

Monday, April 26, 2010

Cold Temperature Start Up of Low Cost Power Supplies with Inrush Thermistors

I often get asked the question: "Regarding the [TDK-Lambda](#) low cost power supply that is rated from -25°C to 70°C, will it start up at -40°C?" I usually reply, "It depends."

Most low cost, low wattage power supplies avoid large surges of current being drawn when the AC input is first applied by using a thermistor in series with the AC line (see figure 1). This device is a type of resistor that when cold has a much higher resistance than when warm.

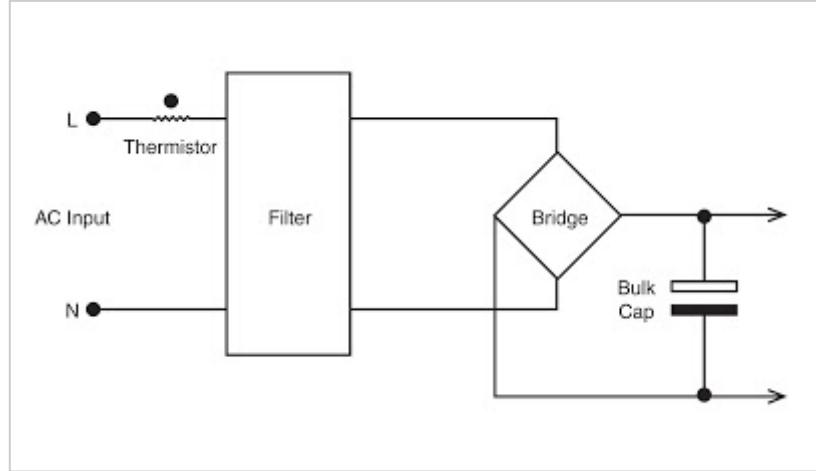


Figure 1: Thermistor

When the AC is first applied, the thermistor limits the amount of inrush current that charges the bulk storage capacitor. Once the power supply starts-up and delivers power, the thermistor self heats and decreases in resistance to improve the power supply efficiency and operation.

At ambient temperatures below freezing, these thermistors have very high resistances, and if the supply is "rated" to start-up at a cold temperature, it should have been tested during the design stage to ensure correct start-up at full load and at minimum AC input. If the power supply is not specifically rated for a cold temperature start-up, there is a possibility that the power supply will turn on, try to deliver power, but the thermistor will not have self-heated due to the very cold ambient and hence will have a large voltage drop across it, causing the power supply to switch off again. The power supply will try to restart again, causing "blips" on the output. (Fig. 2, top trace). In some circumstances, the power supply might not start up at all. These attempts to restart can cause system problems.

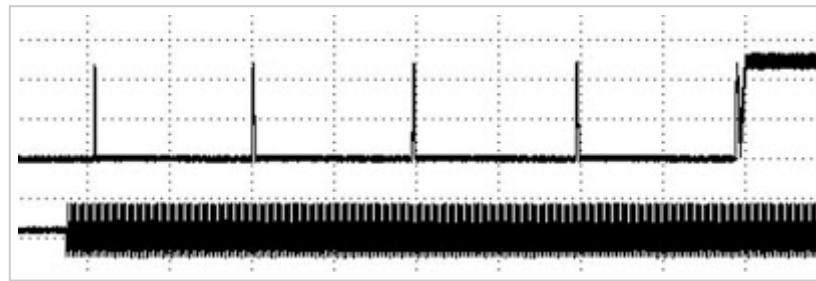


Figure 2: Cold Temperature Start Up

If the output load is light, however, the power supply may be able to start up correctly.

So back to my reply to the initial question! "It depends on what the loading will be at -40°C. If the application has say 20% loading, then usually the answer is yes." There are other issues with cold temperature operation, but I shall cover that in the future.

Posted by [Power Guy](#)