

# Global Standard Power Plant Monitoring and Control System

Yoshio Maruyama  
Hiroshi Suzuki  
Junichi Miyakawa  
Katsuhide Kitagawa  
Takahiro Yamada

*OVERVIEW: With demand for electricity growing around the world and particularly in emerging nations, there is a need to raise operating efficiency and operate power plants in a way that takes account of the environment. Given this background, the HMI systems used for routine operation and monitoring by plant operators are subject to a wide range of requirements including being able to show the operating status of the plant at a glance and allowing users to configure graphic displays and log formats for themselves. Hitachi's HIACS monitoring and control system for power plants has seen extensive use in Japan where it is a key item of power plant control equipment. With the aim of establishing a more global presence, Hitachi has started to offer a more enhanced HIACS on the global market, having taken note of user needs for better presentation, ease-of-operation, usability and similar features in the HMI systems they use for routine operation.*

## INTRODUCTION

DEMAND for electricity on the global market has shown steady growth, particularly in emerging nations such as China, India, Russia, and Brazil.

Together with consideration for the global environment forced by a growing awareness of environmental problems exemplified by the issue of global warming, this requires that the power plant be



Fig. 1—Central Control Room in Power Plant.

The control room used for the centralized monitoring of the operation of the power plant is fitted with a large number of HMI (human-machine interface) systems and large-panel screens that show the operating status of the plant at a glance.

operated at a high level of efficiency. These market conditions place a range of different requirements on the HMI (human-machine interface) systems used for routine operation and monitoring by power plant operators.

In response to these needs, Hitachi has developed a new HMI system for its HIACS (Hitachi integrated autonomous control system) monitoring and control system for power plants (see Fig. 1).

This article describes the global market needs for HMI systems and the functions that satisfy these needs.

### GLOBAL MARKET NEEDS

The following lists the main requirements for the HMI systems used for routine operation and monitoring by power plant operators (see Fig. 2).

- (1) High-resolution graphics screens able to show the operating status of the plant at a glance, multiple monitors, and large-panel display screens
- (2) User-friendly tool set that allows users to design their own screen layouts and log formats
- (3) Systems for long-term storage of power plant operating data that are easy to use for analysis and investigation
- (4) Secure systems that ensure monitoring and operation is performed safely by personnel with the correct privilege
- (5) Systems with a high degree of expandability that can easily be integrated with the power plant's computer automation system

### GLOBAL STANDARD POWER PLANT MONITORING AND CONTROL SYSTEM System Configuration

The newly developed HMI system incorporates monitoring and operating functions necessary for the operation of the plant. It can also display plant information in a visual format, supply control data, and provide operator guidance. Fig. 3 shows an overview of the configuration of a DCS (distributed control system) that includes these features.

The system has an autonomous distributed configuration that connects devices installed across the plant via a network to provide monitoring, control, and data management functions independently. Plant data is converted into engineering values by the control devices that are installed on plant equipment and used for feedback control, sequence control, and other forms of control, and this data is then saved via the  $\mu\Sigma$  Network-100

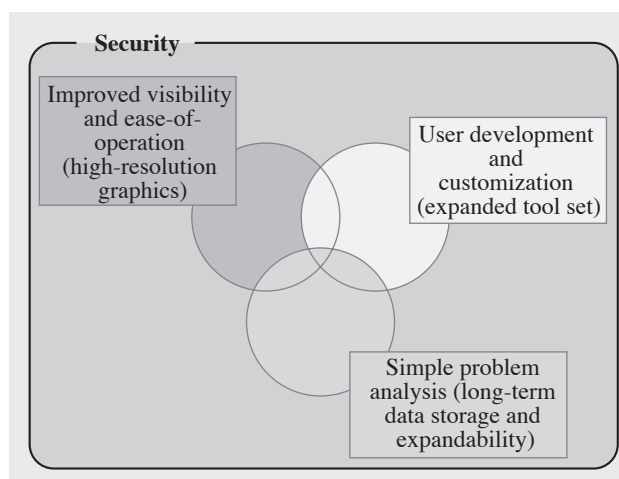


Fig. 2—Global Market Needs for HMI Systems.

The global market needs for the HMI systems used for routine operation and monitoring by power plant operators are shown.

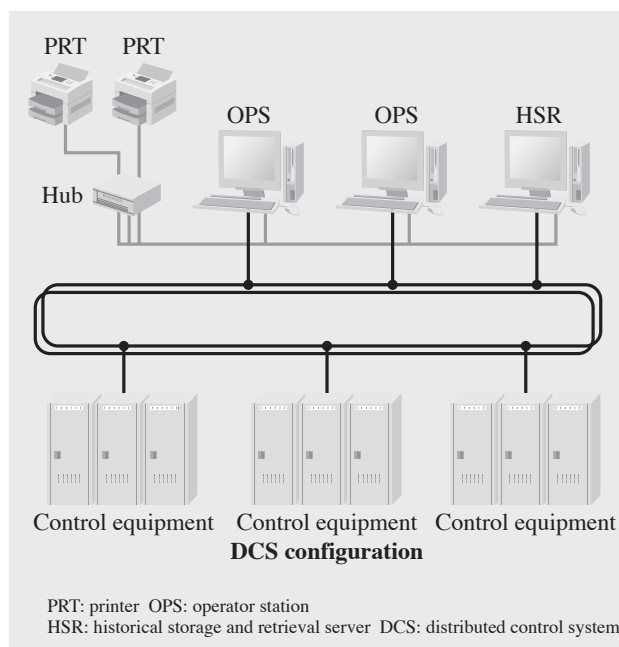


Fig. 3—System Configuration Overview.

Configuration of the power plant monitoring and control system is shown.

control LAN (local area network) in the OPS (operator station) units that are the main components of the HMI system.

### High-resolution Graphics

Graphics screens such as process diagram displays that monitor the operating status of the power plant use three-dimensional images, animations, and similar features to provide a more vivid and intuitive representation of the plant status (see Fig. 4).

To extend the range of plant that can be monitored, the system also supports large-screen

displays and a multi-monitor configuration whereby two monitors can be connected to each HMI CPU (central processing unit) (see Fig. 5).

As ease-of-use for monitoring and operation is an essential requirement for achieving efficient plant operation, the system utilizes the industry-standard Windows\* interface to make the system easier for users to use.

Programs that execute computational formulas can be developed simply by entering equations into spreadsheet software.

The system supports user-configurable access control and authentication. Logs can also be collected to record the actions of authenticated users.

### User-friendly Tools

In the global market, it is standard practice for users to configure their own graphics screens and log formats. By extending a tool set with excellent usability and making it available to users, the system allows screens and reports to be customized even by users who lack special programming skills. The tools developed for this purpose are listed below.

- (1) Graphics builder
- (2) Input and output point database builder
- (3) Calculation builder (see Fig. 6)
- (4) Operation frame builder
- (5) Log builder (see Fig. 7)
- (6) Logic definition tool for APS (automatic plant startup and shutdown system) process chart

### Long-term Storage System for Operating Data

Although the operating status of the power plant is recorded and saved in various reports, there is also a frequent requirement for long-term storage of plant operating data. The system includes an HSR (historical storage and retrieval server) for long term storage of all data points that facilitates analysis and investigation when problems occur.

### Security System

Work is in progress on adding a security system that performs user authentication for graphics screen and log format design as well as for plant operation from the HMI screens and only permits access if the user has been granted the correct privilege(s).

The system supports user-configurable access control and authentication (see Fig. 8). Logs can also

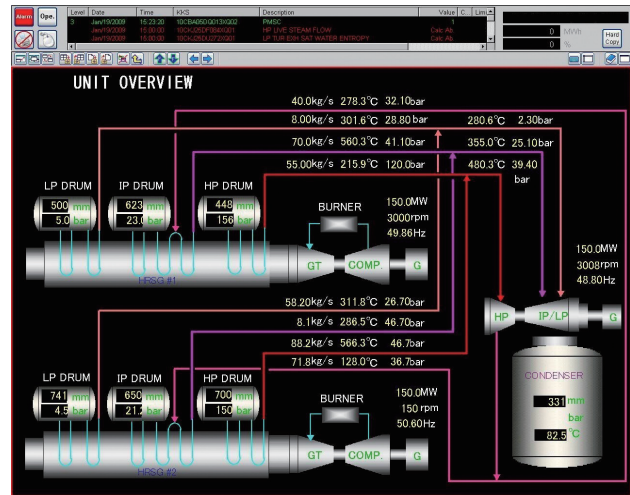


Fig. 4—High-resolution Graphics Screen.

Use of three-dimensional graphics conveys an intuitive view of the plant status.



Fig. 5—Multiple Monitors<sup>(1)</sup>.

More complex monitoring and operation can be facilitated by opening multiple windows at the same time.

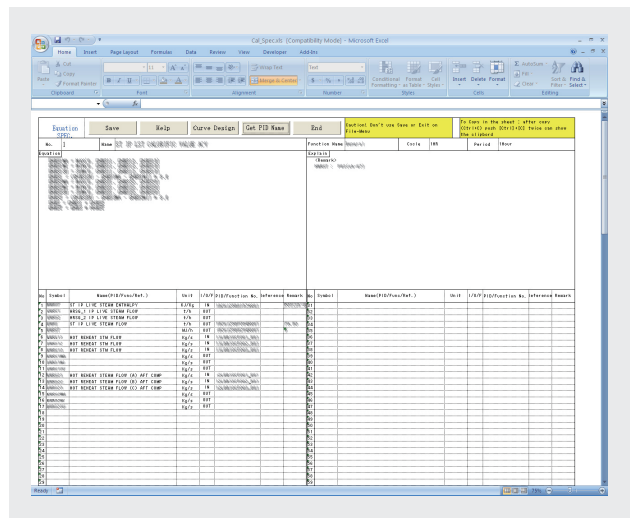


Fig. 6—Calculation Builder.

Programs that execute computational formulas can be developed simply by entering equations into spreadsheet software.

\* Windows is a registered trademark of Microsoft Corporation in the U.S. and/or other countries.



be collected to record the actions of authenticated users.

### System Expandability

The power plant computer automation system and APS are functions of the unit computer which has established a reputation for reliability in previous applications. The HMI system features excellent expandability and can connect seamlessly with these systems as well as other systems such as those for performance calculation and schedule calculation.

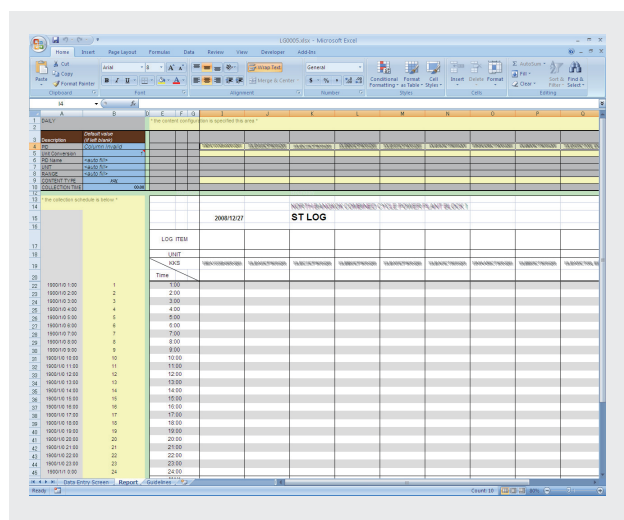


Fig. 7—Log Builder.

Log formats can be configured using spreadsheet software.

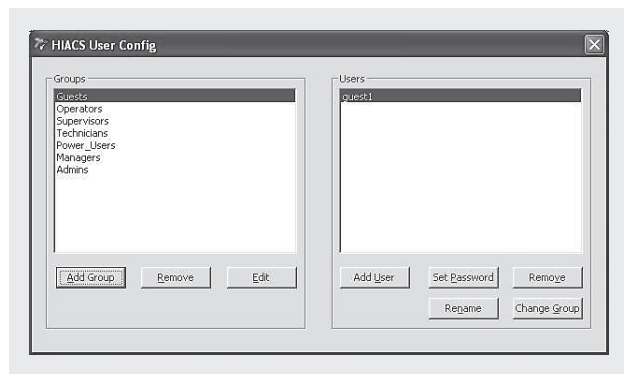


Fig. 8—Security System.

The system supports user-configurable access control and authentication. Logs can also be collected to record the actions of authenticated users.

### CONCLUSIONS

This article has described a newly developed HMI system that meets the needs of the global market.

The three-dimensional graphics, multi-monitor and other functions of the new HMI system deliver excellent presentation and monitoring performance.

Support for a range of tools with excellent usability allows users to configure graphics, log formats, calculation, and other functions for themselves without having to write any programs. The system is a safe and reliable monitoring and control system with excellent security and the ability to connect seamlessly with the unit computers that have a track record in past applications is included as a matter of course.

Hitachi intends to continue developing products that satisfy market needs and supplying systems that are easier to use, safer, and more reliable.

### REFERENCE

- (1) "New HMI for Power Plant" Hitachi Technology, p. 42 (Aug. 2009).

### ABOUT THE AUTHORS



**Yoshio Maruyama**

Joined Hitachi, Ltd. in 1992, and now works at the Power Plant Control Systems Department, Information & Control Systems Company. He is currently engaged in the design of computer control systems for power plant.



**Hiroshi Suzuki**

Joined Hitachi, Ltd. in 1998, and now works at the Power Plant Control Systems Department, Information & Control Systems Company. He is currently engaged in the design of computer control systems for power plant.



**Junichi Miyakawa**

Joined Hitachi, Ltd. in 2007, and now works at the Power Plant Control Systems Department, Information & Control Systems Company. He is currently engaged in the design of computer control systems for power plant.



**Katsuhide Kitagawa**

Joined Hitachi, Ltd. in 1996, and now works at the Power Plant Control Systems Development Center, Information & Control Systems Company. He is currently engaged in the development of control systems for power plant.



**Takahiro Yamada**

Joined Hitachi, Ltd. in 2005, and now works at the Power Plant Control Systems Development Center, Information & Control Systems Company. He is currently engaged in the development of control systems for power plant.