

# DIGITAL PROGRAM CONTROLLER

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## 1 INTRODUCTION

For many years, Fuji Electric has manufactured analogue program controllers [PROZET] as a temperature program controller for various industrial machines, especially for dyeing machines and heat treatment furnaces. Recently, however, automation of machines, energy saving and man power saving are far promoted, and higher functions and accuracy have been required for control systems of the industrial machines and equipment. To cope with the needs like this, control systems are moving to digital types, and temperature program controllers having a higher performance and extensibility have been required more and more.

The digital program controller (TYPE PVN) introduced herein was developed based on such a background as outlined above. With a micro-processor employed, the program pattern memorizing capacity is high, and to this controller, data transmitting functions can be easily added. Consequently, multiple program controls can be realized in a high accuracy, and by combining this controller with a higher level system, control systems can be established for multiple number of machines and many-kind-yet-small-quantity productions. Thus, this controller can be used for a wide range of applications such as dyeing machines, heat treatment furnaces, constant temperature ovens and ceramic industries.

## 2 FEATURES

- (1) Up to 99 program patterns can be set and stored into the memory

Maximum 99 kinds of program pattern (maximum 99 segments per pattern; total 1800 segments) can be set and stored into the memory, and required program patterns can be selected simply by operating the keyboard on the face.

- (2) Multi-function control parameter

The control parameters have various functions such as PID and output limiter, and for each parameter, up to nine kinds can be freely selected by each segment of the program pattern. With these functions, the same high quality

Fig. 1 Appearance of digital program controller (TYPE PVN)



control can be made from the low temperature range to the high temperature range of a set temperature regardless of rising or lowering of the temperature set gradient.

- (3) 10 point time signals — Can be used by each segment

10 points of time signal output can be freely set by each segment, and thus, program control can be made simultaneously with a single sequence control.

- (4) Function to transmit data to a higher level system

The controller can be connected to a high level system by adding a serial data transmitting interface, composing a group control system.

- (5) Easily used monitor function

Set values, measured values, program pattern numbers being executed, program run status, time signal output status and other operating conditions are displayed by LEDs on the face. Also equipped are each two deviation alarms and absolute value alarms.

- (6) Can be operated remotely by applying external signals

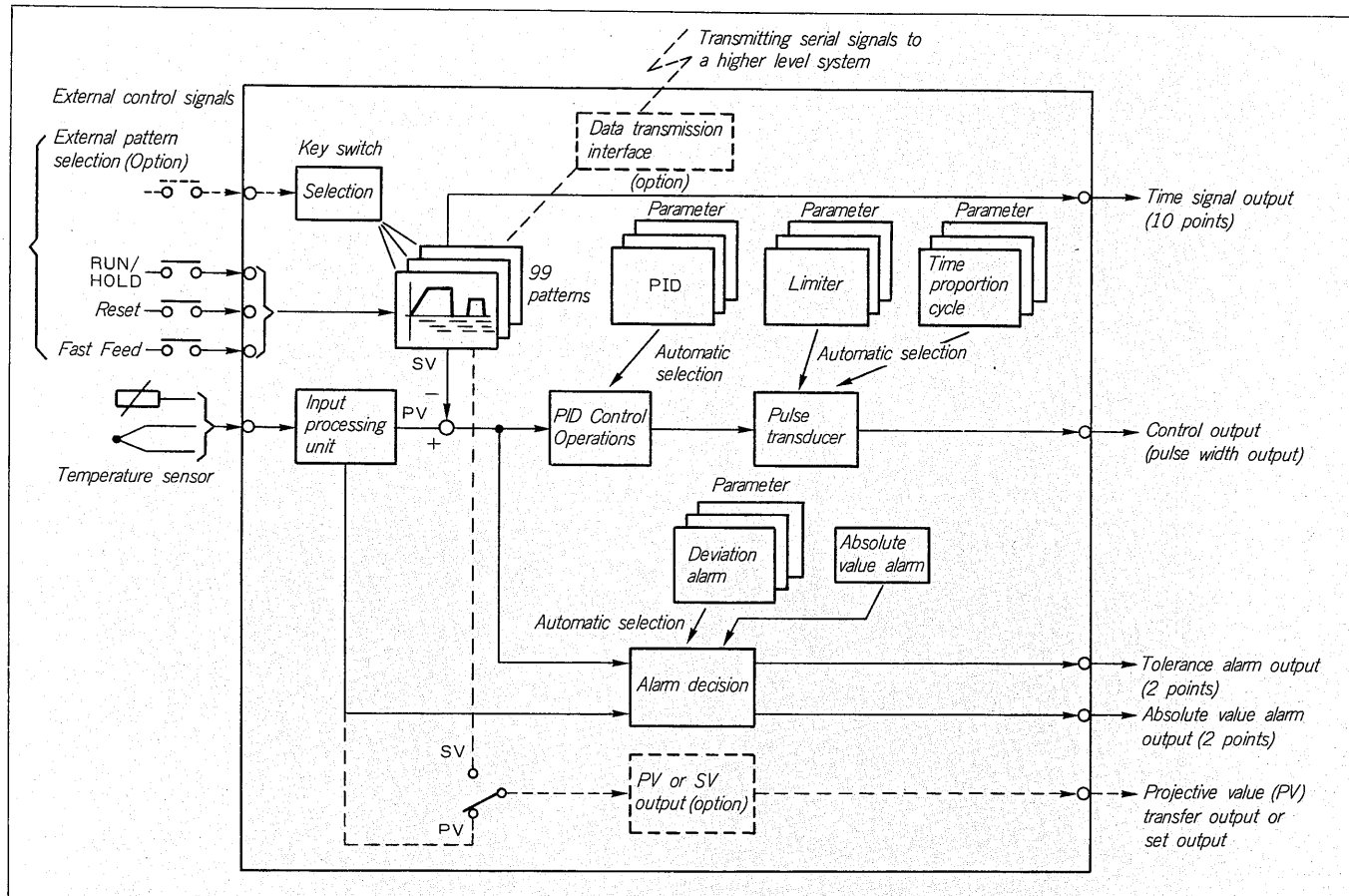
Program run/hold, time axis fast feed, and external selection of a program can be controlled by external contact signals.

## 3 CONSTRUCTION AND FUNCTION

### 3.1 Construction and operation

Fig. 2 shows the internal construction of this control-

Fig. 2 Functions of digital program controller



ler. This controller operates as follows. When a key switch is operated or an external operation signal is applied, the program pattern number to be operated is designated, causing each parameter to be prepared. When the controller enters the RUN mode, set values (SV) are sequentially operated based on the designated parameter and time. On the other hand, projective value (PV) is measured by a temperature sensor such as a thermocouple or resistance bulb, and the measured data are treated by linearize filter and other elements in the input processing unit. Then, the SV values are compared with PV values, PID operations are made, and operation output (MV) is prepared. In the pulse transducer unit, the MV values are converted to pulses by parameters such as limiter and time proportion cycle, and they are output as control output signals. Further, parameters are referred by each segment, and time signals and tolerance/absolute value alarms are output.

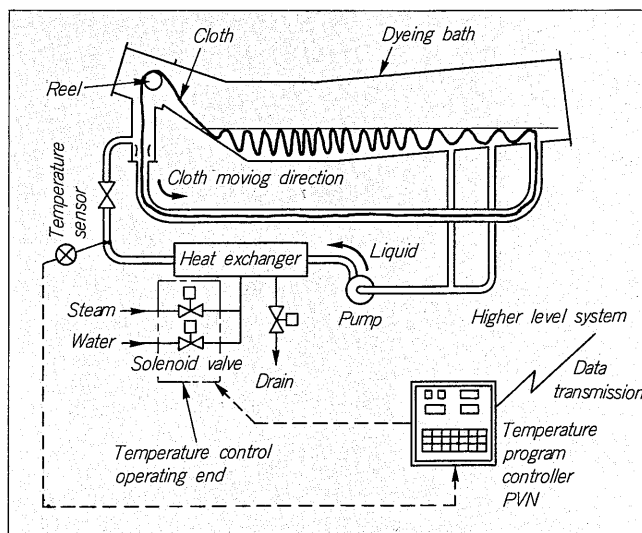
As for program run, the internal timer is controlled by touching the function keys or by external control signals, and program run, hold, fast feed and reset are made.

Table 1 shows the detailed specifications of this program controller.

### 3.2 Application examples

Fig. 3 shows an example, where the program controller is used for a liquid dyeing machine which is one of the

Fig. 3 Example of application to a dyeing machine



typical cloth dyeing machines. Generally, dyeing machines are equipped with a heat exchanger to control temperature of the dyeing liquid. Temperature of the liquid detected by a temperature sensor is compared with the temperature set on the temperature program controller, based on the control output signals, a solenoid valve is operated to control

Table 1 General specifications of digital program controller

Item		Specifications
Input signal	Input and set range	Thermocouple Resistance bulb • J 0~400°C (Pt 100 ohms at • K 0~400°C 0°C 3-wires) • K 0~1200°C • 0~150.0°C • E 0~800°C • 0~400°C • R 0~1600°C • -99.9~+99.9°C
	Digital signals for program run	RUN order, RESET order, FAST FEED order: Each one point Pattern selecting order (option): 3 points
Output signal	Control output	Time proportion pulse output: 1 point
	Time signal output	10 points
	Alarm output	Deviation alarm: 2 sets (upper and lower limits) Absolute value alarm: 2 points (upper limit)
	Auxiliary output (op (option))	Measured value output DC 1~5 V
	Self-diagnosing alarm output	CPU fault: 1 point
Program set	Program pattern	Number of segments (polygonal line): Max. 99 Time: 0 to 999.9 minutes Set range: Refer to the input signals above
	Number of patterns	Maximum 99 patterns However, within maximum 1800 of total number of pattern segments
Control operation	Element	8 bit micro processor
	PID control limiter operation	Nine kinds of parameter can be selected freely by each segment
Display	Set value	LED number display (4 digits)
	Measured value and others	LED 4-digit x 2 (PV and elapsed time), LED 2-digit x 2 (others such as operations)
Others	Power supply	AC 100/200 V, 50/60 Hz
	External dimensions	144 mm (H) x 144 (W) x 320 (D)
	Weight	About 5.2 kg
	Data transmission to a higher level system (option)	Serial transmission RS232C

volumes of steam and water (heat media) applied to the heat exchanger. The valves for heat media switching, water supply, dyeing liquid drain, etc. are operated by time signal outputs from the temperature program controller.

#### 4 POSTSCRIPT

The Fuji Electric's new program controller introduced in this paper is a product developed by reflecting the needs of manufacturers and users of the machines such as dyeing machines and industrial furnaces. It is assumed that, in the fields of these industries, the control systems including controllers will be subject to be further improved as higher quality and energy saving will be required more and more. The digital program controllers are products which respond to the requirements like this. Fuji Electric will continuously concentrate its efforts to respond to the needs of the users.