# Nipron Wave Vol. 48 2017 Summer





#### Special feature on GP power supply

A report on a validation test of PVX100, a package for added installation & surplus power storage system of PV power generation Introduction of "Nipron GP solution" applications

#### 2 New product HPCFX-350P

An appearance of a large capacity Flex ATX power supply with a capacity approx. 1.4 times larger than that of conventional models

# **PVM** accelerates the innovation of **PV** power generation.-

PV Maximizer (PVM) enables installation of panels on a slope, which is not suitable for the installation, and small extra spaces.



8-string type (2in1)







8-string type

# Reduce wastes with PVM for higher efficiency

#### **PV** Maximizer

The PV Maximizer (PVM) maximizes amount of power generation by performing MPPT control for each string.

The string voltage may drip due to panels under the shades of utility poles and/or trees, uneven orientation of arrays, uneven number of panels in series connection, mixing of different panels, etc. If this happens, it will have a negative impact on other normal strings, pulling down their voltage and, thus, reducing the power generation. The PVM boosts a drop in the string voltage to the voltage of other strings while maintaining the maximum power point, eliminating differences in the voltage between strings and making it possible to extract the maximum power from panels available for power generation. This results in increased revenue in the electricity sales.



# Uneven voltage is oosted and stabilize Uneven voltage caused by various factors is boosted up by PVM and is output to power conditioner (PCS).

Concept of system optimization with PVM

# **PV** Maximizer application examples

1. Add panels without worrying about location or number of panels by connecting PVM

By connecting a PV Maximizer, it is possible to add panels without worrying about shadows and fractions. Connecting expansion panels to an existing PCS increases the utilization of existing PCS and it can be expected to increase revenue from sales of electricity.

### Adding panels to remaining spaces

Sufficient power generation can be expected in narrow space and place across which shadow of trees and a mountain lay where installation of panels used to be abandoned.



Existing panels Additionally installed panels

### Adding panels in all sides

Even in a case where panels are installed on slopes with poor conditions, the effects of such poor conditions can be minimized by introducing PVM.



Existing panels Additionally installed panels

2. Minimize the effects of shadows by connecting PVM

#### Addressing shadows on the panels

It is possible to minimize the drop in the power generation by introducing PVM to a power station, where the power generation could drop because of shadows cast on the panels depending on the season or time of the day.

PVM for those who have problems in the efficiency of power generation



Current/voltage monitoring and error detection for strings New remote monitoring system that changes the way of monitoring

# PVGuardmyan

#### Unique current/voltage/power monitoring system from Nipron

PV Guardmyan (PVG) makes it possible to perform unique and accurate monitoring at a low cost by sharing devices for sensing the current and voltage of strings with the MPPT control function of step-up converter. Data collected will then be stored and managed on a cloud storage, making it possible to check the status of power generation anywhere as long as Internet access is available. In addition, the use of cloud storage enhances maintenance and security of data, which makes the PV monitoring more reliable.

#### PVG enables an accurate string monitoring

#### **Common monitoring**

Because the simultaneous control by a power conditioner (PCS) makes the voltage same for all strings, monitoring only the current leaves a room for skepticism on its accuracy. In some cases, the panels and PCS manufacturers that support the system may be limited.



#### Monitoring by PVG

Because each string is controlled independently by PVG, the voltage and current are both monitored and accurate data can be collected. It is also possible to identify a string with a problem immediately.

#### The power can be monitored, extremely accurate



### Enabling a high accuracy real-time monitoring with Nipron's unique system

The user can access the Internet and check the status of power generation, including the voltage and power generated, and I-V and P-V characteristics on each string collected by the monitoring system. It is also possible to compare the present and past data since collected data are kept on a cloud storage



### Simultaneous acquisition of I-V and P-V characteristics with a unique system

#### I-V and P-V characteristics measurement enabled for all strings at the same time!

Because ordinary monitoring systems monitor the current only, for obtaining the I-V and P-V characteristics, a subcontractor should be hired to perform measurements manually on-site, for each string. Such measurements will be time-consuming and, because the insolation changes during the measurement, it is difficult to obtain accurate data with the same condition. Since PVG employs a unique monitoring method, it enables to perform measurements remotely at any time without stopping the system. This makes it possible to determine the I-V and P-V characteristics for all strings connected to the PVM almost simultaneously

Power generation problem diagnosis feature

The performance of PV panels is measured remotely, multi-dimensionally, quantitatively and in accordance with their installation conditions to reduce the power loss. Capturing problems by remote diagnosis without stopping the power generation system makes it possible to save the trouble of on-site investigation. It is also expected that a cloud-based AI system is employed to enable diagnoses based on the configuration and environment of each power generation system.

#### Major diagnosis features

#### Diagnosis based on the amount of power generated [power generation analysis]

 $\rightarrow$  Identification of erroneous strings by comparison of power generated

#### **Diagnosis from I-V characteristics** data [IV characteristics analysis]

→ Diagnosis of erroneous strings by IV characteristics analysis

#### Failure analysis utilizing AI (under development)

- Learning data accumulated on a cloud storage and performing diagnoses suitable for each system



### Optional PVG power generation diagnosis report submission service

Nipron offers a service to prepare reports summarizing data obtained with the PV Guardmyan (PVG) and submit it to the customer. Reports summarizing annual, monthly and daily power generation and troubles encountered will help the customer's "visualization" of power generation status.



#### Concepts of diagnosis feature

By analyzing the I-V characteristics and, if an abnormal measurement was found, it is diagnosed that there is a problem in the string.



Because the power generation is monitored string-by-string, it is easy to determine the string with a trouble. (Under development)



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# Package for added installation, storage of surplus power & night sales of electricity (100 kW package)

# The power sold at night can also be sold at the same FIT price as that of existing system.

# PV eXpander 100



PV eXpander100 is a package of solar cells, PV Maximizer and a power storage system for added installation of photovoltaic power generation system and storage of surplus power. By integrating this package with existing photovoltaic power generation, the amount of power generated and the efficiency of generation can be improved while maintaining the original FIT set at the time of building the existing system. Surplus energy can be stored and discharged at night, effectively increasing the utilization of power conditioner (PCS).

#### Three major advantages of PV expander 100

- Added installation of panels without any limitation of overloading
- 2 Night sales of electricity (surplus power of PCS sold at night)
- 3 No limitation on existing PCS or solar power panels

#### Point[1] Added installation of panels without any limitation of overloadi

Sufficient power generation can be expected in narrow space and place across which shadow of trees and a mountain lav where installation of panels used to be abandoned.



Point[2] Night sales of electricity (surplus power of PCS sold at night) Surplus power exceeding the PCS rating will be stored in a battery and sold during non-surplus hours and nighttime. This enables the sale of power generated by

Materializes the gross rate of return of:

13% (FIT price of 40 yen/ kWh)

12% (FIT price of 36 yen/ kWh)

hese are only representative examples and the return depends on various conditions of the site



Image of operation of PVX100 system

#### oint[3] No limitation on existing PCS or solar power panels

#### Image of connection of PVX100



Power storage system to stabilize solar power stations

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#### Power storage system board, installation example & outline drawing



#### A simulation of PVX100 power generation

Following conditions shown below, a simulation was performed with an assumption that 1MW worth of PVX100 (ten sets) were introduced for a 1MW photovoltaic power generation system after two years of operation.

If the system was in operation for nineteen years after the introduction of PVX100, annual power generation increased approximately 1000 MWh. The result means that an increase in the revenue of electricity sales of approximately 39 million yen, with the FIT unit price of 40 yen, or approximately 35 million yen, if the FIT unit price was 36 yen, could be expected.







Super-overloading supported

Outline drawing (outdoor type)



### Nipron PV surplus power charging/discharging system validation test

This section introduces the results of a validation test of "power storage system board" performed at the National Laboratory for Advanced Energy Storage Technologies.

Super-overloading exceeding the limit in connected capacity

**Surplus power storage** without wasting the power



#### Basic information of the test

#### [Test location]

National Institute of Technology and Evaluation National Laboratory for Advanced Energy Storage Technologies (NLAB)

#### [Charging/discharging system]

Charging/discharging power: max. 15 kW bidirectional



Simulated solar cell power supply/electronic load



A scene of the test



DC/DC converter (in the charging/discharging control board)

### Surplus power charging/discharging test

#### Results of the surplus power charging/discharging test (surplus power charging)

As shown below in Data I, the system operation was validated with a set of fluctuations in the power generation close to those of actual installation. In the test, the input power for electronic load was set at or below 40 kW. The green, light green, orange and gray lines represent the simulated output of existing PV panels, simulated output of added PV panels, the sum of added and existing PV panels, and the power consumption of electronic load, respectively. If

#### Data I. Results of the PV power generation simulation





- the power consumption of electronic load was below 40 kW, the sum of simulated outputs from the existing and added PV panels equals the power consumption of electronic load.
- On the other hand, if the sum of these outputs was 40 kW or higher, the power consumption of electronic load is limited to 40 kW. Hence, it is seen that the surplus power generated by limiting the output is stored in the battery (purple).

#### MPPT control and charging/discharging system of PCS

With the Nipron's charging/discharging system, the control is done at a low frequency of 10 second cycle to avoid interference with the PCS' s MPPT control. For this reason, the result shows temporary (within seconds) ups and downs along the 40 kW control line. However, it is considered that this fluctuation will not affect the system performance as long as it is limited to the allowance of the PCS, i.e. as long as the PCS operation is not disturbed

Nipron's charging/discharging system has a dual control system; it has an emergency power limit control feature in addition to the surplus power storage control and, if the above mentioned overshoot approaches the PCS' s allowance limit, it limits the output of step-down DC/DC converter to a certain level to prevent the allowance limit to be exceeded.

The PVM and GBM are designed not to interfere with the MPPT control to prevent negative impact on the PCS operation.

# Installation example

Yamakoh Co., Ltd

Ujitawara-cho, Kyoto

Products supplied PV Maximizer (PVM) Green Best Mix power supply (GBM)

### Exceeding the limit of connected capacity of power conditioner, 200% super-overloading achieved by the combination of the PV Maximizer and a Green Best Mix power supply

As a company that deals in environment-related materials, Yamakoh Co., Ltd. continues to make their products more environment-friendly products and, at the same time, is also aggressive in introducing photovoltaic power generation. They have adopted our proposal of super-overloading in constructing their plant No.2.



#### The amount of power generated can be improved while maintaining the original FIT set at the time of building the PV system.

Many customers are turning to PVM!

For the existing power conditioner with a 120% overloading limit, an addition of panels was done to achieve an overloading level of approximately 200% without any negative impact on the PCS by combining the PV Maximizer (PVM) and a Green Best Mix power supply (GBM).

There are many PCSs that do not support a significant overloading and the one used by Yamakoh Co., Ltd. was one of them with a limit of 120% overloading, which made it difficult to add extra panels

In the system newly adopted by Yamakoh Co., Ltd., the power generation is optimally controlled to a level that the added panels do not impose an excessive input to the PCS and, therefore, super-overloading is enabled even if the PCS does not support overloading. Because it is an addition of panels to an existing photovoltaic power generation system, an increase in the amount of power generation and an enhancement of power generation efficiency can be expected while maintaining the original FIT set at the time of building the existing system.

Besides maintaining the price of the electricity power, there is an advantage over the construction of a new power station because it is not necessary to install a new grid connection facility, of which the cost could be very expensive.







#### PVMaximizer(PVM)

The PVM maximizes the power generation of panels by the MPPT control of each string. It makes possible to produce power with a high efficiency without suffering from differences in the voltage due to uneven number of panels or shadows cast on the panels and converts to a stable high voltage (600 V) required for the GBM to operate.

#### Green Best Mix power supply (GBM)

The GBM monitors the power generation of existing panels with a current sensor and controls it properly so that the total power generation from the existing and added panels matches the maximum input capacity of the PCS.

#### Increase the revenue of electricity sales

The expected increase in the electricity sales of Yamakoh Co., Ltd. by the addition of panels is approximately 6.2 million yen\* annually (with the unit price of 40 yen/ kWh). Since the investment for the addition was approximately 60 million yen, the gross rate of return is 10.3%.

### Yamakoh Co., Ltd

Yamakoh Co., Ltd. manufactures custom-made PLADAN cases and other products by processing and manufacturing PLADAN (Corrugated plastic packaging) at their factories in accordance with the application and operation of the customer. Their original products, which are light in weight, sturdy and durable, enhance the working efficiency, reduce the transport cost and losses due to breakage, and help reduce the time it takes to construct and demolish event sites. They have successfully produced more than 30,000 products, which have been utilized in a wide variety of fields regardless of industry or type of operation.

Actual data

120

100

20





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#### Small & large capacity

HPCFX-350P-X2S is a 1U size small form factor and large capacity ATX power supply suitable for small built-in PCs and servers. Compared to Nipron's conventional model PCFX-220P-X2S, it has approximately 1.4 times larger capacity while the size remains the same. It also addresses high temperature operating environment and supplies power at the full rating up to the ambient temperature of 50°C. Also, it supports the operation up to the temperature of 60°C.

#### Output capacity vs. ambient temperature





#### High efficiency

It achieves maximum efficiency of 88% typ. It reduces significantly power loss, minimizes power consumption during operation of equipment and contributes to mitigation of environmental load.

#### Efficiency graph \* One example of actual measurement







#### Photograph of internal view

A design to ensure superior quality and high reliability



#### Low noise & low leakage current

Conducted emission of even a single power supply unit clears VCCI Class B. The leakage current value has been reduced to 0.27 mA for 100 VAC and 0.68 mA for 240 VAC.

Since it is not necessary to provide a noise filter on the outside, it contributes to cost reduction and workload reduction.

#### Conducted emission [100 VAC, 60 Hz, during rated load]



Leakage current \* One example of actual measurement

Input voltage	Rated load	Minimum load current
100 VAC	0.27mA	0.28mA
200 VAC	0.58mA	0.60mA
240 VAC	0.68mA	0.69mA

#### Outline drawing



**Optimum for industrial application! Nipron ATX power supply** 

11

#### Input/output specification

Input	85 <sup>*</sup> - 264 VAC(applicable worldwide)				
Output voltage	+3 3\/	+5\/	+12\/	-12\/	+5\/SB
Continuous maximum current / power	12A	12A	20A	0.5A	1A
	66.4W 240W 6W		5W		
	240W				
	245W				
Peak current / power (within 5 s)	16A	16A	28A	0.5A	2A
	83W		336W	6W	1014
	336W			1000	
	346W				
Minimum current	0A	0A	0A	0A	0A
* Derating require					ating required

#### Low standby power

Standby power of 0.5W or lower, ErP Directive compliant

	* One example of actual measurement			
Input voltage	100 VAC	240 VAC		
Standby power	0.06W	0.24W		

#### Other features

- Low noise design with a temperature controlled variable-speed fan
- Minimum load current 0A for all outputs specification
- Plug-in cables for re-configuring power cables (except for the main power cable)
- The use of through-hole plated double-sided circuit board
- Fan monitoring signal included in the standard package
- High efficiency with the adoption of a synchronous rectifier circuit

# **Report of exhibition**

#### Report of Exhibition of Power System Japan 2017

Nipron participated in Power System Japan 2017, which was held from April 19 to 21.

At the Nipron's booth, the complete range of switching power supplies was introduced, in addition to the new ATX power supplies HPCSA-700P, HPCFX-350P and HPCSF-400P-X2B. Also, the superiority of Nipron power supply units was demonstrated by comparing the leakage current and efficiency of PCB type power supply. With a large number of customers visiting our booth, the booth was

filled with the capacity crowd at one point, evidencing the success of

the event



#### Report of Exhibition of Embedded Systems Expo & Conference

Nipron participated in the 20th Embedded Systems Expo & Conference held from May 10 to 12.

With the catch phrase of "safe & secure, Nipron power supply unit", Nipron put a highlight on the reliability of its products. Major players in the exhibition were Nonstop ATX power supply units and PCB type switching power supply units with the capability of addressing instantaneous power failures and blackouts while the same demonstrations as the ones presented in Power System Japan 2017 adding flavors to the event

The exhibition was valuable as it provided opportunities to collect the latest trend and information in the industry.





demonstration

New ATX power supply corne

Scene of Nipron's booth

# Nipron softball tournament

#### The winner was the production engineering team.

On April 22, a softball tournament was held at a ballpark in Amagasaki city. The day was sunny and warm making everybody sweat. Games were played in a tournament style by dividing the Head Office (Hanshin Dream Factory) and Central Dream R&D Department (West District Sales Office) into four teams

About sixty players participated in the games with additional thirty or so, including employees' family members, cheering,

The result was as follows.

Winner: Production engineering team Runner-up: West sales & technical department team 3rd place: Manufacturing/procurement & corporate planning team

Sales department & R&D department team

In the first round, both games were nail-biters with the winners advancing to the final. The final game opened with a ceremonial first pitch by President Sakai and the production engineering team won it all with its powerful hitting.



A diversity of power supply unit is available. First of all please telephone us.

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# President talks! TOP sales corner.

#### 25th

Starting on May 23, I had the opportunity to spend a week in Switzerland and Czech with a group of persons from Shinkin Banks we use and hiked up Jungfrau (4,158 m in elevation), which is one of the three most famous peaks in Switzerland. The view was of course wonderful, but I was amazed by how Switzerland uses their water resources.

Perhaps my thinking stems from our doing business with power supply devices, but Switzerland is like Japan in that it has no natural resources but it has plenty of water from the heavy snow atop its mountains melting. A long time ago, it was a poor country, but they put their wisdom to work and became a wealthy nation on the successes of the watch and other light industries. They are also using their water resources to generate electricity, which apparently accounts for 48% of their energy needs nation-wide. There are waterfalls that drive hydroelectric power stations wherever the snowmelt from way up in the mountains flows. And, they have gone to great lengths, and impressively so, to maintain the amount of electricity they generate by changing wooden gates to control the volume and flowrate of the water against seasonal changes.

Made completely in Switzerland, the trains of the Jungfrau Railway run entirely on this hydroelectric power and have the stamina to climb to the highest station in Europe (3,454 m) - Jungfraujoch. Japan and Switzerland are very alike in terms of national fabric and have much in common as countries. We also marked 150 years of diplomatic relations in 2014, so I could sense the affinity. In any case, the 'electric shock' I experienced on holiday in Switzerland riled up my emotions and got all kinds of thoughts racing through my head, like Japan should build smaller hydroelectric power stations and use natural renewable energies like water, sunlight and wind to supply half or more of the country's power consumption. Whether that happens or not will depend on how serious we are

EVs are predicted to spread rapidly because of the spark lit by Tesla Motors CEO Elon Musk and the big name auto manufacturers in Europe all veering in that direction. By becoming self-sufficient in renewable energies and cutting back on imports of fossil fuels like crude oil, I am convinced Japan can greatly improve its trade balance and current account balance, and quickly rectify its financial problems. At Nipron, we have already spent 5 - 7 years developing products and businesses like our PV Maximizers and Green Best Mix power supply with a sense of duty, after foreseeing the coming of an age of converting green energy into electric power. Because other companies will be pursuing this line of business, too, we cannot afford to come late to the game. We cannot stay in business without being capable of tracking trends and reading the future. Right now, the PV industry is in a bind because of FIT regulations. However, at Nipron, we could not join the photovoltaic power generation boom in the first place, as we foresaw and did everything to prepare for the next age - energy-storable PVs and HVDC. Though our products were not welcomed as we had hoped, we remained committed to stirring demand and creating markets without throwing in the towel. Fortunately, our products have begun to attract attention and business has started to grow.

My recent trip to Switzerland was not just about sightseeing, as I discovered something.

# Invitation to exhibition

Invitation to exhibition at the 4th INT'L SMART GRID EXPO OSAKA

Held inside World Smart Energy Week (CSAXA 2017) 4thINT'L SMART GRID EXPO **OSAKA** 

Nipron will exhibit its product in the 4th International Smart Grid EXPO Osaka held from September 20 to 22 at INTEX Osaka.

This exhibition is dedicated to all the products and technologies necessary to build a smart grid and smart community. Among others, Nipron plans to introduce its PV eXpander100, which is a package aimed at the PV market, in which the return on investment is dropping constantly in photovoltaic power generation due to the FIT regulation, to add panels to existing PV power generation systems to increase the power generation and the efficiency of power generation while maintaining the original FIT set at the time of building the existing system and make it possible to sell surplus power stored in the battery at night. Please also refer to the detailed information on PV eXpander100 given in this magazine. If you plan to come, look for the Nipron's booth by all means.



Event date: September 20 (Wed)-22 (Fri), 2017 Venue: Hall 5. INTEX Osaka Booth number: 18-50

\* We are pleased to send invitation to the exhibition to customers who are interested in it. Please do not hesitate to contact us. Our contact: WEB Support Office, Nipron Co., Ltd. (TEL) +81-6-6487-0611 (FAX) +81-6-6487-0523 (E-MAIL) support1@nipron.com

13

### Supplying half of Japan's energy demand with renewable energies

Setsuo Sakai **Representative Director & President, Sales General Manager** 





In the Sales Head Office & Central Dream Laboratory Building, the front entrance is decorated with flower arrangement. Since these flowers are arranged by an employee of Nipron in a heartfelt manner, please take a look at them



"When you are in trouble with power supply," please consult with Nipron.

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Greetings, everyone! How are things going? I wrote this piece on the train while returning home from my visit to the Matsuzaka Dream Factory where I had attended celebrations for our attaining FY2016 targets this past July 3.

It looks like the strong business confidence that permeates the Japanese economy, which – sad to say – is not being felt by many, will continue in the lead-up to the Tokyo Olympics, but already the USA has started moving its policy towards higher interest rates, which thinkably will put pressure on Japan to raise rates as well at some point in time. When that happens, the yen will depreciate inordinately in value because of the chaos caused by the Bank of Japan dumping excessive liquidity on the market, which may dangerously drive inflation way over the expected 2% level into the 10% range. While that may come to be, many companies like ourselves cannot just stop thinking because of all of the uncertainty; we spend hours strategizing which direction will steer business to success. Though, because of its emphasis on safety, the Japanese approach of putting off any increases in investment and interest-bearing debt until things are clear may seem like the right thing to do, is that decidedly the best way to go? Especially for a company like Nipron that persistently pursues value, doing nothing is tantamount to death.

While industrially advanced nations recede from the picture and become more and more backwards, China is Sinocentristic to the bone and aims to dominate the world through its Belt and Road Initiative. The dynamically active start-ups in China that have the country's back, and the companies in Korea and Taiwan, whose economies are still developing, have vitality. Similarly, the businesses in India, Indonesia and elsewhere that are emerging as powers see the weakening of Japanese companies as an opportunity to catch up. Today, Japan as a nation and its biggest companies are strife with the pangs of an industrially advanced country and, in my eyes, are on the path towards becoming a late great nation. If we lack the energy to face these emerging powers with a new and justifiable mentality, in other words, if we choose antiquated ideas or ere excessively on the side of caution, not just the world market but the Japanese market as well will be taken by businesses with an Asian core. As all of the pieces fall into place, I fear that power supply manufacturers such as ourselves may go the way of other electrical industries and pull out of the business. We have done a lot of serious thinking as to what's right for us, which road we should take, in dealing with these trying structural changes, but if we are to build and maintain our vitality, then our only choice is to continue with – not end – investment and development because that is what spawns our vitality. We cannot afford to stand by and do nothing.

This past July, we began our 10th medium-term management plan. Dubbed our "10 Billion Yen Revenge medium-term plan", it is not about some sort of big gamble but about making efforts upon efforts, steadfast strengthening our vitality and turning Nipron into a 10 billion yen company. It is the starting point for coming together as a workforce and building Nipron into a company that lasts into perpetuity. Today, the AI boom and digital innovations like VR and AR are becoming social phenomena and fueling concern that specialists will become unnecessary and the only jobs people will fill will be heavy labor and service jobs. But, creative jobs for that day and age will appear, so fearing and, worse yet, looking down upon technological progress and development is dangerous. We should always look squarely at reality, confront situations with humility, flexibly incorporate new trends and shape ourselves into a vigorous company. I am also in favor of "innovating how we go about work" so that all of us at Nipron can lead meaningful rewarding lives.

Setsuo Sakai July 2017

# Nipron Co., Ltd.

# http://www.nipron.com

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