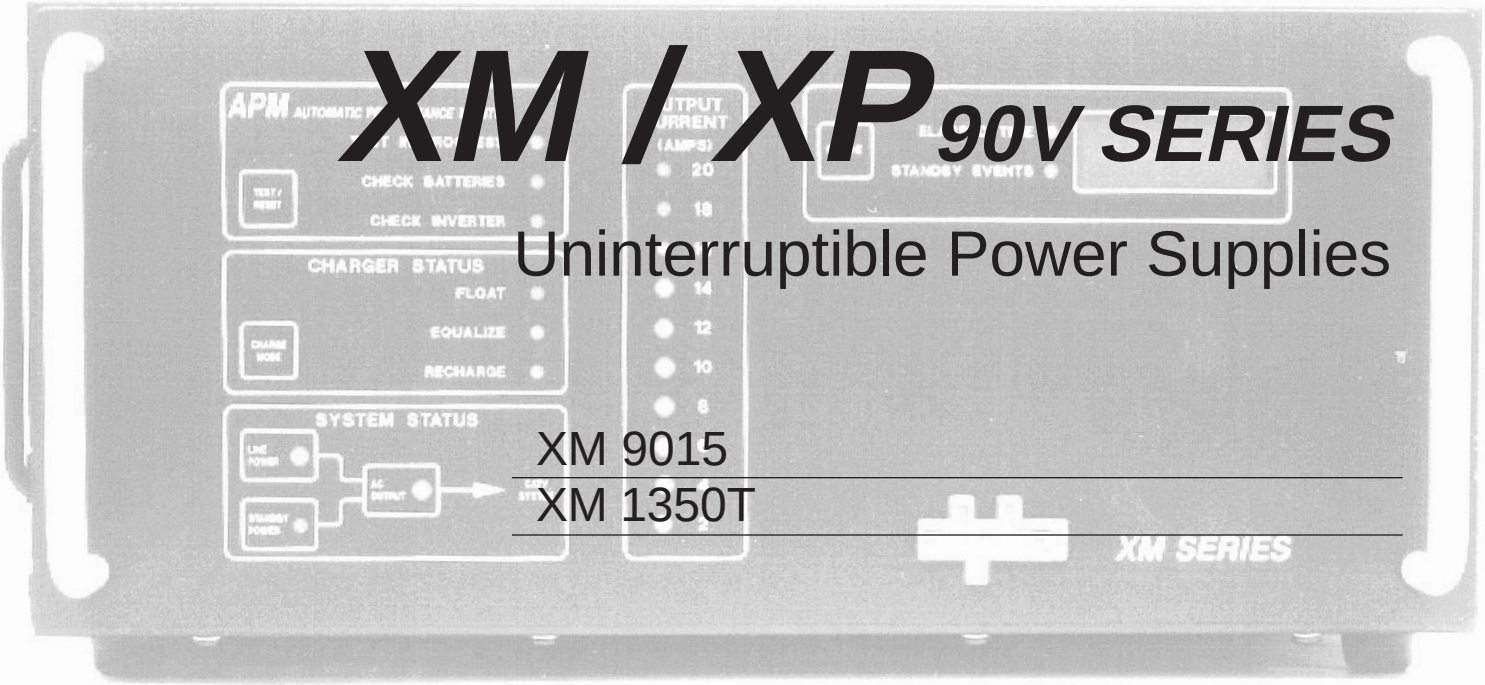
XM / XP 90V SERIES

Uninterruptible Power Supplies



XM 9015
XM 1350T

Technical Manual

ALPHA TECHNOLOGIES

017-720-B2-001 03/97

XM / XP 90V Uninterruptible Power Supplies

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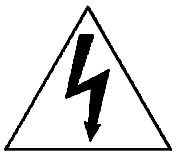
IMPORTANT SAFETY INSTRUCTIONS CONTAINED IN THIS MANUAL

CAUTION: TO REDUCE THE RISK OF ELECTRICAL SHOCK, AND ENSURE THE SAFE OPERATION OF THIS UNIT, THE FOLLOWING SYMBOLS HAVE BEEN PLACED THROUGHOUT THE MANUAL. WHERE THESE SYMBOLS APPEAR, SERVICING SHOULD BE PERFORMED ONLY BY QUALIFIED PERSONNEL.



DANGEROUS VOLTAGE
A DANGEROUS VOLTAGE EXISTS IN THIS AREA OF THE POWER SUPPLY. USE EXTREME CAUTION.

ATTENTION
IMPORTANT OPERATING INSTRUCTIONS. THIS PROCEDURE SHOULD BE PERFORMED ONLY BY QUALIFIED SERVICE PERSONNEL.

SAVE THESE INSTRUCTIONS

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IMPORTANT TECHNICAL NOTE

CAUTION: When operating the XP Series Uninterruptible Power Supply, a minimum load of at least 1.0 Amperes (approximately 10% of the output rating of the power supply) must be connected to the output. Failure to do so could damage the load or the unit's ferroresonant power transformer.

Damage caused by this condition will not be covered under warranty.

For further information, contact Alpha Technologies or your nearest Alpha representative.

IMPORTANT SAFETY PRECAUTIONS

THE POWER SUPPLY SHOULD BE SERVICED ONLY BY QUALIFIED PERSONNEL.

THE POWER SUPPLY CONTAINS MORE THAN ONE LIVE CIRCUIT. EVEN THOUGH AC IS NOT PRESENT AT THE INPUT, IT MAY BE PRESENT AT THE OUTPUT.

WHEN USING AN EXTERNAL SERVICE DISCONNECT, VERIFY THAT IT IS EQUIPPED WITH A HIGH MAGNETIC TRIP BREAKER PROPERLY RATED (AMPERAGE) FOR USE WITH THE POWER SUPPLY.

THE USE OF IMMOBILIZED ELECTROLYTE-TYPE BATTERIES (SUCH AS GELLED OR OTHER VRLA - VALVE REGULATED LEAD ACID - BATTERIES) IS STRONGLY RECOMMENDED OVER LIQUID ELECTROLYTE-TYPES. WET CELL BATTERIES CAN LEAK OR SPILL, INCREASING THE RISK OF EXPOSURE TO CORROSIVE LIQUID ELECTROLYTIC ACID.

WHEN IN STORAGE, BATTERIES SHOULD BE CHARGED AT LEAST ONCE EVERY THREE MONTHS TO ENSURE OPTIMUM PERFORMANCE AND BATTERY LIFE.

WEAR EYE PROTECTION, SUCH AS SAFETY GLASSES OR A FACE SHIELD, WHENEVER WORKING WITH BATTERIES.

USE GLOVES WHEN HANDLING BATTERIES. BATTERY ELECTROLYTE IS ACIDIC AND MAY CAUSE BURNS.

NEVER SMOKE NEAR BATTERIES. SPARKS, FLAMES OR OTHER SOURCES OF IGNITION MAY CAUSE A BATTERY EXPLOSION.

ALWAYS CARRY A SUPPLY OF WATER, SUCH AS A WATER JUG, TO WASH THE EYES OR SKIN IN THE EVENT OF EXPOSURE TO BATTERY ELECTROLYTE.

USE PROPER LIFTING TECHNIQUES WHENEVER HANDLING THE ENCLOSURE, POWER MODULE OR BATTERIES. GROUP 31 SIZE BATTERIES, USED IN THE MAJORITY OF CABLE TELEVISION APPLICATIONS, CAN WEIGH AS MUCH AS 70 LBS.

USE A BUCKET TRUCK, OR SUITABLE SAFETY EQUIPMENT SUCH AS A SAFETY HARNESS AND CLIMBING SPIKES, WHEN SERVICING POLE INSTALLATIONS.

ALWAYS SWITCH THE POWER SUPPLY'S BATTERY CIRCUIT BREAKER TO OFF BEFORE DISCONNECTING BATTERY CABLES. THIS GREATLY REDUCES THE CHANCE OF SPARK AND POSSIBLE BATTERY EXPLOSION.

DO NOT ALLOW LIVE BATTERY WIRES TO CONTACT THE ENCLOSURE OR POWER SUPPLY CHASSIS. POSSIBLE EXPLOSION OR FIRE CAN OCCUR.

BEFORE PLACING A CURRENT LOAD ON THE BATTERIES, (SUCH AS WHEN SWITCHING THE POWER SUPPLY TO STANDBY), USE THE ENCLOSURE DOOR AS A SHIELD IN THE EVENT OF A BATTERY EXPLOSION.

INSPECT BATTERIES FOR SIGNS OF CRACKS, LEAKING OR SWELLING.

WHEN REPLACING BATTERIES, ALWAYS USE THOSE OF AN IDENTICAL TYPE. NEVER INSTALL OLD OR UNTESTED BATTERIES.

CHECK THE BATTERY'S DATE CODE. BATTERIES OLDER THAN SEVERAL YEARS SHOULD NOT BE USED.

AVOID THE USE OF UNINSULATED TOOLS OR OTHER CONDUCTIVE MATERIALS WHEN HANDLING BATTERIES OR WORKING INSIDE THE ENCLOSURE.

SPENT OR DAMAGED BATTERIES ARE CONSIDERED ENVIRONMENTALLY UNSAFE. ALWAYS RECYCLE USED BATTERIES.

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BATTERY CHARGING

ALWAYS REFER TO THE BATTERY MANUFACTURER'S RECOMMENDATION FOR SELECTING CORRECT FLOAT AND EQUALIZE CHARGE VOLTAGES. FAILURE TO DO SO COULD DAMAGE THE BATTERIES.

VERIFY THE POWER SUPPLY'S BATTERY CHARGER FLOAT AND EQUALIZE CHARGE VOLTAGES. REFER TO THE POWER SUPPLY'S OPERATION MANUAL.

BATTERIES ARE TEMPERATURE SENSITIVE. DURING EXTREMELY COLD CONDITIONS, A BATTERY'S CHARGE ACCEPTANCE IS REDUCED AND REQUIRES A HIGHER CHARGE VOLTAGE; DURING EXTREMELY HOT CONDITIONS, A BATTERY'S CHARGE ACCEPTANCE IS INCREASED AND REQUIRES A LOWER CHARGE VOLTAGE.

TO COMPENSATE FOR CHANGES IN TEMPERATURE, THE BATTERY CHARGER USED IN THE POWER SUPPLY IS TEMPERATURE COMPENSATING. FLOAT AND EQUALIZE CHARGE VOLTAGES WILL VARY DEPENDING UPON AMBIENT AIR TEMPERATURE.

IF BATTERIES APPEAR TO BE OVER OR UNDER-CHARGED, FIRST CHECK FOR DEFECTIVE BATTERIES AND THEN VERIFY CORRECT CHARGER VOLTAGE SETTINGS.

BATTERY PREVENTIVE MAINTENANCE

BATTERIES SHOULD BE INSPECTED EVERY THREE TO SIX MONTHS TO ENSURE OPTIMUM PERFORMANCE.

VISUALLY INSPECT BATTERIES FOR SIGNS OF CRACKS, LEAKS OR SWELLING.

CHECK BATTERY TERMINALS AND CONNECTING WIRES. BATTERY TERMINAL CONNECTORS SHOULD BE CLEANED PERIODICALLY AND RETIGHTENED TO APPROXIMATELY 50 INCH/LBS. SPRAY THE TERMINALS WITH AN APPROVED BATTERY TERMINAL COATING SUCH AS NCP-2.

CHECK BATTERY VOLTAGES UNDER LOAD. USE A LOAD TESTER IF AVAILABLE. DIFFERENCES BETWEEN ANY BATTERY IN THE SET SHOULD NOT BE GREATER THAN 0.3 VDC.

CHECK THE POWER SUPPLY'S BATTERY CHARGER VOLTAGES. REFER TO THE BATTERY MANUFACTURER'S RECOMMENDATION FOR CORRECT CHARGE VOLTAGES AND THE POWER SUPPLY'S OPERATION MANUAL FOR CORRESPONDING CHARGER SETTINGS.

NUMBER THE BATTERIES (1, 2, 3, ETC.) INSIDE OF THE ENCLOSURE FOR EASY IDENTIFICATION.

ESTABLISH AND MAINTAIN A BATTERY MAINTENANCE LOG.

2.1 INTRODUCTION

2.1.1 THE XP 90V SERIES UNINTERRUPTIBLE POWER SUPPLY

Alpha XP 90V Series Uninterruptible Power Supplies (UPS) are designed for powering signal processing equipment in Cable Television and Broadband LAN distribution systems. The power supply, which consists of an XM Series Power Module and a pole or ground-mount enclosure, provides the critical load with current-limited, regulated AC power that is free from disturbances such as spikes, surges, brownouts or blackouts. Backup power is achieved by a set of rechargeable batteries.

During LINE operation, AC power enters the module where it is converted to a "quasi" square wave and regulated (at the required output voltage). It is then passed onto the load via the SPI (Service Power Inserter) located inside the power supply enclosure. At the same time, power is directed to the battery charger to maintain a float charge to the batteries.

When the incoming AC line voltage drops significantly, or a utility power outage occurs, the XM Series power module automatically switches to inverter (STANDBY) operation in order to maintain power to the load. During the switching, energy contained in the module's ferroresonant transformer continues to supply power to the output. Depending upon the type of batteries used, and the loading on the power supply, backup power can continue for several hours. When utility line power returns, the XM Series power module waits momentarily for the utility voltage and frequency to stabilize and then initiates a smooth, in-phase switch back to AC line power. Once the switching is complete, the battery charger quickly recharges the batteries in preparation for the next utility power outage.

The XP Series Uninterruptible Power Supply contains an impressive list of features including an "OUTPUT CURRENT" display to indicate output current to the load; a "CHARGER STATUS" block to display the various battery charging modes; a "SYSTEM STATUS" block to display LINE and STANDBY operation, plus indicate acceptable AC output power; an output fuse to protect against excessive short circuit currents; and a battery circuit breaker to protect the DC circuit. Optional features can include a "STANDBY DATA" display to indicate "total outage time" and "number of standby events;" an APM (Automatic Performance Monitor) to self-test the inverter and batteries at regular intervals; and a USM (Universal Status Monitor) plug-in logic upgrade to facilitate status monitoring.

The XP 90V Series Uninterruptible Power Supply is designed to be one of the most rugged, reliable, and versatile power supplies available. Alpha Technologies, recognized as an international market leader in the field of backup power, offers complete technical support and prompt, reliable service to ensure that your power supply continues to provide years of trouble-free operation.

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2.2 Theory of Operation

The XP Series Uninterruptible Power Supply consists of an XM Series power module, a pole or ground-mount enclosure, and a set of gelled electrolyte, no maintenance batteries. The power module contains a ferroresonant transformer, resonant capacitor, dual-mode temperature-compensated battery charger, DC to AC converter (inverter), transfer isolation relay, and a main circuit module assembly containing the logic circuit.

The XM Series Uninterruptible Power Supply

2.2.1 AC (LINE) Operation

During AC LINE operation, utility power is routed into the primary winding of ferroresonant transformer and through the contacts of the transfer isolation relay. At the same time, power is directed to the auxiliary transformer which provides power for the control circuitry. A charger winding on the transformer supplies the battery charger circuit. An AC capacitor forms the resonant circuit of ferroresonant transformer which provides excellent noise and spike attenuation, short circuit current limiting, and output voltage regulation. The ferroresonant transformer produces a "quasi" square wave output which resembles a rounded square wave.

NOTE: WHEN MEASURING THE OUTPUT VOLTAGE OF FERRORESONANT TRANSFORMERS, USE ONLY A TRUE RMS AC VOLTMETER. NON-RMS READING METERS ARE CALIBRATED TO RESPOND TO PURE SINE WAVES AND WILL NOT PROVIDE AN ACCURATE READING WHEN MEASURING A "QUASI" SQUARE WAVE OUTPUT.

2.2 Theory of Operation, *continued*

2.2.2 Inverter (STANDBY) Operation

When the incoming AC line voltage drops significantly, or a complete power outage occurs, the control logic's line monitor activates STANDBY operation. The battery powered inverter comes on-line (in-phase with the failing AC line) as the isolation relay switches to prevent AC power from back-feeding to the utility. During the brief transfer from LINE to STANDBY operation, the energy contained in the ferroresonant transformer continues to supply power to the load. The following changes occur: the isolation relay opens to disconnect the AC line from the primary winding of ferroresonant transformer. The control logic drives the inverter FETs ON and OFF at line frequency. This switching action converts the DC battery current into AC in the inverter winding of the ferroresonant transformer which provides regulated power to the load. The control logic, which includes a circuit to protect the inverter FETs from over-current damage, monitors the condition of the batteries during inverter operation. Since a prolonged AC line outage would severely discharge the batteries, resulting in permanent damage, the control logic disables the inverter when the batteries drop to approximately 10.5 VDC / battery (31.5 VDC / set).

When AC line voltage returns, the power module transfers back to LINE operation within 10 to 50 seconds. This delay allows the AC line voltage and frequency to stabilize before the control logic phase-locks the inverter's output to the utility input. It then de-energizes the isolation relay, re-connects the AC line to the primary of the ferroresonant transformer and disconnects the batteries from the inverter. This results in a smooth, in-phase transfer back to utility power without interruption of service to the load. The battery charging circuit is then activated to recharge the batteries in preparation for the next power outage.

2.2.3 Charger Operation

The XP Series Uninterruptible Power Supply uses a dual-mode, temperature-compensated battery charger. During AC line operation, a charger winding on the ferroresonant transformer feeds the charger circuit which provides "float" and "equalize" charge voltages to the batteries. The circuit consists of a switching regulator, inductor and other associated components. The charger winding of transformer produces an AC voltage that is regulated by SCRs and filtered by the inductor. This produces a regulated DC battery charging voltage. The charge current passes through a resistor to provide current-limit sensing for the charging circuit. Fuses, located on the removable, Main Circuit Module assembly, protect the circuit in the event of charger malfunction or reversal of the battery leads (Refer to the component layout drawing at the back of the manual).

The standard control logic provides a constant (programmable) float charge to the batteries. A CHARGE MODE switch, located on the front panel of the power module, allows a technician to manually activate the charger's equalize mode which has a 1.2 hour duration. With the optional APM or USM logic upgrade installed, the equalize charging mode becomes an automatic user-programmable function.

When the XM Series module resumes LINE operation, the charger quickly recharges the batteries. The charge current is determined by the acceptance level of the batteries, but limited to 10 Amps maximum. As the batteries approach full charge, the charger's current tapers off to normal float levels.

The three color-coded LEDs on the XM front panel "CHARGER STATUS" block display charging modes. When lighted, the LEDs indicate FLOAT (green); EQUALIZE (yellow); and RECHARGE (red), representing a recharge rate greater than 7 Amps and tapering off to 3 Amps as the batteries become recharged.

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2.3 Pole Mount Enclosure Installation

To ensure operator safety:

1. Power supplies should be installed only by qualified personnel and in accordance with applicable electrical codes.
2. Use eye protection whenever working with batteries.
3. Use only sealed, lead-acid type batteries (gelled-electrolyte or equiv., 55 Ah min.)
4. Use a bucket truck, or suitable climbing equipment such as a safety harness and climbing spikes, whenever installing or servicing pole-mount installations.

2.3.1 Unpacking and Inspection

Carefully remove the power module and enclosure from their shipping containers. Make sure that the following items have been included:

1. XM Series Power Module (including BCK-HD battery cable kit).
2. PWE Pole-mount enclosure (with two, galvanized mounting brackets, SPI service power inserter, 20 Amp "HM" trip circuit breaker assembly with duplex receptacle). PWE, CE-1, UPE and UPE/M are optional enclosures. Batteries are shipped separately.
3. Operator's Manual.
4. Any other ordered options.

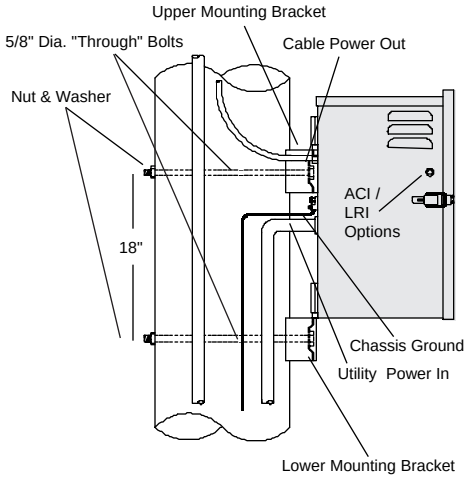
Inspect the contents. If items are damaged or missing, contact Alpha Technologies and the shipping company immediately. Most shipping companies have only a short claim period.

SAVE THE ORIGINAL SHIPPING CONTAINER.

In the event a unit needs to be returned for service, it should be packaged in its original shipping container. If the original container is not available, make sure the unit is packed with at least three inches of shock-absorbing material to prevent shipping damage. NOTE: Do not use popcorn-type material. Alpha Technologies is not responsible for damage caused by improper packaging on returned units.

READ THE OPERATOR'S MANUAL.

Become familiar with the power supply's front and side panel. Review the drawings and illustrations contained in the manual before proceeding. If you have questions regarding the safe installation or operation of this unit, contact Alpha Technologies or your nearest Alpha representative.



PWE Pole-mount Enclosures (Wood Poles)

2.3 Pole Mount Enclosure Installation, *continued*

PWE enclosures are designed to be mounted on wooden poles; however, special brackets are available for concrete pole applications. Mounting bolts should go completely through the wooden pole and be secured from the back with a large washer and nut. The two galvanized mounting brackets mount between the enclosure and pole. Most codes require the base of the enclosure to be located a minimum height from the ground. Always verify height restrictions before proceeding. (Refer to the pole-mount drawings located at the back of the manual.)

NOTE: THE MAJORITY OF POLES ARE THE PROPERTY OF THE LOCAL UTILITY. BEFORE INSTALLING AN ENCLOSURE, THE LOCATION AND THE METHOD OF MOUNTING MUST BE APPROVED BY THE UTILITY.

Wood Pole Procedure: (see opposite page)

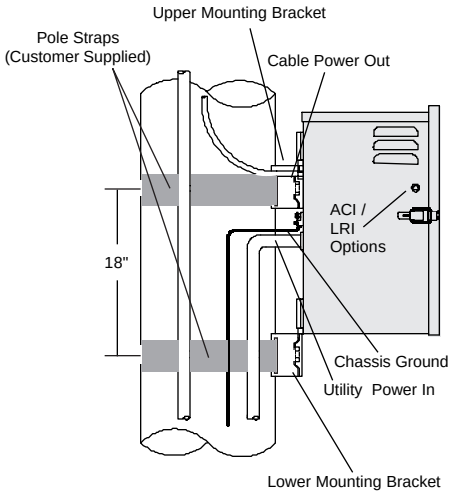
Materials required:	**Tools required:**
Two (2) 5/8" dia. machine bolts (UNC thread) SAE (Grade 5 or better), length to suit pole;	Auger or drill for boring 3/4" dia. holes in the wooden pole;
Two (2) 5/8" dia. zinc-plated flat washers;	Mallet or hammer;
Two (2) 5/8" dia. hex nuts (UNC thread).	Assorted sockets or wrenches.

1. Unpack the galvanized brackets and turn the enclosure face-down on a soft surface.
2. Slide one bracket up through the lower mounting strap on the rear of the enclosure. The bracket's flanges face away from the enclosure. Secure the lower mounting bracket using the 3/8" x 3/4" hex bolt (included).
3. Mark the position for the upper mounting bracket on the utility pole. Drill a 3/4" hole completely through the pole. Secure the bracket with a 5/8" machine bolt, washer and nut. Do not fully tighten the bolt at this time.
4. Position the enclosure on the upper mounting bracket. It may be necessary to slightly rock the enclosure and pull downward to properly seat it on the bracket. Center the enclosure on the pole.
5. Mark the hole for the lower mounting bracket. Lift the enclosure off of the top bracket and drill the lower hole. Spacing between the holes should be 18.0" on center.
6. Slide the enclosure back into place over the top bracket. Align the lower bracket with the hole and secure it with a 5/8" machine bolt, washer and nut. Tighten both brackets until the flanges seat into the wood.
7. The enclosure is now ready for the utility connection, power module and batteries.

Concrete / Steel Pole Procedure: (see below)

Materials required:	**Tools required:**
Two (2) Pole Straps (customer supplied) to fit pole. (straps must be stainless, galvanized or better)	Assorted sockets or wrenches.

1. Unpack the galvanized brackets and turn the enclosure face-down on a soft surface.
2. Slide one bracket up through the enclosure's lower mounting strap. The bracket's flanges should face away from the enclosure. Secure the lower mounting bracket using the 3/8" x 3/4" hex bolt included.
3. Position the upper mounting bracket on the pole and secure using a pole strap. Lift the enclosure onto the upper mounting bracket and pull downward to properly seat it. Center the enclosure on the pole.
4. Secure the lower mounting bracket on the pole using a pole strap.
5. The enclosure is now ready for the utility connection, power module and batteries.



PWE Pole-mount Enclosures (Concrete and Steel Poles)

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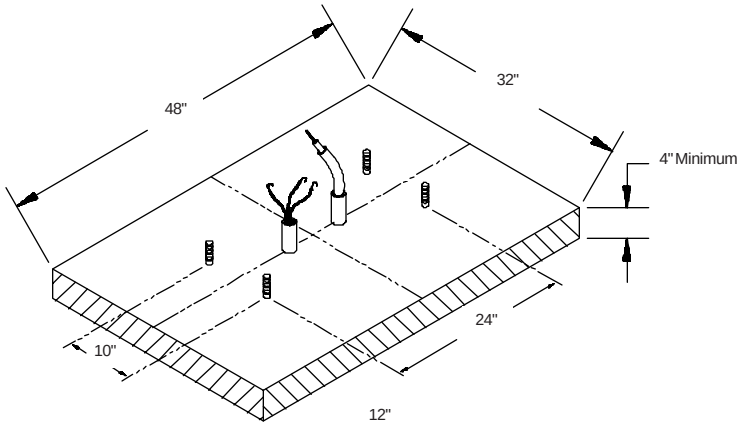
2.4 Ground-Mount Enclosures

UPE and UPE/M enclosures are designed to bolt directly to a Pedestal Support or concrete pad. Four 1/2" holes are provided in the base of the enclosure to accommodate 3/8" Anchor or J-bolts. Secure the enclosure using a flat washer, lock washer and 3/8" nut at each mounting bolt.

NOTE: Enclosures must be mounted flush with a smooth surface and not over-torqued to prevent damage.

2.4.1 Concrete Pad Preparation

UPE - Four 3/8" J-bolts should be centered with the pad 24" (side to side) and 10" (front to back). From the front of the pad, service conduits should be placed with the Utility entrance left of the center line; Cable TV to the right. If required, an 8' dedicated ground rod should be placed near the Utility conduit.

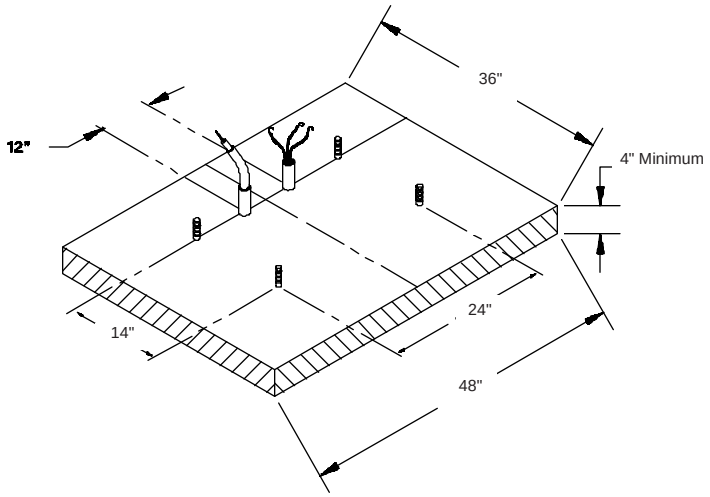


UPE
Concrete Pad

2.4 Ground-Mount Enclosures, *continued*

2.4.1 Concrete Pad Preparation, *continued*

UPE/M - Four 3/8" J-bolts should be centered with the pad 24" (side to side) and 14" (front to back). Service conduits should enter the pad between the rear mounting studs and 6" to either side of the pad's center line. From the front of the pad, Cable TV conduit should be placed on the left; Utility on the right. If required, an 8' dedicated ground rod should be placed near the Utility conduit.



UPE/M
Concrete Pad

NOTE: Pad sizes are approximate and can vary. Always consult local code requirements.

NOTE: For CE Series ground-mount enclosures, refer to the CE enclosure installation guide.

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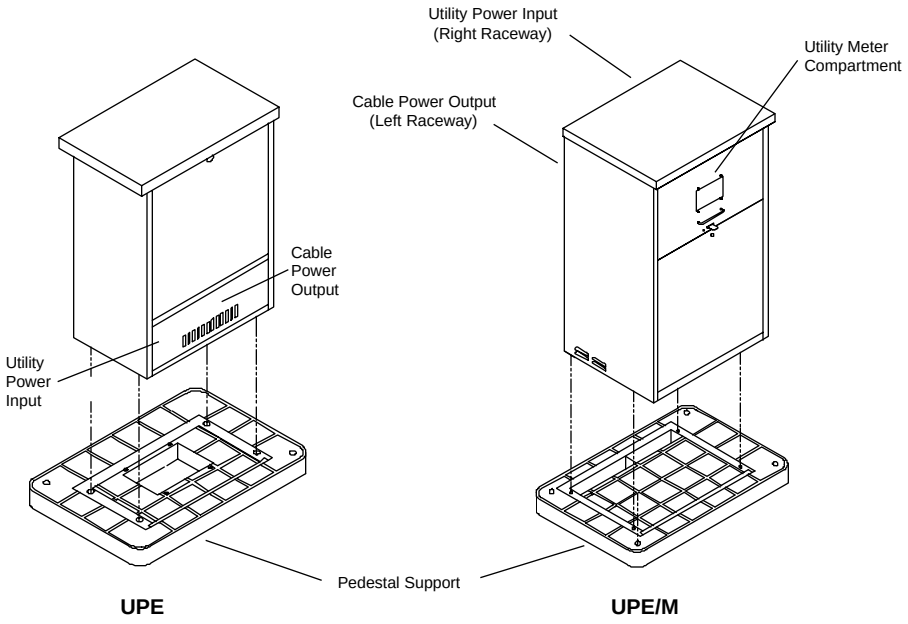
2.4 Ground-Mount Enclosures



UPE and UPE/M Ground-mount Enclosures

2.5 Connecting the Utility Power

CAUTION: THE FOLLOWING SHOULD BE PERFORMED ONLY BY QUALIFIED SERVICE PERSONNEL AND IN COMPLIANCE WITH LOCAL ELECTRICAL CODES. CONNECTION TO UTILITY POWER MUST BE APPROVED BY THE LOCAL UTILITY BEFORE INSTALLING THE POWER SUPPLY.

NOTE: UL, NEC, AND CSA REQUIRE THAT A SERVICE DISCONNECT SWITCH (UL LISTED) BE PROVIDED BY THE INSTALLER AND BE CONNECTED BETWEEN THE POWER SOURCE AND THE ALPHA POWER SUPPLY. CONNECTION TO THE POWER SUPPLY MUST INCLUDE AN APPROPRIATE SERVICE ENTRANCE WEATHER HEAD.

WIRING THE ENCLOSURE'S UTILITY SERVICE

Utility power enters the enclosure through a 1 1/8" opening at the bottom of PME, CE, UPE and UPE/M, and the rear of PWE. The enclosure accepts a standard electrical fitting. The UPE is equipped with a service entrance mounted in the small compartment at the bottom of the enclosure. The PME and PWE are equipped with a circuit breaker assembly located in the enclosure's module compartment. UPE/M is equipped with a dedicated utility raceway.

IMPORTANT NOTE: A "high-magnetic" trip breaker must be used in order to accommodate the high-inrush currents normally associated with the start-up of ferroresonant transformers (400 Amp, no-trip, first-half cycle). Do not replace this breaker with a conventional service entrance breaker. Alpha recommends Square D breakers because of increased reliability in this powering application.

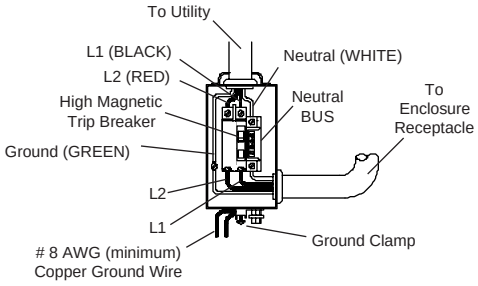
High-magnetic Square D circuit breakers are available from Alpha Technologies, as well as a BBX option which is a UL and CSA listed service entrance.

Description	Alpha Part No.	Square D
High Magnetic Trip Breaker (15A)	470-224-10	Q0215
High Magnetic Trip Breaker (20A)	470-017-10	Q0120HM
Ext. Service Disconnect	020-085-10	Q02-4L70RB

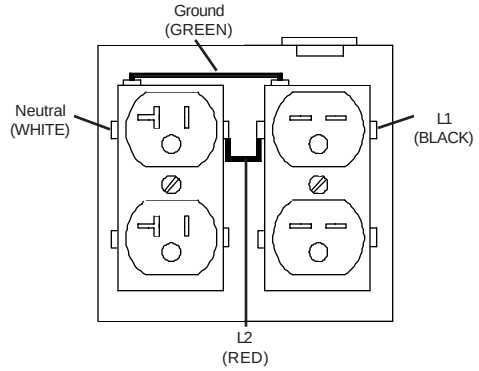
Wiring: (From duplex receptacle to service disconnect)

The enclosure is equipped with a 240 VAC duplex receptacle to provide power to the power supply and peripheral equipment. The receptacle is protected by a single, 2-pole, common trip 15 Amp circuit breaker located inside the service entrance. A grounding clamp, located on the enclosure, facilitates dedicated grounding. For 120 VAC service, the circuit breaker must be removed and replaced with a single 20 Amp, high magnetic trip breaker. The duplex receptacle must be replaced and rewired as well (see section 2.7 "Input Voltage Reconfiguration"). For 230 VAC applications, please consult your local codes for wiring, circuit breaker, and service entrance requirements.

In most cases, the following configuration qualifies for service entrance use, however, other codes may apply. Always contact your local utility to verify that the wiring conforms to applicable codes.



Typical 240 VAC Service Entrance Wiring



Dual Receptacle

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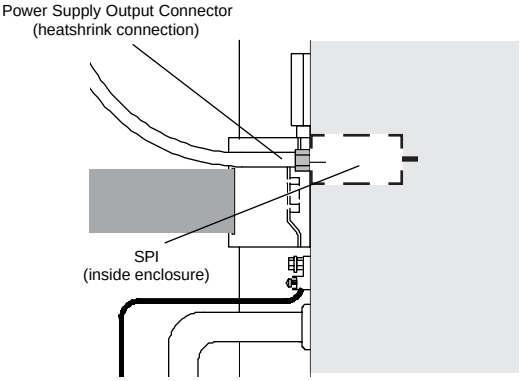
2.6 Connecting the Service Power Inserter (SPI)

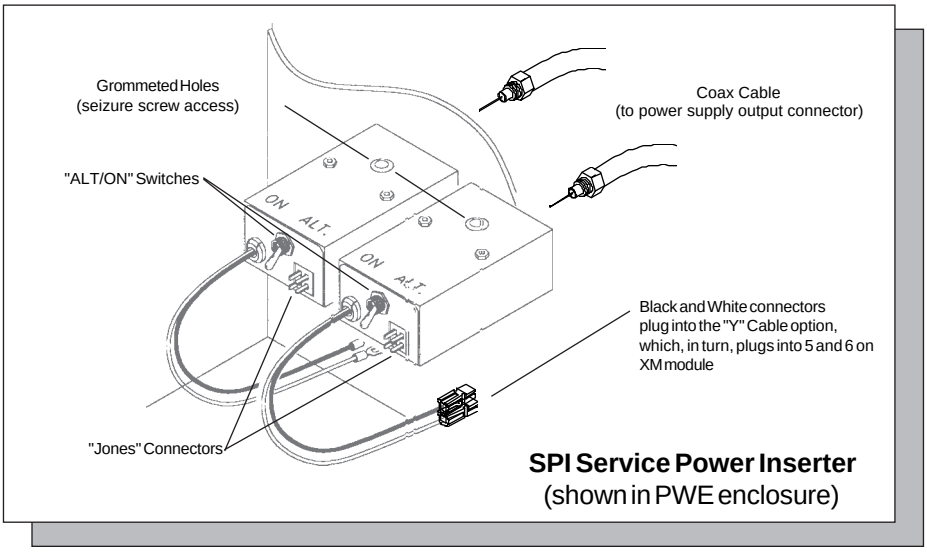
Procedure: (Refer to SPI drawing located at the back of the manual)

1. Prepare the incoming coaxial cable.
2. Remove the two screws from the Service Power Inserter and lift off the cover.
3. Loosen the seizure screw on the PCB, (located inside the SPI), to accommodate the center pin of the cable connector.
4. Screw the connector into the output port located on the rear of the PWE or UPE/M enclosure. Make sure the center pin slides through the seizure screw assembly. Heat shrink the external connection.
5. Tighten the seizure screw on the SPI so that the center pin on the cable connector is firmly clamped. If a connection is left loose, arcing could result and possible damage to the connector or SPI could occur.
6. Replace the cover on the SPI. NOTE: Make sure that the screws securing the SPI's internal PCB to its chassis are tight; otherwise, loss of power, arcing, or possible damage can occur. During routine maintenance, the seizure screw assembly can be accessed through the grommeted hole without removing the SPI's cover.
7. Once the module has been installed in the enclosure, the SPI connects to the"Y" Cable option which, in turn, connects to the AC OUTPUT connector #5 (White) and #6 (Black) on the XM side panel (See section 2.7).
8. Make sure that the "ALT/ON" switch, located on the Service Power Inserter, is in the "ON" position. When the switch is in the "ALT" position, the input is transferred to the SPI's "Jones" connector which is used with an alternative power source such as the Alpha XM90S Service Power Supply during module maintenance or replacement.



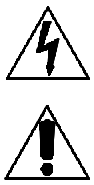
PWE Enclosure

Cable Connection to SPI



SPI Service Power Inserter
(shown in PWE enclosure)

2.7 Battery Installation and Wiring



WHENEVER INSTALLING OR REPLACING BATTERIES, DO NOT ALLOW LIVE BATTERY WIRES TO CONTACT THE ENCLOSURE OR THE POWER MODULE CHASSIS. Insulate any exposed wire ends with electrical tape. Shorting battery wires could result in a fire or possible explosion. Make sure that the power module's battery circuit is deactivated by switching the battery breaker OFF, or removing the battery fuse.

WEAR EYE PROTECTION WHENEVER WORKING WITH BATTERIES.

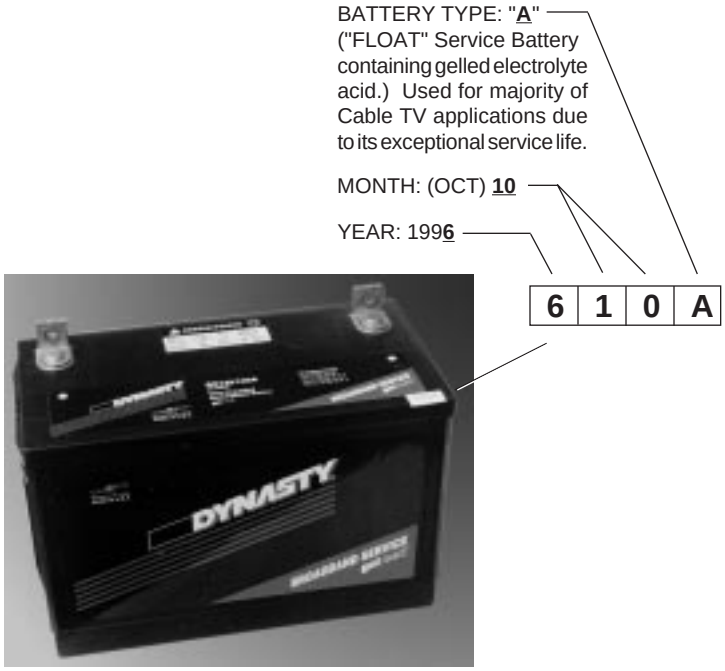
MAKE SURE THAT ALL BATTERY TERMINAL CONNECTIONS ARE TIGHT. Terminal connectors should be torqued to 75 inch-pounds at installation and then re-torqued to 50 inch-pounds during routine maintenance. Loose connections will cause the unit to operate improperly. Use an approved battery terminal coating such as NCP-2 to protect the terminals. If custom battery cables are made, they should be #6 AWG or larger and as short as practical. Battery terminals should be checked for corrosion and cleaned if necessary.

CHECK BATTERY POLARITY. Polarity identifications are clearly marked at the module's battery connector. A single battery connected backwards may go unnoticed until it is required to perform. In the event polarity becomes accidently reversed at the batteries, the battery circuit breaker will trip to protect the module.

IN ADDITION TO VOLTAGE CHECKS, ALWAYS INSPECT BATTERIES FOR SIGNS OF CRACKS, LEAKS OR SWELLING. If a battery has one or more defective (shorted or high impedance) cells, erratic operation or failure to provide standby power will result.

ALWAYS USE NEW BATTERIES WHEN FIRST INSTALLING A POWER SUPPLY. VERIFY THAT THEY ARE THE SAME TYPE OF BATTERY WITH AN IDENTICAL DATE CODE.

NEVER INSTALL OLD OR UNTESTED BATTERIES.
Whenever batteries have been in storage for more than 3 months, they should be recharged for (at least) 24 hours and checked under load prior to installation. Batteries with date codes older than 2 years should not be used unless thoroughly recharged and tested.



Typical Battery Date Code Location and Identification

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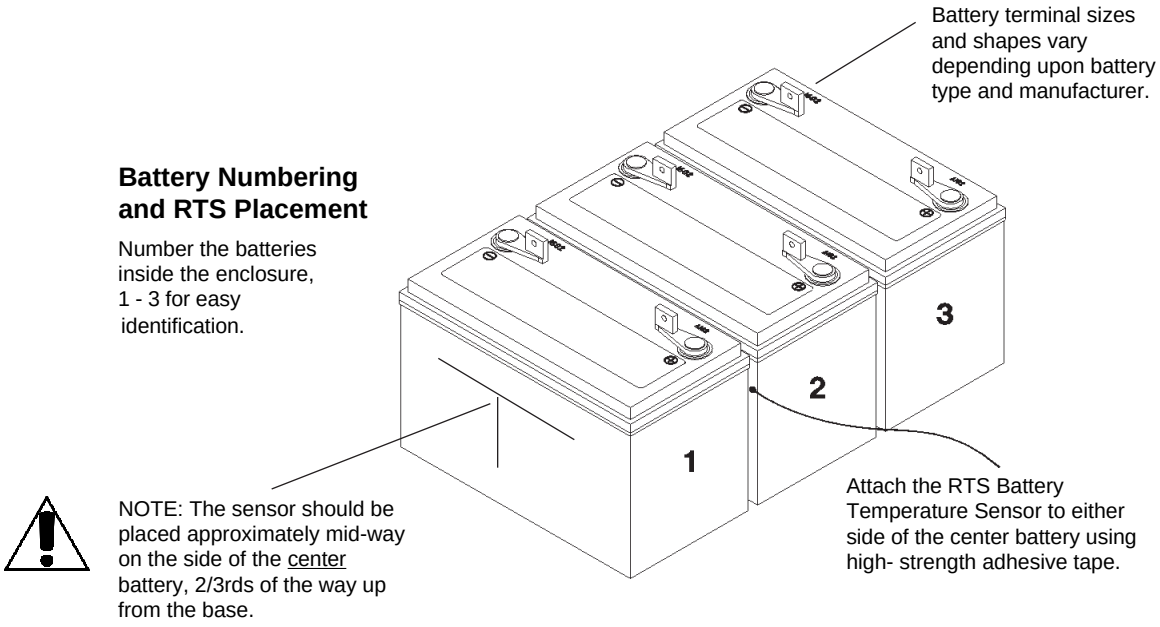
2.7 Battery Installation and Wiring, *continued*



RTS Temperature Sensor Placement

2.7 Battery Installation and Wiring, *continued*

Procedure: (Refer to the Battery Wiring drawing located on the next page and at the back of the manual)

1. Place the batteries with the positive terminals forward on the enclosure's shelf or slide tray. Position the batteries with maximum ventilation space between them (+/- 1").

2. Interconnect the three (or four) batteries in series (negative to positive). The optional in-line fuse, if included, should be connected to the positive terminal on the right-hand battery.

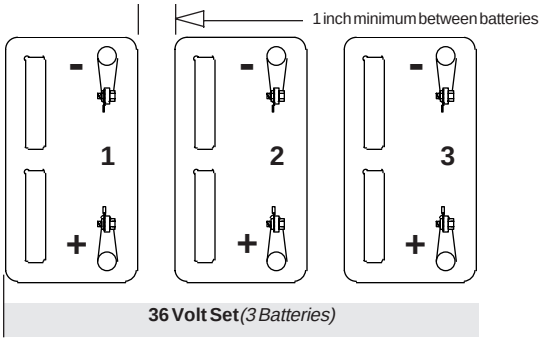
3. Route the lugged ends of the cable through the grommeted holes in the enclosure's shelf and into the battery compartment. Connect the red cable (+) to the positive terminal of the left-hand battery. Connect the black cable (-) to the negative terminal of the right-hand battery. Terminal connectors should be torqued to approximately 75 inch/pounds at installation and then re-torqued to 50 inch/pounds during routine maintenance.

4. Use a voltmeter to verify polarity and DC voltage at the module's battery connector. **Caution:** Whenever making or breaking battery connections, never allow live battery cables to contact the chassis. If necessary, wrap the lugs with electrical tape to prevent arcing and temporarily disconnect one of the leads from the center battery.

5. Number the batteries 1 - 3, left to right, using labels or masking tape. Record each battery's number and date code in the power supply's maintenance log.

6. Uncoil the Remote Battery Temperature Sensor (RTS) cable. Route the sensor end of the cable into the battery compartment and attach it to the side of the center battery using a high-strength adhesive tape (see previous page for exact placement). In the event the sensor is disconnected, or fails, a secondary sensor located on the main board of the XM module provides temperature compensation based upon ambient temperature inside the enclosure.

Do not reset the battery breaker until the module is running on AC LINE power.



Battery Placement and Spacing

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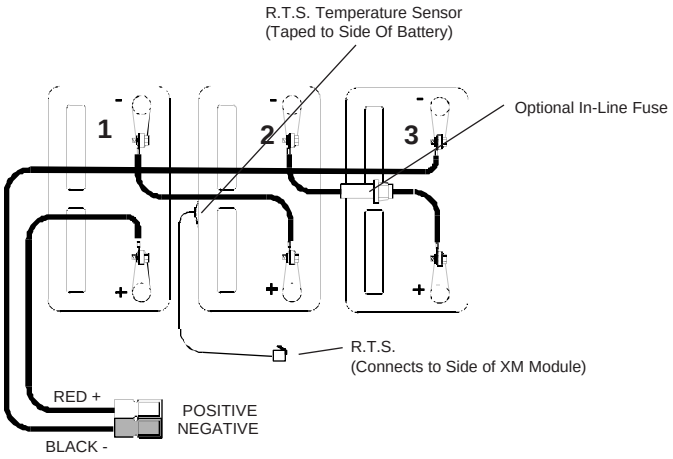
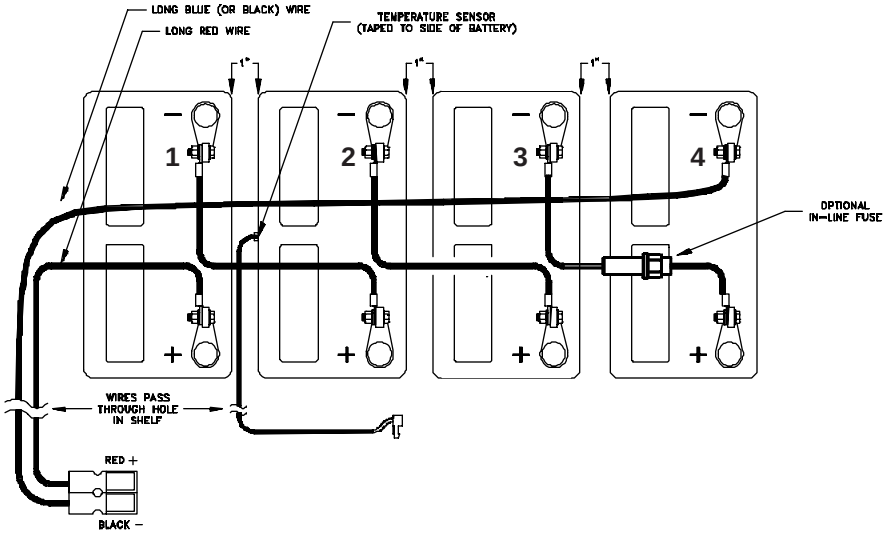
2.7 Battery Installation and Wiring, *continued*



XM Battery Connections for XM9015
(36 Volt Models)



XM Battery Connections for XM9015
(48 Volt Models)

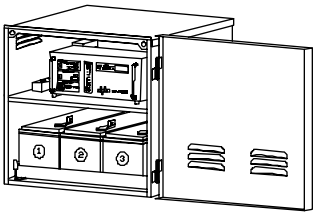
2.8 Power Module Installation

XM Series power modules are placed in the upper-right compartment of CE, PWE, UPE and UPE/M enclosures. The enclosure's lid lifts and the door(s) can be removed. (Refer to the Module and Battery Placement drawings located at the back of the manual).

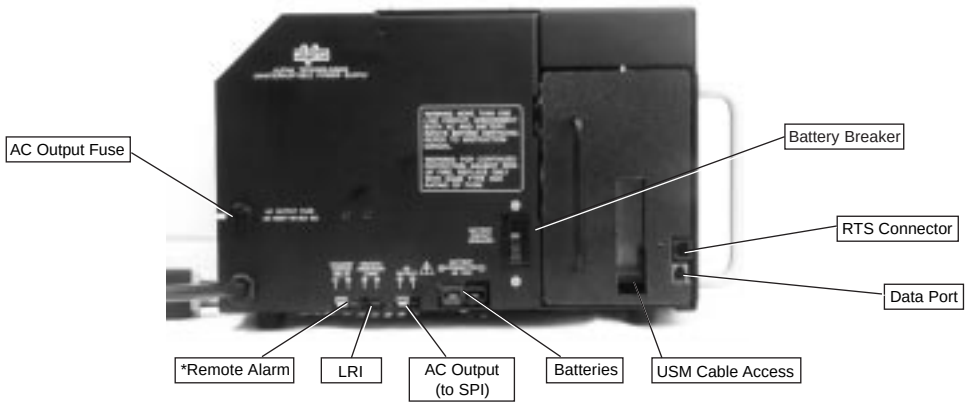
Procedure:

1. Set the XM Series power module on the enclosure's shelf.
2. Plug the connector from the SPI (Service Power Inserter) into the module's "AC OUTPUT" connector. Make sure that the SPI's "ALT/ON" switch is in the ON position. NOTE: If the installation includes an ACI lamp option, plug the lamp's connector into the module's "AC OUTPUT"; then, plug the SPI into the second connector on the ACI.
3. Switch the module's "BATTERY" circuit breaker OFF. This will prevent the inverter from starting when the batteries are first connected to the unit. NOTE: Do not switch the battery breaker ON until the power module is running on utility AC.
4. Plug the quick connects from the battery cable into the module's "BATTERY" connector. The connectors are keyed and color-coded to fit in one direction only.
5. If an optional LRI lamp (Local and Remote Indicator) is included, plug its cable into the module's "REMOTE INDICATOR LAMP" connector.
6. If remote alarms are included in the installation, the cable should be plugged into the module's "STANDBY STATUS RELAY connector. White (1) is configured common; Red (2) is configured "normally open" (contacts close when alarm is present).
7. If the module is equipped with a Remote Temperature Sensor, plug the connector into the RTS port (above the data port) located on the main circuit module assembly. Route the sensor end of the cable into the battery compartment.

NOTE: VERIFY BATTERY CHARGE VOLTAGES BEFORE STARTING THE POWER SUPPLY.



PWE Enclosure
(same placement for UPE and UPE/M)



XM Series Power Module

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2.9 Main Circuit Module Removal and Installation

The XM Series power module comes with a field-replaceable, main circuit module assembly containing the standard control logic. It is designed to accept APM (Automatic Performance Monitor) and USM (Universal Status Monitor) plug-in logic upgrades to facilitate self-testing and status monitoring. The removable module is located on the left side of the unit.

CAUTION: ALWAYS SWITCH THE BATTERY BREAKER OFF PRIOR TO REMOVING OR INSPECTING THE MAIN CIRCUIT MODULE ASSEMBLY.

DO NOT REMOVE THE MODULE ASSEMBLY DURING INVERTER OPERATION.

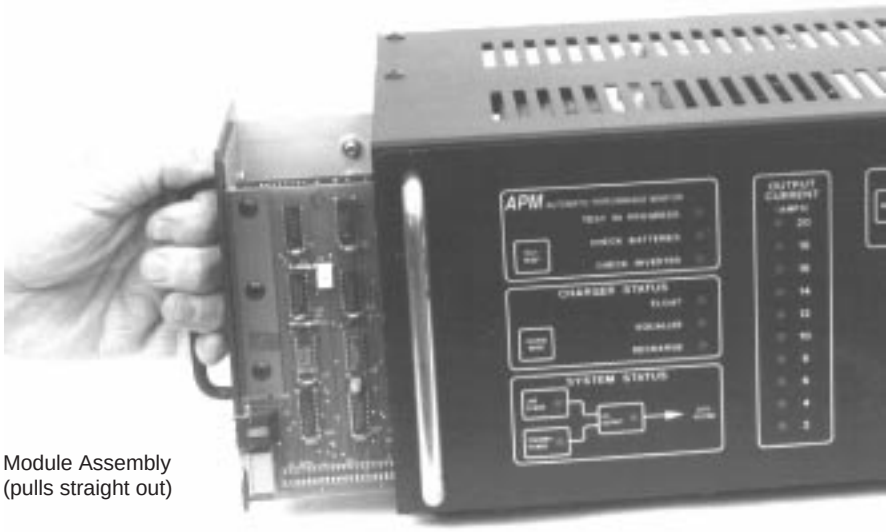
HANDLE THE CARD ASSEMBLY WITH EXTREME CARE. CIRCUIT BOARDS AND LOGIC UPGRADES ARE STATIC-SENSITIVE AND SUSCEPTIBLE TO DAMAGE. HANDLE THE CARD ASSEMBLY WITH EXTREME CARE. CIRCUIT BOARDS AND LOGIC UPGRADES ARE STATIC-SENSITIVE AND SUSCEPTIBLE TO DAMAGE.

WHEN RE-INSTALLING THE MODULE, MAKE SURE THE CARD EDGE CONNECTOR IS FIRMLY SEATED IN THE BACK PLANE ASSEMBLY.

Procedure:

1. To remove the main module assembly, grasp the handle on the left side of the unit. Pull firmly to release the module from the back plane assembly. Gently slide the module assembly straight out. It is designed so that the board can be removed while the power supply is operating on AC line power.
2. Verify that the correct battery charge voltages are selected. If an APM or USM logic upgrade is included, "Auto-Equalize" and "Auto-Test" switches must be set.
3. To reseat the main circuit module assembly, align it with the card guides and gently slide it back into the back plane assembly. Press the assembly firmly to seat it into the card edge connector.

NOTE: The Module Assembly can be rremoved while the power supply is running on line power. It will continue to operate as a non-standby power supply



Module Assembly
(pulls straight out)

Main Circuit Module

2.10 Standard Control Logic

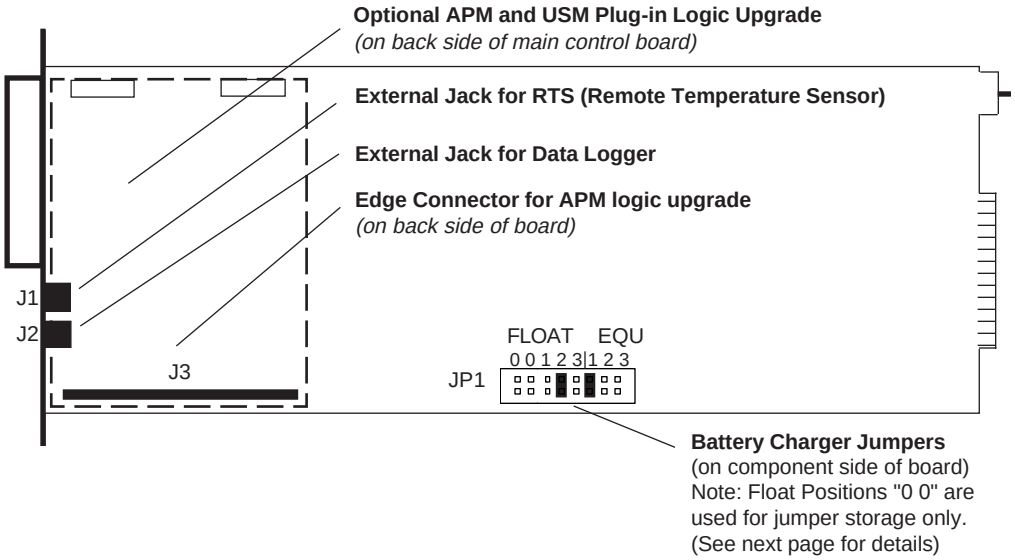
The Main Circuit Module assembly comes equipped with circuitry to monitor incoming AC, charge the batteries and control the inverter. The XM Series power module uses a dual-mode (float and equalize) temperature compensated battery charger to maintain the batteries. A Remote Temperature Sensor (RTS) plugs directly into the side of the module (the other end is attached to the side of the center battery in the battery compartment) to provide optimum temperature measurements. Battery charging voltages are factory set and do not need to be reset unless the module assembly has been repaired or has been tampered with, or when batteries (other than gelled-electrolyte) are being used. NOTE: Always verify the battery charger switch settings before placing the unit into service. The power module can be manually sequenced through its two charging modes by pressing the front panel "CHARGE MODE" switch. The XM's front panel "CHARGER STATUS" display indicates the charging mode.

2.10.1 Selecting Battery Charge Voltages

Always refer to the battery manufacturer's specifications before selecting float and equalize charge settings. Failure to do so could damage the batteries.

Procedure:

1. Remove the Main Circuit Module assembly from the left side of the power module.
2. Select the required float charge voltage by positioning the FLOAT jumper at JP1 located midway along the lower side of the main board (see illustration on below). **The jumper is factory set at FLOAT 2 (40.5V)** for a 36 volt battery string and can be repositioned if necessary. Each position (FLOAT 1, 2, 3) provides a different voltage (refer to the chart on the next page for 36 VDC and 48 VDC applications). If the jumper is removed, the float voltage will default to its 39.0 volt calibration level.
3. Select the required equalize charge voltage by positioning the EQU jumper located at JP1 on the main board. The EQUALIZE jumper adds 0.9V per setting above the value of the FLOAT setting. **The jumper is factory set at EQU 1 (0.9V)** and can be repositioned if necessary. Each position (EQU 1, 2, 3) will provide a different equalize voltage (refer to the chart on the next page for 36 VDC and 48 VDC applications). If the jumper is removed, the equalize voltage will default to 0.0 volts (39.0 volt float calibration level).
4. If the unit is equipped with APM or USM logic upgrades, set the "Auto-Equalize" and "Auto-Test" switches (section 2.10) before reseating the Main Circuit Module assembly. Refer to the illustrations on the following page.



Main Circuit Module Assembly

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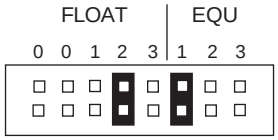
2.10 Standard Control Logic, *continued*

2.10.2 Float and Equalize Chart

In a typical 3-battery system (36 VDC), if a particular battery manufacturer calls for a FLOAT of 40.5 volts and EQUALIZE of 41.4 volts, set the board's FLOAT jumper to FLOAT "2" (40.5 volts) and the EQUALIZE jumper to EQU "1" (0.9 volts).

NOTE: The EQUALIZE value is added to the FLOAT voltage (i.e, 0.9 volts + 40.5 volts = 41.4 volts) to give the required EQUALIZE voltage.

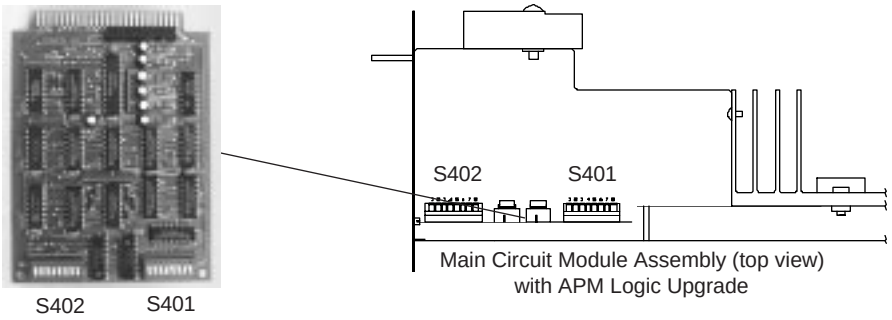


Jumpers JP1

FLOAT				EQUALIZE			
Jumper Position	36V Battery	48V Battery	VDC per Cell	Jumper Position	36V Battery	48V Battery	VDC per Cell
Default	39.0	52.0	2.167	Default	0.0	0.0	0.000
FLOAT 1	39.6	52.8	2.200	**EQ 1**	**0.9**	**1.2**	**0.050**
FLOAT 2	**40.5**	**54.0**	**2.250**	EQ 2	1.8	2.4	0.100
FLOAT 3	41.4	55.2	2.300	EQ 3	2.7	3.6	0.150

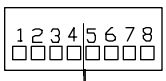
Values calculated at 77°F (25°C)

Alpha Technologies does not assume responsibility for batteries damaged by improper jumper settings. Always consult the battery manufacturer for correct charging levels. If batteries appear to be over or under-charged, first check for defective batteries and then verify the correct charge voltage settings.



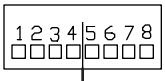
Main Circuit Module Assembly (top view) with APM Logic Upgrade

S402 (TEST)



	INTERVAL (in days)			DURATION (in minutes)	
	60 Hz	**50 Hz**		**60 Hz**	**50 Hz**
1.	6.1	7.3	5.	4.3	5.2
2.	12	14.5	6.	8.5	10.2
3.	24	29	**7.**	**17**	**20.4**
4.	**48**	**57.6**	8.	AOEQ	AOEQ

S401 (EQU)



	INTERVAL (in days)			DURATION (in minutes / hours)	
	60 Hz	**50 Hz**		**60 Hz**	**50 Hz**
1.	3	3.6	5.	17	20.4
2.	6	7.3	6.	34	40.8
3.	12	14.5	**7.**	**1.2 H**	**1.4 H**
4.	**24**	**29**	8.	2.3 H	2.8 H

APM LOGIC UPGRADE

2.11 Automatic Performance Monitor (APM)

The APM is a field-replaceable logic upgrade that allows the XM Series power module to self-test the inverter and batteries at pre-determined intervals and durations. It also allows the battery charger's equalize voltage (interval and duration) to be pre-selected to further optimize battery performance. The APM logic card plugs directly onto the main control board at connector J3 (see illustration on page 20).

NOTE: The Main Circuit Module assembly must be completely removed from the power module when installing the APM.

2.11.1 APM "Auto-Test" Interval and Duration Selection

Select self-test interval and duration settings at switch (S402) located on the APM logic card (see previous page). Positions 1, 2, 3 or 4 determine the test intervals; positions 5, 6 or 7 determine the test duration. When a DIP switch is in the ON position, the mode is activated. If none of the switch positions are selected, the mode reverts to its default setting (manual test only: 34 minute test duration on 60 Hz models; 40.8 minutes on 50 Hz models). If two switch positions are accidently selected for either interval or duration (i.e., 6 and 7), the mode reverts to the lower of the two settings.

NOTE: DIP switch #8 is used only to activate the "After Outage Equalize" (AOEQ) feature.

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2.11 Automatic Performance Monitor (APM), *cont'd.*

2.11.2 APM "Auto-Equalize" Interval and Duration Selection

Equalize increases the normal battery recharge voltage by the amount selected at the main board jumpers (Section 2.9.2). This feature is used to automatically send an equalize voltage to the batteries at predetermined intervals and durations. It is extremely useful in maintaining equal charges among individual battery cells.

Select Auto-Equalize interval and duration settings at switch (S401) located on the APM logic card (see previous page). Positions 1, 2, 3 or 4 determine the equalize intervals; positions 5, 6, 7 and 8 determine the equalize duration. When a DIP switch is in the ON position, the mode is activated. If none of the switch positions are selected, the mode reverts to its default setting (manual equalize only: 2.3 hour equalize duration on 60 Hz models; 2.8 hour equalize duration on 50 Hz models). If two switch positions are accidently selected for either interval or duration (i.e., 3 and 4), the mode reverts to the lower of the two settings.

The APM logic upgrade is also equipped with an "After Outage Equalize"**(AOEQ)** feature that automatically activates equalize mode after<u>every</u> standby event. This allows severely discharged batteries to be aggressively recharged after inverter operation to prepare for the next utility power outage. This feature is extremely useful in areas where long outages occur on a regular basis. AOEQ is activated by placing DIP switch #8 (S402) in the ON position. The AOEQ duration is determined by the duration setting on the equalize switch (S401).

CAUTION: Possible battery damage can occur if used incorrectly. Always refer to the battery manufacturer's recommendations for equalize charging before selecting AOEQ.

NOTE: Interval and Duration settings must be selected. DIP switches must be in the ON position to activate the mode.

2.12 Universal Status Monitor (USM)

The optional, USM status monitoring upgrade plugs directly into the APM logic card.

NOTE: The Main Circuit Module assembly must be completely removed from the power module when installing the USM (see section 2.8). Status monitoring interfaces are listed according to their manufacturer, along with the associated parts. The USM can also accommodate a tamper switch assembly to indicate unauthorized enclosure entries.

1. Remove the APM logic card from the Main Circuit Module assembly (if installed). Verify that the APM's Auto-Equalize and Self-test switches are in their desired positions. Plug the USM logic card into connector J3 (page 20) located on the component side of the APM card. Set the USM switches according to the status monitoring system you will be using (see following page). Plug the card into the Main Circuit Module assembly.

2. If a main board IC upgrade is included, carefully remove the IC (U8) from the main board assembly. Replace it with the one included with the USM upgrade kit. Position the IC with the notch to the left (pin 1 notch in the lower-left corner). Caution: The IC is static sensitive and can be easily damaged if not handled properly.

3. Reinstall the Main Circuit Module assembly.

NOTE: Make sure the assembly slides straight in and seats firmly into the card edge connector.

4. Plug the communications cable into the USM connector.

5. The cable fits in one direction only with the incoming cables to the right (see page 25).

6. Test the unit for normal operation.

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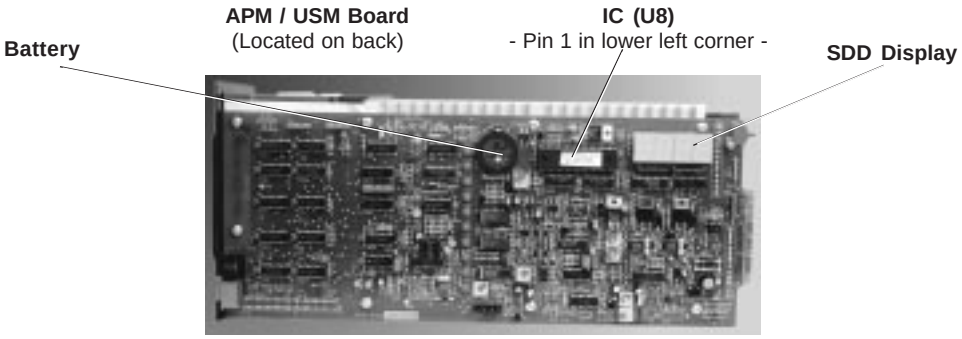
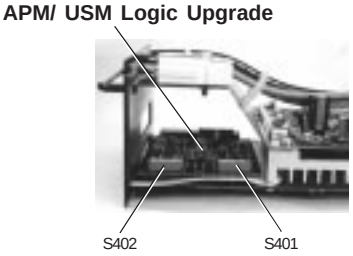
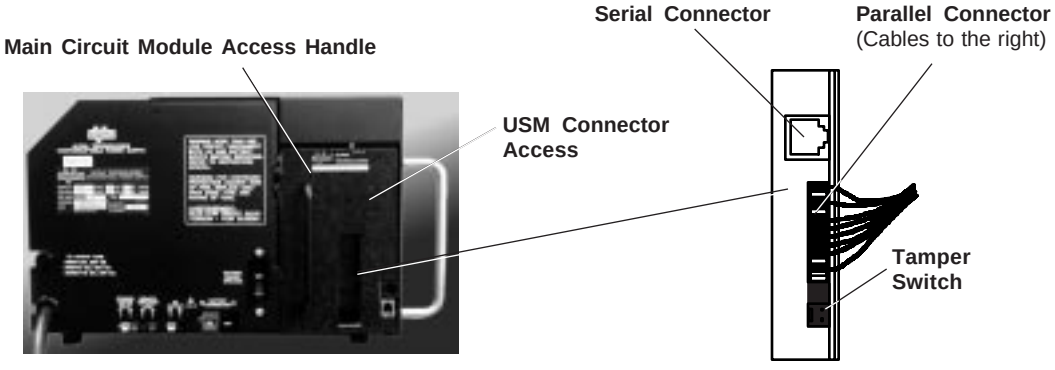
2.12 Universal Status Monitor (USM), *continued*



Main Circuit Module Assembly



Main Circuit Module Assembly (top view)



XM Series Side Panel with USM

NOTE: THE UNIT CAN CONTINUE TO OPERATE AS A NON-STANDBY POWER SUPPLY WITH THE MAIN CIRCUIT MODULE REMOVED.

2.12 Universal Status Monitor (USM), *continued*

	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10	P11	P12	P13	P14	SW4	SW1	SW2	SW3
	TAMPER SWITCH		TRI-STATE ALARM	OUTPUT ALARM	GENERAL ALARM	STANDBY ALARM	AUX. OUT SETTING	BATTERY VOLT SCALING	OUTPUT CURRENT SCALING	OUTPUT VOLTAGE SCALING					MODE SWITCH	ADDRESS SCALING		
USM-T TEXSCAN "VITAL SIGNS"	3	O	C	C	C	C	15V	1	1	P10,P11,P12 NOT USED			1	N/A	0	N/A	N/A	N/A
USM-AM/LL AM COMMUNICATIONS "LANguard"/JERROLD "LifeLine"	3	O	O	C	C	C	15V	1	1				1	N/A	0			
USM-C C-COR "QUICK ALERT"	3	O	C	C	C	C	15V	1	1				1	N/A	0			
USM-J JERROLD "RSM"	1	C	O	O	O	O	15V	3	3				3	3	1			
USM-M MAGNAVOX "6DSS"	3	O	O	C	C	C	5V	N/A	N/A				N/A	N/A	0			
USM-SA SCIENTIFIC ATLANTA "6587"	3	O	O	O	O	O	24V	1	1				3	1	0			
USM-SEG*	3	C	O	C	C	C	5V	1	1				1	N/A	0			
USM-SEG 48V BATT	3	C	O	C	C	C	5V	3	1				1	N/A	0			
USM-ADC	3	C	O	C	C	C	5V	1	1				1	N/A	0	↓	↓	↓
USM-AT Airtouch Teletrac	3	O	N/A	N/A	N/A	N/A	15V	N/A	N/A	N/A	N/A	N/A	N/A	N/A	1	0-9	0-9	1-9

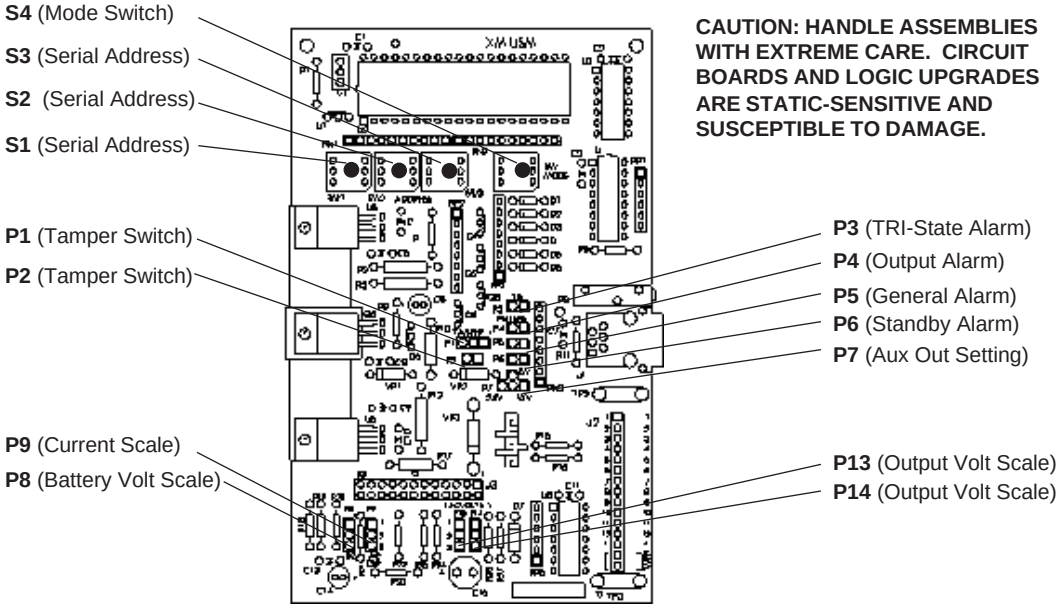
***Cheetah**

KEY:
O = Open
C = Closed
1 = Short pins 1 & 2
3 = Short pins 2 & 3

SWITCH SETTINGS
Parallel Configurations:
Address = 0; Mode = 0
Serial Configurations:
Address = 001-999; Mode = 1-6

Select the pin and switch settings according to your specific application.

Example: If configuring for a USM-SEG:**P1** requires the jumper across pins 2&3;**P2** has the pin jumper closed; **P3** has the pin jumper open; **P4, P5, P6** have their pin jumpers closed; **P7** is set to the 5V position; **P8, P9, P13,** require their jumpers across pins 2 & 3; **SW4** is set to 0.



CAUTION: HANDLE ASSEMBLIES WITH EXTREME CARE. CIRCUIT BOARDS AND LOGIC UPGRADES ARE STATIC-SENSITIVE AND SUSCEPTIBLE TO DAMAGE.

USM Pin Jumper and Switch Locations

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2.13 Input Voltage Reconfiguration

The input voltage of the XM9015 and XM1350T can be reconfigured from 240 VAC to 120 VAC; or from 120 VAC to 240 VAC, depending upon your powering requirements.

NOTE: Input voltage reconfiguration must be performed ONLY by qualified personnel.

WARNING: Before modifying the power supply, always consult local electrical codes for proper wiring procedures.

BEFORE STARTING -

The service entrance must have L1, L2, Neutral and Ground for 240 VAC applications. If it does not, contact the local utility to provide it. Always arrange to have the power switched OFF whenever replacing circuit breakers.

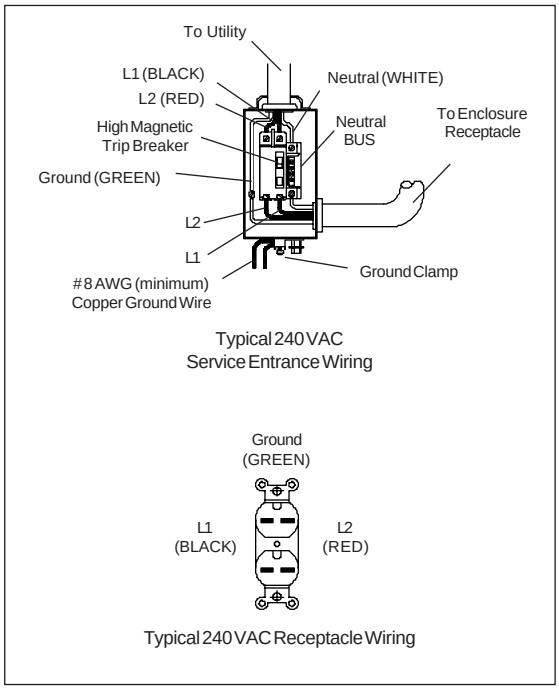
120 VAC to 240 VAC Procedure -

1. Verify that the service entrance is equipped L1, L2, Neutral and Ground.

2. With AC line power OFF, remove the circuit breaker from the service entrance. Connect L1 (BLACK) and L2 (RED) to a 2-pole common trip 15 Amp circuit breaker. Plug it into the service entrance's breaker slot. Verify that the neutral (WHITE) wire is connected to the neutral bus.

3. Replace the enclosure's convenience outlet with a 240 VAC, 15 Amp receptacle. It should be wired L1 (BLACK); L2 (RED); and ground (GREEN).

4. Replace the 120 VAC plug on the XM Series power cord. Alpha Technologies recommends using a 240 VAC, 15 Amp plug.



240 VAC Input Applications

2.13 Input Voltage Reconfiguration, *continued*

CAUTION: Before applying power to the XM power module, verify that the 240 VAC jumper on the backplane board is in place.

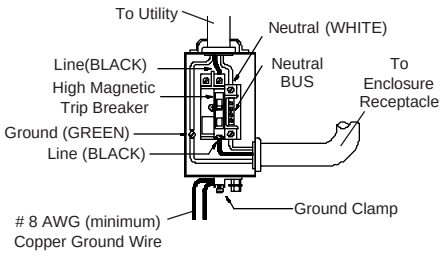
240 VAC to 120 VAC Procedure

1. With AC line power OFF, remove 2-pole circuit breaker from the service entrance. Terminate L2 using a wire nut and / or electrical tape. Make sure that there is no bare wire exposed. Connect L1 <line> (BLACK) to a 20 Amp, high magnetic trip breaker and plug it into the service entrance's breaker slot. Verify that the neutral (WHITE) wire is connected to the neutral bus.

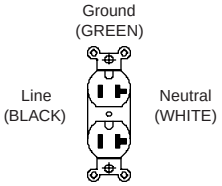
2. Replace the enclosure's convenience outlet with a 120 VAC, 20 Amp receptacle. It should be wired L1 <line> (BLACK); neutral (WHITE); and ground (GREEN).

3. Replace the 240 VAC plug on the XM Series power cord. Alpha Technologies recommends using a 120 VAC, 20 Amp plug.

CAUTION: Before applying power to the XM power module, verify that the 120 VAC jumper on the backplane board is in place.



Typical 120 VAC
Service Entrance Wiring



Typical 120 VAC, 20 Amp, Receptacle Wiring

120 VAC Input Applications

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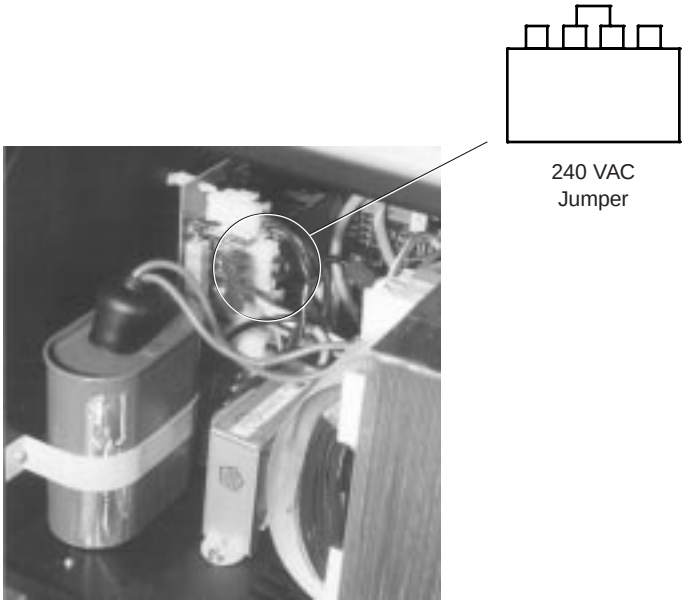
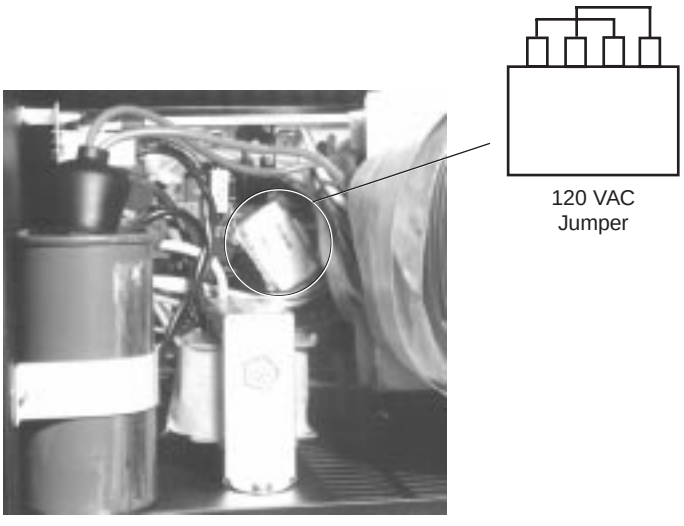
2.13 Input Voltage Reconfiguration, *continued*

The XM9015 and XM1350T can be reconfigured for 120 VAC operation by removing the 240 VAC jumper on module's backplane board and replacing it with the 120 VAC jumper cable-tied to the wire harness. Jumpers are supplied with each unit.



240 VAC Jumper
(connected to backplane board)



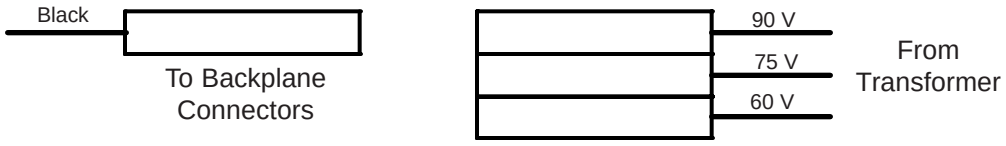
120 VAC Jumper
(cable-tied to wire harness)

Input Voltage Configuration Jumpers

2.14 Output Voltage Reconfiguration

The XM9015 and XM1350T are equipped with multiple output voltage taps (90, 75 and 60 VAC). The units are shipped from the factory configured for 90 VAC operation. To change the output voltage, locate the voltage connector coming from the left-side of the transformer (as seen facing the back of the power module). Move the single wire to the desired location on the connector (90, 75 or 60 VAC, top to bottom). The wires are tagged for easy identification.

CAUTION: Always verify the desired voltage using a voltmeter before placing a load on the power supply.



Output Tap Connector
(shown in 90 VAC configuration)

Output Voltage Configuration Taps
(from ferroresonant transformer)

Output Voltage Configuration Jumpers

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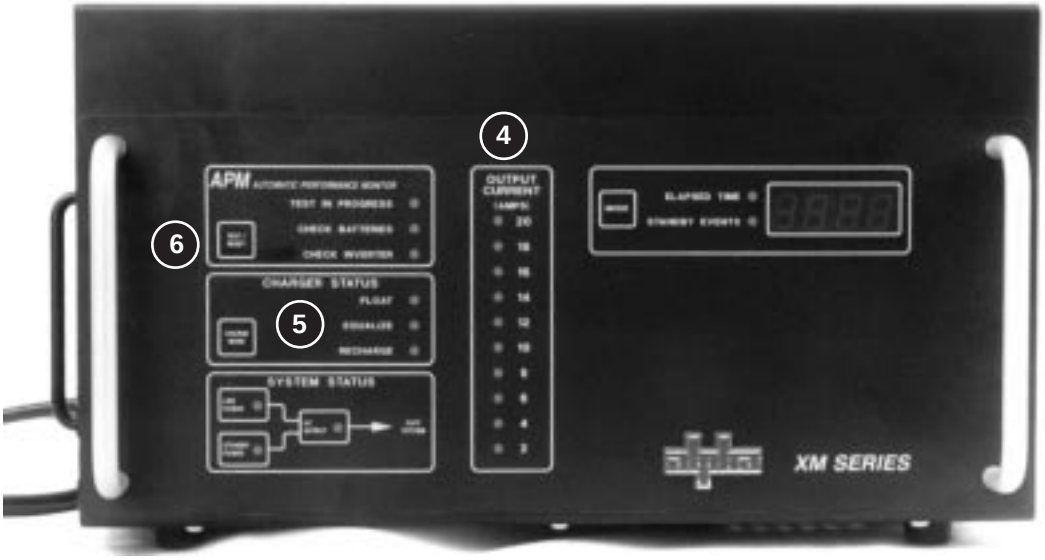
3.1 XM Power Module Start-up and Testing



XM Power Module Start-up and Testing
AC Line Operation (LINE POWER)

(Numerals refer to paragraphs on next page)

3.1 XM Power Module Start-up and Testing, *continued*

Once connections have been made to the power module, it should be tested for AC LINE and STANDBY operation before placing it into service.

NOTE: The power module should always be started from utility AC (not batteries). This is because high inrush currents, associated with the start-up of ferroresonant transformers, could place unnecessary stress on the batteries.

3.1.1 AC Line Operation (LINE POWER)

1. Plug the module's power cord into the enclosure's AC convenience outlet and switch the AC circuit breaker ON. The green, front panel "LINE POWER" LED will light to indicate AC LINE operation. The green "AC OUTPUT" LED will light as well to indicate acceptable output voltage.
2. Wait at least 1 minute and then reset the battery breaker on the side panel.
3. Use a true RMS voltmeter to verify AC output at the module's AC OUTPUT connector. If a non-RMS voltmeter is used, the output reading can vary by as much as 10% due to the "quasi" square wave output of the ferroresonant transformer.
4. Check the module's front panel "OUTPUT CURRENT DISPLAY" to verify output current. Current is displayed in 2 Amp increments.
5. Check the "CHARGER STATUS" block. If necessary, press the "CHARGE MODE" switch to place the charger into FLOAT. Once the green "FLOAT" LED lights, verify the voltage at the module's "BATTERY" connector. It should closely match the FLOAT setting on the main board assembly. Press the "CHARGE MODE" switch again to place the charger into EQUALIZE. Once the yellow "EQUALIZE" LED comes ON, verify the voltage at the "BATTERY" connector. The voltage should closely match the "EQU" setting on the main circuit board assembly (section 2.9). Note: The battery charger is temperature-compensating so the voltages may vary slightly, depending upon temperature. If the red "RECHARGE" LED is ON, the batteries will be drawing more than 7 Amps of charge current (tapering off to 3 Amps).
6. On units equipped with an APM logic upgrade, press the "TEST/RESET" button located in the APM status block to put the unit into self-test. The yellow "TEST IN PROGRESS" LED will come ON. If the logic card detects a problem, it will flash the red "CHECK BATTERIES" or "CHECK INVERTER" LED to indicate the circuit that has failed self-test. Press the "TEST/RESET" button once to cancel and return the module to AC LINE operation.

3.1.2 Inverter Operation (STANDBY)

1. With the unit operating from AC LINE power, indicated by the green "LINE POWER" and "AC OUTPUT" LEDs, switch the AC circuit breaker to OFF. The green "LINE POWER" LED will go out and the red "STANDBY POWER" LED will come ON to indicate inverter operation.
2. Use a true RMS voltmeter to verify AC at the module's "AC OUTPUT" connector.
3. Return the unit to AC LINE operation by switching the AC circuit breaker to ON. The green "LINE POWER" LED will light, indicating that AC LINE power is again available. It then takes 10 to 50 seconds for the unit to completely transfer back to utility power. This delay allows the utility voltage and frequency to stabilize before the module's phase-lock circuitry is activated. The module then synchronizes the inverter's waveform to the utility's before initiating a smooth, in-phase transfer back to utility power. Once the transfer is complete, the red "STANDBY POWER" LED will go out.
4. The XP Series power supply is now fully operational.

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3.2 Identifying Modes of Operation

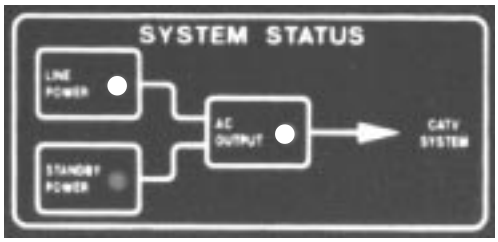
In order to fully understand the power supply functions, it is important to recognize the modes of operation indicated by the LEDs in the front panel SYSTEM STATUS, CHARGER STATUS, and optional APM blocks.

3.2.1 System Status Block

The SYSTEM STATUS block indicates the utility and battery input status, plus verifies the output of the power supply. The green AC OUTPUT LED should remain ON at all times.

3.2.1.1 AC LINE Operation

LINE POWER
LED (green) ON

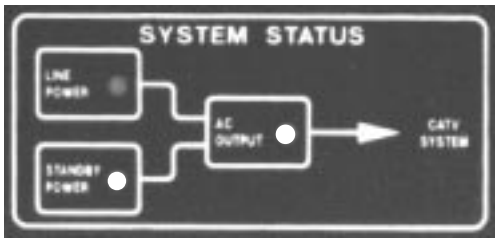


AC OUTPUT
LED (green) ON

Indicates Line operation with the power module operating on utility power. Power is available from the utility and acceptable voltage is present at the output. NOTE: On units manufactured after 7/96, the "LINE POWER" LED will flash to indicate low AC line conditions during STANDBY operation.

3.2.1.2 STANDBY Operation

STANDBY POWER
LED (red) ON



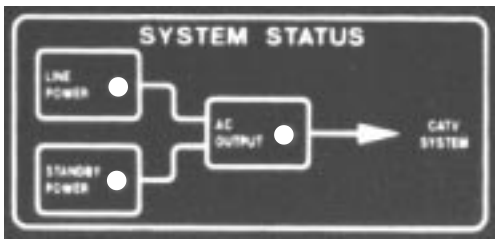
AC OUTPUT
LED (green) ON

Indicates Inverter operation using the batteries and inverter. Standby power is available from the batteries and acceptable voltage is present at the output.

3.2.1.3 TRANSFER or SELF-TEST Mode

LINE POWER
LED (green) LED ON

STANDBY POWER
LED (red) ON



AC OUTPUT
LED (green) ON

On standard XM units:

When all three LEDs are ON at the same time, the power module is in its transfer mode, preparing to transfer back to AC LINE power. The complete re-transfer takes approximately 10 to 50 seconds to ensure that incoming voltage and frequency has stabilized, and to allow the module to synchronize wave forms with the utility. When the transfer is complete, the red "STANDBY POWER" LED will go out.

Units equipped with APM or USM logic upgrades:

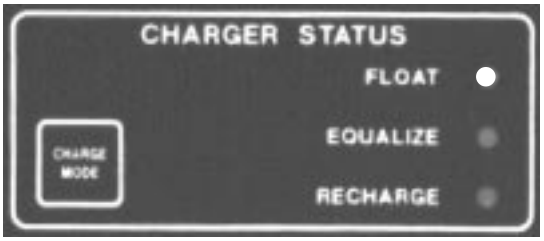
When all three LEDs are ON at the same time, the unit is in either its self-test or transfer mode. Check the yellow LED marked "TEST IN PROGRESS" in the APM block. If the LED is ON, the power module is in its self-test mode; if the LED is OFF, the power module is preparing to transfer back to AC LINE operation.

3.2 Identifying Modes of Operation, *continued*

3.2.2 Charger Status Block

The CHARGER STATUS block indicates the battery charging modes: FLOAT, EQUALIZE or RECHARGE. During AC LINE operation, the green "FLOAT" LED remains ON.

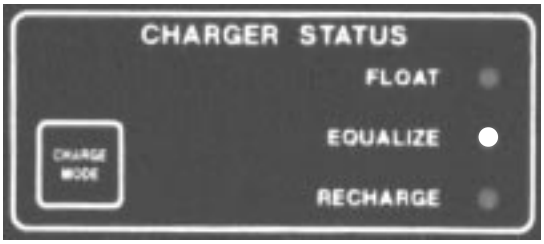
3.2.2.1 FLOAT Mode



FLOAT
LED (green) ON

Indicates that the batteries are being FLOAT charged.

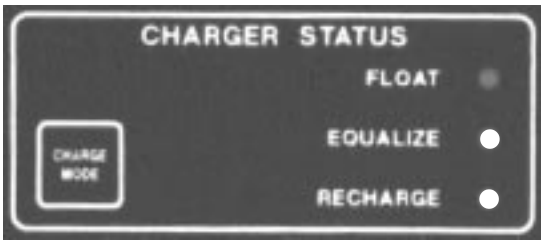
3.2.2.2 EQUALIZE Mode



EQUALIZE
LED (yellow) ON

Indicates that the batteries are receiving an EQUALIZE charge. On the standard XP Series power supplies, EQUALIZE can only be activated by pressing the "CHARGE MODE" switch.

3.2.2.3 RECHARGE Mode



Note:
FLOAT LED (green) or
EQUALIZE LED (yellow)
will also be ON

RECHARGE
LED (red) ON

Indicates that the batteries are drawing more than 7 Amps of current from the charger (tapering off to 3 Amps).

Note: On units equipped with APM or USM logic upgrades, either the "FLOAT" or "EQUALIZE" LED will also be ON during RECHARGE, depending upon the charger's mode.

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3.2 Identifying Modes of Operation, *continued*

3.2.3 APM (Automatic Performance Monitor) Status Block

On units equipped with an APM logic upgrade, the power module automatically self-tests the batteries and inverter at pre-selected intervals. If a failure is detected, either the red "CHECK BATTERIES" or red "CHECK INVERTER" LED in the APM status block will flash to indicate the circuit (AC or DC) that has failed.

3.2.3.1 SELF-TEST Mode

TEST IN PROGRESS
LED (yellow) ON

The yellow "TEST IN PROGRESS" LED indicates that the unit is in self-test mode.

3.2.3.2 BATTERY FAILURE

CHECK BATTERIES
LED (red) FLASHING

Indicates that one or more of the batteries are unable to carry the load and that maintenance is required. Under this condition, the power supply will not be able to support inverter operation. (Refer to Maintenance 4.2.8.2).

3.2.3.3 INVERTER FAILURE

CHECK INVERTER
LED (red) FLASHING

Indicates that the inverter has failed to produce AC and that maintenance is required. Under this condition, the power supply will not be able to support inverter operation. (Refer to Maintenance 4.2.8.3).

NOTE: If the enclosure's external LRI lamp is flashing, indicating that the power supply requires service, it can be cleared by pressing the "TEST/RESET" switch once; however, the front panel LEDs, "CHECK BATTERIES" or "CHECK INVERTER", cannot be cleared until the fault is corrected.

3.3 Power Module Shutdown

When a power module needs to be removed from service, an Alpha XM90-S Service Power Supply is recommended as an alternate non-standby power source to prevent interruption to the cable plant.

NOTE: When powering down a module, always switch the battery breaker OFF before removing AC, otherwise the module will transfer into inverter operation.

Procedure

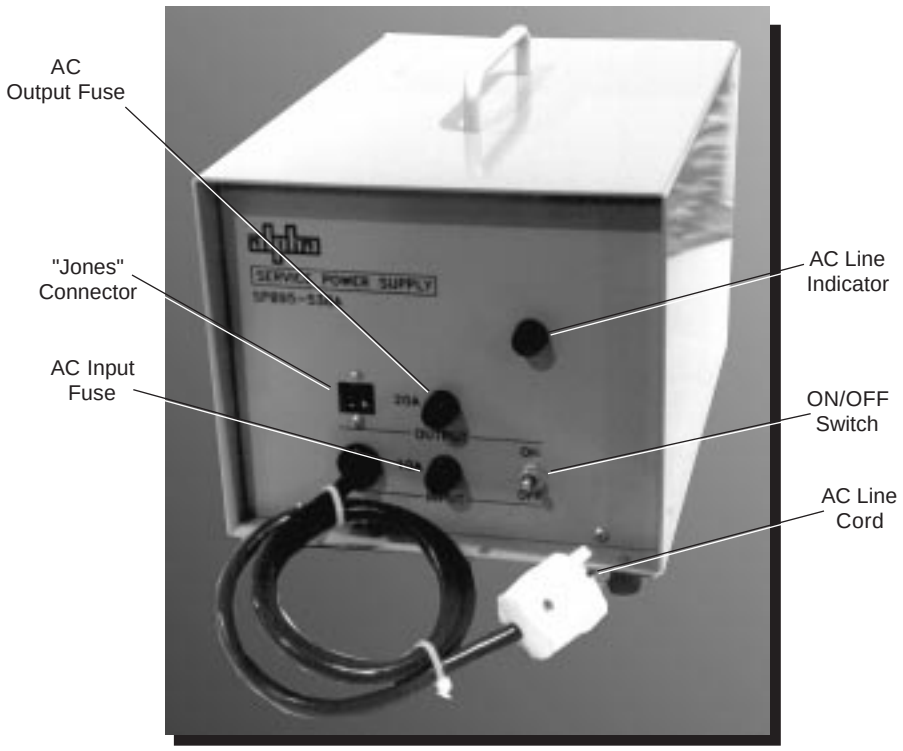
1. Plug the "Jones" connector into the SPI (Service Power Inserter) and the XM90-S.
2. Plug the XM90-S power cord into the enclosure's 240 VAC convenience outlet. Switch the XM90-S ON.

NOTE: Before proceeding, measure the voltage at the "Jones" connector to verify that it is configured for the desired voltage (90 / 75 / 60 VAC). If necessary, the XM90-S output voltage can be reconfigured by opening the case and moving the jumper at the transformer tap.

3. Toggle the switch on the SPI from "ON" to "ALT".
4. Switch the battery breaker on the side panel of the XM Series module OFF.
5. Unplug the XM Series module's power cord from the enclosure's convenience outlet.
6. Wait approximately 1 minute for the module's capacitors to fully discharge.
7. Remove the cables from the module's side panel connectors.
8. Carefully slide the power module out of the enclosure.

CAUTION: The ferroresonant transformer generates heat and may cause burns if handled with bare hands.

9. Reverse this procedure, when re-installing a module. Always test the power module before toggling the SPI's switch from "ALT" to "ON".



XM90-S Service Power Supply (SPB95-538A)

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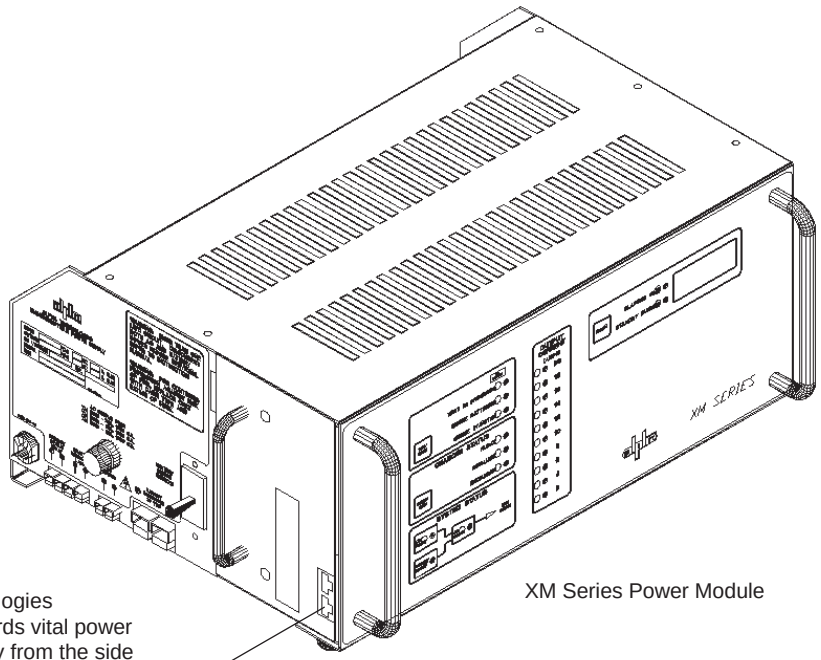
4.1 Data Retreival

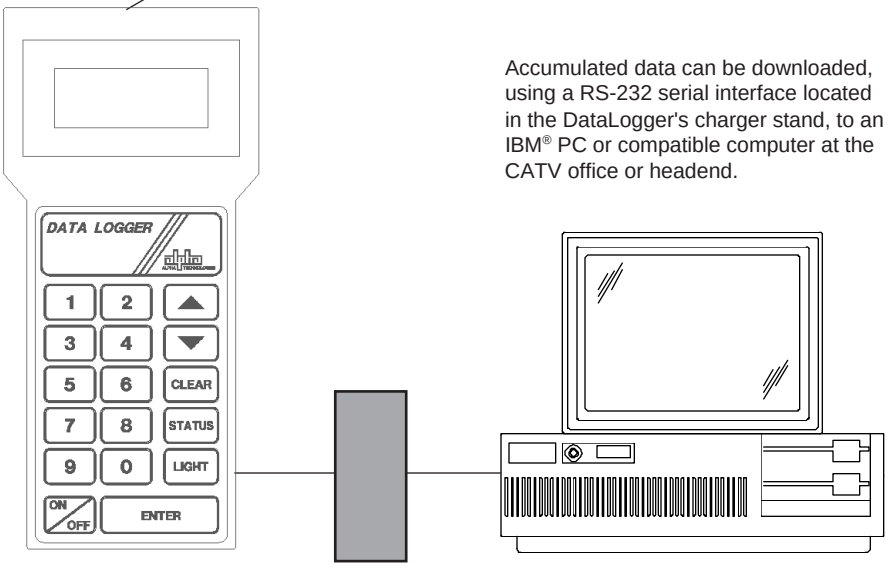
By automating data retrieval, log entry and consistent data formatting, overall maintenance time can be significantly reduced. Data, such as Input Line Voltage, Output Current, Battery Voltage, Battery Charge Voltage (float and equalize), Battery Charge Current, Inverter Events, Accumulated Inverter Run Time, Technician ID Number, Power Supply Address, Test Date and Time, can be retrieved and stored in the DataLogger.



XM Series Power Module

The Alpha Technologies "DataLogger" records vital power supply data directly from the side of the power module.

Accumulated data can be downloaded, using a RS-232 serial interface located in the DataLogger's charger stand, to an IBM® PC or compatible computer at the CATV office or headend.



DataLogger

DataLogger Charger Stand

DOS Compatible Computer

Preventive Maintenance using the optional DataLogger

4.2 Preventive Maintenance

Maintenance should be performed every three to six months. If the power module fails to perform a specific function, refer to the troubleshooting chart. By establishing a routine maintenance program and following the guidelines contained in this manual, the XP Series power supply will continue to provide years of trouble-free operation.

Care of the batteries should be the first step in any power supply maintenance program. In addition to voltage checks, visually inspect the batteries for signs of cracks, leaks or swelling. To aid in quick identification and tracing of voltages in the maintenance log, number the batteries inside the enclosure using labels or masking tape, etc. Because of a battery's chemical composition, it is temperature sensitive and susceptible to over and under-charging. Since batteries behave differently in the winter than they do in the summer, Alpha logic cards automatically compensate for changes in temperature by adjusting float and equalize charge voltages.

SAFETY PRECAUTIONS

THE POWER SUPPLY SHOULD BE SERVICED ONLY BY QUALIFIED PERSONNEL.

USE A BUCKET TRUCK, OR SUITABLE SAFETY EQUIPMENT (SAFETY HARNESS AND CLIMBING SPIKES), WHEN SERVICING POLE-MOUNT INSTALLATIONS.

USE HEAVY GLOVES WHEN HANDLING A POWER MODULE THAT HAS JUST BEEN TAKEN OUT OF SERVICE. THE FERRORESONANT TRANSFORMER GENERATES HEAT AND MAY CAUSE BURNS IF HANDLED WITH BARE HANDS.

NEVER ATTEMPT TO RECALIBRATE A LOGIC CARD IN THE FIELD, OTHER THAN SETTING BATTERY CHARGER VOLTAGE JUMPERS (SECTION 2.9) OR APM AUTOMATIC PROGRAM JUMPERS (SECTION 2.10).

ALPHA TECHNOLOGIES IS NOT RESPONSIBLE FOR BATTERY DAMAGE DUE TO IMPROPER CHARGER VOLTAGE SETTINGS. REFER TO THE CHARGE VOLTAGE CHART (SECTION 2.9) AND CONSULT THE BATTERY MANUFACTURER FOR CORRECT CHARGE VOLTAGE REQUIREMENTS.

WHEN REMOVING BATTERIES, ALWAYS SWITCH THE MODULE'S BATTERY BREAKER OFF BEFORE UNPLUGGING THE BATTERY CONNECTOR.

WEAR SAFETY GLASSES WHENEVER WORKING WITH BATTERIES.

Procedure:

4.2.1 Check Battery Terminals and Connecting Wires

Check each battery terminal and connection. Make sure the posts are clean and the crimped connectors are tight. Terminal connectors be torqued to 75 inch/pounds at installation and then re-torqued to 50 inch/pounds during routine maintenance. If there is an "in-line" fuse in the battery cable, check the fuse holder and fuse. Make sure the terminals are properly greased with an approved battery terminal corrosion inhibitor such as NCP-2.

4.2.2 Check Battery Open Circuit Voltage

Switch the battery breaker on the side panel of the power module to OFF. Disconnect the battery connector from the module and measure the individual voltage across each battery. The difference between any battery in the string should not be greater than 0.3 VDC. Defective or marginal batteries should be replaced with an identical type of battery.

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4.2 Preventive Maintenance, *continued*

4.2.3 Check Battery Voltage Under Load

This is the most accurate method to determine the condition of the batteries.

CAUTION: Weak or severely discharged batteries can explode when put under load. As an added safety precaution, place the enclosure's door between the technician and batteries before attempting inverter operation.

If the batteries appear functional, reconnect the battery connector to the power module and switch the battery breaker ON. Switch the AC circuit breaker OFF to put the unit into STANDBY mode. Measure individual battery voltages under load. There may be a rapid drop in voltage when the inverter first comes on, but it should stabilize within several minutes. The difference between any of the batteries should not be greater than 0.3 VDC. Replace defective or marginal batteries with an identical type of battery.

4.2.4 Check Battery Charger (FLOAT) Voltage

Reconnect the AC input and wait for 1 minute to allow the unit to return to AC LINE operation. The green, "LINE POWER" and "AC OUTPUT" LEDs in the System Status block will be ON. Make sure the green, "FLOAT" LED in the Charger Status block is ON. If necessary, press the "CHARGE MODE" switch once. Switch the battery breaker on the side of the power module OFF and disconnect the battery connector. Switch the battery breaker ON and measure the DC voltage across the contacts of the module's battery connector. Since the battery charger is temperature compensating, the charge voltage will vary depending upon the temperature measured at the batteries or inside the enclosure. The normal float charge for three gelled electrolyte batteries is approximately 41 VDC at 77^0F (25^0C) for 36 VDC systems. On hot days, the charge voltage will be several volts lower; on cold days, it will be higher. Record the float voltage in the power supply maintenance log. The jumpers at JP1 on the Main Circuit Module assembly are designed for easy calibration of float charge voltages for different battery types. Always refer to the battery manufacturer for correct voltages (See section 2.7).

4.2.5 Check Battery Charger (EQUALIZE) Voltage

Press the "CHARGE MODE" switch once on the front panel to activate the yellow, "EQUALIZE" LED. Measure the voltage across the contacts of the module's battery connector. Depending upon the equalize switch setting, the equalize voltage will be in increments of 0.9 VDC (per jumper setting) higher than float. Record the equalize voltage in the power supply maintenance log. Switch the battery breaker OFF and reconnect the batteries to the unit. Switch the battery breaker ON and press the "CHARGE MODE" switch once to return the charger to float mode. The jumpers at JP1 on the Main Circuit Module assembly are designed for easy calibration of equalize charge voltages for different battery types. Always refer to the battery manufacturer for correct voltages (See section 2.7).

4.2.6 Check Output Voltage

Measure the AC output voltage across the contacts of the module's output connector using a true RMS digital voltmeter. Output voltages should appear within +/- 5% of: 87VAC for 90V units; 73VAC for 75V units; and 63VAC for 60V units at a nominal 240 VAC line input.) Record the voltages in the maintenance log.

4.2 Preventive Maintenance, *continued*

4.2.7 Check Output Current

Check the module's output current. The front panel LED display is useful in determining the status of the output load. If none of the LEDs are lit, check the "AC OUTPUT" LED in the System Status block. If it is OFF, check the AC output fuse on the side panel. Also make sure that "ALT/ON" switch on the SPI is in the "ON" position. If the meter appears several Amps above the rated output of the module, a short circuit or overload condition exists in the load.

4.2.8 APM Manual Self-test

On units equipped with the APM (Automatic Performance Monitor) logic upgrade, self-test can be manually activated to trouble-shoot the batteries and inverter. Press the "TEST/RESET" switch once. The yellow "TEST IN PROGRESS" LED will come ON to indicate test mode. If a failure occurs, either the red "CHECK BATTERIES" or "CHECK INVERTER" LED will flash to indicate the circuit that has failed. To manually exit self-test and return the module to AC LINE operation, press the "TEST/RESET" switch once.

4.2.8.1 "TEST IN PROGRESS" (yellow) LED ON

The yellow "TEST IN PROGRESS" LED indicates that the unit is in self-test mode. The duration of the test is determined by the switch setting on the APM logic upgrade.

4.2.8.2 "CHECK BATTERIES" (red) LED FLASHING

If the red "CHECK BATTERIES" LED is flashing, it indicates that one or more of the batteries are unable to carry the load or that a connection in the battery circuit is malfunctioning. Make sure that the battery breaker on the side of the power module is not tripped. Check the battery terminals and crimped connectors on the battery cable kit. Measure individual battery voltages under load and replace the faulty battery if necessary. Reactivate the self-test mode to verify that the problem has been corrected.

4.2.8.3 "CHECK INVERTER" (red) LED FLASHING

If the red "CHECK INVERTER" LED is flashing, it indicates that the inverter has failed to produce AC at the output. Check the AC output fuse on the side of the power module and replace it if necessary. Reseat or replace the main circuit assembly. Reseat or replace the plug-in logic upgrade. Reactivate self-test to verify that the problem has been corrected. If the power module continues to fail self-test, it should be replaced.

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4.2 Preventive Maintenance, *continued*

4.2.9 Main Circuit Module and Logic Board Maintenance

SERVICE AND CALIBRATION SHOULD ONLY BE PERFORMED BY A QUALIFIED TECHNICIAN OR ALPHA SERVICE CENTER.

1. Carefully remove the Main Circuit Module assembly.

2. Inspect the assembly for signs of dust or corrosion.

NOTE: Circuit boards and logicupgrades are static-sensitive and should be handled with care. Clean with a damp rag or soft, non-metallic brush if necessary and allow to dry completely.

3. Clean the card edge connector with an alcohol-based cleaner (such as greaseless TV tuner cleaner). Also check the mating card edge connector inside the power module and clean if necessary.
4. Carefully tighten any screws used for mounting components to the heatsink. Make sure that plug-in attachments such as APM or USM logic upgrades are firmly seated. Do not over-tighten semiconductor mounting hardware.
5. If the module is equipped with a SDD (Standby Data Display), check the lithium battery, located on the front of the main board, and replace if necessary. Use Alpha #185-003-10, (3VDC).

NOTE: To test the Lithium Battery, follow these steps: Record the information that is stored in the SDD. Remove the Module and reinsert. If the stored information is lost, then the battery needs replacement.

6. Re-install the Main Circuit Module assembly and test the unit for proper operation.

4.2.10 Fuse Replacements

BATTERY CHARGER FUSE

The XM Series power module contains 2 internal fuses (F1 and F2) located near the heatsinks on the Main Module assembly. The 10 Amp slow-blow fuses protect the DC charger circuit. If the batteries appear under-charged, first check the terminal connections and measure the voltage at the "BATTERY INPUT" connector. If no charge voltage is present, check the fuses. If open, there may be a problem with the battery charger.

4.2.11 MOV Inspection

The XM module contains 2 MOVs (Metal Oxide Varistors) located near the input terminal block. If either MOV is darkened or destroyed, see section 4.2.14 "Trouble Shooting Guide."

4.2 Preventive Maintenance, *continued*

4.2.12 Repair Instructions

Before returning a unit to Alpha Technologies for repair, a Return Material Authorization (RMA) should first be obtained from Alpha's Customer Service Department. The RMA number should be clearly marked on the unit's original shipping container. If the original container is no longer available, the UPS should be packed with at least 3 inches of shock-absorbent material.

NOTE: Do not use popcorn-type packing material. Returns should be prepaid and insured (COD and freight collect can not be accepted).

ALPHA TECHNOLOGIES DOES NOT ASSUME RESPONSIBILITY FOR DAMAGE CAUSED BY THE IMPROPER PACKAGING OF RETURNED UNITS.

4.2.13 Parts and Ordering Instructions

To order parts, contact the Alpha Technologies Customer Service Department directly at:

United States & Latin America	360-647-2360
Canada & Asia Pacific	604-430-1476
United Kingdom	44-1279-422110
Germany	49-9122-997303
Middle East	357-5-375675
Australia	612-894-7866

TO OBTAIN COMPLETE TECHNICAL SUPPORT
(7 DAYS / WEEK, 24 HOURS / DAY)
CALL

1-800-667-8743
(Inside Canada)

1-800-322-5742
(Inside the United States)

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4.2 Preventive Maintenance, *continued*

4.2.14 Trouble-Shooting Guide

SYMPTOM	PROBABLE CAUSE	REMEDY
No output to cable; No AC line power; Green “AC OUTPUT” LED OFF; Green “LINE POWER” LED OFF;	Utility power outage. input voltage at receptacle.	Use voltmeter to verify
	AC power cord unplugged.	Plug in AC power cord.
Red “STANDBY POWER” LED OFF:	AC input circuit breaker tripped.	Reset AC circuit breaker.
	Battery breaker tripped.	Reset battery breaker.
	In-line fuse open (BCK-FX).	Replace fuse.
	Battery cable disconnected.	Connect battery cable.
	Battery voltage below Low Voltage Cutout threshold from extended power outage. (Batteries have been automatically disconnected by main control board to prevent over-discharging).	If alternative power source is available, connect the power module and allow it to recharge the batteries.
	Marginal battery capacity.	Check batteries and replace if necessary.
Green "AC OUTPUT" LED OFF All AC Output Current Indicators ON.	Overload / short circuit on output.	Find and correct overload / short circuit on output.
No output to cable; AC line power available; Green “AC OUTPUT” LED OFF; Green “LINE POWER” LED ON:	AC output fuse open.	Replace fuse.
No output to cable; No AC line power; Green “AC OUTPUT” LED OFF;. Red “STANDBY” LED ON:	AC output fuse open.	Replace fuse.
Incorrect output voltage:	Wrong type of voltmeter used.	Use true RMS meter.
	Under-loaded output (less than 1 Amp).	Connect load.
	Over-loaded output.	Reduce load.
	Faulty resonant capacitor (will appear swollen or distorted; may leak oil).	Replace capacitor.

4.2 Preventive Maintenance, *continued*

4.2.14 Trouble Shooting Guide, *continued*

SYMPTOM	PROBABLE CAUSE	REMEDY
Low output voltage when unit is in STANDBY mode:	Defective inverter transistors.	Replace main circuit module.
No output voltage when attempting to transfer from LINE to STANDBY; "Clicking" sound from contactor:	Battery Breaker OFF	Switch battery breaker ON.
	Battery voltage below recharge acceptance level.	Check battery voltages; check terminal connections; charge or replace battery(s) if necessary.
	High resistance at battery connector.	Check battery open circuit voltages; clean and tighten each connection; replace faulty battery.
Module does not transfer from STANDBY to LINE mode Contactor "clicks" periodically:	Low AC line voltage when input power is restored:	Use voltmeter to verify nominal voltage at receptacle.
	High impedance AC line.	Check all connections. Check for correct wire gauges. Shorten cables to AC utility.
	Faulty logic.	Replace main circuit assembly.
Batteries will not charge:	Battery breaker OFF.	Switch battery breaker ON.
	Faulty batteries.	Check open circuit voltage; Check voltage under load; Check terminals and connecting wires. Replace faulty battery(s).
	Charger fuses F1 and F2 open (on main circuit module).	Replace fuses.
	Faulty charger circuit.	Replace main circuit module.

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4.2 Preventive Maintenance, *continued*

4.2.14 Trouble Shooting Guide, *continued*

SYMPTOM	PROBABLE CAUSE	REMEDY
Incorrect, or no float or equalize charge voltages:	Battery breaker OFF.	Switch battery breaker ON.
	Jumpers at JP1 incorrectly set on main circuit module.	Check jumpers. (See section 2.9).
	Charger fuses F1 and F2 open (on main circuit module).	Replace fuses.
	Faulty logic.	Replace main circuit module.
Battery breaker trips when attempting to transfer from LINE to STANDBY mode:	Faulty Logic	Replace main circuit module
10 Amp charger fuse F1 and F2 (on main circuit module) open:	Faulty fuses	Replace fuses.
	Faulty charger circuit.	Replace power board and/or main circuit module.
	Defective charger transistors.	Replace main circuit module.
MOV(s) in back of XM module darkened or destroyed:	Lightning or other transient damage on the input.	Remove all power from XM and replace both MOVs.
Red "CHECK BATTERIES" LED and LRI lamp (if installed) flashing:	Low or no battery voltage during APM self-test mode.	Check battery circuit breaker. Check battery fuse if installed. Check terminals and connectors. Check open circuit voltage. Check voltage under load. Replace batteries.

4.2 Preventive Maintenance, *continued*

4.2.14 Trouble Shooting Guide, *continued*

SYMPTOM	PROBABLE CAUSE	REMEDY
Red "CHECK INVERTER" LED and LRI lamp (if installed) flashing:	Short on output during APM self-test mode.	Check for short. Press "TEST/ RESET" switch to re-test.
	Output fuse open. Loss of AC output duringAPM self-test mode.	Replace output fuse. Press "TEST/RESET" switch to re-test.
	Loss of AC output during APM self-test mode.	Replace main circuit module.

RECOMMENDED SPARE PARTS

XM 9015 / 240 VAC

QTY.	PART NUMBER	DESCRIPTION
2	744-035-47	Plug-In Module
10	460-057-10	20 Amp, Output Fuse

XM1350T, 240 VAC

QTY.	PART NUMBER	DESCRIPTION
1	744-035-49	Plug-In Module
10	460-179-10	30 Amp, Output Fuse

XM 9015/1350T

QTY	PART NUMBER	DESCRIPTION
10	460-102-10	Charger Fuse, F1, F2
10	390-004-10	LRI Lamps for 36V, 48V
10	390-006-10	ACI Lamp for 60V output
or	392-030-10	ACI Lamp for 90V output
5	020-098-22	LA-P-E 250V Lightning Arrestor
10	740-142-20	MOV Assembly 120V, 2/unit
2	700-106-20	APM Card
2	020-019-31	SPI, PME/PWE/PMV
2	700-150-29	USM-SEG

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5. SPECIFICATIONS

5.1 Input/Output Voltages

	Model	Input		Output			Battery Voltage
		Volts AC	Amps Max *	Volts[1]	Amps	Watts	
60 Hz	**XM1350T-48**	240	7.9	90	15	1350	48
		240	7.9	75	18	1350	48
		240	7.9	60	22.5	1350	48
		120	15.8	90	15	1350	48
		120	15.8	75	18	1350	48
		120	15.8	60	22.5	1350	48
	XM9015	240	7.9	90	15	1350	36
		240	6.9	75	15	1125	36
		240	5.8	60	15	900	36
		120	15.8	90	15	1350	36
		120	13.8	75	15	1125	36
		120	11.7	60	15	900	36

* at nominal line voltage
Specifications @ 77°F (25°C) @ full load.

NOTE: "-48" models utilize a 48 VDC battery system; All other models listed utilize a 36 VDC battery system.

The output voltages of the XM1350T-48, XM9015 and XM9015E are selectable for 60, 75 or 90 VAC operation.

[1] The actual measured output voltage may vary slightly from the given spec. Output voltages are based on +/- 5% of: 87VAC for 90V units; 73VAC for 75V units; and
63VAC for 60V units. This is to ensure that the output voltage of the power supply
never exceeds 90V RMS or drops below 60V RMS, under normal operating conditions.

5.2 General Specifications

Regulation	
Input Voltage (VAC)	+10 / -20%
Input Frequency (Hz)	+/- 3%
Output Voltage (VAC)	+/- 5%
Output Frequency (Hz)	+/- 1%
Inverter Frequency Stability	+/-0.05%
Output Current Limit	150% of maximum output rating
Transfer Time	Uninterrupted Output
Efficiency	90% or better (LINE)
	80% typical (STANDBY)
Battery Type	AGM Technology 12VDC, 90Ah batteries
Battery Low Voltage Cutout	10.5 VDC per battery (1.75 Volts per cell)
36 VDC Systems	31.5 VDC
48 VDC Systems	42.0 VDC
Battery Recharge Acceptance	
36 VDC Systems	37.5 VDC (typical)
48 VDC Systems	50.0 VDC (typical)
Battery Float Charge Voltage	2.16 VDC to 2.30 VDC per cell
36 VDC Systems	39.0 VDC to 41.4 VDC (selectable)*
48 VDC Systems	52.0 VDC to 55.2 VDC (selectable)*
Battery Equalize Charge Voltage	2.16 VDC to 2.45 VDC per cell
36 VDC Systems	39.0 VDC to 44.1 VDC (selectable)*
48 VDC Systems	52.0 VDC to 58.8 VDC (selectable)*
Temperature Compensation	
36 VDC Systems	-0.05 Volts/°F (-0.09 Volts/°C)
48 VDC Systems	-0.07 Volts/°F (-0.12 Volts/°C)
Battery Charging Current	10 Amps maximum
Battery Recharge Time	12 hours typical (from low cutout) with 75 Ah batteries
Operating Temperature Range	-40° to +131°F (-40° to +55°C)
Finish	Black, Polyester Powder Paint

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5.2 General Specifications, *continued*

Dimensions

Enclosures:

PWV	24.75" W x 36.75" H x 14.2" D
PWE	24" W x 24" H x 14" D (610mm x 610mm x 356mm)
UPE	28" W x 35.3" H x 17" D (711mm x 889mm x 432mm)
UPE/M	28" W x 45" H x 21.3" D (711mm x 1143mm x 540mm)

XM 90V Modules:

15.0" W x 8.75" H x 14.3" D (381mm x 223mm x 364mm)

Weights

Enclosures:

PWV	58 lbs. (26.4 kg)
PWE	47 lbs. (21.4 kg)
UPE	66 lbs. (30.0 kg)
UPE/M	124 lbs. (56.4 kg)

Modules:

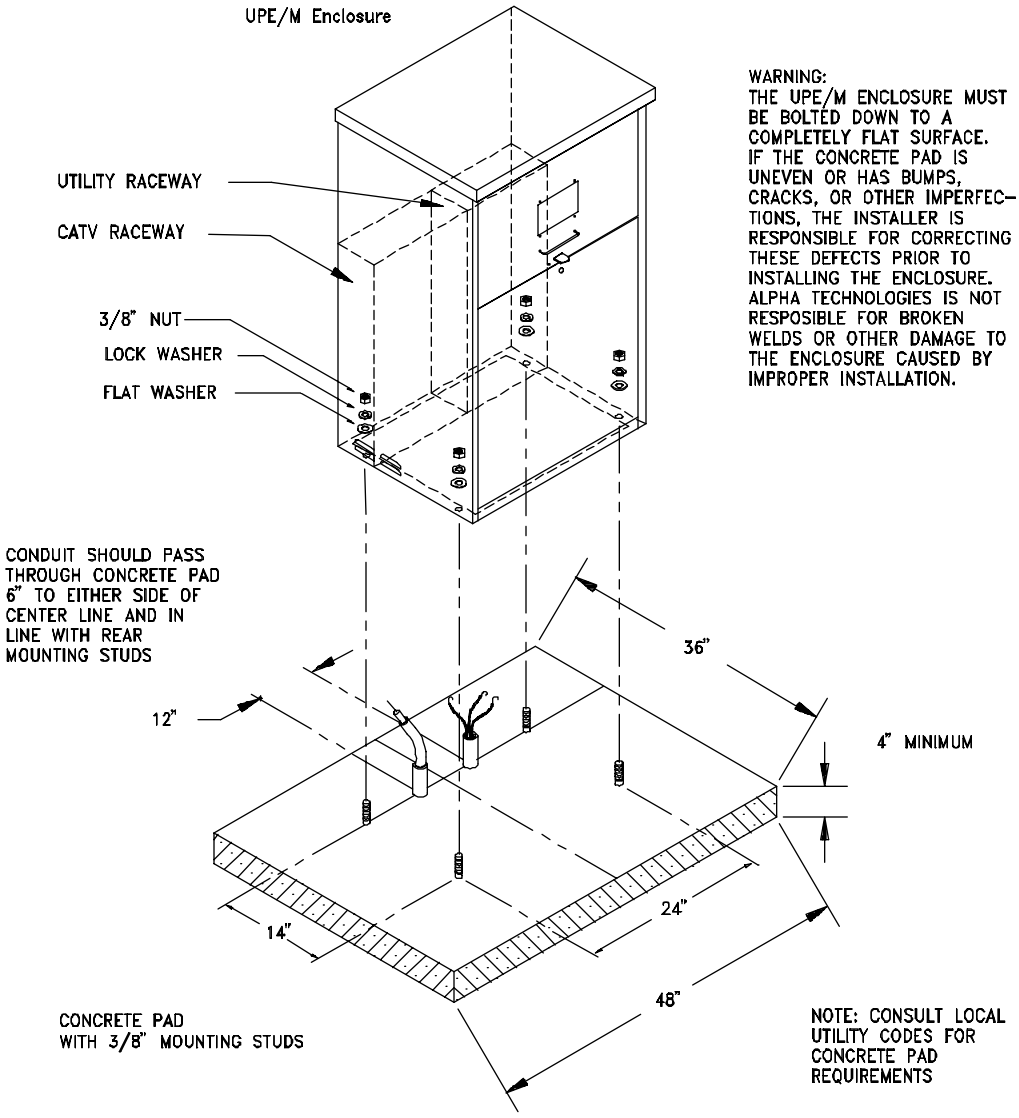
XM 90V Series	82 lbs. (37.3 kg)

NOTE: For CE Series enclosures, please refer to the CE enclosure installation guide for dimensions and weights.

Specifications @ 77°F (25°C) @ load.

***** Charger voltages should be user selected on the XM's Main Module Assembly according to specific battery manufacturer's recommendations (see section 4.2).

6.1 Concrete Pad Layout



Stud Placement for UPE/M
Concrete Pad Mounting

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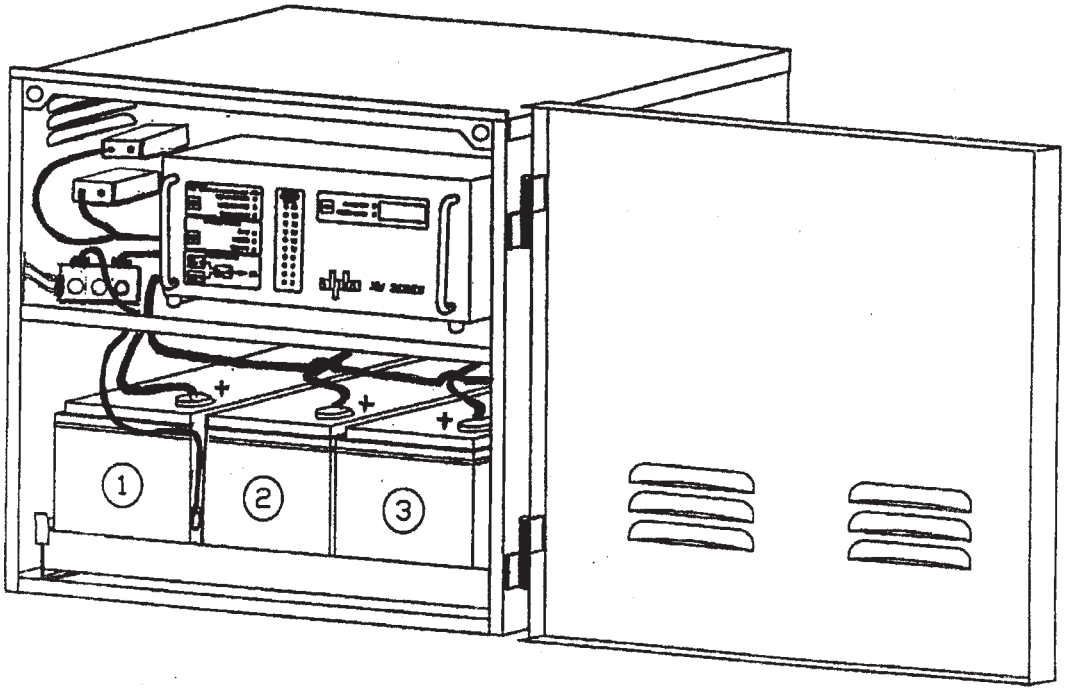
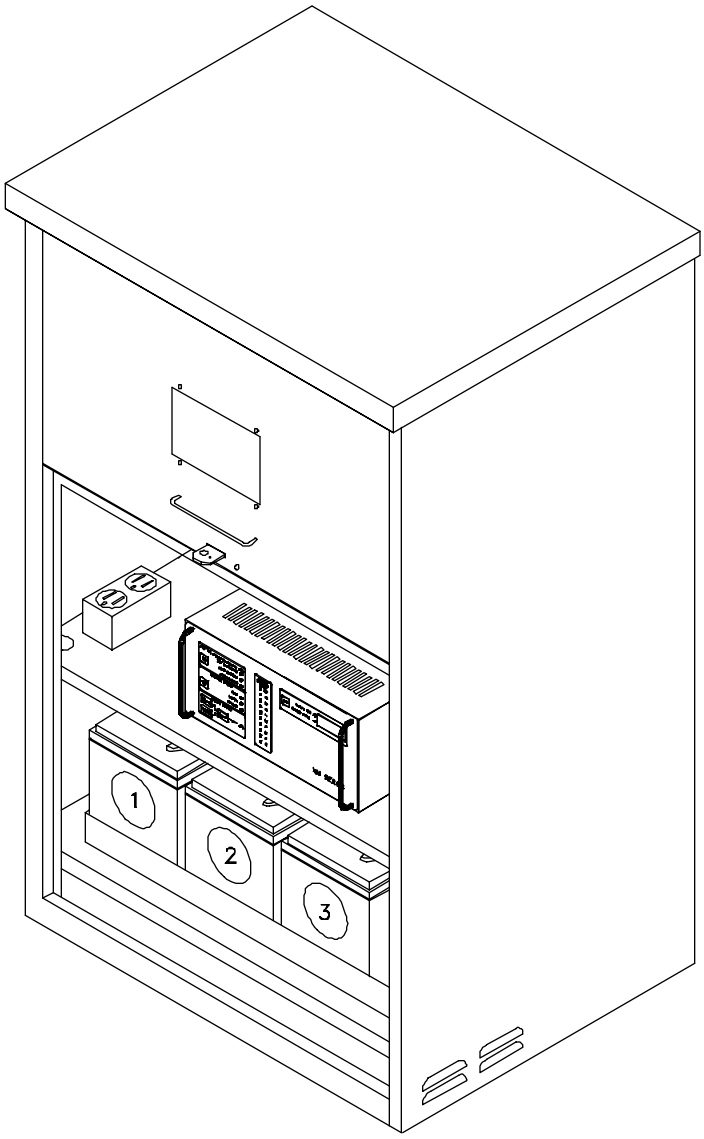
6.2 PWE Enclosure



XM Series Power Supply
Shown in PWE Enclosure

6.3 UPE-M Enclosure



XM Series in UPE-M Enclosure

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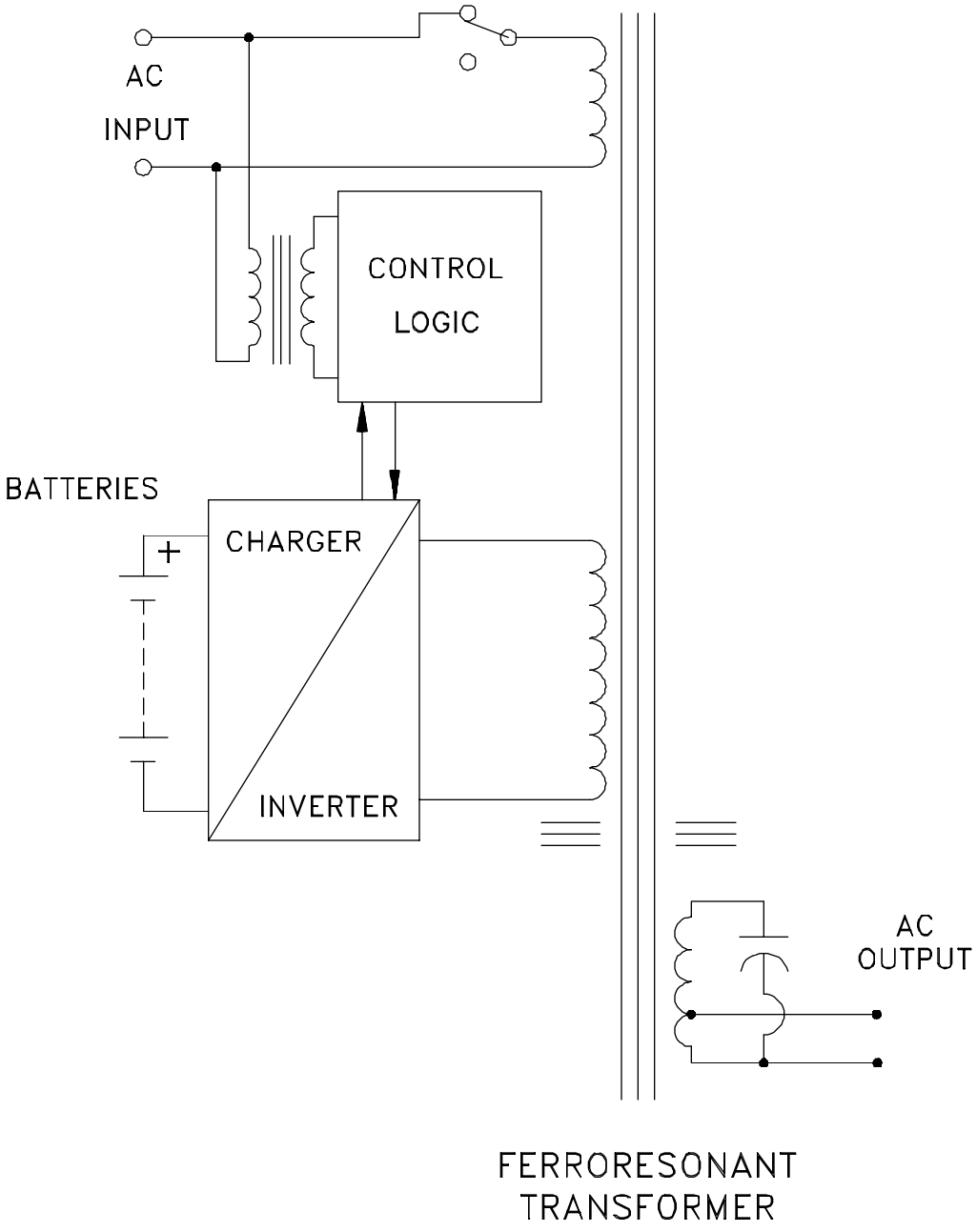
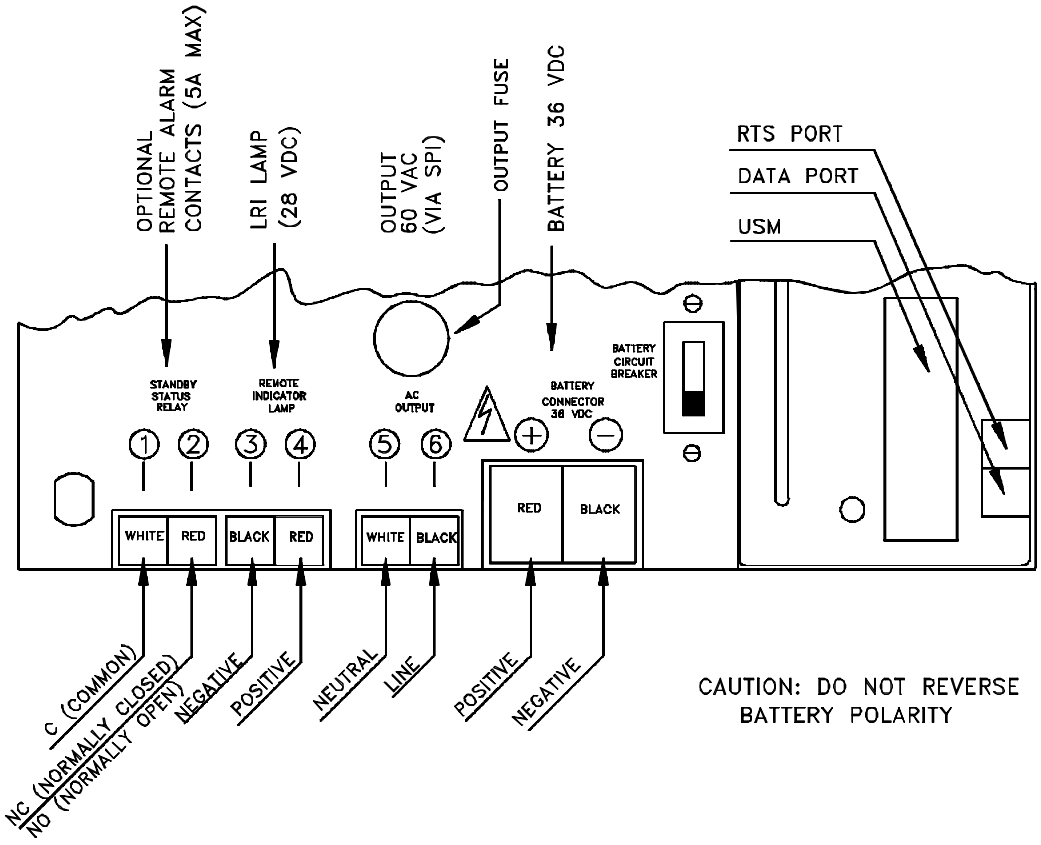
6.4 Block Diagram



XM Series Power Module
Block Diagram

6.5 Side Panel



XM Series Side Panel

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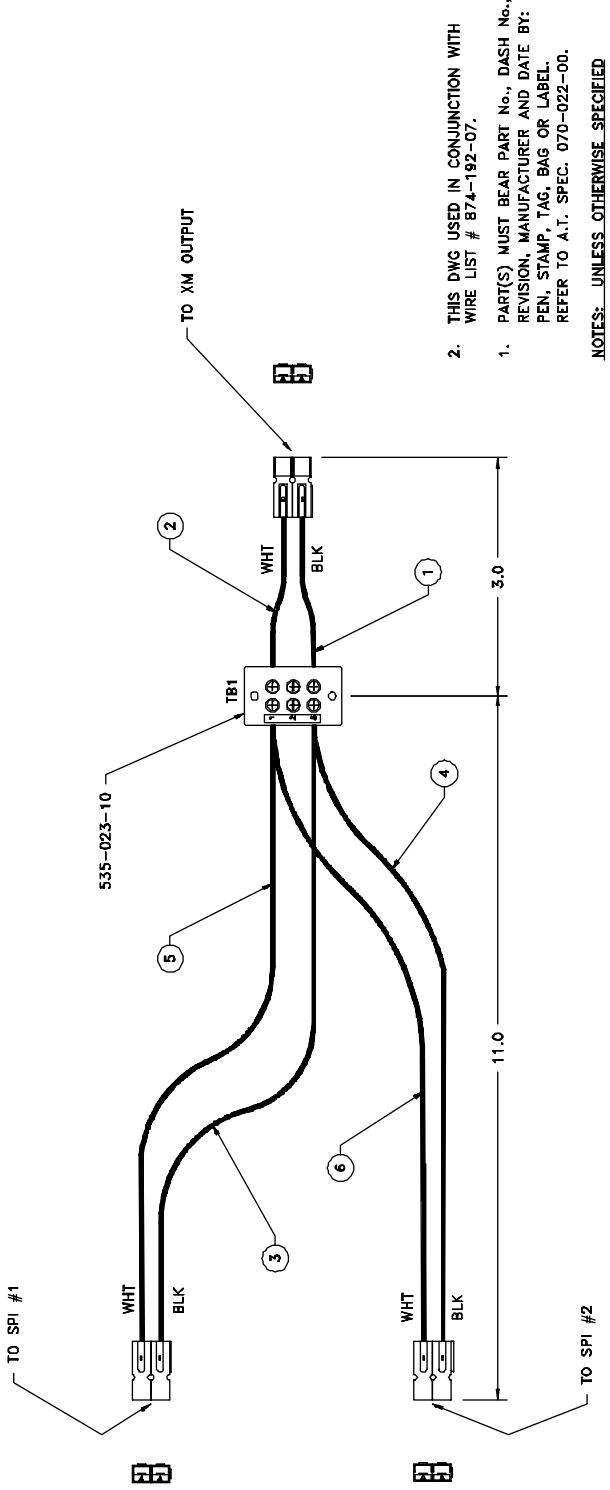
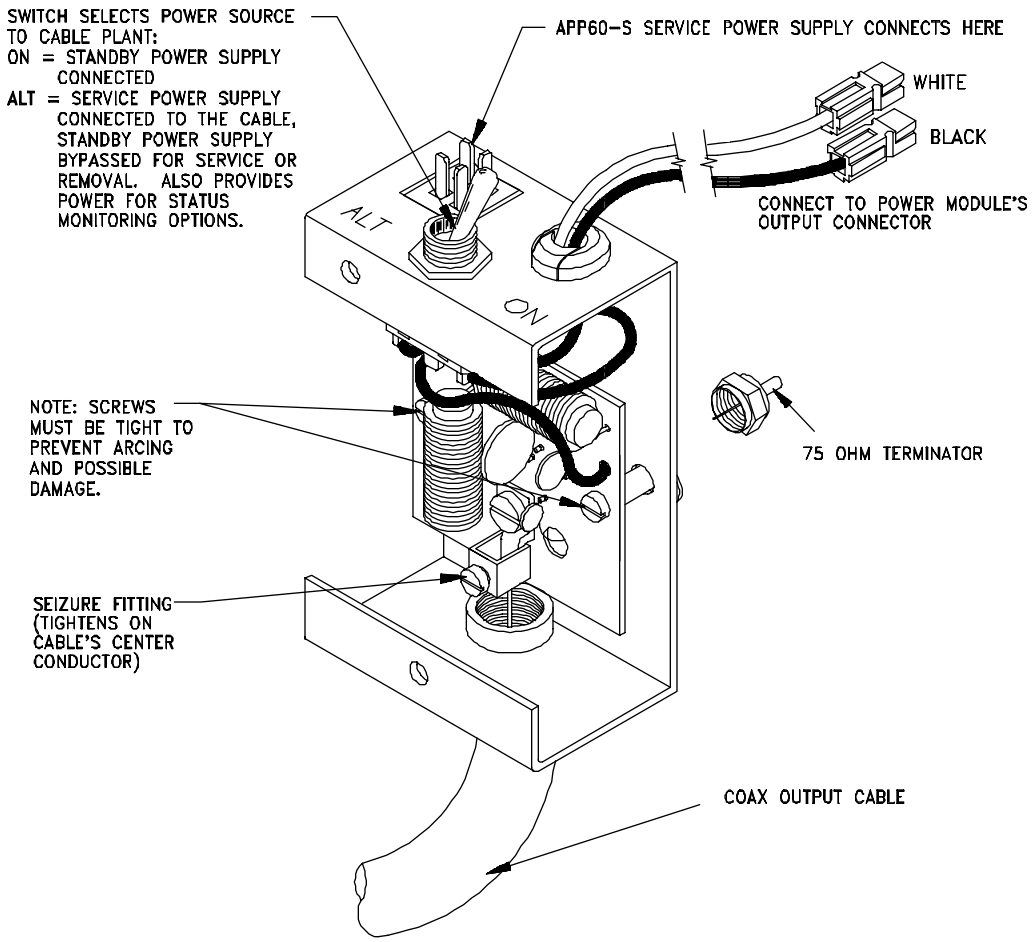
6.6 Output Wire Assembly



XM Series
Single to Dual Output
Wire Assembly

6.7 Service Power Inserter



Service Power Inserter (SPI)

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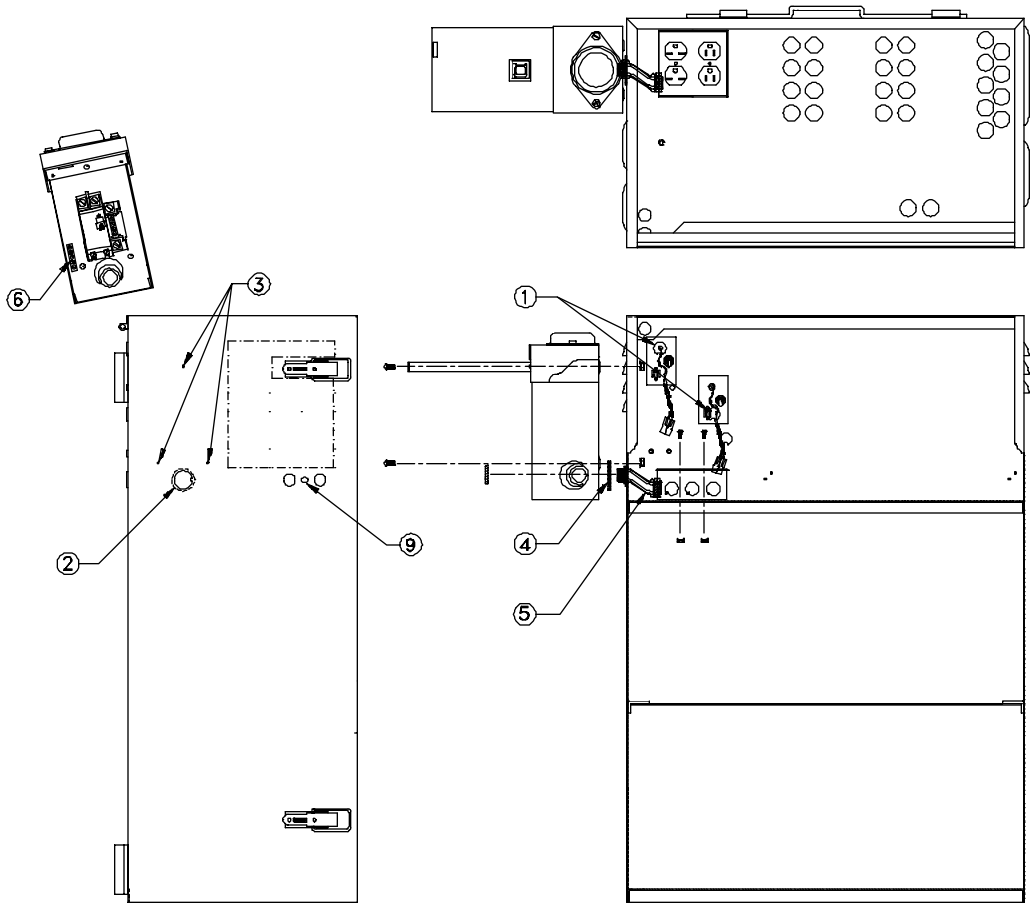
6.8 Dual SPI Arrangement



① KNOCKOUT 0.75" (3/4") HOLES AS SHOWN FOR SPI's.

② CENTER AROUND KNOCKOUT AND PUNCH 1.375" (1-3/8") HOLE AS SHOWN FOR CB BOX ACCESS.

③ DRILL (3) 0.266" (17/64") HOLES AS SHOWN TO HANG CB BOX.

④ MOUNT CB BOX WITH SEAL BETWEEN CB BOX AND ENCLOSURE.

⑤ ATTACH OFFSET NIPPLE TO CB BOX WITH LOCKNUT AND TO RECEPTACLE BOX WITH LOCKNUTS ON EITHER SIDE OF RECEPTACLE BOX WALL. MARK, DRILL AND MOUNT RECEPTACLE BOX TO SHELF WITH #8-32 SEMS AND KEPS HARDWARE.

⑥ ATTACH GROUND BAR TO CB BOX AS SHOWN.

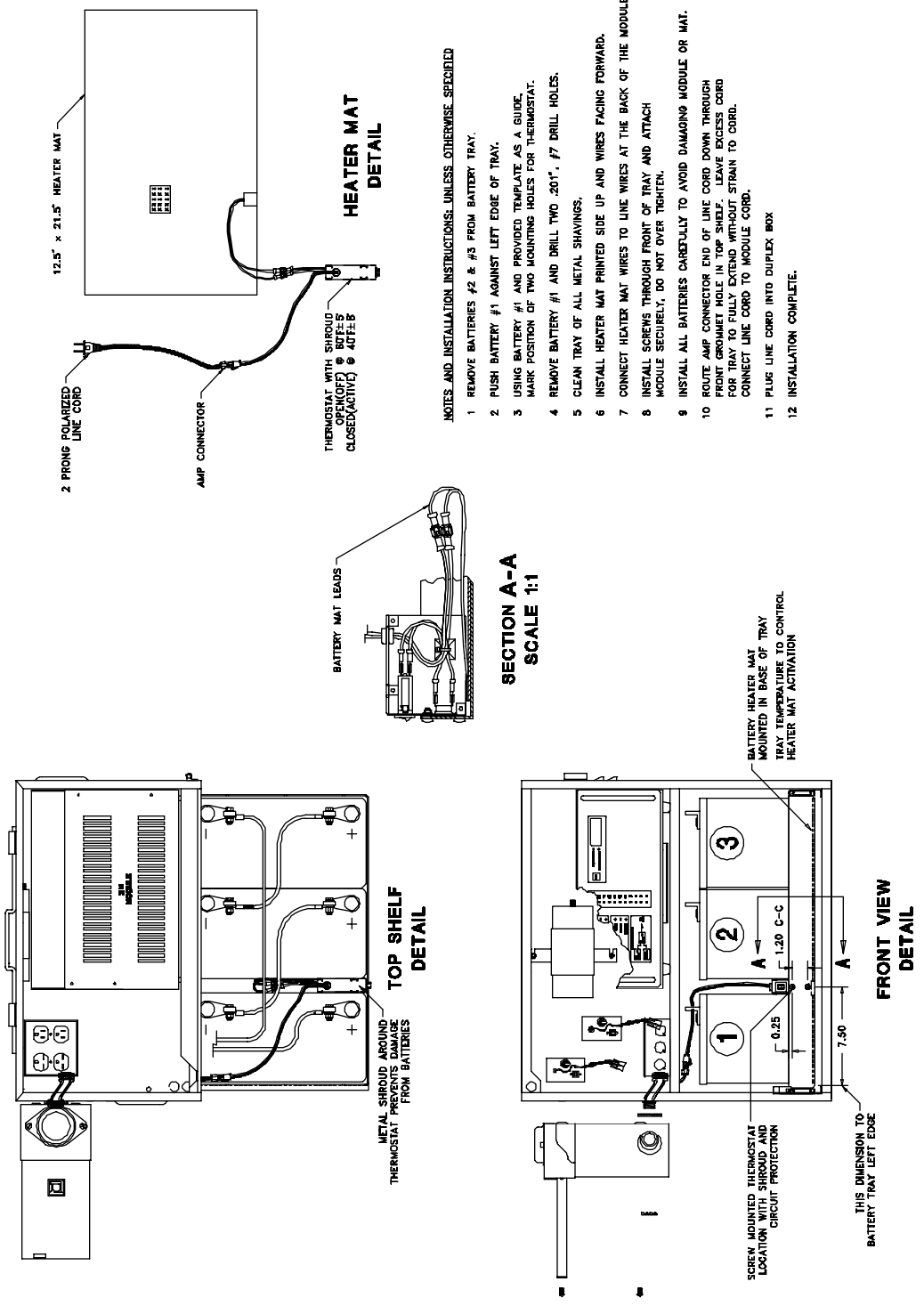
7 HOOK UP CB BOX/AC RCPT WIRE KIT PER SP96-531-A.

8 INSTALL DUAL SPI'S, ACI, LRI, LA-P-E AND "Y" ADAPTER.

⑨ DRILL ø.375 HOLE APPROXIMATELY HERE FOR BULKHEAD CONNECTOR.

Assembly, PWE 240V, Dual SPI

6.9 Battery Heater



Installation Instructions,
Battery heater

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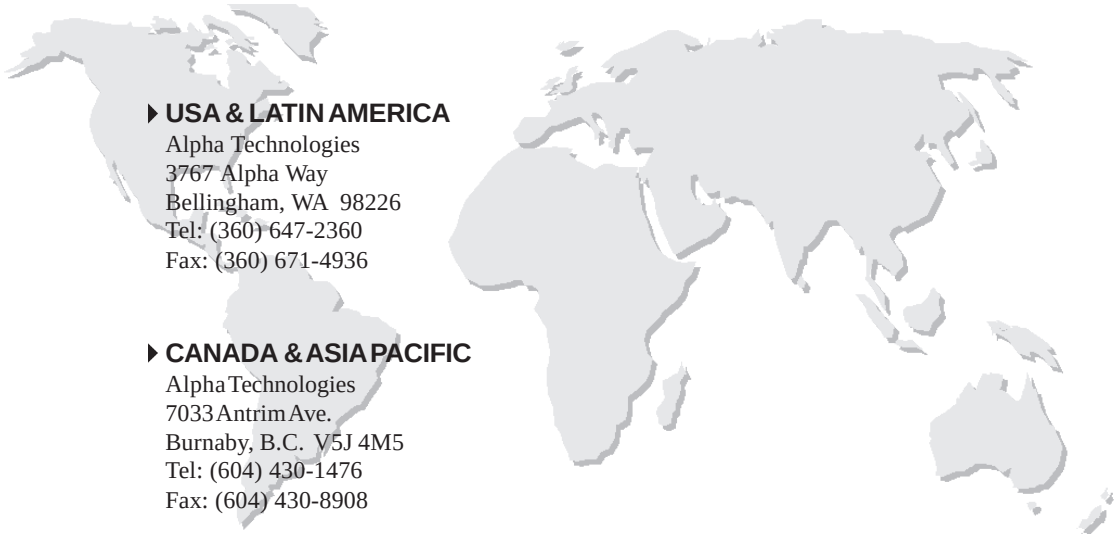

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