

“FCPOP”: A Power Management Platform for UPS Products

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ABSTRACT

Fuji Electric has a wide lineup of UPS products and it is necessary to provide power control systems that integrate products from mid-to-high capacity UPS to mini-UPS.

To achieve this, Fuji Electric built “FCPOP” power management platform for UPS products. With this as a base, we developed a power management system with a new configuration in which sections corresponding to each UPS are stacked. The power management system comprises UPS monitoring software, integrated power management software, a network interface card, shutdown software, and more to provide the user with a unified product concept and operability.

1. Introduction

When an abnormality such as a power outage occurs in an electrical system, it is important to have a power control system for UPS operation in addition to installation of an uninterruptible power supply (UPS). There are various forms of power control systems, ranging from small ones that are comprised of a single UPS to large-scale systems that collectively control multiple UPS's via a network. Fuji Electric has a wide line-up of UPS products and it requires integrated power control systems for these products. Fuji Electric has already developed an integrated power control system in the field of mid-to-high capacity UPS, and mini-UPS is the current target. For such mini-UPS, in addition to a function to control the UPS, a power control system requires a shutdown function to stop the loading apparatus of the UPS when a power outage occurs, and such function and the system's interface differ depending on the intended purpose.

To achieve a comprehensive power control system, we built up “FCPOP”, a power management platform for UPS. Using this as the base, we developed a power management system with a new configuration by stacking up sections corresponding to each UPS.

FCPOP (Fuji common power platform) is made up of components such as hardware composing a power management system, common parts within software, a common processing section and a common user interface section etc. By adding UPS model-dependent function, it is possible to easily make the system compatible with various models.

2. Structure and Main Functions of “FCPOP”

2.1 Overall structure

Figure 1 shows the overall structure of FCPOP. For a single UPS, the UPS monitoring software operates on a computer connected to it and monitors the power supply and UPS, and shuts down loading apparatus (see Fig. 1 (a)). When there are multiple UPSs, a network interface card is mounted on the UPS and integrated power management software is used to collectively control them. The network interface card and shutdown software are used to shut down the devices in the event of a power outage (see Fig. 1 (b)).

Structures of the UPS monitoring software, network interface card, integrated power management software and shutdown software are shown in Fig. 1 (c). FCPOP operates on the Operating System and on that platform, a processing section, which differs depending on the series of UPS, is operated.

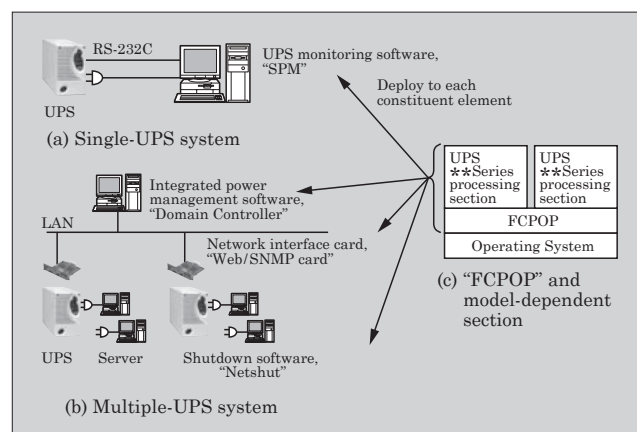


Fig.1 Overall structure of “FCPOP”

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2.2 Main function of component elements

(1) UPS monitoring software

UPS is used as a backup power supply for loads such as computers when an abnormality like a power outage occurs. However, only a finite amount of electrical energy can be accumulated in the battery of a UPS and it can only provide a backup power supply for a limited time. Meanwhile, if the predetermined procedures are not followed when shutting down a computer, data may be corrupted or a hard disk failure may occur. Therefore, our UPS monitoring software shuts down a computer before it becomes impossible to offer a backup power supply when a power outage lasts for a long time. In this manner, the UPS monitoring software operates on a computer connected to the UPS, monitors the UPS and power supply, and shuts down the computer and stops the UPS from providing power.

(2) Network interface card

A network interface card is mounted in an optional slot of the UPS to connect to the network.

In addition to the shutdown function, which is the same as the previously mentioned UPS monitoring software, there are extensive management functions during normal operation such as event notification using a network, remote power supply monitoring performed by a computer on the network, and scheduled operations.

(3) Shutdown software

This is software to be installed in advance on a server and personal computer that are to be backed up by the UPS, and it shuts down the computer by receiving commands from the network interface card. Prior to shutdown, it is possible to run a given user program on such computer.

(4) Integrated power management software

The range of backup functions provided by a UPS covers such various areas as an entire plant or group of floors, and our backup system has many installation modes to suit this range. In any event, it is important to have a device that offers backup power, and it must operate safely.

Such events as a power outage or UPS failure could significantly damage the operation of the load apparatus. Therefore, these events must be accurately notified to the user. On the other hand, it is often the case that multiple UPS are installed on the work floor, and managing each UPS individually is not efficient. Therefore, utilizing integrated power management software to manage multiple UPSs by means of a network reduces the man-hours required to manage them.

3. Characteristics and Technology of “FCPOP” Component Elements

3.1 “Web/SNMP card” for “EX100 Series”

(1) Shape and operability

This card is a network interface card for the mini-UPS “EX100 Series.” The shape of the EX100 Series

optional slot and interface specifications are adopted widely by overseas manufacturers and they are different from the card adopted in the existing “GX Series” or mid-to-high capacity UPS. Therefore, the mounted parts and functions are made uniform for the “Web/SNMP card” in products such as the GX100 Series, and the shape and interface specifications are adapted to the EX100 Series (see Fig. 2).

As a result, when a user who is utilizing the Web/SNMP card of a mini-UPS such as the GX Series and mid-to-high capacity UPS, introduces the EX100 Series, there is no need to learn new operations, and the product can be used in the same way as the existing ones (see Fig. 3).

In addition, for the shutdown software that is installed on a server in advance, it is possible to use “Netshut,” which is available for use on all UPSs manufactured by Fuji Electric, and the server can be shut down via the network. Hence, it is possible to shut down 200 or more servers, and easily accommodate a blade server and server virtualization system.

(2) Control function by segment unit

The output of the EX100 Series can control multiple output outlets called “segments” by group; there-

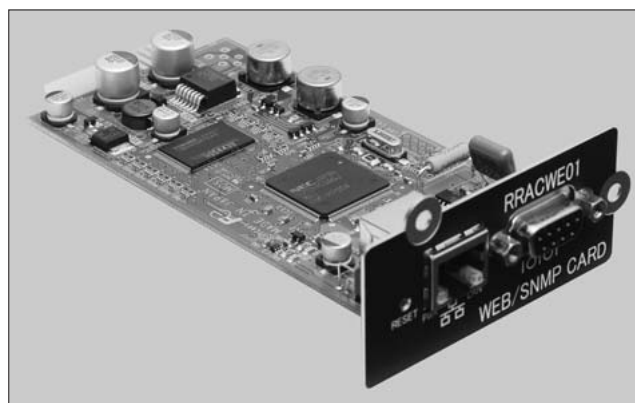


Fig.2 “Web/SNMP card” for “EX100 Series”

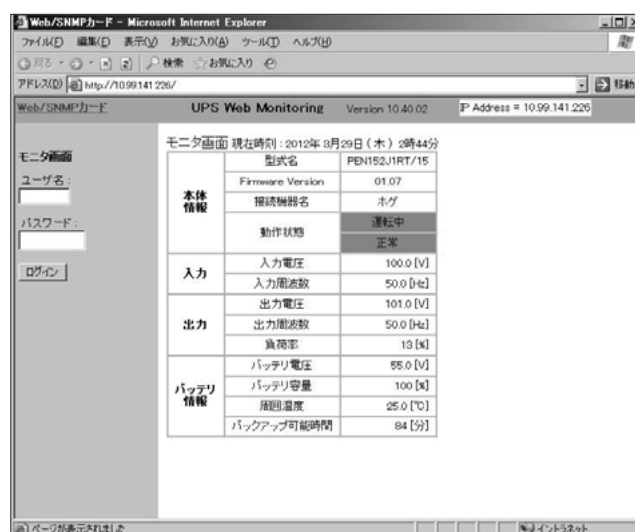


Fig.3 Monitoring screen

fore, it is possible to easily set up a time lag between the starting up and stopping of each device by using an information system that is comprised of servers and storages. This segment control function was newly mounted on the Web/SNMP card and in addition to startup and stop functions, new features such as OS shutdown and scheduled operations were linked. As a result, it has become unnecessary to use a power supply distribution unit for lag operation, which was necessary when a UPS was used for existing system that is comprised of the servers and storages, and the cost of the whole system can be reduced.

(3) Enhancement of security

For UNIX servers, it is sometimes difficult to introduce the aforementioned shutdown software because security measures are in place.

In addition, new software cannot be installed on a Linux-based appliance server for structural reasons. In order to shutdown such a server when there is a power outage, the server used to be controlled via a network card by using Telnet^{*1}. This time, security has been enhanced by introducing SSH^{*2} for information that flows on the network. Serial communication is also available in preventing data leaks, and the user can select the optimal shutdown method according to the environment.

3.2 Integrated power management software, “Domain Controller”

“Domain controller” is software to collectively manage multiple mini-UPSs that exist on a network. For management objects, a group concept called UPS domain was introduced.

When multiple UPSs exist within an information system, they are regarded as the same group in the UPS domain, which is a different group from viewed from the existing power supply side, and this is the information-system-centric concept. By introducing this, when multiple information systems exist on a network and multiple UPSs are included in each information system, it becomes easy to have such power supply management centered on individual information systems as scheduled operations on an information system basis and grasp the area of influence in the event of a power outage.

To allow the domain controller to be used with the Web/SNMP card, we adopted a structure where each UPS-corresponding section was piled up on FCPOP, which is a common base as previously mentioned. This will not only add the GX Series and EX100 Series to the target model, but also make it easy to add future

*1: Telnet⁽¹⁾ (Telecommunication network): Communication protocol that supports virtual terminal connection via network.

*2: SSH⁽²⁾ (Secure Shell): A type of communication protocol for which ciphers or authentication technology is used. Login and commands are executed via network.

models.

3.3 UPS monitoring software, “SPM”

“SPM” (stand power monitor) is software that operates on a personal computer or server that is backed up by UPS and communicates with the UPS via a serial interface.

This software gathers information on UPS and power supply, notifies the user of events such as power outages, and performs a coordinated operation of shutdown and UPS output stoppage.

(1) Decrease in degree of OS dependence

There are currently various types of OS installed in personal computers or servers and each of them is frequently updated. SPM is required to correspond to these OSs and in general, if the degree of dependence on an OS is large, it takes time for release because operation verification work needs to be conducted when a new OS released or the existing OS is updated.

Therefore, SPM was designed so that its dependence on the OS is as low as possible. It has been designed to lessen the degree of dependence at each section. For example, when there is communication between tasks, SPM can handle such communication by using its own resources inside the SPM without the API provided the by the OS. This makes it possible to promptly handle a new or updated OS.

(2) Common platform and model depending module

As for the structure within the software of the SPM, an interface section with UPS is regarded as a model depending module, and it becomes independent from the common platform including the event handling processing section, and communication between tasks is used to exchange data between these modules. Because the interface between SPM and UPS differs in the GX Series and EX100 Series, the connecting UPS is identified when the SPM is started, and the interface to be supported is switched according to the type of UPS.

This allows the SPM to connect to a UPS of both the GX Series and EX Series, and it has given a struc-

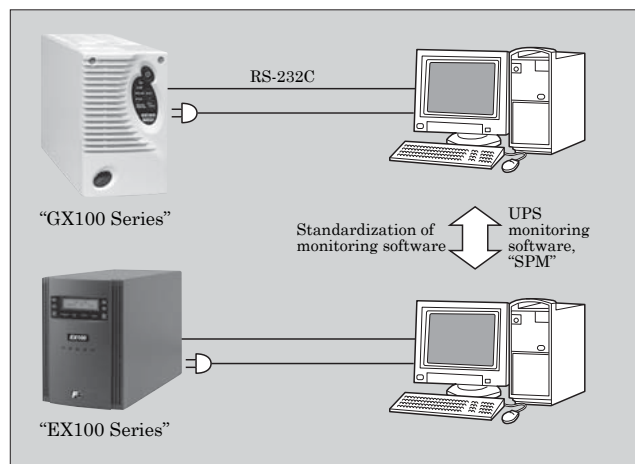


Fig.4 Standardization of UPS monitoring software

ture to allow expansion of the supporting models in the future easily (see Fig. 4).

Users can mutually use monitoring software regardless of the UPS type that is used, and the operability will not change.

Figure 5 shows a screenshot of the SPM. Because



Fig.5 Screenshot of “SPM”

of the simple display method using an icon, which is set up in the task tray and changes depending on the status of UPS, it is easy to grasp the status of the UPS and the power supplies.

4. Postscript

This paper presented “FCPOP,” a platform to manage power supplies for a UPS that can provide the user with a unified product concept and operability. Fuji Electric will continue working to offer more benefits to users by expanding the supporting models and rapidly updating products so that they can run on a latest OS.

Reference

- (1) RFC854: Telnet Protocol Specification (IETF).
- (2) RFC4250: The Secure Shell Protocol (IETF).



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