

Servo Systems Division

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The major technical achievements of the Servo Systems Division in 1997 are outlined below. In the field of controllers, we have developed products in line with the "multiple interface declaration", and have also released "S-MAC" TYPE A, TYPE B and TYPE C that offer both open architecture and network support. In the field of servo motors, three types of Linear Servo Motor that have stronger linkage with the servo system have been developed. The built-in type servo motor, the hollow-axis servo motor and the main axis servo motor for general machine tools also have been released. In the field of sensors, we have worked to create cost-effective, compact and modular sensors, and have developed a high resolution sensor that offers much better reliability. In the field of servo amplifiers, we developed servo amplifiers that support open-architecture SERCOS communication and DeviceNet, and a compact "PB" amplifier. In the field of stepping motor systems, the H-series has been reinforced with a three-phase HB type stepping motor in four sizes, and a series of low back-lash type decelerators in four corresponding sizes. A five-phase stepping motor driver that supports DeviceNet was also developed. These product groups help to offer total solutions.

Servo Motor

1. Built-in servo motor and hollow-axis servo motor
A built-in motor that integrates our servo motor with customers' machinery, and a hollow-axis motor were developed. The motor could contribute to the compact and low-cost machine designing, also improved servo



stiffness makes the performance of machines higher. Through these effect, we could satisfy customer's potential needs.

①The induction type built-in motor, which is used in spindle block of machine tools, now has a top speed of $30,000 \text{ min}^{-1}$. This high-speed motor is either water-cooled or oil-cooled depending on the customers' machinery.

②The synchronous type built-in motor, direct drive type products such as $300\text{N}\cdot\text{m}/300 \text{ min}^{-1}$ have been released and already installed in customers' machinery.

③The hollow-axis motor, which was developed based on P series servo motor, has an improved structure that enables direct coupling with the ball screws or supporting structure to work under heavy loads. Target applications are servo guns, semiconductor manufacturing equipment, and so forth.

2. Spindle use motor for tapping machines A spindle use motor having a rotation speed of $22,000 \text{ min}^{-1}$ and torque of $17 \text{ N}\cdot\text{m}$ has been developed and already installed in customers' mass production machinery.

This is hollow-axis type motor, and used for a spindle shaft in which cutting fluid flow through. These products were developed through technical cooperation with

customers, and the specifications reviewed in the early stages. 3. Linear Servo Motor

The Linear Servo Motor has been demonstrated at various robot exhibitions, System Control Fairs, etc., and has been attracting much attention from the market. Three types of Linear Servo Motor have been developed: the LM guide system with core (IC type), the LM guide system core-less (IL type), and the cylinder type with core (CC type). The IC type is designed for high torque while the IL type is designed for high acceleration speed. Both types are very efficient.

The CC type has a sealed structure like that of a rotary motor, ensuring high reliability in dust, water and cable protection. This product is designed for short stroke applications; details are given in the separate report "Introducing Linear Servo Motor System" in this issue.

Rotary Sensors

1. A wire-saving type sensor has been newly introduced as an optical system rotary incremental sensor. The new sensor has better vibration-proof characteristics and is easier to install. Its main features are as follows.

①The new developed connector between the printed circuit boards eliminates manual soldering during installation. The peripheral components are also integrated into modules enabling single-operation inspection of the required modules.

②The unique connector between the printed circuit board and cable prevents wrong connections.

③The light-reception modules that used to be separate, are now combined into a single body, thus supporting the outer edges of printed circuit boards and eliminating the circuit board resonance peak point. The sensors can be installed without adjustment using a unique jig to fix the light-reception element after coordinate and determining the X- and Y-axes angle with respect to the center of rotation.

2. The family of optical system rotary absolute sensors has gained a new high resolution, high cost-performance ABS-EC type sensor that offers improved absolute angular accuracy. It has the following main features:

①2,097,152 divisions/rotation

②Absolute angular accuracy within ± 10 seconds

③Because of the modular structure, even non-experienced persons can install the sensor without adjustment using the unique installation jig.

④Type EC160 supports especially hollow-axis of up to $\phi 9$.

⑤This sensor prevents to occur mis function such as run-away with built in full time P-D / LED monitoring system and self-diagnostics for optical parts.

⑥Certainty of detected position data is self-diagnosed by calculating velocity and acceleration, and by the allowable limit comparison function, thus preventing run-away in case of defective data.

These features make this servo sensor ideal for highly accurate feed mechanisms and index position setting mechanisms.



AC Servo Amplifier

1. We have developed SERCOS-communication compliant amplifier for an open architecture.

This model of AC servo amplifier conforms to the international communication specifications IEC 1491 and complies with the CE marking.

Since SERCOS uses an optical digital interface, it is superior to analog systems in terms of ① wire-saving, ② improved resolution limitation, and ③ improved EM noise* protection ("PZ-W": 15 A to 150 A, 5 models).

2. The new amplifier for compact motors was developed for AC servo system "ROBUSTSYN" that offers excellent high speed position setting.

The new amplifier is developed for $\phi 28$ to $\phi 56$ motor of "ROBUSTSYN", and has a RS485 serial interface input port. Wiring is also reduced ("PB": 1A).

3. A new compact, general-purpose servo amplifier "PV" has been developed. "PV" has higher performance and functions than that of "PU" which is popular amplifier in many field. "PV" complies with the CE marking and UL regulations used worldwide. The product range also has DeviceNet interface for operating in an open architecture. The model for DeviceNet can be connected PLC or PC as a host controller, and it allows almost connection style such as multi-drop, daisy chain, etc. ("PV": 15 A, 30 A, 2 models).

* EM noise : Electromagnetic noise



Stepping Moter

1. A new three-phase HB type stepping motor of the "STEP SYN H" series have been developed. It comes in 8 models to suit various applications, consisting of 4 sizes of 42 mm sq., 50 mm sq., 56 mm sq., and 60 mm sq., with two types for each size.

The main features of the new model are as follows:

① HIC of 5 A allowable current has been developed simultaneously with the stepping motor to support faster operation for marketable our drive circuits.

② For applications requiring low vibration, vibration characteristics are better than those of a two-phase micro drive and five-phase full-half step drive.

③ Acoustic noise level is kept low by the optimized magnetic circuitry design and the strong internal structure against vibration. The new stepping motor is thus ideal for replacing five-phase stepping motors to reduce cost, or replacing two-phase stepping motors to improve vibration characteristics.

2. The new low backlash gear box minimizes vibration but remains highly accurate at low stepping motor running speeds. By combining the low backlash gear box with the "H" series motor, we have developed a series of high accuracy, high torque stepping motors with gears. These have the following features.

① This series has a wide product range:

Size: 42 mm sq., 60 mm sq.,
90 mm sq.

Reduction ratio: 1/3.6 to 1/36.
Six types

Base motor: Two-phase, five-phase



"H" series motor

②Low backlash

Backlash is greatly reduced by the improved internal structure and use of tapered gears

0.15 degrees to 0.6 degrees (about one-quarter that of our conventional equipment).

③High torque

A high torque is delivered by the combination of higher gear strength and "H" series motor. 3.5 to 12N·m (about 1.5 times that of our conventional equipment).

Stepping Moter Driver

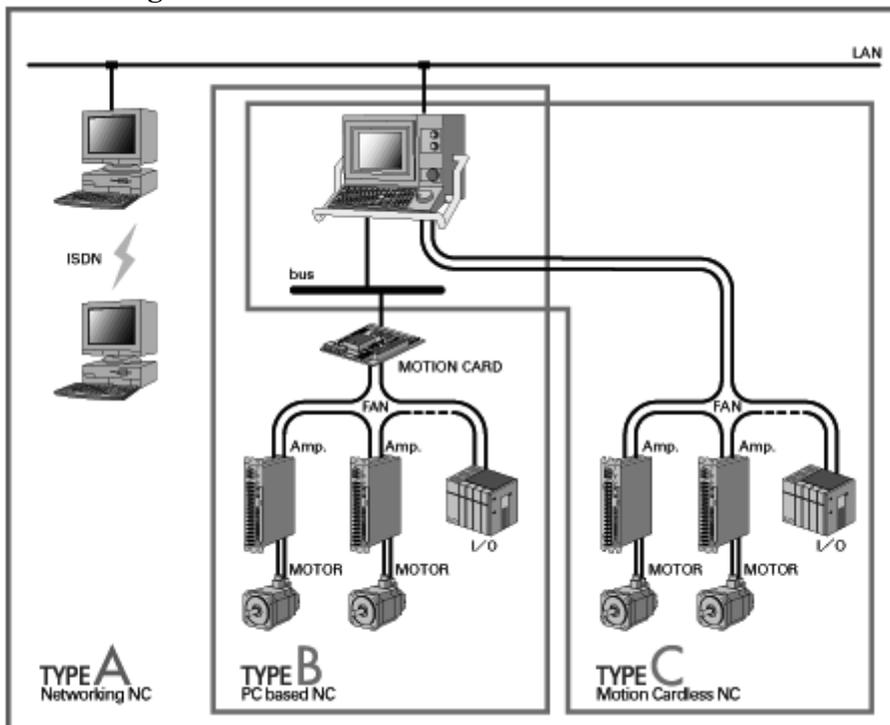
1. We have developed a DeviceNet compatible five-phase stepping motor. The new driver operates on DC input (24/36 V) for the five-phase "PENTASYN" (0.75 A/phase) motor. It has the following features and functions.

①Because of the built-in pulse generator, no external pulse generators are necessary. The motors can be operated by entering parameters such as velocity data, position data, etc.

②The driver can be connected with the host controller such as PLCs or PCs, and thus connected to Sanyo Denki's "PV" and "ROBUSTSYN" servo amplifiers, and even actuators like sensors, I/O, etc. So all devices can be controlled on a single network.

③The multi-drop and daisy chain connection systems improve wiring efficiency and save wiring.

Networking Controller S-MAC



We released S-MAC networking controller in June 1997, that uses SERCOS and CAN (DeviceNet, etc.) as the field bus and has open-architecture support. The basic specifications of TYPE A, TYPE B and TYPE C have been settled.

(Refer to "Development Concept of Networking Controller "S-MAC"" in SANYO DENKI Technical Report No. 4.)

Large orders for widespread system integration are being received for TYPE A and TYPE C.

This issue, Technical Report No. 5, gives examples of applications of TYPE C that has the top performance among full software controllers in practical use. (Refer to "Application of "S-MAC" TYPE C (Development of Work Rotation Type Wire Winding Machine)" in this issue.)

The "3-D simulation and go" function of TYPE A has been tested by application in a two-arm robot controller. The practicality of the off-line teaching system and the usefulness of the interference check function were demonstrated at the System Control Exhibition in November, 1997.

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Joined company in 1965
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