Top 10 tips on selecting and installing Electrical Drive Automation solutions

FESTO

Size from end effector upwards

When considering a handling system of any type, always work from the end effector (gripper or vacuum) upwards. Firstly size the gripper, then any rotary actuator requirements. After this, size the vertical (Z axis) and then any horizontals (X and Y axis).

Minimise quantity of bearings in multi axis solutions

If your requirement is for a multi axis solution, the best practice is to reduce the amount of bearings between the rigid frame and the product. By keeping this to a minimum (5 bearings absolute maximum) you minimise the cumulative deflection and therefore improve accuracy. Also, if the axes are electrical, problems are compounded as high play and deflection effects the tuning of the axis and produces an unstable system.

Mounting servo & stepper motors onto mechanical axis

When considering mounting servo and stepper motors on to mechanical axis, ensure you allow for misalignment. Flexible couplings such as “Oldham” type or bellows, couplings are ideal.

These usually come supplied with set screw fixing or clamping. They also act as a mechanical fuse. If the drive crashes, the coupling slips and therefore minimised expensive damage to the ballscrew or belt drive. The ideal solution is to select a manufacture that can supply the axis, coupling housing, coupling, flange and motor. This minimised the risk and gives a guaranteed solution.

Select your stepper card carefully

Remember if you are using a stepper motor system and you want to use micro stepping, your step pulse from your PLC or stepper card must be able to keep up with your performance expectations. i.e. a typical stepper motor may have 200 steps per revolution. If you want smoother and more precise motion you can of course on most systems go to 32nd step micro stepping. This now gives 6,400 steps per revolution.

If you want to rotate at 900 rpm, it requires 5,760,000 pulses per minute which is 96,000 pulses per second or 96khz. You must ensure this can be achieved. This is often overlooked by the mechanical designer when sizing the system as they do not deal directly with the PLC specification.

Festo Ltd
Caswell Road
Brackmills Trading Estate
Northampton
NN4 7PY

Tel: (0800) 626422
Fax: (01604) 667001
Info_gb@festo.com
www.festo.com/gb/edrives

Benefits of stepper & servo motors

Stepper motor technology is often thought of as the poor cousin in motion control terms when compared with servo. This is often a misconception as, although the dynamics are lower than servo, a correctly sized stepper system can offer major cost benefits over a servo. Remember to oversize a stepper by at least 30%, to ensure it never loses steps and you will have a very reliable and cost effective system. If in doubt, always seek advice from a manufacturer that offers both technologies and you will be assured of a non-biased optimum solution.

Servo motor

Stepper motor

What is inertia mismatch ratio?

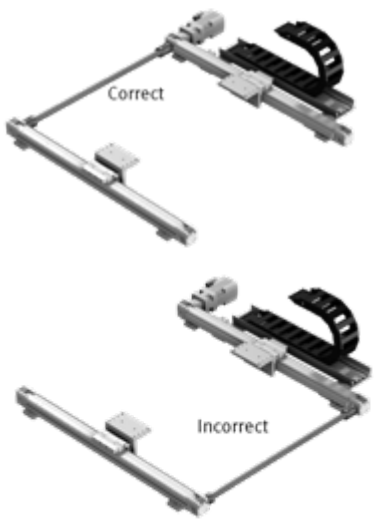
Most stepper and servo systems are sized not on the torque requirement but on the inertia requirement (although torque is an important factor). If a motor is attached to a load that has a much higher inertia than the rotor (rotating part of the motor), the load will tend to drive the motor and not the other way round (a little like a smart car pulling a 2 tonne caravan). This is not a good situation to be in and therefore it is important to ensure the load inertia is not too high in relation to the rotor inertia.

In most simple positioning tasks, this inertia can be up to 10: 1 (load:rotor). A CNC machine that requires very precise positioning throughout its movement would have an inertia match of perhaps 1:1.

If the load inertia is too high, a gearbox can be fitted which will help considerably in reducing this ratio (a 4:1 gearbox will reduce the inertia of the load by nearly 16 times).

Avoiding unnecessary strain & wear on drive belts & bearings

When linking two axes together in a parallel configuration, ensure the coupling shaft between the axes is mounted on the same shaft as the motor. This ensures rigid power transmission and guarantees the two axes run together in a synchronous manner. Mounting the coupling shaft on the opposite end of the axis to motor introduces a lag and additional strain on the belt and bearings.



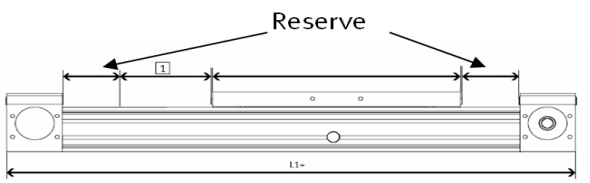
Festo Ltd
Caswell Road
Brackmills Trading Estate
Northampton
NN4 7PY

Tel: (0800) 626422
Fax: (01604) 667001
Info_gb@festo.com
www.festo.com/gb/edrives

The importance of identifying the allowance for reserve stroke

Remember to check whether over travel or stroke reserve is included on your mechanical axis. Many manufacturers include a distance at each end of the axis which is not part of the stroke of the system, but not all manufacturers do this. This feature ensures that if a position is programmed in to the controller incorrectly and the motor hits the end limit sensor at speed, the motor can decelerate down before hits the physical end of the axis.

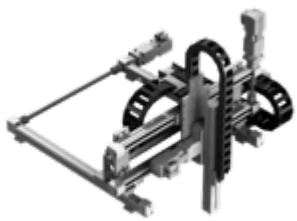
This means that many axis appear longer than others for the same stroke length. It is possible to use some of this stroke reserve and therefore reduce the length of the axis, depending on the speed and load of the application. Beware, if this reserve is totally used up, it can lead to a dangerous catastrophic failure of the system.



The importance of effective cable management systems

Do not discount the importance of cable management systems when integrating electric drives into an application.

These issues are often as important as the of the drive itself. Badly designed and installed cable management can effect the tuning of a drive, create a very noisy application, lead to premature failure of the tubes and cables and dangerous for operators.



Energy chain systems should be treated as an integral part of the design and not as an add-on once the system has been designed.

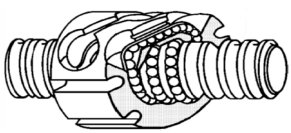
Ensure your electric drive supplier has a grasp of these issues and ensure their axis mountings are designed for the cable management and energy chain systems.

Festo Ltd
Caswell Road
Brackmills Trading Estate
Northampton
NN4 7PY

Tel: (0800) 626422
Fax: (01604) 667001
Info_gb@festo.com
www.festo.com/gb/edrives

What are the differences between spindle drives, lead screws and ballscrews?

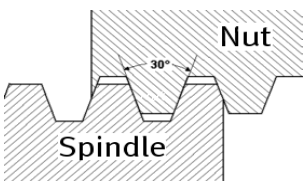
Many people ask what the main differences are between spindle drives, lead screws and ballscrews. Much of the confusion stems from terminology and market location. Terminology in the USA often varies from that in Western Europe.



Ballscrew

Ballscrews, which confusingly are often referred to as spindle drives, consist of a ground or rolled spindle and a helical nut which contains recirculating ball bearings. Ballscrews give a long life and play free, accurate positioning. Disadvantage are the higher cost and they are not self locking, needing a braked motor in vertical

Lead screws, often called trapezoidal spindles, consist of a trapezoidal thread form and often a polymer nut. They tend to be low cost and offer the benefit of being self locking due to the thread form. Disadvantages are lower life expectancy and a small amount of play.



Nigel Dawson is Product Manager for electric drive automation at Festo

Festo Ltd
Caswell Road
Brackmills Trading Estate
Northampton
NN4 7PY

Tel: (0800) 626422
Fax: (01604) 667001
Info_gb@festo.com
www.festo.com/gb/edrives