Programmable Operation Display for MICREX-SX Series

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1. Introduction

In 1988, Fuji Electric was the first to manufacture a programmable operation display (POD). The latest control equipment is comprised of a programmable controller as the controller and a POD as the man-machine interface (MMI) that is indispensable for factory automation (FA).

PODs must be provided with not only pilot lamps and switch functions but also with advanced information such as operation conditions of the equipment and data and video images for maintenance performed by simple operation. In addition, accompanying the increase in the PODs' functions is a strong demand for the rationalization of application software development and improvement in its efficiency.

Based on the new concept Fuji Electric has developed the new POD UG series as the MMI for the integrated controller "MICREX-SX series" (refer to Fig. 1).

This paper introduces the new UG series (UG220, 320, 420, 520) and its corresponding programming support tools.

2. Outline of the New UG Series Products

2.1 Configuration of the new UG series

While the present UG series has two screen sizes of 5.7 inches for the UG210 and of 10.4 inches for the UG400, the new UG series has four screen sizes the above mentioned two sizes along with the additional 7.7 and 12.1 inches. In particular, the 7.7-inch UG320 series, though small in sized, has the same resolution as the 10.4-inch UG400 series and should have a significant impact on the market for medium-sized PODs requiring a small size and low cost. On the other hand, the 12.1-inch UG520 series has a larger screen and additional functions such as monitoring of the video camera image display to meet the increased application of monitoring systems.

Table 1 shows the model listings of the present and new UG series of PODs.

2.2 The aim and features of the new UG series' development

The central aim of the development of the new UG series is described below. Tables 2 and 3 show the specifications of the products to be developed.

2.2.1 Realization of high-speed processing

With the increase of required functions such as macro processing and compatibility with various networks, the problem with the PODs was to increase processing speed.

Owing to the adoption of 32-bit RISC processors, the new UG series realized nearly a fivefold increase in CPU processing speed as compared with the former series. To achieve this high processing speed, a new gate array of 33,000 gates has been developed to incorporate PCI bus controllers and serial communication circuits into the gate array. This resulted in the first adoption of the latest graphic accelerator for the personal computer in the PODs and an increase in plotting speed.

2.2.2 Small-size and easy-to-use construction

The appearance and frame were all newly designed. The construction was designed to be impervious to dust and drips and resistant to vibration. The new UG series has a new construction consisting of front, inside and rear blocks. This enables each block

Fig.1 External view of the new UG series

Table 1 Model listing of the PODs

Screen size	5.7-inch	7.7-inch	10.4-inch	12.1-inch
Present series	UG210	—	UG400	—
New series	UG220	UG320	UG420	UG520

Table 2 General specifications of the new UG series

Item \ Model	UG220	UG320	UG420	UG520
Supply voltage	24V DC		85 to 265V AC	
Power consumption	10W	20W	45VA	50VA
Withstand voltage	1,500V 1 min. between external DC terminals and the case		1,500V 1 min. between external AC terminals and the case	
Noise immunity	By a noise simulator of 1,600V p-p (noise width: 1 μs, 50 ns and noise frequency: 30 to 60Hz)			
Vibration resistance	In accordance with JIS C 0911			
Impact resistance	In accordance with JIS C 0912			
Ambient temperature	0 to +50°C (0 to +40°C for STN)			
Ambient humidity	85%RH or less (no dew condensation)			
External dimensions	182 × 139 × 50 (mm) + op2*	230 × 175 × 66.1 (mm) + op2*	310 × 240 × 92.3 (mm)	334 × 270 × 95.8 (mm)
Size of installation hole	175 × 132 (mm)	220.5 × 165.5 (mm)	289 × 216.2 (mm)	313 × 246.2 (mm)

* op2 (option 2): Purchased separately and provided for the main system

Table 3 Performance specifications of the new UG series

Item \ Model	UG220	UG320	UG420	UG520
Display device	LCD monochrome, STN color	STN color	TFT color, STN color	TFT color, STN color
Number of dots (screen size)	320 × 240 (5.7 inch)	640 × 480 (7.7 inch)	640 × 480 (10.4 inch)	800 × 600 (12.1 inch)
Maximum number of touch switches per screen	768 (Analog resistance film, resolution 1,024 × 1,024)			
User program memory	Flash memory 1MB (expandable to 5MB)			
Interface with host controller	RS-232C, RS-422 (RS-485)			
Modular connector No.1	RS-232C, RS-422 (RS-485), for programming tools, bar code reader, memory card recorder			
Modular connector No.2	RS-232C, RS-422 (RS-485), for bar code reader, memory card recorder			
Printer interface	In accordance with Centronics (NEC PR201, EPSON ESC/P code and its compatible machines)			

to be assembled separately and in less time than required, to comply with various specifications, and backlights that can be easily replaced.

Through assembling built-in on-board control devices into a chip and gate array and mounting high-density electronic parts with multilayer boards, the screen size could be increased compared with POD bezel dimension (an increase in the proportion of effective display area).

2.2.3 Improvement in programming functions

The programming support tool for the new UG series (known as the POD editor) has become easier to use through the incorporation of Windows' operability for Windows NT*1 and Windows*2 95, and the adoption of the same operation procedures as those of the programming support tool of the scalable multi-controller SPH as part of the integrated support system. In addition, in order to enable the creation of images with relative ease, the following three functions have been improved or added, along with about 100 other items.

Table 4 Optional specifications of the new UG series

Item \ Model		UG220	UG320	UG420	UG520
Memory cassette (2M bytes, 4M bytes)		×	op2	op2	op2
Interface memory card		×	×	op1	op1
External card recorder		op3	op3	op3	op3
Interface with video input		×	×	op1	op1
Interface with analog RGB input		×	×	op1	×
Additional I/O unit		op3	op3	op1	op1
Communication interface unit	JPCN-1	op2	op2	op2	op2
	T-link	op2	op2	op2	op2
	SX bus	op2	op2	op2	op2

op 1 (option 1): Incorporated into the main system at the factory
op 2 (option 2): Purchased separately and provided for the main system
op 3 (option 3): Purchased separately and provided outside the main system

(1) End-position-searching function, which permits plotting with the same operation as CAD, in which a cursor is automatically moved to the end of a line or to the corner of the graphics.
(2) Function to open multiple windows and to edit

*1 Windows NT: A registered trademark of Microsoft Corp., USA
*2 Windows: A registered trademark of Microsoft Corp., USA

Fig.2 An example of a video image display in the UG520

characters and bitmaps between those windows by means of cutting and pasting or copying and pasting.

(3) Data conversion function from the DXF file (CAD data file) to the graphic data.

The POD editor can support both the present and the new UG series.

2.2.4 Function enhancement

The major additional functions of the new UG series are described below. Tables 3 and 4 show performance and option specifications, respectively.

(1) Video input display function

Fuji Electric has developed a function that superimposes the video input (65,000 colors, color image signals) from an external video camera on the user's painting surface, and image monitoring by a video camera is now possible.

There are four channels of video input interfaces, one of which can be selected for display in an application. The image display size and position can be freely set by the POD editor (refer to Fig. 2).

(2) Color display enhancement

For display colors, 128 colors and a blinking display are possible by the addition of palette codes (UG220: 16 colors).

(3) Adoption of flash memories

In the new UG series, flash memories have been adopted to transfer system programs and font data from the POD editor. As a result, it has become possible to select a display language on the editor and to handle any language through transferring font data.

(4) Improvement in macro functions

Some commands have been added to obtain a total number as well as average, maximum and minimum values. The new UG series has realized nearly a fivefold speedup in CPU processing as compared with the present UG series.

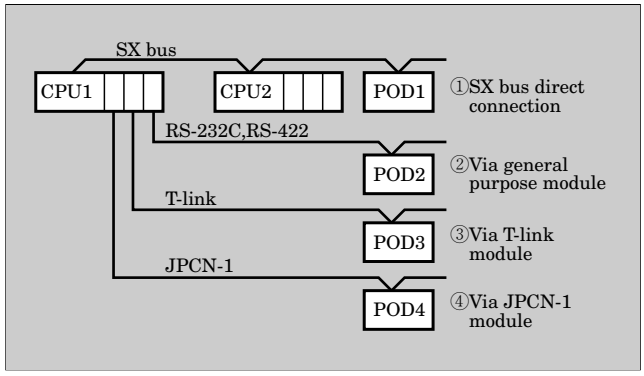
2.2.5 Support for various networks

The standard communication interface is RS-232C/ RS-422 programless communication (relating to 19 PLC manufacturers).

In addition, the communication interface part has been modularized and provided so that a POD body can support the increased use of various networks. This will allow the interface to handle various networks in the future.

Table 4 shows the support for the present open networks and Fuji Electric's original networks.

Fig.3 Connected form of PODs on the MICREX-SX system



3. POD as the MMI of the MICREX-SX Series

The new PODs of the integrated controller MICR EX-SX series will be described in the following.

3.1 POD connection pattern in the new UG series

There are four POD connection patterns in the MICREX-SX Series, as shown in Fig. 3. An SX bus can be selected when high-speed processing is required. RS-232C and RS-422 when the distance for connection is short and there are few devices, T-link and JPCN-1 when long distance connection is required and JPCN-1 when open networks are required.

Figure 3 shows only the connection patterns, but the SX bus can be connected to a total of up to eight scalable multi-controller SPH and software logic SPS (PC + software PLC with an SX bus interface inserted).

3.1.1 SX bus direct connection

PODs can be directly connected to an SX bus, the system bus of the MICREX-SX bus, without the provision of a special communication module on the side of the scalable multi-controller SPH. By means of a high-speed transfer of 25 Mbits/sec, high-speed response that conventional interfaces could have never achieved is now possible.

3.1.2 Connection via general-purpose communication modules

Connection of PODs with a PLC via general-purpose communication modules is the most common method of connection. The connection can be made at the ports of RS-232C and RS-422 featured as standard.

3.1.3 Connection with a T-link

PODs are connected to devices in Fuji Electric's original field network, the T-link, by providing a T-link interface module on the side of the SPH.

Extension of POD functions have been made so that SX loader commands might run on this T-link,

Fig. 4 Programming screen for specifying variable names

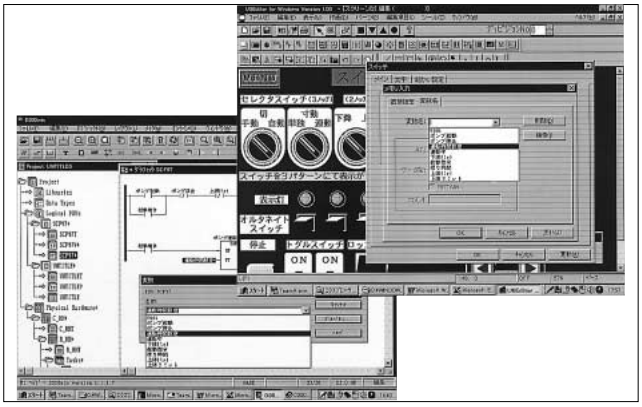
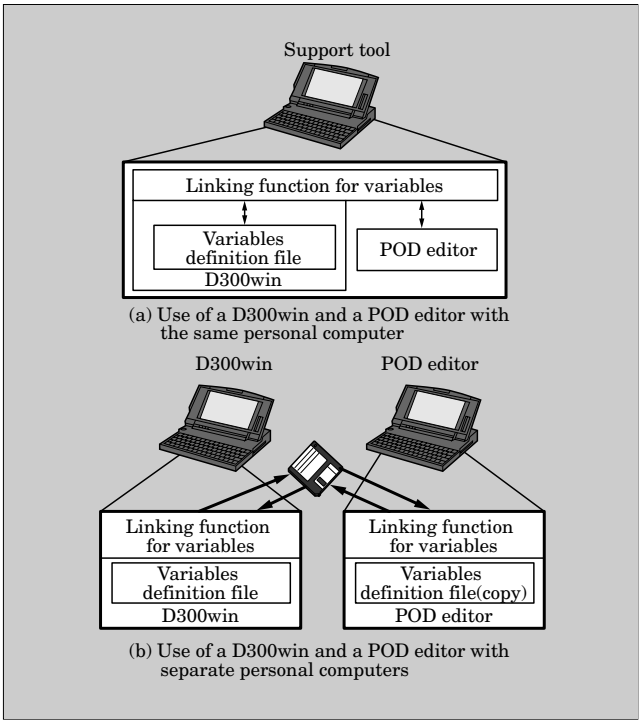


Fig.5 Linking function for variables



which has allowed compatibility of the PODs with former T-link devices and high-speed long-distance transfer.

3.1.4 Connection with JPCN-1

JPCN-1 is the standard network provided by the Japan Electrical Manufacturers' Association (JEMA). PODs are connected to devices in the JPCN-1 by the provision of a JPCN-1 interface module on the side of the SPH. Various I/O devices, including the products of other manufacturers, can be connected to the JPCN-1.

Communication with the PODs has enabled the connection between an SPH and an SPS possible by supporting GET/PUT commands of the JPCN-1.

3.2 Cooperation of programming support tools for controllers and PODs

3.2.1 Linking of variables

Transmission and reception between the former POD series and controllers (PLC) were defined by directly designating the memory addresses of the PLC-with a POD editor.

Scalable multi-controllers (SPH) of the MICREX-SX series conform to IEC61131-3 (formerly IEC1131-3). In their control programming, memory addresses are not directly used; rather, variables (signal names or labels) are used to increase the reusability of programs.

It is only natural that the same variables should be used in the image creation and programming of the PODs. For this purpose, support tools of the scalable multi-controller SPH (D300win) and those of the POD (POD editor) use the same variables definition file for data sharing among controllers and programs.

The variables definition file created while generating control programs can be read out, referred to and specified during programming of the PODs. More specifically, the programming includes an operation to specify variables used for display data and input data with a pull-down menu (refer to Fig. 4). The definition of new variables and redefinition of variables occurring during programming of the PODs can be reflected in the variables definition file.

Figure 5 shows the linking of a D300win and a POD editor.

3.2.2 The case of the same program development environment

Figure 5 (a) shows a standard method of simultaneously running a D300win and a POD editor on the same personal computer as a support tool.

Information on variables is stored in the variables definition file, as shown in Fig. 5.

The POD editor can access the variables definition file in the D300win with the linking function for variables and register and refer to the variables accessed. Common variables are automatically updated.

3.2.3 The case of a different program development environment

Figure 5 (b) shows a method of running a D300win and a POD editor on separate personal computers as a support tool.

In this case, the definition files must be separate in both support tools, and the data of both definition files can be exchanged between the support tools through floppy disks.

4. Conclusion

An outline of the development of the new UG series has been introduced in this paper. Fuji Electric will continue to develop small-sized PODs with diagonal screens less than 5.7 inches and improve the functions and usability of the PODs.