



# Public Safety Solutions

## PS27-2220-FXM HP

**User Guide ID:** 9400031-J0

**Effective:** 03/2022



**Read this document carefully.**

Learn how to protect your equipment from damage and fully understand its functions.



# Public Safety Solutions

## Alpha<sup>®</sup> PS27-2220-FXM HP

### UL 2524 Certified Backup Power System



#### NOTICE

For the latest version of software, firmware, and product documentation, visit the Alpha<sup>®</sup> website, [www.alpha.com](http://www.alpha.com) or [www.alpha.ca](http://www.alpha.ca).



#### NOTICE

Photographs contained in this document are for illustrative purposes only. These photographs may not match your installation.



#### NOTICE

Operator is cautioned to review the drawings and illustrations contained in this document before proceeding. If there are questions regarding the safe operation of this powering system, contact Alpha Technologies Ltd. or your nearest Alpha<sup>®</sup> representative.



#### NOTICE

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# 1. Safety

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## Save these instructions

This document contains important safety instructions that must be followed during the installation, servicing, and maintenance of the product. Keep it in a safe place. Review the drawings and illustrations contained in this document before proceeding. If there are any questions regarding the safe installation or operation of this product, contact Alpha Technologies Ltd. or the nearest Alpha® representative.

### 1.1 Safety symbols

To reduce the risk of injury or death, and to ensure the continued safe operation of this product, the following symbols have been placed throughout this document. Where these symbols appear, use extra care and attention.



#### WARNING

Risk of serious injury or death

Equipment in operation poses a potential electrical hazard which could result in serious injury or death to personnel. This hazard may continue even when power is disconnected.



#### CAUTION

Cautions indicate the potential for injury to personnel.



#### CAUTION

Risk of burns

A device in operation can reach temperature levels which could cause burns.



#### ATTENTION

The use of attention indicates specific regulatory or code requirements that may affect the placement of equipment or installation procedures. Follow the prescribed procedures to avoid equipment damage or service interruption.



#### GROUNDING

This symbol indicates the location or terminal intended for the connection to protective earth. An enclosure that is not properly connected to protective earth presents an electrical hazard. Only a licensed electrician can connect AC power and protective earth to the enclosure.



#### NOTICE

A notice provides additional information to help complete a specific task or procedure or general information about the product.

### 1.2 General warning and cautions



#### WARNING

You must read and understand the following warnings before installing the enclosure and its component. Failure to do so could result in personal injury or death.

- Read and follow all instructions included in this document.
- Only trained personnel are qualified to install or replace this equipment and its components.
- Use proper lifting techniques whenever handling equipment, parts, or batteries.

## 1.3 Electrical safety



### WARNING

Hazardous voltages are present at the input of power systems. The DC output from rectifiers, though not dangerous in voltage, has a high short-circuit current capacity that can cause severe burns and electrical arcing.

Before working with any live battery or power system, follow these precautions:

- Remove all metallic jewelry, such as watches, rings, metal rimmed glasses, or necklaces.
- Wear safety glasses with side shields at all times during the installation.
- Use OSHA approved insulated hand tools. Do not rest tools on top of batteries.



### WARNING

Lethal voltages are present within the power system. Always assume that an electrical connection or conductor is energized. Check the circuit with a voltmeter with respect to the grounded portion of the enclosure (both AC and DC) before performing any installation or removal procedure.

- Do not work alone under hazardous conditions.
- A licensed electrician is required to install permanently wired equipment. Input voltages can range up to 240 Vac. Ensure that the utility power is disconnected and locked out before performing any installation or removal procedure.
- Ensure that no liquids or wet clothes come into contact with internal components.
- Hazardous electrically live parts inside this unit are energized from the batteries even when the AC input power is disconnected.
- The enclosure which contains the DC or AC power system along with customer installed radios must remain locked at all times, except when authorized service personnel are present.
- Always assume electrical connections or conductors are live. Turn off all circuit breakers and double-check with a voltmeter before performing installation or maintenance.
- Place a warning label on the utility panel to warn emergency personnel that a reserve battery source is present which will power the loads in a power outage condition or if the AC disconnect breaker is turned off.
- At high ambient temperature conditions, the internal temperature can be hot so use caution when touching the equipment.

## 1.4 Battery safety

- Servicing and connection of batteries must be performed by, or under the direct supervision of, personnel knowledgeable of batteries and the required safety precautions.
- Always wear eye protection, rubber gloves, and a protective vest when working near batteries. Remove all metallic objects from your hands and neck.
- Use OSHA approved insulated hand tools. Do not rest tools on top of batteries.
- Batteries contain or emit chemicals known to cause cancer and birth defects or other reproductive harm. Battery post terminals and related accessories contain lead and lead compounds. Wash your hands after handling batteries.



### WARNING

Follow the battery manufacturer's safety recommendations when working around battery systems. Do not smoke or introduce an open flame when batteries (especially vented batteries) are charging. When charging, batteries vent hydrogen gas, which can explode.

Batteries are hazardous to the environment and should be disposed at a recycling facility. Consult the battery manufacturer for recommended local authorized recyclers.



## 2. Introduction

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### 2.1 Product overview

The Alpha® PS27-2220-FXM HP is a charger and battery backup system idea for sites with BDA systems installed to improve emergency radio communication per UL 2524.

This enclosure is designed to protect its internal backup power system in accordance with NFPA 1221 and UL 2524 standard requirements.



Figure 1: Alpha® PS27-2220 FXM HP interior view

### 3. Specifications

Table A — Alpha® PS27-2220-FXM HP specifications		
<b>Electrical</b>		
<b>AC input</b>	<ul style="list-style-type: none"> <li>120 V, 5.7 A maximum, 60 Hz, 1 PH (UPS)</li> <li>120 V, 30 A maximum, 60 Hz, (UATS) – optional</li> </ul>	
<b>AC output</b>	<ul style="list-style-type: none"> <li>120 V, 300 VA/W maximum, 60 Hz, 1 PH</li> <li>120 V, 15 A, 60 Hz (UATS, 5-15R) – optional</li> </ul>	
<b>Trouble relay outputs (3 total)</b>	Dry contact voltage, Vdc	24 Vdc
	Dry contact current, A resistive	1 A
<b>Recommended AC input breaker</b>	15 A	
<b>Battery back-up operation</b>		
<b>Charge current</b>	10 A	
<b>Maximum battery configuration</b>	Two 110 Ah (two battery strings in parallel)	
<b>Run time</b>	<ul style="list-style-type: none"> <li>12 hours at 240 watts</li> <li>24 hours at 120 watts</li> </ul>	
<b>Mechanical</b>		
<b>Dimensions (H x W x D)</b>	636 mm x 559 mm x 448 mm (25.03 in. x 22 in. x 19.23 in.)	
<b>System weight (empty)</b>	43.5 kg (96 lb)	
<b>Mounting</b>	Ground with plinth	
<b>Construction</b>	High strength corrosion resistant aluminum	
<b>Finish</b>	Polyester powder coat (red)	
<b>Door prop</b>	0.25 inch aluminum rod, two positions	
<b>Door latch</b>	Compression latches, padlockable	
<b>Environmental</b>		
<b>Operating temperature</b>	–0 to 40°C (32 to 104°F)	
<b>Storage temperature</b>	–40 to 85°C (–40 to 185°F)	
<b>Cabinet rating</b>	UL 50E/CSA C22.2 No.94.2 Enclosure Type 4	
<b>Agency compliance</b>		
<b>System rating</b>	UL 2524	



#### ATTENTION

Only use accessories (such as grommets or fittings) with the proper Type 4 rating or better during field installation.

## 4. Features

### 4.1 Alpha® FXM HP 650 rugged UPS module

Alpha® FXM HP 650 uninterruptible power supply (UPS) modules provide clean, reliable power control and management as part of a complete UPS solution. Temperature compensated battery charging protects batteries from overcharging at extreme temperatures, extending battery life. Event and alarm logging with time and date stamping simplifies and accelerates troubleshooting.

Multiple communication ports including two Ethernet connections permits simultaneous local craft access as well as permanent LAN/WAN connectivity. A USB drive may also be used to quickly backup and restore site configuration settings and data logs. Enhanced security using modern encryption technology ensures proper authentication and privacy for remote connection with the UPS.

For more information, see the [Alpha® FMX 650, 1100, 2000 UPS User Guide: 0170022-J0](#).



Figure 2: Alpha® FXM HP 650 rugged UPS module

### 4.2 Universal automatic transfer switch (optional)

The universal automatic transfer switch (UATS) is an optional add-on switching unit specifically designed for the Alpha® FXM HP UPS family. These switching units provide power or bypass capacity (automatic or manual) so that the operator can safely disconnect the UPS from line or generator power for easy removal and servicing.

In bypass mode, the loads are directly connected to the line or generator power without any conditioning. Depending on the use of one or the other, the UATS allows the use of up to three different back-up sources (line, batteries, and generator).



Figure 3: Universal automatic transfer switch

## 4.3 Alarms, controls, and communications

### 4.3.1 Standard alarm function description

Dry contacts are available for standard annunciation of the following conditions:

- Low battery alarm
- Charger fail alarm
- AC fail alarm
- AC normal

Connections to these alarms are shown in [Table C](#) for Alpha® FXM HP UPS units.

These alarms must be taken to and monitored by a dedicated alarm or annunciator panel in accordance with UL 2524, NFPA 1221, or local regulations.



#### NOTICE

Ensure that the alarm panel or the annunciator panel is terminated with an end of line resistor (EOLR) of proper resistance to be monitored by the control panel.

When attaching an EOLR to the dry contacts of the public safety system, ensure that the UL listed resistor is connected to the dry contacts via pigtail connections using UL listed marrettes.

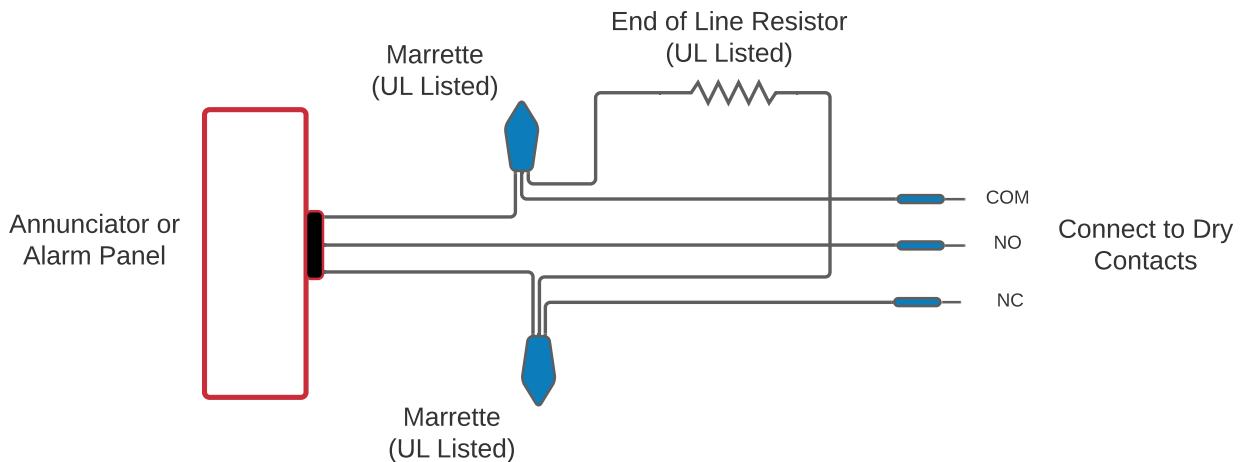


Figure 4: Attaching an EOLR to the dry contacts of the public safety system

### 4.3.2 Temperature compensation



#### NOTICE

Do not splice the temperature probe leads to a conductor larger than 0.75 mm<sup>2</sup> (18 AWG).

The temperature compensation feature will adjust the output float/equalize voltage of the rectifier to protect against thermal runaway and reduce life degradation due to heat.

Each system is equipped with temperature probes to support the function and must be installed on the battery at time of commissioning.

### 4.3.3 Communication

- Ethernet: 10/100 BASE-T Ethernet connection on the front of the controller for local communication.
- Web based user interface for local or remote via a 10/100 BASE-T Ethernet connection.
- Email notification.
- SNMP Communications Protocol.

## 4.4 Battery storage and retainer

The Alpha® PS27-2220-FXM HP enclosure can support one or two strings of VRLA batteries on the battery tray.

A single tray is provided to support batteries and are equipped with a wiring harness.

Battery tray dimensions W × D: 48.3 cm × 40.6 cm (19 in. × 16 in.)

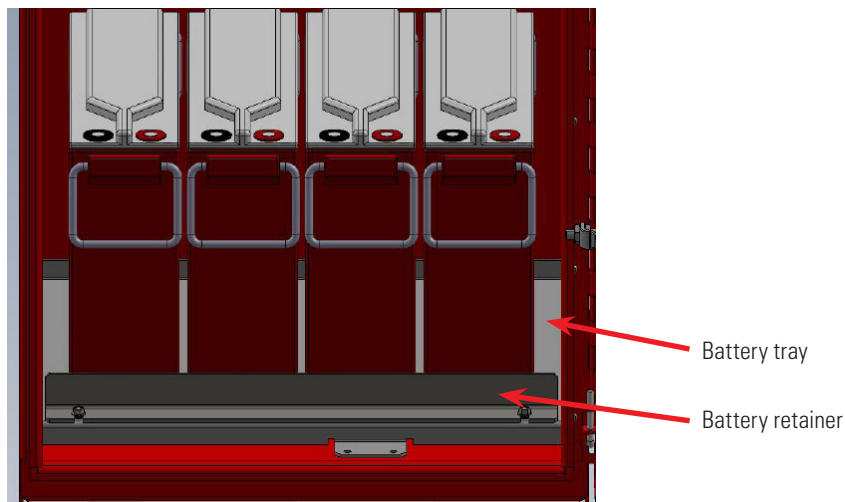


Figure 5: Battery tray and retainer

## 4.5 Enclosure security

The front door can be secured with a separate padlock installed on each latch collar. Install a padlock on the enclosure door after installation to prevent unauthorized access to the system.

## 4.6 Power enclosure system – options, components, and parts

Table B — Part numbers	
AC power system option	Part number
Alpha® FXM HP 650 UPS, 24 V, 1 battery tray	0570318-101
Accessories	Part number
Universal automatic transfer switch (UATS) accessory kit Allows the Alpha® FXM HP UPS module to be removed without turning off the power to the load.	0370498-001
Battery fuses, 20 A	4600003
Plinth kit, 4-inch base assembly, aluminum, red	740-760-23

## 5. Inspection

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### 5.1 Packing materials

EnerSys is committed to providing products and services that meet our customers' needs and expectations in a sustainable manner, while complying with all relevant regulatory requirements. As such EnerSys strives to follow our quality and environmental objectives from product supply and development through to the packaging for our products.

Rectifiers and batteries are shipped on individual pallets and are packaged according to the manufacturer's guidelines.

Almost all EnerSys packaging material is from sustainable resources and or is recyclable.

### 5.2 Returns for service



#### NOTICE

**EnerSys is not responsible for damage caused by improper packaging of returned products.**

Save the original shipping container. If the product needs to be returned for service, it should be packaged in its original shipping container. If the original container is unavailable, make sure that the product is packed with at least three inches of shock-absorbing material to prevent shipping damage.

### 5.3 Check for damage

Before unpacking the product, note any damage to the shipping container. Unpack the product and inspect the exterior for damage. If any damage is observed, contact the carrier immediately. Continue the inspection for any internal damage. In the unlikely event of internal damage, inform the carrier and contact EnerSys for advice on the impact of any damage.

### 5.4 General receipt of shipment

The inventory included with your shipment depends on the options you have ordered. The options are clearly marked on the shipping container labels and bill of materials.

### 5.5 Miscellaneous small parts

Review the packing slip and bill of materials to determine the part number of the "configuration kits" included with your system. Review the bill of materials to verify that all the small parts are included. Contact Alpha Technologies Ltd. if you have any questions before you proceed.

## 6. Site evaluation and pre-installation

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### 6.1 Site selection

Consider the following before selecting a mounting location:

- The Alpha® PS27-2220-FXM HP enclosure is designed for front access only.
- Avoid areas that may be subjected to hot air exhaust from nearby equipment.
- The enclosure should not be installed in direct sunlight.
- Find out if your intended area is subjected to architectural controls or environmental restrictions.
- Avoid areas that are prone to flooding.

The Alpha® PS27-2220-FXM HP indoor power enclosure has been designed for the following mounting option:  
Plinth, mounted on a concrete slab, floor, or similar surface.



#### **NOTICE**

The Alpha® PS27-2220-FXM HP backup power system is designed for indoor use only.

### 6.2 Tools required

Various insulated tools are essential for the installation. Use this list as a guide:

- Battery lifting apparatus (if required)
- Electric drill with hammer action, 1/2 inch capacity
- Various crimping tools and dies to match lugs used in installation
- Load bank of sufficient capacity to load largest rectifier to its current limit
- Digital voltmeter equipped with test leads
- Cable cutters
- Cutters and wire strippers 2.5 to 0.34 mm<sup>2</sup> (14 to 22 AWG)
- Torque wrench: 1/4 inch drive, 0 to 150 in-lb
- Torque wrench: 3/8 inch drive, 0 to 100 ft-lb
- Insulating canvases as required
- Various insulated hand tools including:
  - Combination wrenches
  - Ratchet and socket set
  - Various screwdrivers
  - Electricians knife
- Battery safety spill kit (required for wet cells only)

## 7. Installation

Only qualified personnel should install and connect the power components within the Alpha® power system. For battery installation, refer primarily to the manufacturer's documentation.

### 7.1 Safety precautions

Refer to "[Safety](#)" near the beginning of this document.

### 7.2 Plinth mounting for concrete floor

#### 7.2.1 Mounting the plinth to the concrete floor

This mounting option assumes that a concrete floor is available at the installation site. [Figure 6](#) provides the location of the four bottom plinth mounting holes.

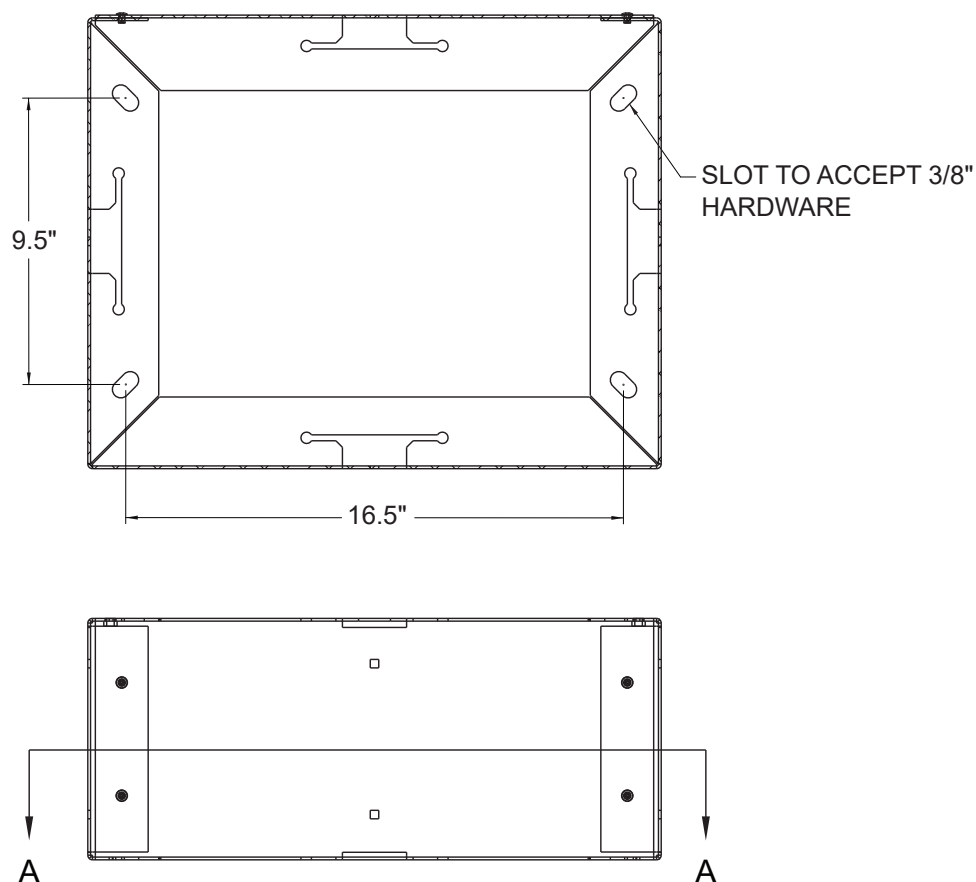


Figure 6: Plinth template for mounting bolts

1. Remove the plinth from the inside of the Alpha® PS27-2220-FXM HP UPS enclosure or from its shipping container.
2. If used, place the vapor barrier material on the mounting surface.
3. Mount the plinth box onto the four installed mounting bolts on the concrete floor.
4. Secure the plinth with four 3/8 inch hex nuts, flat and lock washers (to be supplied by the installer).
5. Check that the plinth is level from front-to-back and from side-to-side.
6. Add shims as needed under one or two of the corners of the plinth, placing the shims as close as possible to the bolts.



- Once the plinth is level, tighten all bolts to the appropriate torque.

Recommended bolt torque values	
1/4 inch	11.93 Nm (8.8 ft-lb)
3/8 inch	44.1 Nm (32.5 ft-lb)
1/2 inch	98.9 Nm (73 ft-lb)

### 7.2.2 Mounting the enclosure to the plinth



**CAUTION**

**Do not hoist or lift the enclosure with batteries installed.**

- Unstrap and unbox the Alpha® PS27-2220-FXM HP UPS enclosure from the shipping pallet.
- Remove the battery tray to access the bottom of the enclosure. There are two retaining screws per side as shown in [Figure 7](#).



Figure 7: Battery tray retaining screw locations

- With at least two installation personnel, lift and position the enclosure on its rear side. Use cardboard or similar material to protect the enclosure surface from any damage.
- On the bottom of the enclosure, locate the four outer mounting hole locations denoted by centerpunch marks as shown in [Figure 8](#). Drill out 0.281 inch diameter holes in each location for the 1/4 inch bolts installed in the next step.

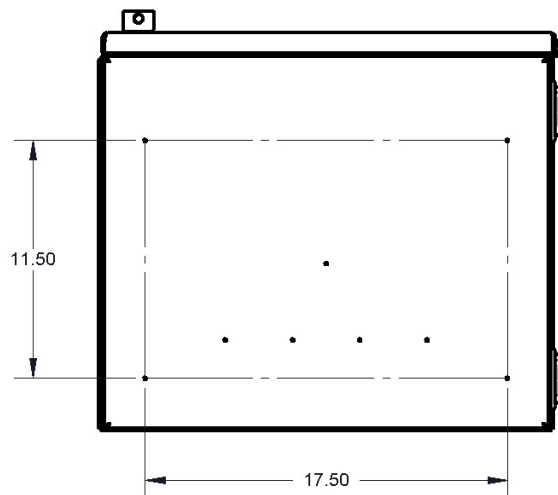


Figure 8: Enclosure/plinth mounting hole locations

5. With at least two installation personnel, lift and position the enclosure onto the plinth.
6. Secure the enclosure to the plinth with the supplied 1/4 inch hardware. Torque bolts to 7 Nm (65 in-lb). See [Figure 9](#).
7. Reinstall the battery tray.

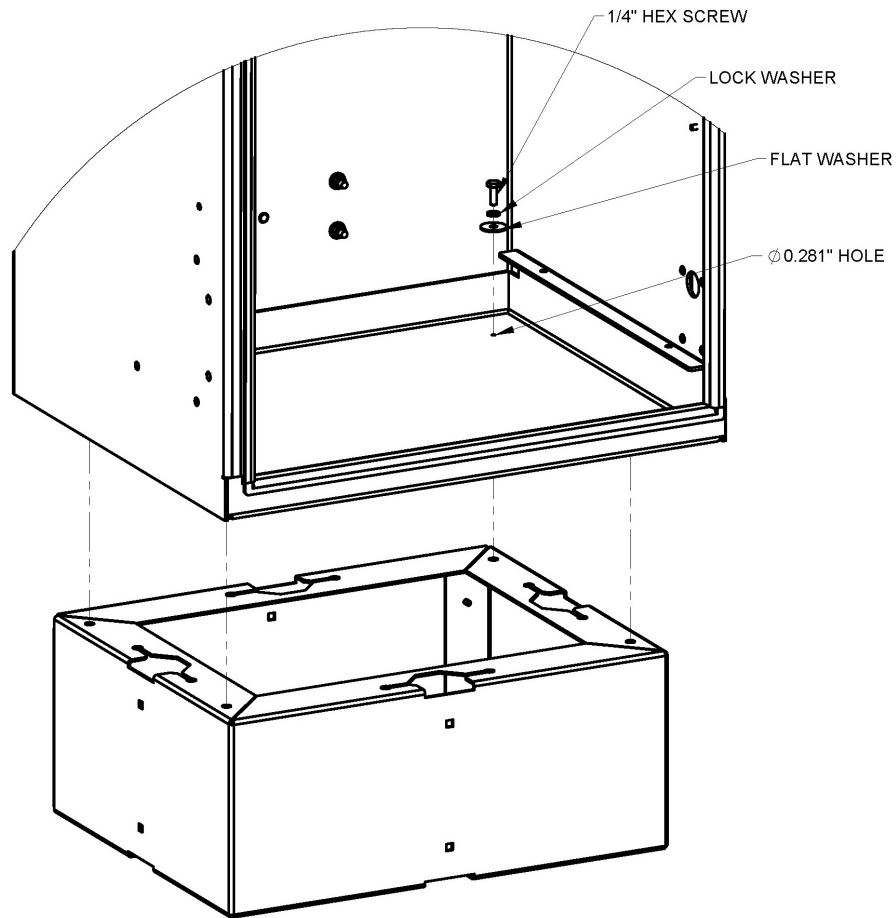


Figure 9: Securing enclosure to the plinth

## 8. Wiring

Only qualified personnel should install and connect the power components within the Alpha® power system. For the battery installation, refer primarily to the manufacturer's documentation.

### 8.1 Grounding the enclosure



#### WARNING

An enclosure that is not properly grounded presents an electrical hazard.

A proper grounding system that meets or exceeds the specifications of the equipment must be designed and installed prior to or in conjunction with the construction of the mounting slab or floor. The ground system must be bonded to the enclosure to ensure a "common" or "single-point" ground. Refer to local building codes.

1. Locate the enclosure master ground bar (MGB) at the left front sidewall of the enclosure.



#### GROUNDING

Chassis ground is connected to the enclosure frame and is terminated at the master ground bar (MGB) within the enclosure.

2. With enclosure securely mounted, select an appropriate location on the enclosure wall for the site ground wire entry. Make a suitable clearance hole and use fittings rated Type 4 or better to maintain enclosure integrity rating.
3. Connect the site ground wire to any unused position (12 to 4 AWG) on the enclosure master ground bar (MGB).

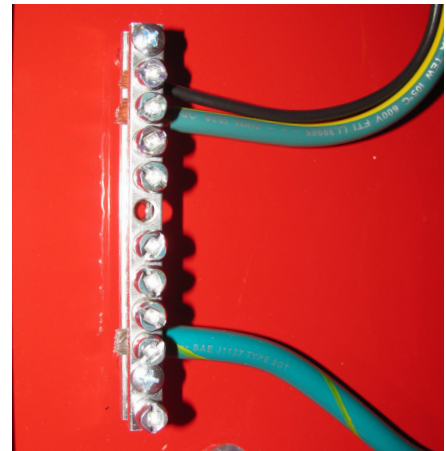


Figure 10: Enclosure MGB and chassis ground

### 8.2 I/O wiring into power enclosure system



#### NOTICE

Power limited and non-power limited wiring must enter the enclosure through separate conduit entrances. All power limited conductors must be separated by a minimum of 6.35 mm (0.25 in.) from all non-power limited conductors. The maximum length of the input/output wiring shall be no longer than 30 meters (98.5 feet).

With enclosure securely mounted, drill holes as needed for cord grips or conduit fittings (installer supplied). Avoid drill shavings from contacting any power components inside the system. You will require a minimum of the following cables entering/exiting the enclosure:

- AC input power cable (non-power limited)
- AC output power cable (non-power limited)
- Alarm/network cables (power limited)
  - Ethernet port (power limited)

Wiring must be routed and secured away from sharp projections, corners, and internal components. Use fittings rated UL Type 4 or better to maintain enclosure integrity rating. Refer to outline drawing for recommended drilling locations.

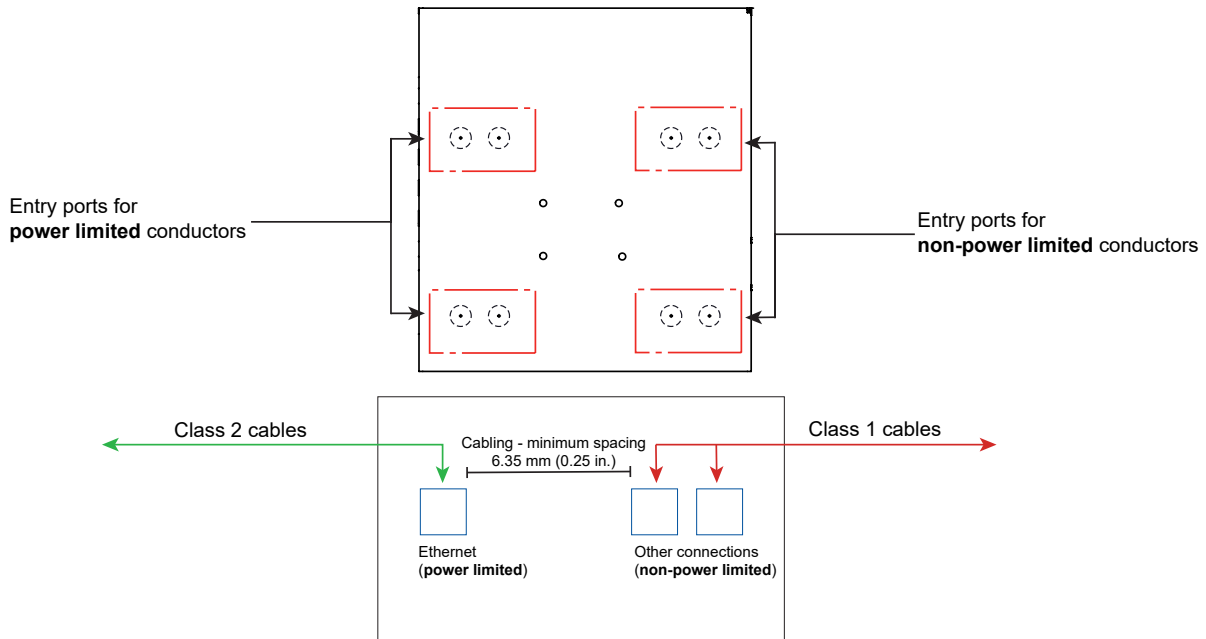


Figure 11: Rear cable entry locations

### 8.2.1 Power enclosure alarm wiring block

The intrusion alarm wiring block, located on the left side wall of the enclosure, uses screw-in DIN-rail mounted terminal blocks. All other alarms are located on the Alpha® FXM HP 650 UPS front panel. Use mating plugs included with the Alpha® FXM HP 650 UPS module packaging. Connect designated alarm outputs to the local alarm-sending unit or device using appropriate wire with gauge sizes from 0.2 to 2.5 mm<sup>2</sup> (22 to 12 AWG). Strip the wires 7 to 8 mm (0.28 to 0.31 in.) before connecting to the terminal block.

Systems are shipped programmed with the appropriate settings. If a replacement power unit is installed in the field, the settings will need to be programmed to the following values.



#### ATTENTION

This product incorporates field-programmable software. In order for the product to comply with the requirements in the Standard UL 2524, certain programming features or options must be limited to specific values or not used at all as indicated.

FXM HP front terminal	Description	Programming (replacement units)
C1	Do not use	Disabled
C2	Do not use	Disabled
C3	Low battery capacity	C3 = Low Battery Warning 1, Low Battery Warning 2, Low Battery and No Line 1, Low Battery and No Line 2
C4	Charger fail alarm	Set C4 = Missing FXM HP UPS, AC Output Overloaded, AC Output Short Circuit, Battery Over Voltage, Battery Under Voltage, Battery Fail Fault, AC Input Backfeed Failure, Frequency Unknown
C5 (NO – COM)	AC fail alarm	C5 = On Battery
C5 (NC – COM)	AC normal operation	Technician to wire to annunciator panel if to indicate AC On.
USB A/USB Mini-B	Do not use	
CAN	Do not use	
LAN	TCP/IP Ethernet port	

## 8.3 Installation of the Alpha® FXM HP 650 UPS



### GROUNDING

The Alpha® FXM HP 650 UPS is intended for permanent AC connection only.

The Alpha® FXM HP 650 UPS must be correctly grounded for proper operation. Older facilities may have inadequate electrical grounding. Inspection must be performed by a qualified electrician before installation to ensure that grounding meets the local electrical code.

The utility line attached to the Alpha® FXM HP 650 UPS input must be protected by a circuit breaker certified for this use in accordance with the local electrical code. The UPS must be connected only to a dedicated branch circuit.

The UPS equipment that is powered by this service panel requires the neutral to be permanently bonded to the ground. Always disconnect the batteries before servicing the circuit breaker panel.

The input and output lines to and from the Alpha® FXM HP 650 UPS must have disconnect devices attached.

**Grounding:** The Alpha® PS27-2220-FXM HP is suitable both for installation as part of a common bonding network (CBN) and an isolated bonding network.

For installations above 1400 meters (4500 feet) elevation, additional cooling may be needed to reduce the operating temperature of the Alpha® PS27-2220-FXM HP. The maximum allowable operating temperature must be reduced by 2°C (3.5°F) for every 300 meters (1000 feet) above 1400 meters (4500 feet).

Observe the following EMC requirements when setting up the Alpha® PS27-2220-FXM HP and its internal equipment:

- All AC mains and external supply conductors must be enclosed in a metal conduit or raceway when specified by local, national, or other applicable government codes and regulations.
- The customer facilities must provide suitable surge protection.

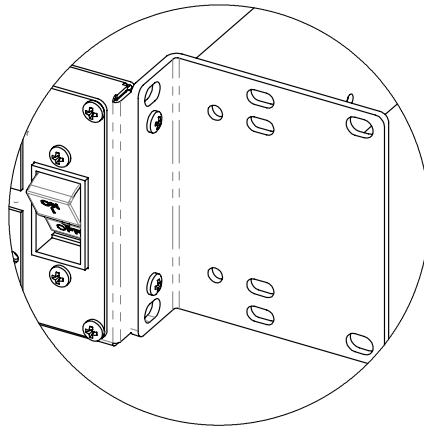
### 8.3.1 Mounting the Alpha® FXM HP 650 UPS in the Alpha® PS27-2220 enclosure



#### CAUTION

The Alpha® FXM HP 650 UPS is heavy, up to 11.3 kg (25 lb). Use proper lifting techniques. The lifting and moving should be done by at least two people to avoid injury.

1. Attach the mounting brackets to each side of the Alpha® FXM HP 650 UPS with the screws with toothed washers provided with the brackets to ensure adequate grounding between the FXM UPS chassis and the rack.
2. Mount the Alpha® FXM HP 650 UPS to the equipment rack in the Alpha® PS27-2220 enclosure.



Mount the brackets from the FXM 650 HP UPS rack mount kit in an offset position with the M5 screws provided in the kit (two per bracket).

Figure 12: Assembling brackets from rack mount kit

### 8.3.2 Wiring the Alpha® FXM HP 650 UPS



#### CAUTION

Make sure the AC line power is off. Switch off all circuit breakers on the Alpha® FXM HP UPS before making any electrical connections.

If stranded wires are used to connect the input and output terminal blocks, ferrules or equivalent crimping terminals must be used.

#### Procedure

1. If used, connect the following ports:
  - Ethernet port
  - USB port
  - Dry contacts
  - User inputs
2. Connect the load equipment power cable to the Alpha® FXM HP 650 UPS output terminal block (see [Figure 13](#)).
3. Connect the utility line power to the Alpha® FXM HP 650 UPS AC input terminal block (see [Figure 13](#)).



#### WARNING

Before proceeding, verify that the individual AC power cable wires are properly connected to their respective line, neutral, and ground terminal connections on the input and output terminal blocks to prevent accidental shock or electrocution.



Figure 13: Connecting AC power input and output load cables

### 8.3.3 Wiring the Alpha® FXM HP 650 UPS with UATS option

1. Connect the TO UPS IN power cable from the UATS to the Alpha® FXM HP 650 UPS AC input terminal block, matching line, neutral, and ground wires to their respective terminal labels.
2. Connect the FROM UPS OUT power cable from the UATS to the Alpha® FXM HP 650 UPS AC output terminal block, matching line, neutral, and ground wires to their respective terminal labels.
3. Torque all connections to 1.4 Nm (12 lb-in).

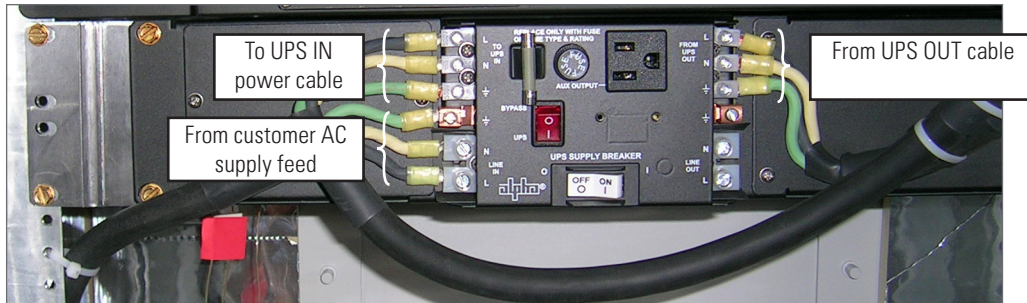


Figure 14: UATS AC power connection wiring

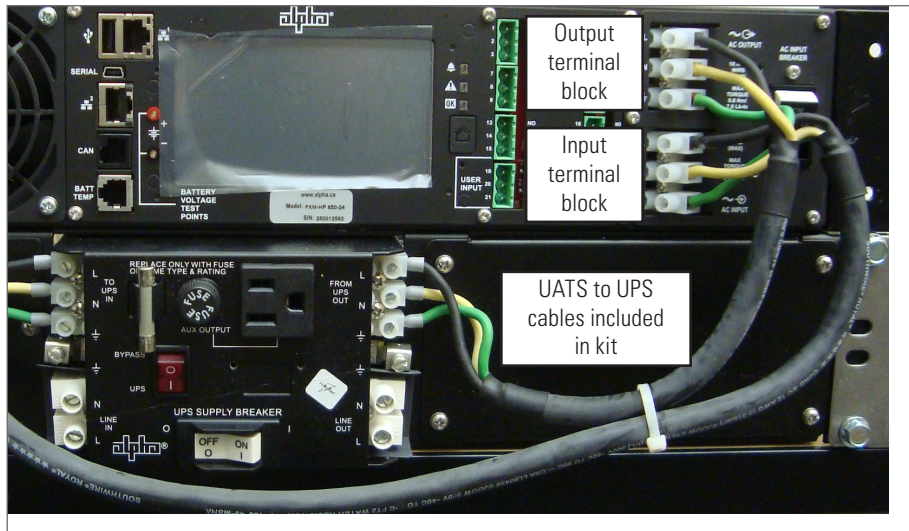


Figure 15: Alpha® FXM HP 650 UPS AC power connection wiring from UATS

### 8.3.4 Wiring the external batteries

- Use new batteries when installing a new unit. Verify that all batteries are the same type with identical date codes.
- The battery return connection is to be treated as an isolated DC return (DC-I) as defined in GR-1089-CORE.

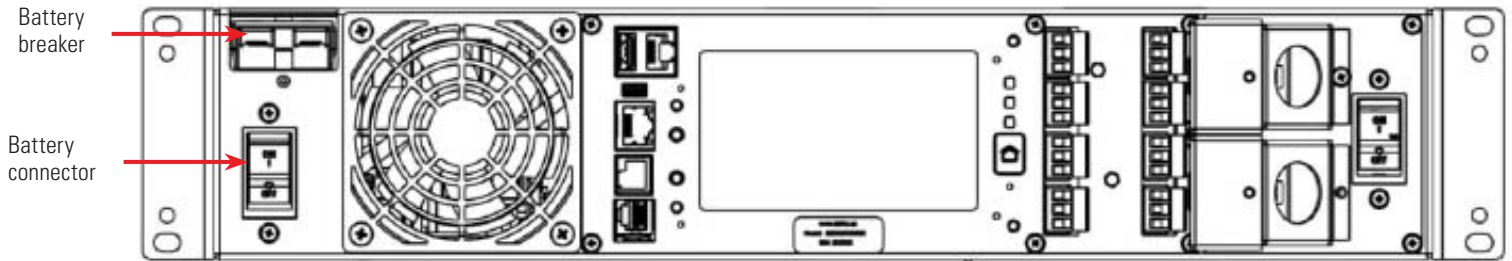


Figure 16: FXM HP 650 front panel

1. Number the batteries from 1 to 4 with labels or tape.
2. Coat the battery terminals with a corrosion inhibitor.
3. Connect the batteries as shown in [Figure 177](#). If the in-line fuse is used, install it as shown.
4. Connect the black battery cable to the negative terminal of the battery string, and the red battery cable to the positive terminal of the battery string.
5. When the batteries are wired together, measure the voltage at the battery connection terminals. It should read between 21 and 27 volts.
6. Note the polarity and ensure that it is correct.
7. Ensure that the battery breaker on the Alpha® FXM HP 650 UPS is OFF.
8. Connect the external batteries to the battery connector on the Alpha® FXM HP 650 UPS (see [Figure 16](#)).
9. Route the sensor end of the battery temperature cable to the batteries.
10. Attach the battery temperature sensor to the body of the battery, about 5 to 7.5 cm (2 to 3 in.) from the base of the battery.
11. If multiple battery strings are used, repeat steps 1 to 4 as required.

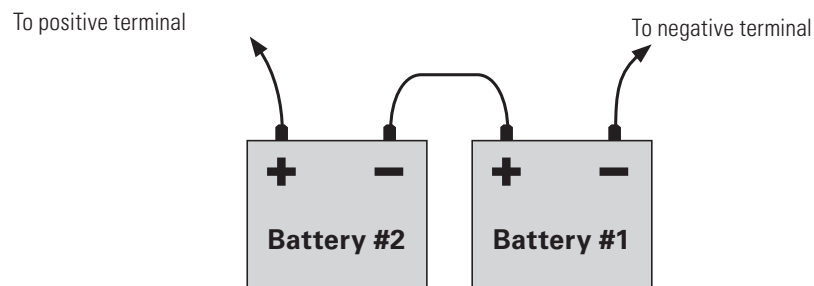


Figure 17: FXM HP 650 UPS external battery wiring for 24 Vdc string



#### ATTENTION

Torque the battery terminals according to the manufacturer's specifications on the battery nameplate or data sheet.



## 9. Maintenance

Although very little maintenance is required with Alpha® systems, routine checks and adjustments are recommended to ensure optimum system performance. Qualified service personnel should do the repairs.

The following table lists a few maintenance procedures for this system. These procedures should be performed at least once a year.



### WARNING

Use extreme care when working inside the unit while the system is energized. Do not make contact with live components or parts.



### ATTENTION

Circuit cards, including semi-conductor devices, can be damaged by static electricity. Always wear a grounded wrist strap when handling or installing circuit cards.



### ATTENTION

Ensure redundant modules or batteries are used to eliminate the threat of service interruptions while performing maintenance on the system's alarms and control settings.

Table D — Sample maintenance log

Procedure	Date completed
Clean ventilation openings and rinse out the enclosure filters.	
Inspect all system connections. Re-torque if necessary.	
Verify alarm/control settings.	
Verify inverter mode operation.	



## 10. Battery calculations

The maximum battery and electrical specifications are provided for the systems. The following calculations provide an example of maximum configuration.

To increase the capacity of a battery bank, additional battery strings may be connected in parallel. Each additional string will increase the overall capacity of the battery bank. Two battery strings in parallel of 110 Ah will provide 220 Ah at the C10 rate or 22 amps for 10 hours. Each battery is still providing 11 amps at the 10-hour rate, and therefore the discharge rating of the battery is maintained.

This calculation may be used to select applicable equivalent or smaller battery products as needed for specific site requirements.

<b>Iac</b>	System load at 120 Vac
<b>Eff</b>	Efficiency of the inverter
<b>T</b>	Run time requirement
<b>1.2</b>	Design life factor required by UL 2524
<b>Vdc</b>	Battery bus voltage
<b>Vpc</b>	End voltage per cell (use for reference on data sheet)

### 10.1 Battery calculation for the Alpha® FXM HP 650 UPS

The following example shows how to calculate and select a battery to support the maximum load on the Alpha® FXM HP 650 UPS.

#### 10.1.1 Calculate the load on the battery

A system with a system load of 2.00 amps at 120 Vac needs to support 12 hours of run time. Alpha® FXM HP 650 UPS efficiency = 75 percent. Battery bus voltage is 24 Vdc.

$$\text{Battery discharge current} = ((I_{ac} \times 120) / \text{Eff}) / V_{dc}$$

$$\text{Battery discharge current} = (2.00 \times 120) / 0.75 / 24$$

$$\text{Battery discharge current} = 13.3 \text{ A}$$

#### 10.1.2 Calculate the required battery size

Multiply the battery discharge current of 13.3 amps by 12 hours and by the design life factor of 1.2.

$$\text{Amp hours} = I \times T \times 1.2$$

$$\text{Amp hours} = 13.3 \times 12 \times 1.2$$

$$\text{Amp hours} = 192 \text{ Ah}$$

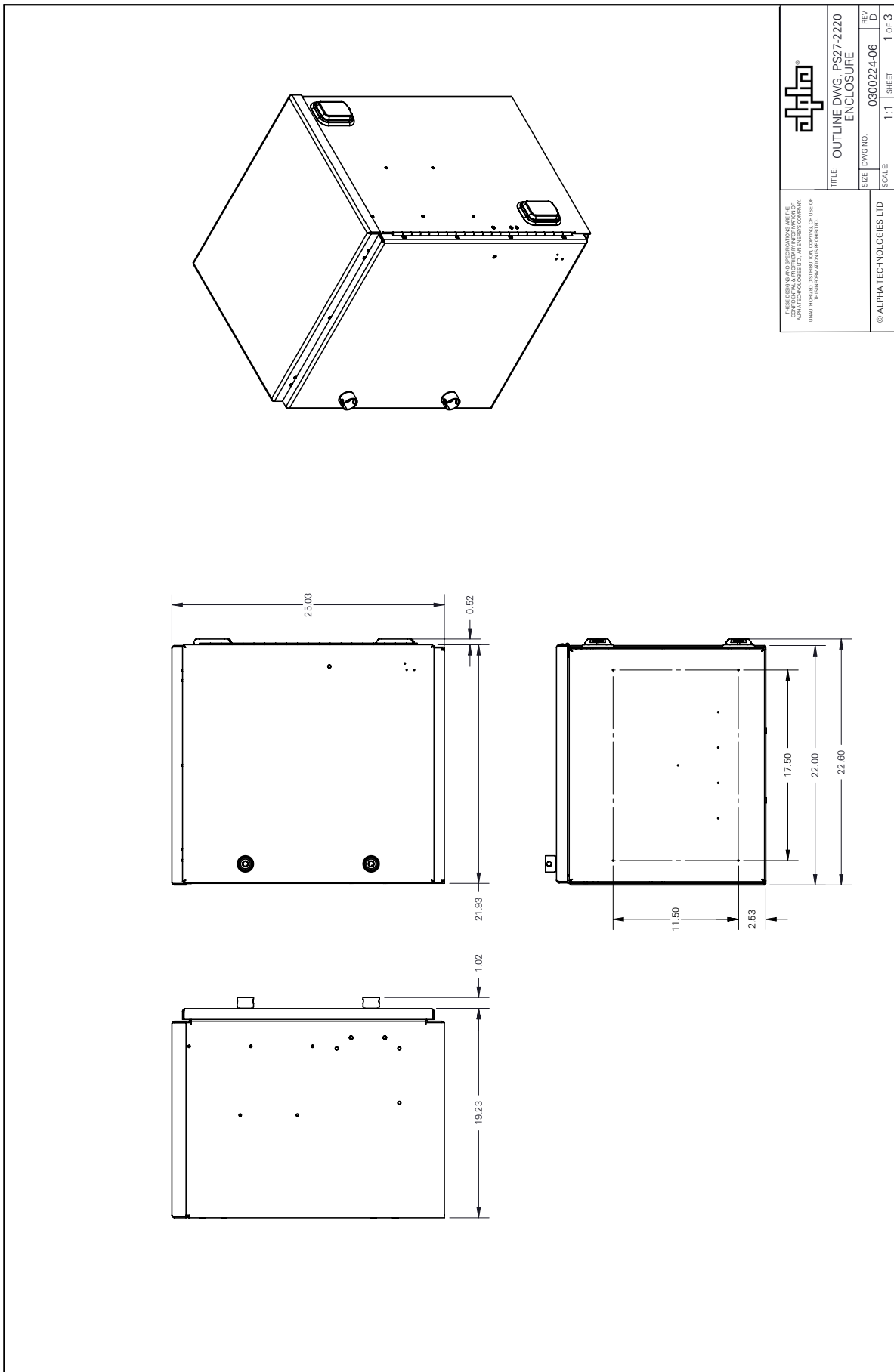
To achieve the maximum capacity out of the system, eight 12 volt batteries with a minimum of 182 Ah (C12) each configured in two parallel strings are required.

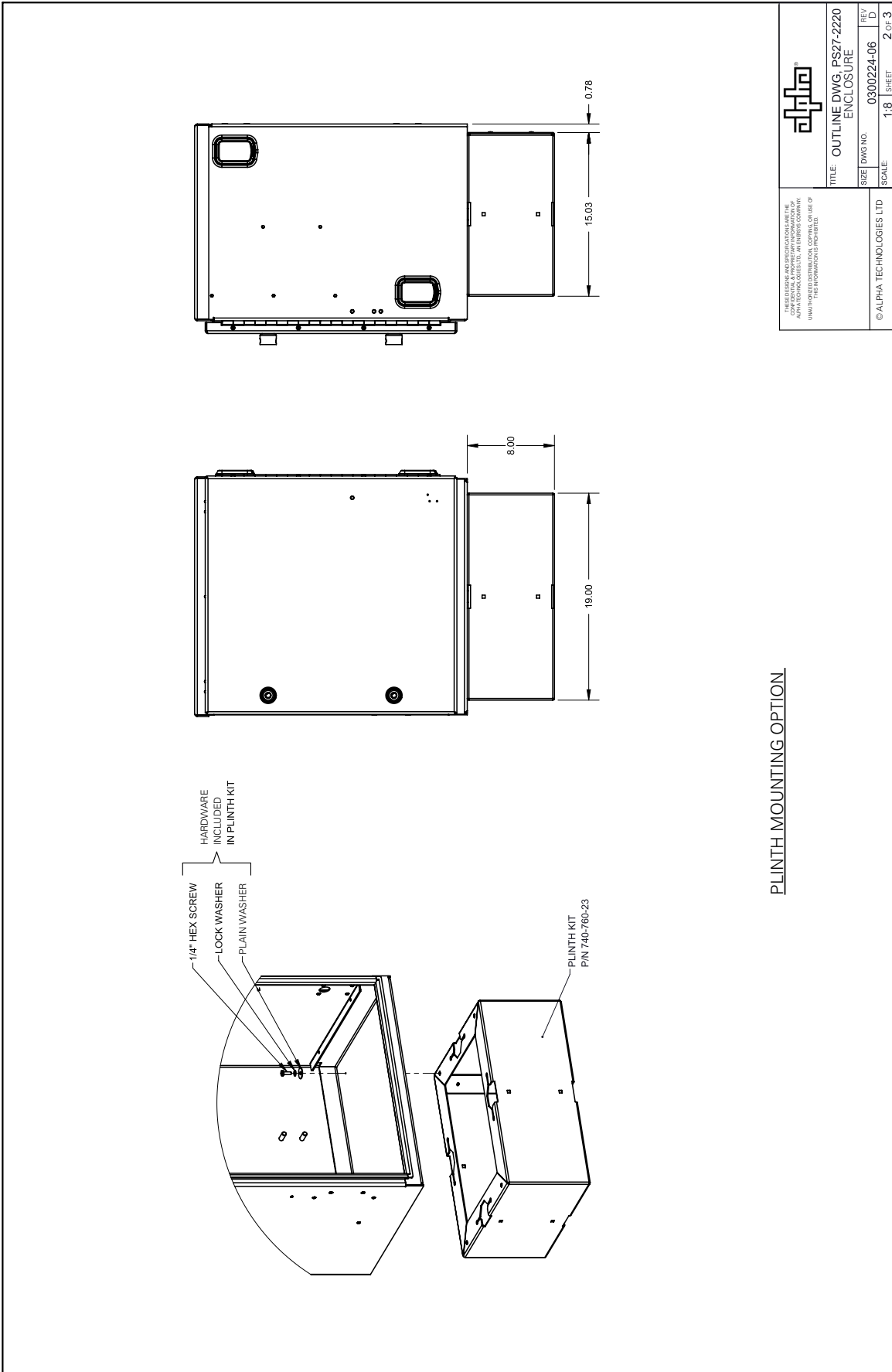
#### 10.1.3 Battery selection

Refer to the manufacturer's data sheet and select a battery. The battery must use the discharge curve on the data sheet for the 10-hour or 12-hour rate for a 12-hour run time calculation at an End Cell voltage of 1.75 volts per cell. For 24-hour applications you can use a 20-hour or the 10-hour rate.

## 11. Acronyms and definitions

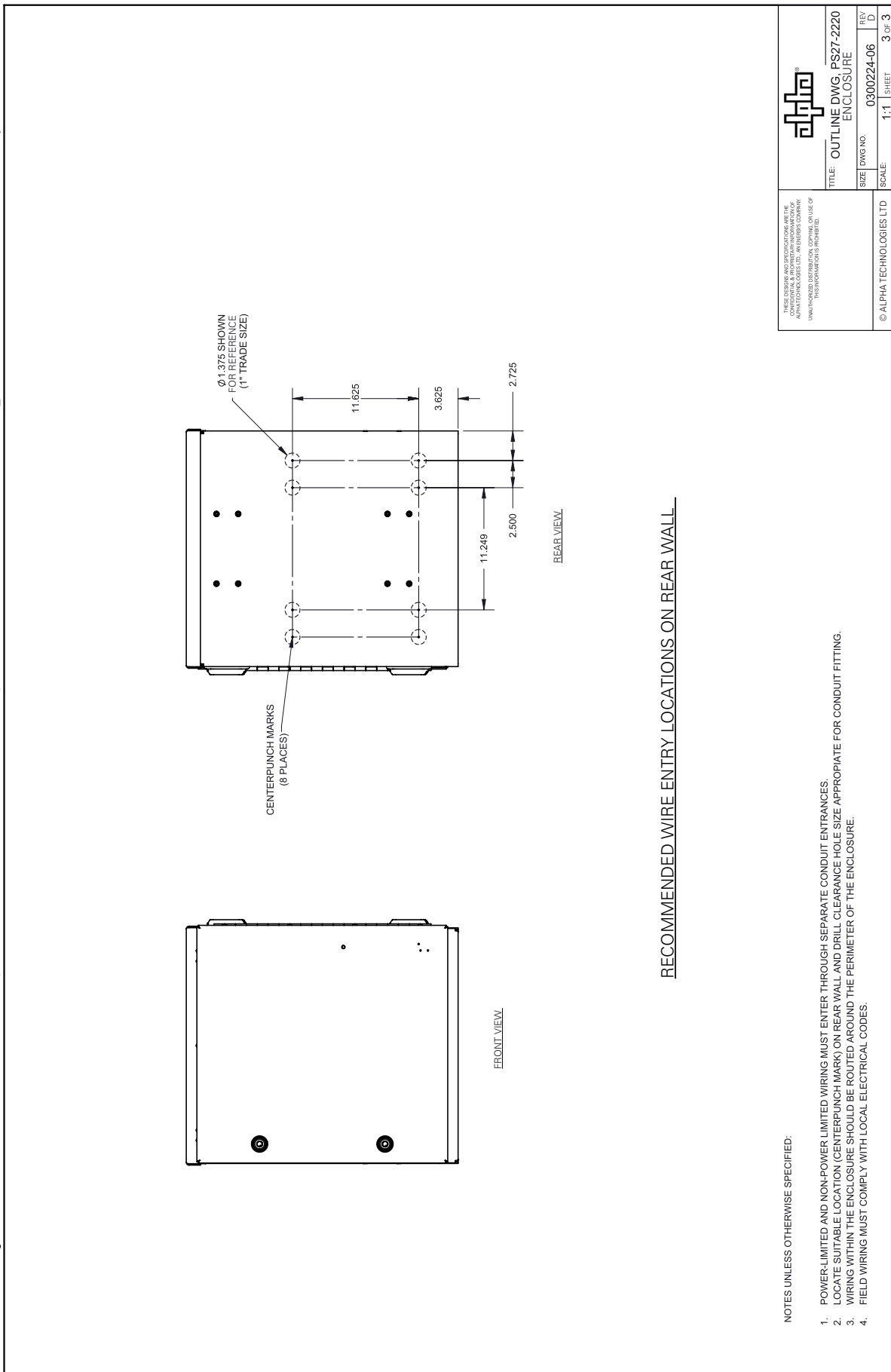
<b>AC</b>	Alternating current
<b>ANSI®</b>	American National Standards Institute
<b>AWG</b>	American Wire Gauge
<b>BTU</b>	British thermal unit
<b>CAN</b>	Controller area network
<b>CEC</b>	Canadian Electrical Code
<b>CPH</b>	Central power hub
<b>CSA®</b>	Canadian Standards Association
<b>CX</b>	Cordex® series; CXC for Cordex System Controller
<b>DC</b>	Direct current
<b>DHCP</b>	Dynamic Host Configuration Protocol
<b>EIA</b>	Electronic Industries Alliance
<b>EMC</b>	Electromagnetic compatibility
<b>EMI</b>	Electromagnetic interference
<b>ERM</b>	Electromagnetic Compatibility and Radio Spectrum Matters
<b>ESD</b>	Electrostatic Discharge
<b>FCC</b>	Federal Communications Commission (for the US)
<b>GFCI</b>	Ground fault circuit interrupter
<b>HVSD</b>	High voltage shutdown
<b>IEC</b>	International Electrotechnical Commission
<b>IEEE®</b>	The Institute of Electrical and Electronics Engineers, Inc.
<b>IP</b>	Internet Protocol
<b>LED</b>	Light emitting diode
<b>LVD</b>	Low voltage disconnect
<b>LVBD</b>	Low voltage battery disconnect
<b>MIL</b>	One thousandth of an inch; used in expressing wire cross sectional area
<b>MOV</b>	Metal oxide varistor
<b>MTBF</b>	Mean time between failures
<b>NC</b>	Normally closed
<b>NEC®</b>	National Electrical Code® (for the US)
<b>NFPA®</b>	National Fire Protection Association, Inc.
<b>NO</b>	Normally open
<b>OSHA</b>	Occupational Safety & Health Administration
<b>OSP</b>	Outside Plant
<b>OVP</b>	Over voltage protection
<b>RU</b>	Rack unit (44.45 mm; 1.75 in.)
<b>TCP/IP</b>	Transmission Control Protocol / Internet Protocol
<b>THD</b>	Total harmonic distortion
<b>TVSS</b>	Transient Voltage Surge Suppressor
<b>UL®</b>	Underwriters Laboratories
<b>UATS</b>	Universal Automatic Transfer Switch
<b>VRLA</b>	Valve regulated lead acid





PLINTH MOUNTING OPTION

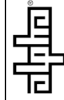
	
TITLE: OUTLINE DWG, PS27-2220 ENCLOSURE	
SIZE	DWG NO.
REV	D
SCALE	1:8 SHEET 2 OF 3
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NOTES UNLESS OTHERWISE SPECIFIED:

1. POWER-LIMITED AND NON-POWER LIMITED WIRING MUST ENTER THROUGH SEPARATE CONDUIT ENTRANCES.
2. LOCATE SUITABLE LOCATION (CENTERPUNCH MARK) ON REAR WALL AND DRILL CLEARANCE HOLE SIZE APPROPRIATE FOR CONDUIT FITTING.
3. WIRING WITHIN THE ENCLOSURE SHOULD BE ROUTED AROUND THE PERIMETER OF THE ENCLOSURE.
4. FIELD WIRING MUST COMPLY WITH LOCAL ELECTRICAL CODES.

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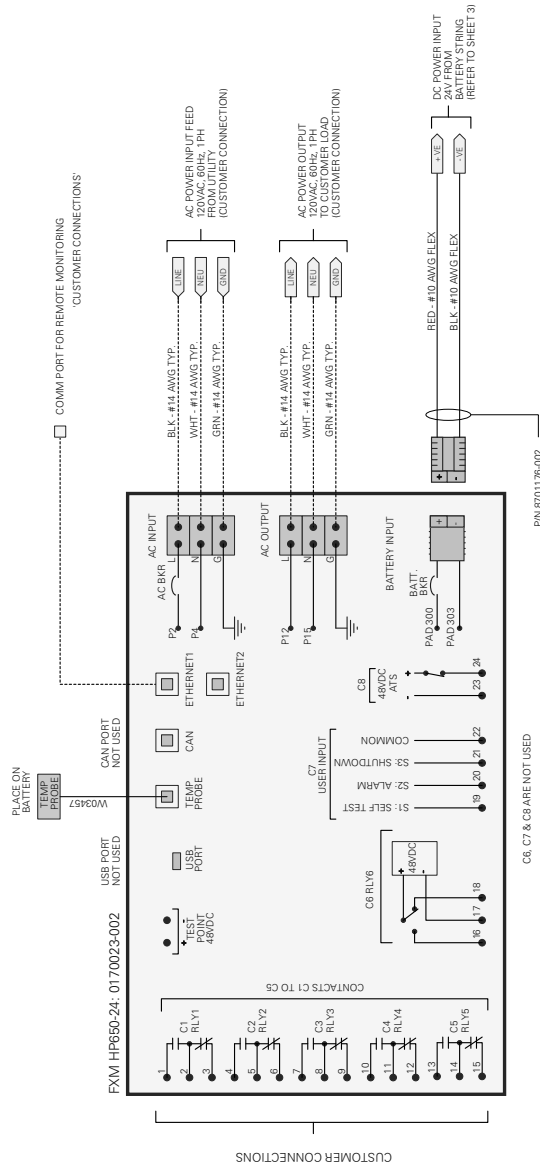
SCALE 1:1

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1:1 SHEET 3 of 3

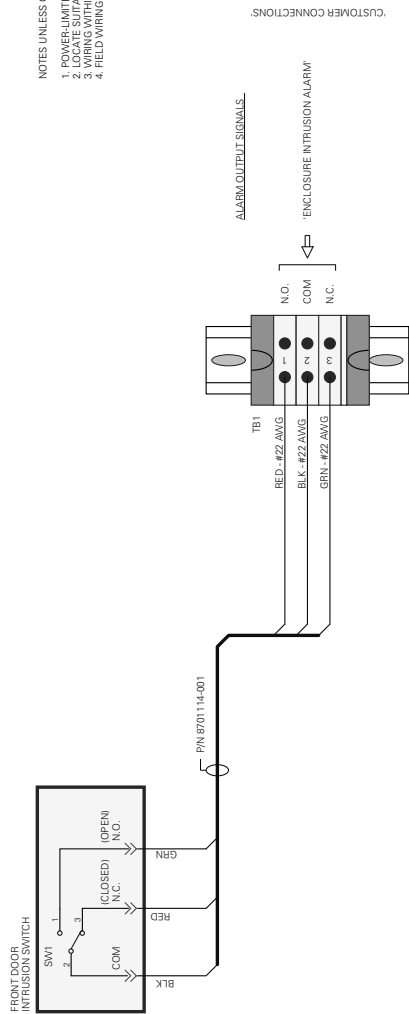
**FXM HP650 UPS MODULE AC POWER, BATTERY STRING, INTRUSION ALARM & TEMPERATURE PROBE WIRING.**



**RELAY ASSIGNMENT:**  
 C3 = LOW BATTERY CAPACITY  
 C4 = CHARGER FAIL  
 C5 = AC FAIL  
 C1, C2 = NOT USED

C6, C7 & C8 ARE NOT USED

**NOTES UNLESS OTHERWISE SPECIFIED:**  
 1. POWER-LIMITED AND NON-POWER LIMITED WIRING MUST ENTER THROUGH SEPARATE CONDUIT ENTRANCES.  
 2. LOCATE SUITABLE LOCATION ON REAR WALL AND DRILL CLEARANCE HOLE SIZE APPROPRIATE FOR CONDUIT FITTING.  
 3. FIELD WIRING MUST COMPLY WITH LOCAL ELECTRICAL CODES.  
 4. FIELD WIRING MUST COMPLY WITH LOCAL ELECTRICAL CODES.



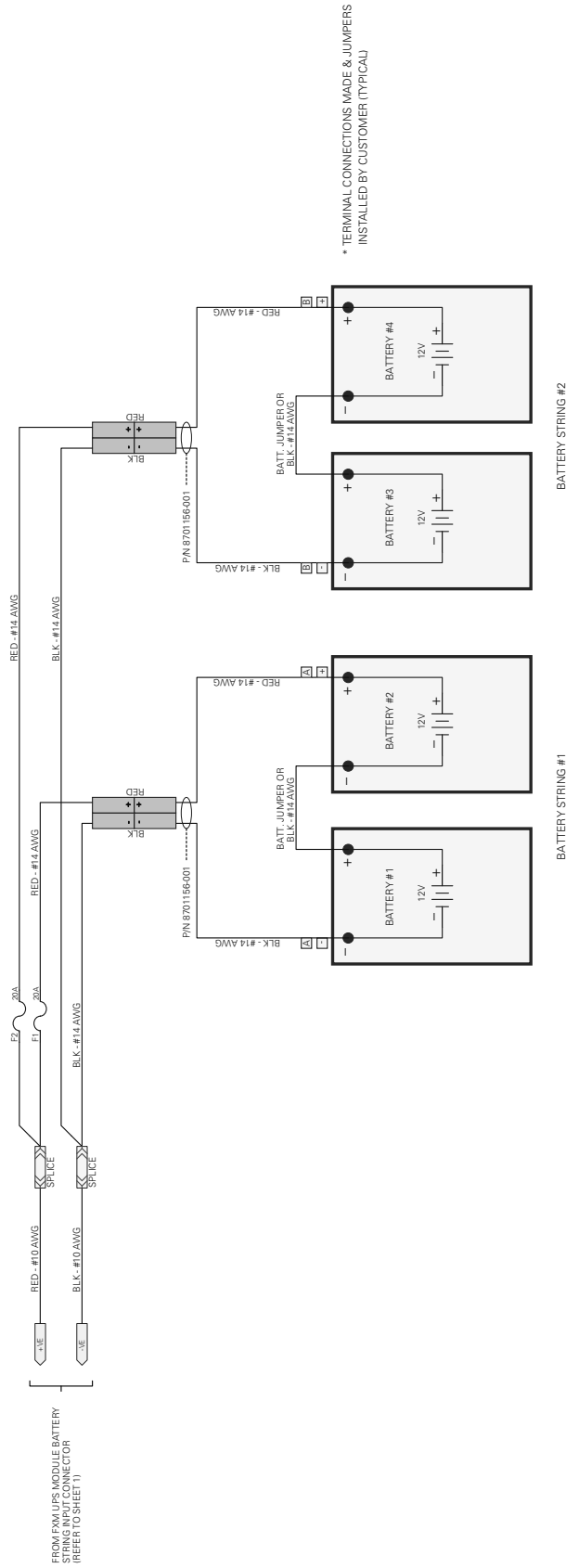
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SIZE: DRAWING: B	SCALE: NTS
SHEET: 0570318-05	REV: A
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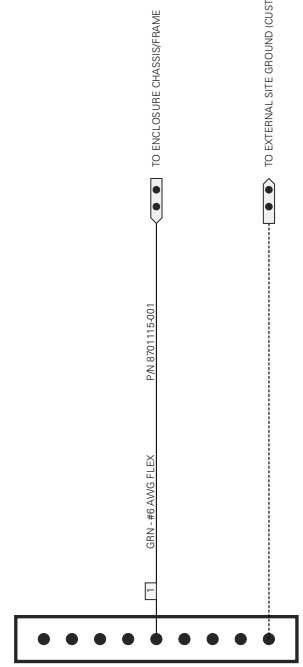


**SYSTEM 24V BATTERY STRINGS CABLING:**



\* TERMINAL CONNECTIONS MADE & JUMPERS INSTALLED BY CUSTOMER (TYPICAL)

**ENCLOSURE MASTER GROUND BAR TERMINATIONS:**



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DWG NO: 0570318-05	SHEET: 3 of 3





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