Don’t Lose Your Cool
Overcoming Thermal Challenges and More With PoE at the Edge

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Chatsworth Products
Product Application Specialist
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

- Removing heat from switches and enclosures
- Upgrading power feeds
- Upsizing batteries and Uninterrupted Power Supplies (UPS)
- Maintaining the rating of the NEMA Type Enclosure
Why? To Support Higher Power End Devices

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

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

*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

• 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?

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

Notes: Illustrative only. Does not include line/heat loss allowance.
Remote Edge Environments
Each Site is Unique

Challenges

- Size
- Shape
- Capacity
- Location
- Architecture

Each Site is Unique
# 5 Pillars of Successful Edge Deployments

<table>
<thead>
<tr>
<th>Environmental</th>
<th>Equipment &amp; Cabling</th>
<th>Security</th>
<th>Thermal Management</th>
<th>Monitoring</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Protect against heat, snow, humidity, precipitation and high salt content</td>
<td>• Proper support for equipment and dedicated pathways for power and network cabling</td>
<td>• Control access to equipment, and keep records as needed</td>
<td>• Keeping equipment at proper temperature and addressing OPEX with efficient solutions</td>
<td>• Power availability/utilization, load balancing, switching, temperature/humidity, open/closed doors</td>
</tr>
<tr>
<td>• Environmental enclosures and seals for penetrations</td>
<td>• Rails, panels and cable management pathways</td>
<td>• Industrial latches and locks, or electronic access control as needed</td>
<td>• Filter fans; active cooling and heating</td>
<td>• PDUs can help monitor environmental conditions and power cycling</td>
</tr>
</tbody>
</table>

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**2020 BICSI FALL Conference & Exhibition**

**Bicsi**
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?

<table>
<thead>
<tr>
<th>NEMA (IP) RATING</th>
<th>Indoor</th>
<th>Outdoor</th>
<th>Corrosion Resistance</th>
<th>Sealed Tight</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type 12</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Type 4</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Type 4X</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
</tbody>
</table>
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**

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<td>7 A</td>
<td>14 A</td>
<td>20 A</td>
<td>22 A</td>
</tr>
<tr>
<td>UPS</td>
<td>1000 VA 900 W 8.3 A</td>
<td>1000 VA 900 W 8.3 A</td>
<td>2000 VA 1800 W 16.6 A</td>
<td>5200 VA 4680 W 21.6 A</td>
<td>6000 VA 5400 W 25 A</td>
</tr>
<tr>
<td>Runtime</td>
<td>12 min.</td>
<td>6 min.</td>
<td>6 min.</td>
<td>6 min.</td>
<td>6 min.</td>
</tr>
<tr>
<td>Power Input</td>
<td>1 x 15 A (10 A)</td>
<td>1 x 15 A (10 A)</td>
<td>1 x 20 A (16 A)</td>
<td>1 x 30 A (32 A)</td>
<td>1 x 50 A (62 A)</td>
</tr>
<tr>
<td>Size</td>
<td>2U, 40 lb</td>
<td>2U, 40 lb</td>
<td>2U, 70 lb</td>
<td>4U, 100 lb</td>
<td>4U, 130 lb</td>
</tr>
</tbody>
</table>

**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

<table>
<thead>
<tr>
<th>Functionality</th>
<th>Basic Power Distribution</th>
<th>Inlet Metering</th>
<th>Branch Circuit Metering</th>
<th>Networking</th>
<th>Access Control</th>
<th>Outlet Metering</th>
<th>Switched Outlets</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Non-Networked</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Basic - Simple, reliable power distribution to equipment in your cabinets. Select a Basic PDU when no power monitoring is required.</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Metered - Includes local LED display for easy reading of input current across phases. Select a Metered PDU when networking of PDUs is not an option.</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Monitored - Includes local and remote power monitoring for the PDU. Select a Monitored PDU when you want to monitor total power usage.</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>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.</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>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.</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>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.</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
</tbody>
</table>
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

<table>
<thead>
<tr>
<th>Factor</th>
<th>Details</th>
</tr>
</thead>
</table>
| Inside the Enclosure | - Minimum Temperature (impacts humidity)  
- Maximum Temperature (equipment specs) |
| 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 # |
| Available Power | - Voltage  
- Phase |
| Space Outside the Enclosure | - Ambient Minimum Temperature (Lowest temp room can reach)  
- Ambient Maximum Temperature (Max temp room can reach) |
| Type of Enclosure | - Freestanding Module (Self-Supporting)  
- Wall-Mount Two-Piece Fixed |
| Size of the Enclosure | - Height in millimeters  
- Width in millimeters  
- Depth in millimeters |
| Equipment Mounting Style | - 19” EIA Equipment Mounting Rails (Four rails)  
- Mounting Plate Mounted Equipment  
  (Controls, Automation, Electrical)  
- Combination 19” EIA Rails & Mounting Plate |
| (bayed enclosures) Location of this enclosure | - End left side  
- End right side  
- Middle |
| Desired Airflow or Cooling | - Calculated Recommendation Based on Values  
- Filter Fans & ambient airflow  
- Active Air Conditioning |
| Mounting Location for cooling | - Roof  
- Sides  
- Front door |
Selecting Thermal Management Method Based on Environmental Conditions

<table>
<thead>
<tr>
<th>AMBIENT TEMPERATURE</th>
<th>DUST</th>
<th>WATER</th>
<th>SPECIFIC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low &lt;40 °F (4.4 °C)</td>
<td>Clean</td>
<td>Dry</td>
<td>Corrosive</td>
</tr>
<tr>
<td>Climate Controlled 65-80 °F (18-26 °C)</td>
<td>Moderate</td>
<td>Light (rain)</td>
<td>Oily</td>
</tr>
<tr>
<td>Medium 80-100 °F (26-37 °C)</td>
<td>Heavy</td>
<td>Washdown</td>
<td>Sea Air</td>
</tr>
<tr>
<td>High 100+ °F (37°C+)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**FILTER FANS**
- Good
- Best
- Call to Specify

**COOLING UNITS**
- Rainhood Recommended

**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

✓ 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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