Introduction to Motor Data

SmartMotor Part Number		
Continuous Torque	2.50	in-lb
	40	oz-in
	0.28	N-m
Peak Torque	4.00	in-lb
	64	oz-in
	0.45	N-m
	181	Watt

The following section covers individual motor data for each Class 4 PLS2 SmartMotor™.

Data Tables

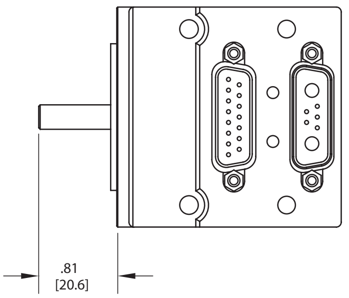
The data table shows **maximum** sustained Torque, Power and Current. Note that the continuous torque numbers are typically over a given RPM range, however the Peak Torque is always at Zero-RPM stall and will not be available at higher RPMs.

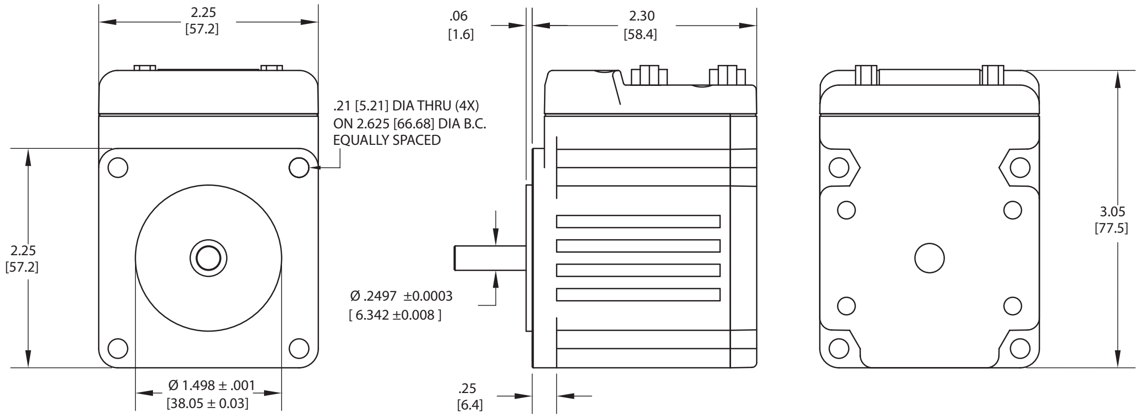
⚠ WARNING

Class 4 PLS2 Series SmartMotors may be used as upgrades to replace older PLS series SmartMotors. However, ALL PLS2 series SmartMotors have twice the encoder resolution of prior equivalent sized PLS SmartMotors where available. As a result, on existing machines, program changes will be required to maintain proper distances, velocities and acceleration. Additionally it may require changes to following error limits and PID tuning parameters. Please consult Users Guide and help files as necessary.

CAD Drawings

Each CAD drawing shown is for reference only. Please consult factory or the Animatics website for the most recent drawing revision. All CAD drawings have both Metric and Standard units shown. Each drawing in the individual motor table section is for the standard motor with no Bus or Brake options. All other reference CAD drawings can be found after the Motor data section of this catalog.





All SmartMotor data and specifications are subject to change without notice. Please consult the factory for the latest updates.

Understanding Animatics Torque Curves

Each Set of Torque curves depicts limits of both Continuous and Peak torque for the given SmartMotor™ over their full range speed.

Peak Torque Curve:

The Peak Torque Curve is derived from dyno testing and is the point at which peak current limit hardware settings of the drive prevent further torque in an effort to protect drive stage components.

Continuous Torque Curve:

The continuous Torque Curve is also derived from dyno testing, but is instead the point at which the temperature rises from an ambient of 25º C to the designed thermal limit.

For example, the motor will be placed on the dyno tester and set to operate at 1000 RPM continuously with the load slowly increased until the controller reaches its maximum sustained thermal limit. This limit is either 70º C or 85º C depending on the model number. All PLS2 SmartMotors are set to 85º C.

The far lower right side of the curve is limited by supply voltage. This is the point at which Back EMF suppresses any further speed increase. Higher supply voltages will shift the zero torque point of the curves further to the right.

Ambient Temperature Effects on Torque Curves and Motor Response:

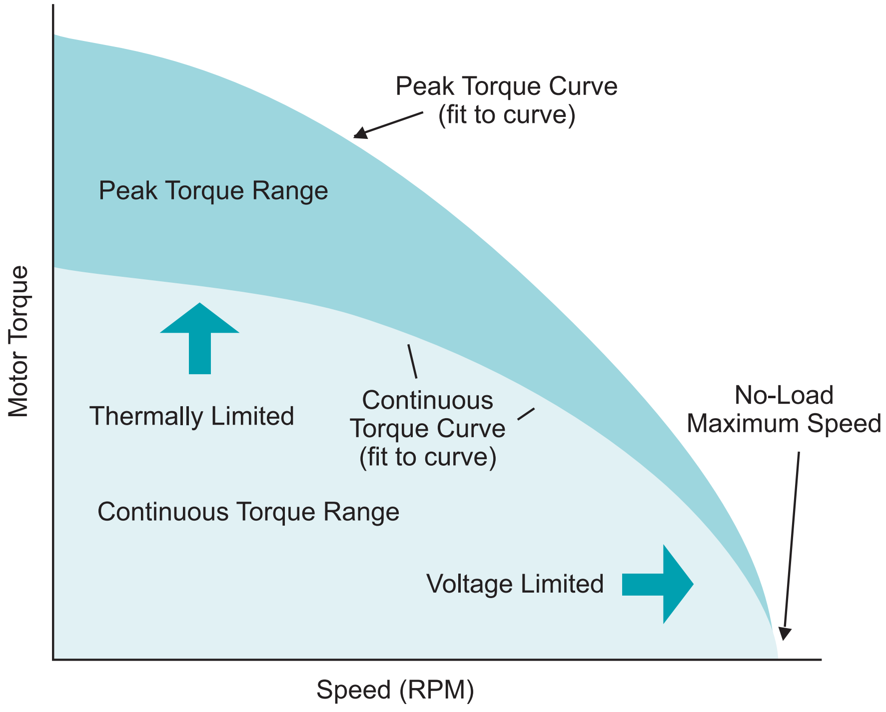
If the motor is operated in an environment greater than 25º C, then it will reach its thermal limit faster for the same given load thereby further limiting continuous torque.

Therefore; any given motor torque curve MUST BE linearly de-rated for a given ambient temperature from 25º C to 70º C, 85º Cfor all PLS2 SmartMotors.

Supply Voltage Effects on Torque Curves and Motor Response:

Higher voltages have two-fold effects on torque curves. As mentioned above, raising voltage will shift the curve to the right. It will also allow higher current into the drive. However, Torque curves depict Torque at a given velocity.

If you double supply voltage, the motor can sustain twice the original velocity. But since acceleration is the differential of velocity, it can achieve 4 times the original acceleration. This is useful for high speed indexing and fast start/stop motion.



All Torque Curves in this catalog also have SHAFT OUTPUT Power Curves overlaid on them as well.

Power can be found by the following equation:

Power (kW) = Torque (N.m) x Speed (RPM) / 9.5488

For any given mechanical system being moved by a SmartMotor™, it is ideal to insure the motor is running within its optimum performance range. This can be achieved via proper mechanical system design by adjusting one of the following as it may apply:

- Gear Reduction
- Belt Reduction
- Lead Screw Pitch
- Pinion Gear diameter

Example 1: (Rotary Application)

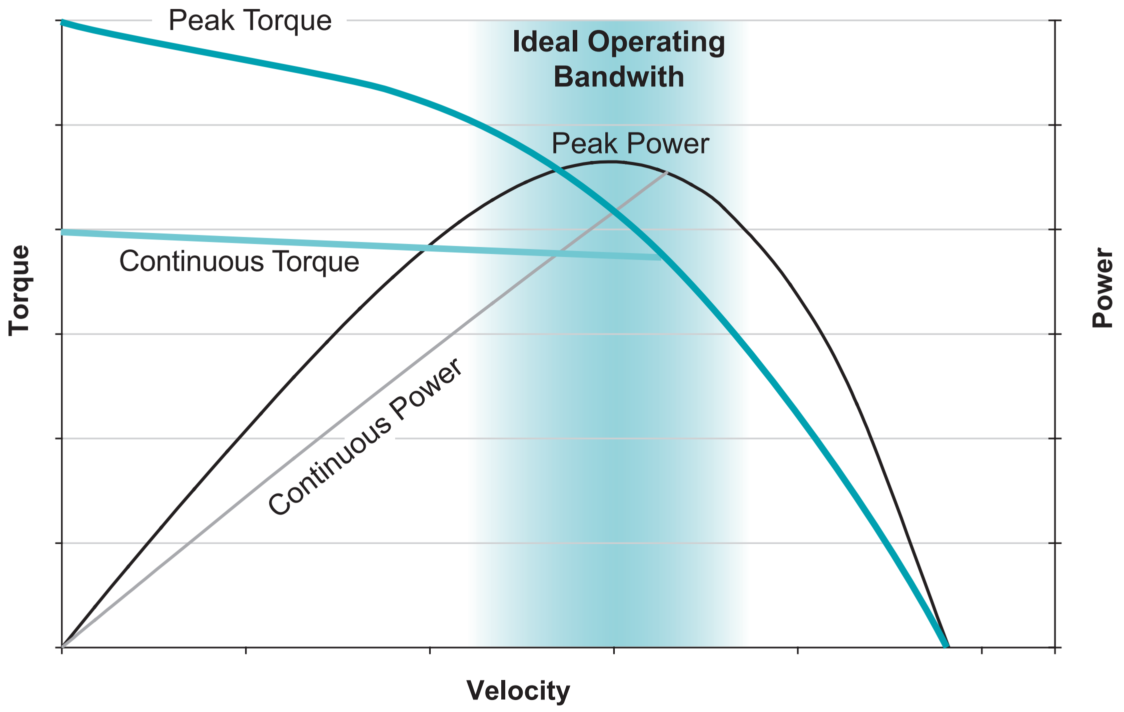
Suppose you have a load that requires 300 RPM at the output of a gear head. Suppose the optimum speed range for the motor is 2100 RPM.

Divide the optimum operating speed by the load speed to get the ideal gear reduction. In this case : 2100 RPM / 300 RPM=7. So a 7:1 gear reduction would allow the motor to operate in its most efficient range.

Example 2 (Linear Application)

Suppose you need to run at 100mm/second via a ball screw and the motor has an ideal range of 3000RPM. 3000RPM/60= 50 Rotations per second. 100mm/sec divided by 50RPS is 2mm per rotation.

So an ideal pitch would be 2mm.



Considerations when using torque curves for motor sizing:

For any given product model number, there may be variations of as much as +/-10%.

The following diagram depicts data points collected from dyno testing of a given model motor. A best-fit torque curve is created from these data points and is then de-rated to at least 5% below the worst case data points. The de-rated curve is what is advertised. This means that within any given model number, EVERY motor sold will perform at or better than the advertised torque. Theoretically, ALL motors should be no less than 5% better than advertised and may be better than 20% higher.

The diagram shows motor loading in 4 areas.

① This is ideal and depicts a load within the normal operating range of the motor. The motor should operate well and have no problems for many years.

② The load is very close to the operating limit. The motor will run quite warm as compared to Point 1.

③ The load exceeds the advertised level and exceeds +10% expected range of possible torque capabilities. In this case, the motor will most likely either overheat quickly and fault out or immediately get a position error because it simply does not have enough power to support the load demand.

⚠ WARNING

④ The load exceeds the advertised operating limit of the motor. However, due to data scatter and de-rating, there may be some motors that will work and others that do not.

Why? Because it is in the area of +/-10% variation expected in motors for a given size. This can become a major problem. Imagine designing a machine that operates in this range. Then you replicate that machine with many of them running on a production floor. One day, a motor at the lower end of the +/-10% expected variation would be placed on a new machine and that motor would get spurious drive faults. It would appear as though the motor is malfunctioning because… "all the other motors work just fine". This is unfortunate because, in reality, all motors were undersized and operating outside of their advertised limits.

This is why it is important to properly calculate load torque to ensure the correct motor is designed into the application. Never assume that without proper load calculation and motor sizing, that testing of one motor means all of that size may work. This is simply not the case. **Try to keep operating conditions below the advertised limits to ensure reliable long-life operation.**

Note: See page 94 for Moment of Inertia Overview