Hyperscale Data Centers and the Importance of Three Phase PDUs

Today's data centers are experiencing an increasing demand in power consumption, driven by server machines that are constantly undergoing consolidation and virtualization.

This trend that started few years ago and is here to stay. The main contributors to this trend are the Internet of Things (IoT), cloud computing and the new 5G systems, all of which are pushing the power demands even further than was previously imagined. The result is an increased demand for more computing and storage capabilities.

The per rack power usage has nearly tripled the last few years. A few years ago, it was possible to install 10 high consumption servers into an IT rack and reach a maximum power load of 6-7kW. Today, the new IT boundaries see more blade servers or a lot more 1RU servers in the same cabinet, consuming up to 20kW per rack.

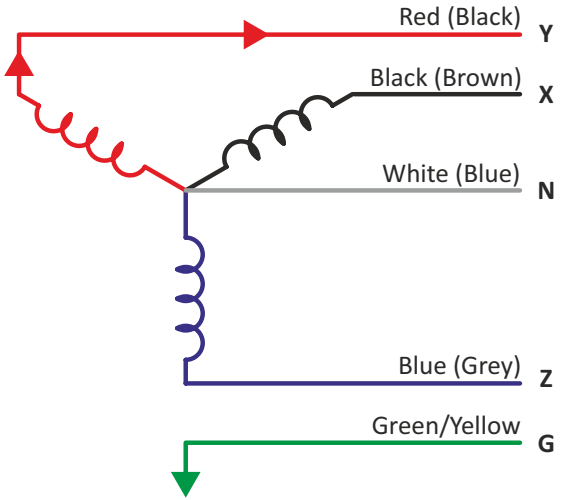
Single phase systems distribute the current over two wires: a live wire (active) and a neutral wire. The alternating current sine wave crosses the zero point at regular intervals. These single phase systems are frequently installed in residential environments that require small power consumption.

Three phase systems consist of three sine waves, each positioned at 120 degrees. Each (phase) carries a separate wire. Due to the relationship between phases, the current and voltage never drops to zero. This allows three phase systems to deliver much more power than a single phase system.

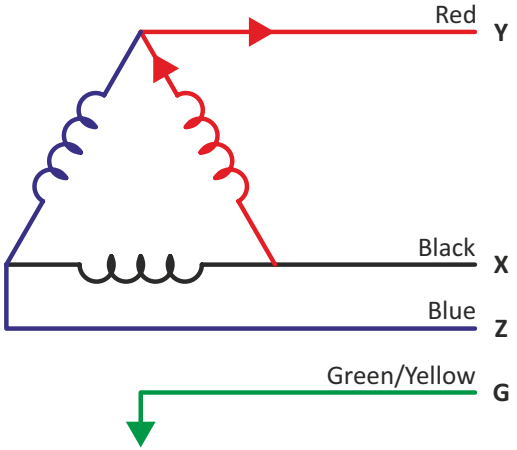
Phase balancing, by connecting the loads across all three phases in the PDUs helps to minimize harmonic currents and the need for oversized neutral wires. This allows for optimal use of upstream electrical infrastructure capacity, resulting in an improved overall data center efficiency and helping to minimize capital expenditure purchases.

The comparison tables below show the dramatic difference of rack power capacity between single phase and three phase PDUs.

3-Phase Wye



3-Phase Delta



PDU North America configurations

Phase Configuration	Voltage / Current	Plug Type	Max. Power Capacity (kW)
Three phase DELTA	208V 60A	IEC60309 3P + E 60A	17.2
Three phase WYE	346-415V 30A	IEC60309 3P + N + E, 30A	16.6
Three phase DELTA	208V 30A	NEMA L15-30P Twistlock	8.6
Three phase WYE	100-120/200-240V 30A	NEMA L21-30P Twistlock	8.6
Three phase WYE	200-240/346-415V 30A 3Phase WYE	NEMA L22-30P Twistlock	16.6
Three phase WYE	100-120/200-240V 20A 3 Phase WYE	NEMA L21-20P Twistlock	5.7
Three phase WYE	200-240/346-415V 20A 3	NEMA L22-20P Twistlock	11
Single phase	200-240V 30A 1 Phase	NEMA L6-30P Twistlock	4.9
Single phase	200-240V 20A 1 Phase	NEMA L6-20P Twistlock	3.3
Single phase	100-120V 30A 1 Phase	NEMA L5-30P Twistlock	2.8
Single phase	100-120V 20A 1 Phase	NEMA L5-20P Twistlock	1.9

PDU International configurations

Phase Configuration	Voltage / Current	Plug Type	Max. Power Capacity (kW)
Three phase WYE	380 – 415V 32A	IEC60309 3P+N +E 32A	22.2
Three phase WYE	380 – 415V 32A	IEC60309 3P+N +E 16A	11.1
Single phase	220-250V 32A	IEC60309 1P+N +E 32A	7.2
Single phase	220-250V 32A	IEC60309 1P+N +E 16A	3.6

Balanced loads across all three phases coming into the datacenter helps maintain power factor of the incoming power and avoid any penalties imposed by utility companies.

Even if the load requirements today are not too high, bringing three phase power to the rack provides the scalability required for the future.

The data center of the future requires an infrastructure that is agile, scalable and flexible. Since power is what keeps critical equipment running, it is important to choose a PDU that meets these requirements.