Power Systems Division

Tetsuo Suzuki

The Paris Agreement (an international agreement reducing the impact of climate change) adopted in December 2015 came into force in November of last year.

This agreement marks the start of global-level climate change countermeasures, and serves as a historical turning point towards a trend of all the world's countries engaging in concrete action to deal with the increasingly serious issue of global warming.

Japan is the world's fifth greatest producer of CO_2 emissions and is promoting countermeasures to meet a high target. Our specific numerical targets are to reduce greenhouse gas emissions by 26% and 80% by 2030 and 2050 respectively compared with 2013 levels through energy saving and utilization of renewable energy.

As a power supply manufacturer, SANYO DENKI is also making ongoing efforts towards achieving these goals by developing products which further promote utilization of renewable energy, high-efficiency, high-reliability power supply units, and so on.

Against this backdrop, the following is a summary of the product development and technological accomplishments of our Power Systems Division in 2016.

In the PV power system field, a new standard has been established for islanding detection of 3-phase PV inverters. SANYO DENKI has developed the "SANUPS P73J" in compliance with this standard.

Furthermore, after the feed-in tariff scheme was launched in 2012, there has been a rapid increase in PV system installations leading to a limit on connectable volume due to power grid capacity restrictions. As a solution, it has become essential to have PV power systems equipped with a remote-control function to control the amount of power generation based on information from power companies. The "SANUPS PV Monitor Type C" was developed as a PV system monitoring device equipped with an output control function.

In the UPS field, SANYO DENKI has developed a technology enabling the easy construction of systems using Li-ion batteries, which are preferred over lead batteries due to their wide operating temperature range and extended backup, as well as being maintenance-free and space-saving.

This paper will provide an overview of these products and technologies and summarize their features.

■ Development of the "SANUPS P73J JEM1505 (new active method type)"

PV inverters feature both an active method and passive method for the swift detection of power outages in commercial power grids. However, a problem arise when the type of active method differs between manufacturers. When a PV inverter made by one manufacturer is installed in a commercial power grid where a PV inverter of another manufacture is already installed, a power company requires an islanding operation test with the other manufacturer to check for any interference with the active method. This test can be time-consuming and costly.

In September 2015, JEM1505 "Standard active islanding detection scheme (a frequency feedback method with step reactive power injection) of three-phase PV inverters connected to low-voltage power distribution lines" was established as the industry standard for islanding detection (active method) of three-phase PV inverters.

The "SANUPS P73J" was newly developed by SANYO DENKI as a 3-phase PV inverter that conforms to JEM1505 (a frequency feedback method with step reactive power injection).

Details of this product are provided in the "New Products Introduction" section of this Technical Report.

■ Development of the "SANUPS PV Monitor Type C"

The "Act on Special Measures Concerning Procurement of Electricity from Renewable Energy Sources by Electricity Utilities" established by Japan's Agency for Natural Resources and Energy calls for the introduction of PV inverters with an output control function.

In order to perform output control, an output control unit is neccessary for obtaining output control schedules from power company servers to control the PV inverters. Therefore SANYO DENKI developed the "SANUPS PV Monitor E Model" with an output control function in August 2015.

At the time, the method for obtaining output control schedules from power company servers had not yet been finalized; therefore, among the functions required of an output control unit, we only developed those enabling control of PV inverters in accordance with a given output control schedule.

Afterwards, in September 2016, Kyushu Electric finalized the method for obtaining output control schedules.

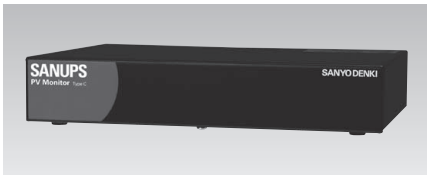
Specifically, output control schedules would be obtained from power company servers using HTTPS (Hypertext Transfer Protocol Secure) by an output control unit communicating directly with the power company's server via the Internet.

In response to this method being finalized, SANYO DENKI developed a product to support the output control planned for implementation within the region covered by Kyushu Electric from April 2017.

This product allows the sale of PV inverters to continue in the region and even sales expansion in the future.

It also serves to establish a foundation for when other power companies require PV inverters with output control functions, as will be inevitable in the future.

Details of this product are provided in the "New Products Introduction" section of this Technical Report.



■ Development of a Technology for "Li-ion Battery-Compatible Small-Capacity UPS Systems"

Conventionally, SANYO DENKI had offered small-capacity UPS for indoor use as backup for servers and ICT equipment or in combination with industrial devices. In recent years, there has been an increased demand for the backup power for outdoor facilities such as communication base stations, traffic lights, planned power outages, coin-operated parking, and outdoor surveillance cameras. Assuming outdoor usage will involve exposure to harsh environments, requirements include a wide operating temperature range, securing installation space, and low maintenance. To date, UPSs have used lead batteries. However, they have a limited operating temperature range, short runtime towards the end of their life cycle, and require replacing. Moreover, to achieve extended backup, more batteries are needed, which in turn requires more installation space.

SANYO DENKI has developed a technology to combine small-capacity UPS with Li-ion batteries (LIB) which are preferred due to their wide operating temperature range and extended backup, as well as being maintenance-free and space-saving.

1. Development of a LIB Monitoring System

SANYO DENKI developed a monitoring system comprised of a battery management unit (BMU) and gateway PWB (GW) in order to use LIB safely. This system has increased safety through a mechanism which isolates the LIB when an error is detected. (Fig. 1: Illustration of system configuration)

Moreover, this system can be connected using the external interface of a SANYO DENKI UPS, therefore making it possible to easily combine our existing UPSs with LIB.

2. Development of a Technology Enabling Outdoor Installation

(1) Environmental durability

- The housing has an ingress protection rating of IP44 and is made from stainless steel to enable installation in regions prone to salt-damage.
- We adopted a standby UPS topology which minimizes internal heat generation, allowing for a sealed structure.
- Operating range of -20˚C to +50˚C.

(2) Reduced device size and weight

- By combining with an LIB, the new system is approximately one-quarter smaller and one-fifth lighter than a 3-hour backup system using lead batteries.

(3) Improved maintainability

- 10-year maintenance free period in an environment with an average temperature of 30˚C.
- Modularization of the battery and UPS to enable replacement for increased maintainability. This product also comes standardly equipped with a maintenance bypass circuit for replacing the battery or UPS without shutting off power supply.

Table 1 shows typical specifications.

3. Conclusion

It is predicted that, with the diversification of small-capacity UPS applications and installation environments, UPS will need to become even more compact and have longer runtime. To satisfy these market requirements, SANYO DENKI will apply the technologies gained from this development project in a new series of UPS and continue to enhance our lineup.

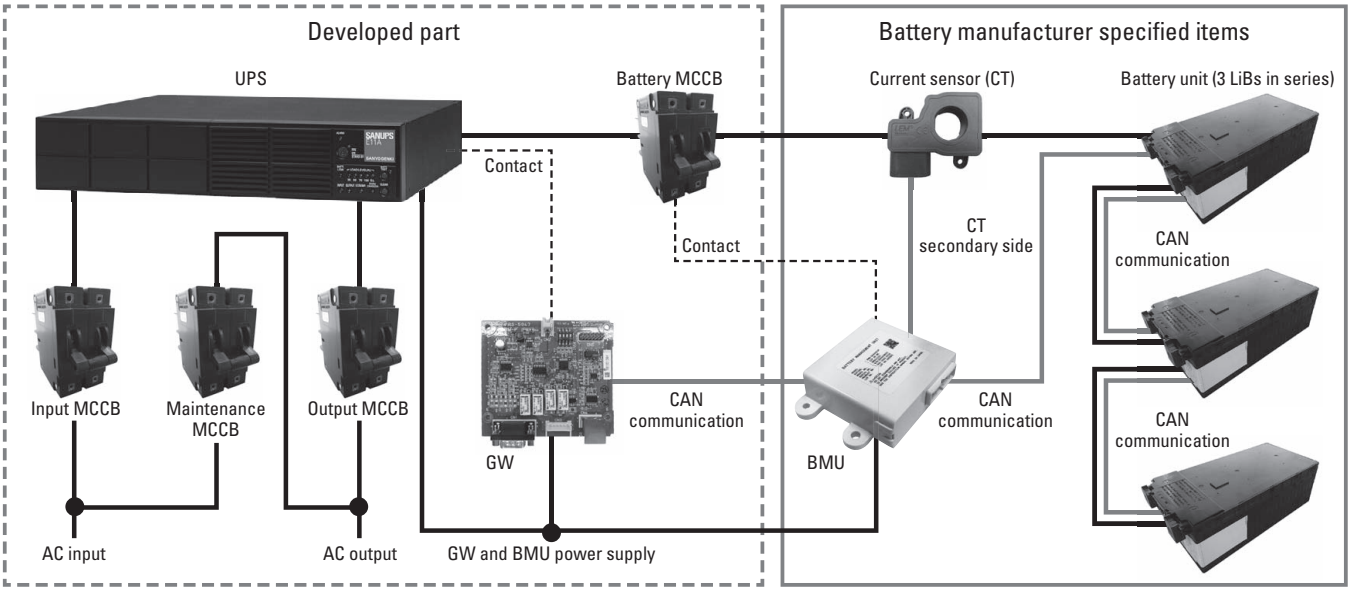


Fig. 1: System configuration of a LIB-equipped UPS

Table 1: Specifications

UPS for outdoor use			Remarks
Rated voltage		100 V	
Output capacity (apparent power/active power)		1.2 kVA / 1.2 kW	
Dimensions	Width	450 mm	
	Depth	300 mm	
	Height	900 mm	
Footprint		135000 mm^2	When using a long-life storage battery: 470000 mm^2 (estimated)
Mass		100 kg or less	
Runtime		180 min (with an output capacity of 1 kW)	Initial battery condition, ambient temperature 25˚C
Operating environment		Ambient temperature: -20 to 50˚C Relative humidity: 20 to 90% (non-condensing)	

Tetsuo Suzuki
Joined SANYO DENKI in 1984.
Power Systems Div., Design Dept. 1
Works on the development and design of power supplies.