

# **Servo Shaft Tubular Linear Motor**

# **FAQ**

**Inoservo.Co.,Ltd.**

**Science & Technology Park**

ShenZhen China

Tel.: +86 (0) 755 86008400

E-mail : [info@inoservo.com](mailto:info@inoservo.com)

<http://www.inoservo.com>

1、 Are Servo Shaft linear motors difficult to integrate into a machine?

Not difficult, just a little different. The Servo Shaft linear motor is simpler to install, as it replaces the ball screw, nut, end bearings, motor mount, couplings, and rotary motor. Alignment of the Linear Shaft Motor is not critical (even for high performance packages) and consists of mainly ensuring there is some clearance between the forcer and shaft over the entire travel. Inoservo will assist with selection of suitable components.

2、 Are versions of the SSLM available for use in waterproof, vacuum or clean rooms?

Yes, the Servo Shaft linear motor can be built for a variety of operating environments. To determine if and which Servo Shaft linear motor is suitable for a specific application, an applications engineer must review the specifications.

3、 Can a Servo Shaft linear motor be mounted vertically?

Yes, a Servo Shaft linear motor provides the same performance when mounted vertically or horizontally. However, it is recommended that a vertically mounted Servo Shaft linear motor be counterbalanced.

4、 Can more than one forcer be used with a single shaft?

Yes, more than one forcer can be used in conjunction with a single shaft as long as the forcers do not physically interfere with each other. Two forcers may also be tied together and driven with one drive to double the output force.

5、 Can the shaft of the Servo Shaft linear motor transmit a rotary force?

Yes, it is possible. To determine which Servo Shaft linear motor is most suitable for your specific application, an applications engineer must review the specifications.

6、 Do magnets ever lose their magnetism over time?

The Servo Shaft linear motors use a rare earth magnet, which will maintain their strength for 99 years. However, when operating at high temperatures ( $>150^{\circ}\text{C}$ ), these rare earth magnets can lose strength. Lower temperatures have no effect the magnets as long as frost does not form in the air gap.

7、 Do standard rotary motor electronics work with linear motors?

The Servo Shaft linear motor is designed to operate with most off-the-shelf motor controls and drives. Basically, the Li Servo Shaft linear motor uses the same electric circuit as other linear motors and rotary servo motors.

8、 Does only one forcer need to have the halls or do both need halls?

In an application where two coils are connected to the same drive, the same coil of each drive must be above the same magnet in order to run. (See drawing below) This is why when the second forcer is flipped the U and V leads must also be flipped. As such only one of the two coils needs to have halls.

9、 How accurate are Servo Shaft linear motors?

By eliminating the conversion of rotary to linear motion, a major source of positioning error is removed. This results in high performance and accuracy. While the Servo Shaft linear motor itself does not have inherent resolution, position accuracy is ultimately determined by the linear encoder feedback accuracy and the core stiffness of the Servo Shaft linear motor. Testing has shown that with encoder resolutions less than 10nm, the

Servo Shaft linear motor will, at worst case, enable a position accuracy of  $\pm 1.2$  pulses of encoder resolution. This position accuracy is not affected by the expansion and contraction of the shaft.

10、 How fast can the Servo Shaft linear motor go?

While the Servo Shaft linear motor itself does not have inherent speed limitations. There are several factors that can limit the maximum speed of a Servo Shaft linear motor system. The control must provide sufficient bus voltage to support the speed requirements. The encoder itself must be able to respond to that speed and its output frequency must be within the controllers capability: for example, with a 0.5 micron encoder and a speed of 5m/s, the controller must handle 10MHz. Finally the speed rating of the stage's bearing system must not be exceeded: for example, in a recirculating ball bearing, the balls start to skid (rather than roll) at about 5 m/s. Under the right conditions the Servo Shaft linear motor can reach speeds exceeding 10 m/s.

11、 What are the advantages of the Servo Shaft linear motor over a lead screw?

The advantages of the Servo Shaft linear motor include higher velocities [ $>240$  in/sec ( $>6$  m/s)], non-wear moving part, free movement when power is off, no backlash because there are no mechanical linkages, easier alignments, and easier manufacturing.

12、 What happens if the system loses power or velocity feedback?

If a power loss occurs, the system loses all stiffness. So, if the payload is moving, it will continue to move until it hits a stop or until friction brings it to a stop. If the system is already stopped, it will not be affected. If the feedback loop is lost, it may lead to a runaway situation. This condition can be avoided with the use of soft and hard stops as well as braking systems.

13、 What is RMS Current?

RMS is the average current flowing through the windings. RMS current for a given application should not exceed the rated continuous current for the selected Servo Shaft linear motor.

14、 What is a Servo Shaft linear motor?

Servo Shaft linear motors are direct drive linear servomotors that consist of a shaft with permanent magnets and a forcer of cylindrically wound coils.

15、 What is cogging?

Cogging is the tendency of some linear motors to move in discrete distances rather than infinitely variable distances. The effect is a result of varying magnetic forces along the length of motor travel. This effect is most often seen when ferrous material is used in the motor or stage construction.

16、 What is motor power duty cycle for a linear motor?

Duty cycle for a linear motor is different than other types of systems. While it is defined as (time on) / (time on+ time off) per cycle, in a linear motor the motor can be on even when not in motion. So for a linear motor the duty cycle is based upon the time the motor is actually working (when current is applied) and NOT the % of time the motor is moving! Thus it is best defined as: Motion duty cycle is defined as time moving / total time. It is possible for Motor power duty to be 100% while the motor is not moving, or the motion duty to 100% with very low motor power duty.

**17、 What is rated current?What is peak current?**

The rated current is what the motor is rated at. The peak current refers to the amount of current the driver outputs.

Non-microstepping drivers

Peak Current = Rated Current

When using a driver that only does full stepping, the rated current is the same as the peak current. (Rated current = Peak Current).

Microstepping Drivers

Peak Current = 1.4 x Rated Current

When using a driver that is capable of doing microstepping (microstepping = 1/2, 1/4 stepping or more), the definition of peak current becomes 1.4 times the rated current. Microstepping drivers are made differently in order to maximize their ability to drive the stepper motor. Therefore, step motors can handle up to their rated current multiplied by 1.4. (Peak Current = 1.4 x Rated Current). This will not damage the motor because the power output is more or less the same.

**18、 What is system resonance?**

To determine a motor's resonance, take the square root of (torque stiffness divided by total inertia). Although resonance frequency cannot be completely eliminated, it can be changed by altering the rotor or system inertia or by altering the torque stiffness.

**19、 What is the MTBF (Mean Time Between Failure) for the Servo Shaft linear motor?**

The current published MTBF for the Servo Shaft linear motor is over 100,000 hours of operation.

**20、 What is the price of a typical Servo Shaft linear motor system?**

The price of the Servo Shaft linear motor is comparable to other ironless core linear motors. Prices for other parts of the system are dependent upon the resolution and size of the system being produced.

**21、 What is the reliability of the Servo Shaft linear motor?**

The Servo Shaft linear motor is a non-contact device. As such, it does not have any parts that can wear out. If the system is designed properly, and the operating parameter limits are not exceeded, a Servo Shaft linear motor should last indefinitely.

**22、 What performance improvements can be expected when using the Servo Shaft linear motor?**

In most applications, repeatability and accuracy will be increased. Move times and settling time will be decreased. Noise will also decrease as well as total power requirements.

**23、 What routine maintenance is required for Servo Shaft linear motors?**

The Servo Shaft linear motor itself is entirely maintenance free. It does not have any parts that can wear out. Inoservo does recommend that you perform periodic minimal inspections. Please see the Maintenance and Service section of the Installation and Users Guide for a full list.

24、 Will the Servo Shaft linear motors produce enough force for my application?

The smallest Linear Shaft Motor will produce 7N of continuous force. The largest can provide 500N of peak force.