Charles Universal Broadband Enclosure CUBE-PM4100-A, CUBE-PM4200-A, CUBE-PM4220-A, and CUBE-PM4300-A General Description and Installation

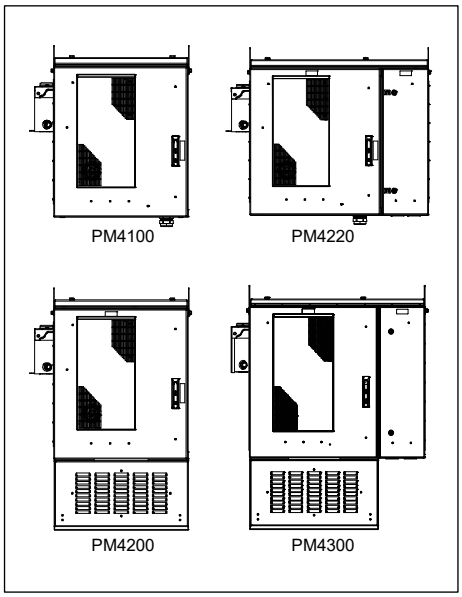

Figure 1 Front View of the CUBE

1. GENERAL INTRODUCTION

1.1. Document Purpose

This document provides general information for the CUBE-PMxxx of the Charles Industries' Universal Broadband Enclosure (CUBE) product line. Figure 1 shows a closed front view of the enclosure.

-NOTE-

Hereafter, the Charles Universal Broadband Enclosure CUBE-PM4100-A, CUBE-PM4200-A, CUBE-PM4220-A,and CUBE-PM4300-A will be referred to as the "PM4100," "PM4200," "PM4220," "PM4300," or collectively as the "CUBE."

1.2. Product Purpose

The CUBE consists of a protective enclosure for an integrated system of electronic components and equipment that can serve fiber and copper interfaces.

1.3. Product Mounting and Location

This enclosure is suitable for outside plant-type (OSP) locations and those that may require NEC compliance. The outdoor, weather-resistant CUBE is to be mounted on a pad, wall, H-frame, or pole. The installer connects the power, fiber, and copper connections. Detailed mounting and installation information is covered in Section 3.

2. PRODUCT DESCRIPTION

The PM4300 has an equipment compartment, a customer compartment, and a battery compartment. The other three models in this series have one or two of these compartments as shown in Figure 1. The PM4300 is described here. Descriptions for the other three models are similar, but depend on what compartments are included in the model.

The PM4300 equipment compartment includes 16RU of 23" horizontal rack mount spacing, a 2-position AC load center, and a 750W heat exchanger. The customer compartment has one 2RU and two 1RU of 19" vertical rack mount spacing. The battery compartment supports four 12VDC 60Ah customer supplied batteries and includes a 100W battery heater pad.

Figure 2 shows the PM4300 dimensions. Figure 3 shows the main components of the PM4300. Dimensions and components for the other three models are the same as those shown in Figures 2 and 3 if the model includes that compartment.

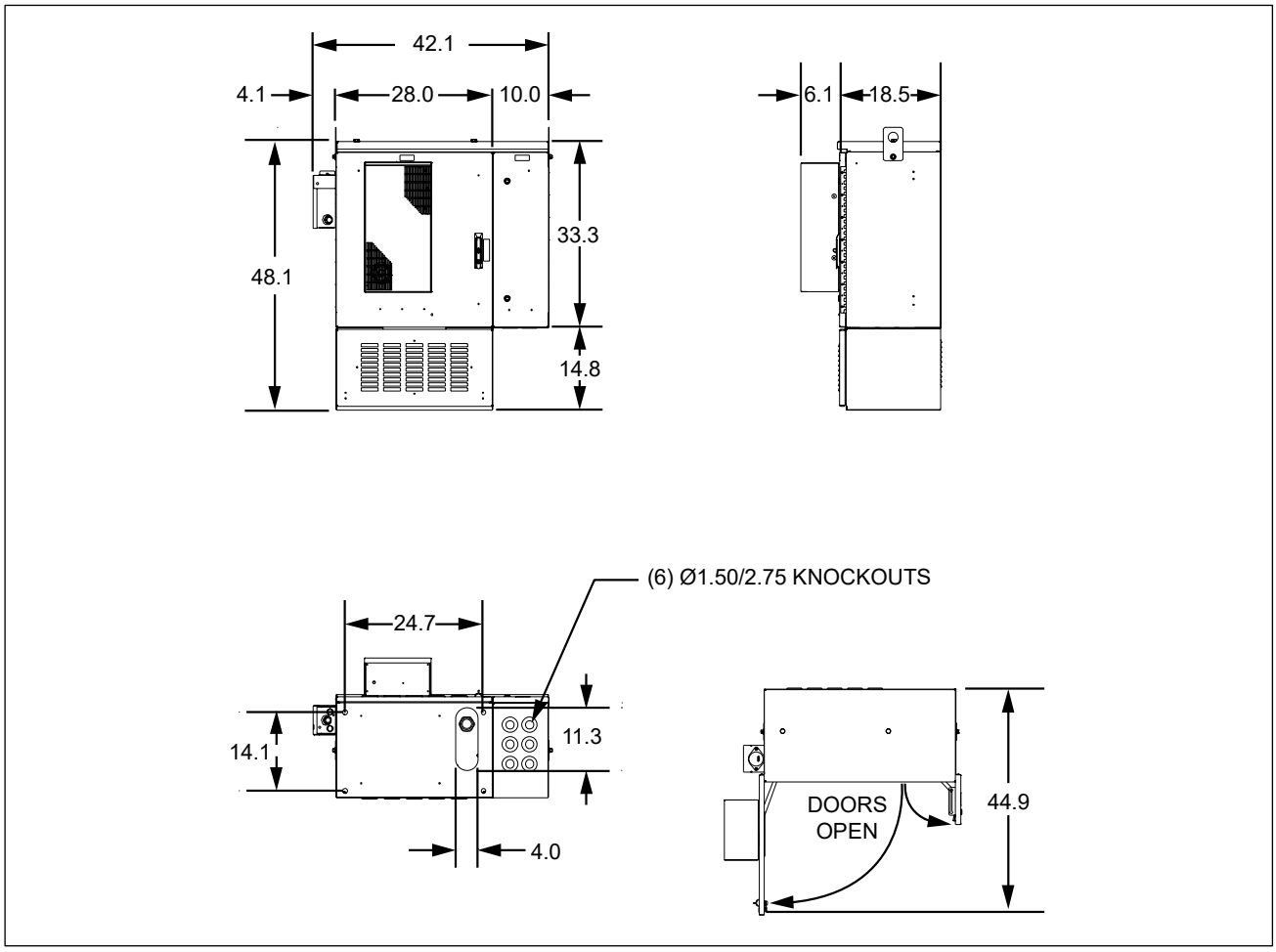

Figure 2 CUBE Dimensions (in inches)

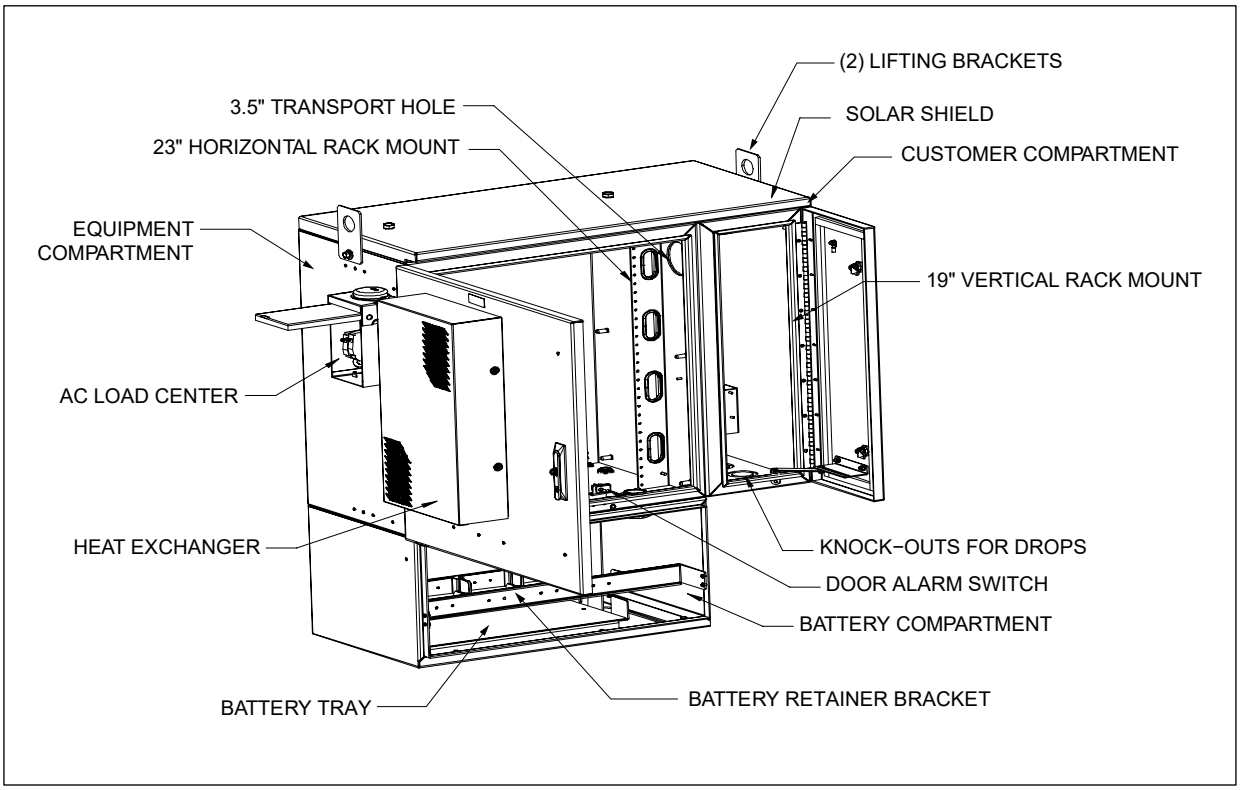

Figure 3 CUBE Components

3. INSTALLATION

3.1. Inspecting the Product

The CUBE is shipped mounted upright on a skid. Remove the bolts, unpack the unit, and dispose of the packaging material.

-INSPECTION NOTE-

Visually inspect the unit for damages prior to installation. If the equipment was damaged in transit, immediately report the extent of the damage to the transportation company.

3.2. Following and Using Safety Precautions

Read the following site and safety tips, cautions, and warnings, then proceed with the paragraphs that follow.

- For installation, follow all National Electrical Codes (NEC) ANSI/NFPA 70, local, environmental, workplace, and company codes, safety procedures, and practices.
- Minimum spacing between the accessories and components and the housing for ITE equipment shall be maintained for safe operation of the equipment when installed in accordance with NEC ANSI/NFPA 70.
- Read all instructions, warnings and cautions on the equipment and in the documentation shipped with the product.
- Always connect ground connections first.
- Do not place this product on weak or unstable surfaces which may allow the product to fall, resulting in potentially serious damage(s) to persons or product.
- Only authorized trained personnel shall install the CUBE.
- In windy conditions, be sure to engage the door latches to secure the door in a stationary position.

3.3. Obtaining Tools and Equipment

Obtain the following recommended or needed items for installing the CUBE.

- Sufficient length and quantities of fiber cable (or pigtails)
- Cable scoring, opening, and cutting tools for cable sheathing, shields, wrappings, strength members and buffer tubes
- Wire strippers
- Crimpers
- Cable, tube, wire, and fiber cleaning materials
- Protective and/or insulated work gloves
- Safety glasses
- Tape measure
- Marking utensil
- #6 ground wire or rod and earth ground materials
- Bond strap (optional, from cable bond clamp to bond post)
- Any exterior cable strain relief, per company practice
- Slotted, hex, and Phillips screwdrivers
- Torque wrench
- Assorted cable ties, clips, or fasteners (optional)
- Can wrench (216 type tool)
- Derrick for lifting
- Level

3.4. Preparing the Installation Site

Observe the following site preparation recommendations.

- Leave adequate horizontal and vertical space between multiple installations to allow for proper cable access, as well as enough room around the enclosure to open the door(s).
- The site must meet minimal personnel and equipment safety requirements.
- The distance from the cable entry point should be consistent with local installation practices.
- The pad, pole, wall, or H-frame must be able to support the weight of the CUBE.
- Run all fiber and copper facilities to the site.

3.5. Lifting the CUBE

See Table 1 for CUBE weight. Charles recommends the following procedure for lifting the CUBE.

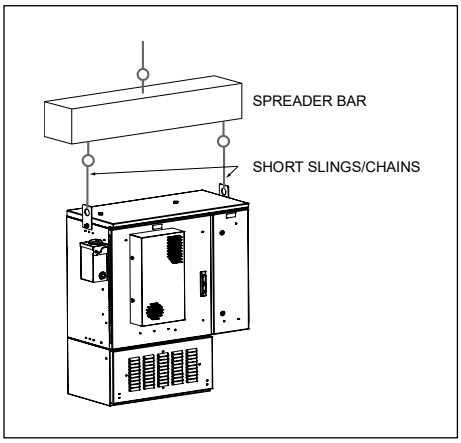

Figure 4 Lifting the CUBE

3.5.1. Required Equipment

- One derrick (crane) capable of lifting the CUBE
- Spreader bar
- Two lifting slings or chains with each having a 2,500 lbs. capacity
- Connecting links to attach slings to the CUBE's lifting brackets
- 75-ft. long tagline rope

Insert the lifting sling connecting links securely through each of the lifting brackets as shown in Figure 4.

3.5.2. Warnings and Specific Safety Precautions

⚠	**WARNING**	**Improper hoisting equipment and unsafe lifting procedures can result in serious injury or death** **Because of the added risk of injury or damage, do not lift enclosures with batteries installed.**

Observe the following local safety procedures when performing the tasks in this section.

- Keep the CUBE away from any power lines.
- Keep bystanders away from the work operations at all times.
- Only trained operators shall operate the crane for lifting and setting the CUBE.
- Do not suspend loads over people or equipment.
- All persons working with hoisting equipment shall wear standard safety gear according to local practices including safety helmets and steel-toed shoes.
- Do not operate the hoisting equipment until all stabilizers are extended and in firm contact with the ground or adequate support structure.
- Do not attempt to retract or extend the stabilizers while a load is suspended.

3.6. Mounting the CUBE

Enclosures can be mounted on a pad, wall, H-frame, or pole. Charles recommends using a minimum SAE Grade 2, corrosion-resistant bolts, washers, and nuts for all mounting applications. Use 1/2" diameter hardware for pad mounting and 3/8" diameter hardware for all other mounting styles. Bolts need to be of sufficient length depending on which type of mounting is used. Mounting hardware is customer supplied. PM4100 and PM4220 require a plinth for pad mounting. Charles also offers a composite mounting pad (CPAD-S2E4300W) for pad installation.

A loose gasket is provided inside the battery or equipment compartment for placing the CUBE on a pad. Should the gasket become damaged during installation, a replacement can be ordered under part number 39-000163-0. The gasket is not needed if mounting on a CPAD.

3.6.1. Torque Requirements

Torque all hardware as shown below (unless otherwise noted). These values apply to SAE Grade 1 & 2 Low Carbon Steel, ASTM A307 Low Carbon Steel, and Stainless Steel Grade 18-8.

Thread Size	In-lbs	Ft-lbs
4-40	4±10%	
6-32	8±10%	
8-32	16±10%	
10-32	26±10%	
12-24	50±10%	
1/4-20/M6	60±5%	5±5%
5/16-18	125±5%	10.4±5%
3/8-16	180±5%	15.0±5%
1/2-13	500±2%	41.7±2%
5/8-11	1000±1%	83.3±1%

3.6.2. Wall or H-frame Mounting

The CUBE can be mounted on a wall or H-frame using Mounting Kit 97-001995-A. A minimum of 3/4" thick plywood or similar surface is required for wall mounting. Refer to the documentation that ships with the kit for mounting details.

3.6.3. Constructing a New Pad

- Use only concrete for new pad construction. Do not use substitute materials since they lack the rigidity for CUBE placement.
- Observe local building practices for pad construction. Charles recommends that the pad should extend a minimum of 8" beyond the CUBE base on all sides.
- Use a minimum of 6" of sand or gravel as a base for the pad for leveling purposes.
- Figure 5 shows the required conduit openings and mounting hole dimensions for entering/mounting the bottom of the CUBE. Use these dimensions when designing the pad.

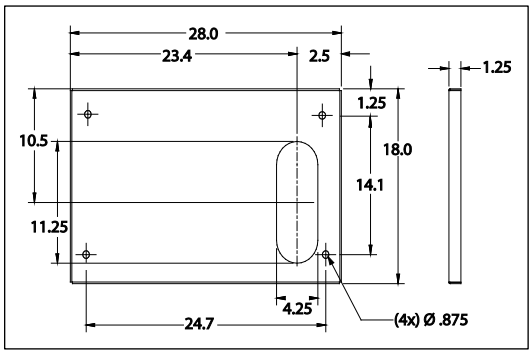

Figure 5
Mounting Hole Dimensions (in inches)

⚠	**WARNING**	**When pad mounting, the compression strength of the pad must be at least 4000 psi as determined by ASTM C39 test of compression strength of concrete cylinders.** **The slump of the concrete shall be 2" to 4" as determined by ASTM C143 test method.**

3.6.4. Mounting the CUBE on a Pad

Four customer supplied, corrosion resistant, 1/2"-13 hex head bolts with anchors are required for mounting the CUBE to the concrete pad. Use the following steps to mount the CUBE to a pad.

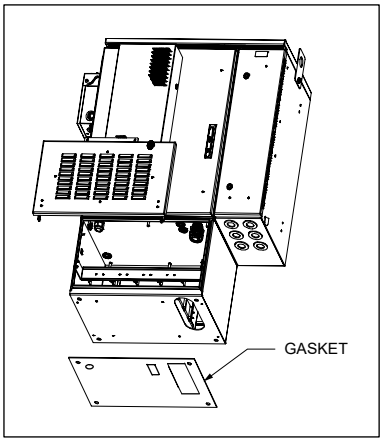

Figure 6
Gasket Installation

1. Layout, drill, and set the 1/2" anchors per manufacturer's recommendations. The embedment depth is not to exceed 3.5". Use the gasket as a mounting hole location template.
2. Clean any debris from the concrete pad.
3. Install the gasket by positioning it on the pad so that it is underneath the bottom of the CUBE when the cabinet is installed. Line up the gasket so that the cutouts are in proper position around the conduit opening and the bolt holes as shown in Figure 6.
4. Open the equipment chamber door and remove the screws at the top of the battery compartment cover. Open the battery compartment to allow access to mounting holes.
5. Ensure that the CUBE is parallel to the pad surface as it is placed onto the pad and that it aligns with the holes in the pad and the gasket. Dress the cable/conduit so that it aligns with the CUBE openings as it is lowered onto the pad.
6. Place the CUBE on the pad. Loosen the slings so that all the weight is on the pad. Check that the CUBE is properly aligned.
7. Secure the CUBE to the pad using the 1/2"-13 hex head bolts. Tighten all bolts securely.
8. Once the CUBE is secured, remove the slings and tagline. Replace any panels removed and close doors.

The PM4100 and PM4220 can be mounted on the plinth mount kit 97-002002-A, which includes a 10" plinth, hardware for mounting the CUBE to the plinth, and sealing plugs to close unused holes in the bottom of the CUBE. Use the following steps to mount the PM4100 and PM4220 to a plinth.

1. Layout, drill, and set the 1/2"anchors per manufacturer's recommendations. The embedment depth is not to exceed 3.5". Use the gasket as a mounting hole location template.
2. Clean any debris from the concrete pad.
3. Remove the front door of the plinth compartment by opening the quarter turn cam latch with a can wrench.
4. Install the gasket by positioning it on the pad so that it is underneath the bottom of the CUBE when the cabinet is installed. Line up the gasket so that the cutouts are in proper position around the conduit opening and over the anchor bolts as shown in Figure 7.
5. Secure the plinth to the pad (through the gasket) using 1/2"-13 bolts with washers and lock washers into the bottom flange. Tighten all bolts securely.
6. Place the CUBE onto the plinth and position it so that the four mounting holes in the corners line up.
7. Insert the four 1/2" hex head screws (provided with kit 97-002002-A) upward thru the top of the plinth into the equipment chamber as shown in Figure 7.
8. Use 5/8" wrench and a 5/8" socket wrench to tighten the hardware securely. Apply a torque value of 42 ft-lb.
9. Once the CUBE is secured, remove the slings and tagline.

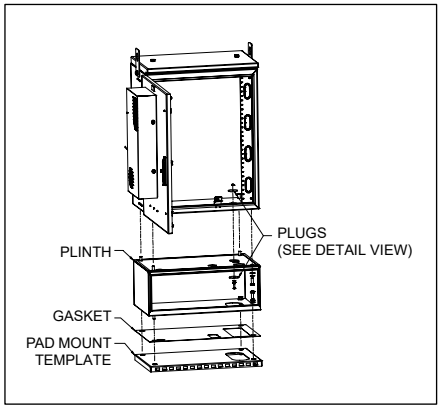

Figure 7
PM4100/PM4220
Gasket and Plinth Installation

3.6.5. Plugging unused holes in the PM4100/PM4220

The plinth mount kit 97-002002-A includes hardware to seal unused holes in the bottom of the PM4100/PM4220.

- Ten 1.65" aluminum plugs for five 1.5" holes.
- Four 2.25" aluminum plugs for two 2" holes.
- Two 3.46" aluminum plugs for one 2.5" hole.
- Eight sets of 1/4" hardware for plug installation.

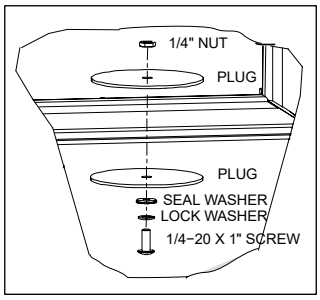

Figure 8
PM4100/PM4220
Plug Detail

Plug installation requires a Phillips screwdriver and a 7/16" can wrench. See Figure 8 for reference.

1. Insert the 1/4-20 x 1" Phillips screw thru the lock washer, seal washer and one of the plugs (see list, above).
2. Insert the screw thru the top of the plinth (or platform if doing pole/wall mount) and into the bottom of the CUBE.
3. Place another plug on the inside of the CUBE onto the screw.
4. Place 1/4" nut on top of plug and secure by tightening with a Phillips screwdriver and 7/16" wrench.

3.6.6. Mounting the CUBE on a CPAD

First, follow the instructions that ship with the CPAD to ensure that the CPAD is securely installed in the ground. Then proceed to mount the CUBE on the CPAD. Four customer supplied, corrosion resistant, 1/2"-13, 2" long fully threaded hex head bolts with flat and lock washers are required for mounting the CUBE to the CPAD. Use the following steps to mount the CUBE to a CPAD.

1. Clean any debris from the CPAD.
2. Open the equipment chamber door and remove the screws at the top of the battery compartment cover. Open the battery compartment to allow access to mounting holes.
3. Ensure that the CUBE is parallel to the CPAD surface as it is placed onto the CPAD and that it aligns with the holes in the CPAD. Dress the cable/conduit so that it aligns with the CUBE openings as it is lowered onto the CPAD.
4. Place the CUBE on the CPAD. Loosen the slings so that all the weight is on the CPAD. Check that the CUBE is properly aligned.
5. Secure the CUBE to the CPAD using the 1/2"-13 hardware. Tighten all bolts securely. Once the CUBE is secured, remove the slings and tagline. Replace any panels removed and close the doors.

3.8. CUBE Wiring and Equipment

After the CUBE is properly mounted in the desired location, apply No-Ox where bus bar and other 2-hole lug connections will be made. Install ground and power connections. Always ground the equipment first, before making any other connections.

⚠	WARNING	Perform all bonding and grounding connections prior to any electrical and communications connections.

In order to prevent condensation prior to being placed in service, do not remove the desiccant until the CUBE is sealed and power is applied. Basic electrical diagrams are shown in Figures 9 through 12.

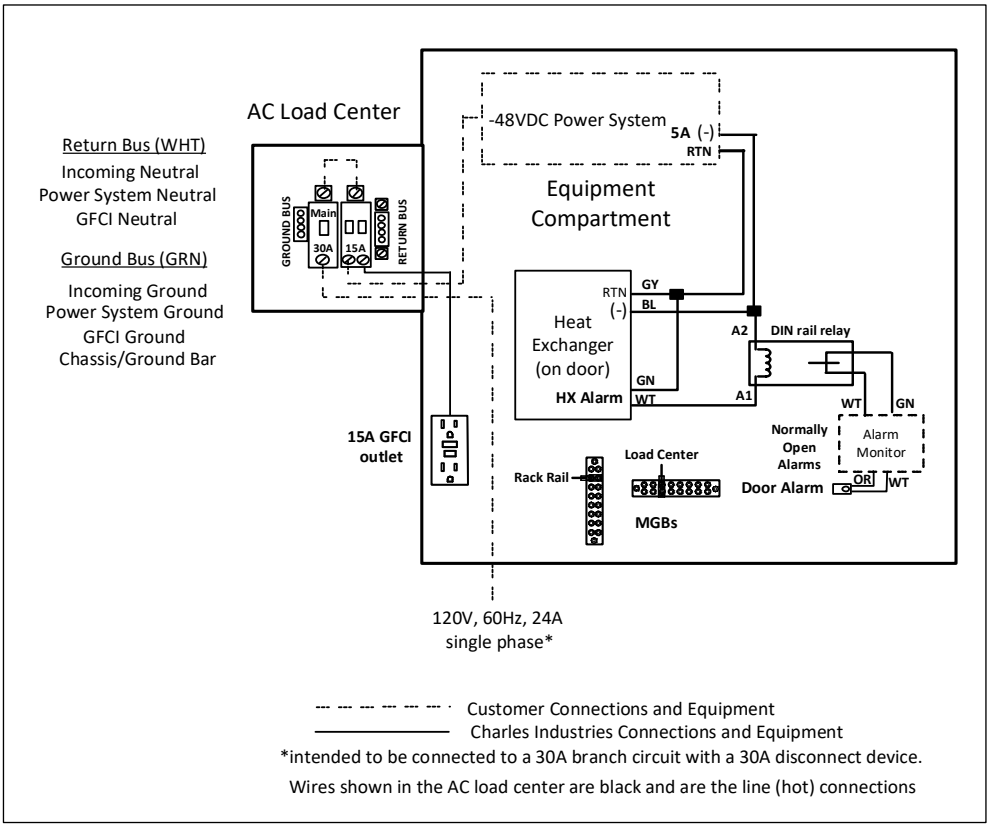

Figure 9 PM4100 Electrical Diagram

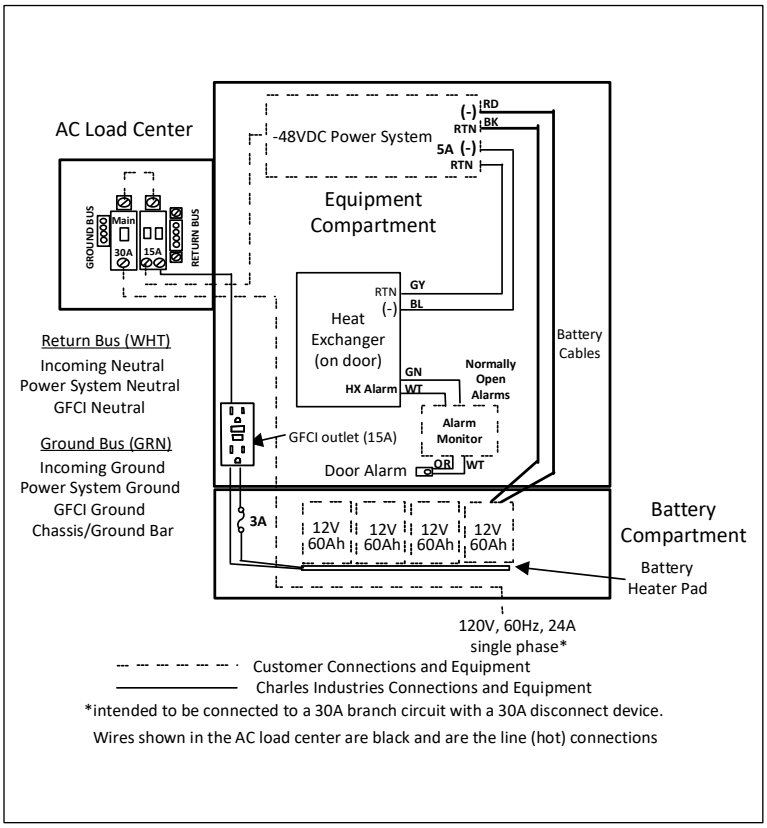

Figure 10 PM4200 Electrical Diagram

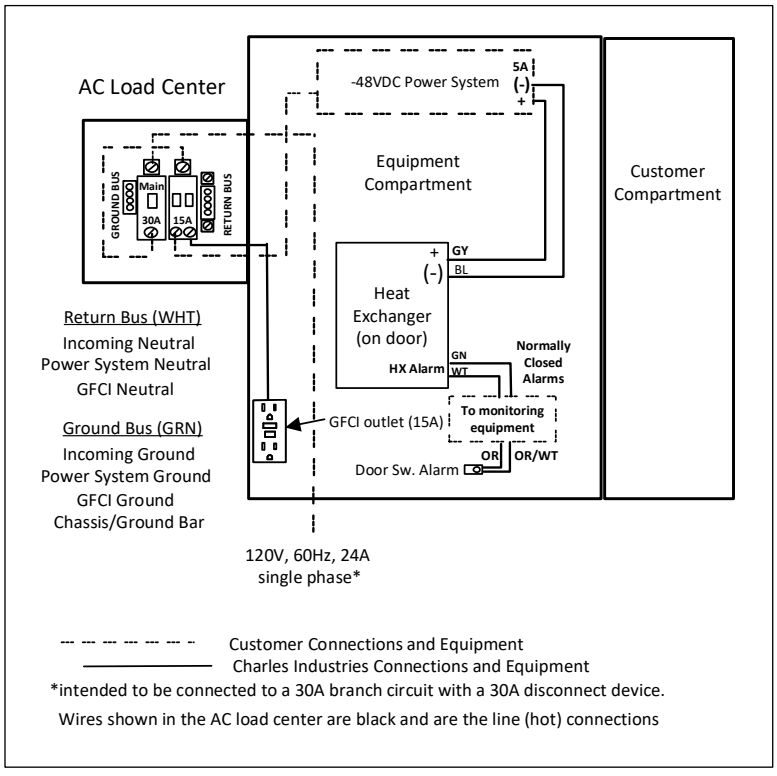

Figure 11 PM4220 Electrical Diagram

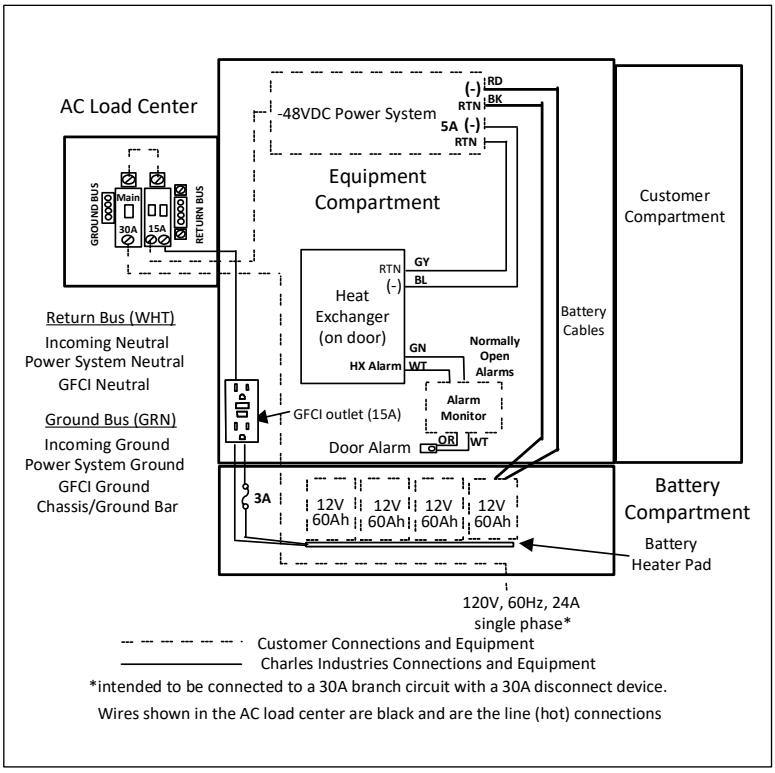

Figure 12 PM4300 Electrical Diagram

3.8.1. Ground Connection

Use the two 2x8 position ground bars provided in the equipment compartment and the one 2x8 position ground bar in the customer compartment for all grounding of internal equipment. Connect the incoming AC earth ground to the ground bar in equipment compartment and terminate it to the position adjacent to the ground symbol. If using a site ground wire, connect this to the same ground bar.

3.8.2. AC Voltage Connection

The incoming AC voltage is a single phase 120V at 60Hz. The voltage needs to supply a maximum load of 24A. Incoming AC wiring requires a minimum 10AWG copper wire and is intended to be connected to a readily accessible 30A disconnect device. The maximum load of the equipment in the PM4200 and PM4300 shall not exceed 24A. Disable the incoming AC voltage prior to installing.

The incoming line (hot) wire is connected to the top of the 30A breaker, the neutral is connected to the return bus and the ground is connected to the ground bus. Circuit breakers should be in the off position. Connect the ground, line, and neutral to the AC input of the customer supplied -48VDC power supply.

3.8.3. Battery Connection

⚠	**WARNING**	**Always turn off battery breakers or disconnect Anderson connectors prior to servicing batteries.** **Disregard the (+) and (-) polarity markings on the Anderson connectors. The cable assemblies are used on both +24VDC and -48VDC products, so markings on the Anderson connectors are misleading.** **If using VRLA batteries, ensure that the power system is set up for VRLA batteries with temperature compensation enabled.**

Verify the polarity of the cables prior to terminating them to the batteries. Ensure the battery terminations are properly insulated to avoid shorting prior to terminating to the batteries.

1. Disconnect the Anderson connector(s) or switch off the battery breaker located in the battery compartment.
2. Remove the battery retainer bracket by removing the hardware.
3. If replacing batteries, disconnect battery cables from terminals and loosen the battery retaining strap(s).
4. Remove the battery temperature probe.
5. Remove the interconnecting straps from the batteries. Remove batteries.
6. Carefully position the new batteries on the battery tray. Connect the interconnecting straps to each battery string.
7. Replace battery temperature probe to the closest battery.
8. Connect the battery cables to the appropriate terminals.
9. Secure the battery retaining straps and reinstall the battery retainer brackets using hardware from step 2.
10. Reconnect the Anderson connector(s) or switch on the battery breaker.

Notes:

- Anderson connectors and battery breakers terminate at the power shelf.
- Ensure temperature compensation probes are installed per power system guidelines.
- Ensure back up battery amperage is inputted into the power system controller per power system guidelines.
- Ensure float voltage is set per power system and battery guidelines.
- Ensure all battery terminations and bus bars have No-Ox applied.
- Refer to the battery manufacturer's documentation for proper battery installation and maintenance information.

3.8.4. Battery Heater Pad

The 100W heater pad in the bottom of the battery compartment is controlled by an internal thermostat that turns on at 15°C and turns off at 24°C. The heater pad is connected to a 3A fuse, which is connected to the GFCI outlet (Figures 10 and 12).

3.8.5. Heat Exchanger Operation

The 760W DC powered heat exchanger in the equipment compartment has a fan speed controller and includes an internal and an external fan. Both fans' speed increases with increasing internal cabinet temperature. Fans and heat exchanger settings are defined below, and are based off of the cabinet interior temperature. The maximum airflow amount supplied to the equipment by the heat exchanger is 147CFM.

Setting	Internal	External
Turn-on Setting (5°C Differential)	0°C	30°C
Medium Temp Setting	30°C	35°C
High Temp Setting	45°C	50°C
High Temp Alarm Setting	70°C	N/A
Low Temp Alarm Setting	-40°C	N/A

For more information, refer to the heat exchanger documentation found inside the CUBE.

-NOTE-
Changing the speed controller default factory set points can lead to system performance issues, such as equipment failures, increased power use, unnecessary alarms, noise, condensation build up, fan failure caused by excessive runtimes and vibration.
Avoid placing items in front of the heat exchanger's return and supply vents. Maintain a minimum of 6" clearance to enable proper air flow.

3.8.6. Alarm Block Connections

Two wires on the door switch provide a normally closed connection whenever the door is open.

3.8.7. Fiber and Copper Entry

Ingress connections. Fiber and copper is fed into the equipment compartment through three Ø1.25" grommets, one Ø.71/.98" cord grip fitting, one Ø1.46"/1.73" cord grip fitting, and one 2x8mm M25x1.5 threaded fitting on the bottom of the equipment compartment. For models with a battery compartment, fiber and copper is first fed into an opening on the bottom of the battery compartment, then up into the equipment compartment.

Customer drop access (PM4220 and PM4300 only). There are six Ø1.75/2.50 knockouts on the bottom of the customer compartment that accommodate Ø1.25"/2.50" conduit fittings. These six knockout holes should have a rubber grommet or conduit fitting installed. The rubber grommets may be sealed with silicone to maintain a proper seal that will prevent moisture from seeping into the customer compartment.

3.9. Conduit Seals

All internal and external conduit openings on the CUBE must be completely sealed with a duct seal compound to prevent moisture from entering the equipment compartment. The battery compartment (if present) must be internally sealed from the equipment compartment to prevent outgassing from the batteries into the equipment compartment. Use a moldable, flame-retardant putty style duct seal material. Do not use an expanding foam seal. Mold the putty so that the open space around the wire or conduit is completely sealed, as shown in Figure 13. If the openings must be accessed at any time, remove the putty and set it aside. When work is complete, re-mold the putty to re-seal the opening.

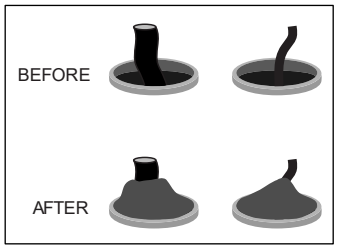

Figure 13 Applying Putty Seal

3.10. Verifying the Installation

Verify that earth ground and all grounding and bonding is complete and functional. After verifying that all installer connections are secure and complete, apply voltage.

4. PERIODIC MAINTENANCE

In the event that the enclosure needs to be opened in freezing conditions, a narrow, pointed metallic object such as a screwdriver or chisel, along with a non-metallic device like a rubber mallet, may be used to remove excessive ice buildup around the door and locking mechanism. A commercial aerosol de-icer spray can be used to free up locks and latched if needed.

Periodic cleaning of the battery filter screens (PM4200/PM4300 only) is important to maintain proper ventilation. To clean the filter screens, remove the four nuts on each screen and take out the screens. Use a soft brush or hose to remove any debris from the screen. Once clean, replace the screens using the four nuts removed previously.

Reset the GFCI duplex receptacle periodically to ensure it is working. The unit meets UL-943, which requires an auto-monitoring (self-testing) feature. A flashing or solid red LED indicates a fault. If the unit continues to show a fault after resetting, replace the unit.

The heat exchanger requires no scheduled maintenance other than cleaning the fans and heat exchanger core if they become contaminated with dust or residue. Remove the cover by removing the screws on the outside. Examine periodically to determine the required cleaning periods based on the installed environmental conditions.

5. TECHNICAL ASSISTANCE AND REPAIR SERVICE

For questions on product repair or if technical assistance is required, contact Charles Technical Support.

847-806-8500
techserv@charlesindustries.com (email)
http://www.charlesindustries.com/techserv.htm

6. WARRANTY & CUSTOMER SERVICE

Charles Industries LLC offers a one-year warranty on the CUBE product. The Charles warranty is limited to the operation of the CUBE hardware as described in this documentation and does not cover equipment which may be integrated by a third party. The terms and conditions applicable to any specific sale of product shall be defined in the resulting sales contract. For questions on warranty or other customer service assistance, contact your Charles Customer Service Representative.

847-806-6300
mktserv@charlesindustries.com (email)
http://www.charlesindustries.com/main/telecom_sales_support.htm

7. SPECIFICATIONS

7.1. Regulatory Specifications

- GR-487 Certified
- UL-2416 Listed
- GFCI: UL-943 Listed

7.2. Product Specifications

Physical	
Dimensions	PM4100: 33”Hx28”Wx18”D, Approx. 105 lbs. as shipped PM4200: 48”Hx28”Wx18”D, Approx. 145 lbs. as shipped PM4220: 33”Hx38”Wx18”D, Approx. 155 lbs. as shipped PM4300: 48”Hx38”Wx18”D, Approx. 190 lbs. as shipped
23” Equipment Rack Space and Hole Spacing	28” (16RU) rack spacing with 1” hole spacing
Battery Tray Size (PM4200/PM4300 only)	12”Hx19.7”Wx11”D
Maximum Supported Weight	Rack Rails: 176 lbs. Battery Tray (PM4200/PM4300 only): 88 lbs.
Materials	.125 aluminum
Color	Off-White
Electrical	
AC Load Center	Square D QO24L70 RB
Supported Batteries	PM4200/PM4300 only: (4) 12VDC 60Ah Power Safe SBS60 or Northstar NSB60
Bonding and Grounding	(2) 2x8 position ground bars in equipment compartment (1) 2x8 position ground bars in customer compartment
Cable Entry	See Figure 2 or Section 3.7.8
Thermal	
Heat Exchanger	760W, 48VDC, Vikinor VHC-040-DC
Maximum Heat Dissipation	720W@19°C above ambient with solar
Environmental	
Operating Temp. Range, Outside Enclosure	-40° to +115°F, -40° to 46°C
Operating Temp Range, Inside Enclosure	-40° to +149°F, -40° to 65°C
Humidity	0 to 95% (non-condensing)
Altitude	Up to 2,000 meters (6560 feet)
Kits and Replacement Parts	
Touch-up Paint	02-000290-0
216 Type Security Tool	07-002070-0
Pin-in-Hex Key	07-002068-0
Plinth Mounting Kit	97-002002-A
Pole Mounting Kit	97-001981-A
Wall/H-frame Mounting Kit	97-001995-A
Replacement Gasket	39-000163-0
Pad Construction Template Kit	97-001982-A
Swing Handle	39-000140-0
2-Wire Door Alarm Switch (White)	17-400314-0
15A GFCI Outlet	04-100244-0
Replacement 3A fuse (for battery heater pad)	010618

Table 1 CUBE Specifications