TB41-1 TB41-1
F45 TB41-2 TB41-2
F46 TB41-3 TB41-3
F47 TB41-1 TB41-1
F48 TB41-2 TB41-2
F49 TB41-3 TB41-3

F1 FUSE IS AN AGC-2 1/2 AMP FUSE
 DAKTRONICS PART NUMBER F-1001
 F41-F49 FUSES ARE FLRN20, 20 AMP FUSES
 DAKTRONICS PART NUMBER F-1037



REV.	DATE	DESCRIPTION	BY	APPR.
03	4 DEC 01	ADDED JUMPER BETWEEN BLK AND BRN WIRES JUMPER PROVIDED BY BLOCK	JAH	
1	29 MAR 00	REMOVED JUMPER. MOVED BLK TO 120V	RLONG	
2	23 JUN 99	REMOVED SPARE WIRE WIRING ALL WIRING IS MARQUEE WIRING	JSO	

REV.	DATE	DESCRIPTION	BY	APPR.
1	23 JUN 99	REMOVED SPARE WIRE WIRING ALL WIRING IS MARQUEE WIRING	JSO	

REV.	DATE	DESCRIPTION	BY	APPR.
03	4 DEC 01	ADDED JUMPER BETWEEN BLK AND BRN WIRES JUMPER PROVIDED BY BLOCK	JAH	
1	29 MAR 00	REMOVED JUMPER. MOVED BLK TO 120V	RLONG	
2	23 JUN 99	REMOVED SPARE WIRE WIRING ALL WIRING IS MARQUEE WIRING	JSO	

TYPICAL CONTROL EQUIPMENT.

DAKTRONICS, INC. BROOKINGS, SD 57006

PROJECT: 1600 SERIES MESSAGE CENTERS

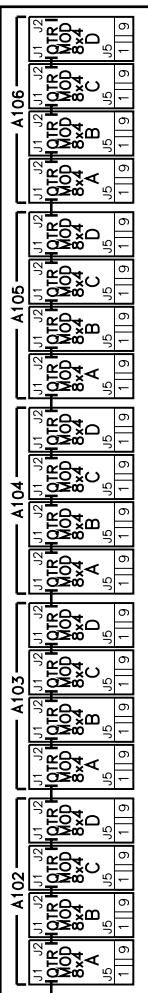
TITLE: SCHEMATIC, 2448-96 18 S1600, V1500

DES. BY: THOODARD DRAWN BY: JOLIVER DATE: 28FEB1999

REVISION: 1=1

SCALE: 1=1

1195-R03B-113973

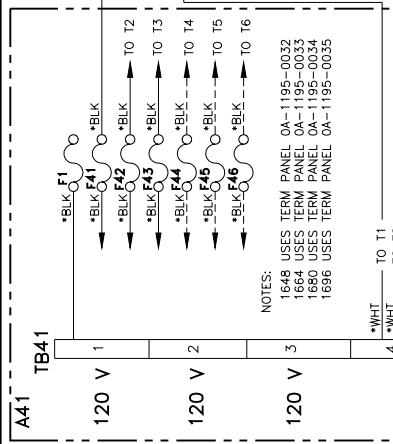


MODULES A101 THRU A106 (ROW 1 OF 2) SHOWN ABOVE. MODULE ROW 2 NOT SHOWN

- NOTES:
- 1648 USES MODULES THROUGH A103, A203
1664 USES MODULES THROUGH A104, A204
1680 USES MODULES THROUGH A105, A205
1696 USES MODULES THROUGH A106, A206
 - ALL WIRING IS 18 AWG EXCEPT • IS 12 AWG
 - TRANSFORMER TO FUSE HARNESS LENGTHS

	F41-T1	F42-T2	F43-T3	F44-T4	F45-T5	F46-T6
7088 48	10'	10'	10'	N/A	N/A	N/A
7088 64	10'	10'	10'	10'	15'	N/A
7088 80	10'	10'	10'	10'	15'	20'
7088 96	10'	10'	10'	10'	15'	20'

INDICATE INSTANTANEOUS WIRING. EACH TRANSFORMER PROVIDES POWER TO TWO 8X16 MODULES.

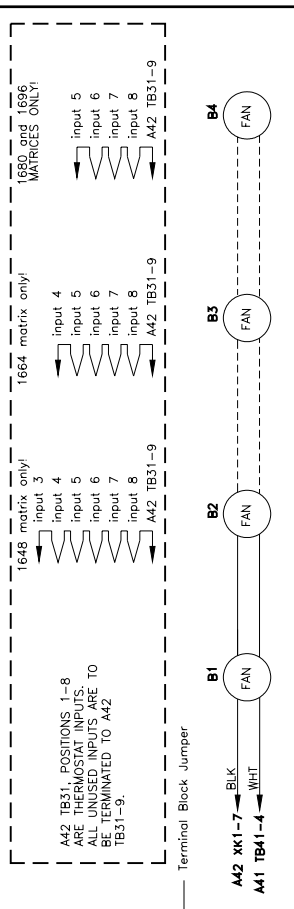
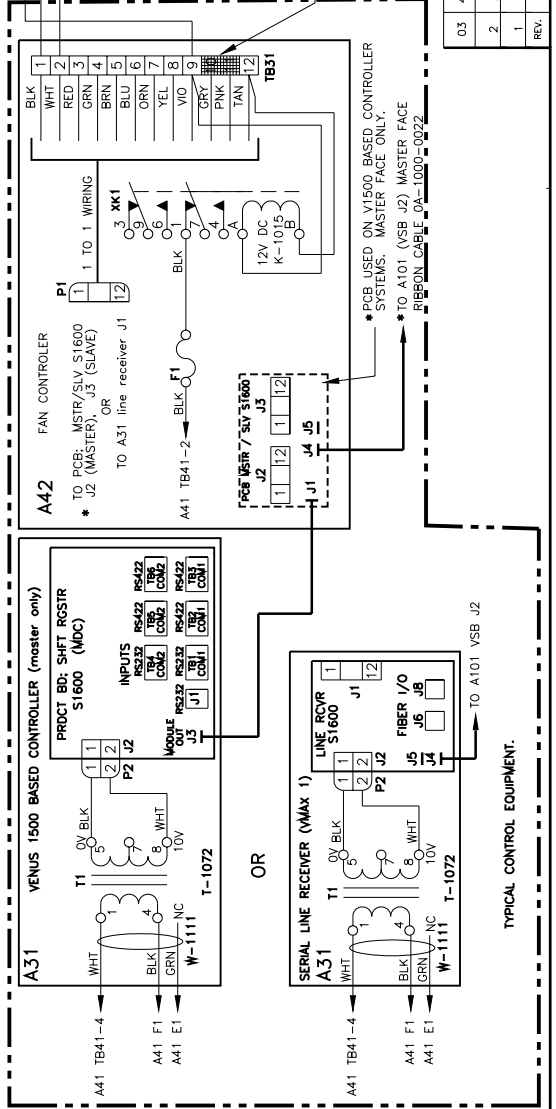
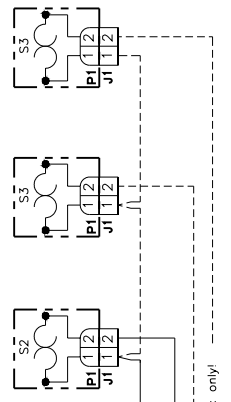


NOTES:

- 1648 USES TERM PANEL OA-1195-0032
- 1664 USES TERM PANEL OA-1195-0033
- 1680 USES TERM PANEL OA-1195-0034
- 1696 USES TERM PANEL OA-1195-0035

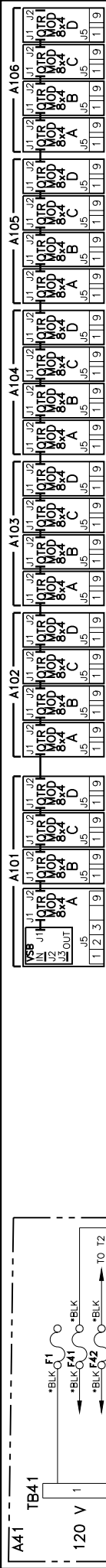
FUSE	120/208 3ø	120/240 SINGL ø
F41	→ TB41-1	→ TB41-1
F42	→ TB41-2	→ TB41-2
F43	→ TB41-3	→ TB41-3
F44	→ TB41-1	→ TB41-2
F45	→ TB41-2	→ TB41-1
F46	→ TB41-3	→ TB41-2

F1 FUSE IS AN AGC-2, 1/2 AMP FUSE. DAKTRONICS PART NUMBER F-1001
E41-E46 FUSES ARE FLRN20, 20 AMP FUSES. DAKTRONICS PART NUMBER F-1037



REV.	DATE	DESCRIPTION	BY	APPR.
03	4 DEC 01	ADDED JUMPER BETWEEN BLK AND BRN WIRES. JUMPER BECOMES A42 AND POWER INTO RED WIRE. REMOVED SPARTS JUMPER, MOVED BLK WIRE TO 120V	RLONG	
2	29MAY00	REMOVED SPARTS JUMPER, MOVED BLK WIRE TO 120V	RLONG	
1	16JUN99	ADDED SPARTS JUMPER BETWEEN BLK AND BRN WIRE. WIRE JUMPED THE SAME.	RLONG	

DAKTRONICS, INC. BROOKINGS, SD 57006
 PROJ: 1600 SERIES MESSAGE CENTERS
 TITLE: SCHEMATIC, 1648-96 18 S1600, V1500
 DES. BY: WOODWARD DRAWN BY: WOODWARD DATE: 10FEB99
 REVISION: 03 SCALE: 1=1
 1195-R03B-112311



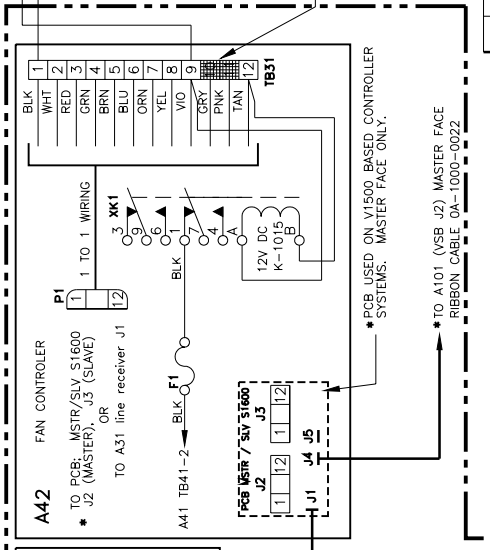
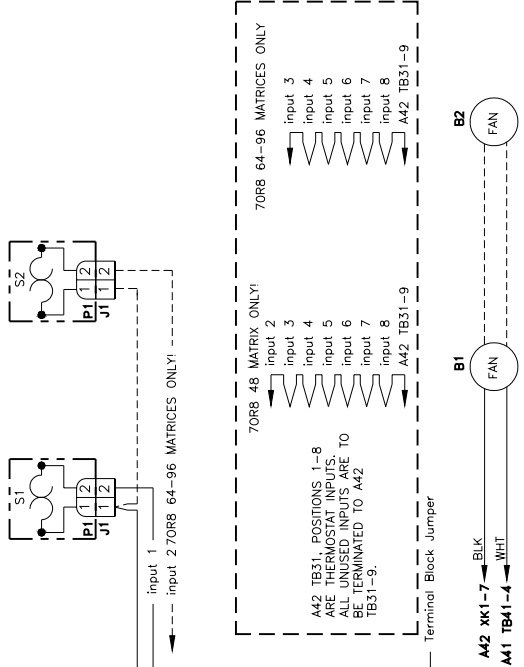
MODULES A101 THRU A106 SHOWN ABOVE.

- NOTES:
- 70R8 48 USES MODULES THROUGH A103
70R8 64 USES MODULES THROUGH A104
70R8 80 USES MODULES THROUGH A105
70R8 96 USES MODULES THROUGH A106
 - ALL WIRING IS 18 AWG EXCEPT • IS 12 AWG
 - TRANSFORMER TO FUSE HARNESS LENGTHS

	F41-T1	F42-T2	F43-T3
70R8 48	10'	10'	N/A
70R8 64	10'	15'	N/A
70R8 80	10'	15'	20'
70R8 96	10'	15'	20'

TYPICAL TRANSFORMER WIRING. PROVIDE POWER TO TWO 70R8x6 MODULES.

F1 FUSE IS AN AGC-2 1/2 AMP FUSE
DAKTRONICS PART NUMBER F-1001
F41-F43 FUSES ARE FLRN20, 20 AMP FUSES
DAKTRONICS PART NUMBER F-1037



TYPICAL CONTROL EQUIPMENT.

REV.	DATE	DESCRIPTION	BY	APPR.
1	17JUN99	REMOVED SPORTS TRANSFORMER. SPORTS AND MARQUEE ARE WIRED THE SAME	RLONG	
2	29MARCH	REMOVED SPORTS TRANSFORMER	RLONG	
3	4 DEC 01	ADDED JUMPER BETWEEN BLK AND BRN WIRES. JUMPER PROVIDES 5V BUCK	JAH	

DAKTRONICS, INC. BROOKINGS, SD 57006
 PROD: 1600 SERIES MESSAGE CENTERS
 TITLE: SCHEMATIC, 70R8 48-96 18 S1600, V1500
 DES. BY: WOODWARD
 DRAWN BY: JOLIVER
 DATE: 17 FEB 99
 APPR. BY:
 SCALE: 1=1

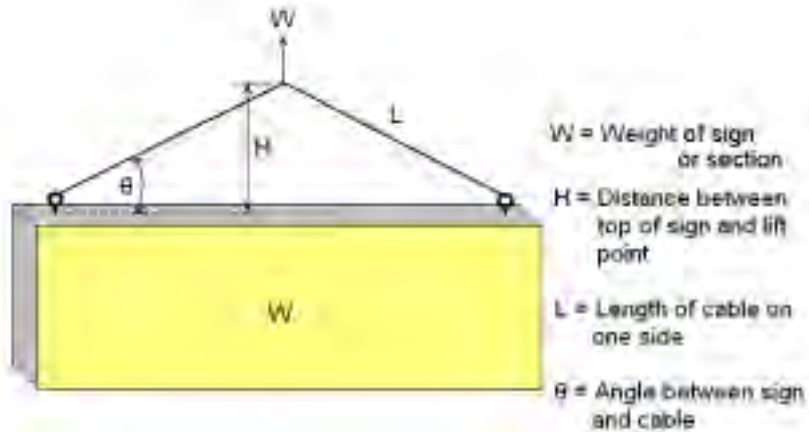
1195-R03B-112505

Appendix C: Forms & Report

Eyebolts

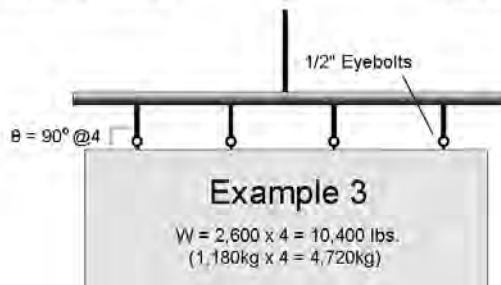
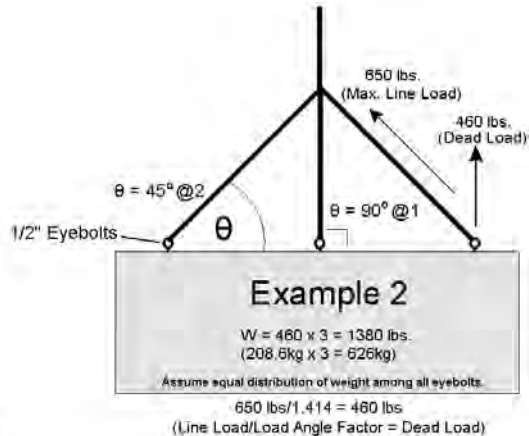
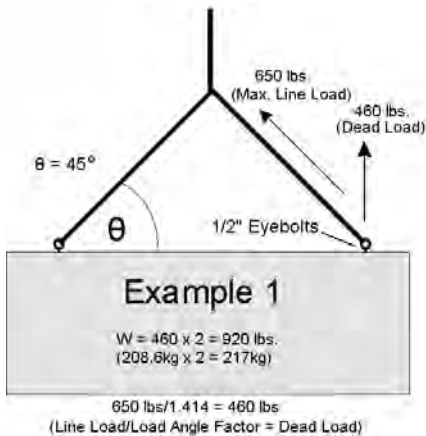
Almost every display that leaves Daktronics is equipped with eyebolts for lifting the display. There are two standard sizes of eyebolts: 1/2" and 5/8".

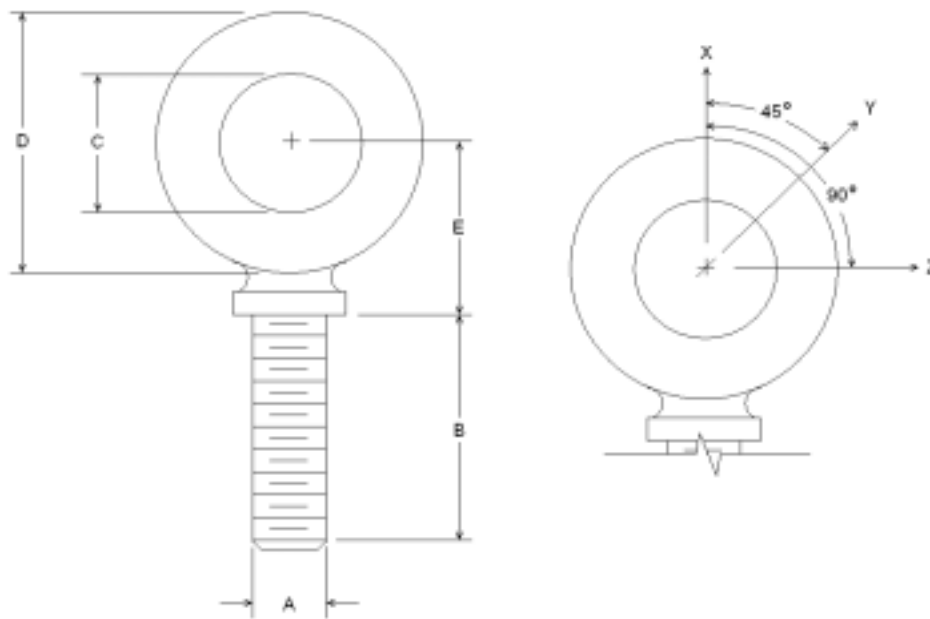
Load Increase Factor: The load increases as the lift angle (θ) decreases. The allowable load on the eyebolts also decreases with the lift angle due to the bending stress on the eyebolts. In sum, the smaller the angle between the cable and the top of the display, the lighter the sign must be to safely lift it. *Do NOT attempt to lift the display when the lift angle is less than 30 degrees.*



Horizontal Angle	Load Angle Factor (L/H)
90	1.00
60	1.155
50	1.305
45	1.414
30	2.00

θ	1/2"		5/8"	
	Line Load	Weight/Anchor	Line Load	Weight/Anchor
90	2600	2600	4000	4000
60	1500	1299	3300	2858
45	650	460	1000	707
30	520	260	800	400





A	B	C	D	E	No.	Min. Proof Load (lbs.)	Min. Break Load (lbs.)	Stocked	Min. Eff. Thrd. Length	Line Loads		
										Wx	Wy	Wz
1/4	1	3/4	1-3/16	25/32	21	600	2,000	Blank 1/4-20	7/8	400	100	80
3/8	1-1/4	1	1-21/32	1-3/16	23	2,100	5,000	Blank 3/8-16	1-1/8	1,400	350	250
1/2	1-1/2	1-3/16	2-1/16	1-13/32	25	3,900	9,200	Blank 1/2-13	1-11/32	2,600	650	520
9/16	1-5/8	1-9/32	2-13/16	1-17/32	26	4,500	11,830	Blank 9/16-12	1-3/8	3,000	750	600
5/8	1-3/4	1-3/8	2-1/2	1-11/16	27	6,000	14,700	Blank 5/8-11	1-9/16	4,000	1,000	800
3/4	2	1-1/2	2-13/16	1-13/16	28	9,000	21,700	Blank 3/4-10	1-5/8	6,000	1,500	1,200
7/8	2-1/4	1-11/16	3-1/4	2-1/16	29	10,000	30,000	Blank 7/8-9	1-13/16	6,600	1,670	1,330
1	2-1/2	1-13/16	3-9/16	2-5/16	30	12,000	39,400	Blank 1-8	2-1/16	8,000	2,000	1,600
1-1/2	3-1/2	2-9/16	5-1/2	3-5/32	34	27,000	91,300	Blank 1-1/2-6	3	17,800	4,500	3,600

- A. Do not use eyebolts on angular lifts unless absolutely necessary. For angular lifts, the shoulder pattern eyebolt is preferred.
- B. Load should always be applied to eyebolts in the plane of the eye, not at some angle to this plane.
- C. Shoulder eyebolts must be properly seated (should bear firmly against the mating part), otherwise the working loads must be reduced to those indicated for regular eyebolts. A washer or spacer may be required to put the plane of the eye in the direction of the load when the shoulder is seated.
- D. No load greater than the safe working load listed in the data table should be used.
- E. To obtain the greatest strength from the eyebolt, it must fit reasonably tight in its mounting hole to prevent accidental unscrewing due to twist of cable.
- F. Eyebolts should never be painted or otherwise coated when used for lifting. Such coatings may cover potential flaws in the eyebolt.
- G. To attain the safe working loads listed for regular eyebolts, 90% of the thread length must be engaged.

Display Power Report

Site: _____

Line Voltage:

Phase A Voltage: _____

Phase B Voltage: _____

Phase C Voltage _____

Line Recorder on Phase: _____

Hours per day display is expected to operate on dim: _____

Send 1 Display Power Report to the Daktronics Address Below.

Daktronics Customer Service
P.O. Box 5128
Brookings, SD
57006-5128

Module Number	Row Number	Column Number	Voltage

Customer Service – Route Copies to the Following:

- 1 Copy – Customer Service File
- 1 Copy – Mechanical Design
- 1 Copy – Project Manager File
- 1 Copy – Sales Person



DAKTRONICS, INC.

P.O. Box 5128 331 32nd Ave. Brookings, SD 57006
Phone (605) 697-4035 or (877) 605-1114 Fax (605) 697-4444
www.daktronics.com e-mail helpdesk@daktronics.com



Display Power Report

Site: _____

Line Voltage:

Phase A Voltage: _____

Phase B Voltage: _____

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Installation Quality Checklist

1½ Inch and 2½ Inch Displays

Send 1 Copy (Front and Back of this Installation Quality Checklist to the Daktronics Address below.

Daktronics Customer Service
P.O. Box 5128
Brookings, SD 57006-51285

This checklist is intended to serve as a general guide during display installation. If this display is to operate in a dependable manner it must be installed properly. Date and initial each of the following tasks as they are completed. Because each installation site is unique, the tasks below may not necessarily be in the order in which they should be performed. If product quality concerns arise during check off, please note them on the back of this form or contact Daktronics Customer Service.

Contract/Work
 Order Number: _____

Display
 Serial Number: _____

Display
 Description: _____

✓ OK box if acceptable. ✓ Rej box if a deficiency is noted & correction is required.

OK	Rej	Initial	Date	
<input type="checkbox"/>	<input type="checkbox"/>			Inspect the display & all crates & boxes for any damage as they are unloaded at the site. Note any shipping damage on this form or notify Daktronics
<input type="checkbox"/>	<input type="checkbox"/>			Review the installation manual & installation procedures with the installation crew prior to beginning the installation work. Stress the importance of water tightness at all points.
<input type="checkbox"/>	<input type="checkbox"/>			Check the display mounting structure to ensure a straight & square mounting frame for the display. The height variation in any 4 foot horizontal should not exceed ¼ inch. This check should be done well in advance of the scheduled installation to allow for repairs if necessary.
<input type="checkbox"/>	<input type="checkbox"/>			Mount the display as per the engineering plan & shop drawing. If the display is shipped in sections, ensure that the sections were bolted together vertically & horizontally.
<input type="checkbox"/>	<input type="checkbox"/>			If eyebolts are removed, plug the holes with bolts & the rubber water sealing washer which was removed with the eyebolt. Plug & silicone around any hole or openings in the top of the display.
<input type="checkbox"/>	<input type="checkbox"/>			Inspect the top & side front shrouds for weather tightness. If the shrouding has been field attached, ensure it was done per the engineering drawing. All shroud overlaps must be siliconed.
<input type="checkbox"/>	<input type="checkbox"/>			Note that there are drain holes in the bottom on the display. There should be a minimum of ½ inch clearance between these holes & any mounting surface.
<input type="checkbox"/>	<input type="checkbox"/>			Check the spacing between modules of sectional displays with the 0.032 feeler gauge. Also check the weather stripping tightness with the feeler gauge (OM-69133).
<input type="checkbox"/>	<input type="checkbox"/>			Check the lens to see if they are secured properly & that the rows of louvers are in proper alignment with each other. Ensure that all lampbanks are secured properly & all lamps are the focal point of the reflector.
<input type="checkbox"/>	<input type="checkbox"/>			During assembly of sectional displays, check the interconnect ribbon cables at the splice locations to ensure they are not pinched.
<input type="checkbox"/>	<input type="checkbox"/>			Use electrical contact cleaner (Daktronics part number CH-1015) to clean the 16 & 20 pin connectors any time a ribbon cable is removed during installation. Use electrical contact lubricant & protector (CH-1019) to protect the connector from moisture.
<input type="checkbox"/>	<input type="checkbox"/>			Ensure that all electrical entrance connections are watertight.
<input type="checkbox"/>	<input type="checkbox"/>			Ensure that each load center is properly earth grounded as per National Electrical Code. Refer to the grounding information in the Electrical Installation section of the manual.
<input type="checkbox"/>	<input type="checkbox"/>			Ensure that the supply voltage rating matches the voltage rating of the display.
<input type="checkbox"/>	<input type="checkbox"/>			Ensure that all cooling fans are operational after the initial fire up of the display.

OK	Rej	Initial	Date
<input type="checkbox"/>	<input type="checkbox"/>		Monitor display voltage per the Line Voltage and 24-Hour Monitoring instructions in the Electrical Installation section of the manual. Fill out and complete both copies of DF-1796 (Display Power Report). Send one copy of the form to Daktronics customer service & keep one copy of the report for your records.
<input type="checkbox"/>	<input type="checkbox"/>		Ensure that the display controller is set to have the lamp level on bright during the daylight hours.
<input type="checkbox"/>	<input type="checkbox"/>		If any modifications have been made to the Daktronics air filtration system, ensure that these changes have been approved by the Daktronics Engineering Staff.
<input type="checkbox"/>	<input type="checkbox"/>		If displays are mounted back to back inside a center cabinet, adequate clearance must be provided between the rain shields to provide for proper air flow to all ventilation fans. Ensure that this clearance has been approved by the Daktronics Engineering staff.
<input type="checkbox"/>	<input type="checkbox"/>		In enclosed display situations, ensure that 12 square inches of unobstructed opening is provided for each module. Allowances must be made to compensate for the percentage of screen or any other material covering the ventilation opening in the enclosed structure.
<input type="checkbox"/>	<input type="checkbox"/>		Ensure that all wiring clears the bottom of the display by a minimum of 1/2" and is not in contact with any sharp edges.
<input type="checkbox"/>	<input type="checkbox"/>		Ensure that the backsheets of rear access displays are removable and are not obstructed by conduit or support structure members.
<input type="checkbox"/>	<input type="checkbox"/>		On displays with bottom ventilation, 2 1/2" of clearance between the bottom of the display & any other display/obstruction is required for air intake & filter maintenance.

I certify that all items listed above have been checked and approved.

Signature of Installer

Date

Signature of Owner/Owner Rep

Date

Owner's signature signifies they have been shown the installation checklist and the periodic maintenance located in the manuals. The owner also understands the importance of air filter and fan maintenance. When customer service receives this completed form, they will send the first set of replacement air filters to the customer at no charge.

Comments

Items rejected and later corrected, and the person making the correction

Return one copy of the installation checklist to Daktronics at the address listed on the front of this form!

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Installation Quality Checklist

1½ Inch and 2½ Inch Displays

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 Order Number: _____

Display
 Serial Number: _____

Display
 Description: _____

✓ OK box if acceptable. ✓ Rej box if a deficiency is noted & correction is required.

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<input type="checkbox"/>	<input type="checkbox"/>			Check the display mounting structure to ensure a straight & square mounting frame for the display. The height variation in any 4 foot horizontal should not exceed ¼ inch. This check should be done well in advance of the scheduled installation to allow for repairs if necessary.
<input type="checkbox"/>	<input type="checkbox"/>			Mount the display as per the engineering plan & shop drawing. If the display is shipped in sections, ensure that the sections were bolted together vertically & horizontally.
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<input type="checkbox"/>	<input type="checkbox"/>			Inspect the top & side front shrouds for weather tightness. If the shrouding has been field attached, ensure it was done per the engineering drawing. All shroud overlaps must be siliconed.
<input type="checkbox"/>	<input type="checkbox"/>			Note that there are drain holes in the bottom on the display. There should be a minimum of ½ inch clearance between these holes & any mounting surface.
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<input type="checkbox"/>	<input type="checkbox"/>			Ensure that all cooling fans are operational after the initial fire up of the display.

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<input type="checkbox"/>	<input type="checkbox"/>		Ensure that the backsheets of rear access displays are removable and are not obstructed by conduit or support structure members.
<input type="checkbox"/>	<input type="checkbox"/>		On displays with bottom ventilation, 2 1/2" of clearance between the bottom of the display & any other display/obstruction is required for air intake & filter maintenance.

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Maintenance Checklist

1½ Inch and 2½ Inch Displays

This form can be used as both as a maintenance guide and a record of maintenance performed. Store these forms in maintenance file as they are completed. Each form is designed to cover one year of maintenance.

Circle the operational year to which this form applies	1	2	3	4	5	6	7	8	9	10
--------------------------------------------------------	---	---	---	---	---	---	---	---	---	----

Maintenance Procedures

1. Check fans at 1,500 hour intervals to ensure proper operation. With display power off, clean dust from blades and spin the blades with a pen or pencil to make sure the bearings are free and the fan is still 'in balance.
2. Check the filters at 1,500 hour intervals. Check the filter for excessive dust/dirt buildup and for damage, such as holes, which may allow unfiltered air into the display.
3. Check line and lamp voltage every 4,500 hours or whenever a significant change occurs in the area that could affect line voltage. Refer to the Electrical Installation section of the Installation and Maintenance Manual for more information.
4. At least once each 9,000 operational hours check the inside of the display, including the circuit boards, for signs of water intrusion such as water stains. Water may enter the display due to any of the following:
 - Loose or deteriorating weather stripping.
 - Loosened fasteners which allow gaps to open between panels.
 - Weak seals around hardware, such as eye bolts, on the top of the display.
5. At least once each 9,00 operational hours inspect the paint and check for signs of corrosion on the structure. Pay special attention to footings, structural tie points and ground rods. Fasteners should be tightened or replaced as required.

Operation Hours	Perform Above Steps Numbered	Date Performed	Checked By
1,500 Hrs * Day 83 * Day 62	1,2		
3,000 Hrs * Day 166 ** Day 125	1,2		
4,500 Hrs * Day 249 ** Day 187	1,2,3		
6,000 Hrs * Day 332 ** Day 250	1,2		
7,500 Hrs * Day 415 ** Day 312	1,2		
9,500 Hrs * Day 498 ** Day 365	1,2,3,4,5		

- * Assuming the display is operated 18 hours per day and is turned off when not in use.
- ** Assuming the display is operated 24 hours per day.

Consult the Installation and Maintenance Manual for additional Maintenance Details.



DAKTRONICS, INC.

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 Phone (605) 697-4035 or (877) 605-1114 Fax (605) 697-4444
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- * Assuming the display is operated 18 hours per day and is turned off when not in use.
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--------------------------------------------------------	---	---	---	---	---	---	---	---	---	----

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1. Check fans at 1,500 hour intervals to ensure proper operation. With display power off, clean dust from blades and spin the blades with a pen or pencil to make sure the bearings are free and the fan is still 'in balance.
2. Check the filters at 1,500 hour intervals. Check the filter for excessive dust/dirt buildup and for damage, such as holes, which may allow unfiltered air into the display.
3. Check line and lamp voltage every 4,500 hours or whenever a significant change occurs in the area that could affect line voltage. Refer to the Electrical Installation section of the Installation and Maintenance Manual for more information.
4. At least once each 9,000 operational hours check the inside of the display, including the circuit boards, for signs of water intrusion such as water stains. Water may enter the display due to any of the following:
 - Loose or deteriorating weather stripping.
 - Loosened fasteners which allow gaps to open between panels.
 - Weak seals around hardware, such as eye bolts, on the top of the display.
5. At least once each 9,00 operational hours inspect the paint and check for signs of corrosion on the structure. Pay special attention to footings, structural tie points and ground rods. Fasteners should be tightened or replaced as required.

Operation Hours	Perform Above Steps Numbered	Date Performed	Checked By
1,500 Hrs * Day 83 * Day 62	1,2		
3,000 Hrs * Day 166 ** Day 125	1,2		
4,500 Hrs * Day 249 ** Day 187	1,2,3		
6,000 Hrs * Day 332 ** Day 250	1,2		
7,500 Hrs * Day 415 ** Day 312	1,2		
9,500 Hrs * Day 498 ** Day 365	1,2,3,4,5		

- * Assuming the display is operated 18 hours per day and is turned off when not in use.
- ** Assuming the display is operated 24 hours per day.

Consult the Installation and Maintenance Manual for additional Maintenance Details.



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Maintenance Checklist

1½ Inch and 2½ Inch Displays

This form can be used as both as a maintenance guide and a record of maintenance performed. Store these forms in maintenance file as they are completed. Each form is designed to cover one year of maintenance.

Circle the operational year to which this form applies	1	2	3	4	5	6	7	8	9	10
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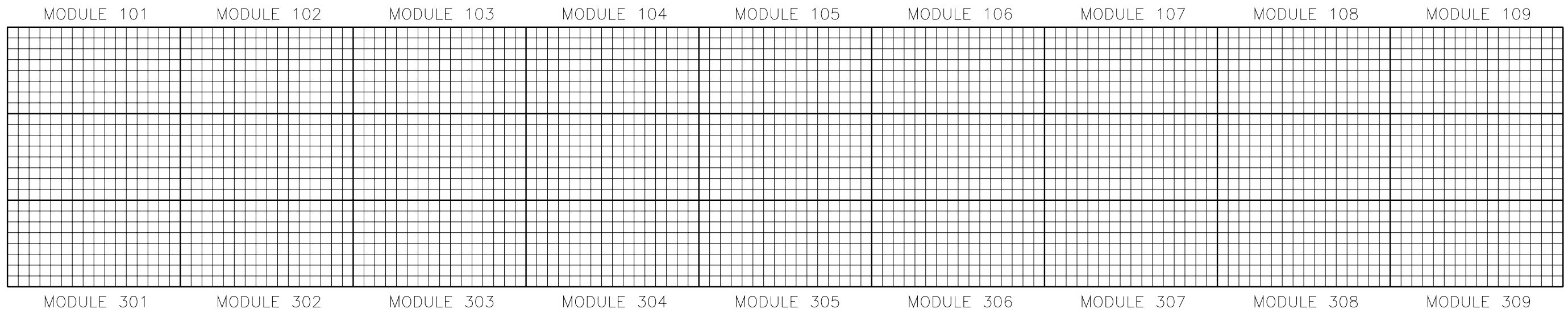
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FRONT VIEW
24 X 144 DISPLAY SHOWN

DAKTRONICS, INC. BROOKINGS, SD 57006	
PROJ: 1600 SERIES MESSAGE BOARDS	
TITLE: FORM, LAMP TEST, 24 X 144	
DES. BY:	DATE: 09NOV99
REVISION	SCALE: 1=2
APPR. BY:	1176-R11B-123847

REV.	DATE	DESCRIPTION	BY	APPR.