Don’t Lose Your Cool

Overcoming Thermal Challenges and More With PoE at the Edge

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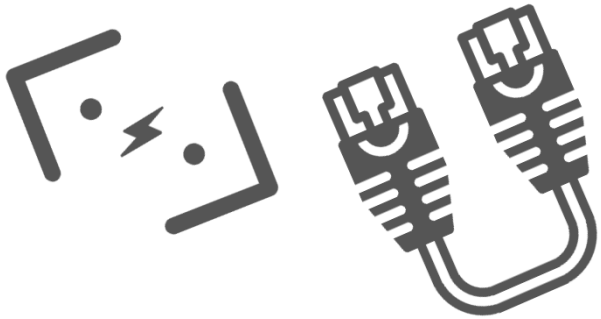
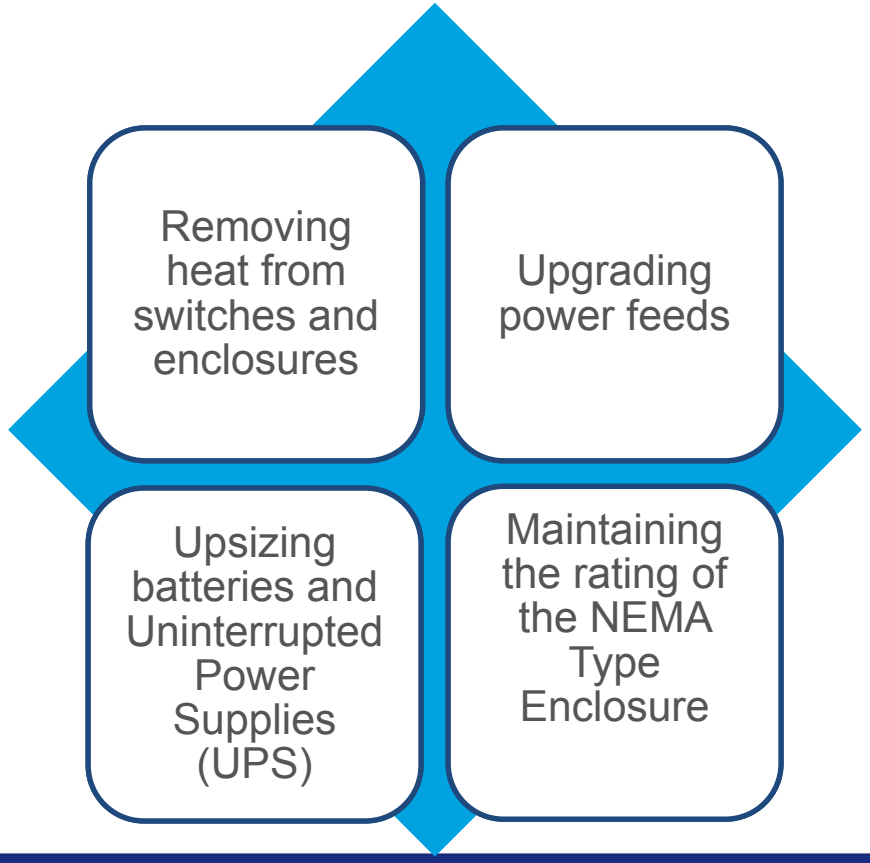
What Is Power over Ethernet (PoE)? Why is It Important?

- Delivering power over a copper or hybrid fiber network connection
- Eliminates the need for a separate power connection for end devices
- Used to power desk phones, wireless access points, security cameras and IoT sensors
- Provides flexibility



Common Obstacles to Overcome



Why? To Support Higher Power End Devices

New Technologies: 5G, Wi-Fi-ax, Desktop Virtualization, IoT, Automation

2003 802.3af	2009 802.3at	2018 802.3bt	2018 802.3bt
Type 1	Type 2	Type 3	Type 4
15 Watts	30 Watts	60 Watts	100 Watts
802.11n WAP IP Camera VoIP Phone	802.11ac WAP PTZ Camera Display Phone	802.11ax WAP 5G Small Cell Video Phones Thin Clients*	Digital Signage POS System LCD HD TV* LCD Monitor* IoT Gateway* Laptops*

*Note: Some of these devices are not yet powered by PoE, but it is possible with 60-100 Watts power.

Network Switches

- Impact on Switches
  - Upgrade switches for Type 3 and Type 4
  - Recommend IEEE 802.3bt compliant switches
  - Some Type 3 (60 watt) models available currently
  - Higher wattage, may require different or more power connection at site
  - Heavier equipment may require rack with higher load
  - Higher capacity UPS and batteries may be required - more rack space, more load

Photo: Cisco Catalyst 9300 Series

- Specify IEEE 802.3bz-2016 compliant for multi-gigabit switching to support higher speed wireless access points (IEEE 802.11ac, IEEE 802.11ax)
  - Auto selects 1 Gbps, 2.5 Gbps, 5 Gbps, and 10 Gbps
  - IEEE802.11ac wave2 WAPs will draw approx. 30 Watts
  - IEEE802.11ax WAPs will likely draw more than 30 Watts

How Will You Power a 24-port, Type 3 or Type 4, PoE Switch?

Power Requirements

Attribute	PoE, Type 1 15.4 Watts	PoE, Type 2 30 Watts	PoE, Type 3 60 Watts	PoE, Type 4 90 Watts	PoE, Type 4 100 Watts
PoE Power 24-Ports	370 W	720 W	1440 W	2160 W	2400 W
Max. Current @110 VAC	4 A	7 A	14 A	20 A	22 A
Power Connection	1 x 15 A (10 A)	1 x 15 A (10 A)	1 x 20 A (16 A)	2 x 15 A (13 A) 1 x 30 A (32 A)	2 x 15 A (13 A) 1 x 30 A (32 A)
Max. Current @220 VAC	2 A	4 A	7 A	10 A	11 A
Power Connection	1 x 15 A (10 A)	1 x 15 A (10 A)	1 x 15 A (10 A)	1 x 15 A (13 A)	1 x 15 A (13 A)

Notes: Illustrative only. Does not include line/heat loss allowance.

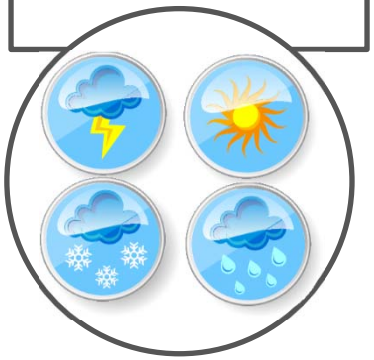

Remote Edge Environments

Each Site is Unique

5 Pillars of Successful Edge Deployments

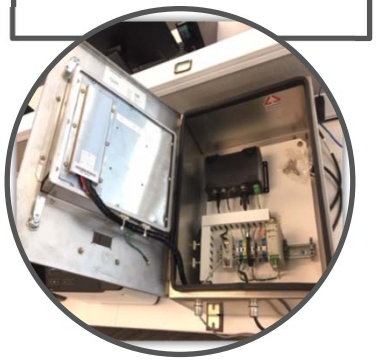
Environmental

- Protect against heat, snow, humidity, precipitation and high salt content
- Environmental enclosures and seals for penetrations



Equipment & Cabling

- Proper support for equipment and dedicated pathways for power and network cabling
- Rails, panels and cable management pathways



Security

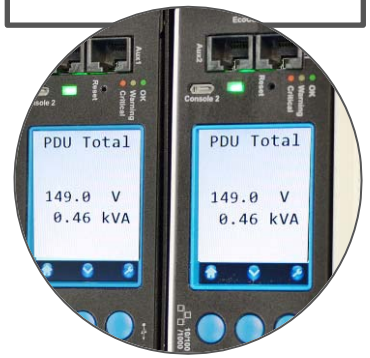
- Control access to equipment, and keep records as needed
- Industrial latches and locks, or electronic access control as needed

Thermal Management

- Keeping equipment at proper temperature and addressing OPEX with efficient solutions
- Filter fans; active cooling and heating

Monitoring

- Power availability/ utilization, load balancing, switching, temperature/humidity, open/closed doors
- PDUs can help monitor environmental conditions and power cycling



Industrial Enclosures

- Designed to isolate the interior of the enclosure from the room environment
- Solid doors, sides, roof and floor
- Gaskets used between frame and all panels
- Bolt-on side panels with strict distance between each connection
- Multiple hinges with strict distance between each
- Multi-point door latches
- Solid bottom or plinth base

NEMA Type Ratings

Selecting the Right Enclosure to Protect Equipment

How long will the network be in place, where is it, and what protection will be needed?

NEMA (IP) RATING	Indoor	Outdoor	Corrosion Resistance	Sealed Tight
Type 12	Yes	No	No	Yes
Type 4	Yes	Yes	No	Yes
Type 4X	Yes	Yes	Yes	Yes

Indoor NEMA Type 12

- Fully welded, steel construction
- Durable finish (Powder-coat)
- Foam gaskets for a tight seal
  - formed-in-place vs peal and stick
- EIA 19” or 23” traditional mounting rails and/or back panel for IoT
- Cooling is important due to load of PoE switches
- Wide width for proper cable management and increased depth to accommodate rack mount devices

NEMA Type 4/IP 66 Outdoor

- Mild steel with durable finish
- Protects large electronic components and controls that require sturdy mounting.
- Floor stands elevate the enclosure above the floor for added clearance and easier cable access
- Dual-access configuration provides access from the front or rear side of the enclosure and for back-to-back plate-mounting option

NEMA Type 4X Outdoor/Corrosive

- Completely sealed
- Stainless Steel
  - Salt: coastline applications
  - Chemical: factory floor or oil rigs typical
- Polycarbonate
  - For wireless applications
  - Allows signal to penetrate enclosure
- Wall, floor, pad, pole mounted

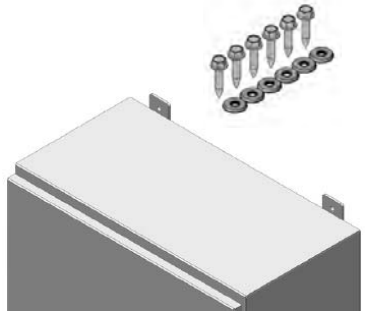
Environmental Enclosure Mounting

Considerations

- ✓ Where is the enclosure going?
  - ✓ PAD
  - ✓ Wall
  - ✓ Pole
- ✓ What is the wall or mount surface made of?
- ✓ When mounting, ensure the NEMA/IP rating of the box is maintained

Recommendations

- ✓ Pad Mounting
  - ✓ Solid sealed base
  - ✓ Match drill and seal anchors
  - ✓ Base clearance for door opening
- ✓ Wall-Mounting
  - ✓ Lag bolts must maintain seal
  - ✓ Welded tabs
  - ✓ Bolt-on brackets must maintain seal
- ✓ Pole-Mount Kit
  - ✓ Bolt-on kit must maintain seal




Power

UPS and Battery Backup

- Impact on UPS and Battery Backup
  - Increased power requirement to support higher PoE power
  - Increased number of batteries to increase runtime
  - New power circuits and UPS to support Type 4 PoE
  - Increased weight/load and space on racks

- Check the full load output current against the switch requirement
  - Specification should include output current sufficient for full power load of PoE switch
  - This may require a much higher wattage UPS than the PoE Wattage value

UPS and Battery Backup

Comparison of UPS and Battery Backup Requirements

Attribute	PoE, Type 1 15.4 Watts	PoE, Type 2 30 Watts	PoE, Type 3 60 Watts	PoE, Type 4 90 Watts	PoE, Type 4 100 Watts
PoE Power 24-Ports	370 W	720 W	1440 W	2160 W	2400 W
Max. Current @110 VAC	4 A	7 A	14 A	20 A	22 A
UPS	1000 VA 900 W 8.3 A	1000 VA 900 W 8.3 A	2000 VA 1800 W 16.6 A	5200 VA 4680 W 21.6 A	6000 VA 5400 W 25 A
Runtime	12 min.	6 min.	6 min.	6 min.	6 min.
Power Input	1 x 15 A (10 A)	1 x 15 A (10 A)	1 x 20 A (16 A)	1 x 30 A (32 A)	1 x 50 A (62 A)
Size	2U, 40 lb	2U, 40 lb	2U, 70 lb	4U, 100 lb	4U, 130 lb

Notes: Based on Toshiba T1 Series Single-Phase UPS.

PoE In Many Spaces

Office

Conference rooms and common areas

Retail

Cash register and stock room

Factory Floor

Automation and tracking

Warehouse

Tracking and drone possibility

Edge for Telco

Reducing complexity of cell sites and microcell sites

Installing Electronic Equipment Outside Traditional Spaces

- Monitoring
- Thermal Management
- Security
- Environment

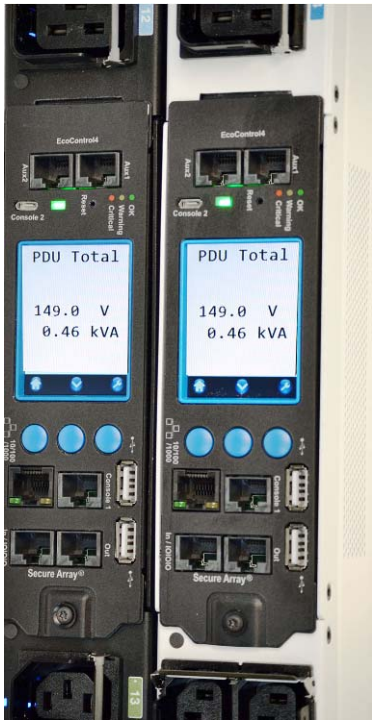
Power Management Functionalities

	Functionality	Basic Power Distribution	Inlet Metering	Branch Circuit Metering	Networking	Access Control	Outlet Metering	Switched Outlets
Non-Networked	**Basic** - Simple, reliable power distribution to equipment in your cabinets. Select a Basic PDU when no power monitoring is required.	✓						
Non-Networked	**Metered** - Includes local LED display for easy reading of input current across phases. Selected a Metered PDU when networking of PDUs is not an option.	✓	✓					
Intelligent Rack PDU	**Monitored** - Includes local and remote power monitoring for the PDU. Select a Monitored PDU when you want to monitor total power usage.	✓	✓	✓	✓	✓		
Intelligent Rack PDU	**Monitored Pro** - Includes local and remote power monitoring for each outlet on the PDU. Select a Monitored Pro PDU when you need to remotely measure individual power used by each piece of equipment.	✓	✓	✓	✓	✓	✓	
Intelligent Rack PDU	**Switched** - Includes local and remote power monitoring for the PDU and individual outlet control. Select a Switched PDU if you need to remotely turn power on or off at each outlet.	✓	✓	✓	✓	✓		✓
Intelligent Rack PDU	**Switched Pro** - Includes local and remote power monitoring for the PDU and each outlet on the PDU, as well as individual outlet control. Select a Switched Pro PDU to remotely measure and control power at each outlet.	✓	✓	✓	✓	✓	✓	✓

Remote Monitoring and Control

Monitoring for Security

- Intrusion detection
  - Dry contact switches to ensure door(s) and panel(s) are secure
  - Alarm notification and audit trail
- Remote access control
  - Electronic locks and latching
  - Alarm notification and audit trail
  - Simpler key management
  - Faster credential changes



Monitoring for Availability

- Incoming power availability
- Power utilization
  - Baseline – average at initial installation
  - Increased usage – may be an indicator of failing devices
- Load balancing
  - Phase-balancing across three-phases
- Switching
  - Ability to turn circuits on/off remotely
- Temperature
- Humidity


Cooling

10 Factors that Impact Enclosure Cooling

1. **Inside the Enclosure**
   - ✓ Minimum Temperature (impacts humidity)
   - ✓ Maximum Temperature (equipment specs)
2. **Equipment Load (select 1)**
   - ✓ Known BTU for all equipment
   - ✓ Known wattage for all equipment
   - ✓ Measured temperature in the enclosure
   - ✓ Attach Equipment List, Qty, and Model #
3. **Available Power**
   - ✓ Voltage
   - ✓ Phase
4. **Space Outside the Enclosure**
   - ✓ Ambient Minimum Temperature(Lowest temp room can reach)
   - ✓ Ambient Maximum Temperature (Max temp room can reach)
5. **Type of Enclosure**
   - ✓ Freestanding Module (Self-Supporting)
   - ✓ Wall-Mount Two-Piece Fixed
6. **Size of the Enclosure**
   - ✓ Height in millimeters
   - ✓ Width in millimeters
   - ✓ Depth in millimeters
7. **Equipment Mounting Style**
   - ✓ 19" EIA Equipment Mounting Rails (Four rails)
   - ✓ Mounting Plate Mounted Equipment (Controls, Automation, Electrical)
   - ✓ Combination 19" EIA Rails & Mounting Plate
8. **(bayed enclosures) Location of this enclosure**
   - ✓ End left side
   - ✓ End right side
   - ✓ Middle
9. **Desired Airflow or Cooling**
   - ✓ Calculated Recommendation Based on Values
   - ✓ Filter Fans & ambient airflow
   - ✓ Active Air Conditioning
10. **Mounting Location for cooling**
    - ✓ Roof
    - ✓ Sides
    - ✓ Front door

Selecting Thermal Management Method Based on Environmental Conditions

	AMBIENT TEMPERATURE				DUST			WATER			SPECIFIC		
	Low <40 °F (4.4 °C)	Climate Controlled 65-80 °F (18-26 °C)	Medium 80-100 °F (26-37 °C)	High 100+ °F (37°C+)	Clean	Moderate	Heavy	Dry	Light (rain)	Washdown	Corrosive	Oily	Sea Air
FILTER FANS	✓	✓	✓	👤	✓	✓	👤	✓	✓	✓ *	👤	👤	👤
COOLING UNITS	👤	✓	✓	✓	✓	✓	👤	✓	👤	👤 *	👤 *	👤	👤

KEY:

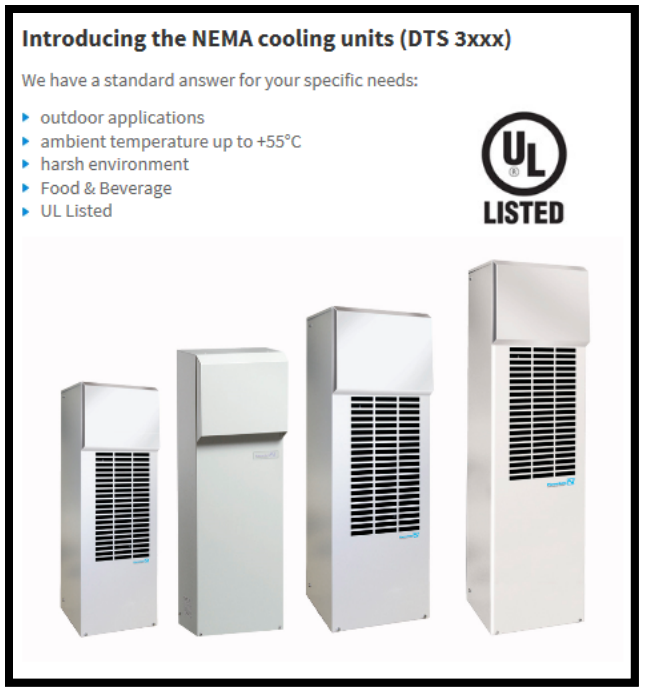
✓ Good ✓ Best 👤 Call to Specify * Rainhood Recommended

Methods for Cooling

- Natural Convection
  - Louvers or grills with filters
  - Effective when minimal heat removal is required
- Forced Convection
  - Fan with filter
  - Forces air into the enclosure to pressurize the interior
- Closed-loop Cooling
  - Use if cooling cannot be accomplished by the outside air
  - If the ambient air is strongly contaminated with oil or dust

Key Features for Cooling Units

- Able to perform efficiently in high temperature areas [131°F (55°C)]
- Backward curve impeller fan optimizes airflow and extends service life
- Condenser coils are coated with corrosion protection to extend service life
- Wide condenser fin spacing reduces particulate clogging while balancing performance
- Hermetically sealed compressors prevent refrigerant loss
- Actively evaporates condensate to remove moisture (900 BTU external)



- 3000-24,000 BTU for Modular
- 900-1300 BTU for Wall-Mount

Summary

Summary

- ✓ PoE standards continue to evolve to meet the needs of adding more power at the rack level
- ✓ Every site is unique and may require some customization
- ✓ Maintaining NEMA Type ratings is vital for the life of the equipment
- ✓ More sophisticated power features are needed for proper security and management
- ✓ Choosing the proper method of cooling based on both your device and the environment is key

Thank you!

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