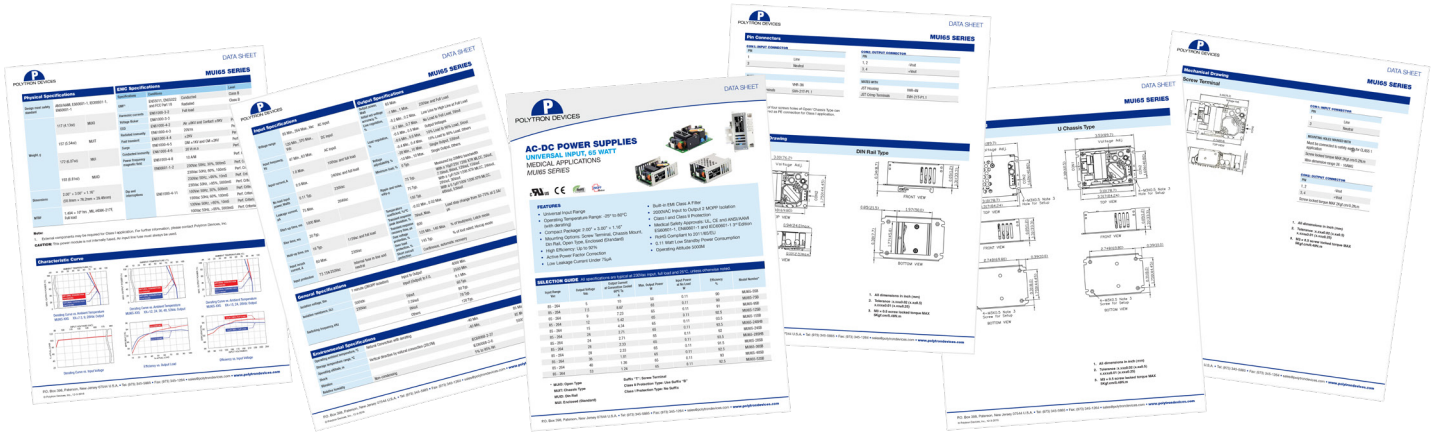
POLYTRON DEVICES

WHITE PAPER

Interpreting Complex Data Sheet Specifications For Power Supplies



The operating and safety specifications for power supplies have become more complex, adding to the length, level of detail and complexity of data sheets. Nowadays, the data sheet for a product series has to include everything from voltage combinations to mechanical drawings—oftentimes for dozens of different models. If you don't know what you're looking for, reading one can be a daunting task.

In this white paper, we'll dig into some of the specifications you can expect to find on today's power supply data sheets, including:

- **Electrical.** To keep up with new technologies on the market, power supply manufacturers have had to add more output voltages to their devices, as well as widen the input voltage ranges.
- **Thermal.** Despite the demands for higher power and wider ranges, customers still want small packages. As a result, engineers have to come up with creative ways to avoid overheating, including adding heat sinks or fans to transfer heat away from the device.
- **Packaging.** In the past, power supply manufacturers typically offered only two mounting options: chassis and PC. Nowadays, however, products must be available in a variety of other mounting options, including screw terminal, vertical mount, DIN rail, surface mount, wall plug-in, open-frame and enclosed types—to name a few.
- **Safety.** Many of the safety certifications listed on data sheets require rigorous testing—especially for medical and railway applications. Data sheets are required to indicate all new certifications, testing procedures, special model numbers and designations.

ELECTRICAL SPECIFICATIONS: THE DEMAND FOR ONE POWER SOURCE

Rather than invest in separate devices to meet the requirements of different applications, nowadays customers are looking to invest in one power source. This need for interchangeability boils down to simple economics: customers want to do more with less devices, which puts pressure on power supply manufacturers to design products that can fit a variety of potential applications.

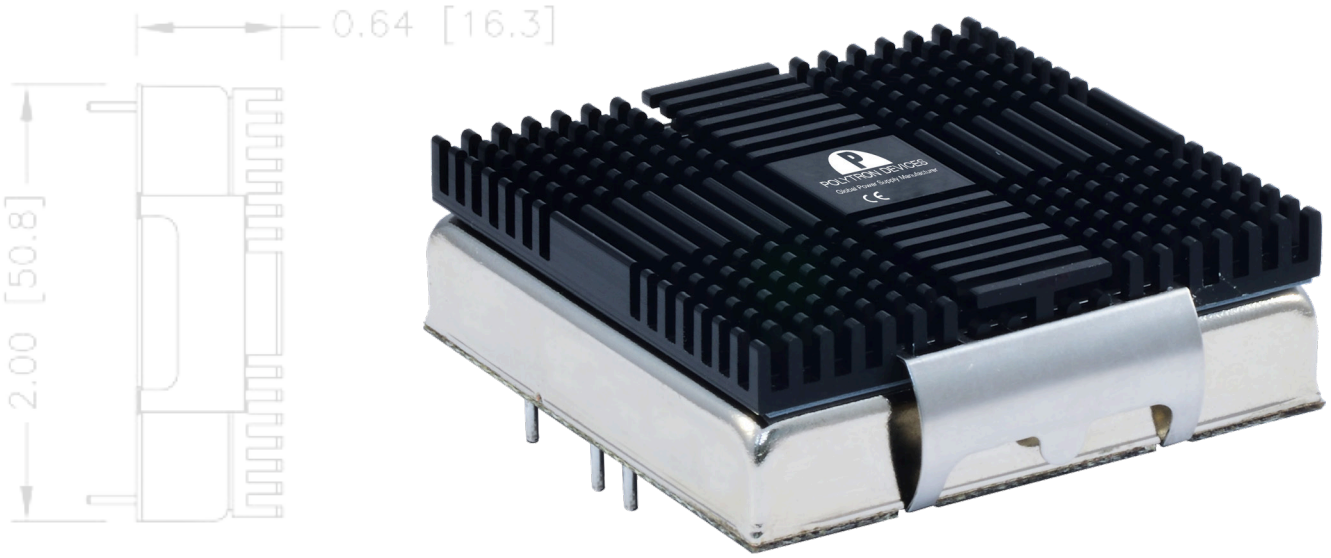
Electrical interchangeability. To be more versatile, power supplies, for one, have to include more voltage combinations. At Polytron, a product series that used to have only 15 models now has well over 50 to account for the new voltages. Secondly, manufacturers now have to offer power supplies with variable output voltages in addition to offering fixed-voltage devices. Having a variable voltage lets users adjust the power output to their preferred level, allowing the device to be used across more applications.

Keep in mind also that not only do data sheets have to list each new electrical specification, but sometimes the information has to be represented as a mechanical drawing or graph. It's no longer enough to simply list a unit's output voltage, for example. Now, customers want to see a graph that illustrates the relationship between a device's output voltage and its temperature range.

Meeting specialized electrical standards. In addition to being interchangeable, power supplies, at the same time, have to meet many specialized requirements. This includes undergoing rigorous, application-specific electrical testing.

Consider the EN 50155, which outlines the specifications of electronic equipment used in railway applications. This standard requires that power supplies have wider input voltages, including a range of 43 to 160 Vdc, as well as pass various tests related to electrical insulation, power surges, ESD, voltage transients and more.

The medical industry also has its fair share of tests, most of which are related to EMI, leakage current, immunity and voltage isolation. Tests like the Hipot (high potential) test, which verifies a device's electrical insulation, are intended to protect patients coming into direct contact with medical equipment. While many of these power supplies were already manufactured to industry standards, manufacturers are now required to list the various tests and results on their data sheets.



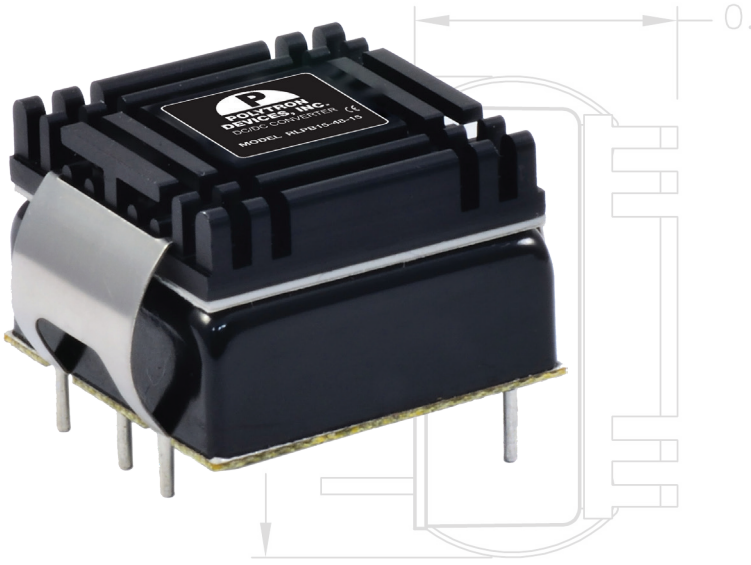
THERMAL MANAGEMENT: CURRENT LIMITING VERSUS HEAT SINKING

Despite demands for higher power and wider input ranges, customers still want their power supplies delivered in small packages. As a result of this demand, engineers have to come up with creative ways to avoid overheating.

Current limiting the output and heat sinking are the two most common ways engineers avoid overheating in power supplies. Deciding which one to use often boils down to operating environment:

- **Current limiting** is a feature that can be built into the circuitry of a power supply, whereby resistors on the PC board limit the amount of current emitted by the transformer. Because this method requires free air convection, however, it cannot be used in enclosed environments.
- **Heat sinking.** This option eliminates heat from inside the power supply by dispersing heat and improving energy use. Adding the heat sink to the outside surface allows for a more direct airflow to reach the direct source of heat. This method radiates heat so it doesn't get trapped inside and overheat the power supply. While heat sinking also relies on free air convection, there are special cases where the power supply can be made with a base plate that functions as the heat sink. This allows the unit to be used in enclosed environments with limited to no airflow, including oil refineries or other applications that involve toxic material or explosive gas.

Data sheets need to reflect all the thermal specifications you need to properly design your power supply. For one, power supply manufacturers often have to test for different thermal environments—the results of which must be listed on the data sheet. Each new thermal management solution, whether current limiting or heat sinking, must also be listed alongside a mechanical drawing. Bear in mind too that each solution can be delivered a number of ways. For example, manufacturers can provide heat sinks with clamps or without, or sometimes heat sinks can be built into the bottom of the package. Listing all of these variations, along with the drawings and test results, takes up a significant amount of real estate on the data sheet.



PACKAGING: MORE MOUNTING OPTIONS THAN EVER

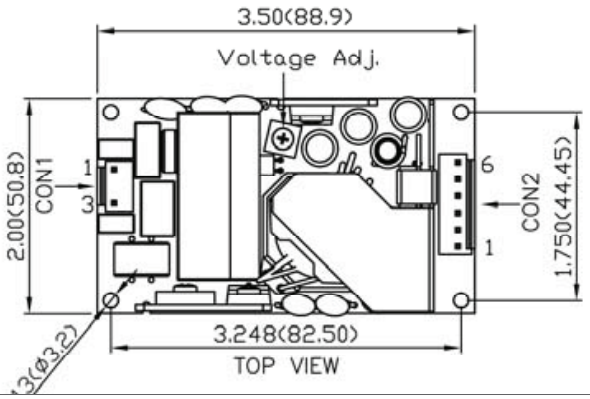
Originally, power supplies were mounted one of two ways: PC mount with pins or chassis mount with screw terminal. But now, customers want smaller power supply packages to fit ever-shrinking end products. Manufacturers have responded by providing more mounting and remote placement options, including DIN rail, open-frame and enclosed types, terminal block, surface mount—and more.

Here's a rundown of some of these options:

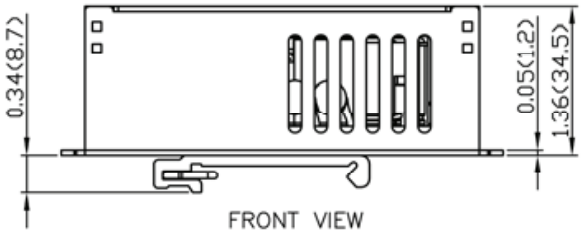
- In a **PC mount**, the power supply is soldered directly onto the printed circuit board using pins. This was the standard for producing larger circuits contained in even larger multi-board designs.
- **Chassis mounts** allow you to remotely mount the power supply in a variety of ways: close to the load, on a frame inside the enclosure or outside the enclosure. What you ultimately choose depends on available real estate, the dimensions of your power supply and the operating environment.
- **DIN rails** let you mount power supplies and other industrial control equipment within enclosures or equipment racks. This mounting option utilizes space efficiently, as devices can be mounted next to each other in a variety of ways to meet system requirements.
- **Surface mounts** are the future of the PC mount. Nowadays, many products—and power supplies, for that matter—are getting smaller. Surface mount technology favors this trend: it utilizes solder paste rather than larger pins, taking up less space.
- **Wall plug-ins** protect equipment from the heat and noise of the switching power supply, thereby avoiding potential damage or interference. This option also lets you easily specify adapters based on different input voltage requirements and outlets.

Mechanical Drawing

Open Type



DIN Rail Type



More options means more drawings. But your options don't end there. Depending on the direction of your connection, you may require a right angle, straight on or vertical mount. You may also require mounting types that integrate fans, heat sinks, input and output cables, connectors and safety tabs.

Not only do these various packages have to be listed on data sheets, but they must be accompanied by mechanical drawings that outline their dimensions and in some cases, provide a view from the top, front and bottom, or in a CAD drawing. Additional graphs, indicating derating curves versus ambient temperature, for example, are also needed when adding fans and heat sinks.

SAFETY SPECIFICATIONS: LENGTHY YET USEFUL

Many certifications listed on data sheets require rigorous testing—especially for the medical and railway industries. Data sheets are required to indicate all new certifications, testing procedures, special model numbers and designations, which adds to their length but provides a lot of useful information for end-users.

Avoiding EMI in medical equipment. The medical industry has many standards related to leakage current, EMI resistance and voltage isolation—all of which must be avoided in machines and devices that come into direct contact with patients. In addition, the close proximity of equipment in hospitals increases the risk of noise interference, which could cause medical devices to work incorrectly at a critical time. Safety specifications, particularly ones related to EMI, therefore ensure power supplies pose no risk of interference.

Some specific examples include:

- IEC-60601-1: the technical standards for medical electrical equipment in terms of safety and performance
- 5000 Vac Isolation: a standard stipulating 1000 V more than the required isolation for IEC 60601-1
- 2 X MOPP: the isolation, creepage and insulation requirements for medical products coming into contact with patients
- Standards related to low leakage currents under 75 uA.

Protecting train passengers. Power supplies used in railway applications also have their fair share of standards. Consider the EN 45545-2, which specifies how materials used on trains must be fire-tested, or the EN 50155, which outlines the specifications of electronic equipment used on railcars. The EN 50155 also requires power supplies to pass various tests related to electrical insulation, power surges, ESD and voltage transients—all of which are intended to protect the passengers onboard.

Additionally, the railway industry requires its own special input voltage range of 43 to 160 V, which doesn't exist for other applications. To account for this, Polytron and other power supply manufacturers have had to add more models to their product portfolios.

Because of the increase in safety specifications and, in many cases, the addition of new products that comply with these standards, data sheets have become longer. While on the one hand, this trend has complicated data sheets, the addition of these details makes data sheets much more useful for customers who require power supplies for medical and railway applications.

To learn more about power supplies and their specifications, please call 973.345.5885 or visit us at www.polytrondevices.com.