

Computer Linkage Function for the Integrated Control System MICREX-IX

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1. Introduction

For the last few years "open architecture systems and downsizing" have been a remarkable trend in the computer and information processing fields. As centralized processing on mainframes shifts to distributed task sharing among workstations, the need for open systems increases.

On the other hand, process control computers are required to have special features such as realtime control, high reliability and high speed data links to the lower level controllers.

Conventional independent plant control systems with their rather limited range are now developing into distributed wide area systems organized between several plants, or to complex systems combined with a general management system.

For the implementation of more sophisticated and effectively automated systems, the linkage function between system components plays a crucial role.

For this reason, Fuji Electric has combined electric control (E) with instrumentation (I) and computer(C), to make the MICREX-IX integrated control system. The basic concept of this system is EIC-integration, which is provided through the "computer linkage function".

In this paper we introduce this "computer linkage function".

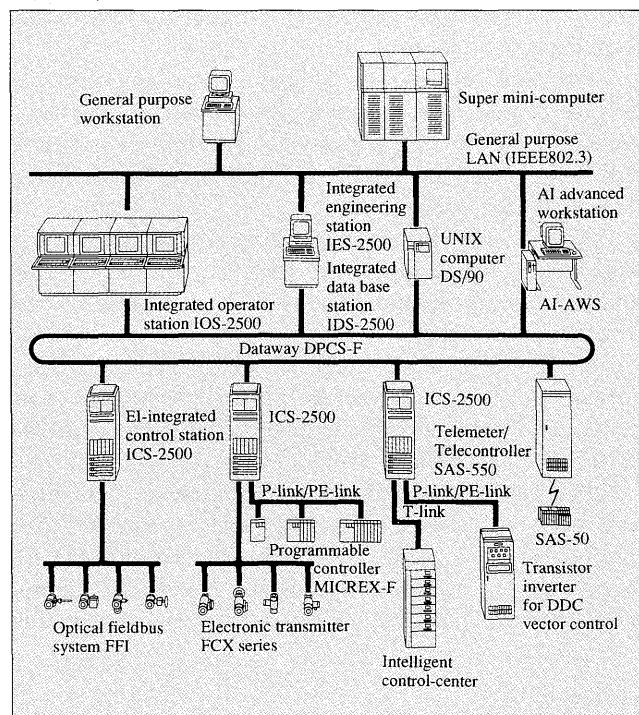
2. System Structure

The MICREX-IX is composed of integrated operator station IOS-2500, integrated data base station IDS-2500, and EI-integrated control station ICS-2500. These stations are linked each other through the control-based dataway DPCS-F, having a transfer rate of 10Mb/s (Fig. 1).

An additional integrated engineering workstation, the IES-2500, supports software engineering.

TCP/IP connection to the general purpose LAN (local area network) Ethernet*¹ is available with the IOS-2500 and IDS-2500. These stations can also be

Fig. 1 System structure of MICREX-IX



linked to mini-computers, workstations and personal computers.

Fuji Electric produces the A-series of mini-computers, favorably recognized in the field of industrial control, and the DS/90 7000 series, introduced to the market in Jan. 1993.

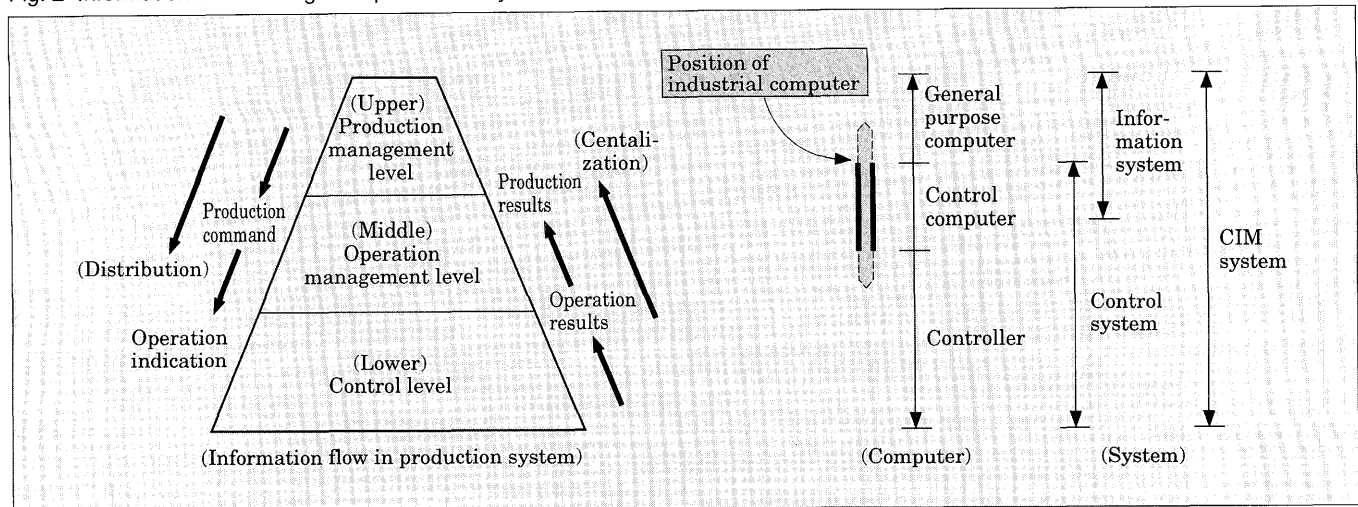
The A-series and DS/90 mini-computers can be connected to both the control-based dataway DPCS-F and the general purpose LAN Ethernet.

3. Outline of Computer Linkage Function

In the CIM system, as shown in Fig. 2, control computers are located between the upper information processing system for production management and the lower control system. They issue production commands from the upper system to operators and/or the lower control system. In addition, they collect and process in real time the various data generated from

*1 Ethernet is a registered trade mark of Xerox Corp.

Fig. 2 Information flow in integrated production system



the lower systems, control the plant operation management, and transmit the data to the upper production management level system.

The MICREX-IX's "computer linkage function" links control computers to the lower control system easily and in standardized way.

To ease plant operation and maintenance as well as to meet the demands of multivendors, the A-series, DS/90, IOS-2500 and IDS-2500 are equipped with the Fuji sensor-base integrated network FSINET, in which the communication protocol and component interfaces are integrativated and standardized. The MICREX-IX builds its "computer linkage function" on this FSINET, making a smooth connection with the computer.

Table 1 shows a list of "computer linkage functions". These function are described below (also see Fig. 3).

3.1 Computer linkage of plant panel display

The graphic display of a plant operation center has the capability a maximum of 1,024 data of a picture from the EI-integrated control stations (such as result values, process values or set values) combined with 512 data of a picture from a computer of production targets or planned production quantities.

Data from controllers or computers can be also indicated in the users dynamic window.

The dynamic window can simultaneously display two pictures overlapped on one plant panel.

Data settings for controllers and computers can be input directly into the multiple data entry field of the "full screen input form".

According to operating conditions and data setting, computers can automatically change the plant panel display to that of the next process or operation.

3.2 Guidance window

Various character or graphic messages sent from a computers to the operator, such as warnings, wait commands etc. can be automatically displayed in windows

Table 1 List of "computer linkage functions"

No.	Functions	
1	Computer linkage on plant panel display	
2	Guidance window	
3	Computer terminal function	
4	Data service function	Access to process data
		Automatic indication of alarm messages
		Read alarm, operation and setting histories
		Read trends and report data

overlapped on any picture screen of the IOS-2500.

This allows the operators to carry out the plant operation without missing any commands, even when bussy with other tasks.

3.3 Computer terminal function

Display data updating and entry data checking are performed by computers, and the IOS-2500 operates in the computer linkage panel as a terminal for each computer.

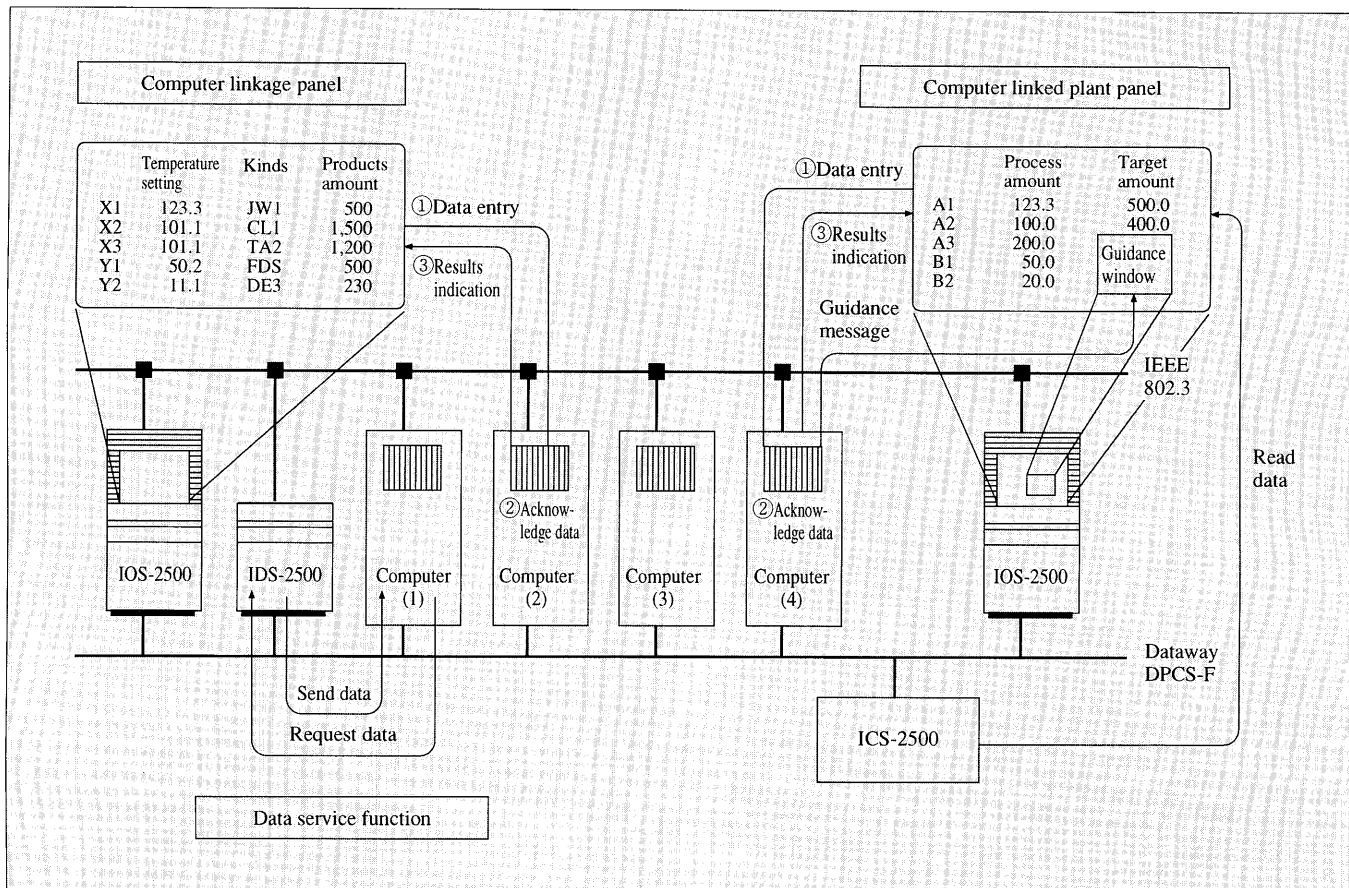
The operator station displays that data from computers which the distributed control system does not have, such as production plans, stock data, various analyzed results and order command data via factory LAN or business networks. It can also tell computers to begin processing data settings, perform calculations, etc.

3.4 Data service function

IDS-2500 is provided with a server function know as the process data service function (PDS). With this function a client computer can easily access data base information or process data stored in the IDS-2500, by Specifying a tag number (data name detemined by the user) and supplementary information.

The IDS-2500's data base is equipped with a reference file for tag numbers.

Fig. 3 Computer linkage functions



When clients specify tag number, a special algorithm, locates that tag number data at high speed and allows access.

Also, data accumulated during processes such as alarms, trends and reports, are time-sequentially stored on a hard disk. On recall, this information is prepared in main memory, so that high speed reference can be executed by server processing.

The details of individual functions are as follows.

3.4.1 Access to process data

When computers want to access controller process data, by specifying tag numbers to the IDS-2500, they can read industrial value data without being conscious of data addresses.

Data can be set at specific controller addresses by having a computer specify tag numbers and industrial value data to the IDS-2500, with this function, plant controls can be carried out by sending controllers prescription management parameters and setting data, based on the computer production plan. Advanced control using computers or AI (artificial intelligence) control is possible.

3.4.2 Automatic indication of alarm messages

Computer generated alarm messages concerning plant operation can be automatically indicated on the windows of the IOS-2500.

These alarm messages are stored in the IDS-2500

to permit confirmation of alarm panel and historical message panel of the IOS-2500.

3.4.3 Reading alarm, operation and setting histories

From the histories of alarm information, process control information, and operator settings stored in the IDS-2500, necessary data can be extracted and read computers, by specifying various reference conditions (sorting by station, tag number, active alarm, equipment group etc).

Fault diagnosis and trouble shooting are performed by using the data read by computers.

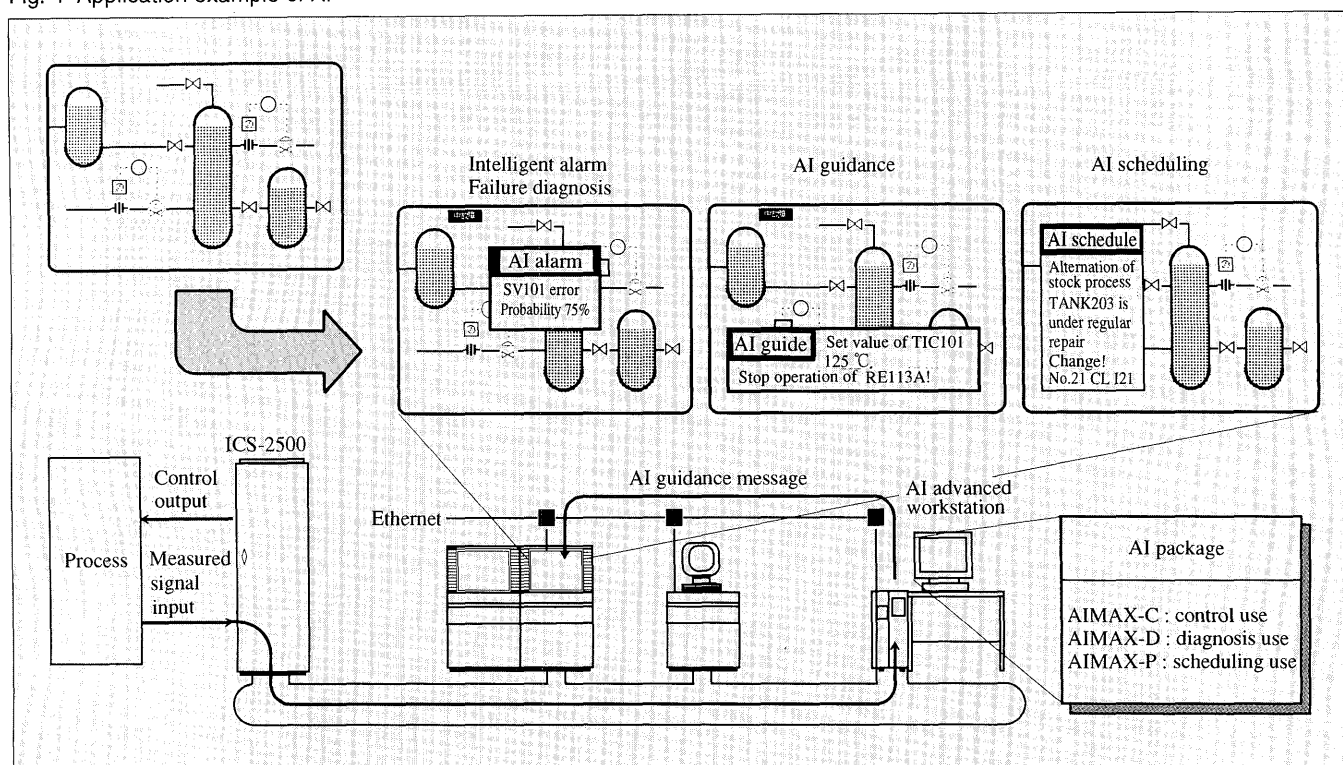
3.4.4 Reading trend and report data

By specifying a sampling rate and tag numbers, process trend and report data collected in the IDS-2500, are read by computers and then process analysis and quality control performed.

For example, it is possible to read report data with personal computers (FMR series) and to store them in the file format of Lotus 1-2-3*2 software. By using Lotus 1-2-3, the user can modify the preserved data and can easily carry out calculations in table format and print them out.

*2 Lotus 1-2-3 is a registered trade mark of Lotus Development Corp.

Fig. 4 Application example of AI



4. Effects of Computer Linkage

4.1 Open architecture systems and downsizing

The IOS-2500 and IDS-2500 can be connected to any computer provided with the TCP/IP protocol to the general purpose LAN Ethernet.

Moreover due to the down-sizing of workstations it has become possible to monitor plant operating conditions from desks in factories or business offices.

4.2 Space and labor saving

Since dedicated CRTs for computers have become unnecessary, replaced with a single window and the computer linkage function, all plant operation and management can be carried out from the IOS-2500 CRT. This reduces the number of CRTs and saves space.

In addition, computer-automated plant operation and process control reduce operator's labor.

4.3 Application of AI technologies

An advanced operation support system may be

used by linking computers or the "AI advanced workstation AI-AWS", provided with AI software packages. The system is provided with such functions as intelligent alarm and fault diagnosis to predict failures, AI guidance that is activated depending on the above alarms or diagnosis results, AI scheduling for timely and flexible production plans, etc. (Fig. 4).

These functions are displayed in AI windows automatically and receive operator support. The "AI navigator", a system provided with AI functions, will become a powerful partner to the operator in improving plant operation efficiency and reducing labor.

5. Conclusion

This paper has introduced the "Computer Linkage Function of MICREX-IX."

Fuji Electric will continue to enhance computer linkage functions and to develop the MICREX-IX for the realization of user-oriented EIC-integrated control systems.