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Public Safety Enclosure PS41-2730-FXM


Technical Guide: 9400032-J0


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PS41-2730-FXM

Public Safety Backup Power Enclosure

 **NOTE:**
Photographs contained in this manual are for illustrative purposes only. These photographs may not match your installation.

 **NOTE:**
Operator is cautioned to review the drawings and illustrations contained in this manual before proceeding. If there are questions regarding the safe operation of this powering system, contact Alpha Technologies or your nearest Alpha representative.

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1. Safety

SAVE THESE INSTRUCTIONS: This manual 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 manual before proceeding. If there are any questions regarding the safe installation or operation of this product, contact Alpha Technologies 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 manual. Where these symbols appear, use extra care and attention.

The use of ATTENTION indicates specific regulatory/code requirements that may affect the placement of equipment and /or installation procedures.



NOTE:

A NOTE provides additional information to help complete a specific task or procedure. Notes are designated with a checkmark, the word NOTE, and a rule beneath which the information appears



CAUTION!

CAUTION indicates safety information intended to PREVENT DAMAGE to material or equipment. Cautions are designated with a yellow warning triangle, the word CAUTION, and a rule beneath which the information appears.



WARNING!

WARNING presents safety information to PREVENT INJURY OR DEATH to personnel. Warnings are indicated by a shock hazard icon, the word WARNING, and a rule beneath which the information appears.



HOT!

The use of HOT presents safety information to PREVENT BURNS to the technician or user.

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 manual.
- 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 and/or energy levels can be present at the input of power systems. The DC output from rectifiers and batteries, though not dangerous in voltage, has a high short-circuit current capacity that may cause severe burns and electrical arcing.

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

- a. Remove all metallic jewelry, such as watches, rings, metal rimmed glasses, or necklaces.
- b. Wear safety glasses with side shields at all times during the installation.
- c. 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

- Never transport an enclosure with batteries installed. Batteries must ONLY be installed after the enclosure has been securely set in place at its permanent installation location. Transporting the unit with batteries installed may cause a short circuit, fire, explosion, and/or damage to the battery pack, enclosure and installed equipment.
- Servicing and connection of batteries must be performed by, or under the direct supervision of, personnel knowledgeable of batteries and the required safety precautions.
- 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 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

2.1 Product Overview

The PS41-2730-FXM is a Type 4 indoor enclosure with AC power and battery features.

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



Figure 1 — Alpha PS41-2730 Interior View

3. Specifications

Table A — Specifications for PS41-2730			
Electrical			
PS41-2730-FXM650		AC Input:	120V, 8.0A maximum, 60Hz, 1PH
		AC Output:	120V, 30A maximum, 60Hz, (UATS) - optional
			120V, 3.8A / 456W maximum, 60Hz, 1PH
Trouble Relay Outputs (3 Total)	Dry Contact Voltage, VDC	24VDC	
	Dry Contact Current, A resistive	1A	
Recommended AC input breaker:		15A	
PS41-2730-FXM1100		AC Input:	120V, 15A maximum, 60Hz, 1PH
		AC Output:	120V, 30A maximum, 60Hz, (UATS) - optional
			120V, 8.3A / 1000W maximum, 60Hz, 1PH
Trouble Relay Outputs (3 Total)	Dry Contact Voltage, VDC	48VDC	
	Dry Contact Current, A resistive	1A	
Recommended AC input breaker:		20A	
PS41-2730-FXM650	Charge Current:	10.5A	Run Time: 12Hrs @ 494 Watts 24Hrs @ 246 Watts
	Maximum Battery Configuration	2 x 208Ah in series, up to 4 strings in parallel	
PS41-2730-FXM1100	Charge Current	10.5A	Run Time: 12Hrs @ 1000 Watts 24Hrs @ 500 Watts
	Maximum Battery Configuration	4 x 208Ah in series, up to 2 strings in parallel	
Mechanical			
Dimensions (H x W x D):		1051mm x 701mm x 775mm (41.4in x 27.6in x 30.5in)	
System Weight (w/o battery):		52kg (115lbs)	
Mounting:		Ground with plinth (option)	
Construction:		High strength corrosion resistant aluminum	
Finish:		Powder coat, red	
Door latch:		3 point latch with L-handle for padlock	
Environmental			
Operating temperature:		-0 to 40°C (32 to 95°F) for indoor installations	
Storage temperature:		-40 to 85°C (-40 to 185°F)	
Agency Compliance			
System rating:		UL 2524	

4. Features

The following power options are available with the PS41-2730-FXM

- FXM 650-24 – 24V, 650W Uninterruptible Power Supply (UPS) Module
- FXM 1100-48 – 48V, 1100W Uninterruptible Power Supply (UPS) Module

4.1 FXM 650, 1100 UPS

The Alpha FXM 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.



Figure 2 — Alpha FXM 650 (top) and FXM 1100 (bottom)

4.2 UATS (optional)

The Universal Automatic Transfer Switch (UATS) is an optional add-on switching unit specifically designed for the FXM UPS family (FXM 650 and 1100). These switching units provide power and/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 and/or the other, the UATS allows the use of up to 3 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 and Table B for the FXM units.

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

NOTE:
Ensure that the alarm panel and/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 Alpha Public Safety System, ensure that the UL listed resistor is connected to the dry contacts via pigtail connections using UL listed marrettes.

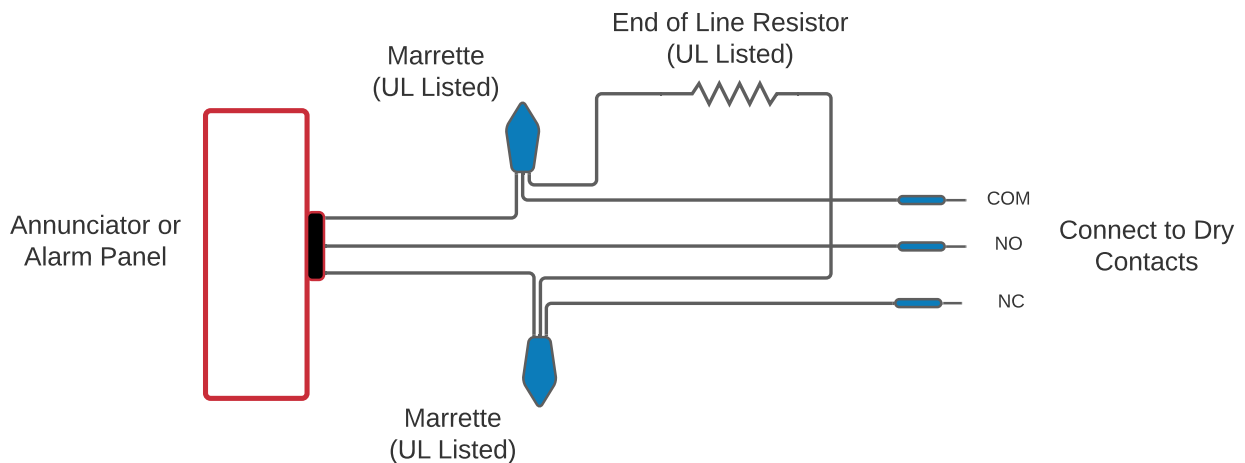


Figure 4 — Attaching an EOLR to the Dry Contacts of the Public Safety System

4.3.2 Temperature Compensation

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: 10/100Base-T Ethernet connection on both the front and rear of the controller for local communication.
- Web based User Interface for local or remote via an Ethernet 10/100Base-T Ethernet connection.

4.4 Battery Storage

The PS41-2730 enclosure can support one or two strings, or four strings of VRLA batteries on two battery trays. One or two trays are supplied, and are equipped with a wiring harness.

Battery tray dimensions: width 521mm (20.5") x depth 594 mm (23.4").

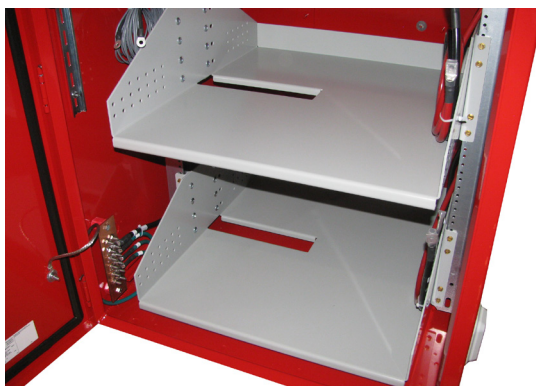


Figure 5 — Battery Tray

4.5 Power Enclosure System – Options, Components and Parts

Alpha Standard Part Numbers	
AC Power System Option	
FXM 650, 24V, 1 Battery Tray	0570188-001
FXM 650, 24V, 2 Battery Trays	0570187-001
FXM 1100, 48V, 2 Battery Trays	0570189-001
Accessories	
UATS (Universal Automatic Transfer Switch)	0370498-001
Plinth Mounting, 4.75" high	0370231-002

5. Site Evaluation and Pre-Installation

5.1 Site Selection

Consider the following before selecting a mounting location:

- The Alpha PS41-2730 enclosure is designed for front and rear access. Only front access is required for maintenance.
- Avoid areas that may be subjected to hot air exhaust from nearby equipment.
- The cabinet 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 PS41-2730 indoor power enclosure has been designed for the following mounting options:

- Plinth, mounted on a concrete slab, floor, or similar surface. (Alpha kit P/N: 0370231-002)

5.2 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" 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 (#14 to #22 AWG) [2.5 to 0.34 mm²]
- Torque wrench: 1/4" drive, 0 - 150 in-lb.
- Torque wrench: 3/8" drive, 0 - 100 ft-lb.
- Insulating canvases as required (2' x 2', 1' x 1', 3' x 3', etc.)
- Various insulated hand tools including:
 - Combination wrenches
 - Ratchet and socket set
 - Various screwdrivers
 - Electricians knife
- Battery safety spill kit required for wet cells only:
 - Protective clothing
 - Face shields
 - Gloves
 - Baking soda
 - Eye wash equipment

6. Installation

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 manual.

6.1 Safety Precautions

Refer to the Safety section near the front of this manual.

6.2 Plinth Mounting for Concrete Pad

6.2.1 Mounting the Plinth to the Concrete Floor (Kit P/N: 0370231-002)

A fully equipped power enclosure with two shelves of AlphaCell 210BT batteries weighs approximately 760lb. The mounting site must be built in accordance with local building practices and codes.

Concrete pad installation requiring seismic compliance requires approval by the appropriate engineering discipline, e.g., civil or structural. Cast-in-place or pre-cast concrete slabs can be used.

Use the template in Figure 5 to place the anchor bolts. Follow the specific recommendations from the fastener manufacturer to ensure that the securing device achieves its full structural capacity.

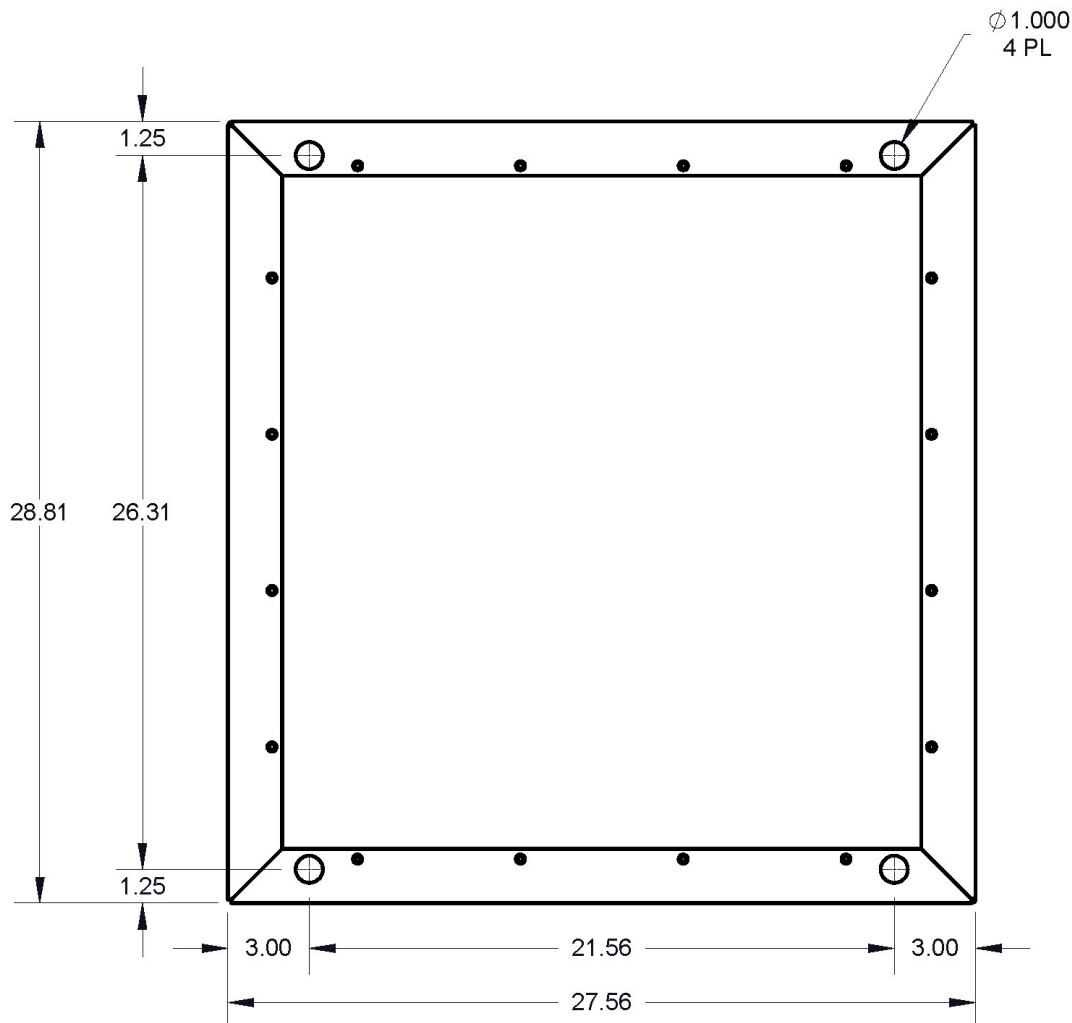


Figure 6 — Plinth Template for Mounting Bolts

1. Place the plinth in position over the anchor holes.
2. Install the anchoring hardware for each anchor FINGER TIGHT.
3. Check that the plinth is level front-to-back and side-to-side.
4. Add shims as needed under one or two of the corners of the plinth, placing the shims as close as possible to the bolts.
5. Once the plinth is level, tighten all bolts to the appropriate torque.

Recommended torque values	
1/4"	8.8 ft-lbs
3/8"	32.5 ft-lbs
1/2"	73 ft-lbs

6.2.2 Unpacking the Power System



CAUTION!

Do not hoist/lift the enclosure with batteries installed.

1. Remove the protective covering from the system. The doors are designed to be locked with a padlock and are secured with tie-wraps for shipping. Cut the tie-wraps and open the doors.
2. Inspect the packing slip to verify that you have received all the equipment that you ordered.
 - All documentation is packed inside the equipment compartment.
 - Inspect all moving parts, hardware, connectors, and other equipment.
3. Report any damage to the shipper and Alpha Technologies.

6.2.3 Mounting Enclosure to the Plinth

1. Unstrap the enclosure from the shipping pallet.
2. Remove the bottom battery tray to access the mounting holes at the edges of the enclosure—eight screws per side as shown in Figure 6.
3. Use a mallet or hammer and slotted screwdriver to remove the 16 mounting hole knockouts at the base of the enclosure. Figure 7 shows the location of all 16 mounting holes.
4. Lift the enclosure onto the plinth.
5. Secure the enclosure to the plinth with the sixteen M6 x 16 screws and rubber washers included with the plinth.
6. Replace the battery tray.



Figure 7 — Battery Tray Screws

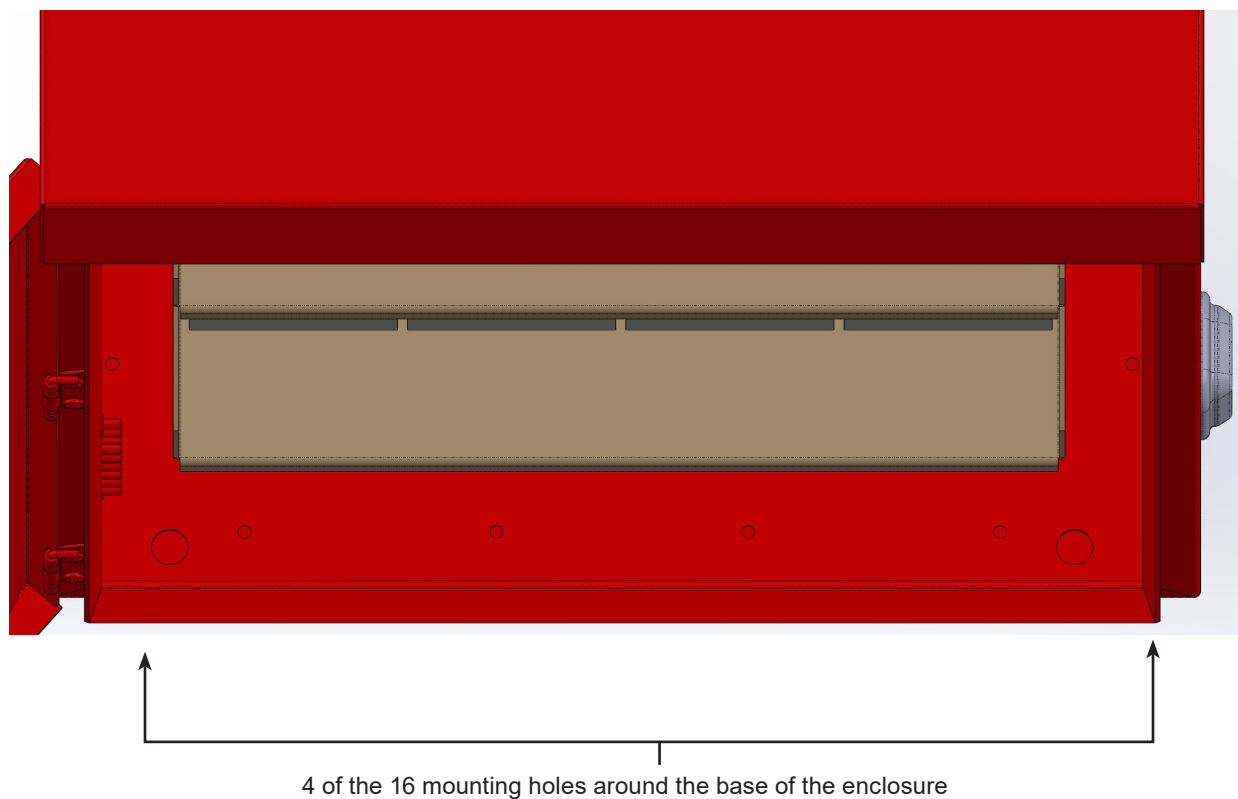


Figure 8 — Mounting the Enclosure to the Plinth

7. 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 manual.

7.1 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/floor. The ground system must be bonded to the enclosure to ensure a “common” or “single-point” ground. Refer to local building codes.



NOTE:

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

1. Locate the enclosure master ground bar (MGB) at the left front sidewall of 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 NEMA Type 4 or better to maintain enclosure integrity rating.
3. Connect the site ground wire to the bottom position (1/4 holes on 5/8" centers) of the enclosure master ground bar (MGB).

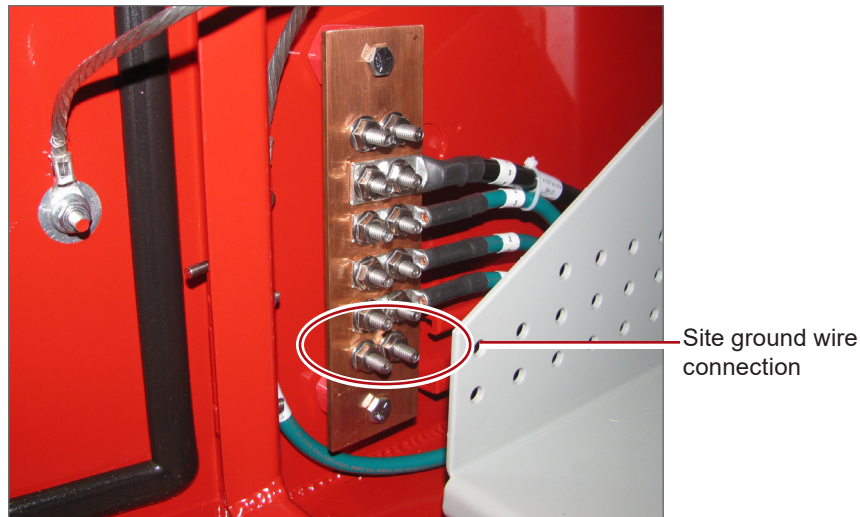


Figure 9 — Enclosure MGB and Chassis Ground

7.2 Input/Output Wiring into Power Enclosure System



NOTE:

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 1/4" from all non-power limited conductors.

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 cable (Non-power limited)
- Alarm/network cable (Power limited)
 - Ethernet port

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. Refer to outline drawing for recommended drilling locations.

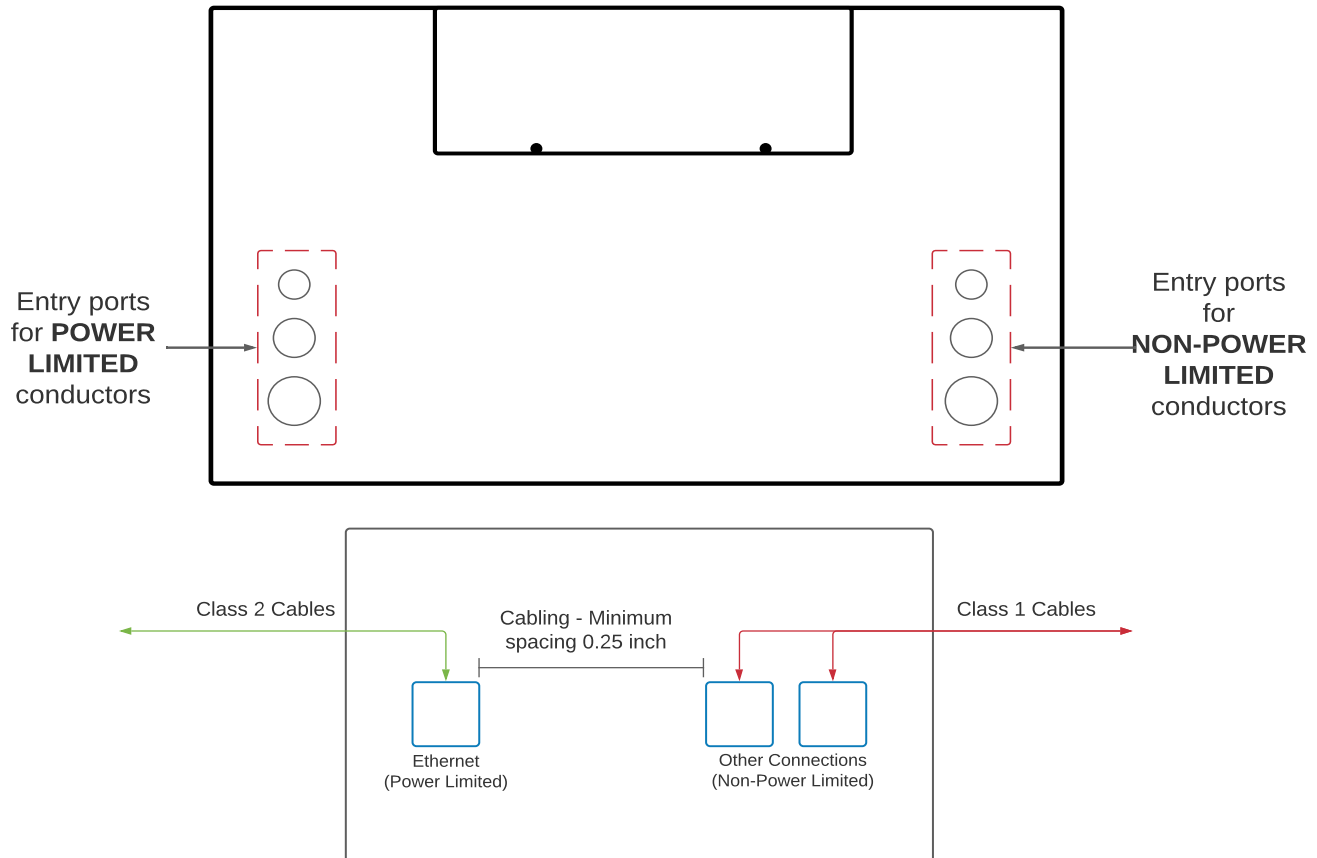


Figure 10 — Rear cable entries for POWER LIMITED (Class 2) conductors and NON-POWER LIMITED (Class 1) (top) and minimum allowable distance between between the two types of conductors (bottom)

7.2.1 Power Enclosure Alarm Wiring Block

The alarm wiring block, located on the left side wall of the enclosure, uses Phoenix type DIN rail mounted terminal blocks. Connect designated alarm outputs to the local alarm-sending unit/device using appropriate wire with gauge sizes from #28 to #16 AWG (0.08 to 1.31 mm²). Wires do not need to be stripped when the connections are made.



NOTE:

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 below.

Systems are shipped programmed with the appropriate settings.

Table B — Alarms for FXM UPS System		
FXM Front Terminal	Description	Programming (Replacement Units)
C1	Do Not Use	Disabled
C2	Do Not Use	Disabled
C3	Low Battery Capacity	Set C3 = "Low Battery Set Low Battery Setting = 36%
C4	Charger Fail Alarm	Set C4 = Alarm
C5 (NO – COM)	AC Fail Alarm	Set C5 = On Battery
C5 (NC – COM)	AC Normal Operation	Technician to wire to Annunciator panel to indicate AC On.
C6	Do Not Use	
C7	Do Not Use	
C8	Do Not Use	
RS 232	Do Not Use	
LAN	TCP/IP Ethernet Port	

7.3 Installation of the FXM UPS



WARNING!

The Alpha FXM is intended for permanent AC connection only.

The Alpha FXM 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 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 **MUST** have disconnect devices attached.

Grounding: The PS41-2730-FXM is suitable both for installation as part of a common bonding network (CBN) and an isolated bonding network.

For installations above 1400m (4500ft) elevation, additional cooling may be needed to reduce the operating temperature of the PS41-2730-FXM. The maximum allowable operating temperature must be reduced by 2°C (3.5 °F) for every 300m (1000ft) above 1400m (4500ft).

7.3.1 Electromagnetic Compatibility (EMC) Requirements

Observe the following EMC requirements when setting up the PS41-2730-FXM 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, and/or other applicable government codes and regulations.
- The customer facilities must provide suitable surge protection.

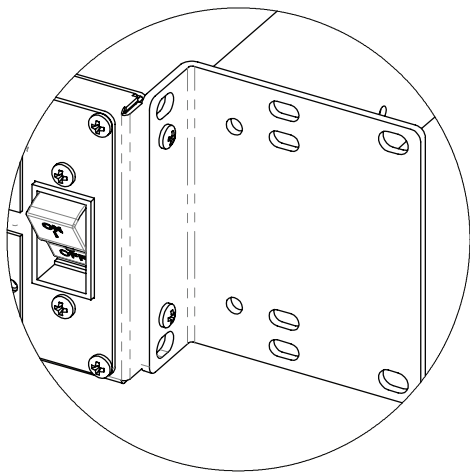
7.3.2 Mounting the FXM UPS in the PS41-2730 Enclosure



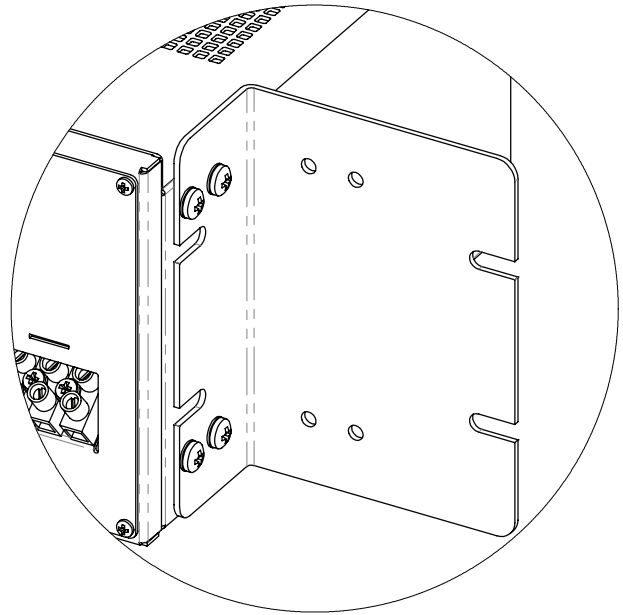
WARNING!

The Alpha FXM is heavy, up to 16 kg (35 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 FXM 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 UPS to the equipment rack in the PS41-2730 enclosure.



Mount the brackets from the FXM650 rack mount kit in an offset position with the M5 screws provided in the kit (2 per bracket).



Mount the brackets from the FXM 1100 rack mount kit in an offset position with the M5 screws provided in the kit (4 per bracket).

Figure 11 — Assembling Brackets from Rack Mount Kit

7.3.3 Wiring the Alpha FXM UPS



WARNING!

Make sure the AC line power is off. Switch off all circuit breakers on the Alpha FXM 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
 - Dry contacts
2. Connect the load cable to the Alpha FXM UPS Output terminal block (see Figure 10). Torque to 1.4 N-m (12 lb-in).
3. Connect the line power to the Alpha FXM UPS AC Input terminal block (see Figure 10). Torque to 1.4 N-m (12 lb-in).



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.

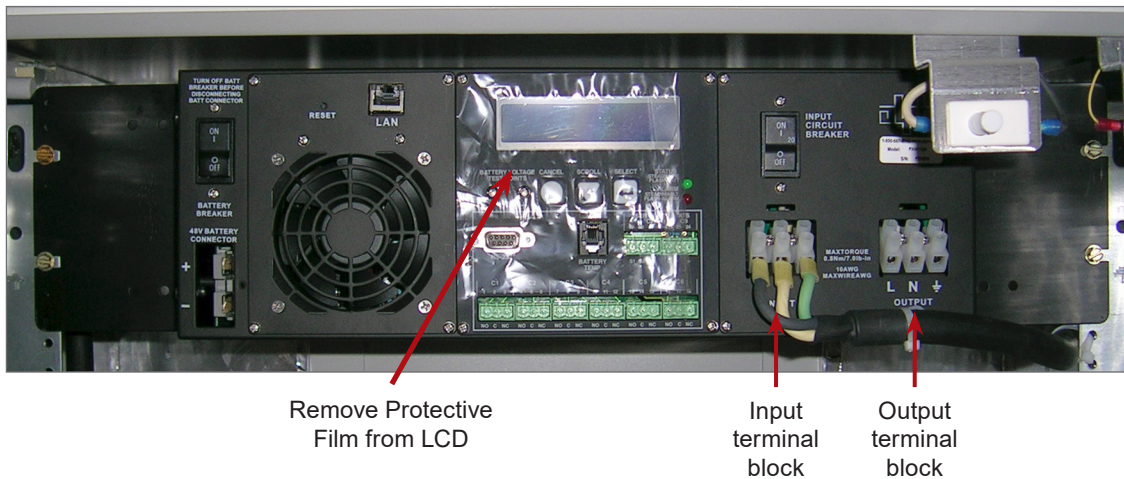


Figure 12 — Connecting AC Power Input and Output Load Cables

7.3.4 Wiring the PS41-2730-FXM with a UATS option

1. Connect the **TO UPS IN** power cable from the UATS to the FXM UPS AC Input terminal block, matching line, neutral and ground wires to their respective terminal labels.
2. Connect the **FROM UPS OUT** cable from the UATS to the FXM UPS AC Output terminal block, matching line, neutral and ground wires to their respective terminal labels.
3. Torque all connections to 1.4 N-m (12 lb-in).

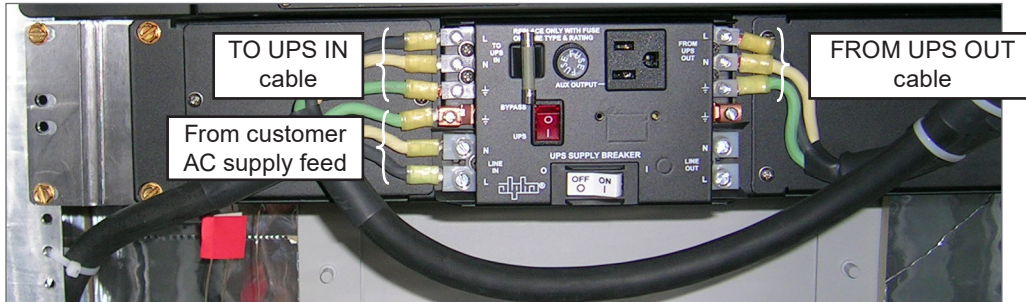


Figure 13 — UATS AC Power Connection Wiring

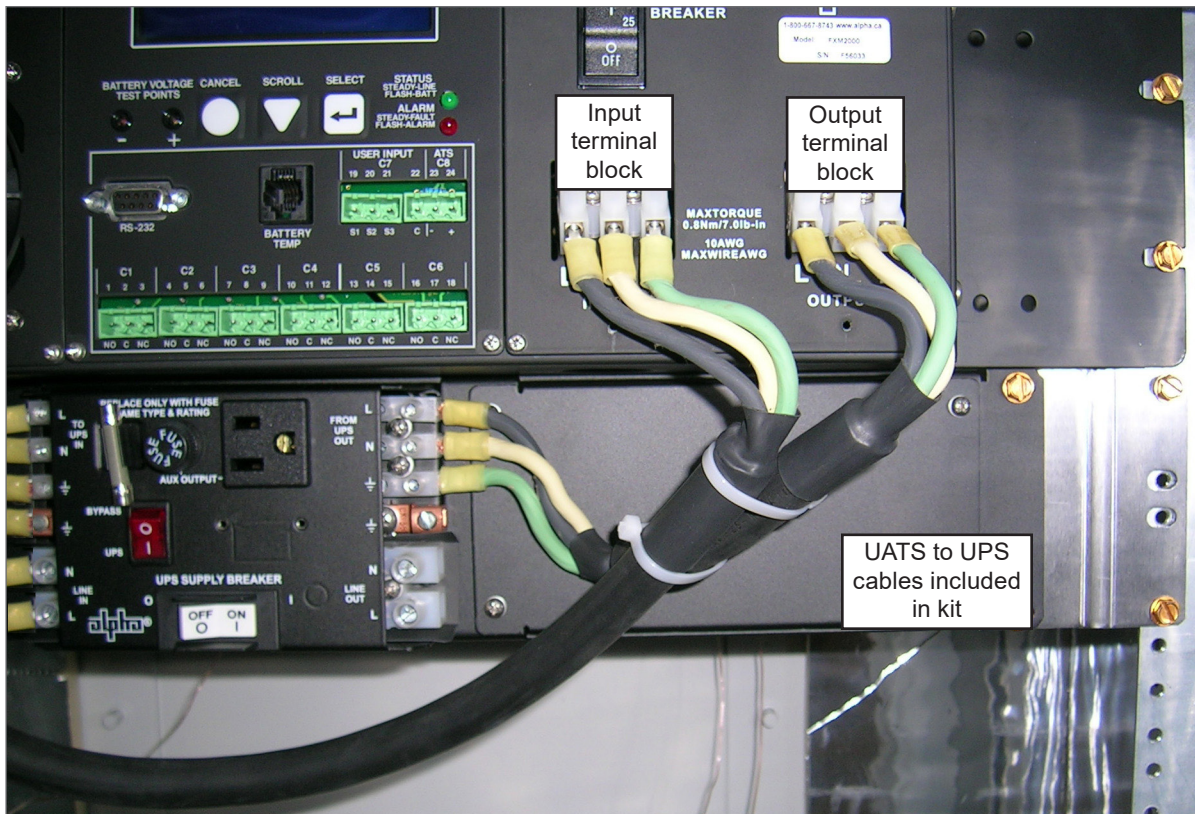


Figure 14 — FXM UPS AC Power Connection Wiring from UATS

7.3.5 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.

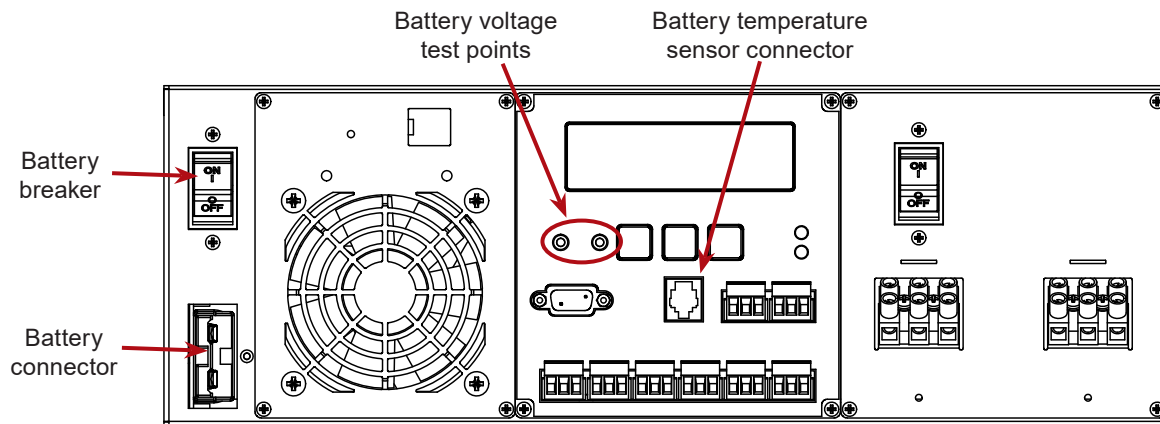


Figure 15 — FXM 1100 Front Panel

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 14 and Figure 15.
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 27V (FXM650 - 24) or between 42 and 54V (FXM1100-48).
6. Note the polarity and ensure that it is correct.
7. Ensure that the Battery breaker on the FXM UPS is OFF.
8. Connect the external batteries to the Battery connector on the FXM UPS—see Figure 13.
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 2 to 3" (5 to 7.5cm) from the base of the battery.
11. If multiple battery strings are used, repeat steps 1 to 4 as required.

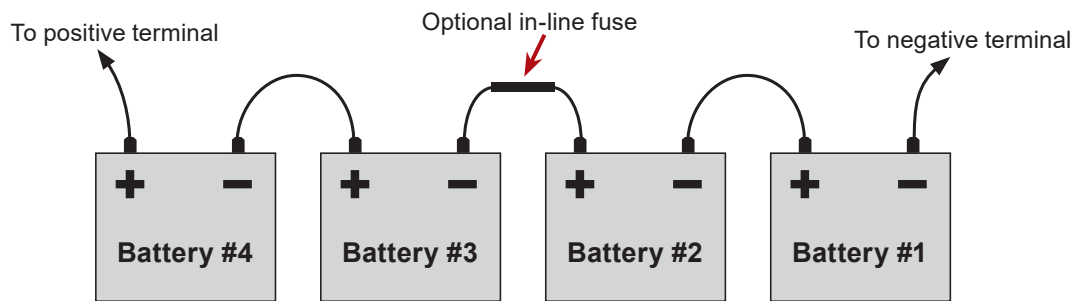


Figure 16 — FXM UPS External Battery Wiring for 48 Vdc String

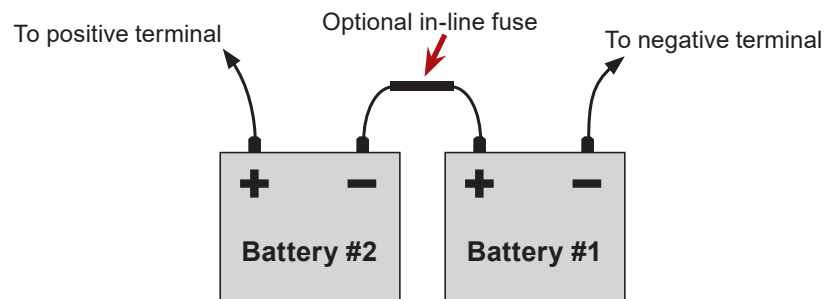


Figure 17 — FXM UPS External Battery Wiring for 24 Vdc String




CAUTION!

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

8. 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.

Circuit cards, including RAM chips, can be damaged by static electricity. Always wear a grounded wrist strap when handling or installing circuit cards.

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 C — 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.	

8.3.1 Battery Maintenance Report

After assembly, number the batteries and take “as received” readings, including specific gravity, cell voltage, and temperature. Designate one cell as the pilot cell. This is usually the cell with either the lowest specific gravity or voltage. Refer to the manufacturer's literature for guidelines. See the following table for typical maintenance report:

Company: _____ Date: _____
Address: _____
Battery location and/or number: _____
No. of cells: _____ Type: _____ Date new: _____

Table D — Typical VRLA Battery Maintenance Report						
Cell #	Serial #	Voltage	Specific	Ohms	Mhos	Observations

Remarks and recommendations: _____

Readings taken by: _____

9. Battery Calculations

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

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 210Ah will provide 420Ah at the C10 rate or 42A for 10 hours. Each battery is still providing 21A 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.

Iac	System load @120Vac
Eff	Efficiency of the inverter
T	Run time requirement
1.2	Design Life Factor required by UL 2524
Vdc	Battery bus voltage
Vpc	End voltage per cell (use for reference on datasheet)

9.1 Battery Calculation for the FXM 1100

The following example shows how to calculate and select a battery to support the maximum load on the FXM 1100.

9.1.1 Calculate the Load on the Battery (FXM 1100):

A system with a system load of **8.3A @120Vac** needs to support **12 hours** of run time. FXM 1100 efficiency = **82%**. Battery bus voltage is **48Vdc**.

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

$$\text{Battery discharge current} = (8.3 \times 120) / 0.82 / 48$$

$$\text{Battery discharge current} = \mathbf{25.3A}$$

9.1.2 Calculate the Required Battery Size:

Multiply the battery discharge current of **25.3A** by **12 hours** and by the design life factor of **1.2**.

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

$$\text{Amp hours} = 25.3 \times 12 \times 1.2$$

$$\text{Amp hours} = \mathbf{364Ah}$$

To achieve the maximum capacity out of the system, eight (8) 12V batteries with a minimum of 182Ah (C12) each configured in two parallel strings are required.

9.1.3 Battery Selection

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

9.2 Battery Calculation for the FXM 650

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

9.2.1 Calculate the Load on the Battery:

A system with a system load of **3.79A @120Vac** needs to support **12 hours** of run time. FXM 1100 efficiency = **75%**. Battery bus voltage is **24Vdc**.

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

$$\text{Battery discharge current} = (3.79 \times 120) / 0.75 / 24$$

$$\text{Battery discharge current} = \mathbf{25.3A}$$

9.2.2 Calculate the Required Battery Size:

Multiply the battery discharge current of **25.3A** by **12 hours** and by the design life factor of **1.2**.

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

$$\text{Amp hours} = 25.3 \times 12 \times 1.2$$

$$\text{Amp hours} = \mathbf{364Ah}$$

To achieve the maximum capacity out of the system, eight (8) 12V batteries with a minimum of 182Ah (C12) each configured in two parallel strings are required.

9.2.3 Battery Selection

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

10. Warranty Statement and Service Information

10.1 Technical Support

In Canada and the USA, call toll free 1-888-462-7487.

Customers outside Canada and the USA, call +1-604-436-5547.

10.2 Warranty Statement

For full information details review Alpha's online Warranty Statement at www.alpha.ca/support.

10.3 Product Warranty

Alpha® warrants that for a period of two (2) years from the date of shipment its products shall be free from defects under normal authorized use consistent with the product specifications and Alpha's instructions, the terms of the manual will take precedence.

The warranty provides for repairing, replacing or issuing credit (at Alpha's discretion) for any equipment manufactured by it and returned by the customer to the factory or other authorized location during the warranty period.

There are limitations to this warranty coverage. The warranty does not provide to the customer or other parties any remedies other than the above. It does not provide coverage for any loss of profits, loss of use, costs for removal or installation of defective equipment, damages or consequential damages based upon equipment failure during or after the warranty period. No other obligations are expressed or implied. Warranty also does not cover damage or equipment failure due to cause(s) external to the unit including, but not limited to, environmental conditions, water damage, power surges or any other external influence.

The customer is responsible for all shipping and handling charges. Where products are covered under warranty Alpha will pay the cost of shipping the repaired or replacement unit back to the customer.

10.4 Battery Warranty

Note that battery warranty terms and conditions vary by battery and by intended use. Contact your Alpha sales representative or the Technical Support team at the above number to understand your entitlements under Battery Warranty.

10.5 Warranty Claims

Any claim under this Limited Warranty must be made in writing to Alpha BEFORE sending material back. Alpha will provide Product return instructions upon approval of return request. A Service Repair Order (SRO) and / or Return Authorization (RA) number will be issued ensuring that your service needs are handled promptly and efficiently.

Claims must be made online at: www.alpha.ca.

10.6 Service Information

For a list of international service centers, refer to the Alpha website: www.alpha.ca

11. Acronyms and Definitions

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

12. Certification

About CSA and UL

CSA (Canadian Standards Association also known as CSA Group) was established in 1919 as an independent testing laboratory in Canada. CSA received its recognition as an NRTL (Nationally Recognized Testing Laboratory) in 1992 from OSHA (Occupational Safety and Health Administration) in the United States of America (Docket No. NRTL-2-92).

When these marks appear with the indicator “C and US” it means that the product is certified for both the US and Canadian markets, to the applicable US and Canadian standards. (1)

As part of the reciprocal, US/Canada agreement regarding testing laboratories, the Standards Council of Canada (Canada’s national accreditation body) granted Underwriters Laboratories (UL) authority to certify products for sale in Canada. (2)

Only Underwriters Laboratories may grant a licence for the use of this mark, which indicates compliance with both Canadian and US requirements. (3)



NRTLs Capabilities

NRTLs are third party organizations recognized by OSHA, US Department of Labor, under the NRTL program.

The testing and certifications are based on product safety standards developed by US based standards developing organizations and are often issued by the American National Standards Institute (ANSI). (4)

The NRTL determines that a product meets the requirements of an appropriate consensus-based product safety standard either by successfully testing the product itself, or by verifying that a contract laboratory has done so, and the NRTL certifies that the product meets the requirements of the product safety standard. (4)

Governance of NRTL

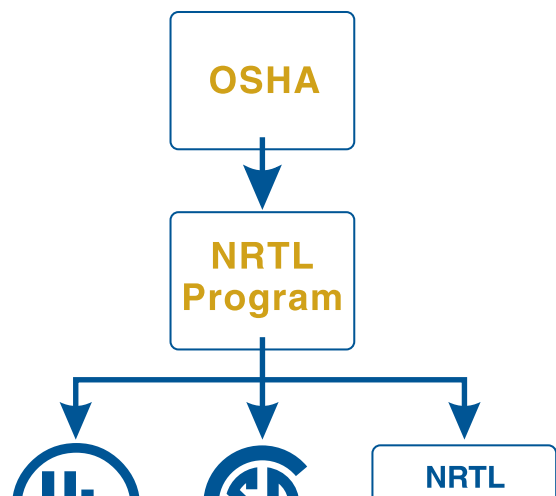
The NRTL Program is both national and international in scope with foreign labs permitted.

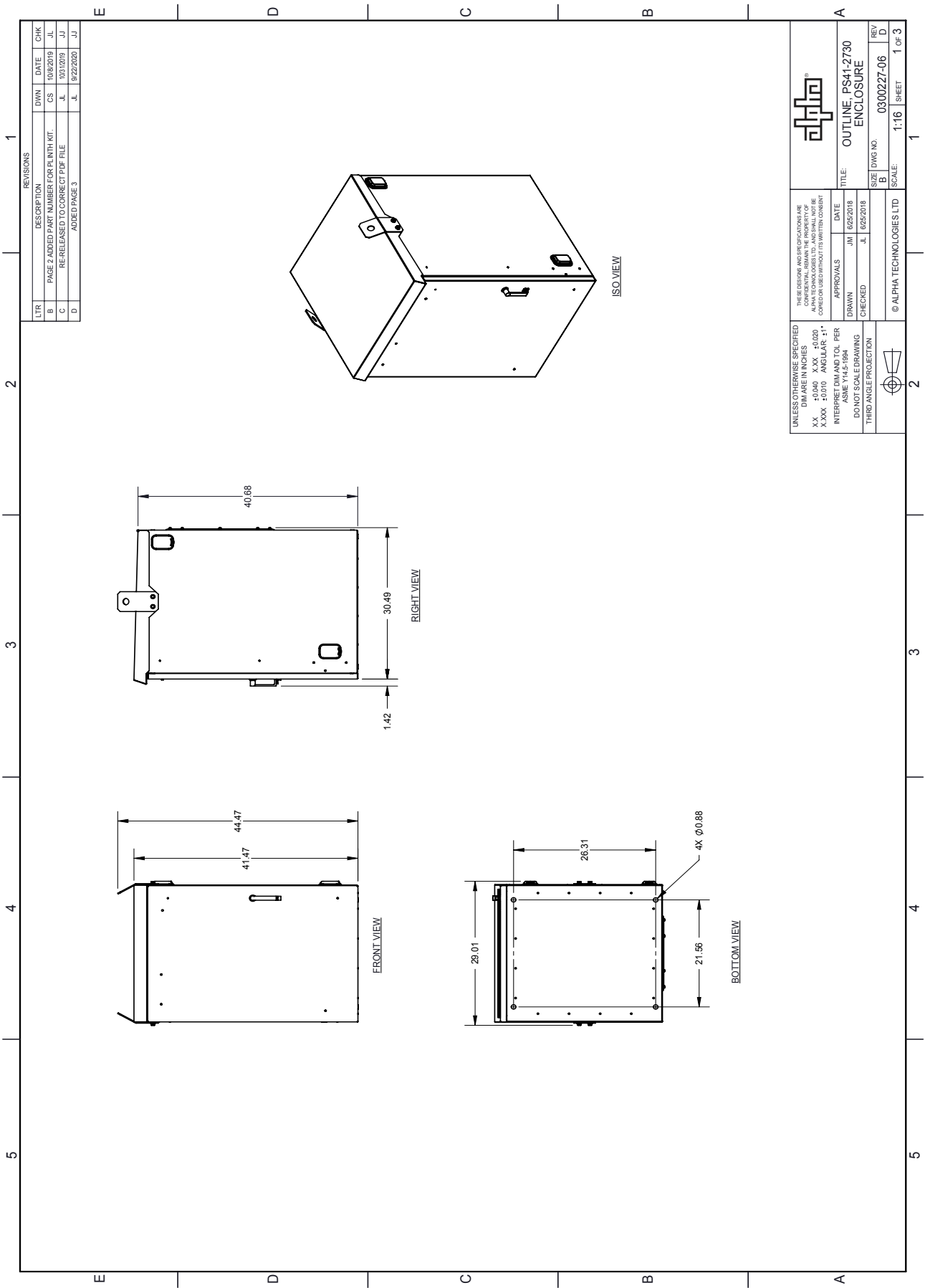
(1) www.csagroup.org

(2) www.scc.ca

(3) www.ulc.ca

(4) www.osha.gov



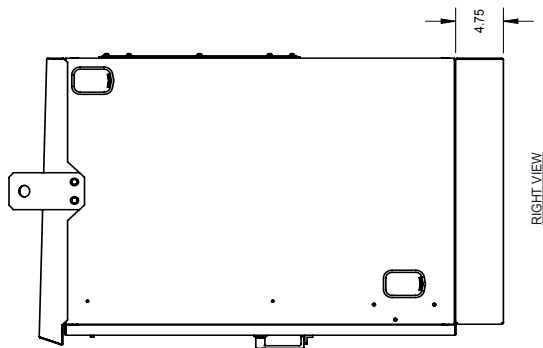
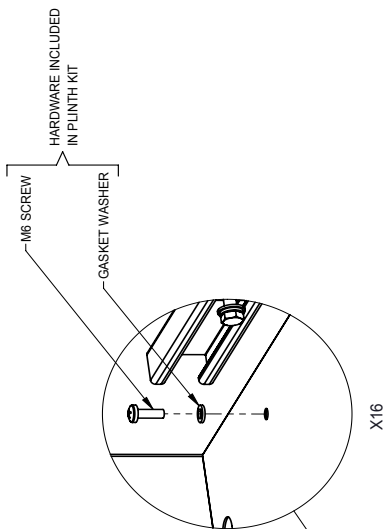




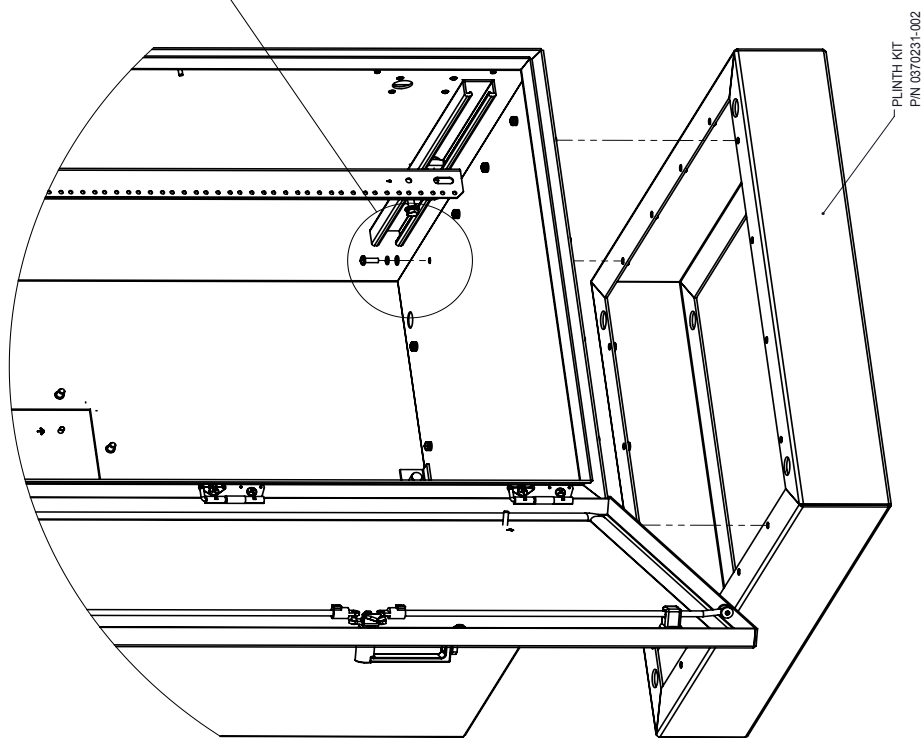
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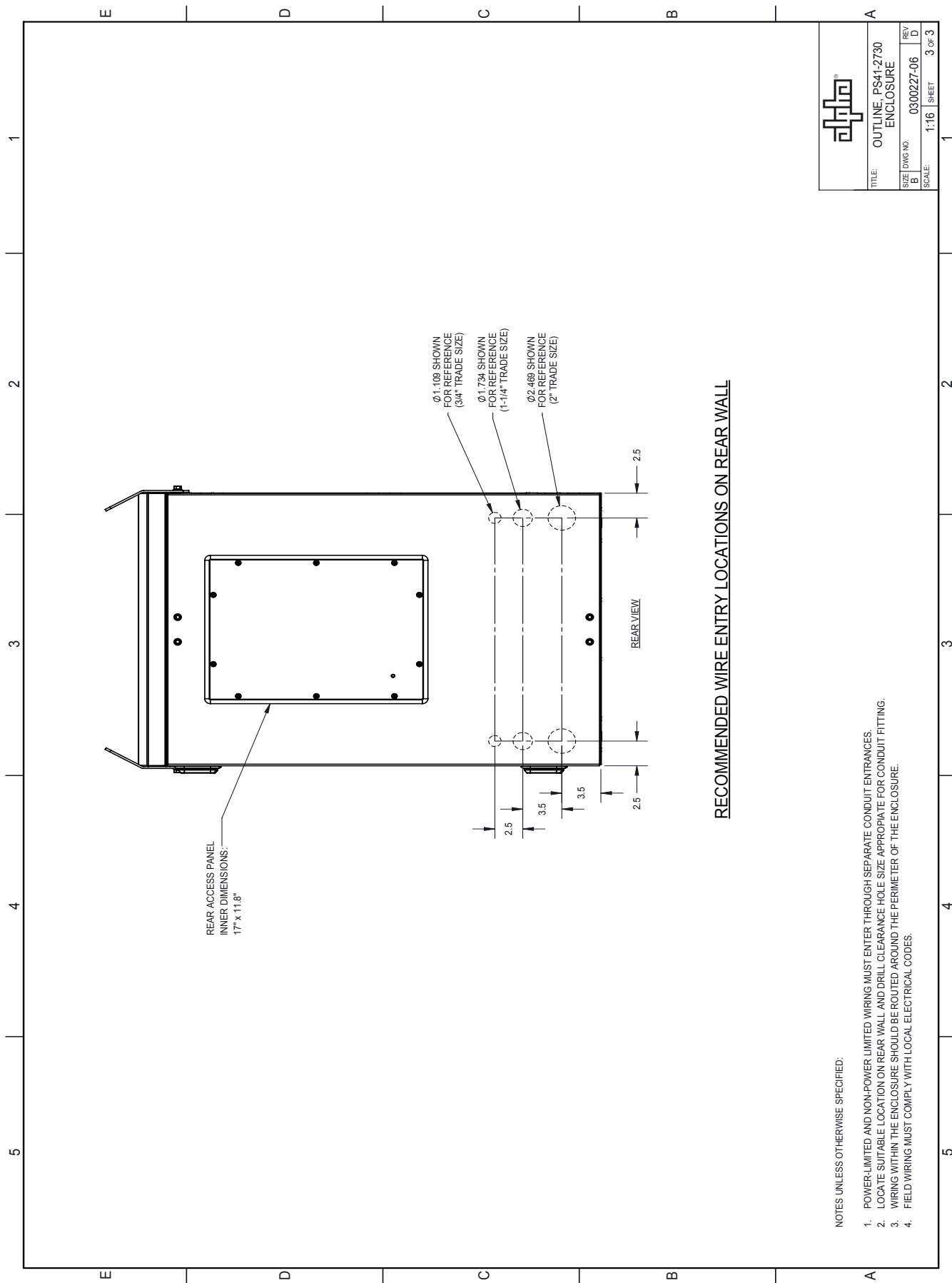
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B	0300227-06	D
SCALE:	1:24	SHEET 2 OF 3

PLINTH MOUNTING OPTION



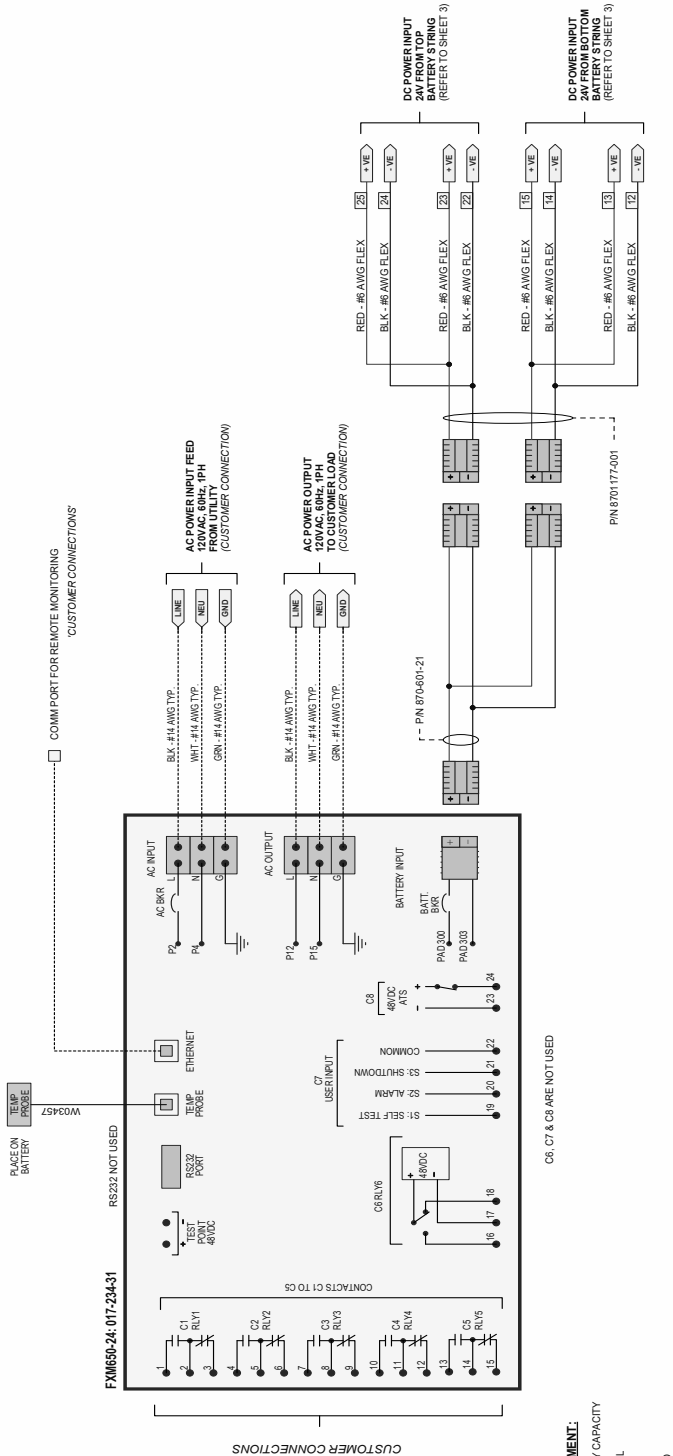
RIGHT VIEW





FXM650 UPS MODULE AC POWER, BATTERY STRING & TEMPERATURE PROBE WIRING:

REVISIONS			
LTN	DESCRIPTION	DRW	DATE
1	DESIGNED BY: JEN-HUNG HSIAO	A	2009/02/27
2	REVISED FOR UL2524	A	2009/02/27

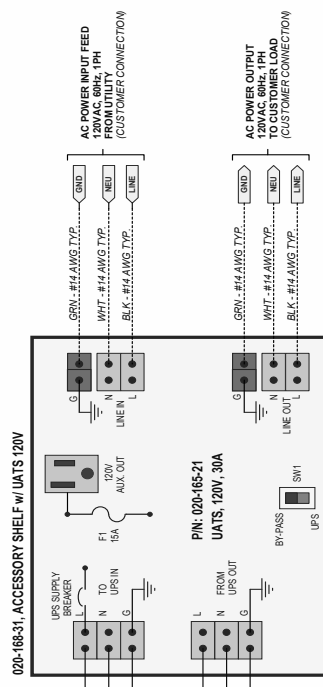


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APPROVALS	DATE	TITLE	DATE
DESIGNED BY: JEN-HUNG HSIAO	2009/02/27	FXM650-24 120V UPS, POWER ENCLOSURE SYSTEM WIRING SCHEMATIC, PS41-2730	2009/02/27
CHECKED BY: JEN-HUNG HSIAO	2009/02/27	SIZE: B	0570187-05
© ALPHA TECHNOLOGIES LTD		SCALE: NTS	SHEET: 1 of 4

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

[illegible]

C6, C7 & C8 ARE NOT USED



REFER TO SHEET 1 FOR BATTERY CONNECTION

C6, C7 & C8 ARE NOT USED



TITLE FXM650-24 120V UPS, POWER ENCLOSURE SYSTEM WIRING SCHEMATIC, PS41-2730			
SIZE B	DWGNO.	REV C	
SCALE	NTS	SHEET	2 of 4

SYSTEM 24V BATTERY STRINGS CABLING:

The diagram illustrates the wiring for the Alpha FXM650-24 120V UPS power enclosure system, showing the connection of eight 12V Alphacell batteries into two 24V strings (top and bottom) from a central input connector.

Top Battery Strings: Consist of Batteries #5, #6, #7, and #8. The positive (+) terminals are connected to a common bus labeled "RED - #6 AWG FLEX" with terminals 22, 23, 24, and 25. The negative (-) terminals are connected to a common bus labeled "BLK - #6 AWG FLEX" with terminals 21, 20, 19, and 18.

Bottom Battery Strings: Consist of Batteries #1, #2, #3, and #4. The positive (+) terminals are connected to a common bus labeled "RED - #6 AWG FLEX" with terminals 12, 13, 14, and 15. The negative (-) terminals are connected to a common bus labeled "BLK - #6 AWG FLEX" with terminals 11, 10, 9, and 8.

Central Input Connector: A 24V input connector with terminals labeled "FROM FXM UPS MODULE BATTERY STRING INPUT CONNECTOR (REFER TO SHEET 1)". The positive (+) terminal is connected to the common positive bus of the top string (terminal 22). The negative (-) terminal is connected to the common negative bus of the bottom string (terminal 11).

Wiring Details:

- Top String:**
 - Battery #5: Positive (+) to terminal 22, Negative (-) to terminal 21.
 - Battery #6: Positive (+) to terminal 23, Negative (-) to terminal 20.
 - Battery #7: Positive (+) to terminal 24, Negative (-) to terminal 19.
 - Battery #8: Positive (+) to terminal 25, Negative (-) to terminal 18.
- Bottom String:**
 - Battery #1: Positive (+) to terminal 12, Negative (-) to terminal 11.
 - Battery #2: Positive (+) to terminal 13, Negative (-) to terminal 10.
 - Battery #3: Positive (+) to terminal 14, Negative (-) to terminal 9.
 - Battery #4: Positive (+) to terminal 15, Negative (-) to terminal 8.

Notes:

- * TERMINAL CONNECTIONS MADE & JUMPERS INSTALLED BY CUSTOMER (TYPICAL)
- PART OF PIN 8701177-001

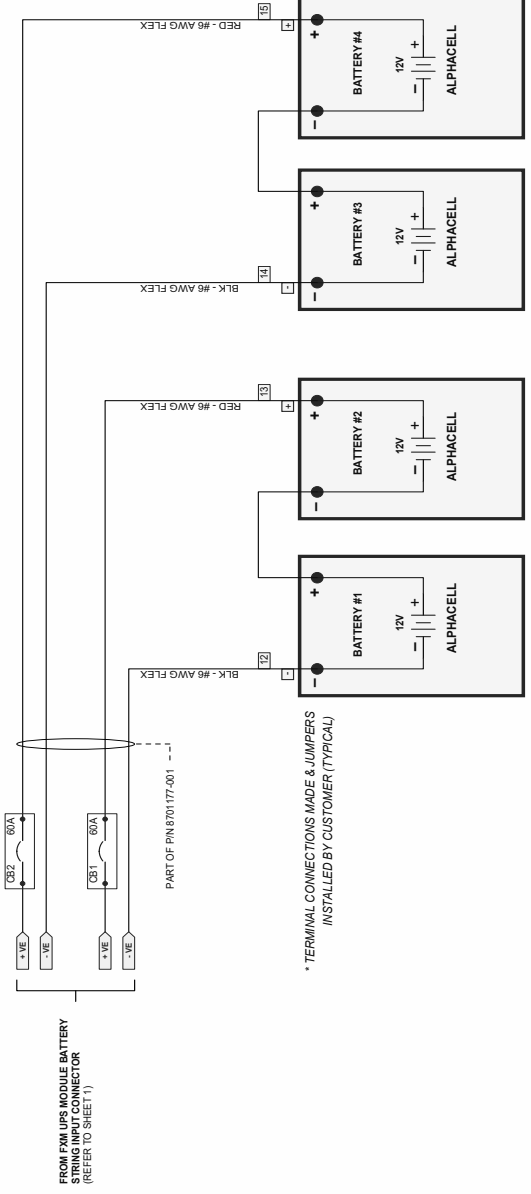
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POWER ENCLOSURE SYSTEM
WIRING SCHEMATIC, PS41-2730

DATE 12/06/00

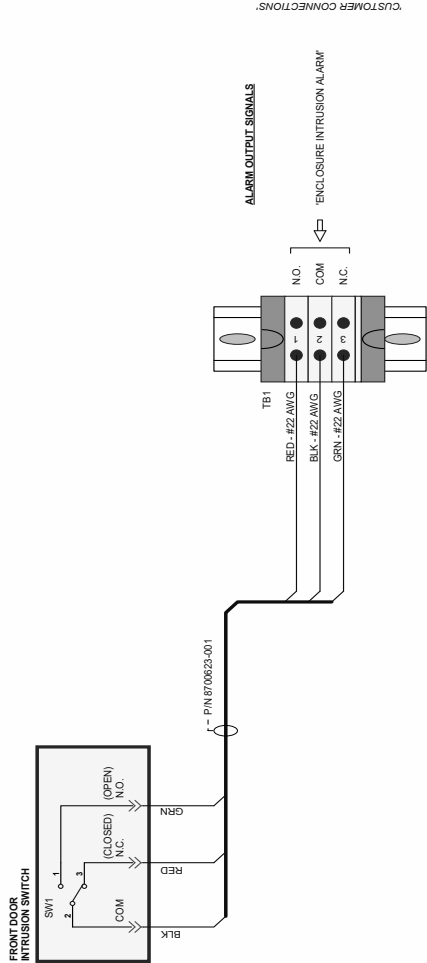
REV B

SCALE NTS

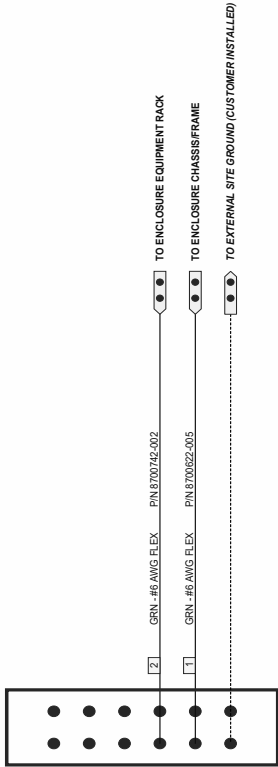
SHEET 3 of 4



ENCLOSURE INTRUSION ALARM WIRING:



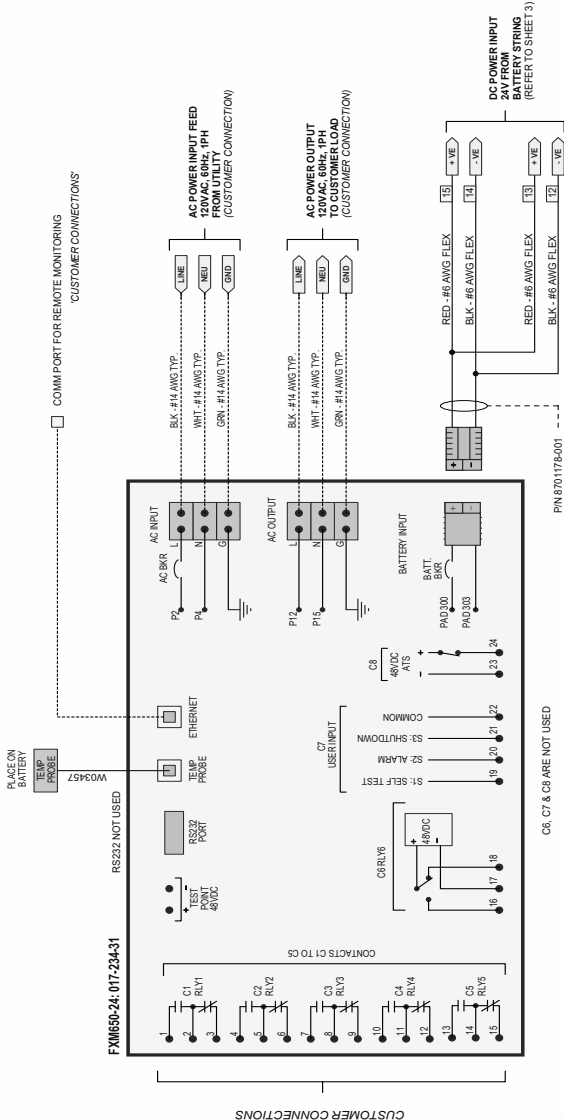
ENCLOSURE MASTER GROUND BAR TERMINATIONS:



TITLE FXM59-24 120V UPS POWER SUPPLY SYSTEM WIRING SCHEMATIC, PSA1-2730		
SIZE B	DRAWING 0570187-05	REV C
SCALE	NTS	SHEET 4 of 4

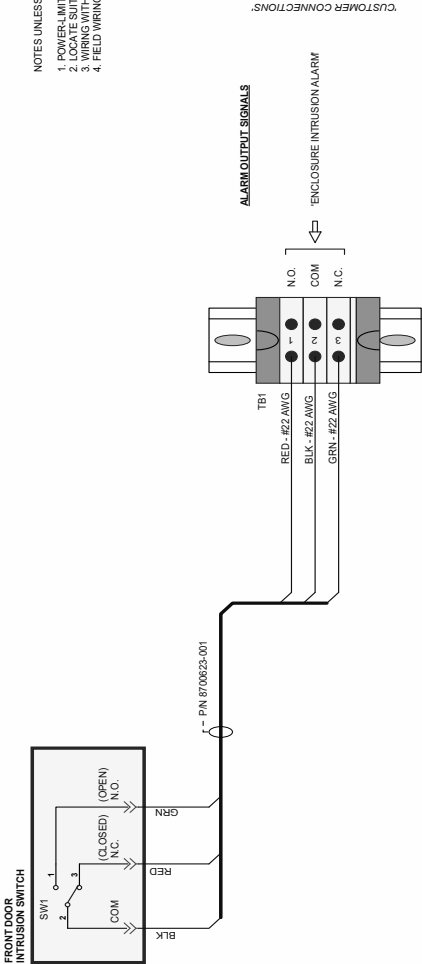
FXM650 UPS MODULE AC POWER, BATTERY STRING, INTRUSION ALARM & TEMPERATURE PROBE WIRING:

REVISIONS			
LTN	DESCRIPTION	DRW	DATE
A	ISSUED BATTERY AND WIRING	A	2018-02-01
B	UPDATED TEMPLATE AND ADDRESS PINS	A	2018-02-01
C	REVISED FOR U2524	A	2018-02-01



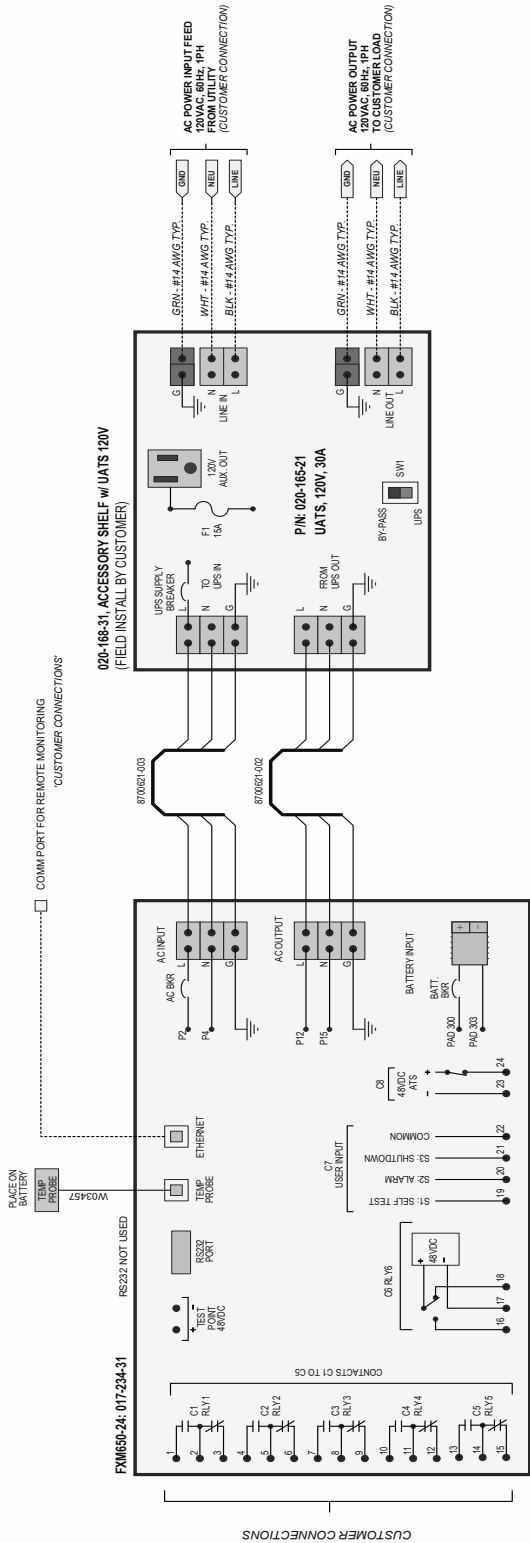
RELAY ASSIGNMENT:
C3 = LOW BATTERY CAPACITY
C4 = CHARGER FAIL
C5 = AC FAIL
C1, C2 = NOT USED

- NOTES UNLESS OTHERWISE SPECIFIED:
- POWER-LIMITED AND NON-POWER LIMITED WIRING MUST ENTER THROUGH SEPARATE CONDUIT ENTRANCES.
 - LOCATE SUITABLE LOCATION ON REAR WALL AND DRILL CLEARANCE HOLE SIZE APPROPRIATE FOR CONDUIT FITTING.
 - WIRING WITHIN THE ENCLOSURE SHOULD BE ROUTED AROUND THE PERIMETER OF THE ENCLOSURE.
 - FELD WIRING MUST COMPLY WITH LOCAL ELECTRICAL CODES.



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APPROVALS	DATE	TITLE	
DRW	J. T. 201803	FXM650-24 120V UPS, POWER ENCLOSURE SYSTEM WIRING SCHEMATIC, PS41-2730	
CHKD	J. T. 201803	SIZE	B
		0570188-05	D
© ALPHA TECHNOLOGIES LTD		SCALE	1 of 3

FXM650 UPS MODULE WITH FIELD INSTALLED UATS MODULE WIRING:

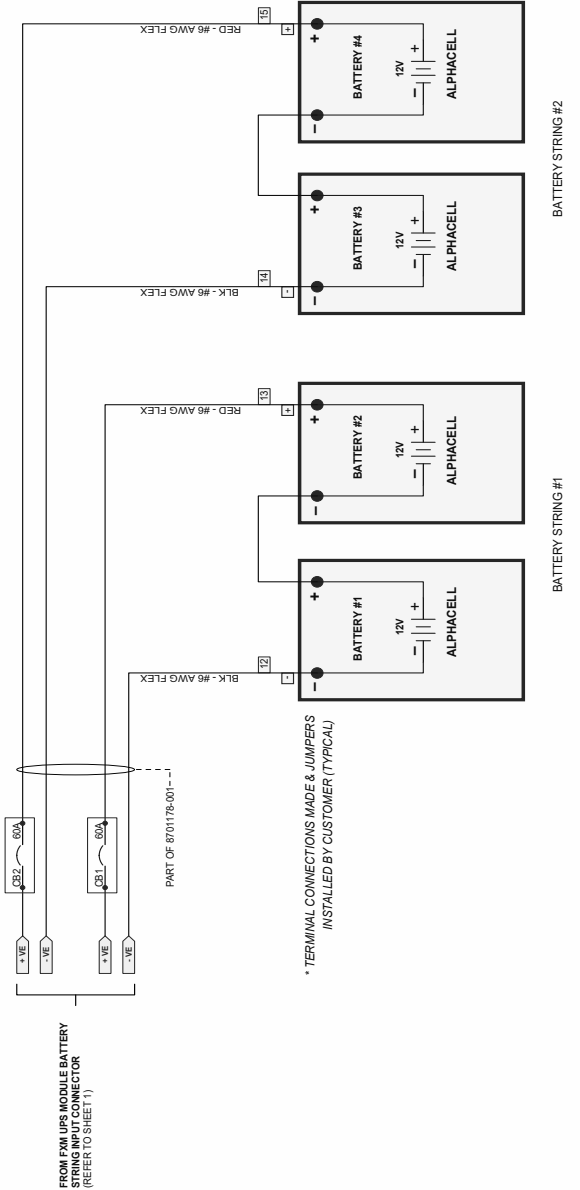


C6, C7 & C8 ARE NOT USED

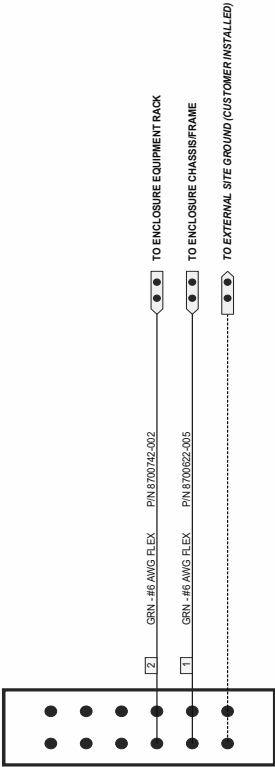


TITLE FXM650-24 120V UPS CUSTOMER CONNECTIONS WIRING SCHEMATIC, PSA4-2730			
SIZE DWGNO	B	REV	D
SCALE	NTS	SHEET	2 of 3

SYSTEM 24V BATTERY STRINGS CABLING:



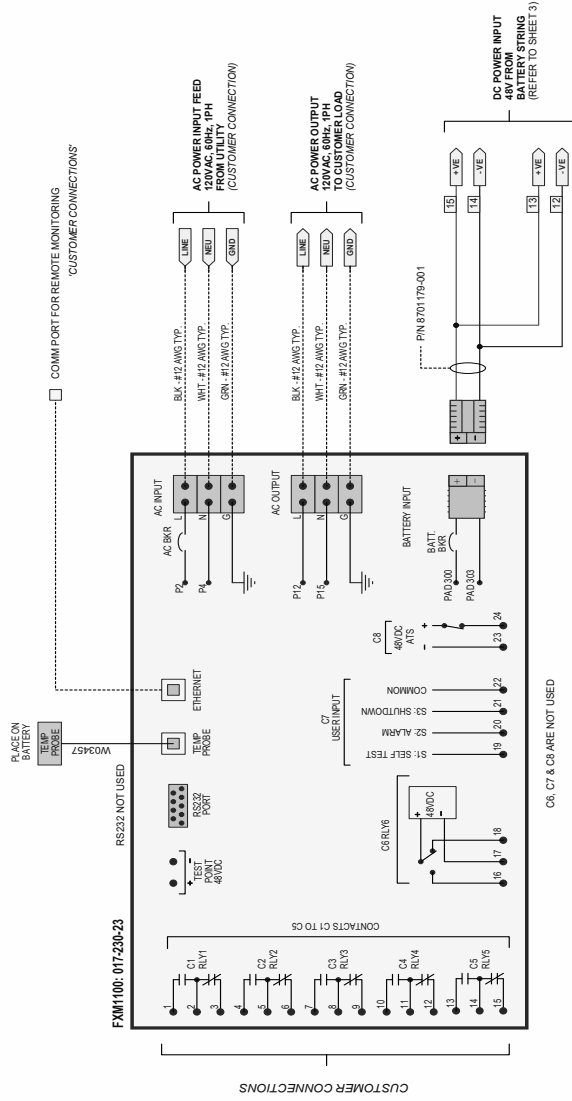
ENCLOSURE MASTER GROUND BAR TERMINATIONS:



TITLE FXM59-24 120V UPS POWER SUPPLY SYSTEM WIRING SCHEMATIC, PSA1-2730			
SIZE	DWGNO	REV	
B	0570188-05	D	
SCALE	NTS	SHEET	3 of 3

FXM1100 UPS MODULE AC POWER, BATTERY STRING & TEMPERATURE PROBE WIRING:

REVISIONS				
LTR	DESCRIPTION	DRW	DATE	CHK
B	ADDED HARNESS PART NUMBERS	JL	2019-02-19	JJ
C	REVISED FOR UL2024	JL	2020-09-22	JJ




RELAY ASSIGNMENT:

- C3 = LOW BATTERY CAPACITY
C4 = CHARGER FAIL
C5 = AC FAIL
C1, C2 = NOT USED

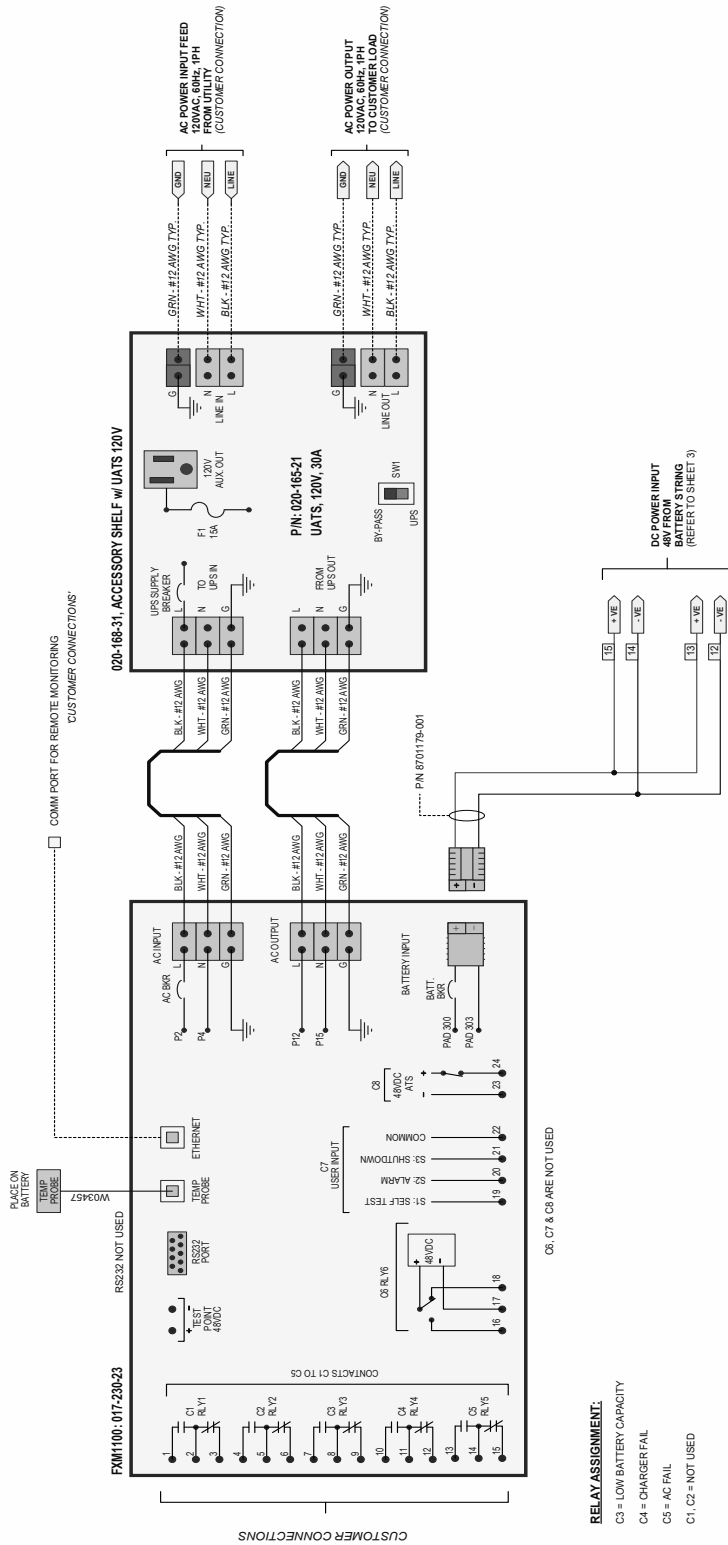
C6, C7 & C8 ARE NOT USED

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. WIRING WITHIN THE ENCLOSURE SHOULD BE ROUTED AROUND THE PERIMETER OF THE ENCLOSURE.
4. FIELD WIRING MUST COMPLY WITH LOCAL ELECTRICAL CODES.

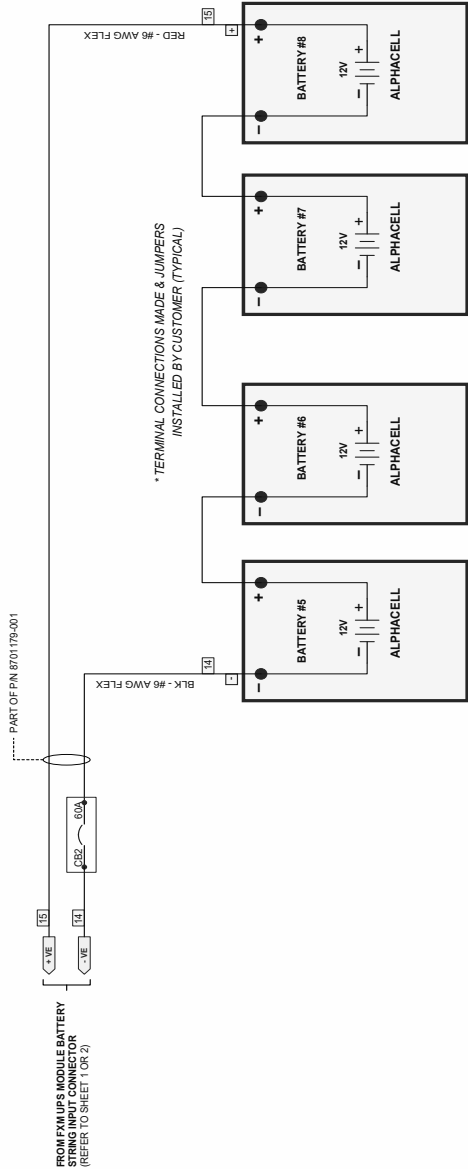
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DRAWN <u>AL</u> 201803 CHECKED <u>JI</u> 201803		TITLE <u>FXM1100-48 120V UPS POWERED ENCLOSURE SYSTEM WIRING SCHEMATIC, P541-2730</u>	
SCALE <u>B</u> SIZE <u>DRG</u>		REV <u>C</u> Q570189-05	
© ALPHA TECHNOLOGIES LTD		SCALE	SHEET 1 of 4

FXM1100 UPS MODULE WITH UATS MODULE, BATTERY STRING & TEMPERATURE PROBE WIRING:

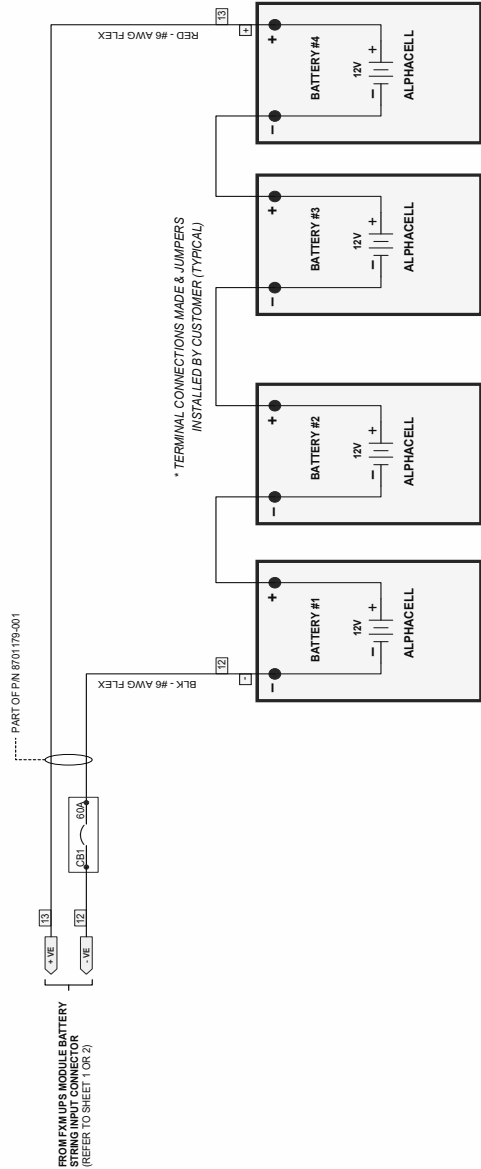


TITLE FXM1100-48 120V UPS POWER SUPPLY SYSTEM WIRING SCHEMATIC, PSA1-2730		
SIZE 10X30	REV B	0570189-05
SCALE NTS	SHEET 2	OF 4

SYSTEM 48V BATTERY STRINGS CABLING:



TOP BATTERY STRING

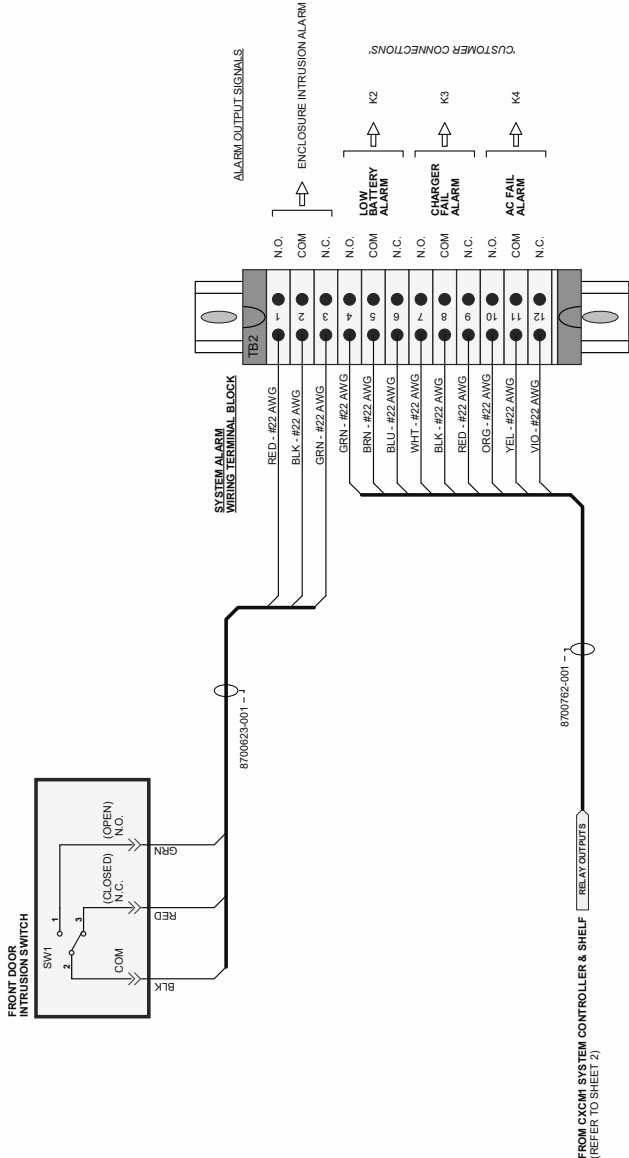


BOTTOM BATTERY STRING

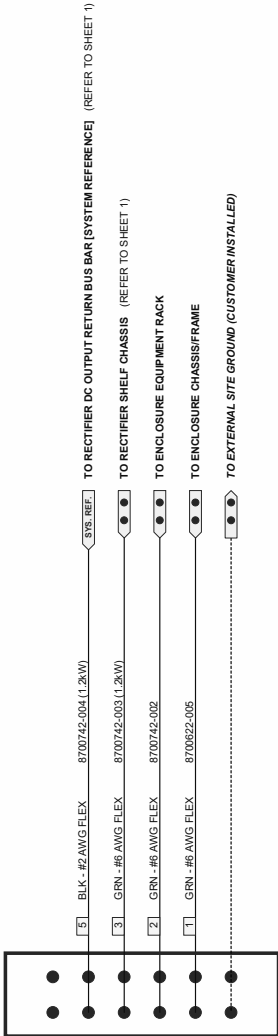


TITLE FXM1100-48 120V UPS SYSTEM OVERVIEW WIRING SCHEMATIC			
WIRING SCHEMATIC: PSA12730			
SIZE	DWGNO	REV	
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SCALE	NTS	SHEET	3 of 4

ENCLOSURE ALARM OUTPUT WIRING:

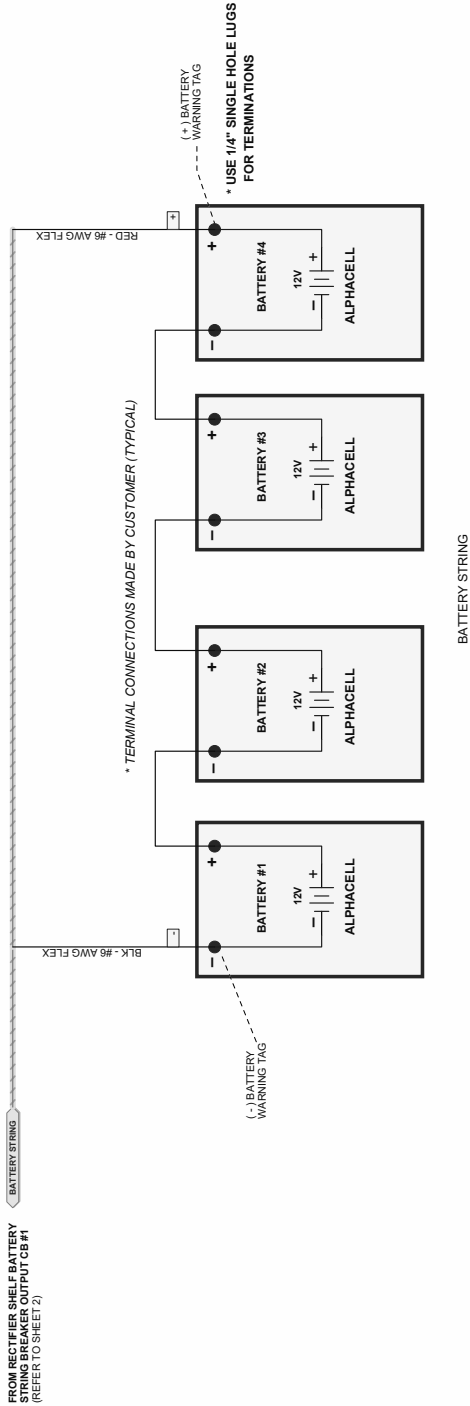


ENCLOSURE MASTER GROUND BAR TERMINATIONS:



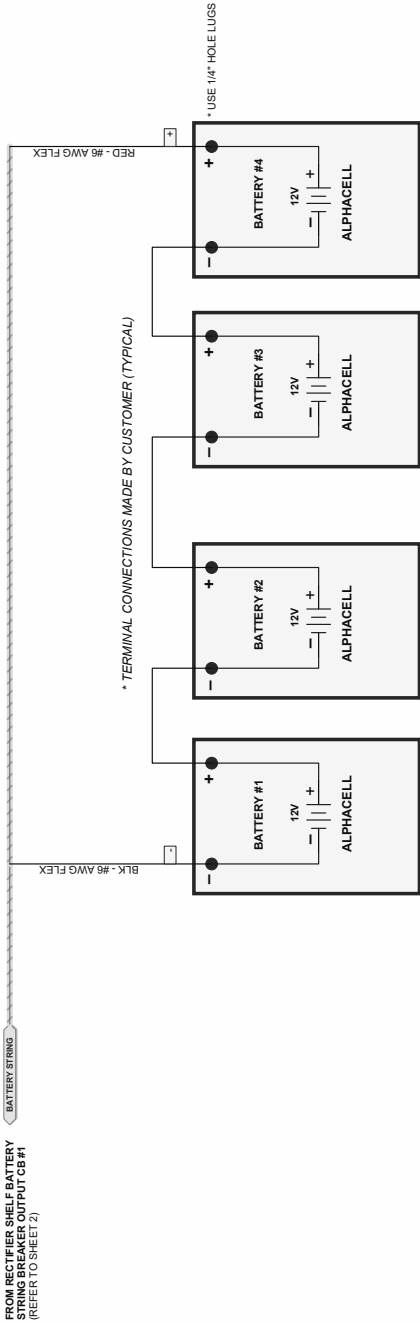
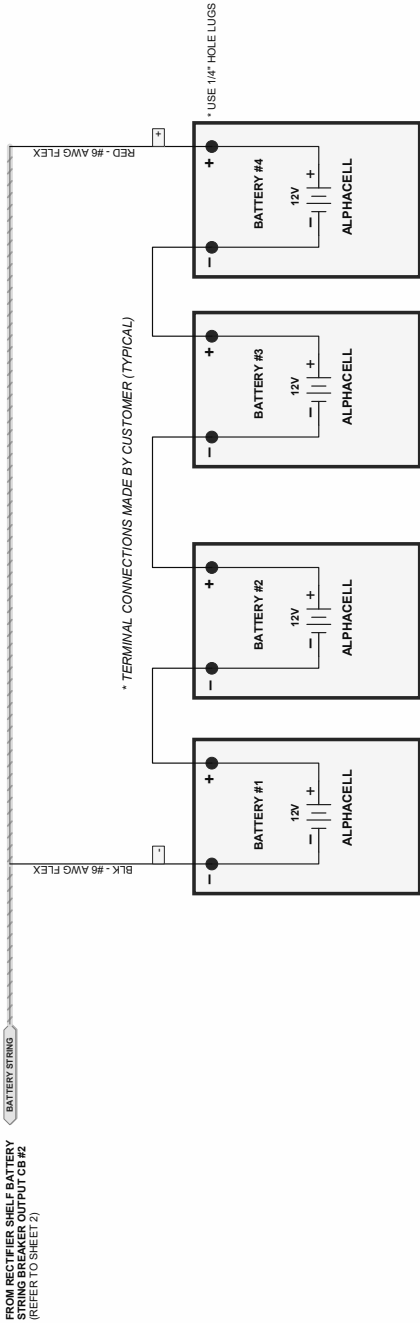
TITLE 48V POS GND 25A POWER ENCLOSURE SYSTEM WIRING SCHEMATIC, PS41-2730			
SIZE	B	0570191-05	B
SCALE	NTS	SHEET	3 of 4

SYSTEM 48V BATTERY STRING CABLING:



TITLE 48V POS GND 25A POWER ENCLOSURE SYSTEM WIRING SCHEMATIC, PS41-2730		
SIZE B	DWG NO. 0570191-05	REV B
SCALE	NTS	SHEET 4 of 4

SYSTEM 48V BATTERY STRING CABLING:





Alpha Technologies Ltd. | 7700 Riverfront Gate, Burnaby, BC V5J 5M4 CANADA

Tel.: Toll Free North America: +1 800 667 8743 | Outside North America +1 604 436 5547 | Technical Support +1 888 462 7487

For more information visit our website at: www.alpha.com

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#9400032-J0 REV A (07/2020)