

# Development of the *SANMOTION R* Power Supply Unit, Power Regeneration Model

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## 1. Introduction

Curbing global warming, which is causing widespread climate change, requires sustainable initiatives focused on environmental conservation and enhancing energy efficiency.

In the field of servo systems, there is a growing demand for products that offer energy savings, low carbon emissions, and enhanced maintainability, in addition to improved servo performance.

In response, we have added to the *SANMOTION R* power supply unit lineup a new power regeneration model that features energy savings, reduced CO<sub>2</sub> emissions, and improved maintainability.

This article provides a product overview and introduces the features of the power regeneration model of the *SANMOTION R* power supply unit (hereinafter, “new model”).

## 2. Product Overview

### 2.1 Appearance

Figure 1 shows the new model and Figure 2 shows its dimensions.

### 2.2 Product lineup

The *SANMOTION R* multi-axis servo system is configured by combining a power supply unit, amplifier unit(s), control board(s), and servo motor(s) according to the customer’s equipment, as shown in Figure 3. To expand the power supply unit lineup, we have added the power regeneration model (200 VAC, 37 kW).

When using the new model, an AC reactor is to be installed to mitigate the current and voltage distortions, as shown in Figure 4.



Fig. 1 New model

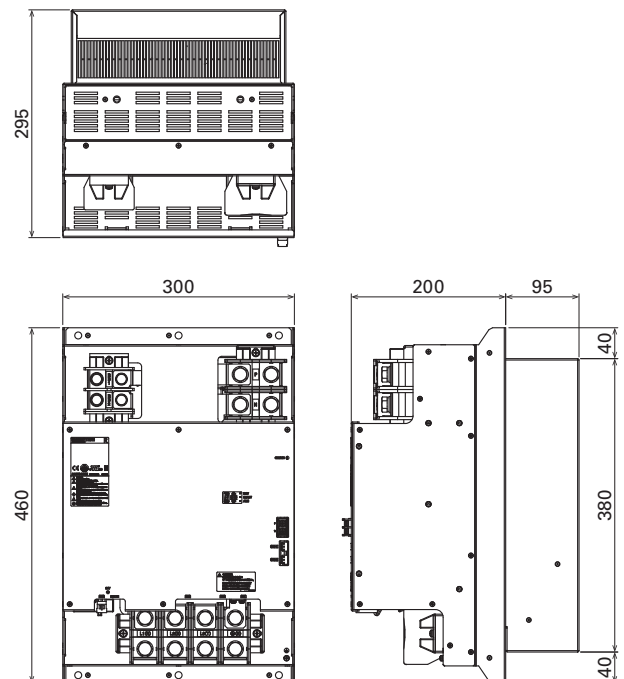


Fig. 2 Dimensions of new model (Unit: mm)

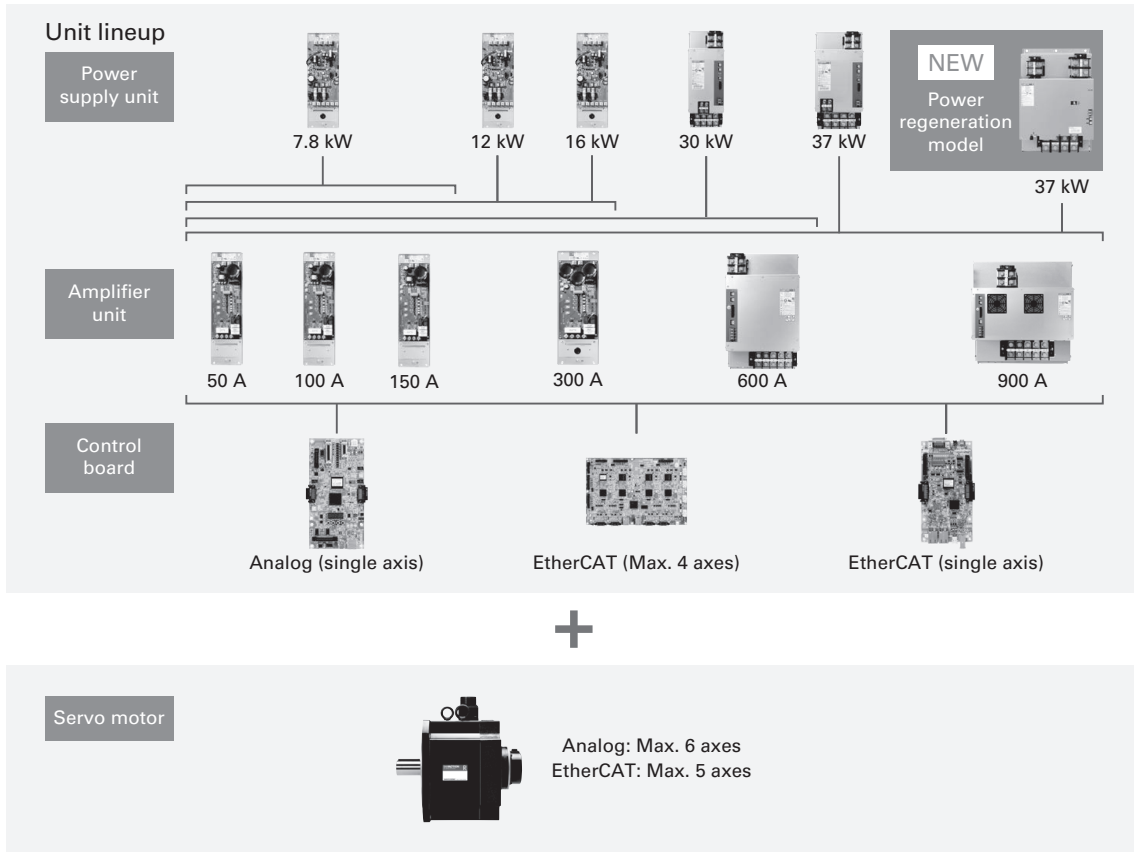


Fig. 3 Lineup of the *SANMOTION R* multi-axis servo systems

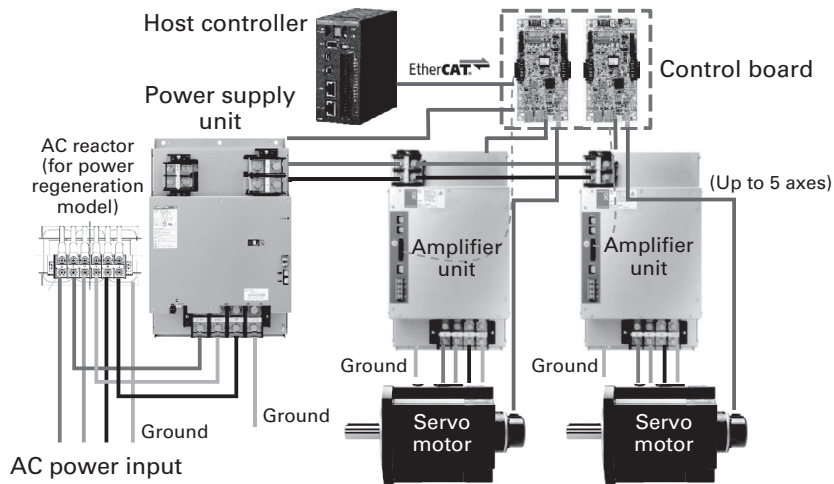


Fig. 4 System configuration for new model

### 2.3 Specifications

The new model supports a 200 VAC input voltage and can output and regenerate a rated power of 37 kW. Table 1 shows the general specifications.

Table 1 General specifications

Items		Specifications and functions
Main power supply voltage (3-phase)		200 to 230 VAC +10%, -15%
Power supply frequency		50/60 Hz ± 3 Hz
Allowable power voltage imbalance		±2%
Control power (power supply unit)		24 VDC ±15%
Control power (amplifier unit)		200 to 230 VAC +10%, -15%
Rated power		37 kW
Maximum instantaneous power		74 kW
Power factor (during power running)		92.0% (at 100% load)
Power factor (during regeneration)		88.0% (at 100% load)
Regenerative capacity		Continuous at 100%, 20 s at 200%
Regeneration control		Combination of power regeneration and regenerative resistor*
Dimensions		300 (Width) × 460 (Height) × 295 (Depth) [mm]
Mass		24.5 kg
Compliance with standards	UL/cUL	UL 61800-5-1
	Electrical safety	IEC 61800-5-1 EN 61800-5-1
	EMC	EN 61000-6-2 IEC 61800-3 EN 61800-3
	KC Mark	KS C 9610-6-2 KS C 9610-6-4
	RoHS Directive	IEC 63000:2018 EN 63000:2018

\* External regenerative resistor required separately.

With a maximum regenerative capacity of up to 200% of the rated output for 20 seconds, the new model is available for equipment that generates large amounts of regenerative power instantaneously. If a momentary outage occurs during regeneration, however, regenerative power cannot be fed back to the power supply. In such cases, the new model switches to the built-in regenerative resistor, ensuring reliable use.

### 3. Features

The main features of the new model are as follows.

#### 3.1 Reuse of regenerative power

Servo motors are powered by the power supply during acceleration and constant-speed operation. During deceleration, on the other hand, they act as generators and produce regenerative power. Figure 5 illustrates how regenerative power is produced during servo motor operation.

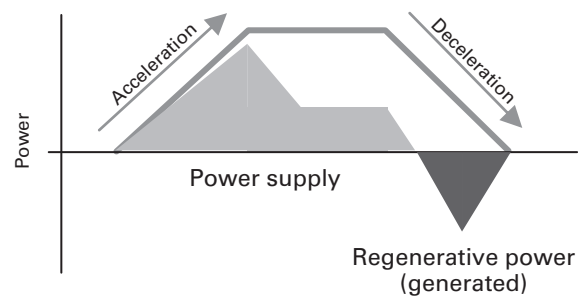


Fig. 5 Illustration of regenerative power produced during servo motor operation

The SANMOTION R multi-axis servo system’s main circuit power supply can be shared through the system and the regenerative power can be used to drive servo motors on the other axes.

With the current regenerative resistor model, any excess regenerative power is only consumed as heat in the resistor, instead of powering other axes. By replacing the current

regenerative resistor model with the new model, the regenerative power can be fed back to the power supply for reuse in other devices within the same equipment or elsewhere in the factory.

Figure 6 illustrates the flow of power during power running and regeneration.

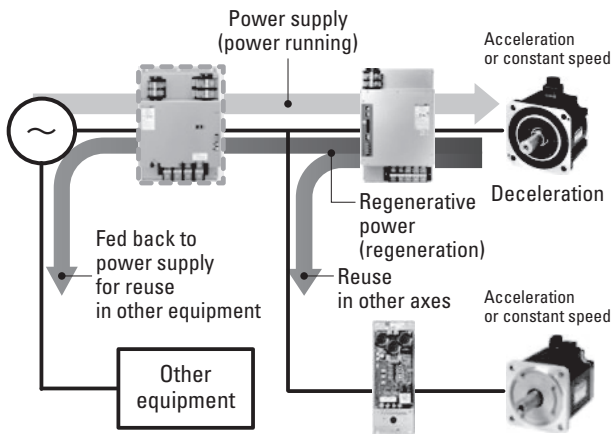


Fig. 6 Flow of power during power running and regeneration

The new model reduces the electricity usage in machinery and entire factories, also reducing CO<sub>2</sub> emissions. For example, if a servo motor runs in a cycle of operating at 100% of its rated output and then switches to regeneration at 50%, the new model reduces CO<sub>2</sub> emissions by 43% compared to the regenerative resistor model. This reduction contributes to mitigating global warming.

### 3.2 Power supply and power consumption monitoring

As shown in Figure 7, the new model is equipped with feature-rich monitoring that allows users to check power supply conditions such as voltage, current, and frequency, as well as the power consumption during power running and regeneration.

No.	Power supply condition and power consumption monitoring
1	Main circuit input voltage effective value monitor
2	Average current monitor
3	Main circuit power frequency monitor
4	Main circuit DC voltage monitor
5	Average power monitor
6	Power running monitor
7	Power consumption integration monitor
8	Power regeneration power monitor
9	Power regeneration power amount integration monitor
10	Power regeneration status monitor

Fig. 7 List of monitored power supply and power consumption items

The new model is equipped with a device designed to detect power supply voltage and current for controlling regeneration. This device measures the actual power supply voltage and current, providing high-precision power monitoring.

These monitoring features help assess input power quality, enabling efficient electricity usage management across equipment and the entire factory.

### 3.3 Improved maintainability (preventive maintenance)

The remaining life of the relays, electrolytic capacitors, and cooling fans used in the new model can be monitored using EtherCAT communication and setup software. Figure 8 shows the remaining life monitoring screen.

ID	Symbol	Parameter Name	Present Value	Unit	Detail
30	RSRLYLF	Remaining life of relay for an inrush current prevention	99.80	%	Detail
31	CAPLF	Remaining life of a main circuit electrolytic capacitor	99.99	%	Detail
32	FANLF	Remaining life of a cooling fan	99.92	%	Detail
40	MAVEPOW1	Average power monitor	10110.3	W	Detail
41	MAVEPOW2	Average power monitor	10.1	kW	Detail
42	FAVEPOW	Power running monitor	10110.3	W	Detail
43	FAVEPOWH	Power consumption integration monitor	1014166	Wh	Detail
44	RAVEPOW	Power regeneration power monitor	0.0	W	Detail
45	RAVEPOWH	Power regeneration power amount integration monitor	93	Wh	Detail
4A	DESATERR	IGBT position when DESAT error occurs	00	-	Detail
4B	RUNTIM	Amplifier Operation Time	109:48:16.530	h:mm:ss.ms	Detail

Fig. 8 Viewing monitored items using the setup software

Based on the remaining life of individual parts, the power supply unit can be maintained systematically.

### 3.4 Enhanced troubleshooting analysis (drive recorder)

The current lineup of the *SANMOTOR R* multi-axis servo system offers a drive recorder on the control board, which is useful for analysis during troubleshooting. The new model offers a drive recorder as well, enabling it to collect data, which was not the case for the current regenerative resistor model.

Figure 9 lists the data that can be stored by the drive recorder.

No.	Data stored by drive recorder
1	Main circuit power frequency monitor
2	Main circuit rectifier voltage monitor
3	Main circuit input voltage effective value monitor
4	R-phase current monitor
5	S-phase current monitor
6	Average current monitor
7	Internal temperature monitor
8	Average power monitor
9	Power running monitor
10	Power consumption integration monitor
11	Power regeneration power monitor
12	Power regeneration power amount integration monitor
13	IGBT monitor on overcurrent condition
14	Power regeneration status monitor

Fig. 9 Data stored by drive recorder

By integrating two drive recorders—one for the control board and another for the new model—more extensive data can be analyzed. This ensures prompt troubleshooting, minimizing downtime and speeding up recovery.

## 4. Conclusion

In this article, we presented an overview of the power regeneration model of the *SANMOTION R* power supply unit (200 VAC, 37 kW) and described some of its features.

The significance of the new model is as follows.

- Energy savings  
Power regeneration technology has been adopted to efficiently reuse regenerative power in other axes of the same equipment or other equipment within the factory, reducing overall power consumption throughout the facility.
- Visualization of power supply conditions and power consumption

Users can check the input power supply voltage and current of the power supply unit, as well as the power consumption of the servo system. This contributes to monitor of quality of the input power source and manage the electric energy consumption within the equipment and factory.

- Improved maintainability

The power supply unit can be maintained systematically based on the remaining life of relays, electrolytic capacitors, and cooling fans, minimizing equipment downtime.

- Enhanced troubleshooting analysis

Equipped with a drive recorder, the new model swiftly identifies and resolves issues that may arise.

Overall, the new model offers increased energy efficiency, reduced carbon emissions, and enhanced maintainability. Going forward, we will continue to develop products that help create new value for our customers.

Note: The company names, product names, and network protocol names mentioned in this article are the trademarks or registered trademarks of their respective owners.

#### References

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