

# A Monitor and Control System of Distributed Electrical Panels for Construction Use

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## 1. Introduction

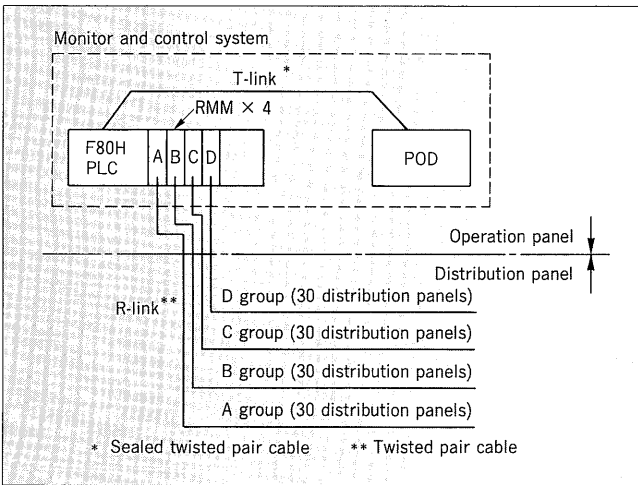
In factories and at construction sites, efforts to conserve energy, provide a stable power supply and to increase the functionality and reliability of individual devices have led to an increased demand for information networks to cover high and low voltage electric equipment.

This paper describes the monitoring and control of electrical system devices used in construction work, citing Fuji Electric's monitor and control system of distributed panels for construction use.

## 2. Outline

- (1) An operation panel is composed of a PLC (Programmable Logic Controller), 4 RMMs (Remote Multiplexing Master) and a POD (Programmable Operation Display). Four systems of signal transmission can be in operation. (Fig. 1)
- (2) Although 30 distribution panels can be in operation per RMM, since signal transmission and reception is performed by a pair of distribution panels, an even number must be installed.
- (3) If more than 120 distribution panels are used, several operation panels will be required.

Fig. 1 System construction



- (4) An RM (Remove Multiplexing Terminal) in a distribution panel can be placed in operation by merely setting its address. Overlapping address are prohibited.
- (5) As the shape and size of the distribution panels differ from customer to customer. Fuji Electric will supply the component pieces and a circuit example. The customer will construct the distribution panels themselves. (Figs. 2, 3)

Fig. 2 Operation panel layout

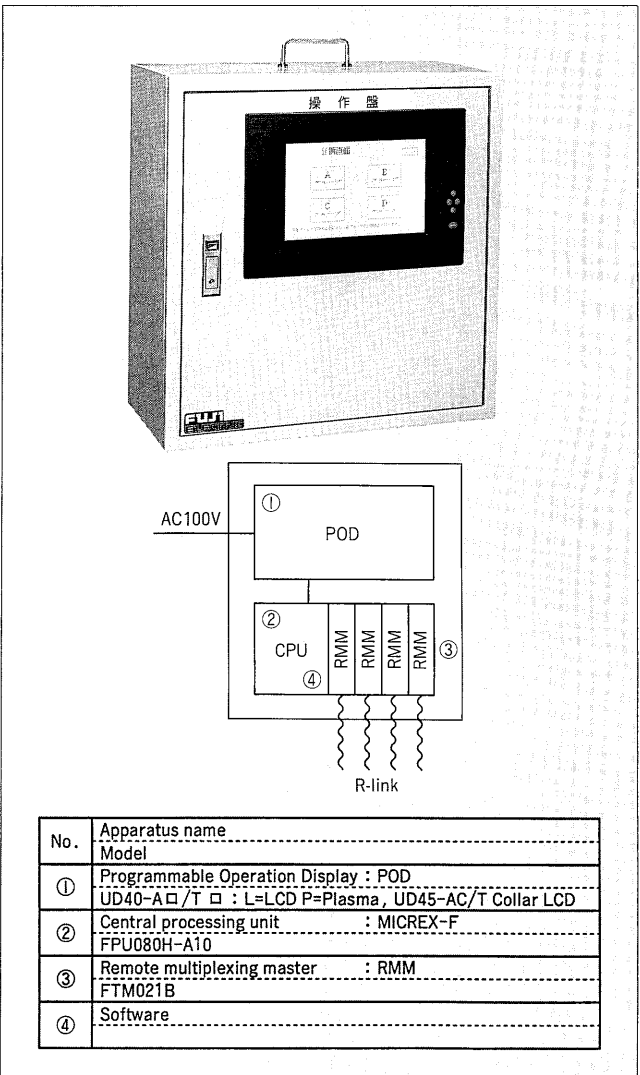
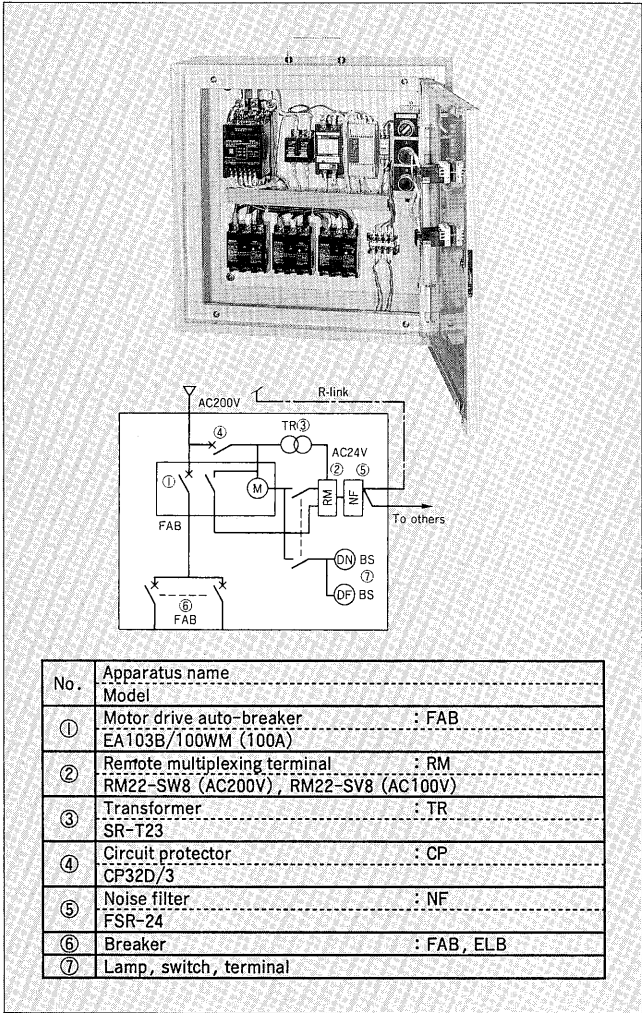


Fig. 3 Distribution panel construction



3. Features

This monitor and control system of distributed electric panels for construction use aims to reduce electricity consumption and to increase wiring efficiency. The main features are listed below.

- (1) At the office it is possible to turn on and off a circuit breaker or group of circuit breakers which are a distance away. This reduces unnecessary electrical power consumption, and results in a large savings of energy.
- (2) The easy to operate Fuji POD is utilized. A built-in dialogue system makes it possible for anyone to operate the POD correctly.
- (3) A small-sized transmission RM unit, which can use twisted pair cables, is utilized as signal transmission equipment. Within the limited total length, it is possible that the signal cable may branch off anywhere. This makes the wiring more efficient.
- (4) One hundred twenty (even number) distribution panels can be connected to one operation panel. Since there are four signal systems due to a stable power supply, it is easy to construct the overall system according to the scale of facilities.

Fig. 4 Size and length of signal cable

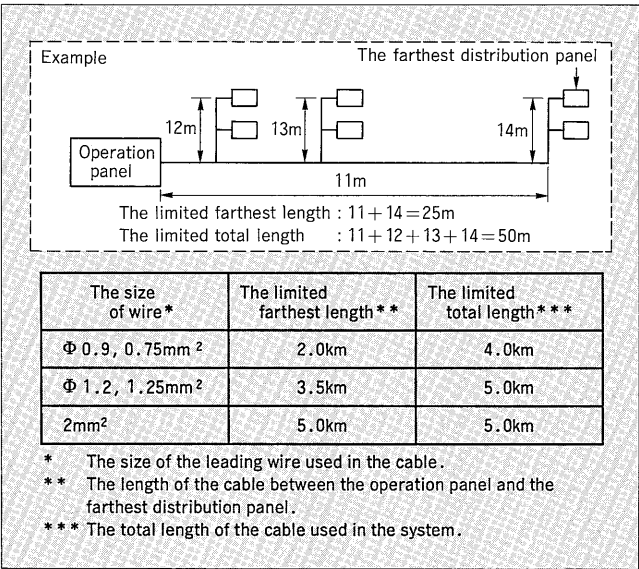
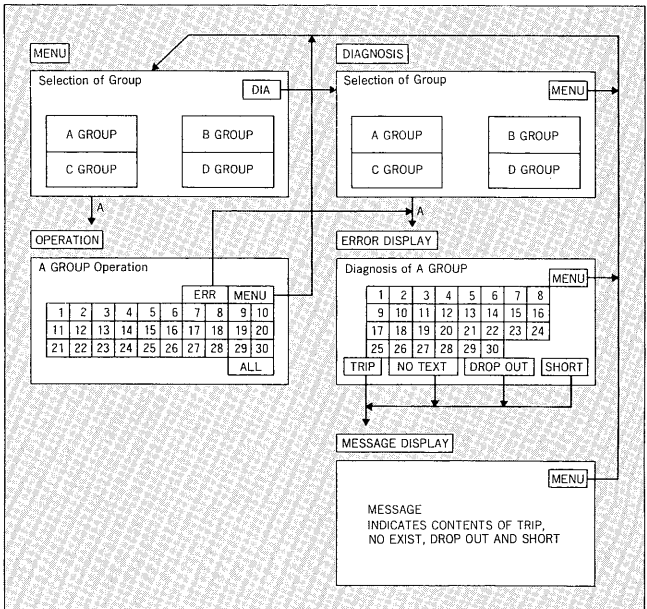


Fig. 5 Flow of POD menus



- (5) This system installed software can be placed in operation at any construction site by setting the RM address.

4. Signal Transmission

- (1) Type of signal cable  
Since there is no need to seal a signal cable unless it crosses a power line, CPEV and KPEV are used. If laid in parallel with a power line. There must be at least 10 cm distance between them (40 cm in the case of a high voltage power line).
- (2) Distance of signal transmission  
There are two factors which affect the signal transmission distance: the limited farthest length and the limited total length. The size of wire must be selected according to the scale of the system. (Fig. 4)

(3) Branching off signal cable

If these two conditions are satisfied, the signal cable can be branched off anywhere. Moreover, by increasing the number of wire lines within the cable, multiple groups with telephone lines may be in operation.

## 5. Structure of POD Software

POD software consists of five screens: menu, operation, diagnosis, error display and message display. (Fig. 5)

### 5.1 Operation screen

- (1) To turn on (off) a distribution panel, first press the distribution panel number switch on the screen, then when this number switch begins to blink, push the ENTER key.
- (2) If a distribution panel is on, the lamp corresponding to it is turned on.
- (3) If a mistake is made before pushing the ENTER key, it can be cancelled by pressing the same switch again.
- (4) Any number of distribution panels can be turned on (off) at the same time by pressing those number switches and then the ENTER key.
- (5) All distribution panels can be turned off at the same time by pushing the ALL key.
- (6) If a distribution panel drops out or a short circuit occurs, the ERROR LAMP turns on. In this situation, the screen error can be changed to ERROR DISPLAY by pushing the ERROR switch and the ENTER key.

### 5.2 Diagnosis screen

- (1) By pressing the appropriate switches, the ERROR DISPLAY for each group may be viewed.
- (2) If a distribution panel drops out or a short circuit occurs, the corresponding group lamps will begin to blink.

### 5.3 Error display screen

#### (1) No exist

After supplying power to the operation panel, the existence of distribution panels connected to the RMM are checked for three seconds. Those distribution panels which are not connected are regarded as NO EXIST. Their number lamps and the NO EXIST lamp will turn on. NO EXIST is canceled by the start of communications or additions of distribution panels.

#### (2) Drop out

If an operation panel can not communicate with the distribution panels in operation, those number lamps and the DROP OUT lamp will blink.

#### (3) Short

If a short circuit occurs in the signal transmission path, the SHORT lamp will blink.

### 5.4 Error and message display

When the NO EXIST lamp is on or the DROP OUT and SHORT lamps are blinking in the ERROR DISPLAY screen, the screen will change to MESSAGE DISPLAY, where the error contents and messages of how to restore operation will be available by pressing the appropriate switches.

## 6. Afterword

As described at the beginning of this article, the demand for a product which integrates a monitor and control system with PLC installed software is growing rapidly.

The system described in this paper is well suited for applications such as the maintenance and illumination of a skiing ground or park, a golf course sprinkler system, or the climate control of an apartment building. We intend to apply this monitor and control system to these fields in the future.