# Power Systems Division

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2019 was the year in which real-world examples of smart factories leveraging IoT and AI emerged. Smart factories use IoT equipment and ICT to gather and analyze data to significantly improve energy efficiency and productivity. In addition to the ongoing advance of 5G communication and the predicted further growth in popularity of AI technology, countries around the world are advancing their respective initiatives,(1) and it is expected that this will bring innovative change to the manufacturing and logistics industries in the 2030s.

Meanwhile, 2019 was also a year in which uneasiness toward climate change intensified considerably. In the past five years, the highest average global temperatures ever recorded(2) have been reached. In addition, the sea rise forecast for the year 2100 increased significantly over previous forecasts.(3) In Japan, a number of large-scale typhoons damaged critical infrastructure and heavily impacted individuals' lives and corporate activities.

Power supply equipment and related products offered by the Power Systems Division include uninterruptible power supplies (UPS) and emergency power supplies supporting factories and critical infrastructure, power conditioners for renewable energy generation systems helping to prevent global warming, and networking products. Many of our customers have high expectations for such products as essential equipment to maintain factory production and critical infrastructure. In 2019, the Power Systems Division released the following new products.

Starting with UPSs, we developed the *SANUPS A11M* highly-reliable parallel redundant UPS, which can be used all over the world. In addition, we added new models to our *SANUPS N11B-Li* and *SANUPS A11K-Li* lineups of UPSs equipped with lithium-ion batteries, which we have been aggressively expanding in recent years.

In terms of renewable energy-related products, we enriched the lineup of our *SANUPS W73A* power conditioner for wind power and hydro power generation systems, adding a grid-connected isolated type that can be used during power outages.

For networking products, we developed the *SANUPS LAN Interface Card*, which is equipped with a Modbus(4) TCP/RTU communication function.

This article provides an overview of each of these products.

(1) Some examples include the German government's Industry 4.0, GE America's Industrial Internet, the Chinese government's Made in China 2025, and Connected Industries advocated by Japan's Ministry of Economy, Trade and Industry (METI).
(2) According to a report by the WMO (World Meteorological Organization).
https://public.wmo.int/en/media/press-release/wmo-seasonal-update-indicates-above-average-temperatures (2019.9.2)
(3) According to a report published by IPCC (Intergovernmental Panel on Climate Change).
https://www.ipcc.ch/2019/09/25/srocc-press-release/ (2019.9.25)
(4) A standard communication protocol for data transfer between industrial equipment.

## ■ Development of the *SANUPS A11M* Double Conversion Online UPS

The *SANUPS A11M* is a double conversion online UPS that easily achieves high reliability and increased capacity through parallel operation of multiple units. The *SANUPS A11M* uses our own parallel operation control technology that controls each unit individually to enable stable operation, including backup operation at power outages, even when a communication error occurs between units. This product has a single-phase 2-wire output and comes in 100 V and 200 V models, and can be expanded up to 8 kVA by combining multiple 1 kVA units. The *SANUPS A11M* is a highly reliable UPS that can be used all over the world.

Figure 1 shows the appearance of the *SANUPS A11M*.

The *SANUPS A11M* has a wider operating temperature range than our current product and can be used in environments between -10˚C and +55˚C. Furthermore, with wider input voltage and frequency ranges than the current product, the *SANUPS A11M* limits transfers to battery operation even in regions with unstable power supplies to prevent battery wear and achieve stable output.

By eliminating the built-in battery and simplifying the internal structure, we have reduced the mass of the *SANUPS A11M* to 15 kg compared to the 19 kg of the current product.

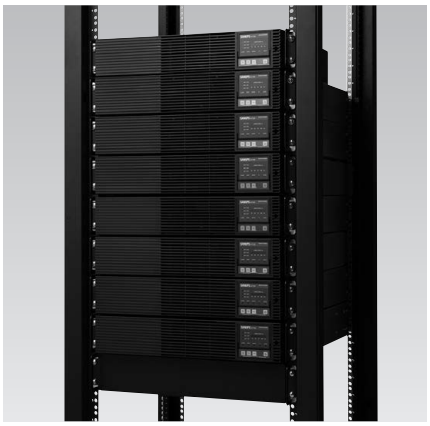

Fig. 1 *SANUPS A11M*

## ■ Expanding the Lineup of *SANUPS A11K-Li* LIB-Equipped Double Conversion Online UPS

We have been selling UPS products equipped with lithium-ion batteries (LIB) since 2017. The *SANUPS A11K-Li* is a double conversion online UPS for indoor use equipped with LIBs. The *SANUPS A11K-Li* is used in applications that demand high reliability, such as data centers and production plants, thanks to features including a wide operating temperature range, wide input range, high power factor output, and good maintainability.

In 2019, we added models offering 19 minutes of backup power to our *SANUPS A11K-Li* series. These are available in output capacities of 1.5 and 3 kVA.

Figure 2 shows the appearance of the *SANUPS A11K-Li* (1.5 kVA).

A detailed introduction of the performance, functions, and features of the *SANUPS A11K-Li* is provided in the New Products Introduction section of this Technical Report.

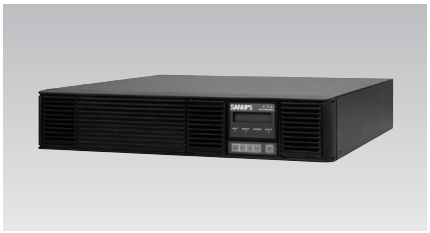

Fig. 2 *SANUPS A11K-Li* (1.5 kVA)

## ■ Expanding the Lineup of *SANUPS N11B-Li* LIB-Equipped Outdoor UPS

The *SANUPS N11B-Li* is an LIB-equipped passive standby UPS for outdoor use. Due to its wide operating temperature range, high energy efficiency, and the convenience of outdoor use, the *SANUPS N11B-Li* is used as backup power for outdoor equipment such as base stations, traffic lights, and metered parking.

In 2019, we added models offering 24-hour backup power to our *SANUPS N11B-Li* series. These can be used in projects for Japan's Ministry of Land, Infrastructure, Transport and Tourism's "Fundamental Plan for National Resilience." They come in output capacities of 70 W and 140 W. Figure 3 shows the appearance of the *SANUPS N11B-Li* (70 W). At an ambient temperature of -20˚C, this product can provide 24-hour backup power to 70 W and 140 W devices.

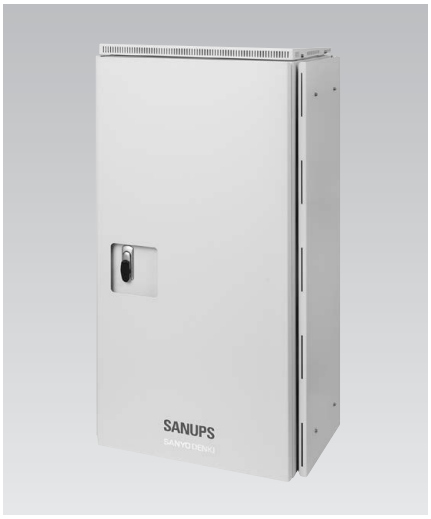


Fig. 3 *SANUPS N11B-Li* (70 W)

## ■ Grid-Connected Isolated Type Added to the Lineup of *SANUPS W73A* Power Conditioners for Wind Power and Hydro Power Generation Systems

In 2017, we released the *SANUPS W73A*, a grid-connected type power conditioner (renewable energy inverter) for wind power and hydro power generation systems. In recent years, there has been a greater need to secure power supplies during emergencies and stronger demand for independent power supplies in non-electrified areas such as remote islands. In 2019, we expanded the lineup of *SANUPS W73A* by adding a grid-connected isolated type, Japan's first(5) power conditioner with an isolated operation function.

Figure 4 shows the appearance of the *SANUPS W73A* grid-connected isolated type.

Using the existing grid-connected type as a base with dimensions unchanged, the *SANUPS W73A* grid-connected isolated type was made capable of isolated operation through the addition of components and modification of component layout and control program. The output electrical system is 3-phase 3-wire 202 VAC, and the maximum output is 9.9 kVA. The *SANUPS W73A* grid-connected isolated type can provide electric power as an independent power source on remote islands and in other non-electrified areas, and also as an emergency power source during power outages.

The product offers startup method and time options, which enable it to perform isolated operation with the motor starting current suppressed regardless of the load connected.

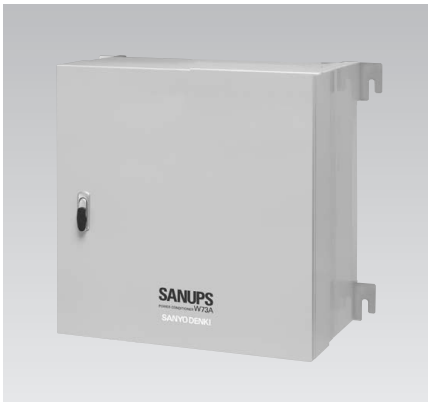


Fig. 4 *SANUPS W73A* grid-connected isolated type

(5) Based on our own research as of March 27, 2019, among power inverters for wind power and hydroelectric power generation systems on the market.

## ■ Addition of a Modbus Protocol Communication Function to the *SANUPS LAN Interface Card* UPS Option Product

In recent years, it has become common practice to use ICT for monitoring production equipment in factories and other manufacturing sites. In 2019, we added a Modbus protocol communication function to our *SANUPS LAN Interface Card* UPS option product. The Modbus protocol is an industry-standard communication protocol widely used in industrial equipment. Figure 5 shows the appearance of the *SANUPS LAN Interface Card*.

The *SANUPS LAN Interface Card* can be used with both the Modbus RTU and Modbus TCP protocols. Moreover, this product has both Modbus master and Modbus slave functions, and both functions can be used simultaneously. For example, it is possible to read measurement values from an instrument and transfer these to a host master device together with UPS information.

A detailed introduction of the performance, functions, and features of the *SANUPS LAN Interface Card* is provided in the New Products Introduction section of this Technical Report.

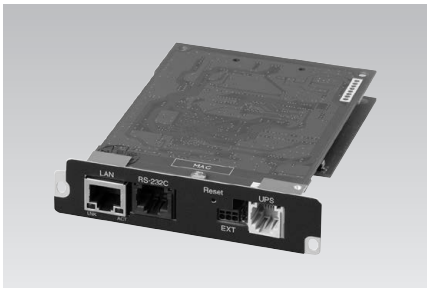


Fig. 5 *SANUPS LAN Interface Card*

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