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FUJI PERSONAL CONTROL SYSTEM FPEC-10

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1 FOREWORD

The Fuji personal control system FPEC-10 is a user-friendly small and medium scale process control system with which a control system can be easily configured.

Especially, since it is a control system developed for user engineering (software-less sale), the user software is simplified considerably.

The system is outlined below.

2 DEVELOPMENT BACKGROUND AND FEATURES

Digitalization of instrumentation systems in the process control field is advancing steadily. Many users want to maintain the software of these digital instrumentation systems by themselves. In the chemical field especially, a greater many users with batch plants want to develop software by themselves from the time the plant is delivered. It is well known that a batch plant is a flexible plant. In the age of low growth, the batch plant is a plant form which will increase in the future to ride past the wave of diversification and sophistication of market needs.

However, from the standpoint of those in charge of instrumentation, whether they be user or manufacturer, a "flexible plant" is nothing but a "troublesome plant" which entails frequent system control program modification, correction, and addition. Therefore, "dependence on the manufacturer for maintenance and the rise of maintenance costs" are a problem to the user. This is also the reason why the user wants to develop and maintain the software himself.

On the other hand, the "offering of a simple and easy to understand control system" is a large topic for manufacturers also. This background was a large prime mover of FPEC-10 development.

The FPEC-10 has the following features:

(1) The main unit is a discrete type with integrated controller and man-machine interface and the PIO that connects the signals to the process is a small capsule type and both take up little installation space. Since the main unit and capsule type PIO are connected by a single cable, wiring cost is low.

(2) A system can be configured in TAG No. description format by using a powerful interactive type system configuration function. Since sequence design is performed by time chart system, normal complex sequence changes can be handled easily.

(3) Because the user can easily create the plant images used in plant operation by interactive image creation function, efficient plant operation is possible.

3 SYSTEM COMPOSITION

The FPEC-10 consists of a main unit, process interface unit, and a transmission unit that connects these two units. An example of a delivered system is shown in *Fig. 1*.

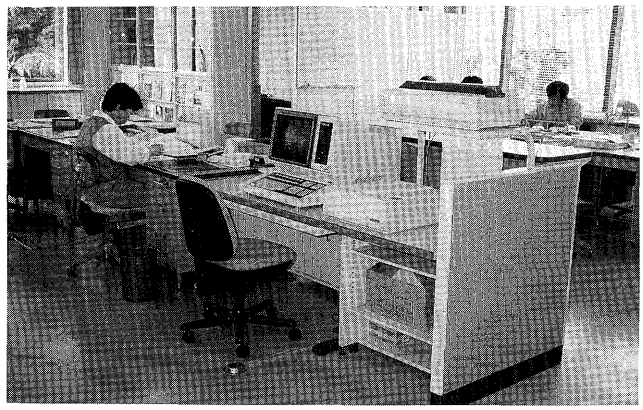
3.1 Main unit

The main unit is a discrete type with 3.5 inch floppy disk and 10MB hard disk. It receives the signals from the process interface unit and executes sequence control and loop control. The process is monitored and operated by CRT.

3.2 Process interface unit

The process interface uses the capsule type PIO that was favorable evaluated with the programmable controller MICREX-F. Various capsule type PIO are available, according to the kind of input/output signals and the application. Since it is also compact, a special locker is unnecessary and independent distributed installation is possible.

Fig. 1 FPEC-10 delivered to Tokyo Gas Engineering Co., Ltd. through Chiba Gas Co., Ltd.



3.3 Transmission unit

The main unit and process interface unit are connected by a high-speed transmission T-link. Connection as a remote PIO or distributed type PIO up to 1 kM is possible with one communication line.

Noise resistance can be improved and the transmission line extended by using an optical T-link adapter.

4 FUNCTIONS

The FPEC-10 functions system is shown in *Fig. 2*. These functions consist of controller functions that execute process control and man-machine interface functions that monitor and operate the process.

4.1 Functions of controller

4.1.1 Loop control function

Cascade control, ratio control, program control, and other kinds of control can be flexibly implemented by combining 32 internal instruments, including PID.

Loop control operation mode switching, program pattern switching, control starting and stopping, etc. can be freely performed with signals from sequence control.

4.1.2 Sequence control function

FPEC-10 sequence control is based on a step system. Of course, logic sequence is also possible.

In process control, the step sequence performs logical operations on the temperature upper and lower limits and valve opening process condition input signals and controls output devices with the result. With the FPEC, this sequence control is packaged.

Fig. 3 outlines the FPEC-10 sequence control function. There are two operation modes: AUTO and MANUAL. In the AUTO mode, the output devices registered in a time chart are controlled. In the MANUAL mode, output devices can be operated independently.

Fig. 2 FPEC-10 functions system

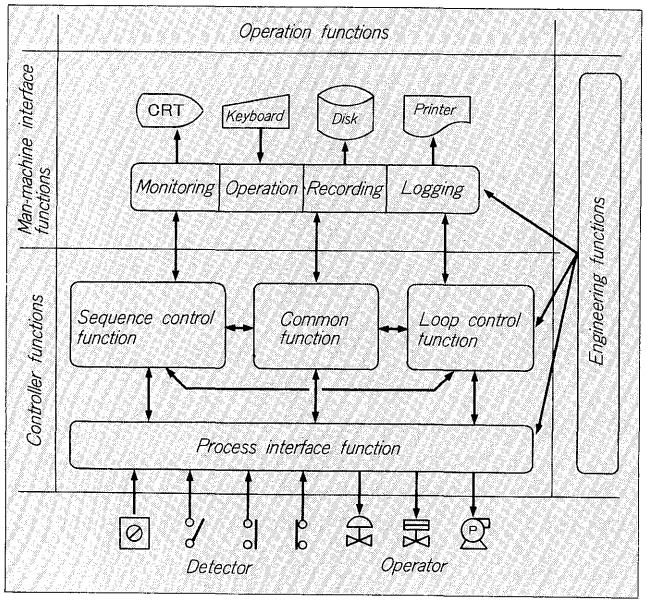


Table 1 Controller specifications

	Item	Contents
Loop control	Number of internal instruments	32
	Control cycle	1 sec (internal instruments $\leq$ 16) 2 secs (internal instruments $\geq$ 17)
	Kinds of internal instruments	7 kinds
	Program setting patterns	32 patterns
Sequence control	Sequence scale	32 patterns 32 output x 32 processes/sequence table
	Control cycle	Within 1 sec (SEQ Nos. 01~16) Within 2 secs (SEQ Nos. 17~32)
	Sequence elements *: Per sequence step	Contact input/output ..... 512 Analog input/output ..... 100 Timer ..... 128 Bit memory ..... 64 Word memory ..... 64 Process condition .....32 Sequence parameter * ..... 32 x 4 kinds
Additional functions	Kinds of common functions	Analog alarm setter ..... 32 Annunciator ..... 128 Switch ..... 64 Congestion monitoring..... 128 Transfer ..... 64 Counter..... 64

During automatic operation, manual intervention and operation of specified output devices and online modification of the output conditions are also possible.

The output devices that can be registered in the time chart have commands to timer and counter, sequence and internal instruments operation mode (AUTO, MANUAL) switching commands, process variables used in timer and loop control, and other control parameters. An output interlock signal can also be added for each output point of these.

A process fault processing function is also considered. The abnormal interlock signal specified for each process is constantly monitored and operation when the signal is received can be specified from among the following three operations:

(1) HOLD . . . . . Hold all outputs at present value.
(2) OFF . . . . . Turn off digital output.
(3) Process transfer . . Transfer to specified process.

All the sequence control functions described up to here are packaged for each sequence. The user can realize functional sequence control by defining signal names.

4.1.3 Common function

Common functions are functions used in common in loop control and sequence control. These functions are input signal upper and lower limites check function, valve and sequence process congestion detection function, annunciator function with logic calculation, etc..

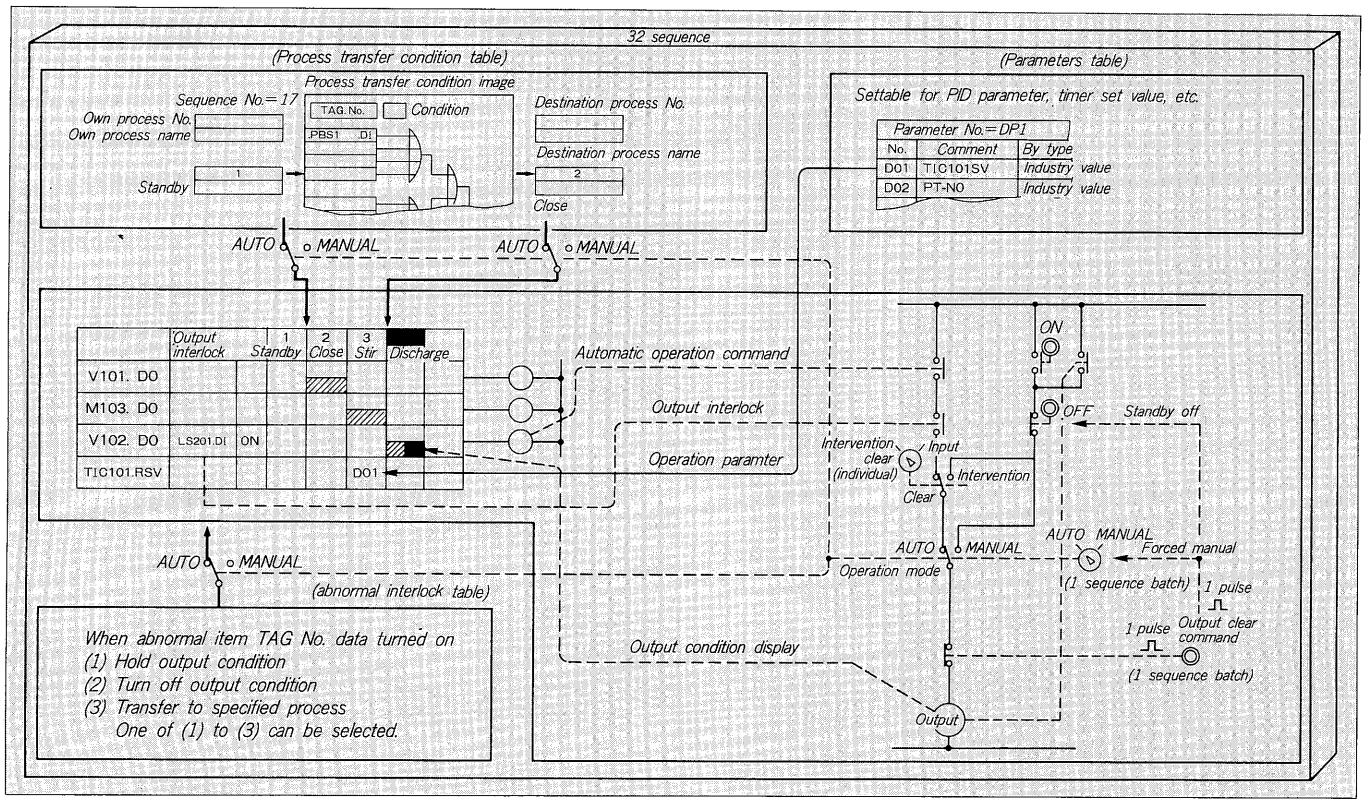
4.2 Man-machine interface function

The FPEC-10 basic concept is:

- Operation centered about plant image
- Word processor sense engineering

The man-machine interface function is completed so

Fig. 3 Sequence functions



that the conventional panel operation image plant image and controller functions can be implemented interactively.

4.2.1 Operation functions

As previously described, with the FPEC-10, plant operation is centered about a plant image.

Since the user can freely create a plant image by combining various display and operation elements, plant operation not only by manufacturer standard image, but also by userfriendly operation image, is possible.

With a system incorporating the main devices of the FPEC-10 controller functions, the following items can be monitored and operated with one plant image:

(1) PID controller (operation possible)
(2) Sequence process name
(3) Product name
(4) Annunciator (abnormality generation, deletion, confirmation color switching possible)
(5) Historical trend, real time trend
(6) Batch trend (with pattern superimposed display)
(7) Operation switches (lighted pushbutton switches)
(8) Timer display and setting
(9) Counter display and setting
(10) Product switching switch
(11) Alarm window (flicker display, confirmation stop possible)
(12) Others (graphic color switching, bar graph, numeric display)

These controller functions and man-machine interface functions are closely linked and the operator can grasp the necessary information at the necessary time.

Alarms generated during plant operation are posted to the operator by buzzer and CRT display. The top of the CRT is the alarm area. The kind of alarm is posted here by message.

The alarm contents can be checked without switching the image by specifying the alarm window display area in the plant image.

The operation support images listed in *Table 2* are available with the FPEC-10, in addition to the plant image. Since the sequence control image has various operation items as standard, simultaneously with grasping sequence operation dynamically, its power is displayed in debugging and plant adjustment.

The operation items are:

(1) Operation mode
AUTO/MANUAL switching
(2) Process specification (step feed)
Execution process switching
(3) Output clear
All outputs forced clear
(4) Manual intervention mode
Individual operation of specific devices during automatic operation
(5) Output device operation
Individual operation of output devices in MANUAL mode.

4.2.2 Engineering function

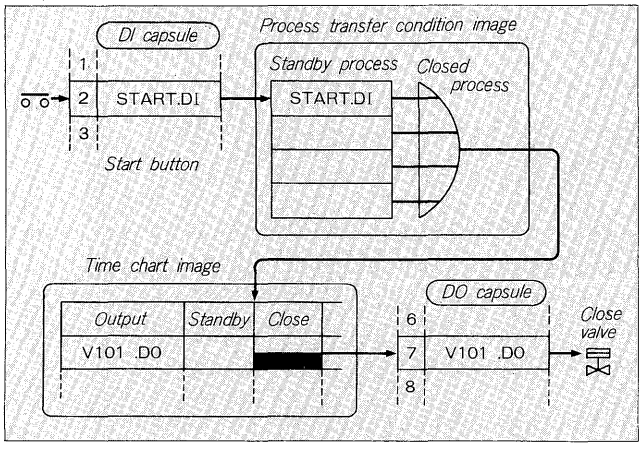
The engineering functions, which perform sequence control and loop control function configuration and plant image and logging creation, can be implemented interactively.

This interactive system configuration function is a

Table 2 Operation images

	Kind of image	Number of display points/ pages	Number of pages	Function
Monitoring and operation	Plant	128	24	Various displays and operations
	Trend	4	4	Data time series display
	Historical message	16	32	Operation record time series display
	Group	8	4	Internal instruments monitoring and operation
	Loop	1	32	Internal instruments operation data setting and adjustment
	Sequence operation	1 sequence	32	Sequence AUTO/MANUAL switching operation
	Process transfer condition			Process transfer condition display
	Abnormal interlock			Abnormal interlock condition display
	System condition display		1	System hardware abnormal monitoring
Operation data set	Analog alarm set	64 pages		Alarm set upper and lower limit values display and setting
	Parameter set	4 x 32 pages		Parameter display and setting
	Linearize pattern set	32 pages		Linearize pattern display and setting
	Program pattern set	32 pages		Program setter set pattern display and setting
Logging output	Data display	20 pages		Data display in printing format
	Arbitrary printing specification	1 page		Arbitrary printing start

Fig. 4 Sequence control design images



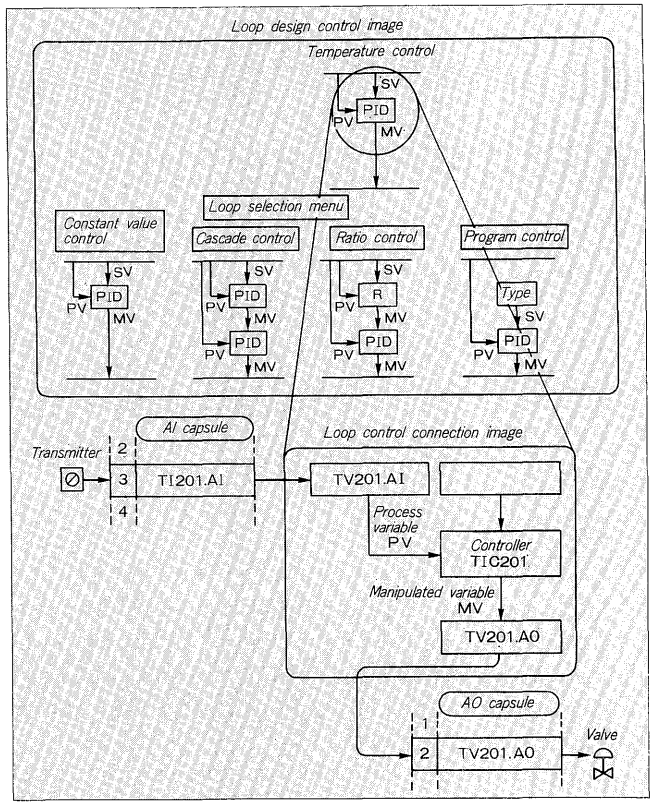
powerful support function which can be said to "see the program with the eye". Anyone familiar with the plant can configure the system without a special knowledge of programming.

(1) Sequence control design (*Fig. 4*)

Sequence control design is performed by using the following two images:

- Time chart image
  Defines the condition for each output device and process.

Fig. 5 Loop control design images



Process transfer condition image

Defines the process transfer signals.

(2) Loop control design (*Fig. 5*)

A loop can be designed with the same sense as designing a conventional single loop by using the following two images:

- Loop control design image
  Selects and assigns the control system from a menu.
- Loop control connection image
  Defines the process input and output (operated amount, measured amount) signals.

(3) Process interface design

Assigns the input and output signals defined by sequence control design and loop control design to capsule type PIO.

5 CONCLUSION

The FPEC-10 is a "simple" and "compact" control system developed for batch plants.

Since it was placed on sale, it has been used in boiler, reactor heating furnace, garbage processing, recipe management system, mixed gas monitoring and control system and various other fields and positive opinions have been received from all areas.

Besides the functions introduced here, a personal computer transmission function is also equipped. Our future aim is an easier to use control system to meet user expectations.