Power Systems Division

Narumi Yanagisawa

The United Nations Climate Change Conference, COP 21[*1], held in Paris late last year ended with the adoption of the Paris Agreement.

This is considered a groundbreaking achievement due to the fact a specific target was set of holding the increase in the global average temperature to less than 2˚C above pre-industrial levels[*2] and because it is the first framework to which all the world's largest emission-producing countries are signatories.

However, in order to achieve the Agreement's target, each nation must properly ratify it and the specific plan must be fulfilled.

For Sanyo Denki and other members of the electrical device manufacturing industry, the effective utilization of energy, promotion of renewable energy and provision of the devices to achieve these are extremely important issues required to achieve the abovementioned target.

Furthermore, the Power Systems Division is exerting particular efforts to achieve the future target by developing products relating to the high efficiency and high reliability of power conversion equipment and the utilization of renewable energy.

The following is a summary of products developed by the Power Systems Division in 2015 while engaging in such activities.

The introduction of photovoltaic power systems has progressed significantly since the establishment of the feed-in-tariff in 2012. However, as a result of the rapid introduction, the issue of connection capability constraints due to the limited capacity of electric power grids has emerged and as a solution to this problem, remote control as a means of controlling power generation volume based on information from power companies has become an essential function of photovoltaic power systems to be introduced in the future.

As products which comply with this, we developed the power conditioner for photovoltaic power generation with an output control function "SANUPS P61B" series, and the remote monitoring tool with an output control function "SANUPS PV Monitor E model".

In addition, we developed the power conditioner for photovoltaic power generation with a peak power cut function "SANUPS P73K" as a device to promote the effective utilization of energy generated through photovoltaic power by combining storage batteries.

In the field of uninterruptible power supply, we developed the online inverter power supply system "SANUPS A11K", which has improved power conversion efficiency and enhanced fundamental performance.

This document provides an overview and features of each product.

*1 COP21: 21st Conference of Parties
The 21st session of the Conference of the Parties to the UNFCCC

*2 'Pre-industrial' refers to before the period around 1850 to 1900.

■ Development of Products for Photovoltaic Power Systems with an Output Control Function

In line with the increase in power generation equipment which utilize renewable energy, and in order to prepare to introduce renewable energy to the maximum extent possible, the Agency for Natural Resources and Energy released ministerial ordinances in January and March of 2015 for the partial amendment of the Act on Special Measures Concerning Procurement of Renewable Electric Energy by Operators of Electric Utilities. This called for a function conforming to the new output control rules which made it possible to suppress output of power generation equipment in units of time.

In regards to the specifications of the new output control rules, the Japan Photovoltaic Energy Association, Japan Electrical Manufacturers' Association and Federation of Electric Power Companies compiled a document entitled "Technical Specifications of PCS* with an Output Control Function". (*PCS is an abbreviation for power conditioner systems.) Based on these technical specifications, we developed the power conditioner for photovoltaic power generation with an output control function "SANUPS P61B" series, and the remote monitoring tool with an output control function "SANUPS PV Monitor E model" in order to comply with the new output control rules.

Figure 1 shows the configuration of our product for a PCS with an output control function. The configuration of this system is explained below.

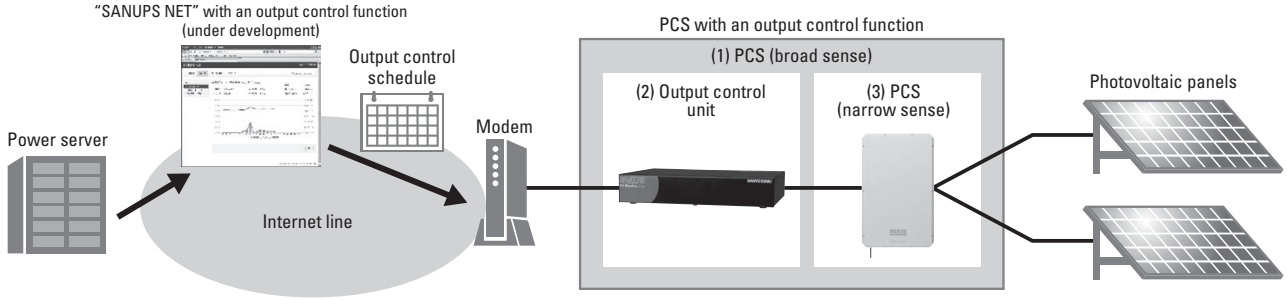


Fig. 1: Configuration of a PCS system with an output control function (in the case of our system configuration)

(1) PCS (broad sense)

A PCS with a function to control power generating output in accordance with output control schedule information presented by power companies or distributors. Essentially, it is configured from the (2) output control unit and (3) PCS (narrow definition) to be discussed herein.

(2) Output control unit

An output control unit is defined as a control device with a function to control (3) PCS (narrow sense) based on the output control schedule obtained from a power server. Even in the absence of an external communication function, the unit controls the (3) PCS (narrow sense) in accordance with a fixed schedule saved within it. Our product, the "SANUPS PV Monitor E Model" with an output control function is an output control unit. In our system, output control schedules are obtained from a power server through the "SANUPS NET" with an output control function which is still being developed.

(3) PCS (narrow sense)

In addition to the conventional functions, a PCS with a function to control the output (maximum) of photovoltaic power generation in accordance with information on output control received from the (2) output control unit. The recently developed "SANUPS P61B" series, a power conditioner with an output control function, is a PCS in the narrow sense.

Figure 2 shows the 5 kW and 5.5 kW models of the SANUPS P61B series with an output control function

Compared with the conventional "SANUPS P61B" series, this series has expanded functions due to software changes but is identical in shape and appearance.

We have prepared two types of LCD panels which can be used with the "SANUPS P61B" series with an output control function: the LCD panel TYPE II C, which can only be used for configuration of the output control function, and the LCD panel TYPE III C, which can be used for both configuration and operation of the output control function. These are shown in Figure 3.

The "SANUPS P61B" series is a power conditioner for photovoltaic power generation offering superior features such as high quietness, high environmental resistance with adoption of IP65*1, a junction box function which is able to connect up to four circuits and an isolated operation function. The "SANUPS P61B" series is equipped with an anti-islanding function conforming with JEM 1498 and satisfies the utility connected system regulation FRT rule of JEAC9701-2012. Moreover, as the new model has already obtained JET certification*2 for multiple-unit connected support models, our customers do not need to spend as much time and money in discussion with power companies regarding utility connected systems.

Also included in our lineup is the "SANUPS PV Monitor E Model" with an output control function which is the remote monitoring tool "SANUPS PV Monitor E Model" with an output control unit function added. This is shown in Figure 4.

In addition to the product shown in Figure 4, we developed a mobile communication package with an output control function contained in the housing for outdoor use with a protection level of IP65.

*1 IP65: No ingress of dust and water jets from any direction shall have no harmful effects.
*2 JET: Japan Electrical Safety & Environment Technology Laboratories

Fig. 2: "SANUPS P61B" series with an output control function

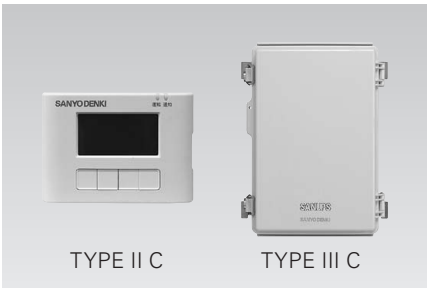


Fig. 3: LCD panel

Fig. 4: "SANUPS PV Monitor E Model" with an output control function

■ Development of the Power Conditioner with Peak Power Cut Function "SANUPS P73K"

We developed the power conditioner for photovoltaic power generation "SANUPS P73K" that can cut peak power by combining lithium ion storage batteries.

This device consists of a 10 kW power conditioner unit, 10 kW charging unit, and an I/O box, and it is a buildup system that can stack up to six 10 kW power conditioners.

The SANUPS P73K comes in two types: the grid-connected, isolated, charging operation type and grid-connected, isolated operation type, with the equipment output capacity ranging from 10 to 60 kW.

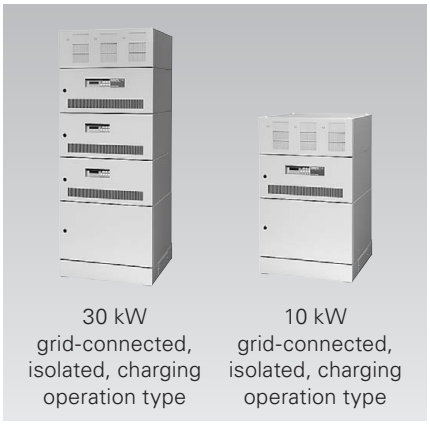
The grid-connected, isolated, charging operation type has a charging unit inserted between the power conditioner unit and storage battery enabling a control of maximum power point tracking either during charging or discharging. This enables the power generated by a photovoltaic panel to be effectively utilized.

The photovoltaic panel input is insulated from the utility grid, therefore when the photovoltaic panels are grounded or if the grounding method differs to that used on the utility grid, there is no need to install an insulation transformer in the system.

As a countermeasure for the distribution systems accompanying the large-scale introduction of photovoltaic power generation equipment, it is possible to change the output power factor at the time of utility connected operation within a range of 0.8 to 1.0. Furthermore, the new model satisfies the FRT requirement under JEAC9701-2012 "utility connected system code".

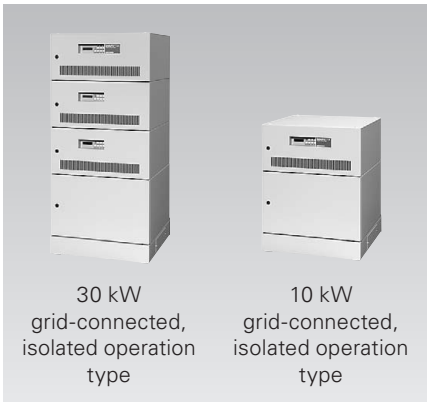
By using our remote monitoring tool "SANUPS PV Monitor E Model" or mobile communication package, it is possible to build an output control system.

Users can effectively utilize storage batteries to suit their application, therefore it is anticipated that power conditioners will play an active role in more markets.



30 kW grid-connected, isolated, charging operation type

10 kW grid-connected, isolated, charging operation type



30 kW grid-connected, isolated operation type

10 kW grid-connected, isolated operation type

■ Development of the Online Inverter Power Supply System UPS "SANUPS A11K"

We developed the online inverter power supply system UPS "SANUPS A11K" (1 kVA, 1.5 kVA, 2 kVA, 3 kVA, 5 kVA) as the successor to the conventional models, "SANUPS A11F" and "SANUPS ASC". The new model offers high efficiency, improved environmental-resistance as well as superior operability and maintainability.

Adopting the online inverter power supply system, the "SANUPS A11K" achieves 92% conversion efficiency, one of the highest in the industry*1, by using the 3-arm method on its main circuit, the optimization of its circuit components and so on.

This device has the following features.

It can be operated in an input voltage range -40% to +20% of the rated voltage*2 and an ambient temperature range of -10°C to +55°C.

By adopting an LCD panel as the operation panel, user operability and visibility have been improved.

Modularization of the inverter and battery has created a configuration which enables replacement from the front of the device. A maintenance bypass circuit is equipped for all model capacities therefore even in the rare event of an error, the module can be replaced while continuing to feed power to the load.

For the communication interface, in addition to the conventional RS-232C communication, a UPS management software can be used because the "SANUPS A11K" is standardly equipped with a USB connector.

The output capacity of this device is a load power factor of 0.8, therefore loads of greater capacity than conventional models can be connected. Furthermore, this series features longer backup time on the 1 kVA and 1.5 kVA models compared to that of conventional models.

*1 As of February 2015. With equivalent voltage and capacity on a online inverter power supply system UPS. Results from Sanyo Denki inspection.
*2 When load factor is less than 70%.


1 kVA, 1.5 kVA, 2 kVA


3 kVA


5 kVA

Narumi Yanagisawa
Joined Sanyo Denki in 1995
Power Systems Div., Design Dept. 2
Worked on the development
and design of power supplies.