Clearfield ODC-200 Installation Guide

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Contents

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About This Guide

This document provides a general installation practice for the Clearfield ODC-200 outdoor cabinet. This document also provides a general description of the cabinet and its subsystems, guidance for planning, site preparation, power installation, splicing to the outside plant, component installation and expansion, and cabinet maintenance.

Intended Audiences

This document is intended for use by network planning engineers, outside plant engineers, field support personnel, and craft personnel responsible for cabinet installation, splicing, equipment installation, and maintenance.

Federal Communications Commission (FCC) Statement

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy, and, if not installed and used in accordance with the instruction manual, may cause interference to radio communications. Operation of this equipment in a residential area may cause harmful interference; the user will be required to correct the interference at his expense.

Safety Notices

This document uses the following safety notice conventions.

	**DANGER!** Danger indicates the presence of a hazard that will cause severe personal injury or death if not avoided.
	**WARNING!** Warning indicates the presence of a hazard that can cause severe personal injury if not avoided.
	**CAUTION!** Caution indicates the presence of a hazard that can cause minor to moderate personal injury if not avoided.
	**ALERT!** Alert indicates the presence of a hazard that can cause damage to equipment or software, loss of data, or service interruption if not avoided.
	**DANGER! CLASS 1 LASER PRODUCT. INVISIBLE LASER RADIATION MAY BE PRESENT.** Fiber optic radiation can cause severe eye damage or blindness. Do not look into the open end of an optical fiber.

Chapter 1

ODC-200 Product Overview

This chapter provides a general description of the base Clearfield ODC-200 outdoor cabinet and Expansion Module (EXM), including standard features and options.

Topics Covered

This chapter covers the following topics:

- A description of the ODC-200 cabinet
- A list of cabinet features
- A list of cabinet options
- A description of the optional EXM
- Views of the cabinet and EXM compartments
- Views of the cabinet and EXM dimensions

Cabinet Description

The Clearfield ODC-200 cabinet is an environmentally-controlled outdoor enclosure designed to house and protect network electronics equipment, providing copper and fiber based broadband services. The compact, low profile ODC-200 supports both copper and fiber applications from a remote node location deep inside the customer serving area, beyond the direct reach of the carrier Central Office. The modular and flexible design of the ODC-200 supports an easy migration from copper based services to fiber-to-the-premises (FTTP), focusing on the mixed deployment of a copper and fiber infrastructure.

The base ODC-200 cabinet has a single compartment that houses electronics equipment together with high density fiber and copper plant terminations, enabling deployment of a broad suite of applications from a single node. The electronics area is equipped with a vertically-oriented 19-inch equipment rack that provides 8RU of mounting space, housing up to nine Calix E7-2 or B6-001 shelves and other 19-inch wide equipment.

The ODC-200 supports local or remote power configurations. The local power configuration includes an internal battery enclosure to support battery reserve power.

The modular design of the cabinet supports incremental system expansion, lowering initial deployment costs while maintaining the capacity for future growth. Modular components designed for expansion include the Expansion Module (EXM), Calix E7-2 or B6-001 shelves, copper line protection, fiber management capacity, power modules, and cooling elements.

Cabinet Features

Standard features of the ODC-200 cabinet include:

Enclosure Design

- Environmentally sealed design protects from dust and water intrusion
- GR-487 enclosure compliant, and ANSI-UL-67 / CSA C22.2 panel board safety compliant
- Environmentally rated from -40C to +46C (per GR-487)
- Environmental and intrusion alarm systems

Equipment Support

- 19-inch equipment rack provides 9RU of mounting space for Calix E7-2 or B6-001 shelves and other 19-inch wide equipment
- Mechanical support for copper 5-pin protection panel and fiber termination assemblies
- Modular, scalable copper line protection (50-pair block increments, 384 pairs maximum); 768 copper pair protection or sixteen 50-pair pro-panels blocks can be supported in the ODC-200 by deploying the internal battery housing in the EXM
- Front access door with 50W/C° Heat Exchanger

Power (Local)

Standard features for the local power configuration include:

- 208/240 VAC load center (ETL-listed); 30 Amp capacity
    - AC main/service disconnect breaker
    - AC surge suppressor
    - Duplex convenience outlet (GFCI protected)
- Alpha non-LVD Cordex HP 1.2kW 1RU rectifier shelf provides -48 VDC bulk power
    - 1 + 1 protected 1200W (25A) rectifier modules
- GMT fuse-protected DC supply to equipment (28 positions)
- Interior battery enclosure in vented compartment
- Up to 100Ah battery reserve capacity

Power (Remote)

Standard features for the remote power configuration include:

- ±190 VDC line power supplied over twisted pairs
- Line protection for up to 25 power pairs; MS^2 interface connector
- General Electric (Lineage Power) ±190 VDC to -48 VDC converter shelf (CPS2500D)
- Fuse-protected DC supply to equipment
- Fan tray for cooling converter shelf

Cabinet Options

Common options for the ODC-200 cabinet include:

Enclosure Mounting

- Concrete pad mounting: site-cast pad (using Clearfield pad template) or pre-cast (third-party supplied)
- Wall or frame mounting (using Clearfield mounting kits)
- Stake platform mounting (using Clearfield mounting kit)
- Foundation vault mounting (third-party supplied)

Clearfield **Platform Equipment**

- **Calix E7-2**: GPON or Active Ethernet fiber access; VDSL2 with POTS (Up to 9 Combo or Overlay units) copper access; 10GE transport & aggregation
- **Calix B6-001**: GPON or point-to-point / AE fiber access; ADSL2+ or VDSL2 with POTS (Combo or Overlay) copper access; 10GE transport

ODC-200 Modular Expansion

- 23-inch rack based Expansion Module (EXM) for increased fiber management, integrated copper cross-connects, or battery capacity

Copper Protection & Trunking, Splicing & Distribution, Cable Management

- Copper line protection for up to 384 lines; MS^2 or 710 interface connectors
- CAT5 interface cabling from the line protection blocks
- Adjunct cross-connect panel with either all MS^2 connectors or MS^2 connectors on the equipment side and 710 connectors on the subscriber side; 2:1 subscriber-to-equipment pairs: one or two cross-connect modules with 192 equipment pairs, 384 subscriber pairs each
- Ethernet over Copper (EoCU) trunking kit for copper transport:
  - Integrated Hatteras HN408 or single or dual Actelis ML600 trunking unit
  - Integrated 25-pair trunk line protection module; RJ-25/MS^2 interface connectors
- 12-, 24-, 48- or 96-position fiber splice or distribution panels (19-inch mount)
- 6- and 12-position dual LGX fiber distribution panel (19- or 23-inch mount)
- GPON and AE fiber management options supporting up to 384 subscriber fiber drops with an internal battery enclosure installed, or up to 576 subscriber fiber drops for GPON applications without an internal battery enclosure installed (SC connectors); up to 18 integrated PON splitters

Note: The EXM supports equal fiber distribution configurations.

Power

- Local power support (commercial AC power supply); additional options include:
  - 208/240 VAC input AC load center
  - 120/240 VAC input AC power junction box
  - Generator connector (Hubbell); 30A NEMA twist lock with breaker
  - 1+1 rectifier module redundancy (25A modules)
- Remote power support (±190 VDC line power supply):
  - N+1 converter module redundancy (±190 to -48 VDC modules)
  - Optional 665W remote power buffer (holdover) capacitor

Battery Support (local power configurations)

- Northstar (OEM) 100Ah VRLA battery string and installation kit
- Saft (OEM) 100Ah Ni-Cd battery string and installation kit
- Secondary battery housing kit (supports second 100Ah battery string installed in an EXM)
- 110/120 VAC Battery heater kit for VRLA batteries

ODC-200 Battery Riser Description

The Clearfield ODC-200 Battery Riser is an environmentally-controlled outdoor enclosure that mounts under the base of the ODC-200 cabinet.

Clearfield provides an optional AC line operated 150W battery heater mat which turns on at 40°F to increase battery capacity in cold environments. Battery mats are available in 120VAC and 240VAC versions.

ODC-200 Expansion Module Description

The Clearfield ODC-200 Expansion Module (EXM) is an environmentally-controlled outdoor enclosure that mounts adjunct to the base ODC-200 cabinet, allowing the expansion of rack space to the usable sealed capacity of the cabinet. You can install the EXM at the time of initial deployment of the cabinet, or later as an expansion.

The EXM can be mounted on the rear or left side of the base ODC-200 cabinet, as shown below.

Rear Mount
(In-line configuration)

Side Mount
(L-configuration)

The field installable EXM provides the ability to grow the ODC-200 cabinet to support rack space for:

- migration of copper loops to fiber drops.
- additional subscriber fiber distribution endpoints.
- additional copper line protection.
- a secondary or alternative integrated battery enclosure.

The EXM offers an ideal platform for migrating copper access services to fiber access infrastructure and electronics, supporting an equal concentration of copper protection blocks and fiber distribution frames.

Clearfield also offers an ODC-200 EXM Riser that is used when a Battery Riser is also mounted under the ODC-200 cabinet. This is an environmentally-controlled outdoor enclosure that mounts under the base of the ODC-200 ODC-200 EXM.

Cabinet and Expansion Module Views

Views of the base ODC-200 cabinet and Expansion Module (EXM) follow.

Base Cabinet Front Compartment

The base cabinet front compartment provides 19 inches of vertical rack space (9RU), and houses the cabinet power system and electronics equipment. The cabinet power system consists of an AC load center or AC junction box and DC rectifier shelf (local power configurations), or a ±190/-48 VDC converter shelf (remote power configurations). The Clearfield equipment typically includes up to nine Clearfield service units.

ODC-200 Front
(local power)

Base Cabinet Side Compartment

The base cabinet side compartment provides access to the cable entry locations, main ground bar, and fiber management or copper line protection. For fiber access, the fiber management accessories may vary greatly according to the ordered options. For copper access, the line protection may include up to eight 50-pair protection blocks. The side compartment also houses an internal battery enclosure for local power configurations. The battery enclosure supports an optional battery heater.

ODC-200 Side
(local power)

Expansion Module Compartment

The EXM compartment provides access to cable entry locations and rack space to support additional fiber management or copper line protection. For fiber access, the fiber management accessories may vary greatly according to the ordered options. For copper access, the line protection may include up to eight 50-pair protection blocks. The EXM compartment also houses a secondary or alternative interior battery enclosure for local power configurations. The battery enclosure supports an optional battery heater.

EXM
(local power)

Cabinet Side and Expansion Module Compartments

A view of an in-line configuration follows, with the EXM mounted on the rear of the ODC-200 cabinet.

In-line Configuration
(local power)

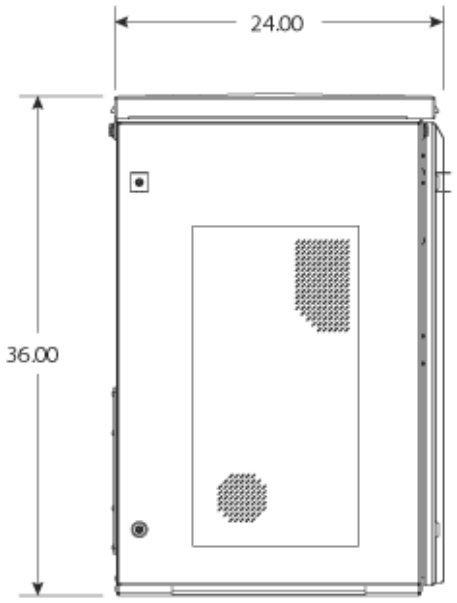
Cabinet and Expansion Module Dimensions and Weights

Dimensions and weights for the base ODC-200 cabinet and Expansion Module (EXM) follow.

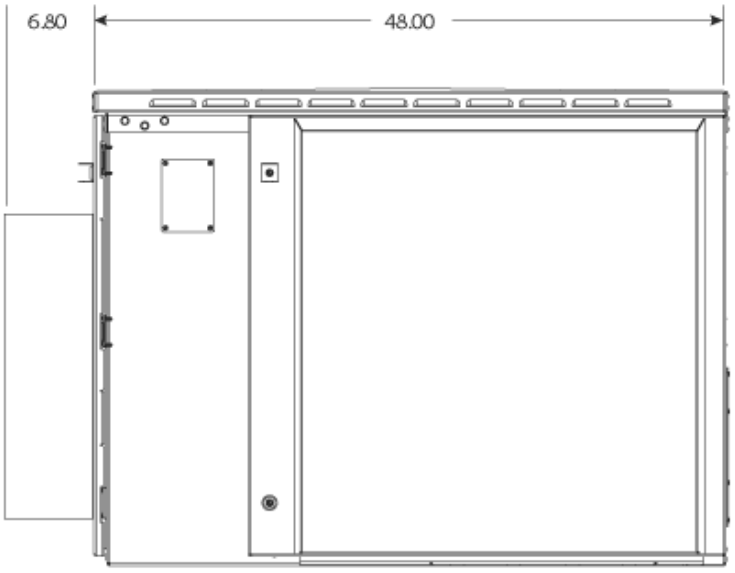
Cabinet Dimensions and Weights

The external dimensions of the base ODC-200 cabinet are shown below.

Dimension	Measurement (SAE)	Measurement (Metric)
Height	36 inches	91 cm
Width	24 inches	61 cm
Depth	48 inches	122 cm



Front



Side

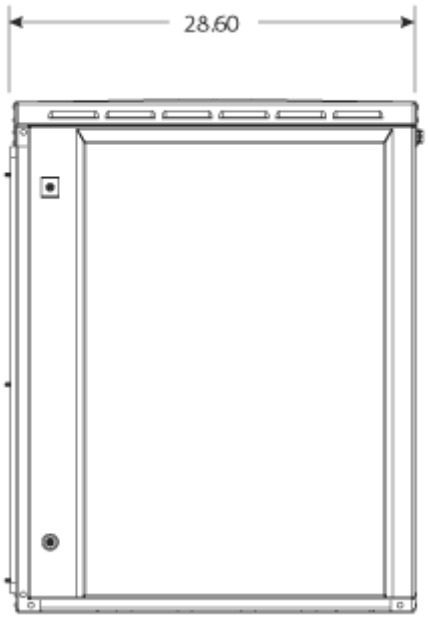
The approximate shipping weight of the base ODC-200 cabinet is shown below.

Configuration Options	Weight (SAE)	Weight (Metric)
Equipped with protection panels and internal battery enclosure	290 lb	132 kg

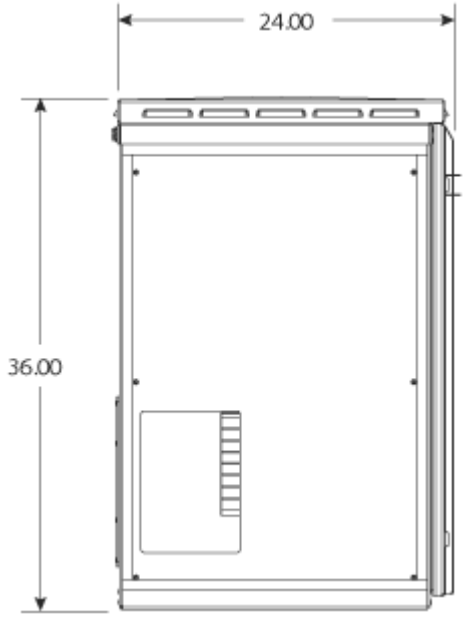
Expansion Module Dimensions and Weights

The external dimensions of the EXM are shown below.

Dimension	Measurement (SAE)	Measurement (Metric)
Height	36 inches	91 cm
Width	24 inches	61 cm
Depth	28.6 inches	74 cm



Front



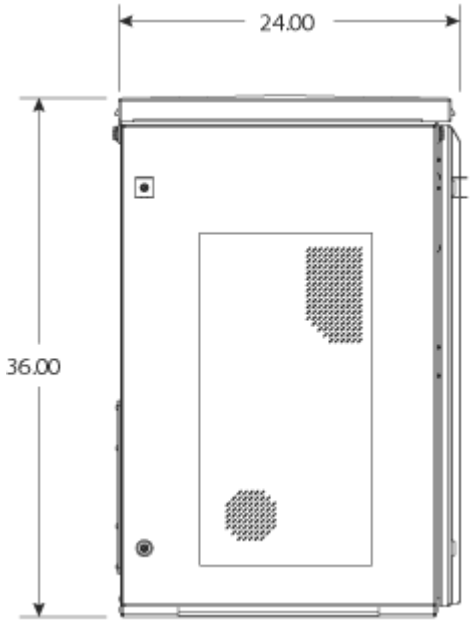
Mating Side

The approximate shipping weight of the (empty) EXM is shown below.

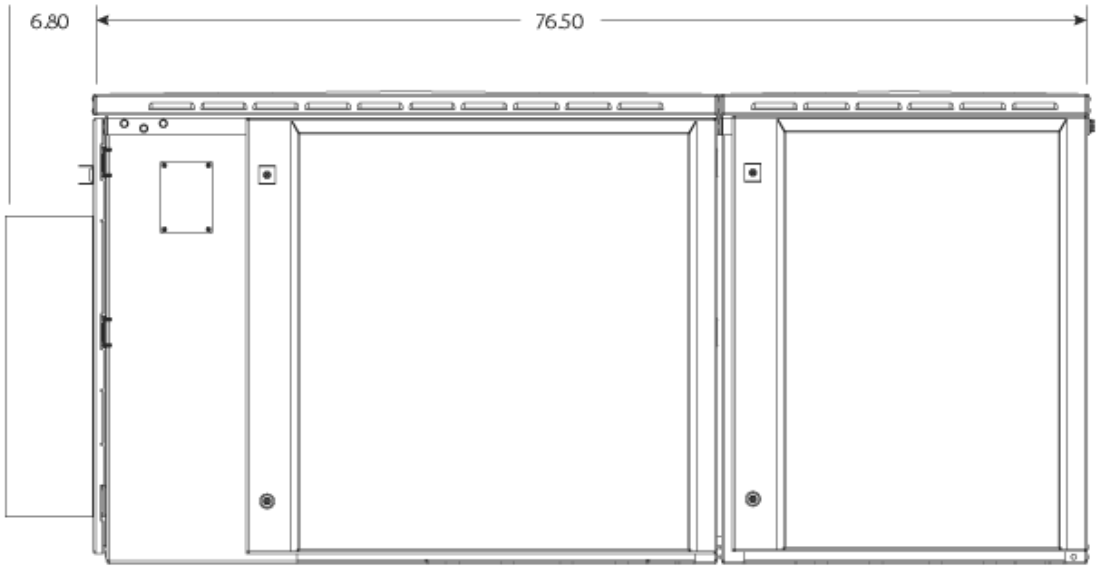
Weight (SAE)	Weight (Metric)
50 lb	23 kg

In-Line Configuration Dimensions

The external dimensions of the in-line configuration are shown below, with the EXM mounted on the rear of the ODC-200 cabinet.



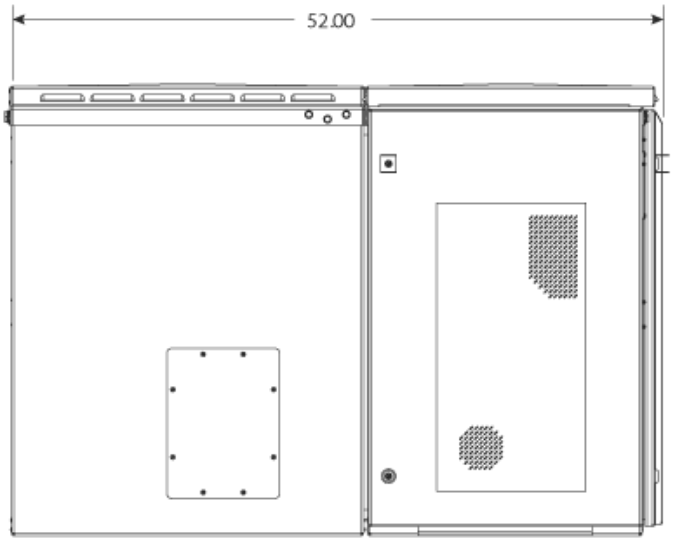
Front



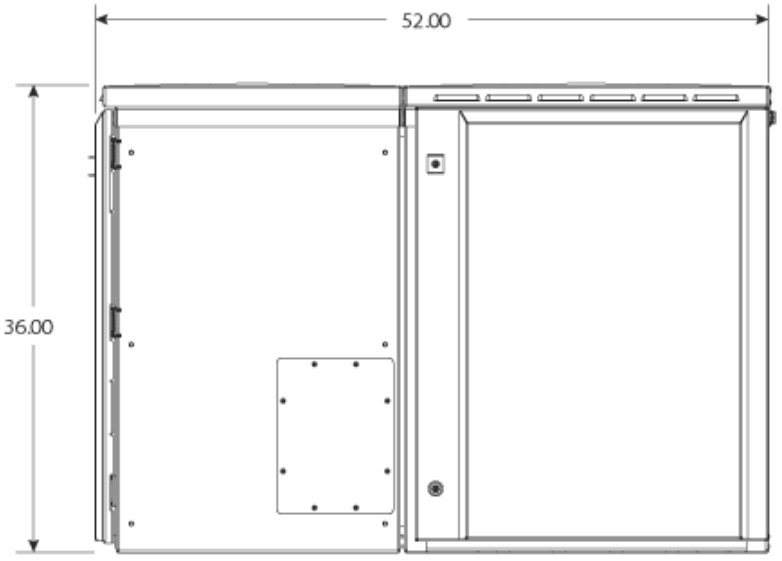
Side

L-configuration Dimensions

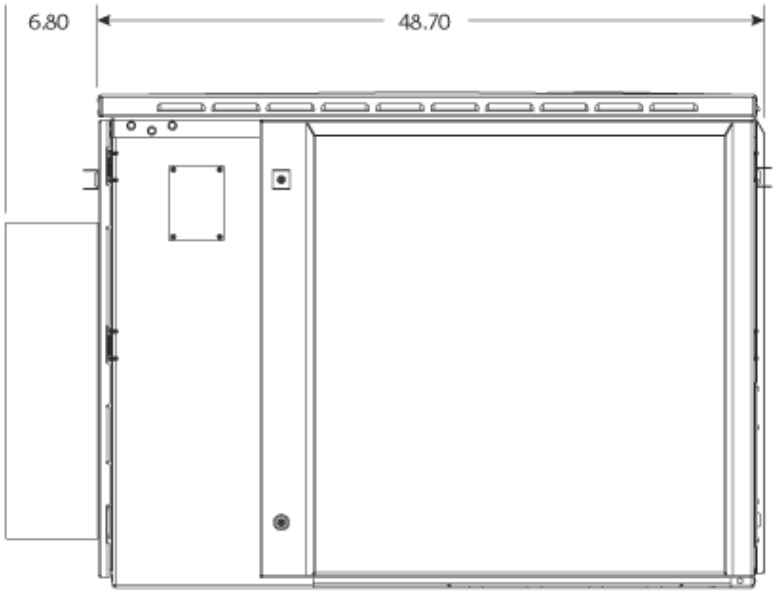
The external dimensions of the L-configuration are shown below, with the EXM mounted on the side of the ODC-200 cabinet.



Front



Rear



Side

Note: For clearance and space requirements when mounting the EXM on the rear or side of the base ODC-200 cabinet, refer to *Space Requirements* (on page 31).

Chapter 2

Installation Considerations

This chapter provides general considerations for cabinet installation. Review this information before starting the cabinet installation process.

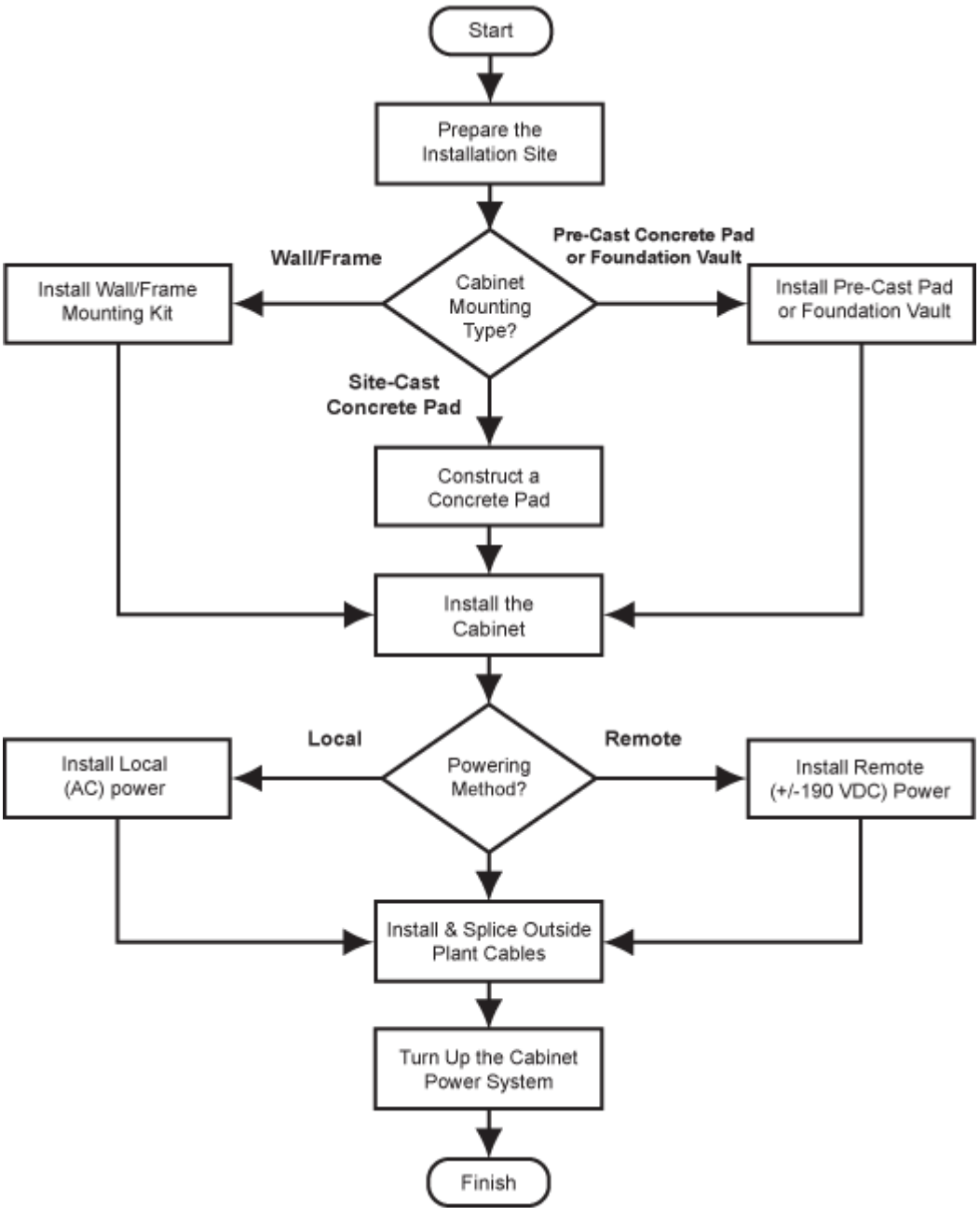
Topics Covered

This chapter covers the following topics:

- Installation process overview
- Installation guidelines
- Space requirements
- General safety recommendations
- Installation kit contentsUser-supplied items
- Cabling requirements

Installation Process Overview

The cabinet installation process involves the following high-level steps:



Installation Guidelines

Review the following guidelines before starting installation activities.

General Guidelines

Follow these general guidelines and practices:

- Read this document completely before starting any installation activities.
- Only qualified personnel should perform the procedures described in this document.
- Follow standard safety precautions when performing installation and maintenance tasks.
- Always wear standard safety gear when performing installation and maintenance tasks (hard hats/safety headgear, eye protection, insulated gloves).
- For safety, keep bystanders and other unauthorized personnel away from work operations at all times.
- Do not perform installation activities when the threat of lightning is present.
- Seal all cable entry locations immediately after the cabinet is installed to prevent ground moisture from condensing inside the cabinet and damaging equipment.

Site Selection

The location of a cabinet installation site should be carefully planned in advance. Consider the following factors when selecting an installation site:

1. Functional requirements:
    - **Suitable terrain.** Whenever possible, the cabinet should be located in an area with a firm flat soil surface that does not require extensive earth work. The location should not be constantly damp or prone to flooding. Check soil maps of potential sites for subsurface conditions.
    - **Grounding properties.** The earth at the cabinet location should have a low ground impedance to provide an effective grounding system for lightning protection and safety. Perform ground testing to determine the grounding requirements.
    - **Safety.** Whenever possible, the cabinet should be located on vacant property away from motor traffic to reduce injury risks to maintenance personnel or damage to equipment. On streets and highways, avoid locations near busy intersections or curves in the road. Erecting guard rails or concrete pillars can provide additional safety barriers against motor traffic.
    - **Solar exposure.** Whenever possible in hot or warm climates, avoid locations with heavy exposure to direct afternoon sun, so as to maximize the life of electronics equipment in the cabinet. High outdoor temperatures and heavy solar exposure raise temperatures inside cabinets, a condition that can reduce the life span of equipment. Conversely, wind exposure improves thermal conditions in a cabinet, so locations that do not block wind are desirable.

2. Accessibility requirements:

   - **Easement size.** Select a location with an easement that provides enough space to walk around the perimeter of the cabinet with its doors open.
   - **Right-of-Way.** Secure a permanent location on private property, whenever possible. Obtain a firm right-of-way agreement that includes right of access. Avoid locations in public rights-of-way.
   - **Electrical access.** Locally-powered cabinets must have access to commercial AC power. Verify the availability of AC service at potential cabinet locations.
   - **Parking.** Whenever possible, the cabinet should be located in an area that provides sufficient parking space for installation and maintenance vehicles.

Space Requirements

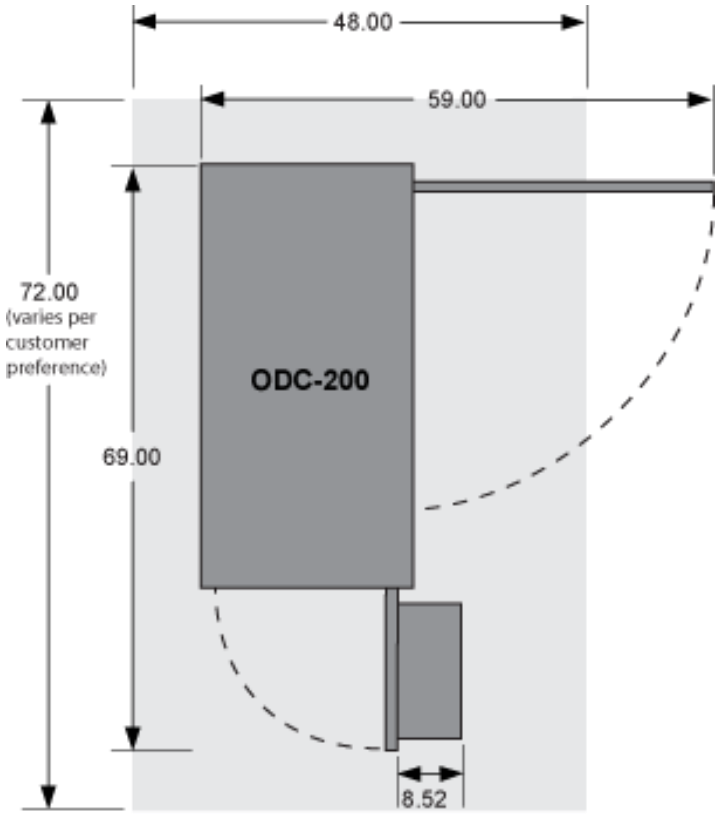
The cabinet configuration determines clearance and space requirements. Clearfield offers the following cabinet configurations for the ODC-200:

- **Stand-alone configuration**: Base ODC-200 cabinet
- **In-line configuration**: ODC-200 with an Expansion Module (EXM) mounted on the rear of the cabinet
- **L-configuration**: ODC-200 with an EXM mounted on the left side of the cabinet

For each configuration, the minimum clearance area around the cabinet site must be free of permanent impediments to allow full swing of the cabinet doors. This area must be kept clear of obstructions at all times to provide adequate access for all installation and maintenance activities.

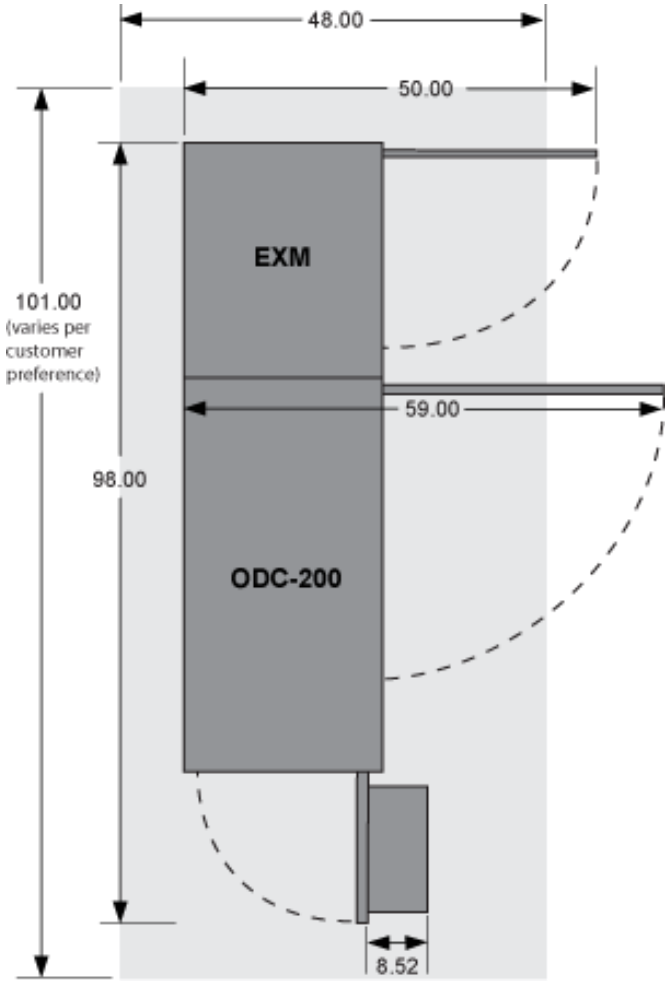
Stand-alone configuration

The illustration below shows the clearance and space requirements for a stand-alone ODC-200 cabinet.



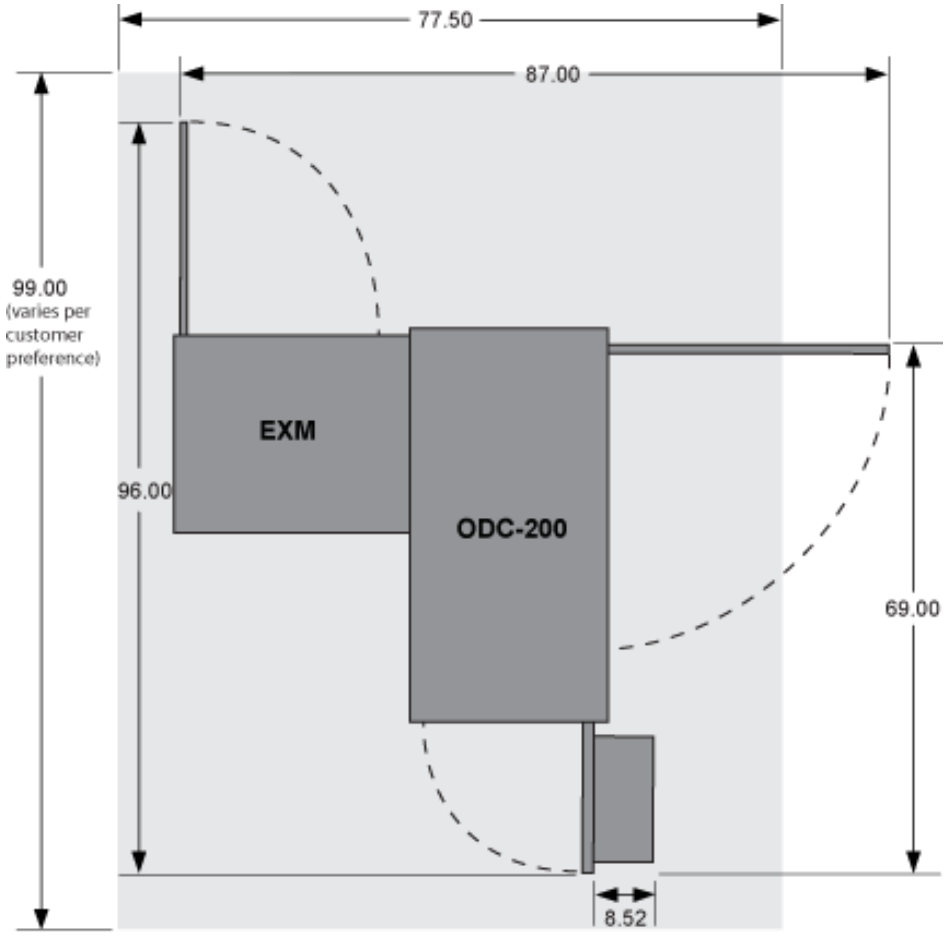
In-line configuration

The illustration below shows the clearance and space requirements for an in-line ODC-200 configuration.



L-configuration

The illustration below shows the clearance and space requirements for an ODC-200 L-configuration.



General Safety Recommendations

	**WARNING!** Only trained, qualified technical personnel should perform the procedures described in this document. These procedures involve potentially hazardous activities, including handling of heavy equipment and exposure to high electrical energy, which could cause injury to untrained personnel.
	**DANGER!** Risk of high power current surge and electric shock. Read and understand all power procedures before performing tasks. Take necessary precautions and use appropriate insulated tools when working with power. This equipment must be installed, operated, and serviced by qualified technical personnel only.
	**WARNING!** The cabinet and its components are heavy. Handle with care to avoid personal injury or damage to the equipment.
	**DANGER! CLASS 1 LASER PRODUCT. INVISIBLE LASER RADIATION MAY BE PRESENT.** Fiber optic radiation can cause severe eye damage or blindness. Do not look into the open end of an optical fiber.
	**CAUTION!** Batteries contain a stored charge. Handle batteries with care.
	**ESD ALERT!** Beware of electrostatic discharge. Follow standard ESD precautions. Always wear a grounded ESD wristband to avoid damaging the electronic equipment.

Installation Kits

Clearfield supplies an installation kit with both the cabinet and EXM that includes materials required for installation. The installation kit contents for the cabinet and EXM are listed below. Check to verify that your kit contains the listed items.

☑	Qty	Item Description
	1	Telco hex key, 5/16" (for cabinet door)
	1	Hex security driver, 5/32" (for access panels)
	1	Isolation mat
	1	Vent cover (for side door; included in installation kit when cabinet/EXM includes an internal battery enclosure)
	4	Hex nuts (for pad mounting)
	4	Flat washers (for pad mounting)
	4	Split lock washers (for pad mounting)
	4	1/2" hex cap screws (for pad mounting)
	1	Ground cable (EXM installation kit only)
	2	Line identification labels (for protection blocks)
	1	Product label (adhere to inside cabinet wall)
	1	Sealant mix for cable entry locations (500g bag)
	12	Tie wraps
Supplied Documentation (supplied with the cabinet installation kit only)		
	1	Cabinet installation guide (this document)
	1	Pair assignment lists

For ordering information, contact your Clearfield Sales Representative.

User-Supplied Items

Supply the following items for cabinet installation.

Tools

Bring the following tools to the installation site:

- Power drill with universal socket and screwdriver bit sets
- Hammer drill with bit set
- Socket wrench/nut driver set (standard)
- Box wrench set (standard)
- Screwdriver set (standard)
- Beam Level
- Insulated needle-nose pliers
- Wire stripper
- Wire cutters
- Crimp tool
- Compression crimping tool
- Fiber cleaver
- Fiber splicer
- Modular MS^2 or 710 splicing tool
- RB Razor-Sharp Cutting Edge knife, or another similar tool
- Wire brush (to clean drill hole for a 1/2-13 inch hole concrete insert)

Materials

Bring the following materials to the installation site:

- Leveling shims
- Silicone sealant
- Two-hole compression ground lug #2-6 AWG, 3/4-inch spacing (for earth ground wire)
- MS^2 or 710 connectors for copper line splicing
- Strain relief for #6-8 AWG wiring
- Red electrical tape (for remote power pairs bundle)
- (4) 1/2-13 inch concrete inserts (for EXM installations)
- River stone rock (to fill EXM riser outside plant cable entry location)
- Plastic sheeting

Equipment

Bring the following equipment to the installation site:

- Digital multi-meter
- Optical power meter
- Digital multi-function test set

Cabling Requirements

Cables supplied to the cabinet must meet the following minimum requirements.

Function	Facility	Requirements
Power		
Ground	Copper	6 AWG solid bare copper wire (to earth ground circuit); terminates to ground bar with screw lug
AC (local power)	Copper	8–10 AWG stranded copper; Follow National Electric Code (NEC) and local codes
±190 VDC (remote [line] power)	Copper	22 to 24 AWG twisted-pair copper, 25 pair cable(s); terminate with MS^2 connector; 655 Ohms maximum resistance
Transport		
10-Gigabit Ethernet (10GE)	Fiber	OSP: single-mode fiber (SMF-28); splices should not exceed 0.5 dB loss. OSP to equipment (SFP+, XFP): single-mode fiber pigtails with fiber connector options
Gigabit Ethernet (GE optical)	Fiber	OSP: single-mode fiber (SMF-28); splices should not exceed 0.5 dB loss. OSP to equipment (SFP): single-mode fiber pigtails with fiber connector options
Gigabit Ethernet (GE metallic)	Copper	(Jumpers to interlink multiple E5 units only) Shielded CAT-5 Ethernet cable, RJ-45 connectors
Ethernet/Cu (802.3ah)	Copper	22 to 24 AWG twisted-pair copper (bonded); terminate with MS^2 connectors
Subscriber		
xDSL, DS0	Copper	19 to 26 AWG twisted pair copper; terminate with MS^2 connectors
AE, PON	Fiber	19 to 26 AWG twisted pair copper; terminate with MS^2 connectors

Note: Local climatic conditions, site conditions, or local practices may require adjustments to cabling requirements.

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Chapter 3

Preparing the Installation Site

This chapter describes how to prepare the ODC-200 installation site for cabinet placement, including establishing the cabinet mounting structure. You can construct a concrete foundation pad using the Clearfield pour-in-place template, and install an optional 6-inch or 12-inch riser.

For all mounting configurations, Clearfield requires installation of an earth ground circuit at the installation site to provide lightning protection.

Topics Covered

This chapter covers the following topics:

- Installing a ground circuit at the installation site.
- Constructing a concrete pad.
- Installing a pre-cast concrete pad.
- Installing a wall/H-frame mount kit
- Installing a stake platform kit
- Installing a composite foundation vault

Installing a Ground Circuit

Clearfield requires installing an earth ground circuit (earth electrode) at the installation site to provide protection from electric shock for equipment and personnel. The ground circuit may consist of a simple copper rod driven into the earth or a complex system of buried rods and wires. The lower the resistance of the electrode-to-earth connection, the more effective the ground system for safety and lightning protection.

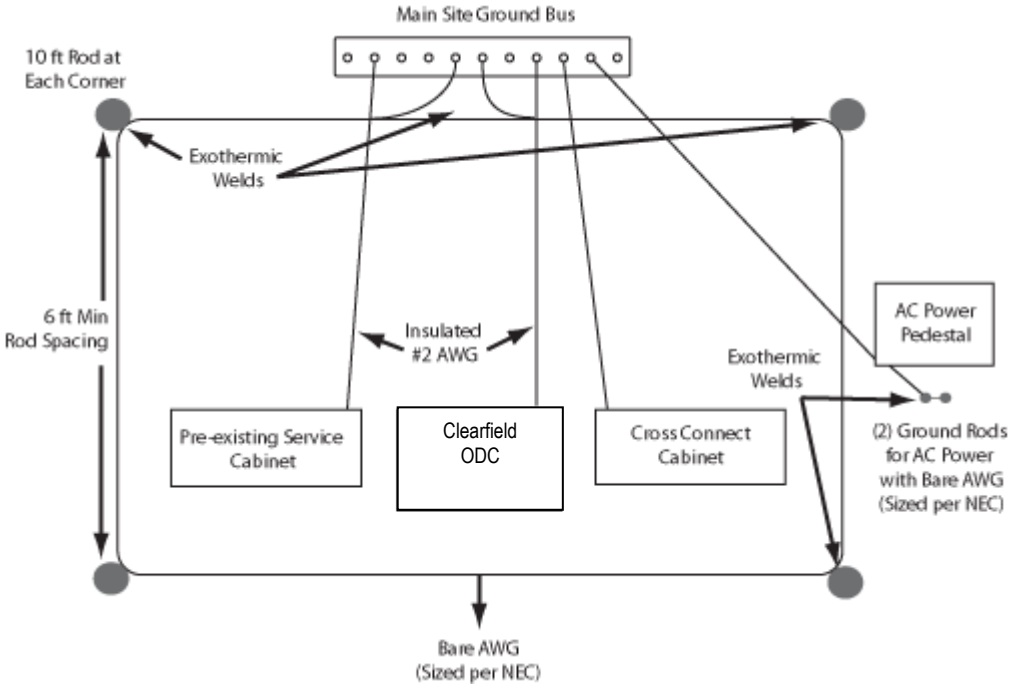
Proper grounding conditions and requirements vary per site. The National Electric Code (NEC) specifies a maximum ground impedance of 25 ohms. Clearfield recommends achieving a ground impedance of no greater than 5 ohms wherever practical. If 5 ohms or less cannot be achieved, the maximum ground impedance should meet local codes or the NEC requirement of 25 ohms, whichever is less.

Grounding options

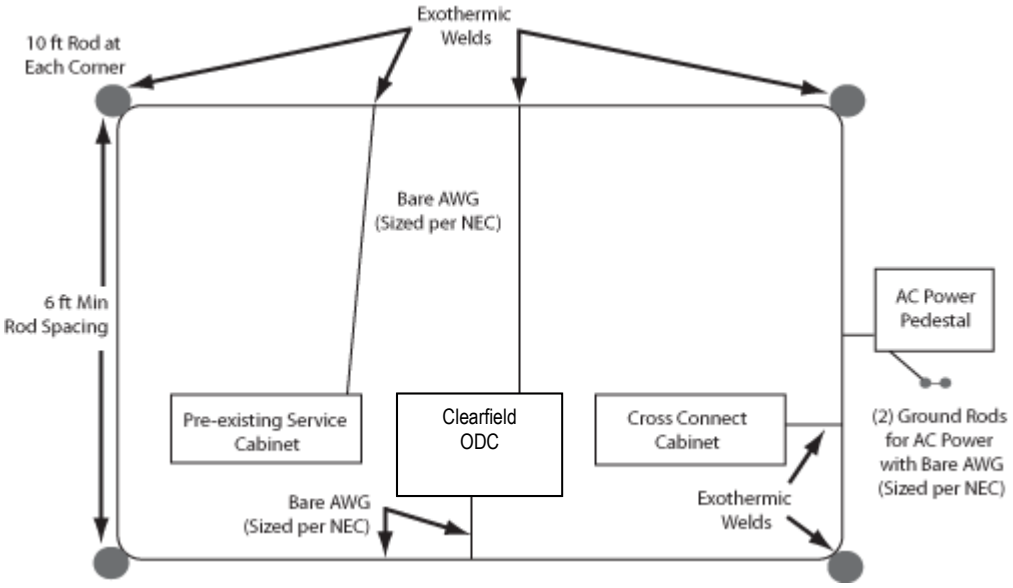
The cabinet main ground system must be bonded to a suitable earth ground circuit, which may include any of the following:

- **Ground rod(s)**: A ground rod consists of a simple copper rod driven into the earth. A ground rod connects to the main cabinet or enclosure ground via an earth ground wire bonded to the ground rod and buried at the site. Multiple inter-connected ground rods provide increased ground electrode-to-earth conductivity (ground grid). You can add supplemental ground rods to a single ground grid in several arrangements, including a linear chain, fan array, or ring configuration. Refer to the NEC or local regulations for restrictions and details. All bonds to grounding electrodes must be suitable for direct burial using irreversible mechanical connections or exothermic welds. Follow local code or site practice to satisfy any additional grounding requirements.
- **Ground ring:** A ground ring consists of multiple ground electrodes that encircle the perimeter of a site. *Ground rings represent the preferred earth grounding system for cabinet deployments.* Ground rings follow the NEC provisions for multiple ground electrodes.

  Example of PANI-compliant ground ring with main site ground buss:



Example of PANI-compliant ground ring without a main site ground buss:



Ground circuit considerations

Following local codes and practices, install a ground circuit at the installation site. Consider the following factors when constructing the ground circuit:

- The ground electrode(s) should be copper-clad steel at least 5/8-inch in diameter.
- The ground rod or pipe electrode(s) should have a minimum of 8 feet of direct contact with earth.
- The wire connecting multiple electrodes should be bare copper sized per NEC, and should be buried at least 30 inches deep or below the frost line (whichever depth is greater).
- The wire connecting multiple electrodes should be connected with an exothermic weld or irreversible mechanical connector suitable for direct burial.
- The wire connecting the cabinet main ground bar to the initial ground electrode should be a 6 AWG or larger bare copper ground wire.
- The ground wire should enter the cabinet separated from power or copper transmission cables. Never bundle the ground wire together with other copper cables.
- Connect the ground wire to the main ground bar.
- Follow the PANI organization for all connections made to the Clearfield equipment cabinet/enclosure ground bar as shown in Clearfield documentation.
- Measurements of the site ground circuit should be conducted to gauge achievement of 5 Ohms or less.

Note: You must install the cabinet's connection to the earth ground circuit before you connect commercial power to the cabinet.

Environmental factors

Environmental factors that may affect grounding conditions include:

- Type and size of an electrical surge; a lightning-induced current surge, voltage spike during an electrical storm, or static build-up from power utility lines may overwhelm the earth ground.
- Wet soil provides low resistance ground, with resistance increasing as the soil dries. Rock, gravel, sand, loam and clay react differently to wet/dry conditions.

Follow local code to satisfy additional requirements, if applicable.

Constructing a Concrete Pad

A concrete pad provides a permanent foundation to anchor the cabinet to the ground while protecting the cabinet from water damage and other outdoor surface conditions.

Construct a concrete foundation pad for the cabinet at the installation site. Pad construction requires excavating the site, trenching cable conduit, constructing a form, and casting concrete. Use the Clearfield -supplied cast-in-place template to provide exact locations for the mounting studs that anchor the cabinet to the pad and to provide the cable conduit locations.

Pad Construction Guidelines

When constructing a concrete pad, observe the following guidelines and refer to the pad drawings for guidance.

Guidelines

Follow these guidelines to ensure proper pad construction. Adjust for local conditions or practices as required.

- Construct a pad for a stand-alone ODC-200 cabinet configuration with minimum perimeter dimensions of 48 x 72 inches.

  Note: Be sure to construct an adequate size pad if you may consider adding an EXM later as an expansion.

- Construct a pad for an ODC-200 in-line configuration with minimum dimensions of 48 x 101 inches.
- Construct a pad for an ODC-200 L-configuration with minimum dimensions of 77.5 x 99 inches.

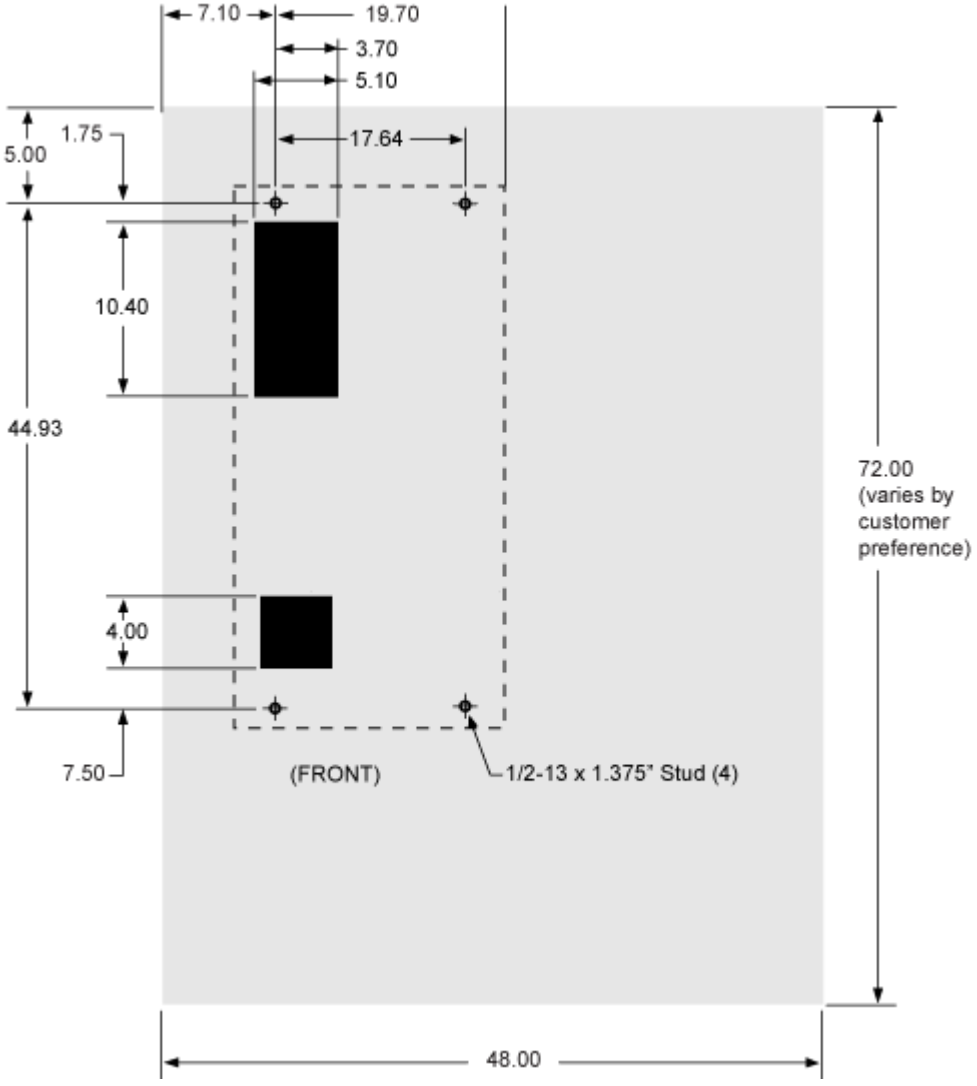
  Note: Refer to *Space Requirements* (on page 31) for more information on cabinet configurations.

- For a pad that includes an EXM, the location of the EXM conduit box is relative to the ODC-200 cast-in-place template.
- Construct the pad with a minimum height of 6 inches.
- Construct the pad with a maximum of 2 inches above-grade exposure.
- Use the Clearfield cast-in-place template to provide exact mounting stud and conduit locations.
- Use rebar or wire mesh inside the form to improve pad strength.
- Cast the pad from a single concrete pour. Do not make multiple pours.
- Ensure that the pad is smooth and level across its entire surface.

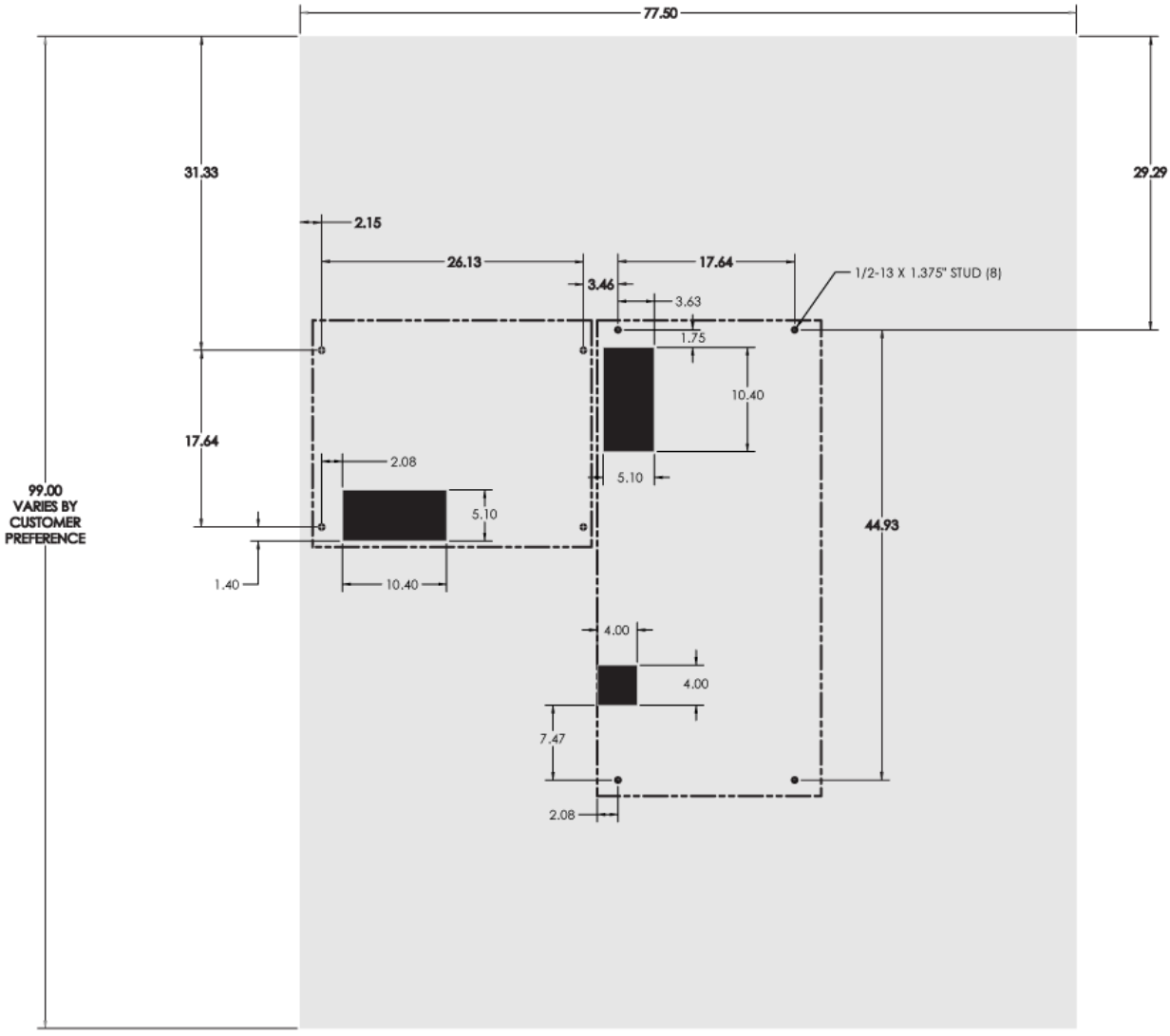
- Use 4-inch conduit (maximum) for outside plant cables. See drawings below for entry locations.
- Use 2-inch conduit (maximum) for AC cable (local power applications only). See drawings below for entry location.
- Include pull cords in all cable conduits.

Pad Drawings

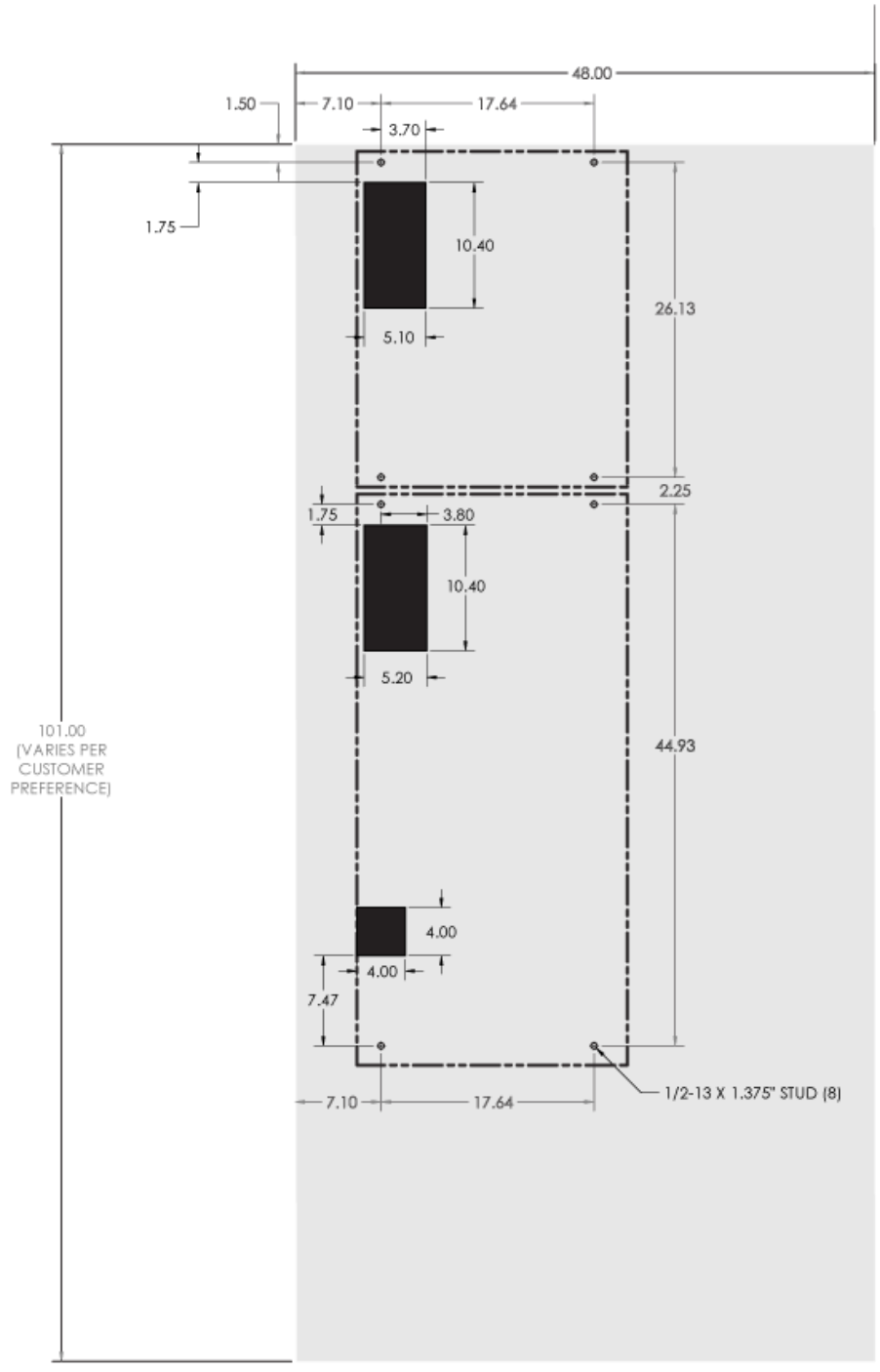
Use the following drawings for reference during pad construction.



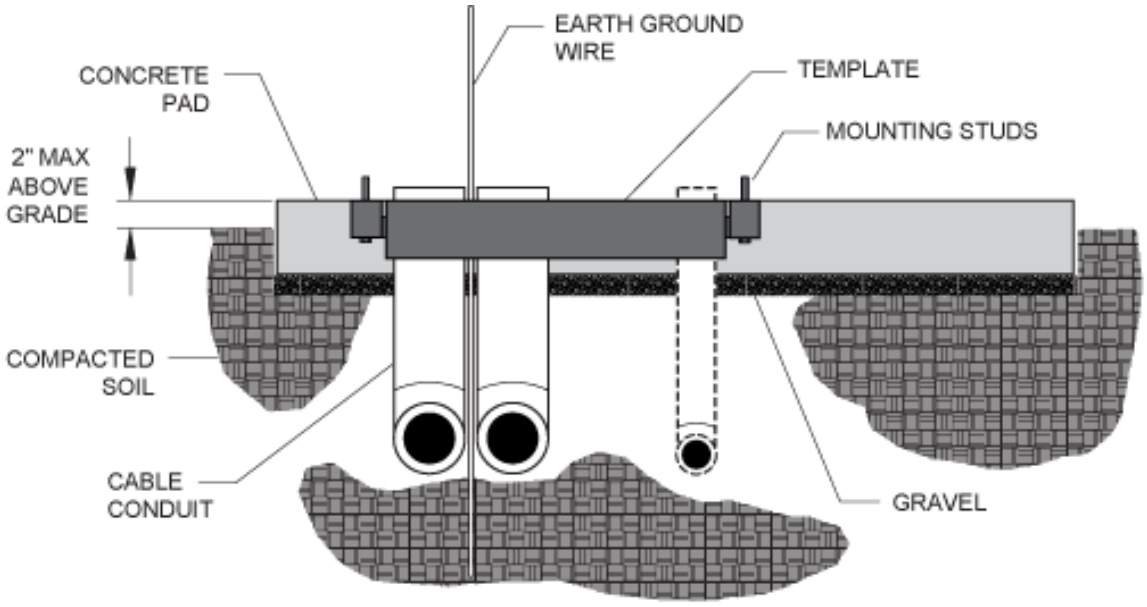
Pad Size: ODC-200 Base Cabinet



Pad Size: L-Configuration



Pad Size: In-Line Configuration



Pad Cross-Section: ODC-200 Base Cabinet

(from left side)

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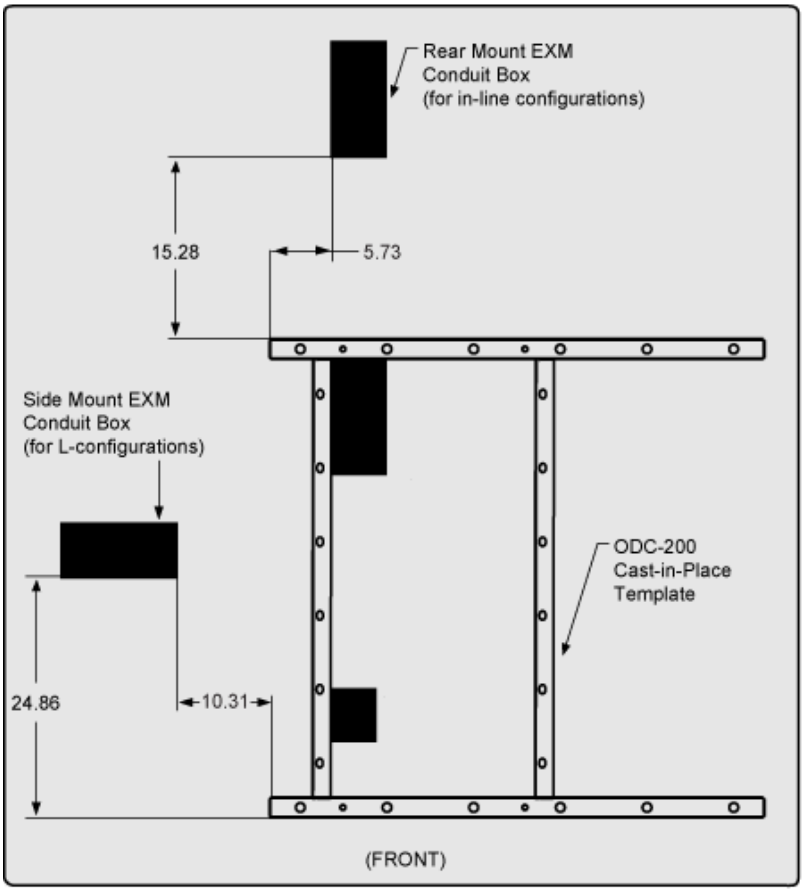
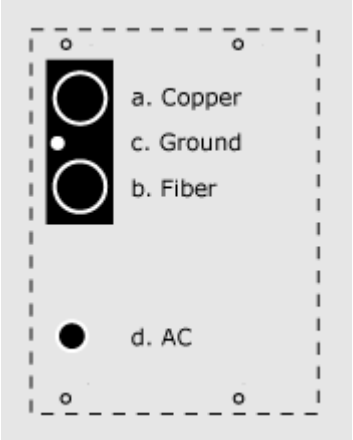


EXM Conduit Box Locations



Conduit Locations

For proper cable entry into the cabinet, place conduit into the following locations.

- **a.** Conduit for outside plant cable (copper).
- **b.** Conduit for outside plant cable (fiber).
- **c.** Earth ground wire.
- **d.** Conduit for AC cable (for local power configurations only).

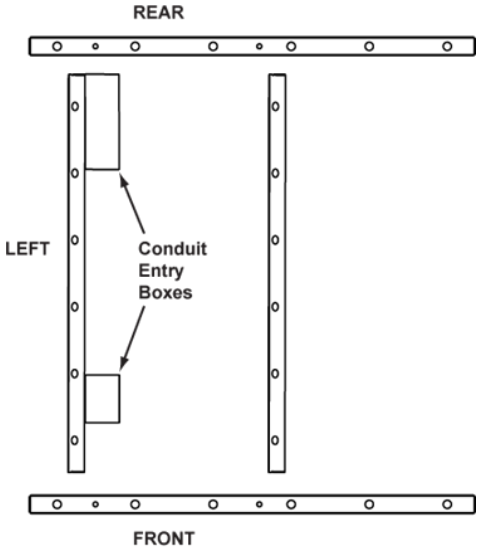
Use the Clearfield cast-in-place template to provide precise conduit orientation.

Assembling the Cast-In-Place Template

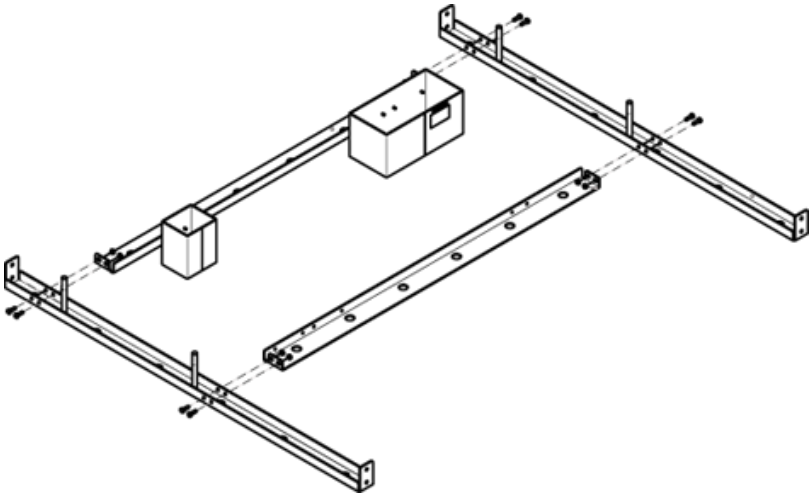
Assemble the Clearfield cast-in-place template as follows.

To assemble the template

1. Unpack the template hardware from the shipping kit.
2. Place the four bracket members on the ground, arranged as follows:
   a. Place the two long brackets parallel with each other, flat side down.
   b. Place the two short brackets between (and perpendicular to) the long members, flat side down, with the conduit entry box bracket on the left.



3. Attach the short and long brackets together using eight supplied screws and nuts, as shown.



4. Tighten all screws to complete the template assembly.

Preparing the Site

Prepare the site for pad construction as described below. Adapt the instructions as needed for local requirements, practices, or conditions.

To excavate the site

1. Excavate the pad area. Dig a foundation hole six inches deep with a perimeter measuring **at least** 48 x 72 inches.

   Refer to *Space Requirements* (on page 31) for more information.

2. Grade and compact the excavated surface until it is firm and level.
3. Trench out conduit paths through the foundation hole from the cable feeder location. Refer to the *pad drawings* (on page 43) for conduit locations.
4. Place the cable conduits into the conduit trench. Refer to the *pad construction guidelines* (on page 43) for conduit sizes and locations.
5. Route the earth ground wire through the conduit trench (from the ground electrode).

To construct a concrete form

1. Using 2 x 6 boards and stakes, construct a concrete form with **minimum** interior dimensions of 48 x 72 inches. Make sure that the top edge of the form is level.

   Refer to *Space Requirements* (on page 31) for more information.

2. Place gravel into the foundation hole to create a level base. The gravel layer should be at least two inches deep, compacted and leveled.
3. Place and tie rebar inside the form elevated above the gravel.
4. Place the Clearfield cast-in-place template into the form, guiding the cable conduits through the conduit entry ducts in the template.
5. Align the template mounting brackets flush with the top of the form, and then nail the template to the form to secure it in place.

   Note: The mounting studs should protrude approximately 1 3/8-inches above the form.

6. Verify that the form remains level across the entire surface. Adjust as required.
7. Pull the earth ground wire (from the conduit trench) through the entry duct in the template, allowing at least three feet of wire to extend above the top of the form.
8. Mask the four mounting studs on the template to protect the threads from concrete.

Casting the Pad

Cast the concrete foundation pad as described below. Adapt the instructions as needed for local requirements, practices, or conditions.

To cast the concrete pad

1. Prepare the concrete mix. Be sure to mix enough concrete to cast the entire pad in a single pour.

   Note: To avoid structural weakening, do not cast a pad from multiple concrete pours.

2. Pour the concrete into the form. Do not allow the cast-in-place template to bend or twist out of shape during the pour.
3. Smooth and level the top surface of the concrete.
4. Leave the pad to cure. Do not remove the form until the concrete has fully cured (at least 72 hours).

   Perform the remaining steps only after the concrete has cured.

5. Remove and discard the form.
6. Backfill the cable conduit trenches with soil or gravel as required.
7. Backfill and grade the perimeter area around the pad with soil, as required.
8. Trim the cable conduits to a height no more than 4 inches above the pad.

Installing a Pre-Cast Concrete Pad

A concrete pad provides a permanent foundation to anchor the cabinet to the ground while protecting the cabinet from water damage and other outdoor surface conditions.

Install a pre-cast concrete pad for the cabinet at the installation site. Installation requires excavating the site, trenching cable conduit, creating a gravel foundation base, and installing the pre-cast pad.

Pre-cast pads typically ship configured with conduit entry cutouts and mounting fixtures (anchor studs or countersunk threaded inserts) for anchoring the cabinet to the pad. Specific features and dimensions vary by manufacturer. Contact your sales representative for a list of Clearfield -certified suppliers to contact directly.

Preparing the Site

Prepare the site for installation of a pre-cast pad according to the manufacturer's instructions. Some pads may require custom preparations.

A general practice is described below for reference. Adapt the instructions as needed for local requirements, practices, or conditions.

DANGER! Do not place outside plant cables into conduits at the pad site before installing the pre-cast pad. Attempting to install a pre-cast pad over existing cables becomes hazardous if a person must reach underneath a lowered pad to feed cables through its entry cutout.

To prepare the site for pad installation

1. Excavate the pad area. Dig a foundation hole six inches deep with a perimeter measuring at least 48 x 72 inches; dimensions may vary based on manufacturing requirements and the selected ODC-200 configuration.
2. Grade and compact the excavated surface until it is firm and level.
3. Trench out conduit paths through the foundation hole from the cable feeder location.
4. Place the cable conduits into the conduit trench.
5. Route the earth ground wire through the conduit trench (from the ground electrode).
6. Place gravel into the foundation hole to create a level base. The gravel layer should be at least two inches deep, compacted and leveled.

Note: When installed, the pad should stand at least one inch above grade. Adjust the compaction and gravel depth accordingly, based on the pad height.

Installing a Pre-Cast Pad

Install the pre-cast pad according to the manufacturer's instructions (typically supplied with the pad).

A general installation practice is described below for reference. Adapt the instructions as needed for local requirements, practices, or conditions.

WARNING! The pre-cast concrete pad is extremely heavy. Do not place any part of your body under the pad during lifting. Handle with care to avoid personal injury or damage to the pad.

To install a pre-cast pad

1. Transport the pre-cast pad to installation site.
2. Using a suitable lifting device (such as a backhoe equipped with lifting slings), lift the pad into position above the gravel base inside the foundation hole.
3. Lower the pad onto the gravel base, allowing the conduits to pass through the cutout in the pad as it descends.
4. Adjust the pad positioning on the gravel base until it is stable and level.
5. Pull the earth ground wire through the cutout in the pad, allowing at least four feet of wire to extend above the top of the pad.
6. Backfill and grade around the pad perimeter with soil to secure the pad in place.
7. Verify that the pad remains level. Adjust as required.
8. Trim the cable conduits to a height no more than 4 inches above the pad.

Installing a Wall/H-Frame Mount Kit

A sturdy, plumb wall or H-frame can provide an effective mounting structure for elevating the cabinet above the ground, particularly in areas subject to severe surface conditions such as flooding, mud, or heavy snow. Wall/H-frame mounting also allows cabinets to be installed in locations where the required terrestrial right-of-way may be unavailable.

Use the Clearfield wall-mount kit to provide the mounting fixture. The wall/H-Frame mount kit consists of mounting brackets that attach directly to a wall or H-frame and a conduit feedthru assembly which provides exact entry locations for cable conduits.

You can install the mounting kit onto an existing wall, or you can construct an H-frame at the installation site to support the cabinet. Installing the wall/H-frame mount kit requires trenching cable conduit to the site and installing the mounting kit on the wall or H-frame.

Wall/H-Frame Mounting Configurations and Drawings

Clearfield supports the following wall and H-frame mounting configurations:

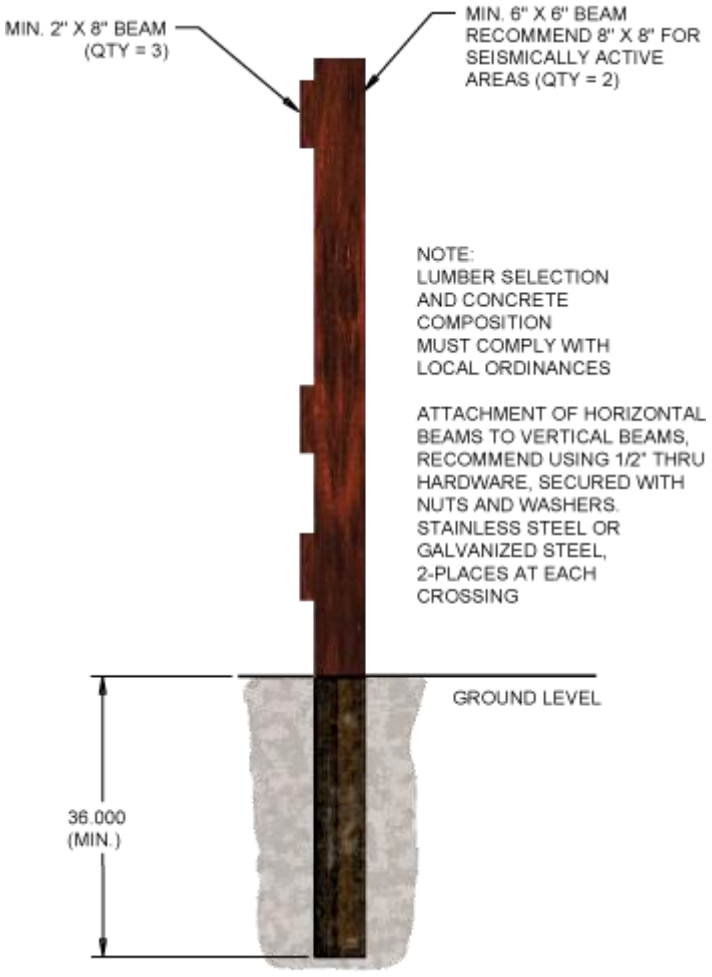
- **ODC-200 low profile**
- **ODC-200 + EXM low profile**
- **ODC-200 high profile**
- **ODC-200 + EXM high profile**

High profile configurations include a space allowance for a splice blister mounted on the rear of the enclosure(s), and low profile configurations do not include this space allowance.

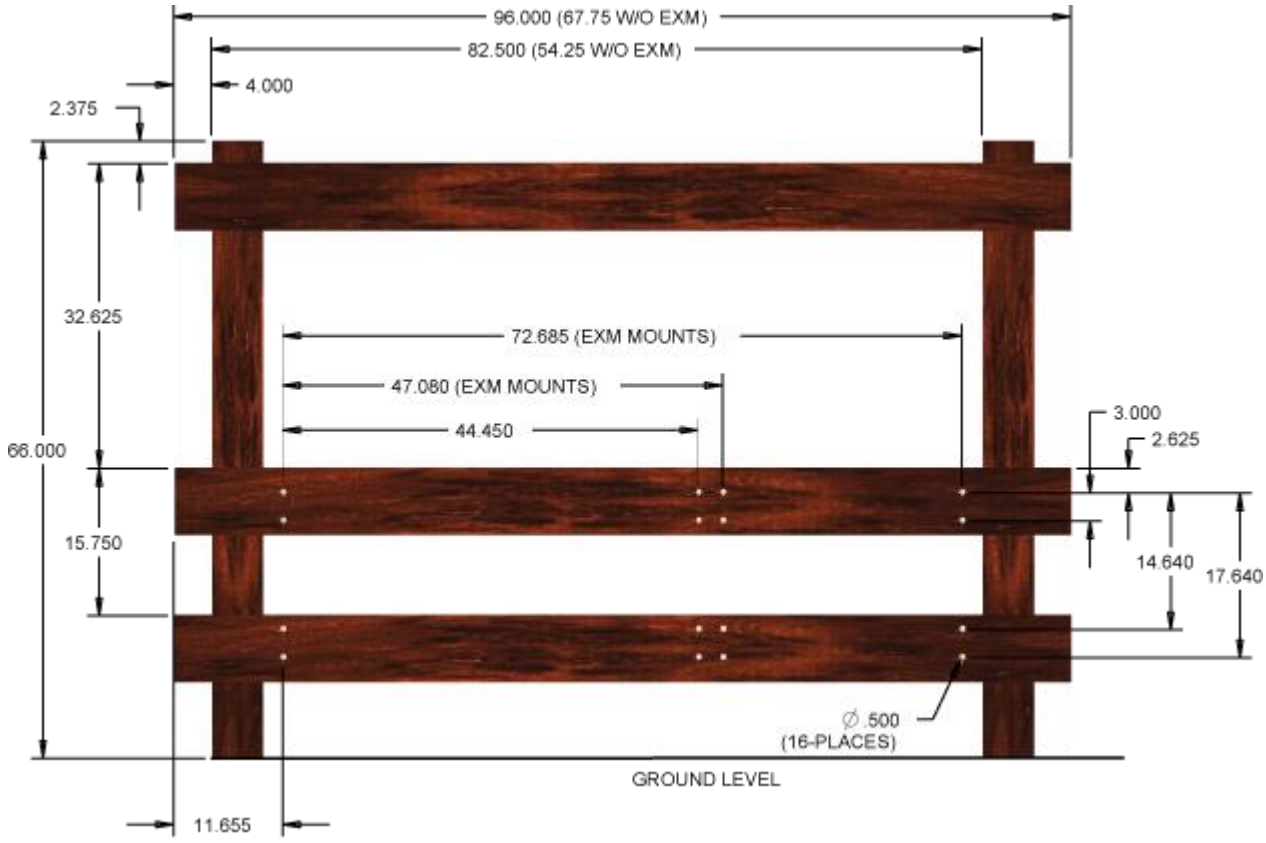
Drawings

Use the following drawings for reference during site preparation. Wall dimensions may vary by site. Defer to local practice where required.

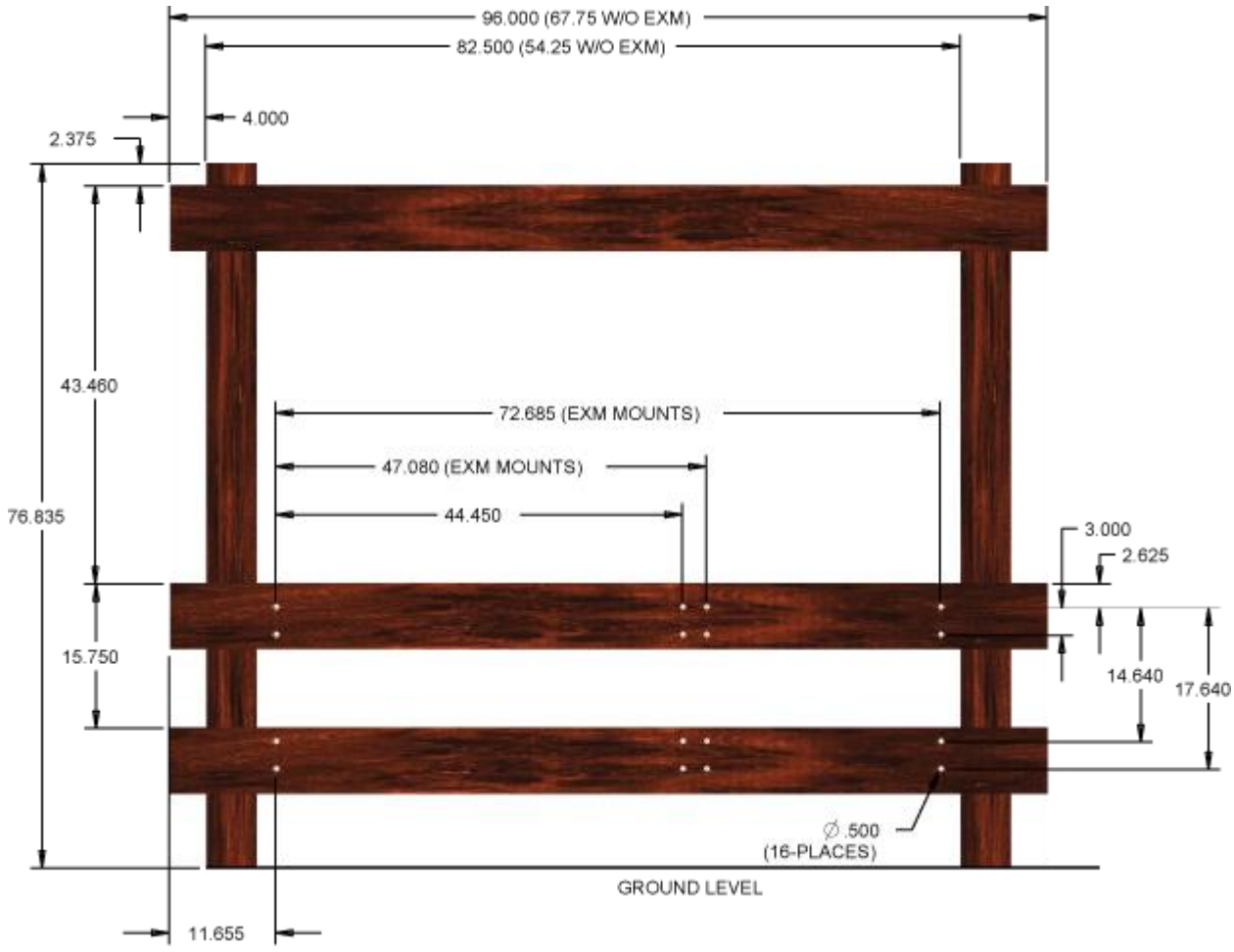
Note: The low profile and high profile mounting dimensions (shown in inches) account for configurations with or without an EXM.



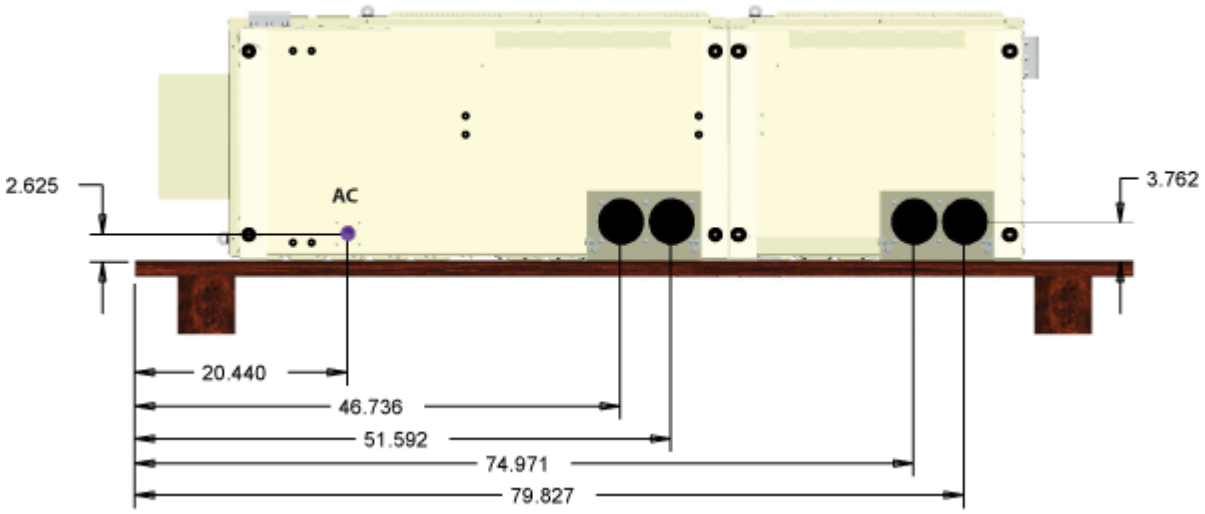
H-Frame Mount: Side View



Wall/H-Frame Mount Dimensions: Low Profile Configurations
(No splice blister allowance on backside)



Wall/H-Frame Mount Dimensions: High Profile Configurations
(Allowance for splice blister on backside)



Conduit Locations
(as viewed from bottom)

Wall/H-Frame Mounting Guidelines

When installing the wall/H-frame mount kit, observe the following guidelines. Refer to the *wall/H-frame configurations and drawings* (on page 54) for guidance.

Guidelines

Follow these guidelines to ensure proper mounting support for the cabinet and EXM. Adjust for local conditions or practices as required.

- The wall/H-frame must be vertically plumb.
- The wall/H-Frame must support a minimum load weight, as follows:
  - **ODC-200 only:** 730 lbs
  - **ODC-200 + EXM:** 880 lbs

  Note: These weights include fully loaded enclosures, with a single battery string.
- The top of the base platform must be a minimum of 15.25 inches above the ground.
- The wall or H-frame must stand a minimum height above the ground, as required for the cabinet mounting configuration:
  - **Low profile configurations:** The wall or H-frame must stand *at least* 66 inches above ground.
  - **High profile configurations:** The wall or H-frame must stand *at least* 76.835 inches above ground.

Note: The minimum heights assume a distance of 15.25 inches above the ground to the top of the base platform. To elevate the cabinet higher than 15.25 inches above ground, use a wall or H-frame with sufficient additional height.

- Use the Clearfield wall/H-frame mount kit to provide the mounting fixture and conduit entry locations.
- The Clearfield wall/H-frame mount kit provides assembly hardware for a wall or wooden H-frame, however y*ou must provide the hardware* to attach the mounting fixture, as appropriate for your site requirements. For example, attaching the fixture to a concrete wall requires different hardware (anchors). Follow local codes and practices to supply the required mounting hardware.
- Use 4-inch conduit (maximum) for outside plant cables. See figure for entry locations.
- Use 2.5-inch conduit (maximum) for AC cable. See figure for entry location.
- Include pull cords in all cable conduits.
- For H-frames, Clearfield recommends the following *nominal* beam sizes, as required for the cabinet mounting configuration:
  - **Low profile configurations**: Two 6" x 6" x 8.5' vertical beams, or two 8" x 8" x 8.5' vertical beams for seismically active areas
  - **High profile configurations**: Two 6" x 6" x 9.4' vertical beams, or two 8" x 8" x 9.4' vertical beams for seismically active areas
  - **(ODC-200 + EXM) Both low and high profile configurations**: One 2" x 8" x 8.0' horizontal beams on the top and two 2" x 8" x 8.0' horizontal beams on the bottom to support the fixture

Note: To use the supplied hardware, do not exceed the nominal size for the horizontal beams. A nominal size of 2" x 8" x 8.0' correlates to an actual size of 1.5" x 7.25" x 8.0'.

  - **(ODC-200 only) Both low and high profile configurations**: One 2" x 8" x 5.6' horizontal beams on the top and two 2" x 8" x 5.6' horizontal beams on the bottom to support the fixture

Preparing the Site

Prepare the site for installation of a wall/H-frame mount kit. A general practice is described below for reference. Adapt the instructions as needed for local requirements, practices, or conditions.

To prepare the site for a wall/H-frame mount installation

1. At the installation site, verify the following:
   - The wall or H-frame is installed and plumb.
   - The wall or H-frame meets the cabinet mounting *requirements* (on page 54).

2. Trench out conduit paths to the wall or H-frame from the cable feeder location. Place the cable conduits into the conduit trench. At the wall or H-frame, allow the conduit to extend above ground to the approximate height of the base platform. Refer to the *wall mounting guidelines* (on page 58) and *drawings* (on page 54) for conduit locations.
3. Route the earth ground wire through the conduit trench (from the ground electrode). Pull six feet of wire above ground and position it adjacent to the wall or H-frame. Backfill the conduit trench with soil.

Installing the Wall/H-Frame Mounting Fixture

This topic describes how to install the wall/H-frame mounting brackets and conduit feed through assembly.

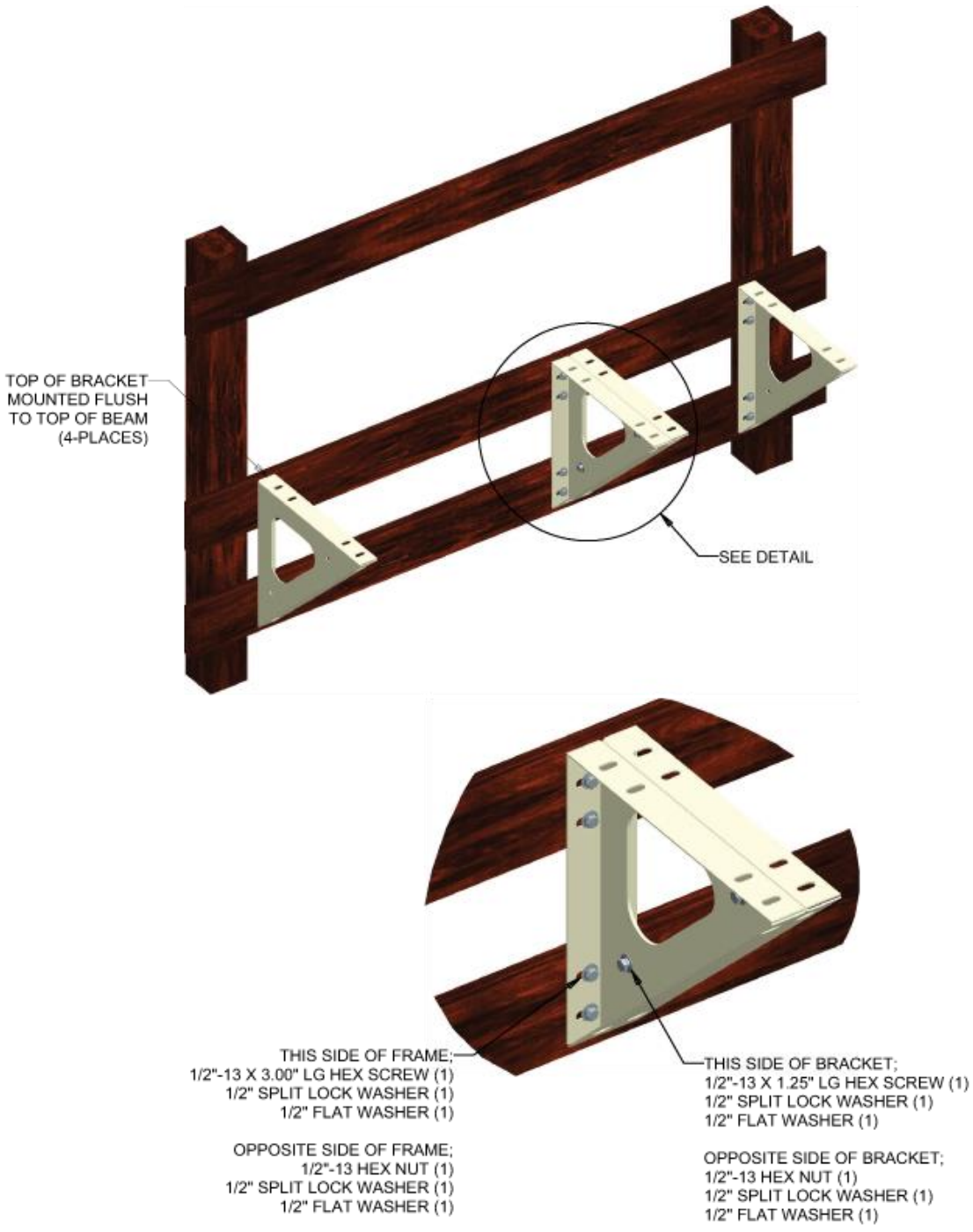
To install the wall/H-frame mounting fixture

1. Attach the mounting brackets to the wall/H-frame horizontal beams as follows:
   a. Mark (4) pilot hole locations on the horizontal beams based on your selected configuration. See *Wall/H-Frame Mounting Configurations and Drawings* (on page 54) for exact locations of pilot holes.
   b. Drill 3/8-inch pilot holes into the horizontal beams at the marked locations.
   c. Position the bracket against the wall/H-frame, as shown in the illustration below:
      - Orient the bracket facing inward, with mounting slots against the wall/H-frame and on the top.
      - Align the top of the mounting bracket flush to the top edge of the middle horizontal beam, and center the mounting slots on the drilled holes in the beam.

   Note: You can offset the horizontal position of the brackets later if needed, once the cabinet is roughly positioned.

   d. Install (1) 1/2"-13 x 3.00" hex screw, 1/2" split lock washer and 1/2" flat washer to attach the mounting bracket to the front of the wall/H-frame.
   e. On the back side of the wall/H-frame, install (1) 1/2"-13 hex nut, 1/2" split lock washer and 1/2" flat washer.
   f. Verify that the bracket is level, and then tighten the hardware to secure the bracket in place.
   g. Repeat steps 1a–1f to install additional mounting brackets.
2. (For ODC-200 + EXM configurations only) Secure the two center mounting brackets together as follows:
   a. From the left side of the brackets, install (1) 1/2"-13 x 1.25" hex screw, 1/2" split lock washer and 1/2" flat washer.

b. On the right side of the brackets, install (1) 1/2"-13 hex nut, 1/2" split lock washer and 1/2" flat washer.



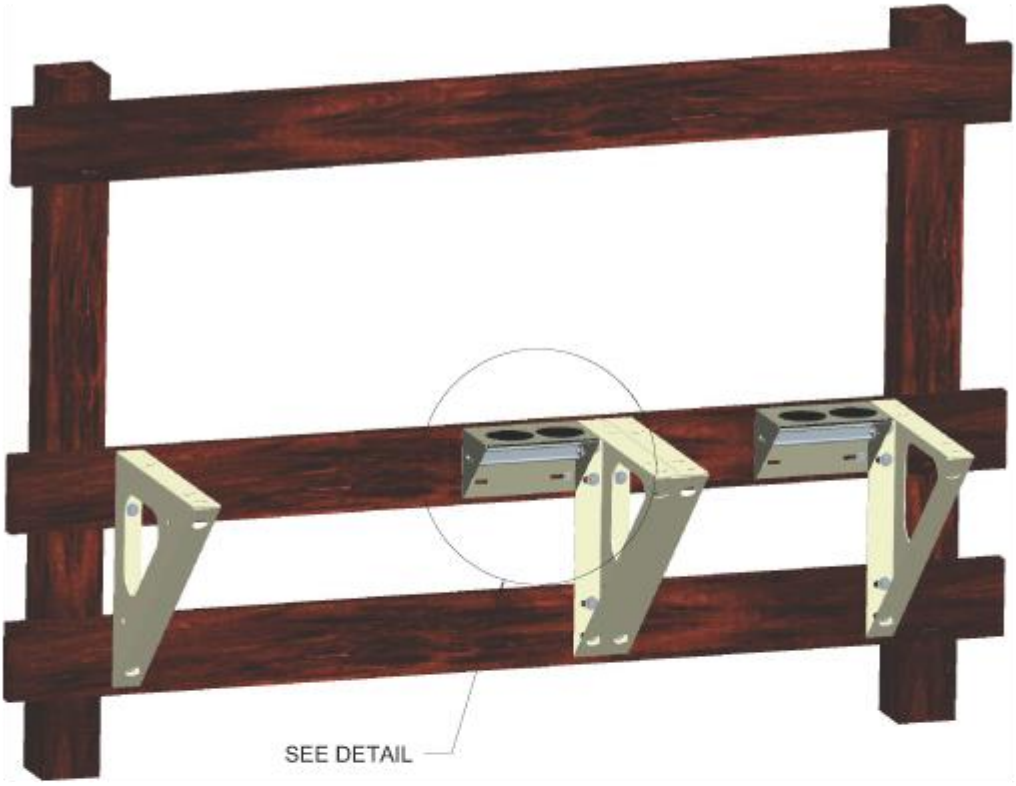
3. Attach the conduit feed through assembly to the wall/H-frame as follows:

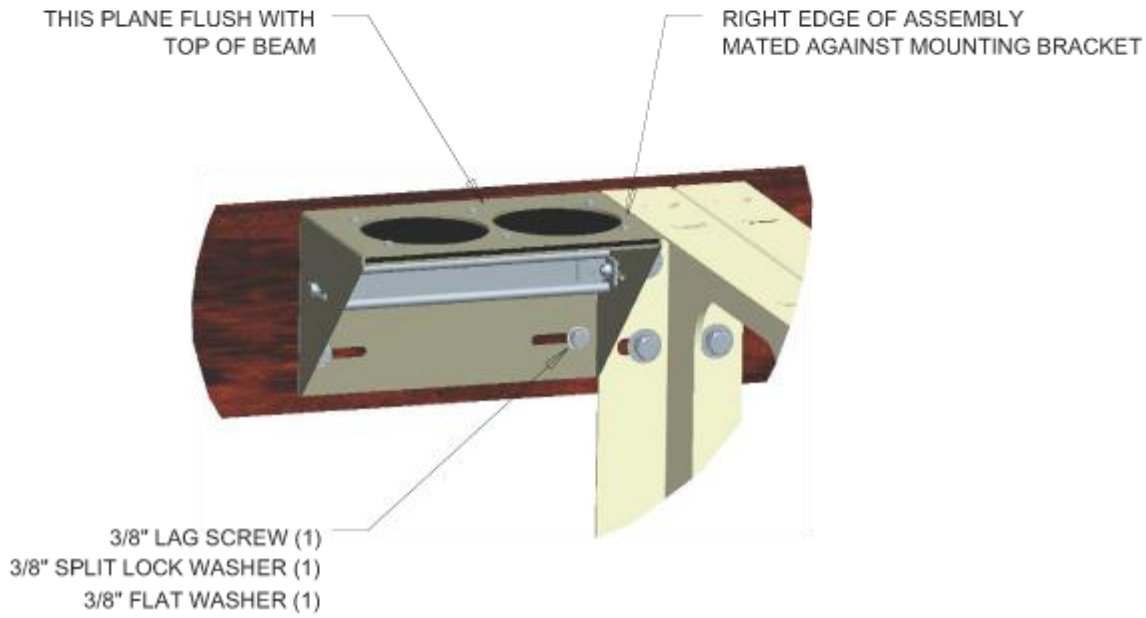
a. Position the feed throughs flush to the top edge of the middle horizontal beam, with the right edge of the assembly mated to the left side of the mounting bracket as shown in the illustration below.

b. Hold the conduit assembly in place with c-clamps and drill 1/8" pilot holes into the beam through the assembly mounting slots.

c. Install (1) 3/8 x 1.50 LAG screw, 3/8"split lock washer and 3/8" flat washer to attach the assembly to the front of the wall/H-frame.

d. For ODC-200 + EXM configurations, repeat steps 3a–3c to attach a second conduit feed through assembly.



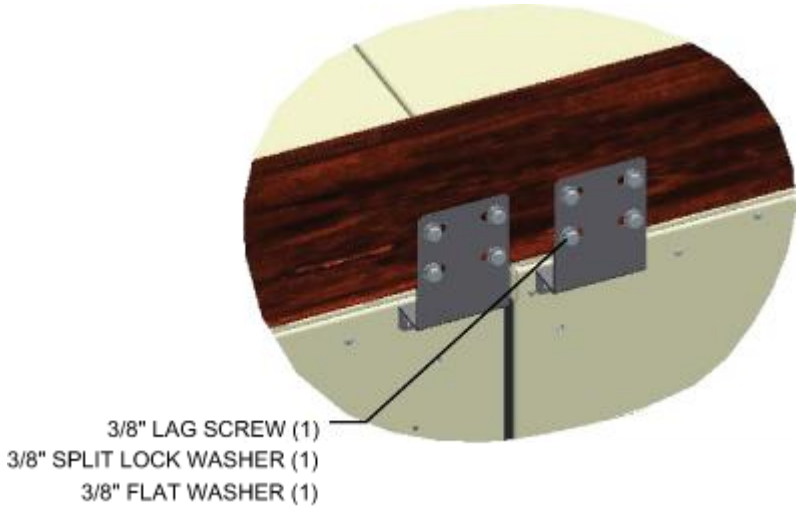


Installing the Stabilizer Bracket(s)

This topic describes how to install stabilizer brackets on the ODC-200 and EXM. The bracket(s) is required for an H-frame mounting.

To install stabilizer bracket(s) for an H-frame

1. Position the stabilizer bracket against the rear enclosure wall in the location where you removed the lifting detail, aligning the (2) bracket holes with the counterpart holes in the cabinet. For low profile configurations the (2) bracket holes are on top; for high profile configurations the (2) bracket holes are on the bottom (as shown in the illustration below).
2. Reinstall the hardware set aside from the lifting detail to secure the bracket to the cabinet.
3. Drill (4) 1/8" pilot holes into the top horizontal beam through the bracket holes.
4. Install (4) 3/8 x 1.50 LAG screws, 3/8"split lock washers and 3/8" flat washers to attach the bracket to the H-frame.



Installing a Stake Platform Kit

The ODC-200 and EXM stake platform kits provide a mounting fixture and stakes, and utilize a gravel bed—eliminating the need for a concrete pad, and significantly reducing the cost and time required for installation.

The stake platform kits consist of an alignment frame and platform that are secured to the earth via stakes. Additionally, the ODC-200 kit includes AC and OSP frames to provide entry locations for cable conduits.

Installing a stake platform kit requires excavating the site, trenching cable conduit, and installing the kit.

Stake Platform Guidelines

When installing the stake platform kit, observe the following guidelines.

Guidelines

Follow these guidelines to ensure proper stake platform installation for the cabinet and EXM. Adjust for local conditions or practices as required.

- Suitable terrain: The cabinet must be located in an area with a firm flat soil surface that does not require extensive earth work. The location should not be constantly damp or prone to flooding. Check soil maps of potential sites for subsurface conditions.
- The stake platform kit option is designed for:
  - a stand-alone ODC-200 cabinet configuration, *or*
  - an in-line or L-configuration, with the EXM mounted on the end or rear of the cabinet.
- If installing both the ODC-200 and EXM, you must attach the EXM alignment frame to the ODC-200 alignment frame.
- Use the alignment frame(s) to determine the area and location to dig the installation pit; make the pit one to two inches larger than the frame on all sides.
- The installation pit must be 3-inches minimum and 10-inches maximum depth.
- The stake platform must be vertically plumb.
- Use the AC and OSP frames provided in the Clearfield stake platform kit to provide the conduit entry locations.
- Use 4-inch conduit (maximum) for outside plant cables.
- Use 2.5-inch conduit (maximum) for AC cable.
- Include pull cords in all cable conduits.

- Stakes suitable for many installations are provided with the kits. However, the customer or customer's installer retain responsibility for suitable installation given the soil and ground conditions. Variants of the same overall cross section compatible stakes are available via various telecom equipment vendors, providing such features as frost heave retention and various lengths, depending on the needs of an individual site.

Preparing the Site

Prepare the site for installation of a stake platform kit(s). Adapt the instructions as needed for local requirements, practices, or conditions.

To excavate the site

1. To install both the ODC-200 and EXM, attach the EXM alignment frame to the ODC-200 alignment frame.
2. Use the alignment frame to determine the rectangular area and location of the installation pit.

3. Excavate the pit. Dig a hole 3–10 inches deep and 1–2 inches larger than the alignment frame.

4. Grade and compact the installation pit surface until it is firm and level.
5. Trench out conduit paths to the installation pit from the cable feeder location.
6. Place the cable conduits into the conduit trench.
7. Route the earth ground wire through the conduit trench (from the ground electrode).

Installing the Stake Platform

Install the stake platform as described below. Adapt the instructions as needed for local requirements, practices, or conditions.

To install the stake platform

1. Determine the location and orientation of the service cabling and entrance into the ODC-200.
2. Use (4) 1/4-inch bolt carriages and nuts to attach the AC cable frame and OSP cable frame to the same side of the ODC-200 alignment frame. Two mounting location options are provided.

3. Match the alignment frame to the cabinet orientation, and place the frame into the installation pit with the short end flanges oriented down.

   Note: This step assumes that you attached the EXM alignment frame to the ODC-200 alignment frame (if needed) when determining the pit size as described in *Preparing the Site* (on page 66).

4. Place 2 x 4 wooden boards across the alignment frame in the pit:
   - For the cabinet frame, use two boards.
   - For the EXM frame, use one board (if applicable).
5. When installing both the ODC-200 and EXM, attach the EXM stake platform to the ODC-200 stake frame.
6. Orient and place the stake platform over the alignment frame in the pit.
7. With the tapered ends down, align and place the stakes vertically through the stake platform and alignment frame.

8. Drive the stakes into the ground approximately six inches, until they are 1/2-inch above the platform. Alternate between stakes as you hammer to ensure that they remain vertical and in position.

Note: Take care not to distort the tops of the stakes.

9. To secure each stake to the platform, do the following:

a. Verify that the stake will line up with the counterpart holes on the platform; adjust the stake with a mallet as needed.

b. Hand tighten a 3/8-inch bolt carriage and nut to attach the stake to the platform.

c. Drive the stake deeper into the ground until the top is flush with the platform.

d. Install a second 3/8-inch bolt carriage and nut to attach the stake to the platform.

e. Tighten the hardware to secure in place.

10. Remove the 2 x 4 wooden boards placed across the alignment frame in step 4.

11. While protecting the platform, drive the corners down until the bottom of the platform is flush with the ground. Use a level to ensure that the platform is level.

12. Backfill the pit with gravel.

Installing a Foundation Vault

A foundation vault constructed of composite materials provides a flexible cabinet mounting option. Because foundation vaults stand approximately three feet tall, you can either bury the vault below ground to provide a pad-like mounting fixture with underneath access for maintenance and splice case storage, or you can install the vault above ground to serve as a riser in areas subject to heavy snow, mud, or flooding.

Installing a foundation vault requires excavating the installation site, trenching cable conduit, creating a gravel foundation base, and placing the vault on the foundation base.

Foundation vaults ship configured with knockouts for conduit entry and mounting fixtures (threaded inserts) for anchoring the cabinet to the top of the vault. Specific features and dimensions vary by manufacturer and model. Contact your sales representative for Clearfield -certified supplier information to contact directly.

Preparing the Site

Prepare the site for installation of a foundation vault according to the manufacturer's instructions. Some vaults may require custom preparations.

A general practice is described below for reference. Adapt the instructions as needed for local requirements, practices, or conditions.

To prepare the site for foundation vault installation

1. Excavate the pad area. Dig a foundation hole to the required depth (six inches deep minimum); perimeter dimensions vary based on manufacturing requirements and selected ODC-200 configuration.
2. Grade and compact the excavated surface until it is firm and level.
3. Trench out conduit paths through the foundation hole from the cable feeder location.
4. Place the cable conduits into the conduit trench.
5. Route the earth ground wire through the conduit trench (from the ground electrode).
6. Place gravel into the foundation hole to create a level base. The gravel layer should be at least one inch deep, compacted and leveled.

Installing the Foundation Vault

Install the foundation vault according to the manufacturer's instructions (typically supplied with the vault).

A general installation practice is described below for reference. Adapt the instructions as needed for local requirements, practices, or conditions.

WARNING! The foundation vault may be very heavy. Do not place any part of your body under the vault during lifting. Handle with care to avoid personal injury or damage to the vault.

To install a foundation vault

1. Transport the foundation vault to installation site.
2. Using a suitable lifting device, lift the vault into position above the foundation hole.
3. Lower the pad onto the gravel base, making sure the conduits and earth ground wire pass inside the vault as it descends.
4. Adjust the vault positioning on the gravel base until it is stable and level.
5. Backfill and grade around the vault perimeter with soil to secure it in place.
6. Verify that the vault remains level. Adjust as required.

Chapter 4

Installing the Cabinet and Expansion Module

This chapter describes how to install the Clearfield ODC-200 cabinet onto its permanent mounting location.

Topics Covered

This chapter covers the following topics:

- Unpacking the cabinet or Expansion Module (EXM) from its shipping crate.
- Operating the cabinet or EXM doors.
- Preparing the cabinet for installation.
- Preparing the EXM for installation.
- Installing the cabinet or riser onto a concrete pad.
- Installing the EXM (and riser) on a concrete pad.
- Removing the cabinet lifting detail brackets.

Unpacking the Cabinet, Expansion Module or Risers

The cabinet, Expansion Module (EXM) and risers ship from the factory on wooden pallets, and are enclosed in cardboard crating for protection.The cabinet, EXM and risers are secured to a pallet by four bolts.

Do not remove the cabinet, EXM or risers from the pallet until after delivery to the installation site. However, you can remove the cardboard crating to inspect them at the staging area, if required. Clearfield recommends keeping the protective packaging in place for transportation.

When transporting the cabinet, EXM or risers to the installation site, strap them down securely to the truck or trailer to prevent shifting or tipping. Unpack the cabinet, EXM or risers at the installation site.

To unpack the cabinet, EXM or risers

1. After the cabinet, EXM or risers have been delivered to the installation site, remove the cardboard packaging from them.
2. Review the packing list to verify that all shipped materials are present.
3. Discard the packaging material.
4. Retrieve the telco hex key tied or taped to (one of) the cabinet or EXM door(s), and unlock the door(s).

   Note: See Operating Cabinet Doors for instructions.

Do not remove the bolts securing the cabinet, EXM or risers to the pallet until the enclosure is ready for placement.

Operating a Cabinet or Expansion Module Door

Cabinet Doors

The cabinet has hinged front and side doors, each equipped with two telco hex-pin latches and a padlock hasp for security. Open and close doors using a Clearfield -supplied telco hex key.

Each door is equipped with an alarm switch that monitors the position of the door. When a door on an in-service cabinet or EXM is opened, an intrusion alarm reports through the equipment. Pull the switch plunger to disable the alarm reporting while you are working on the cabinet or EXM. The alarm switch is located at the upper right corner of the door frame.

To open a cabinet or EXM door

1. Insert the telco hex key into the door's upper hex-pin latch.

2. Turn the key counter-clockwise to disengage the latch.
3. Repeat Steps 1 and 2 to disengage the lower latch.
4. Swing the door open until the wind brace engages.
5. On a powered cabinet, pull the alarm switch plunger to disable reporting of the intrusion alarm.

Note: Do not rotate the switch plunger. Rotating the plunger may damage the switch.

To close a cabinet or EXM door

1. Push up on the wind brace to disengage it.

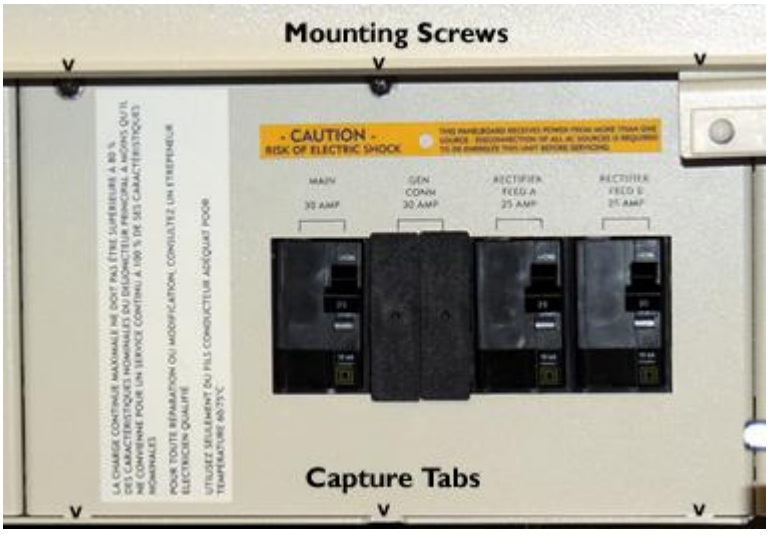
2. Swing the door closed.
3. Insert the telco hex key into the door's upper latch.
4. While holding the door firmly closed, turn the key clockwise to engage the latch.
5. Repeat Steps 3 and 4 to engage the lower latch.

Preparing the Cabinet for Installation

Complete the following preparations before installing the cabinet.

To prepare the cabinet for installation

1. Open the front and side cabinet doors.
2. From the side of the cabinet, remove the isolation mat and the bag containing the installation hardware. Set them aside for use during installation.
3. In the front of the cabinet, remove the right AC cover panel as follows:
   a. Remove the (3) mounting screws securing the cover panel to the fixture.
   b. Push up on the (2) lifting tabs, angle the panel away from the fixture, and lift the panel from the (3) capture tabs on the bottom of the fixture.



4. Remove the four bolts securing the cabinet to the pallet. The bolts are located at the bottom corners of the cabinet, and can be accessed by removing the left and rear access panels as needed.

When the tasks above are complete, the cabinet is ready for installation.

Preparing the EXM for Installation

Complete the following preparations before installing the Expansion Module (EXM).

To prepare the EXM for installation

1. Open the EXM door.
2. Remove the isolation mat and the bag containing the installation hardware from the EXM compartment. Set them aside for use during installation.
3. Remove the four bolts, flat washers, and lock washers securing the EXM to the pallet. The bolts are located at the bottom corners of the EXM, and can be accessed by removing the left and rear access panels as needed.

When the tasks above are complete, the EXM is ready for installation.

Installing the Cabinet or Riser on a Concrete Pad

Clearfield offers several models of optional cabinet risers. The riser ships detached from the cabinet, even when ordered as a factory option. Install the riser onto the concrete pad, and then mount the cabinet onto the riser.

The ODC-200 cabinet's compact design allows you to install it without the use of heavy lifting machinery. Clearfield recommends using two people to install the cabinet (to lift, move, and lower the cabinet onto the pad or riser).

If the required manpower is not available, or local practice requires the use of a lifting device, the cabinet is equipped with two lifting details on which to attach slings to lift and move the cabinet using a boom crane, derrick, or backhoe. Use wire rope slings and appropriately rated connecting links or lifting hooks. The lifting device and slings you use must be capable of lifting at least a 200 lb. working load. When using a lifting device to place the cabinet, follow these guidelines:

- Check the two lifting details on top of the cabinet to ensure that they are securely attached.
- Attach the lifting slings to the lifting device; attach the other sling ends to the cabinet lifting details with connecting links or hooks.
- Do not disconnect the slings from the cabinet until after it rests securely on the pad.

CAUTION! Installing the cabinet requires safe handling to ensure that no injury to personnel or damage to the cabinet occurs. Do not place any part of your body under the load during lifting. Follow local safety practices for lifting and moving heavy loads.

ALERT! Isolation mat usage is mandatory for concrete pad installations. Failure to use the supplied isolation mat can accelerate cabinet corrosion and may void the Clearfield cabinet warranty.

Before installing the cabinet, verify that the doors have been removed or are locked in the open position (wind brace engaged).

To install the cabinet or riser on a concrete pad

1. Sweep the pad free of dirt and debris.
2. Install the isolation mat onto the concrete pad.
3. Using two people, lift the cabinet or riser directly above its mounting position on the pad.

Note: Refer to the instructions above for lifting a cabinet onto the pad with a lifting device.

4. Slowly lower the cabinet or riser onto the pad, keeping the mounting holes in the cabinet base aligned with the anchor studs (or holes) in the pad.

   Note: If properly aligned, the entry ducts should slide down over the conduits as the cabinet or riser lowers. If necessary, trim the conduit down to a height that enables it to pass into the entry duct.

5. Trim the AC sealing boot so that the open diameter is slightly smaller than the conduit to provide a water-tight seal.
6. Pull the earth ground wire into the cabinet or riser through one of the cable entry ducts.
7. Anchor the cabinet or riser to the pad as follows:
   - Site-cast pads with anchor studs:
     a. Get the four hex nuts, four flat washers, and four lock washers from the installation kit.
     b. Install one flat washer, lock washer, and hex nut onto each of the four anchor studs.
     c. Tighten the hex nuts to secure the cabinet or riser to the pad.
   - Pre-cast pads with threaded inserts:
     a. Get four anchor bolts, four flat washers, and four lock washers from the installation kit.
     b. Install one flat washer, lock washer, and anchor bolt into each of the four threaded mounting inserts.
     c. Tighten the bolts to secure the cabinet or riser to the pad.
8. Verify that the doors open and close freely. If necessary, use shims to level the cabinet or riser.

   Note: If you removed the doors previously, re-install them to check door swing alignment. See *Installing a Cabinet Door* (on page 190) for instructions.

Clearfield recommends applying silicone caulking to the bottom perimeter of the cabinet or riser once the installation is complete.

Install the cabinet on the riser

1. Using two people, lift the cabinet onto the riser, keeping the (4) anchor holes in the cabinet base aligned with the counterpart holes in the riser.
2. Attach the cabinet base to the riser using (4) anchor bolts, (8) flat washers, (4) lock washers, and (4) nuts (one set per each of the four anchor holes).
3. Tighten all hardware to secure the cabinet to the riser.

Installing an EXM (and Riser) on a Concrete Pad

Note: Install the base ODC-200 cabinet before installing an Expansion Module (EXM).

Clearfield offers several models of optional risers for use with the EXM when installing an ODC-200 cabinet with a riser. The riser height must match the height of the riser installed for the ODC-200. The riser ships detached from the EXM, even when ordered as a factory option.

The EXM's compact design allows you to install it without the use of heavy lifting machinery. Clearfield recommends using two people to install the EXM (to lift, move, and lower the EXM onto the pad).

If the required manpower is not available, or local practice requires the use of a lifting device, the EXM is equipped with two lifting details on which to attach slings to lift and move the EXM using a boom crane, derrick, or backhoe. Use wire rope slings and appropriately rated connecting links or lifting hooks. The lifting device and slings you use must be capable of lifting at least a 200 lb. working load. When using a lifting device to place the EXM, follow these guidelines:

- Check the two lifting details on top of the EXM to ensure that they are securely attached.
- Attach the lifting slings to the lifting device; attach the other sling ends to the EXM lifting details with connecting links or hooks.
- Do not disconnect the slings from the EXM until after it rests securely on the pad.

CAUTION! Installing the EXM requires safe handling to ensure that no injury to personnel or damage to the EXM occurs. Do not place any part of your body under the load during lifting. Follow local safety practices for lifting and moving heavy loads.

ALERT! Isolation mat usage is mandatory for concrete pad installations. Failure to use the supplied isolation mat can accelerate cabinet corrosion and may void the Clearfield EXM warranty.

Before installing the EXM, identify your *cabinet configuration* (on page 31) (in-line or L-configuration).

To install the EXM on a concrete pad

1. Sweep the pad free of dirt and debris.
2. Prepare for mounting the EXM on the ODC-200 cabinet:
   a. Depending on your cabinet configuration (in-line or L-configuration), remove either the rear or side access panel from the ODC-200. From outside the ODC-200 compartment, use a 5/32 hex security driver to remove the eight tamper resistant screws anchoring each panel to the compartment wall.

b. Repeat step 2a to remove the side access panel on the EXM. Retain all access panel hardware.

c. Remove or lock the EXM door in the open position (wind brace engaged).

3. Mark the locations to drill holes for the user-supplied 1/2 x 13 concrete inserts on the pad as follows:

a. Using two people, lift the EXM directly above its mounting position on the pad, with the sealing gasket on the EXM rear or side wall oriented toward the ODC-200.

Note: Refer to the instructions above for lifting an EXM onto the pad.

b. Slowly lower the EXM onto the pad, and position it against the ODC-200 wall, aligning the mounting holes on the EXM side with the counterpart threaded nuts on the ODC-200.

Note: If properly aligned, the entry ducts should slide down over the conduits as the EXM lowers. If necessary, trim the conduit down to a height that enables it to pass into the entry duct.

c. From inside the EXM, locate the (4) mounting holes in the base of the module, and mark each one on the pad.

d. Remove the EXM from the pad.

4. Install each concrete insert into a marked location on the pad as follows:

a. Use a hammer drill to drill the appropriate diameter hold for a 1/2-13 inch hole concrete insert.

b. Clear all dirt and debris from the hole using a wire brush or vacuum.

c. Install an insert into the hole, making sure that it is level with the pad.

5. Install the isolation mat onto the concrete pad.

6. Using two people, lift the EXM directly above its mounting position on the pad, with the EXM sealing gasket oriented toward the ODC-200 rear or side wall, depending on your configuration.

7. Slowly lower the EXM onto the pad, and position it against the ODC-200 wall, aligning the mounting holes on the base of the EXM with the counterpart concrete inserts in the pad.

8. Pull the earth ground wire into the EXM through one of the cable entry ducts.

9. Attach the EXM to the pad as follows:

a. Get four bolts, four flat washers, and four lock washers from the installation kit.

b. Install one bolt, flat washer, and lock washer into each of the concrete inserts, but do not tighten.

Note: The hardware must be loose enough to allow the EXM to shift slightly when secured to the ODC-200.

10. Attach the EXM to the ODC-200 cabinet as follows:
    a. Get the six shoulder screws, six flat washers and six lock washers from the installation kit.
    b. From inside the EXM, install one screw, lock washer and flat washer in the mounting holes on the EXM wall, and into corresponding threaded nut on the ODC-200 compartment wall.
    c. Tighten the screws to secure the EXM to the ODC-200, ensuring that the EXM gasket is compressed around the entire perimeter of the gasket for a water tight seal.
11. Tighten the bolts in the base of the EXM completely to secure the module to the pad.
12. Route the EXM subground wire through the access panel and to the cabinet's main ground bar. Attach the ground wire lugs to the EXM subground position on the main ground bar. To install the EXM's connection to an earth ground circuit, refer to *Installing the Cabinet and EXM Ground Connections* (on page 94).
13. Verify that the door opens and closes freely. If necessary, use shims to level the EXM.

Note: If you removed the door previously, re-install it to check door swing alignment. See *Installing a Cabinet Door* (on page 190) for instructions.

Clearfield recommends applying silicone caulking to the bottom perimeter of the EXM once the installation is complete.

Install a riser (6- or 12-inch) with EXM on a concrete pad

1. Sweep the pad free of dirt and debris.
2. Attach the EXM to the riser as follows:
    a. Using appropriate lifting straps secured to the lift details, place the EXM onto the riser.
    b. Get four bolts, four flat washers, and four lock washers from the installation kit.
    c. Install one bolt, flat washer, and lock washer into each of the mounting holes in the base on the EXM cabinet.
    d. Tighten the bolts to secure the EXM to the riser.
3. Mark the locations to drill holes for the user-supplied 1/2-13 inch concrete inserts on the pad as follows:
    a. Place the riser and EXM on the pad, and position against the side or rear of the ODC-200 (depending on your configuration), aligning the mounting holes on the side of the EXM with the counterpart threaded nuts on the ODC-200. Allow an offset gap of .35" between the ODC-200 riser and the EXM riser.

Note: If properly aligned, the entry ducts should slide down over the conduits as the riser lowers. If necessary, trim the conduit down to a height that enables it to pass into the entry duct.

b. Apply silicone caulking to the bottom perimeter of the EXM riser, and then allow the silicone to dry.

c. Remove the EXM from the riser, taking care to keep the riser in place on the pad.

d. Locate the (4) mounting holes in the base of the riser, and mark each one on the pad.

e. Remove the silicone mounted riser from the pad by pulling up one side to break the silicone loose.

4. Install each concrete insert into a marked location on the pad as follows:

a. Use a hammer drill to drill the appropriate diameter hole for a 1/2-13 inch concrete insert.

b. Clear all dirt and debris from the hole using a wire brush or vacuum.

c. Install an insert into the hole, making sure that it is level with the pad.

5. Install the isolation mat onto the concrete pad.

6. Place the riser on the pad, and position it against the ODC-200, aligning the mounting holes on the base of the riser with the counterpart concrete inserts in the pad. Verify that you have an offset gap of .35" between the ODC-200 riser and the EXM riser.

7. (Optional) Pull the earth ground wire into the EXM riser through one of the cable entry ducts.

8. Attach the riser to the pad as follows:

a. Get four bolts, four flat washers, and four lock washers from the installation kit.

b. Install one bolt, flat washer, and lock washer into each of the concrete inserts.

c. Tighten the bolts to secure the riser to the pad.

9. Fill the riser's outside plant cable entry location with river stone rock up to the bottom of where the ODC-200 mounts.

10. Prepare for mounting the EXM on the ODC-200 cabinet:

a. Depending on your cabinet configuration (in-line or L-configuration), remove either the rear or side access panel from the ODC-200. From outside the ODC-200 compartment, use a 5/32 hex security driver to remove the eight tamper resistant screws anchoring each panel to the compartment wall.

b. Repeat step 2a to remove the access panel on the EXM. Retain all access panel hardware.

c. Remove or lock the EXM door in the open position (wind brace engaged).

11. Using appropriate lifting straps secured to the lift details, place the EXM onto the riser, aligning the mounting holes on the side of the EXM with the counterpart threaded nuts on the ODC-200.

12. Attach the EXM to the ODC-200 cabinet as follows:

a. Get the six shoulder screws, six flat washers and six lock washers from the installation kit.

b. From inside the EXM, install one screw, lock washer and flat washer in the mounting holes on the EXM wall, and into corresponding threaded nut on the ODC-200 compartment wall.

c. Tighten the screws to secure the EXM to the ODC-200.

13. Attach the EXM to the riser as follows:

a. Get four bolts, four flat washers, and four lock washers from the installation kit.

b. Install one bolt, flat washer, and lock washer into each of the mounting holes in the base on the EXM cabinet.

c. Tighten the bolts to secure the EXM to the riser.

14. Route the EXM subground wire through the access panel and to the cabinet's main ground bar. Attach the ground wire lugs to the EXM subground position on the main ground bar. To install the EXM's connection to an earth ground circuit, refer to *Installing the Cabinet and EXM Ground Connections* (on page 94).

Clearfield recommends applying silicone caulking to the bottom perimeter of the EXM riser once the installation is complete.

Installing the Enclosure(s) on a Wall or H-Frame

The ODC-200 cabinet and EXM are equipped with four lifting details on which to attach slings to lift and move the enclosure using a boom crane, derrick, or backhoe. Use wire rope slings and appropriately rated connecting links or lifting hooks. The lifting device and slings you use must be capable of lifting at least a 200 lb. working load.

Clearfield recommends using at least three people to install the cabinet and EXM: one to operate the crane or derrick, one to guide the enclosure(s) laterally as it lowers, and one to spot-check alignment of the mounting studs/holes and conduits/entry box as the enclosure lowers.

CAUTION! Installing the cabinet or EXM requires safe handling to ensure that no injury to personnel or damage to the cabinet occurs. Do not place any part of your body under the load during lifting. Follow local safety practices for lifting and moving heavy loads.

Before installing the cabinet and EXM, verify that the door(s) has been removed or locked in the open position (wind brace engaged).

To install the enclosure(s) on a wall mount or H-frame

1. Check the two lifting details on top of the ODC-200 to ensure that they are securely attached.
2. Attach the lifting slings to the lifting device; attach the other sling ends to the enclosure lifting details with connecting links or hooks.
3. Lift the ODC-200 at least 12 inches higher than—and position it directly above—the (2) mounting brackets intended for the cabinet.
4. Slowly lower the ODC-200 onto the mounting brackets, keeping the holes in the cabinet base aligned with the mounting holes in the mounting brackets.

   Note: If properly aligned, the entry duct in the cabinet should slide down over the conduits protruding up from the conduit assembly as the cabinet lowers. If necessary, reach down through the entry duct to grasp and align the conduit to guide it through the entry duct. Do not reach under the cabinet.
5. Pull the earth ground wire into the compartment through the cable entry box.
6. Before removing the lifting device, from inside the ODC-200, loosely install (2) 1/2"-13 x 1.25" hex screws through holes at each end of the cabinet base and the counterpart holes in the mounting brackets to prevent the cabinet from slipping off the brackets.
7. Remove the lifting device from the ODC-200.
8. To install the EXM, do the following:

   a. Repeat steps 1–3 above.

b. Slowly lower the EXM onto the mounting brackets, and position it against the ODC-200 wall, aligning the mounting holes on the base on the EXM with the mounting holes in the mounting brackets.

Note: If properly aligned, the entry duct in the EXM should slide down over the conduits protruding up from the conduit assembly as the EXM lowers. If necessary, reach down through the entry duct to grasp and align the conduit to guide it through the entry duct. Do not reach under the EXM.

c. Pull the earth ground wire into the compartment through the cable entry box.

d. Before removing the lifting device, from inside the EXM, loosely install (2) 1/2"-13 x 1.25" hex screws through holes at each end of the EXM base and the counterpart holes in the mounting brackets to prevent the enclosure from slipping off the brackets.

e. Remove the lifting device from the EXM.

9. Attach the EXM to the ODC-200 cabinet as follows:

a. Get the six shoulder screws, six flat washers and six lock washers (provided with the EXM installation kit).

b. From inside the EXM, install one screw, lock washer and flat washer in the mounting holes on the EXM wall, and into corresponding threaded nut on the ODC-200 compartment wall.

c. Tighten the screws to secure the EXM to the ODC-200, ensuring that the EXM gasket is compressed around the entire perimeter of the gasket for a water tight seal.

10. Remove the right-side lifting detail from the ODC-200 and EXM, as required:

a. Remove the (3) bolts securing the lifting detail to the enclosure.

b. Remove the lifting detail, and set aside hardware.

11. Install the stabilizer brackets. Refer to *Installing the Stabilizer Bracket(s)* (on page 64) for instructions.

12. Secure the ODC-200 to the mounting brackets as follows:

a. Remove the 1/2"-13 x 1.25" hex screws loosely installed in Step 6.

b. Slide the enclosure flush against the horizontal beams.

c. Get (4) 1/2"-13 x 1.25" hex screws, (8) 1/2" flat washers, (8) 1/2" split lock washers, and (4) 1/2"-13 hex nuts.

d. Install one hex screw, one flat washer and one split lock washer into each of the four mounting holes.

e. Tighten the screws to secure the enclosure to the mounting brackets.

13. To secure the EXM to the mounting brackets, remove the 1/2"-13 x 1.25" hex screws loosely installed in Step 8d, and then repeat steps 12b–12e.

14. If you removed the door(s) previously, re-install and check the door swing alignment.

15. Apply silicone caulking to seal the conduit feed throughs to the base of the enclosure(s).

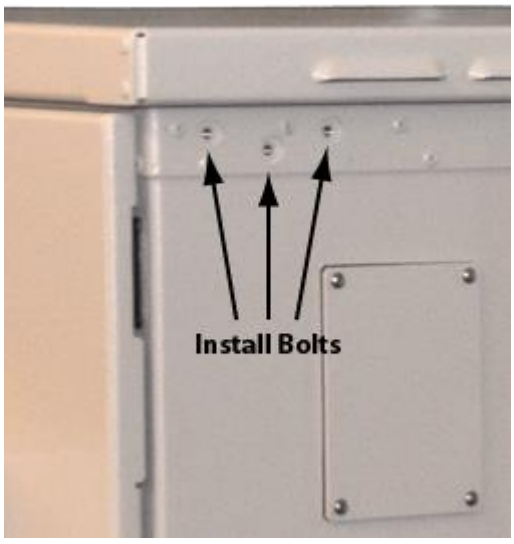
16. Once the silicone dries, use the supplied expansion foam to further seal the feed through tray inside the enclosure(s).

Removing the Lifting Details

After the cabinet or EXM is installed, remove the two lifting details from the enclosure.

To remove the lifting details

1. Locate the two lifting details:
   - **ODC-200**: Attached to the upper left corners of the left and right sides of the cabinet.
   - **EXM**: Attached to the upper left corner of the left side and the upper right corner of the rear compartment wall.
2. Remove the three bolts securing the first lifting detail to the enclosure.
3. Remove and discard the lifting detail.
4. Insert the three removed bolts back into the vacant bolt holes on the enclosure.



5. Repeat Steps 2–4 to remove the other lifting detail.

Chapter 5

Installing Power

This chapter describes how to install power to the cabinet. The cabinet supports two different power configurations: locally-supplied commercial AC power, or remote (line-supplied) ±190 VDC power.

- For cabinets configured for local power, this process includes installing the cabinet earth ground connection and installing and wiring local AC power.
- For cabinets configured for remote power, this process includes installing the cabinet earth ground connection, and installing and splicing outside plant metallic cables for power (twisted copper pairs) to the cabinet power line protection.

Install power according to your cabinet configuration type.

Topics Covered

This chapter covers the following topics:

- Installing the cabinet ground connection
- Installing local AC power
- Installing remote (line) power

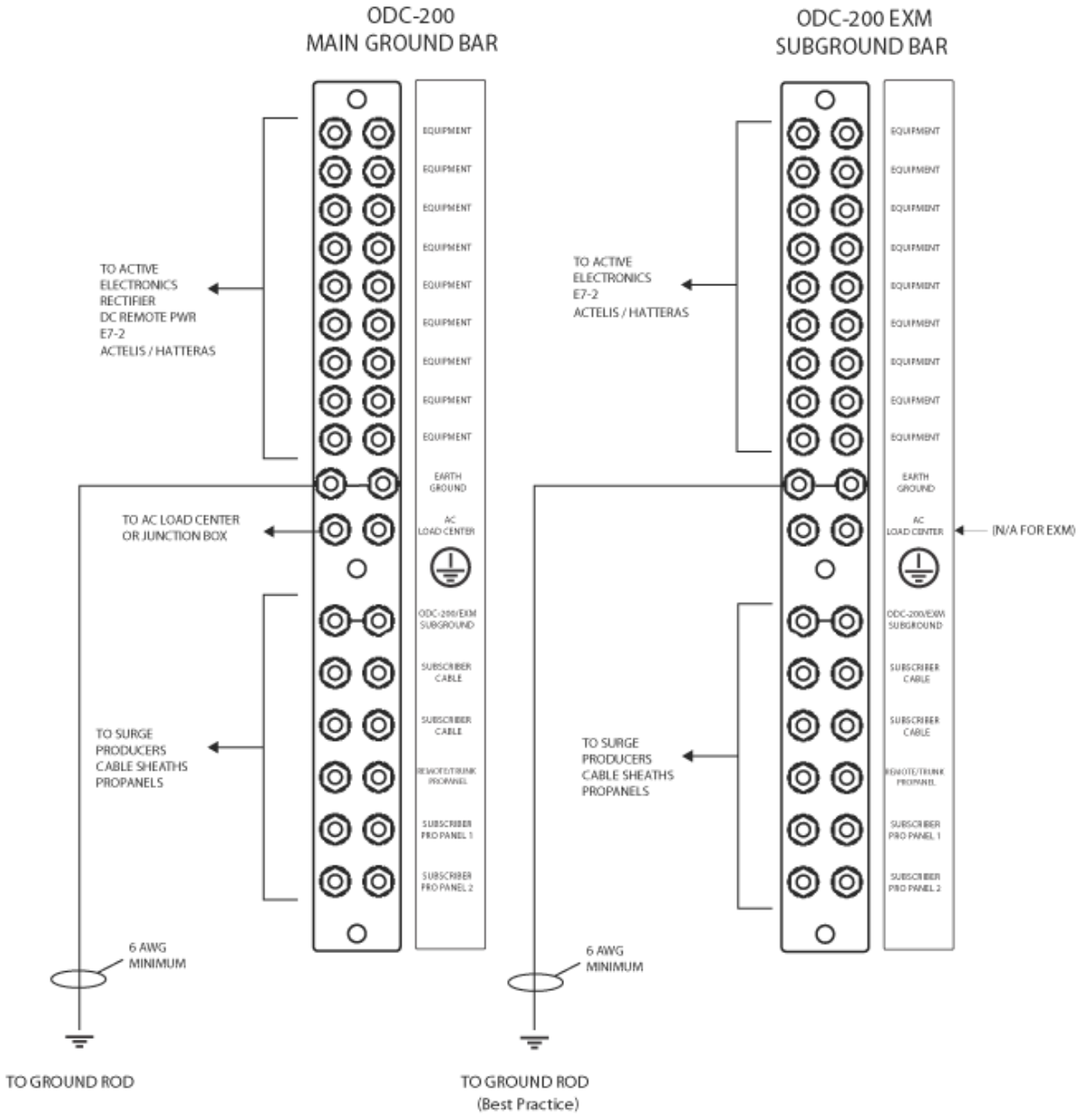
Installing the Cabinet and EXM Ground Connections

You must install the cabinet's connection to the earth ground circuit before you connect commercial power to the cabinet. You may also install the Expansion Module's (EXM) connection to an earth ground circuit, however this is optional.

Guidelines

Clearfield recommends adhering to PANI grounding methods to reduce ground current interaction:

- The PANI system divides the ground bar into sections, with one type of conductor in each section: **P**roducers, surge **A**bsorbers, **N**on-isolated and **I**solated (PANI).
- The middle position on the ground bar bisects separate ground connections for surge producers from surge absorbers/active electronics.
- The earth ground connection on the cabinet ground bar serves as the primary surge absorber to isolate the equipment grounds from the surge-producing grounds.
- The EXM subground bar serves as the primary surge absorber to isolate the equipment grounds from the surge-producing external grounds in the EXM, when installed. For the EXM earth ground connection, choose one of the following methods (but not both):
    - **Best practice**: Connect the "Earth Ground" lugs on the EXM subground bar to a ground rod.
    - **Alternate**: Connect from the "Earth Ground" lugs on the EXM subground bar to the "ODC-200/EXM Subground" lugs on the ODC-200 main ground bar.



To install the cabinet or EXM ground connection

1. Open the side cabinet or EXM door.
2. Route the earth ground wire to the main ground bar (or subground bar for the EXM) and cut the wire to length.

3. Using a ratcheting crimp tool with embossing dies, attach a two-hole compression lug (#2–6 AWG, 3/4-inch hole spacing) to the earth ground wire. Ensure that the correct lug is used to match the earth ground wire.
4. At the middle of the ground bar, locate a ground position with 3/4-inch stud spacing. Remove the nuts from the identified terminal studs.
5. Attach the earth ground wire's two-hole lug onto the 3/4-inch ground terminal studs (labeled *Earth Ground)* per PANI guidelines.
6. Re-connect the nuts to the ground terminal studs and tighten to 26 inch-lbs. of torque.

Installing Local Power

This section describes how to install local AC power (208–240 VAC standard) to the cabinet for an AC load center or AC junction box.

AC Load Center: Installing Power

Cabinets factory equipped with an AC load center support 208-240 VAC service.

DANGER! High voltage may be present. Do not apply AC power to the cabinet until the installation process is complete.

WARNING! Electrical hazard. Only a qualified electrician should perform this procedure.

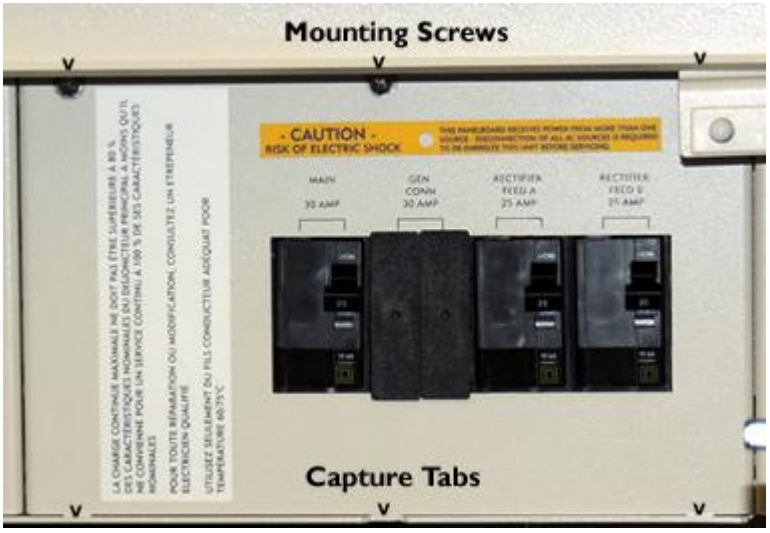
Before proceeding, verify that AC service to the cabinet site is OFF at the local power transfer switch.

To install AC power (208-240 VAC)

Note: Refer to the *AC Load Center wiring diagram* (on page 210) for guidance. An AC wiring label is attached behind the load center front panel for reference.

1. Open the cabinet's front door.
2. At the cabinet AC load center, switch all breakers to the **OFF** position.
3. Remove the right AC cover panel as follows:
   a. Remove the (3) mounting screws securing the cover panel to the fixture.

b. Push up on the (2) lifting tabs, angle the panel away from the fixture, and lift the panel from the (3) capture tabs on the bottom of the fixture.



4. From inside the AC load center, push the plug out from the AC input hole and install the supplied cord grip and locknut.
5. Pull the AC cable into the cabinet through the duct entry in the base of the cabinet.
6. Route the AC cable to the rear of the AC load center and feed it through the cord grip in the AC input hole.
7. Connect the AC wiring as follows:
   - Connect the green (ground) lead to the ground bus bar (strip and tin the wire as needed).
   - Connect the white (neutral) lead to the neutral bar.
   - Connect the black L1 lead to the left side of the Main breaker.
   - Connect the red L2 lead to the right side of the Main breaker.
8. Dress and secure the AC cable, providing adequate strain relief.
9. Replace the right cover panel on the AC load center.

AC Junction Box: Installing Power

Cabinets factory equipped with the AC junction box option support 120/240 VAC service in conjunction with use of 40 Amp rectifier modules.

Note: The AC junction box does not support 110/120 VAC input power.

DANGER! High voltage may be present. Do not apply AC power to the cabinet until the installation process is complete.

WARNING! Electrical hazard. Only a qualified electrician should perform this procedure.

Before proceeding, verify that AC service to the cabinet site is OFF at the local power transfer switch.

To install AC power (120/240 VAC)

Note: Refer to the *AC junction box wiring diagram* (on page 211) for guidance. An AC wiring label is attached behind the junction box front panel for reference.

1. Open the front cabinet door.
2. At the customer supplied circuit breaker box, switch all breakers off.
3. Remove the right AC cover panel as follows:
   a. Remove the (3) mounting screws securing the cover panel to the fixture.
   b. Push up on the (2) lifting tabs, angle the panel away from the fixture, and lift the panel from the (3) capture tabs on the bottom of the fixture.
4. From inside the AC junction box, push the plug out from the AC input hole and then install the supplied cord grip and locknut.
5. Install a user-supplied AC conduit between the outside entry duct in the cabinet floor and the junction box entry location. Install the conduit per local practice. Make sure the conduit is rated for AC cabling.
6. Pull the customer supplied AC wires into the cabinet through the duct entry in the base of the cabinet.
7. Route the AC wires to the rear of the AC junction box and feed it through the cord grip in the AC input hole.
8. Connect the AC wiring as follows:
   - Connect the ground (green) leads to the ground bus bar.
   - Connect the L1 (black) and L2 (white) leads to the terminal block positions: Rectifier Feed A, Rectifier Feed B, GFCI Outlet, and (optional) Battery Heater.
9. Tighten the cord grip around the AC wires at the rear of the junction box.
10. Re-install the right cover panel on the AC junction box.

Installing Remote Power

This section describes how to install remote (line) power to the cabinet, which includes the following tasks:

- Installing the outside plant metallic cable providing the remote power pairs.
- Qualifying pairs and testing line validity for remote power.
- Splicing the power pairs to the cabinet line protection system.

Note: For instructions on how to install a remote power capacitor (to enable a continuous power supply to equipment during brief interruptions), refer to *Installing a Power Buffer Capacitor* (on page 172).

Installing Outside Plant Metallic Cable (Power Pairs)

Install outside plant (OSP) metallic cable into the cabinet to provide twisted pairs for line (remote) power.

Whenever possible, Clearfield recommends using a dedicated cable exclusively for power, completely separate from the cable used for telephony signals. Separating the cable plant provides a safer handling environment.

If you cannot provide separate physical cables for power and telephony from the cross-connect location, then you must segregate one 25-pair binder group from the main OSP cable bundle to use for power. All power pairs must belong to the same 25-pair binder group and cannot include pairs for telephony signaling. Mark the binder group with red electrical tape or red cables ties to clearly identify the group as dedicated for power.

Note: The number of pairs in the 25-pair binder group to carry power will vary from site to site. For more information, refer to the *Clearfield Application Note: Guidelines for Line Powering the E3-48, E3-48C and E3-12C,* available on *seeclearfield.com*. The following procedure assumes that the OSP cable pairs you are installing have already been qualified for remote (line) power suitability per the requirements described in the planning tool.

The following steps are general guidelines only. Follow local practice wherever applicable.

DANGER! Risk of electrical shock. High voltage may be present. Only a qualified technician should perform this procedure.

WARNING! Due to loop capacitance, copper pairs may retain a charge on the line if power was previously applied. Before contacting the pairs, use a volt meter to verify that the lines are not charged.

Before continuing, verify that **no** power is applied to the OSP cable pairs.

To install outside plant cable (power pairs)

1. Open the cabinet's side door.
2. Trim the rubber cone gasket on the cable entry duct to the OSP cable diameter.
3. Route the OSP cable from the feeder location through the conduit and up into the cabinet. Pull approximately six feet of cable up into the cabinet through the entry duct.
4. Strip off the cable's outer sheath and internal metal shielding to a length suitable for splicing. Take care to expose, but not penetrate, the core wrap surrounding the bundled copper pairs.
5. Ground the OSP cable sheath to the cabinet ground bar per local practice.
6. Remove the core wrap from around the bundled copper pairs. Install a red cable tie or red electrical tape around the 25-pair group to identify as power pairs.
7. If splicing will be performed at a later time, arrange and secure the cable inside the compartment per local practice.

Checking Line Validity for Remote Power

Before splicing the incoming OSP cable (power pairs) to the cabinet protection interface, check that the lines retain validity for use with remote power. Some copper pairs, and splices in particular, may have deteriorated or have otherwise become unsuitable for remote power.

This task assumes that the whole span of copper plant has already been qualified for remote power suitability. This step just verifies that no plant degradation has occurred between qualification and installation, particularly on the final cable segment between the feeder location and the cabinet.

The following steps are general guidelines only. Follow local practice wherever applicable.

DANGER! Risk of electrical shock. High voltage may be present. Only a qualified technician should perform this procedure.

WARNING! Due to loop capacitance, copper pairs may retain a charge on the line if power was previously applied. Before contacting the pairs, use a volt meter to verify that the lines are not charged.

Before continuing, verify that **no** power is applied to the OSP cable pairs.

To check line validity for power pairs

1. Using a digital multi-meter, verify that the total loop resistance per pair is between 600 and 800 ohms.

2. Using a digital multi-meter, verify that the loop resistance per pair from wire to wire is within 5% of each other.
3. If resistance levels fall outside the required range, troubleshoot the wiring between the feeder location and the cabinet, including the splices at the cross-connect location. Verify the validity of all pairs before continuing with the installation process.

Splicing Power Pairs to the Protection Interface

Splice the incoming OSP power pairs to the cabinet's 25-pair protection interface cable(s).

The protection interface cable is factory terminated with an MS^2 connector, marked with red electrical tape, and stubs out to the power protection block. Install a counterpart MS^2 connector on the 25-pair group from the OSP cable to splice it to the protection interface cable.

DANGER! Risk of electrical shock. High voltage may be present. Only a qualified technician should perform this procedure. Take precautions and use insulated tools when working with power.

WARNING! Due to loop capacitance, copper pairs may retain a charge on the line if power was previously applied. Before contacting the pairs, use a volt meter to verify that the lines are not charged.

Before continuing, verify that **no** power is applied to the OSP cable pairs.

To splice the OSP cable (power pairs)

1. Open the cabinet's side door.
2. Terminate an MS^2 connector on the end of the OSP cable's 25-pair group.
3. Wrap red electrical tape around the OSP cable (below the MS^2 connector) to mark the cable as line powered.
4. Locate the cabinet's 25-pair power interface cable (identified by red tape wrapped below the MS^2 connector). Remove all ties securing the cable to the tie bars. Remove the protective covers from the connectors.
5. Mate the power interface and OSP MS^2 connectors together using mating clamps.
6. Install a protective cover over the mated MS^2 connectors.
7. Dress and secure the spliced cable to the tie bars with cable ties.

Chapter 6

Installing and Splicing Outside Plant Cables

This chapter describes how to install and splice outside plant cables into the cabinet or EXM, including fiber plant (fiber-optic cables for transport and/or subscriber drops) and metallic plant (copper twisted pairs for subscriber drops and/or transport).

Topics Covered

This chapter covers the following topics:

- Installing fiber cable
- Installing metallic cables
- Sealing cable entry locations

Bonding Cable Sheaths

The subscriber and optical cable sheaths must be bonded as follows:

- Bond the metallic sheaths of all subscriber and optical cables to a grounding rod or system at their first appearance at the cabinet/enclosure site (at the copper pedestal or splice case, and so forth). If this point is close enough to bond to the cabinet/enclosure grounding system, bond to the same point on the main site ground bar (SPGP or equivalent) that the cross-connect bonds to.
- Bond the metallic sheaths of all subscriber and optical cables to a grounding rod or system at regular intervals along the entire run external to the cabinet/enclosure site, per RUS guidelines.
- Clearfield recommends that you bond optical fiber cable sheaths at the first entrance to the cabinet/enclosure site only (the splice case, or similar), and then isolate the sheaths in the short run between splice point and the Clearfield equipment cabinet/enclosure ground. The short run can then be bonded on either side (the Clearfield ground bar side or splice point side, but not both) per local practice.
- Clearfield recommends that you bond the subscriber cable sheaths at the first entrance to the cabinet/enclosure site (the copper pedestal, and the ground bar of any cross-connect cabinet), and then isolate the sheaths in the short run between cross-connect cabinet and the Clearfield equipment cabinet/enclosure ground. The short run can then be bonded on either side (Clearfield ground bar side or cross-connect side, but not both) per local practice.

Installing Fiber Cable

This section describes how to install fiber optic cables into the cabinet or EXM, including how to route and groom the outside plant cable and splice fibers to the distribution systems.

Fiber management guidelines

When installing, splicing, and routing fibers in the cabinet or EXM, follow these guidelines:

- Avoid tight bend radii for fibers and provide adequate strain relief.
- Dress and secure fiber jumpers using velcro straps or other soft-tie method designed for fiber. Avoid using plastic cable ties, which can damage a fiber.
- Label jumpers to simplify identification at splice and distribution locations.

Installing Outside Plant Fiber Cable

Install outside plant (OSP) fiber cable into the cabinet and/or EXM and prepare it for splicing. The following steps are general guidelines only. Follow local practice wherever applicable.

To install outside plant fiber cable

1. Open the side cabinet or front EXM door.
2. Route the OSP fiber cable from the feeder location through the conduit and up into the compartment.
3. Pull the fiber cable up into the compartment through the entry duct. Pull enough cable length to extend to the splicing location.
4. Using ropes or cable ties, temporarily hang and secure the OSP cables inside the compartment.
5. If splicing shall be performed at a later time, make sure the cable arrangement allows the door to close. Take care to not violate the cable bend radius requirements.

The following steps are general guidelines only. Follow local practice where applicable.

To prepare outside plant cables for splicing

1. If necessary, untie or cut the bindings temporarily securing the OSP cable inside the cabinet or EXM.
2. Strip off the cable's outer sheath to expose the core tubing. Take care not to damage the fibers inside the core tubing.
3. Ground the OSP cable sheath to the cabinet's main ground bar or the EXM's subground bar as follows:

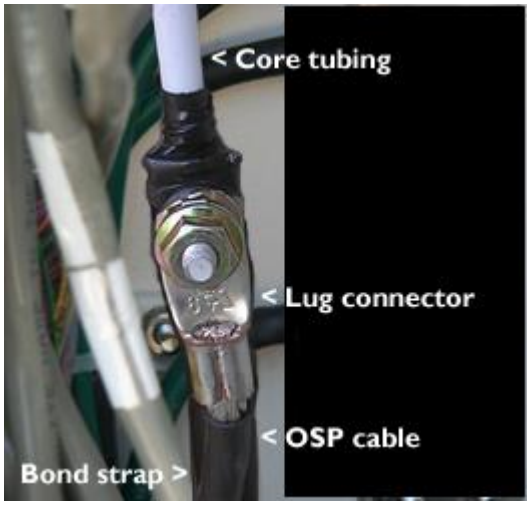
a. Twist the OSP cable's metal strength members together into a single strand.

b. Install a lug connector on the twisted end of the strength members.

Note: Clearfield recommends using a two-hole lug connector, unless local practice indicates otherwise.

c. Install a #6 AWG bond strap onto the lug connector together with the twisted strength members and tighten the lug connector.

d. Terminate the other end of the bond strap to the ground bar in an open position below the AC load center or junction box lug. Refer to *Installing the Cabinet Ground Connection* (on page 94) for more information.



4. Route fiber to the splice location:

   a. Insert the core tubing into the fiber routing duct and feed it through the duct into the cabinet or EXM.

   b. Route the core tubing to the splice location to determine the required length.

   c. Strip off the core tubing to an appropriate length. Take care not to sever or nick the bare fibers.

5. If splicing shall be performed at a later time, neatly coil the bare fibers inside the splice tray. Secure the core tubing in place with cable ties.

Splicing Fibers

Note: If the fiber splices will not reside inside the cabinet or EXM, skip this section. Splice fibers per local practice.

Common methods for splicing fibers to distribution systems or optical equipment include:

- **Pigtail splicing:** Splice OSP fibers to connectorized pigtails that plug into a distribution panel, where they mate with fiber jumpers that connect to the equipment. This method provides flexibility, where the distribution panel serves as a patch panel for equipment with different connector types.

- **Jumper splicing:** Splice OSP fibers directly to jumpers that connect to the optical equipment, bypassing any intermediate patch panels.

Both splicing methods typically use a fiber splice tray to hold the individual splices. Clearfield offers splice tray options with fusion, heat shrink, and mechanical splicing options. Each splice tray can hold up to 12 fiber splices.

DANGER! CLASS 1 LASER PRODUCT. INVISIBLE LASER RADIATION MAY BE PRESENT. Fiber optic radiation can cause severe eye damage or blindness. Do not look into the open end of an optical fiber.

CAUTION! Only a qualified technician should perform this procedure.

To splice fibers

1. Open the side cabinet or front EXM door.
2. If necessary, untie or cut any bindings temporarily securing the core fiber tubing near the splice tray.
3. Remove the fiber splice tray containing bare fibers from the tray holder.
4. Remove enough fiber from the tray to perform splicing. Thoroughly clean all bare fibers, as needed.
5. Splice the fibers to fiber pigtails or jumpers per local practice.
6. Neatly arrange the finished splices and slack fiber in the splice tray.
7. Insert the splice tray into the tray holder and secure the tray in place using a supplied Velcro strap.
8. Dress any slack fiber from the pigtails or jumpers around the dressing assembly. Secure the fibers in place with a Velcro strap.

Routing and Terminating Fibers

Route fibers from the splice location to the termination location. The termination equipment and location may vary by configuration:

- With the pigtail splicing method, you typically route pigtails from the splice tray to a distribution panel and plug the pigtail connectors into the panel. You can then use jumpers to connect to the optical equipment from the distribution panel.
- With the jumper splicing method, you typically route jumpers from the splice tray directly to the optical equipment. No intermediate patch panel is typically used.

Route and terminate fibers per your application requirements and local practice. Clearfield offers optional fiber distribution systems, including 12-, 24-, 48- or 96-position fiber splice or distribution panels. Adapters are available with SC or LC connector options.

DANGER! CLASS 1 LASER PRODUCT. INVISIBLE LASER RADIATION MAY BE PRESENT. Fiber optic radiation can cause severe eye damage or blindness. Do not look into the open end of an optical fiber.

To route and terminate fibers to equipment

1. At the splice tray, locate the fiber pigtails or jumpers to route and terminate.
2. Route the fibers to the termination point and temporarily drape on the equipment.
3. Terminate the fibers using one of the following methods:
   - **Direct connection:** Connect jumpers to the optical equipment.
   - **Fiber distribution bulkhead:** Connect pigtails to the adapter plugs on the back side of the bulkhead.
   - **Fiber termination cassette:**
     a. Open the cassette and connect pigtails to the adapter plugs inside the cassette.
     b. Coil the slack fiber inside, and then close the cassette.
     c. Slide the cassette into any available position in the cassette holder (hook side down), and fold the cassette holder back flush against the bracket.
4. If necessary, neatly coil any excess slack fiber into an arrangement that won't interfere with or become snagged on the equipment.
5. Dress and secure fibers in place with Velcro straps.

Connecting Fibers to the Equipment

Before you can connect fibers to the equipment, you must first install one or more pluggable transceiver modules into the optical Ethernet port sockets. If the laser at the far end is enabled, you can use an optical power meter to test the signal strength on the fibers before connecting to the equipment. Defer to local practice wherever applicable.

Note: To interlink two or more collocated service units, see (Optional) Interlinking Collocated Service Units.

DANGER! CLASS 1 LASER PRODUCT. INVISIBLE LASER RADIATION MAY BE PRESENT. Optical radiation can cause severe eye damage or blindness. Never assume laser power is off. Do not look into the open end of an optical fiber, vacant SFP socket, or an installed transceiver.

To connect fibers to an E7-2 unit

1. Install the E7-2 line card(s) into the chassis.
2. Install pluggable transceiver modules into the appropriate port sockets on the E7 as follows:
   - To equip 10GE ports:

- Install XFP modules into sockets labeled **XFP 1** or **XFP 2**, as required.
- Install SFP+ modules into sockets labeled **SFP+ 1** or **SFP+ 2**, as required.

- To equip GE ports, insert SFP modules into sockets labeled **SFP 1** to **SFP 12**, as required.
- To equip GPON ports, insert GPON OIM modules into sockets labeled **GPON 1** to **GPON 4**, as required.

a. Orient the module with the exposed PCB side facing down.

b. Press the module firmly into the socket until it clicks into place.

3. Connect fibers to the transceiver modules on the E7 unit as required.
4. Neatly dress and secure all fibers/cables per local practice.

Important: Route fibers to the left side of the E7 unit to ensure visibility of status LEDs located on the right side of the shelf.

To connect fibers to a B6-001 unit

1. Install a B6 line card into the chassis.
2. Remove the dust covers from the pluggable transceiver modules.
3. Install pluggable transceiver modules into the appropriate port sockets on the B6 as follows:

- To equip 10GE ports:
  - Install XFP modules into sockets labeled **XFP 3**, **XFP 4**, **XG3**, or **XG4**, as required.
  - Install SFP+ modules into sockets labeled **SFP+ 1**, **SFP+ 2**, or **SFP+1** to **SFP+ 4**, as required.

Note: For the B6-256 and B6-318 cards, SFP+ modules support GE or 10GE operation.

- To equip GE ports:
  - Insert SFP modules into sockets labeled numerically, as required. B6 line cards use the following numerical labeling: **7** to **10**, **7** to **22**, or **1** to **22**.
  - Insert CSFP modules into sockets labeled **1** to **48**.
- To equip GPON ports, insert GPON OIM modules into sockets labeled **GPON 1** to **GPON 4**, as required.

a. Orient the module with the exposed PCB side aligning properly to the connector position inside the module cage on the PCB. This orientation could be either with the PCB facing down or up so care should be taken to check the position first.

b. Press the module firmly into the socket until it clicks into place.

c. Discard the transceiver module dust covers.

4. Connect fibers to the transceiver modules on the B6-001 unit as required.
5. Neatly dress and secure all fibers/cables per local practice.

Important: Route the fibers to prevent an excessive bend radius and to avoid blocking removable devices, such as fan trays and other service units.

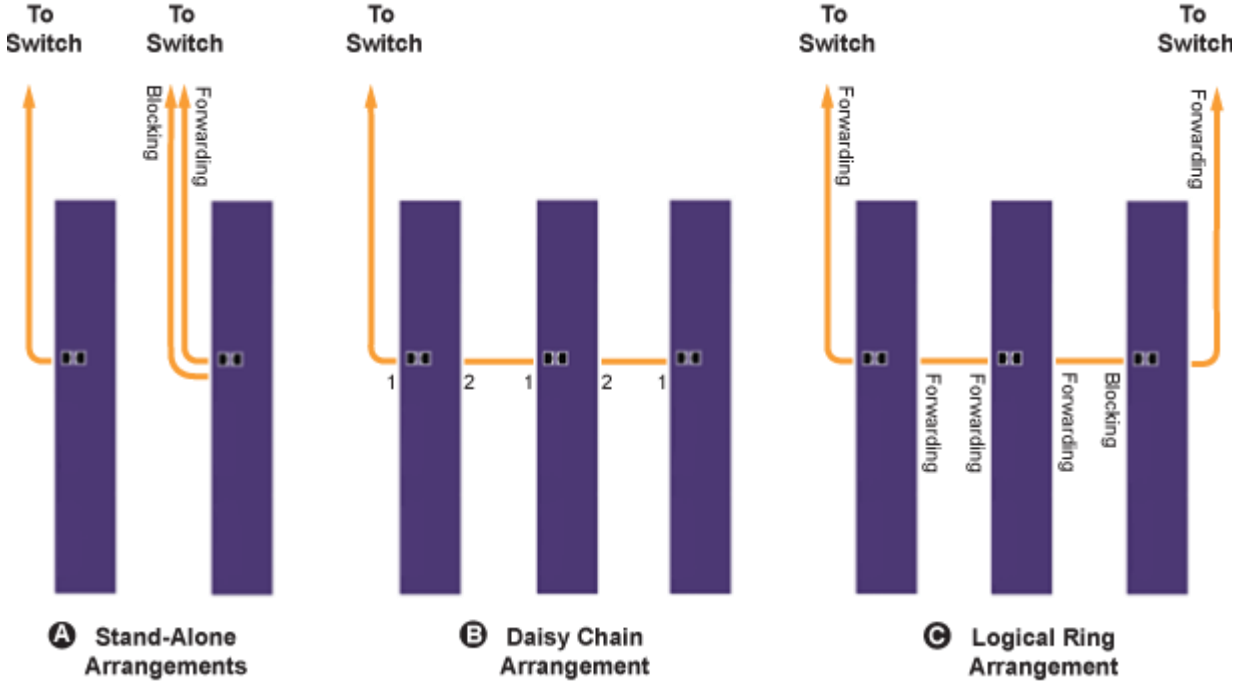
(Optional) Interlinking Collocated Service Units

Clearfield service units support several topology options, based on how you configure the Ethernet links:

a. **Stand-alone:** A stand-alone arrangement provides a dedicated, point-to-point Ethernet link between the service unit and the aggregation switch. RSTP support for link protection is optional. Link bandwidth for each service unit is dedicated, not shared.

b. **Daisy chain:** A daisy chain arrangement interlinks two or more collocated service units together in a linear chain, where Ethernet port 1 points upstream (toward the network), and Ethernet port 2 points downstream (away from the network). Daisy chain arrangements do not support RSTP protection and require traffic aggregation across units in series (link bandwidth toward the switch is shared).

c. **Logical ring:** A logical ring arrangement interlinks two or more collocated service units together, with the end units both linking to the aggregation switch. Logical ring arrangements require RSTP for link protection, so that if any link failure occurs, units downstream of that link can use the reverse path to the switch. Logical rings require traffic aggregation across units in series (link bandwidth to the switch is shared).



To support logical ring or daisy-chain arrangements, interconnect service units together as described below.

Note: You can use either fiber or CAT5E jumpers to interconnect service units. You typically use CAT5E jumpers for collocated units instead of fiber due to the cost savings of not supplying additional SFP modules.

To interlink Clearfield service units

1. On the first, upstream-most service unit, verify that a fiber link (back to an aggregation switch) is connected to its Ethernet uplink port.
2. Install a jumper cable between the upstream unit and a downstream unit.
   a. On the upstream unit, connect the jumper to a second Ethernet port.
   b. On the downstream unit, connect the jumper to the first Ethernet port.

   Note: On powered units, the link LEDs should illuminate when the jumper is installed.
3. Repeat Steps 1 and 2 to interlink additional units, as required.
4. Logical ring configurations only: On the last downstream unit in the string, install a fiber link (back to an aggregation switch) to a second Ethernet uplink port. See *Connecting Fibers to the Equipment* (on page 108) for instructions.

Installing Metallic Cables

This section describes how to install metallic signal cables into the cabinet, including how to route and groom the outside plant cables and splice to the equipment cables.

Removing the Battery Enclosure

For additional space in the cabinet or EXM compartment when installing or splicing outside plant metallic cables, remove the battery enclosure as described below.

To remove the battery enclosure

1. Open the side cabinet or front EXM door.
2. Open the latch on each side of the terminal cover and remove the cover.
3. Remove the seismic retaining bracket from the battery enclosure as follows:
   a. Remove the temperature probe cable from the right upper hole in the retaining bracket.
   b. Remove the (2) hex head screws and washers from each side of the retaining bracket.
   c. Rotate the retaining bracket forward, and lift the bracket from the groove at the base of the battery enclosure.
4. Remove the (8) mounting screws from each side of the enclosure, and lift the enclosure from the base of the cabinet or EXM.

Installing Outside Plant Metallic Cables

Install outside plant (OSP) metallic cables into the cabinet (or EXM) and prepare the cables for splicing. The following steps are general guidelines only. Follow local practice where applicable.

Note: For additional space in the cabinet or EXM when installing OSP metallic cables, remove the *Battery Enclosure* (on page 113) (if present).

To install outside plant metallic cables

1. Open the side cabinet or front EXM door.
2. To keep the cabinet or EXM compartment clear of environmental gel, drape plastic sheeting over the door, protection panels, and the bottom of the splice area.

3. Route the OSP metallic cables from the feeder location through the conduit and up into the compartment.

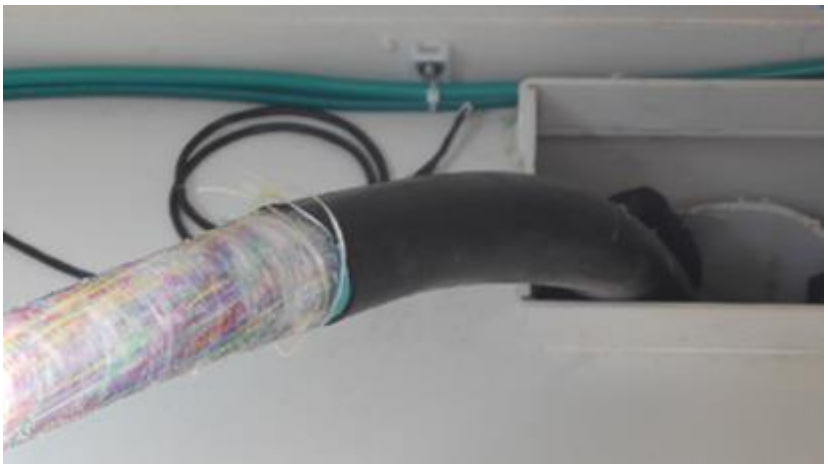
4. Pull approximately six feet of each cable up into the compartment through the entry duct.
5. Using ropes or cable ties, temporarily hang and secure the OSP cables inside the compartment.
6. If splicing shall be performed at a later time, do the following:
   - Remove the plastic sheeting.
   - Make sure the cable arrangement allows the door to close. Take care to not violate the cable bend radius requirements.

The following steps are general guidelines only. Follow local practice where applicable.

To prepare outside plant cables for splicing

1. To keep the cabinet or EXM compartment clear of environmental gel, drape plastic sheeting over the door, protection panels, and the bottom of the splice area, if you have not already done so.
2. If necessary, untie or cut the bindings temporarily securing the OSP cables inside the compartment.

3. Strip off the cable's outer sheath and internal metal shielding down to 12 inches above where the cable enters the compartment. Take care to expose, but not penetrate, the core wrap surrounding the bundled copper pairs.



4. Ground the OSP cable sheath to the cabinet's main ground bar or EXM's subground bar as follows:
   a. Install a B-bond clamp onto the cut end of the OSP cable's outer sheath. Wrap the connection with electrical tape.
   b. Attach a #6 AWG bond strap to the B-bond clamp.
   c. Terminate the other end of the bond strap to the main ground bar in an open position below the AC load center or junction box lug. Refer to *Installing the Cabinet Ground Connection* (on page 94) for more information.
5. Secure the OSP cable to the rack or tie bars with cable ties.
6. Remove the core wrap from around the bundled copper pairs, and then install binder group identification labels on each 25-pair group.
7. Repeat Steps 1–5 for each OSP metallic cable.
8. Remove the plastic sheeting from the cabinet.
9. If splicing shall be performed at a later time, make sure cable arrangement allows the door to close. Take care to not violate the cable bend radius requirements.

Splicing Metallic Cables

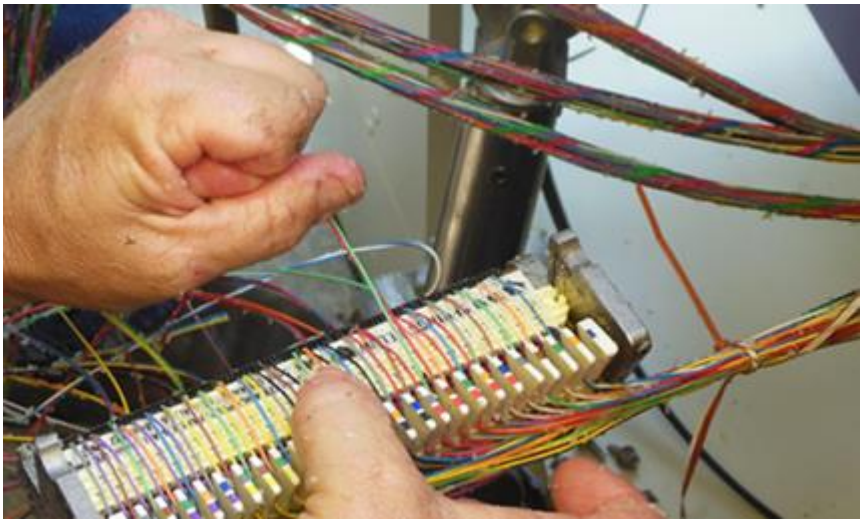
Mate the outside plant (OSP) cables to the equipment interface cables using MS^2 or 710 connectors. Interface cables on the OSP side ('Subscriber' side) of the protection blocks are factory terminated with MS^2 or 710 connectors. You must install counterpart MS^2 or 710 connectors on each 25-pair group of OSP cables before mating.

Note: For additional space in the cabinet or EXM compartment when splicing OSP metallic cables, remove the *Battery Enclosure* (on page 113) (if present).

To splice the metallic cables

Note: Clearfield equipment uses a 'dead pair' scheme, where the 25th pair in each 25-pair cable group is unterminated and not used (dead). Refer to the pair assignment list shipped with the cabinet.

1. Open the side cabinet or front EXM door.
2. Turn the (2) knobs on the left side of the protection mounting frame counter-clockwise, and swing the frame forward.
3. Segregate the bundled pairs from the OSP cable into 25-pair groups.
4. Terminate MS^2 or 710 connectors onto the ends of each 25-pair group per local practice.



5. Remove all cable ties securing the cabinet interface cables to tie bars and remove the protective covers from the connectors.
6. For each 25-pair group, mate the OSP and equipment interface cable connectors together using the appropriate mating clamps.
7. Repeat Steps 3 through 6 for each remaining OSP cable.
8. Dress and secure the spliced cables to the tie bars with cable ties.
9. While holding the swing frame closed against the rack, turn the (2) knobs clockwise to engage the latch, securing it in the closed position.

Reinstall the Battery Enclosure

If you removed the battery enclosure to provide additional space in the cabinet or EXM when installing or splicing outside plant metallic cables, reinstall the battery enclosure as described below.

To reinstall the battery enclosure

1. Place the battery enclosure in base of the ODC-200 or EXM, aligning the mounting bracket holes against the counterpart holes on the equipment rack.
2. Install the eight mounting screws (4 per side) to secure the enclosure to the rack. Tighten the screws to 45 in. lbs. of torque.
3. Ensure that the front bottom edge of the enclosure is up against the inside lip of the door jam. If not, loosen the screws that mount the rails to the top and bottom of the ODC-200 or EXM, pull the battery enclosure forward, and then re-tighten the screws.
4. Replace the retaining bracket and terminal cover.
5. Close the door and check to be sure that the battery housing properly seals against the door gasket. For the ODC-200, this can be viewed through the front equipment compartment; for the EXM, this can be viewed through the rear access panel using a flashlight.

Installing 5-Pin Protection Modules

To complete the circuit connections between the metallic outside plant cables and equipment, you must install 5-pin protection modules into the 50-pair protection blocks. The 5-pin protection modules serve as fuses to protect the equipment from electrical surges on the lines.

The 50-pair protection blocks support Calix E7-2 copper access units as follows:

- One 50-pair block supports each VDSL2 combo card, protecting the 48 user lines.
- Two 50-pair blocks support each two-slot VDSL2 overlay card. One block protects the 48 POTS only (PSTN) lines; the other block protects the 48 DSL/POTS (user) lines.

The 50-pair protection blocks support B6-001 service units as follows:

- One 50-pair block supports each xDSL-only or VDSL2 combo card, protecting the 48 user lines.
- Two 50-pair blocks support one xDSL overlay card. One block protects the 48 POTS only (PSTN) lines; the other block protects the 48 DSL/POTS (user) lines.

Each 5-pin position on the block protects one wire pair (one 2-wire circuit). Install a 5-pin protection module into each block position (circuit) that will be equipped for service. Typically, black modules are used for DS0/DSL circuits. Refer to the cabinet pair assignment list for more information.

Note: Clearfield equipment uses a 'dead pair' scheme, where the 25th pair in each 25-pair cable group is unterminated (dead). Therefore, on each protection block, positions 25 and 50 are not wired. Line identification labels cover the dead pair positions.

Sealing Cable Entry Location

Seal the outside plant cable entry location(s) to protect the cabinet and Expansion Module (EXM) against moisture, dust, pests, and other contaminants. Cable entry locations with or without outside plant cable must be sealed. Use a silicon-based sealant or comparable compound.

Note: Seal the cable entry location immediately after outside cables are installed to prevent ground moisture from condensing inside the cabinet and damaging equipment.

ALERT! The sealant package does not require tools to open or mix the compound. Do not insert tools into the plastic nozzle or pierce the sealant package.

To seal the cable entry location

1. Remove the cabinet or EXM rear access panel to access the cable entry location, if needed. From outside the compartment, use a 5/32 hex security driver to remove the eight tamper resistant screws anchoring each panel to the compartment wall.
2. Locate the package of sealant compound in the installation kit.
3. Mix the sealant compound inside its package per the manufacturer instructions printed on the package.
4. Apply the sealant around open area in the entry duct where the outside plant cables/conduit enter the cabinet. Seal all gaps around the cables, inside and outside of the conduit. Follow the manufacturer's instructions to apply the sealant.

CAUTION! Check to ensure that all gaps are completely sealed. Gaps allow penetration of moisture, insects, rodents, and other contaminants that could damage equipment.

Chapter 7

Turning Up the Cabinet Power System

This chapter describes how to turn up and test the cabinet power system.

For cabinets configured for local power, this process includes checking the cabinet ground connection, checking the AC power supply voltage, installing rectifier modules into the rectifier shelf, installing batteries for reserve power, and turning up and testing the DC power system.

For cabinets configured for remote power, this process includes checking the cabinet ground connection, checking the line power supply voltage, installing converter modules into the converter shelf, and turning up and testing the DC power system.

Topics Covered

This chapter covers the following topics:

- Turning up the cabinet power system (local power)
- Turning up the cabinet power system (remote power)

Turning Up the Power System (Local Power)

This section describes how to turn up and test the power system for locally-powered cabinets. The process includes checking the cabinet ground connection, checking the AC power supply voltage, installing rectifier modules into the rectifier shelf, installing batteries for reserve power, and turning up and testing the DC power system.

Topics Covered

This chapter covers the following topics:

- Checking the cabinet ground connection
- Checking the AC power supply voltage
- Installing rectifier modules into the rectifier shelf
- Installing batteries for reserve power
- Turning up and testing the DC power system

Checking the Ground Connection

Check the impedance of the cabinet ground connection before turning up the cabinet power system.

Note: The following procedure does not test the quality of the earth ground circuit (earth electrode), which should have been installed and tested before the cabinet was installed.

To check the cabinet ground connection

1. Using an ohm meter, test between the main ground bar and the earth ground wire:
   a. Place one lead on the main cabinet ground bar.
   b. Place the other lead on the earth ground wire.
2. Verify that the ohm meter reads 5 ohms or less.
3. If the reading is greater than 5 ohms, check the ground wire connection at the main ground bar, then retest.

Checking the AC Power Supply Voltage

The cabinet ships from the factory equipped to support 208-240 VAC service. Check the AC power supply voltage as follows.

DANGER! High voltage may be present. Only a qualified electrician should perform these procedures.

To check 208-240 VAC power supply voltage

1. Apply AC power to the cabinet at the local power transfer switch.
2. At the cabinet AC load center, do the following:
   a. Remove the front panel from the AC load center.
   b. Switch the 30A Main breaker to **ON**.
3. Using a volt meter, test between the L1 and neutral busses:
   a. Place one lead on the L1 buss.
   b. Place the other lead on the neutral buss.
   c. Verify that the volt meter reads between 110 and 120 VAC.
4. Using a volt meter, test between the L2 and neutral busses:
   a. Place one lead on the L2 buss.
   b. Place the other lead on the neutral buss.
   c. Verify that the volt meter reads between 110 and 120 VAC
5. Using a volt meter, test between the L1 and L2 busses.
   a. Place one lead on the L1 buss.
   b. Place the other lead on the L2 buss.
   c. Verify that the volt meter reads between 208 and 240 VAC.
6. Switch the branch breakers on as follows:
   - Switch the 10A Conv Outlet breaker to **ON**.
   - If you are using an optional battery heater, switch the 5A Battery Heater breaker to **ON**.

   Note: Do not switch on the 20A Rectifier breakers at this time.
7. Re-attach the front panel on the AC load center.
8. Verify that the LEDs on the surge arrestor are lit and green.

Installing the Rectifier Modules

The ODC-200 cabinet uses the Alpha Cordex HP 1.2kW 1RU rectifier shelf to generate and distribute -48 VDC bulk power. The 1RU Alpha shelf consists of a 19-inch rectifier shelf with integrated GMT fuse distribution.

The Alpha shelf supports three rectifier modules. Normal operation for the ODC-200 cabinet requires three 1200W (25A) rectifier modules, which includes 1+1 rectifier redundancy. The Alpha shelf provides integrated distribution, with 8 GMT fuse positions for equipment. The Alpha shelf is equipped with a Cordex CXCM1+ controller module that monitors power functions and alarm information and regulates voltage in response to battery temperature. The controller module ships pre-programmed for operation in the ODC-200 Power Hub. For a complete description of the controller module, refer to the *Cordex Controller Software Manual*. Install Alpha modules into the power shelf as described below.

Note: The controller module ships installed in the rectifier shelf. Push firmly on the controller module to verify that it is fully seated in the slot

To install a rectifier module

1. Unpack the rectifier module.
2. Insert the module in a vacant slot, sliding the module into the rear connector (inside of the shelf). Populate slots top to bottom (shelf oriented vertically).
3. Apply pressure on the front of the module to engage the rear connector in the shelf receptacle. The module has a locking latch to secure the rectifier into the shelf.

Note: Do not force a module into position if it does not seat properly. All modules are keyed to ensure that the correct module type is used.

4. Repeat steps 1–3 to install additional rectifier modules.

Installing VRLA Batteries

The ODC-200 cabinet can house a primary single string of front-terminal 100Ah VRLA (four batteries per string). A cabinet equipped with an optional Expansion Module (EXM) can support a secondary or alternative location for the battery string. See *Supported Batteries* (on page 208) for a list of supported battery types.

This topic provides instructions for the following tasks:

- Preparing batteries for installation
- Installing a 100Ah VRLA battery string

Note: This procedure assumes that the internal battery enclosure is installed. For instructions on installing a battery enclosure, refer to *Installing a Battery Enclosure* (on page 167).

WARNING! Electrical hazard. Batteries contain a stored charge. Only a qualified technician should perform this procedure.

CAUTION! Electrical, chemical, fire, and heat hazard. Handle batteries with care to avoid personal injury or damage to the equipment.

ALERT! Read the battery manufacturer's instructions before installing batteries. Follow the manufacturer guidelines and local safety practices.

To prepare batteries for installation

1. Unpack the batteries from the shipping packaging.
2. Remove the terminal caps from the top of each battery.
3. Clean and apply No-Ox anti-corrosion grease to each battery terminal.
4. Locate the bagged kit containing the string jumper straps and other materials. Set the kit aside for use during installation.

Note: If you are using the optional battery heater, install the heater before installing batteries. See *Installing a Battery Heater* (on page 168) for instructions.

WARNING! In -48V telecom systems, red leads connect to the negative terminal and black leads connect to the positive terminal. Do not reverse the wiring polarities.

CAUTION! Both sides of the Anderson connectors are hot.

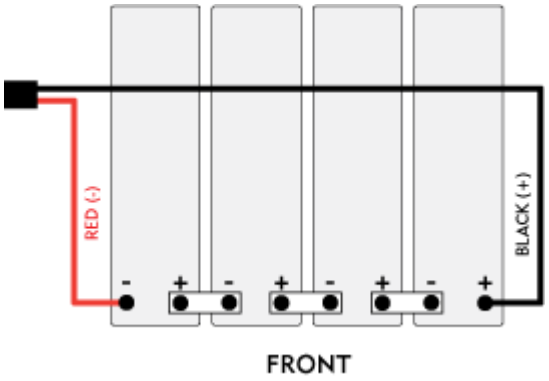
To install 100Ah VRLA batteries

1. Open the side ODC-200 cabinet or EXM front door.
2. Remove the vent cover from the side door, if present:
   a. Remove the (4) pan head Phillips screws from the vent cover, and set aside.
   b. Remove the vent cover.
   c. Reinstall the (4) screws.

   Note: The screws secure both the vent cover and solar shield in place, and must be reinstalled for the solar shield.
3. At the front of the seismic retaining bracket, disconnect the #8 AWG battery power cables from the power supply leads (if connected).

4. Open the latch on each side of the terminal cover and remove the cover.
5. Remove the seismic retaining bracket from the internal battery enclosure as follows:
   a. Remove the (2) hex head screws and washers from each side of the retaining bracket.
   b. Rotate the retaining bracket forward, and lift the bracket from the groove at the base of the battery enclosure.
   c. Place the retaining bracket within close proximity of the enclosure (the battery power cables are connected to the front of the bracket).
6. Place a string of four batteries into the battery enclosure, with the terminals in front.
7. Install the jumper straps between the battery terminal posts per the manufacturer instructions.

8. Connect the battery power supply leads as follows:
   a. Remove the protective caps from the cable ring lugs.
   b. Attach the black cable that is routed through the right upper hole in the retaining bracket to the positive (+) terminal post at the right end of the string.
   c. Attach the red cable that is routed through the left upper hole in the retaining bracket to the negative (-) terminal post at the left end of the string.



ALERT! Use a volt meter to verify correct wiring polarities.

   d. Mount the temperature probe cable lug onto the string's negative (-) terminal post at the left end of the string.
   e. Tighten the hardware on the terminal posts to the torque specified by the manufacturer.
   f. If available, install protective covers (manufacturer-supplied) over the battery terminals.

9. Replace the retaining bracket and terminal cover.
10. Connect the Anderson power connectors together.

To connect a temperature probe cable to the cabinet power system (for VRLA batteries only)

WARNING! Risk of electric shock. Only a qualified electrician should perform this task.

Note: Two temperature probe cables are pre-wired to the rectifier, labeled **1** and **2**.

1. Mate the temperature probe cable from the primary battery string with the rectifier cable labeled **1**.
2. For a secondary battery string, route the rectifier cable labeled **2** to the battery enclosure, and then mate the temperature probe cable with the rectifier cable.
3. Connect the terminal ring sensor end to the red (-) battery terminal.

Installing Saft TelX100 Ni-Cd Batteries

The ODC-200 cabinet can house a primary single string of front-terminal Saft TelX100 Nickel-Cadmium (Ni-Cd) batteries. The battery string consists of four batteries with eight cells, and one battery with six cells. A cabinet equipped with an optional Expansion Module (EXM) can support a secondary or alternative location for the battery string. See *Supported Batteries* (on page 208) for a list of supported battery types.

This topic provides instructions for the following tasks:

- Preparing batteries for installation
- Installing a Saft TelX100 Ni-Cd battery string

Refer to the *Saft Ni-Cd Battery Installation and Operating Instructions* on *seeclearfield.com* for specific guidance before installing the Ni-Cd battery string.

Note: You must modify the default 'Float Charge Voltage' and 'Temp Compensation Probe Number' Emerson rectifier parameters for the Saft TelX100 Ni-Cd batteries. Refer to *Emerson Rectifier Setpoints* (on page 206) for instructions.

WARNING! Electrical hazard. Batteries contain a stored charge. Only a qualified technician should perform these procedures.

CAUTION! Electrical, chemical, fire, and heat hazard. Handle batteries with care to avoid personal injury or damage to the equipment.

ALERT! Read the battery manufacturer's instructions before installing batteries. Follow the manufacturer guidelines and local safety practices.

Note: This procedure assumes that the internal battery enclosure is installed. For instructions on installing a battery enclosure, refer to *Installing a Battery Enclosure* (on page 167).

To prepare Saft TelX100 Ni-Cd batteries for installation

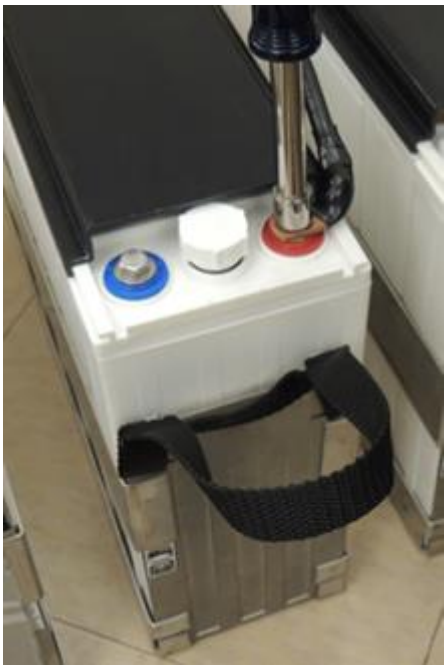
1. Unpack the batteries from the shipping packaging, and locate the bagged kit containing the string jumper straps and other materials.
2. Remove the protective covers from the batteries as follows:
   a. Orient the batteries with the negative (-) terminal posts on the left.
   b. For the six-cell battery, remove the protective cover from the front battery terminal, and slide it away from the battery.
   c. For each eight-cell battery, remove the protective cover from the rear battery terminal, and slide it away from the battery.

3. Connect jumper straps to the battery terminal posts on the six cell battery and three of the eight-cell batteries as follows:

   a. Remove the bolt and flat washer from the negative (-) terminal.

   b. Clean and apply No-Ox anti-corrosion grease to the battery terminal.

   c. Align the jumper strap lug over the terminal screw hole, and then reinstall the washer and bolt to secure the jumper strap in place. Tighten the hardware on the terminal post to the torque specified by the manufacturer.



   d. Align each lip on the protective cover with the corresponding lip on the top of the battery, and then slide the cover over the terminal and snap in place.

4. At the unattached end of the jumper, wrap the lug with electrical tape.

5. For the (3) eight-cell batteries, loop the unattached end of the jumper through the battery lifting handle, as shown below.

Note: On the eight-cell batteries, bridges between the negative terminal posts are not shown.

To install Saft TelX100 Ni-Cd batteries

Note: This procedure assumes that you have prepared the batteries for installation as described above.

CAUTION! Both sides of the Anderson connectors are hot.

1. Open the side ODC-200 cabinet or EXM front door.
2. Remove the vent cover from the side door, if present:
   a. Remove the (4) pan head Phillips screws from the vent cover, and set aside.
   b. Remove the vent cover.
   c. Reinstall the (4) screws.

Note: The screws secure both the vent cover and solar shield in place, and must be reinstalled for the solar shield.

3. At the front of the seismic retaining bracket, disconnect the #8 AWG battery power cables from the power supply leads (if connected).

4. Open the (4) latches on the side and rear of the terminal cover and remove the cover.
5. Remove the seismic retaining bracket from the battery enclosure to access the battery enclosure from the front rather than the top, if needed (for example, when a fiber distribution assembly is installed directly above the enclosure):
   a. Remove the (3) screws and washers from each side of the retaining bracket,and set aside.
   b. Remove the retaining bracket.
6. Orient the batteries with the negative (-) terminal posts on the left, and the positive (+) terminal posts on the right.
7. Remove the protective covers from the batteries as follows:
   a. For each eight cell battery, remove the protective cover from the front battery terminal, and slide it away from the battery.
   b. For the six cell battery, remove the protective cover from the front battery terminal, and slide it away from the battery.
8. Using the lifting handles on each battery, install the batteries into the battery enclosure as follows:
   a. Place the eight cell battery without a jumper strap installed on the far left side of the enclosure. When accessing the enclosure from the front, place the eight cell battery in the middle of the enclosure, and then slide to the far left.
   b. Place the battery with six cells on the far right side of the enclosure. When accessing the enclosure from the front, place the six cell battery in the middle of the enclosure, and then slide to the far right.
   c. Place the remaining (3) batteries with eight cells into the enclosure.
9. Complete installation of each jumper straps as follows:
   a. Remove the unattached end of jumper from the lifting handle at the rear of the battery, if applicable.
   b. Remove the electrical tape from the jumper lug.

c. Route the jumper to the front positive (+) terminal on the battery to the immediate left.

d. Remove the bolt and flat washer from the positive (+) terminal.

e. Clean and apply No-Ox anti-corrosion grease to the terminal.

f. Align the jumper strap lug over the positive (+) terminal screw hole, and then reinstall the washer and bolt to secure the jumper strap in place. Tighten the hardware on the terminal post to the torque specified by the manufacturer.

10. Connect the battery power supply leads as follows:

a. Attach the black cable that is routed through the right upper hole in the retaining bracket to the positive (+) terminal post on the left rear battery.

b. Attach the red cable that is routed through the right upper hole in the retaining bracket to the negative (-) terminal post on the right rear battery.

ALERT! Use a volt meter to verify correct wiring polarities.

c. Tighten the hardware on the terminal posts to the torque specified by the manufacturer.

11. Reinstall the protective covers on the accessible battery terminals in the front.

12. Reinstall the retaining bracket, if removed.

13. Reinstall the terminal cover.

14. Connect the Anderson power connectors together.

Turning Up and Testing the DC Power System

Turn up and test the cabinet DC bulk power system as described below.

To turn up and test the DC power system

1. At the AC load center, verify that the Main breaker is **ON**.

2. At the AC load center, switch the (2) 20A Rectifier breaker **ON**.

3. Verify that the rectifier shelf boots up and the rectifier modules are operational.

Note: The Alpha shelf controller is factory programmed with default settings that enable safe power up and operation. You can modify the settings for system voltages, battery configuration, temperature compensation, and so forth, if required. For programming instructions, refer to the *Alpha Cordex Controller Software Manual*.

4. Verify that the rectifier shelf controller has acquired the rectifier modules as follows:

a. Connect a laptop to the CXCM1+ Ethernet port using a standard network cable.

b. Laptop IP Network settings (**Start > Control Panel**):

- IP address: 10.10.10.202

- Subnet Mask: 255.255.255.0

c. Turn off the pop-up blocker.

d. **Open an IE browser a**nd set the browser to run in compatibility mode.

e. In the Web address bar, enter the IP address of the Alpha controller module (10.10.10.201).

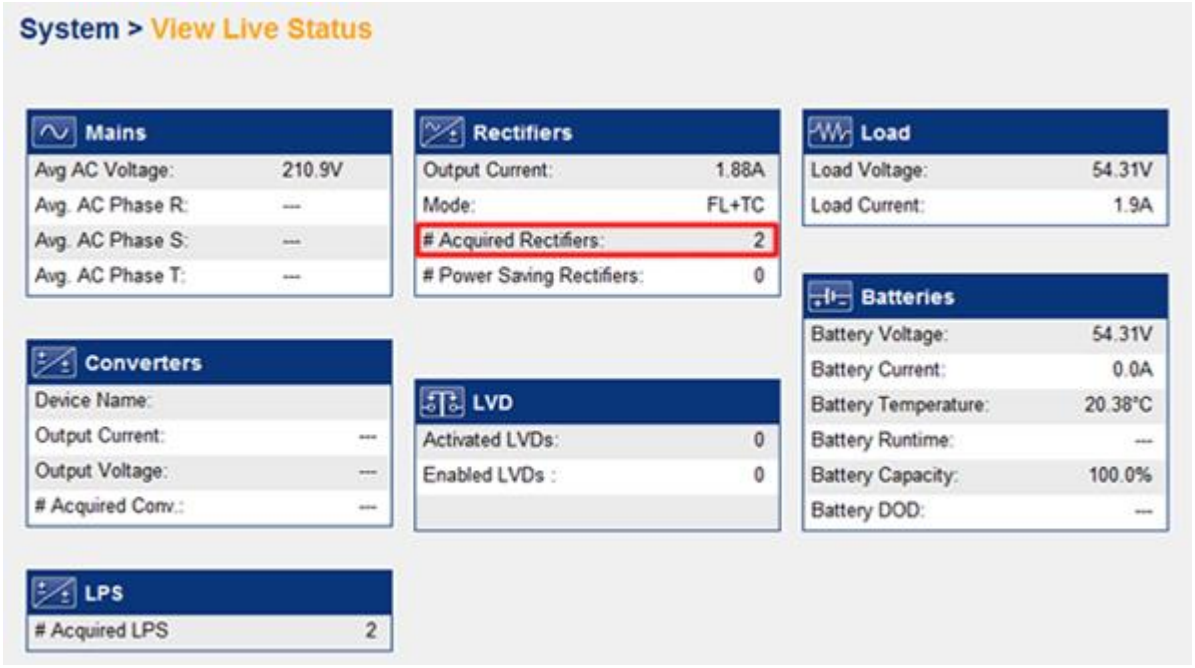
f. Log into the controller module:

- Username: Your initials or other unique identifier
- Password: 1234

g. Enter the language selection: English

h. From the Controller screen (**Controller > Date & Time**), set the correct date and time.

i. On the System screen (**System > View Live Status**), check that the installed rectifiers have been acquired by the controller by verifying the number associated with "# Acquired Rectifiers".



Note: Alarm conditions may be present and will not clear due to no load conditions.

5. At the 20 position fuse panel, do the following:

a. To apply power to the first Clearfield service unit, install a pair of 7.5A GMT fuses in fuse positions 1 and 2. Verify that the unit powers up.

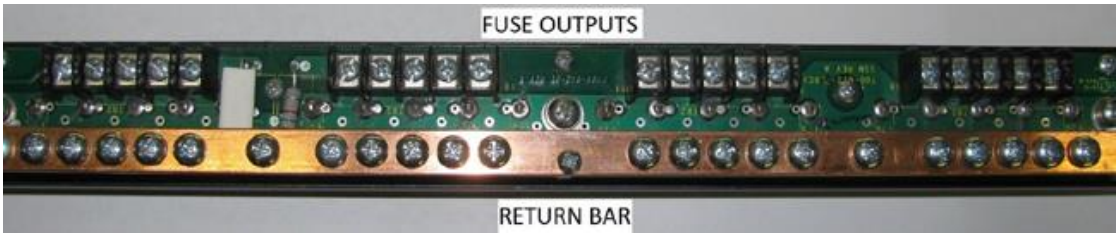
b. If the cabinet is equipped with additional Clearfield service units, install a pair of 7.5A GMT fuses for each unit as follows:

- Second service unit: Fuse positions 3 and 4
- Third service unit: Fuse positions 5 and 6
- Fourth service unit: Fuse positions 7 and 8
- Fifth service unit: Fuse positions 9 and 10
- Sixth service unit: Fuse positions 11 and 12
- Seventh service unit: Fuse positions 13 and 14

c. Verify that the additional service unit(s) power up.

d. Install a 2A GMT fuse in position 20 and verify that the heat exchanger fans start running (if internal temperature is high enough).

6. To test the DC power supply voltage at the GMT fuse panel, pull out the two spring loaded thumbscrews on each side of the fuse panel and swing the panel down to expose the GMT fuse connections. Using a voltmeter, measure the voltage between the fuse panel return bar and one of the GMT fuse outputs that has a fuse populated. Verify that the voltage reads between -48 and -54 VDC.



Testing Batteries

If the batteries are not fully charged, perform this procedure after charging the batteries.

WARNING! Electrical hazard. Only a qualified technician should perform these procedures.

To test the batteries

1. Using a digital volt meter, test the battery connection between the negative and positive battery leads:

a. Place the red volt meter lead on the red negative (-) battery lead.

b. Place the black volt meter lead on the black positive (+) battery lead.

c. Verify that the volt meter reads between -46 and -54 VDC.

d. Measure the voltage difference between the power system and the battery string. The voltage difference should be less than 3V. If the voltage difference is greater than 3V, check for connection integrity, replace bad battery cell as applicable, and retest the voltage.

2. Verify that the cabinet heat exchanger fans are running (if the temperature is high enough).
3. At the AC load center, set the Main breaker to **OFF**. The heat exchanger fans should continue to run.
4. At the AC load center, set the Main breaker to **ON** and verify that power restores to the rectifier shelf.

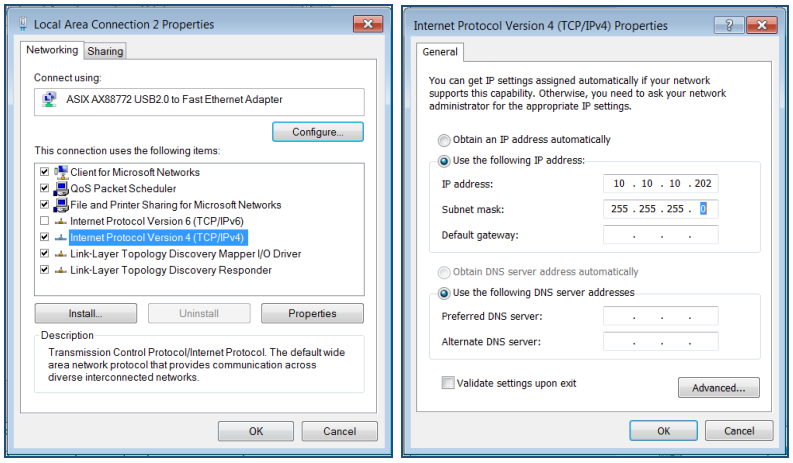
CXCM1+ Controller Battery Charge Current Settings and Alarm Values

The CXCM1+ battery charge current control algorithm limits the amount of charge current available to the batteries. It is imperative that the battery parameters and charge current are set appropriately relative to the installed battery capacity.
The default controller setting for battery capacity is for the Northstar NSB60FT battery with the charge rate at C/6 (11.3A).

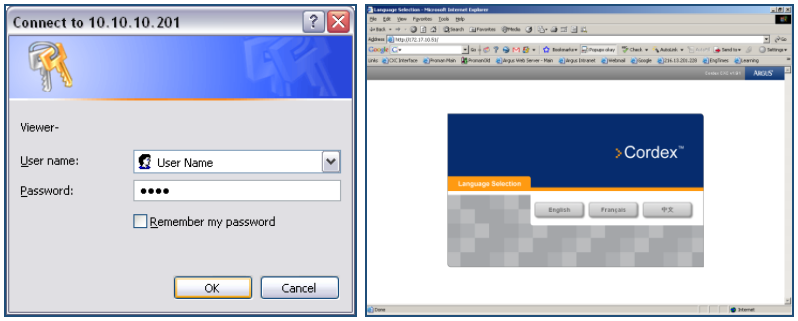
Changing CXCM1+ Controller Battery Configuration Settings and Alarm Values

NOTE: Assumption is that the controller's IP address is defaulted to the factory IP address of 10.10.10.201. Also, we highly recommend that the controller's software version is the latest released version. The latest software released can be downloaded here: http://www.alpha.ca/support/support-main-menu/software-firmware-downloads

5. Connecting to the CXCM1+ controller
   a. Connect a laptop to the CXCM1+ Ethernet port using a standard network cable.
   b. Change laptop IP network settings (**Start** > **Control Panel** > **Network and Internet** > **Network and Sharing Center** > **Local Area Connection** > **Properties** > **Internet Protocol Version 4 (TCP/IPv4)**):
      - IP address: 10.10.10.202
      - Subnet Mask: 255.255.255.0



c. Turn off the pop-up blocker
d. Open an IE browser and set the browser to run in compatibility mode
e. In the IE address bar, enter the IP address of the Alpha controller module (10.10.10.201)
f. Log into the controller module with the following:
   - Username: Your initials or other unique identifier
   - Password: 1234



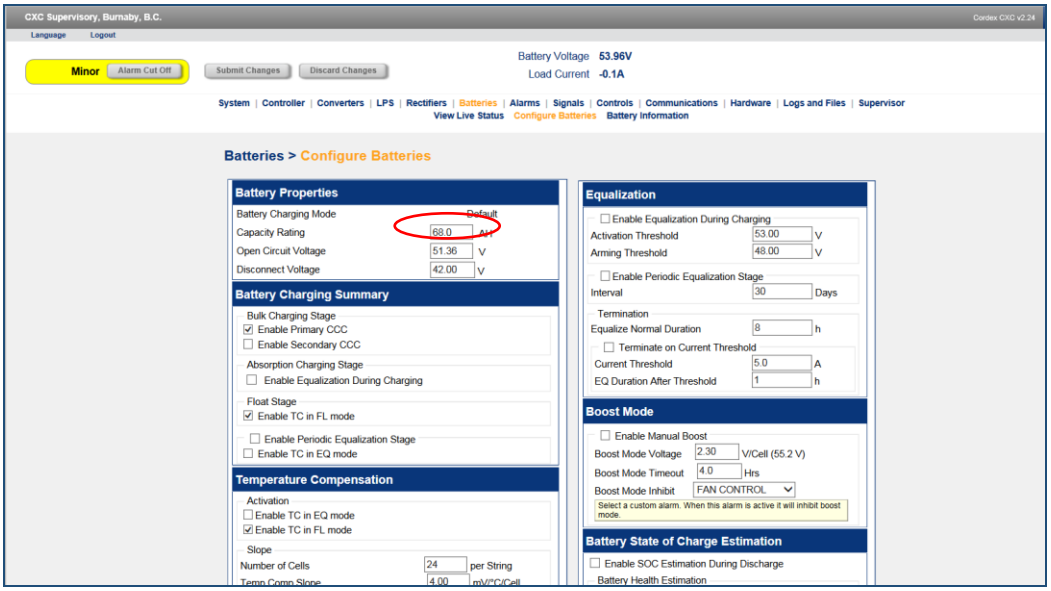
6. Changing the battery configuration parameters

a. Navigate to **Batteries** > **Configure Batteries**

b. In the Battery Properties section, enter the battery string capacity into the Capacity Rating box

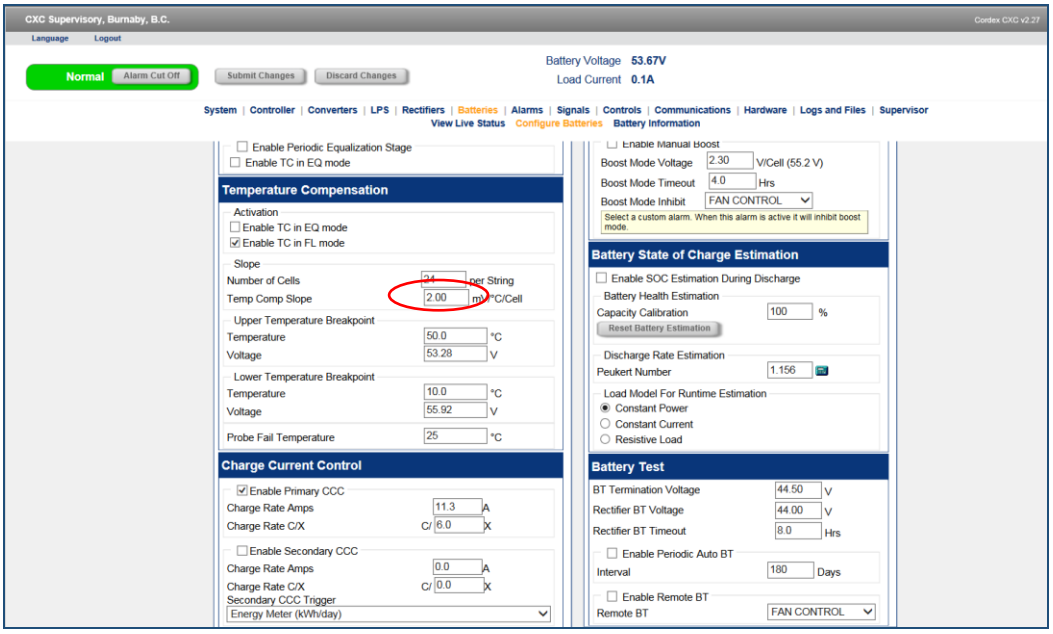
Battery Type	Capacity Value (Ah for One String)*
Northstar NSB60FT Red	68
Enersys SBS B14	68
Northstar NSB100FT Red	106
Northstar NSB170FT Red	180
Enersys SBS 190F	210

***NOTE: For multiple battery strings, increase the capacity value**



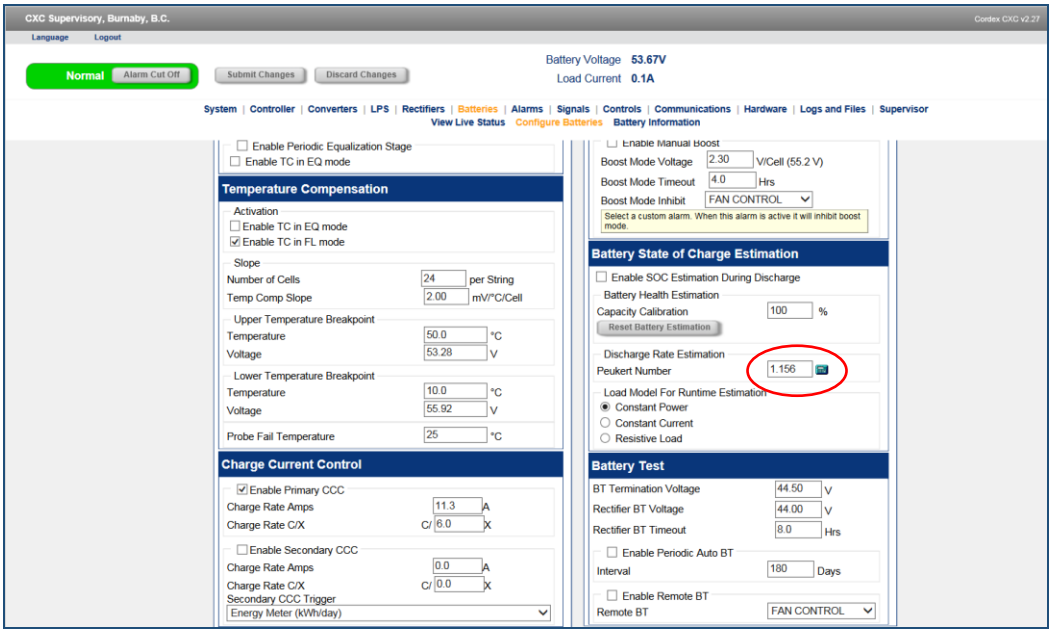
c. In the Temperature Compensation section, enter temperature compensation slope in the Temp Comp Slope box

Battery Type	Temperature Compensation Slope
Northstar NSB60FT Red	2mV/deg C/Cell (1.1mV/deg F/Cell)
Enersys SBS B14	4mV/deg C/Cell (2.2mV/deg F/Cell)
Northstar NSB100FT Red	2mV/deg C/Cell (1.1mV/deg F/Cell)
Northstar NSB170FT Red	2mV/deg C/Cell (1.1mV/deg F/Cell)
Enersys SBS 190F	4mV/deg C/Cell (2.2mV/deg F/Cell)



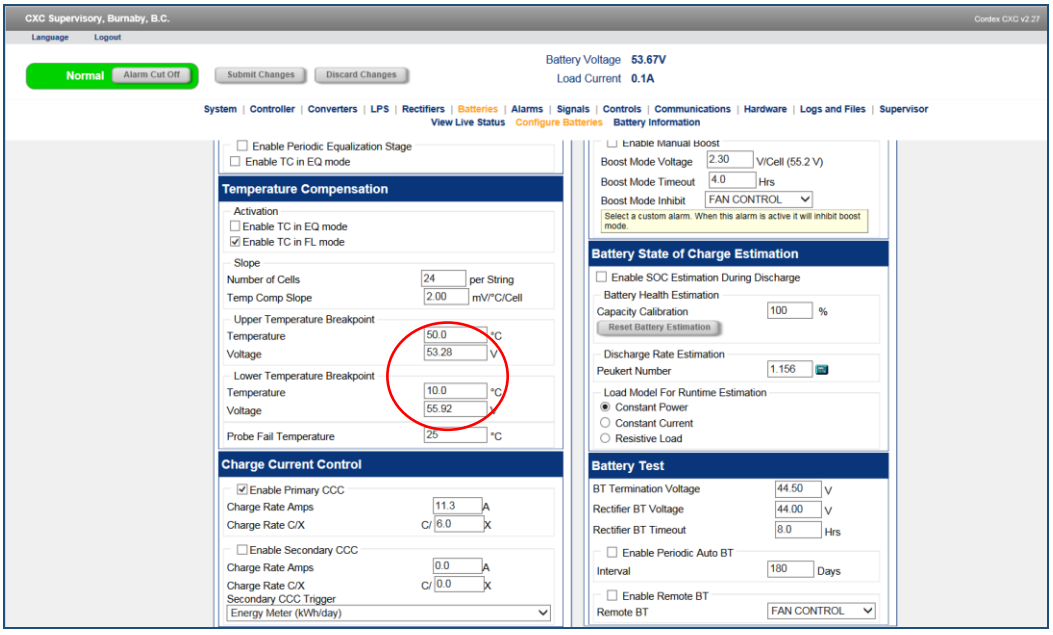
d. In the Battery State of Charge Estimation section, enter the peukert number in the Peukert Number box

Battery Type	Peukert Value
Northstar NSB60FT Red	1.156
Enersys SBS B14	1.130
Northstar NSB100FT Red	1.131
Northstar NSB170FT Red	1.128
Enersys SBS 190F	1.113

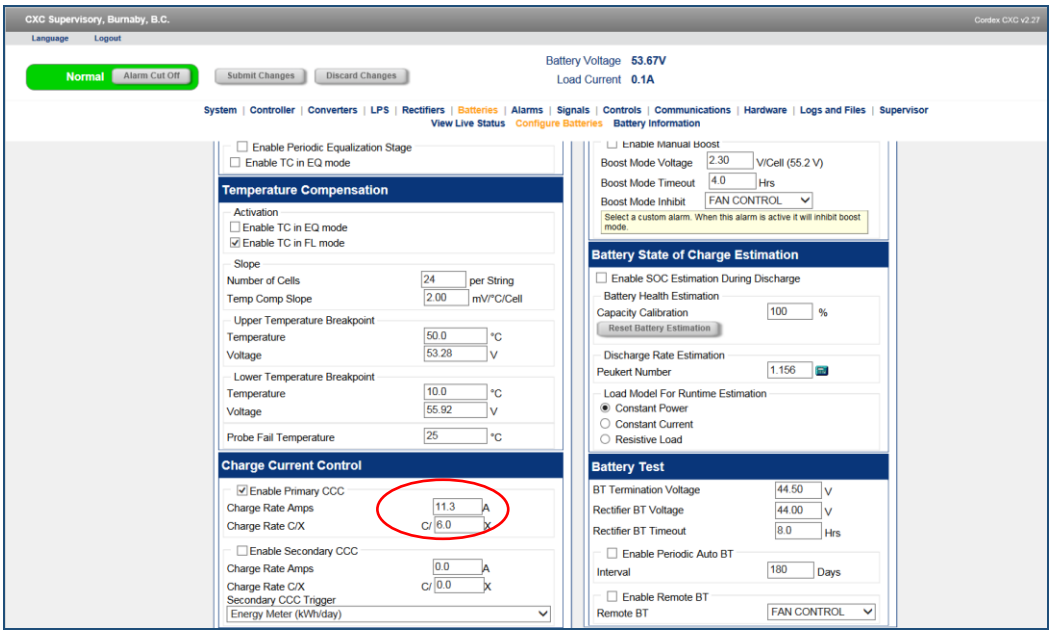


e. In the Temperature Compensation section, enter the upper/lower temperature breakpoint temperature and voltage in the respective boxes

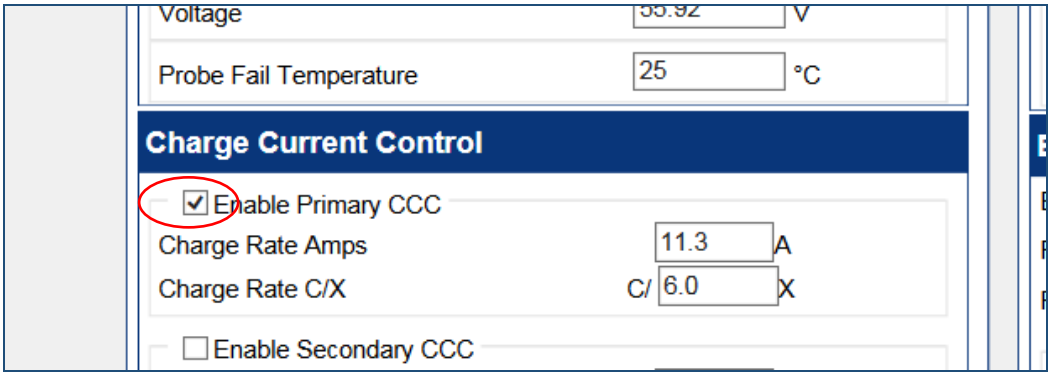
Battery Type	Upper Temperature Breakpoint		Lower Temperature Breakpoint	
	Temperature in C (in F)	Voltage	Temperature in C (in F)	Voltage
Northstar NSB60FT Red	50 (122)	53.28	10 (50)	55.2
Enersys SBS B14	50 (122)	52.08	10 (50)	55.92
Northstar NSB100FT Red	50 (122)	53.28	10 (50)	55.2
Northstar NSB170FT Red	50 (122)	53.28	10 (50)	55.2
Enersys SBS 190F	50 (122)	52.08	10 (50)	55.92



f. In the Charge Current Control section, the charge rate can be entered either in terms of Charge Rate Amps or the C/X charge rate. Enter the desired charge rate in either format into the respective box



g. Ensure the Enable Primary CCC check box is checked



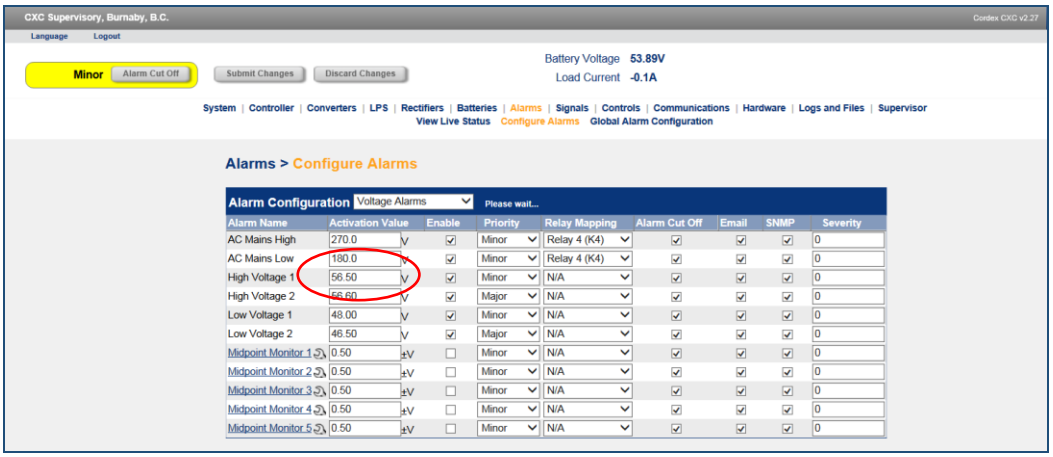
7. Changing the alarm setting:

a. Navigate to **Alarms** > **Configure Alarms**

b. In the Alarm Configuration drop down box, select Voltage Alarms

c. Enter the High Voltage 1 and High Voltage 2 in the Activation Value box

Alarm Name	Activation Value
High Voltage 1	56.5
High Voltage 2	56.6



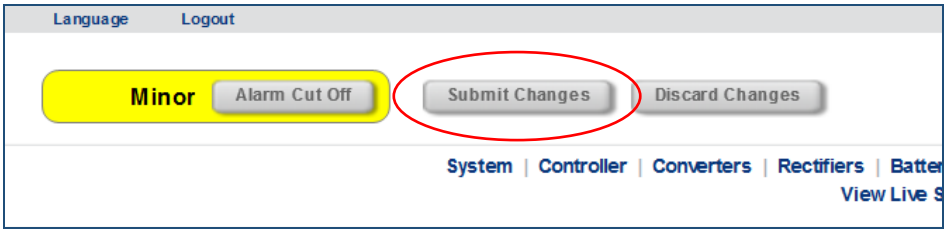
d. Navigate to **Rectifiers** > **Configure Rectifiers**

e. Enter the following in its respective box

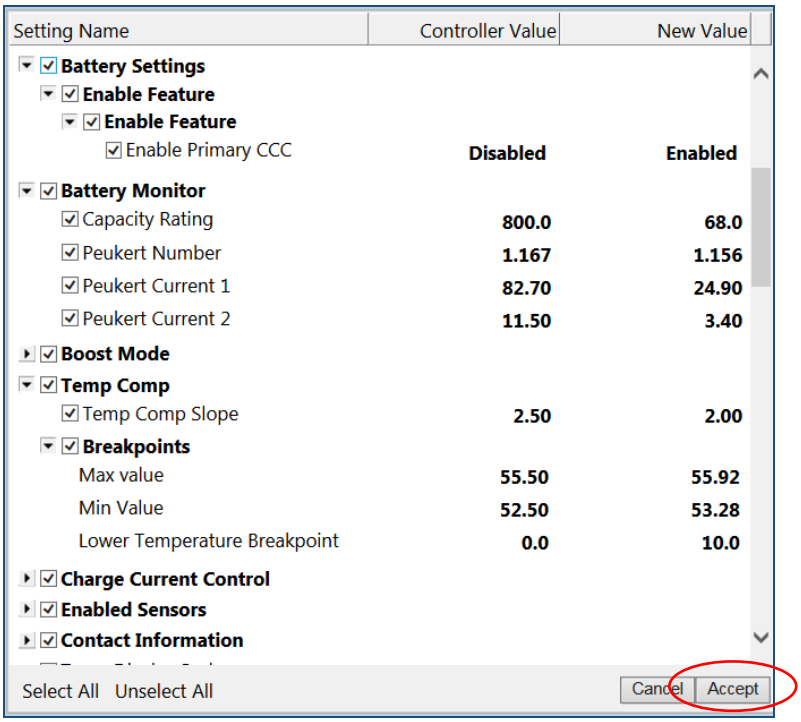
Rectifier Setting Name	Value
Float Voltage	54.48
Equalize Voltage	56.3
OVP	57.7
LVA	46.0
HVA	56.5

8. Submitting and saving the changes

a. At the top left side of the page, click the Submit Changes button. A pop-up window will be displayed comparing the old settings and the new settings.



b. Select all the changes and click the Accept button to save all the necessary changes



Turning Up the Power System (Remote Power)

This section describes how to turn up and test the power system for remote-powered cabinets. The process includes checking the cabinet ground connection, checking the ±190 VDC power supply voltage, installing converter modules, and turning up and testing the DC power system.

Topics Covered

This chapter covers the following topics:

- Checking the cabinet ground connection.
- Checking the ±190 VDC line power supply voltage at the power protection block.
- Installing the fan tray for the DC converter shelf.
- Installing converter modules into the DC converter shelf.
- Turning up and testing the DC power system.

Checking the Ground Connection

Check the impedance of the cabinet ground connection before turning up the cabinet power system.

Note: The following procedure does not test the quality of the earth ground circuit (earth electrode), which should have been installed and tested before the cabinet was installed.

To check the cabinet ground connection

1. Using an ohm meter, test between the main ground bar and the earth ground wire:
   a. Place one lead on the main cabinet ground bar.
   b. Place the other lead on the earth ground wire.
2. Verify that the ohm meter reads 5 ohms or less.
3. If the reading is greater than 5 ohms, check the ground wire connection at the main ground bar, then retest.

Checking the Line Power Supply Voltage

Before turning up power in the cabinet, check the supply voltage on the power pairs to verify that it is within the expected range. Check voltage at the power protection block, located on the rear left wall inside the cabinet.

Performing this task requires two people in separate locations working in coordination:

- One person located at the upstream power source where the CPS3200U supply shelf resides.
- One person located at the cabinet to check the supply voltage on the power pairs.

DANGER! High voltage may be present. Only a qualified electrician should perform these procedures.

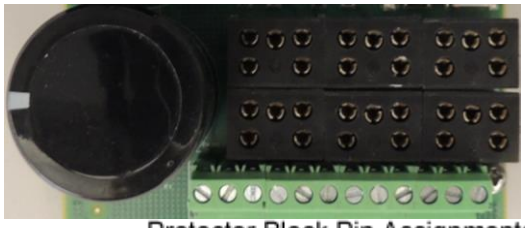
To check the line power supply voltage

1. At the cabinet, open the side door.
2. Verify that **no** 5-pin protection modules are installed in the power protection block.
3. At the upstream power source, apply ±190 VDC power to the lines supplying the ODC-200.

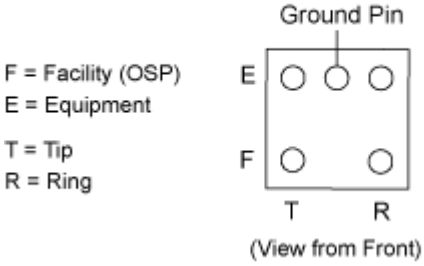
   Note: Applying power typically involves activating fuses or circuit breakers that serve the CPS3200U upstream shelf.

4. At the cabinet's power protection block, locate position 1.

   Note: Positions are arranged from left to right, top to bottom on the block.



Protector Block Pin Assignments



5. Using a volt meter, test between the Facility Tip and ground pins:
   a. Place one lead on the Facility Tip pin.
   b. Place the other lead on the ground pin.
   c. Verify that the volt meter reads between +180 and +190 VDC.
6. Using a volt meter, test between the Facility Ring and ground pins:
   a. Place one lead on the Facility Ring pin.
   b. Place the other lead on the ground pin.

c. Verify that the volt meter reads between -180 and -190 VDC.

7. Using a volt meter, test between the Facility Tip and Ring pins (line to line).
   a. Place one lead on the Facility Tip pin.
   b. Place the other lead on the Facility Ring pin.
   c. Verify that the volt meter reads between ±360 and ±380 VDC (Tip to Ring).
8. Repeat Steps 5 through 7 for each additional position on the power protection block that supports a powered pair.

Note: Do not install 5-pin protection modules into the power protection block at this time.

Installing the Converter Shelf Fan Tray

Cabinets configured for remote power require a fan tray to cool the CPS2500D converter shelf. Install the fan tray into the converter shelf housing assembly.

To install the converter shelf fan tray

1. Unpack the fan tray assembly.
2. Orient the fan tray horizontally, with the fans facing up.
3. Insert the fan tray into the converter shelf housing, aligning the edges with the guides in the slot.

4. Slide the fan tray completely into the slot. Push firmly on the front panel to seat it.

Installing Converter Modules

The ODC-200 cabinet uses the GE CPS2500D downstream power system to convert ±190 VDC to -48 VDC power to supply the equipment.

The CPS2500D shelf supports up to 10 converter modules, each terminating up to two power pairs.

Determining the Required Number of Converter Modules

The number of converter modules required for operation varies by site based on several factors, including the equipment load in the cabinet, and loop length and wire gauge of the copper plant:

- The table below provides power draw for E7-2 system configurations.

E7-2 System Configuration	Typical Power Draw (Watts)
(4) E7-2 (8) VDSL2-48C (COMBO) cards	1044
(4) E7-2 (4) VDSL2-48 (Overlay) cards	596
(4) E7-2 (8) GPON-4 cards	908
(8) E7-2 (8) VDSL2-48 (Overlay) cards	1144

- A single CPS2500D shelf supports 1144W power draw under the following conditions:
  - Nine converter modules (to support N+1 module redundancy)
  - A single power pair is fed to each channel
  - 24 AWG power pairs
  - Loop length: 3281 feet/1000 meters
  - Single power buffer capacitor (provides 2.62 seconds holdover)

Note: Greater than 1144W is not supported by a single CPS2500D shelf.

- For smaller gauge wire or longer distances, use multiple pairs per input (stack MS^2 or bridge 710 connectors at the input of the power protection block, for example).

Clearfield offers a calculator tool to determine your remote power requirements. You input values for the variable factors that affect the power requirements (including the equipment load in the cabinet, and loop length and wire gauge of the copper plant), and the tool calculates the number of copper pairs required for remote power. By extension, you can determine the number of required converter modules for the CPS2500D shelf, as one converter module is required for every two power pairs. For example, if the calculator determines that your application requires 11 pairs for line power, then you should use at least six converter modules in the CPS2500D shelf. (Clearfield would recommend using seven modules in this case, to support N+1 module redundancy.)

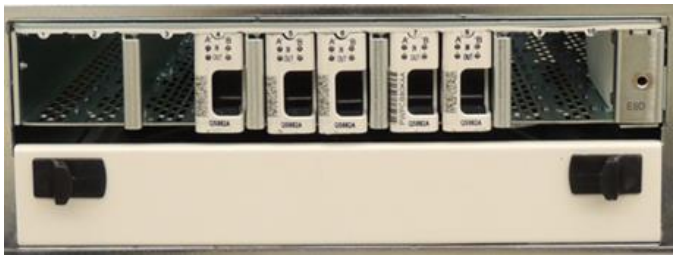
Note: The *Remote Power Planning Calculator* is accessible on *seeclearfield.com*. To use the calculator, you must have Microsoft Excel installed on your PC.

The CPS2500D converter shelf and fan tray are housed in a fixture that also provides integrated DC distribution. Install converter modules into the CPS2500D converter shelf as described below.

To install a converter module

1. Unpack the converter module.
2. Install the converter module into the CPS2500D shelf following the priority sequence and aligning the right-side plastic edge in the notch at the top right edge of the slot.
3. Push the face plate in until the latch on the top catches.

Note: For each module pair, populate the even-numbered slot before the odd-numbered slot. For example, install a module in slot 6 before slot 5, and install a module in slot 8 before slot 7.



Converter Module Slot	Priority Sequence
4, 6, 5, 8, 7	First
10	Second
9	Third
3	Fourth
2	Fifth
1	Last

Note: Refer to the GE CPS2500D +/-190V Downstream System product manual for more information.

Turning Up and Testing the DC Power System

Applying power to the CPS2500D converter shelf requires installing 5-pin lightning protection modules into the power protection block for each powered pair. Use 5-pin protection modules consistent with UL 497. The 5-pin protector must be marked as a "special circuit" consistent with local marking practice, typically red in color. Populate the module positions sequentially, beginning at position 1 (one 5-pin module per powered pair).

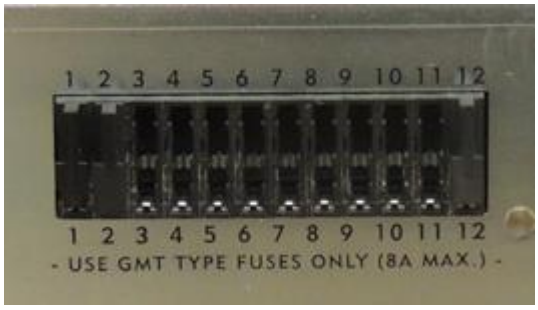
Turning up power to the equipment requires installing GMT fuses into the DC distribution panel located on the converter shelf housing assembly. The GMT fuses are supplied with the cabinet.

To turn up and test the DC power system

1. At the power protection block, do the following:
   a. Verify that line power is applied and the voltage is within the required range. See *Checking the Line Power Supply Voltage* (on page 142) for details.
   b. Install 5-pin protection modules into positions 1 and 2.
   c. Verify that the CPS2500D converter shelf powers up and the first converter module is operational (indicated by green LEDs on A and B).
   d. Install additional 5-pin protection modules into the protection block. Two 5-pin modules correspond to one slot in the CPS2500D converter shelf. Populate positions as required and verify that additional the converter modules are operational.

Note: The converter modules are factory-programmed for safe power up and operation. Refer to the GE CPS2500D +/-190V Downstream System product manual for more information.

2. At the DC distribution panel, do the following:



Note: Clearfield typically installs fuses into the DC distribution fuse panel at the factory. If no fuses are installed, install the fuses as described below.

   a. To apply power to the first Clearfield service unit, install an appropriately rated pair of 7.5A GMT fuses in fuse positions 1 and 2 (A/B power), and then verify that the unit powers up.

b. If the cabinet is equipped with multiple Clearfield service units, install an appropriately rated pair of GMT fuses into each additional position in sequence, as required. Verify that the additional unit(s) power up.

c. If the cabinet is equipped with additional equipment such as a copper trunking unit, install an appropriately rated pair of GMT fuses (2A for an Actelis unit) in positions 7 and 8 (A/B power). Verify that the unit powers up.

d. Install a 2A GMT fuse in position 11. Verify that the heat exchanger fans start running (provided internal temperature is high enough).

e. Install a 1A GMT fuse in position 12. Verify that the CPS2500D converter fan tray fans start running.

3. Using a volt meter, test the DC power supply voltage at the Clearfield service unit. Verify that the voltage reads between -48 and -54 VDC.

Chapter 8

Installing Equipment and Adding Capacity

This chapter describes how to install optional equipment and components into the cabinet and Expansion Module (EXM), including expansion components to increase system capacity. The cabinet and EXM allow for modular growth of line capacity and supports field installation of all factory options.

Topics Covered

This chapter covers the following topics:

- Installing an expansion E7-2 shelf
- Installing an expansion B6-001 shelf
- Installing a protection mounting frame
- Installing a protection block
- Installing a cross-connect panel
- Installing an external splice compartment
- Installing an battery enclosure
- Installing a battery heater
- Installing a power buffer capacitor
- Installing a generator connector
- Installing a heat exchanger door
- Installing fiber management options
- Installing a dual LGX fiber distribution panel

For ordering information, contact your Clearfield Sales Representative.

Installing an E7-2 Shelf

The cabinet supports field expansion of equipment, including adding an E7-2 shelf into cabinets equipped with fewer than the maximum (9).

Follow these guidelines when installing expansion E7-2 shelves in an ODC-200:

- Install an expansion E7-2 unit adjacent to the existing unit(s) on the rack.
- To ensure adequate cooling capacity, the ODC-200 cabinet does not support horizontal mounting of service units above or below the vertical equipment rack.
- In a locally powered cabinet, verify that at least (2) 25 Amp rectifier modules are installed in the rectifier shelf to support the expansion load.
- In a remote powered cabinet, you may need to install additional converter modules into the 2500D converter shelf to support the expansion load. Consult the *Remote Power Planning Calculator* tool on the Clearfield website for guidance.

Installing an expansion unit does not affect services on the existing equipment.

To install an E7-2 expansion shelf into an ODC-200 cabinet

1. Unpack the E7-2 unit from the shipping packaging, and open the cabinet's front door.
2. If present, remove any GMT fuses from the distribution positions that will supply the new unit (for example, positions 3 and 4 for shelf #2) on the rectifier fuse panel (local power) or DC distribution panel (remote power).
3. Pre-wire the power and ground wires to the E7-2 unit as follows:
   a. Get the power and ground cables from the E7-2 kit.
   b. Remove the rear cover from the E7-2 chassis.
   c. Connect the green ground wire to the E7-2 ground terminal as shown.

   d. Terminate the A-side power cables:
      - Connect the black **(A) RTN** wire to the **(A)** + **RTN** terminal.
      - Connect the red **(A) BATT** wire to the **(A) - BATT** terminal.
   e. Terminate the B-side power input:

- Connect the black **(B) RTN** wire to the **(B)** + **RTN** terminal.
- Connect the red **(B) BATT** wire to the **(B) - BATT** terminal.

f. Tighten the power termination screws to 9 in-lbs.

g. Replace the terminal cover and tighten the thumbscrew. Make sure all wires exit cleanly to the left.

4. Install the E7-2 shelf onto the equipment rack as follows:

a. Attach the mounting ears to the E7-2 shelf in the most forward position and oriented for 23-inch rack. Use supplied hardware.

b. Orient the E7-2 shelf vertically, with the left side up and right side down (as viewed from the front).

c. Position the E7-2 shelf against the equipment rack adjacent to the installed unit. Align the mounting ear holes with the counterpart holes on the rack.

d. While holding the E7-2 against the rack, install four mounting screws (2 per side) to secure the unit to the rack. Tighten the screws to 45 in. lbs. of torque.

5. Connect the E7-2 power and ground cables to the cabinet power supply and grounding systems as follows:

a. Route and terminate the ground cable to the cabinet's main ground bar.

WARNING! Hazardous voltages present. Risk of electrical shock. Use extreme caution when connecting to the cabinet power system.

b. Route the power cables to the rear of the rectifier shelf (local power) or DC distribution panel (remote power) and connect as follows:

- For shelf #2, connect to power distribution positions 3 and 4 (A/B power).
- For shelf #3, connect to power distribution positions 5 and 6 (A/B power).
- For shelf #4, connect to power distribution positions 7 and 8 (A/B power).
- For shelf #5, connect to power distribution positions 9 and 10 (A/B power).
- For shelf #6, connect to power distribution positions 11 and 12 (A/B power).
- For shelf #7, connect to power distribution positions 13 and 14 (A/B power).
- For shelf #8, connect to power distribution positions 15 and 16 (A/B power).

6. Install the E7-2 fan module into the housing on the right side of the chassis, pushing the module all the way back into the slot.

Note: Do not install the air filter into the fan module for OSP installations.

7. To apply power to the expansion E7-2 shelf, install the 7.5A GMT fuse(s) into the appropriate positions on the rectifier fuse panel (local power) or DC distribution panel (remote power):

- Positions 3 and 4 for shelf #2
- Positions 5 and 6 for shelf #3
- Positions 7 and 8 for shelf #4
- Positions 9 and 10 for shelf #5
- Positions 11 and 12 for shelf #6
- Positions 13 and 14 for shelf #7
- Positions 15 and 16 for shelf #8

Verify that the E7-2 fan module powers up.

To connect interface cables to the E7-2 unit

1. If the E7-2 shelf will provide VDSL2 services, connect the 25-pair equipment interface cables for DSL/DS0 services as follows:

   Note: This step requires that the copper line protection for the expansion unit is already installed in the cabinet. See for instructions.

   a. Verify that the line protection for the expansion unit is installed.

   b. Route the 25-pair equipment interface cables from the back of the protection block(s) to the expansion E7-2 unit.

   c. Connect the interface cable(s) to the appropriate RJ-21 connector(s) on the rear of the E7-2, as follows:

   Note: Cable assignments vary based on the type of card installed in the unit. For detailed information, see the *Calix E7-2 Installation Guide*.

   - For an RJ-21 male connector with a 110-degree exit, tighten the screws on each side to secure the connector to 3–4 inch-lbs of torque.
   - For an RJ-21 male connector with a 90-degree exit, tighten the screw at the bottom of the connector to 3–4 inch-lbs of torque, and use a cable tie mount and tie wrap to secure the top of the connector.

2. To connect fibers for transport/uplink or fiber access, first install E7-2 line card(s) into the expansion shelf. Then install pluggable transceiver modules and connect fibers. See the *Calix E7-2 Installation Guide* for instructions.

   Note: For options and guidance on connecting transport/uplink fibers, see *Connecting Fibers to the Equipment* (on page 108) and/or (Optional) Interlinking Collocated Service Units for instructions.

Installing a B6-001 Shelf

The cabinet supports field expansion of equipment, including adding a B6-001 shelf into cabinets equipped with fewer than the maximum (9).

Follow these guidelines when installing expansion B6-001 units in the ODC-200:

- Install an expansion B6-001 unit adjacent to the existing unit(s) on the equipment rack.
- To support B6 copper access services, the cabinet's copper line protection capacity may need to be increased to support the expansion unit. See *Installing a Protection Block* (on page 158) for installation instructions, as applicable.
- In a locally powered cabinet, verify that at least (2) rectifier modules are installed in the rectifier shelf to support the expansion load.
- In a remote powered cabinet, you may need to install additional converter modules into the 2500D converter shelf to support the expansion load. Consult the *Remote Power Planning Calculator* tool on the Clearfield website for guidance.
- The B6-001 requires manual shelf ID provisioning; the Shelf ID switch is located on the rear of the shelf. From the front of the cabinet, shelves residing in the vertical mounting frame are counted from left to right, starting with shelf 1 on the far left.

Installing an expansion unit does not affect services on the existing equipment.

To install a B6-001 expansion shelf into an ODC-200 cabinet

1. Unpack the B6-001 unit from the shipping packaging, and open the cabinet's front door.
2. If present, remove any GMT fuses from the DC distribution positions that will supply the new unit (positions 3 and 4 for shelf #2, or positions 5 and 6 for shelf #3) on the rectifier fuse panel (local power) or DC distribution panel (remote power).
3. Pre-wire the power and ground wires to the B6-001 unit as follows:
   a. Get the power and ground cables from the B6 kit, or for cabinets shipped with the B6-001 power cables pre-terminated to the cabinet power supply system, get the ground cable from the kit.
   b. Remove the plastic protection panel from the back of the B6-001.

c. Connect the green ground wire to the B6-001 ground terminal as shown.

d. For cabinets shipped with the B6-001 power cables pre-terminated to the cabinet power supply system, cut the tie wraps and dress cables as needed, and identify the appropriate power cable:

- For shelf #2, locate the power cable connected to power distribution positions 3 and 4 (A/B power).
- For shelf #3, locate the power cable connected to power distribution positions 5 and 6 (A/B power).

e. Terminate the A-side power cables:

- Connect the black **RTN** wire to the **RTNA** power terminal.
- Connect the red **-48V** wire to the **-48VA** power terminal.

f. Terminate the B-side power cables:

- Connect the black **RTN** wire to the **RTNB** power terminal.
- Connect the red **-48V** wire to the **-48VB** power terminal.

g. Replace the terminal cover and tighten the screw.

4. Install the B6-001 shelf onto the equipment rack as follows:

a. On the rear of the shelf, set the Shelf ID as required.

b. Remove the stock mounting ears from the unit and attach the (2) supplied mounting ears to the unit in a flush-mount position using flathead Phillips screws.

c. Orient the B6-001 shelf vertically, with the left side up and right side down (as viewed from the front).

d. Position the B6-001 shelf against into the equipment rack adjacent to the installed unit. Align the mounting ear holes with the counterpart holes on the rack.

e. While holding the B6-001 against the rack, install four mounting screws (2 per side) to secure the unit to the rack. Tighten the screws to 45 in. lbs. of torque.

5. Route and terminate the ground cable to the cabinet's main ground bar.

6. For cabinets without B6-001 power cables pre-terminated to the cabinet power supply system, route the power cables to the rear of the rectifier shelf (local power) or DC distribution panel (remote power) and connect as follows:

WARNING! Hazardous voltages present. Risk of electrical shock. Use extreme caution when connecting to the cabinet power system.

   a. For shelf #2, connect to power distribution positions 3 and 4 (A/B power).

   b. For shelf #3, connect to power distribution positions 5 and 6 (A/B power).

7. To apply power to the expansion B6-001 shelf, install the 7.5A GMT fuse(s) into positions 3 and 4 (for shelf #2) or positions 5 and 6 (for shelf #3) on the rectifier fuse panel (local power) or DC distribution panel (remote power). Verify that the B6-001 fan module powers up.

To connect interface cables to the B6-001 unit

1. If the B6-001 shelf will provide VDSL2 services, connect the 25-pair equipment interface cables for DSL/DS0 services as follows:

Note: This step requires that the copper line protection for the expansion unit is already installed in the cabinet. See *Installing a Protection Block* (on page 158) for instructions.

   a. Verify that the line protection for the expansion unit is installed.

   b. Route the 25-pair equipment interface cables from back of the protection block(s) to the expansion B6-001 unit.

   c. Connect the interface cable(s) to the appropriate RJ-21 connector(s) on the rear of the B6-001, as follows:

      Note: Cable assignments vary based on the type of card installed in the unit. For detailed information, see the *Calix B6-001 Installation Guide*.

      - For an RJ-21 male connector with a 110-degree exit, tighten the screws on each side to secure the connector.
      - For an RJ-21 male connector with a 90-degree exit, tighten the screw at the bottom of the connector, and use a cable tie wrap to secure the top of the connector.

2. To connect fibers for transport/uplink or fiber access, first install the B6-001 line card into the expansion shelf. Then install pluggable transceiver modules and connect fibers. See the *Calix B6-001 Installation Guide* for instructions.

Note: For options and guidance on connecting transport/uplink fibers, see *Connecting Fibers to the Equipment* (on page 108) and/or *(Optional) Interlinking Collocated Service Units* (on page 111) for instructions.

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Installing a Protection Mounting Frame

The ODC-200 copper line protection system allows you to expand line capacity incrementally. Protection blocks are housed in a mounting frame that installs on a 23-inch rack. Each mounting frame holds up to eight 50-pair protection blocks. You can field-install protection mounting frames to expand system capacity. The protection system resides in the cabinet and/or EXM.

To install an 8 position 50-pair protection mounting frame

1. Unpack the protection mounting frame from its packaging.
2. Verify that two ground wires are connected to the mounting frame. Install the ground wires if necessary.
3. Install the protection mounting frame on the rack as follows.
   a. Turn the (2) knobs on the frame counter-clockwise (to the latch's disengaged position).
   b. Position the frame against the rack, oriented with the hinge on the right side.

   Note: To correctly align the frame for mounting, the hinge must align with mounting holes on the right rack, and the alignment pin on the left side must insert into a mounting hole on the left rack.

   c. When the mounting frame is aligned correctly, secure the hinge side to the right rack using (4) self-tapping screws.
   d. While holding the swing frame closed against the rack, turn the (2) knobs clockwise to engage the latch, thereby securing it in the closed position.

Route the two frame ground wires to the main ground bar. Attach the ground wire lugs to an open position on the main ground bar or subground bar per PANI guidelines. Refer to *Installing the Cabinet Ground Connection* (on page 94) for more information.

Installing a Protection Block

You can increase the cabinet's copper line protection capacity in the field to support expansion equipment. Protection blocks are housed in mounting frames that each hold up to eight 50-pair blocks.

For line protection requirements by Clearfield service unit model, refer to *Installing 5-Pin Protection Modules* (on page 117).

Note: Clearfield equipment uses a 'dead pair' scheme, where the 25th pair on each subscriber interface and in each 25-pair cable group is unterminated (dead). Therefore, on each protection block, positions 25 and 50 are not wired. Line identification labels cover the dead pair positions (25 and 50).

To install a protection block

1. Unpack the protection block from the shipping packaging.
2. On the back of the protection block, remove any cable ties that coil up the interface cables (two with MS^2 or 710 connectors, two with RJ-21 connectors).
3. In the cabinet or EXM, locate the next open position on the protection mounting frame, then feed the block's interface cables through the fixture into the area behind it. Populate protection blocks from left to right on the frame.

   Note: For Clearfield overlay service units, where the line protection for the user and overlay lines is split across two adjacent 50-pair blocks, typically the block on the left protects the PSTN (overlay) lines, while the block on the right protects the user (DSL) lines.

4. Attach the protection block to the mounting frame as follows:

   a. Insert the tabs on the left side of the block into the slots on the mounting frame.

b. Pull down the spring-loaded plunger latch on the right side of the protection block. While holding the plunger down, rotate the block back into its mounting position. Release the plunger latch to secure it in the mounting fixture.

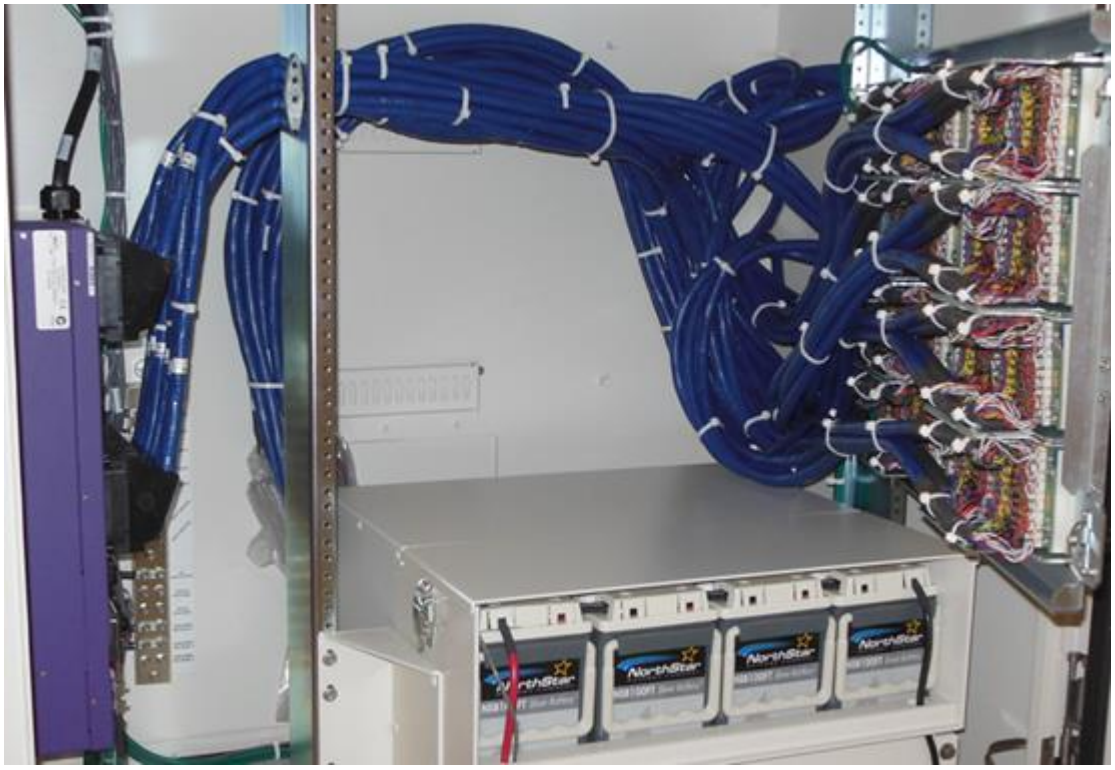
c. Install two supplied screws into the left side of the block to secure it to the frame. (The screws provide a critical ground path to the cabinet's main ground bar or EXM's subground bar.)

5. Terminate the protection block interface cables as follows:

a. Route the two RJ-21 equipment interface cables into the main compartment and connect to the Clearfield service unit's RJ-21 connectors.

b. Mate the two MS^2 or 710 subscriber interface cables to the counterpart OSP interface cables.

c. Dress and secure the interface cables to the rack or towel bars as needed.



6. Apply line identification labels over the protection block's dead pair positions (25, 50).

- Use the blue labels to identify user lines (POTS/xDSL).
- If applicable, use the green labels to identify PSTN overlay lines.

7. Repeat Steps 1–6 to install additional protection blocks for lines served (adjacent to the first), as needed.

Refer to *Copper Access Cable Connections* (on page 200) for equipment-side and subscriber-side cable connection assignments for E7-2 and B6-001 DSL cabinet configurations.

TE LSA-Plus Cross-Connect System

This section describes how to install a standard 2:1 TE LSA-Plus cross connect system into an EXM (768 subscriber/384 equipment pairs). To allow for incremental growth, the cross-connect system is comprised of two modular panels, each supporting 384 subscriber and 192 equipment pairs, arranged in 50-block pairs.

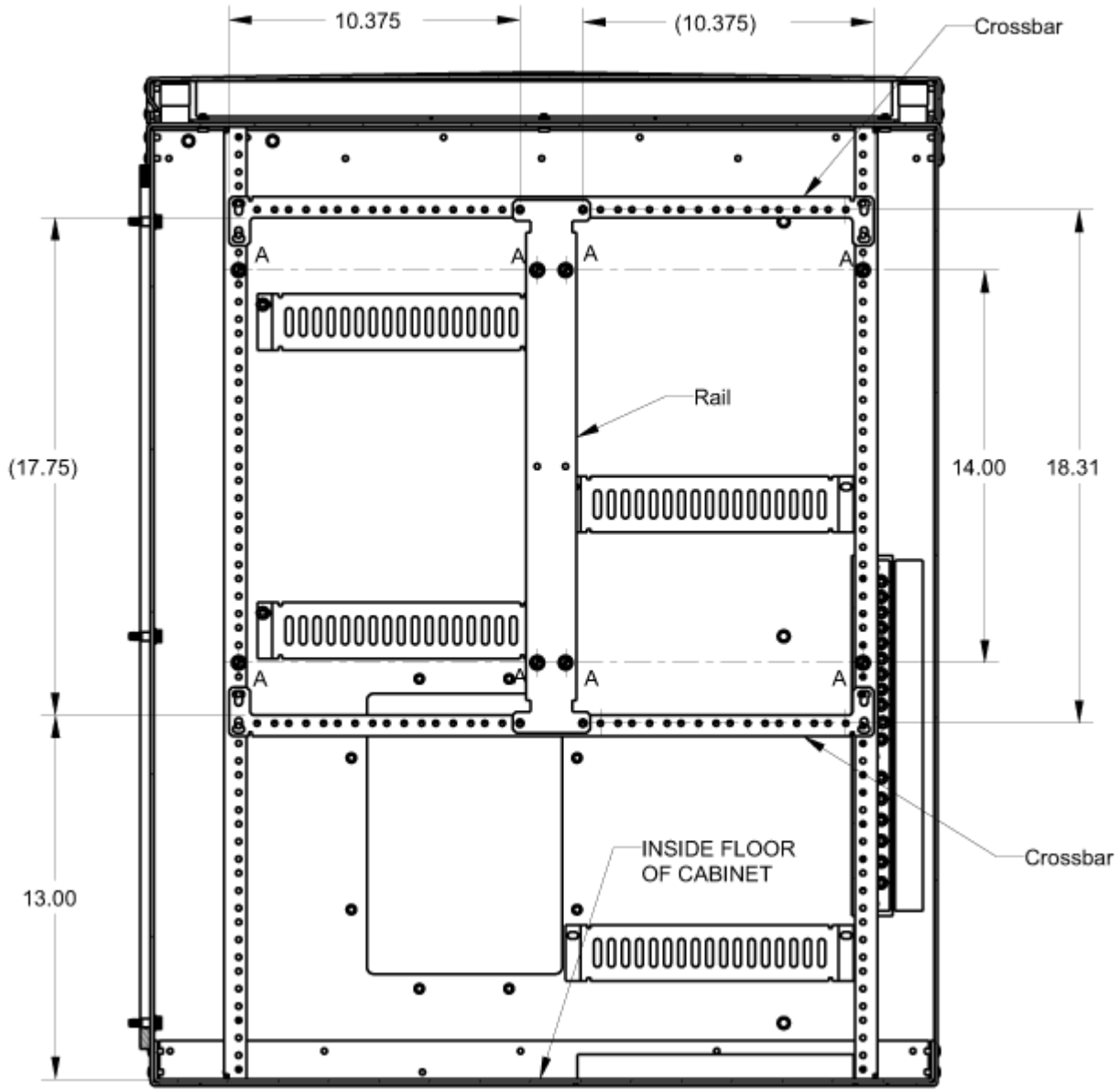
Note: All Clearfield equipment uses a 'dead pair' scheme, where the 25th pair in each 25-pair cable group is unterminated and not used (dead).

For cabinets already in service, installing a cross-connect panel will affect service to subscribers, because the cross-connect panel sits inline between the cabinet's copper line protection and the OSP ('subscriber' side) cables. Clearfield recommends performing the installation during a maintenance window to minimize the service impact.

CAUTION! Installing a cross-connect panel requires safe handling to ensure that no injury to personnel or damage to equipment occurs.

To install a cross-connect mounting frame

1. Unpack the cross-connect mounting frame from the shipping package, and open the EXM door.
2. Install the (2) crossbars on the equipment rack as follows:
   a. Orient a crossbar horizontally between the equipment rails as shown in the diagram below, 13-inches from the bottom of the cabinet.
   b. Secure the lower crossbar to the equipment rack using (4) self-tapping screws.
   c. Orient a crossbar horizontally between the equipment rails, measuring 17.75-inches from the inside of the lower crossbar to the inside of the upper crossbar.
   d. Secure the upper crossbar to the equipment rack using (4) self-tapping screws.
3. Install the rail on the crossbars as follows:
   a. Center the rail vertically between the crossbars.
   b. Secure the rail to the crossbars using (4) self-tapping screws.

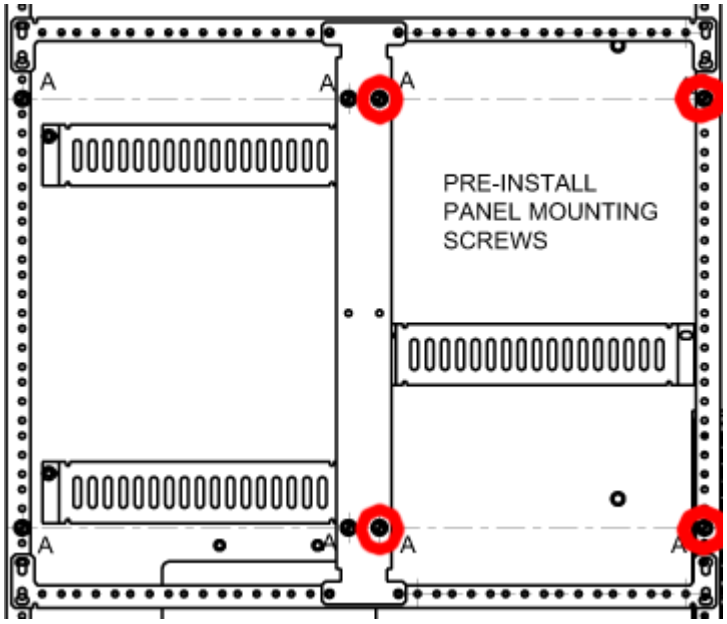


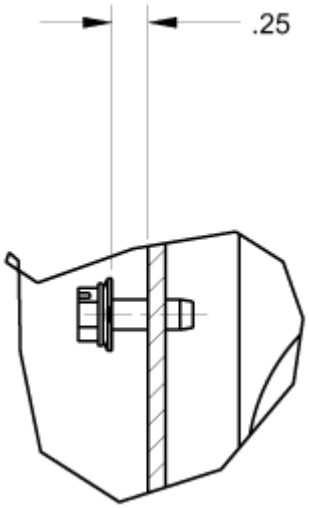
To install a cross-connect panel

1. Unpack the cross-connect panel from the shipping package, and open the EXM door.
2. Mount the test tool holder on the (4) studs located on the interior door, and secure using (4) Keps nuts.

   Note: One test tool holder ships with each cross-connect panel; only one test tool holder is required per enclosure.

3. At the right side of the cross-connect frame, partially insert (4) self-tapping screws, leaving a .25-inch gap between the frame and screw as shown in the diagrams below.



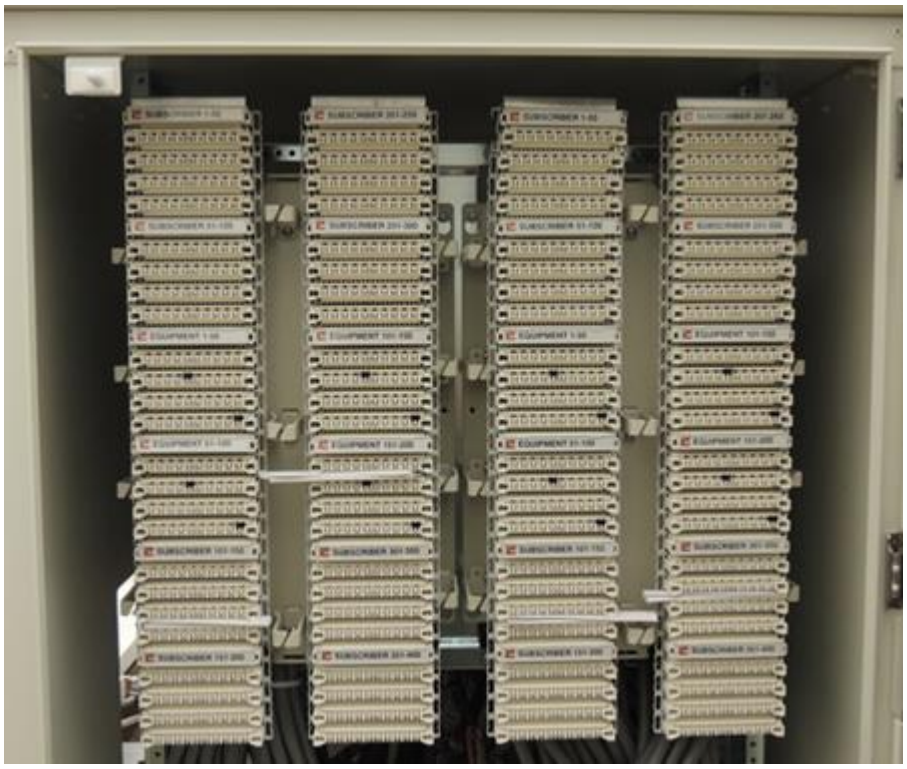


4. Place the pad from the shipping package at the base of the enclosure under the cross-connect frame on the right side.
5. Prepare the cross-connect panel for installation as follows:
   a. Separate the subscriber cables and the equipment cables. (The cables are labeled 'Subscriber' and 'Equipment.')

   Note: To ease installation, it may be advantageous to remove some of the cable bundle tie wraps in some applications.

   b. Orient the panel face down with the bottom of the panel toward the rear of the enclosure, and then route the cables under the cross-connect frame.
   c. Lay the cross-connect panel on the pad.
6. Terminate the cables as follows:
   a. Mate the equipment-side cables to the appropriate protection panel interface cables (MS^2 connectors), toward the left access panel.
   b. Mate the subscriber-side cables (193-384) to the appropriate OSP interface cables (MS^2 or 710 connectors), toward the rear access panel.
7. Dress and secure all cables with tie wraps against the rear wall.
8. Install the cross-connect panel as follows:
   a. Lift the panel up toward the frame, and slide the panel keyholes over the (4) screws that were pre-installed in step 3.
   b. Use a long extension power drill to tighten the screws.
9. Remove the pad from the base of the enclosure.

10. Repeat steps 2–8 to install a second cross-connect panel, adjusting the steps as necessary to install a panel for subscribers 1-192 on the right side of the cross-connect frame.

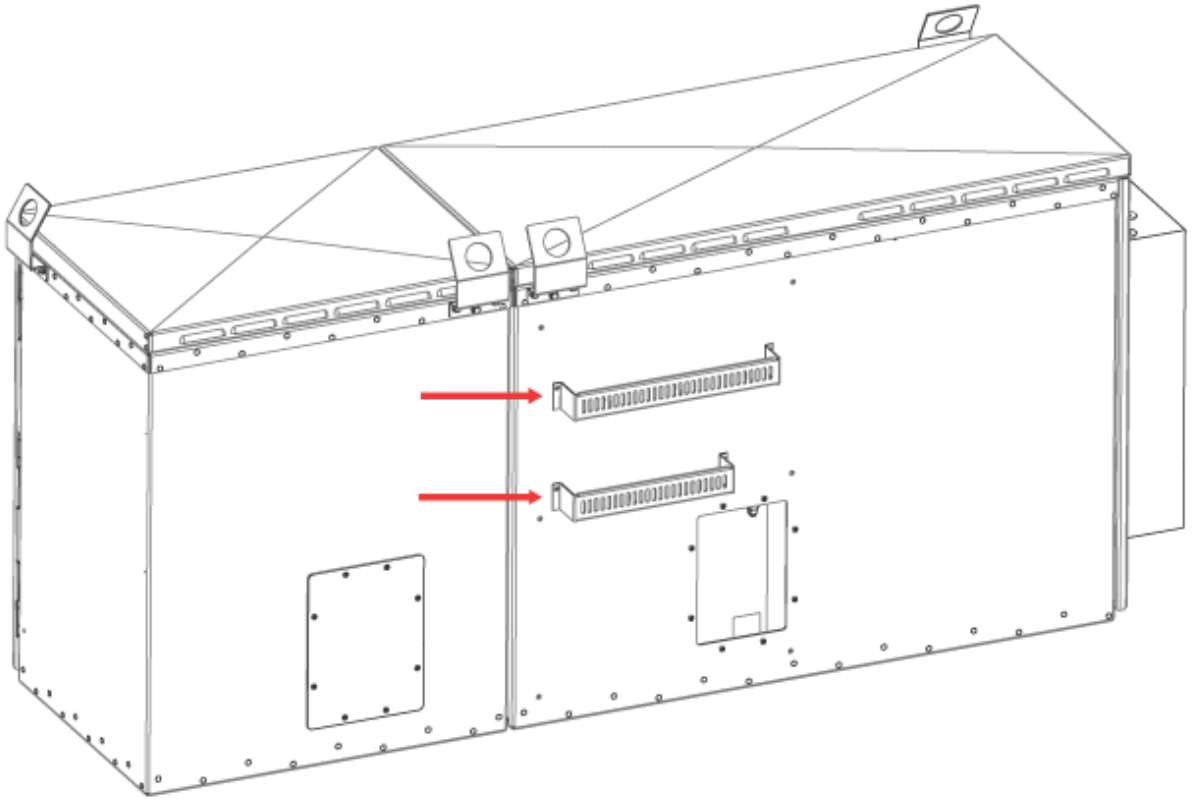


Installing an External Splice Compartment

Complete the steps below to install an external splice compartment on the ODC-200 cabinet.

To install an external splice compartment

1. From outside the ODC-200 cabinet, use a 5/32 hex security driver to remove the eight tamper resistant screws anchoring the rear access panel to the rear wall, and set the panel aside.
2. Install the cable dressing brackets as follows:
   a. Position the short cable dressing bracket horizontally against the rear of the cabinet as shown below, aligning the (2) bracket holes with the counterpart holes in the cabinet.
   b. Install two 10-32 x 3/8 inch Phillips screws (1 per side) to secure the cable dressing bracket in place.
   c. Repeat steps 2a–2b to install the long cable dressing bracket.



3. Route the cables and splices from the main equipment compartment through the rear access hole to the cable dressing bars.

4. Orient the splices upward so that any condensation accumulated on the cables flow downward away from splices, and then tie wrap the splices to the inside and/or outside of the cable dressing bars using the slots provided in bars.

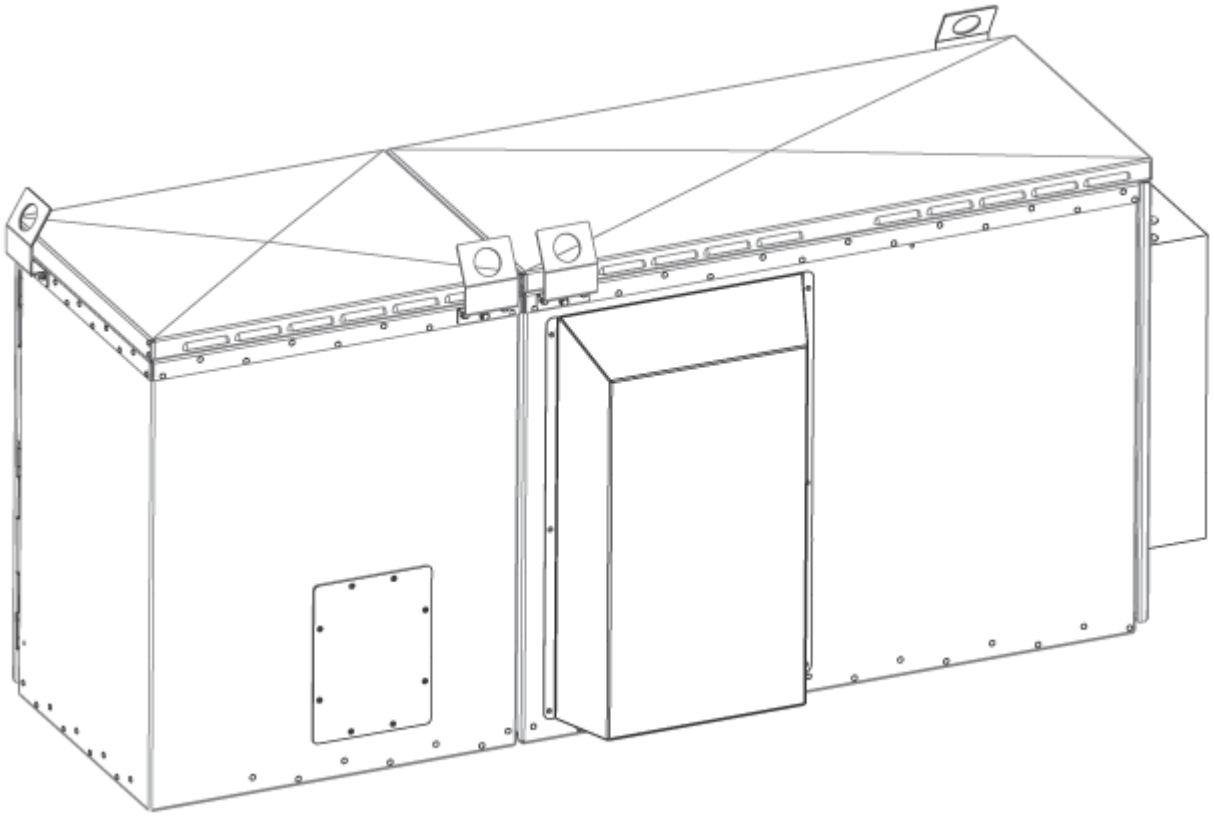
   Note: Clearfield recommends that you cover the splices with plastic bags and secure the bags with tie wraps.

5. Install the splice compartment as follows:

   a. Check the cabinet surface and gasket on the splice compartment for any debris which might prevent a water tight seal of the compartment.

   b. Position the splice compartment against the rear of the cabinet as shown below, aligning the (6) compartment holes with the counterpart holes in the cabinet.

   c. Install six 1/4-20 x 5/8 inch shoulder screws (3 per side) to secure the compartment in place.



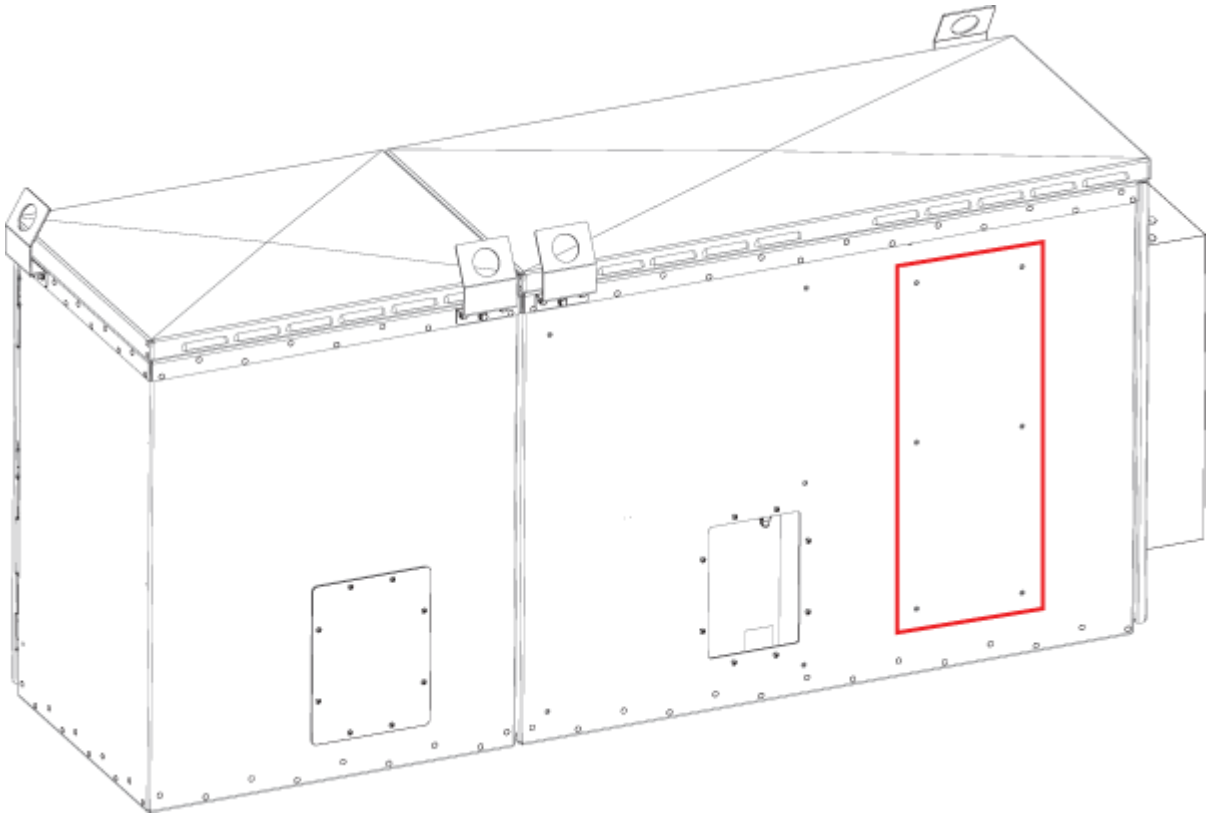
Installing an AC Meter

You can secure a commercial AC power meter and main disconnect boxes to customer-supplied Unistrut® metal framing installed on the exterior of the cabinet. Use the (6) mounting studs located on the left side wall (to the right of the access panel) to install the Unistrut.

For AC wiring information, refer to the AC wiring diagram on the inside cabinet wall.

DANGER! High voltage may be present. Only a qualified electrician should install an AC meter. Follow NEC and local codes when handling power systems.

The figure below shows the mounting location for the Unistrut metal framing:



Installing a Battery Enclosure

Clearfield supports field installation of a primary or secondary internal battery enclosure in the ODC-200 cabinet, EXM or ODC-200 cabinet battery riser. Battery enclosures are available for 100Ah VRLA or Ni-Cd battery strings.

To install a battery enclosure

1. Unpack the battery enclosure from the shipping packaging, and open the side ODC-200 cabinet or front door of the ODC-200 cabinet battery riser or the EXM.
2. Place the battery enclosure in base of the ODC-200, battery riser or EXM, aligning the mounting bracket holes against the counterpart holes on the equipment rack.
3. Install the eight mounting screws (4 per side) to secure the enclosure to the rack. Tighten the screws to 45 in. lbs. of torque (enclosure for VRLA battery string shown below).

4. Ensure that the front bottom edge of the enclosure is up against the inside lip of the door jam. If not, loosen the screws that mount the rails to the top and bottom of the ODC-200 or EXM, pull the battery enclosure forward, and then re-tighten the screws.
5. Close the door and check to be sure that the battery housing properly seals against the door gasket. For the ODC-200, this can be viewed through the front equipment compartment; for the EXM, this can be viewed through the rear access panel using a flashlight.

Installing a Battery Heater

For colder climates, Clearfield recommends using an optional battery heater to prevent VRLA batteries from freezing and to prolong battery life. A battery heater supports one VRLA battery string. Ni-Cd battery strings do not require a battery heater.

The battery heater is controlled by a thermostat set for the following operation:

- **4° C** – Battery heater turns On.
- **16° C** – Battery heater turns Off.

Note: The battery heater sits directly underneath the battery string. You must install the heater into the battery enclosure before installing batteries.

To install a battery heater in an ODC-200 battery enclosure

1. Unpack the battery heater from the shipping packaging.
2. Open the side cabinet door.
3. Install the mounting bracket for the battery heater jumper cable as follows:
   a. Position the bracket against the left equipment rack, aligning the bottom bracket hole with the counterpart hole on the rack immediately above the internal battery enclosure.
   b. Install (2) mounting screws to secure the bracket to the rack.
4. Remove the seismic retaining bracket from the battery enclosure as follows:
   a. Remove the (2) hex head screws and washers from each side of the retaining bracket.
   b. Rotate the retaining bracket forward, and lift the bracket from the groove at the base of the battery enclosure.
5. Install the battery heater into the battery tray in the internal battery enclosure as follows:
   a. Orient the battery heater with the heating element and alignment tabs on the bottom (face down) and the power and ground wires on the left side.
   b. Route the heater power and ground wires through the left rear hole of the battery enclosure.
   c. Place the heater into the battery tray, aligning the heater tabs into the slots in the tray.
6. Connect the heater power and ground wires as follows:
   a. Route the ground and power wires from the rear of the battery enclosure to the mounting bracket installed in step 3.
   b. Attach the ground wire to the mounting stud located on the bracket using the supplied Keps nuts and star washers.

c. Snap the power cord face-up into it's cutout in the mounting bracket installed in step 3.

7. (AC load center) Install the battery heater jumper cable as follows:

a. Snap the jumper cable's power connector face down into it's cutout in the mounting bracket installed in step 3.

b. Route the jumper cable to the rear of the AC load center and feed it through the cord grip in the AC input hole.

c. Attach the supplied fast-on lug to the stripped end of the black wire, and then connect the terminated black wire to the load terminal of the 5A Battery Heater breaker.

d. Connect the white lead to the Batt Htr position on the panel board Neutral bar.

Note: An AC wiring label is attached behind the load center front panel for reference.

e. Tighten the cord grip around the jumper cable at the rear of the load center.

8. (AC junction box) Install the battery heater jumper cable as follows:

a. Snap the jumper cable's power connector face down into it's cutout in the mounting bracket installed in step 3.

b. Route the jumper cable to the rear of the AC junction box and feed it through.

c. Connect the L1 (black) and N (white) leads to the (Optional) Battery Heater terminal block position.

Note: An AC wiring label is attached behind the junction box front panel for reference.

d. Tighten the cord grip around the jumper cable at the rear of the junction box.

9. After the batteries are installed, apply power as follows:

Note: For battery installation instructions, see *Installing Batteries* (on page 123).

a. At the AC load center, switch **ON** the 5A Battery Heater breaker, *or*

b. Switch on the 5A Battery Heater breaker at the external power source that feeds the AC junction box.

To install a second battery heater in an EXM battery enclosure

Note: This procedure assumes that you have installed a battery heater in the ODC-200 battery enclosure.

1. Unpack the battery heater from the shipping packaging.

2. Open the EXM door.

3. Install the mounting bracket for the battery heater jumper cable as follows:

a. Position the bracket against the equipment rack, aligning the bottom bracket hole with the counterpart hole on the rack immediately above the internal battery enclosure.

b. Install (2) mounting screws to secure the bracket to the rack.

4. Install the second string battery heater jumper cable as follows:

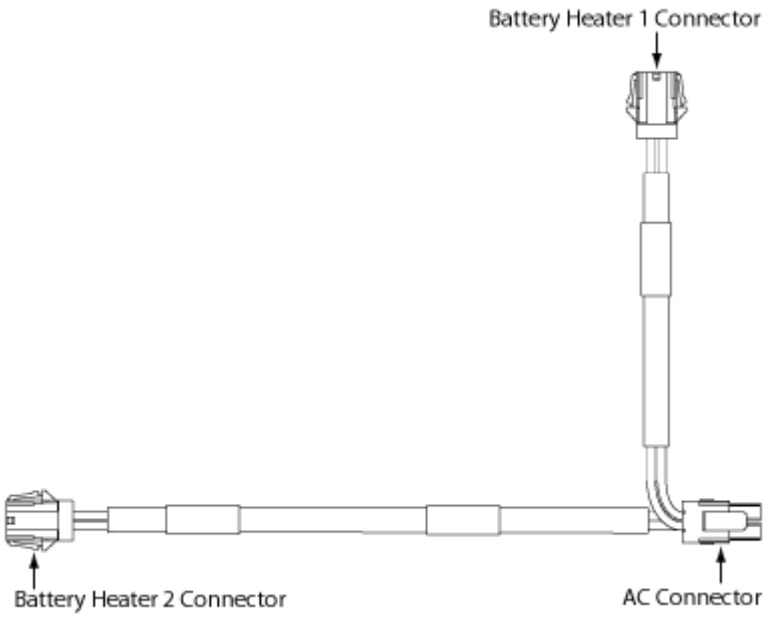
a. Locate the battery heater power cable installed in the primary ODC-200 battery enclosure.

b. Disconnect the primary battery heater power cable connector from the panel mounted connector located on the mounting bracket above the ODC-200 battery enclosure.

c. Connect the AC connector on the second string jumper cable to the face down panel mounted connector from the AC load center (or AC junction box) located on the mounting bracket above the ODC-200 battery enclosure.

d. Connect the second string jumper cable's battery heater 1 connector to the primary battery heater power cable connector that you disconnected in step 4b.

e. Route the second string jumper cable's battery heater 2 connector branch into the EXM and snap it face down into it's cutout located on the mounting bracket above the EXM battery enclosure.



5. Remove the seismic retaining bracket from the EXM battery enclosure as follows:

a. Remove the (2) hex head screws and washers from each side of the retaining bracket.

b. Rotate the retaining bracket forward, and lift the bracket from the groove at the base of the battery enclosure.

6. Install the battery heater into the battery tray in the internal battery enclosure as follows:

a. Orient the battery heater with the heating element on the bottom (face down) and the power and ground wires on the left side.

b. Route the heater power and ground wires through the left rear hole of the battery enclosure.

c. Drop the heater into place over the plastic insulator.

7. Connect the heater power and ground wires as follows:

a. Route the ground and power wires from the rear of the battery enclosure to the mounting bracket installed in step 3.

b. Attach the ground wire to the mounting stud located on the bracket using the supplied Keps nuts and star washers.

c. Snap the power cord face-up into it's cutout in the mounting bracket installed in step 3.

8. After the batteries are installed, apply power as follows:

Note: For battery installation instructions, see *Installing Batteries* (on page 123).

a. At the AC load center, switch **ON** the 5A Battery Heater breaker, *or*

b. Switch on the 5A Battery Heater breaker at the external power source that feeds the AC junction box.

Installing a Power Buffer Capacitor

Complete the steps below to mount the pre-wired power buffer(s) chassis into a remote powered ODC-200 cabinet.

To mount the power buffer chassis into an ODC-200 cabinet

1. Get (2) mounting brackets, (6) flat head screws, and (4) self-tapping screws from the installation kit.
2. Attach the mounting brackets to each side of the power buffer chassis using (3) flat head screws per bracket, as shown.

3. Open the front cabinet door and verify that a left side 1RU position on the equipment rack is available for installation of the buffer chassis.
4. Install the buffer chassis into the equipment rack as follows:
   a. Orient the buffer chassis vertically, with its left side up and right side down (as viewed from front).
   b. Feed the ground and power cables through the equipment rack on the far left side.
   c. Position the buffer chassis against the rack on the left side. Align the mounting ear holes with the counterpart holes on the rack.

d. Install (4) self-tapping screws (2 per side) to secure the chassis to the mounting rack.

5. Route the buffer chassis ground cable to the cabinet's main ground bar and terminate per PANI guidelines. Refer to *Installing the Cabinet and EXM Ground Connections* (on page 94) for detailed information.

6. Route the buffer chassis power cable to the DC distribution panel, and connect to the **Power Buffer 1** connector on the front of the panel, as shown.

Installing a Generator Connector

A generator connector allows an external power generator to be connected to the cabinet to sustain services during an AC power outage. The cabinet supports a 30 Amp generator connector option, which you can install in the field. If the cabinet is equipped with charged batteries, this procedure does not affect service.

Note: Clearfield recommends a generator size of 240 VAC.

DANGER! High voltage may be present. Only a qualified electrician should perform this task. Follow NEC and local codes when handling power systems. Do not restore AC power until the task is complete.

To prepare for generator connector installation

1. At the local power transfer switch, disconnect AC power to the cabinet.

   Note: If the cabinet is equipped with charged batteries, this action does not affect service. The equipment automatically switches to battery reserve power.

2. Open the front cabinet door.
3. Install a circuit breaker for the Gen Conn circuit into the load center as follows:
   a. Remove the right panel from the AC load center.
   b. At the AC load center, switch the Gen Conn (if present) and Main circuit breakers to **OFF**.
   c. Install the Gen Conn circuit breaker:
      - Get the Gen Conn breaker from the shipping package.
      - Set the switch to **OFF**.
      - Insert the breaker to the right of the Main breaker.
      - Install the supplied interlock between the Gen Conn and Main breakers (DO NOT use generator input without this interlock).
4. Remove the blank plate that covers the mounting fixture as follows:
   a. At the exterior side of the cabinet, use a tool for tamper-resistant fasteners to remove the (4) security screws anchoring the blank plate to the cabinet wall.

   Note: Do not discard the four mounting screws. The screws will be reused to install the generator connector.

   b. Pull the blank plate away from the cabinet wall to expose the connector mounting fixture.

To install a generator connector into an ODC-200 cabinet

1. Unpack the generator connector from its shipping packaging.
2. Attach the generator connector to the cabinet mounting fixture as follows:
   a. From the exterior side of the cabinet, feed the generator connector wires into the cabinet through the mounting fixture opening.
   b. Insert the generator connector into the mounting fixture, aligning the mounting holes with the counterpart holes in the fixture.
   c. Install the (4) tamper-resistant screws removed previously to attach the generator connector.
3. Connect the generator connector wires to the AC load center as follows:
   a. Route the generator connector wires through the access hole in the right side of the AC load center.
   b. Terminate the generator connector wires to the load center as follows:
      - Connect the green wire to the ground bar.
      - Connect the white wire to the neutral bar.
      - Connect the black and red wires to the Gen. Conn. breaker.

Note: Refer to the *AC load center wiring diagram* (on page 210) for guidance. An AC wiring label is attached behind the load center front panel for reference.

4. Replace the AC load center cover panel.
5. Install the Gen Conn ID label on the cover panel directly under the Gen Conn 30 Amp breaker.

6. At the AC load center, switch all breakers to **ON**.
7. At the local power transfer switch, restore AC power to the cabinet.

Installing a Heat Exchanger Door

The ODC-200 front door is equipped with an integrated heat exchanger to cool equipment inside the cabinet. Installing a heat exchanger door in the field may become necessary if the existing door becomes damaged or the heat exchanger fails or becomes damaged.

To install a heat exchanger door on an ODC-200 cabinet

1. Remove the existing door that is to be replaced. See *Removing a Cabinet Door* (on page 189) for instructions.
2. Install the new heat exchanger door on the vacant door frame. See for *Installing a Cabinet Door* (on page 190) instructions.

Installing Fiber Management Options

Clearfield ODC-200 cabinet supports GPON and AE fiber management options supporting up to 384 subscriber fiber drops with an internal battery enclosure installed, or up to 576 subscriber fiber drops for GPON applications without internal battery enclosure installed. The EXM supports equal fiber distribution configurations.

Fiber management solutions include:

- 96- and 192-position fiber distribution frames, each supporting two 48-fiber or two 96-fiber termination assemblies respectively (with pre-terminated, 100-foot OSP fiber cable) for high density point-to-point Ethernet and GPON applications
- Up to eighteen integrated 1:2, 1:16 or 1:32 PON splitters (and integrated cage) for GPON applications
- 12-, 24-, 48- or 96-position fiber splice and distribution panels (19-inch mount)
- 6- and 12-position dual LGX fiber distribution panel (19- or 23-inch mount)
- Fiber management accessories (fiber dressing spools and comb)

The fiber termination assemblies are offered as field installed options only. Fiber distribution frames and fiber management accessories are offered as factory integrated and field installed options. You can order and install individual components to scale support as required. Additionally, the field installable EXM provides the ability to grow the ODC-200 cabinet to support rack space for additional fiber distribution endpoints or migration of copper loops to fiber drops (shown below).

Installing an LGX Case Fiber Distribution Panel

This topic describes how to install a 19-inch 1RU fiber distribution panel, housing up to two Light Guide Cross Connect (LGX) cases. Connect transport fibers from the LGX fiber distribution panel to the Clearfield service unit. Refer to *Connecting Fibers to the Equipment* (on page 108) for more information.

The fiber distribution panel supports the following user-installed LGX cases:

- **Plastic LGX cases:** 6-position (SC or LC connector options) or 12-position (LC connectors) Clearfield Clearview xPAK fiber assemblies supporting a fiber patch cord within the case or spliced to a pre-terminated 100-foot OSP fiber cable. For installation instructions, see the *Clearfield Clearview xPAK Installation Note (LGX option)*.
- **Metal LGX cases:** 6-position (SC or LC connector options) or 12-position (LC connectors) Clearview assemblies with pre-terminated 100-foot OSP fiber cable.

To install a dual LGX fiber distribution panel into an ODC-200 cabinet

1. Unpack the fiber distribution panel from the shipping packaging.
2. Mount the LGX case(s) in the fiber distribution panel as follows:
   a. Feed the fiber pigtail on the back of the LGX case through the front of the panel, if present.
   b. Slide the LGX case into the front of the panel.
   c. Align the captive screws or rivets on the LGX case with the holes on the panel, and tighten to secure the case in place.
3. Install the fiber distribution panel from the rear of the equipment rack as follows:
   a. Open the cabinet's side door.
   b. Orient the panel vertically, and insert the panel top end first, through the space on the right end of the equipment rack **on the outside**.
   c. Align the mounting holes with the counterpart holes on the rack.

d. While holding the panel against the rack, install four mounting screws (2 per side) using a short Phillips screwdriver to secure the panel to the rack.

Chapter 9

Cabinet Maintenance

This chapter describes how to perform cabinet maintenance, including routine maintenance and corrective maintenance to replace worn or failed parts and equipment.

Topics Covered

This chapter covers the following topics:

- Routine cabinet maintenance
- Replacing parts and equipment

Routine Maintenance

This section describes how to perform routine maintenance on the cabinet.

Checking Cabinet Surfaces

Clean and inspect the cabinet for contaminants, damage, and wear once a year. Items to check include the following:

Inspect interior surfaces

Items to check inside the cabinet include the following:

- Inspect the interior of the cabinet for signs of visible damage to the metal or paint.
- Note any damage to the metal work. If the damaged area interferes with operation of the cabinet or electronics, contact Clearfield support for assistance with a resolution.
- Repair damage to the paint using touch-up paint available from Clearfield after cleaning the surface and removing rust.
- Inspect all gaskets around the doors and the roof to ensure a tight secure fit.

Inspect exterior surfaces

Items to check outside the cabinet include the following:

- Inspect the exterior of the cabinet for signs of damage to the metal work or paint.
- Repair damage to the paint using approved type touch-up paint after cleaning the surface and removing rust.
- Note damage to the metal work. If the damaged area interferes with operation of the cabinet or electronics, contact Clearfield support for assistance with a resolution.
- Clean all surfaces so that they are free of dirt, dust, and foreign material.
- Remove all material from air intake screens and louvers (i.e. spider webs, leaves, etc.).
- Clean the air vents on the heat exchangers and the battery compartment with a dry, soft brush to ensure optimal airflow.

Checking Electrical Components

Check all electrical components in the cabinet for wear at least once a year.

In cabinets configured for local power, inspections include:

- Check the circuit breakers on the AC load center or junction box. Verify that all breakers are in the **ON** position.
- Check the AC surge arrestor on the AC load center or junction box. Verify that the operational indicators are lit.

- Check the GFCI convenience outlet. Test the outlet per local code.
- Check the controller module on the rectifier shelf. Verify that the controller is operational.
- Check the rectifier modules in the shelf. Verify that the modules are operational.
- Check the fuses on the rectifier shelf. Verify that no fuses are blown.
- Check the heat exchanger. Verify that the air intake locations are unobstructed and that the fans are running.

In cabinets configured for remote power, inspections include:

- Check the line power protection block. Verify that no 5-pin protection modules are blown.
- Check the converter modules in the CPS2500D converter shelf. Verify that the IN and OUT operational indicators are lit on each module.
- Check the fuses on the distribution panel. Verify that no fuses are blown.
- Check the heat exchanger. Verify that the air intake locations are unobstructed and that the fans are running.
- Check the converter shelf fan tray to verify that the fans are running.

If any of the inspected items requires replacement due to failure or damage, replace the item as described in *Replacing Parts and Equipment* (on page 189).

Checking Cable Connections

Check external cable connections at least once a year. External cables are any cable that enters the cabinet from the outside plant.

- Visually inspect all cables for signs of physical damage. If damage is present, cables should be repaired or replaced per local practice.
- Check all outside plant copper connections for complete and secure connection.
- Ensure that all cable management accessories provide a clean appearance. Replace any fastening devices (i.e. cable ties) so that they include all cables being secured.
- Check all fiber optic connectors to ensure that they are securely fastened.
- Check all connections on the cabinet ground bar for a tight and secure fit.
- Check all protector modules to ensure that all devices are securely seated.
- Check all conduits to ensure that any material used to seal between the cable and the conduit is still present and providing a complete seal.

Checking the Heat Exchanger

CAUTION! Always disconnect power to the heat exchanger prior to servicing.

Check the heat exchanger for proper functioning at least once a year.

- Verify that no fan failure ENV alarms are present on the Clearfield equipment.
- Verify fan operation, including visual inspection the following:
  - Verify that all fans are spinning with no obstructions or odd noises.
  - Verify that the heat exchanger is secured to the cabinet and all gasket material is intact and adhered to the cabinet door surface.

Check the heat exchanger for required cleaning based on the environmental conditions (typically once a year).

- Verify that no debris is blocking the inlet and outlet vent screens. Place a piece of paper against the inlet vent and verify that the paper is drawn in; place a piece of paper against the outlet vent and verify that the paper is blown out. Use a whisk broom or other device to clear the vents if debris is present.
- Use a soft bristle brush to remove dust or debris from the fans and heat exchanger core as needed.

  Note: If available, you may use low pressure compressed air (up to 30 PSI) in addition to, or in place of, a soft bristle brush. Compressed air should only be used with cabinet doors closed and only on the external sides of the heat exchanger core. Be sure to use appropriate eye protection.

- For more extensive cleaning, you can remove the exterior heat exchanger cover (by removing the two screws at base of the cover) and the individual cover plates behind the main cover.

Battery Maintenance

Perform routine inspection and maintenance of batteries to improve battery life. Follow the manufacturer's maintenance recommendations. Additional general maintenance guidelines are provided below.

Battery maintenance does not impact cabinet service, provided that an AC power failure does not occur during the maintenance process. Clearfield recommends connecting an external generator to the cabinet while performing battery maintenance to ensure service continuity in the event of an AC outage.

WARNING! Electrical hazard. Batteries contain a stored charge. Only a qualified technician should perform this procedure.

CAUTION! Electrical, chemical, fire, and heat hazard. Handle batteries with care to avoid personal injury or damage to the equipment.

ALERT! To ensure service continuity in the event of an AC outage, connect an external generator to the cabinet while performing battery maintenance.

To perform battery maintenance

1. Open the side cabinet door.
2. Open the latch on each side of the terminal cover and remove the cover.
3. Remove the seismic retaining bracket from the internal battery enclosure as follows:
   a. Remove the (2) hex head screws and washers from each side of the retaining bracket.
   b. Rotate the retaining bracket forward, and lift the bracket from the groove at the base of the battery enclosure.
4. Remove the batteries from the battery enclosure:
   a. Disconnect the battery power cables from the power supply leads.
   b. Remove the red and black battery power cables from the terminals at each end of the string.
   c. Remove the jumper straps from between the terminals of batteries in the string.
   d. Slide the batteries out of the battery enclosure.
5. Visually inspect each battery for defects such as:
   - Fractured housing or other physical damage
   - Leakage
   - Bulging

   Note: Replace any battery that displays a defect. See *Replacing Batteries* (on page 194) for instructions.
6. Perform the following maintenance tasks:
   a. Load test each battery to verify that ample current is available to maintain the system.
   b. Ensure that each battery provides 13.5 VDC (plus or minus .2 VDC).
   c. Clean each battery to remove dust, dirt, or corrosion from the battery surface.

   Note: Only use water for cleaning the battery surface. Do not use any chemicals.

d. Clean the battery terminals and apply No-Ox anti-corrosion grease to each.

e. Record the inspection and maintenance details in the cabinet records per local practice.

7. Inspect the battery housing for any signs of damage. Clean the enclosure and fix any damage to painted areas by removing all rust and dirt from the affected area, and then applying touch-up paint to the area to prevent future corrosion.

8. Re-install the batteries into the battery enclosure. See *Installing Batteries* (on page 123) for instructions.

9. Inspect the battery vent on the side cabinet door, and clear any debris from the vent to ensure adequate ventilation for the batteries.

Replacing Parts and Equipment

This section describes how to replace worn or failed parts and equipment in the cabinet.

Removing a Cabinet Door

You can remove the cabinet doors for convenience during cabinet installation or maintenance activities, or to replace a door.

Replacing a cabinet door may become necessary if:

- A door becomes damaged.
- The heat exchanger fails or becomes damaged.

You can replace cabinet doors in the field without impacting service.

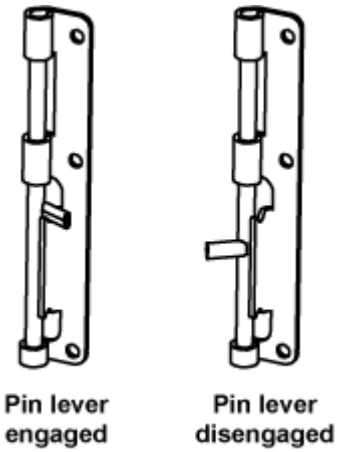
CAUTION! Handle detached cabinet doors with care to avoid personal injury or damage to the door.

To remove a cabinet door

1. For a door (equipped with a heat exchanger), disconnect the heat exchanger cable.
2. Disconnect the ground strap from the door by removing the hex nut. Save the nut to re-attach the strap to the new door.
3. Disconnect the wind brace bracket from the door:
   a. Remove the three nuts securing the wind brace bracket to the door. Save the nuts to re-attach the bracket to the new door.
   b. Detach the wind brace bracket from the three studs on the door.

4. On the door hinges, disengage the hinge pin lever from its cradle:
   a. **Top hinge:** Lift the pin lever up and rotate it away from the cradle.

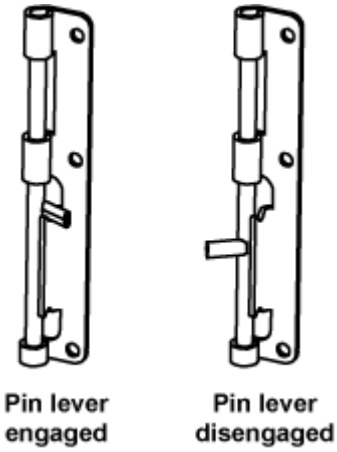
b. **Bottom hinge:** Press the pin lever down and rotate it away from the cradle.



5. Release the hinge pins from the hinge pin channels as follows:
   a. **Top hinge:** Press down on the pin lever until the pin slides free from the channel.
   b. **Bottom hinge:** Lift up on the pin lever until the pin slides free from the channel.
6. Lift the door away from the cabinet.

Installing a Cabinet Door

1. Unpack the new door from its shipping packaging.
2. Remove the pins from the new door's hinges:
   a. **Top hinge:** Lift the pin lever up and rotate it away from the cradle. Press down on the pin lever until the pin slides free from the channel.
   b. **Bottom hinge:** Press the pin lever down and rotate it away from the cradle. Lift up on the pin lever until the pin slides free from the channel.



3. Insert the new door into the vacant door frame. Align the door hinge knuckles with the counterpart hinge knuckles on the door frame.

4. Engage the hinge pins to secure the door in place as follows:
   a. **Top hinge:** Lift up on the pin lever until the pin slides completely into the pin channel.
   b. **Bottom hinge:** Press down on the pin lever until the pin slides completely into the pin channel.
   c. Rotate the pin levers into the cradles to secure the hinges.
5. Attach the wind brace to the bracket inside the door frame using the nut, bolt, and washer removed from the previous door.
6. Attach the ground strap to the door using the hex nut removed from the previous door.
7. For a heat exchanger door, connect the heat exchanger power & alarm cable to the cabinet wiring harness.

Replacing AC Breakers

On cabinets configured for local power, if a circuit breaker in the AC load center fails or becomes damaged, you can replace the breaker in the field as described below. If the cabinet is equipped with charged batteries, this procedure does not affect service.

DANGER! High voltage may be present. Only a qualified electrician should perform this task. Follow NEC and local codes when handling power systems. Do not restore AC power until the task is complete.

To replace an AC circuit breaker

1. At the local power transfer switch, disconnect AC power to the cabinet.

   Note: If the cabinet is equipped with charged batteries, this action does not affect service. The equipment automatically switches to battery reserve power.

2. At the AC load center, switch the Main circuit breaker to **OFF**.
3. Remove the cover panel from the AC load center.
4. Remove any wires from the defective circuit breaker.
5. Remove the defective breaker from the load center and replace it with a new breaker of the same type and rating.
6. Reconnect all wiring to the new circuit breaker.
7. Replace the AC load center cover panel.
8. At the AC load center, switch all breakers to **ON**.
9. At the local power transfer switch, restore AC power to the cabinet.

Replacing Fuses

If a fuse fails or becomes damaged, you can replace the fuse in the field as described below.

Replacing Fuses

Fuses protect the power circuits for the Clearfield service units and heat exchanger. The fuses are located inside the rectifier fuse panel.

Circuit Type	Fuse Rating	Fuse Type
Calix E7-2	7.5 Amp	GMT
Calix B6-001	7.5 Amp	GMT
Heat exchanger	2 Amp	GMT
Fan tray (for converter shelf)*	1 Amp	GMT

* Remote power configurations only.

To replace a fuse

1. At the rectifier shelf, open the fuse panel door and identify the defective fuse.
2. Remove the defective fuse from the fuse panel position.
3. Replace the fuse with a fuse of the same rating and type.

If the fuse fails again do not replace it. Troubleshoot to find the cause of the failure.

Replacing Rectifier Modules

If an Alpha Cordex HP 1.2kW rectifier module experiences a failure in the field, you can replace the module(s) in the field. Modules are hot-swappable and can be replaced without disconnecting power to the Alpha shelf.

To replace a rectifier module

The rectifier is plug and play. When a rectifier module is added to the system, the Controller will detect and update the inventory automatically. However, replacing an installed rectifier requires a manual Inventory Update at the controller to clear the removed rectifier from its current list of rectifiers.

1. To remove a module, push up on the locking clip release and slide the module out of the shelf.

2. At the controller web interface initiate an Inventory Update: **Main Menu > Rectifiers > Inventory Update**.
3. Place the new rectifier module on the shelf bottom and slide the module into the rear connector (inside the shelf).
4. Apply pressure to the module front panel to engage the rear connector in the shelf receptacle.
5. The locking clip automatically secures the rectifier to the shelf.

Replacing Converter Modules

On cabinets configured for remote power, if a converter module experiences a failure, you can replace the module in the field. Converter modules are hot-swappable and can be replaced without disconnecting power to the CPS2500D converter shelf.

To replace a converter module

1. Remove an installed converter module as follows:
   a. Grasp the converter module face plate by the left edge and pull it forward to unseat the module.

b. Slide the converter module out of its slot. Set the module aside.

2. Install a new converter module as follows:
   a. Insert the new converter module into the vacated slot, aligning the right-side plastic edge in the notch at the top right edge of the slot.
   b. Slide the converter module into the slot until it is fully seated.
   c. Push the face plate in until the latch on the top catches.
3. Repeat Steps 1 and 2 to replace additional converter modules.

Note: For detailed instructions, see the GE CPS2500D +/-190V Downstream System product manual.

Replacing Batteries

If a single battery or string of batteries fails, becomes damaged, or wears out its life, you can replace the battery or string as described below. Replacing batteries does not impact cabinet service, provided that an AC power failure does not occur during the replacement process. Clearfield recommends connecting an external generator to the cabinet while performing battery maintenance to ensure service continuity in the event of an AC outage.

WARNING! Electrical hazard. Batteries contain a stored charge. Only a qualified technician should perform this procedure.

CAUTION! Electrical, chemical, fire, and heat hazard. Handle batteries with care to avoid personal injury or damage to the equipment.

ALERT! To ensure service continuity in the event of an AC outage, connect an external generator to the cabinet while performing battery maintenance.

To replace batteries

1. Open the side ODC-200 cabinet or EXM front door.
2. Open the latch on each side of the terminal cover and remove the cover.
3. Remove the seismic retaining bracket from the internal battery enclosure as follows:
   a. Remove the (2) hex head screws and washers from each side of the retaining bracket.
   b. Rotate the retaining bracket forward, and lift the bracket from the groove at the base of the battery enclosure.
4. Remove the old batteries:
   a. Disconnect the #8 AWG battery power cables from the power supply leads.
   b. Remove the red and black power cables from the battery string.

c. Remove the jumper straps from between the batteries.

d. Remove the temperature probe cable from the string's negative (-) terminal post.

e. Remove the batteries from the battery enclosure.

5. Install the new batteries into the battery enclosure. See *Installing Batteries* (on page 123) for instructions.

Replacing a Battery Heater

If an optional battery heater fails or becomes damaged, you can replace the heater in the field. Replacing a battery heater requires removing the batteries from the battery enclosure.

To replace a battery heater

1. Open the side cabinet door.
2. Remove the seismic retaining bracket from the internal battery enclosure as follows:
   a. Remove the (2) hex head screws and washers from each side of the retaining bracket.
   b. Rotate the retaining bracket forward, and lift the bracket from the groove at the base of the battery enclosure.
3. If batteries are present, remove the batteries from the battery enclosure. See *Replacing Batteries* (on page 194) for removal instructions.
4. Unplug the heater power cord from the AC outlet (located on the cabinet wall).
5. Remove the battery heater from the battery enclosure floor.
6. Install the new battery heater into the battery enclosure. Plug the power cord into the AC outlet. See *Installing a Battery Heater* (on page 168) for instructions.
7. Re-install and reconnect batteries. See *Installing Batteries* (on page 123) for instructions.

Appendix A

Reference Information

This appendix provides general reference information about the ODC-200 cabinet.

Topics Covered

This appendix covers the following topics:

- Cabinet specifications
- Support matrix for Clearfield service units
- Copper access cable connections for DSL cabinet configurations
- Environmental alarm mapping to the Calix E7-2 service unit
- Environmental alarm mapping to the Calix B6-001 service unit
- Alpha Cordex HP rectifier alarms and controller settings
- Emerson rectifier alarm matrix
- Emerson rectifier setpoints
- Supported batteries
- Wiring diagrams

Specifications

Specifications for the Clearfield ODC-200 cabinet follow:

Dimensions	
Base cabinet	36" H x 23" W x 48" D
Expansion Module (EXM)	36" H x 24" W x 29" D
Riser options (for base cabinet and/or EXM)	6" H or 12" H (riser only)
Weight	
Standard configuration (base cabinet with equipment shelves, protection blocks and frames, and an internal battery enclosure)	290 lbs
Expansion Module	50 lbs
Internal battery enclosure	25 lbs
Battery string (100Ah)	315 lbs
Enclosure Mounting	
Concrete pad	Clearfield cast-in-place template
Pre-cast concrete pad	Third-party supplied
Foundation vault	Third-party supplied
Wall/H-frame	Clearfield wall/H-frame mounting kit option
Equipment Mounting	
Equipment mounting space	19 inches (8RU); 8RU mounting space for Clearfield service units or third-party equipment
Rack attributes	19-inch EIA standard; oriented for vertical mounting
Access Equipment Configurations	
Calix E7-2, B6-001	Refer to planning guide for configurations
Environmental	
Heat exchanger	Door mounted Internal fan Tmin = 30C (50% RPM) and Thigh = 45C (100% RPM) External fan Tstop = 30C, Tmin = 40C (50% RPM) and Thigh = 55C (100% RPM)
Cooling capacity	47 Watts/°C
Thermal operating range	-40C to +46C
Environmental alarming	Environmental
Electrical (Local Power)	
AC load center	208-240 VAC load center Duplex convenience outlet (GFCI protected)
AC junction box (option)	120/240 VAC junction box (2 inputs/2 outputs) Duplex convenience outlet (GFCI protected)
Generator connector (option)	30 Amp NEMA twist-lock (Hubbell)
DC power system	Alpha non-LVD Cordex 1.2HP 1RU Shelf; (3) 1200W (25A) rectifier modules; fuse protected DC Distribution (28 position)
Battery backup	Support for (1) string of front post VRLA or Saft Tel100 Ni-Cd 100Ah batteries [up to (2) 100Ah strings with optional EXM]; battery heater option available for VRLA battery string
Electrical (Remote Power)	

DC power system	GE (Lineage Power) CPS2500D ± 190VDC to -48VDC converter shelf; up to (10) 65W converter modules; fuse protected DC distribution
Power pair line protection	(2) 25-pair power line protection blocks, with MS^2 (OSP) and RJ-21 (equipment) connectors
Cable Entrance	
Outside plant entry	(1) square feed through accommodating (2) 4.5-inch conduits
AC service entry (local power only)	(1) 2.5-inch diameter entry port
Compliance	
Safety	UL 67
EMC	FCC Part 15, Class A
Telcordia	GR-487-CORE, Issue 2

Support Matrix for Calix Service Units

The table below lists the maximum physical number of Calix service units supported in the ODC-200.

Calix Service Unit	Max # Units Supported[1]
E7-2 (point-to-point / AE and VDSL2 Overlay)	9
E7-2 (VDSL2 Combo)	9
B6-001	9

[1] Refer to the *ODC Capacity Calculator for Calix E-Series & B6 Units* to determine whether the impact of adding unit(s) fits within the cabinet's power and cooling capacity.

Copper Access Cable Connections

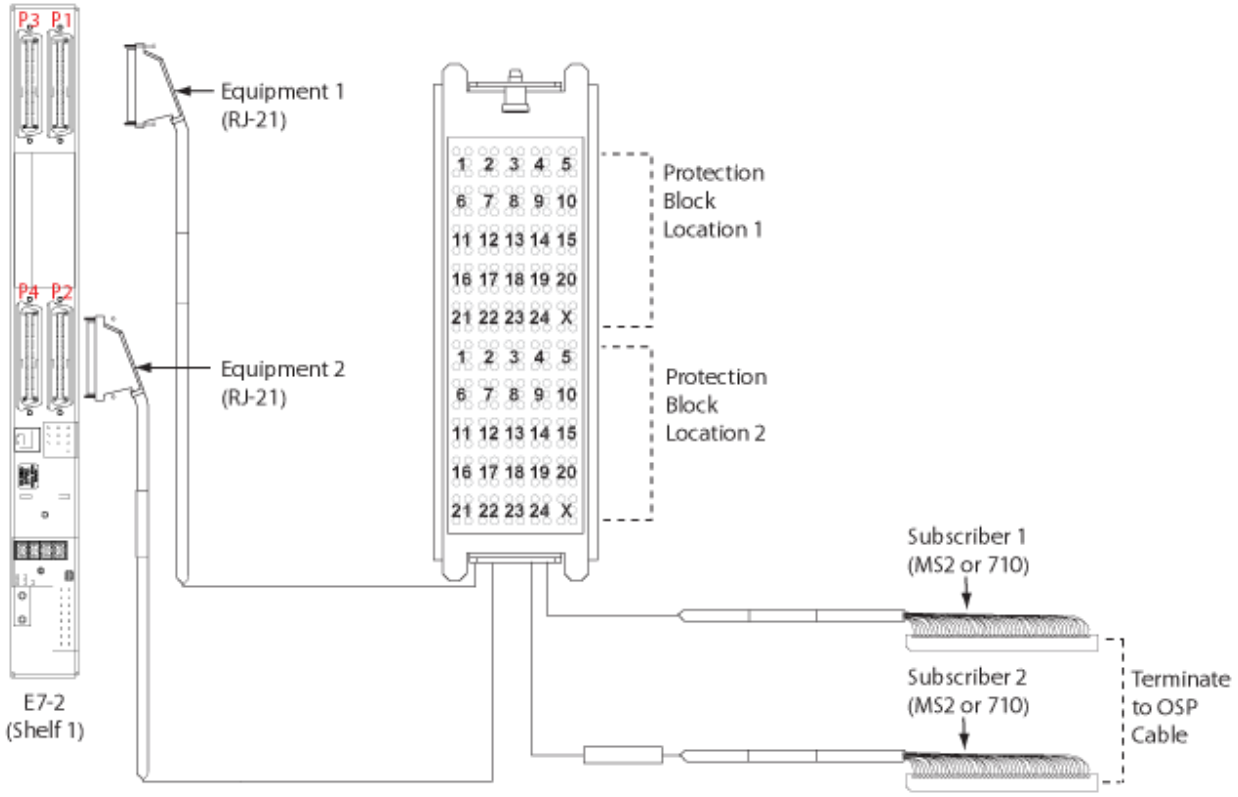
The table below lists the equipment-side and subscriber-side 24-pair group cable connection assignments for E7-2 and B6-001 DSL cabinet configurations.

Note: For the B6-001, the connection assignments only apply to the B6-256 and B6-216 DSL cards.

Clearfield Shelf Connector ID[1] (female RJ-21)	Equipment Cable Connector ID (male RJ-21)	Protection Block Location (24 pair group)	Subscriber Cable Connector ID (MS[2] or 710)
1 (Shelf 1)	Equipment 1	1	Subscriber 1
2 (Shelf 1)	Equipment 2	2	Subscriber 2
3 (Shelf 1)	Equipment 3	3	Subscriber 3
4 (Shelf 1)	Equipment 4	4	Subscriber 4
1 (Shelf 2)	Equipment 5	5	Subscriber 5
2 (Shelf 2)	Equipment 6	6	Subscriber 6
3 (Shelf 2)	Equipment 7	7	Subscriber 7
4 (Shelf 2)	Equipment 8	8	Subscriber 8
1 (Shelf 3)	Equipment 9	9	Subscriber 9
2 (Shelf 3)	Equipment 10	10	Subscriber 10
3 (Shelf 3)	Equipment 11	11	Subscriber 11
4 (Shelf 3)	Equipment 12	12	Subscriber 12
1 (Shelf 4)	Equipment 13	13	Subscriber 13
2 (Shelf 4)	Equipment 14	14	Subscriber 14
3 (Shelf 4)	Equipment 15	15	Subscriber 15
4 (Shelf 4)	Equipment 16	16	Subscriber 16

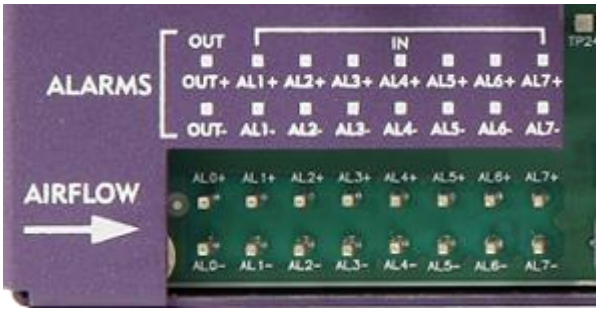
[1] Where 1 = P1 or J1, 2 = P2 or J2, etc.

Example: The following illustration shows cable connections for the first two rows in the table above, with an E7-2 shelf.



Environmental Alarm Mapping to E7-2

When so equipped, ODC-200 environmental alarms are wired to a single Calix E7-2 service unit inside the cabinet. The table below shows the pin assignments for ODC-200 environmental alarms.



E7 Input (Pin Pair)	Alarm Type*	Alarm Source	Description	Default Severity
AL1	rect-fail	Power Critical	Power supply Critical	Critical
AL2	rect-fail	Power Major	Power supply Major	Major
AL3	comm-pwr-fail	AC Fail	AC power failure	Critical
AL4	fuse-fail	Fuse Fail	Fuse failure	Major
AL5	high-temp	HX Fault	Heat exchanger fail/high temp	Major
AL6	contact-off-normal	Power Fan Fail	Remote power fan failure	Major
AL7	intrusion	Open Door	Open door/security	Major

Note: *Alarm Type values shown are modified from the default setting ('contact-off-normal') in the E7 user interface.

Environmental Alarm Mapping to B6

When equipped with at least two Calix B6-001 units, the ODC-200 environmental alarms are wired to both B6 units, split as follows:

- B6-001 unit 1: **Power alarms**
- B6-001 unit 2: **Thermal & Security alarms**

The N/O alarm leads (white) are wired to alarm **pin 5** on each B6 unit, located on the chassis rear panel (8-pin Molex connector). The RTN leads (black, J1 and J2 spade lugs) both connect to the **-48VDC RETURN A** chassis power terminal on B6 unit 1 only (labeled as RTN A in the image below).

The table below shows the ODC-200 alarm mapping assignments to two B6-001 units.

B6 Unit	Input Pin	Alarm Name*	Alarm	Description
B6-001 unit 1	5	Power Alarm*	Power Critical	Power supply Critical
			Power Major	Power supply Minor
			AC Fail	AC power failure
B6-001 unit 2	5	Thermal/Security*	HX Fail	Heat exchanger high temp/fail
			Power Fan Fail	Remote power fan failure
			Open Door	Open door/security

*****You must provision alarm name values in the B6 user interface. Suggested values shown. In addition, you must configure the B6 environmental alarm input for inverse signal detection (for Normally Open contacts; command: **environment alarm in invert**).
Alarms report in the B6 user interface without a severity level.

Note: Alternatively, for cabinets equipped with only one B6-001 chassis, all alarms are trunked together to the single B6 unit (alarm pin 5).

Emerson Rectifier Alarm Matrix

The Emerson rectifier shelf detects and reports multiple alarm conditions in the cabinet, but only the alarms listed in the table below are reported through the Clearfield equipment. For a complete list of alarm conditions reported by the Emerson rectifier, refer to the rectifier product manual. All alarm condition severity levels are programmable.

Alarm Condition	Display Severity	
	Critical	Major
Critical Summary[1]	X	
Major Summary[2]		X
AC Fail		X
Fuse Alarm		X

[1] One or more alarms designated as critical may be reported under the Critical Summary alarm condition.

[2] One or more alarms designated as major may be reported under the Major Summary alarm condition.

Alpha Cordex HP Rectifier Alarms and Controller Settings

The Alpha rectifier shelf detects and reports multiple alarm conditions in the cabinet, but only two umbrella alarms are reported through the E7-2: Minor (MN) and Major (MJ). For a list of the alarms reported through the E7-2 as well as parameters and default settings for the Alpha rectifier shelf controller, refer to the *Cordex HP Rectifier Controller Default Configuration* document or for more detailed information refer to the *Alpha Cordex Controller Software Manual*—both available from **My** Clearfield online (*seeclearfield.com*).

Emerson Rectifier Setpoints

The following table lists the default Emerson rectifier controller setpoints for battery strings supported by Clearfield. For a complete list of battery-related setpoints, refer to the rectifier product manual located at ww.seeclearfield.com.

Parameter	Description	Setting
Battery Thermal Runway Management (BTRM) Action	Action to take on BTRM Temp High 2.	Lowering Voltage
BTRM Voltage	Output voltage if action set to "Lower Voltage" for 48V system	50V
BTRM Temp Sensor	Sensor to use for BTRM function	Interface Board 2 (IB2)
BTRM Temp High 2	BTRM alarm threshold	55°C
BTRM Temp High 1	BTRM alarm threshold	50°C
Maximum Equalize (EQ) Time	If the boost charge cannot finish normally, the duration is longer than the settings, the boost charge will be terminated.	720 min
Temp Compensation Probe Number	Which temperature input is used for temperature compensation	IB2 Temp 1*
ESNA Comp Hi Volt	Temp Comp Max voltage clamp for 48V	54.5V
Test Voltage Limit	To adjust the output of rectifiers at this setting when battery testing for 48V system	51.8V
Test End Voltage	To terminate battery test when this setting is reached for 48V system	52V
End Test Time	To terminate battery test when test time is reached	30 min
IB2 Temp High 1	High 1 alarm point, if IB2 Temp 1 enabled as Battery	98°C
Battery 1: Rated Capacity	Rated capacity for Battery 1 and Battery 2, if equipped	100Ah

*The Temp Compensation Probe Number parameter must be modified for the Saft Ni-Cd TelX100 battery string (see procedure below for details).

To modify default rectifier setpoints for Saft Ni-Cd TelX100 batteries

1. Open Internet Explorer (IE).
2. In the IE address bar, enter the IP address of the Emerson rectifier (the default value is 192.168.1.2).

   The NetSure ACU+ Controller page loads.

   Note: For recent versions of IE, you may need to add the rectifier IP address to the list of Compatibility View sites (press the Alt key to display the menu bar, and then click **Tools** > **Compatibility View settings**).

3. From the NetSure ACU+ Controller page, enter the following credentials:
   - User: **admin**
   - Password: **1**
4. To modify the Float/Equalize Charge Voltage parameter, do the following:

a. From the menu, select **QUICK SETTINGS** > **Float/Equalize Charge Voltage**.

b. In the Set Value box for Float Charge Voltage, enter **54.7**.

c. Click **Set**.

5. To modify the Temp Compensation Probe Number parameter, do the following:

a. From the menu, select **QUICK SETTINGS** > **Temp Compensation Setting**.

b. In the Set Value drop-down list for Temp Compensation Probe Number, select **None**.

c. Click **Set**.

Supported Batteries

The ODC-200 supports the following batteries. For a list of battery distributors, contact your sales representative.

Manufacturer	Model	Capacity (Ah) per String	Max # of Strings
Northstar	NSB 100FT	100 Ah	1*
Saft	TelX100 Ni-Cd	100 Ah	1*

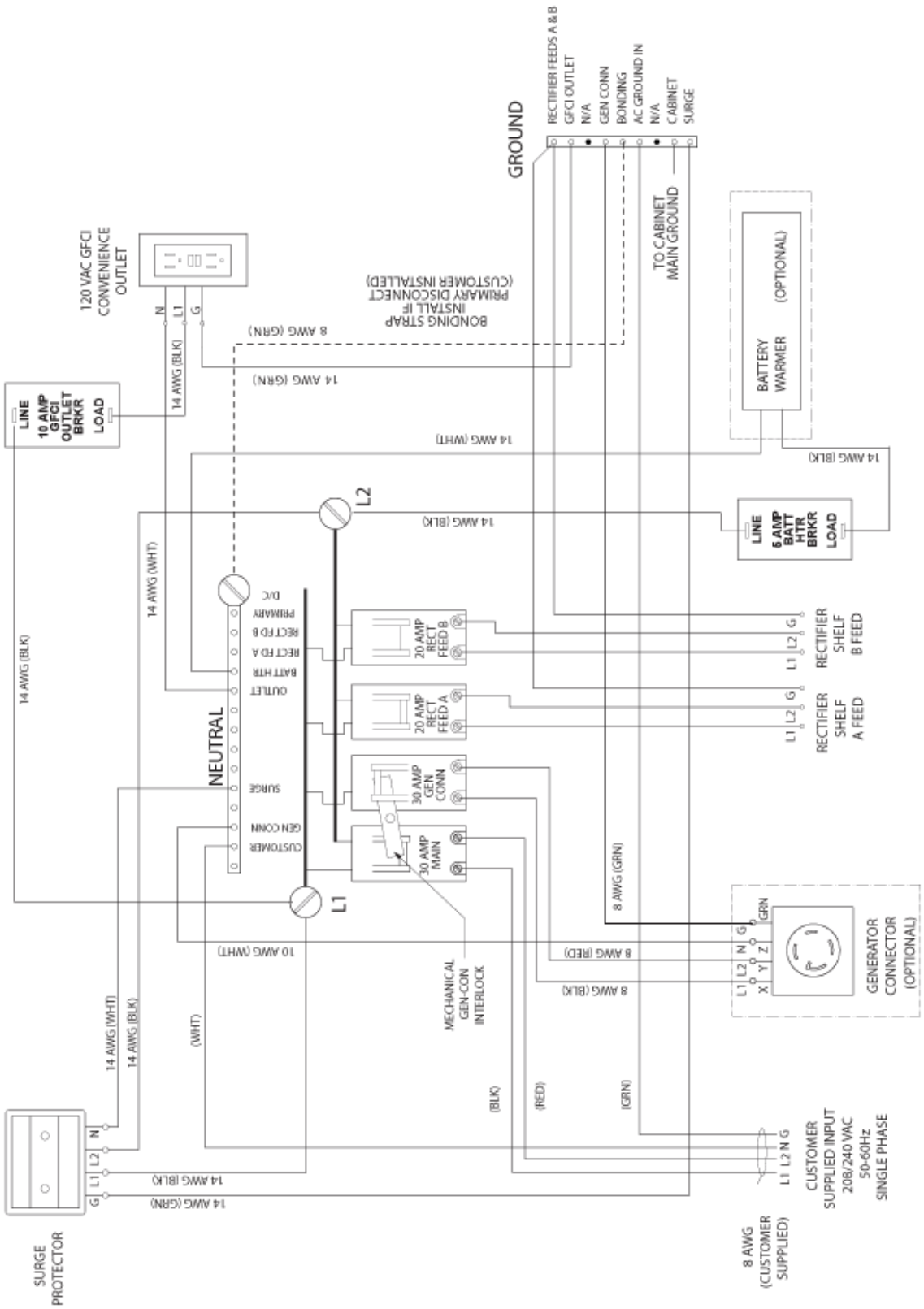
* 2 stings are supported when an EXM is mounted on the rear or left side of the base ODC-200 cabinet.

Wiring Diagrams

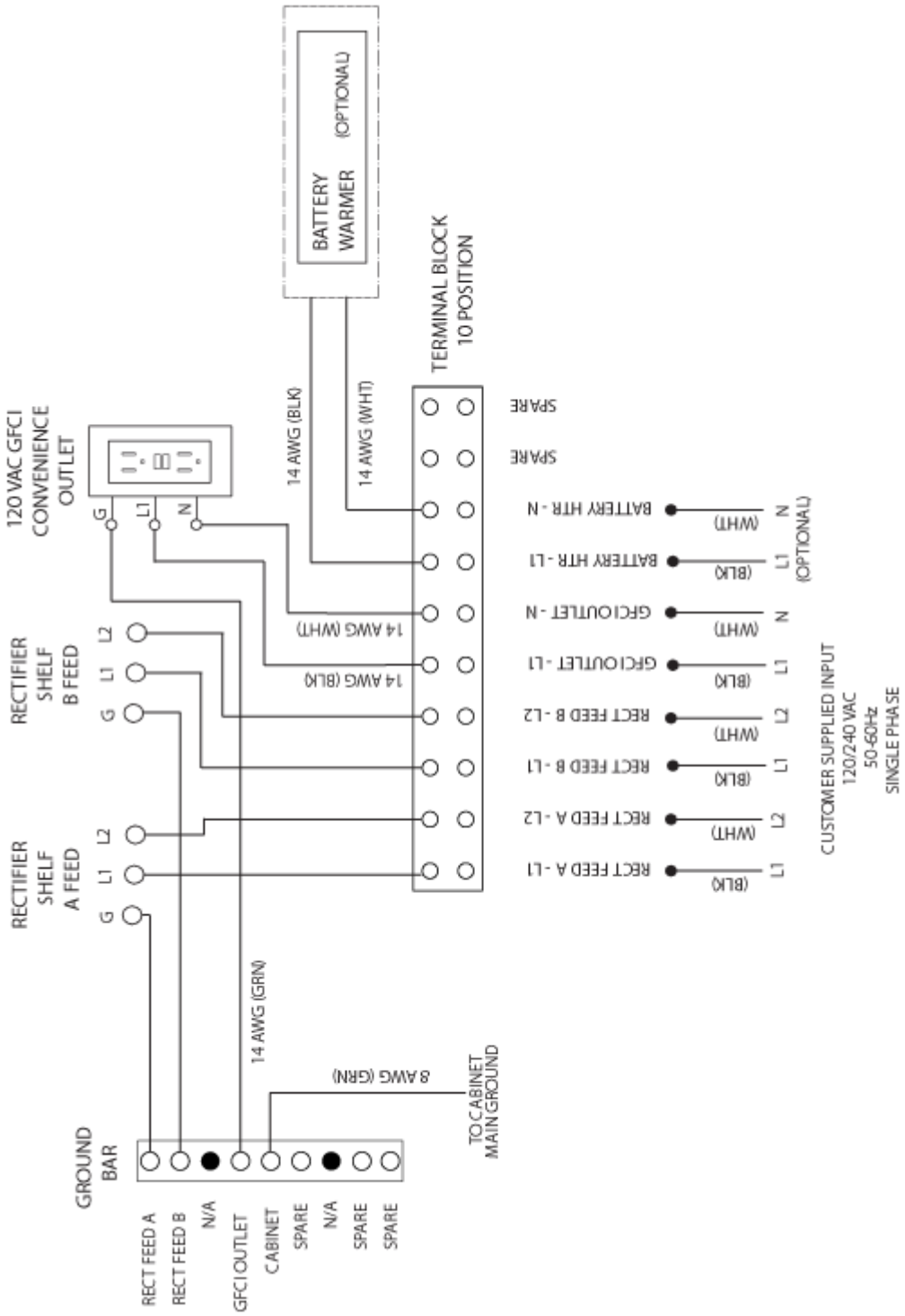
This section includes wiring diagrams of the ODC-200 cabinet power for quick reference.

Wiring diagrams are also available from *seeclearfield.com*

AC Load Center (Local Power)



AC Junction Box (Local Power)



DC Wiring (Local Power) for E7-2