Servo Systems Division

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Sanyo Denki's servo system products aim to largely contribute to improving user-friendliness and to the creation of new value. In 2014, we developed products which were smaller, lighter and offered higher performance in order to further contribute to creating value in machinery and equipment.

First, we expanded our "SANMOTION R" series by adding an inertial AC servo motor with a flange size of 275 mm sq. (rated outputs of 30 kW and 37 kW) and a small AC servo motor with a flange size of 20 mm sq. (rated outputs of 20 kW and 30 kW) as new AC servo motor products. These servo motors are smaller, lighter, offer large angular acceleration and high efficiency.

We have also developed a small cylinder linear servo motor with a motor width of 12 mm. This linear servo motor is small with a large thrust, therefore optimal for high acceleration/deceleration drive.

Next, we renewed the 5-phase stepping system and 2-phase stepping driver. This stepping system is low vibration, small, high torque and highly efficient. It also offers high performance and user-friendliness due to holding brake automatic control, an operation status analysis function and so on.

Sanyo Denki has also developed the "Model No.HA035" ("HA035"), a batteryless absolute encoder. This absolute encoder is small and highly accurate, with no need for a battery. It also has greater resistant against temperature and vibration. The "HA035" greatly contributes to alleviating maintenance work (due to having no battery) and higher reliability regarding temperature and vibration.

As new AC servo amplifiers, we have added the 100 A, 150 A and 300 A current capacity versions to the "SANMOTION R 3E Model" lineup.

The following is an overview of the new product and their respective features.

■ Inertial AC Servo Motor (Rated Outputs of 30 kW and 37 kW)

The AC servo motor is a power source for many applications and plays an important role in the performance and function of machinery and equipment. It is preferable that servo motors are smaller and lighter, at the same time as demonstrating higher performance and efficiency.

This time, Sanyo Denki has developed an AC servo motor with a 275 mm sq. flange and rated outputs of 30 kW and 37 kW in order to expand our "SANMOTION R" inertial servo motor lineup. For both rated output types, the rated speed is 1500 min^{-1}, and the maximum speed is 2000 min^{-1}.

The new product has improved instantaneous angle acceleration and efficiency (reduced loss) compared with the conventional model, and is smaller and lighter.

The new product includes the following features.

1. High Acceleration

In addition to improved maximum instantaneous torque, the rotor inertia moment has been optimized and maximum acceleration has been improved. Compared with conventional models, the angle acceleration is improved by 23% for the 30 kW model and 44% for the 37 kW model.

2. High Efficiency (Low Loss)

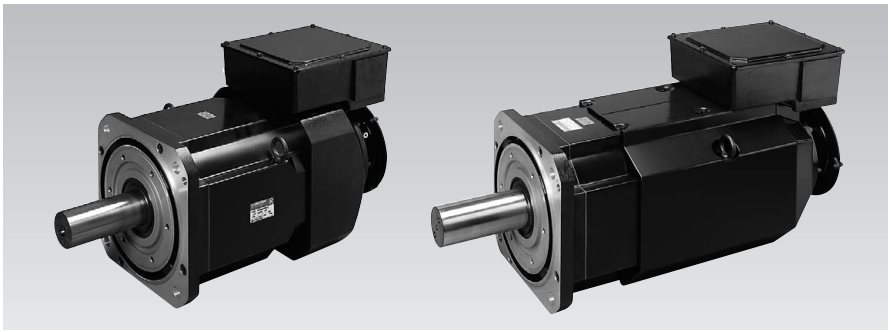
While the conventional model is also highly efficient, with a motor efficiency exceeding 95%, the new product offers reduced loss, optimized cooling and improved motor efficiency. For both the 30 kW and 37 kW, loss was reduced by around 10% at rated output.

3. Small and Lightweight

The 37 kW model is both smaller and lighter than conventional models, with total motor length reduced by around 14% and a motor mass reduced by around 20%.

As described, the new servo motors have large instantaneous angle acceleration and are highly efficient (low loss) while being small and light.

This makes them optimal products for applications which require high response during acceleration/deceleration such as injection molding machines, spring forming machines and hydraulic pump systems.



■ Small AC Servo Motor 20 mm sq. "SANMOTION R" (Rated Outputs of 20 W and 30 W)

Small, light servo motors are required for the head shafts of chip mounters, etc. This time, Sanyo Denki has developed a small AC servo motor which offers high speed, high torque, improved motor efficiency and reduced weight compared with conventional products. Models with a flange angle dimension of 20 mm and rated outputs of 20 W and 30 W have been added to the "SANMOTION R" series. Rates speed is 3000 min^{-1} and the power voltage specification is 48 V DC.

The new product includes the following features.

1. High Output

Compared with our conventional models, the maximum instantaneous torque of the new product has been increased by approximately 17%, while maximum speed of 6000 min^{-1} has been achieved, which is a 20% improvement over the previous speed of 5000 min^{-1}. This speed vs. torque characteristic also contributes to shortening the time required for device positioning.

2. High Efficiency (Low Loss)

Compared with our conventional models, the new product has around 20% less motor power loss and higher efficiency. By minimizing loss, motor heat has been suppressed and the influence of heat on devices has been significantly reduced.

3. Lightweight

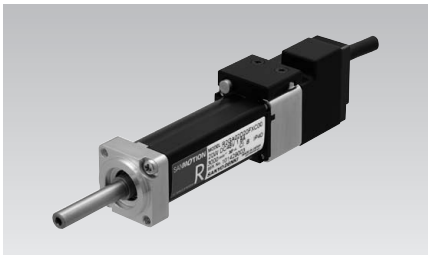
Compared to our conventional models, the motor mass of the new product is approximately 8.5% lighter. This means that the head mechanism of chip mounters and other moving portions can be made lighter, thus helping to further improve the high-speed performance of a device.

On the new product, by being creative with a magnetic circuit configured from coils, permanent magnets and iron cores, we have achieved higher output, higher efficiency (low loss) and reduced weight.

The standard encoder equipped in these servo motors is "MA018", which is a single turn, serial absolute type of encoder. The standard single turn resolution is 13 bit, however the options of 15 bit and 17 bit are also available.

The new servo motors, which are high output, high efficiency (low loss) and lightweight, greatly contribute to energy conservation and downsizing.

These servo motors are optimal for semiconductor manufacturing equipment and general industrial machinery such as chip mounters, pounders and handlers.



■ Small Cylinder Linear Servo Motor (Motor Width: 12 mm)

The linear servo system operates directly via linear drive, therefore there is no mechanism to convert rotational drive to linear drive such as a ball-screw. This greatly contributes to the speeding up of mechanical devices, as well as higher accuracy and better energy conservation.

The newly developed cylinder linear motor which has been added to the lineup is small (12 mm wide) with large thrust (maximum thrust: 16.5 N). Large acceleration is obtainable on this cylinder linear servo motor as it has large thrust and light mover mass.

The new product includes the following features.

1. Small & Large Thrust

This is a small, large thrust cylinder linear motor with a 12 mm wide motor, a rated thrust of 5.1 N and a maximum thrust of 16.5 N.

2. High Speed & High Acceleration

The new product offers high speed drive with a rated speed of 1 m/s and a maximum velocity of 2 m/s. Furthermore, the mover mass is lightweight (45 g) therefore high acceleration/deceleration drive is possible.

3. A Simple System

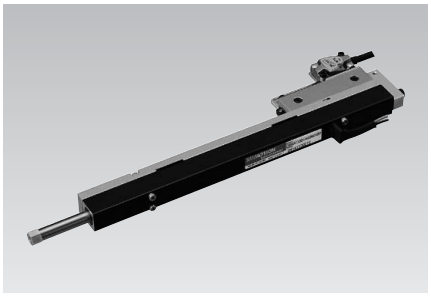
The new product has a built-in linear encoder and linear guide, therefore simplifying the drive system.

4. Parallel Arrangement Possible

The design is one practically free of external magnetic flux leakage, making it possible to use several of these linear motors in parallel. As such, customers are free to create the optimal layout for their specific device.

This linear servo motor can be used together with Sanyo Denki's servo amplifier "SANMOTION R".

As described, the new product is small and lightweight, as well as being capable of high speed and high acceleration drive, therefore optimal for using as the direct drive of chip mounter head shafts or semiconductor manufacturing equipment.



■ 5-Phase Stepping System "SANMOTION F5"

Stepping systems enable easy control with a simple system configuration, and as such are widely used in not only OA devices, but also general industrial devices, semiconductor manufacturing equipment and so on. The 5-phase stepping motor is particularly preferable for applications which require low vibration and low noise.

This time we have developed the "SANMOTION F5" as a 5-phase stepping system which is smaller and lighter than conventional models and has comparatively lower vibration, higher torque and higher efficiency. Motors are available in three flange sizes; 42 mm sq., 60 mm sq. and 86 mm sq. and driver input voltage is either 100 V AC or 200 V AC.

The new product includes the following features.

1. Low Vibration

On stepping motors, speed fluctuation due to torque pulsation causes device vibration however, on the new product, speed fluctuation has been reduced by around 30% compared with our conventional models.

2. High Torque/High Efficiency

Compared with conventional models, holding torque has been increased by 24% and motor loss has been improved by around 24%, thus improving efficiency. The reduced loss means that motor temperature only rises by half of what it did previously.

3. Small and Lightweight

Compared to conventional models, the driver volume has been reduced by 29% and mass has been reduced by 19%, thus achieving downsizing and weight reduction.

4. Easy Deceleration Rate Change

An electronic gear function is equipped, therefore even when the device's deceleration mechanism is changed, it is only necessary to change the electronic gear ratio, not the controller command specifications, etc.

Moreover, the new product is also equipped with a 1/1 – 1/250 micro step function, therefore it is possible to set resolution suited to the deceleration ratio.

5. Built-in Brake Power and Control Function

External power is not required as the new product has power for the holding brake built into the driver. Moreover, the driver monitors the motor's excitation status and automatically controls the brake hold/release timing, therefore the models can be used without the user needing to be conscious of brake control.

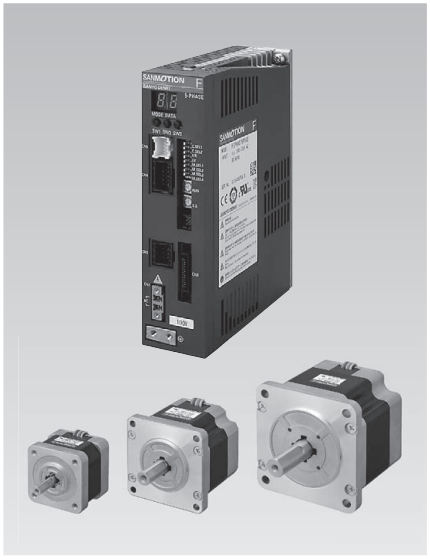
6. Enhancement of Analysis and Startup Support Functions

By using the encoder option, it is possible to monitor the operational status of the motor, including factors such as position and speed. Moreover, there is also a function to record the state when the motor becomes unsynchronized, making it easy to perform adjustment and troubleshooting upon device startup.

Both the motor and driver of the new product are UL and CE certified, therefore simplifying the process of regulation certification of devices for the customer.

In this way, the new product is a 5-phase stepping system which offers high performance and user-friendliness and is optimal for semiconductor equipment, general industrial machinery, food machinery, medical equipment and so on.

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



■ 2-Phase Stepping Driver “SANMOTION F2”

The 2 -phase stepping system is always applied broadly due to the simplicity of its system configuration and control.

This time, we have added a stepping driver with AC power input specifications to the 2-phase stepping system “SAN MOTION F2” lineup.

The new product includes the following features.

1. Low Vibration

The new product is equipped with a low vibration mode function, therefore speed fluctuation is around 10% less than conventional models. As such, it can contribute to reduction of vibration when installed on a device.

2. Wide-Range Input Voltage

We designed this product to have a wide AC power input range, from 100 V to 240 V AC. Input voltage is automatically identified and control is carried out with the optimal motor properties.

3. Small and Lightweight

Compared to the conventional model, the new product is small and lightweight, with 24% less volume and 38% less mass.

4. Built-in Brake Power and Control Function

The new product has power for the holding brake built into the driver and monitors the motor’s excitation status, thereby automatically controlling the brake hold/release timing.

5. Enhancement of Analysis and Startup Support Functions

By using the encoder option, it is possible to monitor the operational status of the motor, including factors such as position and speed. Moreover, the new product has enhanced analysis functions in the event of vibration and loss of synchronism.

This product is optimal for application in machine tools, semi-conductor equipment, food machinery, industrial sewing machines and so on.

■ Small Batteryless Absolute Encoder "Model No.HA035"

Sanyo Denki has developed the “Model No.HA035” (“HA035”), a small, high accuracy, batteryless absolute encoder as an addition to our servo motor encoder lineup.

Previously, we had produced the “Model No.RA035” a batteryless resolver-method absolute encoder, however the new “HA035” has an environmental resistance (temperature/vibration) superior to that of the conventional resolver encoder, and at the same time offers high accuracy, high resolution optical absolute encoder.

The new product includes the following features.

1. Batteryless

Absolute position information, including multi turn, can be held without battery backup. This means that a battery is not required for the encoder, so our customer does not need to concern themselves with battery life and is free of troublesome battery replacements.

2. High Accuracy/High Resolution

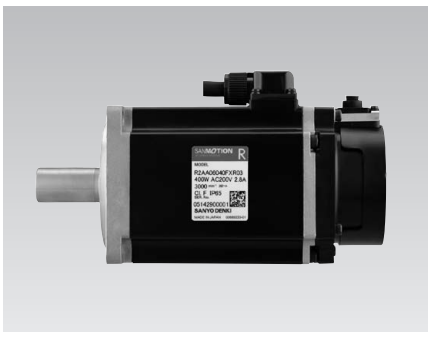
The absolute angular accuracy within one revolution is 0.0167° (1 minute) or less, and single turn resolution is a maximum of 8,388,608 (23 bit). This greatly contributes to improving accuracy of equipment and more precise control.

We have added a 20 bit and 17 bit model.

3. Improved Environmental Resistance

The new product has greater environmental resistance, with an encoder internal temperature resistance of -20°C to 105°C and vibration resistance of 147 m/s^2 (15G).

The details of this new product are provided in the “New Product Introduction” section of this Technical Report.



Appearance of a motor equipped with the “Model No.HA035”

■ AC Servo Amplifier "SANMOTION R 3E Model" 100 to 300 A

We have added 100 A, 150 A and 300 A current capacity models to the AC servo amp "SANMOTION R 3E Model" lineup. These new products are optimal for the drive of servo motors with rated outputs of 1.8 kW to 15 kW.

The new products include the following features.

1. Evolved Performance

Equipped with a function to shorten positioning time, this model can significantly reduce a machine's tact time.

With an improved safety function to turn off motor torque, "SANMOTION R 3E Model" conforms to the international standard of "SIL3"/IEC61508, "PL=e"/ISO13849-1. This means "SANMOTION R 3E Model" can be used with peace-of-mind even on equipment such as medical devices which require a high degree of reliability.

2. Eco-efficient

As well as reducing power loss during operation by up to 10%, this new product has also reduced standby power by up to 10%. Furthermore, the power consumption monitor function makes it possible to monitor the amount of power used by a piece of machinery.

3. Easy to Use

The new products are equipped with a virtual motor operation function, servo adjustment assist function, drive recorder function and so on, making it possible to conduct device startup, servo adjustment and troubleshooting in a short period of time.

In this way, the new products have evolved servo basic performance, beginning with high responsiveness and are easy-to-use servo amplifiers that achieve energy saving.

This makes them ideal for a variety of applications, including robots, machine tools and injection molding machines.

Satoru Onodera
Joined Sanyo Denki in 1986.
Servo Systems Division
Involved in the R&D, design and production of servo systems. Doctor of Engineering