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EXPANSION OF DISTRIBUTED CONTROL SYSTEMS MICREX

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1. FOREWORD

The distributed control system MICREX has been upgraded several times since it was announced in 1975. Especially, the size, functions, and performances of the original system was improved tremendously in 1987.

However, the more the distributed control system (DCS) is used, the more diversified its needs become. These needs have been received and various correspondences have now been performed with the MICREX. Correspondence examples are introduced here.

2. EXPANSION OF MAN-MACHINE INTERFACE

2.1 Completion of CRT operation functions

The shift to CRT operation is increasingly steadily. At the same time, the amount of information displayed on the CRT is also increasing. However, the operator can only view one screen at a time. The operator must switch multiple screens and quickly extract the necessary information from many screens. As a result, there is a strong desire for CRT operation to "handle more information" and "extract data easily". To meet this demand,

(1) two row CRT desk
(2) dynamic window

are provided as the MICREX man-machine interface OCS-1500.

2.1.1 Two row CRT desk

An example of the two level CRT desk is shown in *Fig. 2*. A configuration of up to eight desks (16 CRT) is possible.

All the CRTs are equipped with a touch screen as standard. Top and bottom CRT display interchange is performed by one-touch key operation. The top CRT is used to display the annunicator, plant overall system diagram, and other data which is always necessary, or

Fig. 1 MICREX system configuration

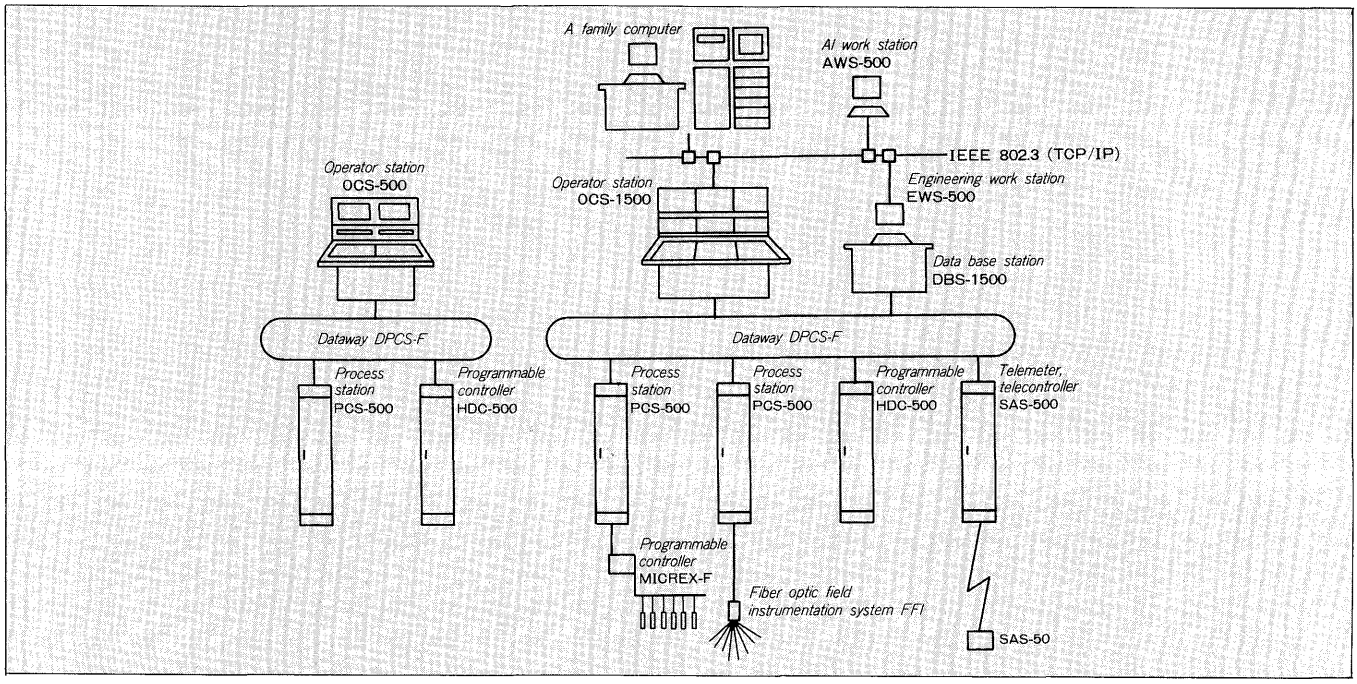


Fig. 2 OCS-1500 new type desk

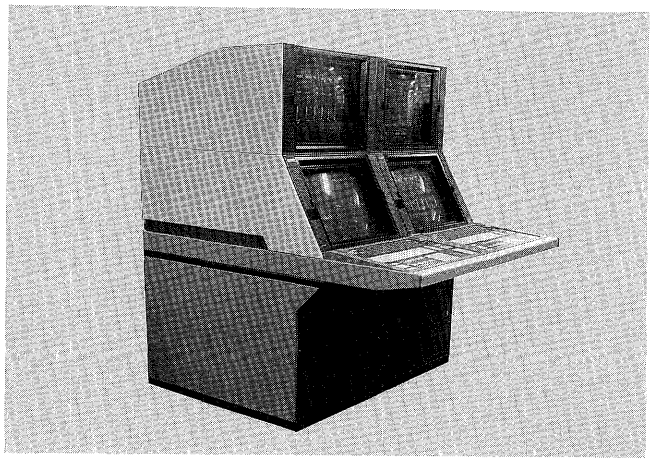


Fig. 3 Top and bottom switching function

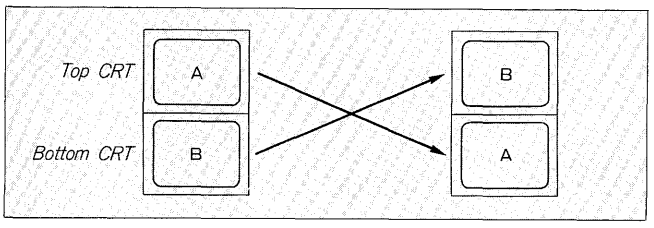
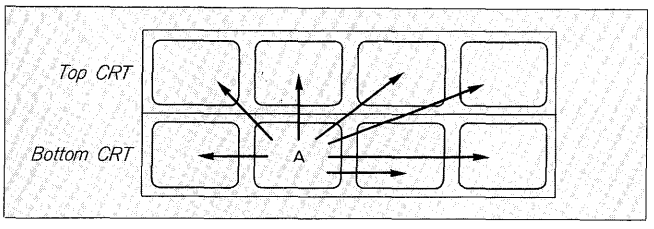


Fig. 4 Panel send function (operation example)



to temporarily save the bottom CRT screen. The bottom CRT is used for operation. Especially, the following functions are provided to make row panel operation more flexible.

(1) Top and bottom switching function (*Fig. 3*)

This function switches the screen displayed on the top and bottom CRTs of the same desk instantly.

(2) Panel send (*Fig. 4*)

This function sends the bottom CRT screen to an arbitrary CRT of an arbitrary desk.

(3) Panel set (*Fig. 5*)

This function batch displays multiple predefined screens (panel set) to multiple CRTs.

All the functions can be performed by one-touch key operation. Functions (2) and (3) can cope with up to four two row CRT desks (eight CRTs).

2.1.2 Dynamic window (DW)

Dynamic window (DW) superimposes and displays small plant panels (called dynamic windows) in the MICREX standard plant panel.

By using dynamic window, more detailed screens and related screens can be superimposed and displayed

Fig. 5 Panel set call function (operation example)

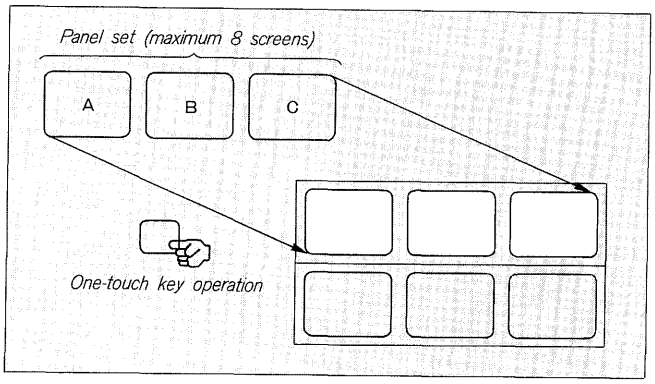
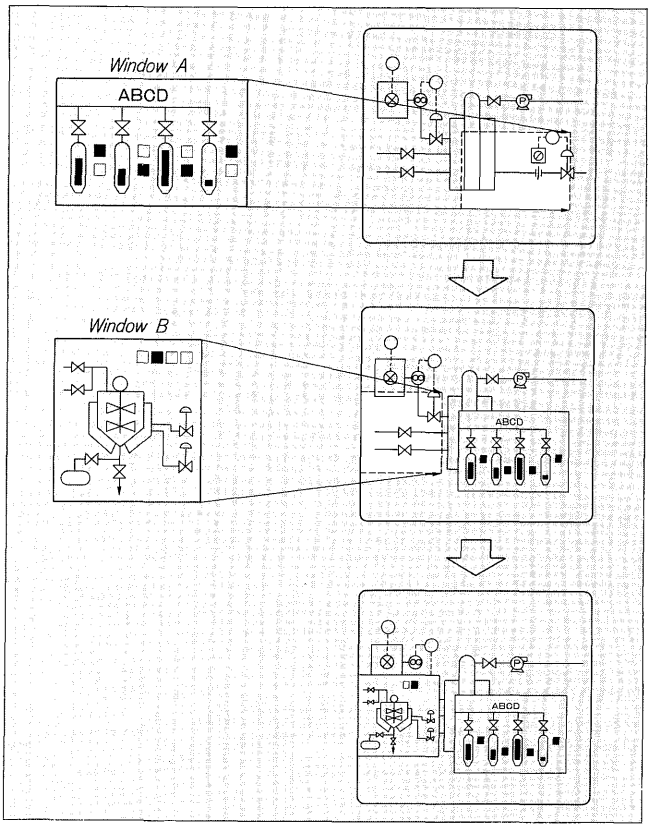


Fig. 6 Dynamic window usage example



without switching the base screen.

(1) What is a dynamic window?

A dynamic window is a small panel whose vertical and horizontal size can be freely specified. It can be created easily in interactive format by the same procedure as a conventional plant panel. A dynamic window has the same data display functions and setting functions as an ordinary plant panel.

(2) Dynamic window operation (Patent pending)

A dynamic window is called from the plant panel by touch operation. Other dynamic windows can be called one by one from a certain dynamic window. By doing this, the screen can be developed from overall information (plant panel) to sequential detailed information (dynamic window). Up to two dynamic windows can be displayed

simultaneously. When this is exceeded, the dynamic windows are erased from the oldest window. An example of dynamic window use is shown in *Fig. 6.*

2.2 Flexible correspondence to plant size

The distributed control system MICREX announced in 1987 was specially configured as a large control system by using a DBC-1500 with an integrated data base.

However, the demand for a higher cost-performance system for medium and small plants is becoming stronger.

(1) Correspondence to medium size system

The OCS-500 was developed as an optimum system for such medium size plants. The OCS-500 was developed as an internal data base type stand-alone system. That is, while it is a system which does not require a data base station DBS-1500, one OCS-500 station and operates up to 16 controllers (process station PCS-500, programmable controller HDC-500).

As shown in *Table 1*, it is a medium size plant oriented system that pursues cost-performance while inheriting the functions of the OCS-1500/DBS-1500.

(2) Correspondence to scale expansion

The OCS-500 is configured so that it can be easily expanded to an OCS-1500/DBS-1500 to prepare addition and other monitoring scale expansion. First, the OCS-500 hardware is common to that of the OCS-1500/DBS-1500. It can be upgraded to an OCS-1500/DBS-1500 by only adding the hardware of several points.

Moreover, OCS-500 application definition can used unchanged by the OCS-1500/DBS-1500. That is, the existing OCS-500 application definitions can be used without any changes even if the hardware is upgraded to OCS-1500/DBS-1500. Therefore, only the definitions accompanying expansion of the scale should be performed.

3. CONTROLLER EXPANSION

Controllers also have various needs, and the requested functions were expanded. Of these, networking which covers an wide field was desired, in particular, and connection of two kinds of networks was made possible for the station PCS-500.

3.1 Connection to FFI field bus

The Fuji fiber optic field instrumentation system FFI is a new instrumentation system with a microcomputer built into the field instruments and which connects the center and the field by means of an optical fiber and exchanges signals by optical digital communication. Since the communication media is an optical fiber, its lightning and noise resistances are high and the intelligent field instruments can be diagnosed remotely from the center.

Moreover, since the optical fibers for eight field instruments are grouped into one and sent to the center by an optical star coupler (OSC) installed in the field, construction costs can be reduced also.

Connection to FFI field instruments is possible by installing an optical distributor (ODB) and FFI connection unit (FFIA) to the PCS-500.

Especially, the following functions were provided for the FFI system for high reliability and maintenance management.

(1) High reliability

A highly reliable system is realized by duplexing the optical fiber which connects the field and center and duplexing the FFIA.

(2) Maintenance management

(1) The result of self-testing of FFI field instruments

Table 1 Specifications of OCS-500 system and OCS-1500/DBS-1500 system

	OCS-500	OCS-1500/DBS-1500
OCS construction	Integrated 20 inch color CRT, keyboard type console desk construction conforming to JEMIS029 standard (Japan Electric Measuring Instruments Industry Association)	
Number of CRT	2 CRT/OCS-500	3 CRT/OCS-1500
Display	640 x 400 dots, 16 colors, 4000 characters, JIS Level 1 and Level 2 kanji	
Special display functions	Virtual screen display (four fold screen scroll) function, multiwindow display, superimpose	
Operation keyboard	Flat dustproof keyboard Engineering keyboard	Flat dustproof keyboard Engineering keyboard Dynamic keyboard
Touch screen	Standard (infrared system)	
Data base	Stand alone data base (in OCS-500)	Integrated data base (in DBS-1500)
LAN connection	–	IEEE802.3 (ETHERNET®)
Number of objective controllers	16 stations/OCS-500	60 stations/system
Number of supervisory and control points Total number of TAG Nos. Status change data Numeric data	 2048 TAG/OCS-500 2048 points/OCS-500 2048 data/OCS-500	 17280 TAG/system 30720 points/system 17280 data/system
Number of historical trend points	256 points/OCS-500	2048 points/DBS-1500
Plant panel	64 screens/OCS-500	512 screens/system
Logging function	32 pages, monthly report/daily report	1 system: 48 pages, annual report/monthly report/daily report Maximum 2 systems
Printer	2/OCS-500	8/DBS-1500

are posted to the DBS-1500 and OCS-1500 and abnormal instruments can be confirmed at the system condition panel.

(2) Various remote diagnosis, transmitter zero adjustment, and span adjustment changes can be made by engineering work station EWS-500.

When the MICREX and FFI systems were connected, a high noise and lightning resistant, high precision, and high reliability system can be built. It is called the system of the new age which performs field instrument maintenance management easily and exactly.

3.2 Connection to P link

Connection of the general purpose programmable controller MICREX-F interprocessor communication network P link to the PCS-500 has been made possible.

This provided the following features:

(1) Connection to MICREX-F series (F120, F200)

The MICREX-F data can be used with the PCS-500, or the MICREX-F can be used as a PCS-500 sequence output device, by using a high speed 5 Mbps P link.

(2) Reduction of construction costs

Wiring costs can be reduced by installing each component (FPK, FTU, FTK, etc.) of the MICREX-F in the relay panel and electric panel and inter-connecting the panels and PCS-500 with one P link cable.

Connection of this P link has made connection of P link architecture products offered by Fuji Electric in the future at application level possible.

4. ENGINEERING WORK STATION EXPANSION

When announced in 1987, the functions of the engineering work station EWS-500 were limited mainly to a narrow range of PCS support, such as process station PCS-500 control operation functions construction, debugging, etc.

Later upgrading make it a powerful engineering tool which supports the entire MICREX system.

4.1 Expansion of support objectives

As of June 1989, there were the following EWS-500 support objectives (*: expanded support objective):

(1) MMI support

OCS/DBS system difinition, standard screen definition, document definition, plant panel assignment definition

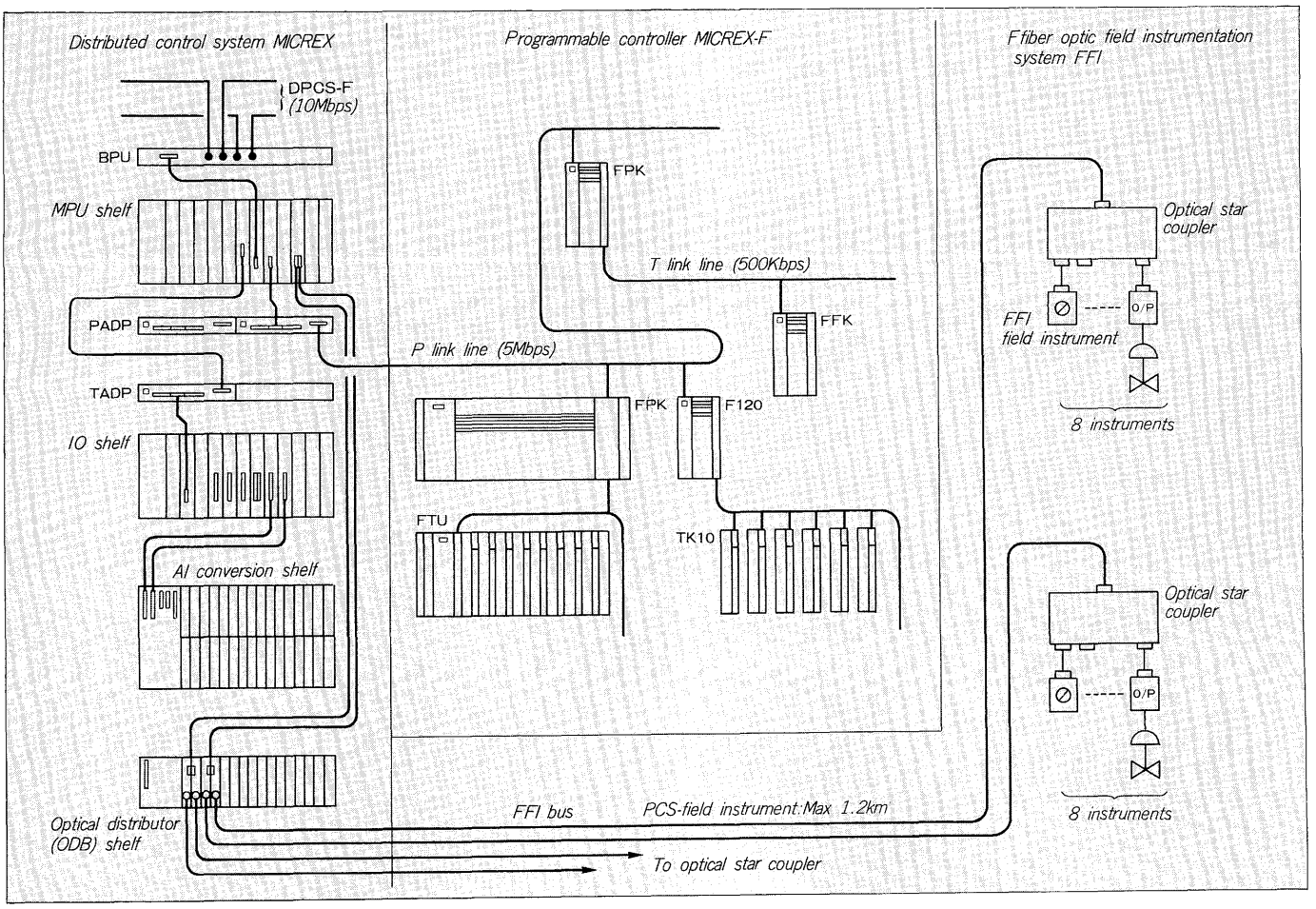
(2) PCS support

PCS-500 loop control function, sequence control function, common functions, preparation of data etc.

(3) TM/TC

Telemeter, telecontroller SAS system definition, position table definition

Fig. 7 Process station PCS-500 network



(4) DKB support*

OCS-1500 dynamic keyboard key definition, key format definition

(5) FFI support*

Configuration definition of FFI connected to PCS-500, on-line diagnosis

(6) User TAG support*

System TAG and user unique TAG mutual conversion function at PCS-500 control operation construction

4.2 Functions expansion

Expansion of the support objectives was also accompanied by expansion of the various engineering functions.

(1) Preparation function

Various definition data key-in and preparation function

(2) Debugging

Mainly, controller internal operation confirmation function

(3) Utility

Auxiliary function which downloads the prepared data to the data base station DBS-1500 integrated data base and operation station OCS-500 definition file or process station PCS-500, or saves the on-line definition data from the PCS-500

(4) Cross reference

PCS-500 internal data reference state cross reference output function

(5) Documenter

Function which prints various definition data as a document at a printer

5. FUTURE PROBLEMS

Expectation and needs must be received from users and the functions, performance, etc. must be steadily improved with the advance of the peripheral devices and technologies used by MICREX.

Examples are upgrading of the support functions accompanying completion of the FFI devices and P link system devices, correspondences to field bus and MAP and other international standards, faster, more advances functions, and higher performance controller and operation, smaller scale oriented DCS, etc.

Unrelenting efforts are continuing to widen use of MICREX in the future.