Servo Systems Division

Yoshinori Kobayashi

We, SANYO DENKI, develop products which support our customers and contribute to society. This section will introduce the features of the servo system products developed in FY2016 and describe how they are contributing to customers as a result of various creative approaches.

This report will cover a total of five products, including a servo motor, two servo amplifiers, a stepping driver, and a controller.

First, in regard to the servo motor product, we have added the "SANMOTION R1" AC servo motor to the "SANMOTION R" series. This new addition boasts high-speed rotation and high acceleration/deceleration performance. There are a total of seven models to choose from, featuring two flange sizes (100 mm/130 mm) and rated outputs ranging from 1 kW to 5 kW. This product shortens equipment cycle time and contributes to increased productivity.

Next, in regard to servo amplifier/stepping driver products, we have added a "MECHATROLINK servo amplifier" to the "SANMOTION R ADVANCED MODEL" DC input lineup. With such a wide-variety of high-speed field bus interface products, our customers are able to develop even more optimal equipment than previously possible.

Moreover, three 400 VAC input servo amplifiers have been added to the "SANMOTION R 3E Model" lineup, which is based on the concept of 3E's: "Evolved, Eco-efficient, Easy to use."

Furthermore, a stepping driver supporting the EtherCAT interface has been added to the lineup of "SANMOTION Model No. PB" DC Input 4 - axis driver products. This driver has a communication cycle of 0.25 ms. With the low-deviation closed loop control, it delivers a smooth-trajectory motion.

Finally, in regard to controller products, we have developed a high-speed controller to enrich our "SANMOTION C" lineup. This gives our customers even more choices in finding the best motion controller to suit the particular equipment they are developing.

Below is an overview of each new product and their respective features.

■ "SANMOTION R1" AC Servo Motor

"SANMOTION R1" is an AC servo motor series characterized by its high-acceleration/deceleration performance. As the successor model of the Q1 series, the lineup includes new seven models with two flange sizes (100 mm and 130 mm) and varying outputs between 1 kW and 5 kW.

The features of this product are as follows.

1. Two rotational speeds

There are two types included in the lineup; one with a maximum speed of 6000 min^{-1}, and the other with an increased low-speed range peak torque of 3000 min^{-1}. Moreover, the 3000 min^{-1} type features lower current consumption, and hence it is designed to be combined with smaller amplifiers than the 6000 min^{-1} type.

This allows customers to choose the motor best suited to their particular application.

2. Enhanced performance and energy-saving

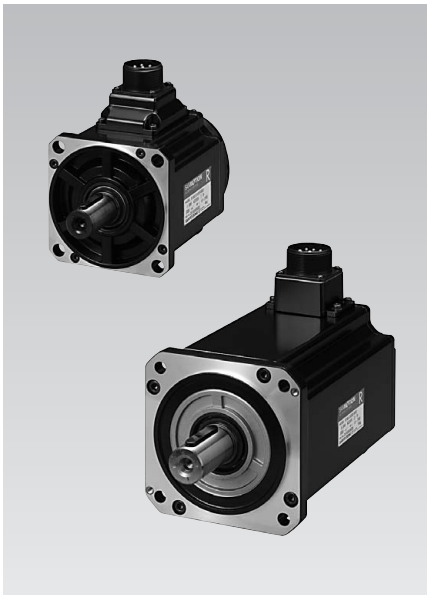
In order to achieve both high acceleration/deceleration performance and high efficiency, the armature core's magnetic saturation has been mitigated and torque increased, and at the same time we optimized the magnetic circuit to secure the winding space factor.

As a result, compared with a Q1 series motor with identical flange size and output, the 6000 min^{-1} type has 20 to 33% higher maximum speed, while the 3000 min^{-1} type has 15 to 20% higher peak torque. Moreover, if a motor with a rated output of 1.5 kW is used, efficiency is improved by 2.3% when operating at the rated output.

3. Reduced size and weight

Thanks to enhanced output density as a result of magnetic circuit optimization, the armature core has been made shorter, and mass has been reduced by an average of 21%. Furthermore, in order to minimize the coil end height, we have adopted a printed wiring board, making overall lengths an average of 18% shorter than the Q1 series.

With its high rotational speed and high torque, this product enables our customers' equipment to operate swiftly, thus shortening cycle time and ultimately improving productivity. Finally, by enhancing efficiency and reducing size/weight, this product contributes to a smaller equipment footprint and energy-saving for society on the whole.



■ “SANMOTION R ADVANCED MODEL” DC Input MECHATROLINK Servo Amplifier

In 2013, SANYO DENKI developed DC input servo amplifiers which have interface of EtherCAT or PROFINET, expanding the “SANMOTION R ADVANCED MODEL” servo system lineup. For borderlessness of interface choices, we have developed a DC input servo amplifier which has interface of MECHATROLINK-III.

With our abundant range of high-speed field bus interface products, we are confident our customers across the globe will enjoy developing optimal equipment with even greater ease than ever before.

The features of this product are as follows.

1. Enhanced functions

A vibration suppression function has been added to torque control mode. Conventionally, vibration occurred when operating in torque control mode in close proximity to the speed limit value, however this function has made it possible to achieve smooth motor drive with minimal vibration.

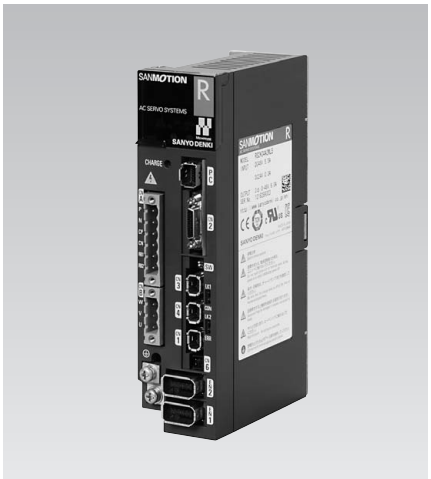
2. Improved ease of use

By adding an electronic gear function to speed commands/speed monitoring, conversion with a gear-mounted output axis is possible, allowing customers to measure operational status using their equipment’s scale.

3. Uniformity

The new model has the same height as the AC power input, small-capacity servo amplifier, therefore even in a system containing both AC/DC power input types, the servo amplifiers can be efficiently arranged within the customer’s control panel, contributing to size reduction.

Moreover, the DC power input servo amplifiers supporting the EtherCAT or PROFINET interface featured in this series have identical performance, functions, and installation size, therefore even if the system configuration is changed, the servo amplifier can be easily switched without needing to be concerned about machine specifications.



■ "SANMOTION R 3E Model" 400 VAC Input Servo Amplifier

SANYO DENKI has added three 400 VAC input servo amplifier models (25 A, 50 A, 100 A) to the "SANMOTION R 3E Model" series. These are ideal products to be combined with servo motors with rated outputs between 0.55 kW and 5.5 kW.

By expanding the operating voltage range, the need for a transformer for power conversion is eliminated, etc., therefore achieving space-saving and reduced wiring.

Also, It remains true to the "3E" (Evolved, Eco-efficient, Easy to use) series concept just as the current 200 VAC input servo amplifiers.

The features of this product are as follows.

1. Evolved performance

With newly equipped high-speed positioning control function, this product helps to significantly reduce equipment takt time.

This lineup also has a safe torque off function as a standard feature, providing our customers with peace-of-mind when using in a broad range of applications such as machine tools, robots, and semiconductor manufacturing equipment.

2. Eco-efficient

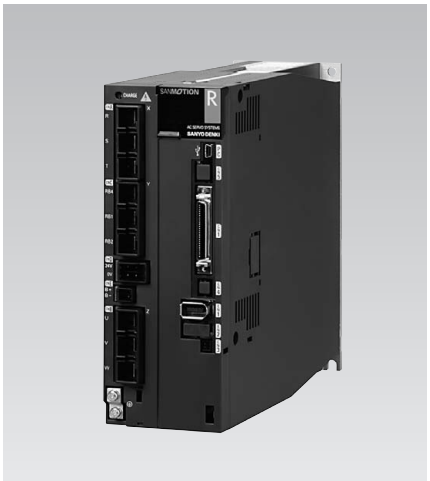
Due to being equipped with a power consumption monitoring function, this product can monitor the amount of power being consumed by machinery in order to detect abnormal power usage. As such it has potential to be used for equipment maintenance purposes.

By incorporating new-generation power devices and temperature variable fans, the new product has reduced power consumption by up to 15% during rated operation and has up to 29% lower standby power consumption.

3. Improved ease of use

The new model has a "holding brake output with built-in power supply" as standard to enable direct drive by an output signal of holding brake, which conventional models also have. This contributes to wire-saving and cost reduction of customers' equipment.

Moreover, there is a virtual motor operation function enabling the equipment's operation pattern to be verified without actually operating the motor. Performing this kind of advance simulation can reduce equipment start-up time.



■ “SANMOTION Model No.PB”, a DC Input, 4-Axis Integrated EtherCAT Driver

In 2015, SANYO DENKI developed a pulse train type, DC input 4-axis integrated driver which has been adopted to drive the X-Y stage. On this occasion, we have developed a driver equipped with an EtherCAT interface and added it to our lineup.

The features of this new product are as follows.

1. Space-saving

Four stepping motors can be driven with one driver, and installation space is less than half of that occupied by four single-axis drivers.

In addition, even further wire-saving can be expected with no need for each axis to receive commands from the host.

2. Evolved performance

In addition to the closed loop control of the current model, this driver is equipped with low-deviation control. Application takt time can be reduced due to the elimination of delay against a position command.

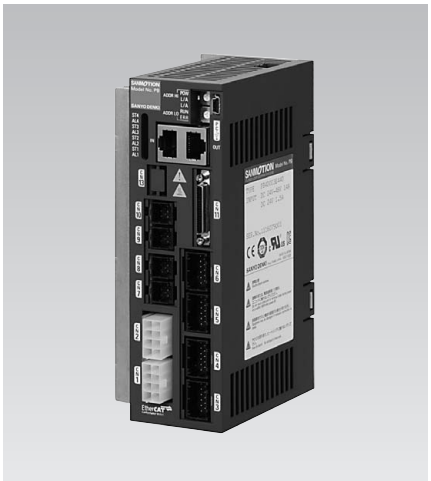
Furthermore, the product is four times faster than the current model as it supports EtherCAT’s shortest communication cycle of 0.25 ms. Commands can be smoothly transmitted to each axis in real time, enabling finer motion of equipment.

3. Improved ease of use

While supporting a battery-less absolute encoder and contributing to improved maintainability, this model eliminates the need for an external sensor and homing operations of machinery, therefore reducing system build time and system start-up time.

It has the same performance, function, and installation size as the standard model (pulse train type), therefore can be easily switched with an existing driver without worrying about machine specifications.

Moreover, as it features a drive recorder function, maintainability has been improved.



■ High-speed Processing Controller "SANMOTION C"

The "SANMOTION C" series are controller products with both a motion control function and a robot control function, and it consists of a CPU module and various expansion modules.

The CPU module, which serves as the heart of this system, was released in 2006 as the "CP232-Z" (first-generation), and again in 2010 as the "CP240-A" and "CP242-A" (second-generation). These are adopted in a variety of our customers' equipment. This time we have newly developed "SMC263X" and "SMC265X" as the third-generation CPU module featuring even higher speed and better performance.

The features of this product are as follows.

1. Evolved performance

The hardware has been upgraded with a CPU capable of high-speed processing as well as increased memory capacity. These improvements have enabled the product to achieve the following performance levels.

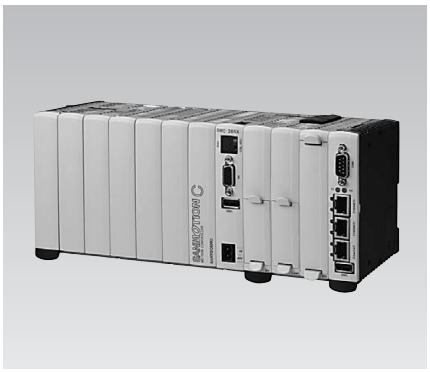
(1) EtherCAT cycle time: 1 ms
(2) Max. no. of controllable axes: 64
(3) Simultaneous control of two 6-axis articulated robots

2. Improved ease of use

By increasing the number of Ethernet ports from one to two channels, it has become possible to connect two peripheral devices without using a hub. Moreover, by incorporating a slot for the plug-in module as standard, which is a type of expansion module, it is possible to install more interfaces without expanding device width.

By improving the refresh cycle of commands sent to the servo amplifier, smoother operation of the controlled equipment has been realized. Moreover, complex tasks normally performed by multiple robots can now be controlled with just one controller.

This helps to make customers' equipment capable of even higher-quality processing and improving productivity.



Yoshinori Kobayashi
Joined SANYO DENKI in 1987.
Servo Systems Division
Works on management tasks relating to servo system production.