

Louisiana  
Department of Transportation  
and  
Development

**Traffic Control Standard  
Number 155  
TS-2 Traffic Signal Cabinet**



Revised February 22, 2024

## DESCRIPTION

This specification sets forth the requirements for NEMA Standards Publication TS 2-2021 compliant ground mount and pole mount TS 2 Traffic Signal Cabinet assemblies. Cabinets shall include all equipment, features and functions specified herein and must be compatible with both Type 1 and Type 2 NEMA TS 2 Cubic/TrafficWare Series 900 ATC, Model No. 980-B240 controller units. Controller shall not be provided with the assemblies.

### **GROUND MOUNT TS 2 CABINET: Product ID 51050**

Ground mount assemblies shall include:

- One (1) TS 2 Power Supply
- One (1) Solid State, Type III, Two-Circuit Flasher
- Eight (8) Flash Transfer Relays
- Sixteen (16) Load Switches
- Four (4) 12-Position Field Terminal Strips
- Two (2) 4-Channel Loop Detector Cards
- One (1) 16-Channel, TS 2 Detector Card Rack
- One (1) 16-Channel Solid State Malfunction Management Unit 2 (MMU2)
- Four (4) Bus Interface Units (BIUs)
- One (1) Global Positioning Device (GPS) and Cable Assembly
- Additional Equipment and Hardware as Specified Herein

The ground mount cabinet shall measure *44" to 46" W x 67" to 77" H x 24" to 26" D* and have a fully open bottom. The bottom of the cabinet shall have enough surface clearance around the bottom edge to fit four (4)  $\frac{5}{8}$ " concrete anchor bolts, centered at least 1-1/2" from the edge, in each corner.

### **POLE MOUNT TS 2 CABINET: Product ID 51060**

Pole mount cabinet assemblies shall include:

- One (1) TS 2 Power Supply
- One (1) Solid State, Type III, Two-Circuit Flasher
- Six (6) Flash Transfer Relays
- Twelve (12) Load Switches
- Three (3) 12-Position Field Terminal Strips
- One (1) 4-Channel Loop Detector Card
- One (1) 16-Channel, TS 2 Detector Card Rack
- One (1) 16-Channel Solid State Malfunction Management Unit 2 (MMU2)
- Three (3) Bus Interface Units (BIUs)
- One (1) Global Positioning Device (GPS) and Cable Assembly
- Additional Equipment and Hardware as Specified Herein

The pole mount cabinet shall measure *30" to 36" W x 52" to 62" H x 15" x 17" D*. The bottom of the cabinet shall have two (2) holes, one (1)  $3\text{-}1/2$ " to  $3\text{-}5/8$ " and one (1)  $1\text{-}1/4$ " to  $1\text{-}3/8$ ". Each hole shall be provided with a National Pipe Thread (NPT) Myers hub. See **Figure 1**.

Pole mount cabinets shall be provided with two (2) C-shape cabinet mounting brackets and a permanently installed reinforcement plate. The mounting brackets shall be pre-attached with bolts to the back of the pole mounted cabinet reinforcement plate. Brackets must have slots for 3/4" banding material and reinforcement plate must be designed to support the weight of the cabinet and the equipment intended to be contained within.

## **GENERAL**

### **Serial Number**

Each cabinet shall have a unique, permanent, waterproof serial number located on the inside of the cabinet near the front.

### **Component Installation Location Perspective**

All installation sites noted within this specification are described from the vantage point facing the interior of the cabinet at the primary door opening.

## **DESIGN REQUIREMENTS**

### **Material**

The cabinet exterior shall be constructed using unpainted sheet or cast aluminum alloy with a minimum thickness of 0.125". The aluminum alloy shall be 5052-H32, or equal, meeting the requirements of ASTM B209. All welds must be neat and of uniform consistency. Shelves and drawers should be of the same material. No wood, wood fiber products or other flammable material shall be used in the cabinet.

The top of the cabinet shall slope to the backside in order to prevent water accumulation on the top surface.

Cabinets shall be provided with two (2) aluminum-lifting eyes or ears attached with a single carriage bolt to permit lifting the cabinet with a sling. The corners of each eye or ear shall be chamfered or rounded and in the down position when shipped.

### **Generator Connection**

Cabinet assembly shall be supplied with a 30A, 3-prong, flanged, male, twist lock Hubbel Model #2615, or equal, generator connector capable of supplying complete power to the traffic cabinet. When an external power source (generator) is connected, the traffic cabinet shall automatically transfer the AC line current from the external generator. When the external power source is removed, the transfer relay must automatically transfer back to the normal AC power without disruption to the signal operations.

The generator connector shall be mounted inside the cabinet and accessible through a flush mounted access door with an external Corbin Type Blank 04266 lock and one (1) brass key. The door shall be hinged for easy access and designed in such a manner that allows the door to be locked while a generator (external power source) is plugged into the connector. Both the lock and the generator connector access port shall be provided with a dust cover that covers the holes when not in use.

## **Doors**

Cabinets shall have one (1) primary door installed on the front to provide access to the components. The door opening shall extend, at a minimum, to the bottom level of the back panel. The door shall be hinged with either one (1) full-length piano hinge with a stainless steel pin or at least three (3) hinges with non-removable stainless steel pins. Hinges shall be mounted in a manner that does not allow them to be removed without first opening the door. Hinges must be designed to support the weight of the cabinet door.

The cabinet door shall be provided with a heavy-duty metal handle, a 3-point latch, a No. 2 Corbin lock and two (2) No. 2 keys. The lock and latch design shall be such that the handle cannot be released until the lock is released.

The doorstop must be designed in accordance with NEMA Standards Publication TS 2-2021, Section 7.5.3., and shall be installed at either the top or bottom of the door.

The primary door shall have a gasket that provides a uniform dust and weather resistant seal around the entire door facing. The gasket material shall be nonabsorbent with a minimum thickness of 0.24" and must maintain its resiliency after long term exposure to the outdoor environment.

The cabinet door shall be louvered with a securely mounted, permanent, washable air intake filter (screen) installed on the interior of the door. Louvers and filter shall be large enough to accommodate the airflow throughout the cabinet.

A police door shall be installed on the primary cabinet door to provide access to a police override panel. A Corbin Type Blank 04266 lock with dust cover and two (2) brass keys shall be installed on the door. The door must also include a gasket that provides a dust and moisture resistant seal.

## **Ventilation**

The cabinet shall have two (2) commercially available fans. Fans shall be thermostatically controlled with an airflow capacity of at least 100 cubic feet per minute and include a screened exhaust vent to prevent excessive back-pressure on the fans. The thermostat must have the ability to be adjusted in the field by switching the fan on and off, a minimum adjustable range of 80° F to 150° F, and include a "press-to-test" switch that tests the operation of the fans.

## **Shelves**

Cabinets shall be supplied, at a minimum, with one (1) controller shelf and one (1) detector card rack shelf constructed from one continuous piece of metal. Shelves shall have raised back edges to prevent equipment from passing the back edge and slotted surfaces to accommodate the fastening of racks and peripherals.

In order to provide sufficient space and ventilation for all applicable components, shelf widths shall make maximum use of available space offered by the cabinet width. Shelves must provide a minimum 0.5" clearance between the back of the shelf and the back of the cabinet with an overall depth as follows:

- Ground mount cabinet shelves shall be 12" deep (+/- .5").
- Pole mount cabinet shelves shall be 10" deep (+/- .5").

Vertical shelf support channels shall allow the shelves to be adjusted in the field. Support channels shall have a single continuous slot to allow shelves to be placed at any height within the cabinet. Channels with fixed notches or holes will not be accepted.

To allow mounting of additional equipment, cabinets shall be equipped with either an additional pair of vertical support channels or a keyhole panel on both sides of the front section of the cabinet.

### **Drawer**

Cabinets shall be supplied with one (1) drawer mounted directly beneath the detector card rack shelf and above the back panel. Drawer shall include a hinged top cover, must open and close smoothly and be capable of supporting up to 50 lbs. when fully extended. Drawer shall be 1.5" (+/- 0.5") thick with a depth that makes maximum use of available space offered by the detector rack shelf. The overall width shall be as follows:

- Ground mount cabinet drawer shall be 23.5" wide (+/- .5").
- Pole mount cabinet drawer shall be 20" wide (+/- .5").

### **Interior Lighting**

Cabinet must be supplied with a minimum of two (2) interior LED lights, one (1) installed in the top to illuminate the entire top half and one (1) installed near the middle to illuminate the bottom half. Lights shall turn on automatically when the cabinet door is opened and turn off when the cabinet door is closed. LEDs must be equipped with a transient suppression device placed across the AC power input to the lights.

## **ELECTRICAL REQUIREMENTS**

### **General**

Cabinet shall be supplied with all necessary cables for the following components, including but not limited to: the controller, the power supply, MMU2, the BIUs, any auxiliary cables, etc.

All SDLC cabling shall be Belden 7203A, or equal.

Outgoing traffic control signal circuits shall be of the same polarity as the line side of the power source.

### **Identification**

Identification sleeves shall be supplied on the power supply, MMU2, controller wires and all other terminals and facilities in accordance with the NEMA Standards Publication TS 2-2021. All sleeve labels shall be waterproof with legible writing and be clearly visible with no obstructions.

### **Wiring**

All wiring within the cabinet shall be neatly installed and routed in such a manner that prevents twists and/or crimps when opening and closing the door and/or raising and lowering the back panel. The controller unit cable shall be at least long enough to reach any point 16" above the controller shelf. The MMU2 cable and any required auxiliary cable shall reach a minimum 24" from the controller shelf.

All wiring and insulation shall be rated for a minimum of 600V. Wiring harnesses, except for those leading to the cabinet door, shall be braided, sheathed in nylon mesh sleeving, or made of PVC or polyethylene insulated jacketed cable. Wiring leading to the cabinet door shall only be sheathed in nylon mesh sleeving or be PVC jacketed cable.

Except where soldered, all wires shall be provided with lugs or other terminal fittings for attachment to binding posts.

The cabinet shall be wired so that the controller unit and any auxiliary equipment will stop timing if a fault activation by the MMU2 is initiated. Cabinet shall be wired for an all red flash should a signal malfunction and/or flash activation occur.

### **TS 2 Power Supply: Product ID 51420**

The power supply shall be a shelf-mounted, enclosed, 24VDC power supply that meets the requirements of NEMA Standards Publication TS 2-2021, Section 5.3.5 except the minimum average continuous current capability shall be as shown below with DC voltages having less than 0.5 volts peak to peak ripple:

- +12 VDC 5.0A
- +24 VDC 2.0A
- 12 VAC 0.250A

Each voltage output shall have individual fuses and line reference LED displays.

The AC neutral (common) and chassis ground shall be provided with copper ground buses that are jumpered together with a minimum number 10 AWG wire. Each bus must have a minimum of ten (10) unused terminals.

Power supply wires shall terminate to terminals on the front of the back panel, bus bars, detector panels, or connectors, as appropriate, via forked terminals. Wires must be long enough to properly reach the point at which it is to be connected.

### **Surge Protection Device (SPD)**

The cabinet shall include a Surge Protection Device (SPD) meeting the requirements of NEMA Standards Publication TS 2-2021, Section 5.4.2.4. The SPD shall be installed between the cabinet AC service input and the load side of the cabinet as part of the power panel. SPD must be rated to operate in an ambient temperature range of - 29°F to +165°F. The device enclosure shall function effectively at the same ambient temperature range and be suitable for outdoor environments.

The Suppressed Voltage Rating shall be 400V maximum and the Voltage Protection Rating 600V maximum as defined by UL1449. The Maximum Continuous Operating Voltage (rms) shall be a minimum of 135VAC.

Devices wired in series shall be rated for 30A maximum continuous operating current at 120V/60 Hz.

The SPD must withstand a peak surge current for an 8 X 20 microsecond waveform; minimum 20 kA for 15 occurrences at 3-minute intervals between surges without damage or degradation to the device (less than a 10% change in operating parameters).

The SPD shall have protection modes for Line to Ground (L-G), Line to Neutral (L-N) & Neutral to Ground (N-G) and a nominal line or system voltage of 120VAC and a minimum short circuit current rating of 20kA.

The ground connection shall connect to the cabinet ground bus by means of a short, copper ground strap or minimum 10 AWG insulated conductor. The line filter and load switch connections must be a 10 AWG or larger wire.

The device must come equipped with NO/NC contacts for a remote alarm and a light or other type of signal to indicate when a failure has occurred in the surge protection circuitry. NO/NC contact connections shall accept or be minimum 18 AWG stranded wire.

All other connections shall be either wire clamping box terminals, lugs, or minimum 12 AWG wire.

### **Radio Frequency Interference (RFI) Suppressor**

Cabinet shall be supplied with one (1) Radio Frequency Interference (RFI) suppressor installed as part of the power panel on the load side of the 30A circuit breaker. RFI shall have a 50A rating and a minimum attenuation of 50 decibels over the frequency range of 200 kHz to 75 MHz and be protected by the Surge Protection Device.

### **Solid State, Type III, Two-Circuit Flasher**

The solid state, type III, two-circuit flasher unit shall be a Traffic Sensor Corp. Model No. 204-15, or equal, rated at 15A per circuit. Flasher shall contain no electro-mechanical devices and must meet the electrical and physical characteristics of NEMA Standards Publication TS 2-2021, Section 6.3.

### **Flash Transfer Relays**

The flash transfer relays shall part of the back panel. They shall be a Struthers-Dunn, Part No. 21ACPX-2/21XBP, or equal, plug-in type relay.

A suppression device shall be supplied per relay. Suppression devices shall be placed on the coil side of the relays. DC relay coils, at a minimum, shall have a reversed biased diode across the coil. AC relays shall have an MOV or equal suppression across their coils. RC networks are acceptable.

### **Solid State Relay**

A 75A, solid state relay, Crydom Part No. A2475, or equal, shall be wired between the RFI suppressor output and the load switch power bus on the power panel. The signal shutdown switch and the flash switch shall control the relay. Relay shall be mounted to a heat sink designed to allow maximum current flow at 165° F without damaging the relay.

### **Load Switches: Product ID 11000**

The solid state load switches shall be a three-circuit type meeting the requirements of NEMA Standards Publication TS 2-2021, Section 6.2.

All load switch output channels shall be protected by surge suppression devices, one (1) per channel. Outputs shall be brought out through the posted 10-32 X 5/16 inch binder head screw terminals of the field terminal strip.

Channels must be able to be wired for a red or yellow flash utilizing simple hand tools and capable of Vehicle, Overlap and Pedestrian movements.

Each load switch socket shall be labeled with a load switch output number for easy identification. No cabinet equipment, including the load switches themselves, may obstruct these identifications. The labels shall be designated from left to right as follows:

- Ground mount cabinets shall be labeled LS1 through LS16.
- Pole mount cabinets shall be labeled LS1 through LS12.

### **Terminals**

Field terminal strips shall be installed horizontally on the lower back panel. All strips and wiring shall be color-coded with color labels that correspond to the appropriate signal indication color, green, yellow and red. Strips must also be consecutively numbered.

A barrier terminal block with a 50A rating shall be installed on the power panel. Terminal block shall include a minimum of three (3) compression fitting terminals designed to accept up to a 4 AWG stranded wire.

All terminals shall be identified in accordance with the cabinet wiring diagram. Where through-panel connectors are used, both sides of the panel shall have the terminals properly identified. Identification shall be permanently attached and as close to the terminal strip as possible. Identification shall not be affixed to any part that is easily removable from the terminal block panel.

### **Conductors**

All conductors between the main power circuit breakers and the signal power bus shall be a minimum size 10 AWG stranded copper wire.

All conductors carrying an individual signal lamp current shall be a minimum size 16 AWG stranded copper wire.

Conductors not listed above shall have a minimum size 22 AWG stranded copper wire.

AC conductors shall be white (neutral/common) and black (line). Equipment grounding conductors shall be green. All other conductors shall be a color different from the foregoing.



## **Power Strip**

A power strip with surge protector shall be mounted in the upper left side of the cabinet and wired to the AC cabinet power. Power strip shall have a minimum of three (3) transformer style plugs and four (4) standard plugs.

## **PANELS AND CARD RACK**

### **General**

All panels shall have legible, high contrast lettering.

All switches, except for detector test switches and preemption switches, shall be heavy-duty toggle switches, rated at 15A or 20A/125VAC.

### **AC Power Panel**

The AC power panel shall be located on the lower half of the right side cabinet wall. The panel shall consist of the RFI suppressor, the surge suppressor, the solid state relay, three (3) circuit breakers, and a GFCI duplex receptacle.

Panel shall include one (1) 30A and a minimum of two (2) 20A thermal type Square "D" QOU 150 Series, or equal, wired circuit breakers. Breakers shall be installed in a position that allows for easy access and provides a clear visual of the rating markings. The 30A breaker shall protect the signal load circuits, controller circuits, MMU2, flasher, and shelf mounted power supply. At minimum, one (1) 20A breaker shall protect the auxiliary equipment and a minimum of one (1) 20A breaker shall be a spare.

The GFCI duplex receptacle shall be wired on the load side of the 20A circuit breaker.

The power panel shall be covered with a minimum 3/16" thick clear non-conductive plastic cover to prevent accidental contact. Circuit breakers must be accessible.

### **Back Panel**

The back panel shall be located on the lower half of the back cabinet wall, no more than 10" but no less than 5" from the cabinet bottom.

Back panels shall be configured in accordance with NEMA Standards Publication TS 2-2021, Section 5.3.1.1 as follows:

- Ground mount cabinets shall be Configuration 4 with a 16-position load bay.
- Pole mount cabinets shall be Configuration 3 with a 12-position load bay.

### **Police Panel**

The police panel, located behind the Police Access Door, shall provide access to the following functions:

- SIGNAL FUNCTION
  - **Type:** On/Off toggle switch.
  - **Label:** "*SIGNAL*"

- **“ON” Mode** – Signal will be in the programmed signal operation.
- **“OFF” Mode** – Signal power will shut off to the signal heads while the controller is running.
- **EVENT FLASH FUNCTION**
  - **Type:** On/Off toggle switch.
  - **Label:** **“EVENT FLASH”**
  - **“ON” Mode** – Controller will apply a program or soft flash through the load switches.
  - **“OFF” Mode** – Controller will run in the normally programmed state.
- **MANUAL FUNCTION**
  - **Type:** On/Off toggle switch and Wired Push Button.
    - The push button wire shall be a coiled, weatherproof cord that is terminated on a terminal strip attached to the back of the police panel. The cord shall extend a minimum length of 5’ and when not in use and coil back to a size that will fit into the police door so that it will close properly.
  - **Label:** **“MANUAL”**
  - **“ON” Mode** – Controller will be in manual operation mode.
    - Manual Mode shall activate the manual control push button, which will advance the controller in accordance with the NEMA standards.
  - **“OFF” Mode** – Controller will run in normal operation mode.
- **SIGNAL FUNCTION**
  - **Type:** Auto/Flash toggle switch.
  - **Label:** **“SIGNAL”**
  - **“AUTO” Mode** – Signal will be in the programmed signal operation.
  - **“FLASH” Mode** – Cabinet will be placed in flash mode through the two-circuit flasher.

### Technician Switch Panel

The technician switch panel with three (3) toggle switches shall be provided on the inside face of the primary cabinet door. Each toggle switch shall have a guard to prevent the switch from being unintentionally activated. The three (3) switches shall have the following functions:

- **STOP TIMING FUNCTION**
  - **Type:** On/Auto toggle switch.
  - **Label:** **“STOP TIMING”**
  - **“ON” Mode** – Controller and any auxiliary equipment shall stop timing.
  - **“AUTO” Mode** – Controller and any auxiliary equipment shall time as programmed.
- **TEST FUNCTION**
  - **Type:** Auto/Flash toggle switch.
  - **Label:** **“TEST”**
  - **“AUTO” Mode** – Controller cabinet will operate as normal.
  - **“FLASH” Mode** – Controller will go into cabinet flash mode.
- **CONTROLLER FUNCTION**
  - **Type:** On/Off toggle switch.
  - **Label:** **“CONTROLLER”**
  - **“ON” Mode** – Controller cabinet will operate as normal.
  - **“OFF” Mode** – Controller power will be off.

### **Preempt/Communication Panel**

The preempt/communication panel shall be installed on the upper left side of the cabinet and contain:

- Three (3) Input Relays
- Three (3) Test Toggle Switches
- One (1) System-Free (Controller Release) Toggle Switch
- Two (2) Terminal Connections
- All necessary interconnection cables

Each preempt circuit shall have a relay and test toggle switches. The input relays shall be plug-in Potter Brumfield K10P series, Magnacraft W-78 series, or an interchangeable equal.

Circuits shall be used to isolate the incoming preempt commands from the controller unit logic circuitry. Circuits shall be programmable to operate with either a normally open or normally closed relay contact by jumpers on a terminal strip that will allow for the use of either a neutral or hot 120VAC input and also protects against accidental contact by service personnel.

To eliminate damage or false preemption commands caused by line transients or lightning surges, the input relay circuits and the preemptor circuitry shall have a protection device with a minimum rating of 20 Joules.

The system-free (controller release) toggle switch shall allow the following functions:

- **SYSTEM-FREE FUNCTION**
  - **Type:** System/Free toggle switch
    - **Position Label 1:** “*SYSTEM*”
    - **Position Label 2:** “*FREE*”
  - “*SYSTEM*” Mode – Controller will operate as normal.
  - “*FREE*” Mode – The local controller will be released to operate in an isolated, fully-actuated manner.

The terminal connections shall be for two (2) twisted pair communication lines. Terminal connections shall be provided with a coordinated 4-stage electrical protection device that includes an integrated closure with input/output terminations and ground connection. The stages shall provide the following protections:

- **Stage 1:** Primary overvoltage protection.
- **Stage 2:** Resettable over current protection.
- **Stage 3:** Secondary clamping voltage protection shall allow peak voltages of no more than 250V.
- **Stage 4:** Fast transient filtering shall provide no less than 40 dB/decade of attenuation to transients above the required pass band.

### **Loop Detector Panel**

The loop detector panel shall be constructed of 0.125” aluminum and installed on the left side of the cabinet. The panel shall provide all connections between detector loops at the street and the 4-channel loop detector amplifier card(s).

Panel shall provide, at a minimum, the following number of connection points for field loop detectors:

Connection Point	Number of Connection Points	
	Ground Mount	Pole Mount
Loop Inputs	32	16
External 24V Power Supply	1	1
Logic Ground	1	1
Chassis Ground Bus Bar	1	1

All inputs from the loops shall be brought either through posted *10-32 X 5/16"* or *8-32 X 5/16"* binder screw terminals. Each loop input pair must be protected by a lightning surge suppressor.

The chassis ground bus bar shall be tied to the loop lead-in grounds and connected to the cabinet by an insulated braided copper ground strap that has been bonded to the cabinet.

The panel shall also include one (1) neutral bus bar that shall be tied to the pedestrian commons.

**Loop Detector Cards: Product ID 54050**

Loop detector cards must conform to the environmental, functional, dimensional, and design requirements of NEMA Standards Publication TS 2-2021, Section 2.8, as applicable. Each card shall be rack mountable, 4-channel, capable of accepting 12V and 24V and individually labeled with the brand/manufacturer name, model number, serial number, date of production, and voltage.

Detector cards shall be supplied without delay/extension timing (Type B) as required by NEMA Standards Publication TS 2-2021, Section 6.5.

Each loop detector card channel shall be provided with one (1) 3-position toggle switch that shall allow the user to test each detector channel as follows:

- UP POSITION
  - **Label: "ON"**
  - **"LOCK TEST" Mode** – Detector channel will place a call in the controller on the assigned phase.
- CENTER POSITION
  - **Label: "NORMAL"**
  - **"NORMAL" Mode** – Detector channel will run off the normal vehicle detection.
- DOWN POSITION
  - **Label: "TEST"**
  - **"MOMENTARY TEST" Mode** – Detector channel will place a call in the controller on the assigned phase only when toggle his held in the down position.

**Detector Card Rack**

The standard 16-channel TS 2 detector card rack shall be 4-channel dominant with an additional four (4) emergency preemption channels; each channel shall be individually labeled with the channel number. Detector channels shall have a communication address in accordance with NEMA Standards Publication TS 2-2021, Section 5.3.4.2.

The rigid frame of the card rack shall be fabricated from aluminum and bolted to the detector card rack shelf in a manner that allows it to be unbolted using simple tools.

Card rack slots shall be set in a modular fashion such that the PCB edge connectors shall plug into the rear while sliding between top and bottom card guides for each module. Slots shall be numbered, from left to right, when viewed from the front of the rack.

### **MALFUNCTION MANAGEMENT UNIT 2: Product ID 51052**

The 16-channel solid state Malfunction Management Unit 2 (MMU2) shall be located on the controller shelf and must meet the requirements of NEMA Standards Publication TS 2-2021, Section 4. The unit must be compatible with the communication requirements the controller and capable of a remote data log upload via an Ethernet connection to the Department's Transportation Management System (ATMS.now).

The MMU2 shall have an LCD screen to display the active or inactive status of each circuit for all 16-channels on the unit and a unique, permanent, serial number displayed on its face.

The unit shall be provided with a programming card, and must support Flashing Yellow Arrow (FYA) operation with the ability of local firmware upgrades. The red enable and remote reset from the MMU2 shall be terminated on the face of the back panel.

### **BUS INTERFACE UNITS (BIU): Product ID 51051**

The Bus Interface Units (BIU) shall be 24DC, rack mounted units meeting the requirements of NEMA Standards Publication TS 2-2021, Section 8.

### **GLOBAL POSITIONING SYSTEM AND CABLE ASSEMBLY: Product ID 10999**

The Global Positioning System and Cable Assembly (GPS KIT) shall be mounted to the top right back corner of the cabinet and must include, at a minimum, the following:

- One (1) GPS device, Garmin Model No. GPS16x-HVS, or equal.
  - Device protocol shall be National Marina Electronics Association (NMEA) compliant.
- One (1) Interconnection Cable Assembly per **Figure 2** to include:
  - One (1) Ethernet/Data Cable with a male DB9 pin connector and an RJ45 connector
    - Cable shall be a minimum of 8' in length.
    - DB9 pin configuration shall be per **Figure 3**.
      - Pin 2 – Data In
      - Pin 3 – Data Out
      - Pin 5 – Ground
  - One (1) RJ45 Coupler
  - One (1) 22 gage, 2 conductor, shielded power cable that includes one (1) red power wire with and one (1) black ground wire; both wires must have prongs
    - Cable shall be a minimum of 3' in length.

The GPS Kit must communicate directly with the controller at a rate of 4800 baud.

The following messages shall generate and display the following messages through the controller interface:

- **“OK Reply”** – The received message was correct and implemented
- **“No Reply”** – The controller did not receive a reply from the GPS module.
- **“No Signal”** – The GPS module has not acquired a signal from the satellite.
- **“Bad Reply”** – The receive message had a data error.

## DOCUMENTATION

Each cabinet shall be supplied with a hard copy of the following:

- Two (2) Hardcopies:
  - Cabinet Wiring Diagrams
- One (1) Digital Copy:
  - Complete Parts List
  - Malfunction Management Unit 2 (MMU2) Manual
  - GPS Manual
  - Detector Card Set Up Manual
  - Instruction Manual Detailing Installation, Programing and Maintenance

**Note:** Digital copies may be supplied as a PDF via Flash Drive, Thumb Drive, USB Stick, or other approved equal. Digital DVD/CD-Rom cannot be accepted.

## WARRANTY

Cabinets shall come complete with a two (2) year manufacturer’s warranty against defects in design, material, function, and/or workmanship for all cabinet parts, materials, components, equipment, wiring, etc. Warranty period will begin on the date of delivery.

FIGURE 1  
POLE MOUNT CABINET BOTTOM  
(TOP VIEW)

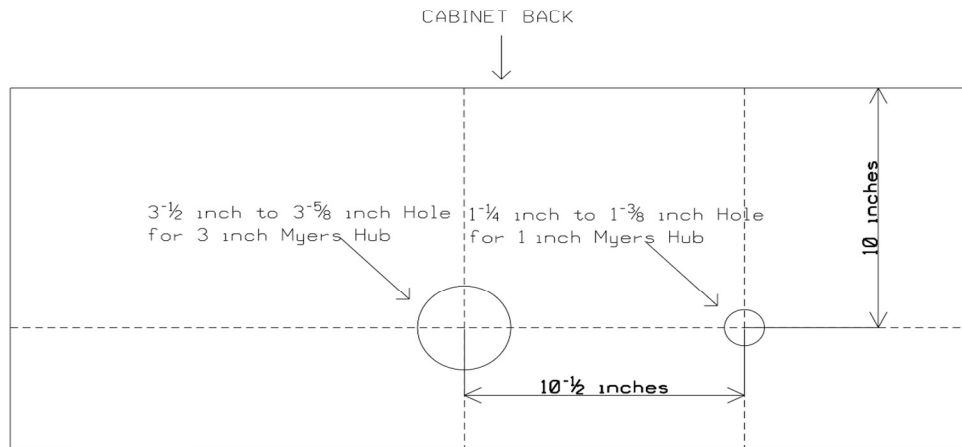


FIGURE 2: GPS INTERCONNECTION CABLE ASSEMBLY

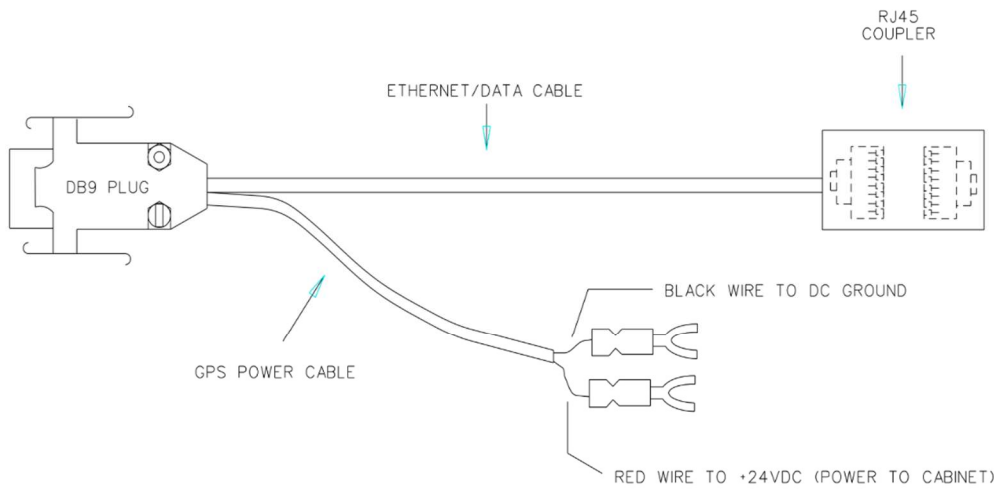


FIGURE 3: GPS POWER/DATA CABLE TO DBP MALE PLUG PIN CONFIGURATION

