Servo Systems Division

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SANYO DENKI contributes to society by developing products that enhance the performance, quality, and reliability of customer equipment, while optimally solving customer challenges and creating new value.

In this article, we present the new products we developed in 2022: an AC servo system product, a linear servo motor product, and stepping driver product, with their features and their contributions to our customers and society.

To begin with, we developed the *SANMOTION G* AC servo systems with rated outputs ranging from 30 W to 1.5 kW. This new servo system is an all-new upgrade of the conventional *SANMOTION R* servo system with a new motor, holding brake, encoder, and servo amplifier, based on the concept of being "powerful" and "friendly."

The "powerful" refers to its high performance and high reliability. While featuring greatly improved servo performance and reliability, the new product can be used with confidence even in harsh environments. In addition to being compact, lightweight, and highly efficient, it is also "friendly" by being both user-friendly and eco-friendly.

Next, for linear servo motor products, we developed the new *SANMOTION* linear servo motor that offers high acceleration and energy savings.

The new product achieves high acceleration motion by improving its thrust characteristics and offers better efficiency by reducing motor loss. Therefore, it contributes to improved productivity by increasing the speed of equipment and the high precision of equipment by reducing the temperature rise of equipment.

With our stepping driver products, we have developed two new stepping driver models (high-power model and basic model) for 2-phase and 5-phase stepping systems, for a total of four new models. The high-power models can drive motors with high torque and contribute to shortening equipment cycle times. The basic models were designed to be an easy replacement for our current models and to be more compact and lightweight. Both models feature significantly reduced vibration during motor rotation.

The new products contribute significantly to higher performance and lower vibration of equipment.

Below are the overviews of these new products and their features.

■ *SANMOTION G* AC servo system

Servo systems are an important element in equipment that have a great impact on the performance, quality, and reliability of the equipment. The role is becoming more important in industrial development to resolve challenges for the global environment, such as improved efficiency and resource conservation of electric equipment to mitigate global warming.

In response to these expectations, we developed the new *SANMOTION G* AC servo system. This new servo system is an all-new upgrade of the conventional *SANMOTION R* servo system, with everything upgraded including the servo motor, holding brake, encoder, and servo amplifier based on the concept of being "powerful" and "friendly."

The "powerful" refers to its high servo performance and high reliability for use with peace of mind in various regions and environments. What we mean by "friendly" is that the product is designed to be energy-efficient, compact, lightweight, environmentally

friendly, and ease of use for customers.

Its servo motor lineup comprises a total of 37 models: 13 low-inertia models ranging from a 40 mm sq., 50 W model to a 100 mm sq., 1.5 kW model, and 24 medium-inertia models ranging from a 40 mm sq, 30 W model to a 130 mm sq., 1.2 kW model. Its servo amplifier lineup comprises a total of 21 models: three 100 V models with output current capacities of 10, 20, and 30 A, four 200 V models with that of 10, 20, 30, and 50 A, and the rest are other models with variations in servo motor combinations and host controller interface.

Their features are as follows.

1. Powerful servo performance

The servo motor has achieved downsizing and higher outputs. Downsizing was achieved by optimizing the electromagnetic field structure of the motor and reducing the size of the encoder. In addition to being compact and lightweight, the motor winding was optimized, increasing the maximum speed to 6500 min^{-1} and achieving higher output power.

The servo amplifier has an improved voltage utilization rate at high speed, which extended the output range of the servo motor.

We also increased the frequency response of the speed control to 3.5 kHz by speeding up the control cycle and improving the torque control. Furthermore, we greatly reduced the positioning time by compensating for the effects of friction and gravity, which hinder settling.

The high-resolution battery-less absolute encoder with a maximum 27-bit resolution provides stable, repeatable motion and high-precision positioning.

2. High environmental durability

The vibration resistance was tested under harder acceleration conditions than before: 50 m/s^2 for the servo motor and 6 m/s^2 for the servo amplifier. We also developed a highly reliable holding brake that has less friction material wear and maintains holding torque even in high-temperature and high-humidity conditions. In addition, the operating altitude of the product has also been extended to 2000 m.

3. Enhanced maintainability

This product offers functions that are convenient for preventive maintenance of components including holding brakes, electrolytic capacitors, cooling fans, and relays. Based on this information, users can plan overhauls.

We also added functions to help diagnose the operation environment of the servo system, such as main circuit rectification voltage monitoring and control power supply frequency monitoring. By investigating the operating environment, these functions can help our customers diagnosing their environment and identify the cause of abnormalities.

4. Friendliness to the environment

The servo motor has up to 9% higher efficiency and up to 48.3% lower CO_2 emissions over the current products thanks to its optimized electromagnetic field design, improved winding fill factor, and use of low-loss materials.

The servo amplifier features a mode that reduces noise from the switching frequency. It is suitable for use in environments that require low noise such as hospitals so that patients would not feel anxious by the operating noise.

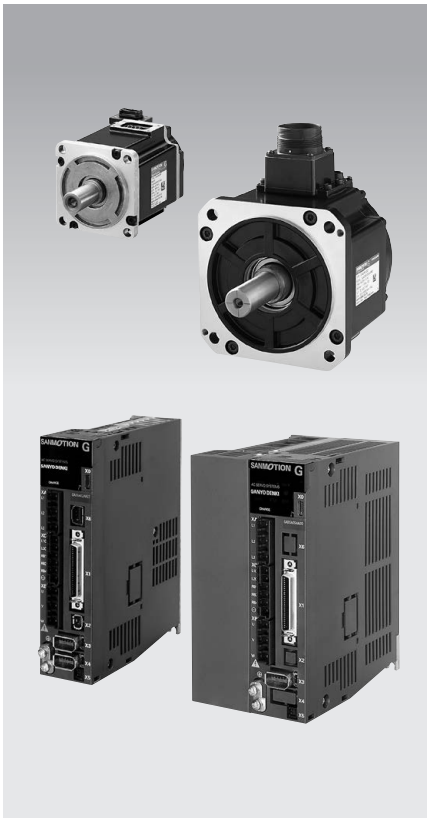
5. Friendliness to operators

It provides high-precision system analysis measurements for frequency analysis with sinusoidal commands.

Its advanced tuning function, which measures machine characteristics and adjusts parameters based on the application, provides optimal adjustments and reduced start-up time.

6. Friendliness to customers

The servo motor's flange size, mounting dimensions, and output shaft shape, as well as the servo amplifier's dimensions and mounting dimensions are highly compatible with those of our current products. This makes replacement of our products currently used in customers' equipment with the *SANMOTION G* very easy.



■ High-acceleration, energy-saving *SANMOTION* linear servo motor

Linear servo motors provide linear motion without using a ball-screw based “rotation-to-linear conversion” mechanism, greatly helping make equipment faster and more precise. Our linear servo products are also used in lithography equipment and chip mounters where the above-mentioned strength can be leveraged.

We developed this new product aiming to help make customer equipment faster and more precise. The features of this product are as follows.

1. High-acceleration motion

The newly designed mover structure and optimized magnetic circuit led to improved thrust characteristics, enabling high-acceleration motion. Compared to our current models, no-load acceleration has been increased by 9%. Capable of high-speed drive, the new product can shorten the cycle time of customer equipment and improve its productivity.

2. Energy savings

The newly designed mover structure and improved winding fill factor led to reduced motor losses and improved efficiency. Furthermore, the reduced motor losses reduce the motor’s heat generation, which in turn, lowers the temperature customer equipment. The reduced motor temperature minimizes thermal expansion in the motor mounting mechanism in the equipment, keeping the high precision of the equipment.

These features make this product ideal for semiconductor manufacturing equipment, lithography equipment, and conveying machines, helping make them faster and more precise.

For more information, refer to the “New Product Introduction” section of this Technical Report.

■ High-output *SANMOTION F* stepping drivers

It is not possible to make industrial equipment faster and more precise without improving its motor system. Therefore, to contribute to shorter cycle time and smoother operation of customer equipment, we developed compact, high-power stepping drivers featuring high-speed drive and small speed variations.

The new stepping drivers are available in a total of four models: a high-power model and a basic model for both 2-phase and 5-phase. The high-power models feature high-torque drive of a motor. The basic models maintain compatibility with our current models.

Their features are as follows.

1. Compact, high power, and low vibration

Both models can drive motors with high torque while being compact and lightweight. In particular, the high-power models have 1.5 to 2.7 times higher torque at high speeds than our current models, greatly speeding up the equipment.

Also, both models have smaller speed variations during rotation, demonstrating improved efficiency over the current models. Therefore, they can contribute to smoother operation and energy savings of equipment.

2. Easy replacement

The drivers come with a new function that allows control of both 2-phase and 5-phase motors with the same resolution (step resolution compatibility). This function enables easy replacement between 2-phase and 5-phase systems without changing the program of the host controller.

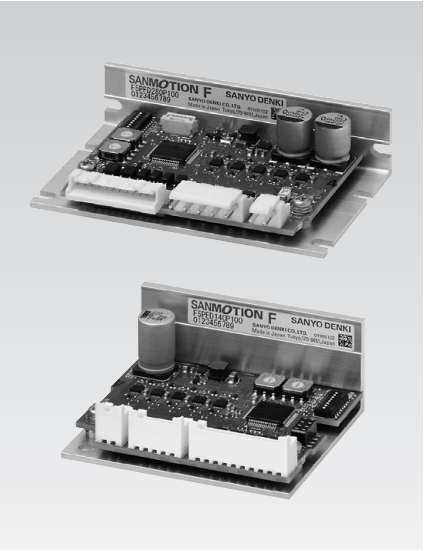
3. Various useful safety functions

The new drivers are equipped with an enhanced self-diagnosis at power-on and status monitoring during operation to ensure safe use. When an abnormality is detected, the drivers will issue a warning and stop the system. In addition, they can also display warnings at the first sign of power supply voltage and temperature issues.

4. PC-based functions

The high-power models are equipped with PC-based functions. When connected to a PC via a dedicated tool, users can set advanced operation parameters, monitor the internal status, use a preventive maintenance function, and check alarm logs. These functions enable users to easily customize the functions to suit their equipment and check the operating status.

For more information, refer to the "New Product Introduction" section of this Technical Report.



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