

Factors to consider when using 1U high power supplies in industrial environments

The height of rack mounted equipment is specified in multiples of "U", where 1U is defined as 1.752" or 44.5mm in accordance with the Electronic Industries Association EIA-310-D standard. The actual rack, or shelf as it is sometimes referred to, is slightly lower in height to allow easy insertion and removal without binding on adjacent shelves. Commonly 1.721 inches (43.7 mm) tall is used. The most common rack width is 19", but is also available with a 23" width. A wide range of standard electronic and electrical equipment is designed to be mounted into a 19" enclosure, including instrumentation, computers and power supplies.

Embedded (chassis mount) power supply height is often referred to as being "suitable for 1U applications" even though it is not offered with a rack enclosure. In this case the product height will normally be less than 41mm (1.61") to allow for the rack sheet metal thickness.

The communications industry has standardized on 1U high power supply racks to power datacenters and other datacom related equipment for networking. These power supplies are frequently configured for redundancy so if one fails, it can be replaced without disturbing equipment operation. The amount of power that can be delivered from a 1U rack can be 10kW to 14kW with four plug-in power supplies.

Why have these high density, cost driven products not found a great deal of popularity in the industrial segment? There are several reasons for this:

Audible noise

To cool a 2kW to 3kW 1U power supply requires fan cooling in the form of two, high speed 40mm fans. These emit very high audible noise levels at frequencies quite annoying to the human ear. As datacenters rarely have human operators present for long periods of time, this is not an issue. For industrial use where operators are constantly monitoring and using equipment, like test and measurement and analyzers, such levels of noise would not be considered acceptable.

Industrial mid power (600-2000W) power supplies tend to be 63mm in height for single phase inputs and use lower speed 60mm fan(s). Three phase mid to high power (3000W+) 2U high units may be fitted with a low speed 80mm fan. Temperature controlled fan speeds extend field life and dramatically reduce audible noise levels.

Fan life and contaminants

The faster a fan rotates, the quicker the life of the fan is reduced due to mechanical bearing wear.

The higher the airflow speed, the more contaminants (dust and dirt) will be drawn into the power supply. Eventually this will block airflow and/or cause product failure due to circuit shorts if the contaminant is conductive. Datacom equipment is usually situated in fairly sterile conditions, unlike industrial equipment particularly in harsh environments.

Operating environment

Datacenters have a controlled operating environment, usually air-conditioned. This is not always the case in the industrial sector.

Redundant configuration of the power supply is usually mandated with datacom products. In this mode, the power supplies are not run at 100% load in normal operation. For example, with in a 3+1 2500W power supply configuration, where the maximum load drawn is 7500W, each of the four power supplies will provide 1875W and be running at 75% capacity. Only if a unit fails will they operate at full load until the faulty unit is replaced. Such derating of a power supply reduces internal temperatures, particularly those of the electrolytic capacitors, and improves its operating life.

The ability to operate power supplies in a redundant mode can be very important to some industrial users, to minimize production downtime.

The input supply to a datacenter is usually two dedicated feeds (again for redundancy), protected from AC line transients by switchgear and backed up by uninterruptable power supplies. Industrial power supplies are subjected to input transients when large neighboring inductive equipment is switched on and off.

Datacom equipment power supply loading is usually well defined and relatively static with few severe load changes. Industrial power supplies can be driving inductive DC motors, relays and capacitive loads, all of which can stress a power supply.

Product availability

The technology in the communications industry is constantly evolving and that includes the power supply architecture. Datacom systems initially required 48V output power supplies and migrated to 12V to drive non isolated DC-DC converters. Now datacenters are being run using high voltage 380VDC outputs. Due to the vast amount of electricity that is consumed by these centers, an increase in efficiency warrants a change in power architecture. This can result in early power supply obsolescence.

Industrial equipment is expected to be in service for 10 or more years. Having to rework a system when a spare power supply is not available can lead to long downtimes. Industrial power supplies are often produced for 15-20 years.

Summary

1U high datacom power supplies are used in some industrial applications where space is extremely limited, audible noise is not an issue and the environment is controlled. Industrial power supplies are more likely to be subjected to uncontrolled environments and noisy AC inputs. Product lifecycle and field reliability are key considerations to industrial users, who value long term availability and maintenance free operation.