Leading Innovation, Creating Tomorrow

MASTER P-5000

for Power Plant Control & Critical Process Automation

Automation Solution

LS Industrial Systems

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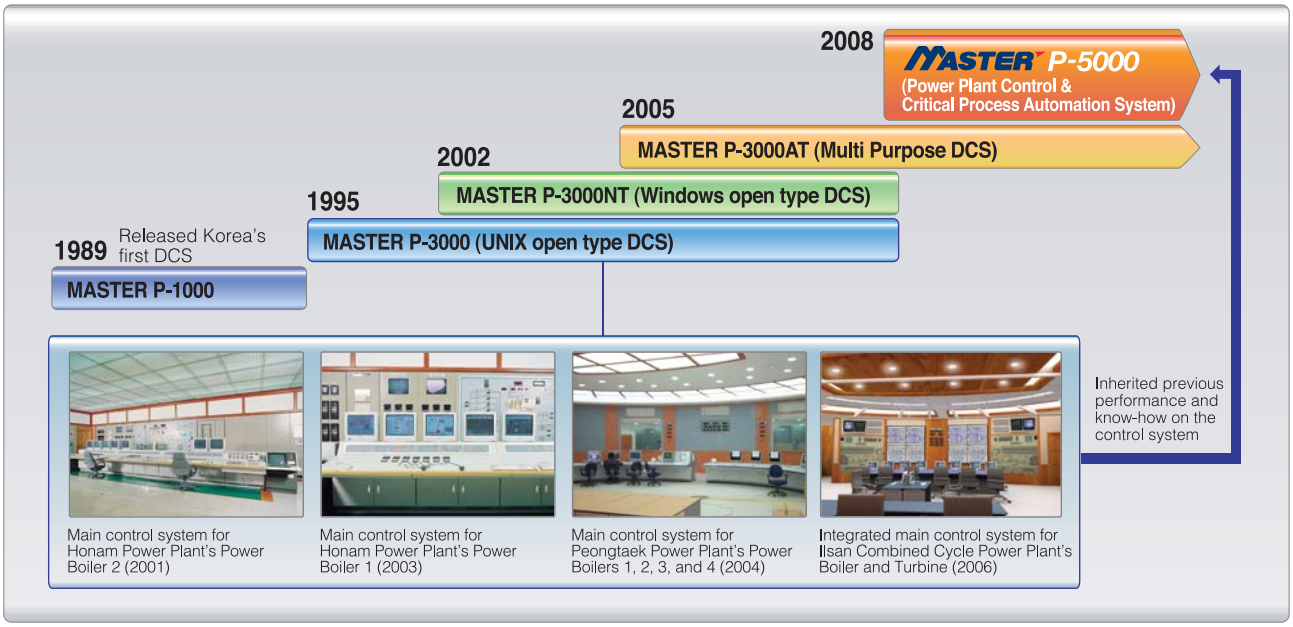
MASTER P-5000

for Power Plant Control & Critical Process Automation

Evolution of the System

LS Industrial Systems, who pioneered the Korean DCS development market, presents a new product for complete control of highly sophisticated processes of power generation plants, steel and chemistry industries, etc.

Back in 1980 when Korea depended on overseas DCS, LS Industrial Systems succeeded in developing the first Korean DCS with its own technology. With the spirit of an innovator, we proudly introduce our new Power Plant Control & Critical Process Automation System 'MASTER P-5000'. As a power plant control system manufacturer, LS Industrial Systems, for the first time in Korea, successfully developed and applied the main control system for Honam Power Plant's boiler 2 with Korea's own technology in 2001, pushing the limit of the Korean DCS industry.
We have provided main control systems for Honam Power Plant's boiler 2in 2003, for Peongtaek Power Plant's boilers 1, 2, 3 and 4 in 2004, and the Ilsan Combined Cycle Power Plant main control system (HRSG, BOP, Turbine) in 2006. MASTER P-5000 is our new innovation in which we invested our knowledge of core process in the power plant control field, and our experience in development, designing, manufacturing, and commissioning accumulated through an excellent track record. MASTER P-5000 is a control system the whole of which is optimized for highly sophisticated processes of various industries, such as power plant, steel, and chemistry.



System Features

High Performance

- Enhanced special features for Power Plant & Critical Process
- Employs a product structure for high-speed control, such as turbine control
  - High-speed control computation MPU H/W and S/W (min. 5ms)
  - High-speed I/O communication function (I/O scan time: max. 5ms)
  - Complete redundancy of the whole system for turbine control (incl. redundant I/O)
- Supports HART communication which is
- Widely-used for plant monitoring and control.

High Reliability

- Fully redundant system (DB, control, communication, I/O board, power supply)
- Fail safe function
- Allows changing the control logic while operating
- RCS self-diagnosis function (MPU, I/O board)

Easy Maintenance

- How swapping
- SMS service
- System online diagnosis (control, network, DPC, WDC, printer diagnosis)

Convenient Operation

- Integrated management of different models (Ethernet, serial)
- High-speed trend • Alarm Server
- X-Y plot, characteristics curve
- Excel conversion (report, trend, etc.) • Control simulator
- Management of the change history of the control logic.
- Engineering data synchronization
- Sequence of Event (SOE) data management

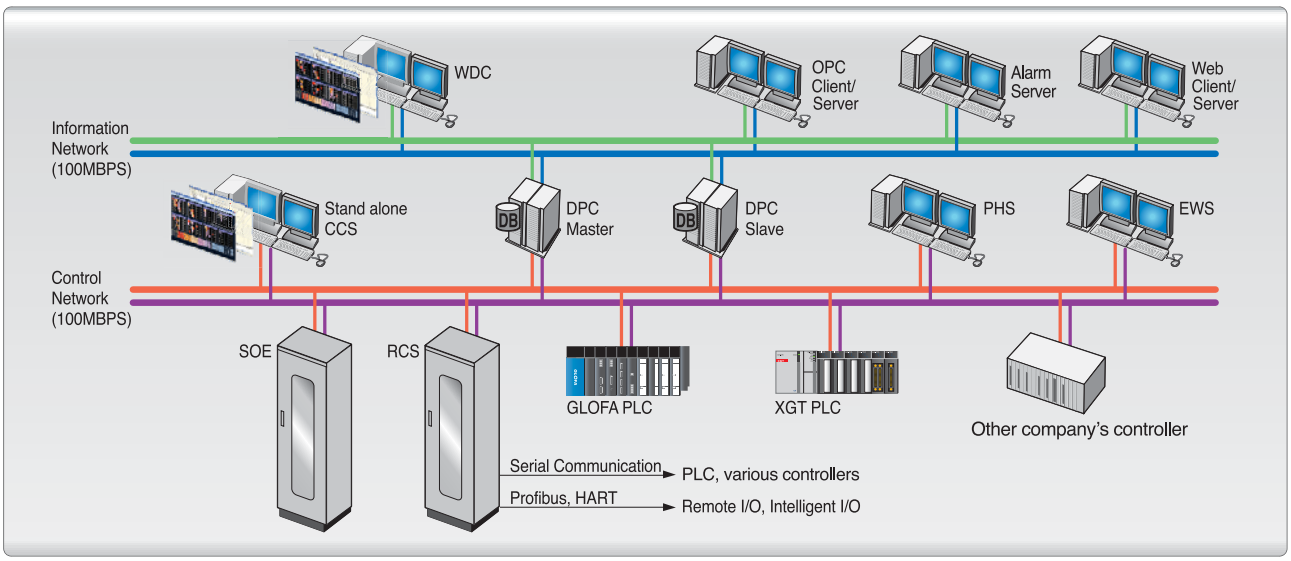
Open Architecture

- Employs Window O/S
- Supports international standard control language (IEC61131-3 : FBD, LD, SFC)
- Provides industrial standard interface (OPC C/S, PROFIBUS, HART)
- Allows applying KKS standard tag name rule
- Supports international standard alarm operation (DIN19325)

Reference

- Grafted the knowledge of power plant process
- Power plant boiler main control system algorithm
- Power plant integrated (boiler + turbine) main control system algorithm

System Block Diagram



System Components

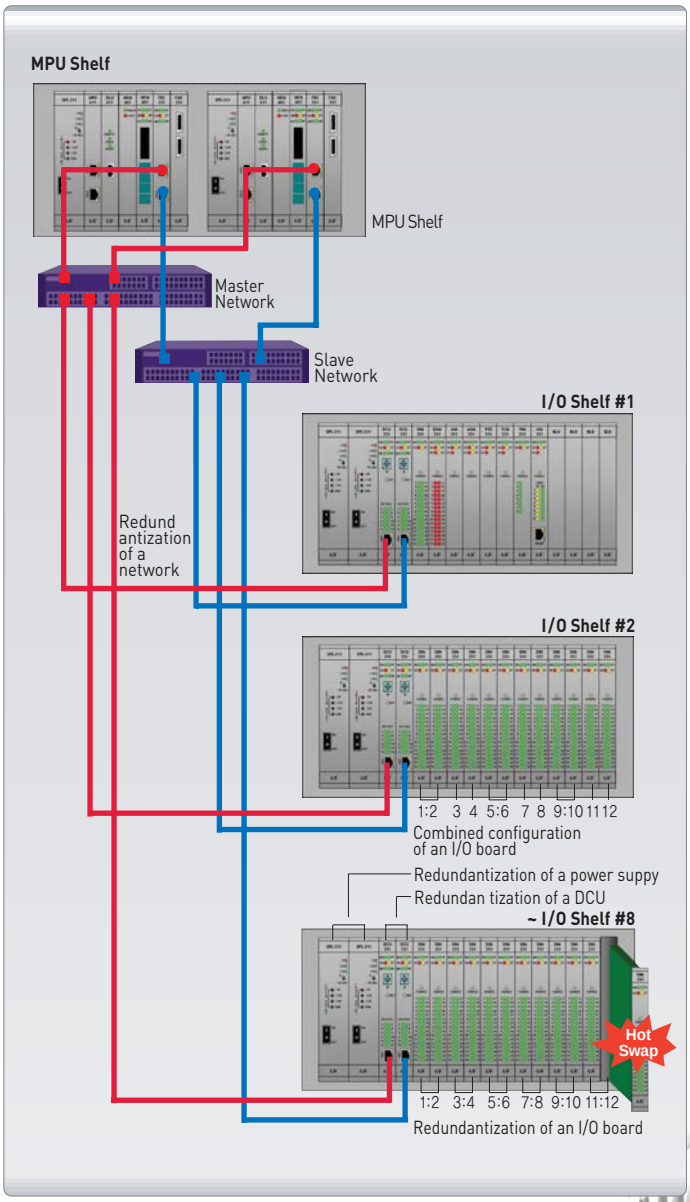
Main Components	Features
WDC	A Workstation Display Center, which works as an operator station that an operator directly operates. It provides various display systems allowing an operator to use the information processed in DPC in any form (s)he wants.
OPC Client/Server	Industrial standard OPC(OLE for Process Control) Client/Server that allows unfettered interface with other systems.
Web Client/Server	Provides the web monitoring service that allows remote monitoring from an office or other places far away from the main monitoring & control room. Also provides real-time plant monitoring and history data through an intranet or the Internet.
CCS	A Central Control Station which can be applied as a stand-alone type that integrates DPC and WDC functions. It processes real-time and history data, and provides the plant monitoring and control functions.
DPC	A Database Processing Center which is a station that manages and processes all the data in the system. It collects data from on-site controllers, such as RCS, creates the database, and then processes, stores and manages it.
PHS	A Plant History System which stores the long-term operation information and history data, and provides analysis to improve efficiency of the plant operation.
Alarm Server	Collects and stores for a long period of time the information of various on-site process alarms and controller alarms that occurred in a critical process, such as a power plant.
EWS	An Engineering Work Station which creates, modifies, and saves the engineering data required to operate the whole system.
SOE	Sequence of Event. In case a major system of a power plant or a critical process trips, it collects the digital point status information once every 1/1000 second and outputs them to a printer to analyze the event and its cause.
RCS	A Remote Control Station which directly controls a plant according to the program prepared in EWS. By making all or any of control, power supply, communication, I/O parts redundant, it can configure the system to be appropriate for specific use of each critical PA process or turbine control. Especially, it can configure a station specialized for a turbine control system which requires high-speed (less than 5msec) control performance.

System Size

- Central Control Station: Max. 48 stations
- Remote Control Station: Max. 64 stations
- Engineering Work Station: Max. 4 stations
- Number of monitoring & control tags: Unlimited
- Number of saved trend history data: Unlimited
- Number of plant display pages: Unlimited

Remote Control Station

- Able to control a less-than-5msec high-speed process, such as turbine control, with the high-speed control function of a MPU shelf and an I/O shelf.
- Complete redundancy of every component of the RCS, including a MPU shelf, an I/O shelf, and communication.
- Able to respond to the needs for system expansibility unique to each process by employing system interface functions, such as Profibus, HART, etc.
- Improved data processing speed and reliability by applying the VME BUS to the entire BUS of a MPU shelf and an I/O shelf.



MPU Shelf

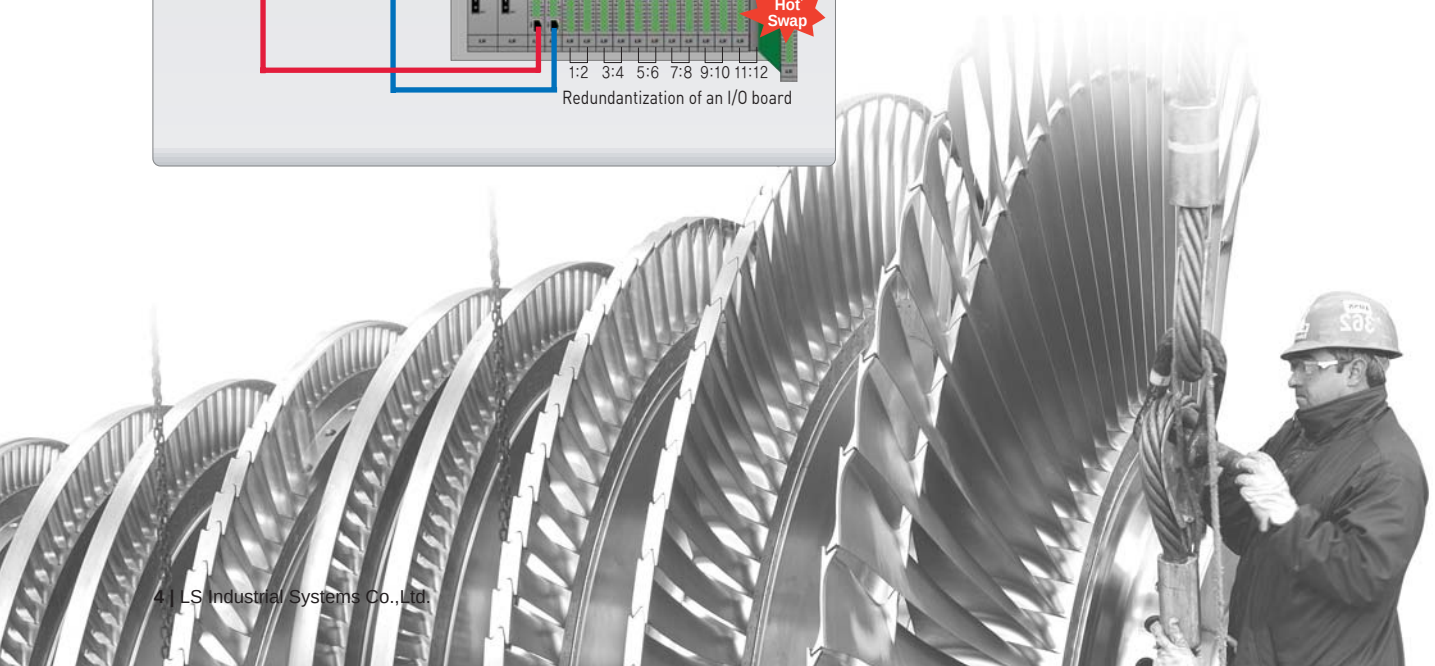
A MPU shelf computes controls and processes alarms for on-site data collected by an I/O BUS, and then notifies its result to the upper level. In addition, to ensure reliability, the Slave MPU takes over the role of the MPU in an uninterrupted state in case the Master MPU fails during the redundantization process.

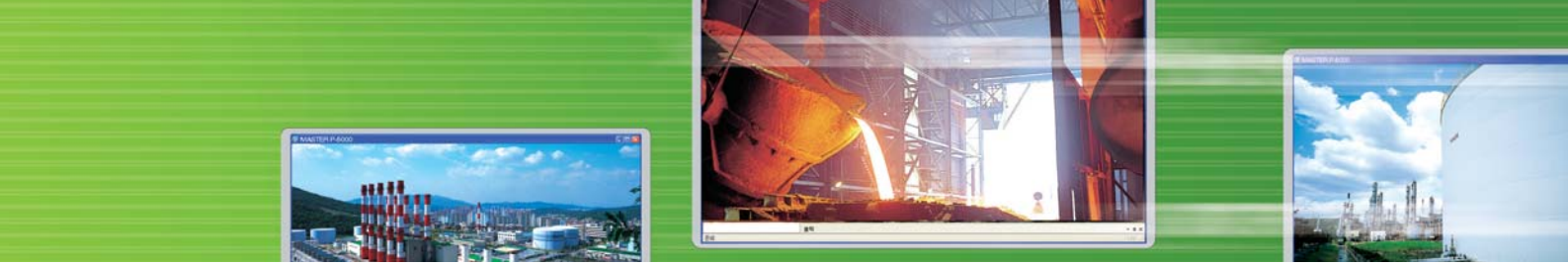
- **Backplane** : VME BUS
- **MPU** : 667MHz, 256MB, Dual Ethernet (100 Mbps)
- **DLU** : VME BUS Extension Board (fiber optic cable)
- **MEM** : 2/4MB, Battery Backup
- **FBC** : Dual Ethernet (100 Mbps)
- **Max. number of RCS Stations** : 64

I/O Shelf

An I/O shelf collects the on-site data, notifies them to the MPU shelf, and then outputs the results of the MPU shelf's control computation to the site. To ensure reliability, the entire power supply, communication, and I/O board of the MASTER P-5000 RCS's I/O shelf can be made redundant. For the system intended for high-speed control, such as turbine control, the MPU shelf's FBC and the I/O shelf's DCU employs the high-speed type.

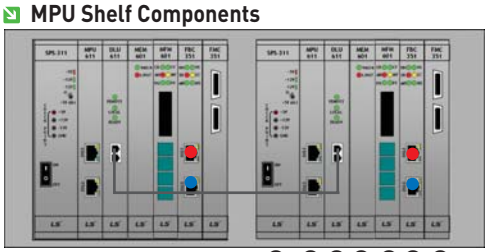
- **Backplane** : VME BUS
- **DCU** : Single Ethernet (100 Mbps)
- **IO** : DI/DO, AI/AO, RTD, TC, PI, HART AI communication board
- Supports Hot-Swapping (DCU, I/O board)
- Combined configuration of an I/O board (both single and redundant)
- **Max. number of boards that can be installed per station** : 96 (12 boards * 8 shelves) However, it is limited to 4 shelves if the control cycle or the I/O communication cycle is set to 5ms, and 8 shelves if the cycle is set to more than 50m.





Specification and Features of Major Components

MPU Shelf Components



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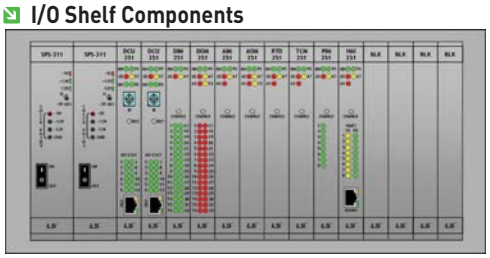
❶ **SPS** : Shelf Power Supply
❷ **MPU** : Main Processing Unit
❸ **DLU** : Data Link Unit
❹ **MEM** : Memory (battery backup)
❺ **MFM** : MPU Shelf Fault Check Module
❻ **FBC** : Field I/O Bus Controller
❼ **FMC** : Fieldbus Master Controller

Type	Specification	Features
SPS	• Input Power: AC220V, 60Hz±10% • Output Power (Capacity) : DC 5V/30A(150W), DC12V/3A(36W), DC-12V/3A(36W)	• Supply the power to each board of the MPU shelf. • Overcurrent/overvoltage protection, output compensation, power failure detection, and auto switching during the configuration of redundancy.
MPU	• CPU : 667MHz • SRAM : 256MB • Network : Ethernet 100Mbps 2 Ports	• On-site data monitoring, sequence control using the IEC61131-3 control language, real-time/periodic task execution, phase control, RAS creation, redundancy control logic, mode selection, and report creation.
DLU	• VME64 Bus-to-Bus Adapters with DMA • Controller Mode DMA : 70MB/s • Cable Interface : Fiber-optic cable	• Redundant board used in the redundantization of the MPU shelf. • Monitoring other MPU shelf, equalization by renewing control-related output, parameters, etc.
MEM	• Memory Size : 2MByte or 4MByte • Battery Backup : The retention period in case of power failure is 8 years for	• Able to retain control logic and operation data using a backup battery even when the power is off. • Low battery display function
MFM	• ADC : 12Bit analog to digital converter • DAC : Outputs the definition of power failure 16Bit DA • LED : LED Matrix : 5X7 LED Matrix X 4	• Able to trigger interruption in case of any fault caused by the MPU shelf's power display, status, power check, relay output and definitions. • The display is composed of four 5x7 dot matrices.
FBC	• CPU : 533MHz • DPRAM : 256KB (shared memory) • Network : Ethernet 10/100Mbps 2Ports • Shared memory refresh cycle : Min. 5ms • High-speed Ethernet communication cycle : Min. 5ms	• Carries out I/O BUS communication with the DCU board of the I/O shelf according to the MPU board's control commands. • Redundantization : making the shelf and the network redundant,Run/Stand-by method • I/O information shared memory interface : I/O data and board diagnosis statuses, and I/O initialization parameter setting information. • Self-diagnosis : diagnosis during the booting and the operation, DCU communication status, etc. Storing the fatal error history • High-speed Ethernet communication cycle: Min. 5ms
FMC	• DPRAM : 64KB • Network : RS485 Profibus 3Mbps 1 Port • Protocol : Profibus DP-Master • Max. number of Slaves : 89 devices	• A master communication board that obtains the input data from, or sends output data to remotely located slave devices using Profibus. • Redundantization : making the shelf redundant, Run/Stand-by method. • What to Diagnose : BUS communication status, FMC board operation status, Slave devices, Profibus configuration information error status, etc.

I/O Shelf Components



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❶ **SPS** : Shelf Power Supply
❷ **DCU** : Data Communication Unit
❸ **DIM** : Digital Input Module
❹ **DOM** : Digital Output Module
❺ **AIM** : Analog Input Module
❻ **AOM** : Analog Output Module
❼ **RTD** : Resistance Temperature Detector
❽ **TC** : Thermal Coupler
❾ **PIM** : Pulse Input Module
❿ **HAI** : HART Analog Input Module

Type	Product Name	# of Channels	Signal	Error Rate (at roo temp.)	Remarks
DIM	DIM-351	32	TR input	-	
DOM	DOM-351	32	Relay output	-	
AIM	AIM-351	8	Current : 4~20mA, Voltage : 1~5V	±0.1%	Multi input function
	AIM-352	16	Current : 4~20mA, Voltage : 1~5V	±0.1%	I/O single only
AOM	AOM-351	4	Current : 4~20mA, Voltage : 1~5V	±0.1%	Multi output function
	AOM-352	8	Current : 4~20mA, Voltage : 1~5V	±0.1%	I/O single only
RTD	RTD-351	12	PT100, JPT100	±0.2%	3 line type
TC	TCM-351	16	K, J, E, T, B, R, S, N Type	±0.2%	Cold junction compensation
PIM	PIM-351	8	0~24VDC pulse signal	±0.1%	
		8	100~220VDC pulse signal	±0.1%	
HART AI	HAI-351	8	HART 4~20mA current	±0.2%	HART comm

Note: The product specification included in this catalogue is based on the RCS configuration for high-speed control, such as turbine control, and is intended to provide a brief introduction of core components. As a result, it may vary according to the model in use and project environments. For more information, please see "ASTER P-5000 User Manual"

MASTER P-5000

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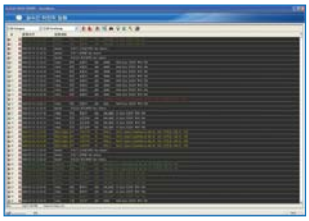
Workstation Display Center

- User friendly: Upon logging in, previous operation settings will be retrieved, and operator settings will be initialized. (Saves/Opens operation screen arrangement information for each operator.)
- Independent modules: Provides various operation screens appropriate for each and every site and operator. (Displays both the alarm and the trend on the same page.)
- Windows integration: Provides a system windows program and a viewport (single line diagram, and P&I monitoring & control screen container) for system operation.
- Provides a solution specially designed to furnish major real-time information during the operation of a system.

Plant Screen

- Process system monitoring & control
- Template page conversion
- Navigation and tabular page functions



Alarm Screen

- Displays information on whether the alarm is recognized, and the operation history.
- Real-time search function
- Alarm history search function

Trend Screen

- Displays real-time trend or trend history data
- Processes the data collected at different times
- Displays a chart in various formats

System Status Screen

- Monitors the status of main elements of a system, such as RCS, network, etc.
- Displays detailed information of MPU and I/O cards of each station.
- Hierarchical screen arrangement

Group Overview Screen

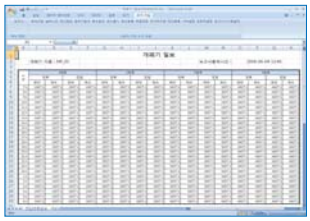
- Provides a clear picture of alarm status of an entire plant
- A click on the group where the alarm occurred brings up the corresponding operation group screen.
- Hierarchical screen arrangement

Operation Group Screen

- Displays related points as a group.
- Displays data in various formats without any additional graphic work
- A click on a tag brings up the loop screen.

Loop Screen

- Displays tags of module types including PID.
- Controls various settings and operation modes
- Provides a real-time trend graph.

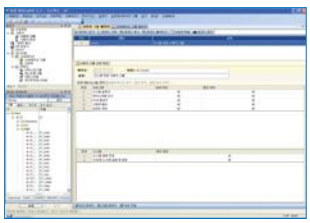


Report Screen

- Provides hourly, weekly, monthly, annual and prompt reports.
- Allows viewing, editing, processing and modifying the report data using Excel.

Engineering Workstation

- Supports IEC61131-3 international standard control language – Provides a Function Block, a Ladder Diagram, and a Sequential Function Chart.
- Provides an integrated engineering tool that can run every engineering program and satisfy various user needs.
- Incorporates a cross reference function to increases the engineer's convenience and reduce the engineering time.
- Allows importing/exporting the information of point tags and the control logic of on-site devices to reduce the engineering time.



Integrated Engineering Screen

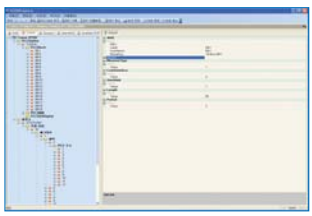
- Provides an integrated environment for all tools required for engineering in relation with system operation
- Provides convenient functions, such as Drag & Drop, IntelliSense, etc.
- User group and user access settings
- Trend-related group/ style settings
- Algorithm editing and management

Graphic Builder Screen

- Provides a wide range of graphic objects and dynamic characteristics
- Graphic symbol library management unction
- Head/Tail layer setting function, and action processing for user events

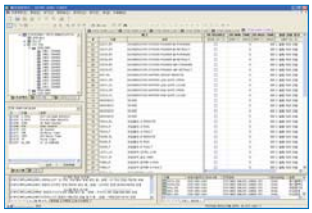
Report Definition Screen

- Developed as an Excel add-on (Office 2007 or higher version)
- Various display formats including a chart and a graph
- Various link functions to display data on the screen



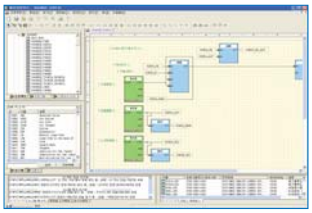
Integrated Database Editor Screen

- Provides various filters and sorting functions
- Easy-to-use user GUI



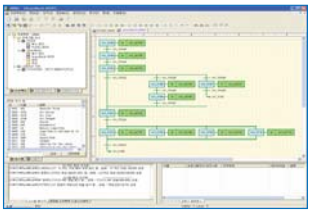
I/O Engineering Screen

- Allows setting the I/O board definitions and parameters
- Allows downloading the I/O board definitions and parameters
- Emulation function



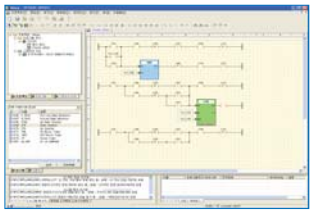
Function Block Diagram Editor Screen

- Provides a system function block with various functions
- Allows writing a custom function block



Sequential Function Chart Editor Screen

- Process writing using Step, Action, and Translation
- Various display formats including a chart and

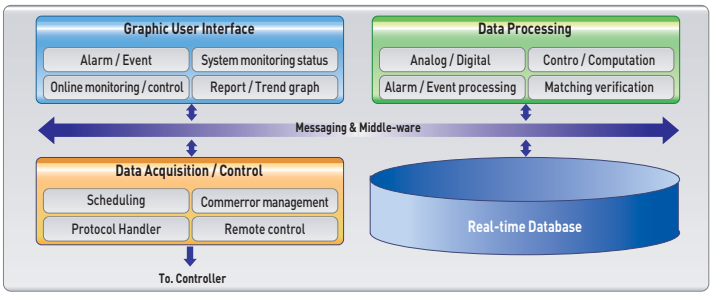


Ladder Diagram Editor Screen

- Control logic writing using Ladder
- The relay logic and the function block can be combined together for use.

Database Processing Center

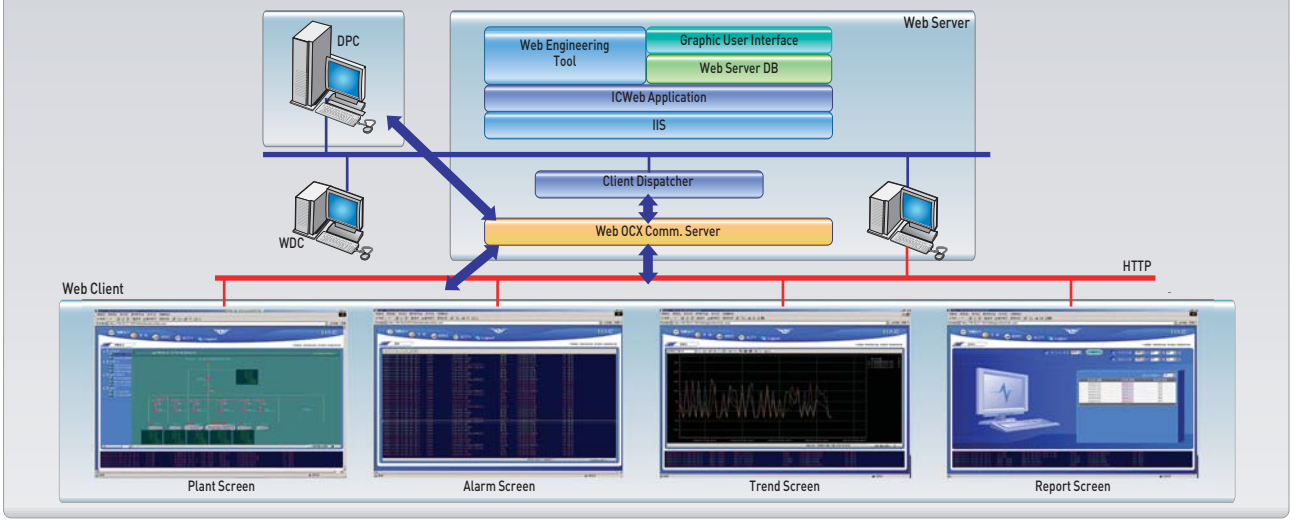
- DPC function : Data collection/ data processing/ alarm and history data storage/ operator interface
- Redundant configuration of the system and the network. Supports the configuration of a stand-alone system.
- Real-time DBMS : Provides an optimized real-time interface operation environment
- Supports a device driver to obtain data from RCS, TMTC, SOE, PLC (GLOFA, XGT) or other company's controllers.
- Provides a GPS time server interface for time synchronization, and supports time synchronization for RCS/SOE controllers.



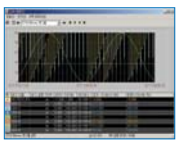
Web Client/Server

- Employs the Microsoft web server program IIS (Internet Information Service)
- Supports HTTP, ASP and ASPX pages
- Employs MS SQL Server as a web server database

To allow viewing/monitoring the same pages as shown in the main monitoring room from remote locations with the Internet/Intranet connection.

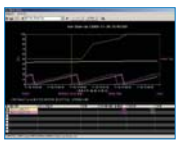


Plant History System



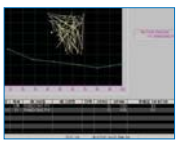
High-speed Trend Screen

- High-speed data saving by the event processing method (50 msec x n (integer))
- With the server separated from the collector, it prevents data error in case of an overcurrent of the server.



Characteristics Curve Screen

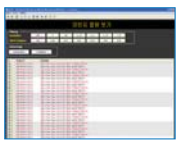
Provides an easy-to- understand comparison between ideal and actual values by displaying on the screen, first, the ideal values preset by a user, and then the actual values.



X-Y Plot Screen

Displays a graph that shows the trend of changes in interconnected points.

Alarm Server

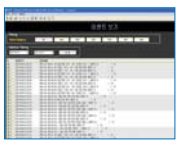


Unrecognized Alarm Screen

Displays the list of process /system alarms an operator has failed to recognize.

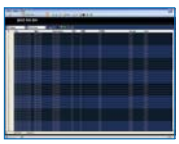
Recognized Alarm Screen

Displays the list of process /system alarms anoperator has recognized.



Event Screen

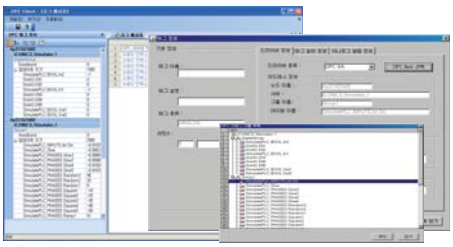
Displays the list of events controlled or modified by an operator



SOE Data Management Screen

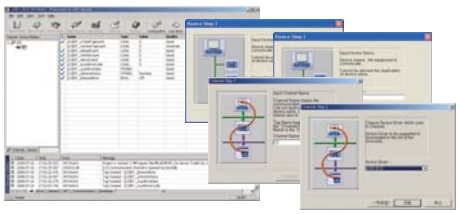
Allows saving and viewing the SOE long-term history, exporting the SOE history to Excel, and also printing it out.

OPC Client/Server



OPC Client

Reads and writes the data from the OPC server of another company's system.



OPC Server

Supports the tag data information OPC-DA interface of our MASTER P-5000 system.

Leading Innovation, Creating Tomorrow

Safety Instructions

- For your safety, please read user's manual thoroughly before operating.
- The product covered in this manual is subject to be discontinued or changed without notice. Be sure to check at the time of purchase.
- Do not disassemble or attempt to repair the product. For inspection and maintenance, please contact an expert.

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