

Development of the Independent Power Supply for Photovoltaic Power Generation Systems “SANUPS P11A”

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1. Introduction

In recent years, photovoltaic power generation systems have spread widely as countermeasures to global warming or to reduce CO₂ emissions. Furthermore, stand-alone operable photovoltaic power generation has come to attention for supplying power even during commercial power outages due to disaster or power shortages, and thus there are great expectations as emergency power.

With this background, we developed the “SANUPS P11A” as a power supply that can turn a currently installed photovoltaic power system without a stand-alone operation function into a system with a stand-alone operation function.

This document introduces these features.

2. Product Overview

Currently, many of the photovoltaic power systems for utility connected systems installed for industrial use do not have a stand-alone operation function, and to turn these systems into systems with stand-alone operation functions, the power conditioner must be replaced or modified.

The “SANUPS P11A” has a structure that can be connected with simple additional work, enabling currently installed photovoltaic power system to be turned into systems with a stand-alone operation function without making major changes.

The lineup consists of two types to support a variety of applications.

2.1 U type (stand-alone, storage type)

- (1) UPS type that supplies stable power even during a power outage
- (2) Output capacity: 1.5 kVA, battery storage time: 180 min.

Fig. 1 shows the system configuration when the “SANUPS P11A U type” is introduced.

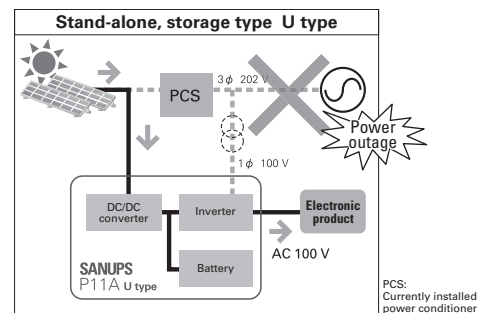


Fig. 1: System configuration of “SANUPS P11A U type”

2.2 D type (stand-alone type)

- (1) Inverter that can be used only when the photovoltaic panel is charged
- (2) Output capacity: 3 kVA or 5 kVA

Fig. 2 shows the system configuration when the “SANUPS P11A D type” is introduced.

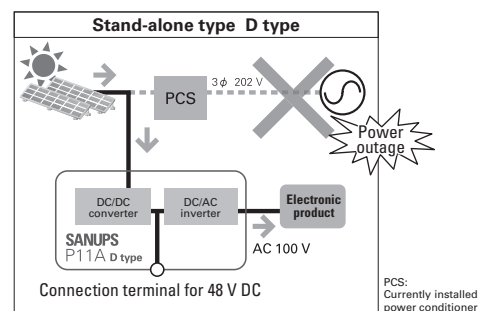


Fig. 2: System configuration of “SANUPS P11A D type”

Fig. 3 shows the appearance of the “SANUPS P11A U type” while Fig. 4 shows the appearance of the “SANUPS P11A D type” .



Fig. 3: Appearance of “SANUPS P11A U type”



Fig. 4: Appearance of “SANUPS P11A D type”

3. Product Features

The “SANUPS P11A” can be used in a photovoltaic power system where the output voltage of the photovoltaic panel reaches up to 500 V DC.

Both the U type and D type have an operation range of 200 to 500 V DC depending on the power of the photovoltaic power generation and AC output of 100 V AC.

3.1 Versatility

The “SANUPS P11A” can connect photovoltaic panel output to the device and be used as a stand-alone power source. Therefore, it can be introduced to already operational photovoltaic power systems with easy additional work without needing to replace or modify a power conditioner.

3.2 Diversity

When a commercial power system operates normally, the product acts as a UPS and supplies AC power and charges the battery. When there is a power outage, the U type continuously supplies power by converting the power from photovoltaic power generation into AC power, while the D type supplies power by converting the power from photovoltaic power generation into AC power. With this lineup of two models, the product can meet a variety of customer needs.

3.3 Expansion interface

The U type supports the following expansion interfaces and can support a variety of applications.

- (1) Power management with the power management software “SANUPS SOFTWARE”
- (2) Power management in a network environment with LAN interface card (optional)
- (3) External transfer signal output of no-voltage contact with a contact interface card. (optional)
- (4) Remote on/off operations of AC output with a remote switch (optional)

4. Basic Operations

4.1 U type (stand-alone, storage type)

When a commercial power system operates normally, the commercial power is converted into stable AC power, which is used to supply power to the electric equipment and charge batteries.

When there is a power outage, the battery power is converted into AC power and it is supplied to the equipment without interruption.

During a power outage, by converting power generated by the photovoltaic panels to AC power, AC power can be continuously supplied without consuming the battery power. Furthermore, when there is insufficient power from the photovoltaic panels, AC power is supplied from the battery power.

Fig. 5 shows the power supply status of the U type during normal commercial power and power outage.

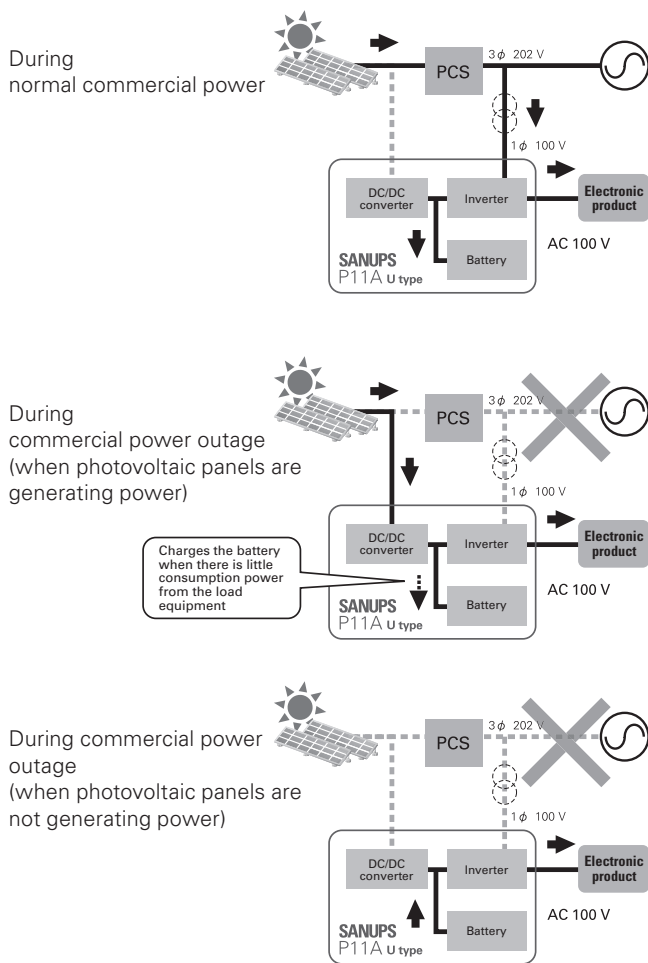


Fig. 5: Block diagram for "SANUPS P11A U type"

4.2 D type (stand-alone type)

The power generated by the photovoltaic panels is converted into AC power and supplied to electric equipment.

When the photovoltaic panels are not generating power, by connecting a 48 V DC power source to the P11A D type, the power is converted into AC and supplied.

Fig. 6 shows the power supply status of the D type when it is receiving power from the photovoltaic power generation system and a 48 V DC power source.

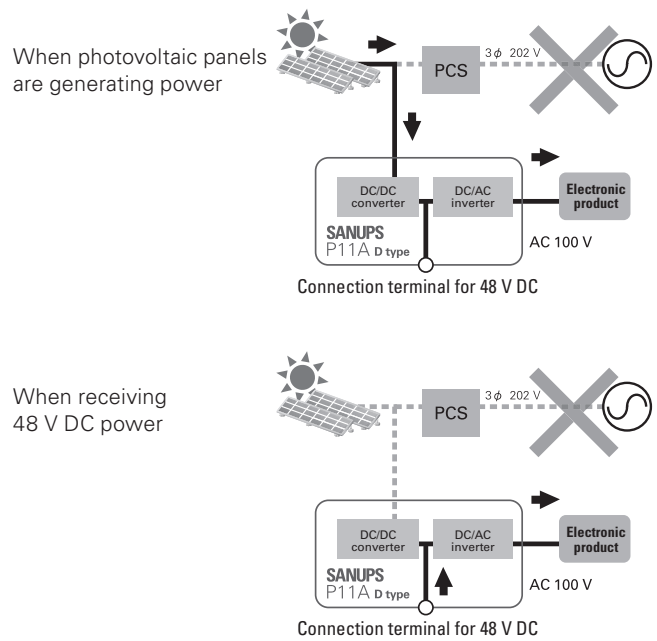


Fig. 6: Block diagram for "SANUPS P11A D type"

5. Specifications

Table 1 shows the specification of the new model.

Table 1: General specifications for "SANUPS P11A"

Item		Units	Rating or characteristic			Remarks	
Model	Type	—	U type		D type		
	Model	—	P11AU152	P11AD302	P11AD502		
	Rating type	—	Continuous				
	Cooling method	—	Forced air cooling				
	INV method	—	IGBT PWM				
AC input	Rated voltage	V	100 AC within $\pm 15\%$	—		(U) When load factor is 70% or less, within +15% to -20%	
	Rated frequency	Hz	50 or 60 $\pm 1,3,5\%$	—		(U) Frequency is selected automatically Note 1 (fluctuation range and output frequency precision selection are the same)	
	No. of phases/wires	—	Single phase, two wire				
	Required capacity	kVA	1.5 or less			(U) Max. capacity when recovering battery charge	
	Power factor	—	0.95 or higher			(U) When input voltage distortion is within 1%	
Photovoltaic battery input	Operation voltage range	V	DC 200 ~ 500			Startup voltage 270 V DC	
	Maximum voltage	V	DC 500				
	Required capacity	kW	1.75 or less	4.4 or less	7.0 or less		
	No. of circuits	—	1 circuit				
AC output	Rated capacity	kVA /kW	1.5 / 1.05	3 / 2.4	5 / 4	Apparent power / effective power	
	No. of phases/wires	—	Single phase, two wire				
	Rated voltage	V	AC 100			Voltage waveform: sine wave	
	Voltage setting precision	%	Rated voltage within ± 2	Rated voltage within ± 5		During rated operations	
	Rated frequency	Hz	50 or 60			(U) Same as input frequency (D) Depends on the switch setting	
	Frequency precision	%	Rated frequency within ± 3 (Synchronized with commercial line)	Rated frequency within ± 1		Note 1	
	Voltage wave form distortion factor	%	3 or less / 7 or less	3 or less / 8 or less		Linear load / wave rectifier load during rated operations	
	Transient voltage fluctuation	Load sharp change	%	Rated voltage within ± 5	Rated voltage within ± 10		Change between 0% and 100% (U) When switching output
		During power outage/return	%		—		(U) During rated operations
		During sudden variation in input voltage	%		—		(U) Fluctuation of $\pm 10\%$
		Response time	—		5 cycles or less		100 ms or less
	Load power factor	—	0.7 (lagging)	0.8 (lagging)		Fluctuation range 0.7 (lagging) to 1.0 Cannot exceed rated power	
	Overcurrent protection	%	105 or higher			(U) Automatic switching to bypass circuit (D) Continuous protection operation time is approximately 20 s	
Overload capacity	Inverter	%	105 or higher	—		(U) 200 msec.	
	Bypass		200 / 800	—		(U) 30 s / 2 cycles	
Battery	Method	—	Small, control valve lead storage battery				
	Rated capacity	A · h	44				
	Units	Units	12 (4 series, 3 parallel)				
	Backup time	Minutes	180			Ambient temperature 25°C, initial value	
48 V DC power input	Operation voltage range	V	—	DC 40.5 ~ 57			
Acoustic noise	During AC input operations	dB	40 or less		1 m from the front of the device, A characteristics		
	During photovoltaic battery input operations	dB	50 or less	60 or less			

* In the Remarks column, (U) applies to U type and (D) applies to D type.

Note 1 (Applies only to U type)

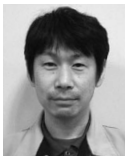
When the AC input frequency has a range of $\pm 3\%$ (selectable between 1%, 3%, or 5%) the rated frequency, and the AC input voltage has a range of $\pm 15\%$ the rated voltage (when load factor is 70% or less, the range is -20% to +15%), the inverter operated synchronous with the AC input and no-break transfers to the bypass circuit are possible. If the AC input frequency exceeds the setting range, operation switches to battery operations.

6. Conclusion

We believe that the demand will increase for various applications of photovoltaic power generation as countermeasures to global warming and as emergency power sources, including during disasters.

We will continue to quickly develop products to meet these market demands and provide devices that fulfill our customers' needs.

We sincerely thank the many people involved in the development and realization of this product for their advice and support.



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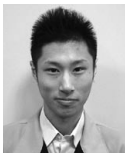
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