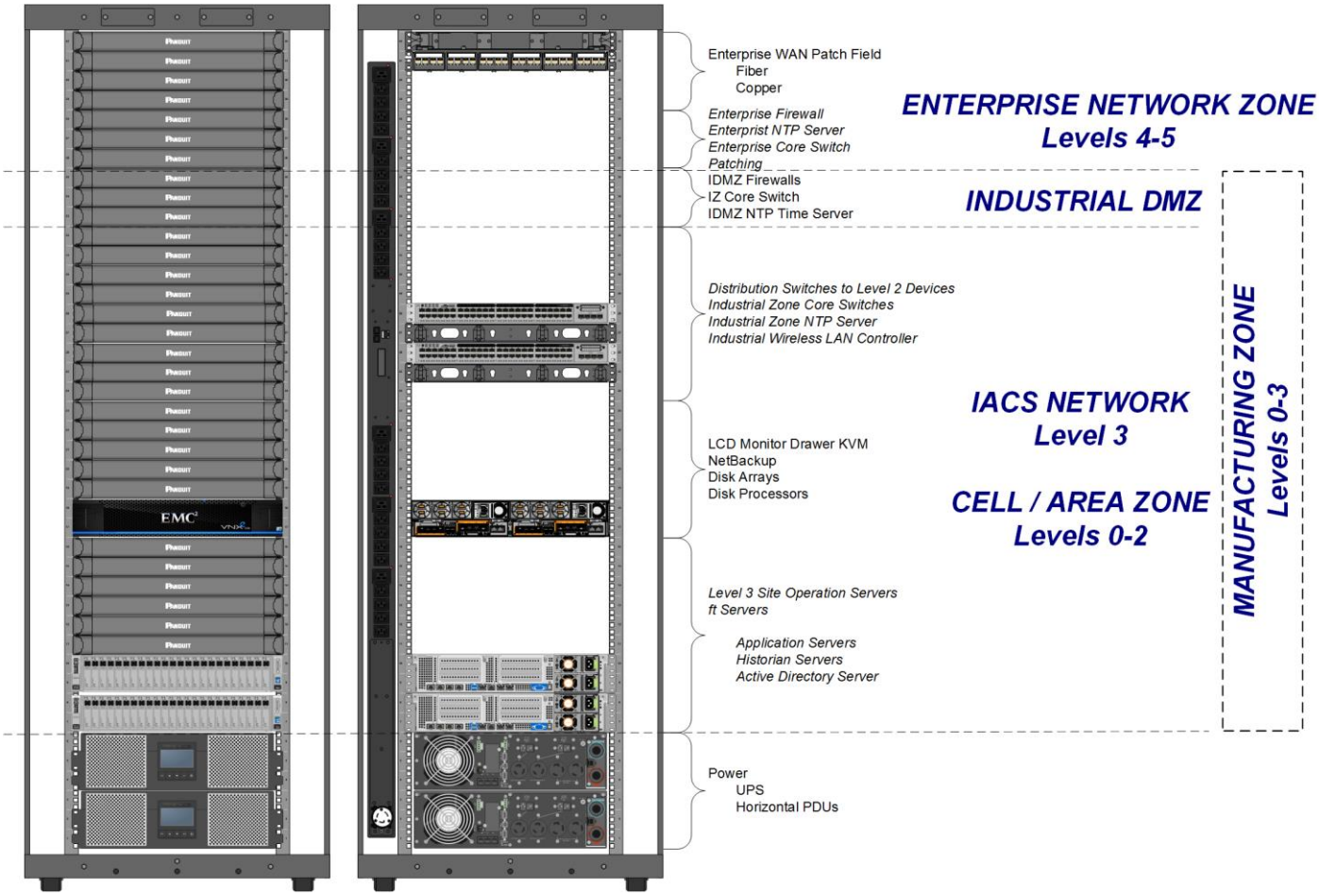
Industrial NEMA 12 Rated Micro Data Center Customer Guide



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Introduction

The Panduit Industrial 42 RU NEMA 12 Rated Pre-Configured Micro Data Center (MDC) is a versatile framework that facilitates the rapid deployment of Information Technology (IT) or Operational Technology (OT) network capability that can be used in the industrial environment as stand-alone system that runs Manufacturing Execution System (MES) applications such as:

- Scheduling, process and event monitoring, production tracking
- HMIs, real-time device control and security
- Asset management, alarms and event handling and simulation
- Process automation, process optimization and safety
- Quality control, databases and historians
- Secure links to enterprise resource planning (ERP) systems for reporting and analysis.

The Micro Data Center design addresses the need for a structured approach to implementing robust, integrated and secure networks in the industrial space. Adhering to Converged Plantwide Ethernet (CPwE) principles, the MDC design represents the basic requirements of the manufacturing environment including:

- Cabinets
- Equipment Layout
- Network Cabling – Media Selection and Security
- Power and Grounding
- Cable Management.

The purpose of this Application Note is to provide guidance for equipment layout, cabling infrastructure, grounding/bonding and labeling for a variety of possible MDC configurations. It is not comprehensive in that every potential use is defined, but rather serves as a starting point and roadmap for the development of a stand-alone datacenter that can deliver a broad range of OT to IT capabilities.

Copper Connectivity

Basic in-cabinet connectivity is provided with the MDC. Utilizing Panduit's shielded CAT 6A patch cords and jacks, the MDC's connectivity will support two rack mounted switches and up to three servers, each with the following patch cords:

Two STP28X**MBU – Category 6A Performance, 28AWG, F/UTP Patch Cords, CM/LSZH, Blue.

- Connects the switch(s) to the GbE LAN ports on the server.

Two STP28X**MIG – Category 6A Performance, 28AWG, F/UTP Patch Cords, CM/LSZH, International Gray.

- Connects the switch(s) to the Out of Band (OOB) management port on the main board of the server, or on a separate expansion card.

- A second cable can be used to expand the LAN port connectivity, or as a connection to an mLOM port where GbE connectivity is provided.

Refer to Figure1, Basic Copper Connectivity, below.

When expanding the copper connectivity, Panduit recommends the following:

- CPPL24WBLY - Unshielded Modular Patch Panels.
- CJS6X88TGY – Category 6A/Class EA, 8-position, shielded jack modules.
- STP28X* - Category 6A Performance, 28AWG, F/UTP Patch Cord, CM/LSZH patch cords.

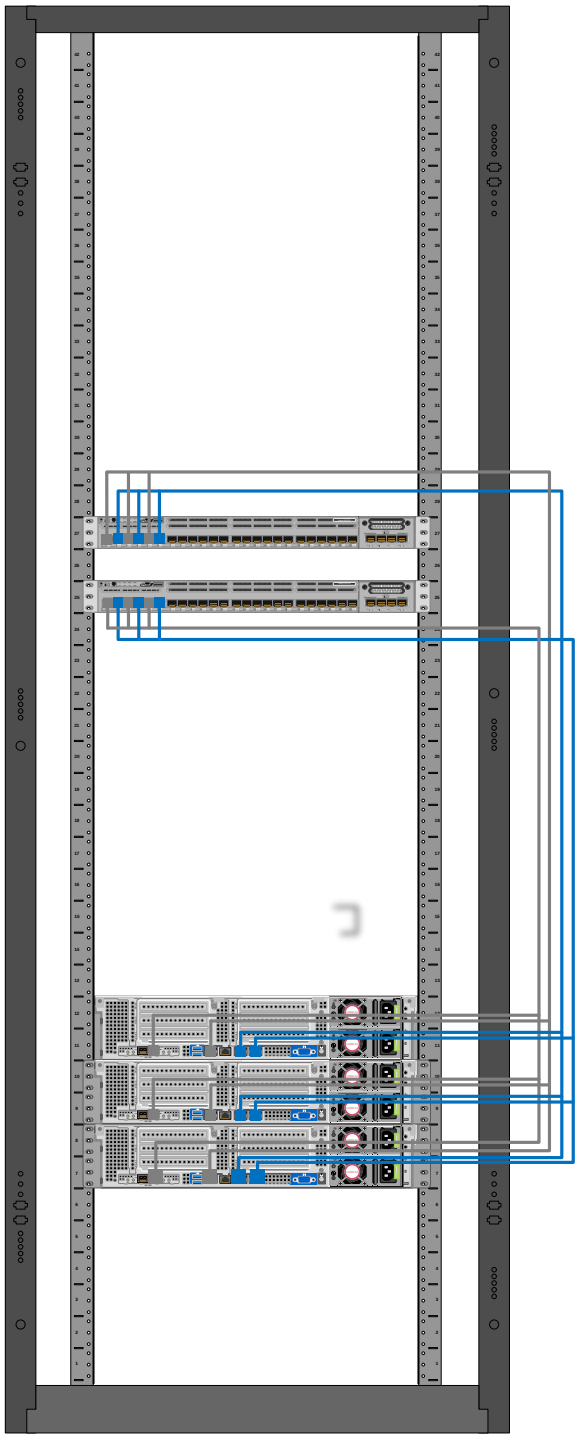

Figure 1 Basic copper connectivity

Fiber Connectivity

Fiber connectivity can be accomplished when the switches are equipped with SFP optical GBIC Transceivers. Either multimode or single-mode fiber, of varying wavelengths, can be specified. On the uplink side, the MDC is flexible enough to support either matching fiber jacks on the patch panel, or Fiber Adapter Panels (FAPs) that mount in the provided FCE1UA slide-out Fiber Cassette Enclosure.

When expanding the fiber connectivity, Panduit recommends selecting compatible FAPs from the list of Opticom Fiber Adapter Panels found at Panduit.com, enter “opticom fiber cassette” in the search box.

Equipment Layout

Equipment layout in a cabinet depends on the number, weight, and type of components as well as segregation. Common design practice locates enterprise network equipment at the top and industrial network equipment at the bottom, with the DMZ positioned in the middle of the enclosure.

Typically, heavy components are located at the bottom of the cabinet with the patch field located at the top for best stability. In general, like equipment should be grouped, and space left between groupings for expansion, improved airflow, and cable management.

Common practice, when combining servers and switches in the same cabinet, is to reverse the switches so that connectivity for all devices is positioned to the rear of the cabinet. This promotes ease of access and cable organization, and mitigates the risks of network interruptions resulting from cabling errors.

Network designers may wish to combine DIN rail mounted appliances within the Micro Data Center cabinet. The MDC design is flexible enough to allow for components such as PLCs, manufacturing switches, power supplies, batteries, and other industrial devices to be mounted in a rack-mounted DIN rail panel. Often this can eliminate the need for separate enclosures while closely linking DIN rail mounted devices to the network.

Network Cabling – Media Selection

Network cabling used in the Micro Data Center can be fiber optic or copper. To properly select the cable media for the application, several design criteria must be considered.

- Distances between the MDC and the zone enclosure or manufacturing equipment
- Type of information transmitted and acceptable latency
- Equipment connectivity
- Environmental conditions, e.g. electrical noise, vibration, temperature moisture, etc.
- Ease of installation and maintenance frequency.

Table 1 shows some key parameters associated with different media choices found in the ANSI/TIA 568-C series.[1]

Table 1. Key Parameters for Cabling System Media

Parameter	Copper Cable	Multi-mode Fiber	Single-mode Fiber
Reach (max)	100m (330ft)	2000m (1.2 miles)	40km (24 miles)
Noise Mitigation	Foil shielding	Noise immune*	Noise immune*
Bandwidth	1 Gb/s (Cat 5e, Cat 6) 10Gb/s	1 Gb/s 10 Gb/s	1 Bb/s 10 Gb/s
Cable Bundles	Large	Medium	Small

*Optical transceivers can be susceptible to electrical noise.

Multiple varieties of copper cabling media are available based on data speed and volume requirements. Typically, Category 6 copper cabling is used for enterprise and manufacturing network connections. Due to the potential for electrical noise, Panduit has specified shielded Cat 6A cabling for connections within the MDC.

The patch panel and jacks provide for essential testing and diagnostic points between equipment and field connections. This speeds network troubleshooting and accommodates future expansion as network speeds increase or equipment connectivity ports change.

[1] ZCTB01—WW-ENG, Rev. 0, 07/2014, Technology Brief, Structured and Point to Point Network Cabling for Industrial Automation.

Power and Grounding

Power

It is essential that robust and clean power be supplied to the MDC. The incoming power feed typically includes Uninterruptable Power Supplies (UPSs) and Power Distribution Units (PDUs) to distribute where needed. PDU voltages can be 208V (nominal) or range from 220V to 240V depending on the world region, with current up to 30 or 32 amps. Configurations include NEMA L6-30 and IEC 60309 2P/3W plugs with C13 and C19 outlets.

Grounding and Bonding

Proper grounding of the MDC is critical to optimizing performance of all equipment located within the MDC. There are several methods used in the MDC to complete the bond between components, cabinet frame, and busbar – all the way to the building ground network. These methods include paint piercing screws and washers to ensure a direct metal-to-metal connection throughout the MDC, grounding jumpers to connect equipment to the cabinet structure, and braided ground to connect the cabinet to the Mesh Common Bonding Network (MCBN).

Cabinet Ground Jumper

Each cabinet in the Micro-Data-Center system must properly grounded per the requirements set forth by these Industry Standards: NEC Articles 250 and 645.15, ANSI/ J-STD-607-A, TIA-942 IEEE Standard 1100, and BISCI. A properly grounded cabinet helps protect from fault currents and helps prevent the build-up of static electricity. Each cabinet should be grounded with a 6 AWG copper stranded conductor to the data center grounding infrastructure using irreversible copper compression connections as shown in Figure 2.

A 6 AWG cabinet ground jumper is pre-installed on the ground bar. After the cabinets have been ganged and leveled, run the cabinet ground jumper down into the floor to the MCBN conductor and attach using an irreversible copper compression tap.

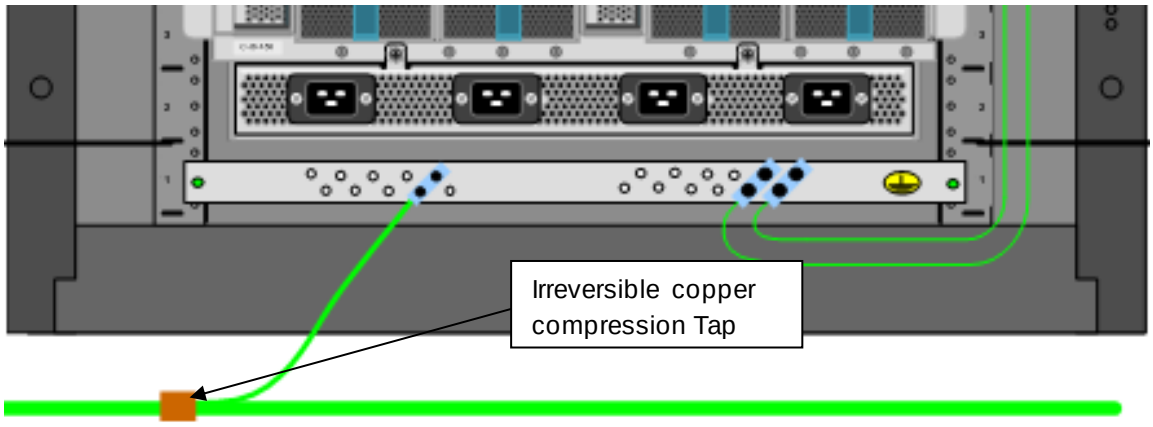

Figure 2: Cabinet Ground Jumper Going Down to Underfloor MCB

ESD Protection

ESD wrist strap ports are pre-installed in each cabinet. After all the equipment has been mounted, the ESD wrist strap (Figure 3) should be plugged-in and hung on the ESD port.

The ESD wrist strap should be used whenever working on the inside of the cabinet, including when installing equipment. Additional precautions such as anti-static footwear and clothing, floor coverings and workstation mats can also be used to greatly reduce the chances of accidental static electrical discharges that might damage sensitive electrical equipment.

Figure 3: ESD Wrist Strap

Thermal

Panduit recommends that no MDC be used without also including a properly sized air conditioner. This not only prevents the equipment's air inlet temperature from rising above the manufacturer's recommendations, but also mitigates the potential for humidity to damage equipment. Panduit has taken the guesswork out of specifying an AC unit by offering pre-configured solutions for units requiring from 12,000 BTU/hr, (MDC82NS) up to 20,000 BTU/hr (MDC82NL) of cooling capacity. The MDC82NS has one solid side panel, and a side panel with openings that are designed to match the SpectraCool G52 AC from Hoffman/nVent, while the MDC82NL is designed to match the SpectraCool G57 AC. Reference https://hoffman.nvent.com for additional information.

Additionally, Panduit's MDC82NN option has two solid side panels that can be modified to accept nearly any AC unit. Reference https://hoffman.nvent.com or your AC manufacturer's website for additional information.

Equipment Overview

The Panduit Micro Data Center design has been built around a proven minimum combination of server, storage and switches with free space left for server expansion, storage expansion, added functionality and/or DIN rail mounted switches and supporting devices. To ensure that the MDC is suitable for remote office locations and industrial applications Panduit recommends that network components are installed in a structured manner, and include compatible components, including the following or similar items:

Compute

- Cisco C240 M* server(s).

Network

- Cisco Catalyst 3850 switches.
  - 48 Port
  - 24 Port
- 1000BASE-SX SFP transceiver modules for multimode fibers.
- 1000BASE-*X for single mode fibers across different span lengths.
- 1000BASE-LX/LH SFP for both multimode and single-mode fibers.

Storage

- EMC VNXe 3200 disk processor enclosure
- EMC VNXe 3200 disk array enclosure.

Physical Infrastructure Expansion

- STP28X**xx – Panduit 28 AWG Shielded Category 6A network cabling
- FX2ERLNLNSNM*** – OM3 2 Fiber LC Duplex/LC Duplex Patch Cord
- Power Distribution Unit Options
    - Reference www.panduit.com for the latest SmartZone networked MSPO series vertical PDUs.
- CPPL24WBLY – 24 port patch panel with labels, front removable snap-in CFFPL4 faceplates.
- CJS6X88TGY - Mini-com TX6 10 GIG Shielded Jack Modules.
- CMDSLCZBU - Duplex LC Sr./Sr. Fiber Adapter With Module Zirconia ceramic split sleeves.
- RGEJ1024URT - #10 AWG network grounding equipment jumper, 24"
- RGEJ660U, RGEJ696U - #6 AWG network grounding equipment jumper 60”, 96”.
- Fiber connectivity – QuickNet Cassettes, FAP* adapter panels, or FOSM* splice modules.
- Cable management:
    - SRBBRWC-Kit – Strain relief bar kit.
    - CMPHF1 – Horizontal D-Ring cable manager.
    - IABDIN4 – For installing DIN-mountable equipment into a standard EIA 19” rack or cabinet.
- Identification:
    - R100X150V1T – Thermal transfer Turn-Tell label.
- Network Monitoring:
    - SNMS-0128 – IntraVUE Industrial Ethernet visualization and monitoring for network assessment and troubleshooting.
- Air Conditioner Options
    - Small air conditioner
    - Large air conditioner

Converged Plantwide Ethernet and the Manufacturing Zone

In the design of the industrial Ethernet network, one of the critical elements is to ensure the separation between the enterprise network and the Manufacturing Zone. In terms of the Purdue Reference Model, this is the separation between Levels 0 to 3 and Levels 4 to 5. This separation is necessary because real-time availability and security are the critical elements for the traffic in the Industrial Automation Control System (IACS) network.

This approach permits the Manufacturing Zone to function entirely on its own, irrespective of the connectivity status to the higher levels. As a best practice, it’s recommend that all manufacturing assets required for the operation of the Manufacturing zone should remain there. These assets include factory applications as well as services such as Active Directory, and DNS.

Within the Manufacturing Zone, resides the IACS network and potentially, elements of the Cell and Area Zones. The Level 3 Site Operations layout includes virtual servers, security and network services, and a

robust physical layer that addresses the environmental, performance, and security challenges present when deploying IT assets (e.g., servers, storage arrays, and switching) in industrial settings.

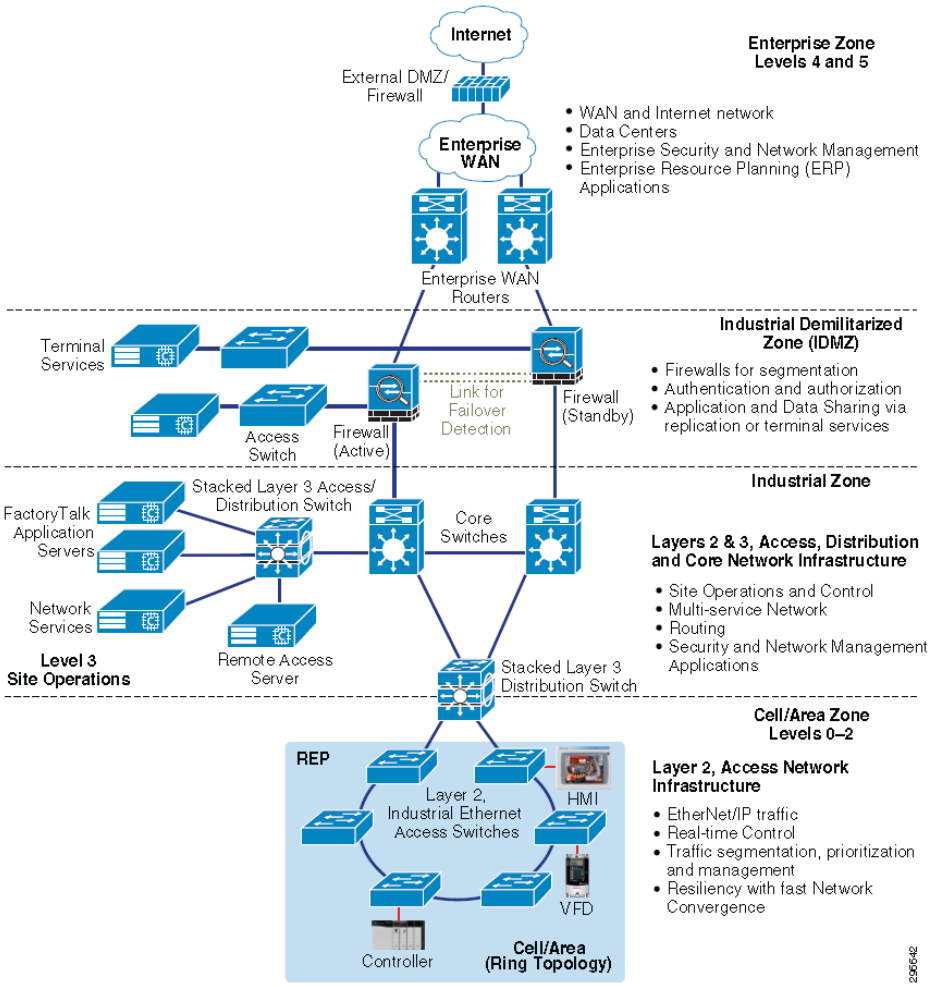

Figure 4 CPwE Zone Diagram

Cabinet Elevation

Panduit's Micro Data Center (MDC) provides the basic structure for the stand-alone data center in a factory setting and follows CPwE recommended architecture to provide standard network services to the applications, devices, and equipment in modern IACS applications. The MDC provides design and implementation guidance to achieve the real-time communication and deterministic requirements of the IACS as well as the reliability and resiliency required by those systems.

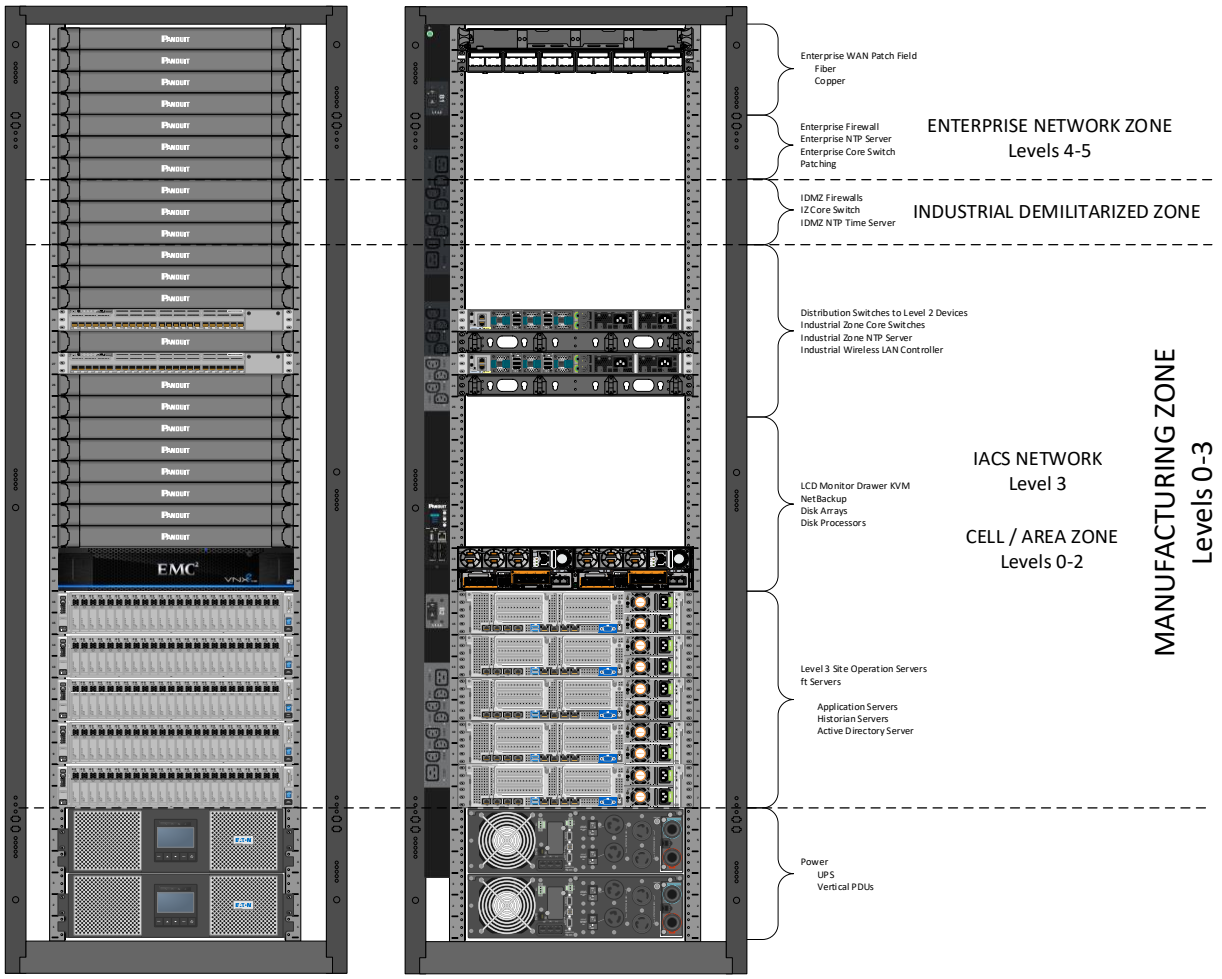

Figure 5 Planning the Elevation in the 42 RU NEMA 12 MDC

The 42 RU Micro Data Center is preconfigured for a minimum of two 2 RU servers, one 2 RU storage device, and two switches along with power accessories and adequate connectivity that supports the devices. Additional network equipment should be stacked in the cabinet according to the CPwE architecture defined in Figure 4 (Page 8).

Cabinet Preparation

Cabinet preparation includes unpacking, securing, cage nut installation, cabling and cable management, system grounding hardware.

General Installation Guidelines:

When you decide where to place the Micro Data Center cabinet, be sure to observe these recommendations:

- The chosen location is in a level and dry place and has plenty of space for air circulation.
- There is an available ground connection.
- To prevent the equipment from tilting due to unbalanced weight during installation, the anti-tilt brackets should be installed.
- The power requirements will depend on the equipment installed. Options are described in the POWER section above.

Equipment Installation Guidelines

Once the anti-tilt brackets are installed and the cabinet is secure at its chosen location, it is always recommended to install the heavier equipment first starting from the lower RU and working towards the top of the cabinet. This will improve cabinet stability during installation.

For ESD protection, the cabinets feature two ESD ports (one on the front and back of the unit) to connect the ESD wrist strap to prevent any electrical shock that can damage the equipment.

Please follow instructions below for equipment installation. Use these instructions as general guidelines only and always refer to the original equipment manufacturer for updated and more detailed installation instructions.

UPS Installation Guidelines:

Install the UPS in the lower RU locations close to the floor. Make sure that anti-tilting brackets have been installed on the cabinet to prevent it from tilting and causing damage to equipment and personnel while heavy equipment is being installed. Always exert caution when installing heavy equipment on cabinets.

To properly install the UPS, always follow the manufacturer's instructions for mounting in a 19-inch rack.

Server Installation Guidelines

Depending on the server equipment and manufacturer chosen for the MDC, follow the manufacturer's instructions for mounting slide rails before installing the servers. See Figures 1 & 5. Always exert caution when mounting heavy equipment.

Switch Installation Guidelines

To install a switch in a rack (see Figure 5), choose one of the following options:

- Four-point mount if the cabinets are being shipped (*preferred method).
- Two-point mount if the switch and cabinets are not going to be shipped or for field installation when slide brackets are not available.

Use the cage nuts already preinstalled in the cabinets on the switch location. Refer to equipment location in Figures 1 and 5.

As a rule, it is preferred to install the power cables in a different path from the communication cables. To avoid crosstalk and noise in the data lines, always wire power cables using one side of the vertical cable-managers, and route communication cables separately using the other side of the vertical cable managers.

For more information contact your local distributor, Panduit Sales Representative, or the Panduit Industrial Network Infrastructure team at networkinfrastructure@panduit.com.