DC Power Source Input Driver "SANMOTION F" Series

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1. Introduction

Stepping motors are finding greater use not only in semiconductor manufacturing equipment, but also in such things as office automation equipment and food preparation equipment. This is mainly due to the ease of open loop control and the low system cost of stepping motors.

In recent years, the market globalization has caused an increase in demand for products compliant with various safety standards and environmental regulations.

At the same time, price competition has become extremely fierce. It is with these conditions in mind that we set out to develop a competitive product that offers high cost performance and that increases customer satisfaction. Thus the "SANMOTION F" series DC power source input driver was born.

This document introduces the features, specifications, and outline of the "SANMOTION F" series DC power source input driver.

2. Product Outline

2.1 Product Development

The products we have developed are three different drivers: a two-phase unipolar driver, a two-phase bipolar driver, and a five-phase pentagonal driver, as well as a hybrid IC (henceforth, HIC) for a five-phase pentagonal driver with a merged power bridge and current controller.

Figures 1 and 2 show exterior views of the product.

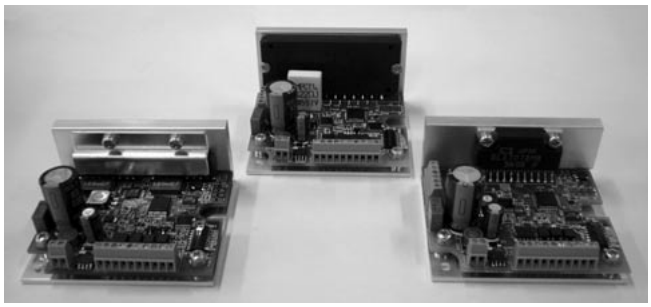

Figure 1 Exterior view of the driver
FS1D140P10 (Center)
BS1D200P10 (Left) US1D200P10 (Right)

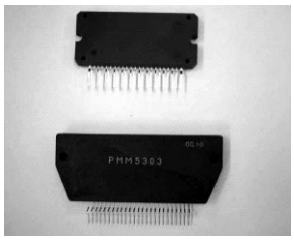

Figure 2 Exterior view of the HIC
PMM5320－E (Top) and PMM5303 (bottom)

2.2 Product Specifications

Table 1 shows the specifications for this product. The "SANMOTION F" series DC power source input driver is based on conventional devices and thus compatible with other devices. It also has protection functions built in.

・Motor Compatibility

The device is compatible with motors ranging from small capacity motors with a flange size of 28 mm sq. to large capacity 86 mm diameter motors (two-phase unipolar: up to 56 mm sq.; two-phase bipolar: up to 60 mm sq.).

・Safety Standards

UL Certification

After receiving certification from the third party TÜV, it has been self-certified for the CE mark.

・Environmental consciousness

Compatible with the RoHS directive

The HIC PMM5320-E uses a transfer mold process instead of the hollow package used in the conventional product, the PMM5303. The employment of the transfer mold package has increased reliability while reducing heat emanation and size.

・Motor compatibility

Flange size 28 mm sq. to 86 mm diameter

Table 1 Product specifications

Basic Specifications	**Interface**	**Photocoupler**	**C-MOS**
	Main circuit power source	24 V DC/36 V DC ±10%	
	Control source	–	5 V DC ±5%
	Main circuit power source current (A)	3	
	Control source current (A)	–	0.5
	Environment Protection class	Class III	
	Operation environment	Installation Category (over voltage category) : 1 Degree of pollution : 2	
	Effective standard	EN61010-1, UL508C	
	Operating ambient temperature	0 to 50°C	
	Storage temperature	–20 to +70°C	
	Operating ambient humidity	35 to 85% RH (No condensation)	
	Storage humidity	10 to 90% RH (No condensation)	
	Operating altitude	1000 or fewer meters above sea level	
	Vibration	4.9 m/s² Pulse range: 10 to 55 Hz, 2H in each of the X, Y, and Z directions	
	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 0.5 kV AC	
	Insulation resistance	500 V DC and 10 MΩ or higher between power input terminal and cabinet	
	Mass (g)	Two-phase unipolar : 80 g Two-phase bipolar : 90 g Five-phase pentagonal : 100 g	
Function	**Select function**	Step angle : pulse input format, low vibration mode, stop current, operating current	
	Protective function	Open phase protection	
	LED display	Power source monitor, alarm display	
	Command pulse input type	Photocoupler input type, input resistor 220 Ω Maximum input frequency : 150 kpps	C-MOS input type Maximum input frequency : 150 kpps
	Power down input signal	Photocoupler input type, input resistor 220 Ω	C-MOS input type
	Phase origin monitor output signal	Photocoupler open collector output	Transistor open collector output
	Alarm output signal	Photocoupler open collector output	Transistor open collector output

・Exterior dimensions

60 x 27 x 6 (Not including leads)

・Environmental consciousness

Compatible with the RoHS directive

3. Features

3.1 Size and Weight Reductions

The use of smaller parts, better integration, and reduction of the size of the heat sink due to decreased heat generation from the power module has allowed a 68% reduction in size and a 57% reduction in weight over conventional models.

Figure 3 shows a comparison in size between the conventional model and this product. Figure 4 shows a comparison by weight.

3.2 Built-in Protection Functions

The two-phase unipolar lines had a disadvantage in damaging the driver from an open phase, but the product we have developed detects open phases and protects against them while outputting an alarm and lighting an LED. The two-phase bipolar driver and five-phase pentagonal driver have similar functions.

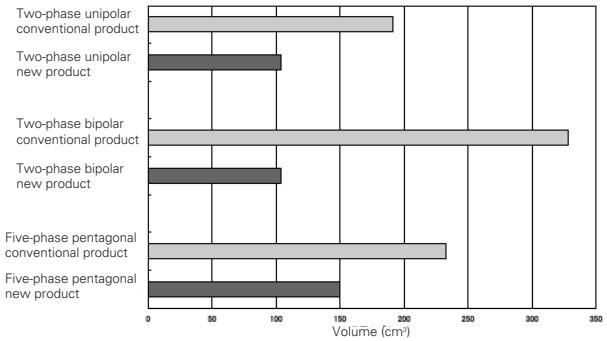

Figure 3 Size comparison

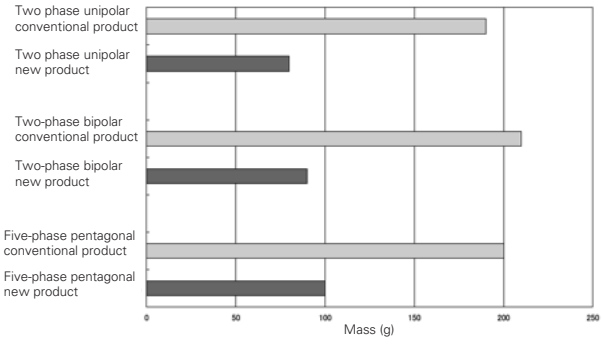

Figure 4 Weight comparison

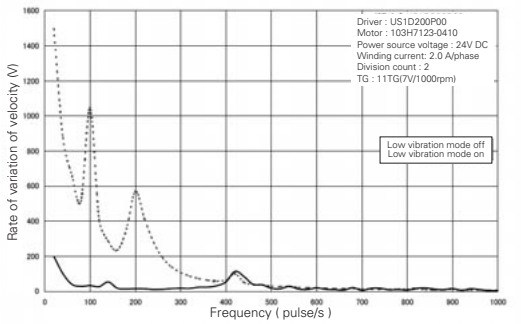

Figure 5 Low vibration mode

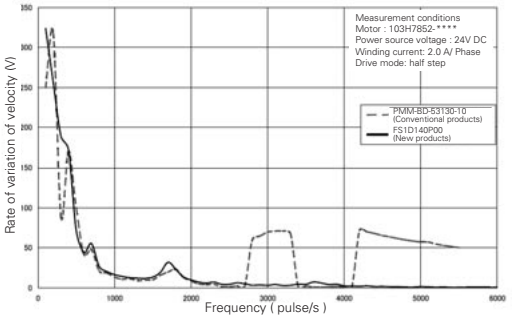

Figure 7 Vibration characteristics

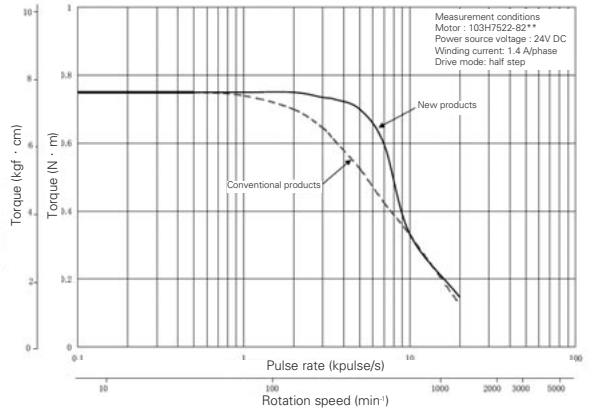

Figure 6 Frequency and torque characteristics

3.3 Wiring

In addition to wiring with conventional connectors, we have also created a wiring system that uses the terminals. Wiring can now be done without the need for a special crimp tool. As with conventional products, the photocoupler type and the C-MOS type are available as the input/output interface.

3.4 Longer Life

The control circuit and the main circuit both use long life electrolytic capacitors. The lifetime of the electrolytic capacitor used in the control circuit is 2000 hours at 105°C for the conventional product but 5000 hours for the new product. The lifetime of the electrolytic capacitor used in the main circuit is 5000 hours at 105°C for the conventional product but 10000 hours for the new product. By reducing the heat generated by the power module, the ambient heat of the electrolytic capacitor is also reduced, leading to a lifespan twice that of the conventional product.

3.5 Micro-Step Function

The two-phase unipolar and bipolar drivers each have a micro-step function. Resolution can be set to one of five levels, from 1/1 to 1/16, with the DIP switch. Additionally, with low vibration mode on, even coarse settings such as 1/1 or 1/2 can proceed smoothly with micro-step operation.

3.6 Improved Torque Characteristics and Vibration Control

The five-phase pentagonal driver uses a new PWM control method. The conventional product had a maximum on duty PWM of 70%. This has been raised to 100% in the new product. Switching to this new control method allowed for an increase in output torque in high speed areas. Additionally, the conventional five-phase pentagonal product consumed more drive current than necessary in medium speed areas, causing vibrations. The new product uses a different excitation method to solve this problem. Figure 6 shows the frequency and torque characteristics. Figure 7 shows the vibration characteristics.

4. Conclusion

The "SANMOTION F" series DC power source input driver was developed to offer excellent cost performance. Our future goals include the development of the PMM5320-E micro-step driver and greater reductions in vibration to meet market demand.

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