Energy Supervisory System

Masaya Suzuki,
Keiji Hamasaki

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Abstract

In order to respond to general concerns regarding "energy saving," we have developed a supervisory system that offers features such as an increased visibility of power consumption, a critical function for the promotion of energy saving, a function of identifying actual energy use volume situation, and analytical functions.

1 Preface

When we propose or ship supervisory control systems to our customers, they tend to ask for many additional effective and useful features for energy-saving such as increased visibility of power consumption, detailed capability and analysis of power demand, in addition to conventional functions of status supervision, control, and recording.

In order to respond to these requirements, we have developed the Supervisory Control System ESC-N2000 ("ESC-N2000" hereafter) and the Energy Telemetry Web System ESW-100E ("ESW-100E" hereafter), drawing on many years of our past proposals for many customer facilities, our supply records, market trends analysis, and customers' requests. The ESC-N2000 can perform complex supervision including conventional supervision and controls, and ESW-100E realizes its low-cost introduction by limiting energy to the supervision-related functions.

This paper introduces an outline of the system and some examples of applications and actual projects.

2 Outline of the System

2.1 ESC-N2000

Fig. 1 shows a system configuration diagram. The ESC-N2000 comes in a combination of a general-purpose Personal Computer (PC) and a general-purpose I/O unit. This is a supervisory control

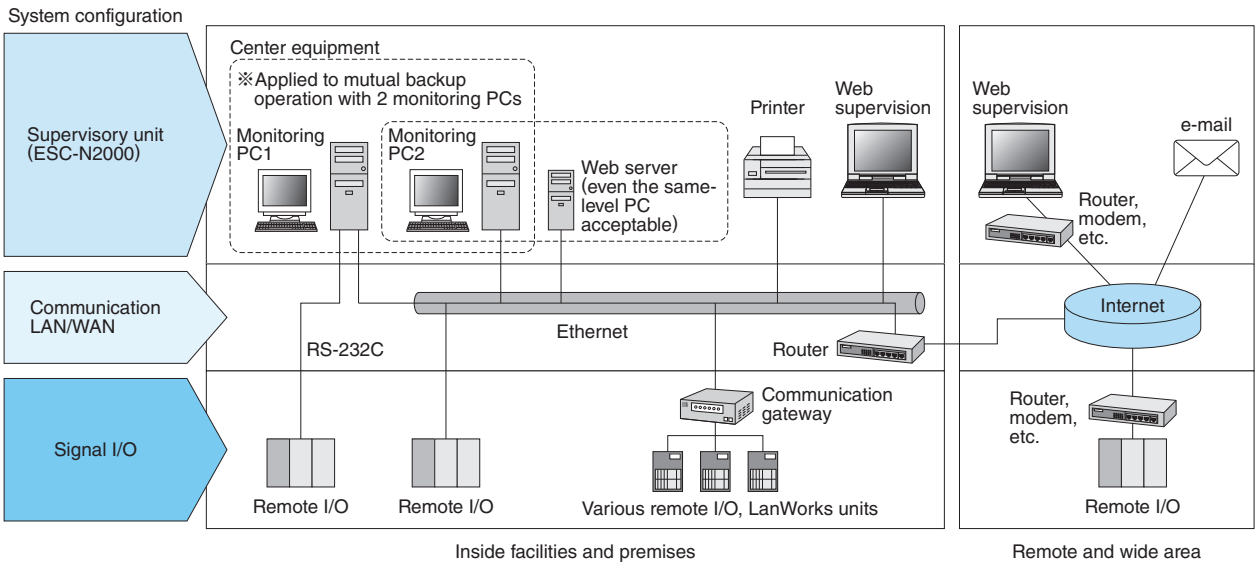

Fig. 1 System Configuration Diagram of ESC-N2000

A configuration diagram of ESC-N2000 system is shown.

system designed for applications for small and medium-capacity facilities.

2.1.1 Features

(1) The necessary functions are combined so that this system can be used for any application for facilities of power systems, buildings, and plants.

(2) It is applicable to a variety of operation modes in the field of premises and yard supervision, wide area supervision, and remote supervision.

(3) The I/O unit is applicable to the generally available PLC (sequencer) and remote I/O.

(4) It is applicable to a graphic supervisory display of a multi-monitor and a large-sized monitor.

(5) It is applicable to various requested forms of reporting formats by using form customizing functions.

(6) It is applicable to various setting changes.

(7) It is applicable to the operation of redundancy systems for central equipment.

2.1.2 Functions

The typical functions related to energy supervision are as follows:

(1) Graphic display function

Energy demand and status can be indicated in real-time mode in a graphic display; therefore, it is possible to grasp the present status visually and intuitively. Fig. 2 shows an example of the graphic display.

(2) Demand supervisory control function

In regard to the quantity of electric power consumption, demand supervision and control are carried out. With this function, prediction of power demand, supervision for alarming, prevention of an excess of contract demand by load control can be performed. Fig. 3 shows an example of demand display.

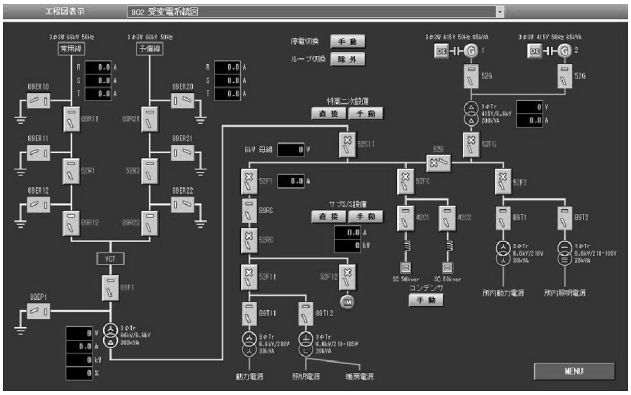

Fig. 2 Example of Graphic Display

An example of display is shown regarding the graphic display functions of ESC-N2000 (power system diagram).

(3) Recording function for 30-minute power consumption

Apart from a per-hour power consumption saved by a daily report function, data for power consumption quantity for every 30 minutes can also be saved. With this function, it is possible to assess and analyze more detailed energy consumption in the same time unit as that of the demand supervision.

2.2 ESW-100E

Fig. 4 shows a system configuration diagram of ESW-100E.

In order to realize the increased visibility of an energy saving program, ESW-100E is designed to be a Web-based system where a Modbus commu-

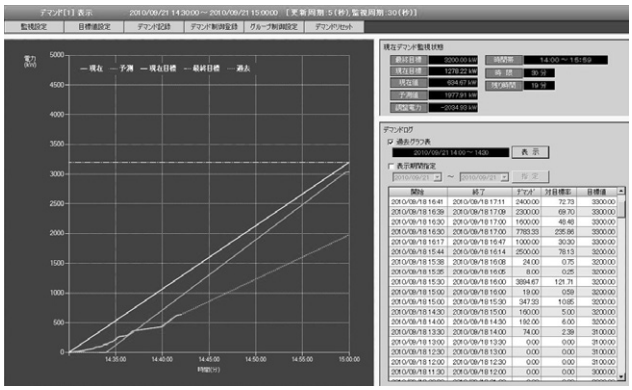

Fig. 3 Example of Demand Level Display

This shows an example of the display of the demand level monitoring functions by ESC-N2000.

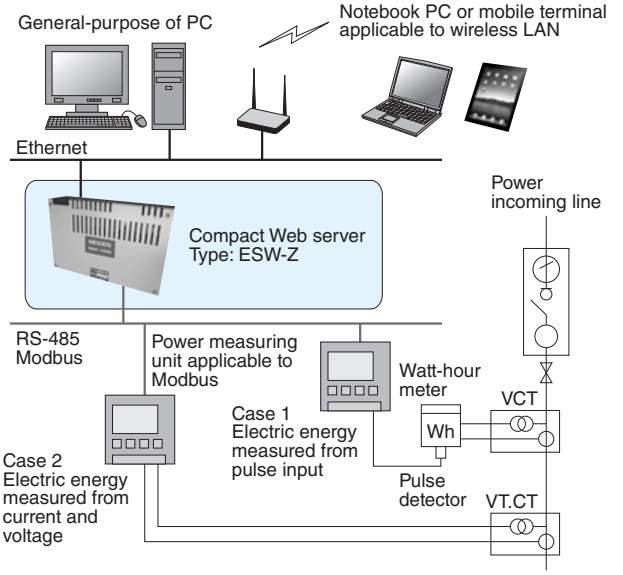

Fig. 4 System Configuration Diagram of ESW-100E

A system configuration diagram of ESW-100E is shown.

Fig. 5 ESW-100E

An external appearance of ESW-100E is shown.

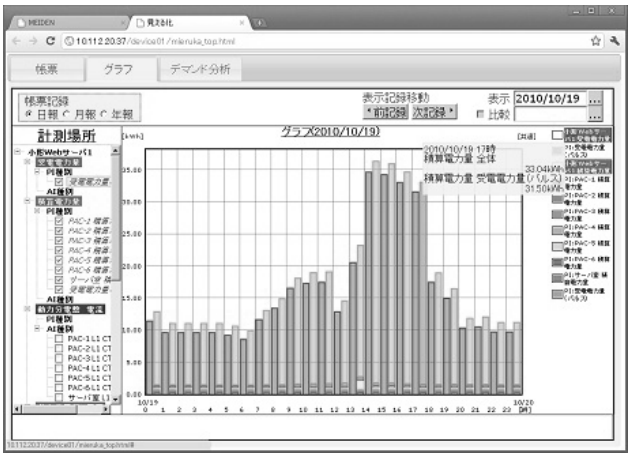

Fig. 6 Web-Based Graphic Presentation Screen

This shows an example of a graphic data screen by ESW-100E.

nication unit is adopted for the telemetry sensor so that data downloading and browsing can be carried out with only a small Web server unit.

2.2.1 Features

This system is applicable to various forms of energy management works by such functions as a display of telemetry values, supervision of upper and lower limit values, and demand supervision in facilities of large buildings, factories, and plants. Easy browser-based supervision is possible by accessing the Web server from a general-purpose PC.

Since no dedicated software is needed, browsing is possible not only from a general-purpose PC but also from an internet-ready intelligent terminal like a tablet PC. Fig. 5 shows an external appearance of the system.

2.2.2 Functions

The major functions are as follows:

(1) Supervisory function

Telemetry data supervision and message recording

(2) Alarming function

Upper/lower limits supervision and mail transmission

(3) Demand function

Simplified demand supervision and alarm output generation

(4) Increased visibility function for power consumption monitoring

Web-based format reporting and graphic representation screens

(5) Reporting function

FTP file transfer, daily/monthly/annual reports, graphic report forms (using MS Excel)

Fig. 6 shows an example of a Web-based graphic presentation screen.

3 Examples of System Application and Supply Cases

3.1 Application to Power Demand Supervisory Web-based System

The power demand supervisory Web-based system is adopted to increase the awareness of power saving and realize energy-saving by sharing daily power demand by all workers. The ESC-N2000 system collects power-related data from each power network measured by telemetry sensors, and discloses the acquired data through a dedicated Web server. Users can share the disclosed information by using internet browsers.

Based on the site map information screen (Fig. 7), overall power demand, power consumption in each area, and goal values can be identified. Detailed information is displayed if any map area is selected using a mouse. With a graphic data function, demand monitoring can be performed and comparisons of date-specific power demand trends. In addition, the degree of goal achieving level can be compared among systems.

3.2 Application to Solar Power Supervisory Control System

Information from the Power Conditioning Subsystem (PCS) for solar power installed in a large building is collected by ESC-N2000 system using

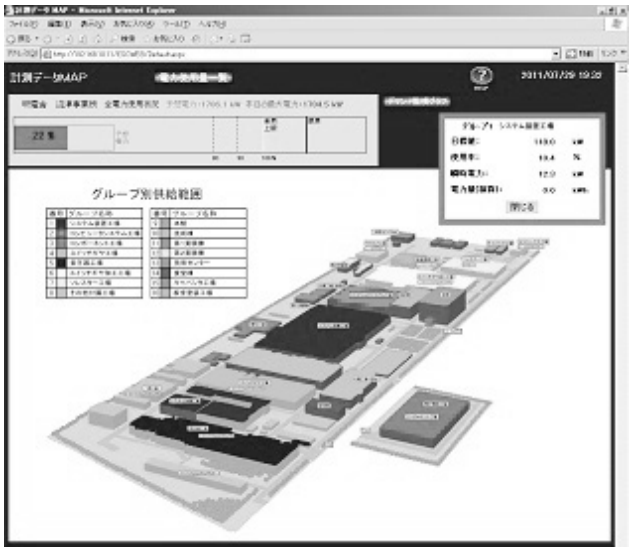

Fig. 7 Site Map Information Screen

An example of a supervisory screen display is shown presented at the time of application to the power demand supervisory Web system.

Fig. 8 Solar Power Monitoring Screen

An example of supervisory screen display is shown presented at the time of application to the solar power monitoring system.

the sequencer. It is displayed at a large-scale monitor installed in a hall using the Web function. Fig. 8 shows an example of a solar power monitoring screen.

Regarding the monitoring data, not only solar power yields and but also a buildings' power consumption data, can be collected and displayed using ESW-100E system. It is therefore possible to compare power loads and power generation. Since the monitoring data can be displayed using an Internet browser, information can be viewed not only in the hall but also at a PC of a power use monitoring manager through a LAN network.

4 Postscript

In order to meet the requirements of our customers, we will continue to add functions and improve system features. In addition to the functions related to information about power demand, we will study the possibility of adding more functions of power supply monitoring and control. Such functions are attracting general interest and request such facilities as solar and wind power, microgrid system, etc. Going forward, we will try to add and improve such specified functions.