

SECTION 676

170 ACTUATED CONTROLLER CABINET

676-1 SCOPE:

This Section specifies the requirements for the Tallahassee 170 type cabinet and adapter bases used for Model 170 E Controller Units to be used in this contract.

All cabinets shall include a Standard Adapter Base. See Section 676-6 for details.

All cabinets shall include a fiber optic compartment, police compartment, rack assembly for the controller and auxiliary equipment and miscellaneous wiring panel(s) required to operate the intersection under computer and time based standby system control. All cabinet assemblies shall utilize the Bi-Tran software as specified in Section 681 of these specifications.

676-2 DESIGN AND CONSTRUCTION:

676-2.1 General:

All cabinets shall be supplied as described in this specification. Commonality in mechanical and electrical design requirements for the various controller/cabinet combinations shall be a prime consideration in the construction of the cabinet to be supplied. Cabinet design shall incorporate a pullout and rotatable rack assembly (see Section 676-3.7).

676-2.1.1 Assemblies:

(a) The following equipment shall be completely removable from the cabinet without removing any other equipment and using only a slotted or Phillips screwdriver:

- | | |
|---|-------------------------------|
| 1) Power Supply Assembly | 5) Storage Compartment |
| 2) Power Distribution Assembly | 6) Aux. Output File |
| 3) Output File | 7) Emergency Preempt Receiver |
| 4) Controller Unit complete with operating software | |

(b) All fuses, circuit breakers, switches (except Police Panel/Technician Panel Switches; Fiber Optic Compartment circuit breaker; and Fan Fuse) and indicators shall be readily visible and accessible when the cabinet front door is open.

(c) All equipment and panels in the cabinet, when required, shall be clearly and permanently labeled by the silkscreen method.

(d) Resistor-capacitor transient suppression shall be provided at all AC relay sockets (across relay coil) except for the Flash Transfer Relay (FTR) in the output files where one (1) suppression device may be common for all.

(e) A leakage resistor, which permits a small amount of current to pass through the heavy-duty relay coil, shall be installed across the terminals at relay sockets to overcome the residual magnetism.

(f) Assembly or file depth dimension shall include terminal blocks.

- (g) All assemblies and files shall allow air circulation through its top and bottom unless specifically called out otherwise.
- (h) The Input Files shall be hardwired only; no printed circuit motherboard shall be used.
- (i) Socket types for the following equipment shall be as listed below:

<u>UNIT</u>	<u>SOCKET</u>
1) Switch Pack	BEAU S-5412 (or approved equal)
2) Transfer Relay	BEAU S-5408 (or approved equal)
3) Flasher Unit & Power Supply Module	BEAU S-5406 (or approved equal)
4) Conflict-Voltage Monitor	PCB 28/56S

- (j) Connector sockets for Flasher Unit, Power Supply, and Switch Pack modules shall be mounted with their front face 7 1/2-inches deep from assembly or file front plane. (Note Output File Exception).
- (k) Nylon guides (Top and Bottom) shall be provided for Switch Pack Modules, Flasher Units, Conflict-Voltage Monitor Unit, Input Files I & J and Power Supply Module (Bottom only). The guides shall begin 1.0 (±0.5) inches in from front panel surface and extend to within 0.5 inches from the connector socket face.
- (l) Assemblies and Files shall be fabricated of 0.060 inch minimum thickness aluminum or stainless steel sheet. The metal surface shall be treated with clear chromate.

676-3 PHYSICAL AND MECHANICAL REQUIREMENTS:

In the selection of parts and materials, fulfillment of the requirements of this specification shall be of prime consideration. In so doing, equipment design shall utilize the latest available techniques.

676-3.1 Materials:

- (a) Cabinets shall be constructed of domestic sheet aluminum alloy 5052, with a minimum thickness of 0.125 inches.
- (b) The cabinet surface shall have a smooth finish and be free of rivet holes and visible scratches and gouges on the outer surface of the cabinet.
- (c) The cabinet interior and exterior shall be painted by the Powder Coating method with the exception of the rack assembly and wiring panels which shall have a natural aluminum finish.

(1) Cabinet Finish

The entire cabinet shall have a painted finish done by the Powder Coat method and shall be done in accordance with the following procedures:

(a) SURFACE PREPARATION:

(1) Cleaning:

The controller cabinet (inside and outside) including all aluminum components (i.e., rack assembly, door rods, shelf, panels, etc.) shall be cleaned according to ASTM-B-117.

- (a) Cleaning by immersion in inhibited alkaline cleaner such as Fremont 767, for 2 ½ minutes at a temperature of 140°F (60°C). Concentration of cleaner is approximately 3% by volume.
- (b) All components shall be rinsed in cold water with a constant overflow.
- (c) All components shall be etched in a solution such as Sodium Hydroxide ELDORADO ALK-205 for 2½ to 5 minutes. Concentration is approximately 13+. Temperature shall be 140°F (60°C).
- (d) All components shall be rinsed again in cold water with a constant overflow.
- (e) Desmut components in a 50% by volume Chromic Acid solution such as ELDORADO D-3 by immersion. Immersion process requires six (6) to twelve (12) ounces of D-3 dissolved per gallon of water for 2½ to 5 minutes.
- (f) Rinse components again in cold water with a constant overflow.
- (g) All components shall have Yellow Chromate by immersion in Chromic Acid mixture such as Parker+Amchem Alodine 1200. Components should remain in tank 2½ to 5 minutes. Solution concentration 1.2 to 2.2 pH at normal temperature.
- (h) Rinse components a final time in cold water.

(2) Masking:

Care shall be taken to prevent overspray of Powder Coat from one surface color to another. Standard industry practices shall be followed.

(b) Powder Coat:

(1) General:

Powder Coat shall be applied to the entire cabinet walls, roof and doors, both inside and out. Powder Coating of the cabinet shall be performed according to AAMA-603 and AAMA-605 specifications.

(2) Application:

- (a) Powder shall be applied electrostatically with TGIC Polyester powder, Fuller O'Brien Powder Coatings or approved equivalent, to a thickness of 2 to 3 mils.
- (b) All components shall be baked in an oven at 375°F (190°C) for 20 minutes.
- (c) Paint test shall be performed for adhesion, cure and film thickness on test panels.

(c) Cabinet Color:

The cabinets shall be painted as follows:

- (a) The cabinet shall be painted beige color, Fuller O'Brien Paint Number PFT-401-S6 "CAMEL" or an approved equivalent.
- (d) All exposed edges shall be broken, free of burrs and bit marks.
- (e) All welds shall be neatly formed and free of cracks, blow holes, and other irregularities. Corner and flat tack welds shall show good flow characteristics. Weld finish shall be smooth and free of residual discoloration along the edges and from black smut caused by inadequate gas shielding. All welds shall be made by the Heliarc welding method. All welding shall conform to applicable standards and procedures published by the AWS.
- (f) Rivets shall not be used.
- (g) Insofar as possible, all welds, especially those at eye level, shall be done internally. External welding shall be held to an absolute minimum.
- (h) All cabinets shall have neoprene sponge gaskets permanently secured on all doors to exclude dust and moisture. Cabinets shall be constructed so that water will not enter under any weather conditions.

676-3.2 Mechanical Dimensions and Layout:

The mechanical dimensions are to be determined by the cabinet manufacturer. The layout of equipment, in the rotatable rack assembly, shall be from the top of the rack to the bottom as follows: Controller; Laptop Computer Shelf / Storage Compartment; Input File "I"; Input File "J"; Output File # 1; Auxiliary Output File; and Power Distribution Assembly # 2 (PDA).

676-3.3 Ventilation Requirements:

All cabinets shall each be equipped with two (2) vent fans and two (2) aluminum frame mounted, removable dust filters. The fans used shall be mounted at the top of the cabinet and each fan shall be capable of moving a minimum of 100 cubic feet per minute of still air at sea level pressure 14.7 lbs/square inch. The 100 cfm rating shall apply to a non installed fan in free air.

The fans shall be rated for continuous duty and a lifetime of at least three (3) years. The fans shall be mounted in a manner shown in the plans package. The fans shall circulate the air via an intake at the bottom of the cabinet and passing it through a removable dust filter mounted directly behind the intake and exhausting the air through openings at the top of the cabinet.

Each fan shall be equipped with a thermostat which shall have a minimum adjustable range between 70°F and 125°F. The maximum operating temperature inside the cabinet shall be 165°F for all the furnished cabinets. The thermostats shall be set to allow one (1) fan to turn on first and then, if the temperature continues to rise, the second fan shall turn on.

The cabinet air filter shall be of the reusable, washable aluminum type with dimensions of 12 x 16 x 1 inches. The filter bottom shall rest in an aluminum channel and shall have a captive clamp mounted above the top edge of the filter to secure the filter in place. The filter shall be installed, positioned and therefore firmly held in place so that all intake air is filtered with no bypassing permitted through clearance spaces or gaps. There shall also be a separate aluminum water deflecting ventilation panel located on the inside of the cabinet door securing the filter to the door.

676-3.4 Cabinet Doors and Locks:

- (a) All cabinets shall be provided with hinged, rain-tight and dust-tight front and rear main doors.
- (b) The main cabinet doors shall be a NEMA type with a neoprene gasket in the door.
- (c) Hinges shall be made of 14 gauge stainless steel and shall be continuous the full length of the doors.
- (d) Cabinet hardware (bolts, nuts, etc.) shall be made of stainless steel.
- (e) All cabinets shall be furnished with a three-point locking system for the main cabinet doors. The three-point locking system shall consist of the following security points:
 - 1) Center of cabinet-lock unit operated by cabinet key and removable door handle. Two (2) handles shall be provided per cabinet.

- 2) Top of cabinet - operated by the removable door handle.
 - 3) Bottom of cabinet - operated by the removable door handle.
- (f) Security points 2) and 3) shall be designed so that they will remain in the unlocked position when the main cabinet lock(s) are unlocked.
- (g) All cabinets shall be furnished with a minimum of a two (2) position door stop.
- 1) The Door stop must be internally mounted and secured at the bottom of the cabinet and shall hold the door open at 90 degrees and at the full open position (minimum of 120 degrees).
 - 2) The door stop shall be designed to lock into position and withstand the force of a 30 M.P.H. wind.
- (h) The main cabinet doors shall be supplied with PPB-1 Corbin locks and two (2) sets of keys. The police door shall be equipped with a #2 Corbin lock and two (2) sets of keys. The fiber optic compartment door shall be equipped with a #18 Corbin lock and two (2) sets of keys. No other locks shall be acceptable. All locks shall have a rubber seal to keep moisture out.

676-3.5 Police Door and Panel:

All cabinets shall be provided with a NEMA type police door.

676-3.5.1 Switches:

There shall be two (2) switches located in the police panel (from left to right) and they shall be as follows:

- (a) Auto/Flash -- This toggle switch shall:
- 1) Place the intersection on FLASH immediately.
 - 2) Maintain power to the controller.
 - 3) Remove AC power from the load switches.

The Flash Circuit shall be designed such that:

- 1) Flashing operation shall continue with any or all electronic units disconnected.
 - 2) A command signal from the central computer through controller shall place the intersection on FLASH via the Uniform Control Flash (UCF) command set of the controller.
- (b) Auto/Manual -- This toggle switch shall allow the controller to be operated manually through all intervals, except for vehicle clearance. All vehicle clearance intervals shall be timed by the controller unit and shall not be terminated by actuation's from the manual push-button switch

676-3.5.2 Hand Control:

The cabinet shall be wired for and shall include a hand control to permit manual operation of the controller. This hand control shall be wired to a standard jack and accessible via the police door and shall consist of a manual push-button with a neoprene retractable power cord. The retractile power cord shall be SVO, two (2) conductor Belden #8601 or approved equivalent. The retracted length shall be 12-inches with a practical extended length of 6 feet. The manual push-button shall be encased in a neoprene rubber housing no less than 1-inch in diameter and 4-inches in length and shall be waterproof. The retractile power cord shall be wired to a standard ¼ inch phone jack.

676-3.5.3 Information and Function Identification:

The following switch and indicator functions [paragraphs (a) & (b), below] located in the police panel shall be silk screened directly on the police panel:

(a) Labeling of each switch per function:

- 1) Auto/Flash
- 2) Auto/Manual

The following pertinent information shall be silk screened on the inside of the police door.

(b) Internal Clearance Timing -- Notifying the police officer that the yellow and all red clearance intervals are timed internally. This label shall have a RED background with natural aluminum finish for the lettering and shall read as follows: "WARNING" "During Manual Control Operation, Yellow and Red Clearances are timed internally". This label shall be 4-3/4 X 2-1/4 inches in size.

676-3.6 Technician Service Panel:

All cabinets shall be provided with a technician service panel which is mounted on the back side of the police panel (inside of the main cabinet front door).

676-3.6.1 Switches:

There shall be four major switches and a bank of 12 technician test push button switches located on the technician service panel.

- (a) **SIGNALS** On/Off -- This toggle switch shall disconnect all power to the signal lights through the use of a mercury contact switch.
- (b) **UCF** -- This toggle switch shall:
 - 1) Place the intersection on FLASH only after completing the requirements as specified under UCF requirements (see Subsection 676-5.7).
 - 2) After meeting the UCF requirements, all power shall be removed immediately from signal load switches.
- (c) **DETECTOR RESET** – Momentary On – This momentary on switch shall provide for remote resetting of all vehicle detectors. This switch shall be wired to the detector-reset line on the Input Files “I” and “J”.
- (d) **The Technician Test Push Button Bank of switches** shall be of the momentary on type and to provide for eight (8) vehicle and four (4) pedestrian inputs. This bank of switches along with the Detector Reset switch can be located on a separate panel on the front of the rack above the controller.

676-3.6.2 Function Identification:

All switches located on the technician service panel shall be clearly marked as to function, silk screened directly on panel. No other method shall be acceptable.

676-3.7 Rack Assembly:

676-3.7.1 General:

- (a) The cabinet shall be provided with a pullout and rotatable rack assembly. The rack assembly shall house, from top to bottom of the rack assembly; the 170 Controller, Laptop Shelf / storage compartment, Input Files - “I” and “J”, Output File #1, Auxiliary Output File, and a PDA #2.
- (b) The rack and slide/hinged mounting brackets shall be constructed so that when the rack assembly is extended from the cabinet interior the entire rack assembly (fully loaded) can be pulled out with one (1) hand with complete ease of operation including rotation of the assembly.
- (c) The fully loaded rack assembly when pulled out of the cabinet, at any point from its resting position (inside cabinet), to its full extension and rotation shall not cause any member of the assembly to bend, warp or bind. Nor shall any increased friction be applied to the roller guides, extension brackets, etc. A maximum deflection of the entire rack assembly (with all equipment installed) shall not exceed 1/8-inch.

- (d) The rack assembly shall have a spring-loaded hatch mechanism to secure the rack assembly inside the cabinet while in the "rest" position.

676-3.7.2 Construction:

- (a) The rack shall be made from 1-inch square aluminum tubing with welded joints.
- (b) Rack assembly shall be constructed to house components designed to be installed in a standard EIA 19-inch rack. Clearance between the mounting rails shall be 17 3/4-inches.
- (c) The front of the rack assembly shall be tapped with 10-32 threads with EIA universal spacing for 19-inch electrical equipment racks.
- (d) The rack assembly shall be attached to the left cabinet wall through combination slide/hinged mounting brackets.
- (e) The slide/hinged mounting brackets shall be fabricated from aluminum and/or stainless steel only.
- (f) The mounting brackets guides shall utilize 7/8" stainless steel ball bearing rollers for easy pullout operation of the rack assembly.
- (g) The rack assembly shall be capable of rotating 210 degrees from its rest position after full extension from the cabinet.
- (h) Rack assembly shall have an aluminum rack stop rod 7/16" attached to the inside left cabinet wall from the left side of the rack assembly to lock the rack into final position.

676-3.7.3 Storage Compartment:

- (a) An aluminum storage compartment shall be mounted in the rack assembly as per the description location described in Subsection 676-3.6.1.
- (b) The storage compartment shall have telescoping drawer guides for full extension on drawer from rack assembly
- (c) Compartment shall have a continuous front lip for opening the compartment top for storage.
- (d) Compartment top shall have a plastic non-slip (rough texture) plastic laminate attached.

676-3.8 Cabinet Rails:

The cabinet shall be provided with four (4) cabinet rails for the purpose of mounting miscellaneous wiring panels and various mounting brackets. The rails shall extend from the bottom to the top of the cabinet right and left sides. Rails shall be keyhole design

with slots 2-inches on center with a top opening of 5/8-inch diameter to allow the insertion of a 5/8-inch x 1-inch carriage bolt. The rails shall be approximately 1 1/2-inches to 2-inches wide by 1/2-inch in depth. No uni-struts or other rails shall be accepted.

676-3.9 Mounting Requirements:

The cabinet shall have welded inside two (2) aluminum plates for anchoring it to an adapter base or concrete base. The plates shall be aluminum alloy 5052, 4-inches wide by 1/8-inch thick and shall have four (4) 1-inch diameter holes.

676-3.10 Cabinet Accessories:

676-3.10.1 Neoprene Plastic Pouch:

A 10-inch x 14-inch durable multiple-ply, neoprene plastic pouch with zip-lock shall be provided for the purpose of storing and retrieving documents. This pouch shall be located inside of the storage compartment.

676-3.10.2 Fiber Optic Compartment:

The Fiber Optic Compartment shall be a minimum of 10 inches high, 17 inches wide and 6 - 5/8 inches deep. It shall have a minimum opening of 8 inches high and 15 - 3/4 inches wide. The compartment shall have a door that covers the opening and provides a waterproof seal. The door shall use a #18 Corbin lock that is installed 3 - 7/8 inches from the top of the door on the right side. The left side of the door shall contain the hinge. The floor of the Fiber Optic compartment shall have three rows of 1-inch holes across the length of the floor for ventilation. Installed on the back wall of the Fiber Optic Compartment shall be the following equipment:

- 1 Fiber Optic Modular Coupler Panel
- 6 Fiber Optic Couplers - Type FC

676-3.10.3 Cabinet Lifting Brackets:

The cabinet shall be equipped with two (2) removable aluminum mounting brackets. Each bracket shall be attached with 5/16-inch x1 1/4-inch carriage bolts and hex nuts, grade 18-8 stainless steel.

Cabinets shall be delivered with the brackets attached in the upright position, to be used for lifting of the cabinet. Each mounting bracket shall be able to support a weight load of 500 pounds and shall be fabricated from 1/4-inch thick 6061-T6 extruded aluminum rectangular bar.

676-3.10.4 Manufacturer ID:

The manufacturer's name shall not appear on the outside of the cabinet, but shall appear on the inside of the cabinet front door, with the month and year of manufacture. This shall be done by a moisture resistant label (or other method approved by the Department).

676-4 ELECTRICAL APPURTENANCES:

676-4.1 Transient Protection:

The cabinet shall be supplied with transient protection devices specified herein. Other circuits shall have transient protection devices or circuits when called for in the specifications.

676-4.1.1 Main AC Power Input:

The controller cabinet AC service shall be protected by a unit consisting of a series of hybrid type elements that include primary clamp, secondary clamp, and a RFI filter. The surge protector shall be part No. SHA-1210, manufactured by EDCO, Incorporated, of Florida, or approved equivalent.

- (a) The surge protector shall be rated at 20,000 amps (minimum) and 8 x 20 microsecond wave shape.

Terminals shall be as defined below:

- 1) Main Line (AC line first stage terminal).
 - 2) Main Neutral (AC neutral input terminal).
 - 3) Equipment Line In (AC line second stage input terminal, 10 amps).
 - 4) Equipment Line Out (AC line second stage output terminal, 10 amps).
 - 5) Equipment Neutral Out (neutral terminal to protected equipment).
 - 6) Ground (earth connection).
- (b) The inductor in the second stage must not saturate with 10 amps, 120 volts AC, continuous service current applied. The first stage clamp must be between mainline and ground terminals.
- (c) The second stage clamp must be between equipment line out and equipment neutral. Main neutral and equipment neutral out shall be connected together

internally and shall have a gas charge tube rated at 20 kilo-amperes between main neutral and ground terminals.

- (d) The filter circuit shall meet MIL-STD-220 loss test and spike test.
- (e) With an input spike voltage of 700 Volts (peak to peak), the maximum voltage excursion above/below sine wave at all phase angles from 0 to 180°, shall not exceed ± 30 Volts.
- (f) Main line and equipment line terminals shall be isolated internally. The first stage clamp must be of solid-state design with no holdover current allowed.
- (g) Peak clamp voltage shall be 250 volts at 20 kilo-amperes. The unit must be encapsulated in flame retardant epoxy continuous service current of 10 amps at 120 VAC RMS.
- (h) The protector response time shall be such that the voltage never exceeds 250 volts during surges.

676-4.1.2 Field Terminal Transient Protection:

The signal head output terminals shall be protected by a transient protection device or circuit to reduce the effect of transient voltages applied to the output terminal circuits. The protection device or circuit shall have the following minimum ratings:

- (a) Recurrent peak AC voltage of 212 volts.
- (b) Energy rating of 20 joules.
- (c) Average power dissipation of 0.85 watts.
- (d) Peak current rating of 2,000 amperes for pulses less than 6 microseconds.
- (e) Standby current less than 1 milliampere.

A typical cabinet transient protection device is shown in Figure 676-34.

676-4.1.3 Mercury Contact Switch:

A 60 amp mercury contact switch shall be placed in series with the load switch packs to provide for disconnection of AC+ light inputs to all switch packs during flash operation.

676-4.1.4 Circuit Breaker:

A 50 amp circuit breaker shall be included in the cabinet as protection to control equipment and also for the purpose of providing a disconnect for the AC power.

676-4.1.5 AC Receptacle:

One (1) Ground Fault Circuit Interrupter (GFI) type receptacle shall be provided. It shall be mounted in the upper right rear corner of the fiber optic compartment and shall be separately fused by a 15-ampere circuit breaker. The circuit breaker (CBT1) for the outlet in the Fiber Optic compartment shall be located within the compartment immediately under the outlet. They shall be wired so that the outlets remain energized when the main cabinet circuit breaker is opened.

676-4.1.6 Cabinet Light:

Cabinets shall be equipped with one (1) 15-Watt self-starting fluorescent fixture for internal illumination. The fixture shall be mounted at the top center of the cabinet. The fixture shall be Standard Electric Fixture Co. Model UCL15 or approved equivalent.

676-4.1.7 Main Cabinet Door Light Switch:

The cabinet shall have two (2) main cabinet door light switches, one (1) for the front and one (1) for the rear main doors located on the door switch brackets. These switches shall control the interior cabinet light LT1. The switches shall be of the DPST type. The second pole shall be used for the "cabinet door open" circuit.

676-5 CABINET AND VARIOUS PANEL WIRING:

The nomenclature used to define signal heads, vehicular movements and pedestrian movements in the cabinet wiring and on wiring diagrams shall be in accordance the following City of Tallahassee standard wiring methods: Phase 2 is always the North Bound Through Movement on a Major Street is oriented in a North-South Direction, Likewise Phase 2 is always the West Bound Through Movement on a Major Street is oriented in a East-West Direction

The street wiring shall be wired in a Standard Operating Plan # 10, (Full eight phase configuration). This allows for future sequence changes without having to rewire the street system.

676-5.1 Controller Subsystem Files and Panels:

Printed Circuit Boards shall be **PROHIBITED** for use on any controller cabinet subsystem file or panel. These include but are not limited to the following:

- (a) Output Files (Except for the "Red Monitor Program Board")
- (b) Field Service Panel
- (c) Auxiliary Field Service Panel
- (d) Input files

676-5.2 Wiring:

676-5.2.1 General:

The wiring in the cabinets shall conform to latest applicable requirements of the National Electrical Code and all of these specifications as listed below:

- (a) All wires shall be cut to a proper length before assembly. No wire shall be doubled back to take up slack.
- (b) Wires shall be neatly laced into cables with Nylon lacing. Cables shall be secured with Nylon cable clamps, unless specified otherwise.
- (c) The position of cables between the components must be such that when the door is closed, it does not press against the cables or force the cables against the various components inside the controller cabinet.

676-5.2.2 Terminals:

Soldering of conductors to terminal lugs may be omitted, provided a calibrated ratchet type crimping tool is used.

The cabinet wiring and controller equipment and terminals shall be so arranged within the cabinet that they will not conflict with the entrance, training and connection of the incoming conductors, and will be easily traceable and without entanglement.

676-5.2.3 Wiring Lists:

The wiring list for the C1 connector harness is provided in Figure 676-1. The wiring list for the C4 connector harness is shown in Figure 676-2. The wiring list for the C5 connector harness is shown in Figure 676-3.

676-5.3 Field Service Panel:

676-5.3.1 General:

The Field Service Panel for the cabinet shall consist of ten (10) terminal strips, two (2) circuit breakers, forty-eight (48) transient protection devices, twelve (12) load resistors, sixteen (16) capacitors, eight (8) cable tie mounts and associated wiring for making all field wiring for making all field wiring connections.

676-5.3.2 Requirements:

- (a) The Field Service Panel shall be mounted in the Cabinet on the right exterior cabinet wall. This panel shall extend from the top to the bottom of the right cabinet wall.
- (b) All components shall be accessible from the front of the panel. No components or wires shall be mounted/attached behind the panel.

- (c) The panel board shall be made of aluminum. It shall be a minimum thickness of 3/16-inch to 1/8-inch.

676-5.3.3 Panel Wiring Configuration:

The Field Service Panel shall provide the necessary interconnecting junction points between the rack assembly and cabinet for the field service wires.

The panel is grouped for the three (3) functions listed below:

- (a) Internal connections (jumpers) between terminal boards.
- (b) Wiring from the panel to the rack assembly.
- (c) Wiring from the panel to the cabinet.

<u>PIN</u>	<u>SOURCE</u>	<u>DESTINATION</u>	<u>FUNCTION</u>
1	DC GND	DC-GND	LOGIC GROUND
2	0-1-1	C4-1	SWPK 4P RED
3	0-1-2	C4-2	SWPK 4P GRN
4	0-1-3	C4-3	SWPK 4 RED
5	0-1-4	C4-4	SWPK 4 YEL
6	0-1-5	C4-5	SWPK 4 GRN
7	0-1-6	C4-6	SWPK 3 RED
8	0-1-7	C4-7	SWPK 3 YEL
9	0-1-8	C4-8	SWPK 3 GRN
10	0-2-1	C4-9	SWPK 2P RED
11	0-2-2	C4-10	SWPK 2P GRN
12	0-2-3	C4-11	SWPK 2 RED
13	0-2-4	C4-12	SWPK 2 YEL
14	DC GND	DC-GND	LOGIC GROUND
15	0-2-5	C4-13	SWPK 2 GRN
16	0-2-6	C4-14	SWPK 1 RED
17	0-2-7	C4-15	SWPK 1 YEL
18	0-2-8	C4-16	SWPK 1 GRN
19	0-3-1	C4-17	SWPK 8P RED
20	0-3-2	C4-18	SWPK 8P GRN
21	0-3-3	C4-19	SWPK 8 RED
22	0-3-4	C4-20	SWPK 8 YEL
23	0-3-5	C4-21	SWPK 8 GRN
24	0-3-6	C4-22	SWPK 7 RED
25	0-3-7	C4-23	SWPK 7 YEL
26	0-3-8	C4-24	SWPK 7 GRN
27	0-4-1	C4-25	SWPK 6P RED
28	0-4-2	C4-26	SWPK 6P GRN
29	0-4-3	C4-27	SWPK 6 RED
30	0-4-4	C4-28	SWPK 6 YEL
31	0-4-5	C4-29	SWPK 6 GRN
32	0-4-6	C4-30	SWPK 5 RED
33	0-4-7	C4-31	SWPK 5 YEL

Figure 676-1: C1 HARNESS WIRING LIST

<u>PIN</u>	<u>SOURCE</u>	<u>DESTINATION</u>	<u>FUNCTION</u>
34	0-4-8	C4-32	SWPK 5 GRN
35	0-5-1	C4-33	SWPK 2P YEL
36	0-5-2	C4-34	SWPK 6P YEL
37	0-5-3	C4-35	SWPK 4P YEL
38	0-5-4	C4-36	SWPK 8P YEL
39	I-1-1	I 1-F,W	Ø 1 - EXT,CALL,COUNT
40	I-1-2	I 2-F	Ø 2 - EXT,CALL,COUNT
41	I-1-3	I 2-W, I 3-F,W	Ø 2 - EXT,CALL,COUNT
42	I-1-4	I 4-F,W	Ø 3 - EXT,CALL,COUNT
43	I-1-5	I 5-F	Ø 4 - EXT,CALL,COUNT
44	I-1-6	I 5-W, I 6-F,W	Ø 4 - EXT,CALL,COUNT
45	I-1-7	I 7-F,W	Ø 5 - EXT,CALL,COUNT
46	I-1-8	I 8-F	Ø 6 - EXT,CALL,COUNT
47	I-2-1	I 8-W, I 9-F,W	Ø 6 - EXT,CALL,COUNT
48	I-2-2	I 10-F,W	Ø 7 - EXT,CALL,COUNT
49	I-2-3	J 8-F	SPEED LOOP 1A
50	I-2-4	J 8-W	SPEED LOOP 1B
51	I-2-5	J 14-F	RR 1 PREEMPT
52	I-2-6	J 14-W	RR 2 PREEMPT
53	I-2-7	J 9-F	SPEED LOOP 2A
54	I-2-8	J 9-W	SPEED LOOP 2B
55	I-3-1	J 10-F	SPEED LOOP 3A
56	I-3-2	I 11-F	Ø 8 - EXT,CALL,COUNT
57	I-3-3	I 11-W, I 12-F,W	Ø 8 - EXT,CALL,COUNT
58	I-3-4	I 1-F	SYSTEM SENSOR 1
59	I-3-6	J 1-W	SYSTEM SENSOR 2
60	I-3-6	J 2-F	SYSTEM SENSOR 3
61	I-3-7	J 2-W	SYSTEM SENSOR 4
62	I-3-8	J 3-F	SYSTEM SENSOR 5
63	I-4-5	J 3-W	SYSTEM SENSOR 6
64	I-4-6	J 4-F	SYSTEM SENSOR 7
65	I-4-7		DOOR SWITCH ALARM
66	I-4-8	J 4-W	SYSTEM SENSOR 8

Figure 676-1: C1 HARNESS WIRING LIST

<u>PIN</u>	<u>SOURCE</u>	<u>DESTINATION</u>	<u>FUNCTION</u>
67	I-5-1		MCE
68	I-5-2	J 10-W	SPEED 3B
69	I-5-3	J 11-F	SPEED 4A
70	I-5-4		FLASH IN
71	I-5-5	J 13-F	EV - A PREEMPT
72	I-5-6	J 13-W	EV - B PREEMPT
73	I-5-7	J 12-F	EV - C PREEMPT
74	I-5-8	J 12-W	EV - D PREEMPT
75	I-6-1	I 13-F	PED 2 PUSHBUTTON
76	I-6-2	I 13-W	PED 6 PUSHBUTTON
77	I-6-3	I 14-F	PED 4 PUSHBUTTON
78	I-6-4	I 14-W	PED 8 PUSHBUTTON
79	I-6-5	J 11-W	SPEED 4B
80	I-6-6		INTERVAL ADVANCE
81	I-6-7		FLASH SENSE
82	I-6-8		STOP TIME
83	0-6-1	C5-1	DET FAIL
84	0-6-2	C5-2	SPARE OUTPUT
85	0-6-3	C5-3	OVERLAP 4 RED
86	0-6-4	C5-4	OVERLAP 4 YELLOW
87	0-6-5	C5-5	OVERLAP 4 GREEN
88	0-6-6	C5-6	OVERLAP 3 RED
89	0-6-7	C5-7	OVERLAP 3 YELLOW
90	0-6-8	C5-8	OVERLAP 3 GREEN
91	0-7-1	C5-9	SPARE OUTPUT
92	DC GND	DC-GND	LOGIC GROUND
93	0-7-2	C5-17	SPARE OUTPUT
94	0-7-3	C5-11	OVERLAP 2 RED
95	0-7-4	C5-12	OVERLAP 2 YELLOW
96	0-7-5	C5-13	OVERLAP 2 GREEN
97	0-7-6	C5-14	OVERLAP 1 RED
98	0-7-7	C5-15	OVERLAP 1 YELLOW
99	0-7-8	C5-16	OVERLAP 1 GREEN
100	0-5-5		DET RESET
101	0-5-6		FLASH OUTPUT (UCF)
102	0-5-7		RED MONITOR
103	0-5-8	C4-37	WATCHDOG OUTPUT
104	DC GND	DC-GND	LOGIC GROUND

Figure 676-1: C1 HARNESS WIRING LIST

<u>PIN</u>	<u>SOURCE</u>	<u>DESTINATION</u>	<u>FUNCTION</u>
1	C1-2	SWPK 4P	RED
2	C1-3	SWPK 4P	GRN
3	C1-4	SWPK 4	RED
4	C1-5	SWPK 4	YEL
5	C1-6	SWPK 4	GRN
6	C1-7	SWPK 3	RED
7	C1-8	SWPK 3	YEL
8	C1-9	SWPK 3	GRN
9	C1-10	SWPK 2P	RED
10	C1-11	SWPK 2P	GRN
11	C1-12	SWPK 2	RED
12	C1-13	SWPK 2	YEL
13	C1-15	SWPK 2	GRN
14	C1-16	SWPK 1	RED
15	C1-17	SWPK 1	YEL
16	C1-18	SWPK 1	GRN
17	C1-19	SWPK 8P	RED
18	C1-20	SWPK 8P	GRN
19	C1-21	SWPK 8	RED
20	C1-22	SWPK 8	YEL
21	C1-23	SWPK 8	GRN
22	C1-24	SWPK 7	RED
23	C1-25	SWPK 7	YEL
24	C1-26	SWPK 7	GRN
25	C1-27	SWPK 6P	RED
26	C1-28	SWPK 6P	GRN
27	C1-29	SWPK 6	RED
28	C1-30	SWPK 6	YEL
29	C1-31	SWPK 6	GRN
30	C1-32	SWPK 5	RED
31	C1-33	SWPK 5	YEL
32	C1-34	SWPK 5	GRN
33	C1-35	SWPK 2P	SP FUNCTION
34	C1-36	SWPK 6P	SP FUNCTION
35	C1-37	SWPK 4P	SP FUNCTION
36	C1-38	SWPK 8P	SCH FLASHER
37	C1-103	WDT-MU	WATCHDOG

Figure 676-2: C4 HARNESS WIRING LIST

<u>PIN</u>	<u>SOURCE</u>	<u>DESTINATION</u>	<u>FUNCTION</u>	
1	C1-84	SWPK 6	SP2 IN	RED
2	C1-91	SWPK 6	SP2 IN	GRN
3	C1-85	SWPK 5	OVERLAP 4	RED
4	C1-86	SWPK 5	OVERLAP 4	YELLOW
5	C1-87	SWPK 5	OVERLAP 4	GRN
6	C1-88	SWPK 4	OVERLAP 3	RED
7	C1-89	SWPK 4	OVERLAP 3	YELLOW
8	C1-90	SWPK 4	OVERLAP 3	GRN
9		SWPK 3	SP1 IN	RED
10		SWPK 3	SP1 IN	GRN
11	C1-94	SWPK 2	OVERLAP 2	RED
12	C1-95	SWPK 2	OVERLAP 2	YELLOW
13	C1-96	SWPK 2	OVERLAP 2	GRN
14	C1-97	SWPK 1	OVERLAP 1	YELLOW
15	C1-98	SWPK 1	OVERLAP 1	GRN
16	C1-99	SWPK 1	OVERLAP 1	RED
17	C1-93	SWPK 6	SP2 IN	YELLOW
18		SWPK 3	SP1 IN	YELLOW
19				
20				
21				
22				
23				
24	TB1-18	+24VDC		

Figure 676-3: C5 HARNESS WIRING LIST

676-5.3.4 Field Service Panel Wiring:

As specified below, the wiring harness shall have flexible wire covered by a flexible non-metallic conduit from the Field Service Panel to the:

- (a) Power Distribution Assembly
- (b) Output File
- (c) Aux. Output File

The Harness shall be long enough to reach from the Field Service Panel to the PDA after the rack assembly is fully extended and rotated to its maximum limit, with some degree of slack in the harness. However, the Harness shall not be excessive in length to cause binding or crimping to the wires when the rack assembly is in its "rest" position inside the cabinet.

The harness shall have a metal clamp with a rubber grommet center attached to the Field Service Panel to secure the harness to the panel for proper orientation of the harness with the rack assembly.

The panel wire size shall be the #18 AWG (minimum). All wire sizes are properly sized by the Controller Cabinet Assembly Manufacturer.

676-5.3.5 Terminal Strips:

The Terminal strips for the panel shall be as listed below:

- (a) TBS1 - Marathon 1103 or approved equal.
- (b) TBS2 - Cinch 16-140B or approved equal.
- (c) TBS3 - Cinch 20-140B or approved equal.
- (d) TBS4, TBS5 & TBS6 - Cinch 12-142B or approved equal.

676-5.3.6 Circuit Breakers:

The panel shall have a main cabinet circuit breaker rated at 50 amp and a cabinet accessory circuit breaker rated at 15 amp (for cabinet fans and light). Circuit Breakers shall be mounted near the back cabinet door on the panel for the purpose of providing an easily accessible quick disconnect for the AC Power and protection to the control equipment.

676-5.3.7 Load Resistors and Capacitors:

Load resistors shall be provided for all yellow and yellow arrow Switch Pack outputs and capacitors shall be provided for all green and green arrow Switch Pack outputs to keep the Conflict-Voltage Monitor from going into "Flash" due to a Failed signal lamp. Load resistors shall be 2K 10 Watt and capacitors shall be 1.5 microfarad 250 Volts.

676-5.3.8 Metal Oxide Varistor (MOV):

MOVs shall be physically tied to one (1) side of each terminal on TBS4 and TBS5 and shall be physically secured to a Field Service Panel with a 6-32 screw.

676-5.4 Auxiliary Field Service Panel:

676-5.4.1 General:

The Auxiliary Field Service Panel for the cabinet shall consist of an adequate number of terminal strips to accommodate 46 detector surge protectors and another set of terminal blocks to accommodate the termination of the input circuits for the ped pushbuttons, EV preemption, and RR preemption.

676-5.4.2 Requirements:

- (a) The Auxiliary Field Service Panel shall be mounted in the Cabinet on the left interior cabinet wall.
- (b) All components shall be accessible from the front of the panel. No components or wires shall be mounted/attached behind the panel.
- (c) The panel board shall be made of aluminum with a minimum thickness of 3/16-inch to 1/8-inch

676-5.4.3 Panel Wiring:

The input files "I" and "J" shall be wired to separate terminal blocks located on the Auxiliary Field Service Panel.

The Harness shall be long enough to reach from the Auxiliary Field Service Panel to the Input File (through expandable braided polyester sleeves) after the rack assembly is fully extended and rotated to its maximum limit, with some degree of slack in the harness. However, the wires shall not be excessive in the length to cause binding or crimping to the wires when the rack assembly is in its "rest" position inside the cabinet.

676-5.4.4 Terminal Strips:

The panel shall have terminal strips for termination of 46 Loop Detector Inputs, 4 Pedestrian Push buttons, 4 Emergency Vehicle Inputs, 2 Railroad Inputs, and Earth Grounds. These terminal strips shall be Cinch 20-142B or approved equivalent.

676-5.4.5 Surge Protectors:

The forty-six (46) surge protectors shall be a three terminal device, two of which are connected across the signal inputs of the detector for differential mode protection and the third terminal is grounded to protect against common mode damage. Unit shall be EDCO SRA-6LCA or approved equivalent.

676-5.4.7 Relays and Relay Bases:

Relays shall be Potter Bromfield KUMP Series Silver Cadmium Quick Connect Relays for socket mount models with contact rating of 15 amps or approved equivalent. Bases shall be Potter Bromfield 27E893 or approved equivalent. All relay contacts shall be terminated and identified on a terminal strip located on the Auxiliary Field Service Panel.

676-5.5 Controller Interface Panel:

676-5.5.1 General:

The Controller Interface Panel for the cabinet shall consist of an adequate number of terminal strips to accommodate all input pins C1-39 thru C1-82 on the C1 connector. The following output and ground pins will also be terminated on the Controller Interface Panel: C1-1, 14, 83, 92, 100, 101, 102, and 104.

676-5.5.2 Requirements:

- (a) The Controller Interface Panel shall be mounted on the back of the rack behind the input file on some type of fold down attachment.
- (b) All detector wiring shall be accessible from the front of the panel. All controller C1 cable wiring and jumpers shall be attached behind the panel.
- (c) The panel board shall be made of aluminum with a minimum thickness of 3/16-inch to 1/8-inch

676-5.5.3 Panel Wiring:

The input files "I" and "J" shall be wired to separate terminal blocks located on the Controller Interface Panel.

The Harness shall be long enough to reach from the Controller Interface Panel to the Input File after the Controller Interface assembly is fully folded to its maximum limit, with some degree of slack in the harness. However, the wires shall not be excessive in the length to cause binding or crimping to the wires when the panel assembly is in its "rest" position.

676-5.5.4 Terminal Strips:

The panel shall have terminal strips for termination of 38 Loop Detector Inputs, 4 Pedestrian Push buttons, 4 Emergency Vehicle Inputs, 2 Railroad Inputs, 6 Special Inputs (Manual Control Enable, Interval Advance, Stop Time, Flash Sense, Uniform Code Flash, and Door Alarm); Detector Reset; Detector Fail; Red Mon; 24 Volts DC; and Logic Ground. Any unused pins in the C1 Connector shall be terminated on these terminal blocks and properly identified. These terminal strips shall be Cinch 50A-44A-30 or approved equivalent.

676-5.6 Cabinet Completion Requirements:

676-5.6.1 General:

The cabinet shall be supplied completely wired including all inter-equipment connections, to accept all computer interface equipment.

676-5.6.2 Cable Harnesses:

Cable harnesses for all interface equipment shall be supplied, wired to their respective terminal strips, as a part of this specification. Cable harnesses must be long enough to reach from the terminal strips to the shelf location of the auxiliary units.

676-5.7 Flashing Operation:

676-5.7.1 Uniform Code Flash (UCF):

When a non-emergency flashing operation is required the selected operation shall be performed by the UCF format. The following shall utilize UCF format:

- (a) UCF Flash Switch - A Switch located on the Technician Service Panel for Traffic Signal Technicians/Engineers – wired to C1-70.
- (b) Time Base Coordination Flash - An integral part of the 170 Controller unit used for pre-programmed flashing operation.

When flashing operation is selected by one (1) of the above procedures the controller assembly shall transfer from normal operation to flashing operation only at the end of the

common major street red interval, the common minor street yellow interval, or the all red interval.

Uniform Code Flash shall be an internal function of the controller unit, it shall not be inhibited by the Time Based Hold Command, and no external logic shall be used to provide this function.

676-5.7.2 System/Emergency Flash:

In the event of an emergency when flashing operation is required, the controller assembly shall immediately place the intersection on flash. Emergency flash shall be selected by one (1) of the below procedures:

- (a) Auto/Flash Switch- A switch located on the Police Panel for Police or Traffic Signal Technicians/Engineers (Refer to Subsection 676-3.4).
- (b) Conflict-Voltage Monitor - Auxiliary unit in the controller cabinet senses a conflicting indication or voltage problem (Refer to Subsection 678-2.1).

When flashing operation is selected by the Auto/Flash Switch on the Police Panel, the system's remote flash command or by the Conflict-Voltage Monitor, the controller assembly shall immediately transfer to flashing operation.

676-5.7.3 Return To Normal Operation:

The transfer of the controller assembly from flashing operation to normal operation shall cause the controller unit to revert to its start-up sequence unless the Conflict-Voltage Monitor has transferred the controller assembly to flashing operation. If transferred to flashing operation by the Conflict-Voltage Monitor, the controller assembly shall remain in flashing operation until the Monitor Unit is reset and automatic operation can be implemented through the normal start-up sequence.

676-6 Cabinet Adapter Base:

A Cabinet shall include either the Standard Adapter Base or Standard Power Adapter Base depending upon how the electrical service is being brought into the assembly. See Plans for details on Electrical Service Requirements.

676-6.1 Standard Adapter Base

The Standard Adapter Base shall adapt the controller assembly cabinet to a standard Type V cabinet pad. Cabinet pads may be either concrete or composite fiber embedded with concrete. The Standard Base shall be used when the electrical power feed and power disconnect are located on other poles away from the cabinet assembly.

The Standard Base Adapter shall be built from Aluminum with a minimum thickness of .125 inches and 5052 alloy. The Base shall be a minimum of 38 X 24 X 12 inches. The

base shall have elongated holes in each corner to allow for the matching of an existing Type V concrete pad.

The Standard Base Adapter shall have a taper starting 5 inches above the base to allow for the reduced size of the cabinet assembly base. There shall be matching holes in the adapter base to accommodate all bolts and wiring entrances.

676-6.2 Standard Power Adapter Base

The Standard Power Adapter Base shall adapt the controller assembly cabinet to a standard Type V cabinet pad. Cabinet pads may be either concrete or composite fiber embedded with concrete. The Standard Power Adapter Base shall be used when the electrical power feed and power disconnect are to be located at the cabinet assembly.

The Standard Power Base Adapter shall be built from Aluminum with a minimum thickness of .125 inches and 5052 alloy. The Base shall be a minimum of 38 X 24 X 12 inches. The base shall have elongated holes in each corner to allow for the matching of an existing Type V concrete pad.

The Standard Power Base Adapter shall have a taper starting 5 inches above the base to allow for the reduction of width for the cabinet assembly base and sufficient support members to allow the 6 inch square metal pedestal to be mounted 6 inches from the left wall of the cabinet assembly. The metal pedestal shall be centered on the width of the Standard Power Base Adapter. The metal pedestal shall have a 5 ½ inch x 1 foot - 10 inch access panel near the top of the pedestal. This access panel shall allow for the access during wiring of the electric meter and breaker box which shall be located at the top front of the pedestal. There shall be matching holes in the adapter base to accommodate all bolts and wiring entrances.