5-phase Stepping Motor Driver "SANMOTION F" Series S Type

Nobutoshi Nakamura Sigehiro Kamada Masao Mizuguchi Kengo Uchiyama

1. Introduction

Because of the usefulness of open loop control and its economical system cost, the stepping motor is used as a positioning actuator in various types of equipment. In recent years, because of market globalization, a wide market exists for a product that can meet various demands, such as compatibility with various safety standards and a wider range of power types. Furthermore, the fall of the demand price is remarkable. In response to this situation, the 5-phase stepping motor driver "SANMOTION F" series S type was developed. It aims to improve a customer's degree of satisfaction and to increase product competitiveness by offering high cost performance at an inexpensive cost.

This document introduces outline and features of the 5-phase stepping motor driver "SANMOTION F" series S type.

2. Outline of the Product

2.1 Outer View/Structure

Fig. 1 and Fig. 2 show the outer view and the appearance of the development product. By adopting a die cast as the power element of the heat sink and a mold as the cover, about a 20% reduction of weight was achieved in comparison to the conventional product. A mounting hole has been made in the back of the heat sink to ensure compatibility with the conventional product.

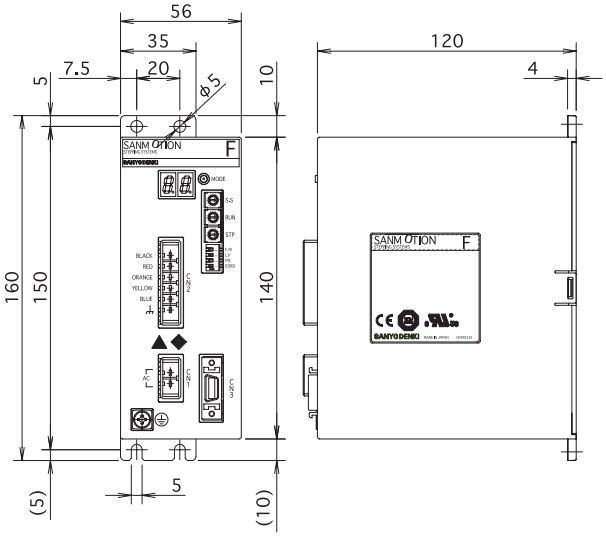

Fig. 1 Outer View of the Driver

2.2 Unification of Main Parts

The main parts of a power part were accumulated on the aluminum board HIC, and the number of parts was cut down about 30% from the conventional product. The discrete parts of the power element were eliminated. Therefore, fixing parts to the heat sink has become unnecessary, and the work hours for assembly were cut down sharply.

2.3 Product Specifications

Table 1 shows a list of the product specifications. Since the 5-phase stepping motor driver "SANMOTION F" series S type is a follow-up model of the PMM-MA and PMAMA series, it is compatible with both series.

- Motor Compatibility
  It is compatible with seven kinds of motors: from small capacity with a flange size of 28mm sq. to large capacity with a 106mm sq. flange size.
- Safety Standards
  After receiving certification from the third party TÜV, it has been self-certified to both UL and CE standards.

Fig. 2 Driver

3. Feature

The 5-phase stepping motor driver "SANMOTION F" series S type is equipped with the micro step functionality, which was indispensable for the low-vibrations drive of a stepping motor. Also, in the full step or the half step drive, the auto micro function, which offers about the same vibration performance as a micro step, was carried at the time of a low speed. In addition, alarms and warnings can be subdivided and displayed, preventing system trouble and easing restoration.

(1) Micro Step
- Micro step standard equipment
- Resolution: 16 kinds, a range of 1/1-1/250 can be chosen.
- Auto micro function
  About the same vibration control performance as a micro step is obtained for a large resolution at the time of a full step and a half step.

(2) Wide range of power supply type
- Wide-range type of AC100V-230V input
- The step-down transformer at the equipment side is unnecessary.
- Strong resistance to a power supply voltage change

(3) Soft Control
  The motor control is now performed by software running on a CPU. In contrast, the conventional machine was controlled in hardware using an ASIC.
- Extendibility
  It became easy to introduce or add a new control technology by changing the motor control to a soft controller.
- Alarm and warning function
  The 7 segment LED was added to the front, allowing the display of alarm or warning codes. It can subdivide and display alarms and shorten the time required for investigation and system troubleshooting.
  The warning function can prevent system shutdown and can suppress the damage caused by system shutdown to a minimum.

(4) Consideration of environment
- Current detection system
  In the conventional 5-phase pentagon system, winding current detected all the 5-phase current together. By the single detection system, the regeneration current inside the motor was undetectable in the medium speed area, resulting in excess drive current. This caused vibration and heat generation. In this development, each phase of the winding current is detected and controlled, reducing the heat generation and the current consumption. (Refer to Fig.3)
- Reduction of heat generation
  The newly developed power HIC suppresses 10% of the heat generation by adopting the tip of small ON resistance, as compared with the conventional model.
- Compact
  Accumulation of power parts to the HIC realized the reduction of size by the volume ratio shown below compared to the conventional product.
  230V Type: 50% reduction from PMAMA1S6A01
  100V Type: 10% reduction from PMAMA1S6B20

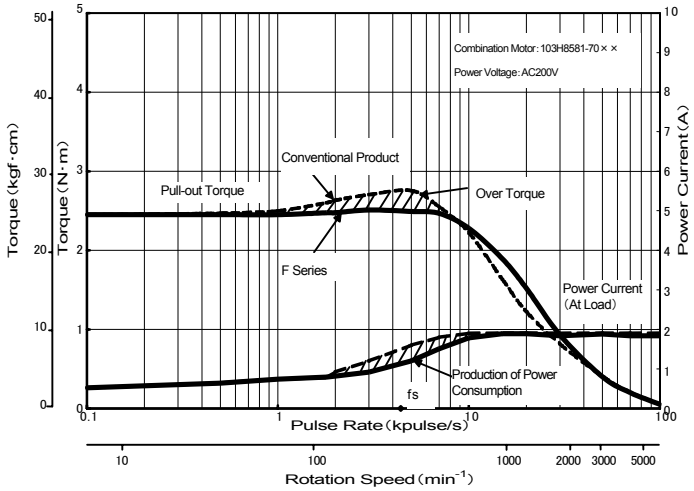

Fig. 3 Speed vs. Torque/power Current

4. Conclusion

The 5-phase stepping motor driver "SANMOTION F" series S type was developed as a product that combines ease of use for a customer with a high performance. In the future, using this S type as a base, we want to advance the competitiveness of the product by expanding the products to include a serial interface and controller functions.

Table 1 List of Types

			"SANMOTION F" Series S Type
Basic Type	Input Power		Single-phase AC100 - 230V+10、-15% 50/60Hz
	Power Current (A)		4max
	Environment	Protection Class	Class Ⅰ
		Operation Environment	Installation category (over voltage category) : Ⅱ Degree of pollution : 2
		Effective Standard	EN50178,UL508C
		Operating Ambient Temperature[2]	0-50℃
		Storage Temperature	-20 - +70℃
		Operating Ambient Humidity	35 - 85%RH (without dew)
		Storage Humidity	10 - 90%RH (without dew)
		Operating Altitude	Above sea level 1000m or lower
		Vibration	0.5G pulse rate range 10-55Hz X.Y.Z Examine in each direction 2H
		Shock	No abnormality in NDS－C－0110 standard 3.2.2 classification "C"
		Dielectric Strength	No abnormality between power input terminal and housing after 1 min. of carrying out AC1.5kV
		Insulation Resistance	DC500V and 10MΩ or higher between power input terminal and housing
	Mass (kg)		0.8
Function	Protective Function		Driver over heat, main circuit power abnormality, over current, open phase
	LED Display		7 seg. LED display Power monitor, origin monitor, pulse monitor, alarm and warning display
	Command Pulse Input Type		Pulse/direction signal CW pulse/CCW pulse
	Max. Command Pulse		300kpps max
	Step angle selection		16 kinds of resolution 1/1, 1/2 , 1/2.5 , 1/4 , 1/5 , 1/8 , 1/10 , 1/20 , 1/25 , 1/40 , 1/50 , 1/80 , 1/100 , 1/125 , 1/200 , 1/250
	Input signal		Step angle selection Power down
	Output signal		Alarm output Origin output

Nobutoshi Nakamura

Joined company in 1985
Servo Systems Division, 2nd Design Dept.
Worked on the design and the development of the stepping driver through the design and the development of the stepping motor

Shigehiro Kamada

Joined company in 1986
Servo Systems Division, 2nd Design Dept.
Worked on the design and the development of the stepping driver through the design and the development of the controller

Masao Mizuguchi

Joined company in 1998
Servo Systems Division, 2nd Design Dept.
Worked on the design and the development of the stepping driver

Kengo Uchiyama

Joined company in 1996
Servo Systems Division, 2nd Design Dept.
Worked on the design and the development of the stepping driver