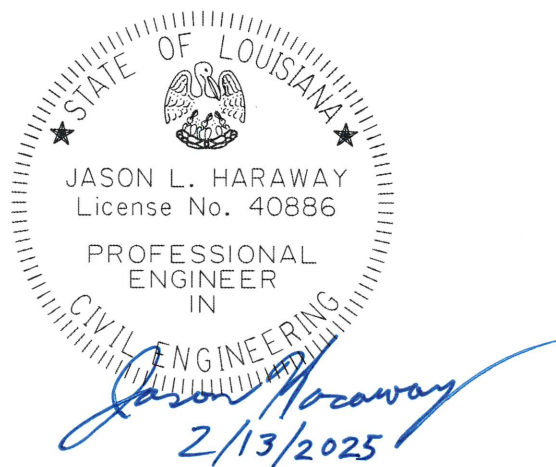


Louisiana
Department of Transportation
and
Development

**Traffic Control Standard
Number 155**

TS-2 Traffic Signal Cabinet



Revised February 13, 2025

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) Police Override Panel
- One (1) Technician Switch Panel
- One (1) AC Power Panel including:
 - One (1) Surge Protection Device (SPD)
 - One (1) Radio Frequency Interference (RFI) Suppressor
 - One (1) Solid State Relay
 - One (1) Barrier Terminal Block
 - Three (3) Circuit Breakers (Minimum)
 - One (1) GFCI Duplex Receptacle
- One (1) Generator Receptacle
- One (1) Power Strip
- One (1) 16-Position Load Bay Panel (Back Panel)
 - One (1) Solid State, Type III, Two-Circuit Flasher
 - Eight (8) Flash Transfer Relays
 - Four (4) 12-Position Field Terminal Strips
 - Sixteen (16) Load Switches
 - Two (2) Facility Terminal Bus Interface Units (BIUs)
- One (1) Preempt/Communication Panel
- One (1) Detector Panel
- Two (2) 4-Channel Loop Detector Cards
- Two (2) 16-Channel, TS 2 Detector Card Racks
 - Two (2) Bus Interface Units (BIUs)
- One (1) 16-Channel Solid State Malfunction Management Unit 2 (MMU2)
- One (1) Global Positioning Device (GPS) with One (1) Interconnection 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. These are outside dimensions exclusive of hinges, doors, handles, overhangs, vents, and adapters. Cabinet heights are measured to the lowest point of the top of surface of the cabinet. The bottom of the cabinet shall have enough surface clearance around the bottom edge to fit four (4) 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) Police Override Panel
- One (1) Technician Switch Panel
- One (1) AC Power Panel including:
 - One (1) Surge Protection Device (SPD)
 - One (1) Radio Frequency Interference (RFI) Suppressor
 - One (1) Solid State Relay
 - One (1) Barrier Terminal Block
 - Three (3) Circuit Breakers (Minimum)
 - One (1) GFCI Duplex Receptacle
- One (1) Generator Receptacle
- One (1) Power Strip
- One (1) 12-Position Load Bay Panel (Back Panel)
 - One (1) Solid State, Type III, Two-Circuit Flasher
 - Six (6) Flash Transfer Relays
 - Three (3) 12-Position Field Terminal Strips
 - Twelve (12) Load Switches
 - Two (2) Facility Terminal Bus Interface Units (BIUs)
- One (1) Preempt/Communication Panel
- One (1) Detector Panel
- Two (2) 4-Channel Loop Detector Card
- One (1) 16-Channel, TS 2 Detector Card Rack
 - One (1) Bus Interface Unit (BIUs)
- One (1) 16-Channel Solid State Malfunction Management Unit 2 (MMU2)
- One (1) Global Positioning Device (GPS) with One (1) Interconnection 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 (16" to 18" D)*. These are outside dimensions exclusive of hinges, doors, handles, overhangs, vents, and adapters. Cabinet heights are measured to the lowest point of the top of surface of the cabinet. The bottom of the cabinet shall have two (2) holes, one (1) 3-1/2" to 3-5/8" and one (1) 1-1/4" to 1-3/8". See **Figure 1** for details. Each hole shall be provided with a National Pipe Thread (NPT) Myers hub.

Pole mount cabinets shall be provided with a permanently installed reinforcement plate and two (2) C-shape cabinet mounting brackets with slots for 3/4" banding material, Pelco SE-0118 or equal. The mounting brackets shall be pre-attached to the back of the reinforcement plate with bolts. The 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 shell, including all access doors, 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. Shelves and drawers should be of the same material. All welds must be neat and of uniform consistency. No wood, wood fiber products or other flammable material shall be used in the cabinet.

Top Design

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

Lifting Eyes/Ears

Cabinet shall be provided with two (2) aluminum-lifting eyes or ears with chamfered or rounded corners. Eyes/ears shall be attached to the exterior of the cabinet via a single carriage bolt in a manner that will ensure proper distribution of weight when the cabinet is lifted with a sling. During shipment and after installation, eyes/ears shall be in the down position.

Doors

Primary Access Door

The primary cabinet door shall be installed on the front to provide access to the components. The door opening shall extend, at a minimum, to the bottom level of the load bay panel (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 primary cabinet door shall be provided with a heavy-duty metal handle, a 3-point latch, a No. 2 Corbin lock, two (2) No. 2 keys and a doorstop. 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 cabinet 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 primary cabinet door shall be louvered near the bottom of the door at the installation site of an air intake filter (screen). Louvers shall be large enough to accommodate the filter and the airflow throughout the cabinet.

Police Override Panel Access Door

A police override panel access door shall be installed on the primary cabinet door to provide access to a police override panel. The police door shall be hinged and include an external Corbin Type Blank 04266 lock with dust cover, two (2) brass keys, and a gasket that provides a dust and moisture resistant seal. Hinge shall be mounted in a manner that does not allow it to be removed without opening the primary door.

Generator Receptacle Access Door

The generator receptacle access door shall be a flush mounted door that includes an external Corbin Type Blank 04266 lock, one (1) brass key, and a cord slot. 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 receptacle. The key hole and the cord slot shall be provided with dust covers that cover the holes when not in use.

Ventilation

Air Intake Filter

A permanent washable air intake filter (screen) shall be securely mounted on the interior of the primary cabinet door behind the louvers. Filter shall be large enough to accommodate the airflow throughout the cabinet.

Thermostatically Controlled Fans

The cabinet shall have a minimum of two (2) commercially available fans. Each fan 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 include a “press-to-test” switch that tests the operation of the fans and have the ability to be adjusted in the field according to NEMA-2021 Section 7.9.2.2 standards.

Shelves

Cabinets shall be supplied, at a minimum, with one (1) controller shelf, one (1) detector card rack shelf, and one (1) spare shelf. See **Figure 4** for shelf locations. Each shelf shall be constructed from one continuous piece of metal. Shelves shall have raised back edges to prevent equipment from passing the back edge. Shelf surfaces shall be slotted 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 wall of the cabinet. The overall shelf depth shall be 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. See **Figure 4** for drawer location. 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 have a nominal height of 1.75" (+/- 0.25") with a nominal depth that makes maximum use of available space offered by the detector rack shelf and an overall width 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

Cabling & Wiring

Cabinet shall be supplied with all necessary cables for the following components, including but not limited to the: controller, TS 2 power supply, MMU2, BIUs, auxiliary components, etc. Cables shall be labeled with an identification sleeve in accordance with the NEMA Standards Publication TS 2-2021. Sleeve label shall be waterproof with legible writing and be clearly visible with no obstructions.

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, when raising and/or lowering the load bay panel, and opening and closing the drawer. 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 cables shall reach a minimum 24" from the controller shelf.

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

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.

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 within the circuit for field terminals 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.

Busses, Ground Bars and Chassis

All busses, ground bars and chassis shall be copper and shall accept up to 10 AWG wire.

TS 2 CABINET POWER SUPPLY: Product ID 51420

The TS 2 cabinet power supply shall be a shelf-mounted, enclosed unit installed on the controller shelf. See **Figure 4** for placement. Power supply must meet 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.

TS 2 cabinet power supply wires shall terminate on the load bay panel, detector panel, preempt panel, or connectors, as appropriate. Wires must be labeled with identification sleeves in accordance with NEMA Standards Publication TS 2-2021. Sleeve labels shall be waterproof with legible writing and be clearly visible with no obstructions.

GENERAL REQUIREMENTS FOR PANELS

All panels and panel components shall include but not be limited to switches, wires, connectors, etc. Panels and panel components must be labeled with legible, high contrast lettering. All terminal strips shall be barrier type.

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

POLICE OVERRIDE PANEL

Panel must be permanently mounted to the primary door in such a manner that it cannot be removed.

The police override panel shall provide access to the following functions and be labeled accordingly:

- **Signal Function**
 - Label: “*SIGNAL*”
 - Type: On/Off toggle switch.
 - “*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**
 - Label: “*EVENT FLASH*”
 - Type: On/Off toggle switch.
 - “*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**
 - Label: “MANUAL”
 - Type: On/Off toggle switch and Wired Push Button.
 - “ON” Mode – Controller will be in manual operation mode.
 - This mode will activate the manual control wired push button to advance the controller in accordance with the NEMA standards.
 - The push button wire shall be a coiled weatherproof cord that is terminated on a terminal strip that is attached to the back of the police panel. The cord shall extend a minimum length of 5’ when in use and coil back to a size that will fit into the police panel door allowing it to close properly when not in use.
 - “OFF” Mode – Controller will run in normal operation mode.
- **Emergency Function**
 - Label: “EMERGENCY”
 - Type: Auto/Flash toggle switch.
 - “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 shall be installed on the inside face of the primary cabinet door on the back of the police override panel and include three (3) toggle switches. Each toggle switch shall be supplied with a guard to prevent the switch from being unintentionally activated. Toggle switches shall have the following functions and should be labeled accordingly:

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

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 a surge protection device (SPD), a radio frequency interference (RFI) suppressor, a solid state relay, a barrier terminal block, circuit breakers, a GFCI duplex receptacle, a neutral (common) bus and a chassis ground bus.

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.

Surge Protection Device (SPD)

The Surge Protection Device (SPD) shall be a Hesco SPD130K, or equal 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.

Radio Frequency Interference (RFI) Suppressor

The Radio Frequency Interference (RFI) suppressor shall be installed on the load side of the 30A circuit breaker meeting NEMA-2021 5.4.2.5.2. The RFI shall have a minimum of 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 (SPD).

Solid State Relay

The solid state relay shall be a Crydom Part No. A2475 or a solid state relay with equal electrical function and mounting design. Relay shall be wired between the RFI suppressor output and the load switch power bus. The relay shall be mounted to a heat sink designed to allow maximum current flow at 165° F without damaging the relay.

Barrier Terminal Block

The barrier terminal block shall have a 50A rating and include a minimum of three (3) compression fitting terminals designed to accept up to a 4 AWG stranded wire.

Circuit Breakers

The AC power panel shall include a minimum of three (3) thermal type Square "D" QOU 150 Series, or equal, wired circuit breakers, one (1) 30A and a minimum of two (2) 20A. 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.

GFCI Duplex Receptacle

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

GENERATOR RECEPTACLE

The generator receptacle shall be a 30A, 3-prong, flanged, male, twist lock Hubbel Model #2615, or equal, capable of supplying complete power to the traffic cabinet. Receptacle shall be mounted inside the cabinet on the lower right nearest the AC power panel behind the generator access door. Receptacle shall be mounted to the top of the generator access and connect to the AC power panel via the transfer relay. See **Figure 5** for orientation.

When an external power source (generator) is connected, the traffic cabinet shall automatically transfer from the AC line current to the external generator. When the external power source is removed, the transfer relay (transfer switch) must automatically transfer back to the normal AC power without disruption to the signal operations.

POWER STRIP

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

LOAD BAY PANEL (BACK PANEL)

The load bay panel shall be located on the lower half of the back cabinet wall. See **Figure 4** for placement.

Load bay panel 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.

Solid State, Type III, Two-Circuit Flasher

Flasher shall be a Model No. 204-15, or equal, rated at 15A per circuit meeting the electrical and physical characteristics of NEMA Standards Publication TS 2-2021, Section 6.3.

Flash Transfer Relays

The flash transfer relays shall be a Struthers-Dunn, Part No. 21ACPX-2/21XBXPL, or equal, plug-in type relays.

- Ground mount cabinet load bay panels shall include eight (8) flash transfer relays.
- Pole mount cabinet load bay panels shall include six (6) flash transfer relays.

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.

12-Position Field Terminal Strips

Field terminal strips shall be installed horizontally at the base of the load bay panel with signal head terminals facing down. Strips must be consecutively numbered and all wiring shall be color-coded with color labels that correspond to the appropriate signal indication color, green, yellow, and red.

- Ground mount cabinet load bay panels shall include four (4) 12-position field terminal strips.
- Pole mount cabinet load bay panels shall include three (3) 12-position field terminal strips.

Solid State 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.

- Ground mount load bay panels shall include sixteen (16) solid state load switches.
- Pole mount load bay panels shall include twelve (12) solid state load switches.

All load switch output channels shall be protected by surge suppression devices, one (1) device per channel. Outputs shall be brought out through the posted 10-32 X 5/16" binder head screw terminals of the field terminal strip. All load switch output 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 the identification markings. The labels shall be designated from left to right as follows:

- Ground mount load bay panels shall be labeled LS1 through LS16.
- Pole mount load bay panels shall be labeled LS1 through LS12.

Facility Terminal Bus Interface Units (BIU): Product ID 51051

Two (2) Facility Terminal Bus Interface Units (BIU) shall be installed on the load bay panel. Each terminal BIU shall be rack mounted 24 VDC units meeting the requirements of NEMA Standards Publication TS 2-2021, Section 8.

Buses

An AC neutral (common) copper bus and a chassis copper ground bus shall be included. Buses shall be jumpered together with a minimum number 10 AWG wire. Each bus must have a minimum of ten (10) unused terminals. The panel shall be grounded to the cabinet using an independent circuit by either an insulated braided copper ground strap or 10 AWG wire that has been bonded to the cabinet.

PREEMPT/COMMUNICATION PANEL

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

- Three (3) Preempt 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 an input relay and a test toggle switch.

Preempt 1 relay shall be a Potter Brumfield K10P 11A15-12 (12 VAC) or an interchangeable equal in both electrical function and mounting design.

Preempt 2 and Preempt 3 relays shall be Potter Brumfield K10P 11A15-120 (120 VAC), or an interchangeable equal in both electrical function and mounting design.

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.

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 be labeled and allow the following functions:

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

Preempt/communication panel shall include two (2) terminal connections for two (2) twisted pair communication lines. Terminal connections shall be provided with a Hesco HE642C-008B or equal electrical protection device.

DETECTOR PANEL

The detector panel shall be constructed of 0.125” aluminum and installed on the lower left side of the cabinet.

Detector panels shall be supplied with the following channel connections:

- Ground mount cabinet detector panels shall be provided with connections for 32 loop channels and eight (8) pedestrian channels.
- Pole mount cabinet detector panels shall be provided with connections for 16 loop channels and eight (8) pedestrian channels.

Each detector 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: “*CALL*”
 - “*CALL*” Mode – Detector channel will place a **call** in the controller on the assigned phase.
- **Center Position**
 - Label: “*AUTO*”
 - “*AUTO*” 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 is held in the down position. Switch must rebound to **AUTO** when released.

All inputs from the loops and peds shall be brought through either 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.

A terminal strip shall be included on the panel for the following electrical connections: AC neutral, chassis ground, 12 VAC, 120 VAC, line frequency reference, 24 VDC+, and 12 VDC+ logic ground.

The chassis ground bus bar shall be grounded to the cabinet using an independent circuit by either an insulated braided copper ground strap or 10 AWG wire 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

All cabinets shall be supplied with two (2) loop detector cards. Cards must conform to the environmental, functional, dimensional, and design requirements of NEMA Standards Publication TS 2-2021, Section 2.8 and 6.5, as applicable. Each card shall be rack mountable, 4-channel, and capable of accepting 12V and 24V. Cards shall be individually labeled with the brand/manufacturer name, model number, serial number, date of production, and voltage.

As required by NEMA Standards Publication TS 2-2021, Section 6.5.2.2.1, detector cards shall be supplied without delay/extension timing (Type B).

DETECTOR CARD RACK

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

- Ground mount cabinets shall be supplied with two (2) 16-channel TS 2 detector card racks.
- Pole mount cabinets shall be supplied with one (1) 16-channel TS 2 detector card rack.

Each detector rack shall include one (1) Bus Interface Unit (BIU). BIUs shall be rack mounted 24 VDC units meeting the requirements of NEMA Standards Publication TS 2-2021, Section 8.

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 (Printed Circuit Board) 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. See **Figure 4** for placement. MMU2 must meet the requirements of NEMA Standards Publication TS 2-2021, Section 4 and include a unique, permanent, serial number clearly displayed on the unit. MMU2 must be compatible with the communication requirements of the controller and capable of a remote data log upload via an Ethernet connection.

The MMU2 shall include an LCD screen to display the active or inactive status of each circuit for at least 16-channels.

The unit shall include a programming card and must support Flashing Yellow Arrow (FYA) operation with the ability of local firmware upgrades.

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 that will activate if a signal malfunction and/or flash activation occur. The red enable and remote reset from the MMU2 shall be terminated on the face of the load bay panel.

MMU2 wires shall come complete with identification sleeves in accordance with NEMA Standards Publication TS 2-2021. All sleeve labels shall be waterproof with legible writing and be clearly visible with no obstructions.

GLOBAL POSITIONING SYSTEM & INTERCONNECTION CABLE ASSEMBLY

Global Positioning System: Product ID 55726

The Global Positioning System (GPS) shall be a Garmin Model No. GPS16x-HVS, or equal with a National Marina Electronics Association (NMEA) compliant device protocol. The device shall communicate directly with the controller at a rate of 4800 baud.

The GPS device shall be mounted to the outside top right back corner of the cabinet. See **Figure 4** for placement. A weather tight hole located just under the device installation site shall allow entry of the GPS data cable.

Interconnection Cable Assembly: Product ID 55727

The Interconnection Cable Assembly shall connect the GPS data cable to the controller and a power source. At a minimum, the assembly shall consist of a Female RJ45 coupler, a Male DB9 pin connector, a minimum 3' Ethernet/data cable, and a minimum 8' GPS power cable. See **Figure 2** for details.

The Female RJ45 coupler shall be installed on one end of the 3' Ethernet/data cable; the other end of the 3' cable shall connect to the Male DB9 pin connector via **Pin 2** (Data In), **Pin 3** (Data Out) and **Pin 5** (Ground). See **Figure 3** for pin connection details. The Female RJ45 coupler shall connect to the GPS device via the GPS data cable. The Male DB9 pin connector shall plug into the AUX 232 port on the 980 ATC Trafficware Controller.

Note: The Male DB9 Pin connector shall have latches to connect to the latching block on the controller panel. Screw connections will not be accepted.

The GPS power cable shall be a shielded 22 gauge, 2-conductor cable with one (1) red power wire and one (1) black ground wire. The ground wire shall connect to the DB9 pin connector via **Pin 5** (Ground). See **Figure 3** for connection details. The red power wire shall be spliced to the 3' Ethernet/data cable +24 VDC wire, to send power back to the GPS. Splices shall not occur outside the DB9 assembly.

The opposite end of the power cable shall be terminated with forked ends for connection to a 24 VDC power source.

Note: Functional alternative interconnectivity cable configurations may be considered.

DOCUMENTATION

Each cabinet shall be supplied with the following:

- Two (2) Hardcopies:
 - Cabinet Wiring Diagrams
- One (1) Digital Copy:
 - Complete List of Replaceable Parts
 - 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)

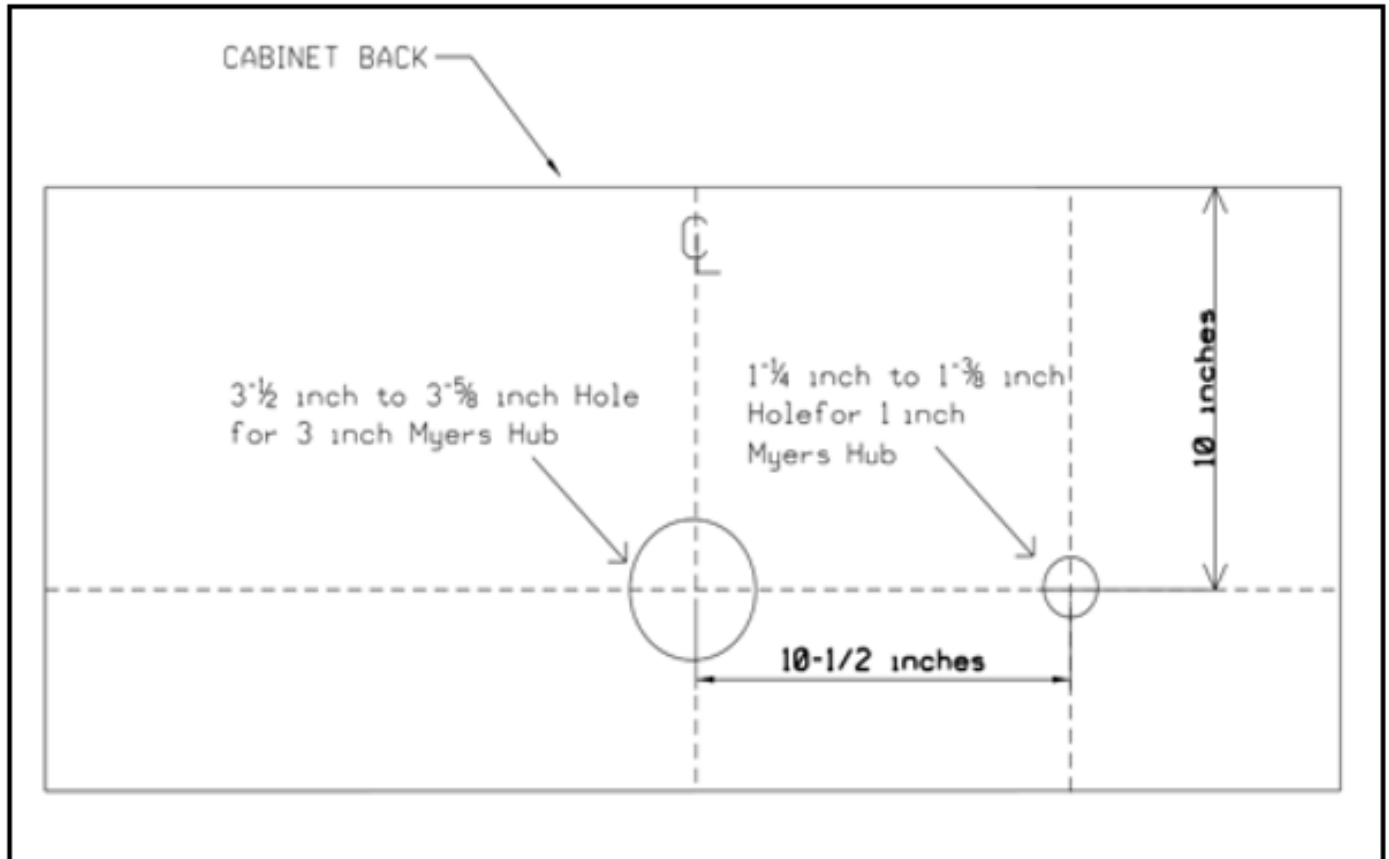


FIGURE 2
GPS INTERCONNECTION CABLE ASSEMBLY

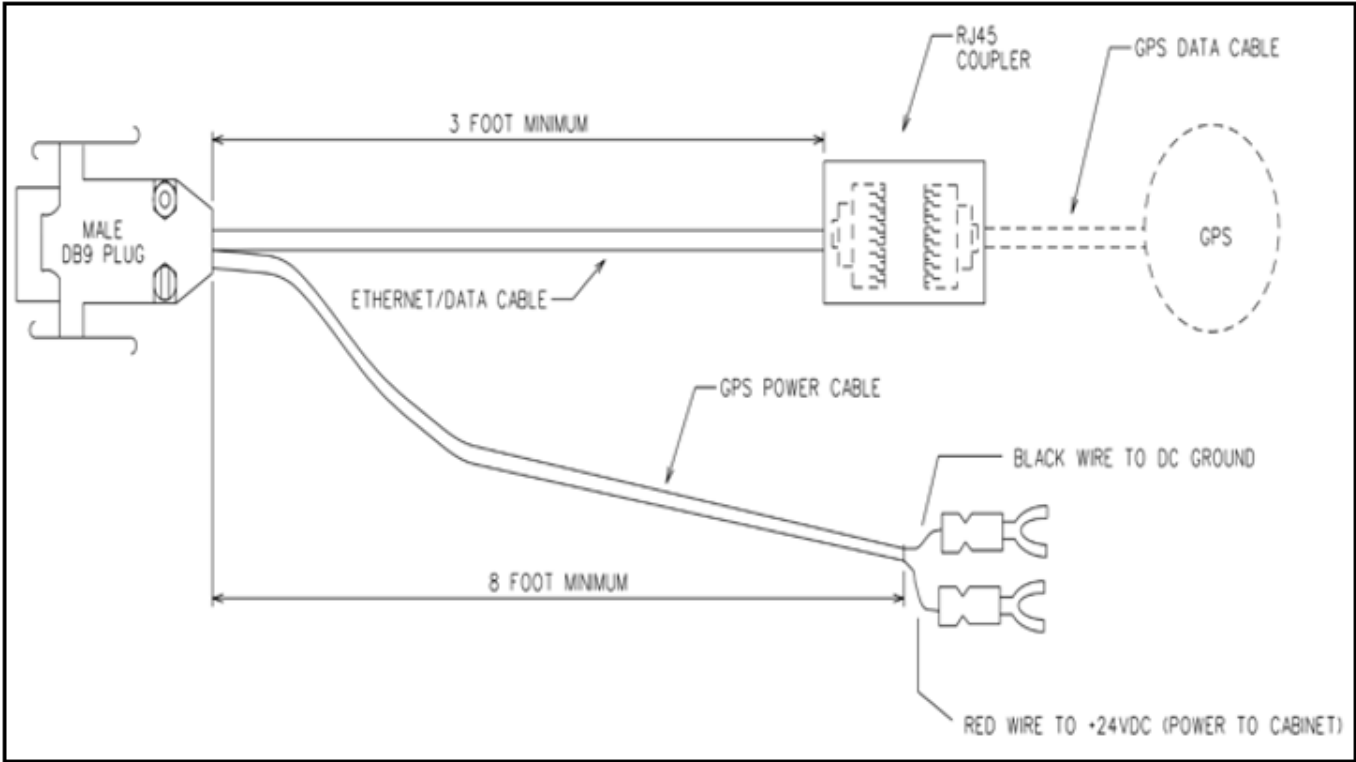


FIGURE 3
GPS POWER/DATA CABLE TO DB9 PIN CONFIGURATION

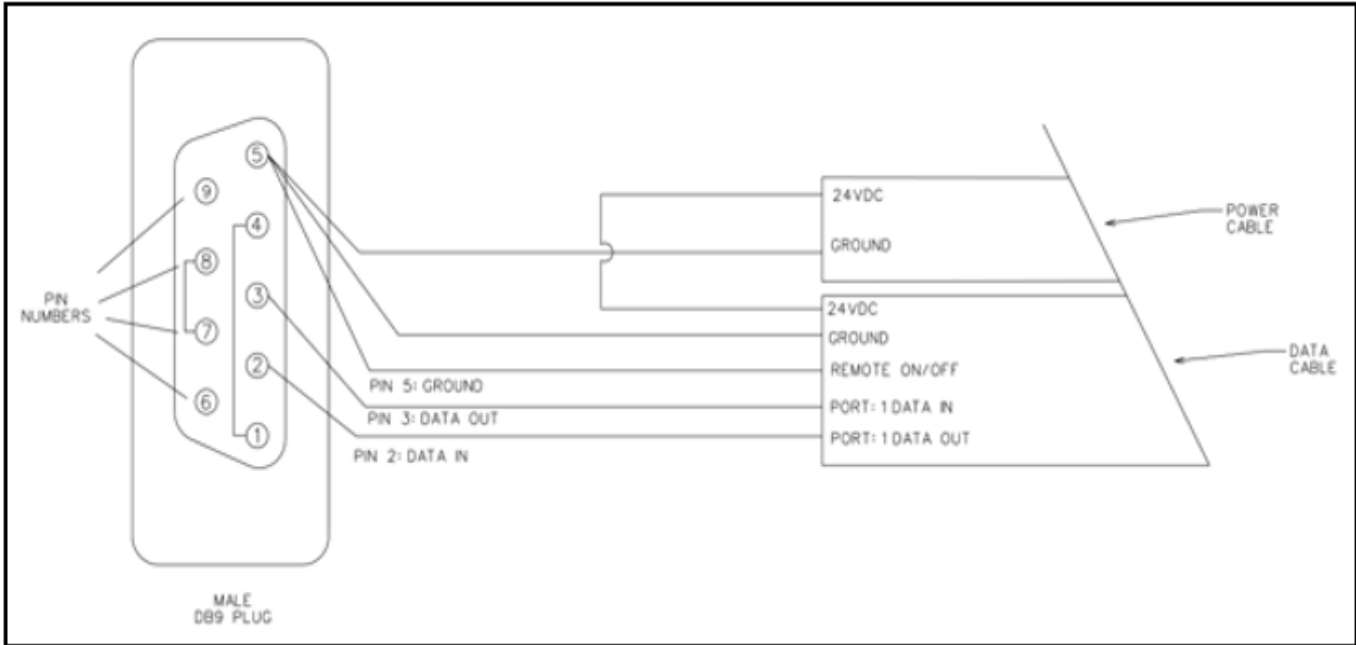


FIGURE 4
BASIC CABINET LAYOUT

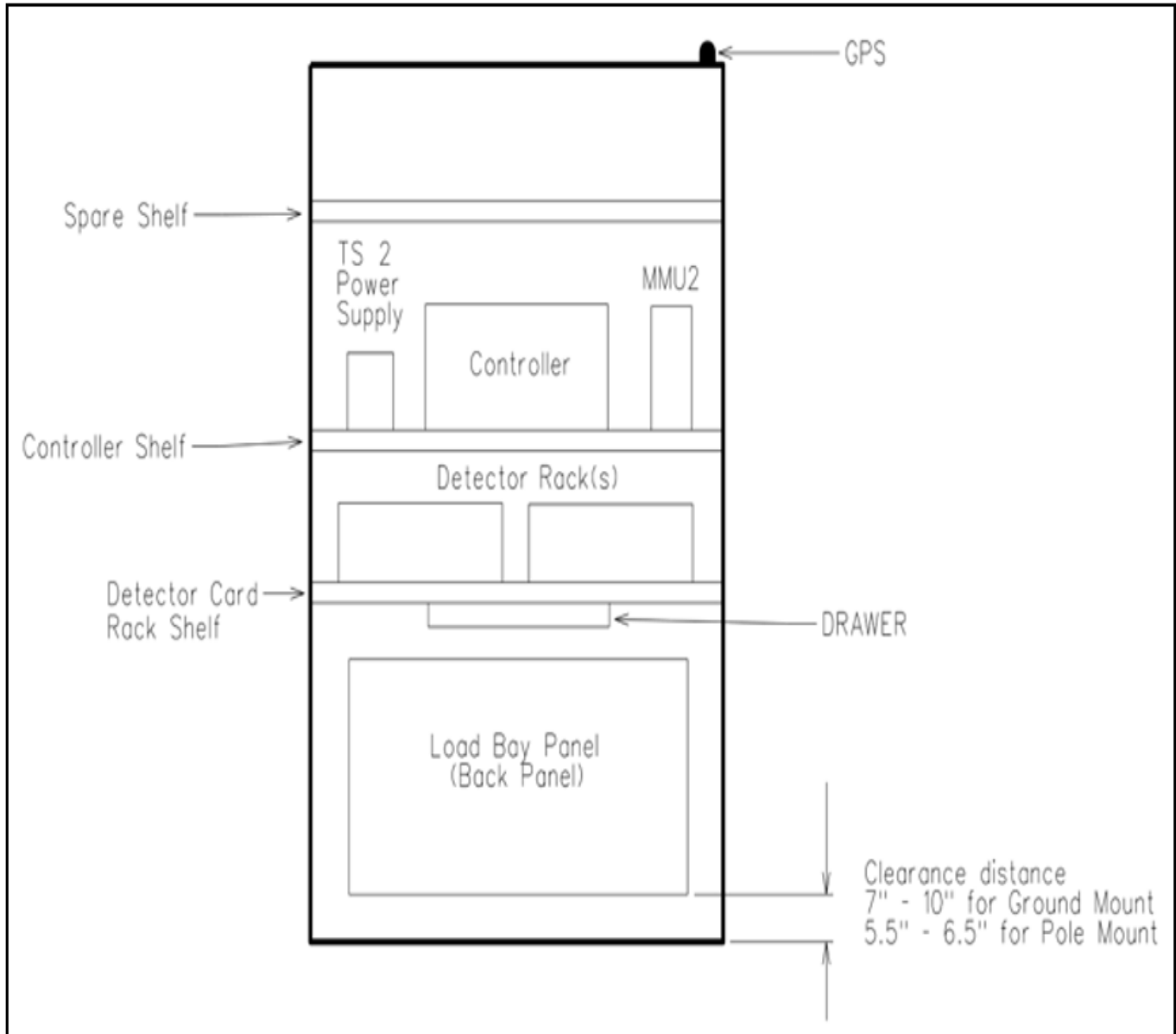


FIGURE 5
GENERATOR RECEPTACLE LOCATION

