

# Control System Division

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Here are the technical results of the Control Systems Division in 2000.

The division developed solution technologies for an order received for the "S-MAC" system and various component technologies constituting the system.

The division developed the following: (1) a controller for fast, high-precision servo press units which incorporates synchronizing control of the rotary coordinate system of the motion control language, "AML", (2) a control system for hybrid actuators (hydraulic cylinder with servo motor) by the "AML", (3) the "SMS-30", an industrial PC capable of processing data at high speed and in large capacities with high environmental resistance and reliability, (4) new functions for the "AML", (5) the "PV2/DeviceNet", which is a great enhancement of the DeviceNet interface amplifier in terms of functions and performance, and (6) the "PV2/SERCOS", a SERCOS interface amplifier designed as one of the smallest-size, highest-performance, and lowest-cost versions in the world.

The development results of these solution technologies and component technologies are expected to meet market demands for the company's "S-MAC" system and AI's "Soft Motion" system.

## Solution technologies: S-MAC/SERCOS for a high-performance press

We developed a controller for a servo press using a network controller, the "S-MAC" and a SERCOS driver. The control was made possible by the "AML", which is for motion control suited for the control of the rotary coordinate system and the synchronizing operation of the axes.

As a result, we obtained the following features:

- ① Synchronizing control became easier to build up. Machining speed became two or three times higher than before without reducing machining precision.
- ② The increase of synchronizing control precision and the reduction of vibrations made the service life of punching dies two or three times longer.
- ③ System expandability became higher. It became possible to connect additional network-compatible drivers without adding hardware on the side of the controller. Thus, the system became suited to a wider range of applications with different machine specifications.
- ④ Adjustment and maintenance became possible on a network.
- ⑤ Making the system silent, using a servo motor and excepting a hydraulic device made the system environmentally friendly.
- ⑥ A mechanical change from an inverter-controlled system to a servo increased efficiency, resulting in the total power consumption of the machinery being reduced to less than half. Thus, the system produced energy-saving effects.



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## Solution technologies: Development of a control system for an AML-based hybrid actuator

As an actuator for plastic forming machines, a hybrid actuator (which is a composition of a hydraulic cylinder pump and a servo motor amplifier) is spotlighted in the market. As part of the development efforts for solution technologies, we constituted the drive system for this hybrid actuator with an industrial PC, the "SMC-10" and a multi-axis servo amplifier, the "PQ" type M, and realized a high-precision positioning control system of the micrometer resolution based on a full-closed loop.

Here are the features:

- ① The "AML" for object-oriented control was used to establish a control system for hybrid actuators. (An operation pattern for two-speed positioning became a reality.)
- ② The position control loop of the "PQ" type M was given an integratunetion to increase positioning precision against disturbance and other inconveniences. See Fig. 1.
- ③ It is easy to build a control system consisting of a position control loop as a linear system and a speed control loop as a rotary system.
- ④ System configuration:  
Hydraulic cylinder: ID 100mm x rod OD 71mm x stroke 150mm  
Pump: Gear pump (displacement 6.3cm<sup>3</sup>/rev.)  
Motor: P60B18200HXS(2kW)  
Amplifier: "PQ" typeM (100A)  
Linear sensor resolution: 1μm/pulse

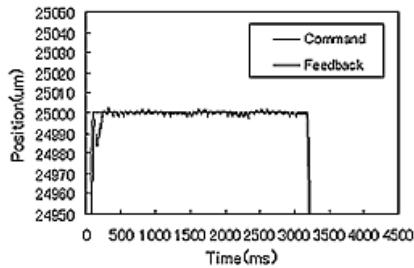


Fig. 1 Typical positioning precision when loaded at 86kN

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## Component Technology: Development of "SMS-30"

An industrial PC, the "SMS-30," was developed as part of a high-level series of platforms for PC-base solutions consisting of an open network and software.



As part of the "S-MAC PC" series of industrial PCs, the "SMS-10", which uses an Am486DX-133MHz as a CPU and a PC/104 bus as an internal bus, has already been released. However, these days, some user applications require the high-throughput CPUs. Demand is also high for 32-bit PCI bus. To propose solutions to meet these demands, we developed the "SMS-30".

The "SMS-30" uses AMD's K6<sup>TM</sup>-2E 233MHz as a CPU and an NLX bus (ISA/PCI) as an internal bus. This will hopefully expand our business of HMI and other solutions.

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## Component Technology: Development of New Functions of the "AML"

This company's solution business, the "S-MAC", is based largely on the functions of the "AML", an object-oriented advanced language. For this reason, the company has continued incessant development efforts jointly with Automation Intelligence Inc. in Atlanta. Here are the new functions developed during this fiscal year.



- ① Compatibility with Ethernet (TCP/IP):  
The "AML" enables directly describing TCP/IP used on the Internet.
- ② Compatibility with Profibus I/O:  
The "AML" is now capable of controlling the I/O of Profibus, which is a field network developed by Siemens and widely spread all over the world.
- ③ Compatibility with the I/O, encoder, watchdog and other functions of the "SMS-10":  
The "AML" is now capable of directly controlling RAS modules of this company's industrial PCs. The language can now also describe the optional modules of I/O and encoder.

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## Component Technology: Improvement and Enhancement of the Servo Performance of "PV" DeviceNet-compatible Amplifiers

Since our "Open Architecture Declaration" in 1996, we have been commercializing the "PV1/DeviceNet," a network interface amplifier. With a 32-bit RISC chip, we have now developed the "PV2/DeviceNet", which achieves double speed loop characteristics, higher customizability and maintainability with a larger memory capacity, and incorporates new motion control and power supply specifications.



Table 1 Comparison of characteristics

Item	PV1/DeviceNet	PV2/DeviceNet
Speed loop characteristics	200Hz	400Hz
Add-on functions	–	Registration, master encoder, full close control, etc.
Memory capacity	ROM: 32KByte RAM: 4KByte	ROM: 256KByte RAM: 512KByte
Maintainability	Setting of servo parameters with special-purpose tools	EDS files are set to servo parameters from high-level equipment via a network.
Product line-up	230V AC input type	AC115V Input type AC230V Input type DC48V Input type (Under development)

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## Component Technology: Development of a "PV2" SERCOS-compatible Amplifier

Sanyo Denki was the first to have commercialized SERCOS interface amplifiers (PZ-W and PE-W). We reduced them in size, increased their performance and functionality, cut its costs and developed a "PV2/SERCOS" amplifier.



Its specifications are as follows:

- ① Size: 60% down from conventional models (as compared in volume with PZ-W)
- ② High performance: The speed loop characteristics are double (frequency characteristic 400Hz). The communications speed options are extended to 2M/4M/8M /16Mbps.
- ③ High functionality: Master encoder input, full closed control, modulo, registration (Probing), torque observer, auto-tuning, dual location feedback, parameter saving, etc.
- ④ Cost cuts: Costs are 20–35% lower than those of conventional models due to the use of fewer parts as a result of integration and the use of fewer assembly steps.
- ⑤ Conformity to international standards: Products conforming to CE, UL, and c UL requirements are now standard. The power input is single-phase 115/230V AC.

\*The product names mentioned in the text are either registered trademarks or plain trademarks of the respective manufacturers.

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Toshiro Tani  
Joined company in 1969  
Control Systems Division  
Worked on user-oriented solutions business

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