Power Distribution Units Play a Vital Role for Mission-Critical and OEM Platforms

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Long gone are the days of thinking that a power distribution unit (PDU) is nothing more than a surge strip on steroids. Today's PDU's offer an array of important power options for industrial environments, control systems and IT/data centers as well as a wide variety of mission-critical military aerospace platforms and applications.

Thanks to the advancements in power technology and packaging, product designers and integrators can choose from standard off-the-shelf units, COTS, COTS-modified or a custom solution designed to meet the exacting needs of a particular application. And, versatility in power ranges is also available from a low 12 Amp current all the way up to hundreds of Amps. So, how do you determine which PDU fits your application?

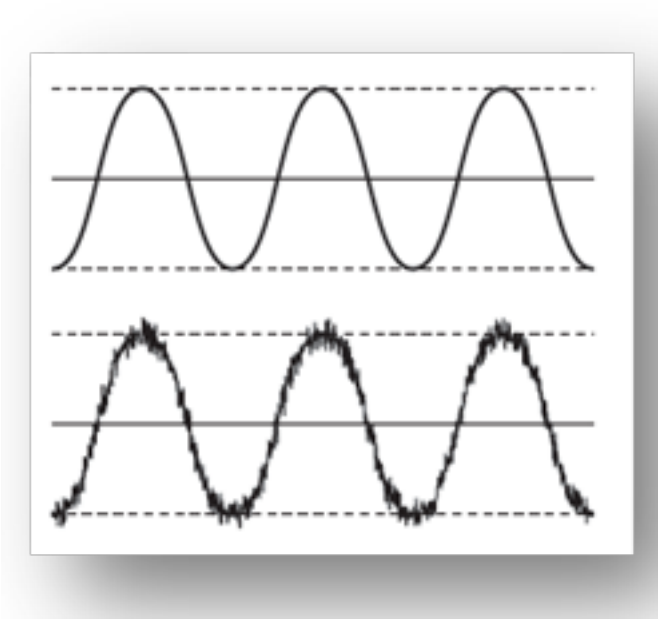
Key Considerations

When designing a power distribution scheme, one needs to consider many options, including:

a. What type of power conversion do I need (facility voltage/configuration vs. equipment needs)?
b. What type of power receptacles do I need for my equipment?
c. What type of control and monitoring capabilities do I need?
d. What type of power conditioning do I need:
• What kind of noise and transients are present in my facility power?
• How stable is the facility power (do I need to worry about brownouts and blackouts)?
• How sensitive is my equipment to the issues listed above?

Before diving in and selecting a PDU, it's important to understand the variety of power challenges as this can determine what type of power distribution is needed.

Electronics Need Clean Power



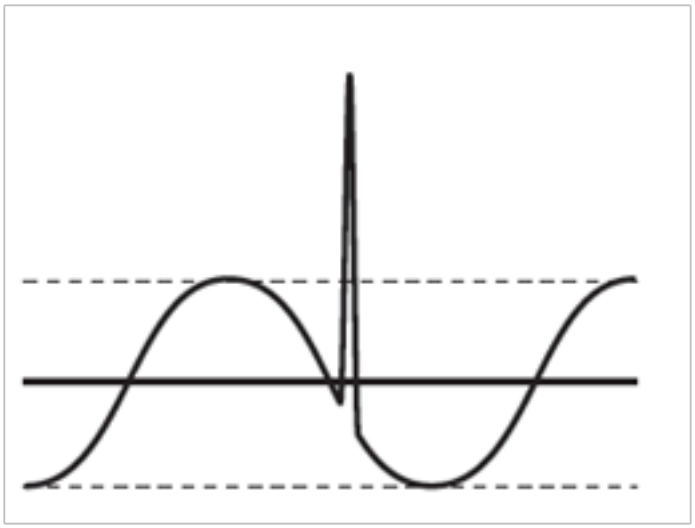
Signal conditioning of AC power seeks to ensure as close to a perfect sine wave in the voltage signal as possible. The upper waveform has no noise, where the lower one is quite noisy.

Modern electronic equipment such as computers, communications hardware, process control, security systems, data acquisition systems, and others require clean, stable power free of noise in order to perform their functions optimally and reliably. A clean alternating current (AC) signal has a perfectly smooth sine wave when viewed on an oscilloscope. Any imperfections in this signal can adversely affect electrical equipment causing poor performance, incorrect functionality, or even damage to sensitive circuitry. Most electronic equipment will have some minor power conditioning capabilities built in, but there’s a basic assumption that incoming power is pretty close to a perfectly clean signal. However, that’s not always the case.

Clean power supplied by a utility will become degraded within a facility. This degradation is caused by the very devices using the power such as:

- air conditioners and compressors
- electric heating equipment
- motor-driven industrial machinery
- elevators, conveyors
- computers, printers, copy machines
- ballasts for fluorescent lights

Voltage Spikes



A voltage spike may have a very high voltage value, up to several thousand volts, but the duration is on the order of microseconds.

Spikes are very short increases in voltage and commonly come from power switching equipment like circuit breakers, contactors, and other causes. Less common sources include short circuits, static electricity, lightning, and even large electromagnetic fields. While spikes are short, the increased voltage for even that short time may be enough to damage microelectronic components and/or cause malfunctions. Counteracting voltage spikes is done with surge protection devices (“SPDs,” a.k.a. surge suppressors). These devices typically divert excess voltage from the power line being protected straight to ground, though there are other techniques. There are a variety of technologies to choose from, each with advantages for particular power environments.

Electromagnetic Interference (EMI)

EMI is a broad term covering multiple causes where the net effect is that electromagnetic waves of a wide spectrum of frequencies cause interference with the power signal. This interference, or noise, on an AC power line is any deviation in the signal from the desired perfect sine wave form.

Types of EMI Noise

EMI can be classified in several ways. One way is to identify how interference gets into the power line which includes conduction, capacitive coupling, and induction. Another way is to address the frequencies being added to the signal. RFI, or radio frequency interference, is a name to identify a subset of frequencies common to communications and other equipment.

A third distinction is identifying common mode and differential mode noise. Common mode noise manifests identically on multiple power conductors where the noise signal flows in the same direction, in phase, and typical returns through ground. Differential mode noise occurs when the noise on each power line is not identical. Here, the noise signal flows through one power line and returns through another.

Power Conditioning Integration

Surge protection devices, EMI filters, isolation transformers, and shielding are power conditioning strategies well suited to integration within PDUs. Adding these capabilities
help isolate sensitive equipment connected downstream of the PDU from the noise created by upstream power consumers. When needing an integrated solution, work with the PDU manufacturer to identify:

- The appropriately sized surge suppression device
- EMI filters to address application-specific or general purpose frequency bands of common mode and differential mode noise.
- Unique details to control the performance of isolation transformers
- Power capacity and packaging efficiency
- Any special weight, space or environmental conditions

Power Monitoring

Monitoring PDU performance is also important. Being able to view a specific parameter such as input voltage is important to be assured that the power for the application is within acceptable limits. In cases with sensitive downstream equipment or processes, it may be important to monitor a wide range of parameters regarding power quality and status. With some equipment designs, the PDU is not visible to the user, so a method of remotely monitoring this information is desired. Since the PDU is the focal point of power in a design, it is the most logical place to implement some kind of power monitoring.

Whether an off-the-shelf, modified or a complete custom power design is required, today’s PDUs offer a smarter, lighter and more cost-effective solution over PDU’s of the past. A combination of power performance, packaging efficiency and reliability are key attributes to consider when choosing your next PDU.

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