



TS2 Type 1 Rack Mounted Cabinet Assembly



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Design Specification/Requirements

Model NEMA Rack Mounted Type Cabinet

The cabinet shell shall meet the minimum requirements of a Caltrans 332 type. The cabinet enclosure shall include, but not be limited to, enclosures, doors, hinges, gasketing, ventilation, latches, locks, police panel, cage supports, and mounting devices.

Base Adapter

When required by a special provision, a base adapter shall be furnished to match the exterior dimension and finish of the Type 332 cabinet furnished under this specification. The adapter shall have a minimum height of 6 inches.

Door Latches and Locks

The latching mechanism shall be a three-point drawer roller type. The locks and handles shall be on the left side of the front door and right side of the rear door. The lock and lock support shall be rigidly mounted on the door. A seal shall be provided to prevent dust or water entry thorough the lock opening. The cabinet locks shall be keyed to #2 type locks.

Ventilation

The cabinet ventilation shall include an intake, exhaust, filtration, fan assembly, and environmental controls. Each electric fan shall be equipped with a ball or roller bearing and have a capacity of minimum 100 Cubic Feet per Minimum (cfm). The fan shall be mounted with the housing and be vented. The fan shall be thermostatically controlled and shall be manually adjustable between 80-150 degrees Fahrenheit.

Cabinet Cage

A standard Electronic Industries Alliance (EIA) 19-inch rack cage shall be installed inside the housing for mounting of the controller unit and cabinet assemblies. The EIA rack portion of the cage shall consist of 2 pairs of continuous adjustable equipment mounting angels. The angles shall be tapped with 10-32 threads with EIA universal spacing. The angle shall comply with standard EIA-310-B and shall be supported at the top and bottom by either welded or bolted support angels to form a cage.

There shall be a minimum of 2" of clearance above the controller at the top of the rack for fiber optic unit installation. As an option, there shall be space for a minimum of 6 auxiliary outlets, either all in one assembly or two assemblies of 3 outlets, located on each side in the rear of the cabinet, this allows for extra equipment power.

Aluminum Surface

The cabinet exterior shall be natural, unpainted aluminum, unless otherwise specified.

Lighting

When required by a special provision, fluorescent lamps shall be installed on the top of the front and rear part of the cabinet. Door control switches shall be installed on the front and rear doors. Opening of either door shall illuminate the lighting.

Each fluorescent lamp and switch shall be equipped with noise suppression devices. Activation of the fluorescent lamps and associated switches shall not cause any disruption of the controller or any other electrical or electronic device in the cabinet.

Fluorescent lamps and associated ballast transformers shall be rated for high output in cold environments (temperature of -25 degrees C/77 degrees F).



The cabinet lamp circuit shall be fused and the fuse holder shall be easily accessible from the front of the cabinet.

Pullout Drawer

A pullout drawer hinged at the top and sliding tracks shall be provided in the cabinet. The drawer shall have dimensions not exceeding 1"H X 16"D X 13"D. The drawer assembly shall be capable of holding 40 pounds when extended. The drawer shall be located so that access to the front panel of the controller is not restricted when a laptop computer is in use on the computer shelf.

A resealable print pouch shall be mounted to the door of the cabinet. The pouch shall be of sufficient size to accommodate one complete set of cabinet prints.

A minimum of two sets of complete and accurate cabinet drawings shall be supplied with each cabinet.

A minimum of one set of manuals for the controller, Malfunction Management Unit (MMU) and vehicle detector amplifiers shall be supplied with each cabinet.

Controller Assembly

The controller assembly shall be a Safetran Model *ASC/3 RackMount*.

Terminals and Facilities

Output LoadBay Assembly

The output loadbay assembly shall be a 19" rack mounted assembly used to house the loadswitches, flash transfer relays, connectors, terminal blocks, and other control devices so that complete connections can be established between the controller outputs and the field terminals

All 16-position output loadbay assemblies are provided with a mounting mechanism which allows easy access to all wiring on the rear of the assembly without removal of any cabinet shelves or equipment.

The terminals and facilities shall be available as a minimum in the following configuration:

- Configuration #1 – Sixteen (16) load switch sockets, up to eight (8) flash transfer relay sockets, one (1) flasher socket, two (2) main panel Bus Interface Unit (BIU), one (1) sixteen channel detector rack with one (1) BIU, and one Type 16 MMU A dual-row, 64-pin female DIN 41612 Type B connector shall be provided for both edges of the BIU. Terminal and facilities BIU mounting shall be an integral part of the output loadbay assembly.
- All BIU rack connectors shall have pre-wired address pins corresponding to the requirements of the TS2 specification. The address pins shall control the BIU mode of operation. BIUs shall be capable of being interchanged with no additional programming.
- The 16-loadswitch position output loadbay assembly shall have all field wires accessible in the rear of the assembly, on vertically mounted non-fused terminal blocks with a minimum rating of 10amps.
- All field input/output (I/O) terminals shall be identified by permanent alphanumeric labels. All labels shall use standard nomenclature per the NEMA TS2 specification.
- It shall be possible to flash either the yellow or red indications on any vehicle movement by means of Molex Flash Plugs.
- A minimum of one (1) flasher socket shall be located in the power distribution assembly and shall be capable of operating a 15amp, 2-pole, NEMA solid-state flasher. The flasher shall be well supported in the assembly.
- One RC network shall be wired in parallel with each group of three flash transfer relays and any other relay coils.



- All logic level NEMA controller and MMU input and output terminations on the output loadbay assembly shall be permanently labeled.
- Terminations shall be provided as part of the output loadbay assembly to provide access to the controller units programmable and non-programmable I/O when needed.

All terminal and facilities wiring shall conform to the following wire size and color:

GREEN/WALK LOAD SWITCH OUTPUT	14 GAUGE BROWN WIRE
YELLOW LOAD SWITCH OUTPUT	14 GAUGE YELLOW WIRE
RED/DON'T WALK LOAD SWITCH OUTPUT	14 GAUGE RED WIRE
MMU (OTHER THAN AC POWER)	22 GAUGE VIOLET WIRE
CONTROLLER I/O	22 GAUGE BLUE WIRE
AC LINE	VARIOUS GAUGE BLACK WIRE
AC NEUTRAL	VARIOUS GAUGE WHITE WIRE
EARTH GROUND	VARIOUS GAUGE GREEN WIRE
LOGIC GROUND	VARIOUS GAUGE GRAY WIRE
FLASH PROGRAMMING	ORANGE WIRE

All wiring, 14AWG and smaller, shall conform to MIL-W-16878/1, Type B/N, 600V, 19-strand tinned copper. The wire shall have a minimum of 0.010 inches thick PVC insulation with clear nylon jacket and rated to 105 degrees Celsius. All 12 AWG and larger wire shall have UL listed THHN/THWN 90 degrees Celsius, 600V, 0.020 inches thick, PVC insulation and clear nylon jacketed.

Connecting cables between assemblies shall be sleeved in a braided nylon mesh or poly-jacketed. Commonly reconfigurable wiring may be left out of the sleeving for ease of factory or field modifications, but shall be adequately protected against damage on the assembly edges.

All terminals and facilities configurations shall be provided with sufficient RS-485 Port 1 communication cables to allow for the intended operation of that cabinet. Each communication cable connector shall be a 15-pin metal shell D subminiature type. The cable shall be a shielded cable suitable for RS-485 communications. Each cable shall have a Port 12 connector on each end. This will allow that no hardwiring of cables is necessary and cables can be removed without the use of hand tools.

All output loadbay assemblies shall be pre-wired for a Type-16 Malfunction Management Unit.

All wiring shall be neat in appearance. All cabinet wiring shall be continuous from its point of origin to its termination point. Butt type connections/splices are not acceptable.

Where needed, all connecting cables and wires shall be secured by mechanical clamps. Stick-on type clamps are not acceptable.

The grounding system in the cabinet shall be divided into three separate circuits (AC Neutral, Earth Ground, and Logic Ground). These ground circuits shall be connected together at a single point.

The output loadbay assembly shall incorporate a relay to remove +24 VDC from the common side of the load switches when the intersection is placed into mechanical flash. The relay shall have a momentary push button to apply power to the load switch inputs for ease of troubleshooting. As an alternate, the loadswitch power will be controlled through circuit breakers similar to the Caltrans signal bus circuit breakers. A minimum of 4 circuit breakers will be required for a standard 8 phase intersection.



All pedestrian push button inputs from the field to the controller shall be Opto-isolated through the BIU. Pedestrian signals shall be wired on outputs 9 thru 12.

Power Distribution Assembly (PDA)

The power distribution assembly shall consist of a separate rack mountable module. The power distribution panel shall be wired to provide the necessary filtered power to the load switches, flasher, and cabinet power supply.

The power distribution assembly shall house the following components:

- One (1) NEMA cabinet power supply. As an alternate this unit will be rack mountable and have provisions for plugging into the PDA
- One (1) 16-channel TS2 MMU unit. As an alternate this unit will be rack mountable and have provisions for plugging into the PDA
- One (1) NEMA TYPE 5-15R GFI utility outlet
- A minimum of four (4) signal bus circuit breakers are wired for signal bus control of the loadswitches
- One (1) flasher socket with provisions to add an additional flasher socket if needed
- Two (2) 12-position feed thru terminal blocks shall be located on a fold down door on the rear of the PDA assembly and contain terminals for all power requirements within the NEMA TS2 cabinet environment

The hinged door on the rear of the assembly will allow for access to the MMU Interface Board (MIB). All power supply connections on the rear of the PDA assembly will be protected from accidental human contact when the hinged door is closed.

The rear of the power distribution assembly shall contain access to the MMU connections and power supply connection with plug-in devices that will interface with the terminals and facilities as required by the NEMA specification.

The rear of the power distribution assembly shall contain a minimum of five (5) power plug connectors for supplying power to existing and future cabinet assemblies for ease of connection and disconnection.

Cabinet Switches

Police Door

The police door, at a minimum, shall contain the following switches, and access shall be provided without opening the main cabinet door.

Auto/Flash Switch

When in the flash position, power shall be maintained to the controller and the intersection shall be placed into flash. The controller shall be stop timed when in flash. When exiting flash, the start-up sequence will be initiated in the controller.

Signals On/Off Switch

In the OFF position, power shall be removed from the signal heads in the intersection and the controller shall continue to operate. When in the OFF position, the MMU shall not conflict or require reset.

Cabinet Auxiliary Switches

At a minimum, the following test switches shall be accessible when the cabinet door is open. These switches shall be an integral part of the power distribution assembly.

**Auto/Flash Switch**

When in flash, the power shall be maintained into the controller and the intersection shall be placed into flash. The controller shall not be stop timed when in flash.

Stop Time Switch

When applied, the controller shall be stop-timed in the current interval.

Control Equipment Power ON/OFF Switch

This switch shall control the power to the controller, MMU, and cabinet power supply AC.

Service Panel Assembly

A separate power auxiliary panel shall be located on the bottom portion of the service panel and be mounted on the cabinet rails (front to back). This assembly shall not interfere with access to the field terminals or the hinged door on the rear of the output loadbay assembly; the power auxiliary unit will, at a minimum, contain the following components and be wired per the NEMA TS2 specification.

- An EDCO MODEL SHA-1210 Surge Suppressor minimum
- A 50 AMP, 125 VAC Radio Interference Line Filter

A normally open, 60amp Mercury Contactor, model Durakool BBC-732, or equivalent. As an alternate a suitable solid-state relay may be substituted for the mercury contactor as governed and specified by the approving agency which the cabinet will be supplied to.

A minimum of one (1) 50-amp safety shut-off main circuit breaker will be installed in the cabinet. The safety shut-off breaker shall supply power to the controller, MMU, signals, cabinet power supply, and auxiliary assemblies. The safety shut-off breaker shall be located in the rear of the cabinet assembly and be protected from accidental de-activation.

- A minimum of 1 (one) 15-position Neutral Bus Bar capable of connecting three #12 wires per position.
- A minimum of 1 (one) 15-position Ground Bus Bar capable of connecting three #12 wires per position.

Auxiliary Cabinet Equipment**Cabinet Power Supply**

The cabinet power supply, at a minimum, shall meet the requirements of Section 5.3.5 of the current NEMA TS2 Standard. As an alternate, the cabinet power supply may be a plug-in device and plug into the power distribution assembly.

The cabinet power supply shall provide LED indicators for the line frequency, 12VDC, 12VAC, and 24VDC outputs. The cabinet power supply shall provide (on the front panel) jack plugs for access to the +24 VDC for test purposes. One cabinet power supply shall be included with each cabinet assembly.

As an alternate this unit will be configured for rack mounting and be a plug-in device in the power distribution assembly.

Malfunction Management Units (MMU)

Each cabinet assembly shall be supplied with one (1) MMU as defined by the requirements of Section 4 of the NEMA TS2 Standard.



MMUs shall be a Type 16. The MMU Model MMU-16LE shall have the capability to monitor Manual on Traffic Control Devices (MUTCD) and Flashing Yellow Arrow (FYA) left turn signal head configurations.

The MMU shall be packaged in such a way that the interfacing connectors for the cabinet do not cross over the front side of the rack assembly.

As an alternate, this unit may be configured for rack mounting and be a plug-in device in the power distribution assembly.

Bus Interface Units (BIU)

All BIUs shall meet the operating requirements of Section 8 of the NEMA TS2 Standard.

The BIU face plate may be half-width but shall have all indicators and connectors in place, as required by the NEMA specification.

The BIU shall be supplied with each cabinet to allow for maximum phase and function utilization for which the cabinet is designed.

Vehicle Detection

A minimum of two (2) vehicle detector amplifier racks shall be provided in each cabinet.

Detector Rack Assembly

Each detector rack assembly shall be rack mountable and include the capabilities to house a minimum of:

- 2 or 4 channel detector cards (total of 8/4)
- 16 detector inputs
- 1 BIU
- 4 channels of EVP preemption

Detection Interfacing

Each cabinet shall contain detector interface panels for the purpose of connecting field loops and vehicle detector amplifiers. The panel shall be manufactured from FR4 G10 fiberglass, 0.062 inches thick, with a minimum of 2 oz. of copper for all traces.

One (1) 16-position interface panel shall be provided for each 16-channel detector rack in the cabinet. The interface panel shall be secured to a mounting plate and attached to the left side of the cabinet from the rear door.

Each interface panel shall allow for the connection of sixteen independent field loops. A ground bus terminal shall be provided between each loop pair terminal to provide a termination for the loop lead-in cable ground wire.

Each interface panel shall provide a 10-position terminal block to terminate the field wires for up to two (2) 2-channel preemption devices.

Lightning protection mounting holes shall be provided to accommodate an EDCO SRA-16C lightning protection device. Lightning protection devices shall be provided when called for in the special provisions or specification.

A cable consisting of 20 AWG twisted pair wires shall be provided to enable connection to and from the interface panel to the detector rack assembly. The twisted pair wires shall be color coded red and white and be encased in nylon mesh sleeving for protection.



All termination points shall be identified by a unique number and be silkscreened on the panel.

Each detector rack shall accommodate rack mountable preemption devices.

Each detector rack shall be powered by the cabinet power supply and be connected to the power supply by means of a detector rack power cable.

Each BIU shall include power-on, transmit and, valid data indicators. All indicators shall be LEDs.