“SANMOTION F” Series Linear Actuator Stepping Motor

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1. Introduction

The stepping motor is a motor that can be controlled by the open loop control, easily controlled by the simple system without any sensor. Therefore, it is used in many customers such as general industrial equipment manufacturers, semiconductor equipment manufacturers, etc. In many of these equipment, rotation of the stepping motor is converted to linear drive with the ball screw.

For this reason, we thought that there are potential demand for the actuator that is driven linearly with simple control, and developed the “SANMOTION F” Series linear actuator stepping motor with integrated stepping motor and ball screw (Refer to the following as to new model).

This document shows the structure and specification of the new model, and benefits to the customer devices.

2. Structure

Fig. 1 shows the structure figure of the new model.

The hollow rotor can house the output-axis when the output-axis (boll screw shaft) is retracted. The hollow rotor and the ball screw nut are fastened together, and make an integrated structure.

The operating principle is as follows:

1. The hollow rotor rotates
2. The ball screw nut rotates
3. The output-axis is driven linearly with the principle of screw

Fig. 2 shows the external view when the output-axis is retracted, and Fig. 3 shows the external view when the output-axis is extended.

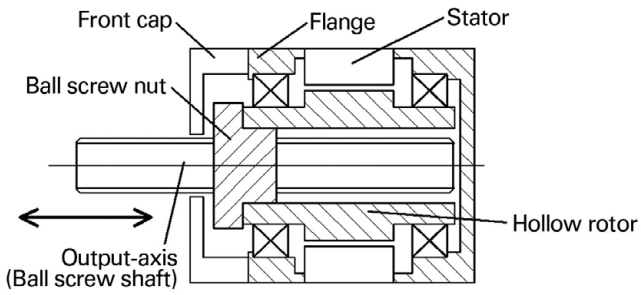

Fig. 1: Structure figure
(when the output-axis is retracted)

Fig. 2: External view when the output-axis is retracted

Fig. 3: External view when the output-axis is extended

3. Specifications

Table 1 shows the specifications for the new model. There are four models of 42 mm square (with and without holding brake) and 60 mm square (with and without holding brake).

Maximum stroke for the 42 mm square motor is 50 mm, and 60 mm square motor is 80 mm.

Fig. 4 and Fig. 5 are velocity-thrust force curves. Both 42 mm square and 60 mm square motors have large thrust at lower velocity.

Table 1: Specification of the linear actuator stepping motor

Item	Model / Units	SL5421-72XB41	SL5421-7241	SL5601-82XB41	SL5601-8241
Holding brake	–	Yes	No	Yes	No
Flange size	mm	42		60	
Motor length	mm	117	87	135.6	
Rated current	A	0.75		1.4	
Maximum stroke	mm	50		80	
Maximum thrust force	N	370		450	
Maximum velocity	mm/s	48		64	
Resolution	mm	0.004		0.008	
Positioning repeatability	mm	±0.02			
Lost motion	mm	0.1 or less			
Applicable driver	–	FS1D140P10			

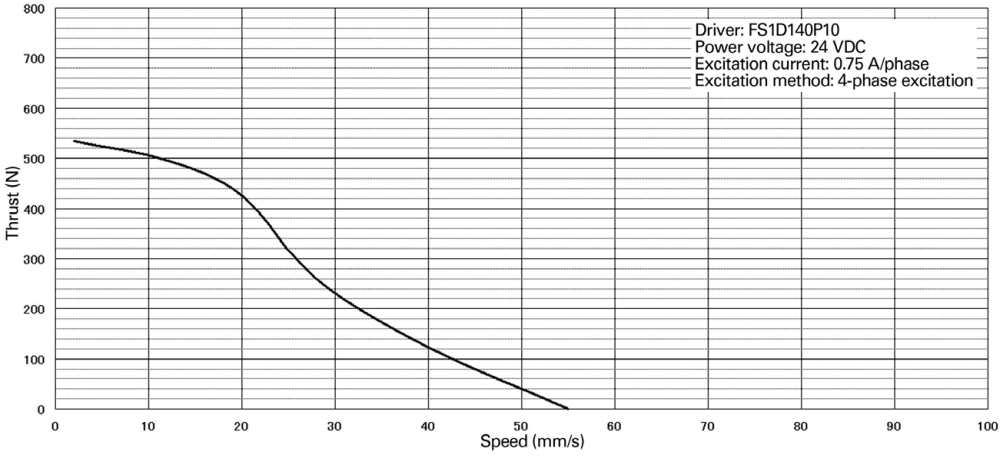

Fig. 4: SL5421-72□□ Velocity-thrust force curve

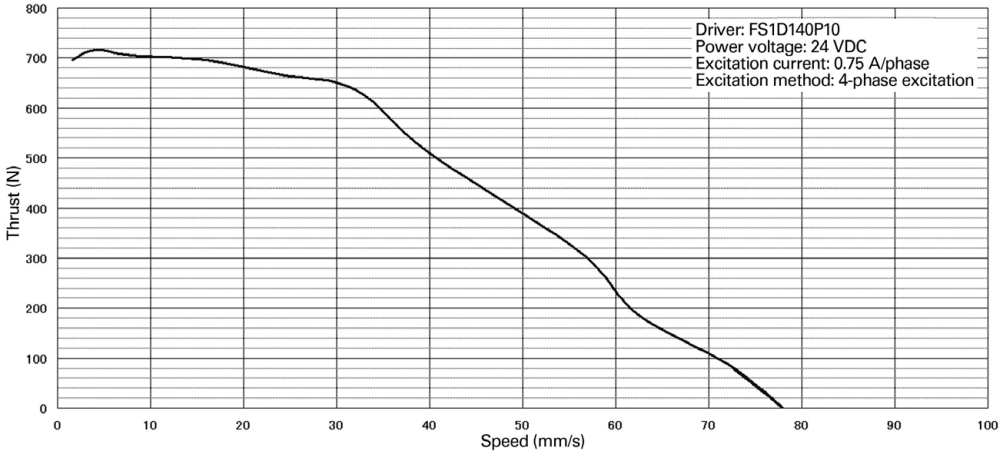

Fig. 5: SL5601-82□□ Velocity-thrust force curve

4. Features

Three main features from the viewpoint of mounting to customer's device are described here.

4.1 Downsizing

Fig. 6 is a structure figure of the new model and the cylinder-type linear actuator. The cylinder-type linear actuator is constructed with motor, coupling, bearing, and output-axis all in series. The length of the actuator becomes long as a result.

The length of a new model become short significantly by the built-in ball screw nut in inside of the motor, and housing the output-axis in the hollow rotor.

Comparing with the actuator for 42 mm square (50 mm stroke, without holding brake), motor length of the cylinder-type linear actuator is approximately 200 mm, but the motor length of the new model is less than half with 87 mm.

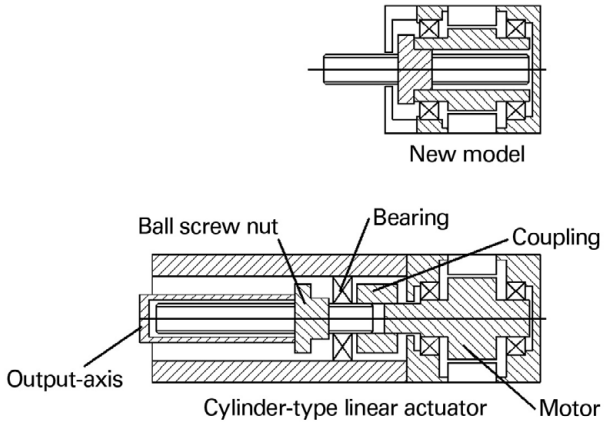

Fig. 6: Comparison with a linear actuator

4.2 Easiness of mounting

Fig. 7 shows the comparison of direction to bolt when mounting the actuator to an equipment.

Cylinder-type linear actuator can only be bolted from the output-axis side when mounting to an equipment. But there are structural parts of the equipment on the output-axis side. So the customer has to design the structure of equipment to allow the mounting of motor through those parts.

By making a space for bolts and tools to fit in on the new model, it is structured to allow bolting from the opposite side from the output-axis side. This will reduce the restriction for customer design, along with reduction of production costs of the equipment.

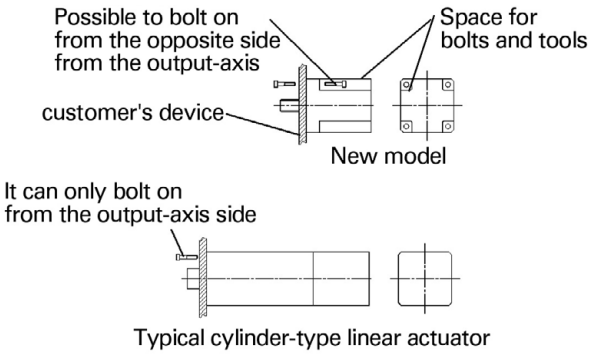

Fig. 7: Comparison of bolting direction

4.3 High customizability

Fig. 8 shows example of the customizing the new model.

The new model can be customized by removing the front cap. By the design which functions as a front cap to the motormounting surface of a customer's device, The length can be shortened more.

Also, the motor is structured so that it can withstand heavy thrust load (axial load). The thrust load for typical 60 mm square stepping motor is 20 N, but the thrust load for the new model is over 800 N. It can be used as a hollow shaft motor that can take heavy thrust load by removing the ball screw structures. It can be adopted to the purpose where the gravity load of the workpiece is applied toward the thrust direction of the motor. In this case, customer's device needs not to have the especial structure to withstand the thrust load.

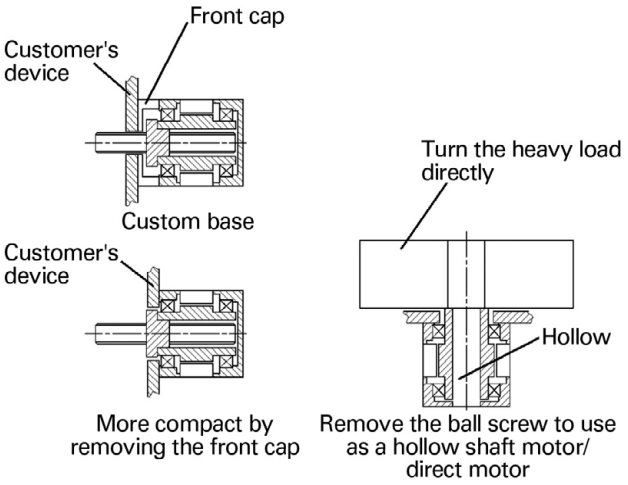

Fig. 8: Example of customizing

5. Conclusion

In this document, we presented structure and specification of the linear actuator stepping motor. And we described benefits such as;

- Downsizing
- Easy to mount
- High customizability

were also described.

We have a lineup of "SANMOTION LINEAR SERVO SYSTEMS" in linear servo motors, and added the Linear Actuator Stepping Motor in the "SANMOTION F" series newly. It will assure the expansion of the linear actuator system application.

We intend to expand of lineup and create the best customize for a customer's device.

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