

Expanded Line of MICREX-SX PLC Components

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1. Introduction

In recent years, applications for programmable controllers (PLCs) have continued to diversify and evolve, for instance adoption of open standards and progress to multi-functionality. This evolution has been accompanied with relentless marketplace demands on PLCs to support open networks or international standards such as IEC (International Electrotechnical Commission), to acquire industry-specific certifications, and to improve the development efficiency and maintainability of programs capable of supporting larger scale and more advanced systems.

Developed as a “global system component,” MICREX-SX integrated controller has been satisfying marketplace demands since it was introduced to the market. With a focus on the latest family of products, this paper describes the expanded lineup of MICREX-SX components and the status of the acquisition of relevant certifications.

2. Expanded Line of CPU Modules

Figure 1 shows a product map of CPU module

models that form the core of MICREX-SX series. Previously there were two product lines of CPU modules, SPH300 series and SPH200 series, but now a newly developed SPH2000 series that uses a general-purpose microprocessor has been added. The product models and functionality of the high-end SPH300 series have been expanded to support a broadening range of applications. In May 2005, 245 k-step model was released, which had the largest program capacity among the SPH300 series, to be capable of supporting even larger-scale systems.

2.1 Features of SPH300 series

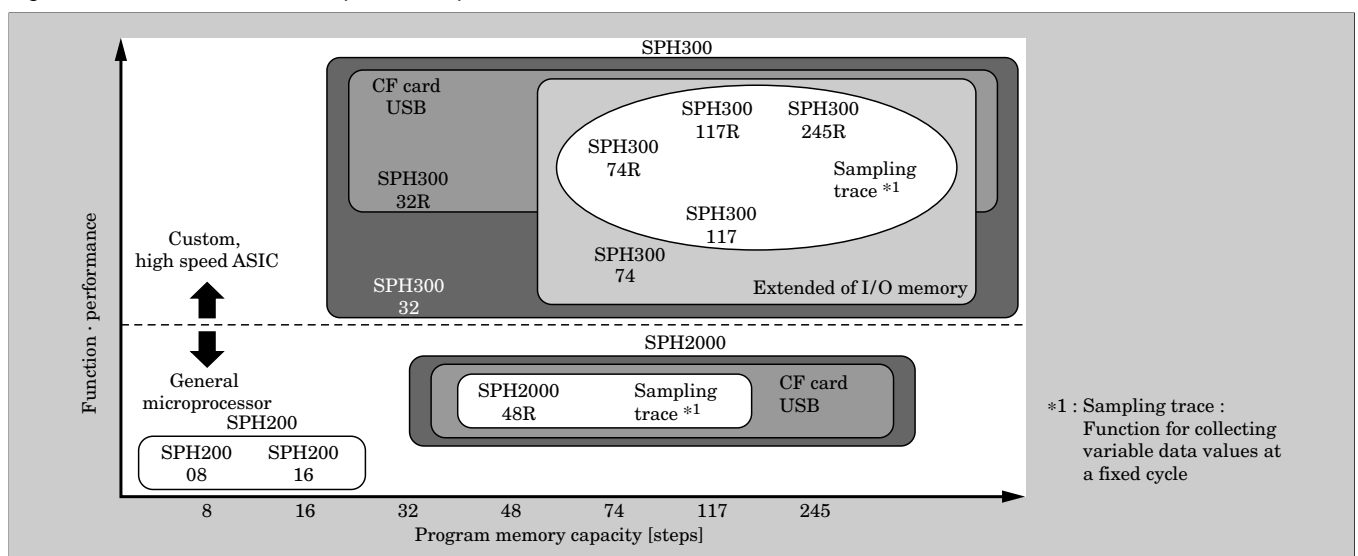
Presently, SPH300 series have two versions of its flagship CPU modules, a standard type and an R-type providing compact flash (CF) cards and USB interface.

Since SPH300 series is equipped with a high-speed processor ASIC optimized for PLC application and realizes, on average, an operational performance of 19,000 instructions per 1 ms, it is suitable for the real-time control of various devices.

2.2 Support of large-scale systems

Simultaneously with the release of 245 k-step

Fig.1 MICREX-SX CPU module product map



model in May 2005, 74 k- to 117 k-step models also expanded their functionality, and in order to facilitate the support of large-scale systems, I/O memory was made expandable from conventional 512-word size to 4,096 words maximum (8 times increase) (See Table 1).

Figure 2 shows an example configuration of conventional large-scale system. In order to construct a large-scale system with I/O memory larger than conventional size 512 words, it was necessary to partition the system into a multiple controller system configuration. As a result, a controller level network module was needed to communicate between controllers as well as CPU module, power supply module, and baseboard, therefore there are problems of increased system cost and a complex system design.

Figure 3 shows an example configuration of large-scale system having an extended I/O memory. The extension of I/O memory resolves the abovementioned problems. Large-scale system having I/O memory of 4,096 words or less on device level network with single-system configuration, thereby minimizes system cost, simplifies system design, and makes it possible for MICREX-SX to replace MICREX-F series large-scale systems.

3. Support of International Standards

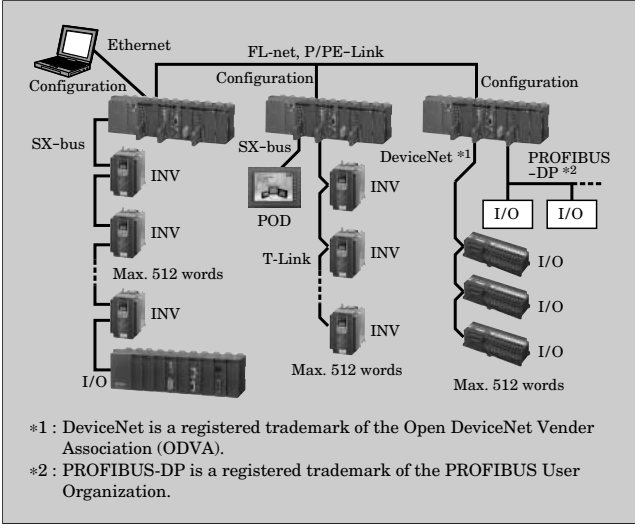
In recent years, new standards and regulations

Table 1 SPH300 series extended I/O memory

| | 32 k-step model (32, 32R) | 74 k-step model (74, 74R) | 117 k-step model (117, 117R) | 245 k-step model (245R) |
|--------------------------|------------------------------|------------------------------|---------------------------------|----------------------------|
| Conventional I/O memory | 512 | 512 | 512 | – |
| With extended I/O memory | 512 | 1856 | 4096 | 4096 |

Units: [words]

Fig.2 Example of conventional large-scale system configuration



concerning electromagnetic interference of electronic devices, prevention of electric fires and shocks, and preservation of global environment have been enacted. Depending on the locality of use and the type of application, PLCs are required to comply with those standards and regulations. MICREX-SX series supports these standards and regulations as a normal feature (See Table 2).

An overview of these standards and regulations, and compliance of MICREX-SX series are presented below.

3.1 CE marking

PLCs to be distributed and sold within the EU market are required to have a CE marking. The MICREX-SX series displays CE markings as recognition of its conformance with the EMC Directive and Low Voltage Directive, specifically, its conformity with the EMC and safety items of European standard EN61131-2:2003.

3.2 UL

In the US, with the exception of certain specific consumer household products, there is no legally

Fig.3 Example of large-scale system configured with extended I/O memory

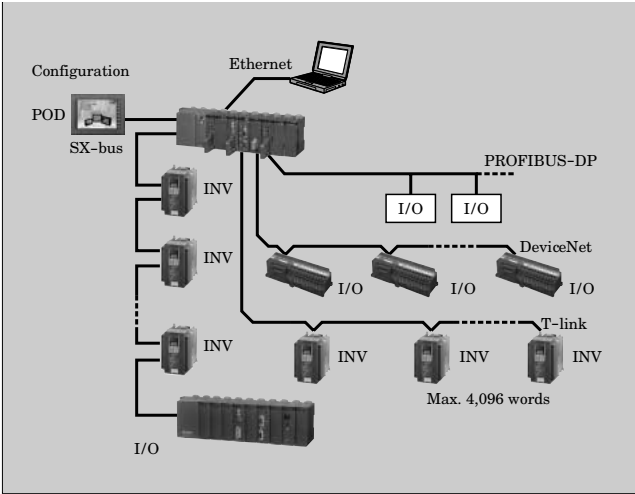


Table 2 Standards supported by MICREX-SX series

| Standard/ Regulation | | Cert. No. (*1) |
|----------------------|--|----------------|
| CE marking | | FIN571306 (*2) |
| UL | | E140422 |
| Marine certification | NK (Nippon Kaiji Kyokai : Japan) | 99A107 |
| | ABS (American Bureau of Shipping : USA) | 00-Y038419-X |
| | BV (Bureau Veritas : France) | 12082/A2 BV |
| | CCS (China Classification Society : China) | DBT02720034G |
| | DNV (Det Norske Veritas : Norway) | A-9402 |
| | GL (Germanischer Lloyd : Germany) | 24758-04HH |
| | LR (Lloyd's Register : UK) | 99/10003 |

(*1) Partially compliant (as of July 1, 2005)
(*2) Declaration of conformity

mandated standard and certification system for the manufacture and sales of products. Therefore UL certification and the UL mark verify the safety of electronic products. UL certification is recognized by most states. MICREX-SX series has acquired UL standard (UL508) certification for industrial control equipment.

3.3 Approval for marine use

Marine-use PLCs must use products certified by a classification society that registers ships. Since MICREX-SX series has acquired certification from seven out of ten classification societies (NK/ABS/BV/CCS/DNV/GL/LR) officially admitted to the IACS (International Association of Classification Societies), it conforms to most requirements for marine-use.

In response to user requests, Fuji intends to aggressively pursue certification from other classification societies.

3.4 RoHS directive

RoHS^{*1} directive bans the use of certain hazardous substances [lead, mercury, cadmium, hexavalent chromium, polybrominated biphenyl (PBB), and polybrominated diphenyl ether (PBDE)] in electrical and electronic equipment in the EU market as of July 1, 2006. Due to the end of FY2005, transition is scheduled to comply with this directive gradually.

4. Expanded Line of Communication Modules

Figure 4 shows network hierarchy of MICREX-SX. MICREX-SX supports major open network protocols worldwide, and is additionally equipped with Fuji's original T-link and P/PE-link networks. Thus, these networks enable optimal selection regardless of the

^{*1}: RoHS: restriction on the use of certain hazardous substances in electric and electronic devices.

network device manufacturer, and provide support for various systems requirement such as minimum cost or replacement of existing system.

Although MICREX-SX network is already extensible, new modules are being developed and the functions of existing modules are being expanded to broaden the range of applications further. Several examples are introduced below.

4.1 LE-net

As systems have trended toward larger scale and greater sophistication in recent years, demand for decentralized control system has been increasing. To meet this demand, an original network named LE-net has been developed.

Decentralized control is characterized by a master-less distribution of the processing load and easy implementation of system changes. LE-net realizes these characteristic features at low cost, with easy connectability, and a simple protocol.

LE-net network topology supports either multi-drop or loop arrangements. Since communication is still kept with a loop topology, even if network cable becomes disconnected, it enables highly reliable systems to be constructed at low cost (See Fig. 5).

LE-net is positioned as one of the main controller networks connecting PLCs in the future, and is targeting applications in systems requiring high reliability within the fiercely cost-competitive FA industry.

4.2 Standard 2-channel RS-232C communication module

Standard communication protocol is widely used in the marketplace, and new 2-channel RS-232C product is released as one of the general-purpose communication module lineup. This module provides customers with a wider selection of available devices, increases the number of supported networked devices, and contributes to lower total cost of SX system (See Fig. 6).

Fig.4 MICREX-SX supported network

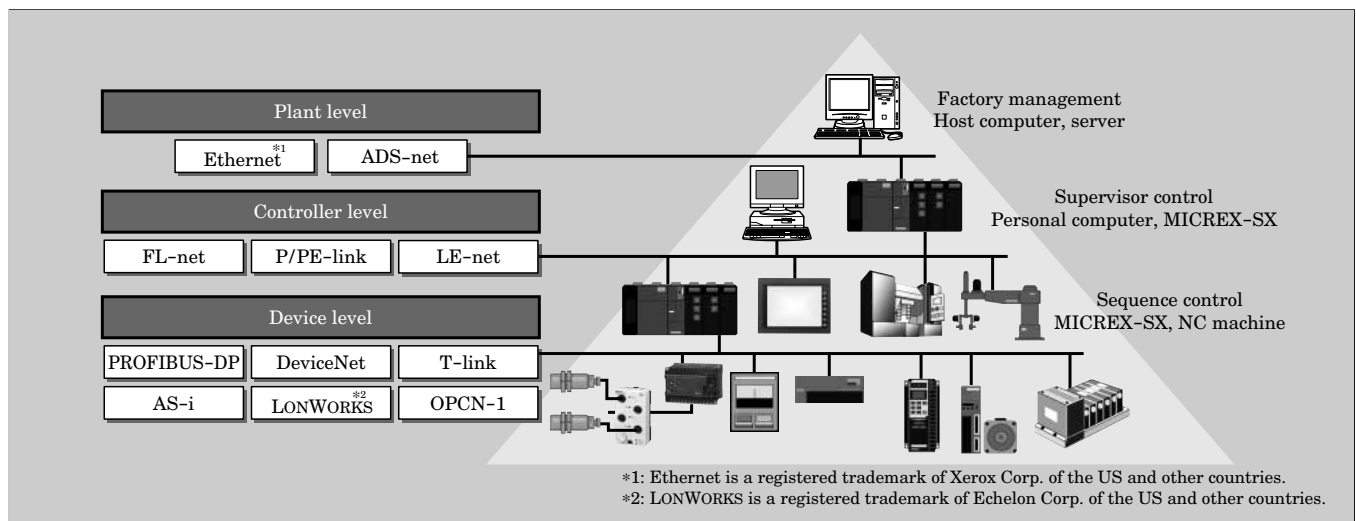


Fig.5 LE-net topology

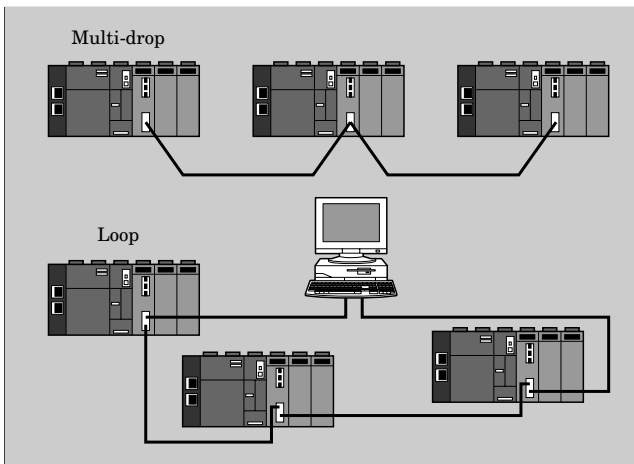
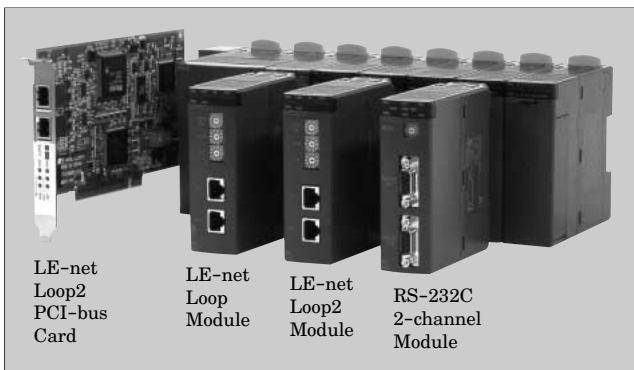


Fig.6 LE-net family of products and the RS-232C 2-channel module



5. Expanded Line of Analog Modules

NR2 series of I/O terminals has been expanded with the following four analog models that support OPCN-1 open network standard: (1) 8-channel analog voltage input, (2) 8-channel analog current input, (3) 4-channel analog voltage output, and (4) 4-channel analog current output.

5.1 Support of multi-channel analog measurement

Since analog I/O terminals did not exist, an SX bus expansion system or an assembled-type expansion system was used in order to construct an analog multi-channel system, as shown in Fig. 7. In this type of configuration, maximum 336 analog channels could be realized per system.

Figure 8 shows an example system configuration using analog I/O terminals. Here, the combination of analog I/O terminals with an I/O memory extension function of the CPU module realizes maximum 1984 channels per system configuration. Therefore, it can provide multi-channel data logging system at low-cost.

Fig.7 Example of conventional analog system configuration

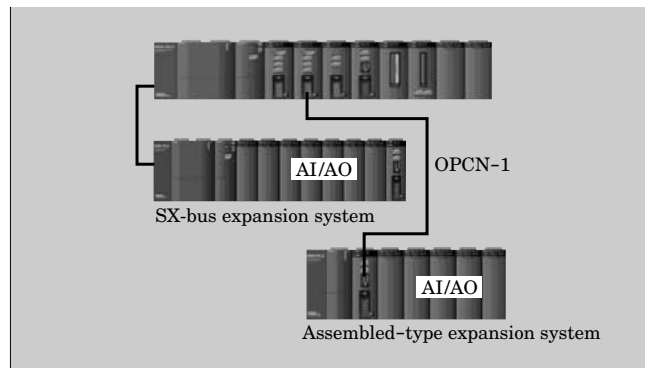
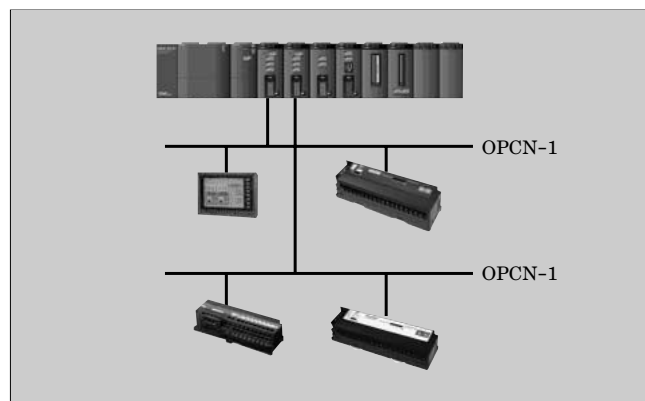


Fig.8 Example system configuration using analog I/O terminals



5.2 Improvement of analog performance

Since these analog I/O terminals realize performance improvements such as: (1) the smallest installation footprint in the industry, (2) 250 μ s/channel high-speed A/D and D/A conversion, (3) $\pm 0.1\%$ high accuracy, they support precision measurement control. Additionally, user interface is improved and range setting, a basic analog parameter, can be implemented from the front panel DIP switch.

6. Conclusion

The latest expanded line of MICREX-SX components and the status of certification acquisition for these components have been presented herein. A diverse variety of PLC functions and model types will be required in the future to meet the demands of increasingly globalized marketplace. Programming tools for MICREX-SX support five programming languages that conform to IEC standards, and when used in combination with the MICREX-SX family, they enable support flexible application programming in various fields. In the future, Fuji Electric intends to provide optimal systems that leverage the advantages of SX series.



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