

# UPS Management System for Supporting Network

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## 1. Introduction

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Computer network environments are rapidly advancing. Accordingly, uninterruptible power systems (UPS) that protect computers from power supply troubles must not only backup the computers against momentary voltage drops and momentary power failures, but also perform computer management under networked environments to allow automation of operations and power supply monitoring.

We have developed a new UPS management system called "SanGuard III" which adds the following network functions to the conventional UPS management system (SanGuard I and II) used for UPS management under a non-networked environment:

- Remote monitoring of the commercial power supply status and UPS status information
- Setting of various control conditions of computers and UPS from a remote location, such as a time limit to check for power failures and shut-down delay time.
- Setting of scheduled operating conditions of the UPS from a remote location
- Coordination operation of multiple computers connected to a single UPS

In a network environment, the network is typically operated by several systems administrators without an operator. The newly developed remote monitoring and remote setting functions reduce the workload of the network administrators and ensure reliable system operation.

This system supports the universal network management system called SNMP (Simple Network Management Protocol).

This paper reports on the structure and functions of the UPS management and also the future of the UPS management system.

("SanGuard III " is abbreviated as "SGIII" hereafter in this report.)

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## 2. Function of UPS Management System

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"SGIII" has the following basic functions.

- When a power failure continues, or when the battery voltage falls, the computer is shutdown and the UPS is stopped.
- Shutdown of the computers, and stopping and starting of the UPS are performed according to a weekly, monthly or single schedule set by the user.
- The status of the UPS is displayed in real time.

- Log information of the UPS is saved and displayed.
- Various conditions such as the time schedule of shutdown and UPS stoppage are set.

"SGⅢ" is developed so that the above described basic functions can support a network to enable supplying power to multiple computers from a single UPS, and monitoring and setting of various parameters from a remote location.

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### 3. Structure of UPS Management System

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#### 3.1 Basic Structure

The core structure of "SGⅢ" is "SGⅢ" server. [Fig. 1](#) shows the basic structure of "SGⅢ".

"SGⅢ" server performs serial communication with the UPS in order to monitor the status of the UPS and commercial power line, and to perform shutdown of WindowsNT or stop control of the UPS when required.

#### 3.2 Structure of Supplying Power to Multiple Computers from Single UPS

When "SGⅢ" client is used together with "SGⅢ" server, power can be supplied to multiple computers from a single UPS, as shown in [Fig. 2](#). In this structure, "SGⅢ" client must have the same operating conditions as that of "SGⅢ" server.

This UPS management system coordinates operations by communicating between "SGⅢ" server and "SGⅢ" client over the network.

#### 3.3 Structure for Global Management of "SGⅢ" Server Groups

"SGⅢ" integrated management server can control multiple (up to 128) "SGⅢ" servers as shown in [Fig. 3](#).

"SGⅢ" integrated management server can set or modify from a remote location, the operation schedule of "SGⅢ" servers and operating conditions during a power failure and other problems.

"SGⅢ" integrated management server can display the UPS status via "SGⅢ" servers. Any status changes of the UPS that are reported from "SGⅢ" server can be saved and displayed in a log of changes.

#### 3.4 Structure of the UPS Management System Operating Together with SNMP

The UPS management system has the following two types of SNMP supporting functions as shown in [Fig. 4](#) and [5](#) in order to support the de facto SNMP network management system standard.

[Fig. 4](#) shows the structure in which Sanyo Denki's expanded UPS agent is installed in the SNMP agent function of WindowsNT. The expanded UPS agent is supplied as a DLL and conforms with the standard UPS Mib (Message Information Base) (RFC1628).

[Fig. 5](#) shows an example of installing the SNMP box. The SNMP box conforms with the standard Mib and the standard UPS Mib as the SNMP agent.

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## 4. Internal Structure of the UPS Management System

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### 4.1 Outline of Internal Functions of the UPS Management System

As described in section 2, the basic functions of the UPS management system are to end WindowsNT and stop the UPS when the power failure continues or when the battery voltage falls, as well as to perform scheduled operations. These operating conditions can be set freely by the user.

The UPS status can also be monitored and a log taken of the operating status as needed.

"SGIII" expands these basic functions by using the network. The expansion functions are as follows:

(1) Coordinated operation is realized by notifying the UPS change information and computer status change information.

- "SGIII" servers notify "SGIII" clients and "SGIII" integrated management server of the occurrence of power failure and the recovery information.

- "SGIII" servers notify "SGIII" integrated management server of the start of execution of "SGIII" server itself.

- "SGIII" clients notify "SGIII" servers of the start of execution of "SGIII" clients themselves.

- "SGIII" clients notify "SGIII" servers of the start of shutting down "SGIII" clients themselves.

(2) Conditions such as the operating conditions and operation schedule are agreed by issuing an information request and notification of change request.

- "SGIII" clients and "SGIII" integrated management server can obtain the operating conditions of "SGIII" servers such as a time limit to check for power failures and shutdown delay time by requesting them from "SGIII" servers. They can also request "SGIII" servers to modify these conditions.

- "SGIII" clients and "SGIII" integrated management server can request and obtain the weekly, monthly or single schedules of "SGIII" servers.

- "SGIII" clients can request from "SGIII" servers information regarding the UPS stopping time and next startup time.

(3) The contact information and measurement information of the UPS can be requested and notified.

- "SGIII" clients and "SGIII" integrated management server can request "SGIII" servers for the data to be used for displaying the UPS information.

- "SGIII" clients can request and obtain from "SGIII" servers the UPS information to be used for saving the UPS log information.

(4) Control requests for the UPS can be performed.

- "SGIII" clients and "SGIII" integrated management server can request "SGIII" servers that are directly communicating with the UPS, to stop the UPS.

## 4.2 Internal Structure of Programs

[Fig. 6](#) shows "SGIII" program configuration.

### 4.2.1 Functions of the UPS Services

The UPS service program automatically starts in the background when WindowsNT starts up. The following functions are executed in order to implement the functions

described in Section 4.1.

- Acquisition of the UPS information and the UPS control (in UPS server service only) using serial communication with UPS
- Communication between "SGIII" servers and "SGIII" clients  
Communication between "SGIII" servers and "SGIII" integrated management server, and that between "SGIII" servers and the GUI program
- Execution of operating condition judgment such as power failure, and schedule condition judgment. Based on the judgment, shut down WindowsNT and stop UPS control.

#### **4.2.2 Functions of the GUI Program**

The GUI program performs the man-machine interface such as setting the various conditions and monitoring information as described in Section 4.1, displaying the log information, and UPS control.

Additional functions such as registration and setting of host name of "SGIII servers, "SGIII" clients and "SGIII" integrated management server are incorporated in "SGIII" in addition to the basic functions.

#### **4.3 SNMP Related Functions**

The SNMP agent function is implemented by both software and hardware as noted in Section 2.

##### **(1) SNMP agent function by software**

This function can be installed in "SGIII" server only.

It must be installed in the standard SNMP agent of WindowsNT as described before. The expansion UPS agent is installed as a DLL and is called from the SNMP agent.

The expansion UPS agent shares the UPS information with "SGIII" servers.

"SGIII" servers send the events to the SNMP agent in accordance with the change of information of the UPS.

When the SNMP manager sends the UPS control information, this information is notified to "SGIII" server service so that the control operations are activated in accordance with the operating conditions of "SGIII".

##### **(2) Functions of the SNMP Box**

The SNMP box acquires the UPS information in the form of monitoring serial communication between "SGIII" servers and UPS. When the SNMP manager issues any information request, it returns the SNMP information in accordance with the request. When the UPS status changes, Trap information is notified to the SNMP manager.

The SNMP box itself acquires the UPS information by issuing an information request to the UPS when the computer executing "SGIII" is stopped.

The SNMP box can receive the UPS control requests from the SNMP manager.

Among the UPS controlling operations, the UPS startup control is executed unconditionally. However, when the UPS stop command arrives, the UPS sends the control information to "SGIII" server so that "SGIII" server executes the control operation.

However, when the computer executing "SGIII" server is stopped (i.e., when notification fails three times consecutively), the SNMP box executes the UPS stop control.

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## 5. Future of the UPS Management System

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The UPS management system includes various components and functions as shown in Section 3. However, there are also a great many different user network systems, and network systems themselves are changing and rapidly progressing. Further improvements are thus necessary.

Software makers are also supplying different types of management systems not only SNMP to manage the networks. Therefore, the UPS management system must be installed on various types of management systems.

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## 6. Conclusion

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Networks are spreading rapidly worldwide due to their versatile functions and expandability.

UPS is mission-critical equipment that supports network systems and so must progress in line with advances in system network technology as a part of those networks.

We will continue to strengthen the functions of our UPS management system to support future network developments and management systems.

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Fig. 1 Basic structure of "SGIII"

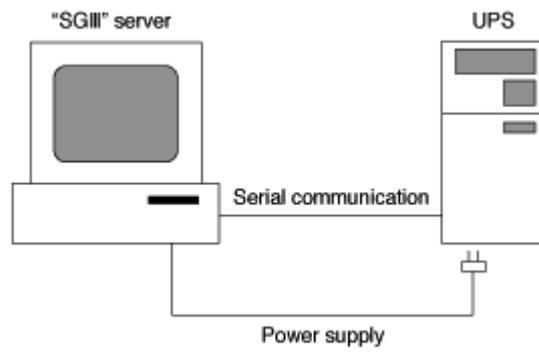


Fig. 2 Server-clients configuration

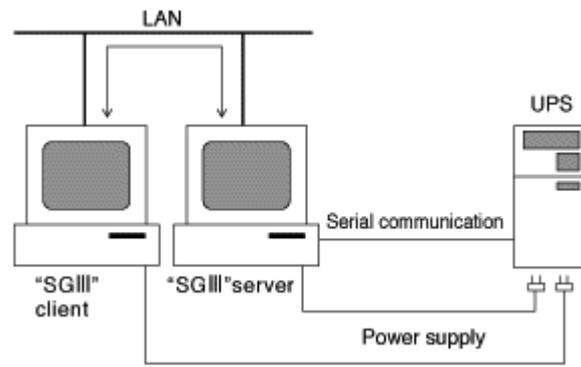


Fig.3 Structure including integrated management function

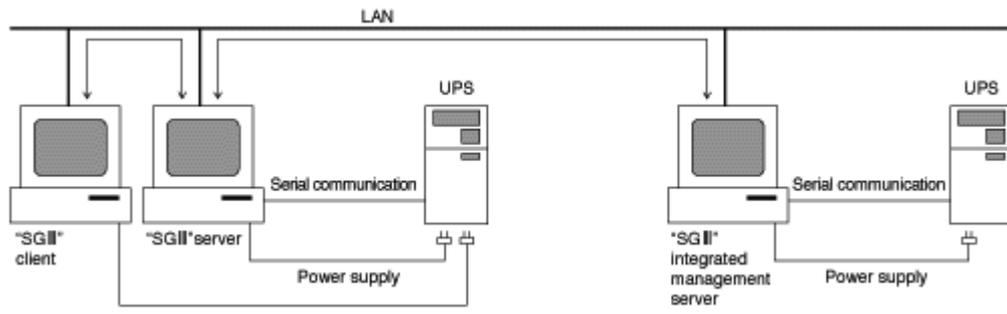


Fig.4 Structure of working with SNMP (software agent)

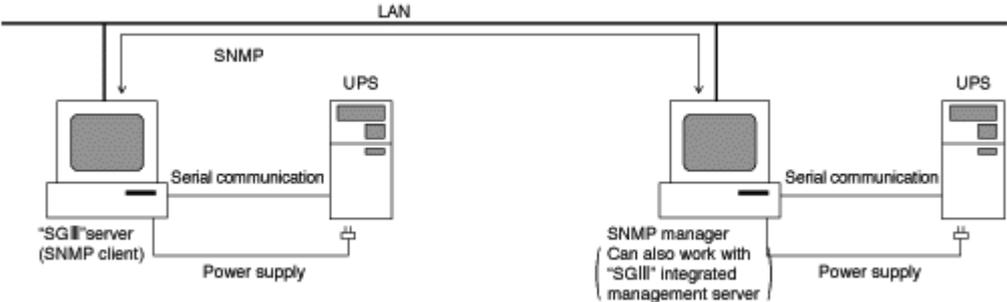


Fig.5 Structure of working with SNMP box

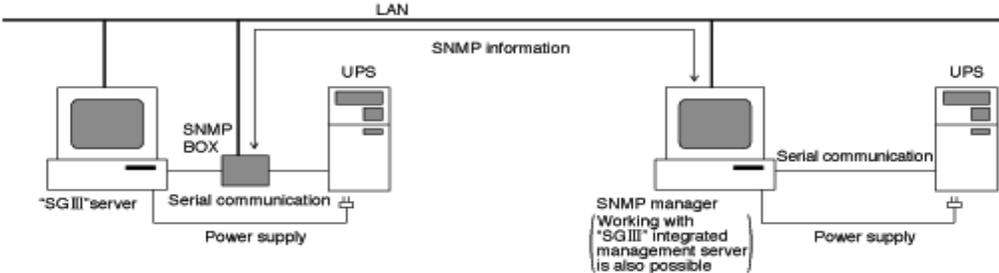


Fig.6 "SGⅢ" program configuration

