# HOW THE G203V GETS THE MOST FROM YOUR MOTOR

Many things affect your motor's performance in a system. Motor power output, motor positioning resolution and motor heating while it's stopped. Maximum motor power output requires full-stepping, maximum motor positioning resolution requires microstepping. Both require non-recirculating-mode drive switching for best results.

Motor heating while stopped doesn't do well with non-recirculating mode. It is reduced when the drive is in recirculating-mode. The G203V switches between these modes depending on whether the motor is stopped or not.

Microstepping is good for low speeds. Microstepping is bad for medium and high speeds. It is bad for high speeds because:

1) Motor torque is only 70.7% of what it could be.

2) Microstepping drive switching switching activity at medium and high speeds aggravates motor midband instability especially if the drive doesn't have instability compensation. The motor is exquisitely sensitive to drive's waveform timing.

A Full-Step sequence is bad for low speeds. A Full-Step sequence is good for high speeds. The reasons respectively are:

1) Torque robbing resonances makes the motor performance insufferable at low speeds.

2) The motor delivers all the possible power it has to give at medium and high speeds with a Full-Step sequence (given the drive has midband compensation).

Conclusion: Microstep at low speeds, Full-Step at high speeds. This means morphing from a microstepping to full-stepping when the motor speed is above where microstepping is of any benefit (above 4 revs / sec.).

Why "morph" instead of just switching modes? An abrupt mode change introduces an abrupt change in the motor torque load. This may result in motor stall if it is carrying a large torque-load. The change must be gradual, hence the morphing. This is the method used in the G203V drives. The current references morph from a sine-cosine to quadrature squarewaves. The motor winding currents follow these references. Please see Fig 1 thru Fig 4 on the following page:

Test conditions: 7A / phase @ 24VDC, 600uH winding inductance.

Fig 1: This is a motor microstepping at 150RPM. The motor motion is as smooth as a servomotor equipped with a 500-line encoder. This is because microstepping is eliminating low-speed resonance behavior.

Fig 2: Morphing to full-step is just beginning at 267RPM. The motor speed is high enough and microstepping offers no further benefit. The step rate is above the motor's mechanical cutoff frequency and the response becomes smooth as a consequence.

Fig 3: Halfway done morphing. The motor speed is 375RPM and torque is peaking.

Fig 3: Done morphing. The motor speed is 565RPM and it is now being driven with a pure full-step sequence. The motor is delivering its maximum possible mechanical power and the switching timing thru the origin (current reversal point) is completely clean.

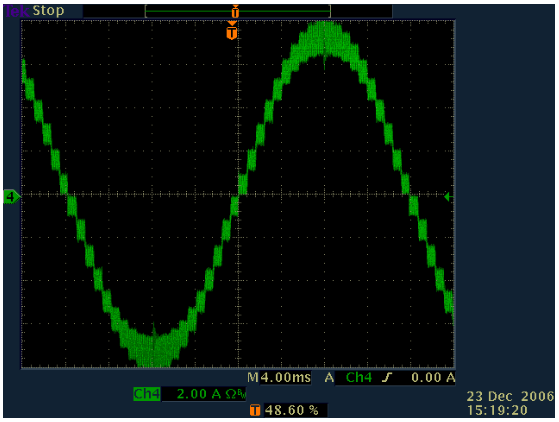


Fig. 1

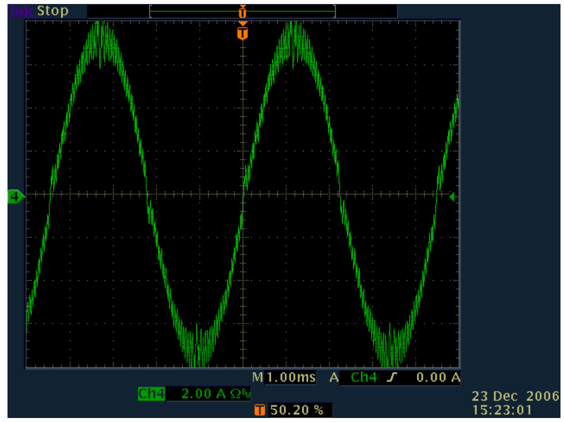


Fig. 2

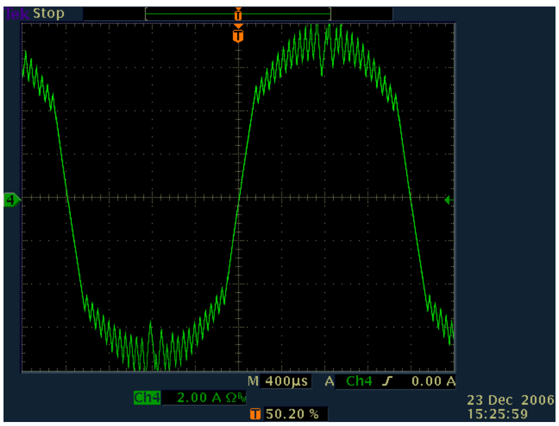


Fig. 3

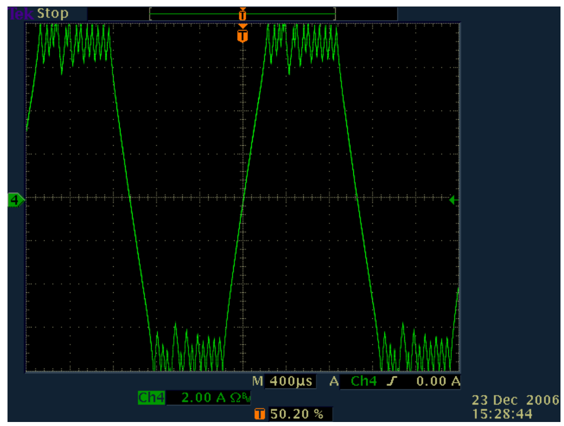


Fig. 4

The G203V reduces motor heating by switching from a non-recirculate mode to a recirculating mode when the motor is stopped. This eliminates unnecessary motor heating while idling.

Figure 5 shows a scope trace capture of a running motor at the 3.6A current level. Note the 1A peak-to-peak ripple current amplitude. Figure 6 shows a stopped motor idling at the 3.6A current level. Note the much lower (300mA) ripple current amplitude. This reduces the idling motor's heat dissipation due to eddy-current losses 8-fold. The result is a much cooler motor.

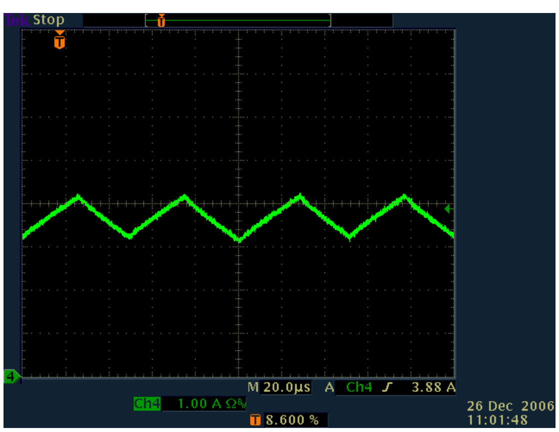


Fig. 5

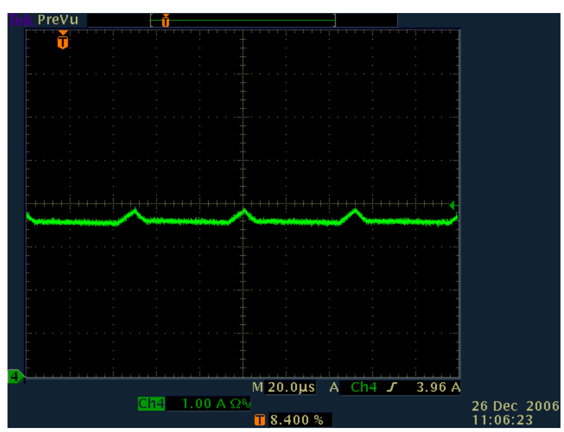


Fig. 6