Development of DC Power Supply Input "SANMOTION Model No. PB" System

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1. Introduction

Our company's DC power supply input "SANMOTION Model No. PB" systems were initially introduced to the market as products to bridge the gap between open loop stepping systems and AC servo systems. In recent years, the demands for equipment with less vibration and noise and for general industrial devices with a wider range of interfaces have risen. In response to these market demands, we improved the conventional system to provide higher performance and shared interface.

This document describes the features of the new DC power supply input "SANMOTION Model No. PB" system.

2. Product Overview

Our conventional DC power supply input "SANMOTION Model No. PB" amplifier was available in six models, each with different motor capacity and interface. When the users wanted to change the motor capacity or interface in order to shorten the takt time or to deploy the system in another device with a different interface, the amplifier had to be replaced. Also, having more than one model had sometimes become a bottleneck in stock reduction and quick delivery.

In terms of performance and functions, there were increasing market demands for vibration reduction at low speed operation and higher positioning resolution.

With our new DC power supply input "SANMOTION Model No. PB" system, a single amplifier model provides different motor capacities and interfaces, overcoming these previous problems. It also features performance improvements including higher sensor resolution.

The following section outlines the features of the new DC power supply input "SANMOTION Model No. PB" system.

Fig. 1: Exterior view of the amplifier

3. Product Features

3.1 Product configuration

Tables 1 and 2 show the basic specifications of the amplifier and motor, respectively. Figures 2 and 3 show the external wiring diagrams for each interface (RS-485 and pulse train input).

3.2 Sensor resolution

Our conventional DC power supply input "SANMOTION Model No. PB" system used an optical incremental sensor with a resolution of 200 P/R as the feedback sensor to create a closed loop. Since the closed loop was partly controlled by hardware, sensor resolutions other than 200 P/R could not be applied.

This became a bottleneck in reducing vibration and noise at low speed operation and in improving performance and functions such as speed and positioning resolution.

With the new system, we adopted a sensor with resolution of 500 P/R to overcome these problems. Also by changing the drive mode from rectangular to SIN, we were able to achieve the following results:

Table 1: General specifications of the amplifier

Item	Specifications	
Amplifier model No.	PB3D003M200	
Interfaces	RS-485 half-duplex + parallel I/O (R type)	Pulse train input (P type)
Drive mode	PWM controlled SIN drive mode	
Input power source	24/48 VDC ±10%	
External dimensions	H160×W32×D95	
Weight	Approx. 0.35 kg	
Structure	Tray-type	
Positioning resolutions	500, 1000, 2000, 4000, 5000, 10000 P/R	
Rotation speed	0 to 4500 min^{-1} (28 mm sq., 42 mm sq., 60 mm sq. motors)	
Speed command resolution	$1min^{-1}$	—
Incorporated functions	Holding brake control function Regeneration control function Home return function	
	Point, PRG function Teaching function Modulo function	S-curve filter
Display	7-segment LED display	
Protective functions	Power supply voltage error, sensor disconnection, excessive speed, RST action, CPU error, EEPROM error, overloading error, deviation error, servo error	
Input signal functions	Point/program No. EXE (execution signal) SELECT H.Limit SDN General purpose input Emergency stop Pause Interlock ALMCLR Home return activation	Pulse input: H.Limit SDN Emergency stop Deviation clearance ALMCLR Gain selection
Output signal functions	Ack In-Position Home return completed ZONE ALM Point No.	SON monitor Home return completed ALM In-Position Sensor signals

* The input and output signal functions and logics are set via communication for each function.

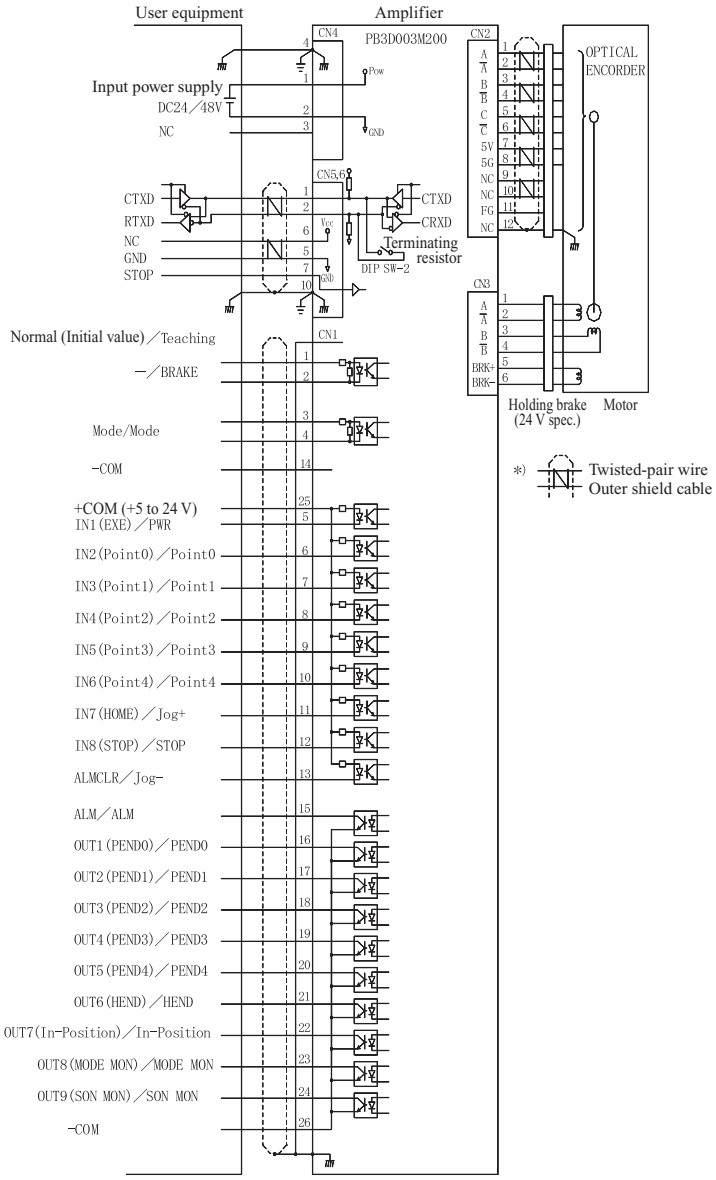

Fig. 2: External wiring diagram for the RS-485 interface

Table 2: General specifications of the motor

	Item	PBM282	PBM284	PBM423	PBM603	PBM604
General specifications	Maximum stall torque (N-m)	0.055	0.115	0.39	1.3	1.9
	Rotor inertia ($kg\text{-}cm^2$)	0.008	0.016	0.056	0.4	0.84
	Allowable thrust load (N)	9.8	9.8	9.8	14.7	14.7
	Allowable radial load (N)	33	33	49	167	167
	Motor weight (kg)	0.16	0.23	0.35	0.85	1.42
	Sensor specifications	Optical, INC 500 P/R A/B/C channel				
Options	Holding brake	△	△	○	○	○
	Low backlash gear	—	—	○	○	○
	Harmonic gear	○	○	○	○	○

Legend ○: Supported, △: Limited support, -: Not supported

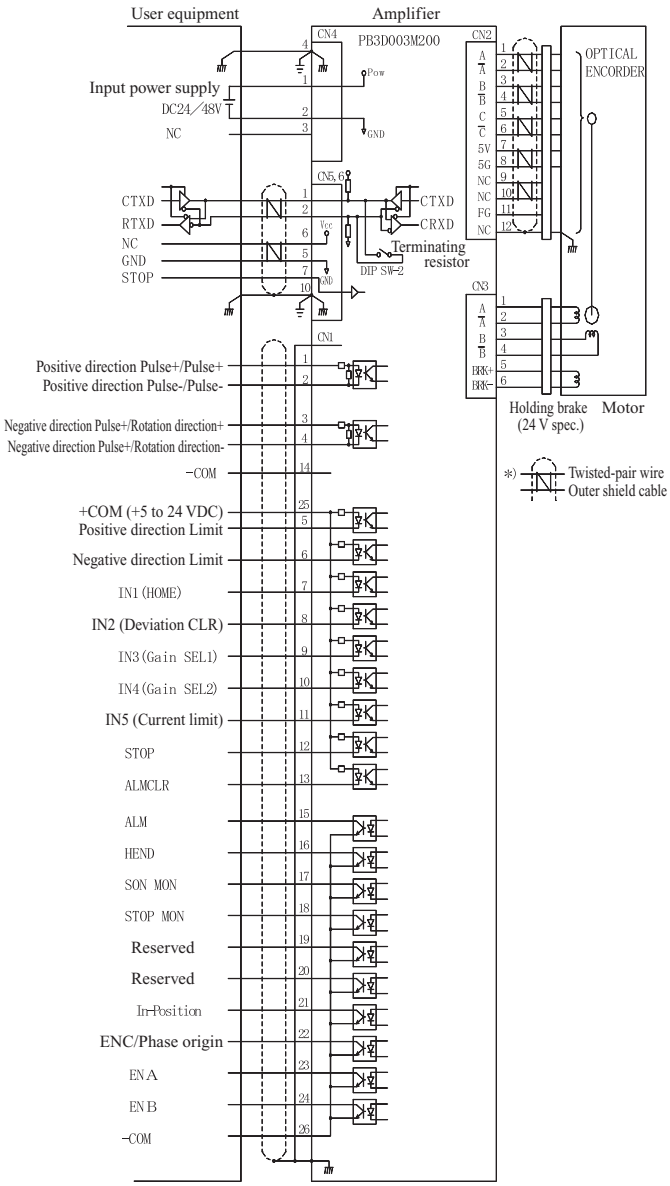

Fig. 3: External wiring diagram for the pulse train interface

- A positioning resolution equivalent to five phases are applied which was limited to two phases in the conventional system.
- By adopting software for functions which had been dependent on hardware in the conventional system (increasing software dependency), it is possible to reduce the number of components and flexibly respond to market demands.
- Changing the speed command resolution from 18.75 min^{-1} to 1 min^{-1} with the target position command type (R type) enabled finer speed control.
- Shifting from rectangular drive mode to SIN drive mode allowed for speed variations and reduction of motor noise.
- The problem of drop in torque in the high speed region that had been associated with the SIN drive mode was solved by implementing a new function that seamlessly changes the drive mode in accordance with speed.

3.4 Functions specific to the R type

The R type continues to provide the point function (128 points) and program function that were included in the conventional system.

In addition, a teaching function, which saves the current position as point data to the amplifier, and a point link function, which calls point data within a program, were introduced for quicker equipment startup and load reduction of the upper level controller.

3.5 New tools

The RS-485 communication protocol was adopted to maintain compatibility with the conventional system.

In order to facilitate PC control, we now provide DLL's and sample programs enabling users to build software without any regard to communication protocols.

We also added a waveform tracing function for speed and current commands that allow monitoring of activities from a PC.

4. Conclusion

In this document, we have described the features of our new DC power source input "SANMOTION Model No. PB" system.

This product enhances the performance and functions of the conventional DC power source input "SANMOTION Model No. PB" series and is suitable for various applications including general industrial devices, as well as single axis robots and electric-powered hydraulic and pneumatic systems that will be in high demand in the near future.

With this product, we will continue to flexibly respond to market demands and strive to increase its market share.

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