

# PROCESS INTERFACE EQUIPMENT RTC

Katsuhiro Nakajima

Tokyo Factory

## I. INTRODUCTION

The real time transfer of information between various process metering, control, and monitoring devices and a central processing unit (CPU) requires the use of equipment possessing signal conversion and interface functions. This equipment is called real time controller (RTC). The RTC introduced here connects FACOM 270-10, 20, 25, 30, and FACOM R central processors with these devices. The composition of the RTC differs from each other at the interface section according to the CPU's model coupled with it. In addition, since the RTCs for FACOM 270-10, 20, and 30 employ discrete components in their electronic circuit and ones for FACOM 270-25 and FACOM R employ integrated circuits, there are a number of constructional and electrical differences between them. However, their common features are;

- (1) A wide variety of input and output functions ideally suit to process control. The equipments employing integrated circuits are equipped with a high speed type analog input device employing the newest circuit techniques which provide a superb overall balance between high speed conversion, precision, and input noise rejection. Moreover, the analog input/output devices and digital output devices are isolated from ground potential, thus facilitating system construction and widening the range of applications of the equipment.
- (2) The various input-output functional units, terminals, and power supply units composing the RTC employ a highly standardized mechanical and electrical construction and can be freely mounted in the locker. Almost all interconnections between units are performed by connectors, thus making rapid manufacture of the equipments of any scale possible and the modification and expansion of the equipments easy after they come in operation.
- (3) The components and manufacturing methods used are highly reliable, and since failure points are detected by a performance check function during

system operation and the plug-in type construction of all units permits rapid replacement of faulty units, the availability of the equipment is extremely high.

## II. RTC COMPOSITION

The interface and information control mode between the CPU and RTC differs slightly with the model of the CPU. In addition, the functional devices also differ between the RTCs employing discrete component circuits and those employing integrated circuits. The RTC for FACOM 270-10, 20 or 30 and those for FACOM R or FACOM 270-25 will be described in the following based on the points at which they differ.

### 1. The RTC for FACOM 270-10, 20 or 30

In the case of connection with FACOM 270-10, the data line of the CPU and the various functional units of the RTC are connected through RTC channel 10 (RCH-10). RCH-10 receives the XIO instruction from the CPU and transfers information between the *A* register of the CPU and the functional unit of the RTC under program control. The functional units consist of from 1 to 8 functional devices. The functional devices serve to convert the digital or analog quantities of the input-output signals, every device possesses a single address and performs information access between channel or adapter and the outside and handles information in one word 16 bits. FACOM 270-20 system uses RTC channel 20 (RCH-20) which is connected to the data channel of the CPU and performs direct accessing to the core memories or *A* register of the CPU from functional units of the RTC by means of the contents of the IOC command specified by the XIO instruction of the CPU. This is also the same for FACOM 270-30. The construction of the RTC which connects FACOM 270-20 is shown in Fig. 1. RTC channel 20 is connected to 3 buses (*A*, *B* and *C*). Of these, the *A* bus is a special bus for the units having an interrupt input function. Up to 8 units possessing 2 devices can be connected

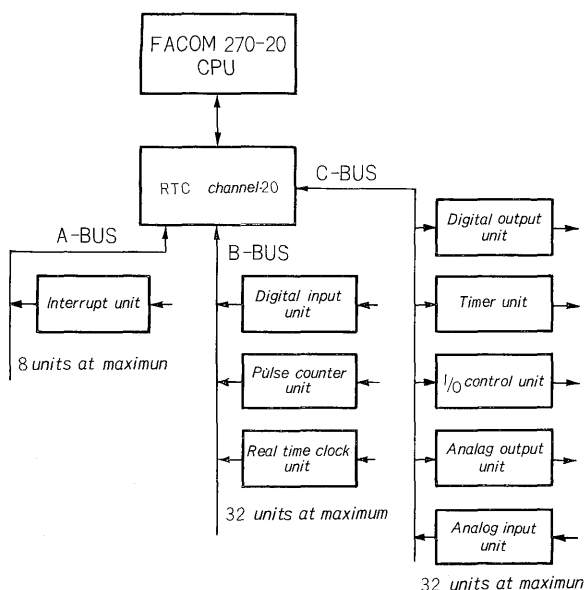


Fig. 1 FACOM 270-20 and functional diagram of its RTC

to the bus. The B bus is for use with units having the read-in functions required for digital input, pulse counter or real time clock and other external data. Up to 32 units can be connected to the bus. The C bus also permits the connections of units required for external data read-in or data write-out. Up to 32 units can be connected. The RTC for FACOM 270-<sup>10</sup>/<sub>30</sub> differs from that for FACOM 270-20 only in the number of units which can be connected and its construction is the same as that given in Fig. 1.

## 2. The RTC for FACOM R and FACOM 270-25

In the case of the connection of FACOM R, the connection is performed between the input-output interface of the CPU and adapter A of the RTC. In the case of the connection of FACOM 270-25

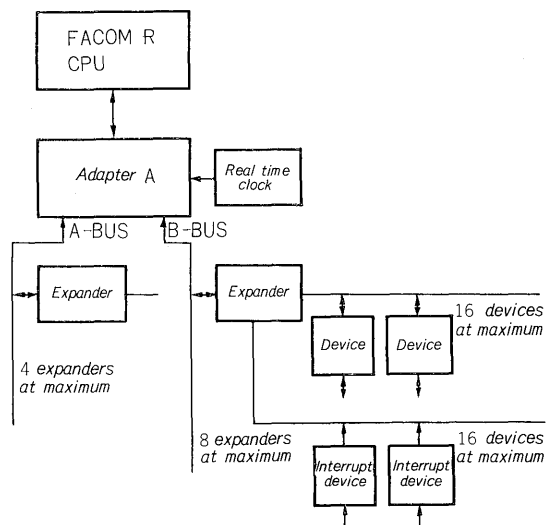


Fig. 2 FACOM R and functional diagram of its RTC

is performed between the direct line of the CPU and adapter B of the RTC. In both cases, informations are transferred in 1 word by program control between the A register of the CPU and the adapter of the RTC. The construction of the RTC for FACOM R is shown in Fig. 2. Adapter A has two buses, A and B, which serve the transfer of both data and address informations. Devices having various functions are connected with these buses through expanders. The expander performs partial decoding and amplification of the signal between the adapter and the devices. Sixteen devices can be connected per expander. Up to 4 expanders can be connected to the A bus and up to 8 expanders can be connected to the B bus as standard. The construction of the RTC for FACOM 270-25 differs from Fig. 2 only in the point of the system scale.

## III. DESCRIPTION OF VARIOUS FUNCTIONS

### (1) Digital input

The state of the relay contacts or the state of a common ground voltage of 6 V~48 V is read-in in 16 bits by CPU instruction.

### (2) Digital output

There are two types of output mode, one type holds in 16 bits data and the other is a one-shot type which resets after generation of an output at fixed intervals. Output types consist of relay contacts, transistor switch, and isolated transistor switch.

### (3) Pulse input

A 1~12 bit counter counts the number of make operations of relay contact or common ground 6 V~48 V voltage pulses below 10 kHz and is read them into the CPU by means of a CPU read instruction.

### (4) Timer

The timer generates an interrupt signal when the count of the time base pulses of the real time clock or external pulses reaches the value specified from the computer. This is used as a pulse width or pulse count output from a computer.

### (5) I/O control

Drives a typewriter, paper tape punch, or other I/O device.

### (6) Analog output

A unit which converts binary 10 bits data from the CPU into a 0 V~9 V voltage or a unit which converts binary 9 bits data from the computer into a 0 mA~20 mA or 50 mA current is available. The former can be used grounded while the latter can be used ungrounded.

### (7) Analog input

This consists of multiplexers which selectively switches analog signals of up to 256 points or 1024 points, amplifiers and an A-D converter. Voltages from 10 mV up to several V are converted to a sign and binary 11 bits. A multiplexer employing relays

or a multiplexer employing semiconductors is available. The conversion speed of the former is about 80 points per second and that of the latter 4,000 points per second at maximum.

(8) Real time clock

Crystal oscillator as standard generates hours, minutes, and seconds as well as short period pulses, which can be used as a logging clock or for various control pulses.

(9) Interruption input

Possesses a function which sends an interrupt signal to the computer in order to permit modification of the computer program due to the change in the status of the process, etc. The RTC for FACOM 270-10, 20 or 30 has 8 interrupt signal priorities. In the RTC for FACOM R or FACOM 270-25, each interrupt input can be divided and connected in groups of 8. The priority between groups is decided by the software.

(10) Others

In order to perform the various functions previously described, the RTC has the various power supply

units, terminal boards, operator's panel, signal conditioners, etc. inside the locker.

#### IV. CONSTRUCTION

The external shape and dimensions and the interior construction of the RTC for FACOM 270-10, 20, 30 and those for FACOM R and FACOM 270-25 differ due to differences in the components used. In both cases, printed wiring plug-in cards and the shelves to which they are mounted are installed inside the locker. In addition, power supply units, terminal boards, operator's panel, etc. having standard dimensions and construction are provided. Signal line connections between units and power supply connections are almost all performed by means of connectors. Locker external dimensions are 950 (width)×700 (depth)×1800 (height) mm for FACOM 270-10, 20 or 30 and 700 (width)×650 (depth)×1900 (height) mm for FACOM R or FACOM 270-25. From 1 to several of these lockers can be used depending upon the scale of the system.

