Sizing Considerations

GS/X Actuator Sizing - Easier Than You May Think

It is important to remember that when sizing a GS actuator, you are simply sizing a servo motor for a linear application using a lead screw.

The one catch is that the screw inertia is part of the motor armature inertia. So when entering your calculation values in a sizing program, or when calculating by hand, enter the GS armature inertia as the motor inertia, and enter the screw inertia as zero.

The rest is straightforward motor sizing. The friction torque and damping torque for each size actuator are given in the catalog, so please refer to those pages as you make your calculations.

Size for motor torque. Then look to the motor torques available for the GS actuators. There are typically two -- one torque for the standard length stator and one for the DS (double stack option) which is higher. If the required torque for the application is available from one of these stators, look to its current rating and required bus voltage to select the proper sized servo amplifier. The parameters are shown for trapezoidal commutation amplifiers, sinusoidal commutation amplifiers, and sinusoidal amplifiers that rate their current at the peak of the sine wave rather than give the RMS value. You will need to know your amplifier type to properly select this.

Repeatability, Resolution and Accuracy More to Consider than Just the Actuator

A very common question for us is "What is the accuracy of the actuator?" For the actuator itself, that is easy. There is a mechanical lead accuracy of the screw which is typically 0.001in/ft. This is a typical spec for precision positioning screws of any type. This means that at any point over the cumulative length of the screw, the lead will vary by a maximum of 0.001 inches per foot of screw length.

This is not the same as mechanical repeatability. The mechanical repeatability is a tolerance on how close to the same linear position will the screw will return, if approaching from the same direction, and driven exactly the same number of turns. This value is typically 0.0004 inches.

The electronic positioning resolution is a function of the feedback device and the servo amplifier. Let's assume that we have Exlar's standard encoder on a GS30 with 0.2 inches per revolution lead on the roller screw.

Exlar's standard encoder has 2048 lines and 8192 electronic pulses per revolution that it outputs to the servo drive. So in a perfect world, the positioning resolution would be (0.2 in/rev)/(8192 pulses/rev) or 0.0000244 inches.

Any one who has used servo drives knows that you can't position to one encoder pulse. Let's use 10 encoder pulses as a reasonable best positioning capability. This gives us a positioning resolution of 0.000244 inches.

More things to consider . . . When addressing repeatability and accuracy, there are several things that must also be taken into account. One of these is the stiffness of the system. Stiffness is how much the system will stretch or compress under compressive or tensile forces. If the combination of the stiffness of the actuator and the stiffness of the mechanical system, including all couplings, mounting surface, etc. allows for more compression or stretch than the required positioning resolution of the system, obtaining acceptable positioning results will be nearly impossible.

Another consideration is thermal expansion and contraction. Consider a GS actuator attached to a tool that is doing a precision grinding process. Assuming that the tool is steel and 12 inches long, a 5 degree rise in temperature will cause the tool to expand by 0.0006 inches. If the system is programmed to make 0.0002 inch moves, this expansion could cause serious positioning problems.

The same applies to the components of the actuator itself. The actuator rod can change in temperature from a cold start up to running temperature. This change may need to be accounted for in very precise positioning applications.