Feature

Development of Small Capacity UPS, "SANUPS 001 ASC"

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1. Introduction

Computers are becoming more widespread, such as for office automation, POS (point-of-sales) terminals in retail stores, and for factory automation, and extensive information networks such as the Internet are being built. Protection and control of power supplies in such networked environments are essential.
In the UPS market, the trend is moving from a centralized power supply backup to distributed backups, thus increasing demand for small-capacity, low-cost UPS systems.
We have developed "SANUPS 001 ASC" of 1 to 5 kVA range by upgrading our conventional small-capacity UPS. This product offers compactness, ease of operation, improved maintenance, network support and better cost performance, while still delivering a reliable, stable power supply.

2. Features

"SANUPS 001 ASC" has the following features.

2.1 Larger Product Range

"ASC" series includes the conventional "ASA" 1 kVA, 1.5 kVA, 2 kVA, 3 kVA and the newly added 5 kVA models, thus creating a broad product range.

2.2 High Power Factor and High Efficiency

The input rectifier is a high power-factor converter, so the input current waveform is almost a pure sine wave without harmonics that damage other equipment.
In addition, because the input voltage and the input current are maintained in the same phase at all times, there is no ineffective power, so the power-receiving equipment need only have a low input capacity that is used effectively.
In the 5 kVA model, insulation circuitry without transformer is used for the first time, which improves the overall efficiency from AC input up to the output by about 10% compared with conventional systems and reduces the running cost. An on-line UPS system, in which we are well-experienced, supplies stable AC power to the load at all time.

2.3 Compact, Lightweight Configuration and Rack Mountable

The 5 kVA model, which is designed to be as small and compact as possible, is 50% smaller and so can be used in offices that have limited to power supply room.
Designed for office use, the basic configuration is the vertical type that minimizes the required floor space. Operation and monitoring are performed from the molded front panel while external connections and main switch are provided on the rear.
The sizes and structure of all models are designed for rack mounting. The 1 kVA and the 1.5 kVA models are mounted on 19-inch racks horizontally, and the 2 kVA, 3

kVA and the 5 kVA models are installed with the inverter block and the battery block mounted side by side in the rack.
Fig. 1 shows the outside view and Fig. 2 shows an example of rack mounting.

2.4 Improved Operability

An LCD display is used for the 2 kVA, 3 kVA and the 5 kVA models.
The LCD has a UPS status display function that indicates the operating status of the UPS, a measurement and display function that measures and indicates the input/output voltages and their currents as well as the battery charging current, a maintenance assistance function that indicates the power failure history, operation history, expected remaining life of the battery and performs battery checks, and a setup function that is used to set the clock and internal conditions. Even inexperienced operators can check the operating status and any abnormalities. These functions make it easy to operate and promptly control the UPS conditions.
The operation display block is shown in Fig. 3.

2.5 Improved Maintainability and Safety

Networked computer systems are increasingly being required to run 24 hours a day, so the power cannot be shut down for inspection and maintenance of the UPS. To overcome this constraint, "ASC" has a bypass circuit that enables parts to be inspected and replaced without turning off the power. The 2 kVA and larger models are structured such that the inverter block, battery block and maintenance bypass circuit block are independent of each other.
Because the maintenance bypass circuit block has a unit structure in which the input and output connections are integrated, the inverter block and battery block can be removed while the bypass power remains turned on. This reduces maintenance problems, ensures the safety of maintenance engineers and makes the bypass circuit easier to maintain. The maintenance bypass circuit is an option in the 1 kVA and 1.5 kVA models.
The inverter block and the battery block are shown in Fig. 4. The maintenance bypass unit block is shown in Fig. 5.

2.6 Network Support

As UPS systems are now considered as a part of the computer system, various communication functions between the computer and UPS are desired. "ASC" is equipped with a contact signal interface that sends the UPS status to the computer, as a standard feature. A serial interface for serial data communication between the UPS and computer, and LAN interface are available as an optional card that can be installed.
The contact signal interface allows the UPS to be monitored by functions of the network operating system such as NetWare and WindowsNT. By connecting such a network OS with the UPS using a special cable, the power can be automatically shut down in the event of a power failure.
Table 1 shows the types of OS supported and the functions that can be used.

Table 1 Monitoring functions of network OS supported by UPS

	NetWare,VINES	WindowsNT LanManager OS/2,LANServer
Alarm display	○	○
Automatic shut-down	○	○
Turn off UPS after automatic shut-down	×	○

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By installing UPS control software "SAN GUARD", developed by Sanyo Denki, on the computer, the serial interface enables not only shut-down in the event of a power failure, but also other functions such as scheduled operation, operating condition display, measurement value display, UPS log information storage and so on.
The LAN interface of the computer enables the power to be supplied from a single UPS to multiple computers (server-client configuration).
Table 2 shows the types of OS supported and the functions of SAN GUARD.

Table 2 Types of OS supported and the functions of SAN GUARD

○ : Supported △ : Option × : Not supported

	SAN GUARDⅡ		SAN GUARDⅢ
	UNIX	Network OS	Network OS
Automatic shut-down function	○	○	○
UPS automatic shut-down function	○	○	○
Power failure alarm function	○	○	○
User command function	○	○	○
Status command function	○	○	○
Status display function	○	○	○
History control function	○	○	○
Single-touch shut-down function	○	○	○
Client support function	○	△	△
Scheduled operation function	○	○	○
Schedule modification function	×	×	△
Integrated control function	×	×	△
SNMP support function	×	×	△
Supported OS	SUN,IBM,HP NEC,SONY,SGI	NetWare Windows95	WindowsNT

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Fig. 6 shows the server-client configuration.
SNMP, which is the standard for network control, is used as the LAN interface.

By installing the SNMP card in the UPS and the Sanyo Denki's UPS control software "SAN GUARD Ⅲ" on the computer, the UPS can be started up and shut down from the remote computer in addition to shutdown in the event of a power failure, scheduled operation, operating condition display, measurement value display and UPS log information storage. Remote start-up and shut-down are made possible because, whereas the conventional serial interface and UPS control software control the UPS within the closed environment of the computer and UPS, our system implements control at the network environment level.
The system configuration using the SNMP card is shown in Fig. 7.

2.7 Reduced Maintenance Cost

Since the battery is a consumable item, a battery having an expected life of five years is used. Long-life fans and electrolytic capacitors are used such that they do not need to be replaced for ten years, which is the life-span of the product. This reduces maintenance and parts replacement costs.

2.8 Options

Various options are available to satisfy the customers' needs, such as:
(1) Long discharging time battery (30, 60, 180 minutes)
(2) Transformer supporting different input and output voltages
(3) Floor fixing metal brackets
(4) Rack mount
(5) Serial interface card
(6) SNMP card

3. Circuit Configuration

The circuit block diagram is shown in Fig. 8.
The main circuit consists of the input/output filters, high power-factor converter, half-bridge PWM inverter, bypass circuit, battery, etc.
The control circuit consists of the control block, display block and option block (communication).
The technical implementations of the above-described features are described below.

3.1 Main Circuit Configuration

No transformer is used in the main circuit. This transformer-less system is normally used in small-capacity UPS (1 to 3 kVA class), but we have extended it to the 5 kVA product.
In the transformer-less system the converter and inverter circuits have a half-bridge structure instead of full-bridge structure. In this configuration, the input and output power lines are common, thus doing away with the isolating transformer. This system makes the product more compact, lighter and efficient.

3.2 Add-on Capacity System

This series of products has a basic unit structure of either 1 kVA or 1.5 kVA. The desired capacity of system (add-on capacity) can be configured by adding N units of the basic unit.
The basic unit and quantity used in the respective systems are shown in Table 3.

Table 3 Basic unit and quantity used in the respective models

Model	Basic unit	Quantity
ASC10S1	1.0kVA unit	1
ASC15S1	1.5kVA unit	1
ASC20S1	1.0kVA unit	2
ASC30S1	1.5kVA unit	2
ASC50S1	1.5kVA unit	3

This add-on capacity technique offers the following advantages:
(1) Common parts can be used. 80% of the electronic and related parts are the same as those of our existing products.
(2) Low-cost, commercially available parts can be used. Using common parts in large quantities reduces the cost.
(3) The basic units are packaged on printed circuit boards. By combining printed circuit boards, wiring is reduced, by 43% on average from conventional products and by up to 95%. The outside view of the unit is shown in Fig.9.

3.3 Cooling System

To cool the system, a fan is used to draw in the air heated by the equipment (fin), but exhausts the air heated by the equipment (fin) in "ASC" to improve the cooling efficiency.
And the fin is 60% smaller than that in the conventional equivalent.

3.4 Control Block

"ASC" has a main CPU, CPU for the LCD and a CPU for communication (two CPUs are used in the SNMP) to implement the various functions such as monitoring, LCD display, communication, etc., in a compact size.
The main CPU has delivered the four functions of (1) UPS sequence control, (2) converter block and inverter block control, (3) operation status monitoring and (4) measurement and display in the conventional model. Two functions of (5) optional unit support and (6) LCD block support are added in this series.
The optional unit support function can set about 150 items such as remaining battery life, battery temperature, battery replacement data, UPS condition, etc., in the dual port RAM that serves as an interface. With this configuration, new functions in the future can be implemented simply by creating an option card, thus making the system more general-purpose.
The LCD block support function is reinforced so that adjustments can be performed by using a connected personal computer instead of LCD block (LCD card). Thus, the items that could be adjusted only from the LCD block can now be adjusted from the PC. This enables automatic inspection with the inspection system.

4. Conclusion

We have introduced the main features of our "ASC" that complements the small-capacity UPS "SANUPS 001".
Users will continue to demand low-price, high performance, small-capacity UPS systems as computers become smaller and more widespread.
"ASC" has been developed in order to satisfy such demands.
We will continue to develop low-cost products according to the demands of the market quickly, and develop new products to protect the earth's environment.

We thank all those who helped us develop and release this series.

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Fig.1 Outside view of "SANUPS 001 ASC"

Fig.2 Example of rack mounting

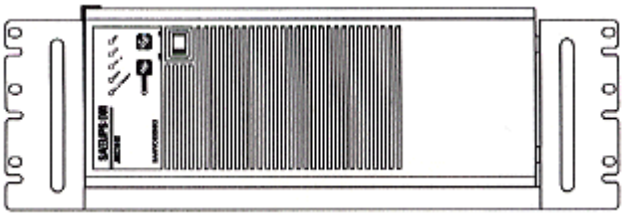

Fig.3 Operation display block

Fig.4 Inverter block and the battery block

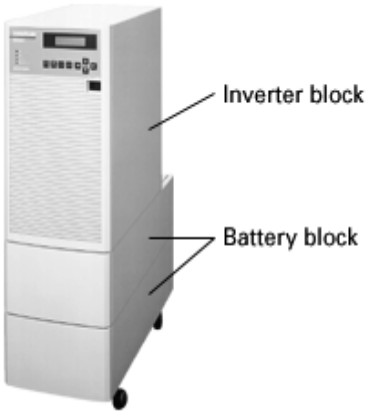

Fig.5 Maintenance bypass unit block

Fig.6 Server-client configuration

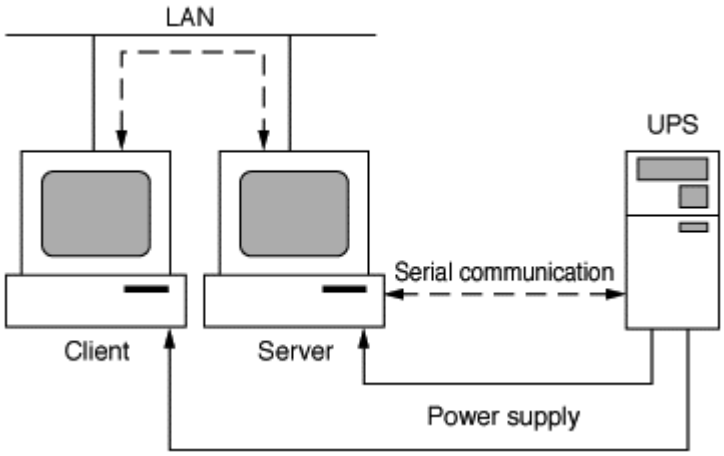

Fig.7 Configuration example using SNMP card

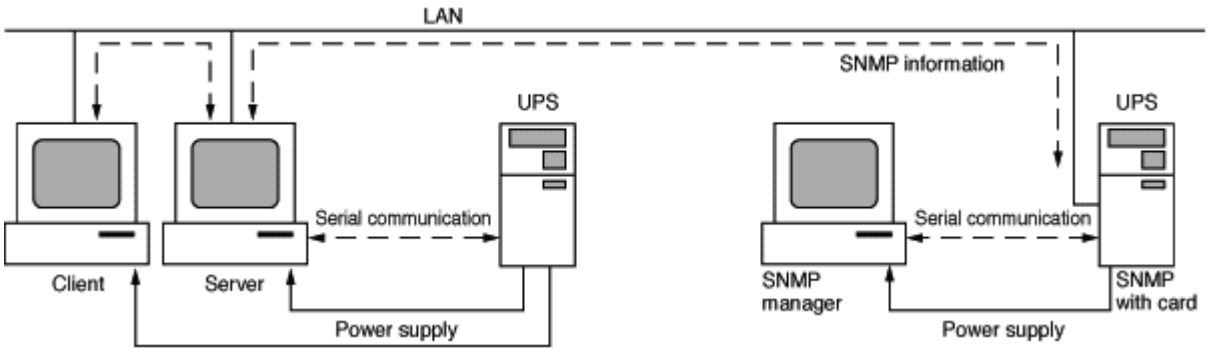

Fig.8 Circuit block diagram

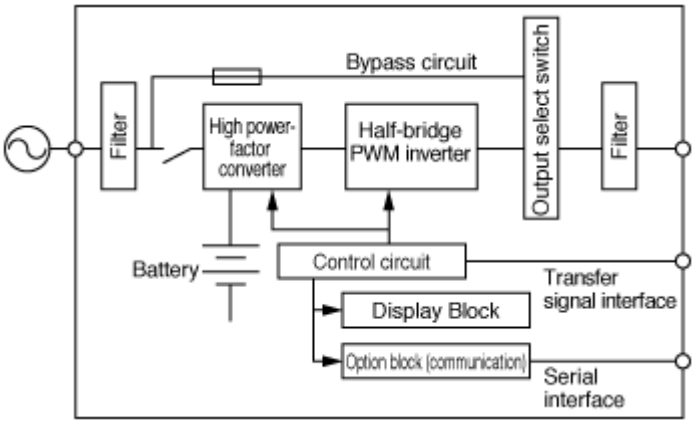

Fig.9 Outside view of a unit