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Powering Business Worldwide

Distributing Power to Blade Servers

Ten steps to selecting the optimal power distribution design

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

Eaton® offers a complete suite of enclosure-based power distribution units (ePDU™) that streamline the power architecture and support rapidly escalating blade server 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.

Which blade server ePDU is right for your application? What deployment considerations apply? With the right ePDU model and implementation strategy, you can satisfy present and future needs, optimally balance loads and enhance data center efficiency and uptime.

Although the Eaton ePDU family encompasses a host of models and options, selecting the right product and implementation scheme for any given application is a simple matter based on 10 key factors.

1. How many blade servers will be powered?

Eaton offers models for applications of all sizes. A "Mid-Range" ePDU (8.6-10 kW) supports two blade server chassis. A "High-Range" ePDU (10-15 kW) supports up to three blade server chassis. An "Ultra" ePDU (15 kW and up) supports up to four blade chassis. The following chart shows some sample configurations.

Approximate number of blade servers that can be supported by various electrical configurations

Configuration	No. of servers	Max Power	Total Power	Eaton ePDU	Height
30A/208V (three-phase)	1 – 2*	2,878W / phase	8,636W	PW309MOOU079	0U
60A/208V	2	3,200W / breaker	9,600W	PW110MOOU087	0U
				PW110ME1U083	1U
60A/208V (three-phase)	3	2,878W / breaker	17,272W	PW317ME2U092	2U
80A/208V (three-phase)	4	3,200W / breaker	23,030W	PW323MO0U095	0U

Note that the figures above are approximate, based on typical servers that are not fully loaded.
Your hardware supplier will be able to provide actual operating requirements for your specific blade servers.

2. What type of input power plugs do your blade servers use?

Most blade servers come with appliance plugs (IEC320-C20) or industrial plugs (such as L15-30P). The C20 appliance plug type is traditionally used for ePDUs with C19 outlets. The L15-30P plugs are used to plug directly into a UPS or independent outlet box. Some ePDUs offer L15-30R receptacles, but the options are limited and restricted to 19" horizontal rackmount power solutions. Deploying multiple L15-30P power cables to the rack can be much more costly than installing one larger amperage rated circuit.

Eaton ePDUs are offered with a variety of power inputs and outputs to fit most power requirements. You can select from NEMA, IEC and hardwired inputs from 30A to 80A at 208V single- or three-phase. On the output side, you can select a mix of NEMA- and IEC-type output receptacles.

3. What other type of equipment must be served?

In addition to blade servers, you may also need to accommodate other equipment that uses different receptacle types. The best solution, if possible, is to convert the other equipment to the IEC320-style connectors, rated at 208V. This approach will typically enable you to deploy more equipment in the rack, and power supplies are typically more efficient at the higher voltage level. Contact your hardware suppliers for IEC C13-to-C14 or C19-to-C20 optional cord sets. Most power supplies in today's IT equipment will auto-sense the input voltage and allow either 120V or 208V based on the cord set.

4. Does the equipment use single-phase or three-phase power?

Most blade server power supplies are single-phase, except where an actual three-phase plug is being used, and then there may be the need for three-phase power. Larger storage array systems may also require three-phase power. There are advantages to either 30A/208V three-phase or 60A/208V single-phase solutions.

- *Three-phase*. If you are powering legacy equipment that might require 120V power (such as routers, hubs and switches), consider the option of using 30A/208V three-phase power strips, as they are available with both 208V and 120V single-phase outputs. However, a shortcoming of this solution is that it 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).

- *Single-phase*. 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 more racks from the same panelboard.

For higher power applications, you can also use 60A three-phase power distribution, but you must be aware of the limitations of the panelboard itself, as you could max out the panelboard with as few as four (4) circuits.

5. Will you distribute power feeds for optimum redundancy and load balancing?

Some blade servers permit the operator to adjust the performance of the primary between two and three internal power supplies. We recommend that the power be distributed across the maximum number of power supplies. Remember, the breakers for three-phase and single-phase, in-rack power units are divided into groups of three. A distributed power approach ensures the highest degree of load balancing at the enclosure level.

6. In what manner will you connect power sources to maximize availability?

Blade servers have at least four input power cords. That means you have various options for how you plug server power cords into the ePDU(s). For maximum availability, you should alternate not only the ePDU sections you plug the primary power cords into, but alternate the ePDUs as well. The following is an effective example for load-balancing two blade servers with six power cords across two ePDUs.

	Plug #	ePDU #1	ePDU #2
Server #1	1	Outlet 1 - Section 1	
	2		Outlet 1 - Section 2
	3	Outlet 1 - Section 3	
	4		Outlet 1 - Section 1
	5	Outlet 1 - Section 2	
	6		Outlet 1 - Section 3
Server #2	1		Outlet 2 - Section 1
	2	Outlet 2 - Section 2	
	3		Outlet 2 - Section 3
	4	Outlet 2 - Section 1	
	5		Outlet 2 - Section 2
	6	Outlet 2 - Section 3	

Note that this section refers to the output phases (AB, BC, CA) or sub-feed breakers.

7. Do you require onboard metering?

It is critical that the ePDU has an onboard ammeter to help prevent overload conditions, optimize power distribution, and, when applicable, to accurately bill internal customers for power usage. The ammeter also helps you set up a balanced equipment load in the enclosure. (Remember that inputs of large power devices are measured differently than the outputs. This is particularly important on three-phase power units where the outputs are single-phase.)

While branch circuit monitoring may be used, it does not help in balancing loads on the output of the ePDUs. It is also impractical to walk back and forth between the panel board and the enclosure as you attempt to balance loads. Therefore, the power distribution unit you choose should monitor both inputs and outputs for three-phase units and all of the outputs for single-phase units.

All but the most basic Eaton ePDUs have onboard metering at the outlet, branch circuit and ePDU levels, with time-stamped activity logging. Eaton offers the only ePDUs on the market that support outlet-level monitoring. Other enclosure-based ePDUs only show aggregated current at the branch circuit or ePDU level.

8. Will blade servers be clustered or distributed in the data center?

Depending on the total number of blade servers being deployed, you need to evaluate whether these units should be isolated in their own location in the data center. After all, these high-density systems create unique powering and cooling concerns. Grouping blade servers together offers some benefits from an electrical architecture perspective, and can offer advantages in developing a modified cooling strategy as well.

9. Where do you want to mount the ePDU?

As ePDUs have become more powerful and sophisticated, they have grown larger as well, to accommodate UL489 branch circuit breakers and internal wiring. Mounting large ePDUs can be problematic in 24" wide enclosures. Some of these ePDUs can extend 3.5" to 4" from their mating surface and, if not mounted correctly, can block rear rackmount rails and cabling—and inhibit airflow for cooling. Some customers elect to use deeper enclosures (44" to 48"), but Eaton recommends 30" deep enclosures for better thermal management and ease of access.

Eaton offers ePDU models that mount horizontally in minimal rack space (1U or 2U), or vertically in rack side pockets or rear channels. Our high-density "Ultra" ePDUs can be hardwired directly to the panelboard.

10. What will your data center look like in 12 to 18 months?

What expansion plans are on the horizon? With the rate of change in most IT environments, it is not uncommon for the load profile of a datacenter to change even before the day equipment is commissioned. Plan ahead for this inescapable reality. You don't want to find yourself redesigning the power distribution system for your enclosures or a portion of the data center. Eaton recommends that you factor in at least 20 to 30 percent headroom over today's requirements for future expansion.

Closing thoughts

Eaton is unique in providing a full complement of ePDUs that combine the functionality you need with the power range you need. Eaton ePDUs offer features and options to match your unique requirements, from various mounting options to remote monitoring to individual control of load segments.

ePDUs are just one element of Eaton's unified family of data center solutions, which also includes power protection, backup power, power monitoring, enclosures, services and more. For example, the Eaton BladeUPS® power system, designed for high-density blade server environments, delivers 12 kW of protected power in a 6U module, up to 60 kW with redundancy in a single rack. Eaton's Rack Power Module (RPM) distributes up to 36 kW of power in an organized manner to loads of various voltages, power cords and layouts. Eaton's software and connectivity options enable administrators to monitor power conditions from anywhere.

The unified power architecture has fewer cables to manage, fewer distribution points to monitor and greater flexibility for IT personnel to make changes without an electrician. With integrated, compatible elements, you create a power infrastructure that is as resilient, flexible and adaptable as the data center needs 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.

About Eaton

Eaton is a global leader in power quality and management solutions —named by Frost & Sullivan as "Power Quality Company of the Year" for three years in a row (October 2006). Eaton's rugged ePDUs reflect more than 40 years of expertise in industrial-strength power quality solutions. In fact, Eaton has been manufacturing ePDUs for several other major brands for years.

For more information - www.powerware.com **-** 1-800-356-5794.

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