



DC POWER PLANT

PRODUCT MANUAL

MODEL MX28B-1200/2400



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1. GENERAL INFORMATION

1.1 Introduction

DC Power Plants from APC have unique features that make them easy to install, maintain, and upgrade. The rectifier units are modular and truly “hot-pluggable” into the shelf assembly without any separate ac wiring.

All system settings are made from the system control unit that provides monitoring and control functions for each component of the system as well as alarm listings for system diagnosis and maintenance.

The APC international network of sales and service offices and qualified representatives provides sales assistance for proposals, purchases, and after-sales support.

APC provides nationwide 24-hour, 7-day service response by dialing:

(800) 800-4APC

This service will answer your call, gather specific service information, and have a qualified APC service representative contact you as quickly as possible (refer to section on customer service and support).

1.2 Precautions

It is extremely important to read, understand, and strictly follow the instructions in sections on installation and setup. Also, please note the special SAFETY PRECAUTIONS outlined in Section 5.1.4 before beginning actual installation of the power system.

If any precautions are not clearly understood, or local conditions are not covered, contact the nearest APC representative or APC at (214) 342-5000 for clarification.

Also, refer to all applicable federal, state, and local regulations, and industry guidelines for correct installation of this power system.

1.3 Inspection upon Receipt of Goods

1.3.1 General

APC has taken precautions in packing the power equipment for shipment to ensure its safe arrival; however, the entire shipment including any boxes or crates should be inspected upon receipt for evidence of damage that may have occurred during transit.

1.3.2 Visible External Damage

It is the responsibility of the person receiving the shipment to inventory and inspect all materials against the bill of lading or waybill provided **IMMEDIATELY** upon taking delivery while the carrier representative is **STILL ON SITE**. Please be sure that all items are accounted for, including the correct number of pallets and the quantity of accessory and/or component boxes. Also, note any visible external damage that may have occurred during transit.

If damage has occurred or the quantity of items is not correct, then:

- 1) Make a descriptive notation on the delivery receipt before signing.

- 2) File a damage or shortage report with the carrier that delivered the shipment.

1.3.3 Concealed Damage

It is the customer's responsibility to unpack the power system and equipment received from APC and check for concealed damage. Within 15 days of receipt, check the materials received against the detailed packing list to verify that the quantity and condition are complete and satisfactory.

Again, note any damage to the internal packing material and/or material shortages. If damage or shortage is noted, then:

- 1) Request an inspection by the carrier;
- 2) File a concealed damage claim; and/or
- 3) File a material shortage claim with your APC representative.

DELAY IN NOTIFYING THE CARRIER MAY RESULT IN LOSS OF RIGHT TO REIMBURSEMENT FOR DAMAGES OR LOSS.

If you are unsure about the appearance of a part while conducting the materials inventory and inspection, refer to the manual or contact the Customer Service Department of APC

Should you have any questions concerning potential damages or should you experience a lack of cooperation from your carrier, please contact your APC representative, or call APC

1.3.4 Return of Damaged Goods

Should equipment be damaged and require return to APC for repair, the APC service representative will provide instructions along with a valid returned material authorization (RMA) number to facilitate return of the damaged goods to the APC repair center.

It is important that the steps outlined in Section 1.3.2 and Section 1.3.3 above are followed carefully. Your APC representative will assist you, if required, in obtaining proper disposition of an initial delivery return issue; however, a valid RMA number must be obtained before returning any equipment to APC.

2. CUSTOMER SERVICE AND SUPPORT

APC manufactures a line power plants and provides customers with complete product and systems support and service. APC has an international network of factory trained service technicians. The service organization is on call 24 hours a day, 365 days a year.

**If there is a problem with the power system, contact APC at
(800) 800-4APC**

Units returned for repair can be turned around within 24 to 48 hours of receipt at the factory location. Shipment should be sent pre-paid. The unit will be returned pre-paid provided it was received that way.

An RMA must be obtained for all equipment returned to APC. It is important that correct procedures be followed in filing an RMA, including providing an accurate written description of the problem. An accurate written problem description will help ensure that the unit will be properly repaired.

If a unit is returned and a “No Fault Found” results, APC reserves the right to bill the customer for labor and assess a service charge to cover extra costs incurred.

3. WARRANTY PROVISIONS

3.1 General Provisions

APC warrants the power equipment and components it manufactures or sells against defective materials and workmanship for a period of TWO (2) YEARS from the date of shipment.

3.1.1 Warranty Returns

If initial physical inspection results in identification of a material or workmanship flaw(s) that could impair product performance as defined by APC's electrical and physical specification in effect at the time of shipment, and if this flaw(s) is not due to transportation damage or installation abuse, contact APC or call the 24-hour emergency number, (800) 800-4APC, to request assistance.

You will be provided either a) an RMA number with instructions for return of the equipment or component(s) to the APC factory service center, FOB destination, freight pre-paid, for examination, or b) for non-returnable systems and equipment, notice to wait until an APC authorized service representative arrives at the site to inspect the equipment. Repaired or advance replacement modules or circuit components will normally be available within 24 to 48 hours of receipt of equipment or RMA.

3.1.2 Warranty Repair or Replacement

If, during the warranty period, the supplied equipment is found to be physically or electrically faulty due to defective materials or workmanship on the part of APC, the defective product(s) or component(s) will be repaired or replaced at the sole option of APC without charge to the user for replacement materials or repair labor. (The procedure outlined above for contacting APC must be followed.) Costs incurred for replacement installation including, but not limited to, installation equipment, travel expenses of an APC representative(s), and costs of installation material transportation expenses are not the responsibility of APC. Any replacement product(s) or component(s) shall only complete the remaining unused portion of the original warranty of the replaced product(s) or component(s).

3.2 Exclusions and Limitations

1. This warranty applies only to the original US domestic purchaser (user) and is not transferable internationally, except with expressed written consent from APC facility in Dallas, Texas.
2. APC reserves the right to void the warranty if identification marks or serial numbers have been removed or tampered with, or the defect is determined to have been caused by misuse, neglect, improper installation, environmental conditions, non-authorized repair, alteration, or accident.
3. This warranty does not cover physical damage due to the acts of nature or man that stress the equipment or component(s) beyond design limits and exert undesirable influence aside from normal wear and tear.
4. APC assumes no responsibility for any work accomplished or expenses incurred except with expressed written consent from APC

5. APC shall not be liable to the user (purchaser) or any third party for indirect, incidental, or consequential damages such as, but not limited to, loss of use, loss of profits, costs associated with removal/installation of a defective product(s) or component(s) arising out of the sale or relating to the use of this product, and the user (purchaser) assumes responsibility for all personal injury and property damage resulting from the handling, possession, or use of the product. In no event shall the liability of APC for any and all claims, including claims of breach of warranty or negligence, exceed the purchase price of the product that gave rise to the claim.

The above warranty is in lieu of all other remedies, including actions for contract or negligence.

All other warranties, expressed or implied, including but not limited to the implied warranties of merchantability and fitness for a particular purpose, are hereby excluded.

4. PRODUCT OVERVIEW AND TECHNICAL DESCRIPTION

4.1 Description

The APC Models MX28B-1200/2400 represents a family of stand-alone -48V dc power plants. Through the use of modular power and distribution box frames, a system is configurable in such a manner that it will support most typical applications within the specified current range of up to 3600 amps without special application engineering or assistance.

The system is designed to start as a base unit capable of supplying 1200 amps of -48V dc power in a single box frame with integrated power distribution breakers and an advanced control and monitoring module. Standard distribution for a power bay includes up to 48 plug-in circuit breakers (1 to 100 amps), or large panel-mounted circuit breakers (250 to 700 amps).

Expansion of the base unit is accomplished by adding power frames and distribution frames on either side of the base unit. The distribution box frames come with a variety of circuit breaker and fuse options. Power expansion of the 1200 amp plant to a 2400 amp plant only requires the addition of splice plates to the existing bus structure.

An optional low voltage disconnect (LVD) can be provided on either the battery or the load side in each power bay. Systems incorporating power distribution frames need an external LVD unit.

A 1200 amp MX28B is shown in Figure 4-1. A block diagram is shown in Figure 4-2.

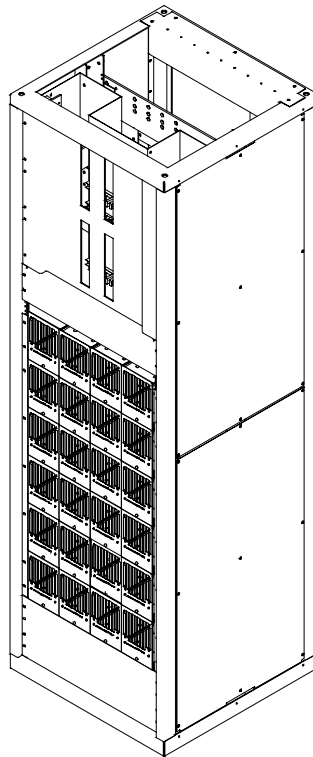


Figure 4-1 MX28B-1200

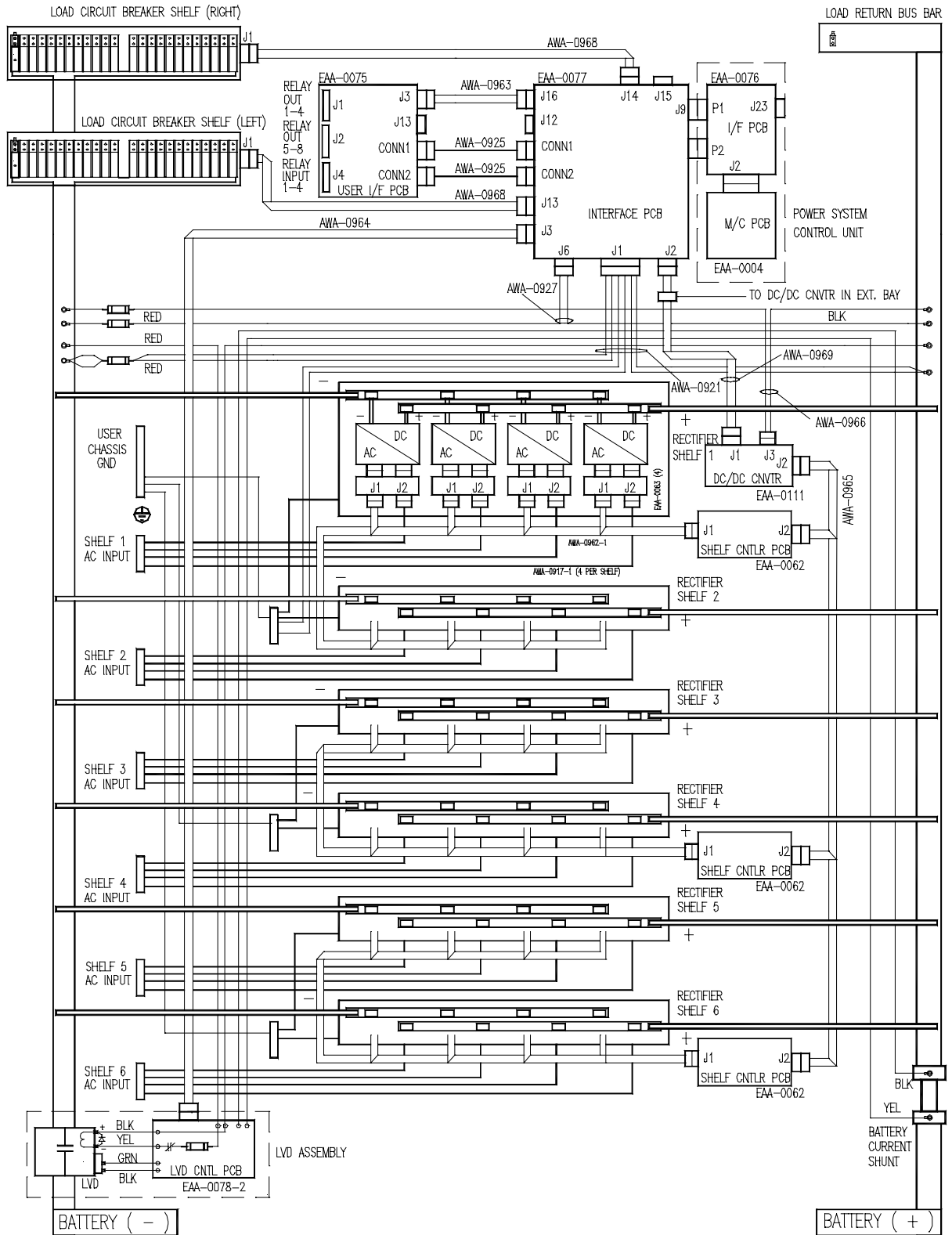


Figure 4-2 MX28B-1200 System Diagram

4.2 Power Output Capacity

A single power box frame consists of six rectifier shelves, each shelf accommodating up to four hot-plug, 50 amp rectifiers. A completely configured power frame with 24 rectifiers is rated at 1200 amps. Each additional power frame will add up to 1200 amps for a maximum total of 2400 amps using 48 rectifiers. A single master control unit in the first power frame provides control and monitoring for the entire system.

4.3 Rectifiers

The rectifiers are APC Model MRF28H54BV with specifications as follows:

- Input Voltage: 176-264V ac (230V ac nominal) @ 45-66 Hz
- Input Current per Rectifier: 13.9 Amps @ 230V ac
- Apparent Power Factor: 99% Typical, 98% Minimum
- Output Voltage: 54.5V dc
- Overvoltage Protection: Set at 59.5V dc
- Output Current per Rectifier: 50 Amps Minimum Continuous
- Power Output per Rectifier: 2800W Continuous, $V_{in} > 198V$ ac
- Efficiency: 91% Typical
- Cooling: Fan cooled, front to rear airflow
- Ambient Temperature: -25°C to 65°C Operational

4.4 Control Unit

The microprocessor-based power system control unit is 1U high (1.75”) and provides control and monitoring functions. Features implemented are:

- 32-character alphanumeric display (2 lines by 16 characters)
- LED alarm and status indicators
- Standard voltage and battery charging control
- Battery temperature compensation (optional temperature probe)
- Monitoring of up to 18 shelves of four rectifiers each
- Individual alarm monitoring of 72 breakers
- Individual alarm monitoring of ten power distribution fuses
- Eight alarm / annunciation relays (Major, Minor, and six user defined) with form C contact outputs
- Four external alarm inputs (either N.O. or N.C. contacts)
- Control for two independent Low Voltage Disconnects (LVD's)

4.5 AC Input Power

Each rectifier requires 208/220/240V ac, single-phase, 50/60 Hz, supplied through an external 20-amp two-pole breaker. A vertical wire channel at the rear of the box frame provides terminal strips for ac input power connection of each shelf. Separate “Earth Ground” terminal bars are provided for the connection of the safety ground wires. A power entry box is provided at the top and rear of the box frame where AC wiring conduit can be attached. Refer to Figure 4-3.

4.6 Battery connections

Battery connections are made at the top rear of the unit. The -48V and Battery Return buses each provide four sets of threaded 3/8”-16 holes on 1 inch or 1 3/4 inch centers for connecting two-hole battery cable lugs. Refer to Figure 4-3.

A battery disconnect breaker is required external to this equipment. The power plant can monitor auxiliary contacts from this breaker. Battery temperature compensation is available. APC’s master control unit, in conjunction with the optional temperature monitor sensor cable, is used to implement this function.

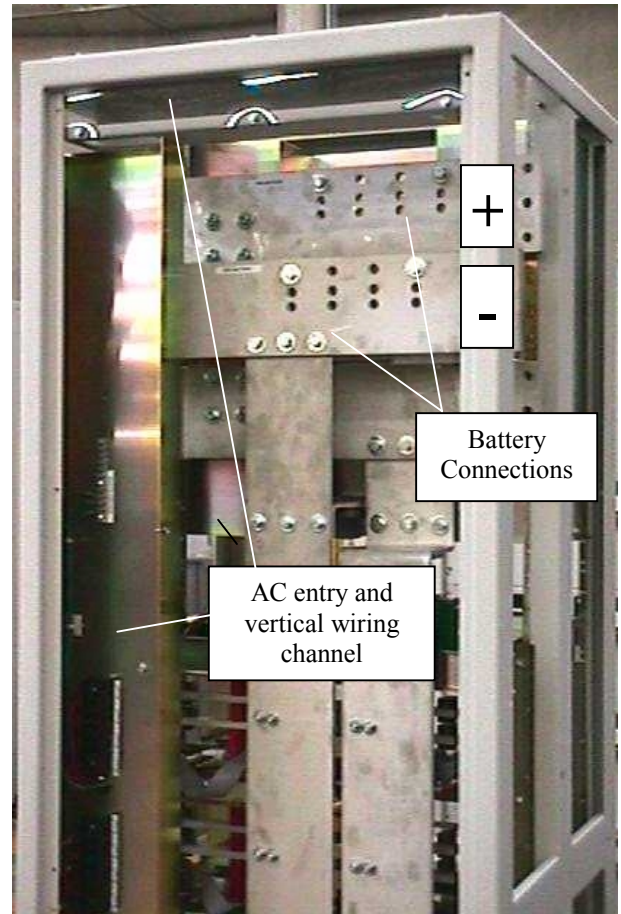


Figure 4-3 Power Entry Box and Battery Connections

4.7 DC Distribution

A standard power distribution module within the power box frame contains two 24-position plug-in circuit breaker columns, providing -48V power for customer loads. Each breaker column is connected at its center to the -48V dc bus, with each side having an ampacity of 300A. Connections for the -48V dc loads are located directly to the side of the corresponding breaker. A typical load connection would utilize a #6 AWG wire with a two-hole lug on 5/8-inch centers, attached with standard #10-32 mounting screws.

The load return cables for each circuit breaker section connect to a return bus directly opposite the circuit breakers. These return buses contain patterns for 28 two-hole #10-32 lugs on 5/8-inch centers, and 14 two-hole 1/4”-20 lugs on a double-pattern of either 5/8-inch or 1-inch centers. Figure 4-4 shows the power plant’s dc

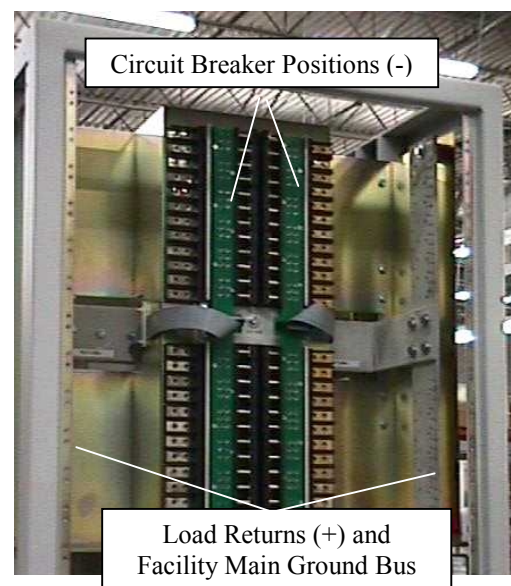


Figure 4-4 DC Distribution

distribution section with the front cover removed.

Alternate circuit breaker configurations are available in order for the power frames to provide support for larger individual load connections. Six circuit breakers in the 100 amp to 400 amp range or four circuit breakers in the 225 to 700 amp range in a panel-mount arrangement can be specified instead of the distribution module with 48 plug-in breakers.

Optional power distribution box frames can be added to a power system to support additional circuit breakers or telecom fuses. Auxiliary alarm contacts from circuit breakers can be brought back to the control unit through the use of an alarm extension printed circuit board in each bay. Ten fuses outputs can also be directly monitored by the control unit.

4.8 Environmental

- Ambient Temperature: -20°C to +65°C operating
-40°C to +85°C storage
- Humidity: 0% to 85% RH non-condensing operating
0% to 95% RH non-condensing storage
- Altitude: Up to 3000m, operating
Up to 10,000m, storage

4.9 Mechanical

- Weight: Base Power Frame – 400 to 600 lbs. (181 to 272 kg)
Extension Power Frame – 400 to 600 lbs. (181 to 272 kg)
Rectifier - 11 lbs. (5 kg.)
- Dimensions: Box Frame: 84” high x 26” wide x 26” deep
(2134 mm x 660 mm x 660 mm)
- Color: Dawn Gray (fronts)

4.10 Compliance

- Safety: UL 1950

5. INSTALLATION PROCEDURES

5.1 Preparation

5.1.1 Recommended Tools

- Standard selection of insulated hand tools.
- Proper tools for crimping the selected cable lugs.

5.1.2 Recommended Test Equipment

- Digital Multimeter

5.1.3 Equipment Inspection

Remove equipment from packing material and inspect for shipping damage to verify the safety and operational suitability for the installation site. *[Refer to Section 1.3]*

5.1.4 Safety Precautions

***** WARNING *****

The MX28B dc power plant is supplied from a nominal 220V ac, 60 Hz source. Keep the ac input enclosure cover in place when the system is operational or energized.

***** CAUTION *****

Handling or touching the controller boards located inside this unit without being electrostatically discharged (grounded to the frame) may cause extensive damage to the electronics. Before touching or handling the controller boards, it is recommended that an ESD wrist strap be utilized.

***** WARNING *****

Hazardous energy levels are present on bare conductors in the -48V dc distribution connection area of the plant. Accidental shorting of distribution conductors can cause arcing and high currents that can cause serious burns or other physical harm.

It is recommended that:

- Any jewelry, rings or watches be removed while working on this equipment.
- Handles of all wrenches, screwdrivers, cutters and pliers be insulated.
- Shafts of screwdrivers be wrapped in electrical tape or otherwise insulated.

5.1.5 Room/Locations

NOTE: The APC Model MX28B dc power plant is to be installed in a room, vault, or similar enclosure that is accessible only to qualified persons in accordance with the NEC or the authority having jurisdiction.

Prior to installation, drawings, floor loading requirements, external alarm points, ac service entrance, and grounding schemes should all be checked and confirmed. If batteries are to be mounted in a room separate from the power plant, careful attention should be paid to battery cable voltage drop effects. Environmental operating temperatures and ventilation/cooling considerations should also be noted, not just for the power system but for all other equipment that may reside in the power room area.

5.1.6 Mounting

The box frame housing the MX28B components is self-supporting, but designed to be bolted to the floor of the housing structure. Figure 5-1 shows the footprint of the box frame and the mounting points with dimensions (shown in inches). Consult the system design specifications to see if it is necessary to electrically isolate the frame from the floor structure. This is required in many installations.

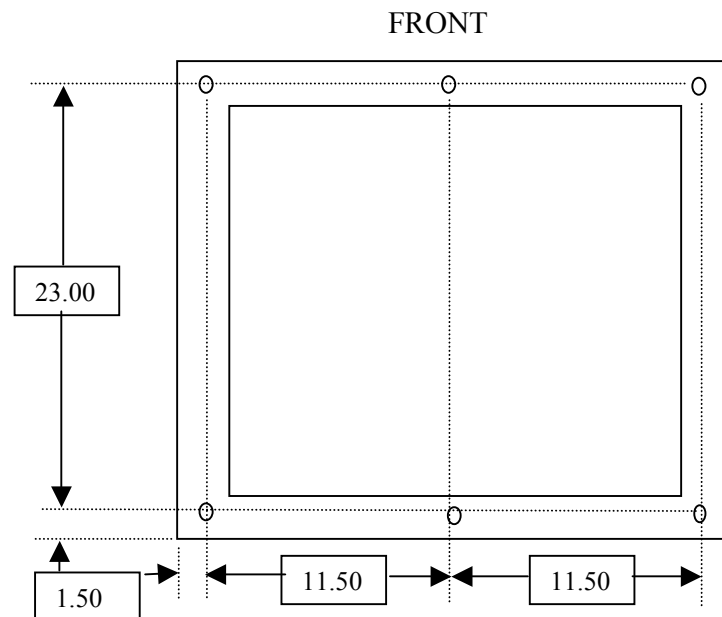


Figure 5-1 Floor Mounting Dimensions

Systems with multiple box frames are mounted with each frame touching, side by side. The side cover panels where two frames touch are removed so that bus work and control cables can pass between the frames. Three holes are provided in center vertical rail of each side to allow the frames to be mechanically secured to each other if desired.

5.1.7 Ventilation

The rectifiers have fans that provide front to rear airflow for internal cooling. The MX28B housing should be mounted such that there is free airflow to the front and top of the unit. [Refer to Section 4.8 for environmental characteristics.]

5.2 AC Service and Ground Connections

***** WARNING *****

Ensure that all of the dc and external ac circuit breakers are in the OFF position prior to connecting service to the power plant. Confirm that all voltages have been removed including any battery sources before proceeding.

The MX28B dc power plant requires the supply of 208/220/240V ac, single-phase, 50/60 Hz power through individual external 20-amp two-pole circuit breakers to the ac input terminal block connections for each rectifier in the system. The ac wiring, from the ac input terminal block connections to the hot-pluggable ac input connector for each rectifier, is factory installed.

The ac input enclosure, located at the top rear of the MX28B housing, is provided with nine ¼-inch conduit pilot holes in the top plate (Figure 5-2). Remove the ac input enclosure from the box frame in order to punch or drill the appropriate number of conduit openings for the conduit size(s) desired. *Do not leave the ac input enclosure in place when punching or drilling holes in order to prevent metal pieces from falling into the power system.*

AC wiring passing through the conduit will be routed through the access opening in the ac input enclosure into the vertical wiring channel where safety ground bar and rectifier input terminal blocks are located. The terminal block(s) is labeled as Rectifier 1 through Rectifier 4 with each position having inputs designated “L1” and “L2” for connection of the two ac wires (Figure 5-3). Each terminal block represents connections for one shelf, with positions 1 through 4 corresponding to the rectifier shelf positions numbered from left to right as view from the front.

The suggested wire size is #10 AWG rated at 90°C or higher; however, the ambient temperature and number of wires in a

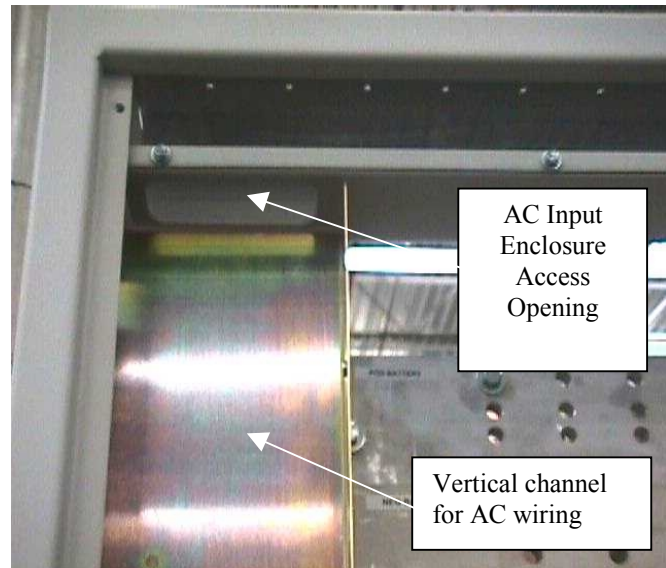


Figure 5-2 AC Wiring Access

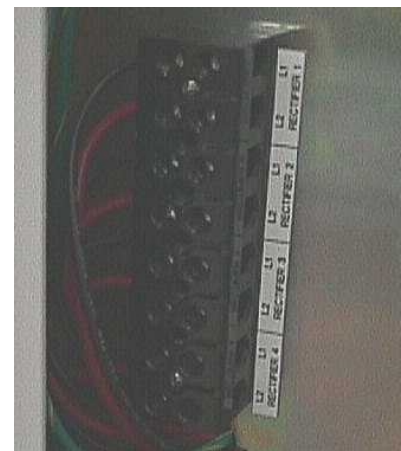


Figure 5-3 AC Terminal Block

conduit must also be considered in accordance with NEC requirements. It is suggested that feeds for four rectifiers (8 wires) and one safety ground wire be run in a one-inch conduit; however, be sure to follow any local electrical wiring codes.

If the ac input power is provided from a three-phase distribution panel, the circuit breaker positions should be selected such that the load is balanced as much as possible.

5.3 Battery Connections

5.3.1 Battery Disconnect

An external circuit breaker (not supplied) is required in the negative line (located at the battery end) to protect the cables from the battery to the MX28B dc power plant. The power plant can monitor auxiliary contacts from this breaker. Selection of a circuit breaker for a battery string should take into account maximum battery short circuit current and cable sizing.

5.3.2 Cable Sizing Considerations

The battery cable(s) should be sized sufficiently large to limit the voltage drop from the MX28B dc power plant to the battery during charging per system design requirements. The cable(s) must also carry the full load current during battery operation. If assistance is required to determine the necessary cables for the application, contact your sales representative or APC.

5.3.3 Connecting the Cables

The battery cable connections are located at the top rear of the unit as shown in Figure 5-4. The battery positive (return bus) and battery negative (-48V bus) buses each provide four sets of 3/8"-16 holes on a double pattern one-inch and 1 3/4-inch centers for connecting two-hole battery cable lugs. Connect the battery cables as applicable using 3/8"-16 bolts (not provided) and tighten them with a torque wrench to 200 in-lbs.

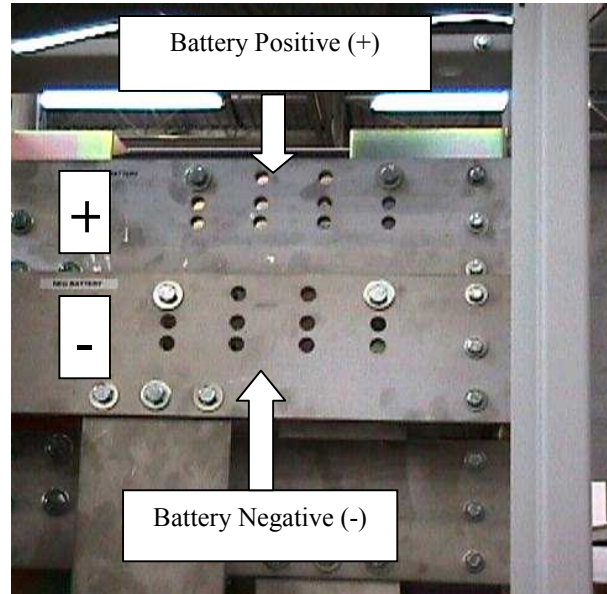


Figure 5-4 Battery Connections

***** CAUTION *****

Make certain that the battery polarity is correct when making connections to the Model MX28B dc power plant. Incorrect connection could cause severe equipment damage.

5.4 DC SYSTEM GROUNDING

THE POSITIVE LOAD CONNECTION (RETURN BUS) FOR THE POWER PLANT MUST BE CONNECTED TO THE FACILITY MASTER STATION GROUND. THE CONNECTION SHOULD BE MADE ON THE RETURN BUS IN THE BASE UNIT DISTRIBUTION AREA. DETAILS FOR THIS CONNECTION SHOULD BE PROVIDED IN THE SITE ELECTRICAL GROUNDING PLANS.

5.5 Rectifier Installation

The APC Model MRF28H54BV rectifiers are shipped in separate containers. Follow the procedure below to install a rectifier.

- 1) Remove the rectifier from its shipping container.
- 2) Remove the rectifier retaining screw from the shelf position where the rectifier is to be installed.
- 3) Slide the rectifier into the shelf between the guides until it is fully seated.
- 4) Fasten the rectifier in place with the rectifier retaining screw.

Since all adjustments are made from the system control unit, no rectifier adjustments are necessary.

NOTE: All “FLOAT” – “BOOST/EQUALISE” switches (one is located on the front of each rectifier in the system) must be set to “FLOAT” to allow the MX28B to control the output voltage properly.

5.6 Multiple Frame Assembly

5.6.1 Power Bus Connections

Installations with multiple box frames requires splicing of the power buses. The MX28B-1200 / 2400 family of power systems and distribution bays are designed so that the power buses can be connected from bay to bay through the use of simple splice plates. Figure 5-5 shows the connection between two box frames for the normal 2500 amp bus work.

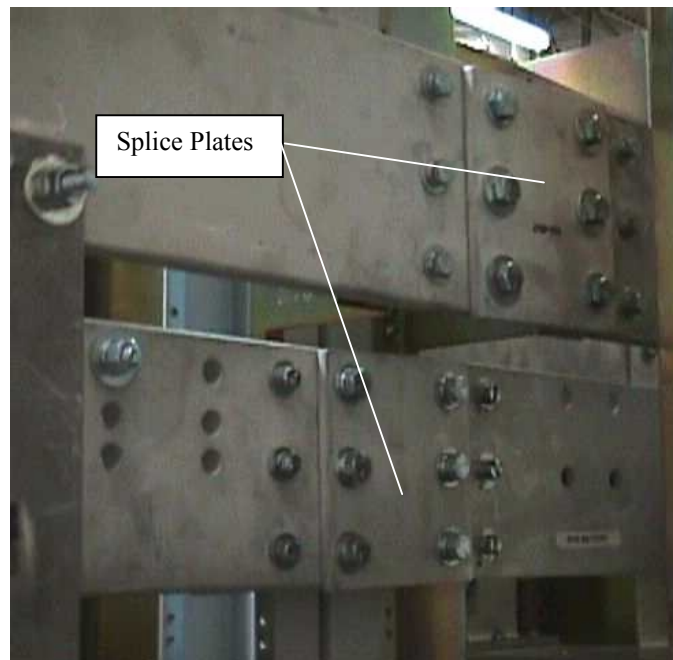


Figure 5-5 Multi-Bay Splice Plates

5.6.2 Control Wiring

Cables for controlling and monitoring the rectifiers and circuit breakers/fuses must be run from expansion frames to the control unit in the base frame. There are three basic cables used for these functions:

- The AWA-0970 ten-pin ribbon cable connector handles serial communications for rectifier reporting and control. This cable connects to the J1 connector of the DC/DC converter PCB's (EAA-0111) in each power box frame.
- Circuit breaker reporting in extension power and distribution bays is communicated back to the control unit through the AWA-0972 cable. This cable is connected to J15 on the control unit interface PCB in the base unit and runs to connector J2 on the Alarm Extension PCB (EAA-0072) in the remote bay. Additional bays are connected via the same cable, which connects up to four Alarm Extension PCB's.
- Fuse reporting is routed from the Fuse Sense PCB (ADV-1204) to the control unit via cable AWA-0967.

Refer to Figure 5-6 for a pictorial representation of multi-bay cable connection. Figure 5-7 shows the information as a wiring diagram.

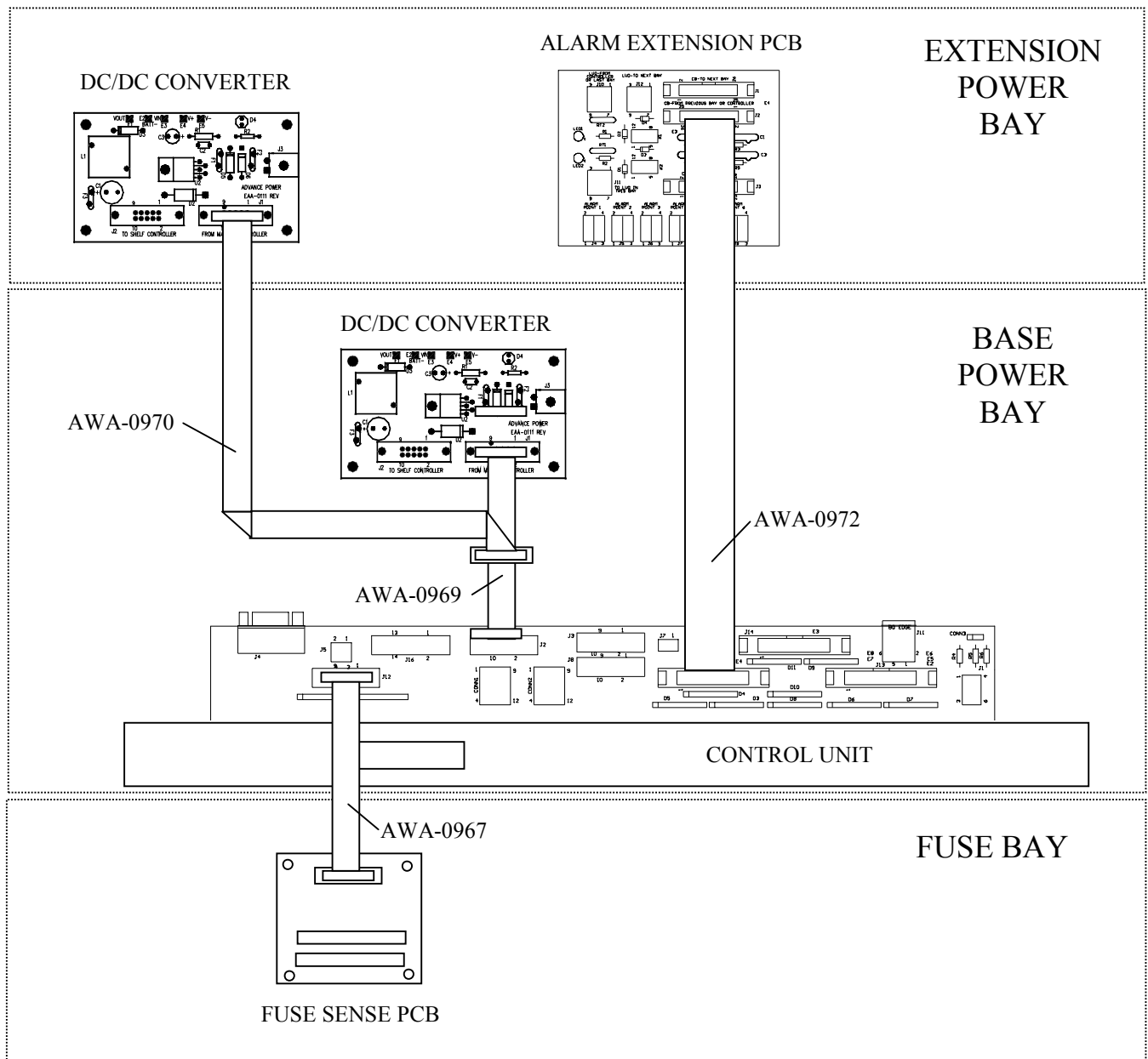


Figure 5-6 Typical Connection of Cables in Multi-Bay System

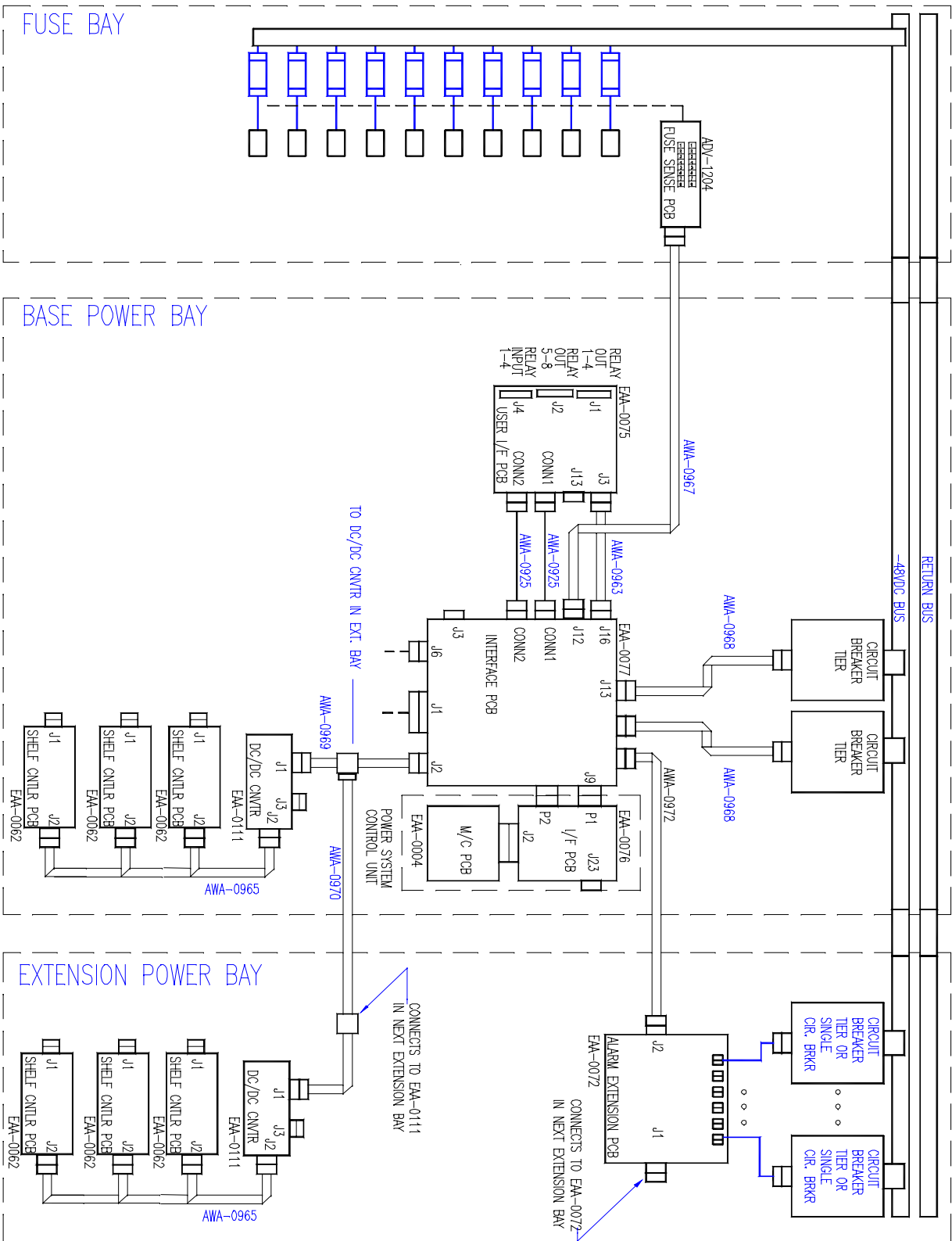


Figure 5-7 Multi-Bay Wiring Diagram

5.7 Alarm Connections

The alarm connections for all rectifiers, breakers, and fuses are factory pre-wired. The MX28B dc power plant, however, permits the user to program the system alarms in various ways. A Printed Circuit (PC) board designated “EAA-0075” is mounted in the space above the master control unit and provides terminal block connection points for alarm outputs and alarm inputs (Figure 5-8). These cage-clamp terminal blocks are operated by pushing back the lever, inserting the wire and then releasing the lever to clinch the connection. Recommended wire size is #28 AWG to #20 AWG.

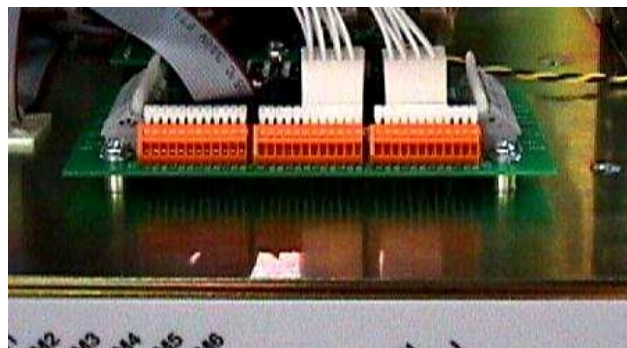
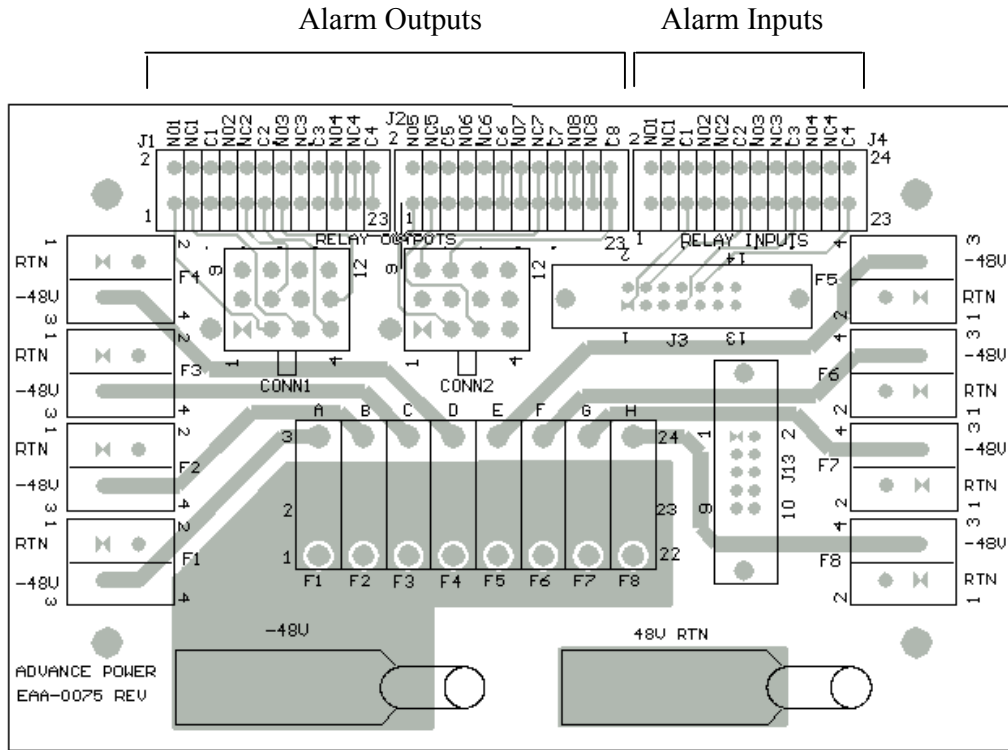


Figure 5-8 Alarm Interface PC Board

5.7.1 External Alarm Inputs

Four external alarm inputs with assignable priority levels are available. These alarm inputs respond to external dry contact closures between normally open (NO) and common (C) or contact openings between normally closed (NC) and C (see Table 5-1).

| External Alarm Source (non-alarm state) | Connect To Input Alarm Terminals |
|--------------------------------------------|-------------------------------------|
| OPEN | NO-C |
| CLOSED | NC-C |

Table 5-1. External Alarm Input Definition

Table 5-2 shows the external alarm input connection designations. Connector J4 is located on the alarm interface board mounted in the space above the control unit. Systems are shipped with jumper wires connecting each NC and corresponding C contact. A jumper wire should be removed only if the corresponding NC-C contacts are going to be used.

| EXTERNAL ALARM INPUT | J4 TERMINAL DESIGNATION (NO-NC-C) | USER ALARM NOTES |
|----------------------------|-----------------------------------------|------------------|
| #1 | NO1-NC1-C1 | _____ |
| #2 | NO2-NC2-C2 | _____ |
| #3 | NO3-NC3-C3 | _____ |
| #4 | NO4-NC4-C4 | _____ |

Table 5-2. External Alarm Input Connections

5.7.2 Alarm Outputs

There are eight alarms available that provide outputs via Form “C” relay contacts. The last two of these are pre-assigned as the Minor and Major alarm outputs. The Major relay is energized (NO-C contacts closed) during normal (non-alarm) operating conditions; all the other relays energize when an alarm condition occurs. The other six outputs are initially designated as “Relay 1” through “Relay 6” (the user may assign more meaningful names if desired). The various system alarm conditions can be assigned to any of the eight alarm outputs.

Table 5-3 shows the alarm output connection designations. Connectors J1 and J2 are located on the alarm interface board mounted in the space above the control unit. The relay contacts should only be used to switch resistive loads of 0.5 amperes or less at 60 volts or less.

| ALARM OUTPUT | TERMINAL DESIGNATION NO-NC-C | USER ALARM NOTES |
|--------------|---------------------------------|------------------|
| | J1 | |
| RELAY #1 | NO1-NC1-C1 | _____ |
| RELAY #2 | NO2-NC2-C2 | _____ |
| RELAY #3 | NO3-NC3-C3 | _____ |
| RELAY #4 | NO4-NC4-C4 | _____ |
| | J2 | |
| RELAY #5 | NO5-NC5-C5 | _____ |
| RELAY #6 | NO6-NC6-C6 | _____ |
| MINOR | NO7-NC7-C7 | _____ |
| MAJOR | NO8-NC8-C8 | _____ |

Table 5-3. Alarm Output Connections

5.8 Connecting The Loads

5.8.1 DC Circuit Breakers and Fuses

Both plug-in circuit breakers and Telecom fuses can be installed in the MX28B power plant for dc distribution circuit protection. Available plug-in circuit breakers are shown in Table 5-4. Plug-in circuit breakers rated at 60A or more require two mounting positions and require a breaker adapter kit, which is included (see kit selection information below the table). The breaker adapter kit includes all necessary mounting hardware.

| BREAKER RATING | PART NUMBER | | BREAKER RATING | PART NUMBER |
|----------------|-------------|--|----------------|--------------|
| 1 A | FFA-0014 | | 40 A | FFA-0020 |
| 3 A | FFA-0015 | | 50 A | FFA-0025 |
| 5 A | FFA-0016 | | 60 A | FFA-0021-X * |
| 10 A | FFA-0017 | | 70 A | FFA-0022-X * |
| 15 A | FFA-0028 | | 80 A | FFA-0023-X * |
| 20 A | FFA-0018 | | 100 A | FFA-0024-X * |
| 30 A | FFA-0019 | | | |

- * -1: adapter has #10 studs on 5/8" centers for two-hole cable lug
 -2: adapter has #10 studs on 3/4" centers for two-hole cable lug
 -3: adapter has 1/4" studs on 1" centers for two-hole cable lug

Table 5-4. Plug-in Circuit Breakers

Fuse holders that accommodate telecom fuses are located in a separate fuse power distribution box frame. The fuse holders are designed to hold Bussmann® (or equivalent) TPL-series fuses in sizes of 70 amps to 600 amps. The following stock sizes are available from APC:

| FUSE RATING | APC PART NUMBER |
|-------------|-----------------|
| 200 A | FFA-0106 |
| 300 A | FFA-0093 |
| 600 A | FFA-0099 |

Table 5-5 Telecom Power Fuses

5.8.2 Installation of Circuit Breakers and Fuses

5.8.2.1 Plug-in Circuit Breakers

- 1) Remove the circuit breaker cover panel and the plastic cover(s) from the desired location(s).
- 2) Install the circuit breaker(s) by snapping the top terminal onto the upper bus bar and rotating the unit down until the second terminal snaps onto the breaker termination post as shown in Figure 5-9. The breaker alarm terminals are designed to make contact with the alarm terminal board as the breaker is snapped into place.

NOTE: Circuit breaker alarm contacts close when the circuit breaker is tripped but not when it is turned OFF.

***** CAUTION *****

During circuit breaker installation, carefully align the breaker alarm terminals with the alarm terminal board to avoid breaker terminal damage.

- 3) Reattach the circuit breaker cover panel.

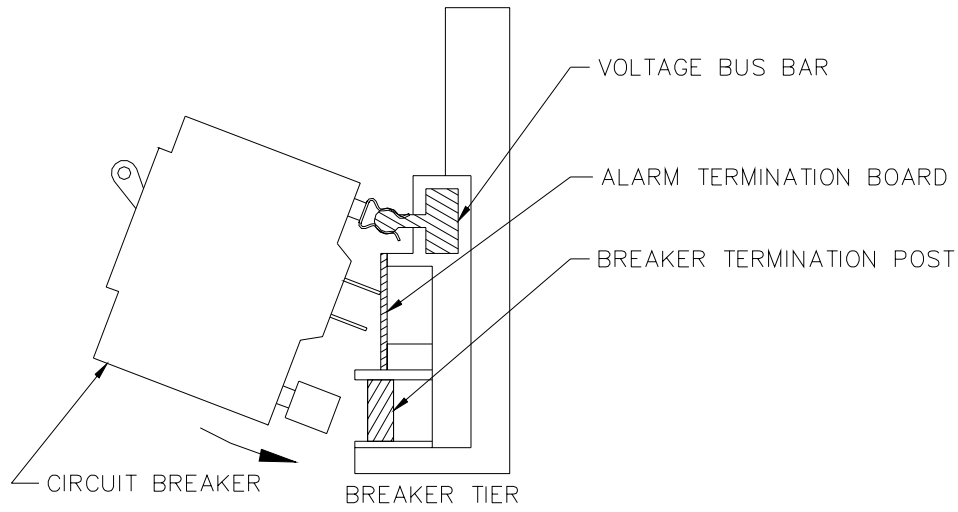


Figure 5-9 Plug-in Circuit Breaker Insertion

5.8.2.2 Circuit Breaker Load Connections

Connections for the -48V dc loads are located directly to the side of the corresponding breaker. A typical load connection would utilize a #6 AWG wire with a two-hole lug on 5/8-inch centers, attached with standard #10-32 mounting screws.

The load return cables for each circuit breaker section connect to a return bus directly opposite the circuit breakers. These return buses contain patterns for 28 two-hole #10-32 lugs on 5/8-inch centers, and 14 two-hole 1/4"-20 lugs on a double-pattern of either 5/8-inch or 1-inch centers.

5.8.2.3 Power Distribution Fuse Load Connections

Connection for the -48V dc loads are made to L-shaped landing pads connected to the distribution side of the fuse. All the fuses within a given box frame have a common bus connection to -48V dc. Load side connections utilize a double-hole lug on 1 3/4 -inch centers and return connections are made to the common return bus bar at the top of the cabinet using 1-inch or 1 3/4 -inch lugs (Figure 5-10).



Figure 5-10 Fuse Bay Connections

5.9 Battery Temperature Probe Installation

The optional temperature probe is used to monitor the battery string temperature. To get the most representative temperature measurement, the probe should be placed in contact with a battery cell that is centrally located. The probe should be placed directly in contact with the cell (not the frame surrounding the cell). Generally, the cell cover can be used; be careful not to allow the probe body to touch the terminals.

- 1) Plug the connector end of the temperature probe into J5 the control unit interface card in the base power bay.
- 2) Route the cable as required to position the probe on the selected battery cell
- 3) Remove the adhesive protection strip from the probe body and press the adhesive side of the probe on the battery cell cover.

| BATTERY TEMPERATURE PROBE CABLE | APC PART NUMBER |
|---------------------------------|-----------------|
| 15 ft. (4.6m) | FFA-0013-1 |
| 50 ft. (15.2m) | FFA-0013-2 |

Table 5-6 Temperature Probe Cables

5.10 Power-Up and Checkout

Before initiating power-up and checkout, ensure that the following conditions exist:

- 1) Make sure that the external circuit breaker protecting the cables from the battery to the power plant is turned **OFF** (the battery cables should be connected to the power plant, but the battery should **not** be connected).
- 2) Make sure that all load circuit breakers are turned **OFF** and all load distribution fuses are removed.
- 3) Verify that all rectifiers have been installed.

5.10.1 Apply AC Power

Turn on the circuit breakers that supply ac power to the rectifiers in the MX28B dc power plant. The main screen should appear on the control unit display (see Figure 5-11). The display on the control unit is a 2-lines by 16-characters display. The cursor cycles below the characters of the active selection on the display. Information shown in the second line of Figure 5-11 that extends beyond 16 characters (to the right of the “S” in “ALARMS”) can viewed on the control unit display by using the scrolling controls (refer to Section 6 for operation of the control unit).

NOTE: When ac power is initially applied, there is a 60-second period during which no alarms are reported.



Figure 5-11 Control Unit Display

5.10.2 System Parameters Verification/Adjustment

The MX28B system control unit is delivered with pre-programmed parameter default settings. A complete listing and description of all system configuration parameters as well as displayable system status and information is provided in Section 6. Read Section 6 to gain an understanding of and how to use the operational features provided by the MX28B dc power plant. As a minimum, the following parameters should be verified and adjusted, if required, before connecting batteries or loads to the power plant:

- 1) **Battery Float Voltage** - default = -54.00V dc (Check the manufacturer's recommendation for the batteries being used in the system.)
- 2) **Battery Maximum Recharge Rate** - default = 50A. (Bellcore specifications recommend a maximum charging rate of battery capacity (in Ampere-hours) divided by 20 hours; check the manufacturer's recommendation.)
- 3) **System Voltage** - measurement \cong -54.00V dc (This is a measurement by the system of the dc output bus voltage.)
- 4) **LVD Option** - default = "Enable" (If the MX28B does not have an LVD installed, this should be changed to "Disable".)
- 5) **Rectifier Information** - Check the rectifier information displays to verify that all rectifiers installed can be viewed on the control unit display and that no rectifier alarms are active.

Section 6 provides location information for these parameters and how to make changes if required.

5.10.3 Full System Power Up

To complete a full system power up, perform the following steps

- 1) Turn **OFF** all the circuit breakers that supply ac power to the rectifiers in the MX28B dc power plant.
- 2) Turn on the external circuit breaker from the battery to the power plant.
- 3) Turn on all the circuit breakers that supply ac power to the rectifiers in the MX28B dc power plant.
- 4) Load circuit breakers and distribution fuses may now be turned on and inserted as required.

6. SETUP, ADJUSTMENTS, AND OPERATION

6.1 User Interface

The MX28B control unit provides a user interface designed with a hierarchical menu that can be viewed on the 32-character display by “navigating” with the “ ” (left), “ ” (right), “ ” (up), and “ ” (down) arrow keys located on the front panel. The selected item on the display is identified by the cursor cycling beneath its characters.

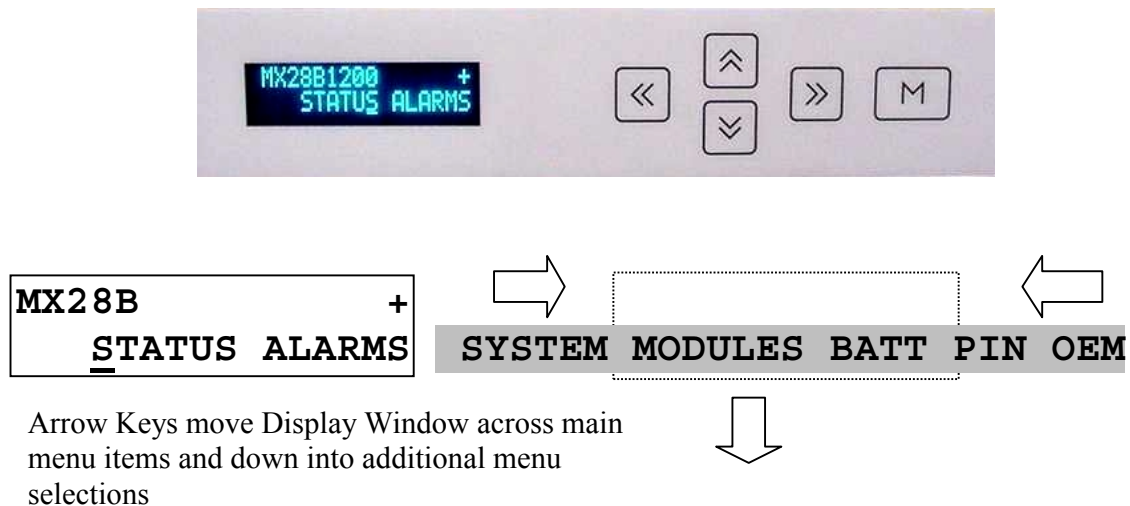


Figure 6-1 Navigating the Menu

The “M” (Modify) key and the arrow keys are used to set parameters and text to customize the system operation for a specific application. Items that can be modified have "m+" in the upper right corner of the display. If a security level higher than the one presently set is required to modify the parameter, "s+" is displayed instead of “m+”. Status, alarms, and information screens have "+" in the upper right corner of the display (or “#” in the case of rectifier information screens) and cannot be modified. When ac power is initially applied, there is a 60-second period during which no alarms are reported.

Pressing the "M" key on the front panel will change the "m+" to "M+", indicating that the parameter can now be changed using the arrow keys. Some parameters can be changed to other predefined selections by pressing the up or down arrow keys to display an alternative selection. These parameters can be recognized after the “M” key is pressed by the cursor cycling beneath the characters of the selection. For other parameters, such as text and most numeric values, after the “M” key is pressed the cursor will be displayed under an individual character. The right or left arrow key is used to position the cursor below the character to be changed and the up or down arrow key is used to "spin" the digit or letter to the desired value. When the desired changes have been made to an individual parameter screen, the “M” key is pressed again; the “M+” changes back to “m+” and the new entry is stored in memory.

If the user plans to make any changes to system parameters, the first item that should be verified or entered is the appropriate password for the security level required for the parameters to be modified. Security level 2 enables modification of all variable system parameters, level 1

permits modification of some parameters; no security is required for viewing status items. The security level password is entered through the “PIN” screen. If no front panel keys are pressed for 60 minutes, the active password reverts to “0000” and “**APC**” begins to move about the display. Pressing any key returns the display to normal; the password must be re-entered if system parameters require changes. The default passwords for level 1 and level 2 are “1111” and “2222”, respectively. There are no alternate passwords or “backdoors” for accessing the system. A forgotten password may require a new master controller board, at customer expense.

System control parameters are stored in non-volatile memory and will not be erased when power is removed for the master control unit. However, if a new program EPROM is installed or a different device model selected, the system control parameters will be re-initialized to the factory default settings.

Eleven LEDs are provided on the front panel of the control unit to indicate system status. Three LEDs grouped together vertically provide overall system status; they are “MAJOR”, “MINOR”, and “NORMAL”, indicating the presence of a major alarm, a minor alarm, or normal operation. The other eight LEDs correspond to the active state of each of the alarm output relays and are labeled “ALM1” ••• “ALM6”, “MIN”, and “MAJ”.

6.2 External Alarm Inputs

The four external alarm inputs (also referred to as “Input Relay Alarms”) can be assigned a priority and routed or “mapped” to alarm output relays. Available assignments are “Ignore”, “Major”, “Minor”, and “Relay 1” ••• “Relay 6”. Screens for making the assignments are located at [**SYSTEM/IN-RLY/RLY-MAP**]. This special menu notation is explained with an example in section 6.4

A user defined name or “alias” may also be assigned to each of these input alarms. Screens for making these assignments are located at [**SYSTEM/IN-RLY/ALIAS**]. For information on wiring connections to these inputs refer to Section 5.7.1.

6.3 Alarm Output Relays

There are eight alarm output relays designated Relay 1 through Relay 6, Minor, and Major, respectively. Various system parameters may be programmed to activate any of these alarm relays when set thresholds are exceeded or specific conditions occur. The first six relays can also be assigned a priority and routed or “mapped” to other output alarm relays. Available assignments are “Ignore”, “Major”, “Minor”, and “Relay 1” ••• “Relay 6”. Screens for making these assignments are located at [**SYSTEM/OUT-RLY/RLY-MAP**]. This feature makes it possible for a single alarm condition to activate multiple alarm output relays including the Minor or Major alarm relay. A user defined name or “alias” may also be assigned to each of the eight output relay alarms. Screens for making these assignments are located at [**SYSTEM/OUT-RLY/ALIAS**]. For information on making wiring connections to the alarm output relays refer to Section 5.7.2.

6.4 Parameter Locations, Descriptions, and Default Values

The location, description, and factory programmed default value for each of the MX28B system parameters is found in Table 6-1. The table also shows all of the status and information screens with typical displays. The location of a parameter screen is shown in brackets, for example: [**SYSTEM/IN-RLY/RLY-MAP**]. To find the parameters that can be accessed in this category, starting from the main menu screen, do the following:

- 1) Use the right or left arrow keys to position the cycling cursor below “SYSTEM”.
- 2) Press the down arrow key once.
- 3) Use the right arrow key to position the cycling cursor below “IN-RLY”.
- 4) Press the down arrow key once; the cursor will be cycling below “RLY-MAP”.
- 5) Press the down arrow key (repeatedly if necessary) until the desired parameter screen is displayed (there are eight parameter screens in this category).
- 6) After making any desired changes (refer to Section 6.1 for the procedure), to return to the main menu press the up arrow key repeatedly.

If a parameter requires a level 1 or level 2 security access to permit changes to it, the security level will be found in braces, i.e. {2}, in the “PARAMETER” column of Table 6-1.

The complete menu structure shown in the order in which it is accessed from the control unit display is presented in outline form in Figure 6.2. Each indentation to the right represents a menu level below the indicated title.

Figure 6-2. Control Unit Menu Structure

```
MX28B-1200  +
STATUS
  Sys Voltage
  Sys Current
  Sys Temp
  Batt Current
  Batt Temp
ALARMS
  Alarm Item 1
  Alarm Item 2
  Alarm Item 3
  Alarm Item 4
  Alarm Item 5
  Alarm Item 6
  Alarm Item 7
  Alarm Item 8
  Alarm Item 9
  Alarm Item 10
  Alarm Item 11
  Alarm Item 12
  Alarm Item 13
  Alarm Item 14
  Alarm Item 15
  Alarm Item 16
SYSTEM
  SET-ALM
    Sys HV Thr
    Sys HV Alm
    Sys LV Thr
    Sys LV Alm
    Rect Cfg Alm
    Rect 1ofN Alm
    Rect 2ofN Alm
    Sys HT Thr
    Sys HT Alm
    Sys LT Thr
    Sys LT Alm
    Hw Sys V Alm
    Hw Batt C Alm
    Hw Batt T Alm
    Hw Sys T Alm
    Hw LVD1 Alm
    Hw LVD2 Alm
  SETUP
    PIN 1
    PIN 2
    Address 1
```


(Figure 6-2. Control Unit Menu Structure)

```
Address 2
Address 3
Model
Fahrenheit
Cntrl Rev
FW Version
Display Type
DATE
  Date
  Time
OUT-RLY
  RLY-MAP
    Out-Rly 1 Alm
    Out-Rly 2 Alm
    Out-Rly 3 Alm
    Out-Rly 4 Alm
    Out-Rly 5 Alm
    Out-Rly 6 Alm
    Out-Rly 1 Dly
    Out-Rly 2 Dly
    Out-Rly 3 Dly
    Out-Rly 4 Dly
    Out-Rly 5 Dly
    Out-Rly 6 Dly
  ALIAS
    Out-Rly 1
    Out-Rly 2
    Out-Rly 3
    Out-Rly 4
    Out-Rly 5
    Out-Rly 6
    Relay Minor
    Relay Major
IN-RLY
  RLY-MAP
    In-Rly 1 Alm
    In-Rly 2 Alm
    In-Rly 3 Alm
    In-Rly 4 Alm
  ALIAS
    In-Rly 1
    In-Rly 2
    In-Rly 3
    In-Rly 4
DIAG
  Store Cfg
  Lamp Test
```

(Figure 6-2. Control Unit Menu Structure)

```

Test Relay En
Test Relay 1
Test Relay 2
Test Relay 3
Test Relay 4
Test Relay 5
Test Relay 6
Test Min Rly
Test Maj Rly
MODULES
  RECT
    SET-ALM
      Rect CL Alm
      Rect Stdby Alm
      Rect FF Alm
      Rect RFA Alm
    PARAM
      Rect Fail Safe
      Rect Fail Comm
    INFO
      Rect # Desc
      Rect # Curr
      Rect # CL
      Rect # Stdby
      Rect # FF
      Rect # RFA
  CIRBKR
    SET-ALM
      Cir Bkr 1 Alm
      Cir Bkr 2 Alm
      Cir Bkr 3 Alm
      Cir Bkr 4 Alm
      Cir Bkr 5 Alm
      Cir Bkr 6 Alm
      •
      •
      •
      Cir Bkr 70 Alm
      Cir Bkr 71 Alm
      Cir Bkr 72 Alm
    ALIAS
      Cir Bkr 1
      Cir Bkr 2
      Cir Bkr 3
      Cir Bkr 4
      Cir Bkr 5
      Cir Bkr 6

```

(Figure 6-2. Control Unit Menu Structure)

```

Cir Bkr 7
Cir Bkr 8
    •
    •
    •
Cir Bkr 70
Cir Bkr 71
Cir Bkr 72
FUSE
  SET-ALM
    FUSE 1 Alm
    FUSE 2 Alm
    FUSE 3 Alm
    FUSE 4 Alm
    FUSE 5 Alm
    FUSE 6 Alm
    FUSE 7 Alm
    FUSE 8 Alm
    FUSE 9 Alm
    FUSE 10 Alm
    FUSE 11 Alm
    FUSE 12 Alm
    FUSE 13 Alm
    FUSE 14 Alm
    FUSE 15 Alm
    FUSE 16 Alm
  ALIAS
    FUSE 1
    FUSE 2
    FUSE 3
    FUSE 4
    FUSE 5
    FUSE 6
    FUSE 7
    FUSE 8
    FUSE 9
    FUSE 10
    FUSE 11
    FUSE 12
    FUSE 13
    FUSE 14
    FUSE 15
    FUSE 16

```

(Figure 6-2. Control Unit Menu Structure)

```
LVD
  SET-ALM
    LVD1 Option
    LVD1 Open Alm
    LVD2 Option
    LVD2 Open Alm
  PARAM
    LVD1 Trip
    LVD1 Reset
    LVD2 Trip
    LVD2 Reset
BATT
  SET-ALM
    Batt Disc Thr
    Batt Disc Alm
    Batt HV Thr
    Batt HV Alm
    Batt LV Thr
    Batt LV Alm
    Batt HT Thr
    Batt HT Alm
    Batt LT Thr
    Batt LT Alm
  PARAM
    Batt Float
    Batt Max Rech
  COMP
    Comp Method
    Comp TC
    Comp HKnee
    Comp LKnee
PIN
  PIN
OEM
  OEM R Offset
  OEM R Gain
  OEM S Offset
  OEM S Gain
```

Table 6-1. Parameter Locations, Descriptions, and Default Values

| PARAMETER | DESCRIPTION | DISPLAY SCREENS / DEFAULT SETTINGS |
|-----------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------|
| SYSTEM SETUP | | |
| Password Entry | | |
| PIN Entry [PIN] | Screen for entry of the active password (PIN). | PIN m+ 0000 |
| Password Setup | | |
| Level 1 PIN {2} [SYSTEM/SETUP] | Password (PIN) that permits security Level 1 parameter changes - limited access. | PIN 1 m+ 1111 |
| Level 2 Password {2} [SYSTEM/SETUP] | Password (PIN) that permits security Level 2 parameter changes - unlimited access. | PIN 2 m+ 2222 |
| OEM Calibration | | |
| OEM R Offset {2} [OEM] | Voltage offset adjustment for factory calibration of voltage readings/settings. | OEM R Offset m+ 0.000 V |
| OEM R Gain {2} [OEM] | Voltage gain adjustment for factory calibration of voltage readings/settings. | OEM R Gain m+ 1.000 V |
| OEM S Offset {2} [OEM] | Current offset adjustment for factory calibration of battery current readings/settings. | OEM S Offset m+ 0.0 A |
| OEM S Gain {2} [OEM] | Current gain adjustment for factory calibration of battery current readings/settings. | OEM S Gain m+ 1.000 A |
| Site Address/Identification | | |
| Address 1 {1} [SYSTEM/SETUP] | Power plant address or identification - first line. | Address 1 m+ APC |
| Address 2 {1} [SYSTEM/SETUP] | Power plant address or identification - second line. | Address 2 m+ 11035 Switzer Av |
| Address 3 {1} [SYSTEM/SETUP] | Power plant address or identification - third line. | Address 3 m+ Dallas, TX. |
| Control Unit Setup & Info. | | |
| Model Type {2} [SYSTEM/SETUP] | Model type number for the MX28B dc power plant NOTE: Changing the model number causes the system to reinitialize. | Model m+ 0001 |
| Temperature Scale {1} [SYSTEM/SETUP] | Enables selection of Fahrenheit or Celsius temperature scale (Fahrenheit "OFF" displays readings in °C). | Fahrenheit m+ OFF |
| Control Unit Revision [SYSTEM/SETUP] | Hardware revision level of the control unit. | Cntrl Rev + 000002 |
| Firmware Version [SYSTEM/SETUP] | Version number of the control unit firmware. NOTE: Actual firmware version number displayed is the current version as of the date of manufacture. | FW Version + 000131 |

(Table 6.1 Parameter Locations, Descriptions, and Default Values)

| PARAMETER | DESCRIPTION | DISPLAY SCREENS / DEFAULT SETTINGS |
|----------------------------------------------------|------------------------------------------------------------------------------------------------------|---------------------------------------|
| Display Type [SYSTEM/SETUP] | Type number for the control unit display. | Display Type + 000255 |
| Date/Time Setup | | |
| Date {1} [SYSTEM/DATE] | Internal system calendar date. | Date m+ DEC 16 1999 |
| Time {1} [SYSTEM/DATE] | Internal system clock time (24-hour format). | Time m+ 9:00:25 |
| Alarm Threshold Setup | | |
| High Voltage Threshold {1} [SYSTEM/SET-ALM] | System High voltage alarm threshold. | Sys HV Thr m+ -58.00 V |
| Low Voltage Threshold {1} [SYSTEM/SET-ALM] | System Low voltage alarm threshold. | Sys LV Thr m+ -50.00 V |
| High Temperature Threshold {1} [SYSTEM/SET-ALM] | Over temperature alarm threshold. | Sys HT Thr m+ 70.0 C |
| Low Temperature Threshold {1} [SYSTEM/SET-ALM] | Under temperature alarm threshold. | Sys LT Thr m+ 0.0 C |
| System Status | | |
| System Voltage [STATUS] | System output voltage measured between the MX28B dc power plant -48V and return buses. | Sys Voltage + -54.00 V |
| System Current [STATUS] | The total system output current (calculated as the sum of the individual rectifier output currents). | Sys Current + 145.8 A |
| System Temperature [STATUS] | System temperature measured within the control unit. | Sys Temp + 26.7 C |
| Battery Current [STATUS] | Battery current measured at the current shunt. | Batt Current + -15.0 A |
| Battery Temperature [STATUS] | Battery temperature measured by the optional battery temperature sensor probe. | Batt Temp + 25.2 C |
| System Alarms | | |
| System High Voltage {1} [SYSTEM/SET-ALM] | System voltage is above the high voltage threshold. | Sys HV Alm m+ Minor |
| System Low Voltage {1} [SYSTEM/SET-ALM] | System voltage is below the low-voltage threshold. | Sys LV Alm m+ Minor |
| System High Temperature {1} [SYSTEM/SET-ALM] | The control unit temperature is above the high temperature threshold. | Sys HT Alm m+ Minor |

(Table 6-1. Parameter Locations, Descriptions, and Default Values)

| PARAMETER | DESCRIPTION | DISPLAY SCREENS / DEFAULT SETTINGS |
|------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------|
| System Low Temperature {1} [SYSTEM/SET-ALM] | The control unit temperature is below the low temperature threshold. | Sys LT Alm m+ Minor |
| Rectifier Configuration {1} [SYSTEM/SET-ALM] | The rectifier configuration differs from its stored configuration. | Rect Cfg Alm m+ Minor |
| Rectifier Fail 1-of-N {1} [SYSTEM/SET-ALM] | Rectifier Fail 1-of-N alarm - one rectifier has at least one alarm condition. | Rect 1ofN Alm m+ Minor |
| Rectifier Fail 2-of-N {1} [SYSTEM/SET-ALM] | Rectifier Fail 2-of-N alarm – two or more rectifiers have at least one alarm condition each. | Rect 2ofN Alm m+ Major |
| Hardware System Voltage {2} [SYSTEM/SET-ALM] | This alarm indicates there is a hardware failure in the system voltage monitoring function. | Hw Sys V Alm m+ Minor |
| Hardware Battery Current {2} [SYSTEM/SET-ALM] | This alarm indicates there is a hardware failure in the battery current monitoring function. | Hw Batt C Alm m+ Minor |
| Hardware Battery Temperature {2} [SYSTEM/SET-ALM] | This alarm indicates there is a hardware failure in the battery temperature monitoring function. | Hw Batt T Alm m+ Minor |
| Hardware System Temperature {2} [SYSTEM/SET-ALM] | This alarm indicates there is a hardware failure in the system temperature monitoring function. | Hw Sys T Alm m+ Minor |
| Hardware LVD1 {2} [SYSTEM/SET-ALM] | This alarm indicates there is a conflict between the commanded and sensed positions of the LVD1. | Hw LVD1 Alm m+ Minor |
| Hardware LVD2 {2} [SYSTEM/SET-ALM] | This alarm indicates there is a conflict between the commanded and sensed positions of the LVD2. | Hw LVD2 Alm m+ Minor |
| SYSTEM ALARMS DISPLAY | | |
| Alarms Item 1 [ALARMS] | Display of up to 16 active alarms (a typical alarm screen is shown). | Alarm Item 1 + Batt LV Alm On m |
| • • • | • • • | • • • |
| Alarms Item 16 [ALARMS] | Display of up to 16 active alarms (a typical alarm screen is shown). | Alarm Item 16 + |
| SYSTEM DIAGNOSTICS | | |
| Store Configuration {1} [SYSTEM/DIAG] | Setting this parameter to “Enable” will cause the current rectifier configuration to be stored (the display toggles back to “Disable” after entry). | Store Cfg m+ Disable |
| Lamp Test {1} [SYSTEM/DIAG] | Setting Lamp Test to “ON” will turn on the “MAJOR”, “MINOR”, “NORMAL”, “MAJ”, and “MIN” LEDs on the control unit front panel. | Lamp Test m+ OFF |
| Test Relay Enable {1} [SYSTEM/DIAG] | This parameter must be set to “Enable” to permit the eight output relays to be manually tested; otherwise, the state of the relays will be per system conditions. | Test Relay En m+ Disable |

(Table 6-1. Parameter Locations, Descriptions, and Default Values)

| PARAMETER | DESCRIPTION | DISPLAY SCREENS / DEFAULT SETTINGS |
|--------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------|
| Test Relay 1 {1} [SYSTEM/DIAG] | Setting this parameter to “ON” energizes Relay 1 and turns on the “ALM1” LED on the control unit front panel. | Test Relay 1 m+ OFF |
| • • • | • • • | • • • |
| Test Relay 6 {1} [SYSTEM/DIAG] | Setting this parameter to “ON” energizes Relay 6 and turns on the “ALM6” LED on the control unit front panel. | Test Relay 6 m+ OFF |
| Test Minor Relay {1} [SYSTEM/DIAG] | Setting this parameter to “ON” energizes the Minor Relay and turns on the “MIN” LED on the control unit front panel. | Test Min Rly m+ OFF |
| Test Major Relay {1} [SYSTEM/DIAG] | Setting this parameter to “ON” de-energizes the Major Relay and turns on the “MAJ” LED on the control unit front panel. | Test Maj Rly m+ OFF |
| BATTERY SETUP | | |
| Float Voltage {1} [BATT/PARAM] | Float voltage at 25°C battery temperature. | Batt Float m+ -54.00 V |
| Maximum Recharge Current {1} [BATT/PARAM] | Maximum battery recharge current (the system limits the charging current to this programmable value). | Batt Max Rech m+ 12 A |
| Compensation Method {1} [BATT/COMP] | Activate “000001” or de-activate “000000” battery temperature compensation. | Comp Method m+ 000000 |
| Temperature Compensation {1} [BATT/COMP] | Temperature compensation between low knee and high knee in mV/cell/°C. (Compensation equals zero at 25°C.) | Comp TC m+ - 3.00mV |
| Compensation High Knee {1} [BATT/COMP] | The temperature compensation high knee is the point above which there is no additional battery voltage compensation for further increases in temperature. | Comp Hknee m+ 40.0 C |
| Compensation Low Knee {1} [BATT/COMP] | The temperature compensation low knee is the point below which there is no additional battery voltage compensation for further decreases in temperature. | Comp Lknee m+ 0.0 C |
| Discharge Threshold {1} [BATT/SET-ALM] | An alarm is generated if the battery discharge current exceeds this value. | Batt Disc Thr m+ 10 A |
| High Voltage Threshold {1} [BATT/SET-ALM] | An alarm is generated if the magnitude of the battery voltage rises above this value. | Batt HV Thr m+ -58.00 V |
| Low Voltage Threshold {1} [BATT/SET-ALM] | An alarm is generated if the magnitude of the battery voltage drops below this value. | Batt LV Thr m+ -44.00 V |
| High Temperature Threshold {1} [BATT/SET-ALM] | An alarm is generated if the battery temperature exceeds this value. | Batt HT Thr m+ 70.0 C |
| Low Temperature Threshold {1} [BATT/SET-ALM] | An alarm is generated if the battery temperature drops below this value. | Batt LT Thr m+ 0.0 C |

(Table 6-1. Parameter Locations, Descriptions, and Default Values)

| PARAMETER | DESCRIPTION | DISPLAY SCREENS / DEFAULT SETTINGS |
|----------------------------------------------------|-----------------------------------------------------------------------------------------------------------------|---------------------------------------|
| Battery Alarms | | |
| Discharge Alarm {1} [BATT/SET-ALM] | An alarm that is generated if the battery discharge current exceeds the programmed battery discharge threshold. | Batt Disc Alm m+ Minor |
| High Voltage Alarm {1} [BATT/SET-ALM] | An alarm that is generated if the magnitude of the battery voltage rises above the high voltage threshold. | Batt HV Alm m+ Minor |
| Low Voltage Alarm {1} [BATT/SET-ALM] | An alarm that is generated if the magnitude of the battery voltage drops below the low voltage threshold. | Batt LV Alm m+ Minor |
| High Temperature Alarm {1} [BATT/SET-ALM] | An alarm that is generated if the battery temperature exceeds the high temperature threshold. | Batt HT Alm m+ Minor |
| Low Temperature Alarm {1} [BATT/SET-ALM] | An alarm that is generated if the battery temperature drops below the low temperature threshold. | Batt LT Alm m+ Minor |
| RECTIFIER SETUP | | |
| Fail Safe Voltage {1} [MODULES/RECT/PARAM] | Rectifier default output voltage if communication with the control unit fails. | Rect Fail Safem+ -54.00 V |
| Communications Timeout {1} [MODULES/RECT/PARAM] | The maximum rectifier communications response time allowed before a communications failure is declared. | Rect Fail Comm+ 1 min |
| Rectifier Information | NOTE: This information can be viewed for each rectifier installed by using the horizontal arrow keys. | |
| Rectifier Description [MODULES/RECT/INFO] | Displays the model number of the installed rectifier. | Rect 1 Desc # MRF28H54 |
| Rectifier Current [MODULES/RECT/INFO] | A display of the dc output current for the individual rectifier. | Rect 1 Curr # 24.9 A |
| Current Limit Alarm [MODULES/RECT/INFO] | The status will be "ON" if the rectifier has been forced into its current limited mode. | Rect 1 CL # OFF |
| Standby Alarm [MODULES/RECT/INFO] | The status will be "ON" if the control unit is holding the rectifier in the standby mode. | Rect 1 Stdbby # OFF |
| Fan Fail Alarm [MODULES/RECT/INFO] | The status will be "ON" if the rectifier fan has failed. | Rect 1 FF # OFF |
| Rectifier Fault Alarm (RFA) [MODULES/RECT/INFO] | The status will be on if the rectifier output has failed. | Rect 1 RFA # OFF |
| Rectifier Alarms | | |
| Current Limit Alarm {1} [MODULES/RECT/SET-ALM] | This alarm indicates that a rectifier has been forced into the current limited mode. | Rect CL Alm m+ n of N |

(Table 6-1. Parameter Locations, Descriptions, and Default Values)

| PARAMETER | DESCRIPTION | DISPLAY SCREENS / DEFAULT SETTINGS |
|----------------------------------------------------|----------------------------------------------------------------------------------------|------------------------------------|
| Standby Alarm {1} [MODULES/RECT/SET-ALM] | This alarm indicates that the control unit is holding a rectifier in the standby mode. | Rect Stdby Almm+ n of N |
| Fan Fail Alarm {1} [MODULES/RECT/SET-ALM] | This alarm indicates that a rectifier fan has failed. | Rect FF Alm m+ n of N |
| RFA Alarm {1} [MODULES/RECT/SET-ALM] | This alarm indicates that a rectifier output has failed. | Rect RFA Alm m+ n of N |
| CIRCUIT BREAKER SETUP | | |
| Breaker 1 Alias {1} [MODULES/CIRBKR/ALIAS] | An alternate name (alias) that can be assigned to a circuit breaker if desired. | Cir Bkr 1 m+ -48V |
| • • • | • • • | • • • |
| Breaker 72 Alias {1} [MODULES/CIRBKR/ALIAS] | An alternate name (alias) that can be assigned to a circuit breaker if desired. | Cir Bkr 72 m+ -48V |
| Circuit Breaker Alarms | | |
| Breaker 1 Tripped {1} [MODULES/CIRBKR/SET-ALM] | An alarm that indicates Circuit Breaker 1 is tripped. | Cir Bkr 1 Alm m+ Major |
| • • • | • • • | • • • |
| Breaker 72 Tripped {1} [MODULES/CIRBKR/SET-ALM] | An alarm that indicates Circuit Breaker 24 is tripped. | Cir Bkr 72 Almm+ Major |
| FUSE SETUP | | |
| Fuse 1 Alias {1} [MODULES/FUSE/ALIAS] | An alternate name (alias) that can be assigned to a Fuse 1 if desired. | FUSE 1 + -48V |
| • • • | • • • | • • • |
| Fuse 16 Alias {1} [MODULES/FUSE/ALIAS] | An alternate name (alias) that can be assigned to a Fuse 16 if desired. | FUSE 16 + -48V |

(Table 6-1. Parameter Locations, Descriptions, and Default Values)

| PARAMETER | DESCRIPTION | DISPLAY SCREENS / DEFAULT SETTINGS |
|--------------------------------------------------------|-----------------------------------------------------------------------------------------------------------|--------------------------------------------|
| FUSE Fuse Alarms | | |
| Fuse 1 Blown {1} [MODULES/FUSE/SET-ALM] | An alarm that indicates Fuse 1 is blown. | FUSE 1 Alm m+ Major |
| • • • | • • • | • • • |
| Fuse 16 Blown {1} [MODULES/FUSE/SET-ALM] | An alarm that indicates Fuse 16 is blown. | FUSE 16 Alm m+ Major |
| INPUT RELAY SETUP | | |
| Input Relay 1 Alias {1} [SYSTEM/IN-RLY/ALIAS] | An alternate name (alias) can be assigned to the relay if desired. | In-Rly 1 m+ Input Relay 1 |
| • • • | • • • | • • • |
| Input Relay 4 Alias {1} [SYSTEM/IN-RLY/ALIAS] | An alternate name (alias) can be assigned to the relay if desired. | In-Rly 4 m+ Input Relay 4 |
| Input Relay Alarms | | |
| Input Relay 1 {1} [SYSTEM/IN-RLY/RLY-MAP] | An alarm activated in response to an external contact closure or opening at the Input Relay 1 connection. | In-Rly 1 Alm m+ Ignore |
| • • • | • • • | • • • |
| Input Relay 4 {1} [SYSTEM/IN-RLY/RLY-MAP] | An alarm activated in response to an external contact closure or opening at the Input Relay 4 connection. | In-Rly 4 Alm m+ Ignore |
| OUTPUT RELAY SETUP | | |
| Output Relay 1 Alias {1} [SYSTEM/OUT-RLY/ALIAS] | An alternate name (alias) can be assigned to the relay if desired. | Out-Rly 1 m+ Relay 1 |
| • • • | • • • | • • • |
| Output Relay 6 Alias {1} [SYSTEM/OUT-RLY/ALIAS] | An alternate name (alias) can be assigned to the relay if desired. | Out-Rly 6 m+ Relay 6 |
| Output Relay Minor Alias {1} [SYSTEM/OUT-RLY/ALIAS] | An alternate name (alias) can be assigned to the relay if desired. | Relay Minor m+ Minor |

(Table 6-1. Parameter Locations, Descriptions, and Default Values)

| PARAMETER | DESCRIPTION | DISPLAY SCREENS / DEFAULT SETTINGS |
|--------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------|
| Output Relay Major Alias {1} [SYSTEM/OUT-RLY/ALIAS] | An alternate name (alias) can be assigned to the relay if desired. | Relay Major m+ Major |
| Output Relay 1 Delay {1} [SYSTEM/OUT-RLY/RLY-MAP] | Delay between sensing of the alarm condition and activation of the alarm relay. An alarm condition must exist for longer than the delay to be activated. | Out-Rly 1 Dly m+ 0 sec |
| • • • | • • • | • • • |
| Output Relay 6 Delay {1} [SYSTEM/OUT-RLY/RLY-MAP] | Delay between sensing of the alarm condition and activation of the alarm relay. An alarm condition must exist for longer than the delay to be activated. | Out-Rly 6 Dly m+ 0 sec |
| Output Relay Alarms | | |
| Output Relay 1 {1} [SYSTEM/OUT-RLY/RLY-MAP] | Output Relay 1 alarm can be “mapped” to activate other output relays (“Ignore” activates no additional relays). | Out-Rly 1 Alm m+ Ignore |
| • • • | • • • | • • • |
| Output Relay 6 {1} [SYSTEM/OUT-RLY/RLY-MAP] | Output Relay 6 alarm can be “mapped” to activate other output relays (“Ignore” activates no additional relays). | Out-Rly 6 Alm m+ Ignore |
| LVD SETUP | | |
| LVD1 Trip {1} [MODULES/LVD/PARAM] | LVD1 trip (disconnect) threshold voltage. | LVD1 Trip m+ -42.00 V |
| LVD1 Restore {1} [MODULES/LVD/PARAM] | LVD1 restore (reconnect) threshold voltage. | LVD1 Reset m+ -48.00 V |
| LVD2 Trip {1} [MODULES/LVD/PARAM] | LVD2 trip (disconnect) threshold voltage. | LVD2 Trip m+ -42.00 V |
| LVD2 Restore {1} [MODULES/LVD/PARAM] | LVD2 restore (reconnect) threshold voltage. | LVD2 Reset m+ -48.00 V |
| LVD Alarm | | |
| LVD1 Option {1} [MODULES/LVD/SET-ALM] | Set to “Enable” if the unit has an LVD1. | LVD1 Option m+ Enable |
| LVD1 Alarm {1} [MODULES/LVD/SET-ALM] | Sets the priority or “mapping” of an LVD1 Alarm. | LVD1 Open Alm m+ Minor |
| LVD2 Option {1} [MODULES/LVD/SET-ALM] | Set to “Enable” if the unit has an LVD2. | LVD2 Option m+ Enable |
| LVD2 Alarm {1} [MODULES/LVD/SET-ALM] | Sets the priority or “mapping” of an LVD2 Alarm. | LVD2 Open Alm m+ Minor |

