Development of the "SANMOTION Model No.PB", a DC Input, 4-Axis Integrated EtherCAT Driver

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1. Introduction

In recent years, there has been a growing demand for IoT to manage factory devices through connection via a network. As a field bus, EtherCAT is a promising candidate. SANYO DENKI already offers the "SANMOTION Model No.PB" pulse train input type, 4-axis integrated driver for closed loop stepping systems in the market, and this time we have added a driver supporting EtherCAT communication to the series.

This paper will introduce the features of this new model.

2. Product Overview

2.1 External view and dimensions

Figure 1 shows an external view of the new model, while Figure 2 shows the external dimensions. The external dimensions are the same as the pulse train input 4-axis integrated driver.
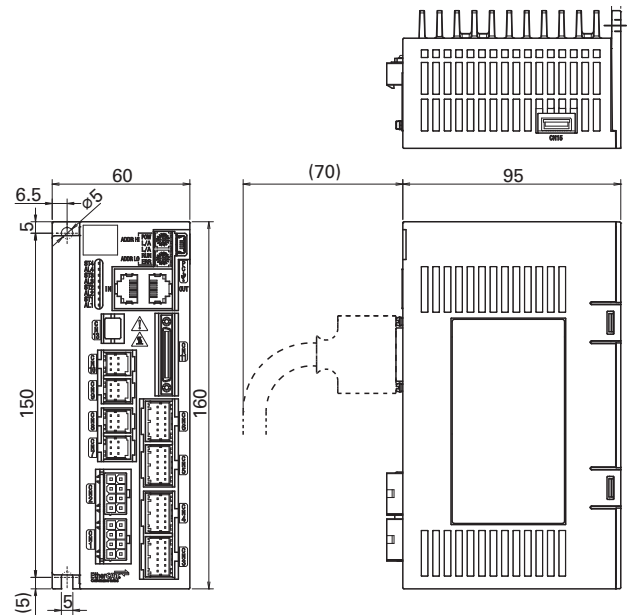

Fig. 2: Dimensions

Fig. 1: External view

2.2 Main specifications

Table 1 shows the main specifications of the new model.

The EtherCAT drive profile supports CiA402; device profile supports CoE and FoE. There are five supported operation modes; profile position (pp), profile velocity (pv), homing (hm), cyclic sync. position (csp), and cyclic sync. velocity (csv).

In addition to the 2000 P/R and 16000 P/R incremental encoders, which has been available for use with the current model, absolute encoders are now supported. The PC interface has been changed from the conventional RS-485 to USB 2.0. The new model also complies with international standards such as Europe's Low Voltage Directive, the EMC Directive, the US's UL/cUL, and Korea's KC mark.

Table 1: Main specifications

Item	Specifications
Interface	EtherCAT
Drive profile	CiA402
Device profile	CoE, FoE
Minimum communication cycle	0.25 ms
Synchronization mode	DC, SM2, FreeRun
Compatible operation mode	Profile position (pp) Profile velocity (pv) Homing (hm) Cyclic sync. position (csp) Cyclic sync. velocity (csv)
Max. number of motors	4
Main circuit power supply voltage	24/48 VDC
Control circuit power supply voltage	24 VDC
Operating ambient temperature	0 to 55°C
Operating ambient humidity	Below 90% RH (No condensation)
Operating altitude	1000 m or less above sea level
Dimensions	W60 x H150 x D95
Mass	0.7 kg
Compatible motor size	(28, 42, 60 mm sq.)
Compatible encoder	Incremental encoder (2000 P/R, 16000 P/R) Absolute encoder (42, 60 mm sq.)
Holding brake	Non-excitation type (power supplied from driver)
Control method	Closed loop control Low-deviation closed loop control
Protection function	Overcurrent, overload, driver overheat, voltage monitoring, encoder disconnection, overspeed, position deviation, etc.
LED indicators	Servo on LED Alarm LED Power LED For EtherCAT: ERR, L / A, RUN LEDs
Rotary switch	Node ID setting
General-purpose input port	Photocoupler input method No. of inputs: 16
General-purpose output port	Photocoupler output method No. of oOutputs: 12
PC communication	USB2.0
Standards conformity	Low-voltage directive, EMC directive, UL / cUL KC mark

3. Features

3.1 Space-saving and wire-saving

The new model is a 4-axis integrated driver that supports EtherCAT communication. Figure 3 shows the illustration of system configuration.

It can control up to four motors with only one LAN cable. Moreover, there is no need to have one power cable or I/O signal cable for each motor as these can be made common, thus reducing the amount of wiring necessary. Furthermore, two power connectors are available for power cable use, enabling a daisy chain connection on devices where multiple drivers are used in series.
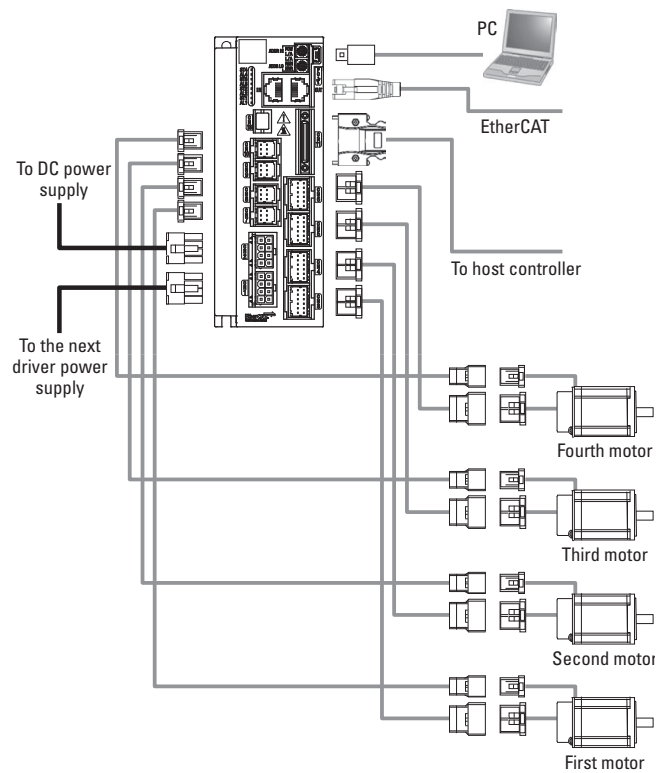

Fig. 3: Illustration of system configuration

3.2 Compatibility with the pulse train input, 4-axis integrated driver

The external dimensions, motor connector, encoder connector, and power connector of the new model are the same as those of the pulse train input 4-axis integrated driver, and its motor characteristics are equivalent. This makes transition from a pulse train command system to a network system easy.

3.3 Improved subdivision and command following

Compared to the current model, the new model has reduced EtherCAT's minimum communication cycle from 1 ms to 0.25 ms. Position and speed commands can be finely subdivided and sent, enabling smoother equipment operation.

Furthermore, all operation modes support "low-deviation closed loop control" as well as the current closed loop control. This control method achieves the same level of following ability of the system relative to the position command as an open loop stepping motor, while being free of step-out.

By using this control method, deviation during driving is lowered and this enables to perform such operations as interpolation on X-Y tables which require high following ability to commands, such as the arc interpolation on X-Y tables, etc.

3.4 Enhanced encoder support

In the past, incremental encoders and absolute encoders required separate drivers, but this new model can connect to both encoders.

The absolute encoder doesn't require the "return to home position" operation, and can be recovered quickly after maintenance. Moreover, there is no need for limit sensors or home position sensors, simplifying the maintenance and reducing the man-hours required for wiring tasks. Meanwhile, incremental encoders are effective for building low-cost systems. For the new model, a different encoder can be used for each axis, meaning that the respective advantages of each can be fully leveraged.
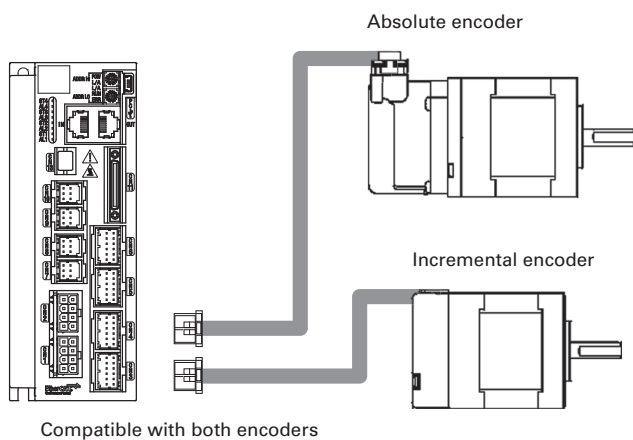
3.5 Improved analysis function

The new model supports "SANMOTION Motor Setup Software", which is a user support service for system start-up. In the same way as the pulse train input 4-axis integrated driver, it uses operation tracking, trial operation, alarm history, drive record function, and the like to perform analysis in the event of an error. The new model uses a USB 2.0 PC interface and connection can be easily made with commercially available cables. Moreover, by improving communication speed, analysis data can be swiftly acquired, alleviating the burden on the user during analysis.

4. Conclusion

This paper has provided an overview of the "SANMOTION Model No.PB" DC input, 4-axis integrated EtherCAT driver and introduced its features.

With the development of this new model, SANYO DENKI has realized a product that saves on space and wiring and supports network connection. Through improving control performance, enhancingencoder compatibility, and improving analysis functions, we believe this product contributes to user convenience.

SANYO DENKI will continue developing drivers which help enhance the performance of our customers' equipment.

Absolute encoder

Incremental encoder

Compatible with both encoders

Fig. 4: Driver-motor connection

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