GECKODRIVE
MOTION CONTROLS

G540 HEATISINKING

DETERMINING THE OPTIMAL HEATSINK FOR THE G540

GECKODRIVE INC.
14662 FRANKLIN AVE.
SUITE# E
TUSTIN, CALIFORNIA 92780
1-714-832-8874

OBJECTIVE

This test determined the optimal configuration for heatsinking the G540. The test was run using a G540 without a heatsink, a G540 with only a 12V computer case fan blowing on it and a G540 with a CPU heatsink. The objective was to determine if a supplemental heatsink is required on the G540 when running it at full power.

EXPERIMENT ONE

G540 SETUP: REV4 G540 with no supplemental heatsink
CURRENT SET RESISTORS: 3.48K 1% resistors
MOTORS: Four 3.5A Keling NEMA-23 (KL23H284-35-4B)
POWER SUPPLY: Unregulated 48VDC 9.3A
STEP PULSE SOURCE: Function generator outputting for four revolutions per second
AMBIENT TEMPERATURE: 18C
FAN USED: N/A

This test was run with no heatsink on the G540 and four motors running on an unregulated supply. An ammeter was in series with the power supply to measure the amount of current flowing into the G540 and a thermocouple was attached between the case and a 2” x 2” piece of insulating foam. A reading was taken every 5 minutes until the change in temperature between readings was less than or equal to 1C. The graph of the first experiment (Figure 1) has been normalized to 25C can be seen below.

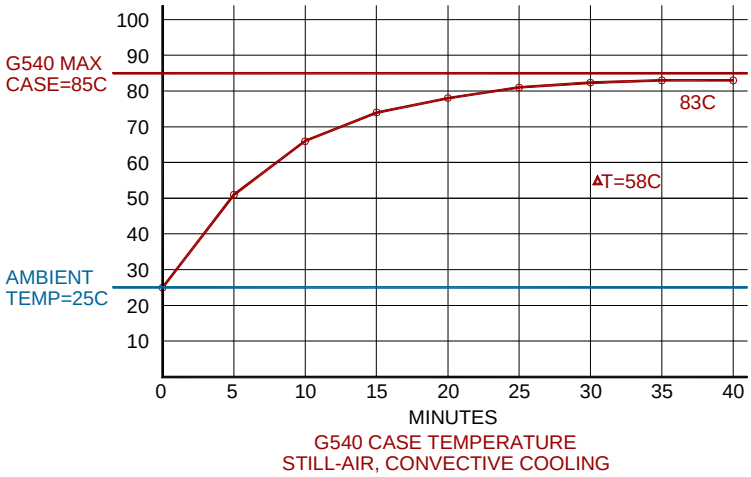

FIGURE 1
NORMALIZED TO 25C

GECKODRIVE INC.
14662 FRANKLIN AVE.
SUITE# E
TUSTIN, CALIFORNIA 92780
1-714-832-8874

EXPERIMENT TWO

G540 SETUP: REV4 G540 with no heatsink and computer case fan 6” away
CURRENT SET RESISTORS: 3.48K 1% resistors
MOTORS: Four 3.5A Keling NEMA-23 (KL23H284-35-4B)
POWER SUPPLY: Unregulated 48VDC 9.3A
STEP PULSE SOURCE: Function generator outputting for four revolutions per second
AMBIENT TEMPERATURE: 19C
FAN USED: 12VDC 120mA fan outputting (1/1000 HP assuming 50% efficiency)

This test was run with only a 12VDC computer case fan blowing on the G540 and four motors running from an unregulated supply. An ammeter was in series with the power supply to measure the amount of current flowing into the G540 and a thermocouple was attached between the case and a 2” x 2” piece of insulating foam. The foam used covered a significant area of the G540 bottom plate, slightly skewing the results to show a higher temperature than would have existed with 100% of the G540 having air flowing over it. A reading was taken every 5 minutes until the change in temperature between readings was less than or equal to 1C. The graph of the second experiment (Figure 2) has been normalized to 25C and can be seen below.

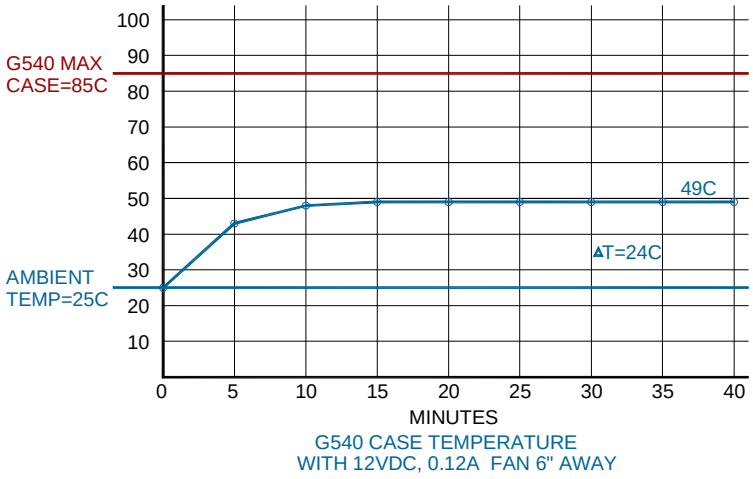

FIGURE 2
NORMALIZED TO 25C

GECKODRIVE INC.
14662 FRANKLIN AVE.
SUITE# E
TUSTIN, CALIFORNIA 92780
1-714-832-8874

EXPERIMENT THREE

G540 SETUP: REV4 G540 with CPU heatsink
CURRENT SET RESISTORS: 3.48K 1% resistors
MOTORS: Four 3.5A Keling NEMA-23 (KL23H284-35-4B)
POWER SUPPLY: Unregulated 48VDC 9.3A
STEP PULSE SOURCE: Function generator outputting for four revolutions per second
AMBIENT TEMPERATURE: 21C
FAN USED: Intel Celeron CPU heatsink with12VDC 90mA fan onboard

This test was run with a CPU heatsink on the G540 and four motors running on an unregulated supply. An ammeter was run in series with the power supply to measure the amount of current flowing into the G540 and a thermocouple was attached between the case and a 2” x 2” piece of insulating foam. The foam was placed on the far end of the G540 to ensure it would be minimally affected by proximity to the heatsink. The heatsink was held on using Arctic Silver thermal epoxy. This was used to ensure that a heatsink could be reliably attached without screwing it down to the case. A reading was taken every 5 minutes until the change in temperature between readings was less than or equal to 1C. The graph of the third experiment (Figure 3) has been normalized to 25C and can be seen below.

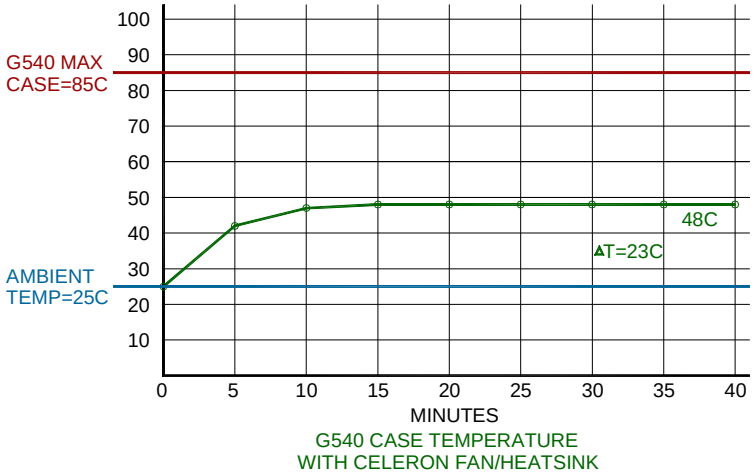

FIGURE 3
NORMALIZED TO 25C

GECKODRIVE INC.
14662 FRANKLIN AVE.
SUITE# E
TUSTIN, CALIFORNIA 92780
1-714-832-8874

COMPILED DATA

The data has been compiled in Figure 4 below to show the different heatsinking options. All of the data has been normalized to a 25C ambient temperature. The red curve is with no heatsink, the green curve is with the 12VDC fan and the blue curve is with the CPU heatsink and thermal epoxy.

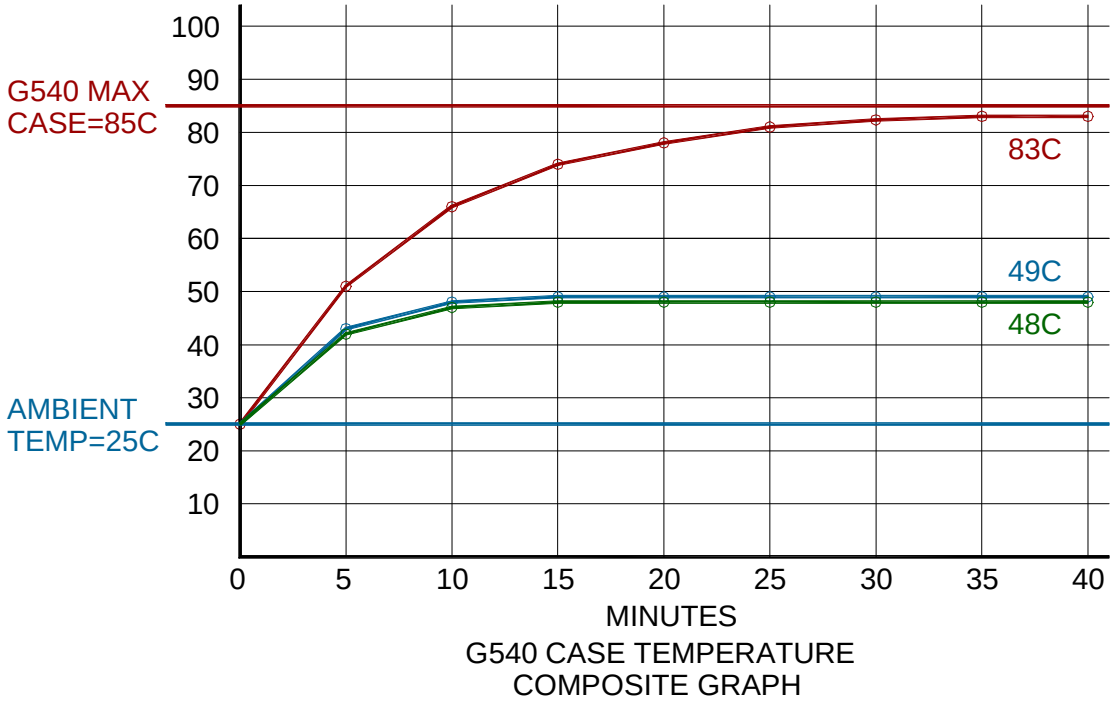

FIGURE 4

CONCLUSION

Any control box containing a G540 must have an adequate input and exhaust fan or an exhaust fan and an internal fan to circulate the air. The red graph shows if the G540 is left in still air or in a sealed environment under full load it will overheat, which may result in damage to the G540. The green and blue graphs show the effectiveness of a circulation fan. Note from the blue graph that nothing is gained by having a fan/heatsink combination. Every degree above 25C ambient will push the peak temperature up one degree as well; it is recommended to monitor the temperature in your case to take this into account.

Marcus Freimanis
Geckodrive, Inc.
February 23, 2009