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Development of the "SMS-15" Industrial Personal Computer

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1. Introduction

Driven by the dramatic development of IT (Information Technology), industrial controls and monitoring devices have increasingly become computer-based and open architecture. The resulting market for the industrial personal computer (Industrial PC) is expanding at a rapid rate.

Considering this market for Industrial PCs, the user requirements are very diversified. Requirements include the normal increases in CPU speed but also includes a scalable product system that can meet the unique needs of the user.

Considering the full range of user needs, we have discovered keywords such as "compact", "larger display", "complete networking capability including Local Area Network", "optional assembly", and "value-oriented price". The "SMS-15" was developed with these requirements in mind to complement the top-end market as compared with our existing "SMS-10". This article reviews the background and features of the "SMS-15".

2. Development Objectives

Fig.1 shows the "SMS-15" model which includes the SERCOS interface™ option.



Fig.1 "SMS-15" with the SERCOS interface

2.1 CPU Speed

A concept of the earlier "SMS-10" is to eliminate all rotating parts such as the CPU cooler and hard disk. This enhances the product reliability in an industrial environment. The AMD Am486DX5-133MHz CPU is used which allows the heat radiation of the CPU to completely dissipate through the case. In addition, the "SMS-10" is designed with a TYPE I Compact Flash Card in order to have a solid-state disk instead of a conventional hard disk. We feel the "SMS-15" needs to maintain the elimination of all rotating parts.

One purpose of the "SMS-10" is to run our motion control software, "AML". In this case, the "SMS-10" is also equipped with the SERCOS interface.

"AML" is able to perform synchronous control for up to 32 servo axes and I/O stations. However, the "SMS-10" CPU speed imposes some limits with "AML". For example, the update rate of the multiple position commands needs to be lengthened as the number of SERCOS nodes increases. In addition to faster update rates with higher axis counts, further improvement of CPU speed was also required since "AML" has been extended to include new functions such as linear/circular interpolation ("AML" Ver. 7.0).

Traditional motion controls include a PC and built-in motion card (with separate CPU). However, in the case of "AML", the only CPU in the control system is the CPU of the Industrial PC. The SERCOS motion bus connects "AML" to the fully-digital servo drives. Therefore, for all of the reasons above, increasing the CPU speed was a top priority for the new "SMS-15".

2.2 SERCOS interface

The existing "SMS-10" has a SERCOS interface board conforming to the PC/104 standard (IEEE 996.1). This PC/104 SERCOS board uses the SERCON410B ASIC to support the SERCOS interface (available data rates are 2 and 4 Mbps).

The most recent ASIC for SERCOS is the SERCON816, which has achieved the communication rate of 2, 4, 8, and 16 Mbps. For the "SMS-15", we used the new ASIC and embedded the SERCOS interface circuit integral to the body in order to save space.

The "SMS-15" with faster CPU and latest SERCOS ASIC allows the "AML" motion controller to have a faster response with higher axis count.

2.3 Consideration for Non-Motion Control Applications

The "SMS-15" architecture is compatible with the standard PC/AT so the user can add off-the-shelf peripherals and software as sold in computer stores. In addition to this flexibility, other design themes including "long-term stable products supplies" and "robustness" are our key concepts of making controllers. These characteristics are required not only for motion control applications but also for non-motion control applications in which PC/AT compatibles are used as controllers. We expect that the SMS-15 will be the type of controller that can fulfill the various needs of customers in a wide range of fields.

By supporting the added functions of the general purpose PC such as large capacity memory, improved graphic capability, increased processor speeds, and interfaces such as Ethernet and USB, we have extended potential applications of this product to security systems and many other general-purpose applications.

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3. Features

The “SMS-15” has the following features to extend applications beyond standard motion control while achieving interchangeability with the “SMS-10”.

3.1 Diverse Product System

Contrasted with the “SMS-10” which had separate modules for options such as the “VGA module” and “SERCOS module”, the “SMS-15” includes these functions by incorporating them into the “SMS-15” body. As a result, the “SMS-15” is reduced in space by approximately 23% and is reduced in cost by approximately 30%. However, the height and depth of the “SMS-15” body are equal to the “SMS-10” so interchangeability is achieved as well.

3.2 Improvement of the CPU Speed

The “SMS-15” CPU is a Geode GX1-300MHz which is made by National Semiconductor. The processor is manufactured with 0.18-micron CMOS process and has achieved speed improvement and lower power consumption. In addition, the processor is supported by many operating systems such as various Windows OS, VxWorks, QNX, and Linux.

3.3 Improvement of Graphic and Diverse Interface Functions

The “SMS-15” includes two USB 1.0 compatible interfaces and two 10/100BASE-T Ethernet ports to improve the networking speed as compared to the “SMS-10”.

Graphic function of the “SMS-15” supports 1280×1024 (with 256 colors) or up to 1024×768 (with 65,536 colors).

3.4 Supports for Large-Capacity Device

The “SMS-15” includes a slot for a Type II compact flash card. This allows a large-capacity compact flash card or IBM micro drive (1GB or less) to be used.

4. System Configuration

The system configuration of the “SMS-15” is shown in Fig.2 and Fig.3. The body is configured with two boards, one board is the CPU part with PC/AT compatible function while the second board is the SERCOS part including other peripherals. The PC/104 standard bus and the signals such as the serial interface and the keyboard interface connect to each board. Fig.2 shows the block diagram of the CPU part while Fig.3 shows the block diagram of the SERCOS part.

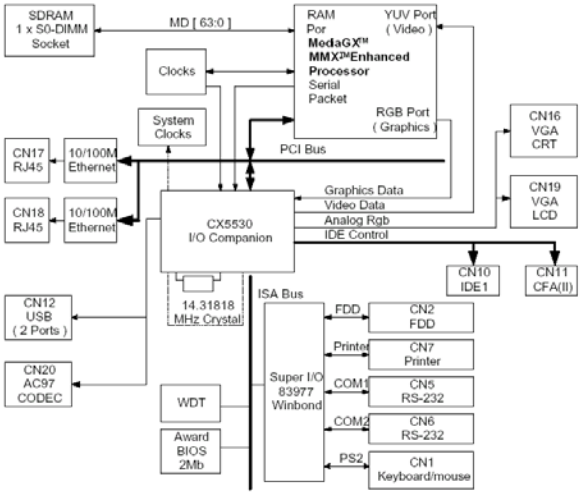
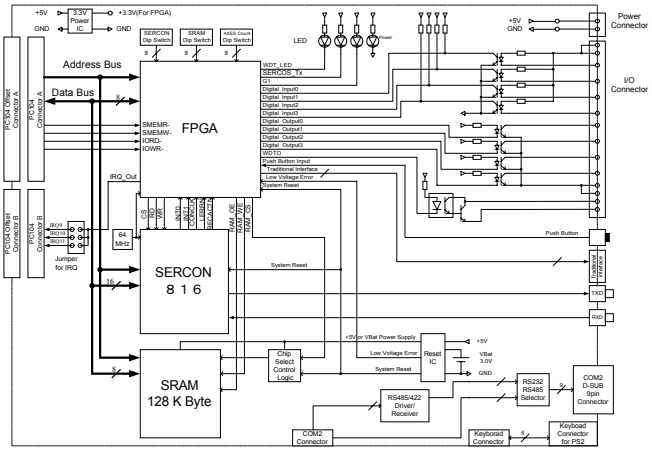


Fig.2 Block Diagram of CPU Part

Fig.3 Block Diagram of the SERCOS Part



5. Specifications

Table 1 shows the basic specifications of the “SMS-15”, Table 2 shows the SERCOS specifications, Table 3 shows the general specifications, and Fig.4 shows the outside view.

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Table 1 Basic Specifications

CPU		NS Geode GX1-300MHz
Companion I/O		CX5530A
System Memory		64MB or 128MB（1x144 pin SO-DIMM）
LAN Interface		10/100BASE－T（RJ-45 connector） with ACTIVITY、LINK display
	Chip	Intel 82559 x2
Display		Built-in CX5530A chip set
	V-RAM	Shared with the system memory （Set with BIOS up to 4MB）
	Resolu-tion	1280x1024、256 colors or up to 1024x768、65536 colors
Serial Interface		2 ports COM2 can be set RS-232/422/485
USB Interface		2 ports、USB1.0 compatible
Compact Flash Card		Either TYPE1 or TYPE2 is usable. Allot the secondary IDE port
Keyboard, Mouse Interface		PC/AT compatible keyboard, PS/2 mouse can be connected
Watchdog Timer		Overflow Time: select from 64,32,16,8,4,2,1,0.5msec, watchdog timer error output
Expansion Bus		PC/104 bus
General-purpose I/O		Optical isolated input and output, four each
Display LED		POWER, DISK, WDT
Input Power Supply		DC5V ±5%
Current Consumption		2.5A max
Mass		Approx. 1.2kg
Outside Dimensions		57.6×180×123.7（mm, W×H×D）

Table 2 SERCOS Specifications

SERCOS Interface		SERCON816 controller installed Follow IEC 61491 standard
	Communication Rate	2,4,8,16Mbps
	Light Module	HFBR-1505A、HFBR-2505A (Agilent Technologies)
	Memory Ad-dress	Allot 8kB out of D8000h ～ DFFFFh
	Interruption	Select form INT0,INT1,DIVCLK,CONCLK
	Battery Backup RAM	4096x8 bit Backup Battery: CR2450 equivalent
	S1（switch）	State is readable with internal resistor.
	Display LED	G1, ERR

Table 3 General Specifications

Operational Conditions

Power Supply Voltage	DC5V±5%
Operating Temperature	0～50℃
Operating Ambient Humidity	90%Rh or less （w/o condensation）
Vibration	4.9m/s^2
Shock	49m/s^2
Site	Indoor

Structure

Material	Aluminum alloy
Paint Color	Dark gray（DIC F144 equivalent）

Transportation and Storage Conditions

Ambient Temperature	-20～65℃
Ambient Humidity	90%RH or less（w/o condensation）
Vibration	9.8m/s^2
Shock	49m/s^2

Other Specifications

Earth	The third-type earth
Cooling Method	Natural air-cooling

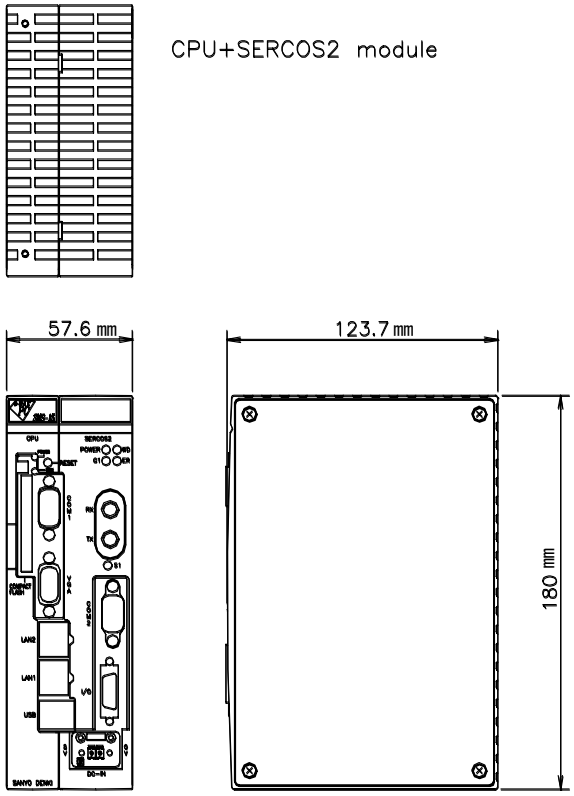


Fig.4 Outside View

6. Conclusion

This document introduced the development target of the new “SMS-15” along with features and specifications. Two models were considered, one model with the SERCOS interface (primarily used for motion control applications with “AML” software) and another model without the SERCOS interface. The second model is more general purpose in nature and is expected to be used as a server/terminal for security and remote services.

Industrial PCs are often used continuously over an extended period of time in harsh environmental conditions. We will continue to capture the needs of various users and the computer market so that we can make every effort to develop new products like the “SMS-15”. We feel the “SMS-15” provides users many advantages based on the combined technologies of Sanyo Denki and the standard computer industry.

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