

Specifying power distribution for IT enclosures

Three questions that IT, facilities and engineering consultants should ask

With the growth in blade servers with dual or triple power supplies, a single equipment enclosure can easily produce dozens of power cords to manage—and an appetite for up to 20kW or more of reliable power. Traditional power strips are just not up to the task.

Eaton offers a complete suite of Powerware enclosure-based Power Distribution Units (ePDUs) that streamline the power architecture and support rapidly escalating IT power requirements. Eaton is unique in the industry for providing a tiered set of ePDU product families along two dimensions—tiered both in power capacity and in functionality. That means you can precisely match up the combination of features and power rating needed for each application.

Powerware ePDU families by functionality

Basic	Power distribution from the UPS to up to 24 receptacles in a rack or wiring closet, substantially reducing the number of plenum cables from input source to each rack
Metered	Also monitors electrical current, and displays power utilization on any branch circuit or the entire unit— on a bright, easy-to-read LED display to prevent overload conditions and tripped circuits.
Monitored	Enables users to securely view the status of each circuit from anywhere on the company intranet or the Internet, and receive automated alerts of potential trouble (serial RS-232 and IP communications available).
Switched	All the features above plus the ability to control remote server boot-up or electronically lock designated receptacles to prevent unauthorized use.
Managed	All the features above, plus metering down to the individual receptacle level.

Powerware ePDU families by power rating

Standard	Up to 4 kW, 15 to 30A—for example, to support up to six 1U/2U servers or peripherals
Mid-Range	4 to 10 kW, 15A to 40A—supports up to 16 1U/2U servers or two blade server chassis
High-Range	10 to 15 kW, 30A to 60A—for up to 25 1U/2U servers or three blade server chassis
Ultra	15 kW and up, 60A—supports up to four blade chassis and other power-hungry equipment

The right ePDU model and implementation strategy will satisfy present and future needs, optimally balance loads, and enhance data center efficiency and uptime. But which ePDU model is the best choice for the application at hand? It can be difficult to get a complete equipment list from the customer— and figures for voltage and amperage do not paint the whole picture either.

This application note presents three questions to ask customers to help determine which ePDU offers the optimal combination of capacity, functionality and price for their needs.

Question #1—Is the equipment old or new?

Older equipment still in service will typically require 120V power, while most newer hardware runs on 208V. The average service life of IT hardware is three years, so you may find that 208V predominates. However, there are exceptions— such as routers, hubs, KVM, monitors and rackmount enclosure fans— running on 120V power.

If the customer requires 120V, specify an ePDU with a neutral wire, such as with L14 (four-wire, single-phase) or L21 (five-wire, three-phase) receptacles.

Customers regularly buy their IT hardware with 5-15P plugs (15A/120V) plugs and are not sure whether it can run on 208V power. The answer is generally yes. If you can remove the plug from the hardware chassis, it will run on 208V. Hardware is sold globally and has auto-sensing power supplies to adapt to local voltage standards. Furthermore, 208V cordsets (C13 to C14, or C19 to C20) are readily available across the market.

Key issue for consultants: Do you specify single-phase or three-phase? If the customer is powering legacy equipment that might require 120V power (such as routers, hubs and switches), you might be considering 30A/208V three-phase power strips, since they are available with both 208V and 120V single-phase outputs. However, this approach requires three pole positions at the panelboard, so you will only be able to power 14 ePDUs from one 42-pole panelboard (42 poles / 3 pole breakers = 14 circuits).

In contrast, the 60A/208V single-phase power option only requires two pole positions at the panelboard, so you can feed 21 ePDUs from one 42-pole panelboard (42 poles / 2 pole breakers = 21 circuits). You can therefore serve 50 percent more enclosures from the same panelboard.

Single Phase = **21 ePDUs** (or enclosures) = 42 pole positions / double pole breaker
Three Phase = **14 ePDUs** (or enclosures) = 42 pole positions / three pole breaker

APC often leads with three-phase solutions, but you can make a strong case for a single-phase solution. Here's your talk line:

“Eaton's high-density, single-phase ePDUs support 50 percent more enclosures and better maximize the upstream electrical architecture. Eliminating the neutral wire and traditional three-phase power strips will reduce copper across the facility, maximize panelboard pole positions, and maximize power per pole position. These are the key reasons 60A/single-phase (10kW) is taking precedence over 30A/three-phase (8.6kW) power.”

(Note that this statement refers to 50 percent more “enclosures” rather than “power.” IT leaders and resellers think in terms of enclosures.)

Question #2—Is the equipment big or small?

Increasingly, customers are not adequately reviewing or preparing for the variety of plug types they will need—especially as they expand the use of blade servers and network servers. Next-generation equipment, typically occupying 4U (7”) and up in the rack, use 20A or 30A plugs. It is important to identify this early in the specification process.

Large systems can be ordered with either “appliance” or “industrial” plugs. Proper advance planning of plug types can eliminate a lot of chaos for IT and Facilities managers. Here are some examples:

Server	Appliance plug	Industrial plug
Cisco 4000 Series	2 x C19	2 x L6-20P
Cisco 6500 Series:	4 x C19	2 x L6-30P
HP ‘C’ Class:	6 x C19	2 x L15-30P
IBM BladeCenter:	6 x C19	2 x L15-30P

If the overall count of large systems is low, it is generally best to order the equipment with “appliance” plugs and power them via an ePDU. Some Powerware ePDUs offer L6-20R receptacles, but these are impractical because they take up about so much space on the ePDU mounting surface, about 3” outside dimensions. As the IEC standard gains acceptance, most customers now use C19 plugs. Here’s a brief guideline to how many blade servers can be plugged into an ePDU:

ePDU configuration	Number of servers
30A/3P	1 blade server
60A/208V	2 blade servers
60A/3P	3 blade servers
80A/3P	4 blade servers

If the overall count of large systems is high—or if the customer received equipment with L6-30P or L15-30P plugs— you would be best to specify Powerware Rack Power Module (RPM) units. The Powerware Rack Power Module (RPM) distributes up to 36 kW of power in an organized manner to loads of various voltages, power cords and layouts. The table below shows the benefits of using the Powerware RPM to power **four** HP ‘C’ Class Servers with L15-30R outlets:

	Powerware RPM	Independent Whips
Maximum power	100A/three-phase (hardwired)	Server-dependent
Input cables	Two (2)—(A and B source)	Eight (8)— 4 x (A and B source)
Pole positions	Six (6)—(2 inputs x 3 poles)	24— 8 inputs x 3 poles)

Using a Powerware RPM clearly offers significant financial and functional advantages. And because fewer cables are required beneath the raised floor, this approach improves airflow, which is a particularly pressing issue in older buildings.

Key issue for consultants: What’s the best way to maximize pole positions, a top area of concern for data center managers? The electrical architecture is based on a ‘use it or lose it’ scenario. If you consume the panel board pole positions without consuming the power, more panelboards need to be installed. Under-loading is actually a much bigger source of concern to data center managers than over-loading.

Question #3—How full is the rackmount enclosure?

One of the best ways to estimate overall power load is to simply look at the density of equipment in enclosures. Excluding devices that consume little power (such as routers and hubs), here’s a simple guideline that can be used to propose an appropriate power solution:

Enclosure density	Power range	Power solution
50 percent full	4 – 5kW	30A/208V
75 percent full	6 – 7kW	30A/Three-phase
100 percent full	8 – 10kW	60A/208V

Key issue for consultants: Simply match the estimated power requirement with a Powerware ePDU. For instance, a Powerware “Standard” ePDU (up to 4 kW, 15 to 30A), supports up to six 1U/2U servers or peripherals. A Powerware “Mid-Range” ePDU (8.6-10 kW) supports a fully loaded rack of legacy equipment or two blade server chassis.

The Powerware RPM is classified as a *Monitored PDU* and is particularly well suited to partner with a Powerware three-phase UPS, such as Powerware 9390, Powerware 9355 or Powerware BladeUPS.

The chart shows some sample ePDU configurations for various power requirements.

Powerware ePDU	Configuration	Height	Max Power	Total Power
PW309MOOU079	30A/208V (3-phase)	0U	2,878W / phase	8.636 kW
PW110MOOU087	60A/208V	0U	3,200W / breaker	9.6 kW
PW110ME1U083		1U		
PW317ME2U092	60A/208V (3-phase)	2U	2,878W / breaker	17.27 kW
PW323MOOU095	80A/208V (3-phase)	0U	3,200W / breaker	23 kW

Summary

Eaton is unique in providing a full complement of Powerware ePDUs, both in terms of functionality and power rating. Once you have determined the right voltage, receptacles and power requirements, you can then specify other features and options to meet customers’ unique requirements— from various mounting options to remote monitoring to individual control of load segments.

With the right ePDUs in place, the power architecture has fewer cables to manage, fewer distribution points to monitor, and greater flexibility for IT personnel to make changes without an electrician. In short, you can help customers create a power infrastructure that is as resilient, flexible and adaptable as their data centers need to be.

About the author

Kevin Macomber is a business development manager for power quality solutions at Eaton Electrical. He holds a BS in business economics and started his career as an electrician in the U.S. Navy. Kevin has more than 10 years of experience in data center electrical architectures and has been instrumental in the design and development of dozens of market-leading power distribution products.

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Powerware-branded products protect critical systems around the world in medical, networking, financial, industrial, communications, military, and aerospace applications—wherever continuous quality power is essential to operations.

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