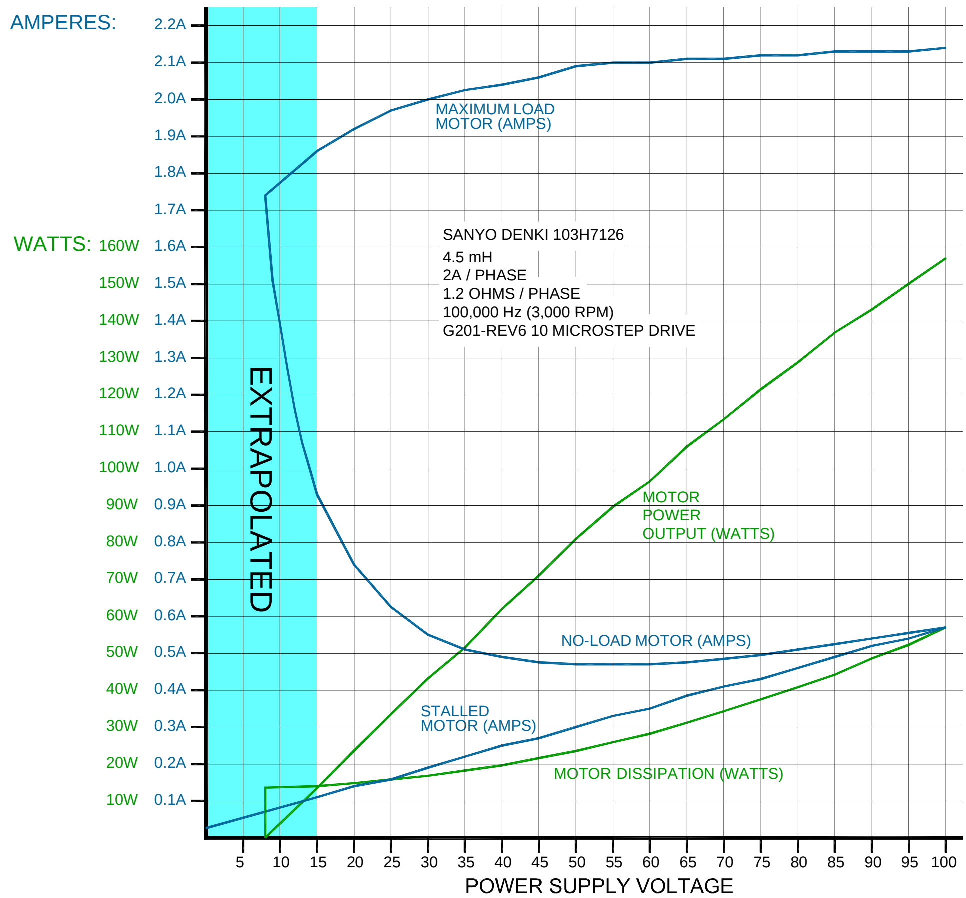
STEP MOTOR OUTPUT VS. SUPPLY VOLTAGE

This data was taken to determine motor losses (heat dissipation) and power output (Watts mechanical) versus power supply voltage. A speed of 10,000 full steps per second was chosen. This speed is high enough to guarantee the drive will not pulse-width modulate the motor current at the highest test voltage (100VDC). Data was taken every 5 volts from 15VDC to 100VDC. The G201 drive contribution was minimal, less than 2W and 20 mA to the readings.

Motor detent torque was measured at 6.4 in-oz and at 3,000 RPM consumes 14.2W of motor power. Offsetting the MOTOR POWER OUTPUT curve by that amount would cause it to project from the origin. As expected, The STALLED MOTOR curve is proportional to voltage and would extend to the origin if the 20 mA drive component were to be subtracted.



The curves are extrapolated for power supply voltages below 15V because the G201 stops running below that voltage.

The NO-LOAD curve is the power supply current required by the motor. Below 15VDC this is extrapolated as the current needed for a 14.2W load.

The MOTOR POWER curve will intersect the X-axis at 8VDC. This represents the minimum voltage at which the motor can maintain 3,000 RPM. At that point the no-load and maximum load currents are the same by definition.

Because no power is delivered by the motor to a load, the MOTOR DISSIPATION curve represents heat dissipated in the motor. It is the product of the power supply voltage and the NO-LOAD curve.

Interestingly, motor output power can be calculated by taking the difference between the no-load and the maximum load currents, then multiply them by the power supply voltage. The results match dynamometer readings very closely. The calculated shaft power at 30VDC is 43.2W while the dyno measures it as 41.6W. At 60VDC the results are 96.6W and 97.2W respectively. This also implies motor heat dissipation is independent of load.

Unexplained yet is the reason for the slight convex curvature to the MOTOR POWER curve. This is found by taking the difference between it and the STALLED MOTOR curve, then multiplying it by the power supply voltage. The result is a straight line with a negative slope ranging from 12.3W at 15VDC to 2W at 100VDC.

Copper losses are nearly negligible. A quick inspection of the above data shows 2.15A as the maximum current anywhere on the graph. The motor winding resistance is 1.2 Ohms for a parallel equivalent of 0.6 Ohms. Taking I squared R, the maximum power dissipated is only 2.8W.

The G201 is rated for 24VDC to 80VDC power supply limits. Though the drive was operated at 100VDC in the course of gathering this data, this was done using a regulated lab type power supply. Please do not run these drives above 80VDC.

Mariss Freimanis
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