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PROCESS STATION AND DATAWAY FOR DISTRIBUTED CONTROL SYSTEM MICREX

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1 FOREWORD

Fuji distributed control system MICREX process control station PCS-500 and control dataway DPCS-F were newly developed and are outlined below.

Process station PCS-500 is applicable to a wide range of fields, from continuous control, batch control, instrumentation sequence control, and other process automation to motor high-speed sequence control. The PCS-500 has the following features:

(1) Internationalization of architecture

Internationalization of each unit by using an international standard bus (MULTIBUS(R) (Note) II: IEEE-P 1296 deliherating)).

(2) Wide control objectives

Application to loop control main form, sequence control main form, and any combination of these is possible.

(3) Space saving

Reduction of installation space of entire system by high-density design PIO card, built-in signal conditioning unit, etc.

(4) Increased reliability

High reliable system configuration possible by duplexing of common section and output section, in-line maintenance of units, etc.

(5) Connection to fiber optic field instrumentation system FFI Realization of full scale fiber optic field instrumentation control system.

DPCS-F is a local area network system for control developed as the nucleus dataway in the MICREX system. Higher speed and higher volume data transmission, based on the DPCS-E, which has an abundant record of achievements up to here, is realized, DPCS-F has the following features as a distributed control system dataway:

(1) High-speed transmission of 10M bits/sec
(2) Higher reliability possible by duplexing of transmission units and transmission line.
(3) Mixing of optical fiber cable and coaxial cable possible.
(4) Broadcast transmission function suitable for process data cyclic transmission.

(Note) MULTIBUS(R) is a registered trademark of Intel Co.

2 PCS-500 SYSTEM ARCHITECTURE

2.1 Basic system architecture

The PCS-500 consists of an MPU shelf, IO shelf, signal conditioning units, interface terminal, optical distributor, etc. The basic system architecture is shown in *Fig. 1*. The basic specifications are listed in *Table 1*.

(1) MPU shelf

This is the PCS-500 common section. It has control calculation, dataway connection, IO shelf connection, and other functions. Its architecture is MULTIBUS(R) II compatible. Up to four IO shelves can be connected to the MPU shelf. The names and functions of the cards mounted in the MPU shelf are given in *Table 2*.

(2) IO shelf

This shelf inputs and outputs external signals. Similar to the MPU shelf, its architecture is MULTIBUS(R) II compatible. Up to eight PIO cards are mounted in the IO

Fig. 1 Process station PCS-500 basic system architecture

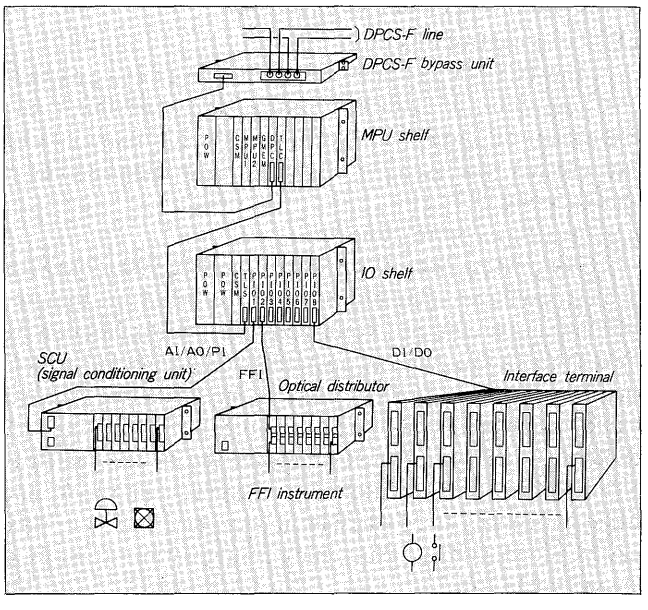


Table 1 PCS-500 basic specifications

Process input/output	Number of input/output points (standard specifications)	• Loop control input/output ..... 32 points • Digital input/output ... 512 points • Analog input/output ... 256 points
	Kinds of input/output	• Digital input/output • Analog input/output • Pulse input • Fiber optic field instrumentation system FFI input/output
Control calculation functions	Loop control function	• Control instruments ..... 32 • Indicators 256
	Sequence control functions	• Step sequence control • Time chart table • Sequence table number..... 32 • Process number/sequence 32
	Common functions	Switch, annunciator, logic calculation, etc.
	Data processing functions	Temperature and pressure compensation, selector, limiter, etc.

Table 2 Cards mounted in MPU shelf

Name	Abbreviation	Functions
Power unit	POW	Power supply to each unit in shelf AC100 V, 50/60 input
Central service module	CSM	Shelf internal bus common control
Master unit	MPU1 MPU2	Control calculation display and program memory
General memory unit	GMEM	Dataway memory
Communication unit	DPC	Dataway DPCS-F connection
T-link adapter	TLC	T-link (internal serial bus) connection

Table 3 Cards mounted in IO shelf

Name	Abbreviation	Function
Power unit	POW	Power supply to each unit in shelf
Central service module	CSM	Shelf internal bus common control
T-link adapter	TLS	T-link (internal serial bus) connection
Analog input	AI	DC1~5 V, 32 points input, used with signal conditioning unit
Analog output	AO	DC1~5 V, 16 points output, used with signal conditioning unit
Digital input	DI	DC24 V, 64 points input, used with interface terminal
Digital output	DO	64 points output, used with interface terminal
Pulse input	PI	Voltage input, 16 points input, used with signal conditioning unit
FFI interface unit	FFIC	32 points input (output), fiber optics field instrumentation system FFI connection, used with optical distributor

shelf. The names and functions of the cards mounted in the IO shelf are given in *Table 3*.

(3) Signal conditioning unit (SCU)

This shelf is the unit which conditions external signals. It interfaces with the PIO cards. SCUs for analog input (AI), analog output (AO), and pulse input (PI) are available. The SCU has isgnal conditioning, input filtering, and other functions. Each SCU is constructed to mount individual units in a shelf. Two external signal points can be connected to the individual unit. Various units are available by input/output specifications. The kinds of signal conditioning units are shown in *Table 4*.

Table 4 Kinds of signal conditioning units

Kind of input/output		Number of points/unit	Function
Analog input	DC1~5 V	2 points	Non-isolated/isolated
	DC4~20 mA	2 points	Non-isolated/isolated
	Resistance bulb	2 points	Pt100Ω connection
	Thermo-couple	2 points	Connection to J, E, K, R, and T type
	mV input	2 points	Corresponds in 10~1,000 mV range
Analog output	DC1~5 V	2 points	Non-isolated/isolated
	DC4~20 mA	2 points	Non-isolated/isolated
Pulse	Pulse input	2 points	Counter input Flow transmitter signal input, etc. (w/filter)

(4) Interface terminal

This unit connects digital input/output signals are interfaces the PIO cards and external signals. The signals of 32 points can be connected to one unit.

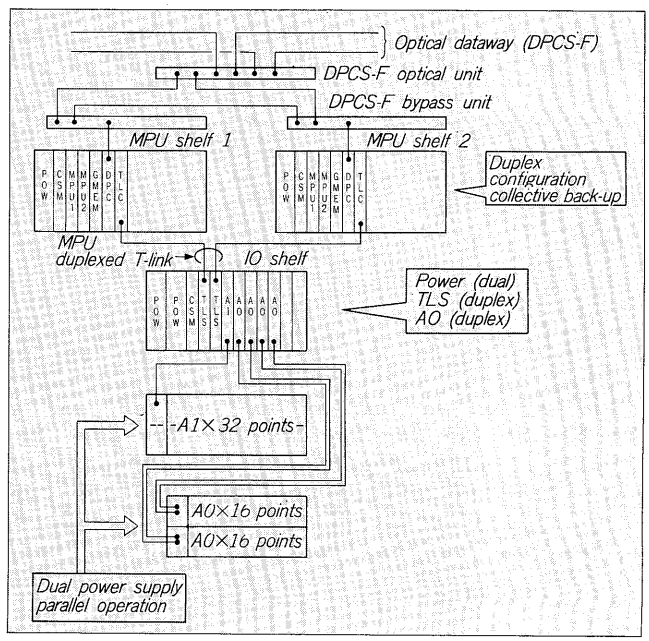
(5) Optical distributor

This unit performs signal connection with fiber optics field instrumentation system FFI field instruments.

2.2 High reliability system

The high reliability system has a common section duplex configuration and is collectively backed up in MPU shelf units. The loop control output section can be duplex-

Fig. 2 High reliability system architecture example



ed in card units. When trouble occurs, in-line maintenance of the faulty unit of the duplexed PIO is possible and operation can be continued without stopping the plant. Since the instrumentation power supply and IO shelf power supply are also duplexed, system reliability can be easily increased. A high reliability system architecture example is shown in *Fig. 2*.

2.3 Connection to fiber optics field instrumentation system

The following features can be obtained by connecting the fiber optics field instrumentation system to the PCS-500.

(1) Total optical systemization including field instruments, higher reliability by digitalization, explosion-proof systemization, improved noise resistance, etc. are possible.

(2) Since optical fiber can be connected directly, a signal conditioning and repeating locker is unnecessary and reduction of the number of lockers and other system simplifications are possible.

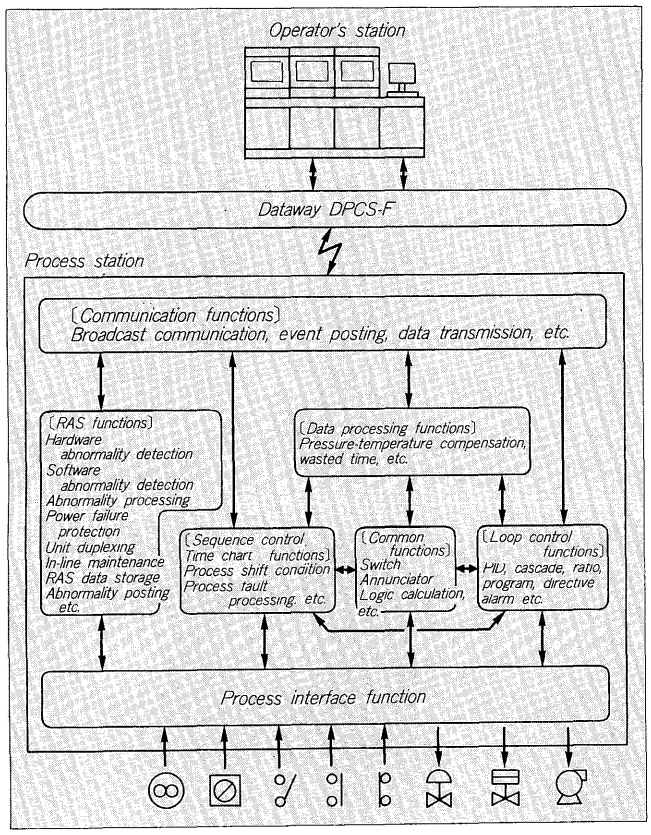
An optical system is connected by interface card (mounted in IO shelf) and optical distributor. Up to 32 optical field instruments can be connected per interface card and up to 256 optical field units can be connected per IO shelf.

3 PCS-500 FUNCTIONS

3.1 Functions system

The PCS-500 has process interface, sequence control, loop control, data processing, communication, RAS, and other functions. The functions system is shown in *Fig. 3*.

Fig. 3 PCS-500 functions system



3.2 Control functions

The sequence control functions and loop control functions are outlined in *Table 5*.

4 PCS-500 SYSTEM CONSTRUCTION

PCS-500 application software can be easily generated and modified from the engineering station (EWS) screen. A sequence table example is shown in *Fig. 4*. For more information, refer to the "Distributed Control System

Table 5 PCS-500 control functions

	Item	Function
Sequence control functions	Control system	Step sequence control, time chart system
	Sequence table	Max 32 sequence tables
	Sequence processes	32 processes/sequence table
	Process transfer condition	4 preprocesses/1 postprocess
	Sequence table output	32 points/sequence table
	Sequence table input	12 points/1 preprocess x 4 x 32/1 sequence table
	Sequence control element	Contact input/output, analog input/output Timer, counter Bit memory, word memory, data file Process condition, control instrument condition Sequence parameters
Loop control functions	Control system	Control instrument system
	Control instrument	Control loops 32 + monitoring loop
	Kinds of control instruments	PID controller (PID, feed forward, powered deviation, gain scheduling, etc.) ratio calculator Indicator, analog integrate indicator, pulse integrate indicator, program setting indicator (continuous/step, second/minute) Manual operation unit, 2-position on/off controller, parameter setting instrument (software), data gathering instrument, etc.
	Control calculation cycle	Min 0.2 sec
	Program patterns	32 patterns

Fig. 4 Sequence table image example

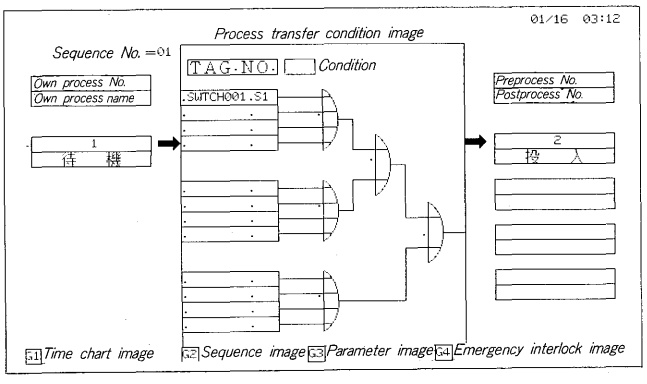
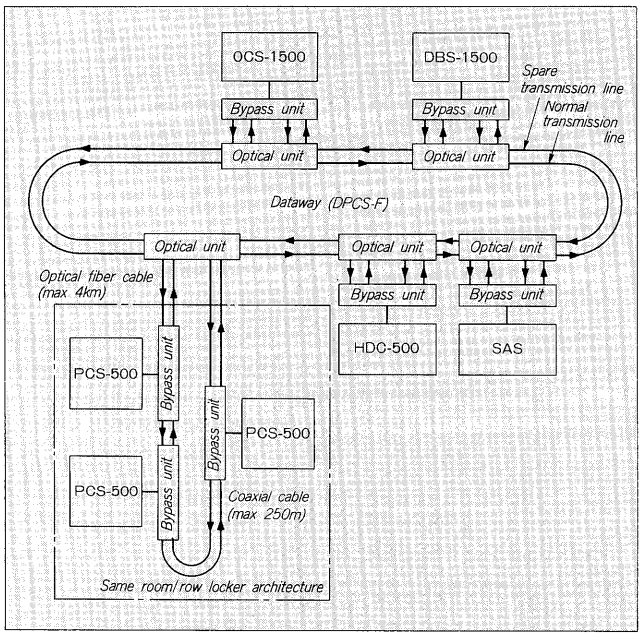


Table 6 Dataway DPCS-F specifications

	Item	Specification
System specifications	Connectable stations	• Process station: PCS-500, HDC-500, SAS • Operator's station: OCS-1500, DBS-1500, PMS-500 • Computer: FASMIC G500, A series
	Number of stations	Max 64 stations/loop
	Transmission line	Loop configuration (transmission line duplex configuration standard)
	Line access method	Token-passing (no dataway common part)
	Transmission line	• Optical fiber cable (G1): Max 4 km between stations • Coaxial cable (5C2V): Max 250 m between stations Two kinds of transmission lines can be mixed in dataway • Transmission line total length: Max 32 km
Communication specifications	Data exchange system	*N:N* communication between arbitrary stations
	Transmission frame structure	HDLC standard
	Frame length	Header (32 bytes) + data (maximum 8 K bytes)
	Transmission speed	10 M bits/sec
Communication functions	Data transmission function	Memory/file read/write processing bit processing
	Message transmission function	YES (message transmission between programs between stations)
	Broadcast communication function	YES (cyclic data transmission between stations)
	System control	Process station starting and stopping via DPCS
	IPL function	Process station IPL via DPCS
RAS function	Self-check function	YES (automatic disconnected from transmission line by hardware bypass function when faulty)
	Transmission line duplexing	Automatic loop back at trouble generation
	Communication unit duplexing	Possible
	Trouble data posting	Communication unit (DPC), master unit (MPU) trouble and alarm data posted simultaneously to all stations by broadcast communication function

Fig. 5 Dataway DPCS-F system architecture



MICREX Operator's Station" article.

5 DPCS-F SYSTEM ARCHITECTURE AND SPECIFICATIONS

5.1 System configuration

A DPCS-F system architecture example is shown in *Fig. 5*. The DPCS-F can organically connect the process station PCS-500, programmable controller HDC-500, operator's station OCS-1500, data base station DBS-1500, and other distributed control system component elements.

An optical fiber cable or coaxial cable is used as the transmission line. The maximum distance between stations is 4 km for optical fiber cable and 250 m for coaxial cable. The bypass unit is a DPCS-F coaxial cable connection unit. It executes the faulty station disconnection (bypass) function and transmission line fault loopback function. The optical unit is an optical fiber connection unit and performs E/O and O/E conversion.

5.2 Specifications

The DPCS-F specifications are shown in *Table 6*.

6 CONCLUSION

The PCS-500 and DPCS-F were outlined above.

These are system which use a new architecture which considers future technological growth. We are confident that the PCS-500 and DPCS-F, with their many features, have a wide range of applications in the PA and FA fields.