Expansion of the Large-capacity UPS "SANUPS E33A" Lineup

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1. Introduction

We have expanded the lineup of 400 V large capacity UPS SANUPS E33A, which uses the parallel processing method. We have already released the parallel type up to 300 kVA and the parallel redundant type up to 200 + 100 kVA, but with completely individual parallel operation controls with the parallel processing method, we established basic technology that realizes capacity enlargement flexibly while achieving high reliability. This time, we used this technology to realize even larger capacities.

Like the conventional model, we newly added the parallel type for 400 to 600 kVA and parallel redundant type for 300 kVA to 500 kVA to the lineup by using the 100 kVA for a base unit. This document introduces the expanded lineup of "SANUPS E33A."

2. Background of the Development

With reduction of CO_2 to prevent global warming and restrictions to balance the supply and demand of power since the Tohoku Earthquake, the shift towards even greater energy conservation has gained attention among the public. With this in mind, the expectations for high efficiency UPS that does not waste energy are growing more and more. Sanyo Denki was one of the first to develop high-efficiency UPS, and in 2002 we released the 200 V "SANUPS E23A" as the first parallel processing UPS. At the time, the parallel processing method improved the efficiency of the UPS from around 90% for the conventional on-line inverter power supply system method to 97%. Furthermore, in 2008, we developed the "SANUPS E33A" as a 400 V parallel processing method UPS that achieved an efficiency of 98%. The "SANUPS E33A" also realized completely individual parallel operation control with the parallel processing method, which is the first in the industry, enabling parallel operation systems. Sanyo Denki's parallel processing UPS achieved high quality through high efficiency and no-break transfer, and it flourished as the new UPS for the era of energy conservation.

Meanwhile, the UPS market trends are shifting. In addition to the business fields focused on communication infrastructure and computer devices, the demand is growing in factory manufacturing equipment and data centers. In particular, the predicted spread of cloud computing has resulted in a growing trend towards a market for UPS in data centers. This market primarily uses 500 kVA class, large capacity UPS, and needs are growing for a 400 V power distribution type that can reduce electric current decreases caused by wire loss for higher efficiency. Sanyo Denki aims to increase its presence in the data center market with the parallel processing type UPS "SANUPS E33A" , which has dramatically higher efficiency compared to on-line inverter power supply system as well as high quality from no-break transfer and high reliability with parallel redundant operations. Furthermore, in the factory manufacturing market, parallel processing UPS are ideal for backup of power equipment, and the Sanyo Denki UPS could answer the demands for even larger capacity backup power. With this in mind, we planned to expand the lineup by developing large capacity "SANUPS E33A" .

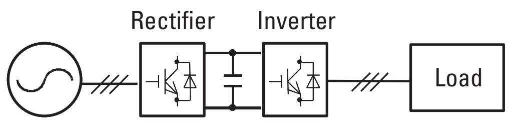
3. Features of Larger Capacity "SANUPS E33A"

This section explains the characteristics of the newly developed, larger capacity "SANUPS E33A" .

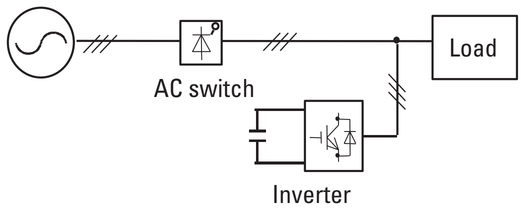
3.1 Basic structure

Fig. 1 shows the basic circuit structure of the UPS. (a) is the on-line inverter power supply system method, and (b) is the parallel processing type. The parallel processing method is used in the "SANUPS E33A," meaning that the inverter is connected in parallel with the commercial power supply, and main electricity is supplied through the path with the AC switch only. At this time, the inverter is operated as the parallel redundant operation with the commercial power supply, and at the same time it is performing active filter function to control the harmonic current and charging function to the battery simultaneously.

In other words, "power is supplied from the commercial power supply, and the quality is from the inverter" where only the "quality" part is going through the inverter during normal operations. Therefore, the electrical loss is significantly smaller compared to the on-line inverter power supply system, shown in Fig. 1(a), which goes through 2 convertors continuously, making it possible to supply the electricity with high efficiency and high quality.

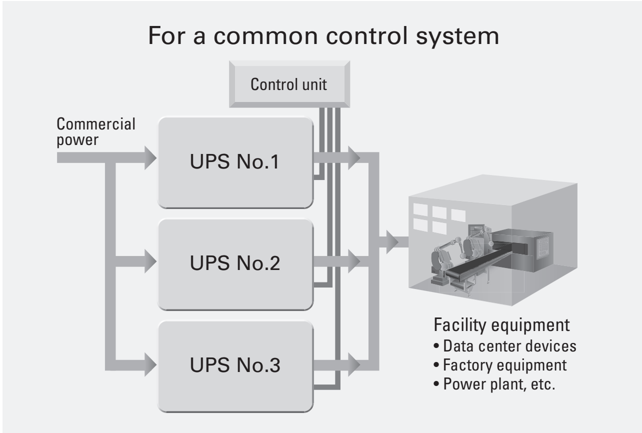


(a) Basic circuit structure of the on-line inverter power supply system method

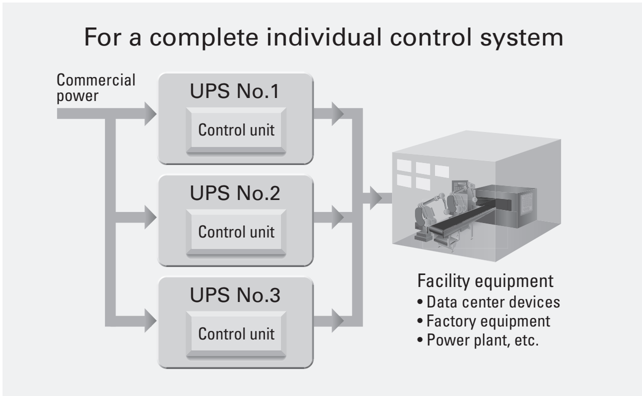


(b) Basic circuit structure of the parallel processing type

Fig. 1: Basic circuit structure of the UPS



(a) Common control system



(b) Complete individual control system

Fig. 2: Control system for parallel operation

To be able to enlarge the capacity efficiently and easily, the "SANUPS E33A" is using a parallel processing type UPS, which is to be able to construct a parallel system, as a base unit. In general, when the UPS is operated in parallel, it is necessary to match the voltage magnitude, phase, and frequency since the output of each UPS unit is AC. If there are any differences in these, voltage differences will occur between each unit. Also, since each UPS unit is connected with wiring only, the impedance between them is very small, but with the relationship of "current = voltage difference / impedance," there will be excessive current running between each UPS units (this is called cross current) even if the voltage difference is a small amount. In this case, each UPS unit will not be able to supply this excessive current, and so it will stop. The most common controls to control this cross current are establishing a control unit to perform parallel operations, like in Fig. 2(a), and distributing the common voltage, phase, and frequency commands to each UPS unit.

But if there is a control circuit that is common to all, the whole system will halt when there is any malfunction in this control unit. Even if the reliability of each UPS is very high, if the reliability of this common control unit is not as high, the reliability of the whole system will be low.

Therefore, if each of the UPS units can operate in parallel without constructing a common control unit as shown in Fig. 2(b), the whole system can be made highly reliable without being tied to the common control unit reliability. For high reliability in the whole system, the reliability of each UPS unit must be raised. The parallel processing type that was adopted this time has less parts and a low error rate compared to on-line inverter power supply systems, so it is able to construct a more reliable system.

3.2 UPS configuration

Fig. 3 shows the UPS configuration. UPS units are placed on both sides of the I/O board to keep the difference in wiring impedance between the I/O board and each UPS unit as small as possible.

If an I/O power board for the maximum power supply capacity is installed beforehand, each UPS unit can be installed separately in accordance with the systematic plan.

(a) 4 unit configuration

(b) 5 unit configuration

(c) 6 unit configuration

Fig. 3: UPS configuration by number of units

3.3 Other features

This section introduces the newly added features for this lineup expansion.

(1) Resting device settings

A function was added so that each UPS unit can be set to operating or resting from the I/O board. With this function, the system capacity can be set by 100 kVA.

Fig. 4 explains an example of implementation of a 500 + 100 kVA parallel redundant type system. If the load already meets 500 kVA, it can be operated as is. If the initial capacity of the operating devices is lower than that, for example, a capacity of less than 200 kVA as in Fig.4, then by resting three UPS units, the UPS system becomes 200 + 100 kVA. There is no loss from the resting UPS units, leading to more efficient operations. For a large scale system, such as a data center, there are cases where load equipment is introduced gradually as the data grows. This function is useful for these cases.

(2) Improvement of the man-machine interface

The informational display for the UPS has been changed from the conventional LCD to a touch panel. The screen layout was revised so that operators can operate it intuitively. Fig. 5 shows the UPS data display screen. The operability of the display has been improved: each menu is always displayed as a tag, and touching this menu tag switches the display to other menu screens. Furthermore, the man-machine interface has been drastically improved. For example, UPS output voltage now can be adjusted by touch panel operations by the maintenance person.

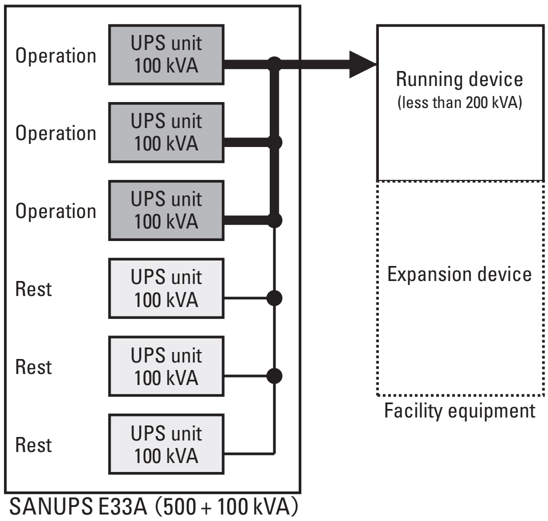


Fig. 4: Settings for resting device in a 500 + 100 kVA system implementation

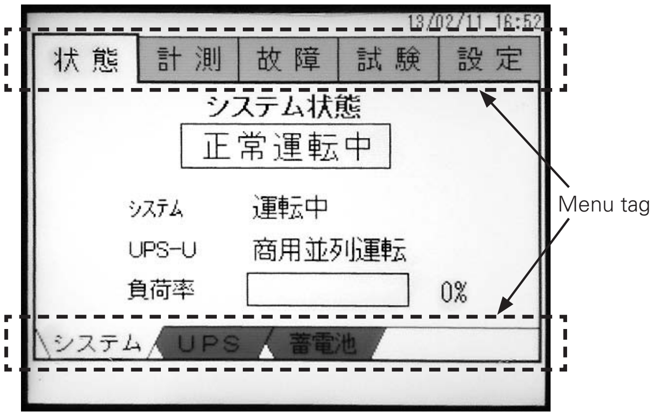


Fig. 5: UPS data display screen

4. Specifications

Table 1 shows the basic specifications. Also, Fig. 6 shows the appearance of the newly developed parallel redundant type (500 kVA).

As part of the new lineup, we added the parallel type for 400 to 600 kVA, and parallel redundant type for 300 kVA to 500 kVA by using the 100 kVA for base unit. They consist of the UPS units and the I/O board that integrates all the UPSs.

Table 1: Standard specifications

Item									Remarks
Model			E33A104	E33A204	E33A304	E33A404	E33A504	E33A604	
Method			Parallel operation						
Model			E33AR104	E33AR204	E33AR304	E33AR404	E33AR504		
Method			Parallel redundant operation						
Rated output capacity (Apparent power/effective power)			100 kVA/ 90 kW	200 kVA/ 180 kW	300 kVA/ 270 kW	400 kVA/ 360 kW	500 kVA/ 450 kW	600 kVA/ 540 kW	
Operation system			Parallel processing system (on-line inverter parallel power supply system)						
AC input	**No. of phases/wires**		Three phase, three wire / three phase, four wire						
	Rated voltage		380 V, 400 V, 415 V, 420 V						Default setting
	Voltage fluctuation range		Within +10%, -8%						
	Rated frequency		50 / 60 Hz						
	Frequency fluctuation range		Within ±5%						
	Required capacity		120 kVA	240 kVA	360 kVA	480 kVA	600 kVA	720 kVA	
	Compensation of distorted current	**Compensation capacity**	Within rated capacity						
		Compensation order	2 to 20 order harmonic						
		Compensation rate	75%						
	Input power factor		0.97 min.						During rated operations
AC output	**No. of phases/wires**		Three phase, three wire / three phase, four wire						Same as AC input
	Rated voltage		380 V, 400 V, 415 V, 420 V						Same as AC input
	Voltage setting precision	**During commercial parallel operations**	Rated voltage within +10%, -8%						
		During battery operations	Rated voltage within ±3%						
	Rated frequency		50 / 60 Hz						
	Frequency precision	**During commercial parallel operations**	Rated frequency within ±5%						
		During battery operations	Rated frequency within ±0.5%						
	Voltage wave form distortion factor	**Linear load**	2% or less						During battery operations
		Wave rectifier load	5% or less						
	Instantaneous voltage fluctuation rate		Within ±5%						During battery operations
	Load power factor	**Rated**	0.9 (lag)						
		Fluctuation range	1.0 to 0.7 (lag)						
	Overload capacity	**During commercial parallel operations**	200% (30 seconds), 800% (0.5 seconds)						
		During battery operations	125% (10 minutes), 150% (1 minute)						
	Switching time to battery operations		Without momentary power breaks						
Acoustic noise	**During parallel operations**		70 dB max.	73 dB max.	76 dB max.	76 dB max.	76 dB max.	76 dB max.	Within 1 m from the front, Height 1 m
	During parallel redundant operations		73 dB max.	76 dB max.	76 dB max.	76 dB max.	76 dB max.	—	
Heat generation	**During parallel operations**		2.8 kW max.	5.6 kW max.	8.4 kW max.	11.2 kW max.	14.0 kW max.	16.9 kW max.	After charging is complete, during rated output
	During parallel redundant operations		4.8 kW max.	7.6 kW max.	9.8 kW max.	11.2 kW max.	14.0 kW max.	—	
Cooling rate	**During parallel operations**		14.4 m³/min	28.8 m³/min	43.2 m³/min	57.6 m³/min	72.0 m³/min	86.4 m³/min	After charging is complete, during rated output
	During parallel redundant operations		24.5 m³/min	38.8 m³/min	50.6 m³/min	57.6 m³/min	72.0 m³/min	—	
Operation environment			Ambient temperature: 0°C to 40°C, Relative humidity: 20% to 90% (non-condensing) Installation location: Indoors, Altitude: 1000 m or less						

Fig. 6: Appearance of the UPS

5. Conclusion

We introduced the expanded, larger capacity lineup for the 400 V large capacity parallel processing type "SANUPS E33A". The newly developed models expanded the lineup with a maximum capacity of 600 kVA for parallel type and 500 + 100 kVA for parallel redundant type.

Making the most out of the high efficiency, which is the biggest feature of parallel processing UPS, this product is expected to contribute to energy savings in data centers and factory manufacturing equipment.

Documentation

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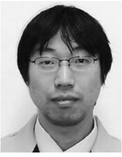
4) Okui, Ota, Nakamura, Yanagisawa, Hirata, Yamaguchi, Tanahashi: "Development of the Low Energy, High Quality, and High Reliability Large-capacity UPS 'SANUPS E33A'", SANYO DENKI Technical Report Issue 26, pages 21-24 (2008).



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