Technical Article

Energy Efficiency of Component Power Supplies

Whilst it is easy to discuss Energy Star and energy efficiency (meaning active efficiency and no load power) requirements of external power supplies with customers, it is harder to have a similar discussion regarding component power supplies. This is because external power supplies are considered as a product in their own right (and as such have easy to understand requirements), but component power supplies are not.

The efficiency discussion must therefore relate to the application if it falls within one of the product groups that Energy Star list (see below). By this we mean that a product group may contain several actual products, for example the product group 'imaging equipment' covers digital duplicators, mailing machines, printers, scanners & all in ones.

If we take the case of simple printers, the energy efficiency requirements depend on whether the printing technology is direct thermal transfer, dye sublimation, electrophotography, impact, ink jet, solid ink or thermal transfer. Further to this, the format size (A6, A4, A2 etc) is also relevant. Therefore the same power supply used in different types of printer will have differing energy efficiency effects. Let's consider an application involving imaging equipment. There are two ways of demonstrating Energy Star compliance. One is to use the Typical Electricity Consumption (TEC) method, the other is to use the Operational Mode (OM) method.

The TEC approach reflects assumptions about how many hours a day the product is in general use, the pattern of use during those hours and the default delay times that the product has before entering a low power mode (sleep). Electricity consumption is measured in the form of accumulated energy used and converted to power by dividing by the test period.

The calculation takes into account that there will be two periods of use per day with a low power mode in between simulating a lunch break and it also assumes that there will be no weekend usage.

The TEC value is derived from the various energy measurements taken during active usage, sleep mode and auto off periods. The maximum allowable TEC value is dependant upon the format size, product speed (images per minute) and marking technology.
The OM approach is to measure power during the ready, standby and sleep modes and also to measure the default time period until

the product enters sleep mode. To be compliant with Energy Star, the product has to meet 3 criteria:

- The default time to entering sleep mode must be less than a given value in minutes, depending on product size format and product speed (images per minute) for imaging equipment except for mailing machines. For mailing machines the default sleep time delay is only dependant on speed (mail processed per minute).

- The standby power should be less than 1W for small and standard format products without fax capability or less than 2W for small and standard format products with fax capability. For large format product and mailing machines there is currently no limit.

- The sleep power should be less than a given value according to type of machine, format size and printing technology. There is a base figure for each case and this can be increased by the type of functions that the product has beyond the basic print engine. As an example, having a network connection port, memory card reading capability, infrared port, or cordless handset increases the allowable sleep power. The value of additional allowance depends on whether the additional function is active whilst the product is in sleep mode or inactive. There is also an adder for the power supply. This is based on its output rating and is (0.05x(rated power-10)).

It can be seen that factors other than the power supply contribute greatly to the energy efficiency rating of the imaging equipment application.

Energy Star Products

In all there are six categories of product types which are subdivided into products. These are:

- **Appliances**
  Clothes washers
  Dehumidifiers
  Dishwashers
  Refrigerators and freezers
  Room AC

- **Commercial food service**
  Dishwashers
  Fryers
  Hot food cabinets
  Refrigerators & freezers
  Steam cookers

- **Lighting**
  CFLs
  Light fixtures
  Advanced lighting package
  Ceiling fans
  Exit signs Traffic signals
  Decorative light strings

- **Home electronics**
  Battery chargers
  Cordless phones
  D to A converters
  DVD products
  Home Audio
  Televisions
  VCRs

- **Office equipment**
  Computers
  Power management
  Copiers and fax machines
  Digital duplicators
  Notebooks
  Mailing machines
  External power adapters
  Monitors
  Printers, scanners & all in ones
  Water coolers

- **Heating & cooling**
  Air conditioning
  Boilers
  Ceiling fans
  Ventilation fans
  Furnaces
  Heat pumps
  Programmable thermostats

Some of the products have their own program requirements whereas others are grouped together such as the copiers & fax machines, mailing machines and printers, scanners & all in ones.

Summary

As each application of product type needs to meet differing requirements to comply with Energy Star it is not possible to have component power supplies which can guarantee that all applications can be Energy Star compliant. The functions that products run whilst in standby or sleep mode, the time taken to enter standby mode and the average energy consumed within a working day must all be taken into account. It is therefore the intention for our new developments to minimise no load power consumption by utilising the latest green mode control ICs and so provide our customers with the best possible starting point allowing them to design and build Energy Star compliant product.

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