Operator Station for the Integrated Control System MICREX-IX

Kisaburo Sasano
Masaru Tanoshita
Hiroyuki Motosu

1. Introduction

In recent years, "EIC-integrated systems" have become the central systems of industrial PA, FA, and CIM plant control. Fuji Electric developed the MICREX-PIII as the first EIC-integrated system in the world. Then in 1992, we released the new MICREX-IX, which inherited the concepts and assets of the MICREX-PIII and utilizes the latest technological advances. The MICREX-IX has been delivered to many users.

When monitoring and operating a plant, the interface between operator and plant in this MICREX-IX system is the "Integrated operator station IOS-2500" (Fig. 1). The IOS-2500 is a human interface which collects various information about the plant, displays information essential for monitoring and operation of the plant on high resolution CRT monitors and realizes an environment more suitable for monitoring and operation through the use of multi-window and touch operation functions.

2. Summary of the System

The "Integrated operator station IOS-2500" is constructed as a specialized console desk equipped with CRT monitors, keyboards, panel display control units, memories, etc. A maximum of four CRT's and keyboards can be mounted on one operator station. Since up to eight stations can be connected to one dataway (DPCS-F), it is possible to configure a system with as many as 32 console desks on the data way.

In addition, the "Integrated database station (IDS-2500)" can be connected to this dataway to integrally manage plant data.

The aforementioned configuration and specifications, such as display resolution of the CRT, number of data points for display, etc. are listed in Table 1.

The development of this operator station was based on the following experiences and requirements of MICREX-PIII users.

(1) to respond to various user needs
(2) to enhance monitoring and operation efficiency and

Fig. 1 MICREX-IX operator station

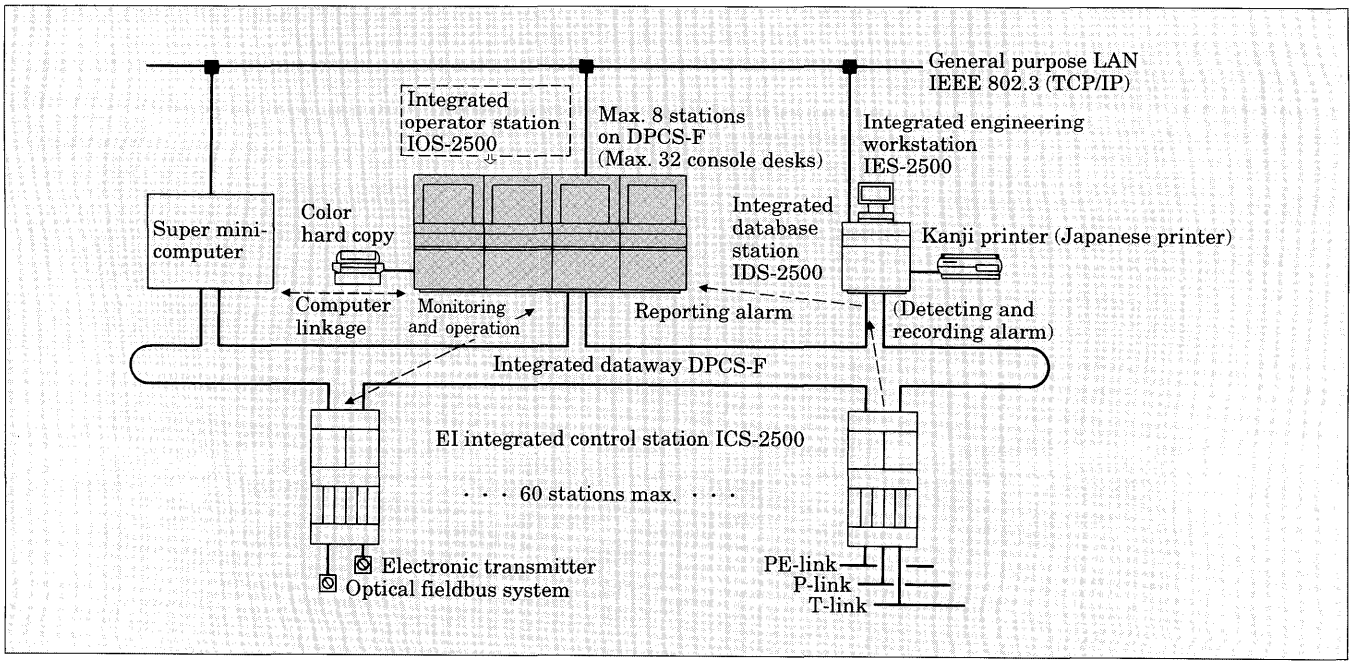


Table 1 Integrated operator station (IOS-2500) specifications

Item	Specification
IOS structure	21-inch color CRT desk with keyboard console desk : Up to 4 console desks may be connected per station.
Dimensions	(H) 1,150 × (W) 600 × (D) 1,300 (mm)
Display resolution	1,120 × 750 (dots)
Special display function	Virtual panel display (nearly double panel scroll) function Window display function Overlapped display function
Display color	Basic 16 color + 16 blink colors ⇨ total 32 colors
Displayable characters and number of characters	① Half : 8 × 8 dot sized···13,020 characters ② Half : 8 × 16 dot sized··· 6,440 characters ③ Full : 16 × 16 dot sized ··· 3,220 characters ④ Half : 12 × 24 dot sized ··· 2,883 characters ⑤ Full : 24 × 24 dot sized ··· 1,426 characters
Operation keyboard	Flush mounted in console desk (flat dustproof type)
Touch screen	Photoelectric type using infrared rays (standard equipment on each display) Resolution : 6.1 × 6.1 mm or better
Number of points of displayed data	① Module tag data (total 17,280 points) ◦ Constant monitored tag data····· 2,048 ◦ Non-resident module tag data ·····15,232 ② User tag data (total 17,280 points) ◦ Graph, numerical value color change, etc. ·····17,280 ◦ Status change information·····30,720
Number of lines connected to dataway	① Dataway (DPCS-F)·····2 lines max. ② LAN conformed to IEEE 802.3···1 line max.

to save space

(3) to increase operation ease and to reduce the burden of the operator

(4) to provide security measures for monitoring and operation

3. Measures to Fulfill These Requirements

3.1 Response to various user needs

This Integrated Operator System (IOS) is flexible enough to construct user system requirements such as a back up should the IOS stops due to a malfunction, remote IOS installation, etc. By combining the various hardware, the following variations may be realized.

3.1.1 Redundant configuration of CRT and keyboard

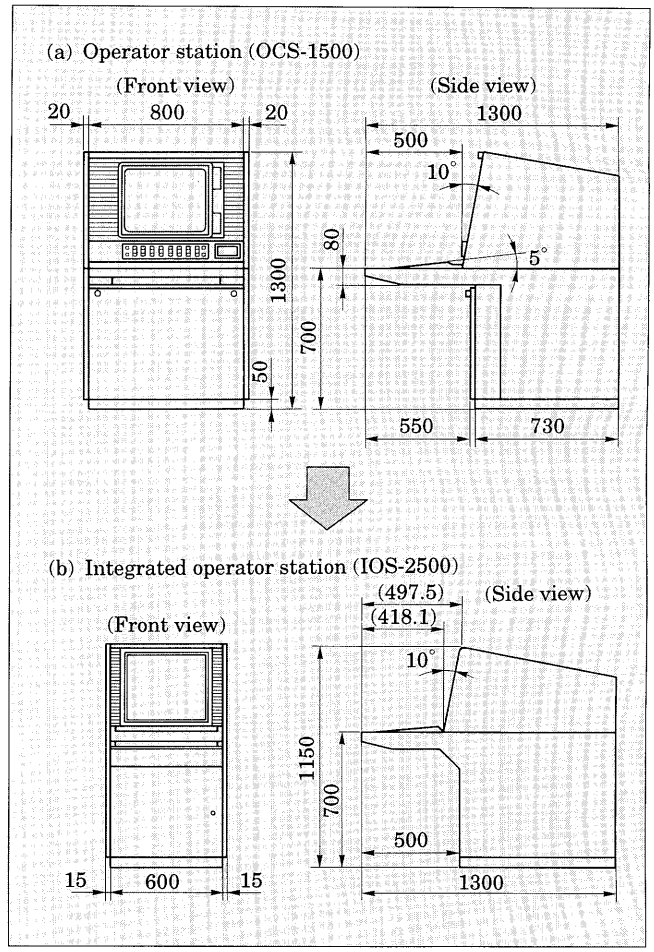
It is desirable to continue monitoring and operation should the IOS stop due to malfunction.

For this reason, IOS shelfs (mounted with an MPU, memory, panel display control board, power supply, etc.) are installed and operated in parallel so that the signals from IOS shelfs can be switched with a CRT/KB selector. Since one CRT and keyboard can alternatively use two IOS shelfs, when an IOS stops, another IOS can perform monitoring and operation by switching the CRT/KB selector.

3.1.2 Remote CRT installation

When console desks with CRT's and keyboards cannot be installed adjacently, for example, when a console

Fig. 2 Reduction of console desk size



desk is to be installed in a remote control room, it is desired that this remote installation be done economically.

This is possible by installing a remote CRT desk in a local site a maximum of 500 m away from the IOS shelf using an optical fiber cable connected to an extension adapter on the IOS shelf.

3.1.3 Large-size display

A complex plant with high level operations may desire to transmit information to several operators simultaneously.

Therefore, a large-size (70 to 100 inches) display is installed, to display IOS pictures. The information can be transmit simultaneously to several operators.

3.2 Highly efficient monitoring and operation with space reduction

3.2.1 EIC-integration and reduced desk size

Conventionally, CRT's for monitoring and operation are provided separately for electrical control (E), instrumentation control (I) and computer (C). By integrating the monitoring and operation for E, I and C, space will be conserved. By adding data displays and setting functions for controllers and computers to the operating station, the monitoring and operation of E, I and C can be performed by a single CRT.

Furthermore, since the desk size is reduced as shown in Fig. 2, operators can observe the graphic panel and large size display beyond the desk without standing up.

The desk size is reduced from 800 mm to 600 mm in width, and from 1,300 mm to 1,150 mm in height.

3.3 Increasing operation ease and reducing operator burden

3.3.1 High-resolution CRT and increased number of display colors

A high-resolution graphic panel is realized to achieve an environment well suited for monitoring and operation. The following measures are adopted.

(1) Improved display resolution of CRT (high-resolution CRT)

The CRT display resolution is improved from the conventional 640 × 400 (dots) to 1,120 × 750 (dots), nearly doubling resolution.

(2) Increased number of display colors

Since intermediate colors are used in addition to primary colors, more natural and human-friendly colorings become possible.

3.3.2 Realization of virtual panel of nearly double size and scroll display

It is desired to limit the increase in number of CRT's with accompany an expansion in the scope of the objects to be monitored and operated.

Monitoring and operation on a large size panel (virtual panel) of 2,048 × 1,024 (dots), nearly double the size of a standard size panel of 1,120 × 750 (dots), can be realized. Since the total area of this virtual panel exceeds the CRT display area size, this total area cannot be displayed at once, but can be displayed by smoothly scrolling over the range of the standard display size.

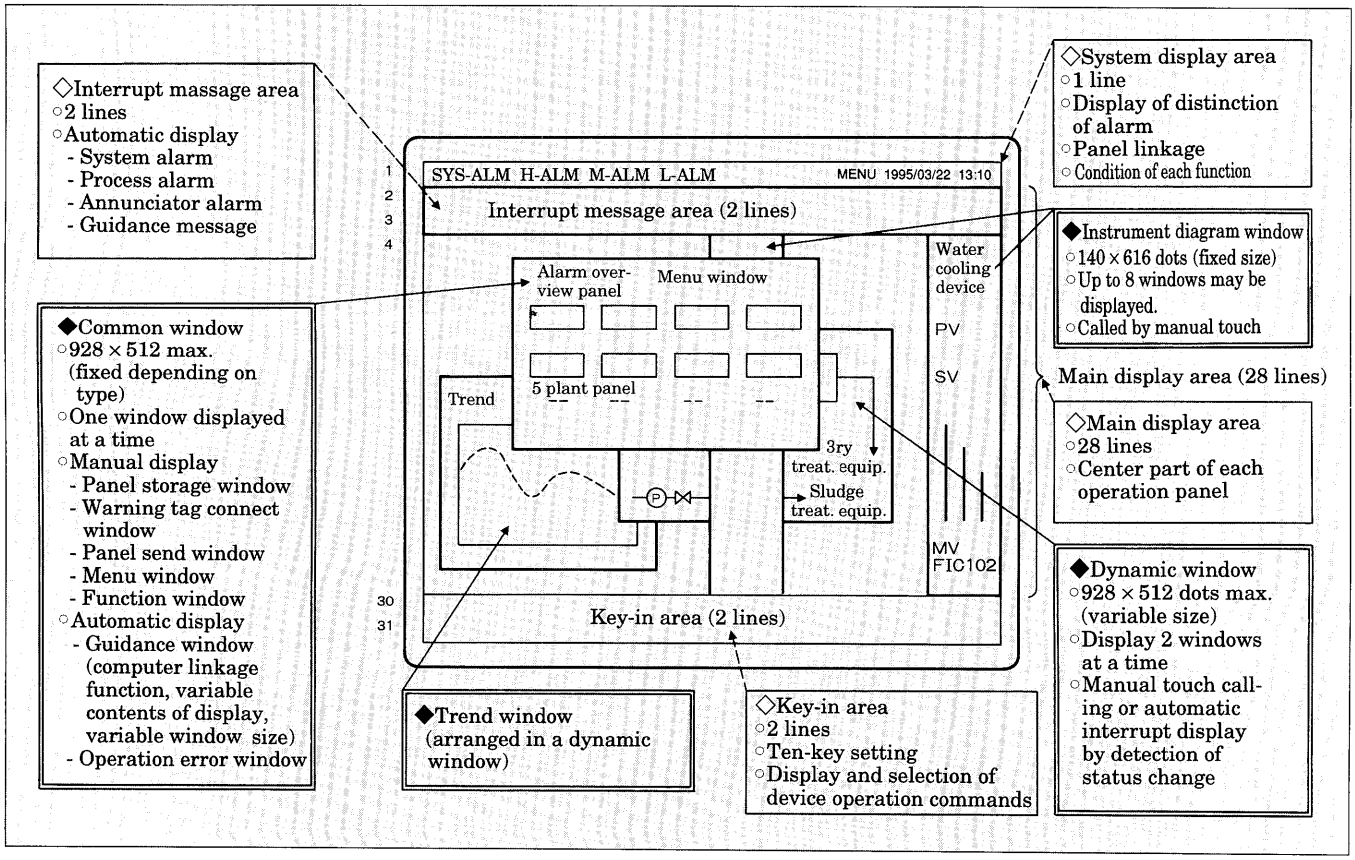
3.3.3 Realization of multi window operation function

(1) Since only a limited amount of information may be shown on a display panel, separate display panels must be used to handle the various information. However, it is desired to eliminate the operation for switching display panels due to the complexity for the operator.

(2) The operator wants to be accurately supplied with necessary information when changing set values or operating devices.

For these reason, the display panel is divided into the following four display areas. The various windows are overlapped on these display areas and operation is possible from these windows. This "Multi-window function" can satisfy the aforementioned requirements (1) and (2), and improve operability for the operator (Fig. 3). For example, in the case of the plant display panel, plant configuration or a flow diagram of the operation may be a base display (foundation), and a trend graph (dynamic window), indicating the variation of process data over time, can be displayed overlapping the base display through a manual operator command or an

Fig. 3 IOS-2500 Multi-window operation function



automatic display function. This will accurately supply the operator with necessary information. Display areas and windows are listed below.

(a) Display areas:
- ① System display area
- ② Interrupt message area
- ③ Main display area
- ④ Key-in area

(b) Windows:
- ⑤ Common window
- ⑥ Dynamic window
- ⑦ Instrument diagram window,

etc.

The system display area ① is always displayed. It is used to gain a rough understanding of system conditions per alarm division to link relevant panels, etc.

The interrupt message area ② is a display area in which various alarm messages automatically interrupt a program. The conditions of the occurring alarm are displayed to the operator without having to switch to an alarm panel.

The main display area ③ is the base for every operation panel. Plant panels, system alarm panels, which show alarm histories of the constructing devices, etc. are displayed.

The key-in area ④ is a display area in which data is input by 1-point data input, and items for operating devices are indicated and selected.

The common window ⑤has common operation/support functions such as panel menu, guidance, warning tag connection, etc. and is displayed overlapping each operation panel.

The dynamic window ⑥ can be displayed overlapping the plant panels. This window may be called up to display main panel device operating conditions for guidance or to display and operate relevant devices as a subpanel of the main panel.

The instrument diagram window ⑦ can display instrument diagrams overlapping the plant panel in the same manner as dynamic window ⑥.

3.3.4 Enrichment of data setting function

It is desired that settings for each data point or group of data points be made according to the features and contents of setting items.

Therefore, "1-point data input", to set one data point, and "Full screen input", to set a group of data at once, may be selected by touching a setting item on the screen (Fig. 4). The conventional 1-point data is suitable for setting data after confirmation by a touch operation.

Full screen input is suitable for setting a group of data together through table format input on the screen.

3.4 Security for monitoring and operation

3.4.1 Adoption of EXIT system to touch operation

A faulty touch on the screen due to parallax error or mistaken selection of an operation object should not influence the system operation.

For this reason, a highly reliable "EXIT mode", is adopted. This mode is invoked not when a finger is touched to the screen, but instead when the finger is removed from the screen. Therefore if a mistake is made, the finger can be dragged to another location to cancel the action, and the operation may be easily performed again.

3.4.2 Prevention of data setting and devices from faulty operation

To prevent faulty operation by the operator, input may be prohibited depending on start-up conditions, operation is prohibited while adjustments are being

Fig. 4 Data setting of plant panel

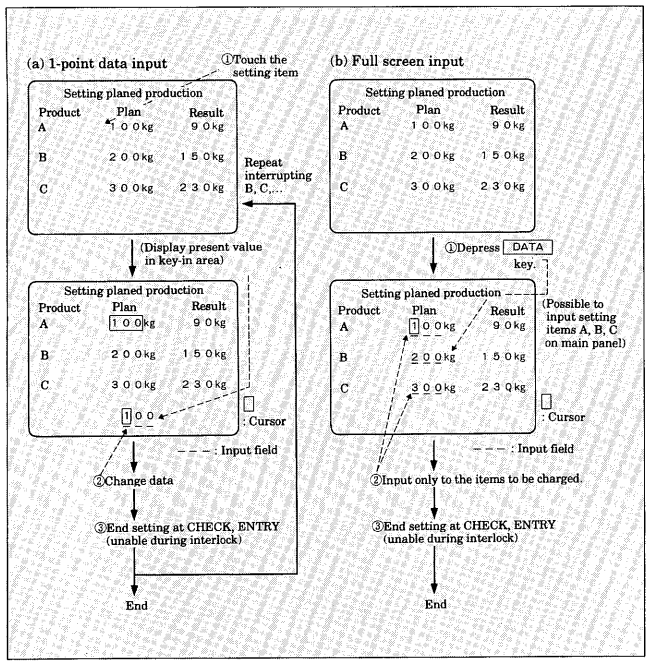
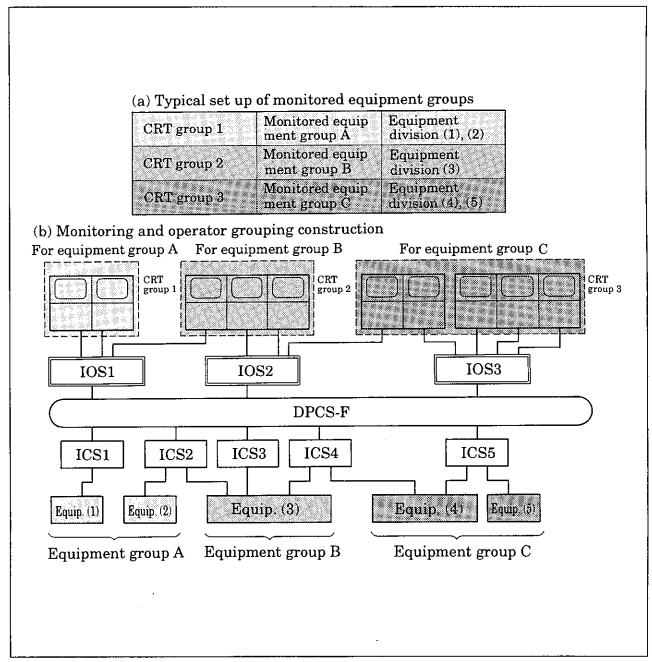


Fig. 5 Example of CRT monitoring grouping



made, etc.

For this reason, the number of actions (number of operations), 1, 2, or 3, can be selected according to the operation device or its importance.

Further, 2 and 3-action device operation or data setting is interlocked through the operation signals.

In addition, there are three types of tag functions for internal instruments. The "caution tag" urges attention, the "inhibit tag" conventionally disables operation and the "alarm stop tag" cannot accept a new process alarm. These functions prevent operators from causing faulty operation.

3.4.3 Development of grouping function for monitoring CRT's

The objects for monitoring and operation must be limited to accurately operate and manage a large-scale, complex control system.

For this reason, the following grouping function was developed. The objects of process alarm, historical message, data setting and device operation are selected and limited for each CRT by this grouping function (Fig. 5).

When a process alarm outside the objects occurs, the alarm is not transmit to a CRT (outside the objects) and the history of that alarm does not remain on the process alarm panel.

The same is true for the historical message. Data outside the objects cannot be set with the CRT. This means that data setting and device operation cannot be performed on the plant panel.

This function is defined in the following. The engineering work station (IES-2500) assigns each CRT to any one of up to eight "CRT groups". The objects for monitoring by each CRT group are known as "equipment groups", and up to 64 equipment groups are allocated by the IES-2500. These equipment groups are structured with a maximum of 16 kinds of "equipment division codes", and are defined by the IES-2500. Equipment division codes include individual codes which are limited to monitoring object equipment and codes common for all equipment.

So that this system is able to respond in a flexible manner to changes in operation features, definitions of monitoring equipment (allotment of CRT groups to monitoring equipment groups) may be changed.

4. Conclusion

In this paper we have described features of the integrated operator station (IOS-2500) for the MICREX-IX.

In the field of computer and information processing, downsized, open systems, and the development of image technology such as multimedia, virtual reality, etc. are frequently reported.

Furthermore, in industry, improvements to the labor environment, labor savings, improvements in productivity, etc. are urgently needed to respond to severe changes in the market place. There are also requirements for the construction of plant monitoring and operation systems, which are both operator-friendly and helpful to managers, and offer flexibility and a favorable performance/cost ratio.

We will attempt to develop a wide variety of technology such as the integration of these systems with conventional systems, to reinforce cooperation with computers and to introduce new image technology based on the concept of "system integration with evolution and succession".