Development of Industrial PC "SMS-30"

Shigeki Satou   Masahiko Okamura

1. Introduction

This company made the "Open Architecture Declaration" in November 1996, that it would make its FA technology open to meet the needs of the times. By targeting PC-based systems using open networks, we have been developing various components. We have been putting various products into the market, such as object-oriented "AML (Advanced Motion Language)", along with an industrial PC "SMS-10" which can contain a SERCOS interface board for PC/104 bus, multi-axis intelligent servo amplifiers "PQ" type M and "PQ" type R, I/O units compatible with the SERCOS interface, and SERCOS interface boards for PCI buses.

This company's industrial PC, the "S-MAC PC", consisted only of an "SMS-10," which incorporated an Am486DX5-133MHz CPU and a PC/104 internal bus. Thus, the line-up was insufficient to meet the requirements of users wishing to use applications demanding faster CPUs and boards other than the PC/104 bus. To meet these requirements, we developed the "SMS-30" in the "S-MAC PC" series. Fig. 1 is an external view of the "SMS-30".

2. SMS-30

2.1 System positioning

The "SMS-30" can be positioned as component (B) in this company's FA intelligent system as shown in Fig. 2.

Similar to the "SMS-10", SMS-30 is designed to be connected to PCs for factory management, typified by production control system, via Ethernet which is high-level network mounted on the "SMS-30" as standard equipment and for the low-level network such as motion bus or field bus, it is necessary to build a special-purpose interface board into the "SMS-30".

2.2 System configuration

Fig. 3 shows the configuration of the "SMS-30".

The system is roughly divided into four parts: the power supply, CPU, riser board (a board containing a PCI and ISA bus in its extension slots), and CF interface board (a disk-less system using a commercially available CF containing flash memory). The power supply is a wide input capable of meeting input voltages from 85V to 264V AC without switchover. It meets the FCC/VDE class B for its noise terminal voltage specifications. It also comes standard with a metal fitting designed to clamp the AC cable to prevent it from coming off when assembly is effected.

The CPU is an A5-size single board computer. The processor is AMD's K6^{TM}-2E 233MHz to ensure high speed. Similar to the "SMS-10", the system is naturally air-cooled with a radiator fin alone without using a CPU cooler, thus achieving a long service life and high reliability. The second cache is 512Kbytes and the user memory is 64MB SDRAM that synchronizes with the CPU clock and enables continued access to memory. The user memory can be up to 256Mbytes. The board is provided with LAN (Ethernet), graphic functions, sound functions, and various interfaces (E-IDE, keyboard,

USB x2, mouse, parallel, and serial x2). Fig. 4 is an external view of the CPU board.

The riser board is connected to the CPU and NLX bus. The NLX is a bus standard for PC/AT compatibles, which was released by Intel Corp. in the USA in February, 1997. The extension connectors are separated from the motherboard (CPU board), and the riser board equipped with extension connectors is connected to it by the card edge connector on the motherboard. Signals passing through this card edge connector consist of PCI and ISA signals and are advantageous in that a riser board can be designed in a manner that meets user requirements. The CPU board and extension board become parallel when mounted, and they are highly maintainable in board removal, memory add-on, CPU replacement and other operations. For the "SMS-30", we commercialized a B type, which is applicable to up to four full-size extension boards (PCI-only slot x 1, ISA-only slot x 1, PCI/ISA slot x 2), and a C type, which is applicable to up to two full-size extension boards (ISA-only slot x 1, PCI/ISA slot x 1). We also plan to commercialize a D type case, whose power supply is installed externally, and which is applicable to all kinds of extension boards up to half-size. Fig. 5 is an external view of the riser board.

The CF interface board is connected to the CPU by an E-IDE interface. The E-IDE is an interface designed to connect a PC to a built-in hard disk drive or CD-ROM drive. The "S-MAC PC" series is based on the concept of not using components having a rotary mechanism (such as CPU cooler and hard disk drive) for increasing product reliability. This board therefore can accommodate up to two Type I compact flash cards (CF cards) instead of an HDD. CF cards are widespread as a storage medium for storing images from digital cameras. In recent years, even Type I is available with capacities as large as 192Mbytes. Fig. 6 is an external view of a typical CF interface board.

These constituents are assembled together in a desired manner that meets user requirements to support FA total solutions.

3. Specifications

Table 1 shows the basic specifications of the "SMS-30", while Table 2 shows its general specifications.

Table 1 Basic specifications

Item			B type	C type
CPU	CPU		K6-2E 233MHz (manufactured by AMD)	
	Socket		Socet7	
System bus clock			66MHz	
Cache memory	Primary		64kB (built in CPU)	
	Secondary		512kB (onboard)	
Chip set	North Bridge		Intel 430TX	
	South Bridge		Intel PIIX4	
Memory	BIOS ROM		512kB (Flash ROM)	
	RAM	Main memory	64MB (256MB max.)	
		Socket	DIMM x 2 slots (SDRAM)	
		ECC functions	Unsupported	
		VRAM	4.0MB (built in Windows accelerator chip)	
Display functions	Windows accelerator		C&T Corporation, equipped with 69030, onboard PCI connected	
	Graphic display		640 x 480 dots, 16 M colors, 4k colors, 256 colors 800 x 600 dots, 16 M colors, 64k colors, 256 colors 1024 x 768 dots, 16 M colors, 64k colors, 256 colors 1280 x 1024 dots, 16 M colors, 64k colors, 256 colors	
Storage units	Floppy disk drive		2.54mm pitch on CPU board 34-pin pin header provided	
	Storage device		CF card or hard disk Accommodates up to two CF cards (Type I)	
Interface	Keyboard		Connector: Mini DIN 6 pin (PS2 interface)	
	USB		Connector: 4 pins x 2	
	Mouse		Connector: Mini DIN 6 pin (PS2 interface)	
	Serial	COM1	Connector: D-sub 9-pin (115.2kpbs)	
		COM2	2.54mm pitch on CPU board, 10-pin pin header provided	
	Parallel		2.54mm pitch on CPU board, 26-pin pin header provided	
	Display		Analog RGB signal output, connector: Mini D-sub 15-pin	
	LAN	Chip	Equipped with Intel 825559ER	
		Functions	100BASE-TX (compatible with 10BASE-T as well)	
Beeper	1			
Sound	Equipped with YMF-715E, compatible with Sound Blaster, FM/PCM/MID capability, SPK_OUT x 1, LINE_OUT x 1, LINE_IN/MIC_IN x 1 (exclusive use), equipped with a 14-pin box type connector on the CPU board (a DC +12V supply to be provided from outside)			
BIOS	Phoenix (old AWARD)			
System monitoring functions	Chip		Manufactured by NS Corporation, LM79CCVF	
	Temperature monitoring		2 (CPU temperature, temperature in the unit)	
	Power supply monitoring		DC+3.3V / +5V / +12V	
	Watch Dog Timer monitoring		1	
CPU cooler	None (cooled by a radiator fin)			
Riser board	ISA-only slot x 1 PCI-only slot x 1 ISA/PCI slot x 2 Secondary IDE interface provided			ISA-only slot x 1 ISA/PCI slot x 1 No secondary IDE interface provided
Applicable card	Max. 340.74 mm (from card edge to metal fittings)			
CF interface board	Interface		- IDE interface: 2.5 inch x 1, 3.5 inch x 1 - DMA mode unsupported - Master/slave switchability (configurable with DIC 1) - Compact flash Type I slot x 2 - True IDE mode connection	
	Display		- IDE access LED x 1	
Supply power	AC100V +10% / -15% 1 Φ 50/60Hz AC200V +10% / -15% 1 Φ 50/60Hz DC-5V, DC ± 12V ± 5% (supplied when used on an extension board)			
Outside dimensions (mm)	163(W) x 222.5(D) x 372(H)			128(W) x 233(D) x 372(H)
OSs supported	Microsoft WindowsNT Workstation 4.0 Microsoft WindowsNT Embedded 4.0 Microsoft Windows 98 Second Edition Microsoft Windows 98 Microsoft Windows 2000 Professional (scheduled) VxWorks (scheduled), Linux (scheduled)			

Table 2 General specifications

Item	Specifications	
Internal current consumption	DC5V 4.2A (typ.) (Except for the portions of the storage device.) (The maximum output of the internal 5V DC power supply is 10A.)	
AC input current	1.2A/0.7A max. (At 100V/200V AC input, 5V DC 10A output)	
Temperature	Operation	0 to 50 °C (5 to 45 °C when HDD is used)
	Storage	−20 to 60 °C
Humidity	Operation	20 to 90%RH (non−condensing)
	Storage	20 to 90%RH (non−condensing)
Vibration	0.5G (while on the fly) / 1G (while not on the fly)	
Impact	10G (while not on the fly)	
Method of installation	Wall−hung (vertical installation only)	
Other	Internal ground connected to chassis ground	

Fig. 7 is an external view ofthe "SMS−30" B type, while Fig. 8 is an external view of the "SMS−30" C type.

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4. Software

The "S−MAC PC" is functionally PC/AT compatible and has various applications. Of these, applications as a platform for implementing the "AML" constitute products functioning as the core of Sanyo Denki's total solutions.

The "AML" has already been implemented in a plurality of applications so that it can be executed on some OSs. WindowsNT version of AML running on WindowsNT is one of them. This version of AML is such that its Runtime portion controlling the motor and the HMI portion programmed as a Windows application can be executed on a single PC platform. On the "SMS−10", this software was difficult to run because the CPU performance was not high enough.

When a user wishes to implement the HMI portion on a Windows application, it was unavoidably necessary to incorporate a Runtime−purpose PC and an HMI−purpose PC into the device. Naturally, if the HMI application consumes much of the CPU performance, this configuration is the best method. However, in the case of an HMI application that does not need such a high CPU performance, running these on a single PC will result in a much higher cost performance. The commercialization of the "SMS−30" has paved the way for providing users with a wider range of options.

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5. Conclusion

The "SMS−30" is a key component that increases system proposal options for total solutions, thus increasing cost performance. The features of the "SMS−30" as differentiated from the "SMS−10" are described below:

- Accommodates extension boards of the PCI bus and ISA bus types.
- A rise in CPU performance from Am486DX/133MHz to K6/233MHz and the use of a high−performance graphic display chip enable the HMI portion to be processed by software.
- User memory is increased from 16MB to 64MB.
- The number of compact flash memory units is increased from one to two.

We would greatly appreciate if the "SMS−30," together with the "SMS−10," help promote FA total solutions that this company pursues.

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

Shigeki Satou
Joined company in 1984
Control Systems Division, 1st Solution Dept.
Worked on development of S-MAC components

Masahiko Okamura
Joined company in 1985.
Control Systems Division, 1st Solution Dept.
Worked on development of S-MAC components

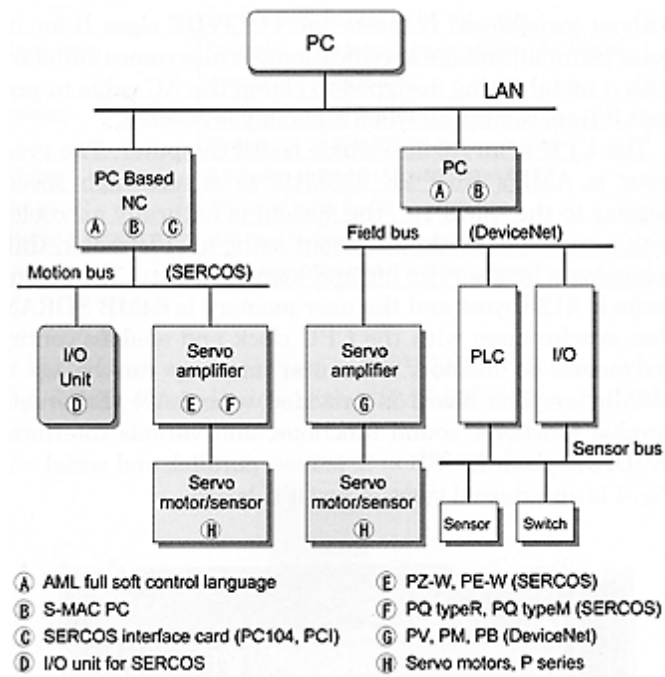Fig. 1 External view of the "SMS-30"
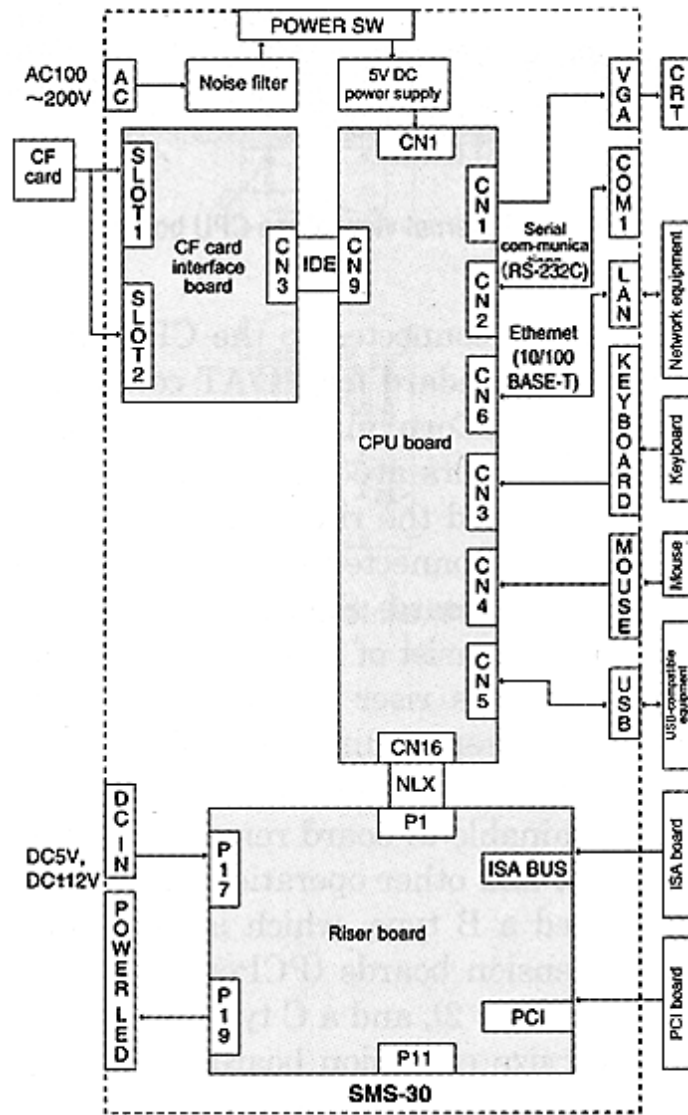
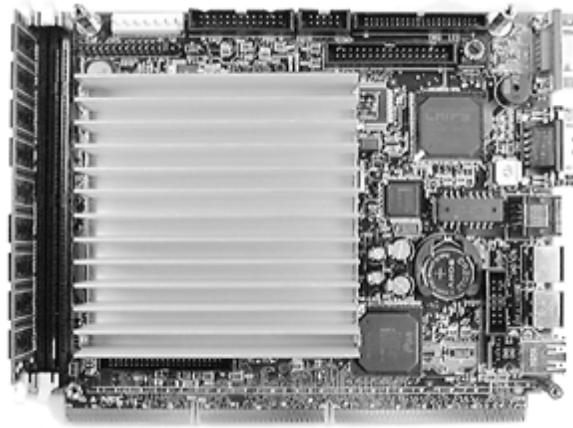Fig. 2 Components of the FA intelligent system

Ⓐ AML full soft control language
Ⓑ S-MAC PC
Ⓒ SERCOS interface card (PC104, PCI)
Ⓓ I/O unit for SERCOS
Ⓔ PZ-W, PE-W (SERCOS)
Ⓕ PQ typeR, PQ typeM (SERCOS)
Ⓖ PV, PM, PB (DeviceNet)
Ⓗ Servo motors, P series

Fig. 3 Configuration of the "SMS-30"

Fig. 4 External view of the CPU board
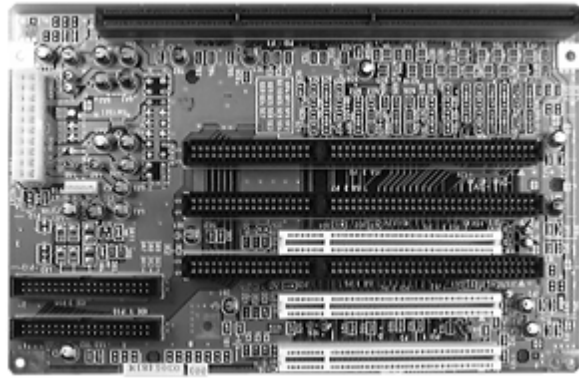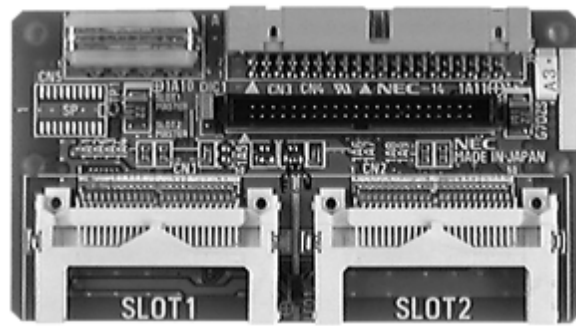
Fig. 5 External view of the riser board

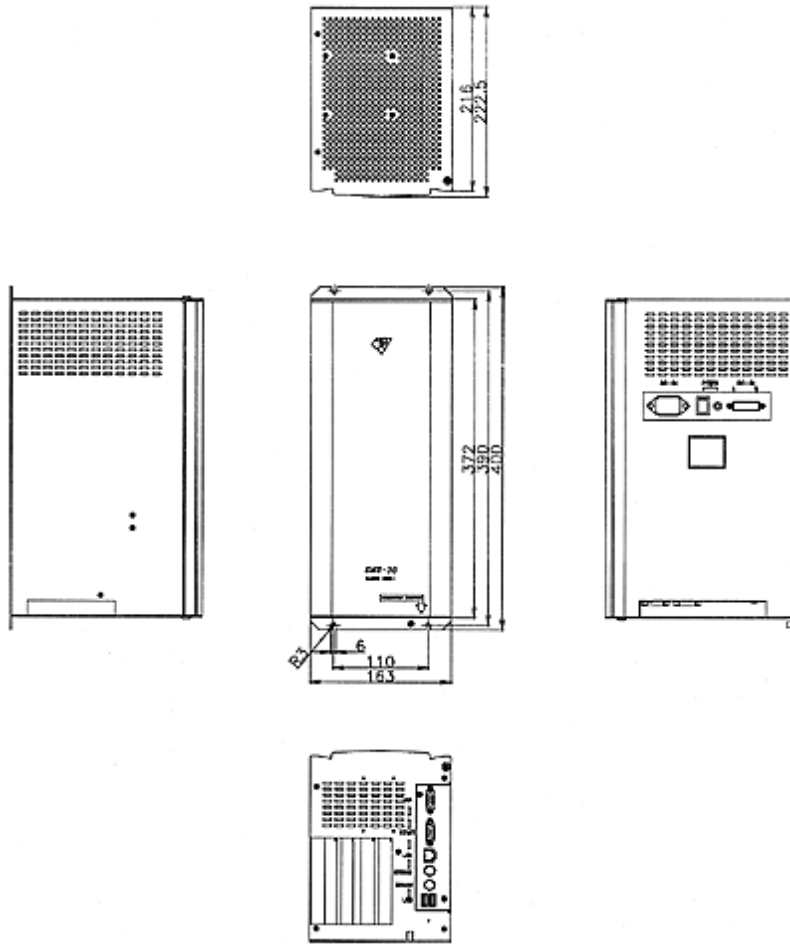Fig. 6 External view of a typical CF interface board
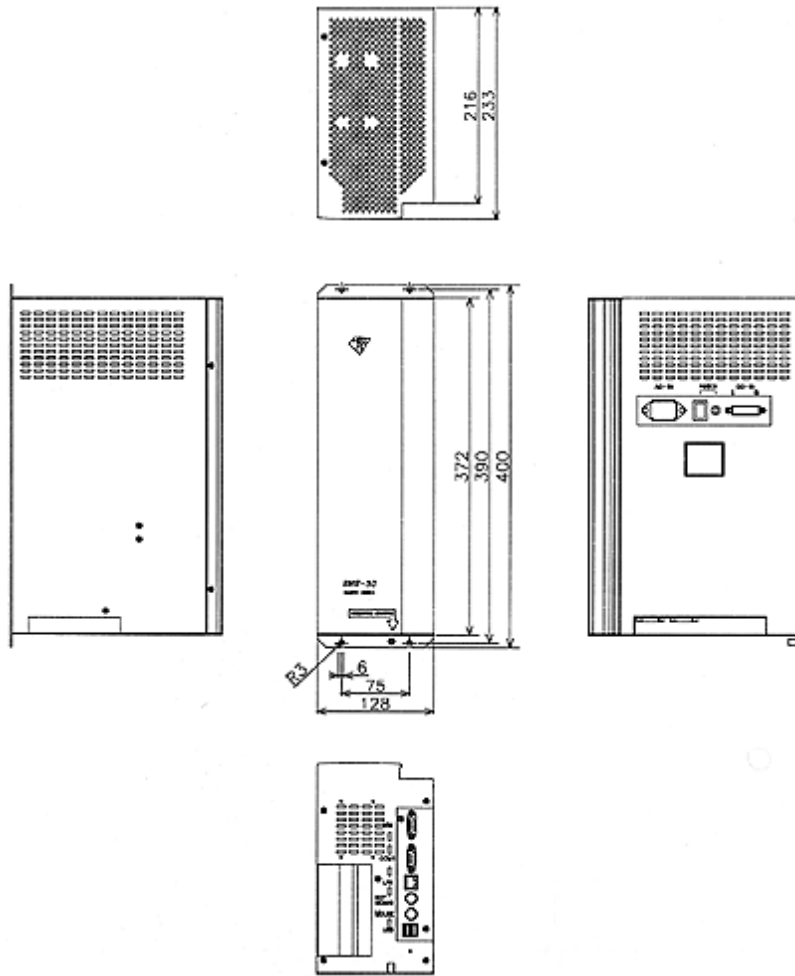
Fig. 7 External view ofthe "SMS-30" B type

Fig. 8 External view of the "SMS-30" C type