

**Galaxy Full Matrix Display
Outdoor 34mm Monochrome
3400 Series**

Procurement Specification

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DAKTRONICS

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Section 1: Introduction

This document contains procurement specifications for a monochrome LED display based on Daktronics, Inc. Galaxy Full Matrix 34mm Monochrome 3400 display series. The Galaxy display offers text, graphics and animation display capability. Specifications describe major 3400 Series components, including:

- ∞ Display Construction
- ∞ Controlling software
- ∞ Signal connection
- ∞ Approvals

Specifications also address other key LED display project needs:

- ∞ LED display manufacturer qualifications
- ∞ Product testing
- ∞ Product documentation

This specification describes attributes common to all sizes of the Galaxy 34mm Monochrome Series. For features and data that are unique to different sizes, refer to the tables below.

Model Specification Table: 3400 Series 34mm Monochrome Amber

Model #	Pixel Rows [A]	Pixel Columns [B]	Cabinet Height (In.) [C]	Cabinet Length (In.) [D]	Cabinet Depth (In.) [E]	Weight (lbs) [F]	Max Power (Watts/face) [G]	Typ. Power (Watts) [H]	Character Height
AF-3400-48x112-34mm-Amber-SF	48	112	5'10"	13'0"	8"	670	2210	550	9"-64"

Daktronics Galaxy model data is subject to change.

This document is available in MS Word® format. Contact Daktronics for additional Galaxy product information.

Section 2: Special Provision for Galaxy Full Matrix Outdoor 34mm Monochrome 3400 Series LED Displays

2.1 Introduction

This special provision describes minimum specifications for the Galaxy 34mm Monochrome Series light emitting diode (LED) displays required by the contract. The contractor shall provide all the materials, software, and services necessary to deploy an electronic LED system that fully complies with the functional requirements specified herein, including incidental items that may have been inadvertently omitted.

2.2 Pre-Build Technical Submittal

The electronic LED display manufacturer shall provide a complete technical submittal within 60 days of contract award and shall not proceed manufacturing the LED Matrix until the Engineer has approved the submittal.

The submittal shall include:

- ∞ All LED display manufacturer qualifications, as specified herein.
- ∞ LED display shop drawing, including an illustration of the recommended installation method.
- ∞ LED display riser diagram
- ∞ LED display control software operator's manual

2.3 LED Display Manufacturer Qualifications

The LED display manufacturer for this contract shall:

- ∞ Have been in the business of manufacturing permanently mounted outdoor displays, for a minimum period of five (5) years prior to the contract bid date. An "LED" display contains pixels constructed solely of high-intensity discrete lighting components.
- ∞ Have in operation a minimum of fifty- (50) large outdoor permanently mounted LED displays in Houston Texas. Each of these LED displays shall have operated successfully for a minimum period of one (1) year prior to the contract bid date.
- ∞ Have been in business under the same corporate name for a period of no less than twenty (20) years prior to the contract bid date.
- ∞ Utilize a documented in-house quality management procedure that has been in place for no less than two (2) years prior to the contract bid date.
- ∞ Shall have factory owned office located in Houston for main contact and service.

Experience with manufacturing the following types of electronic sign products will not satisfy the requirements of this LED display specification:

- ∞ Indoor displays of any size or type
- ∞ Back-lit displays
- ∞ Split-flap displays
- ∞ Any type of display that is not pixilated and can not be programmed to show a nearly infinite quantity of messages
- ∞ Displays that have a pixel technology comprised of something other than high-intensity light emitting diodes (LED). Examples of unacceptable technologies are incandescent lamp, liquid crystal, fiber optic, flip disk, flip-fiber combination, and flip-LED combination

2.4 Glossary

The following abbreviations and definitions shall govern this specification:

- ∞ **100% Relative Humidity**-The condition under which the amount of water vapor in the air is the maximum possible at the existing temperature and pressure.
- ∞ **A**-Amperes
- ∞ **AllnGaP**-Aluminum Indium Gallium Phosphide. A type of LED semiconductor.
- ∞ **Baud Rate**-The speed of data transmission
- ∞ **Column**-A vertical group of pixels
- ∞ **Com Port**-A connector on the back of the controller PC. The Com Port is used to control the display network through either a 9 or 25 pin serial connector.
- ∞ **Display Controller**-Controls the data for the entire display. It is located behind the bottom left module
- ∞ **Display Configuration**-Refers to a display's model number, address, etc. This information will be automatically displayed when the display is powered up.
- ∞ **Fiber Optic**-A standard communication method using light (signal) transmitted through a glass fiber. Fiber optic cable has a maximum length of 2,000 feet. A signal converter is required.
- ∞ **LED**-A light emitting diode is an electrical component, which creates light when energized.
- ∞ **Modem**-The modem option uses standard telephone cable routed through conduit. Ask the telephone company which the TIP uses colors, and the RING for signal hook up. **NOTE:** The telephone lines must be dedicated lines and not run through a switch board/communications system.
- ∞ **Module**-A unit of the display, which contains the LEDs.
- ∞ **Network**-consists of multiple displays connected to each other.
- ∞ **RS232**-Is a standard PC communication type with a maximum cable length of 25 feet (8 meters).
- ∞ **RS422**-A standard differential communication type with a maximum cable length of 4,000 feet.
- ∞ **Row**-A horizontal group of pixels.

- ∞ **Sign Address**-An identification number assigned to each display in a network. The control software uses the address to locate and communicate with each display independently. Displays that are on the same network cannot have the same address.
- ∞ **Signal Converter**-Converts the data from RS232 to RS422 or RS232 to light signals. The signal converter is used in RS422 systems or fiber systems respectively.
- ∞ **VAC**- Volts of alternating current
- ∞ **VDC**- Volts of direct current
- ∞ **Venus 1500[®]**-Is a Daktronics designed, Windows based software used to create and edit messages on the displays.

Section 3: Display Construction

The display housing shall provide access to all LED display modules, electronics, power supplies, photo sensor assemblies, wiring, and other internal Display components. The cabinet consists of two major assemblies: the face panel and the display housing.

3.1 General Specifications

Note: Refer to the specifications table in **Section 1** for dimension information.

Dimensions – Display housing dimensions shall measure [5'10"] inches tall by [13'0"] inches wide. The front-to-back housing depth shall measure [8"] inches.

Weight – Display weight shall be approximately [5'10"] pounds/kg.

Power – Maximum AC power shall exist at [2210] watts, when 100% of the pixels are operating at their maximum possible drive current.

Display shall operate from one of the following power sources:

- ∞ 120 VAC, 50/60 Hz single-phase, including neutral and earth ground

The Display housing shall be constructed to have a neat, professional appearance. The housing shall protect internal components from external contaminants including: rain, ice, break dust, and corrosive elements.

Display shall operate in a minimum ambient temperature range of -40 to +120° F (-40 to +50° C) and to a 100% humidity.

Internal display component hardware (nuts, bolts, screws, standoffs, rivets, fasteners, etc.) shall be fabricated from stainless steel, aluminum, nylon, or other durable corrosion-resistant materials suitable for the signage application.

3.2 Housing Frame

In order to provide structural integrity of the display housing and long life of the entire display, the housing frame shall be constructed of aluminum. To meet the anti-corrosive, degradation, and oxidation requirements, the display housing aluminum sheet quality shall be no less than the properties of alloy 5052-H34.

3.3 Exterior Finish

The LED display cabinet shall be painted with automotive-grade acrylic urethane paint.

3.4 Front Face Construction

To meet the display readability requirements the front face must be constructed in such a manner that it provides high contrast, low sunlight reflection, and durability in all weather and site conditions.

Surface materials in the LED active area such as metal, plastic, or other face materials must be designed for low sunlight reflectivity.

Minimum features of front face shall:

- ∞ Include louvers for contrast enhancements
- ∞ Provide UV resistance to minimize discoloring
- ∞ Provide water shedding ability
- ∞ Withstand all general weather conditions

3.5 Serviceability

The display housing shall provide safe and convenient front service access for all modular assemblies, components, wiring, and other materials located within the housing. All internal components shall be removable and replaceable by a single technician with basic hand tools. Displays shall be designed with service features that minimize potential bodily harm.

Service access shall be easily obtained by removing individual LED modules. Removing the associated module as specified in the component layout diagram shall access internal components.

3.6 Display Components

Electrical display components shall be 100% solid-state.

The presence of ambient radio signals and magnetic or electromagnetic interference, including those from power lines, transformers, and motors, shall not impair performance of the display system. The display system shall not radiate electromagnetic signals that adversely affect any other electronic device.

The display shall contain a full LED matrix composed of [48] pixel rows high by [112] pixel columns wide. The LED display shall display messages that are continuous, uniform, and unbroken in appearance. The following sections detail the necessary components of a high quality LED display.

3.7 Display Controller

- ∞ The controller shall be able to run independently from the controlling computer allowing the display to operate even when computer is unhooked or turned off
- ∞ All signal inputs shall be protected, by transient protection or optical isolation (with the exception of RS232)

- ∞ Communication protocol shall support other products from the vendor such as other outdoor or indoor displays of varying sizes and/or colors
- ∞ Shall be able to be operated via serial, radio, fiber or Ethernet communication.
- ∞ Each controller shall be connected to a light sensor allowing each LED display to automatically adjust a minimum of 64 levels of brightness according to display direction and lighting conditions.
- ∞ The controller shall allow connection to a temperature sensor that provides accurate site temperatures.
- ∞ Controller will have a time of day clock/calendar
- ∞ Active messages, stored messages, message schedules, display configuration, time, and date shall be stored in non-volatile memory. No external power will be required to maintain this data.
- ∞ Controller can be configured with a unique name for the display.

LED Display Modules

LED modules shall be constructed for clear readability, long life and ease of service.

Modules shall be mounted to an internal aluminum frame using hardware that requires basic hand tools for removal and replacement. Each display module shall be constructed as follows:

- ∞ An LED module shall consist of LEDs and drive electronics mounted on a Printed Circuit Boards (PCB).
- ∞ LEDs shall be Auto inserted in order to maintain quality and uniformity of the LEDs within each LED module.
- ∞ All PCBs shall be wave soldered to ensure uniformity, quality and durability of all solder joints.
- ∞ All PCBs shall be cleaned in a manner so as not to contain more than 2 parts per million contaminants.
- ∞ All PCBs shall be coated to protect electronics against corrosion.
- ∞ LED display module signal and electrical connections shall be of the quick-disconnect locking connector type. Removal of a display module from the display shall not require a de-soldering operation.
- ∞ All LED display modules in a single display shall be identical in construction and interchangeable throughout the display.
- ∞ Module LED uniformity should be consistent to the point that modules can be interchanged between displays without a noticeable difference in appearance.
- ∞ Modules shall have louvers for sunlight shading and enhanced contrast.
- ∞ Modules should have a dark potting for additional contrast and protection of LEDs.
- ∞ Removal of one or more modules shall not affect the displays structural integrity.
- ∞ The distance from the center of one pixel to the center of all adjacent pixels shall be 34 mm both horizontally and vertically.
- ∞ The failure of a single pixel shall not cause the failure of any other pixel in the display.

Discrete LEDs

Pixels shall be constructed with discrete LEDs. Discrete LEDs shall conform to the following specifications:

- ∞ LEDs shall be flush mount, ultra-bright, solid-state light emitting diodes constructed of AlInGaP technology.
- ∞ The LED lens diameter shall be 0.2 inches (5 mm). This is sometimes referred to as a T 1-3/4 style LED package
- ∞ LEDs shall emit either red or amber light that has a peak wavelength of 630 ± 4 nm and 592 ± 4 nm respectively.
- ∞ LEDs used in all LED displays provided for this contract shall be from the same manufacturer and of the same part number.
- ∞ LED half life shall be a minimum of 100,000 hours

Regulated DC Power Supplies

The LED modules shall be powered with regulated switching DC power supplies. Power supplies shall protect the LED pixel, LED display, and driver circuitry in the event of power spikes or surges.

Regulated DC power supplies shall conform to the following specifications:

- ∞ Operating input voltage range: +85 to +264 VAC
- ∞ Power supply efficiency: 74%, minimum
- ∞ Power factor rating: 0.95, typical
- ∞ Over current protection: 105%
- ∞ Over voltage protection: 115 – 140%
- ∞ UL listed.

Internal Wiring

Wiring for LED display modules and other internal components shall be installed in the housing in a neat and professional manner. Wiring shall not impede the removal of display modules, power supplies, or other display components. Wires shall not make contact with or be bent around sharp metal edges. LED display module power and signal wiring shall be cut to a length, and labeled. All wiring shall conform to the National Electric Code.

The LED display shall be UL and ULC listed, and FCC Class A compliant.

Transient Protection

The display shall be protected from electrical spikes and transients.

3.8 Earth Grounding

The manufacturer shall provide an earth ground lug in the display. The installation contractor shall provide the balance of materials and services needed to properly earth ground the display.

Section 4: Display Performance

4.1 Display Capability

The display shall contain a full LED matrix equaling a minimum of [48] pixel rows high by [112] pixel columns wide. The LED display shall present messages that are continuous, uniform, and unbroken in appearance.

The LED display shall be capable of displaying alphanumeric character fonts measuring a minimum of 9 inches tall.

The LED display shall have a minimum of 64 measured shades of monochrome amber. This does not include stages of dimming.

The display shall be able to display messages composed of any combination of alphanumeric text, punctuation symbols, and graphic images.

Displays shall be legible under the following conditions:

- ∞ 24 hours per day and in most normally encountered weather conditions
- ∞ During dawn and dusk hours when sunlight is shining directly on the display face or when the sun is directly behind (silhouetting) the display

When powered on, the display will present the following information at a minimum on the display face:

- ∞ Product name
- ∞ Size of pixel matrix
- ∞ Firmware revision
- ∞ Communication port configuration information
- ∞ Frequency of the AC power line
- ∞ Hardware address of the controller
- ∞ Software address of the controller
- ∞ Name of the sign
- ∞ Indicate if a modem is present in the display

4.2 Control and Communications

Its own display controller shall control each display. The display controller shall be a stand-alone processor, which does not require continuous communication with control software in order to perform all functions.

The display controller shall be able to receive instructions from and provide information to computer containing control software using the following communication modes:

- ∞ **RS232/RS-422** – Via direct RS232 connection or using an RS232 signal converter. The RS422 signal converter shall provide signal optical isolation between the display and the control computer and/or network.
- ∞ **Radio communications**—Via a server and client that is placed in line of sight. Shall use frequency hopping and password protection for security.
- ∞ **Fiber Optic Cable** – Via fiber optic cable from a RS232 signal converter.
- ∞ **Ethernet --** Via 10base-T or 100base-T Ethernet connection.

Section 5: Control Software

The control software for the displays shall be windows based. It shall provide simple, user-friendly features for creating, editing, scheduling, running and deleting messages.

The software shall include profanity protection.

5.1 Messaging

- ∞ The display shall have the ability to store a minimum of 100 messages
- ∞ Each frame shall have the ability to contain a minimum of 50 frames
- ∞ Hold times for each frame must be variable in 0.1 second increments with a minimum of 0 seconds and a maximum of 1 hour
- ∞ Each message shall be stored in a single file
- ∞ Messages shall run in a looping queue
- ∞ The software must have the ability to schedule the messages
- ∞ A single frame shall encompass the entire face of the display
- ∞ The contents of a text window shall be capable of being left, center, or right justified horizontally
- ∞ Messages may be retrieved from the display for editing
- ∞ Messages shall consist of a series of frames with each frame containing a set of windows.
- ∞ Each frame may have a bitmap in the background with the ability to overlay text in windows.
- ∞ Windows may be placed free form at any location within the frame.
- ∞ Windows may be overlapped.
- ∞ Text windows may be assigned foreground and background colors.
- ∞ Text windows have a transparent background.

5.2 Display of Alphanumeric Text

For message creation, the display shall support the storage and use of a minimum of five (5) English alphanumeric character fonts. Foreign language characters shall also be included in the available font set. Additional fonts shall be downloadable and savable. Fonts shall be able to be created utilizing a font editor.

Each font shall include the following characters at a minimum:

- ∞ The letters “A” through “Z”, in both upper and lower case
- ∞ Decimal digits “0” through “9”
- ∞ A blank or space
- ∞ Punctuation marks, such as: . , ! ? - ‘ ’ ”
- ∞ Other characters, such as: # & * + / () [] < >

Additionally, each text font will include the following in the extended ASCII range:

- ∞ Eight (8) directional arrows: ↓, ↘, ©, ™, ⋄, , ®, and Σ
- ∞ A minimum of 25 characters used for the display of non-English Latin-based text (ie., Ç and é)

Font files shall include data that includes the inter-character (horizontal) spacing.

The following character font files shall be supplied with the display for this contract:

- ∞ **“Normal 7”** or **“7x4 Single Stroke”** – Characters average seven (7) pixel rows high by four (4) pixel columns wide, have a single-pixel stroke width, and provides one pixel column of inter-character spacing
- ∞ **“Wide 7”** or **“7x6 Double Stroke”** – Characters average seven (7) pixel rows high by six (6) pixel columns wide, have a two-pixel stroke width, and provides one pixel column of inter-character spacing
- ∞ **“Fixed Width 7”** – All characters are seven (7) pixel rows high by five (5) pixel columns wide, have a single-pixel stroke width, and provides one pixel column of inter-character spacing
- ∞ **“Graphic 7”** – Displays graphical characters. A typical font is seven (7) pixel rows high with varying width and provides no inter-character spacing
- ∞ **“Normal 16”** – Characters average sixteen (16) pixel rows high by eight (8) pixel columns wide, have a two-pixel stroke width, and provides one pixel column of inter-character spacing
- ∞ **“Graphic 15”** – Displays graphical characters. A typical font is seven (15) pixel rows high with varying wide and provides no inter-character spacing
- ∞ **“Fixed Width 15”** – All characters are fifteen (15) pixel rows high by nine (9) pixel columns wide, have a two-pixel stroke width, and provides one pixel column of inter-character spacing

If the display is greater than 16 pixel rows high, the following fonts will be substituted for the “Normal 16” included above.

- ∞ **“Normal 15”** or **“15x6 Double Stroke”** – Characters average fifteen (15) pixel rows high by eight (8) pixel columns wide, have a two-pixel stroke width, and provides one pixel column of inter-character spacing. Replaces “Normal 16 font listed above”
- ∞ **“Normal 23”** or **“23x11 Double Stroke”** – Characters average twenty-three (23) pixel rows high by eleven (11) pixel columns wide, have a three-pixel stroke width, and provides two pixel columns of inter-character spacing
- ∞ **“Normal 31”** – Characters average thirty-one (31) pixel rows high by thirteen (13) pixel columns wide, have a quad-pixel stroke width, and provides two pixel column of inter-character spacing

Text may be displayed in several modes including:

- ∞ Outline
- ∞ Drop shadow
- ∞ Bold
- ∞ Italic
- ∞ Underline

The software shall have the ability to copy and paste text from most windows applications.

5.3 Time, Date and Temperature Fields

The software shall have the ability to display time and date in widely used formats within a message. The software shall be programmable to automatically adjust time zone offsets.

The software shall have the ability to accurately display local temperature in both Fahrenheit and Celsius. A feature will be included to calibrate the temperature sensor up or down in the range +/- 9°F.

5.4 Display of Graphic Images

The display and control software provided for this contract shall have the capability of using “graphic frames”. The display shall be able to show messages containing graphic images of any size that will fit on the LED matrix.

5.5 Presentation Modes

- ∞ **Change / Instant**
- ∞ **Roll (Right, Left, Up, Down)**
- ∞ **Scroll (Right to left & Left to Right)**
- ∞ **Travel**
- ∞ **Flash**
- ∞ **Scroll**
- ∞ **Wand**
- ∞ **Unveil**
- ∞ **Zoom**
- ∞ **Splice**
- ∞ **Slot Machine**
- ∞ **Radar**
- ∞ **Kaleidoscope**
- ∞ **Page Turn**
- ∞ **Coalesce**

5.6 Hold Effects

- ∞ **Twinkle**
- ∞ **Flash**
- ∞ **Steady**
- ∞ **Bijou**
- ∞ **Rumble**

5.7 Message Exit Effects

- ∞ Stay
- ∞ Dissolve
- ∞ Venetian
- ∞ Roll
- ∞ Scroll
- ∞ Wand
- ∞ Unveil
- ∞ Zoom
- ∞ Page Turn
- ∞ Splice
- ∞ Slot Machine
- ∞ Radar
- ∞ Kaleidoscope
- ∞ Blank

5.8 Display Communication and Protocol

All communications between the display control software and display(s) shall be accomplished using a protocol meeting the following specifications:

Multi-layer protocol consisting of data-link and application layers at a minimum

- ∞ The data-link protocol will use a check summing technique to guarantee packet integrity. Packets must be discarded if the packet's check sum is not valid
- ∞ Each display on the network will be assigned a unique physical address in the range 1 to 240
- ∞ Each display must respond to every packet addressed to it, except in the case of broadcast addressing. Displays must never initiate communication on the network. Each response will indicate the success or failure of the display to act upon the received packet
- ∞ A software address may be assigned to each display. The address will override the physical address
- ∞ Broadcast addressing will allow multiple displays to receive one packet

5.9 Diagnostics and Status Information

The software shall be capable of displaying operational status of each display. This shall minimally include the following information:

- ∞ **Display Name:** Name of the display as entered by the operator
- ∞ **Address:** An identification number associated with a specific sign by which the software locates the sign to establish communications
- ∞ **Communications Status** – Pictorially represented as “Normal” or “Failed”
- ∞ **Current Message** – As {name of message being displayed} or “Blank”
- ∞ **Time and Date** – As running on the display
- ∞ **Last Reset** – Date and time of last communications with sign

- ∞ **Available Memory** – Pictorially and numerically represented memory available in the LED controller.
- ∞ **Brightness** – The intensity control of the LEDs at which the display is currently operating, set as “Automatic” or “Manual”
- ∞ **Firmware Version** – Current firmware version of the LED controller
- ∞ **Schedule Status** – Indicates if a schedule is active at the display