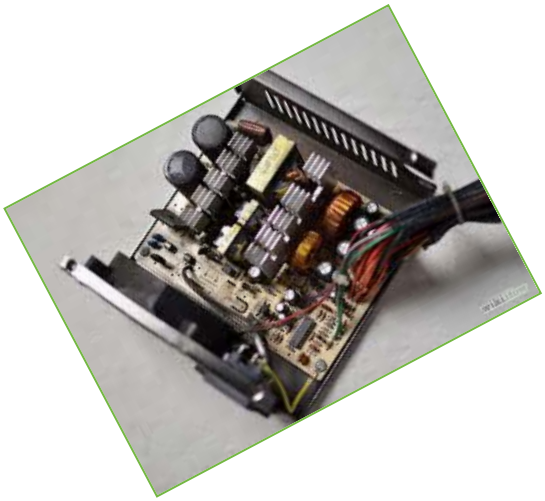
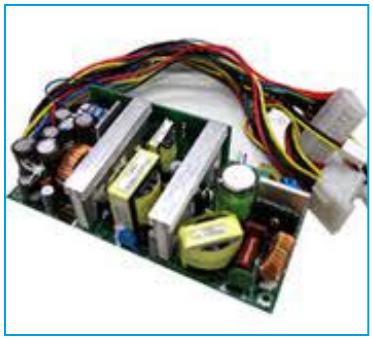
Percept™
Product Engineering
Your partner for objective product information

Tips for Evaluating Power Supplies (and what to watch out for)





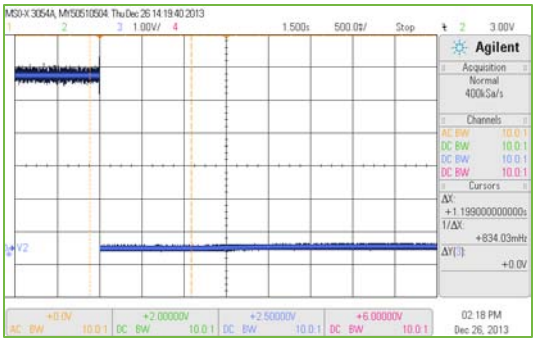
Authors: Martin Best,Terry Anderson

May 2014

Introduction

Power supplies are theoretically simple devices, and conceptually, evaluating them is quite straightforward: *Do they put out the correct voltage and current?* Today's modern power supplies are anything but simple. Most have sophisticated features like input power factor correction circuitry and output regulation control systems making the supplies complicated and unique. *With all the additional features available, which power supply should a designer look for in a quality power supply – and might not be available in a low cost supply?* In Percept's experience, there are several capabilities and features that separate the performance of a quality supply from a budget supply. Some of the features are safety related and others are related to how well the supply provides DC voltage.

Short Circuit Protection

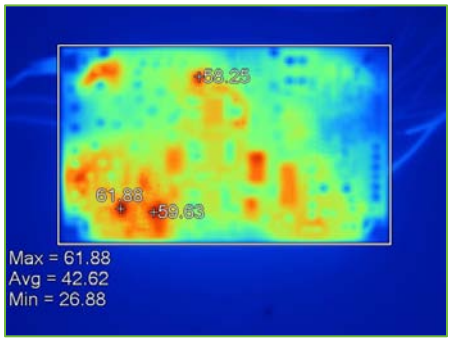


Power supplies provide significant energy at the output. In the event of an accidental shorting of the output leads, the supply should shutdown until the short is removed. High quality supplies will detect this condition and immediately remove the voltage from the output until the condition is removed. The supply should be able to handle this repeatedly without damage.

Over Current/ Over Power Protection

Sometimes power supplies encounter an overload condition in which too much current is drawn. The supply should detect this condition and either reduce the output voltage until the current falls below the rated level or simply shutdown until the overload condition is met.
Most cheap supplies will not detect an over-current condition. Instead they will detect when the amount of power drawn exceeds the capabilities of the supply. Either method can be satisfactory. However, it should match the requirements of the system being powered.

Thermal Shut Down



The ability of the power supply to detect when it is not being cooled adequately or whether excess current is being drawn, causing the supply to heat up is another important feature implemented to power supplies. In addition, if the system being powered is operated in a warm environment, the power supply may be affected first. A quality power supply should detect a high temperature condition and shut down when that condition exists. A surprising number of supplies rely only on over current or over power protection to protect the supply from high heat conditions. Since power supplies are often the largest heat generator, this can lead to unsafe conditions. We have seen supplies actually melt instead of shutting down.

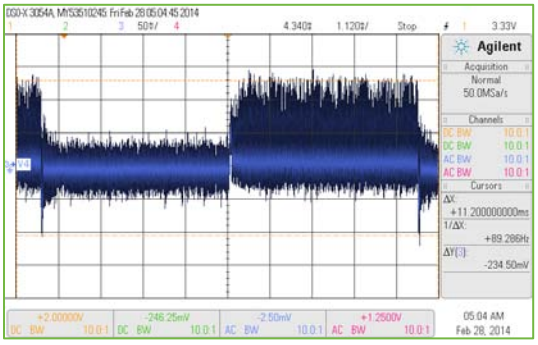
Two Types of Output Variances Adversely Affect Power Supplies

Output Regulation

The basic function of a DC power supply is to provide DC voltage and current to the system that requires it. A 12 volt supply may only provide 11.8 volts if the input voltage to the supply drops. If the system designer expects a tight tolerance on the output voltage of the supply, he/she may be disappointed. Worse yet, the output voltage may have AC noise from the input power or from the internal switching of the supply. This noise can have a negative impact on the entire system.

Dynamic Load Response

One of the most challenging environments for a power supply is one in which the current load changes quickly or repeatedly. The power supply must be designed to accommodate this adjustment in load and keep its output in regulation. In some cases, we have seen the supply does not accommodate the change in load to the point where it doesn't provide a DC output any longer, but a DC output with an AC signal riding on top of it. Quality supplies will have enough internal energy storage to accommodate changes in load.



In Summary

The key to choosing the correct supply for your application is to be able to properly evaluate the supply under a proper set of conditions for the environment it in which it will operate. Evaluating supplies in real life systems requires experience in testing and knowledge about how the systems work. Most importantly, the evaluator must know what to look for and what is acceptable for the design. It is a relatively simple matter to measure the voltage and current put out by a power supply during normal operation. However, it is another matter entirely to evaluate the performance under conditions of intermittent input voltages, transient startup conditions, and elevated temperatures under limited airflow.