New Features of PLC Programming Tools for MICREX-SX Series

Noriyuki Nakama
Koji Fukushima
Daisuke Wakai

1. Introduction

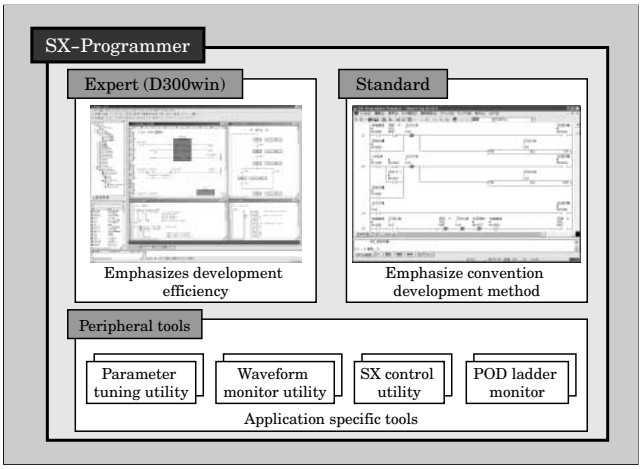
As performance and functionality of machinery and facilities have progressed, controller application software has year-by-year become larger in size and more complex. Meanwhile, shorter software development time is required, therefore controller support system is expected to provide more efficient software development environment.

Figure 1 shows an overview of the programming tools for "integrated controller MICREX-SX series."

(1) SX-Programmer Expert (D300win) (hereafter referred to as the "Expert") aims to improve development efficiency through genuine structured design.
(2) SX-Programmer Standard (hereafter referred to as the "Standard") inherits the conventional ladder programming method and still facilitates structured design, which is a characteristic feature of MICREX-SX series.
(3) Application specific tools efficiently support system startup, operation, and maintenance.

These controller programming tools for MICREX-SX are compatible with various development methods, from conventional ladder programming to genuine structured development, and provide efficient development environment throughout the lifecycle from development, operation, to maintenance. This paper describes the latest progress of these programming tools.

Fig.1 Overview of PLC programming tools for MICREX-SX series



2. SX-Programmer Expert (D300win)

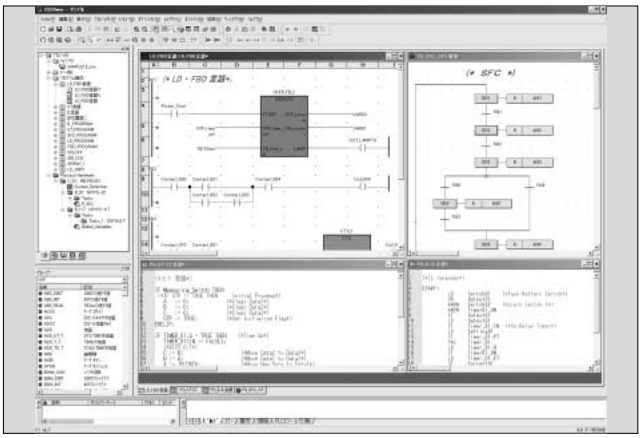
2.1 Overview

The Expert is a programming tool that realizes high level conformity to IEC61131-3 standard programming concept for programmable logic controllers (PLC), and enables genuine structured design. Figure 2 shows a screenshot of Expert programming screen. The Expert can support larger scale and more complexity of recent programs, furthermore it aims to improve development efficiency and management efficiency.

2.2 Enhancement of structured development

Based on IEC61131-3 standard, basic program units are called "program organization units" (POUs). Depending on the increase of POUs, program management becomes more complex as a program is getting larger in size, therefor group-management capability of associated POUs in a tree format has been added. This function can provide hierarchical management of up to 6 tiers, and allows POUs on the tree to be edited with drag and drop operations. As a result, POUs can be classified associated with function units, process units or the like, to enhance further the efficiency of

Fig.2 Programming screen of Expert support tool



structured design. Figure 3 shows a screenshot of this function.

2.3 Large-scale project development support

With increase trend of application software size, it is getting common for several developers to work together for a program development jointly. In such case, management of the concurrent development is complicated, and there is a risk that the development efficiency may decrease as a result of the increase in man-hours necessary for management tasks or due to a management mistake. Thus, multi-user support function has been developed, an overview of which is shown in Fig. 4. This function enables program files to be consistently and exclusively managed with a center server. As a result, it is able to avoid simultaneous changes to the same program from multiple developers, and meanwhile, the historical management of the master program is facilitated.

2.4 Enhanced variable management

Variable programming that does not depend on a PLC memory address is a fundamental concept of the Expert to improve program modularization and reusability. Variable names are often defined with sequential numbers. In such case, as shown in Fig. 5, linking those definitions to spreadsheet software such as Excel*1 is an extremely effective technique. From the beginning the Expert has supported a function to import and export data from and to Excel, and has subsequently added cut and paste operations between a variable definition worksheet and Excel, so that the variable definitions may be used directly. With this functionality, the tasks of defining and managing variables can be implemented with greater efficiency.

*1: Excel is a registered trademark of Microsoft Corp. in the US and other countries.

Fig.3 POU group managing function

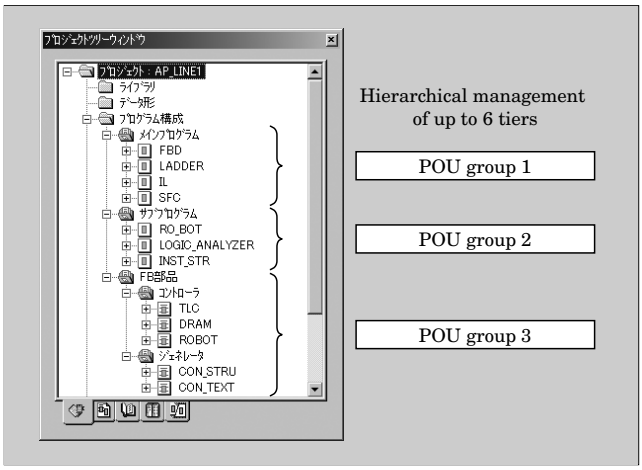


Fig.5 Mutual use of variable declaration between Expert and Excel

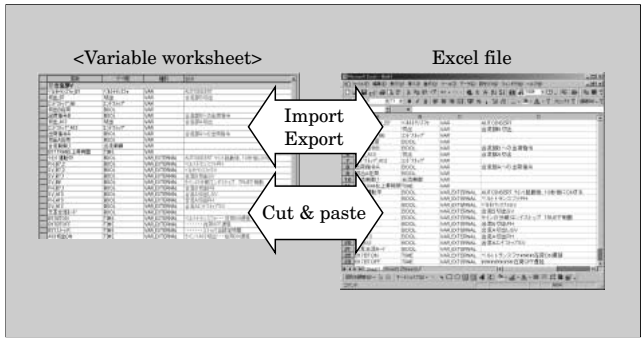
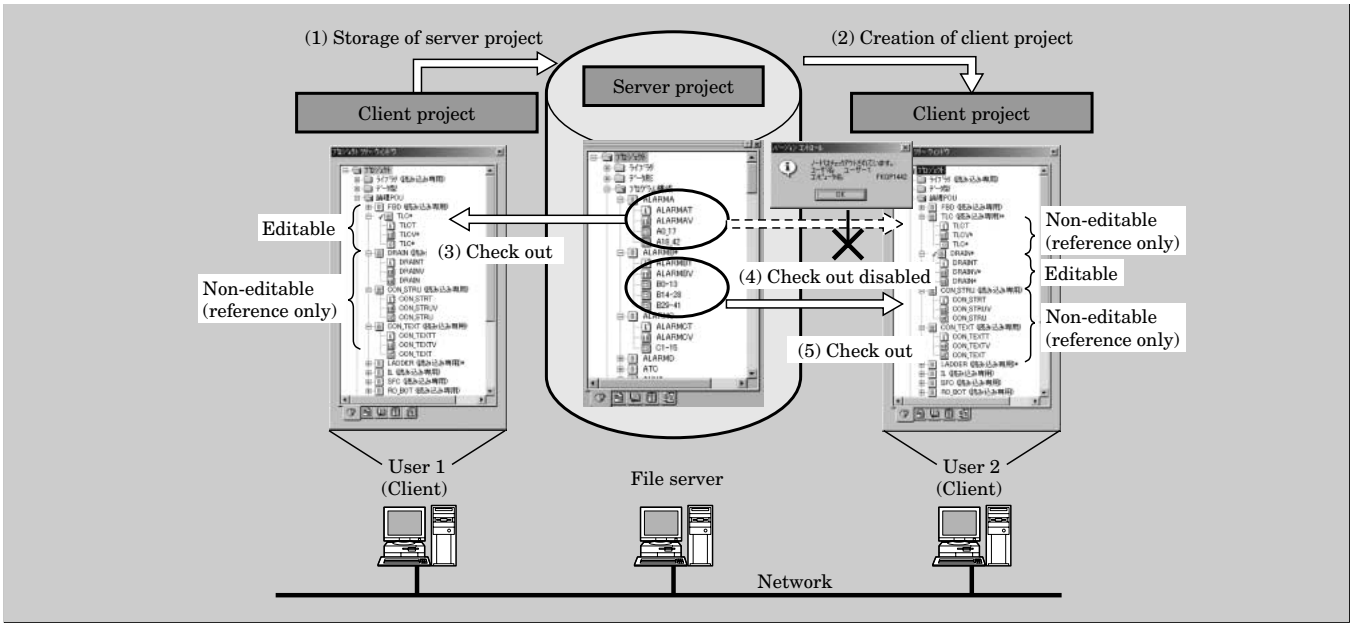


Fig.4 Multi-user support function



3. SX-Programmer Standard

3.1 Overview

The Standard is a conventional-type ladder programming tool that facilitates structured programming. Conventional tool elements, such as scrolling of the whole program area, implementing programming changes while running, uploading with complete restoration and the like are realized without limitation. Meanwhile, function blocks (FBs), structured text (ST) language and the like, which are essential for structured and modular design, can be used with conventional skill. By facilitating the use of structured programming technology on a conventional-type tool, Fuji aims to increase development efficiency with programming methods familiar to major PLC user. Figure 6 shows the programming screen of the Standard.

3.2 Enhancement of structured programming

(1) FB expression

FB is a modular program structure, and its function is essential to improve programming efficiency. As shown in Fig. 7, the Standard uses two types of FB call expression, a conventional data instruction type and a box type. The data instruction type has the advantage of collapsing parameters, but the box type has the advantage of easy understanding correlation between input and output.

(2) Program display

With the Standard, POUs are treated as pages. The display method can be switched between a scroll mode for scrolling through whole program area and a mode for managing whole program structure with a tree configuration. As these two modes reduce barriers to the transition from a conventional programming culture to a structured programming culture, it aims to increase user convenience. Figure 8 shows the program display modes.

3.3 Support of ST language, arrays and structures

The standard provides ST language, optimal for the effective modularization and reuse of program parts, and well suited for describing computational control. Program described by ST language can be modified during uploading or while the PLC is running without limitation. Furthermore, debug functions such as break points and step execution can be used. Arrays and structures are also supported, therefore, it can be applied into instrumentation field, such as

Fig.6 Programming screen of Standard support tool

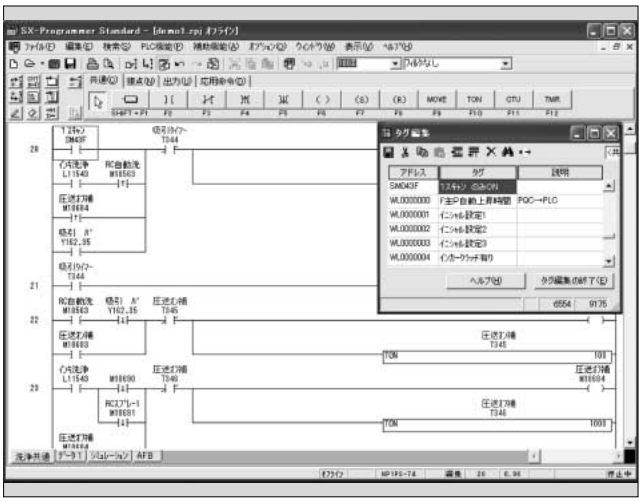


Fig.7 FB expression

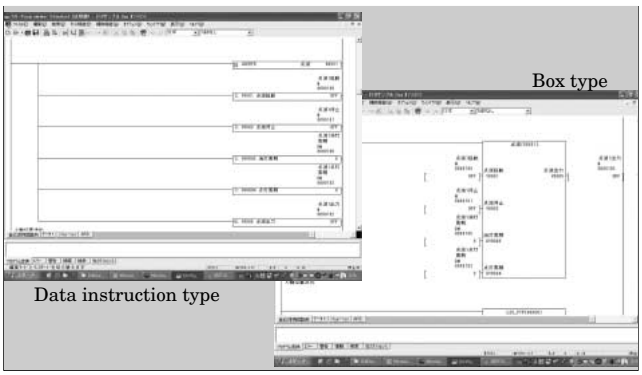


Fig.8 Program display modes

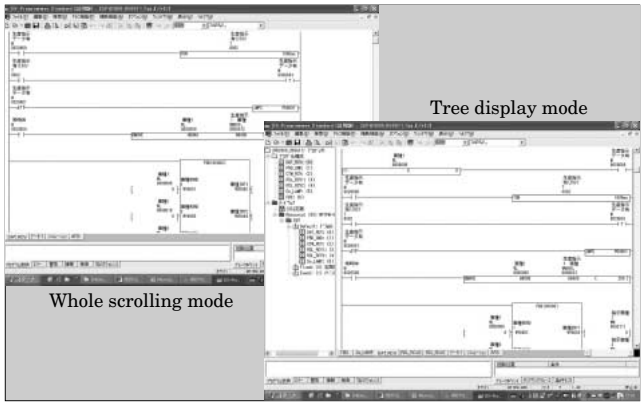
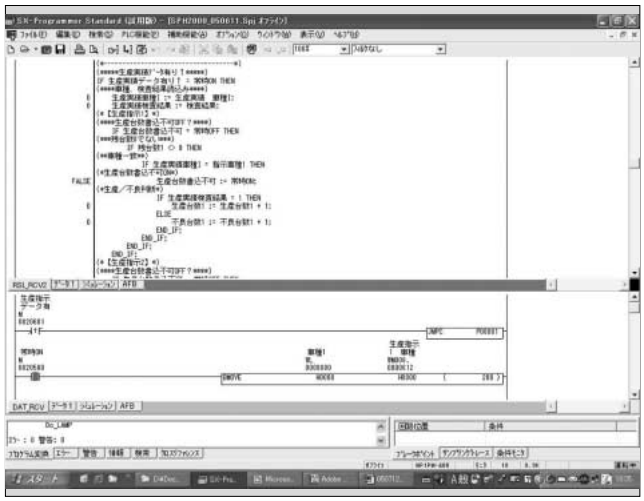


Fig.9 ST programming screen on Standard support tool



temperature control system. Figure 9 shows the ST language programming screen.

3.4 Simulation

Simulation tool, which is provided as a standard function, enables program debugging without having an actual PLC ready. As a result, the logical operation of a program can be verified on a PC. Moreover, as I/O devices such as switches, lamps and the like can be positioned on the screen, it can provide a debugging environment that resembles a control panel. Figure 10 shows an example screenshot of simulation.

4. Application Specific Tools

4.1 Parameter tuning utility

Parameter tuning utility is a software tool that provides a function for tuning and managing operating parameters in instrumentation systems, temperature control systems, and the like. In case of instrumentation systems, management of lots of operating parameters is extremely important. Thus, parameter tuning utility has been developed as a tool for modifying, tuning, performing historical archiving, and saving operation parameters associated with an FB such as PID or other loop control block. Since operation and maintenance workers may not know programming or operation of the Expert, this parameter tuning utility has been developed as a custom tool independent of the Expert. This tool enables consistent management of programs and parameters.

Moreover, since the sheet for tuning and managing parameters is generated automatically from the Expert, there is no need for labor-intensive screen generation tasks. Figure 11 shows a screenshot of the parameter tuning utility.

Fig.10 Simulation screen on Standard support tool

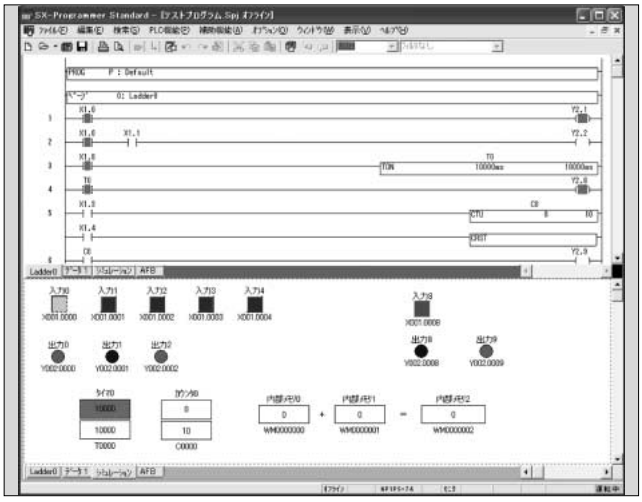
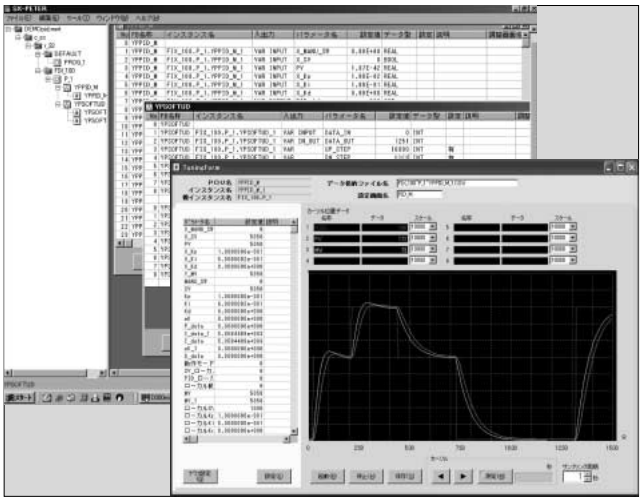


Fig.11 Parameter tuning utility screen



4.2 Waveform monitoring utility

The waveform monitoring utility is a custom tool to display waveforms sampled by a PLC. This tool is capable of segmenting signals, sampling, and then assembling them to generate continuous waveform. In addition, this tool provides various other functions such as merging and superpositioning, which are useful in waveform analysis. Figure 12 shows a screen shot of the waveform monitoring utility.

Fig.12 Waveform monitoring utility screen

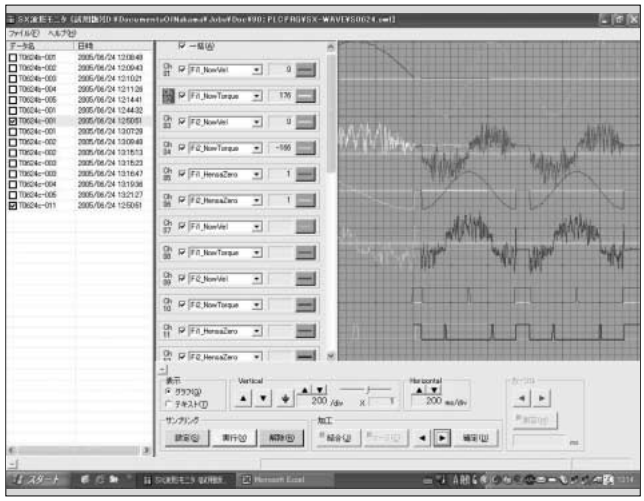
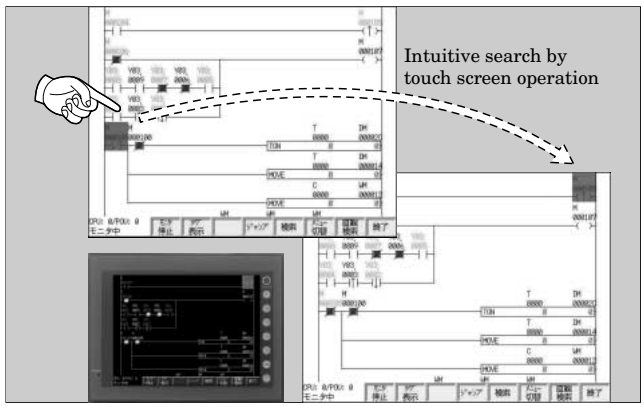


Fig.13 POD ladder display



4.3 POD ladder monitor

POD ladder monitor is a tool intended to facilitate the timely provision of information for the purpose of a primary diagnosis to engineers and maintenance workers, and therefore to reduce the mean time to repair (MTTR) of the system when system trouble occurs in the machinery or facilities. Ladder programs developed with the Standard can be displayed and monitored on programmable operation display (POD) UG series, and intuitive program search can be performed by touching contacts and coils on the ladder diagram. Figure 13 shows a screenshot of the POD ladder monitor display.

5. Conclusion

An overview and summary of the progress in controller support tools for MICREX-SX series has been presented above. In the future, Fuji Electric continues not only to develop each support tool, but also to broaden the scope of tools by enhancing cooperation among the various support tools and computer aided design (CAD) system, and human-machine interface (HMI) tools in order to increase productivity.