

629 LIGHT EMITTING DIODE (LED) ELECTRONIC SIGN**629.01 DESCRIPTION**

Work under this item includes provision of acceptable design and operating requirements for Light Emitting Diode (LED) Electronic Signs, for display of specific messages, as required in the contract documents.

629.02 GENERAL REQUIREMENTS

All sign messages shall meet the standards contained in the most recent edition of the Manual on Uniform Traffic Control Devices, and Standard Highway Signs, unless otherwise indicated.

All sign messages shall be at least standard size, as defined in the Standard Highway Signs.

Signs shall have message display capabilities on both sides of the sign. Signs shall be capable of displaying one or more multiple messages on each side of the sign.

Sign messages shall be formed of rows of Light Emitting Diodes (LEDs).

Sign messages shall be clear and legible under any ambient lighting condition. When not illuminated, the sign message shall not be visible regardless of outside ambient lighting conditions.

Signs shall be no more than 8 inches in depth, excluding the visor. All sign messages shall be displayed at full intensity within a 15° cone of vision centered about the optical axis. Signs shall be provided in three (3) sizes:

1. 18 inches by 24 inches. This sized sign shall be clear and legible at distances up to 200 feet.
2. 30 inches by 30 inches. This sized sign shall be clear and legible at distances up to 500 feet.
3. 36 inches by 36 inches. This sized sign shall be clear and visible at distances up to 500 feet.

The sign assembly shall be designed to ensure that all internal components are adequately supported to withstand mechanical shock and vibration from wind ratings meeting AASHTO requirements for sustained winds of 80 mph with a 30% gust factor.

Unless otherwise specified, only red and lunar white LED shall be used to portray messages. Red shall be used to form all letters, arrow way arrows, and the left turn arrow in the symbolic No Left Turn sign.

Each sign delivered to the District of Columbia must include a full complement of six (6) drive modules in the driver rack. Drive modules not used for the sign application shall be retained by the District of Columbia for maintenance purposes.

Each sign delivered to the District of Columbia must include two (2) visors; one to be mounted on the sign during field installation, and one to be used for future maintenance purposes.

629.03 SIGN HOUSING CONSTRUCTION

General. The sign housing shall be fabricated from extruded aluminum with a minimum thickness of 0.125 inches.

Signs featuring messages on one side of the sign only shall feature a flat aluminum panel welded to the back of the housing.

All housing corners and seams shall be heli-arc welded to provide and ensure a weatherproof seal around the entire housing.

The housing shall meet the requirements of NEMA Type 4 enclosures

The housing shall be reinforced as necessary at proper locations to provide structural integrity.

Each sign housing shall include four (4) screened holes, 3/16 inch in diameter at the bottom of the housing.

Housing Door. Each sign housing shall include an extruded aluminum door with minimum thickness of 0.125 inches.

Each door shall be appropriately welded and reinforced for structural integrity and to prevent excessive door flexure when open.

Each door shall include a drip edge around the mating flange.

The extruded aluminum sign door shall be hinged on the left side with a continuous, full length stainless steel hinge.

Each door shall be locked on the right side of the sign using a minimum of two (2) Number 3 stainless steel ¼ turn link-locks to allow tool free access to the interior of the sign.

Door gaskets shall be 3/16" x 1" neoprene and shall provide a continuous weatherproof seal between the door and the housing.

One side of the door shall be removable to allow access to the sign face.

A retaining rod shall be provided to hold the front door in the open position.

Mounting Hubs. Each sign housing shall feature mounting hubs on the top and the bottom of the sign for cable access and to facilitate mounting and affixing to poles.

Mounting hubs shall be cast aluminum alloy with 1-½ inch standard pipe threads.

Hubs are to be mounted on a gasket to the sign housing by three 5/16 x 1 inch stainless steel hex head bolts and nuts.

Gaskets shall be serrated and shall lock into the housing to prevent sign mis-alignment.

The connection between the sign housing and the mounting hubs shall be waterproof.

The holes in the sign housing at the mounting hubs shall be 1-½ inches in diameter and shall be machined to eliminate burrs that may snag electrical cables.

Visor. The entire housing shall feature a visor that extends over the top and both sides of the sign.

Each visor shall be 0.063 inch thick aluminum.

Each visor shall be 6 inches in length and shall extend off the housing door.

Each visor shall be affixed to the sign housing using stainless steel screws.

Face Lens. The face lens shall fit into the door. The entire sign face shall be protected by a ¼ inch clear polycarbonate lens in the door frame.

The lens shall be non-glare matte-finished polycarbonate with UV resistant surface treatment and light transmission properties of at least 82%.

The lens shall minimize all unwanted reflections.

The entire display face, including the face lens and the LED Message Display Board, shall be assembled as a one-piece self-contained module that can be easily removed from the sign housing without the need of any tools.

Sign Finishes. The entire sign housing shall be acid etched and painted with two (2) coats of zinc chromate primer.

The interior of the sign housing assembly and the inside of the visor shall be painted with two (2) coats of high quality flat black enamel.

The exterior of the sign housing, sign door frame, and the outside of the visor shall be painted with two (2) coats of high quality enamel, colored battleship gray (MVC 1417, GE LEXAN No. 7040Z, Federal Color No. 16099). In certain specified applications, Federal Black, Color No. 27038 may be substituted for battleship gray.

Vents. Two air vents shall be installed on the sides of the housing; one at the lower lefthand side and one at the upper right hand side of the sign. Vents shall be designed to prevent moisture or rainfall from penetrating the housing and both shall have replacable air filters to keep the enclosure dust-free.

Modularity. The sign construction shall be of a modular configuration consisting of hand-removable, self-contained modules, message display, rack-mounted individual message drivers, driver rack assembly and the housing shell.

Fasteners and Hardware. All mechanical fasteners and hardware shall be corrosion-resistant stainless steel.

629.04 ENVIRONMENTAL REQUIREMENTS

The sign shall be rated for use in ambient operating temperatures in the range of minus 40 ° C (minus 40 ° F) to plus 74 ° C (plus 165 ° F). The LED display module shall be completely sealed against dust and moisture intrusion in conformance with NEMA Moisture Resistant Standard 250-1991, Section 4.7.2.1 and 4.7.3.2 for Type 4 enclosures to protect all internal components.

629.05 CHROMATICITY

The measured chromaticity coordinates for red, yellow, green, lunar white and Portland orange shall conform to the chromaticity requirements of Section 8.04 and Figure 1 of the

VTCSH Standards. Chromaticity requirements shall remain unchanged over the input line voltage of 95 VAC to 135 VAC.

The measured chromaticity coordinates of LEDs shall conform to the following requirements:

RED:	Y: not greater than 0.308 or less than 0.998 – X:
YELLOW:	Y: not less than 0.411, not less than 0.995 – X, not less than 0.452.
GREEN:	Y: not less than 0.506 – 0.519 X, nor less than 0.150 + 1.068 X, not more than 0.730 – X.
PORTLAND ORANGE:	Y: not greater than 0.390, not less than 0.331, nor less than 0.997 – X
LUNAR WHITE:	X: not less than 0.290 nor greater than 0.330 Y: not less than 1.5X-0.175, or greater than 1.5X-0.130

629.06 LED MESSAGE DISPLAY BOARD

The message display shall consist of LEDs mounted on a PCB Matrix with a matte black solder mask. The universal PCB matrix shall have the capabilities to display sign messages conforming to MUTCD requirements. LEDs shall be arrayed on the mat to depict the required message.

The LEDS shall be arranged in a manner to form the outline of the symbols and shall be distributed evenly along the message outline.

The maximum distance between consecutive LEDS shall be .550 inches and shall vary by more than 10%.

The PCB matrix shall have a maximum thickness of 0.93 inches.

The PCB shall have a component identifier screen.

The red LEDS shall be of the latest Alln GaP Technology; the lunar white LEDS shall be of the latest In GaN Technology.

The minimum nominal luminous intensity of the LEDs shall be 6,000 mcd at 20mA.

The individual LED light sources shall be interconnected so that a catastrophic failure of a single LED will result in a total loss of not more than 5 % of the signal light output.

There shall be no electronic components visible from the front of the display. The display face shall consist solely of LEDs mounted on a mat black PCB.

The rear side of the PCB shall be protected by a molded polymeric back cover to seal and protect it from any possible damages.

The display PCB with back cover shall fit into the front door which consists of an aluminum frame and face lens.

The display module shall have a multi-conductor cable with an individual 2-pin connector for each message.

629.07 DRIVE CIRCUITRY

The sign shall feature one individual LED drive module for each message. A drive module shall be provided for each individual symbol, for each message line and for each overlapped message on any given line. The drive modules shall be designed to be rack-mounted as per standard industry dimensions of 6.5 inches x 4.5 inches.

The drive modules shall consist of a PCB (0.62 inches in thickness) with an aluminum front plate and handle, as used for inductive loop detectors.

The drive modules shall drive the LEDs at a DC current not exceeding the maximum rating as recommended by the LED manufacture (20 mA).

The drive modules shall regulate the LED drive current to compensate for line voltage fluctuations over a range of 95 VAC to 135 VAC. The luminous output of the display shall not vary more than 10% over the voltage range and shall not be perceptible to the human eye.

The drive modules shall be fused and shall include voltage surge protection to withstand high-repetition noise transients and low-repetition high-energy transients as stated in section 2.1.6, NEMA Standard TS-2, 1992.

The on-board circuitry shall meet FCC title 47, sub-part B, section 15 regulations concerning the emission of electronic noise. The circuitry shall ensure compatibility and proper triggering and operation of load switches and conflict monitors in signal controllers currently in use in the District of Columbia.

The drive modules shall have a capacity of 25 watts. The modules shall be designed to maintain a constant LED drive current regardless of the outside temperature, within a range of minus 30 ° C to + 40 ° C.

The drive modules shall be designed to dim automatically based on the ambient light level. In order to reduce the long-term degradation of LEDs, the automatic dimming circuit shall be tuned to reduce the light intensity of the display by 35%. The dimming circuit shall have a 30 second delay to prevent interference caused by shadows or headlights. LED drive current shall be regulated effectively when in the dimmed state.

The drive modules shall be designed to monitor the proper operation of the message display and to provide an alarm if the display is not operational. The drive modules shall be capable of providing a confirmation or alarm signal which can be configured for 120 Vac or 24 Vdc PLC application (sinking or sourcing type). In the event of a malfunction in one sign drive module rendering that part of the message blank, the monitoring circuit shall detect the malfunction and disable all other drive circuits displaying a blank sign to prevent any possible conflict.

Drive modules shall include a green LED for power status and a red LED for alarm status.

All electronic components shall be standard industry type, available from wholesale electronic distributors.

629.08 DRIVER RACK ASSEMBLY

The driver rack assembly shall be a single part self contained module consisting of an interconnect PCB and an ionized aluminum frame. The driver rack shall have the capacity to house up to six (6) drive modules.

The aluminum rack shall be vented from top to bottom and shall include latches to secure the modules in place. The rack assembly shall be secured in the sign enclosure by four (4) captive type spring-loaded thumbscrews. The entire assembly shall be removable in less than one minute without the need of any tools.

The interconnect PCB shall include connectors for 6 drive modules and 6 display messages. The interconnect PCB shall include terminals for all field wiring, 120VAC controls, external photocell, and alarm signals. The field wiring and display terminals shall be spring-loaded, anti-vibration type.

All interconnections within the sign shall be accomplished through the PCB. No internal wiring shall be permitted with the exception of a single cable for the message display.

The interconnect PCB shall be equipped with a 10 position binary switch for each message to allow the drive current to be calibrated for each individual message and to increase drive current in case of long-term degradation to LEDs. Each step shall provide a 1mA increment up to a maximum of 25mA.

All connectors and terminals shall be identified via the silk screen identifier on the surface of the PCB.

The driver rack assembly shall be mounted on the left side of the sign enclosure.

All PCBs shall be mounted vertically to facilitate air-cooling and to prevent collection of dust and moisture.

629.09 ELECTRICAL REQUIREMENTS

The sign power rating shall not exceed 15 watts per message. Each sign shall operate from a 60HZ \pm 3HZ AC line over a voltage ranging from 95 volts to 135 volts. Fluctuations in line voltage shall have no visible effect on the luminous intensity of the sign message. The operating voltage of the LEDs shall be 120 volts AC. All operating parameters shall be measured at this voltage. Sign circuitry shall prevent perceptible flicker to the unaided eye over the 95 to 135 volt range.

The sign's on-board circuitry shall include voltage surge protection to withstand high-repetition noise transients as stated in Section 2.1.6 of the NEMA Standard TS-2, dated 1992.

Each sign and associated on-board circuitry shall be in compliance with FCC noise regulations and must meet FCC Title 47, Subpart B, Section 15 regulations concerning the emission of electronic noise.

Each sign shall be operationally compatible with controller assemblies and peripheral equipment including solid state load switches, flashers, and conflict monitors currently in use in the District of Columbia. Current controller specifications are available for review at the specific request of the Contractor or vendor. Each sign shall feature control circuitry to prevent current flow through the LED module in the off state to avoid any false indication as may be perceived by the human eye during daylight and evening hours.

All LEDs will have an expected lifetime of 100,000 hours.

629.10 WARRANTY

All warranties shall pass from the Contractor to the District of Columbia following final acceptance of the sign after it is placed in service.

Individual LEDs shall be warranted against defects in materials and workmanship for a period of 60 months.

The sign assembly shall be warranted against defects in materials and workmanship for a period of 24 months.

The warranty period for all products shall begin on the date the sign is placed into operational service in the District of Columbia or ninety (90) calendar days after the sign is delivered to the District of Columbia, whichever occurs first.

Replacement signs, LEDs or component parts shall be provided on a one for one basis after receipt by the manufacturer of the failed unit. Replacement of signs, LEDs, or component parts which failed while under warranty shall occur at no cost to the District of Columbia.