Servo Systems Division

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SANYO DENKI contributes to society by developing new products that help enhance the performance and quality of our customers' equipment and create new value. This article will introduce the features and innovative points of the servo systems products developed in FY2019, and describe how they are contributing to our customers and society.

We will cover a DC servo motor product, a cylinder linear servo motor product, and a servo amplifier product.

First, we developed and released the *SANMOTION K* series DC servo motors. Compared with our current product series, these motors feature significantly reduced cogging torque and loss that minimizes temperature rise.

Moreover, we have devised the brushes and body structure to successfully reduce noise. These improvements in performance and characteristics make *SANMOTION K Series* motors ideal for use in coordinate measuring machines (CMMs) and other precision measurement equipment, and medical devices used in close proximity to people.

Next, we expanded the lineup of compact cylinder linear servo motors with the addition of a new 20 mm wide model. We increased thrust by optimizing the magnetic circuit and the combination of the number of coils and the number of poles while achieving a 14% increase in the motor's maximum acceleration over our current model by reducing the weight of moving elements. Maintainability has also been improved thanks to a self-lubricating linear guide. With improved acceleration and maintainability, this product can help improve the performance and reliability of semiconductor manufacturing equipment and other machinery.

Regarding AC servo amplifiers, we have added models with a built-in positioning function to the lineup of our *SANMOTION R 3E Model* series. The built-in positioning function provides customers a high degree of freedom, allowing positioning control for up to 254 points, continuous operation, and simple program operation. This product allows customers to build systems easily without using a dedicated positioning controller, contributing to downsizing and wire-saving of customers' equipment. For interfaces with host controllers such as PLCs, we have prepared the following two types: a parallel type with contact inputs and outputs, and a serial communication type (RS-485, Modbus RTU) to allow customers to choose the one best suited to their systems.

Below are overviews of the new products and their features.

■ *SANMOTION K Series* DC Servo Motors

The *SANMOTION K Series* DC servo motors achieve reduced cogging torque, loss, and noise compared to our current series. The new series lineup has the same flange sizes as the current series (42 mm, 54 mm, 76 mm, and 88 mm). The features of this product series are as follows.

1. Reduced cogging torque

We optimized magnet and armature core shapes to minimize cogging torque while maintaining torque characteristics. In addition, we devised manufacturing techniques for laminating electromagnetic steel plates and automating magnet attachment to reduce cogging torque stably. Thanks to these techniques, we successfully reduced cogging torque by more than half compared to the current series.

2. Reduced loss

For the new product, we devised a control method for our coil winding machine, and reduced copper loss by using thick windings with a high fill factor. By optimizing the number and material of brushes, we have also reduced mechanical loss from friction between brushes and commutators while maintaining equivalent brush life to the current series. For the 42 × 42 mm 60 W model, we reduced loss by 31% compared to the current series. This reduced the motor frame temperature rise by 25% and increased motor efficiency by around 10%. This means customer equipment is less affected by the motor temperature, contributing to energy saving.

3. Less noise

DC servo motors have a mechanical sliding portion consisting of a brush and commutator, and the vibrations generated by the contact between the brush and commutator is one of the main causes of noise during motor rotation. For this product, vibrations and noise caused by brush and commutator contact have been suppressed to reduce noise levels by up to 8 dB by optimizing the number of brushes and improving the rigidity of the bracket that supports the brushes.

As described above, this product features reduced cogging torque, loss, and noise compared to current products. With these superb performance levels, the *SANMOTION K Series* DC servo motors are suitable for use in CMMs and other precision measurement equipment that require speed stability in ultra-low-speed ranges, and medical devices used in close proximity to people.

■ *SANMOTION* 20 mm Wide Compact Cylinder Linear Servo Motor

In recent years, there has been a growing need for compact cylinder linear servo motors in semiconductor manufacturing equipment and various automatic assembly equipment for the purposes of downsizing equipment and increasing productivity. In response to this, we developed the *SANMOTION* 20 mm wide compact cylinder linear servo motor which offers improved thrust density and acceleration that result from its increased thrust, and excellent maintainability. The features of this product are as follows.

1. Higher thrust

By creatively arranging magnets and using magnet spacers, we succeeded in both increasing the interlinkage magnetic flux of windings and reducing the amount of magnet used.

We employed creative techniques for both the arrangement and processing of windings and leads to secure maximum winding space, and increased the effective winding volume. Because of these improvements, we successfully increased the motor thrust and reduced loss.

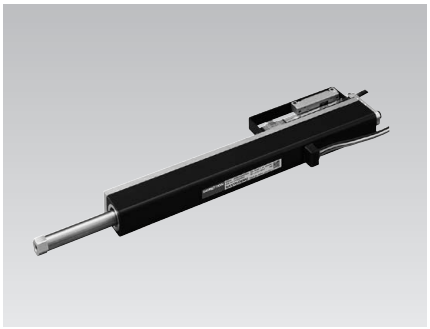
2. Improved thrust density and acceleration performance

As mentioned above, we improved thrust density (thrust per unit armature volume) by increasing the thrust. Compared to our current 12 mm wide model, both continuous and maximum thrust densities have been improved by approximately 40%. Furthermore, the lightened moving elements make it possible to drive heavier load weights at greater accelerations.

3. Improved maintainability

This product is equipped with an optical linear encoder. By devising a linear guide mounting method that ensures encoder detection and using a self-lubricating linear guide, we realized long-term stable motor operation and improved maintainability.

Details of this new product are provided in the "New Product Introduction" section of this Technical Report.



■ *SANMOTION R 3E Model* Servo Amplifiers with Built-In Positioning Function

Over the past few years, in response to the rapidly increasing performance and speed of machines, we have released several controller and servo amplifier products equipped with high-speed motion network functions, best represented by EtherCAT. These products have been used in a wide range of applications, including machine tools and articulated robots.

Meanwhile, in conveying machine and indexing applications that perform PTP positioning control, there is a demand for systems that enable easy positioning control from a PLC using contact signals or universal serial communication. To meet these needs, we added new built-in positioning function models to the lineup of the *SANMOTION R 3E Model* AC servo amplifiers. The features of this product are as follows.

1. Positioning control with a high degree of freedom

Positioning for up to 254 points can be performed according to the preset point data simply by designating point numbers from a host controller. This amplifier is able to reduce the burden on host controllers through continuous operation, simple program operation, and shortest path control, thus realizing positioning control with a high degree of freedom. This product allows systems to be built easily without using a dedicated positioning controller, contributing to downsizing and wire-saving of customers' equipment.

2. Startup support function

With the *SANMOTION MOTOR SETUP SOFTWARE* setup tool, point data can be edited and registered from a computer. Compared with our conventional *SANMOTION R* AC servo amplifiers with a built-in positioning function, startup has been made more convenient with an editing function for point data registration and a support function for easily checking motor and equipment motion.

3. Rich lineup

For interfaces with host controllers, we have prepared the following two types: a parallel type with contact inputs and outputs, and a serial communication type (RS-485, Modbus RTU) to allow customers to choose the one best suited to their systems.

Moreover, in addition to the standard "Safe Torque Off (STO)," the lineup also includes Safety models that are equipped with a variety of safety functions such as "Safe Stop (SS1, SS2)" and "Safely-Limited Speed (SLS)."

Details of this new product is provided in the "New Product Introduction" section of this Technical Report.

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