

# M ADVANCED TRAFFIC SIGNAL CONTROLLER (ATC) CABINET ASSEMBLY - Rack Mount Specification

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Version 1.0



## VERSION HISTORY

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# **1. GENERAL EQUIPMENT SPECIFICATIONS**

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## **1.1 GENERAL SPECIFICATIONS**

- 1.1.1 The M ATC 120VAC High Voltage Cabinet (HV) Cabinet shall be delivered complete with all equipment and accessories necessary for safe and efficient operation.
- 1.1.2 The M ATC 120VAC High Voltage (HV) Cabinet shall be ready for immediate job site operation.
- 1.1.3 Wiring Routing and Hardware Requirements
- 1.1.4 All wiring shall have adequate protective covers wherever there is a possibility of contact with any other components.
- 1.1.5 Separators shall be used where applicable. No tape or adhesive fasteners will be accepted.
- 1.1.6 All wiring shall be routed to be clear of all heat sources and shall be protected from any present or potential source of snags, abrasions or sharp edges.

# **2. ATC CABINET COMPONENT**

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## **2.1 MODEL 2202-HV HIGH-DENSITY SWITCH PACK / FLASHER UNIT (HDSP/FU)**

- 2.1.1 The HDSP/FU shall be compact, pluggable, modular PCB-based, and equipped with DIN connector.
- 2.1.2 The HDSP/FU shall be compatible with ultra-low power LED signal heads and it shall have a current monitoring feature for each output of each channel.
- 2.1.3 The HDSP/FU shall use real-time standardized high-speed Serial Bus #3 (SB3) communications with the Cabinet Monitor Unit (CMU) to send a complete set of RMS voltage and load current measurements.

- 2.1.4 The HDSP/FU shall be 4.5" H x 6.5" D and shall be equipped with a handle, reset push button switch, six RYG LED indicators, four flasher LED indicators, one power LED indicator and two Rx/Tx LED indicators.
- 2.1.5 The HDSP/FU can function as either a switch pack (HDSP) or as a flasher unit (HDFU).
- 2.1.6 When installed in the Output Assembly, the High-Density Switch Pack (HDSP) shall provide two RYG channels of operation (6 outputs).
- 2.1.7 When installed in the Service Assembly, the High-Density Flasher Unit (HDFU) shall function as a four-output flasher.
- 2.1.8 The load switch shall be Model 2202-HV High-Density Switch Pack / Flasher Unit.

## **2.2 MODEL 2212-HV CABINET MONITOR UNIT (CMUIP)**

- 2.2.1 The Cabinet Monitor Unit (CMUIP) shall be compact, pluggable, and modular.
- 2.2.2 The CMUIP shall use real-time standardized 614.4 Kbs SDLC communications with the ATC to transfer command and response data on Serial Bus #1 (SB1).
- 2.2.3 The CMUIP shall be capable of monitoring up to 32 physical switch pack channels (RYG) and shall have optional four virtual channels.
- 2.2.4 The CMUIP shall provide a Flasher Alarm feature.
- 2.2.5 The CMUIP shall analyze the ATC output commands and field input status to isolate the failure source by channel and color.
- 2.2.6 The CMUIP configuration programming shall be provided by an interchangeable Datakey nonvolatile memory device.
- 2.2.7 This rugged key shall store all CMUIP configuration parameters and shall eliminate programming using jumpers, diodes, or DIP switches.
- 2.2.8 The CMUIP shall maintain a nonvolatile event log recording the complete intersection status as well as time stamped previous fault events, AC Line events, configuration changes, monitor resets, cabinet temperature and true RMS voltages and currents for all field inputs.

2.2.9 The signal sequence history log stored in nonvolatile memory graphically shall display up to 30 seconds of signal status prior to the fault trigger event with 50 ms resolution to ease diagnosing of intermittent and transient faults.

2.2.10 The Cabinet Monitor Unit shall be Model CMUip-2212-HV.

## **2.3 MODEL 2218 SERIAL INTERFACE UNIT (SIU)**

2.3.1 The Model 2218 Serial Interface Unit (SIU) shall be a compact, pluggable, and modular.

2.3.2 The SIU shall use real-time standardized 614.4 Kbs SDLC communications with the ATC to transfer command and response data on Serial Bus #1 (SB1).

2.3.3 The SIU shall be equipped with 54 programmable input/out pins, four optically isolated input pins, one line sync reference input pin and 4 address select input pins.

2.3.4 The optically isolated inputs shall work with either 12VAC or 24VDC.

2.3.5 The SIU outputs shall be rated at 150 mA continuous sink current.

2.3.6 Each output shall provide a 500mA typical current limit and shall be rated to 50V and utilize a voltage clamp for inductive transient protection.

2.3.7 The SIU shall be equipped with a front panel LED indicator that can report the current SIU assembly address assignment of the SIU for cabinet configuration verification.

2.3.8 The SIU shall be Model SIU-2218.

## **2.4 MODEL 2220 AUXILIARY DISPLAY UNIT (ADU)**

2.4.1 The ADU shall install in a 1U height 19" rack space as illustrated on Figure 1: Auxiliary Display Unit and shall provide a menu driven user interface to the enhanced features of the CMUip monitor including the built-in Diagnostic Wizard.

2.4.2 The ADU shall provide 32 channels of Red, Yellow and Green LED indicators that display full intersection status and 32 Blue fault status LED indicators shall identify faulty channels.

2.4.3 The ADU shall provide proper electrical termination to SB3.



- 2.4.4 The ADU shall have a 4 line by 20-character menu driven liquid crystal display with backlight and heater.
- 2.4.5 The ADU built-in Diagnostic Wizard shall automatically pinpoint faulty signals and offers trouble-shooting guidance and automatically isolate and identify problems.
- 2.4.6 The ADU shall be equipped with Event Logging displaying the CMUp time-stamped nonvolatile event log records with the complete intersection status as well as AC Line events, monitor resets, temperature and true RMS voltages and currents.
- 2.4.7 The ADU unit shall be Model ADU-2220.

## **2.5 MODEL 2216-24 CABINET POWER SUPPLY (CPS)**

- 2.5.1 The CPS shall install in a 1U height 19" rack space as illustrated in Figure 2: Cabinet Power Supply.
- 2.5.2 The CPS shall be rated at 168 Watts, 48VDC @ 2 Amp and 24VDC @ 8 Amp.
- 2.5.3 The CPS shall have power factor corrected features and shall ensure a full load power factor of 0.98 or better, reducing peak AC Line input current and associated stress on wiring.
- 2.5.4 The CPS shall use modern switching technology and shall provide full output regulation across changes in AC Line voltage and output load over the full operating temperature range of -34°C to +74°C without the need for a fan.
- 2.5.5 The CPS shall have separate green LED indicators that display AC input status, DC output status and associated fuse integrity.
- 2.5.6 The CPS outputs shall be fused for over-current protection and shall be protected against voltage transients by a 1500-Watt suppressor.
- 2.5.7 The CPS shall be Model 2216-24. Install CPS as per applicable ATC Cabinet Model as illustrated on the Cabinet Layout Diagrams on pages 51, 52, 53, and 54.

## **2.6 MONITOR KEY PROGRAMMING TOOL**

2.6.1 The Programming Tool provides the capability to Read and Write data from the CMUip Datakey device. The MonitorKey software shall be compatible with the CMUip-2212.

2.6.2 The Monitor Key Programming Tool shall be EBERLE Design INC.

## **2.7 MODEL 21H HIGH-DENSITY FLASH TRANSFER RELAY (HDFTR)**

2.7.1 The HDFTR shall have a hermetically sealed cover and shall be moisture proof.

2.7.2 The HDFTR shall be filled with dry nitrogen to protect contacts from corrosion and to prevent condensation.

2.7.3 The HDFTR shall have a shock/impact resistant metal can cover with solid and bend proof pins.

2.7.4 The HDFTR contacts shall be rated at 120VAC @ 10 Amp. The coil of the HDFTR shall be rated at 48VDC.

2.7.5 The HDFTR shall have an LED indicator to display contact transfer position.

2.7.6 The HDFTR shall be STRUTHERS-DUNN Model 21XBHL-48VDC or approved equivalent.

## **2.8 MAIN CONTACTOR (MC)**

2.8.1 The MC shall be mercury free and shall be rated at 120VAC @ 60 Amp.

2.8.2 The coil of the MC shall be rated at 48VDC. The MC shall be equipped with input indicator and shall have SPST- N.O. contacts.

2.8.3 Main Contactor shall be Struthers-Dunn 428AXXL-48VDC or approved equivalent.

## **2.9 CABINET SUPPRESSOR-FILTER**

2.9.1 The cabinet shall be equipped with a Cabinet Suppressor–Filter. The unit shall incorporate the use of warning and failure indicators and shall have a dry relay contact remote sensing circuit.

2.9.2 The unit shall be modular and pluggable with a 6-position Beau 5406 connector.

2.9.3 The unit shall be rated at continuous service current of 15 Amp and maximum clamp voltage of 390VAC.

2.9.4 The unit shall filter noise and spike from 10 KHz to 25 MHz and shall have a peak surge current of 48 KA.

2.9.5 The Cabinet Suppressor Filter shall be HESCO HE1750R or approved equivalent .

## **2.10 HIGH-DENSITY SWITCH PACK SUPPRESSOR**

2.10.1 The HDSP Suppressor shall be modular and pluggable.

2.10.2 The unit shall be epoxy encapsulated and equipped with 9-position 5.08 mm Phoenix Contact connector.

2.10.3 The unit shall be able to protect 6 circuits.

2.10.4 The device operating voltage shall be 120VAC and clamping voltage shall be 340VAC.

2.10.5 The unit dimensions shall be 2" H x 0.7" W x 2" D.

2.10.6 The HDSP Suppressor shall be Model Hesco HE103C-9 or approved equivalent.

## **2.11 DETECTION MODULE SUPPRESSOR**

2.11.1 The Detection Module Suppressor shall be modular and pluggable.

2.11.2 The unit shall be epoxy encapsulated and equipped with 6-position 5.08 mm Euroblock style connector.

2.11.3 The unit shall be able to protect 6 circuits.

2.11.4 The device operating voltage shall be 75VDC and clamping voltage shall be 130VDC.

2.11.5 The device dimensions shall be 2" H x 0.7" W x 1.5" D.

2.11.6 The Detection Module Suppressor shall be Hesco HE6LC-6 or approved equivalent.

### **3. GENERAL REQUIREMENTS**

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#### **3.1 THE CABINET SHALL ADHERE TO THE FOLLOWING REQUIREMENTS:**

- 3.1.1 The assemblies shall be completely removable from or installable in the cabinet without removing any other equipment and using only a standard slotted or Phillips screwdriver.
- 3.1.2 The cabinet shall be capable of Cabinet Flash signal operation in the absence of any of the following assemblies: Input Assembly, Output Assembly, Cabinet Power Supply, and Controller.
- 3.1.3 A momentary push button shall be provided that, when pressed, energizes the 24 VDC to the HDSPs during Flash Mode.
- 3.1.4 The button shall be labeled “24 VDC BYPASS” and shall be located on the front of the Output Assembly.
- 3.1.5 High-voltage components (over 50 Volts) shall be protected from incidental contact per NEC.
- 3.1.6 All fuses, circuit breakers, switches (except police panel switches) and indicators shall be readily visible and accessible from the area accessed by opening the front door.
- 3.1.7 All circuit breakers located on the rack shall have covers to prevent accidental tripping.
- 3.1.8 All Assemblies shall be modular with pluggable cabling.
- 3.1.9 The ventilation fans shall be fastened to the cabinet via two thumb screws and shall not be fastened in a manner that requires any tools for removal or installation.
- 3.1.10 Door switches shall be powered by 48 VDC.
- 3.1.11 Wire raceway shall be integrated as part of the cabinet allowing for neat internal and field wiring.
- 3.1.12 All equipment in the cabinet shall be clearly and permanently labeled.
- 3.1.13 The marker strips shall be made of material that can be easily and legibly written on using a pencil or ballpoint pen. Marker strips shall be located

immediately below the item they are to identify and must be clearly visible with the items installed.

3.1.14 Guides (top and bottom) shall be provided for assembly plug-in units. The guides shall begin 0.50 inch from the assembly front panel face.

## **4. ATC CABINET SPECIFICATION**

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### **4.1 GENERAL**

4.1.1 The ATC Cabinet family is a modular, serially interconnected cabinet architecture that is designed to fulfill a variety of transportation applications.

4.1.2 The cabinet shall include: Service Assembly (SA), Input Assembly (IA), Output Assembly (OA), SB1/SB2 and DC/Clean Power Bus, Field Input Termination Assembly (FITA), AND Field Output Termination Assembly (FOTA).

### **4.2 CABINET HOUSING**

4.2.1 The housings shall include, but not be limited to, the following:

- Enclosure
- Doors
- Gasket
- Lifting Eyes & External Bolt Heads
- Latches & Locks
- Ventilation
- Hinges and Door Catches
- Police Panel
- Cage Supports and Mounting

#### **4.2.2 Housing Construction**

4.2.2.1 The housing shall be rainproof.

4.2.2.2 It shall have front and rear doors, each equipped with a lock and handle.

4.2.2.3 The enclosure top shall be crowned to prevent standing water.

4.2.2.4 The ATC Model cabinet housing dimensions (Tolerance  $\pm 1/4"$ ) shall be in accordance to Figure 10: M ATC Cabinet Housing Detail.

#### **4.2.3 Material Thickness**

4.2.3.1 The enclosure, doors, lifting eyes, gasket channels, police panel door, spacer supports, and all supports welded to the enclosure and doors shall be fabricated of 0.125-inch minimum thickness aluminum sheet.

4.2.3.2 The filter shell, filter trough, fan support and police panel enclosure shall be fabricated of 0.080-inch minimum thickness aluminum sheet.

4.2.3.3 The spacer supports shall have the option to use 0.059-inch minimum stainless-steel sheet.

#### 4.2.4 Welds

4.2.4.1 All exterior seams for enclosure and doors shall be continuously welded and shall be smooth.

4.2.4.2 All edges shall be filled to a radius of 0.03125 inch minimum.

4.2.4.3 Exterior cabinet welds shall be done by gas Tungsten arc TIG process only.

4.2.4.4 ER5356 aluminum alloy bare welding electrodes conforming to AWS A5.10 requirements shall be used for welding on aluminum.

4.2.4.5 Procedures, welders, and welding operators shall conform to the requirements and practices in AWS B3.0 and C5.6 for aluminum.

4.2.4.6 Internal cabinet welds shall be done by gas metal arc MIG or gas Tungsten arc TIG process.

#### 4.2.5 Cabinet Finish

4.2.5.1 The exterior can be powder coated or natural aluminum.

4.2.5.2 The interior can be powder coated or natural aluminum.

4.2.5.3 All surfaces, burrs, and welds to be cleaned and smoothed before painting.

#### 4.2.6 Enclosure Door Frames and Door Seals

4.2.6.1 The enclosure door frames shall be double flanged out on all four sides and shall have strikers to hold tension on, and to form a firm seal between, the door gasket and the frame.

4.2.6.2 The dimension between the door edge and the enclosure external surface when the door is closed and locked shall be 0.156 inch (+/-0.08 inches).

#### 4.2.7 Gaskets

4.2.7.1 Gaskets shall be provided on all door openings and shall be dust tight.

4.2.7.2 Gaskets shall be 0.25 inches minimum thickness closed cell neoprene or silicone (BOYD R- 108480 or approved equal) and shall be permanently bonded to the metal.

4.2.7.3 A gasket top and side channels shall be provided to support the top gasket on the door to prevent gasket gravitational fatigue.



#### 4.2.8 Lifting Eyes and Exterior Bolt Heads

4.2.8.1 The housing shall be provided with 2 lifting eyes for placing the cabinet on its foundation.

4.2.8.2 Each eye opening shall have a minimum diameter of 0.75 inch.

4.2.8.3 Each eye shall be able to support the weight load of 1000 lbs.

4.2.8.4 All bolt heads shall be tamperproof type.

#### 4.2.8.5 Door

4.2.8.5.1 MATC cabinets shall have twin doors on the front and twin doors on the rear of the cabinet as illustrated on Figure 10: M ATC Cabinet Housing Detail.

4.2.8.5.2 The front and rear door on the right shall be equipped with a three-point latching mechanism with nylon rollers at the top and bottom.

4.2.8.5.3 The front door on the right shall have Louvered Air Vent with Filter Retainer Bracket.

#### 4.2.8.6 Latching Handles

4.2.8.6.1 The latching handles shall have provision for padlocking in the closed position.

4.2.8.6.2 Each handle shall be 0.75 in minimum diameter stainless steel with a minimum 0.5 in shank.

4.2.8.6.3 The padlocking attachment shall be placed at 4.0 in from the handle shank center to clear the lock and key.

4.2.8.6.4 An additional 4.0 in minimum gripping length shall be provided.

#### 4.2.8.7 Latching Mechanism

4.2.8.7.1 The latching mechanism shall be a three-point draw roller type.

4.2.8.7.2 The pushrods shall be turned edgewise at the outward supports and have a cross section of 0.25 in thick by 0.75 in wide, minimum.

#### 4.2.8.8 Locks and Handles

- 4.2.8.8.1 When the door is closed and latched, the door shall be locked.
- 4.2.8.8.2 M ATC Cabinet locks and handles shall be on the left side of the right front door and left side of the right rear door.
- 4.2.8.8.3 The lock and lock support shall be rigidly mounted on the door.
- 4.2.8.8.4 In the locked position, the bolt throw shall extend a minimum of  $0.25 \pm 0.03125$  in into the latch Cam area.
- 4.2.8.8.5 A seal shall be provided to prevent dust or water entry through the lock opening.

#### 4.2.8.9 Locks

- 4.2.8.9.1 The locks shall be Corbin 2 type.
- 4.2.8.9.2 One key shall be supplied with each lock.
- 4.2.8.9.3 The keys shall be removable in the locked position only.

#### 4.2.8.10 Bolts

- 4.2.8.10.1 The locks shall have rectangular, spring-loaded bolts.
- 4.2.8.10.2 The bolts shall have a 0.281 in throw and shall be 0.75 in wide by 0.75 in thick (tolerance is  $\pm 0.035$  in).

#### 4.2.8.11 Center Latch Cam

- 4.2.8.11.1 The center latch cam shall be fabricated of a minimum thickness 0.1875 in steel or aluminum.
- 4.2.8.11.2 The bolt surface shall horizontally cover the cam thickness.
- 4.2.8.11.3 The cam shall be structured to only allow the door to open when the handle is moved toward the center of the door.

#### 4.2.8.12 Rollers

- 4.2.8.12.1 Rollers shall have a minimum diameter of 0.875 in with nylon wheels and steel ball bearings.

#### 4.2.8.13 Hinges

- 4.2.8.13.1 Doors shall have a heavy duty continuous hinge with a 3/16" minimum diameter stainless steel hinge pin.

4.2.8.13.2 The pin ends shall be welded to hinge and ground smooth.

4.2.8.13.3 The pins and bolts shall be covered by the door edge and not accessible when the door is closed.

4.2.8.13.4 The hinge pin shall be secured with ¼-20 stainless steel carriage bolts and stainless-steel lock nuts.

4.2.8.13.5 A ground strap between the door and the main cabinet housing shall be required when 120 VAC devices are mounted on the door.

#### 4.2.8.14 Door Catches

4.2.8.14.1 Front and rear doors shall be provided with catches to hold the door open at both 90 and 165 (+/-10) Degrees.

4.2.8.14.2 The catch minimum diameter shall be 0.375-inch aluminum rods.

4.2.8.14.3 The catches must be capable of holding the door open at 90 degrees in a 60-mph wind acting at an angle perpendicular to the plane of the door.

#### 4.2.9 Police Panel

4.2.9.1 As illustrated on each of the ATC Cabinet Model's Layout Diagram in Section 6, a police panel assembly shall be provided to allow limited control access.

4.2.9.2 The police door shall include a gasket to prevent entry of moisture or dust and the panel door shall be equipped with a lock and master police key (SM-200).

4.2.9.3 The front and back of the panel shall be enclosed with a rigid metal covering so that no parts having live voltage are exposed.

4.2.9.4 The panel assembly shall have a drain to prevent water from collecting within the assembly.

4.2.9.5 The drain shall be channeled to the outside.

4.2.9.6 The Police Panel shall include the following control switches:

- SIGNALS ON/OFF Switch: When in the SIGNALS OFF position, power shall be removed from all signal heads at the intersection. The CMU shall not fault or require reset.
- FLASH / AUTO
- MANUAL CONTROL ENABLE ON / OFF switch.
- INTERVAL ADVANCE cord, six feet in length, shall be provided. Receptacle for the INTERVAL ADVANCE cord shall be provided.
- All switches shall be adequately labeled and shall be equipped with Toggle. Switch safety cover.

#### 4.2.10 Rack Cage

- 4.2.10.1 A standard rack cage shall be installed inside the housing for mounting of the ATC and cabinet assemblies.
- 4.2.10.2 The EIA rack portion of the cage shall consist of four continuous, adjustable equipment mounting angles.
- 4.2.10.3 The mounting angle nominal thickness shall be minimum 10-gauge plated steel.
- 4.2.10.4 The mounting angles shall be tapped with 10-32 threads with EIA universal spacing.
- 4.2.10.5 The mounting angle shall comply with standard EIA-310-B and shall be supported at the top and bottom by either welded or bolted support angles to form a cage.
- 4.2.10.6 The mounting angles shall provide holes to mount the side panels.
- 4.2.10.7 Rack Cages dimensions shall comply with Figure 11: M ATC Cabinet Cage Assembly.
- 4.2.10.8 Cage Connection
  - 4.2.10.8.1 The cage shall be bolted to the cabinet at four points via the housing cage supports and four points via associated spacer brackets (top and bottom).
- 4.2.10.9 Cage Location
  - 4.2.10.9.1 The cage shall be centered within the cabinet door opening(s).
- 4.2.10.10 Cage Mounting Supports
  - 4.2.10.10.1 Cage mounting supports shall be provided on either side, level with the bottom edge of the door opening, for horizontal support and bolt attachment; side cage supports provided for the bracket cage supports; and bracket cage support attachments.
- 4.2.10.11 Clearance between Rails
  - 4.2.10.11.1 Clearance between rails for mounting assemblies shall be Left Cage 17.75-inch, Right Cage 11.44-inch.
- 4.2.11 Housing Ventilation
  - 4.2.11.1 Housing ventilation shall include intake, exhaust, filtration, fans and thermostat.
  - 4.2.11.2 Intake & Filter

4.2.11.2.1 The right front door and rear left door shall have a Louvered Air Vent as illustrated on Figure 14: M ATC Cabinet Layout Diagram Sheet 3 of 4.

4.2.11.2.2 Provide installed one Flanders PrecisionAire Model ST55R-1216, Ring Panel Air Filter with each cabinet.

#### **4.2.11.3 Fans**

4.2.11.3.1 Each electric fan shall be equipped with ball or roller bearings and shall have a minimum capacity of 100 cubic feet of free air delivery per minute.

4.2.11.3.2 M ATC cabinet shall be equipped with one fan mounted within the housing and protected with a finger guard.

4.2.11.3.3 A Fan Test switch shall be provided.

#### **4.2.11.4 Temperature Controlling**

4.2.11.4.1 The fans shall be thermostatically controlled and shall be manually adjustable to turn on between 32° Fahrenheit and 140° Fahrenheit with a differential of not more than 20 Fahrenheit between automatic turn on and off.

4.2.11.4.2 The fan circuit shall be protected at 125% of the fan motor ampacity.

4.2.11.4.3 The manual adjustment shall be graded in 20 Fahrenheit increment scale.

4.2.11.4.4 The thermostat shall be an Omega KT01101141900 or approved equal. Set fan thermostat to come on at 105° Fahrenheit or 40.5° Celsius.

#### **4.2.12 Cabinet Lights**

4.2.12.1 M-ATC cabinet shall be equipped with front and rear LED light fixtures activated by door switches and equipped with fuses.

### **4.3 ATC CABINET ASSEMBLIES:**

#### **4.3.1 Output Assembly (16-Channel)**

4.3.1.1 As illustrated on Figure 4: 16 Channel Output Assembly, the Output Assembly shall be a 3U high rack mounted assembly.

4.3.1.2 The Output Assembly shall accommodate eight Model 2202-HV High-Density Switch Pack / Flasher Units (HDSP/FU), providing 48 output circuits.

4.3.1.3 The Output Assembly shall accommodate one Model 2218 Serial Interface Unit (SIU) to provide interface and control via system SB1/SB2.

4.3.1.5 The Output Assembly shall accommodate one Model 2212-HV Cabinet Monitor Unit (CMUip), Main Contactor, Stop Time Switch, Flash / Auto Switch, four Circuit Breakers and Momentary 24VDC Bypass Switch.

#### 4.3.2 Field Output Termination Assembly (16-Channel)

4.3.2.1 As illustrated on Figure 6: Field Output Termination Assembly (FOTA), the 16-Channel Field Output Termination Assembly shall be coupled with the 16-Channel Output Assembly and shall house eight Model 21H High-Density Flash Transfer Relays (HDFTR).

4.3.2.2 The HDFTRs and Flash Program Blocks (FPB) shall be provided to control and select the color (red, yellow, or dark) during ATC Cabinet flash mode.

4.3.2.3 HDSP Suppressors shall be provided at the field terminals for the protection of the HDSP.

4.3.2.4 Each HDFTR position shall be labeled with the number of its associated HDSP (1-16).

4.3.2.5 Each FPB position shall be labeled with the number of its associated channel (1-16).

4.3.2.6 The Field Output Termination Assembly shall be provided with 16, 6-position Phoenix Contact terminal block model number 18-04-94-6 plugs and 18-61-19-6 sockets or approved equal.

4.3.2.7 Each Load Terminal Block receptacle shall be labeled with the number of its associated channel (1-16).

4.3.2.8 Additional labels shall be provided to clearly indicate which terminals correspond to the red, yellow, and green switch pack outputs.

4.3.2.9 The color of these labels shall match the color of their associated output (red, yellow, or green).

4.3.2.10 The Field Output Termination Assembly shall be provided with each 16-channel cabinet.

4.3.2.11 The 16-Channel Field Output Termination Assembly shall be mounted across the EIA rails and it shall swing down to provide access to the HDSP Suppressors.

#### 4.3.3 Service Assembly (2-HDFU)

4.3.3.1 As illustrated on Figure 5: 2-HDFU Service Assembly, the Service Assembly shall be modular and shall be mounted as illustrated on the applicable ATC Model's Cabinet Layout Diagrams in Section 6.

4.3.3.2 It shall house: two Model 2202-HV High-Density Switch Pack / Flasher Units (HDSP/FU), Cabinet Suppressor-Filter, BBS landing wire terminals,

GFCI, one convenience outlet NEMA 15-5 format, eight HDFU glass output fuses rated at 2A , six Circuit Breakers and a Raw AC+ terminal block having 5 screw terminals.

4.3.3.3 120VAC Service Terminal Block Assembly Provide Marathon CAT#1423570 Panel Mount Barrier Terminal Block assembly for 120VAC Service as illustrated on Figure 8: 120VAC Service Assembly and shall be mounted as illustrated on the applicable Cabinet Layout Diagrams in Section 6.

- ATC Cabinet Serial Bus #1/Serial Bus #2 (SB1/SB2) and DC/Clean Power Bus

4.3.3.4 As illustrated on Figure 7: ATC Cabinet Bus Assembly 611 SB1/SB2 and DC/Clean Power Bus shall include eight DB25 d-submodular socket connectors to interconnect the SB1/SB2 communication ports of the assemblies and Controller.

4.3.3.5 It shall include a termination circuit at the end of the connections (S8) to prevent radio frequency signal reflection. It shall include one Phoenix Contact plug block or approved equal to bring the DC power to the Bus; such power shall be distributed to the ATC Cabinet

4.3.3.6 Assemblies through seven Phoenix Contact receptacle blocks or approved equal. The copper traces for the DC voltages shall support at least 10 Amp. The AC Clean Power Bus shall also include eight NEMA 5-15 receptacles, to provide AC Clean Power to the ATC Cabinet Assemblies, the Controller and Cabinet Power Supply.

4.3.3.7 SB1/SB2 and DC/Clean Power Bus shall be mounted across the EIA rails and it shall swing down to provide access to the back of the assemblies mounted in the opposite side.

4.3.3.8 Mount this panel as illustrated in Figure 14: M ATC Cabinet Layout Diagram Sheet 3 of 4.

#### 4.3.4 Drawer Shelf Unit

4.3.4.1 As illustrated on Figure 3: Drawer Assembly, a telescopic slide out drawer to storage document shall be provided.

4.3.4.2 The Drawer Shelf Unit shall be mounted across the EIA rails and shall have a non-conductive top, locking provision when fully extended and lip or handle for pulling.

4.3.4.3 Drawer Shelf Unit shall be mounted as illustrated on the applicable ATC Cabinet Tables & Figures in Section 6.

#### 4.3.5 Field Output Termination Assembly



- 4.3.5.1 Provide Field Output Termination Panel with the following requirements:
- 4.3.5.2 The panel shall be made of .090, 5052 H32 aluminum material.
- 4.3.5.3 Field Output Termination Panel shall be mounted at the bottom of the rack as illustrated on each of the ATC Cabinet Model's Layout Diagram in Section 6 ATC Cabinet Tables & Figures.
- 4.3.5.4 The panel shall have 2 rows of 42 blocks. Blocks shall be color coded from left to right, 2 red (GRR6), 2 yellow (GRY6), 2 green (GRG6) this would be LS-1. Repeat this pattern thru to LS-16.
- 4.3.5.5 Use NEMA Type Terminal Blocks Class 9080 (type GR6).
- 4.3.5.6 Mount Blocks on din 3 9080 MH3\*\* or Phoenix Contact NS 35/7, 5 Perforated – 0801733 or Allen Bradley 199-DR1/DR2.
- 4.3.5.7 Use end barrier GM6B.
- 4.3.5.8 Use screw on end clamp (MHA10).
- 4.3.5.9 Use blank vinyl marking strip (9080 GH220) with marking strip end plug (9080 GH60) and leave marking strip blank.
- 4.3.5.10 The panel shall have 25 Position AC Neutral Buss.
- 4.3.5.11 Silkscreen panel as illustrated on the silkscreen panel as illustrated on the detailed Figures per Cabinet Figure 15: M ATC Cabinet Layout Diagram Sheet 4 of 4.
- 4.3.5.12 Silkscreen panel as illustrated on the silkscreen panel as illustrated on the detailed Figures per Cabinet Figure 10: M ATC Cabinet Housing Detail.
- 4.3.5.13 Use 2 pole jumpers (9080 GH72) for continuity of Phase colors. Install cabinet wiring and 2 pole jumpers (9080 GH72), on the top side of the terminal blocks. And install the jumper portion of the 9080 GH72 facing the din rail.
- 4.3.5.14 Load Switch driver wiring to the Field Output Termination Panel shall be 20 AWG stranded copper wire.
- 4.3.5.15 Use TE Connectivity Part # 34294 Male Blade Nylon Insulated or approved equal prior to termination.
- 4.3.5.16 See wiring assignment details in Figure 16: M ATC Cabinet Wiring Diagram Sheet.
- 4.3.5.17 The wiring from the Output Assemblies to the Field Output Termination Panels must be labeled with permanent markings showing load switches that are attached to the Field Output Termination Panels.



## **4.4 DOOR SWITCH ASSEMBLY**

4.4.1 Provide front and rear door switches. The CMU shall monitor the DOOR SWITCH FRONT and DOOR SWITCH REAR inputs.

## **4.5 35MM DIN RAIL**

4.5.1 Each cabinet shall include 35mm Din Rail mounted as per following:

4.5.1.1 MATC: provide two 35mm din rail, each installed centered between each shelf clearance, mounted with support brackets between front to the rear cage EIA rail on the right side of the right cage when viewed from the front of the cabinet.

## **4.6 TRAFFIC SIGNAL CABINET CONFIGURATION AND COMPONENTS**

4.6.1 The ATC Cabinet shall consist of the following Assemblies and Components installed as per the following Table and Cabinet Diagrams as illustrated in Section 6:

- Table 2: M ATC Cabinet I/O Assignments
- Table 3: ATC Cabinet IO Assignment (Input Assembly)
- Table 4: Model 2212-HV CMUip
- Table 5: SB1/SB2 Connector (DB 25)
- Table 6: Serial Bus 3 (RJ-45) Connector
- Table 7: Model 2202-HV High-Density Switch Pack (HDSP) Connector
- Table 8: Model 2218 Serial Interface Unit (SIU) Connector
- Table 9: Model 2216-24 Cabinet Power Supply (CPS) Connector
- Table 10: Switches Definitions
- Table 11: Circuit Breakers Definitions
- Table 12: Model M ATC Cabinet Configuration
- Figure 10: M ATC Cabinet Housing Detail
- Figure 11: M ATC Cabinet Cage Assembly
- Figure 12: M ATC Cabinet Layout Diagram Sheet 1 of 4
- Figure 13: M ATC Cabinet Layout Diagram Sheet 2 of 4
- Figure 14: M ATC Cabinet Layout Diagram Sheet 3 of 4
- Figure 15: M ATC Cabinet Layout Diagram Sheet 4 of 4

4.6.2 In order to avoid various cabinet manufacturer's unique wiring diagrams and labeling conventions, the Wiring Diagram and wire labels shall conform to Figure 16: M ATC Cabinet Wiring Diagram Sheet

## **5. ATC CABINET ELECTRICAL, ENVIRONMENTAL AND TESTING**

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### **5.1 GENERAL**

5.1.1 The requirements called out in this specification dealing with equipment evaluation are a minimum guide and shall not limit the testing and inspection to ensure compliance.

### **5.2 CERTIFICATION**

5.2.1 These test procedures shall be followed by the manufacturers who shall certify that they have conducted inspection and testing in accordance with this specification.

### **5.3 INSPECTION**

5.3.1 A visual and physical inspection shall include mechanical, dimensional and assembly conformance of all parts of this specification.

### **5.4 ENVIRONMENTAL AND ELECTRICAL**

5.4.1 All components shall properly operate within the following limits unless otherwise noted:

- Applied Line Voltage: 90 to 135 Vac
- Frequency: 60 (+/-3.0) Hertz
- Humidity: 5% to 95%
- Ambient Temperature: -34.6 °F to +165.2 °F
- Shock - Test per Specification MIL-STD-810G Method 516.6
- Vibration - per Specification MIL-STD-810G Method 514.6

### **5.5 COMMENCEMENT OPERATION**

5.5.1 All circuits, unless otherwise noted, shall commence operation at or below 90 VAC as the applied voltage is raised from 50 to 90 Vac at a rate of 2 (+/-0.5) volts / second.

## **5.6 EQUIPMENT COMPLIANCE**

5.6.1 All equipment shall be unaffected by transient voltages normally experienced on commercial power lines. Where applicable, equipment purchased separately from the cabinet (which normally is resident) will be tested for compliance.

## **5.7 POWER LINE SURGE PROTECTION**

5.7.1 The power line surge protection shall enable the equipment being tested to withstand (non-destructive) and operate normally following the discharge of a 25 $\mu$ F capacitor charged to  $\pm 2,000$  volts, applied directly across the incoming AC line at a rate of once every 10 seconds for a maximum of 50 occurrences per test. The unit under test will be operated at 68°F  $\pm$  41°F and at 120 ( $\pm$ 12) Vac.

## **5.8 OPERATING**

5.8.1 The equipment shall withstand (non-destructive) and operate normally when one discharge pulse of plus or minus 300 volts is synchronously added to its incoming AC power line and moved uniformly over the full wave across 360 degrees or stay at any point of Line Cycle once every second. Peak noise power shall be 5 kilowatts with a pulse rise time of 500 ns. The unit under test will be operated at 68 °F  $\pm$ 41 °F and at 120 (+/-12) Vac.

## **5.9 UL REQUIREMENTS**

5.9.1 Equipment shall comply only with the requirements of UL Bulletin of Research No. 23, "Rain Tests of Electrical Equipment."

## **5.10 NORMAL OPERATION**

5.10.1 All equipment shall continue normal operation when subjected to the following:

## **5.11 LOW TEMPERATURE TEST**

5.11.1 With the item functioning at a line voltage over Electrical Range the Device in its intended operation, the ambient temperature shall be lowered from 68°F to 34.6 °F at a rate of not more than 64.4 °F per hour. The item shall be cycled at - 34.6 °F for a minimum of 5 hours and then returned to 68 °F at the same rate.

## **5.12 HIGH TEMPERATURE TEST**

5.12.1 With the item functioning at a line voltage over Electrical Range the Device in its intended operation, the ambient temperature shall be raised from 68 °F to 165.2 °F at a rate of not more than 64.4 °F per hour. The item shall be cycled at 165.2 °F for 5 hours and then returned to 68 °F at the same rate. The test shall be repeated with the line voltage at 135 Vac.

- Applied Line Voltage: 90 to 135 Vac
  - Frequency: 60 (+/-3.0) Hertz
  - Humidity: 5% to 95%
  - Ambient Temperature: -34.6 °F to +165.2 °F
  - Shock - Test per Specification MIL-STD-810G Method
  - Vibration - per Specification MIL-STD-810G Method
- 514.6

## **5.13 COMMENCEMENT OPERATION**

5.13.1 All circuits, unless otherwise noted, shall commence operation at or below 90 VAC as the applied voltage is raised from 50 to 90 Vac at a rate of 2 (+/-0.5)volts / second.

## **5.14 EQUIPMENT COMPLIANCE**

5.14.1 All equipment shall be unaffected by transient voltages normally experienced on commercial power lines. Where applicable, equipment purchased separately from the cabinet (which normally is resident) will be tested for compliance.

## **5.15 POWER LINE SURGE PROTECTION**

5.15.1 The power line surge protection shall enable the equipment being tested to withstand (non-destructive) and operate normally following the discharge of a 25µF capacitor charged to  $\pm 2,000$  volts, applied directly across the incoming AC line at a rate of once every 10 seconds for a maximum of 50 occurrences per test. The unit under test will be operated at 68°F  $\pm$  41°F and at 120 ( $\pm$ 12) Vac.

## **5.16 OPERATING**

5.16.1 The equipment shall withstand (non-destructive) and operate normally when one discharge pulse of plus or minus 300 volts is synchronously added to its incoming AC power line and moved uniformly over the full wave across 360 degrees or stay at any point of Line Cycle once every second. Peak noise power

shall be 5 kilowatts with a pulse rise time of 500 ns. The unit under test will be operated at 68 °F  $\pm$ 41 °F and at 120 (+/-12) Vac.

## **5.17 REQUIREMENTS**

5.17.1 Equipment shall comply only with the requirements of UL Bulletin of Research No. 23, "Rain Tests of Electrical Equipment."

## **5.18 NORMAL OPERATION**

5.18.1 All equipment shall continue normal operation when subjected to the following.

## **5.19 LOW TEMPERATURE TEST**

5.19.1 With the item functioning at a line voltage over Electrical Range the Device in its intended operation, the ambient temperature shall be lowered from 68°F to 34.6 °F at a rate of not more than 64.4 °F per hour. The item shall be cycled at -34.6 °F for a minimum of 5 hours and then returned to 68 °F at the same rate.

## **5.20 HIGH TEMPERATURE TEST**

5.20.1 With the item functioning at a line voltage over Electrical Range the Device in its intended operation, the ambient temperature shall be raised from 68 °F to 165.2 °F at a rate of not more than 64.4 °F per hour. The item shall be cycled at 165.2 °F for 5 hours and then returned to 68 °F at the same rate. The test shall be repeated with the line voltage at 135 Vac.

## **5.21 NORMAL OPERATION**

5.21.1 All equipment shall resume normal operation following a period of at least 5 hours at -34.6 °F and less than 10 percent humidity and at least 5 hours at 165.2 °F and 22% humidity, when 90 Vac is applied to the incoming AC.

## **5.22 HUMIDITY AND AMBIENT TEMPERATURE**

5.22.1 Values on Table 1: Humidity and Ambient Temperature shall not be exceeded.

## **5.23 QC / FINAL TEST**

5.23.1 A complete QC / final test report shall be supplied with each ATC Cabinet. The test report shall indicate the name of the tester and shall be signed by a responsible manager.

## **5.24 QUALITY CONTROL PROCEDURE & TEST REPORT**

5.24.1 The quality control procedure and test report format shall be supplied to the Traffic Signal Shop personnel or approval within 15 days following the award of the contract. The quality control procedure shall include the following:

- Acceptance testing of all supplied components
- Physical and functional testing of all modules and items
- A minimum 100-hour burn-in of all equipment
- Physical and functional testing of all items

## **5.25 CABINET PRINT**

5.25.1 Cabinet wiring and cabinet layout diagrams shall be provided as follows:

- Two printed sets dimensions 24"x36", folded to finished size of 8 ½" X 11" placed inside the Drawer Assembly. Cabinet wiring diagrams shall be on Compact Disk or USB Flash Drive in CAD and PDF format.

## **5.26 MANUAL**

5.26.1 One copy of manual documentation shall be supplied for each item purchased. The manual shall be printed on 8.5 in by 11 in paper, with the exception that schematics, layouts, parts lists and plan details may be on 11 in by 17 in sheets, with each sheet neatly folded to 8.5 in by 11 in size. The manual shall be formatted as per Table 2: Model 352i/MS65/MSF75 ATC Cabinet I/O Assignments.

## 6. ATC CABINET TABLES & FIGURES

*Table 1: Humidity and Ambient Temperature*

Ambient Temperature/Dry Bulb (in °F)	Relative Humidity (in percent)	Ambient Temperature/ Wet Bulb (in °F)
-34.6 °F to 33.98 °F	10%	1.04 °F to 108.86 °F
33.98 °F to 114.8 °F	95%	108.86 °F
119.84 °F	70%	108.86 °F
129.92 °F	50%	108.86 °F
140 °F	38%	108.86 °F
149.72 °F	28%	108.86 °F
160.16 °F	21%	108.86 °F
165.2 °F	18%	108.86 °F

Ambient Temperature versus Relative Humidity @ Barometric Pressure (29.92In.Hg.)

Table 2: M ATC Cabinet I/O Assignments

ATC Cabinet 16-Channel (CH) Output Assembly								
Controller Phase/Overlap/Pedestrian Assignments								
CH1/2	CH3/4	CH5/6	CH7/8	CH9/10	CH11/12	CH13/14	CH15/16	
HDSP1	HDSP2	HDSP3	HDSP4	HDSP5	HDSP6	HDSP7	HDSP8	
R	R	R	R	R	R	R	R	SIU 1
Y	Y	Y	Y	Y	Y	Y	Y	
G	G	G	G	G	G	G	G	
R	R	R	R	R	R	R	R	
Y	Y	Y	Y	Y	Y	Y	Y	
G	G	G	G	G	G	G	G	
CMU Channel (CH) Assignments								
HDSP1	HDSP2	HDSP3	HDSP4	HDSP5	HDSP6	HDSP7	HDSP8	
CH-1	CH-3	CH-5	CH-7	CH-9	CH-11	CH-13	CH-15	SIU 1
CH-1	CH-3	CH-5	CH-7	CH-9	CH-11	CH-13	CH-15	
CH-1	CH-3	CH-5	CH-7	CH-9	CH-11	CH-13	CH-15	
CH-2	CH-4	CH-6	CH-8	CH-10	CH-12	CH-14	CH-16	
CH-2	CH-4	CH-6	CH-8	CH-10	CH-12	CH-14	CH-16	
CH-2	CH-4	CH-6	CH-8	CH-10	CH-12	CH-14	CH-16	
SIU Output (IO) Assignments								
HDSP1	HDSP2	HDSP3	HDSP4	HDSP5	HDSP 6	HDSP 7	HDSP8	
IO 0	IO 6	IO 12	IO 18	IO 24	IO 30	IO 36	IO 42	SIU 1
IO 1	IO 7	IO 13	IO 19	IO 25	IO 31	IO 37	IO 43	
IO 2	IO 8	IO 14	IO 20	IO 26	IO 32	IO 38	IO 44	
IO 3	IO 9	IO 15	IO 21	IO 27	IO 33	IO 39	IO 47	
IO 4	IO 10	IO 16	IO 22	IO 28	IO 34	IO 40	IO 48	
IO 5	IO 11	IO 17	IO 23	IO 29	IO 35	IO 41	IO 49	
HDSP Addresses								
HDSP1	HDSP2	HDSP3	HDSP4	HDSP5	HDSP6	HDSP7	HDSP8	SIU 1
0	1	2	3	4	5	6	7	
(00000)	(00001)	(00010)	(00011)	(00100)	(00101)	(00110)	(00111)	SIU 1
Model 352i/MS65/MSF75 ATC Cabinet I/O Assignments (Output Assembly)								



Table 3: ATC Cabinet IO Assignment (Input Assembly)

ATC Cabinet 24-Channel Input Assembly #1												
SIU Input (IO) Assignments												
2-CH Card	2-CH Card	2-CH Card	2-CH Card	2-CH Card	2-CH Card	2-CH Card	2-CH Card	2-CH Card	2-CH Card	2-CH Card	2-CH Card	SIU 9
IO 6	IO 8	IO 10	IO 12	IO 14	IO 16	IO 18	IO 20	IO 22	IO 24	IO 26	IO 28	
IO 7	IO 9	IO 11	IO 13	IO 15	IO 17	IO 19	IO 21	IO 23	IO 25	IO 27	IO 29	
	*IO 6	*IO 8	*IO 10	*IO 12	*IO 14	*IO 16	*IO 18	*IO 20	*IO 22	*IO 24	*IO 26	
	*IO 7	*IO 9	*IO 11	*IO 13	*IO 15	*IO 17	*IO 19	*IO 21	*IO 23	*IO 25	*IO 27	
SIU Input (CH) Assignments												
2-CH Card	2-CH Card	2-CH Card	2-CH Card	2-CH Card	2-CH Card	2-CH Card	2-CH Card	2-CH Card	2-CH Card	2-CH Card	2-CH Card	
CH-1	CH-3	CH-5	CH-7	CH-9	CH-11	CH-13	CH-15	CH-17	CH-19	CH-21	CH-23	
CH-2	CH-4	CH-6	CH-8	CH-10	CH-12	CH-14	CH-16	CH-18	CH-20	CH-22	CH-24	
	*CH-1	*CH-3	*CH-5	*CH-7	*CH-9	*CH-11	*CH-13	*CH-15	*CH-17	*CH-19	*CH-21	
	*CH-2	*CH-4	*CH-6	*CH-8	*CH-10	*CH-12	*CH-14	*CH-16	*CH-18	*CH-20	*CH-22	

\* If 4-Channel (CH) device being used

ATC Cabinet 24-Channel Input Assembly #2												
SIU Input (IO) Assignments												
2-CH Card	2-CH Card	2-CH Card	2-CH Card	2-CH Card	2-CH Card	2-CH Card	2-CH Card	2-CH Card	2-CH Card	2-CH Card	2-CH Card	
IO 6	IO 8	IO 10	IO 12	IO 14	IO 16	IO 18	IO 20	IO 22	IO 24	IO 26	IO 28	
IO 7	IO 9	IO 11	IO 13	IO 15	IO 17	IO 19	IO 21	IO 23	IO 25	IO 27	IO 29	
	*IO 6	*IO 8	*IO 10	*IO 12	*IO 14	*IO 16	*IO 18	*IO 20	*IO 22	*IO 24	*IO 26	
	*IO 7	*IO 9	*IO 11	*IO 13	*IO 15	*IO 17	*IO 19	*IO 21	*IO 23	*IO 25	*IO 27	
SIU Input (CH) Assignments												
2-CH Card	2-CH Card	2-CH Card	2-CH Card	2-CH Card	2-CH Card	2-CH Card	2-CH Card	2-CH Card	2-CH Card	2-CH Card	2-CH Card	
CH-1	CH-3	CH-5	CH-7	CH-9	CH-11	CH-13	CH-15	CH-17	CH-19	CH-21	CH-23	
CH-2	CH-4	CH-6	CH-8	CH-10	CH-12	CH-14	CH-16	CH-18	CH-20	CH-22	CH-24	
	*CH-1	*CH-3	*CH-5	*CH-7	*CH-9	*CH-11	*CH-13	*CH-15	*CH-17	*CH-19	*CH-21	
	*CH-2	*CH-4	*CH-6	*CH-8	*CH-10	*CH-12	*CH-14	*CH-16	*CH-18	*CH-20	*CH-22	

\* If 4-Channel (CH) device being used

Table 4: Model 2212-HV CMUip

Pin	FUNCTION	Pin	FUNCTION
1A	+24vdc	1B	
2A	+12vdc	2B	ExtReset in
3A	DC gnd	3B	
4A		4B	
5A		5B	
6A		6B	
7A	SB1 TXD+	7B	SB1 TXD-
8A	SB1 RXD+	8B	SB1 RXD-
9A	SB1 TXC+	9B	SB1 TXC-
10A	SB1RXC+	10B	SB1 RXC-
11A		11B	
12A		12B	
13A		13B	
14A		14B	
15A	LineSync+	15B	LineSync-
16A	NReset+	16B	Nreset-
17A	PwrDwn+	17B	PwrDwn-
18A	SB3 TX+	18B	SB3 TX-
19A	SB3 RX+	19B	SB3 RX-
20A	SB3 TXC+	20B	SB3 TXC-
21A	LF status	21B	LF status
22A	LF status out	22B	LF status out
23A	signals ON	23B	
24A	MC coil	24B	
25A	MC sec	25B	
26A	FTR coil	26B	
27A	FDS	27B	
28A	RDS	28B	
29A		29B	
30a		30B	+48VDC
31A	EQ gnd	31B	
32A	FUNCTION	32B	DC- bus

Table 5: SB1/SB2 Connector (DB 25)

PIN #	AT THE CONTROLLER	AT THE SIU	PIN #	AT THE CONTROLLER	AT THE SIU
1	SB1 TXD+	SB1 RXD+	14	SB1 TXD-	SB1 RXD-
2	SB1 RXD+	SB1 TXD+	15	SB1 RXD-	SB1 TXD-
3	SB1 TXC+	SB1 RXC+	16	SB1 TXC-	SB1 RXC-
4	SB1 RXC+	SB1 TXC+	17	SB1 RXC-	SB1 TXC-
5	SB2 TXD+	SB2 RXD+	18	SB2 TXD-	SB2 RXD-
6	SB2 RXD+	SB2 TXD+	19	SB2 RXD-	SB2 TXD-
7	SB2 TXC+	SB2 RXC+	20	SB2 TXC-	SB2 RXC-
8	SB2 RXC+	SB2 TXC+	21	SB2 RXC-	SB2 TXC-
9	LINE SYNC+	LINE SYNC+	22	LINE SYNC-	LINE SYNC+
10	NRESET+	NRESET+	23	NRESET-	NRESET-
11	PWR DWN+		24	PWR DWN-	
12	+5VDC ISO		25	EQ GND	
13	ISO GND	DC GND			

Table 6: Serial Bus 3 (RJ-45) Connector

PIN	FUNCTION
1	Reserved
2	Reserved
3	Neutral (AC- Raw)
4	RxDATA +
5	RxDATA -
6	Neutral ( AC- Raw)
7	TxDATA +
8	TxDATA -

*Table 7: Model 2202-HV High-Density Switch Pack (HDSP) Connector*

PIN	A (Bottom Row)	C (Middle Row)	E (Top Row)
2	CH 1 Red In	CH 1 Yellow In	CH 1 Green In
4	CH 2 Red In	CH 2 Yellow In	CH 2 Green In
6	+24VDC	DC Ground	Address 4
8	Equipment Ground	Neutral	Neutral
10	SB #3 Rx+	SB #3 Tx+	Address Common
12	SB #3 Rx-	SB #3 Tx-	Address 3
14	Address 0	Address 1	Address 2
16	CH 1 Red Sense	CH 1 Red Out	CH 1 Red Out
18	CH 1 Yellow Sense	CH 1 Yellow Out	CH 1 Yellow Out
20	CH 1 Green Sense	CH 1 Green Out	CH 1 Green Out
22	CH 2 Red Sense	CH 2 Red Out	CH 2 Red Out
24	CH 2 Yellow Sense	CH 2 Yellow Out	CH 2 Yellow Out
26	CH 2 Green Sense	CH 2 Green Out	CH 2 Green Out
28	LV+ Signal	LV+ Signal	LV+ Signal
30	HV+ Signal	HV+ Signal	HV+ Signal
32	LV+ MAINS	Neutral	HV+ MAINS

Table 8: Model 2218 Serial Interface Unit (SIU) Connector

Pin	Description	Pin	Description	Pin	Description
A1	+24 VDC in	B1	+24 VDC in	C1	Input / Output 47
A2	Input / Output 0	B2	Input / Output 1	C2	Input / Output 48
A3	Input / Output 2	B3	Input / Output 3	C3	Input / Output 49
A4	Input / Output 4	B4	Input / Output 5	C4	Input / Output 50
A5	Input / Output 6	B5	Input / Output 7	C5	Input / Output 51
A6	Input / Output 8	B6	Input / Output 9	C6	Input / Output 52
A7	Input / Output 10	B7	Input / Output 11	C7	Input / Output 53
A8	Input / Output 12	B8	Input / Output 13	C8	SB1 TxD +
A9	Input / Output 14	B9	Input / Output 15	C9	SB1 TxD -
A10	Input / Output 16	B10	Input / Output 17	C10	SB1 RxD +
A11	Input / Output 18	B11	Input / Output 19	C11	SB1 RxD -
A12	Input / Output 20	B12	Input / Output 21	C12	SB1 TxC +
A13	Input / Output 22	B13	Input / Output 23	C13	SB1 TxC -
A14	Input / Output 24	B14	Input / Output 25	C14	SB1 RxC +
A15	Input / Output 26	B15	Input / Output 27	C15	SB1 RxC -
A16	Input / Output 28	B16	Input / Output 29	C16	LINESYNC +
A17	Input / Output 30	B17	Input / Output 31	C17	LINE SYNC -
A18	Input / Output 32	B18	Input / Output 33	C18	NRESET +
A19	Input / Output 34	B19	Input / Output 35	C19	NRESET -
A20	Input / Output 36	B20	Input / Output 37	C20	ASSEMBLY ADR
A21	Input / Output 38	B21	Input / Output 39	C21	INBUS RTS
A22	Input / Output 40	B22	Input / Output 41	C22	SB2 TxD +
A23	Input / Output 42	B23	Input / Output 43	C23	SB2 TxD -
A24	Input / Output 44	B24	Input / Output 45	C24	SB2 RxD +
A25	Input / Output 46	B25	Opto Input 1	C25	SB2 RxD -
A26	Opto Input 2	B26	Opto Input 3	C26	SB2 TxC +
A27	Opto Input 4	B27	Opto Input Ground	C27	SB2 TxC -
A28	Address - 0	B28	Address - 1	C28	SB2 RxC +
A29	Address - 2	B29	Address - 3	C29	SB2 RxC -
A30	INBUS TxD	B30	INBUS RxD	C30	INBUS TxC
A31	Equipment Ground	B31	AC Line Reference	C31	INBUS RxC
A32	24 VDC Ground	B32	24 VDC Ground	C32	SIU/BIU

*Table 9: Model 2216-24 Cabinet Power Supply (CPS) Connector*

Pin	Function
1	+48VDC
2	48VDC Ground**
3	+24VDC
4	+12VDC (PS-2216-2412 only)
5	24/12 VDC Ground
6	Chassis Ground

*Table 10: Switches Definitions*

Manual Control Enable (MCE) switch places call into the CU and activates stop time
Interval Adv. switch advances the CU when MCE is on
FDS (Front Door Switch) 1 or 2 to notify the CMU when Front Door is open
RDS (Rear Door Switch) 1 or 2 to notify the CMU when Rear Door is open
FLS (Front Light Switch) 1 or 2 to turn on the Front cabinet Light
RLS (Rear Light Switch) 1 or 2 to turn on the Rear cabinet Light
Fan Test 1 or 2 to verify if the Fans work

*Table 11: Circuit Breakers Definitions*

Service Assembly (SA) MAIN Circuit Breaker (CB) controls power to the entire ATCC
SA CLEAN POWER CB controls power to PMU
SA RAW PWR/GFCI/FAN/LIGHTS CB controls power to outlets , GFCI, fans and lights
SA HDFU1 CB controls power to SA HDSP/FU1
SA HDFU2 CB controls power to SA HDSP/FU2
SA OUTPUT ASSEMBLY (OA) CB controls power to OA
OA CB1 controls power to HDSP1 & 2
OA CB2 controls power to HDSP3 & 4
OA CB3 controls power to HDSP5 & 6
OA CB4 controls power to HDSP7 & 8
OA CB5 controls power to HDSP9 & 10
OA CB6 controls power to HDSP11 & 12
OA CB7 controls power to HDSP13 & 14
OA CB8 control s power to HDSP15 & 16

*Table 12: Model M ATC Cabinet Configuration*

Item #	Modules / Assemblies	Quantity
1.	M ATC Housing	1
2.	M ATC Rack Cage	1
3.	M ATC Side Panels	3
4.	Police Panel Assembly	1
5.	Housing Ventilation (Thermostat, Fan, Door Filter)	1
6.	GARMIN GPS Antenna and GPS Communication Panel	1
7.	LED Cabinet Light Assembly	2
8.	Input Assembly (24 – Channel)	1
9.	Drawer Shelf Unit Assembly	1
10.	Output Assembly (16 - Channels)	1
11.	Shelf Assembly	2
12.	Service Assembly (1 – HDFU)	1
13.	Field Output Termination Assembly (16 - Channel)	1
14.	M ATC Field Output Termination Panel Assembly	1
15.	SB1/SB2 and DC/Clean Power Bus	1
16.	Field Input Termination Assembly (24 - Channel)	1
17.	120VAC Service Terminal Block - mounted on the rear right housing facing front of the cabinet.	1
18.		2
19.	35mm Din Rail	2
20.	Model 2216-24 Cabinet Power Supply (1 Spare Unit)	2
21.	Model 2202-HV High-Density Switch Pack / Flasher Unit. (6 Spare Unit)	15
22.	Model 2218 Signal Interface Unit (SIU) (2 Spare Unit)	4
23.	Model CMUp-2212-HV (One Spare Unit)	2
24.	Monitor Key Programming Tool	1
25.	Model ADU-2220 CMU Auxiliary Display Unit.	1
26.	High-Density Switch Pack Suppressor Edco Model MPA-303-9	8
27.	STRUTHERS-DUNN Model 21XBHL-48VDC High-Density Flash Transfer Relay (4 Spare Unit)	12
28.	Red Flash Program Block	16
29.	Yellow Flash Program Block	8
30.	White Flash Program Block	8
31.	Edco MRA-6LC-6 Field Input Detection Module Suppressor	12
32.	HESCO/RLS HE1750R Cabinet Suppressor Filter.	1

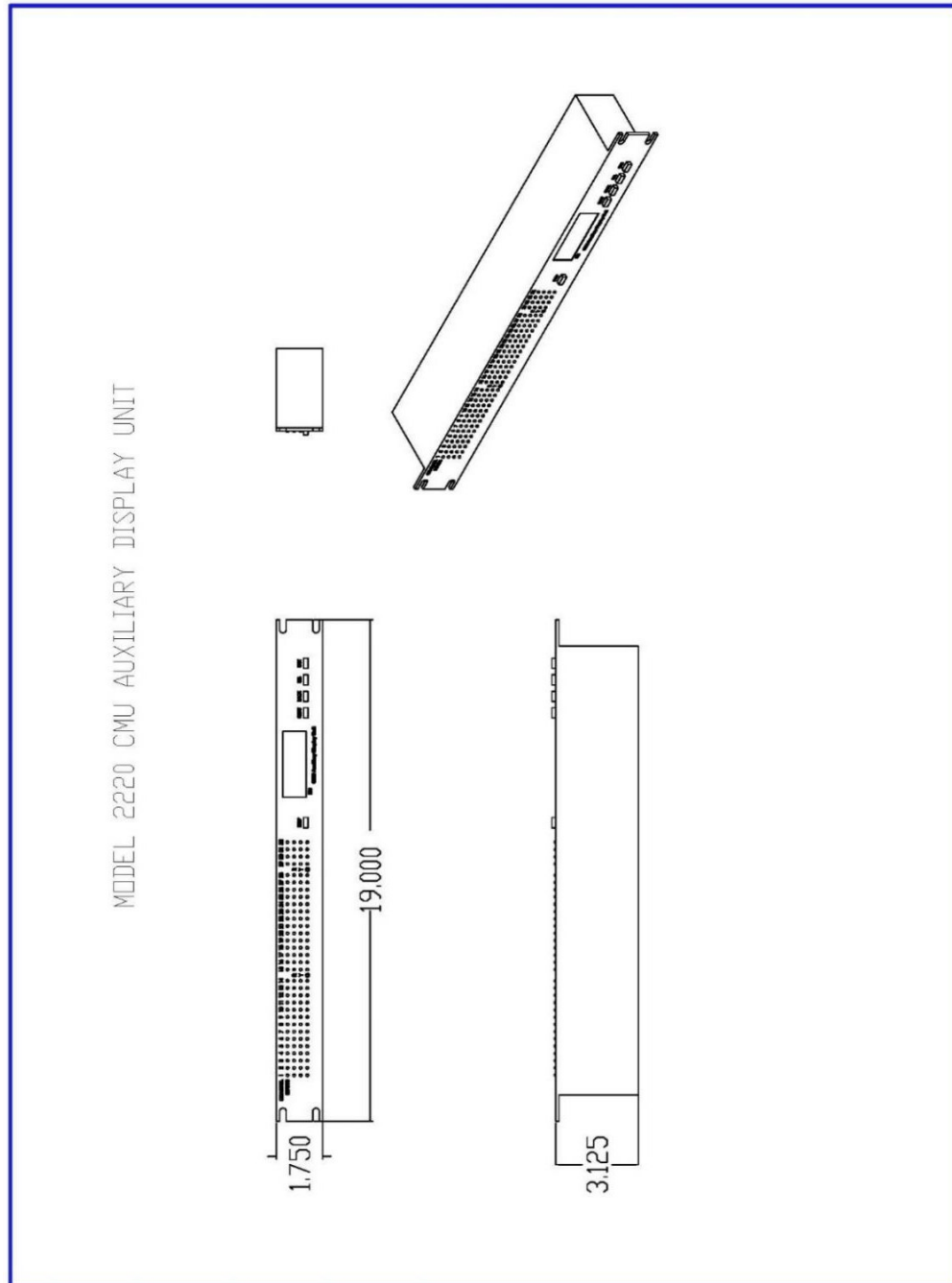


Figure 1: Auxiliary Display Unit



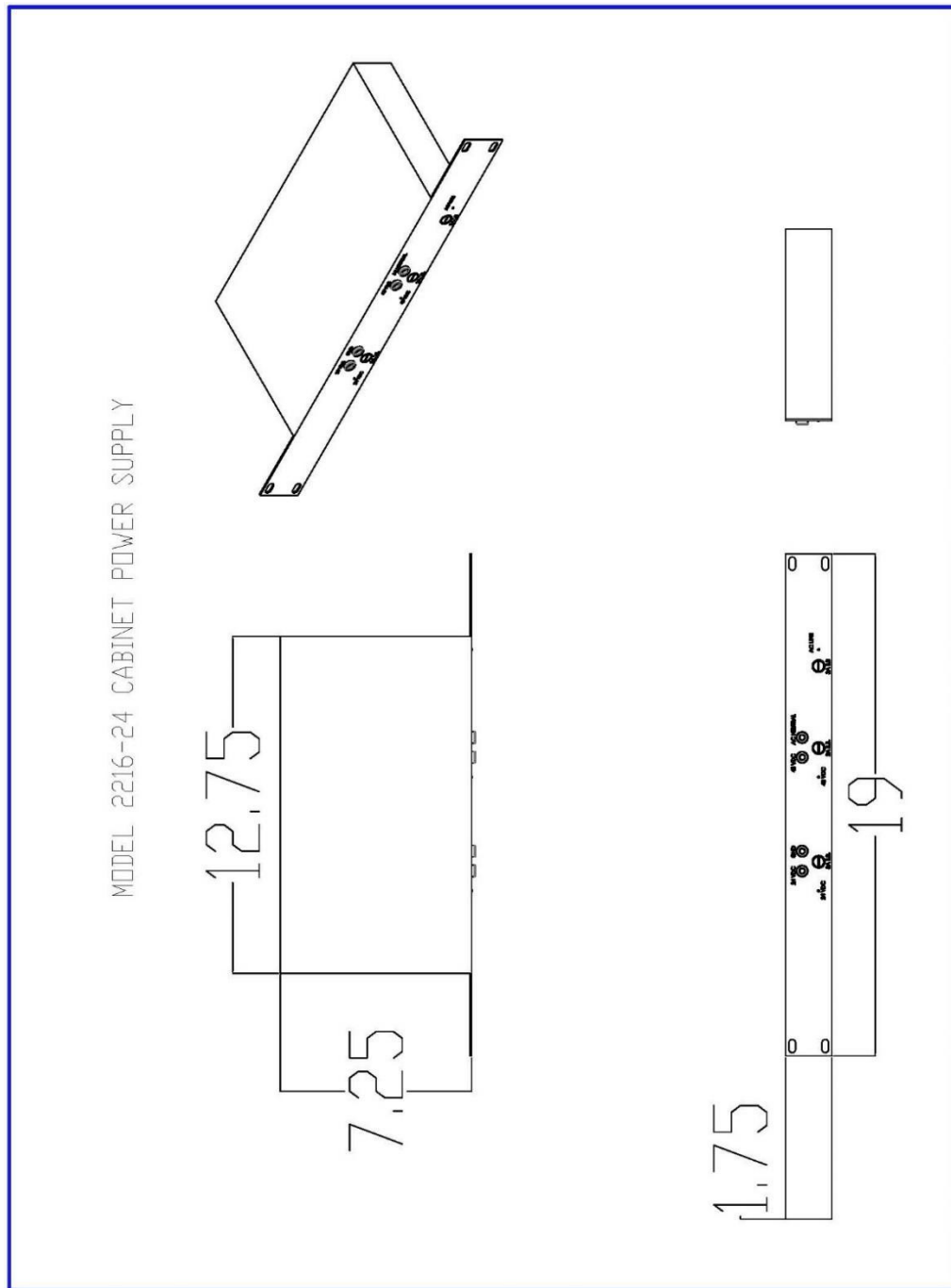
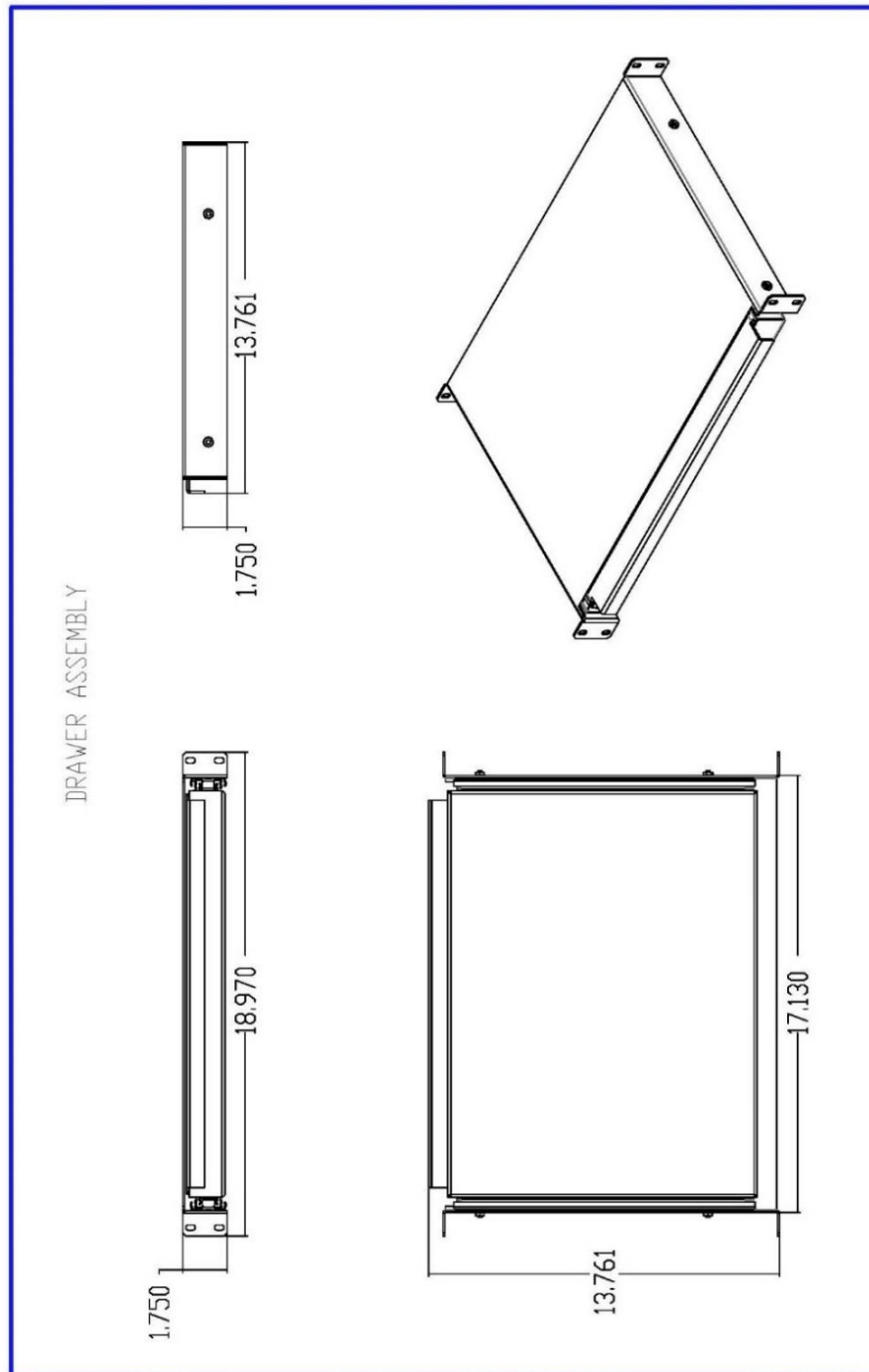


Figure 2: Cabinet Power Supply



*Figure 3: Drawer Assembly*

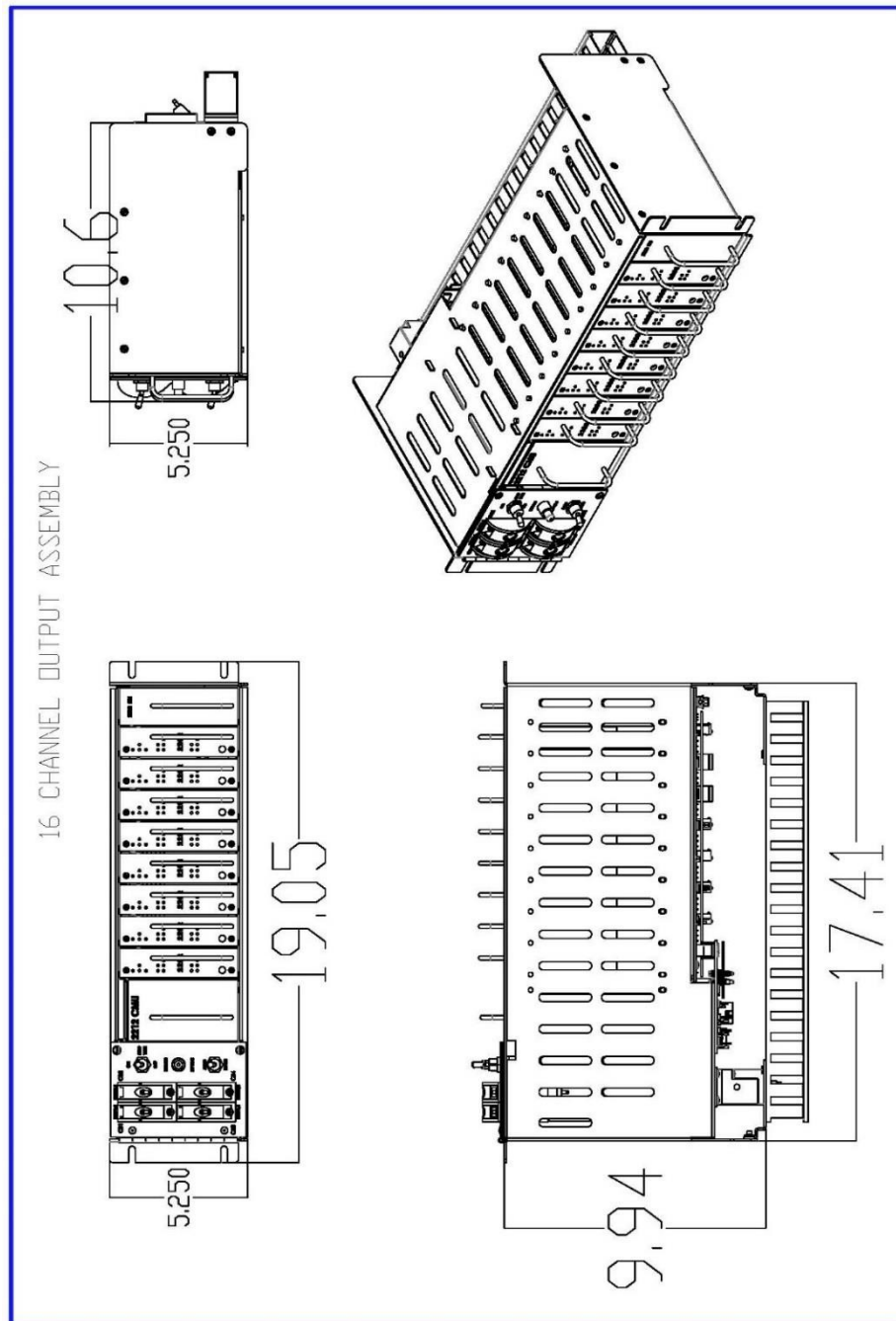


Figure 4: 16 Channel Output Assembly

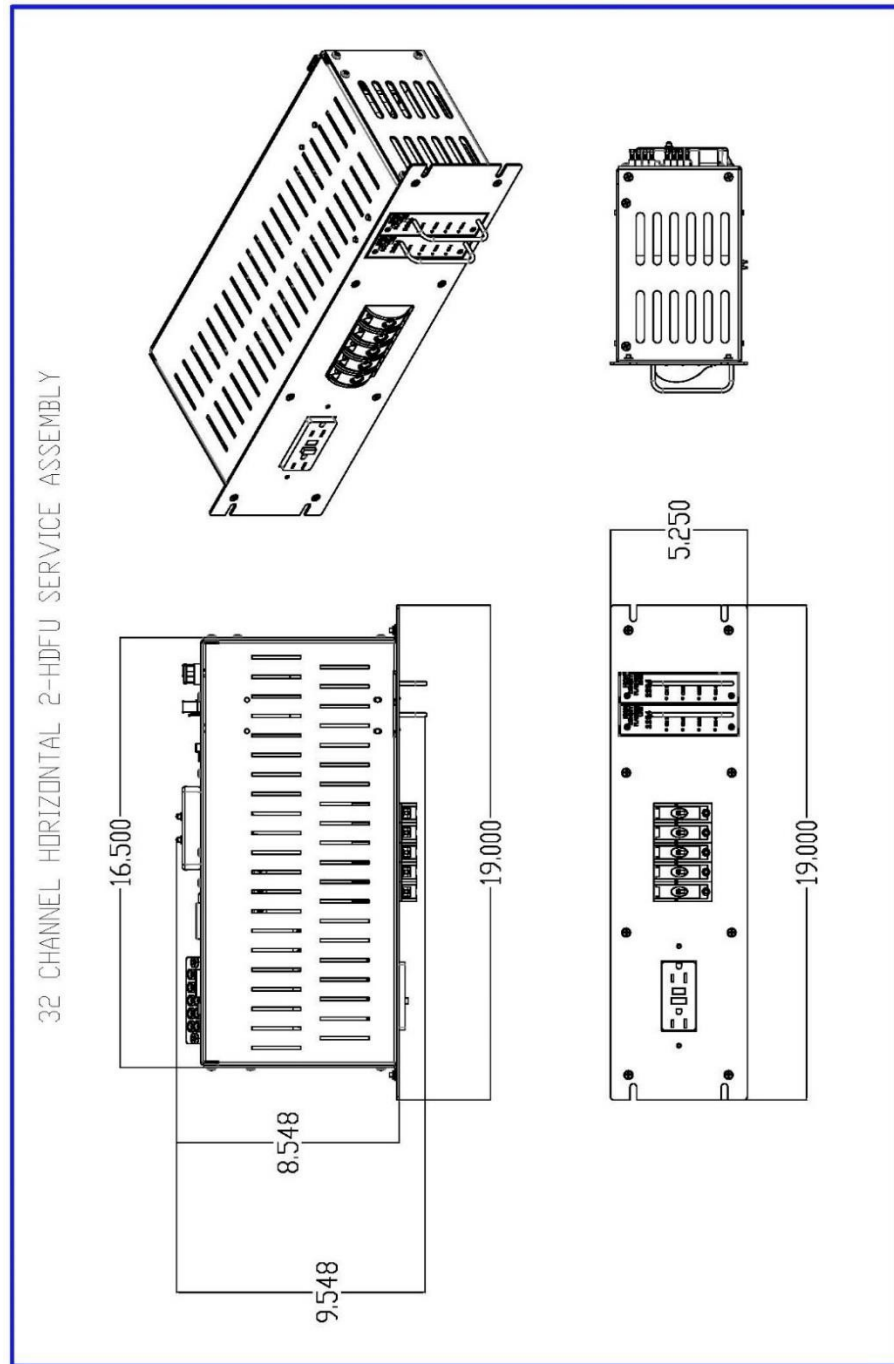


Figure 5: 2-HDFU Service Assembly

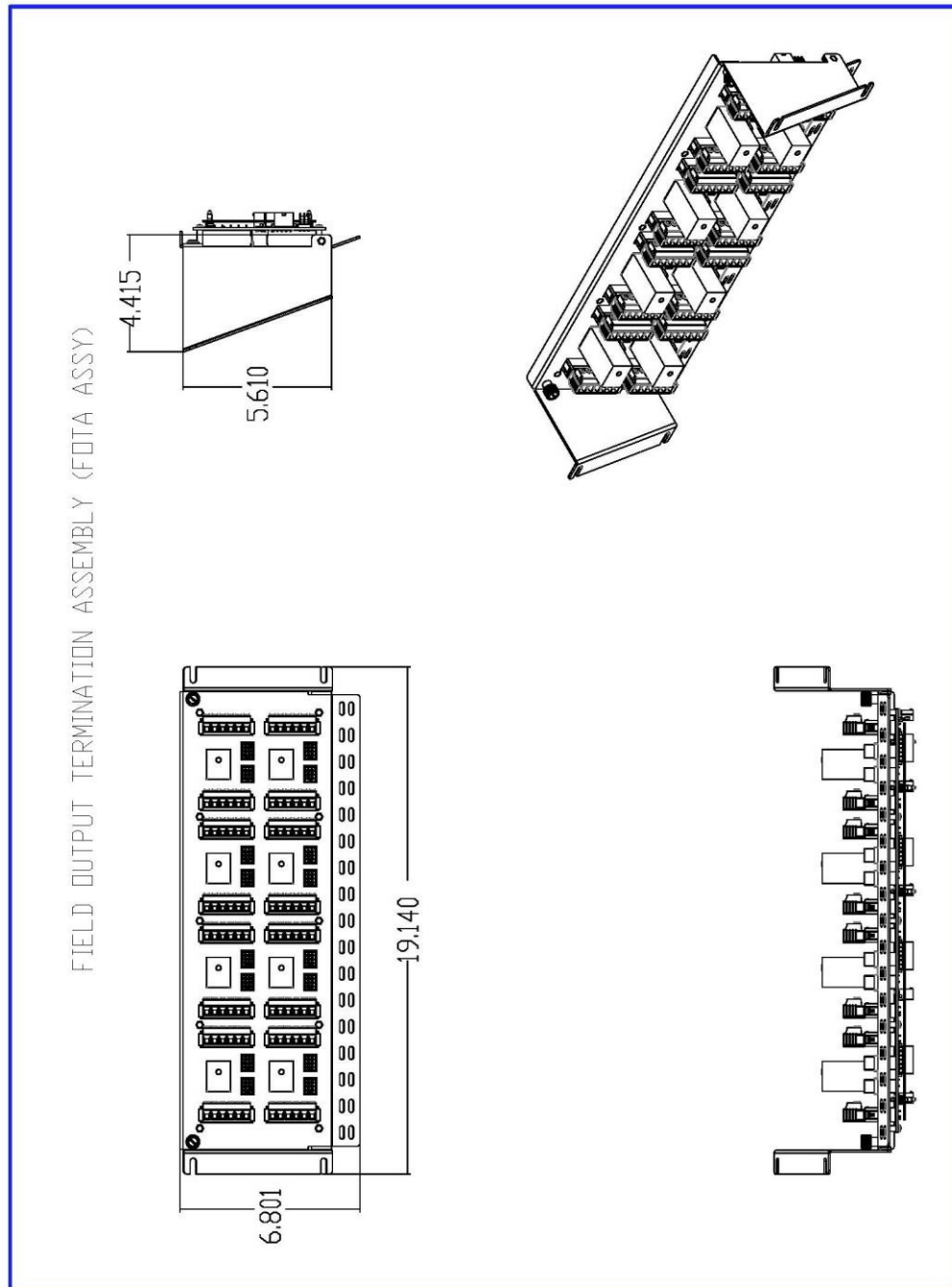


Figure 6: Field Output Termination Assembly (FOTA)

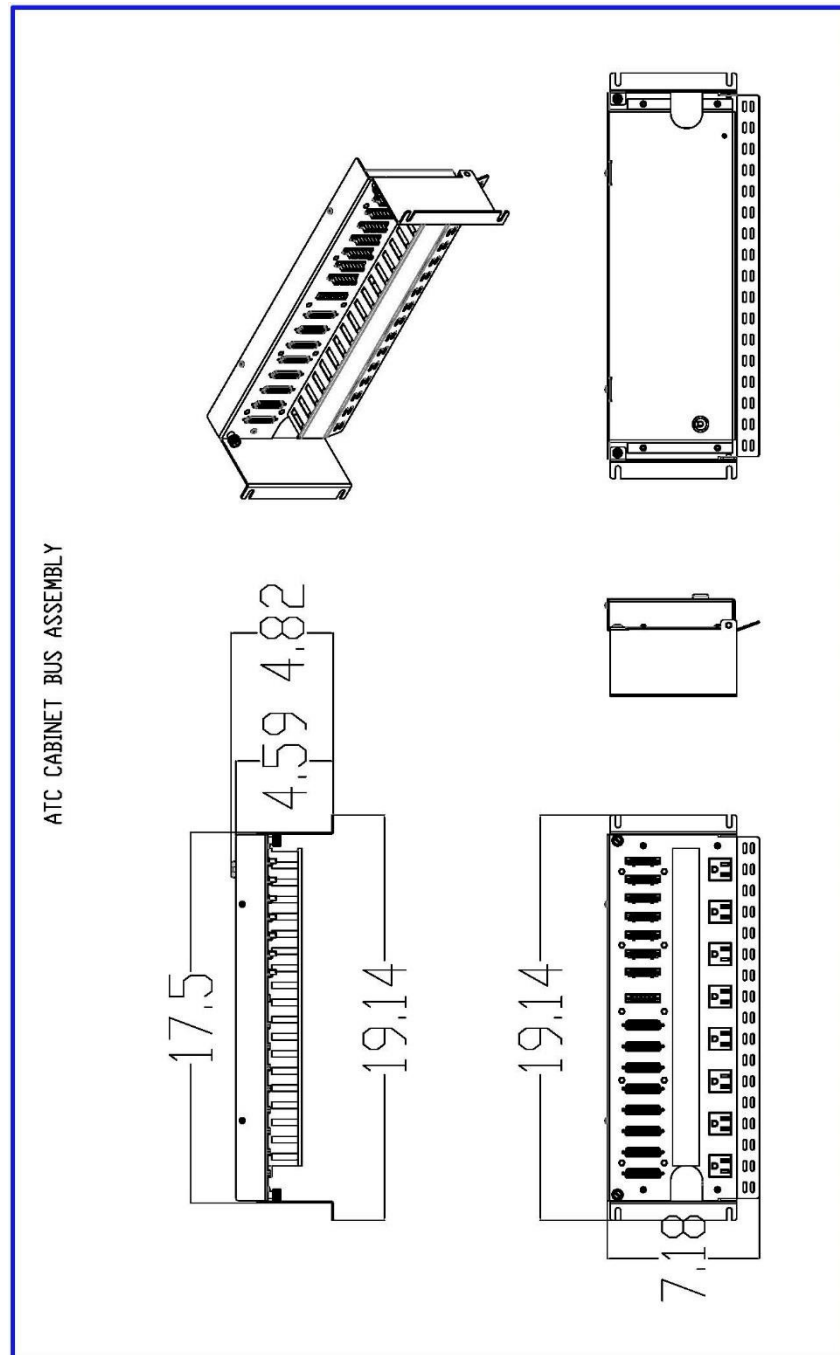
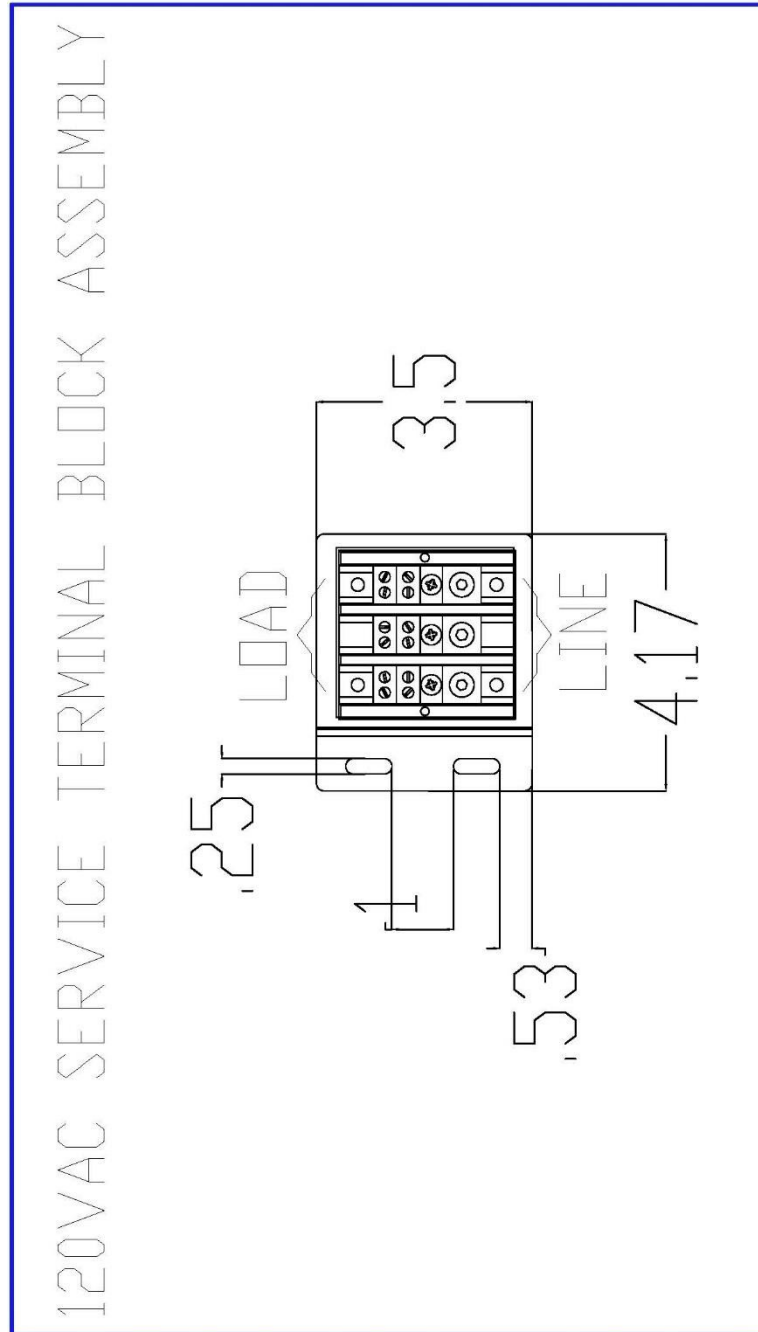


Figure 7: ATC Cabinet Bus Assembly



*Figure 8: 120VAC Service Assembly*

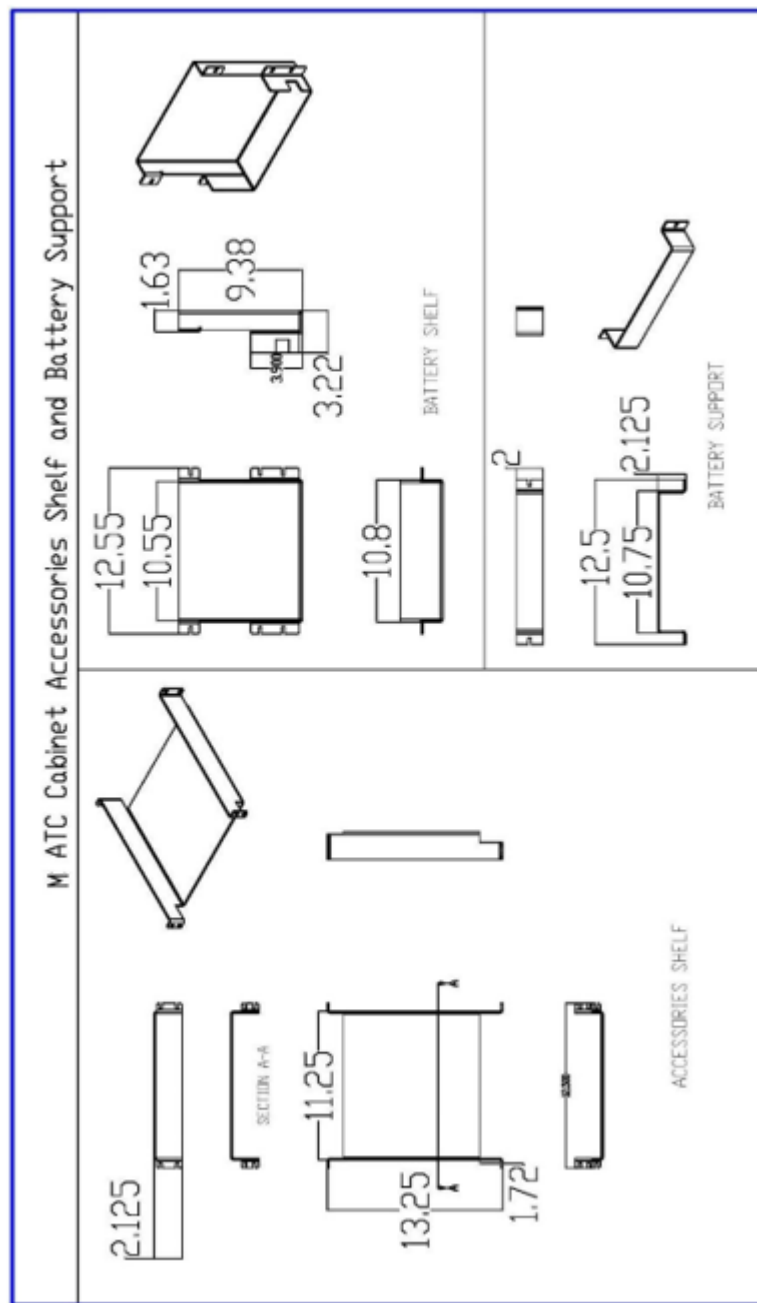


Figure 9: M ATC Cabinet Accessories Shelf, Battery Shelf and Battery Support



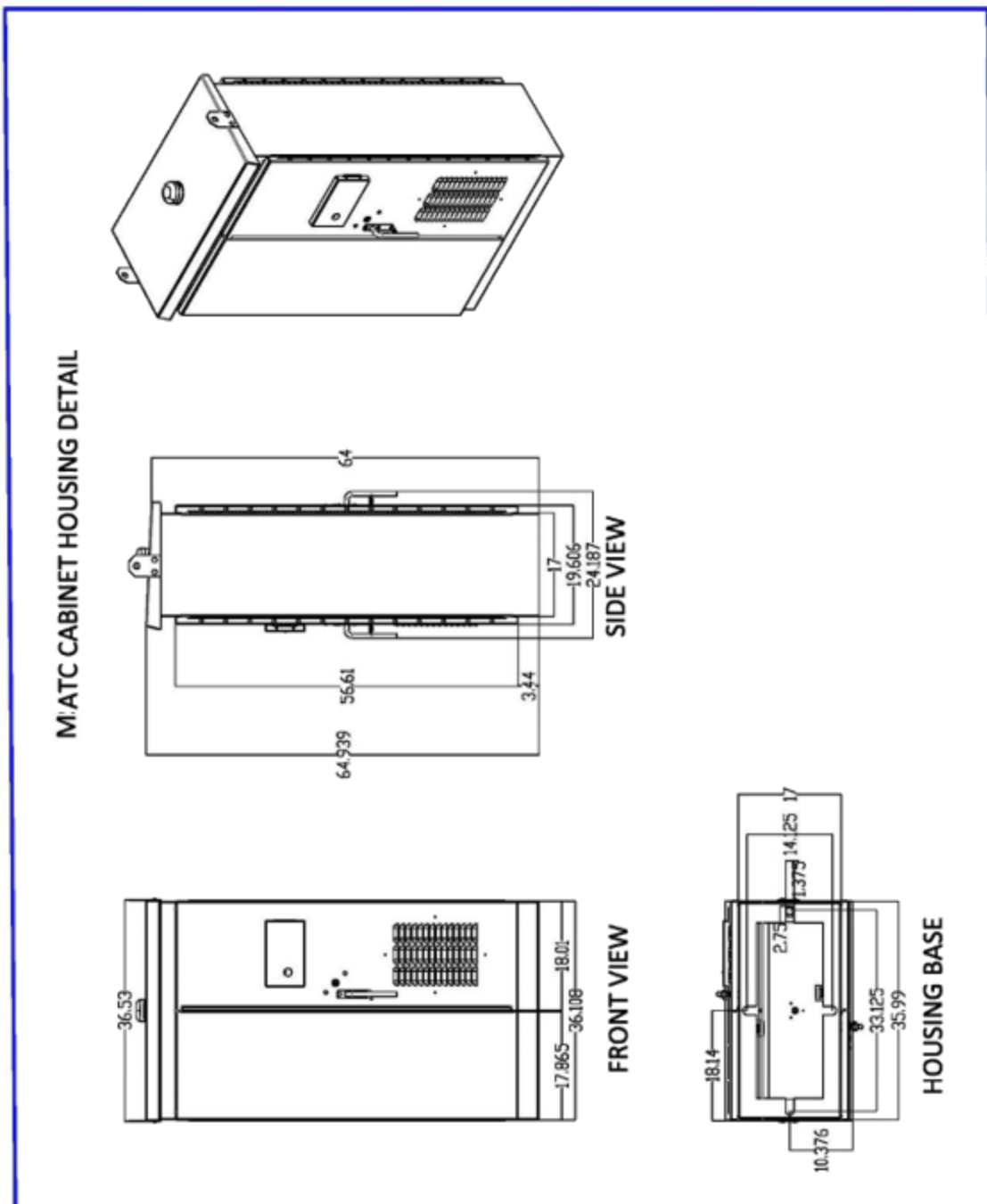


Figure 10: M ATC Cabinet Housing Detail

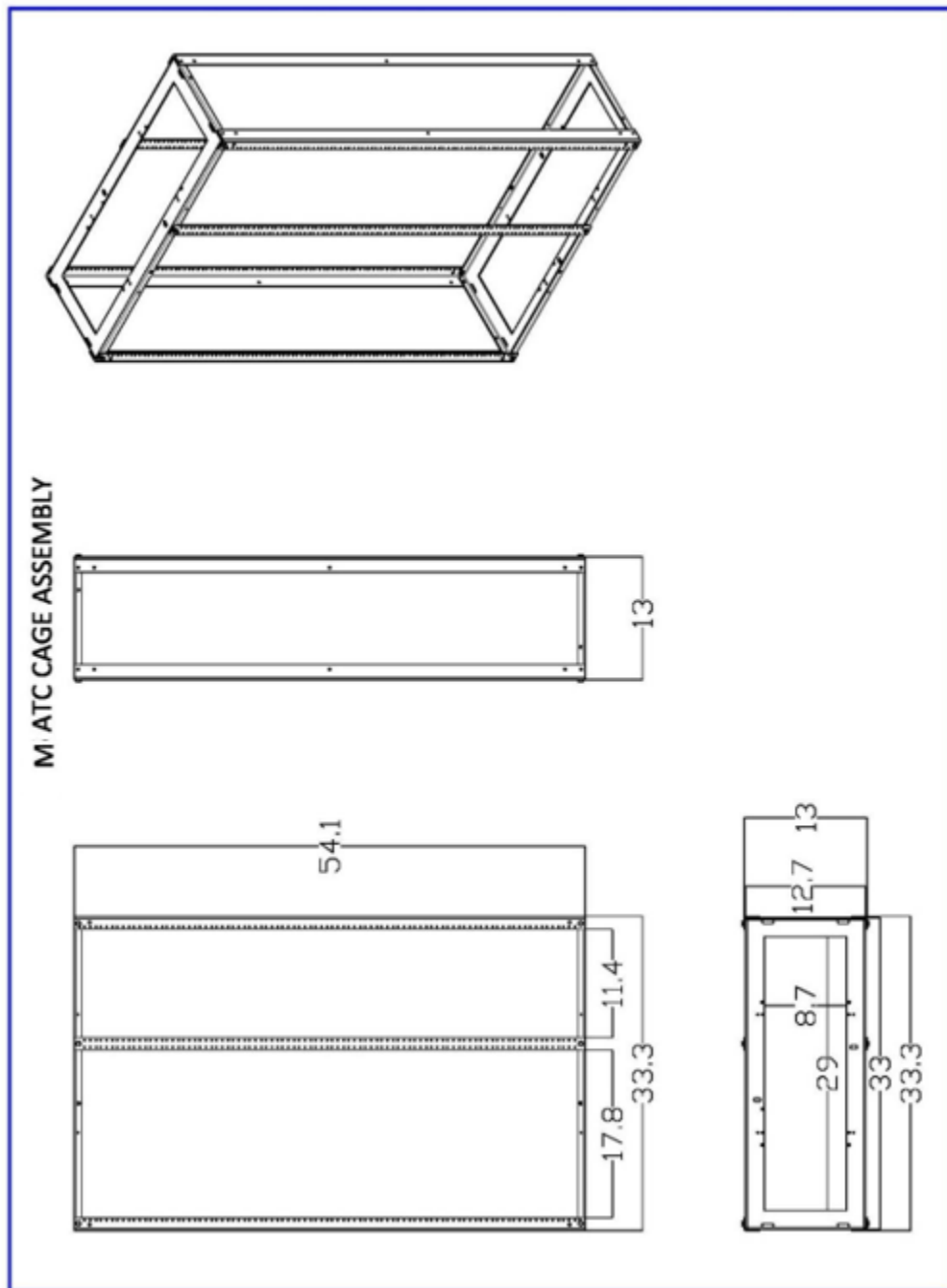


Figure 11: M ATC Cabinet Cage Assembly

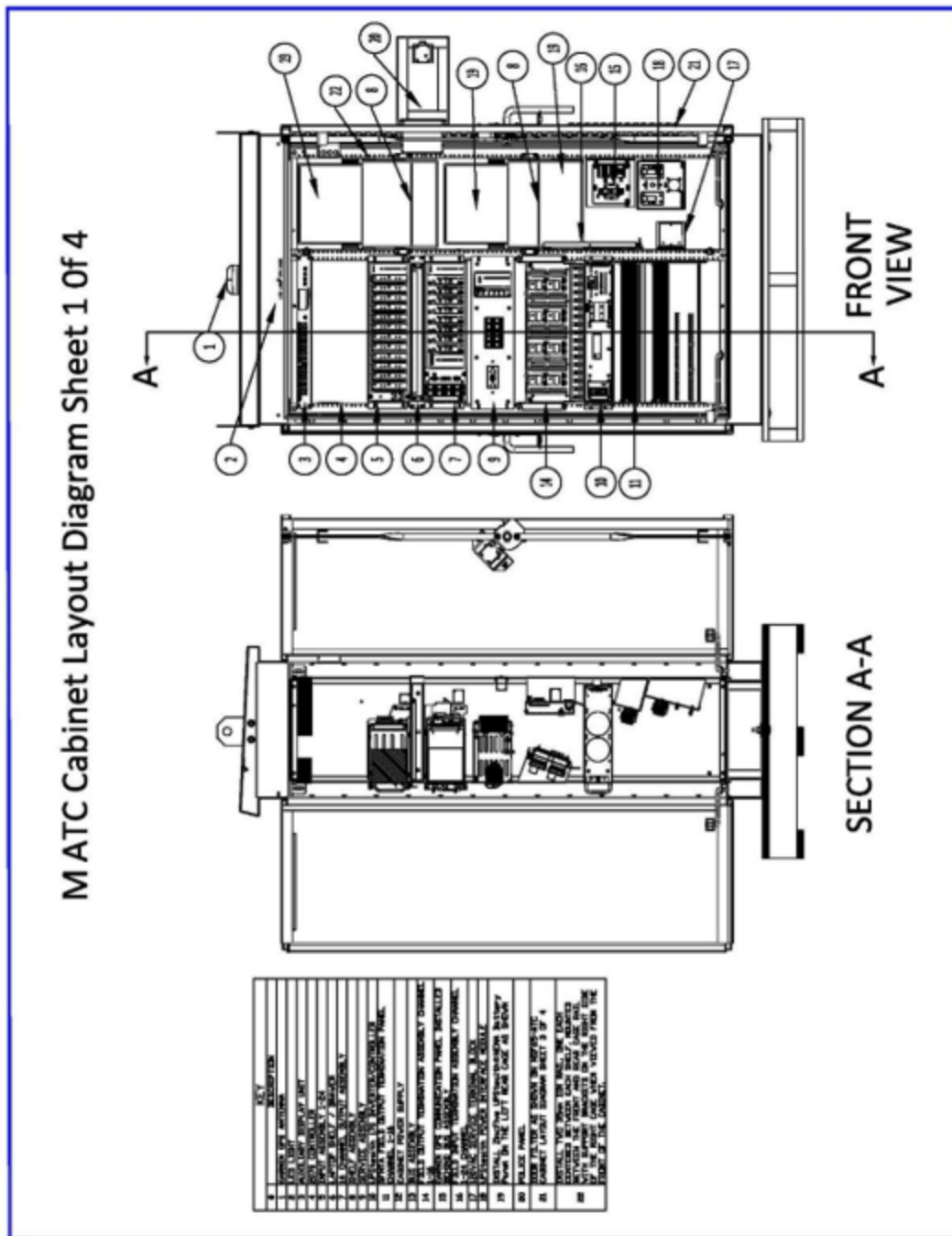


Figure 12: M ATC Cabinet Layout Diagram Sheet 1 of 4

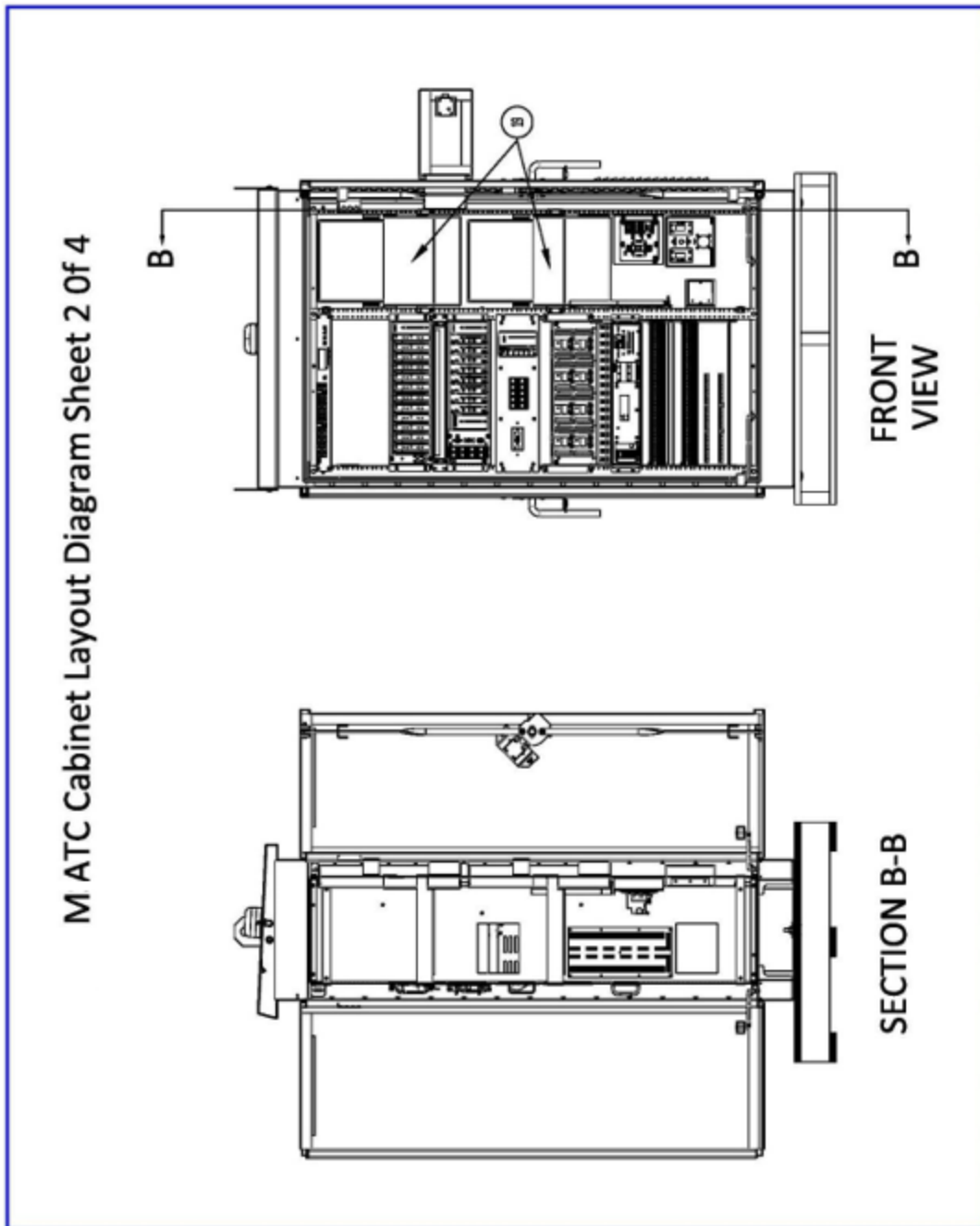


Figure 13: M ATC Cabinet Layout Diagram Sheet 2 of 4

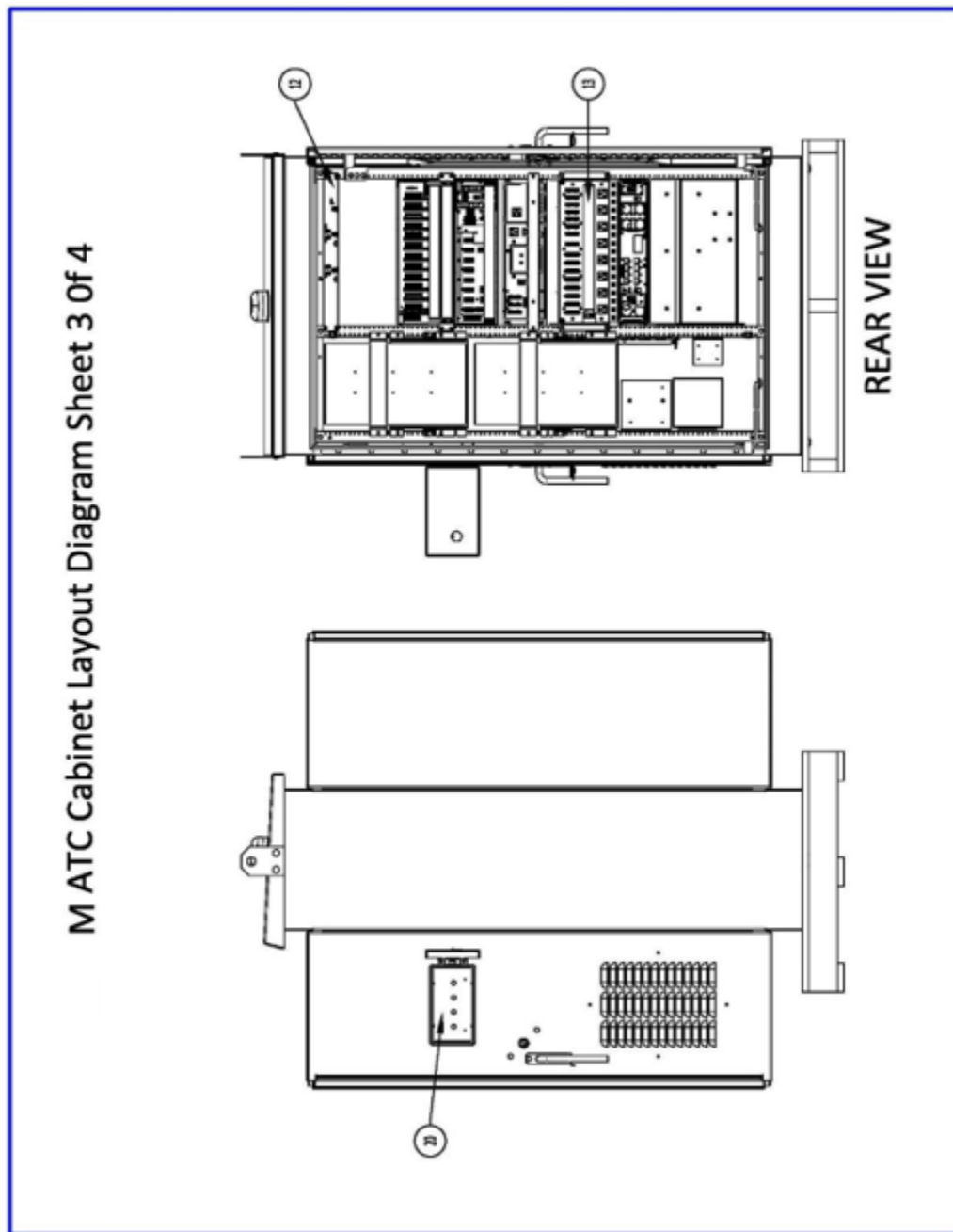
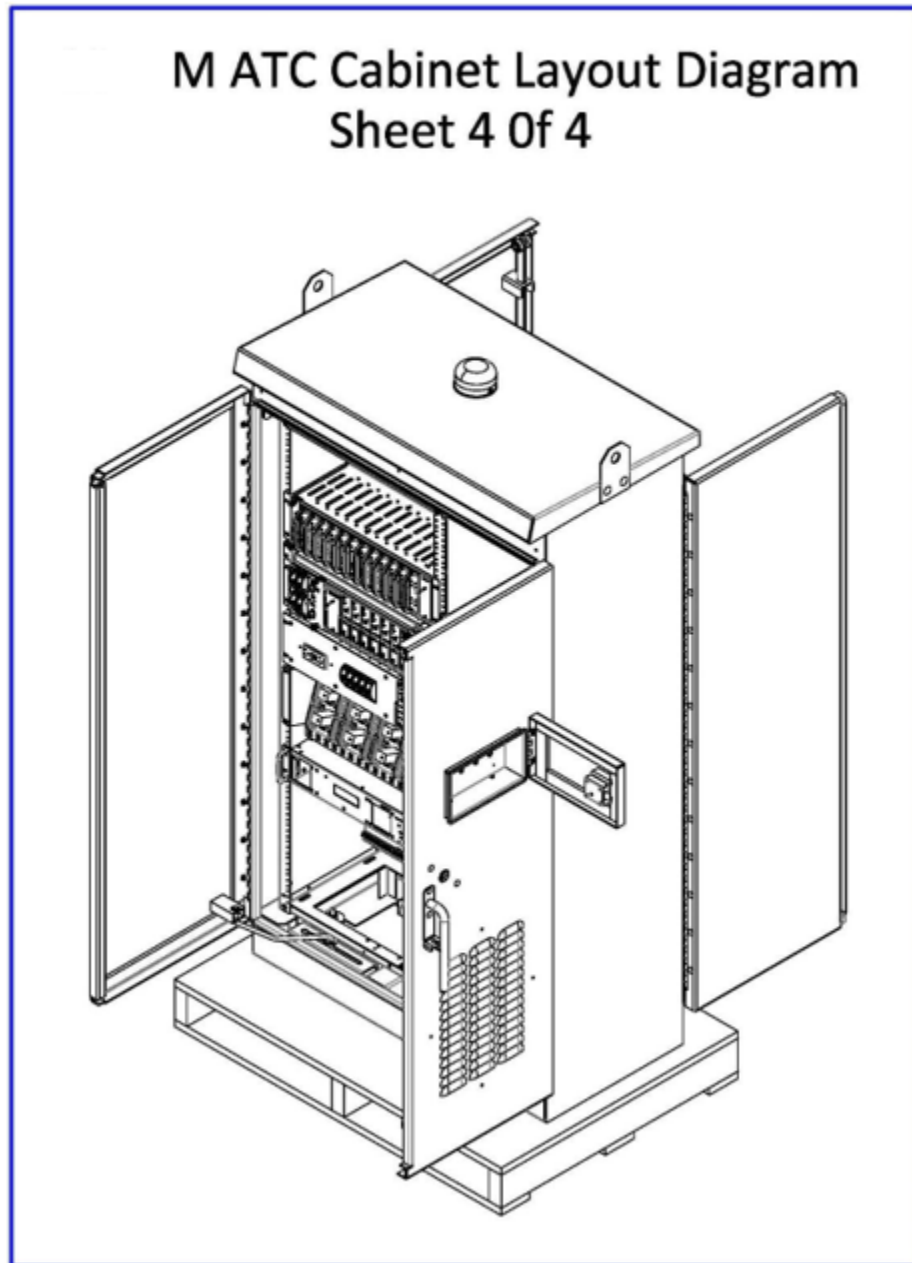


Figure 14: M ATC Cabinet Layout Diagram Sheet 3 of 4



*Figure 15: M ATC Cabinet Layout Diagram Sheet 4 of 4*

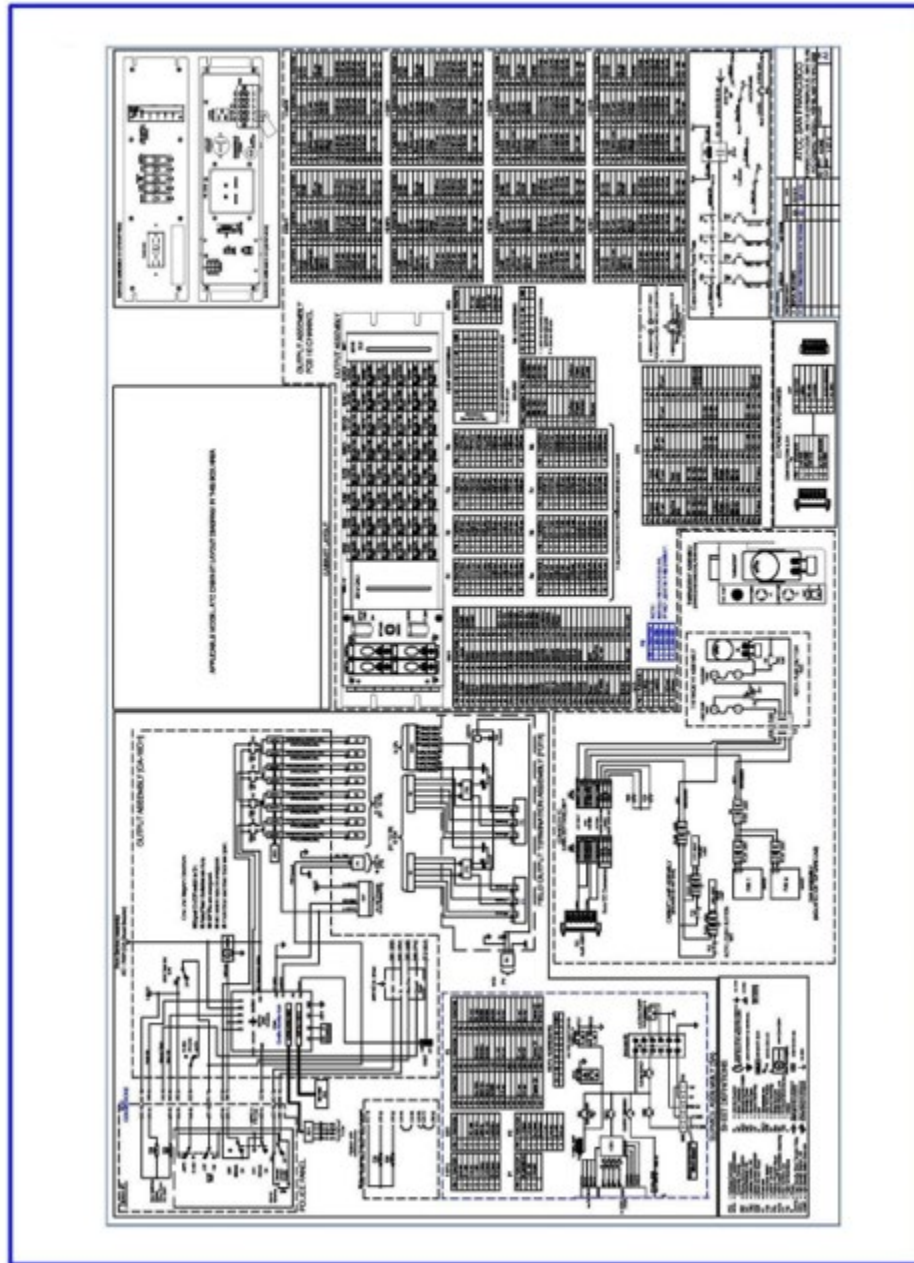


Figure 16: M ATC Cabinet Wiring Diagram Sheet

## 7. GLOSSARY OF TERMS

A	Ampere	LV	Low-Voltage
AC	120 Volts AC, 60 Hertz	M	Mega
AC-	120 Volts AC, 60 Hertz grounded return to the power source	mA	milliampere
AC+	120 Volts AC, 60 Hertz ungrounded power source	MHz	Mega Hertz
ADU	Auxiliary Display Unit	mm	millimeter
ATC	Advanced Transportation Controller	mph	mile per hour
AWG	American Wire Gauge	ms	millisecond
C	Celsius	N.C.	Normally Closed
CB	Circuit Breaker	N.O.	Normally Open
CH	Channel	NA	Not Assigned
CMU	Cabinet Monitor Unit	NEC	National Electric Code
CMUip	Cabinet Monitor Unit - Internet Protocol	OA	Output Assembly
CPS	Cabinet Power Supply	Opto	Opto Isolator
D	Depth	OVA	Overlap A
DIN	Deutsche Industrie Norm	OVB	Overlap B
DOT	Department of Transportation	OVC	Overlap C
EG	Equipment Ground	OVD	Overlap D
EIA	Electronic Industries Association	PCB	Printed Circuit Board
F	Fahrenheit	Ped	Pedestrian
FITA	Field Input Termination Assembly	Ph	Phase
FOTA	Field Output Termination Assembly	QC	Quality Control
FPB	Flash Program Block	RMS	Root Mean Square
GFCI	Ground Fault Circuit Interrupter	Rx	Received
H	Height	RYG	Red Yellow Green
HDFTR	High-Density Flash Transfer Relay	SA	Service Assembly
HDSP	High-Density Switch Pack	SB	Serial Bus
HDSP/FU	High-Density Switch Pack / Flasher Unit	SB1	Serial Bus 1
HDFU	High-Density Flasher Unit	SB2	Serial Bus 2
HV	High-Voltage	SB3	Serial Bus 3
I/O	Input /Output	SDLC	Synchronous Data Link Control
IA	Input Assembly	SIU	Serial Interface Unit
In	Inch	SPST	Single Pole Single Throw
iP	Internet Protocol	TBD	To Be Determined
K	Kilo	Tx	Transmit
KA	Kilo Ampere	U	Rack Unit
Kbs	kilobit per Second	UL	Underwriter's Laboratories, Inc.
KHz	Kilo Hertz	V	Voltage
lbs	Pounds	VAC/Vac	Voltage Alternate Current



LED	Light Emitting Diode	Vdc	Voltage Direct Current
		W	Width