



## Alternating Phase



A New Look at 3-Phase Power Distribution

### Executive Summary

The principles of 3-Phase power are not always well understood by the installer, whose only task is to power up the equipment being installed in the computer rack. Load balancing (matching current draw on each phase) is critical in these applications for multiple reasons:

- 1) If the three phases are not balanced, heat is generated resulting in higher cooling costs.
- 2) Unbalanced loads lead to inefficiency and higher power bills.
- 3) High loads on a single phase means greater chance of tripping either a PDU or upstream breaker, and losing power at the rack.

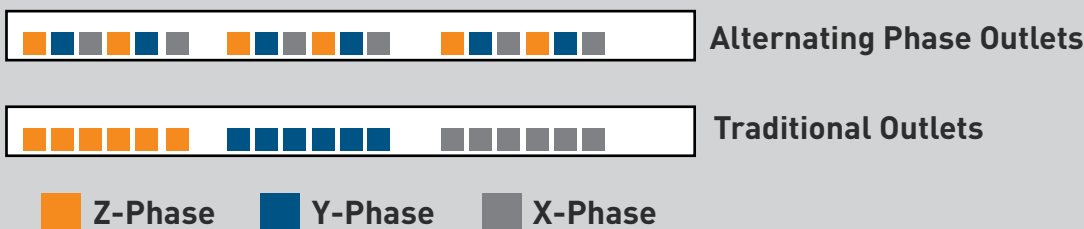
Good practice in the data center is to install rack mounted equipment so that the current draw is similar on each branch. This is relatively easy if the rack is filled with only one type of device. Unfortunately this is often not the case. Mixed devices such as switches, storage devices, blade servers and different brands and types of 1U/2U/3U servers can create a crazy mesh of power cables in the back of the rack. This can potentially inhibit airflow and add to the heat problems mentioned above.

The issues above are compounded by the move to higher density racks that demand more kilowatts of power. Higher power distribution at 60A and 100A force even more complex PDUs with six, nine, and even twelve branches. The power draw still must be evenly distributed across these branches.

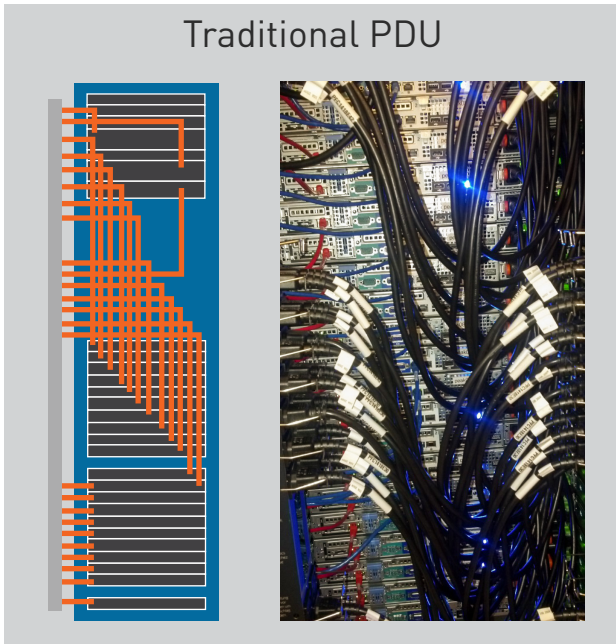
A solution to these issues is to use an alternating phase PDU. These specially designed PDUs alternate the phased power on a per-outlet basis instead of a per-branch basis. An example of these products can be seen below:



### Alt-phase vs. a traditional PDU Phase Placement

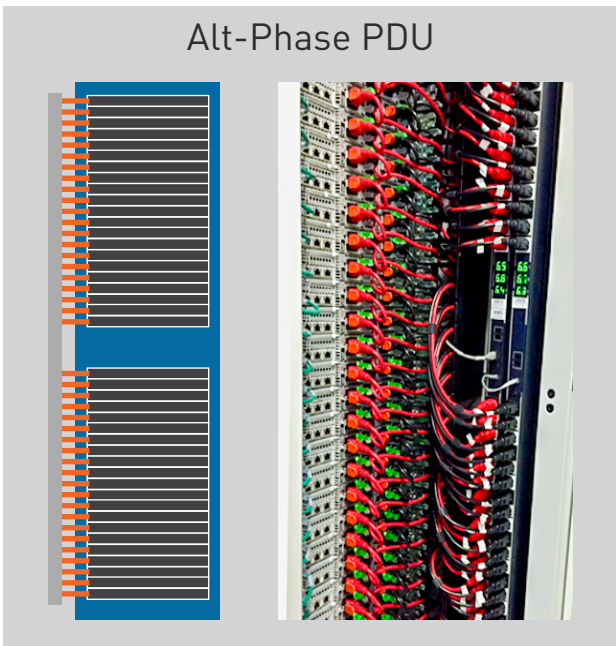


Power wiring becomes much more simplified with this type of PDU since power cords do not need to be stretched across the length of the vertical PDU to reach separate branches. Plugging into a different phase only means moving the cord several inches to the next available receptacle. Shorter power cords from the server to the PDU can now be used thus cleaning up the back of the rack cabling.



Alternating phase outlets are also a great choice for Basic PDUs where there is no current measurement or display on the unit to assist with load balancing. Installers can plug in servers from the bottom to top of the rack with less risk of blowing a breaker since there are no dedicated branches across the length of the PDU.

Server Technology has patent pending unique method of distributing the alternating phase power to each outlet. Instead of using wires, our products use a multi-layer circuit board to separate the phases. Each outlet contacts a different trace within the board to distribute the proper phased voltage. This helps to reduce heat build-up in the PDU, lessens the human error during manufacturing and finally creates a cleaner design to reduce the physical size of the product.



Three-Phase power distribution at the rack level traditionally meant that power was divided into separate branches. Load balancing and cabling can be difficult. Alternating phased power on a per-receptacle basis provides tangible benefits in the form of simplified cabling, better airflow, better load balancing and greater efficiencies.



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