

Spectrotek Services

2 August 2015

Engineering Change Order – SPA4-4

Units affected: All versions of the PA1, PA3, PA3, and SPA4.

This is a recommended ECO.

This ECO will improve the cooling of the STW20NK50Z MOSFET under high power operating conditions.

PROBLEM

The STW20NK50Z in the SPA4 may become too hot when operating under the following conditions:

- 1) The SPA4 is operating with a DC voltage greater than 133 volts, and;
- 2) The duty cycle of the input signal is greater than 60%, and;
- 3) The ambient air temperature is above 25°C.

This happens because the temperature sensor in the cooling fan does not sense the heat sink air temperature; instead, it senses the temperature of the incoming ambient air.

SOLUTION

Reversing the direction of the cooling fan will reverse the direction of air flow through the STW20NK50Z heat sink. This will enable the temperature sensor in the cooling fan to sense the actual heat sink air flow temperature. The fan speed will automatically increase as the heat sink becomes warmer, which will lower the temperature of the STW20NK50Z. The addition of a covering or shroud to enclose the heat sink will confine the air flow to the interior of the heat sink and assist the cooling process.

After this ECO is complete, the SPA4 will safely operate at voltages up to 152 volts with a duty cycle up to 100%. Above 152 volts, the duty cycle should be limited to 70% or less for safe operation.

To accomplish this modification, follow these steps:

1) Cut and remove the two plastic zip ties that hold the power wires that run from the cooling fan to the white plug that connects to the circuit board connector on the SPA4.

2) Remove the four screws that attach the cooling fan to the front of the heat sink.

3) The cooling fan wires will have either two or four wires. The four wire colors are **red, black, yellow** and **blue**. If there are only two wires, go to Step (5).

4) If there are four wires, cut and remove both the **YELLOW** and **BLUE** wires. Cut the wires at the white plastic plug and cut the wires as close to the fan circuit board as possible. Be careful not to damage the fan circuit board or the red and black wires.

5) Look at the back of the cooling fan that was mounted against the heat sink. **(See Figure 2, LEFT.)** If the back side of the fan has four corner standoffs that space the fan slightly away from the heat sink, then cut away the standoffs to make the back of the fan smooth. If this is not done, the mounting screws will be too short to reinstall the fan on the heat sink.

6) After removing the standoffs, use the four mounting screws that were removed in Step (2) to reinstall the cooling fan against the heat sink facing the opposite direction from which it was originally installed. Attach the fan so that the red and black power wires are visible. **(See Figure 1, RIGHT.)**

7) Use some adhesive backed tape, such as plastic electrical tape, and carefully wrap the outside of the heat sink so the heat sink is completely covered. This ensures that no cooling air can escape through the sides and edges of the heat sink. Overlap the tape between the heat sink and the cooling fan to prevent air leaks at the junction between the heat sink and the fan. **(See Figure 4.)**

8) Replace the fan power plug on the circuit board connector.

9) For neatness, you may replace the plastic zip ties that hold the cooling fan power wires to the SPA4 circuit board. It is not necessary to replace the plastic zip ties for the SPA4 to function correctly.

After this modification, the speed of the cooling fan will be controlled automatically by the thermal sensor in the fan. As the heat sink becomes warm, the speed of the fan will increase as necessary to maintain the proper temperature.



Figure 1.

LEFT – Fan in original mounting configuration.
RIGHT – Fan in reversed air flow mounting configuration after modification.

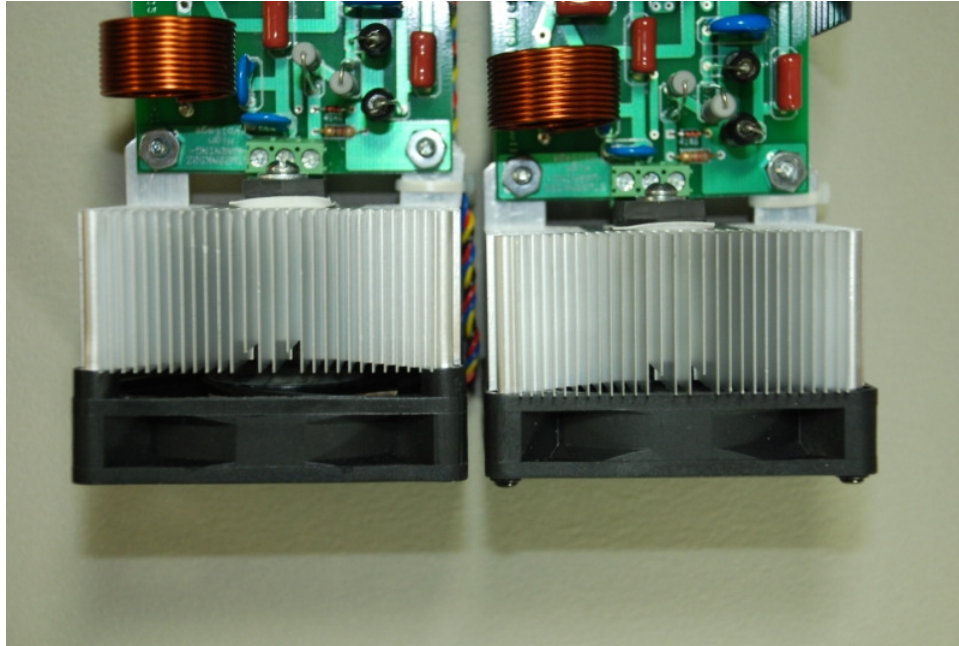


Figure 2.

LEFT – Original mounting configuration. Fan is spaced away from heat sink by plastic standoffs. Air discharge is towards the circuit board.

RIGHT – New mounting configuration shows fan mounted against heat sink. Air discharge is away from the circuit board.

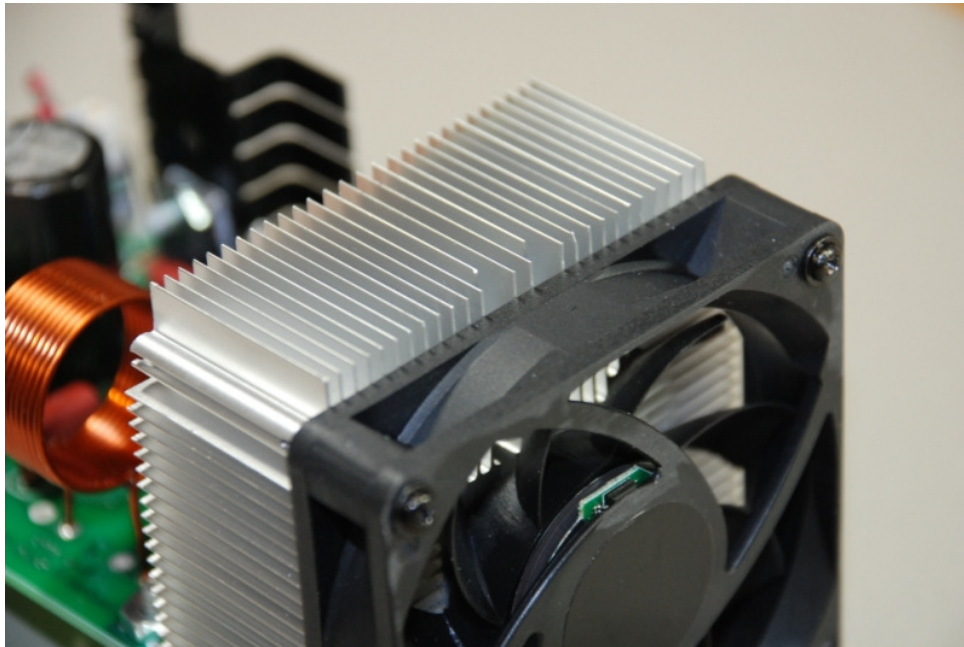


Figure 3.

Fan in new reversed airflow mounting configuration.

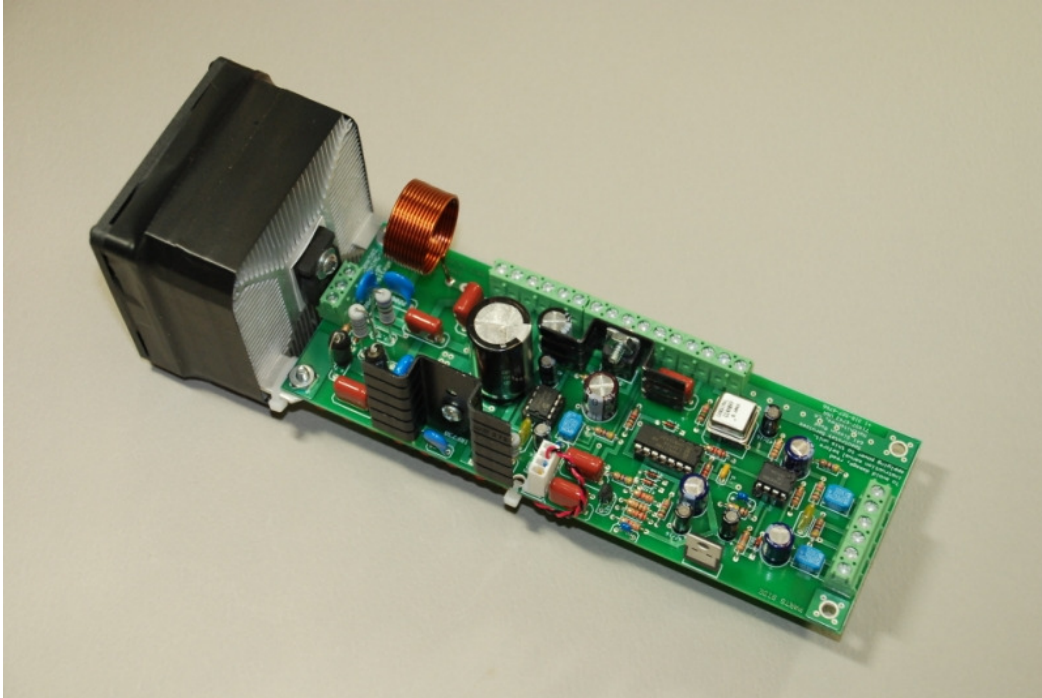


Figure 4.

SPA4 v2.0 processor-amplifier shown with fan configured for reversed airflow with heat sink shroud tape installed.



Edited by CAT