

Meet growing power demands in your data center— providing more circuits and power to IT enclosures

Using Eaton Rack Power Modules (RPMs) to create a more versatile and adaptable data center

Equipment upgrades are necessary for any data center, even recently constructed facilities. With advances in server technology and the increasing demands for IT processing power, IT managers must always be ready to modify, adapt and upgrade their systems to stay in line with customer needs. This constant evolution in the data center often leads to problems within the power infrastructure.

As older servers are replaced with new ones—generally with dual or triple power cords—the space under the data center raised floor becomes a complicated mess of cables running back to wall-mounted panelboards.

Airflow and access become severely restricted. Cabling issues can be difficult to troubleshoot. Nearly every time a rack configuration is changed, a licensed electrician must be brought in to modify and install power cables.

With “dumb” panelboards, it is difficult to understand power conditions and trace loads back to their breakers. Which circuit has enough spare capacity to support more equipment? Which breaker is approaching the tripping point? It is often hard to tell.

Constant evolution in the data center often leads to problems in the power infrastructure—not enough power at the rack level, or not enough circuits to support new, multi-corded IT equipment.

Traditionally, data center managers could plan for about 60 to 100 watts of power consumption per U of rack space. A full rack of equipment averaged 3 to 4 kW of power. Now power demand has grown to 600-1000 watts per U. Power consumption may soon reach more than 40 kW per rack.

It is common to find that there are not enough circuits to support these high-density racks or enough power drops to add more equipment. A typical electrical panelboard has 42 breaker poles to support either 42 120V single-pole circuits, or 20 208V double-pole circuits, or only 14 208V three-pole (three-phase) circuits, or some combination of these circuit types.

A typical computer room that was wired five to 10 years ago was probably designed to feed one 20A 208V circuit to each rack (less than 3.5kW per rack). If you now have to support 20 kW of equipment in each rack, it could take up to six of these 20A circuits. The existing electrical infrastructure will be unable to support this load growth—and could easily run out of circuits or capacity.

Beyond traditional power distribution

Traditional thinking about data center power distribution needs to change. Data center managers need to bring higher-density power distribution closer to loads. They need to find a way to provide more circuits, even though wall space for panelboards is limited. And they need greater visibility into power conditions at a more granular level, to see trouble coming and prevent tripped circuits.

Those requirements can be met with the Eaton® Rack Power Module (RPM), a highly configurable power distribution unit that delivers up to 36 kW of power to loads of various voltages, input power cord types and output receptacles (single-phase and three-phase). The RPM distributes power:

- **From** a three-phase source, such as a three-phase UPS, panelboard, large power distribution unit (PDU) or the electric utility input
- **To** directly connected IT equipment or secondary power distribution devices, such as enclosure-based power distribution units (Eaton models are known as ePDUs) and power strips

This flexibility gives the RPM several advantages over traditional power cabling to enclosures:

- **Brings the functionality of a panelboard closer to each enclosure**
With the RPM, you can eliminate many of those long cable runs from enclosures to distant, wall-mounted panelboards or to large, freestanding PDUs.
- **Adds more circuits for IT equipment where space for PDUs or panelboards is limited**
With the RPM, you can place high-density power distribution anywhere in the data center—in any enclosure—not just near a wall or in a dedicated space left vacant for a freestanding PDU.
- **Sets the stage for future capacity requirements, with plug-and-power ease**
You can hardwire an RPM with locking receptacle outlets now, and when you need to add more capacity, just plug in a new ePDU, without the need for a licensed electrician.
- **Displays power conditions at a glance**
Technicians can readily see how to best balance loads and where new equipment can be safely added without risk of tripped circuits.

The resulting architecture has fewer cables to manage, fewer distribution points to monitor, and greater flexibility for IT personnel to install and change the power distribution architecture. Furthermore, it extends the modularity and scalability established by new rack-mount, modular UPS products, such as the Eaton BladeUPS.

Architecture of an RPM

The 3U RPM mounts in an enclosure using adjustable rails. The RPM does not generate additional heat, which makes it well suited for high-density environments where cooling is an issue.

The front of the unit houses the most frequently used components of the RPM. With front access to breakers, communications and local monitoring information, there's no need to go around to the back of an enclosure unless you are plugging or unplugging equipment. A large, color display shows the power consumption of each breaker-protected outlet and also monitors the input power to the unit. This power graph provides a quick and easy-to-read overview of the power integrity of each unit. Color-coded breakers make the status of each outlet clear at a glance. An optional PowerXpert® card can be installed in a slot on the front of the unit, providing Ethernet/IP ports for remote monitoring and management.

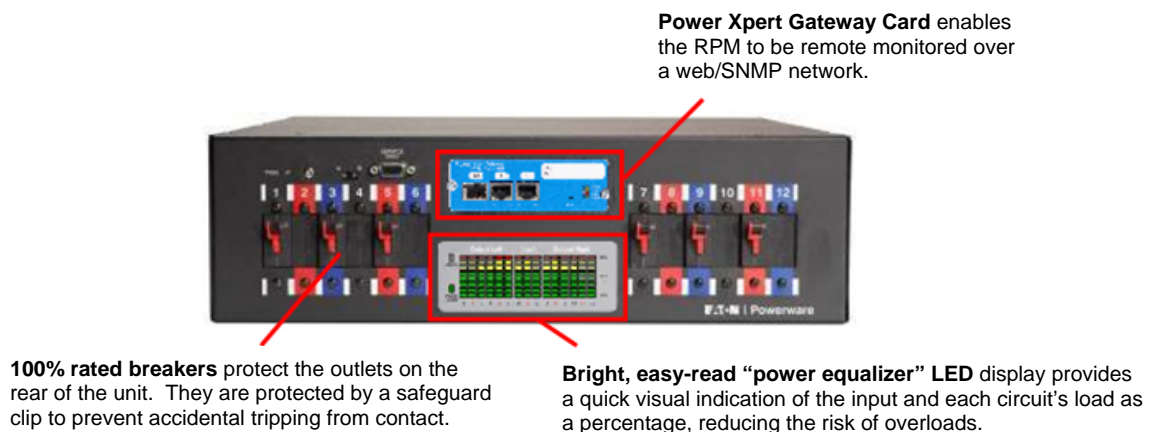


Figure 1. The front panel of the RPM houses the most frequently used components.

The back of the unit houses the input cord (or hardwire terminal) and two independent receptacle plates. There are four input options and 15 available outlet plates, including single- and three-phase, straight and locking receptacles, IEC and NEMA receptacles, 120V and 208V—all protected by breakers. Any of these input and outlet options can be installed on the RPM, making it easy to customize to your specific applications.

If you need locking receptacles, the RPM offers a huge advantage. Due to the physical dimension of locking receptacles, it's a daunting task to install them in long and skinny 0U power strips or even in 1U or 2U distribution units. In contrast, the RPM was designed to handle up to six locking outlets in a 3U box. With this option, there's no need to get an electrician to install new three-phase cable runs every time power distribution requirements grow.

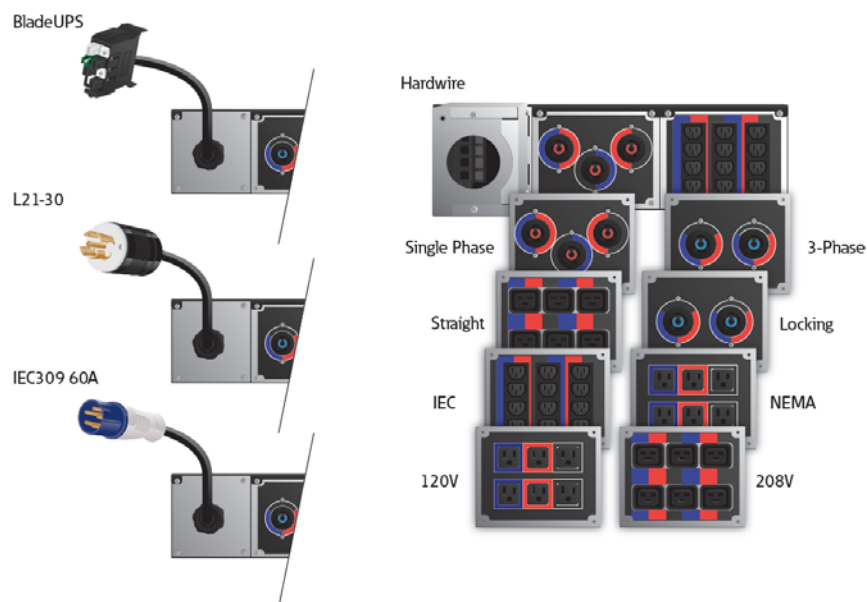


Figure 2. The RPM offers a broad range of input and output options.

Most popular applications for the RPM

What inputs and receptacles do you need? Where do you want to deploy it? Do you need the RPM to serve IT equipment directly or to distribute power to an enclosure PDU (such as an Eaton ePDU®). The choice is yours. The RPM is highly configurable, adaptable for many applications and locations. The following sections describe the most commonly used RPM applications and configurations.

To distribute power from a panelboard to enclosures...

The RPM can be hardwired directly to a wall-mounted or freestanding panelboard, providing up to 36 kW to critical loads. When configured with locking receptacles, the RPM can redistribute power to up to six ePDUs, increasing flexibility, outlet count and facilitating future changes. (Traditionally, there would have been a separate cable for each ePDU in an enclosure—an expensive, complex and inflexible proposition that required an electrician whenever power requirements changed.)

Figure 3a.

The RPM streamlines data center power distribution while increasing flexibility.

Before

Each ePDU or power strip had its own cable run back to the panelboard, increasing installation costs, disrupting raised floor cooling and requiring electricians to make any future changes

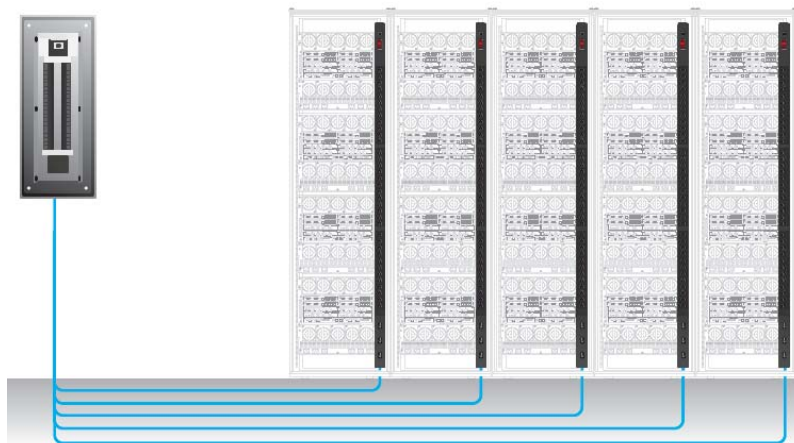
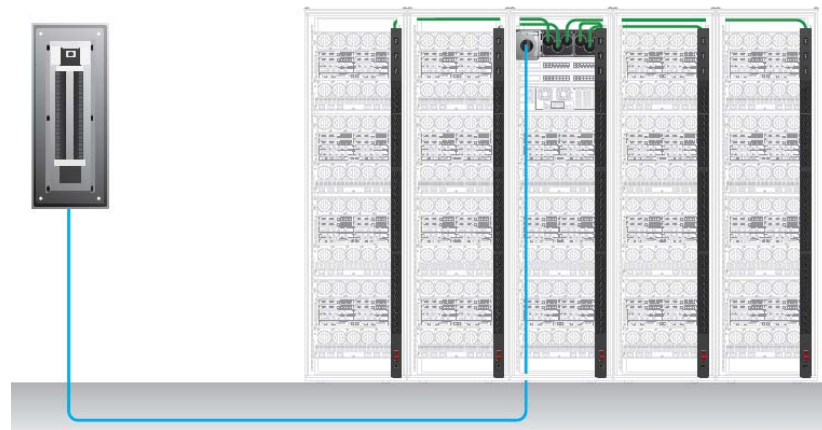


Figure 3b.
The RPM streamlines data center power distribution while increasing flexibility.

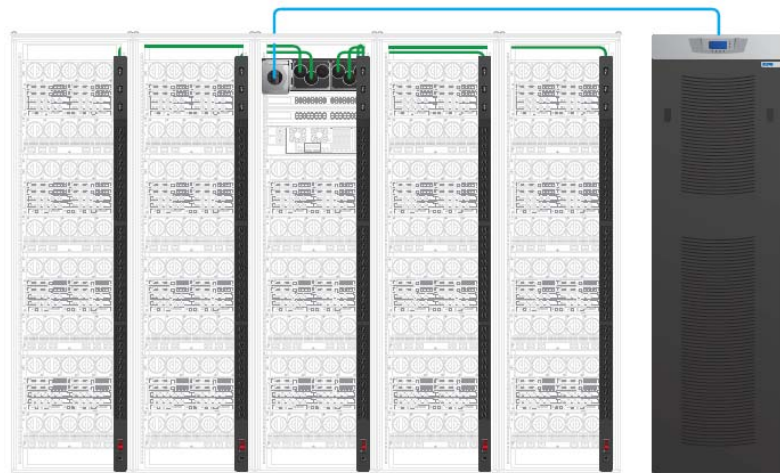
After
The RPM significantly streamlines cabling, reduces installation cost, and brings smart monitoring of power conditions closer to loads.



Distributing power directly from a UPS to enclosures

The RPM is hardwired to the breaker-protected output of the UPS, such as an Eaton 9355 or other UPS, to bring power outlets and power monitoring closer to the loads. The RPM can be customized with application-specific receptacles such as: locking receptacles for ePDUs, C19 receptacles for direct connection of blade servers, C13s for 1U and 3U servers, and 5-20R receptacles for legacy equipment.

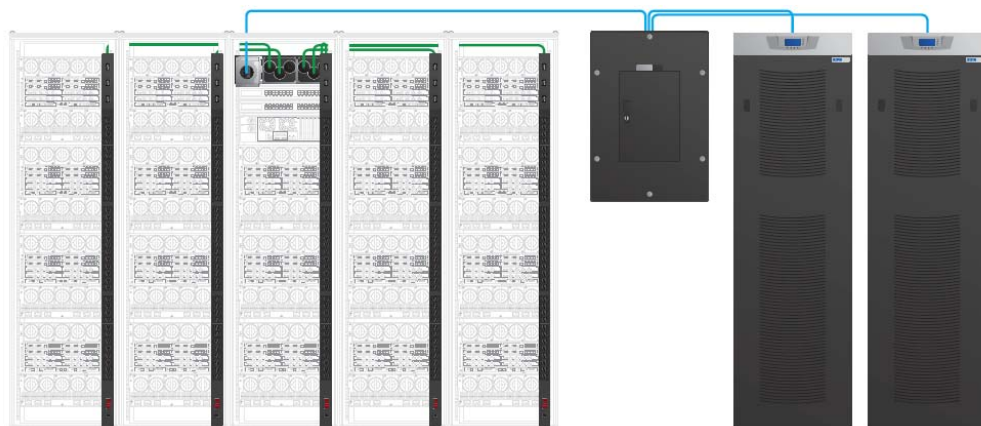
Figure 4.
This RPM is hardwired to the breaker-protected UPS output.



Delivering power from a multi-module UPS to enclosures

The RPM is connected to the tie cabinet that links multiple UPSs into a parallel configuration. This scenario is typical when a UPS has reached capacity and could not be upgraded, so two or more UPS modules were joined via a tie cabinet to add capacity. Additional UPS modules can be added to this configuration without disrupting power to the loads.

Figure 5.
In multi-module, parallel UPS configurations, the RPM is connected to the tie cabinet.



Delivering power directly from an Eaton BladeUPS to enclosures

The RPM can be configured with a special connector that plugs directly into the back of the 12 kW BladeUPS module with no need for an electrician. (Popular RPM configurations with the BladeUPS input are kept in stock for rapid shipping.)

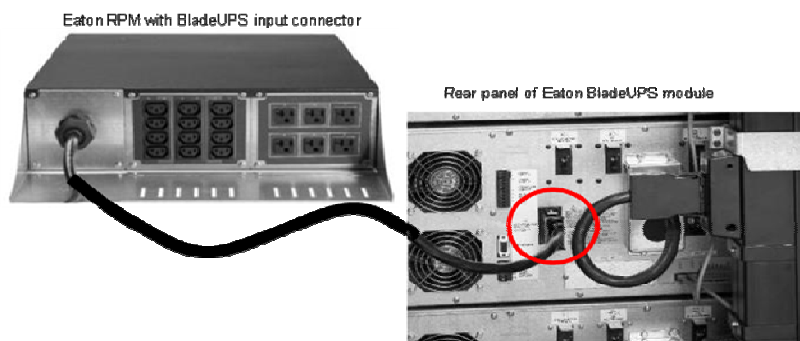


Figure 6. The RPM can be powered directly from an Eaton BladeUPS module and is sized to be the ideal partner for this 12 kW modular UPS.

The cords for this connection can be ordered up to 20 feet long, so the RPM can be several enclosures away from the BladeUPS, depending on where in the enclosures the units are installed. For example, if the BladeUPS and RPM are both installed at the top of their respective enclosures, they could be as far as nine enclosures apart. If one is at the top of its enclosure, the other at the bottom, they could be perhaps four to six enclosures apart.

The diagram below represents approximate guidelines for the maximum available cord length. You should carefully measure the specific distances for your installation, including the wire routing path, to order the appropriate length input cable.

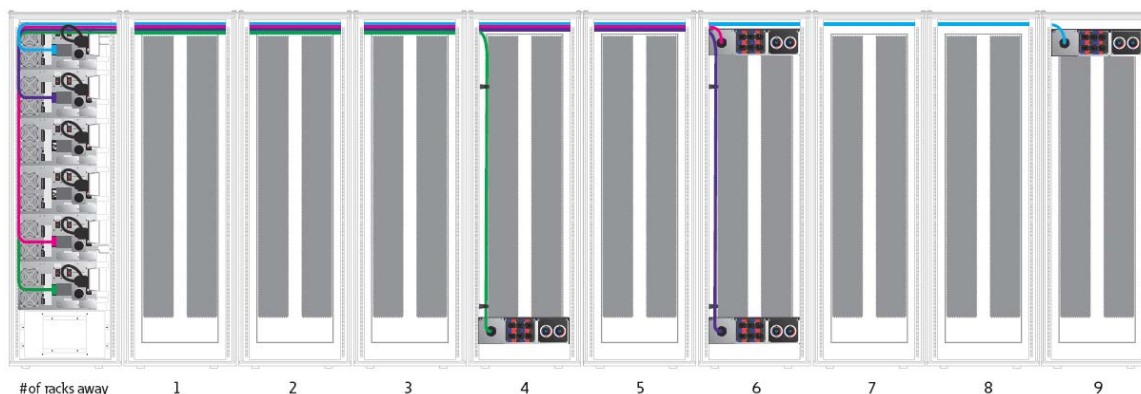


Figure 7. Maximum installation distances for RPM with 20 foot input cable. (Approximate)

Primary and secondary power distribution in a box

The RPM adapts to serve two roles simultaneously in a single box: distributing power from the UPS or panelboard to PDUs in the enclosure, or directly to IT equipment. One RPM can serve both roles simultaneously, depending on the outlet receptacle plates.

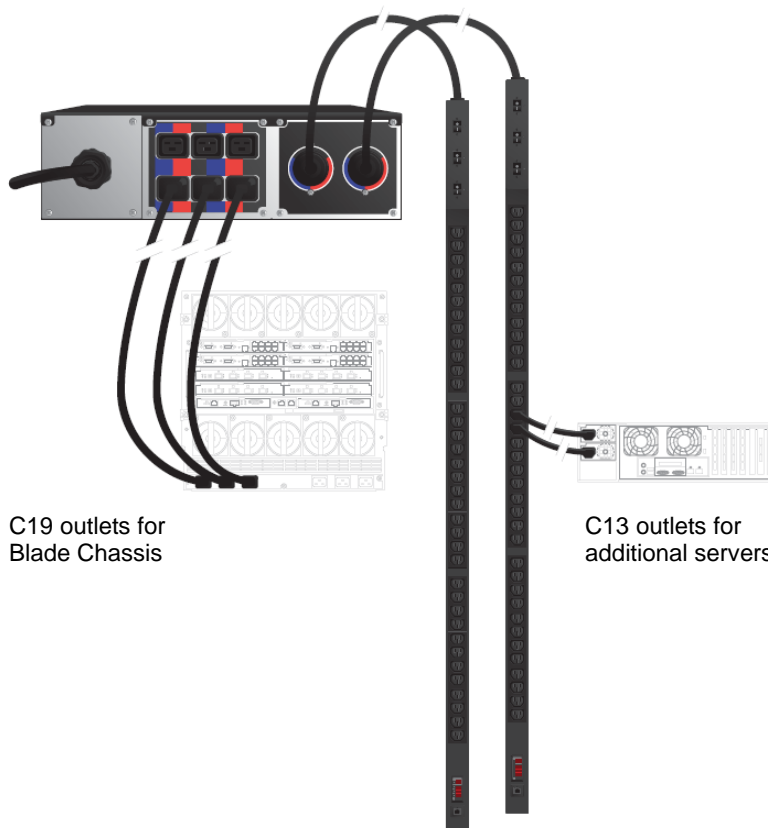
The RPM back panel can be configured with C19s to power blade chassis, C13s to power traditional 1U and 3U servers, NEMA receptacles to power legacy equipment, locking receptacles to power enclosure-based PDUs—and any combination of these outlet types.

When used for secondary power distribution, the RPM connects directly to the following Eaton enclosure-based PDUs (ePDUs):

Output Plug	ePDU Model Number	ePDU Model Description
L6-20P	PW103BA0U195 PW103MI0U180 PW103SW0U153	(4) IEC 60320 C19, (24) IEC 60320 C13 (24) IEC 60320 C13, (4) IEC 60320 C19 – IP (24) IEC 60320 C13 – Switched
L6-30P	PW105BA0U055 PW105MI0U096 PW105SW0U154	(4) IEC 60320 C19, (24) IEC 60320 C13 (4) IEC 60320 C19, (24) IEC 60320 C13 – IP (16) IEC 60320 C13 – Switched
L14-30	PW105MI0U098 PW105MI0U99	(24) 5-20R - IP (24) IEC 60320 C13, (2) IEC 60320 C19, (4) 5-20R – IP
L21-20	PW306MI0U113 PW306MI0U181 PW306MI0U182 PW306SW0U156	(24) IEC 60320 C13, (3) IEC 60320 C19, (6) 5-20R – IP (21) 5-20R, (6) L6-20R – IP (6) IEC 60320 C19, (36) IEC 60320 C13 – IP (24) IEC 60320 C13 – Switched
L21-30	PW309MI0U114 PW309MI0U115 PW309MI0U183 PW309SW0U178	(9) IEC 60320 C19, (24) IEC 60320 C13 – IP (3) IEC 60320 C19, (6) 5-20R, (24) IEC 60320 C13 – IP (42) IEC 60320 C13 – IP (24) IEC 60320 C13 – Switched

Figure 8.

The RPM can deliver power to in-rack PDUs, such as Eaton ePDUs, and/or directly to IT equipment.



Installing your Eaton Rack Power Module

The RPM is a compact, 3U box that mounts on provided rails in any position inside an enclosure, depending on the application, available space and input/output cabling:

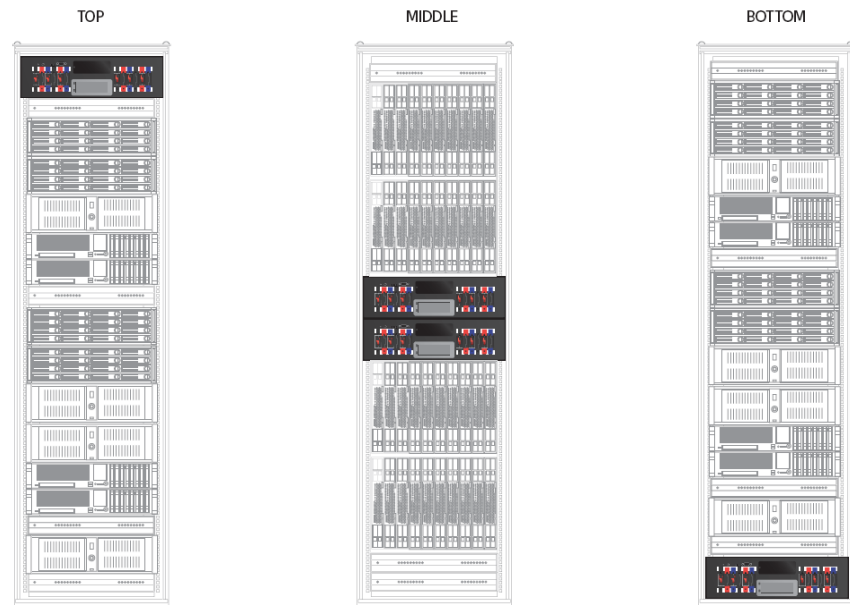
Figure 9.

The RPM can be installed in any available 3U space.

Top is ideal for top cable entry applications and to have local metering display at eye level

Middle is best if you need to accommodate shorter power cords to servers or blades

Bottom is perfect for simple cable management in raised-floor environments



An optional cable tray can be installed to secure smaller output cables. Cable claws and tool-less D rings can be installed in the enclosure to secure larger input and output cables. These cable management accessories help protect power cables from over-stretching or being accidentally unplugged.



Cable tray to secure smaller cables.

Front rail mounting brackets.

Tool-less D rings secure large cables.

Figure 10. RPM cable management and mounting

Summary

The size of a server... the power of a panelboard... the flexibility of an ePDU... all in one box.

With four possible power inputs from 9 kW to 36 kW, 15 options in IEC and NEMA output receptacle plates—and the ability to mix and match all these options to create hundreds of custom configurations from a single, standard unit—the RPM is extraordinarily adaptable.

Compared to traditional power distribution approaches, the RPM offers significant advantages:

- *Simplicity.* Power distribution is streamlined and well organized. It is easy to follow the power path to the load, enabling better load management and cable management.
- *Self-reliance.* The plug-and-power architecture enables you to change equipment in the rack without an electrician
- *Assurance.* Load balancing is somewhat automated by the use of three-phase inputs and either three-phase outputs or balanced single-phase output receptacles.
- *Visibility.* Local and remote monitoring enables you to not only prevent overloads and tripped circuits, but to proactively and holistically manage energy use and costs.

For more information about how the RPM can extend the value of your existing power distribution system—even as evolution and new technologies stress the data center—contact your Eaton reseller or visit us on the Web at www.powerware.com/ups/rpm.asp.

Contact information

Anderson Hungria, M.S.Eng.
Application Engineer, Data Center Solutions
Eaton Corporation
Phone 919.870.3330
Email AndersonHungria@eaton.com

Top 10 Features and Benefits of the Eaton Rack Power Module (RPM)

	Feature	Benefit
1	Plug-and-power architecture with customer-selected output receptacle types	Organizes power distribution and simplifies cable management, making it easier to follow the power path to the load Enables installation and changes of IT equipment without the services of a licensed electrician
2	Input power sources: Up to 17 kVA (with 60A input plug) or 36 kVA (with optional 100A@208V hardwire input)	Supplies sufficient power to support two racks of high-density IT equipment or up to nine racks at low density (~2 kVA)
3	Output power distribution: To 12 poles of distribution, divided into two banks of 6 poles, which correspond to two receptacle output plates	Simplifies the distribution of power from three-phase input source to secondary power distribution devices Improves load balancing, reducing nuisance alarms from the UPS
4	Compact 3U steel chassis that can be installed in any EIA 19" rack (or wall-mounted), all hardware included	Small footprint, more power in less space, flexibility to deploy in the same rack with IT and UPS equipment
5	Local monitoring —Bright, easy-read "power equalizer" LED display	Quick visual indication of each circuit's load (as a percentage of NEC-derated rating), reducing the risk of overloads and tripped breakers. No need to check individual power strips in the rear of the cabinet
6	Color-coded and numbered labeling of breaker poles and output receptacles, linked to the LED load display	Gives the user a clear view of the phase that will be affected by adding more load onto the three-phase source
7	Remote monitoring —Port for optional PowerXpert card	Enables network communication to remotely monitor input and output loads Reduces inventory spare requirements, by using the same communication cards as Eaton UPSs Supports Eaton remote monitoring option via eNotify service
8	Branch circuit monitoring via the Eaton Energy Management System (EMS)	Enables easy load monitoring over the network; optimizes management of the RPM as part of a unified, end-to-end power infrastructure
9	Branch circuit breakers (UL-449-listed, 15A through 32A ratings available) with cable retention brackets.	Provide branch circuit protection and on/off operation for groups of receptacles; prevents power cords from being accidentally disconnected
10	Optional TVSS (transient voltage surge suppression)	Provides surge protection for applications where the RPM is connected directly to a utility input source instead of a UPS-protected source