LINE-UP OF FUJI GENERAL-PURPOSE PROGRAMMABLE CONTROLLER

Keisuke Nakagawa
Shiroh Saeda

I. INTRODUCTION

In the recent years, controllers and automation equipment tend to be electronic types more and more, and in such a trend, programmable controllers (hereinafter abbreviated to as PC) application range is rapidly being expanded.

With the wealthy control techniques accumulated during many years, Fuji Electric has prepared two series of PC, FUJI MICREX series and FUJILOG series and responded to the wide needs. To be more specific, as a comprehensive electrical equipment manufacturer, Fuji Electric has manufactured and delivered various plants and equipment, and in this process, Fuji Electric developed the first PC of stored program system having a high function in 1971. Thereafter, Fuji Electric has successively arranged and expanded the technologies of the PC, and has manufactured and delivered PCs in the comparatively large scale control fields such as process controls in the steel plants, chemical plants and power plants.

On the other hand, use of the PC tends to increase also in the general-purpose medium and small scale control fields, and to respond to the needs, Fuji Electirc developed FUJILOG-μT as a general-purpose PC in 1977. Continuously to the trend like this, use of the PC has penetrated into small scale control fields more and more, and Fuji Electric has developed the board type FUJILOG-μB, FUJILOG-μYmini, etc. Further, as the PCs are used in small scale control fields more and more, the maintainability has been regarded to be important, and for this purpose, Fuji Electric developed FUJILOG-μY. Succesively to the development of FUJILOG-μY, Fuji Electric developed the highly functional PC FUJILOG-μH to correspond to the advancement of the PC into the control fields which require high functions such as comparison and calculation.

This paper introduces the whole aspect of the general purpose PC FUJILOG Series which can be applied to all the fields of medium and small scale controls requiring 1024 input/output points or less.

II. TYPE SERIES

When classified by the structures, the FUJILOG Series can be classified into rack type, board type and block type as shown in *Table 1*. For the rack type, all the units such as

I/O unit, power source unit and central processor unit are constructed in modules, and these modules are equipped in a rack. For this rack type PC, there are three types; namely, FUJILOG-μT (256 input/output) FUJILOG-μH (1024 input/output, and program loader built-in FUJILOG-μY (256 input/output). In the board type, as much input/output elements as possible are arranged on one sheet of printed wiring board (hereinafter abbreviated to as PWB). The power source, central processing unit, etc. are also arranged on one sheet of PWB so that the system can be composed of a small number of PWBs of a comparatively large size. For this board type PC, there are two types; namely, FUJILOG-μB and -μBmini (128 and 60 input/output). The block type uses PWBs arranged by each function such as I/O, power source and central processing units, and accommodates the PWBs compactly in a rectangular parallelopiped or regular hexahedron case. For this block type PC, there is FUJILOG-μT mini and -μYmini (112 input/output).

Also for the programming loaders, separate types such as FUJILOG-μT, -μH and -μB series, built-in type such as FUJILOG-μY and detachable type such as FUJILOG-μYmini are available, allowing a wide selection. Further, various support tools such as CRTs, printers, and PROM writers are available.

III. FEATURES

1. Features of FUJILOG-μT

1) Easy Programming

The instructions consists of four basic instructions R(READ), W(WRITE), A(AND) and O(OR)), functional instructions such as TMR (timer), CTR (counter), SR (shift register) and SC (step controller), and addresses of decimal numbers. Further, the instructions are so composed that the programmings can be made directly from the relay sequence (ladder diagram), and therefore, as long as the programmer has knowledges of relay sequential controls, he can make programs easily.

2) Easy Maintenance.

Each one of the central processing unit, power source unit, memory and I/O cards in the unit of eight points is constructed in a module, and these modules are accom-

modated in a case, composing a basic unit. Since each one of these modules is of a plug-in type, the removal, installation and replacement can be made easily, and this construction is very convenient for the maintenance and inspection.

3) The data memory can be used freely.

The data memory is so composed that the functional instructions such as auxiliary relays, TMR, CTR, SC and SR can be addressed freely without limitations and designations of memory area.

2. Features of FUJILOG-μH

In addition to the features of the FUJILOG-μT introduced above, the FUJILOG-μH has the following features.

1) Fast scan time

With such an extremely fast executing time as 25ms/ 8k words, the timing trouble which tends to become a problem in a 512-point class PC can be completely solved.

2) Wealthy instructions

For the instruction systems, there are sequential control instructions which are used to execute sequential controls only (for example, FUJILOG-μT) and sequential control expanded instructions which execute data calculations in the unit of a byte (8 bits). As for the sequential control instructions, flip-flop, differential, etc are added to those which have been provided in the FUJILOG-μT, further, program control instructions such as jump and end instructions are added, and total of 30 sets of instructions are available. For the sequential control expanded instructions, total of 25 sets of instructions including data transfer, addition, subtraction, comparison, invert and data shift are available.

3) Freely addressable non-volatile area.

When using a partial area of the data memory as a non-volatile one, the area can be addressed freely. Therefore, programmers can use the data memory extremely easily.

4) Wealthy diagnostic functions

As for the self-diagnostic functions, the FUJILOG-μH not only detects abnormal condition of the CPU itself but also supervises other devices, and detects abnormal occurrences on RAM and ROM and program errors. On the other hand, also as an external diagnostic function, the FUJILOG-μH has special diagnostic functions so that major and minor faults can be detected and output.

5) Highly interchangeable input/output cards

Except for the special cards, the input/output cards are compatible between FUJILOG-μT and -μY.

3. Features of FUJILOG-μY

1) Loader built-in type of high maintainability

Since the programming loader is built-in, operations and maintenances at various modes such as programming and monitor can be made easily at the operating site.

2) Wealthy diagnostic functions

The FUJILOG-μY has many diagnostic functions such as detections of broken expansion cable, loose connector, poor contact and five types of memory fault which were not provided in the conventional medium and small size PCs. Further, the data memory has a special area so that the PC can timely and correctly respond to major and minor

faults, providing high degree diagnostic functions.

4. Features of FUJILOG-μYmini

With the FUJILOG-μY's high degree functions and wealthy diagnostic functions kept in the PC, the FUJILOG-μYmini has reduced the dimensions and price. The number of input/output points of the basic unit is 40 and that of the expansion unit is 24. Small in dimensions, yet the FUJILOG-μYmini has such an outstanding extensibility as 112 maximum input/output points.

5. Features of FUJILOG-μB and -μBmini

These are board types of the FUJILOT-μT, and have the following features.

(1) The same support tools can be used commonly with the FUJILOG-μT.

(2) Programmable with the same simple instructions as the FUJILOG-μT.

(3) Has the same wealthy instruction sets as the FUJILOG-μT.

(4) Has the data memory which can be used as freely as in the FUJILOG-μT.

6. Features of FUJILOG-μTmini

FUJILOG-μTmini, a small in dimensions and low price PC has totally employed the functions and features of FUJILOG-μT and is block-constructed.

The external dimensions and composition are the same as above described FUJILOG-μYmini. The number of input/output points of the basic unit is 40. Up to three expanded units can be connected, and when three expanded units are connected, number of input/output points can be increased to 112 points. Further, the instruction words can be used commonly with FUJILOG-μT so that the special program loader and conventional program support tools can be applied, allowing an optimum tool selections.

7. Features of FUJILOG-μP

1) Freely made programming

With the input signals up to 32 points and AND and OR logics of the timer time up signals, step-by-step conditions can be selected. Further, the FUJILOT-μP has 16 useful functional instructions such as jump and subroutine, allowing an extremely flexible programmings.
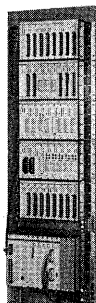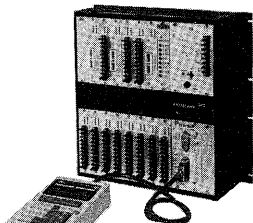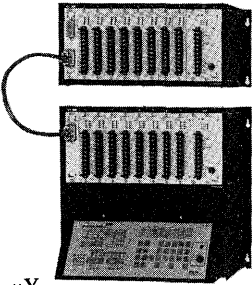
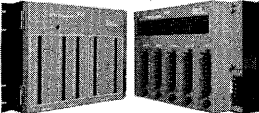2) Wealthy power failure processing functions

For restarting after recovery from a power failure, the FUJILOT-μP has a power failure processing function which was not provided in the PCs of this type conventionally, and 16 types of mode can be freely programmed.
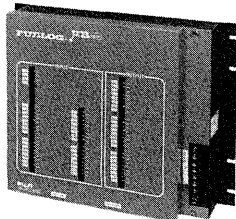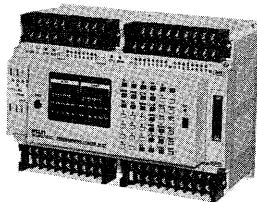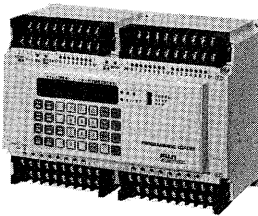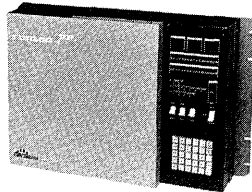
IV. POSTSCRIPT

The FUJILOG Series PCs are designed and manufactured so that they can be used for wide applications of medium and small scale controls under the optimum conditions. All the types of these series and programming devices which support the series will be introduced in a separate paper.

In the field of PC where the technological revolution is moving very fast, Fuji Electric will proceed developments of the products which meet with the generations.

Table 1 Specifications of Fuji General-purpose programmable controllers

		-µH	-µT	-µY	-µB
	External view				
	Construction	Rack type			Board type
Arithmetic and Logic processing unit	Programming	Stored program			
	Execution	Cyclic			
	Scan time	10~33.3 ms	20 ms fixed	Approx. 30/33 ms	20 ms fixed
	Instruction and function	○ Logic and timer/counter instructions: 25 sets ○ Data and arithmetic instructions: 25 sets ○ Program control instructions: 5 sets	○ Logic and timer/counter instructions: 18 sets ○ Other: 2 sets	○ Logic and timer/counter instructions: 14 sets ○ Other: 1 set	○ Logic and timer/counter instructions: 18 sets ○ Other: 2 sets (Compatible with FUJILOG-µT)
	Data memory	8192 points (1024 cards)	1024 points (128 cards)	Relay: 512 points Keep relay: 192 points Diagnostic relay: 32 points Timer/counter: 128 points Battery fault: 1 point	1024 points (128 cards)
Program memory	Capacity	8 k words max.	2 k words max.		1 k words fixed
	Unit of expanded capacity	2 k words (RAM) 8 k words (EPROM)	1 k words		–
	Memory element	RAM, EPROM	RAM, EPROM	RAM	RAM, EPROM
	Memory backup	NiCd battery rechargeable type (The data memory is also backed up with this battery)			NiCd battery rechargeable type (Backs up program memory only)
Input/output	Points	1024 max.	256 max.		64/104/128 points fixed
	Unit of expanded points	8/16 points	8 points		–
	Input	AC 100V, AC 200V, DC 24V, Switch input card			DC 24V
	Output	AC 100/200V, DC 24/48V, Relay card			DC 24V, AC 100/200V
General	Power source	Rated input AC 100V $^{+10}_{-15}$% 50/60 Hz			Rated input AC 100V $^{+10}_{-15}$% 50/60 Hz
	Environmental	0~45°C (RAM) 0~55°C (EPROM) 10~85% RH Without condensation		0 to 50°C (0 to 45°C for relay card) 10~85% RH Without condensation	0~45°C (RAM) 0~55°C (EPROM) 10~85% RH Without condensation
	Dielectric strength	AC 1500V 50/60Hz 1 minute			AC 1500V 50/60Hz 1minute
	Noise immunity	1000V 1µs With a noise simulator			
Programming support tool		Small size program loader UT34A, High function type loader A28H, CRT loader A38H	Small size program loader UT33A, High function type loader UT35P, CRT loader UT37P	Commercially available audio cassette recorder (program loader built-in)	Small size program loader UT33A, High function type loader UT35P, CRT loader UT37P

-µBmini	-µTmini	-µYmini	-µP
	Block type		Rack type
Stored program			
Cyclic			Step control
20~35 ms	20 ms (1024 words)	40 ms Mean	40ms/step (steping time)
○ Logic and timer/counter instructions: 18 sets ○ Other: 2 sets (Compatible with FUJILOG-µT, Temporary memory MRG is one stack)	○ Logic and timer/counter instructions: 18 sets ○ Other: 2 sets (Compatible with FUJILOG-µT, Temporary memory MRG is one stack)	○ Logic and timer/counter instructions: 14 sets ○ Other: 1 set (Compatible with FUJILOG-µY)	○ Logic and timer/counter instructions: 8 sets ○ Program control instructions: 9 sets ○ Other: 1 set
508 points (64 cards), 4 points for card address 0	512 points (64 cards)	Relay: 240 points Keep relay: 96 points Diagnostic relay: 32 points Timer/counter: 32 points Battery fault: 1 point	
0.5 k words fixed	1 k words fixed	0.7 k words fixed	80 steps fixed
–	–	–	–
EPROM	RAM, EPROM	RAM, EPROM	RAM
–	Capacitor and NiCd battery (also backs up data memory)	Capacitor (also backs up data memory)	NiCd battery rechargeable type
60 points fixed	112 points max.	112 points max.	64 points max.
–	8 points (output),16points (input)	8 points (output), 16 points (input)	8 points
DC 24V	DC 24V	DC 24V	DC 24V
DC 24V, AC 100/200V Relay card	DC 24/48V, AC 100/200V Relay card	DC 24/48V, AC 100/200V Relay card	Relay card
Rated input AC 8~10V 50/60 Hz	Rated input, AC 100V $^{+10}_{-15}$% 50/60 Hz	Rated input AC 100$^{+10}_{-15}$% 50/60 Hz	Rated input AC 100/200$^{+10}_{-15}$% 50/60 Hz
0~55°C 10~85%RH Without condensation	0~50°C 10~85%RH Without condensation	0~50°C 10~85%RH Without condensation	0~45°C 10~85%RH Without condensation
AC 1500V 50/60Hz 1 minute	AC 1500V 50/60Hz 1 minute	AC 1500V 50/60Hz 1 minute	
1000V 1µs With noise simulator			
High function type loader UT35P	Program loader A12T, and same as -µT series.	Commercially available audio cassette recorder (program loader detachable)	Commercially available audio cassette recorder (program loader built-in)