Development of the Power Conditioner for Photovoltaic Power Generation System "SANUPS P73F"

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1. Introduction

Recently, global warming has become a dire topic of discussion adopted on a global scale and brought up in numerous international gatherings.

Against this background, photovoltaic power systems have gained worldwide attention as a type of clean energy that does not emit carbon dioxide or other green-house emission gases, which are known as one of the sources of global warming. Many countries around the world are actively attempting to expand photovoltaic power systems as national projects, while still more are hoping to increase their use of these systems. Many countries are looking towards photovoltaic power systems as a solution to environmental problems.

Our company has developed the "SANUPS P73F" as a power conditioner for photovoltaic generation system that supports international electricity systems.

2. Background of the Development

Currently, the market for photovoltaic power systems is starting to slow down within Japan, but at the same time, it is gaining attention in other countries around the world. The South Korean government, for example, drafted a national energy plan (2002) to increase reusable energy sources to 5% by 2011 and 1300 MW by 2012.

Therefore, there is a possibility that photovoltaic power systems will quickly become high demand products in South Korea.

Currently, our company makes several power conditioners that support Japanese specifications, such as "SANUPS P73D", "SANUPS P73E", and "SANUPS P83B". However, we did not have a product that supported the electrical systems used international, which meant that when our products were used abroad, customers had to attach a separate voltage conversion transformer to the product. However, these types of products have a difficult time competing in terms of dimensions, weight, and cost, making it more difficult as a newcomer in international markets.

In light of these facts, we developed the power conditioner "SANUPS P73F" that supports the 3-phase 4 wire AC 380 V electrical system that is most commonly used in many countries abroad.

3. Features

3.1 Stationary build-up system

"SANUPS P73F" has the same stationary structure as the conventional model, "SANUPS P73E" and uses a build-up system built from 10 kW units. Therefore, this structure allows 10 to 30 kW to be produced using the same installation space.

By developing only 10 kW units, a power conditioner with a total output of 10 to 60 kW can be constructed. This eliminates the need to develop separate units for each capacity, allowing the development time to be effectively shortened.

Fig. 1 shows a photograph of "SANUPS P73F", Fig. 2 shows the circuit block diagram, and Fig. 3 shows an example of the system configuration.

Fig. 1: "SANUPS P73F"

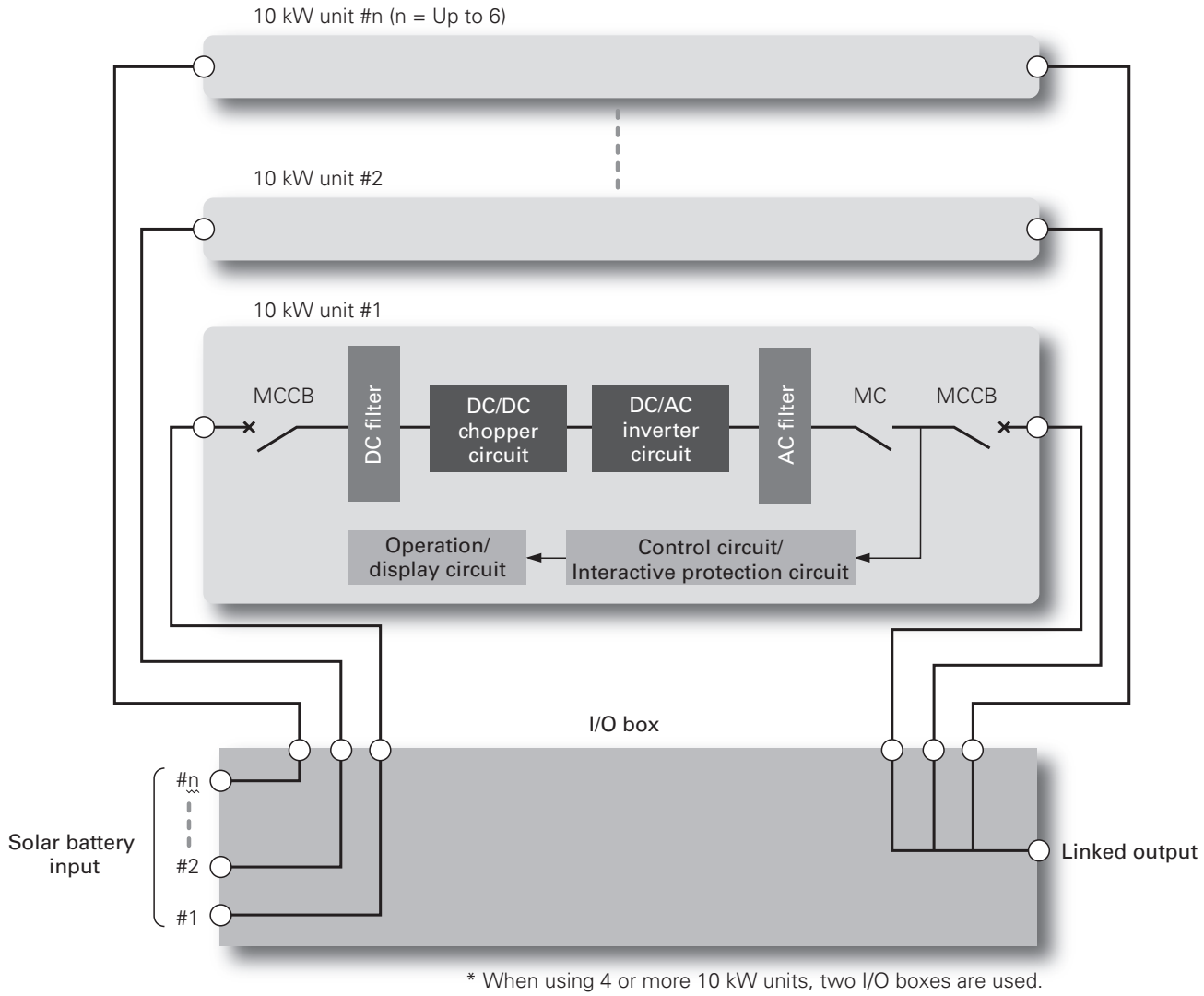

Fig. 2: “SANUPS P73F” circuit block diagram

Fig. 3: “SANUPS P73F” system configuration

3.2 High conversion efficiency

In order to allow the conventional device to support international electrical systems, a voltage conversion transformer had to be attached to the AC output for the power conditioner. In this situation, the total conversion efficiency is the conversion efficiency of the power conditioner multiplied by the conversion efficiency for the transformer, so therefore the total conversion efficiency is reduced.

However, with "SANUPS P73F", the device can connect to international electric power systems directly without a voltage conversion transformer, so the total conversion efficiency is equal to the conversion efficiency for the power conditioner, making the conversion efficiency higher than before.

Also, the main circuit parts were redesigned so that even when just comparing the power conditioners, the "SANUPS P73F" achieved a conversion efficiency of 93%, which was even higher than the conventional device.

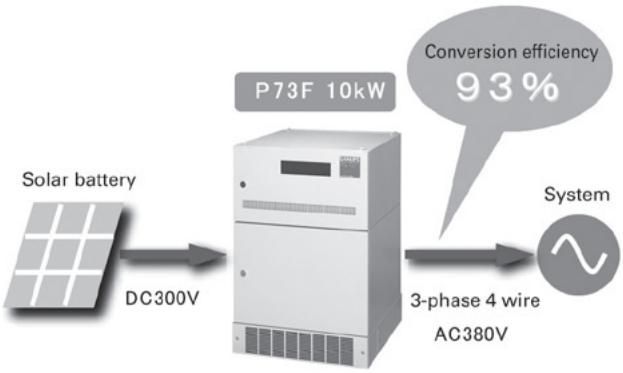

Fig. 4: "SANUPS P73F" conversion efficiency

3.3 Environmental considerations

Recently, companies have begun limiting chemicals that are typified by the RoHS directive to affect the human body or global environment in products.

Therefore, "SANUPS P73F" uses parts that support the RoHS directive along with chrome free plates with superior resistance to corrosion as compared to the conventional product. This reduces the overall environmental strain of the product.

Furthermore, the expected life is 15 years, giving the product a long life like the conventional product. During this time, no replacement parts are needed due to wear on our long life fan or derating on the electrolytic capacitor.

3.4 Support for a monitoring system

A monitoring system is a system that ultimately gathers measurement information from power conditioners and other sources into central servers and performs integrated control.

In "SANUPS P73F", the communications protocol with the RTU is standardized so that it supports a system that transfers information to the central server through the RTU (transmission device) in this monitoring system.

Therefore, when installing a photovoltaic power system, a monitoring system can easily be constructed.

An overview of a monitoring system is shown in Fig. 5.

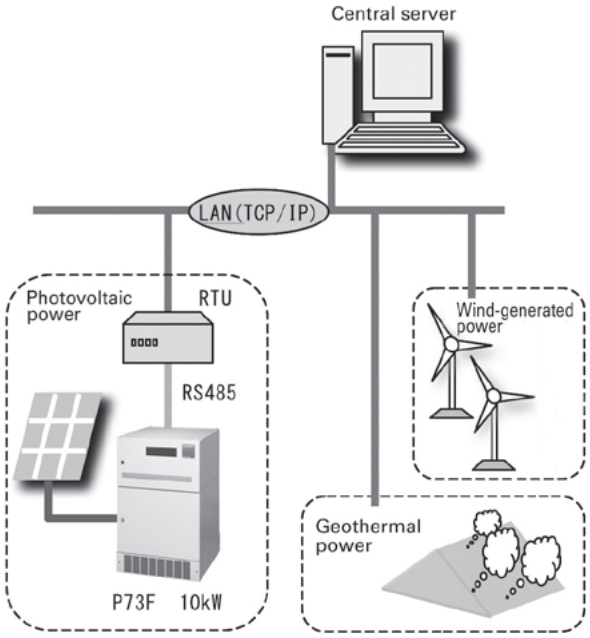

Fig. 5: Overview of a monitoring system

4. Specifications

Table 1 shows the specifications for the "SANUPS P73F".

Table 1: Specifications for "SANUPS P73F"

Item		SANUPS P73F	Remarks
Output capacity		10kW	
Method	Main circuit method	Self communication voltage control type	
	Switching method	High frequency PWM method	
	Insulating method	Transformer-less system	
DC input	Rated voltage	DC300V	
	Maximum allowance input voltage	DC500V	
	Input operating voltage range	DC200 to 500V	Rated output range: DC 280 to 450 V
	Maximum output follow-up control range	DC200 to 450V	
AC output	No. of phases/wires	3-phase 4 wire	Neutral contact
	Rated voltage	AC 380 V (line)	AC 220 V (phase)
	Rate frequency	60Hz	Can also support 50 Hz
	AC output current distortion	Total 5%, 3% or less each	Rated output current
	Output power factor	0.95 min.	At rated output
Efficiency		93%	
Linked protection		Over-voltage (OV), under-voltage (UV) Over-frequency (OF), under-frequency (UF) Ground fault overvoltage (OVGR)	OVGR is external
Independent operation detection	Passive method	Voltage phase jump method	
	Active method	Non-effective power fluctuation method	
Environment	Ambient temperature	-10 to 40℃ (50℃)	Operations possible with limited output between 40 and 50 ˚C
	Relative humidity	30 to 90%	Non condensing
	Altitude	Max. 2000m	

5. Conclusion

This document introduces the main features of "SANUPS P73F".

The development of this product adds a model that can even be used internationally to our line-up of power conditioners.

In the future, we are planning to develop different models based on this "SANUPS P73F" for various countries around the world.

We will pursue planning and developing products that can contribute to the global environment while aiming for power conditioners that offer even higher performance at an even lower cost.

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

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