

I/O Unit Supporting SERCOS Interface

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1. Introduction

Since 1996, Sanyo Denki has been developing and proposing systems using a SERCOS interface as the core technology for an open FA system. As "S-MAC components" aiming at FA total solutions, the company has been offering a object-oriented control language AML and an industrial PC "SMS-10" along with servo amplifiers for SERCOS interface, including "PQ" type R, "PQ" type M, "PZ-W" and "PE-W." Adding I/O units for SERCOS interface to the aforementioned line-up will open up new solution options for customer systems.

Here is a presentation of the I/O units for SERCOS interface.

2. I/O Units for SERCOS Interface

2.1 Positioning of the Units in a System

The I/O units for SERCOS interface ("SERCOS I/O units") can be classified as (D) in Components in the FA Intelligent System in [Fig. 1](#).

We used to propose system configurations using expensive units commercialized by different manufacturers. The recent addition of new units with high cost performance to the line-up of components has made it possible to make proposals designed to integrate the network by means of the company's own products.

[Fig. 2 External view of the unit](#)

2.2 Configuration

[Fig. 3](#) shows a standard configuration of a SERCOS I/O unit. This unit is modularized by function. The standard configuration consists of one power supply module and SERCOS communications module common to all configurations, along with one digital input/output module (32 points each for input and output) and one analog input/output module (4 channels each for input and output).

Modules are connected by means of connectors of a multi-stage stacking structure. They are highly expandable and does not need a motherboard (a board designed specifically for connecting modules).

Targeting the standard configuration improves cost performance greatly in comparison to I/O units for commercially available SERCOS interfaces.

Modules can also be recombined to select a configuration of two digital input/output modules and a configuration of two analog input/output modules. If a new type of module is developed in the future, the new module can be incorporated into the configuration.

2.3 Features

Main features of the SERCOS I/O unit are as described below.

- (1) The SERCOS I/O unit is connectable with our industrial PC "SMS-10" and servo amplifiers "PQ" type R, "PQ" type M, "PZ-W" ,and "PE-W" on the same SERCOS interface without an I/O-only gateway. This unit thus allows designers to develop compact and inexpensive systems and save system wiring.
The interface specifications conform to the SERCOS Interface Specifications and SERCOS Interface I/O Functions.
- (2) An analog input/output module has four analog input channels and four analog output channels.
Analog inputs are fast: their conversion time is 1mS/4ch, and performed sample-hold simultaneously for all channels. The SERCOS Interface Specifications allow users to set a time from synchronous signal MST (Master Sync Telegram) to holding from a high-level controller by means of SERCOS IDN parameters ("IDN").
- (3) Analog outputs are fast: their conversion time is 1mS/4ch. They begin to be converted simultaneously for all channels. The timing for the onset of conversion can be set to a setting different from that of analog input by means of an IDN.
When controlling system applications including a servo system, traditional I/O devices whose conversion is slow and asynchronous had difficulties in terms of safety and controllability. Analog I/O units that can be converted fast and simultaneously are best suited for this kind of application.
- (4) Digital input/output modules have 32 digital inputs having a delay time of 2mS or less. All these 32 inputs are captured by the same timing. (The timing is the same as that of analog input.) They have 32 digital outputs and begin to convert all channels simultaneously. (The timing is the same as that of analog output.)
- (5) The use of an integral module that has integrated the input and output parts into one and of the small stacking connector structure mentioned above as opposed to the traditional I/O units has resulted in a combination of size reduction with improved cost performance by matching the height to that of our industrial PC "SMS-10."
- (6) Since the inside of the unit consists of modules having different roles, provision is made to allow users to develop and add new modules according to future needs.
This facilitates the spread of technology to new networks, such as Fire Wire, Ethernet and Profibus.

2.4 Standard Specifications

As mentioned above, the standard configuration of a SERCOS I/O unit consists of a power supply module, a SERCOS communications module, a digital input/output module, and an analog input/output module. Shown below is the standard specification of a SERCOS I/O unit.

Table 1 Standard specification

Model number		SIO-012
Basic specifications	Input supply voltage	DC24V ± 6V
	Operating temperature range	0 to 55°C
	Storage temperature	-20 to 65°C
	Operating and storage humidity	90%RH or less (non-condensing)
	Vibration resistance	0.5G or less
	Impact	2G or less
	Structure	Tray structure
	Outside dimensions	H180mm×W100mm×D140mm
	Weight	Less than 3kg
SERCOS interface	Transmission speed	2/4Mbps (8/6M scheduled to appear)
	Address	1 to 254
	Light quantity adjustment	Adjustable in 6 stages from level 1 to 6
Built-in I/O	Digital input circuit	24V DC, 32 circuits Photo-coupler insulation
	Digital output circuit	24V DC, 32 circuits Photo-coupler insulation
	Analog input circuit	12-bit, 4-circuit non-insulated ± 10V full-scale Simultaneous sample hold
	Analog output circuit	12-bit, 4-circuit non-insulated ± 10V full-scale Simultaneous sample hold

Here, we would like to mention something about the SERCOS ASICs that is under development. The new ASICs called the SERCON 816 will achieve a speed of up to 8/16Mbps while ensuring compatibility with the traditional transmission speed of 2/4Mbps.

A great rise in performance is called for, together with the review of the manufacturing process. The SERCOS Association members are now assessing the new ASICs. I/O units are scheduled to be made compatible with the new ASICs after being officially released.

3. Overview of the SERCOS I/O Functions

This section describes the SERCOS Interface I/O Functions (" I/O Specifications "), which are a set of optional specifications for the SERCOS Interface Specifications.

The I/O Specifications are controlled by means of a data structure called the IDN, similarly to ordinary servo amplifiers suited for SERCOS interface.

[Fig. 4](#) shows the structure of a main IDN used in the I/O Specifications.

The structure of an IDN used in the I/O Specifications is hierarchical as shown in the above figure. Only when this contains IDN 00290 and its value is 1 (representing an I/O-only unit) or 2 (representing a combination unit with an amplifier), the NC unit is recognized as a SERCOS I/O unit.

The subsequent IDN 00291 is called the I/O base and takes the top ID number in the I/O-only region. One usually uses 2048 and the numbers following that one will constitute an IDN region for I/O only.

The I/O-only region consists of an I/O common region for alarm and other

information and a region called the data channel having I/O ports and related information.

The top IDN of the common region is called "Data Base" Data channels 0 through 15 are arranged at that and later numbers.

The data channels consist of a channel container which is an I/O port, the channel type indicating the type of I/O port, the list of channels representing a list of parameters related to the I/O ports, and channel parameters 0 through 6.

Since the system is a hierarchical structure, we have given much explanation. As a matter of fact, the unit can be operated simply by reading and writing on channel containers. The rest of the information is additional information for I/O.

4. Conclusion

The SERCOS I/O units are key components that can improve the cost performance and reliability of system proposals for total solutions. This adds main components to the product line-up of SERCOS interfaces.

We hope that these products will help promote the implementation of the open FA system which Sanyo Denki pursues.

References

Yasuhiro Kyuma et al.: "SERCOS-compatible Servo Amplifiers," SANYO DENKI, Technical Report No.5, pp.38-41 (1998-5)
Hiroshi Yoshikawa: "Development and Features of the AML Language," SANYO DENKI, Technical Report No.7, pp.28-36 (1999-5)
IGS: "SERCOS interface I/O-Functions"

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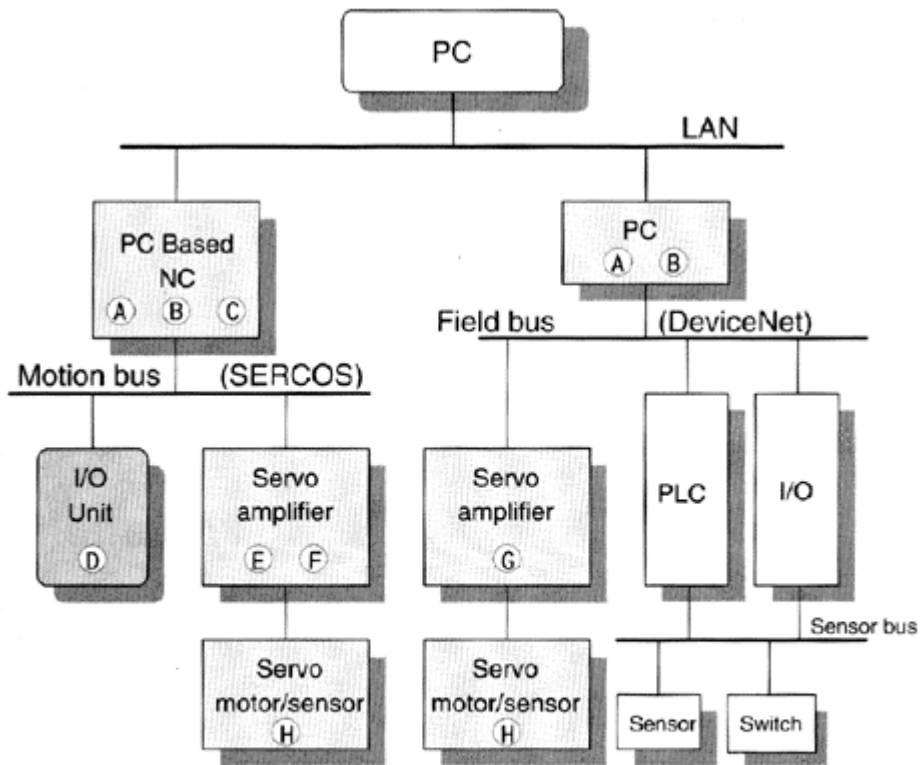
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- Ⓐ AML full-software control language
- Ⓑ SMS-10
- Ⓒ SERCOS interface card (PC104, PCI)
- Ⓓ I/O unit for SERCOS
- Ⓔ PZ-W, PE-W (SERCOS)
- Ⓕ PQ type R, PQ type M (SERCOS)
- Ⓖ PV, PM, PB (DeviceNet)
- Ⓗ Servo motor, P series

fig. 1 Components in FA intelligent system



fig. 2 External view of the unit

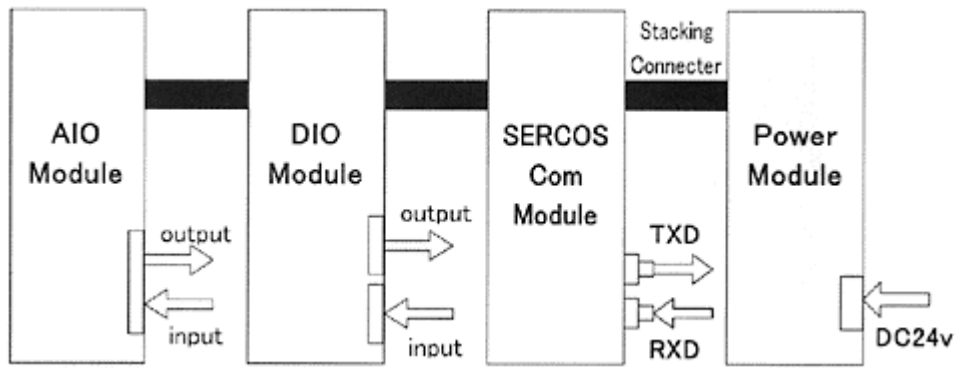


fig. 3 Standard configuration of I/O unit

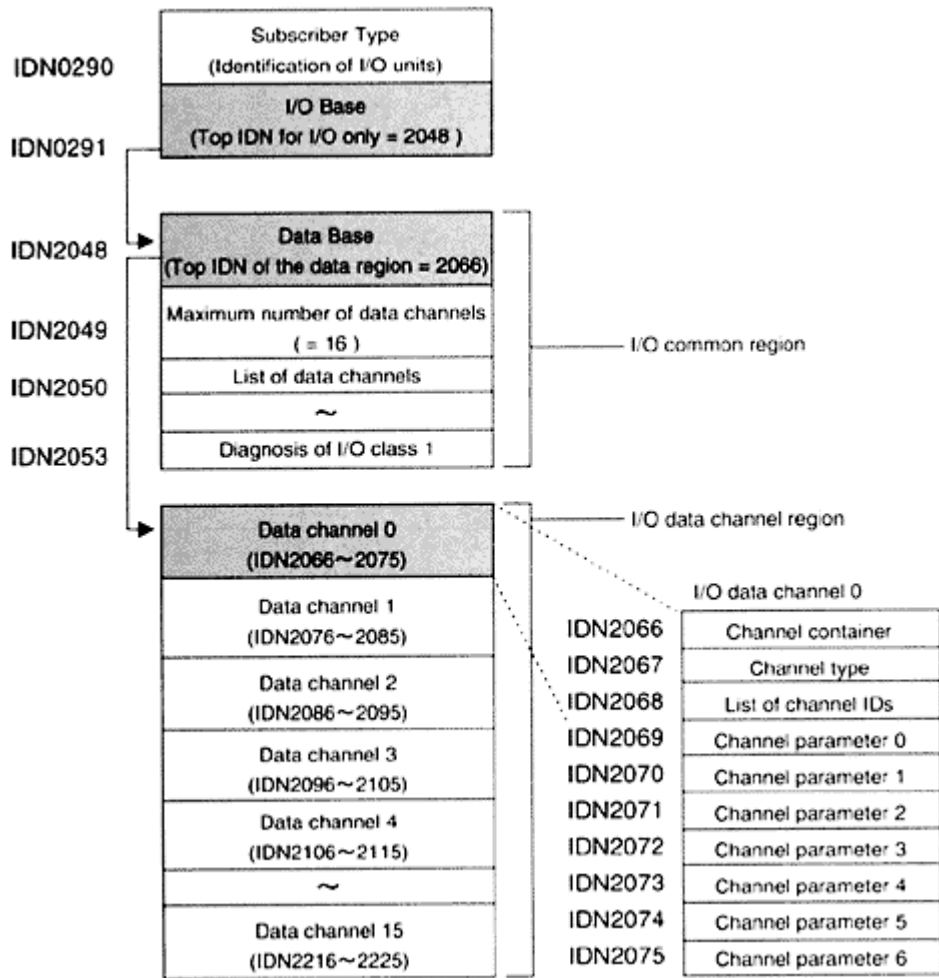


fig. 4 IDN structure of the I/O Specifications