Stepping Motor With Drive Function

Nobutoshi Nakamura Tetsuji Takizawa Ikuo Takeshita Hiroaki Koike Masaaki Ohashi Takao Oshimori
Yasushi Yoda Kengo Uchiyama

1. Introduction

Brushless DC motors and induction motors that can be driven only by creating simple connection points are used in a wide range of applications, including chip mounters, printed circuit board production, and actuators for delivering workpieces in circuit board inspection equipment.

There is a recent trend towards increased use of a stepping motor in an attempt to increase responsiveness and positioning accuracy. It is getting difficult to reserve space for the driver mountings, make the necessary wiring, and control problems. Because of this, these same functions are being required of stepping motors. In response to these needs, we have developed a "stepping motor with drive function," which combines the stepping motor and drive function. Beyond this integration, the product was designed with the objectives of improved control and reduced size.

This document outlines the stepping motor with drive function and describes its features.

2. Development Background

2.1 Exterior View and Architecture

The products we have developed are based on a newly developed high torque, two-phase, 0.9° stepping motor and come in 42 mm sq. and 60 mm sq. sizes. Figure 1 shows exterior views of both models. The motor has the driver affixed to its rear. The motor and driver are manufactured separately to be assembled later. If there is no space at the rear of the motor, a junction cable can be used to allow the driver to be installed separately from the motor.

2.2 Driver Architecture

The driver is sealed in a case cover to prevent damage from outside objects and to protect the internal electronic parts. In addition, a switch and a five-figure, seven-segment LED are installed on the front face of the cover to make it easy to determine the condition and settings of the driver at a glance.

Figure 1 Exterior view of stepping motor with drive function (left 42 mm sq.) (right 60 mm sq.)

3. Product Specifications and Features

3.1 Specifications

Table 1 shows the product specifications for the 42 mm sq. and 60 mm sq. products.

This product was designed for safety and environmental friendliness while aiming to be "Usable anywhere in the world."

・Safety standards

Certified with the UL standard

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

・Environmental consciousness

Compatible with the RoHS directive that is going into force in July 2006.

3.2 Micro-Step Function

The product can perform up to 1/250 micro step operations and be driven at very slow speeds using a direct drive instead of a reducer.

Table 1 Product specifications

			Stepping motor with drive function	
			42 mm sq. DB21M142S-01	60 mm sq. DB22M162S-01
Basic specifications	Input power source		24V DC ±10%	
	Environment	Operating ambient temperature	0 to 40°C	
		Operating ambient humidity	35 to 85% RH (No condensation)	
	Mass (kg)		0.5	0.86
Functions	Protection functions		Driver overheat, overcharge	
	LED display		Seven-segment LED display Operating mode, resolution, operating current, stopped current, address, program number, operating speed, status display	
	Command pulse mode	Pulse	1. Pulse / directional signal, 2.CW pulse / CCW pulse	
		Maximum command pulse	300 kpps max	
		Step angle selection	16 types 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 / Full-half selection / EMG	
		Output signal	Alarm output / Phase origin output signal	
	General-purpose I/O mode	Programs	16 programs	
		Input signal	Program selection / Start-stop signal / Pause ±ELM signal / Origin signal	
		Output signal	Alarm output / Busy output	
	Serial I/F mode	RS485 compliant	Synchronized half duplex Communication rate: 9,600/38,400 bps Position command operation / Continuousrevolving operation / Homing function	
		Input signal	±ELM signal/Origin signal/EMG	
		Output signal	Alarm output / Busy output	

3.3 Operating Mode

This product includes a position generator function and communications functions as well as three operating modes so the customer can configure the device to best fit the operating environment.

・Pulse Input Mode

Speed and position can be handled with pulse commands from the host controller. The auto micro function is activated when operating at low speed. This means that, even when the micro step resolution is relatively coarse, the driver automatically sets an appropriate resolution for the speed and runs as smoothly as the micro step.

Additionally, communications functions are possible even in this mode so that the status can be read and checked when an error occurs, and maintainability can be improved.

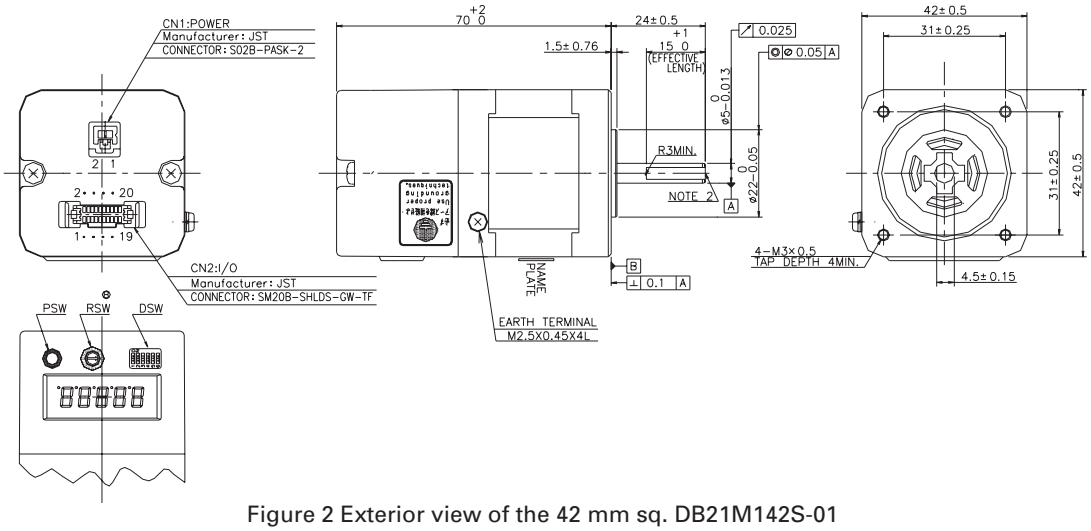

Figure 2 Exterior view of the 42 mm sq. DB21M142S-01

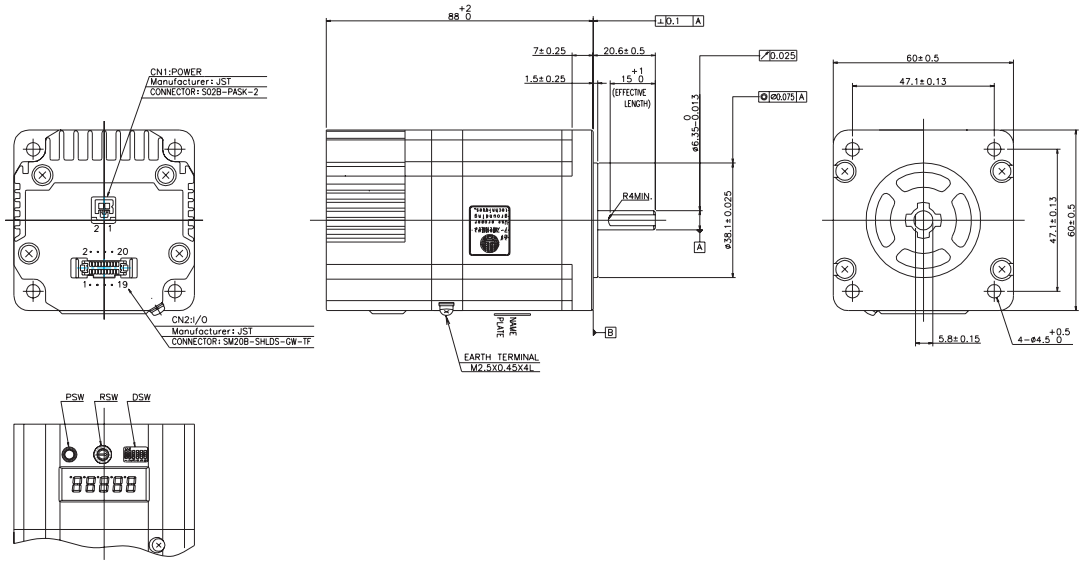

Figure 3 Exterior view of the 60 mm sq. DB22M162S-01

・General Purpose I/O Mode

First, using communications from the host controller or the computer, the operating program can be saved in the nonvolatile memory of the driver.

This program can carry out a desired operation when it receives a specified program number and the startup signal through the general purpose I/O signal. This function can be reduced the calculation load on the host controller and reduces the cost of the overall system.

・Serial I/F Mode

This mode can configure the speed and position parameters, and issue commands for the position setting and homing operations over the RS485 serial interface. The driver has the position generator function so the calculation load on the host controller can be reduced.

3.4 Confirming Function Settings and Status

The product allows function settings and status readings to be handled through the communications protocol. All of these functions can also be handled though the switch and the five-figure, seven-segment LED on the face of the driver. This feature allows driving the motor and confirming its status just by connecting a power source. No communications device or host controller needs to be connected. This feature reduces maintenance time and lowers costs.

Figure 2 shows an exterior view of the 42 mm sq. DB21M142S-01. Figure 3 shows an exterior view of the 60 mm sq. DB22M162S-01.

4. Conclusion

The “stepping motor with drive function” can reduce wiring between the driver and the motor as well as the load on the controller by using a position generator function so system costs can be lowered. This product was developed for excellent cost performance.

Our future goals include no loss of synchronism, reduced loss in the voltage controller and smaller size through greater integration, as well as increased reliability and a smaller environmental impact.

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

Ikuo Takeshita
Joined Sanyo Denki in 1985
Servo Systems Division, 3rd Design Dept.
Worked on the structural design of the stepping motor

Masaaki Ohashi
Joined Sanyo Denki in 1982
Servo Systems Division, 3rd Design Dept.
Worked on development and design stepping motor

Yasushi Yoda
Joined Sanyo Denki in 2002
Servo Systems Division, 3rd Design Dept.
Worked on development and design stepping motor

Kengo Uchiyama
Joined Sanyo Denki in 1996
Servo Systems Division, 2nd Design Dept.
Worked on development and design stepping motor driver

Testuji Takizawa
Joined Sanyo Denki in 1996
Servo Systems Division, 2nd Design Dept.
Worked on the design and development of the stepping motor driver through the design and development of the controller

Hiroaki Koike
Joined Sanyo Denki in 1988
Servo Systems Division, 2nd Design Dept.
Worked on the structural design of the servo amplifier and driver through fan motor production technologies

Takao Oshimori
Joined Sanyo Denki in 1990
Servo Systems Division, 2nd Design Dept.
Worked on the structural design of the servo amplifier and driver