



## Industrial Automation Headquarters

**Delta Electronics, Inc.**  
Taoyuan Technology Center  
No.18, Xinglong Rd., Taoyuan City,  
Taoyuan County 33068, Taiwan  
TEL: 886-3-362-6301 / FAX: 886-3-371-6301

## Asia

**Delta Electronics (Jiangsu) Ltd.**  
Wujiang Plant 3  
1688 Jiangxing East Road,  
Wujiang Economic Development Zone  
Wujiang City, Jiang Su Province, P.R.C. 215200  
TEL: 86-512-6340-3008 / FAX: 86-769-6340-7290

**Delta Greentech (China) Co., Ltd.**  
238 Min-Xia Road, Pudong District,  
ShangHai, P.R.C. 201209  
TEL: 86-21-58635678 / FAX: 86-21-58630003

**Delta Electronics (Japan), Inc.**  
Tokyo Office  
2-1-14 Minato-ku Shibadaimon,  
Tokyo 105-0012, Japan  
TEL: 81-3-5733-1111 / FAX: 81-3-5733-1211

**Delta Electronics (Korea), Inc.**  
1511, Byucksan Digital Valley 6-cha, Gasan-dong,  
Geumcheon-gu, Seoul, Korea, 153-704  
TEL: 82-2-515-5303 / FAX: 82-2-515-5302

**Delta Electronics Int'l (S) Pte Ltd.**  
4 Kaki Bukit Ave 1, #05-05, Singapore 417939  
TEL: 65-6747-5155 / FAX: 65-6744-9228

**Delta Electronics (India) Pvt. Ltd.**  
Plot No 43 Sector 35, HSIIDC  
Gurgaon, PIN 122001, Haryana, India  
TEL : 91-124-4874900 / FAX : 91-124-4874945

## Americas

**Delta Products Corporation (USA)**  
Raleigh Office  
P.O. Box 12173, 5101 Davis Drive,  
Research Triangle Park, NC 27709, U.S.A.  
TEL: 1-919-767-3800 / FAX: 1-919-767-8080

**Delta Greentech (Brasil) S.A.**  
Sao Paulo Office  
Rua Itapeva, 26 - 3º andar Edifício Itapeva One-Bela Vista  
01332-000-São Paulo-SP-Brazil  
TEL: 55 11 3568-3855 / FAX: 55 11 3568-3865

## Europe

**Delta Electronics (Netherlands) B.V.**  
Eindhoven Office  
De Witbogt 20, 5652 AG Eindhoven, The Netherlands  
TEL : +31 (0)40-8003800 / FAX : +31 (0)40-8003898

# Delta ASDA-A3 Series Servo Drive User Manual



## Delta ASDA-A3 Series Servo Drive User Manual

2017-04-26

\*We reserve the right to change the information in this manual without prior notice.

[www.deltaww.com](http://www.deltaww.com)



# Preface

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Thank you for purchasing this product. This manual provides information regarding the ASDA-A3 series servo drive (A3) and the ECM-A3 series servo motor.

This manual includes:

- Installation and inspection of servo drive and servo motor
- Servo structure and wiring diagram
- Steps of trial operation
- Instructions for servo tuning
- Description of parameters
- Description of communication protocol
- Troubleshooting
- Inspection and maintenance

ASDA-A3 product features:

Delta developed a new control algorithm that enables users to easily overcome the problems of lacking of stiffness or flexibility of mechanism structure. The new automatic tuning function is more user-friendly that allows users to complete tuning easily. In addition, users can also utilize the gain adjustment function to improve the performance of the drive. Its compact design can reduce space usage inside the cabinet. The smaller design of the new generation of ECM-A3 can also meet the needs for equipment structures' size and weight reductions.

How to use this manual:

This manual can be used as a reference while applying the servo drive, which contains information regarding product installation, setting, as well as instructions on how to use and maintain this product. Before initiating the tuning or setup process, please read through Chapter 1 to 5.

Both table of contents and subject index are provided in this manual. If you cannot find the information needed in the table of contents, you may also quickly search for the information in the subject index.

DELTA technical services:

Please consult the distributors or DELTA customer service center if any problem occurs.

## Safety Precautions

ASDA-A3 is a high resolution and open type servo drive. It should be installed in a shielded control box during operation. This product uses precise feedback control and the digital signal processor (DSP) with high-speed calculation function to control the current output which generated by IGBT so as to operate three-phase permanent magnet synchronous motors (PMSM) and to achieve precise positioning.

ASDA-A3 series are utilized on industrial applications and are suggested to be installed in the control box. (Servo drives, wire rods, and motors should all be installed in an environment which complies with the minimum requirement of UL50 Type 1.)

Pay special attention to the following safety precautions at any time during inspection, installation, wiring, operation, maintenance, and examination.

The symbols of “DANGER”, “WARNING” and “STOP” indicate:



**Danger. It may cause severe or fatal injuries to personnel if the instructions are not followed.**



**Warning. It may cause moderate injury to personnel, or lead to severe damage or even malfunction of the product if the instructions are not followed.**



**Absolutely prohibited activities. It may cause serious damage or even malfunction of the product if the instructions are not followed.**

## Inspection



Please follow the instructions when using the A3 servo drive and servo motor, or it may cause fire or malfunction.

## Installation



Do not expose the product to an environment containing water, corrosive gas, inflammable gas...etc., or it may result in electric shock or fire.

## Wiring



- Connect the ground terminals to class-3 ground system (Ground resistance should not exceed 100 Ω). Improper grounding may result in electric shock or fire.
- Do not connect the three-phase source to the motor output terminals U, V, and W, or it may cause personnel injury or fire.
- Please tighten the screws of the power and motor output terminal, or it may cause fire.
- Please refer to description of wire rod selection in Chapter 3 to prevent any danger.

## Operation



- Before operating, please change the parameter setting according to the application. If it is not adjusted to the correct setting value, it may lead to malfunction of the machine or the operation might be out of control.
- Before the machine starts to operate, please ensure that the emergency stop can be activated at any time.
- When applying power, please make sure the motor will not rotate because of inertia of mechanism or other causes.



During the operation, it is prohibited to touch any rotating motor parts, or it may cause personnel injury.



- To avoid accidents, please remove all units during the first test run, so that the motor is operating without any load.
- If users fail to operate the machine properly after the servo motor connects to the equipment, it may damage the equipment and lead to personnel injury.
- In order to prevent danger, it is strongly recommended to check if the motor can operate normally without load first. Then, operate the motor with load.
- Do not touch the heat sink of the servo drive during operation, or it may cause scalding.

## Maintenance and Inspection



- It is prohibited to touch the internal parts of the servo drive and servo motor, or it may cause electric shock.
- It is prohibited to disassemble the panel of the servo drive when the power is on, or it may cause electric shock.
- Do not touch the ground terminal within 10 minutes after turning off the power, or the residual voltage may cause electric shock.
- Do not disassemble the motor, or it may cause electric shock or personnel injury.
- Do not change the wiring when the power is on, or it may cause electric shock or personnel injury.
- Only qualified electricians can install, wire, and maintain the servo drive and the servo motor.



## Main Circuit Wiring



- Do not put the power cable and the signal cable in the same channel or bond them together. Please separate the power cable and the signal cable for at least 30 centimeters (= 11.8 inches).
- Please use stranded wires and multi-core shielded-pair wires for signal cables and encoder feedback cables. The maximum length of signal input cable is 3 meters (= 9.84 feet) and the maximum length of feedback cable is 20 meters (= 65.62 feet).
- The high voltage may remain in the servo drive when the power is just turned off. Please wait for 10 minutes before touching the terminal.



Do not turn the power on and off too often. If continuous power on and off is needed, please ensure that the interval is one minute at least.

## Terminal Wiring of the Main Circuit



- When wiring, please disassemble the terminal socket from the servo drive.
- Insert one electric wire per terminal socket only.
- When inserting the electric wires, do not short circuit the adjacent conductors.
- Before connecting to the power source, please inspect and ensure that the wiring is correct.

## Leakage Current



- The leakage current of the servo drive is greater than 3.5 mA.
- According to the IEC 61800-5-1 standards, the wire rod must comply with one of the following specifications to ensure proper grounding:
  1. Copper wire of cross-sectional area of at least 10 mm<sup>2</sup>.
  2. Aluminum wire of cross-sectional area of at least 16 mm<sup>2</sup>.
- Failure to comply with the specifications may result in personnel injury.
- Before applying power, please inspect and ensure that the wiring is correct.

Note: If there is any difference between each version, please refer to DELTA's website (<http://www.deltaww.com>) for the latest information.

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# Product Overview

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Before using this servo drive, please pay attention to the description about the inspection, nameplate, and model type. Suitable motor model for your A3 servo drive can be found in the table of Section 1.3.



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### 1.1 Components of the servo set

A complete servo set should include:

- (1) A servo drive and a servo motor.
- (2) A UVW motor power cable: One side of the U, V and W wires connect to the servo drive and the other to the motor (Optional purchase)
- (3) A green ground wire: it connects to the ground terminal of servo drive. (Optional purchase)
- (4) An encoder cable: One side of it connects the encoder and other side to the CN2 on the servo drive. (Optional purchase)
- (5) Communication type converter box (Optional purchase)
- (6) The 26-pin connector for the communication type converter box (Optional purchase)
- (7) A 50-pin connector for CN1. (Optional purchase)
- (8) A 6-pin connector for CN2. (Optional purchase)
- (9) An RJ45 connector for CN3, which is applied for general (RS-485) and high-speed (CANopen) communication (Optional purchase)
- (10) A 4-pin connector for CN4 (Mini-USB connector) (Optional purchase)

(11) Power supply of the servo drive:

Model	Control circuit	Main circuit
100 W ~ 400 W	L1c, L2C, P1, P2, ⊖ quick connector	R, S, T quick connector

- (12) A 3-pin quick connector (U, V, W)
- (13) A 3-pin quick connector (P3, D, C)
- (14) A plastic lever
- (15) Two metal sheets for short circuit.
- (16) An installation instruction sheet

## 1.2 Model overview

### 1.2.1 Nameplate information

#### ASDA-A3 series servo drive

##### ■ Nameplate information

Model Name -----● MODEL:ASD-A3-0421-L


Capacity Specification -----● POWER: 400W

Applicable Power Supply -----● INPUT: 200~240V 3PH 50/60Hz 2.67A

Rated Current Output -----● 200~240V 1PH 50/60Hz 4.63A

-----● OUTPUT:110V 0-500Hz 2.6A

-----● A30421LT16100001

Barcode -----● 

Firmware Version -----● 0.41

DELTA ELECTRONICS, INC

20 UL CERTIFIED SAFETY US-CA E176972 IND. CONT. EQ.

CE EAC TÜV Rheinland CERTIFIED Functional Safety Type Approved www.tuv.com ID 060000000

No.18, Xinglong Rd., Taoyuan City 33068, Taiwan

Designed by DELTA Taiwan MADE IN TAIWAN

**WARNING** DISCONNECT ALL POWER AND WAIT 10 MINUTES BEFORE SERVICING. MAY CAUSE ELECTRIC SHOCK.

**CAUTION** DO NOT TOUCH HEATSINK WHEN POWER IS ON. MAY CAUSE BURN.

**CAUTION** READ THE USER MANUAL BEFORE OPERAITON.

**USE PROPER GROUNDING TECHNIQUES**

##### ■ Serial number

A	30421L	T	15	07	0006	(1) Model name
(1)	(2)	(3)	(4)	(5)		(2) Manufacturing plant (T: Taoyuan; W: Wujiang)
						(3) Year of production (15: year 2015)
						(4) Week of production (From 1 to 52)
						(5) Serial number (Production sequence of a week, starting from 0001)



1

**ECM-A3 series servo motor**

■ **Nameplate information**

Model Name ----- Input Power ----- Rated Speed and Rate Output ----- Barcode -----	● MODEL: ECM-A3H-CY0602RS0 ● INPUT: VAC110 A1.45 Ins.A ● OUTPUT: r/min 3000 N.m 0.64 kW 0.2 No.18,Xinglong Rd., Taoyuan City 33068,Taiwan ABCYB1JAT16070001 Designed by DELTA Taiwan	
--	--	--

■ **Serial number**

<table border="0"> <tr> <td style="border-bottom: 1px solid black; padding: 0 5px;">ABCYA3AA</td> <td style="border-bottom: 1px solid black; padding: 0 5px;">T</td> <td style="border-bottom: 1px solid black; padding: 0 5px;">16</td> <td style="border-bottom: 1px solid black; padding: 0 5px;">07</td> <td style="border-bottom: 1px solid black; padding: 0 5px;">0001</td> </tr> <tr> <td style="text-align: center;">(1)</td> <td style="text-align: center;">(2)</td> <td style="text-align: center;">(3)</td> <td style="text-align: center;">(4)</td> <td style="text-align: center;">(5)</td> </tr> </table>	ABCYA3AA	T	16	07	0001	(1)	(2)	(3)	(4)	(5)	(1) Model name (2) Manufacturing plant (T: Taoyuan; W: Wujiang) (3) Year of production (16: year 2016) (4) Week of production (From 1 to 52) (5) Serial number (Production sequence of a week, starting from 0001)
ABCYA3AA	T	16	07	0001							
(1)	(2)	(3)	(4)	(5)							

**ECMC series servo motor**

■ **Nameplate information**

Model Name ----- Input Power ----- Rated Speed and Rate Output ----- Barcode -----	● MODEL: ECMC-CW1010RS ● INPUT: VAC 110 A 7.3 Ins A ● OUTPUT: r/min 3000 N.m 3.18 kW 1.0 CW1010RST16070001 Delta Electronics,Inc.	
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■ **Serial number**

<table border="0"> <tr> <td style="border-bottom: 1px solid black; padding: 0 5px;">CW1010RS</td> <td style="border-bottom: 1px solid black; padding: 0 5px;">T</td> <td style="border-bottom: 1px solid black; padding: 0 5px;">16</td> <td style="border-bottom: 1px solid black; padding: 0 5px;">07</td> <td style="border-bottom: 1px solid black; padding: 0 5px;">0001</td> </tr> <tr> <td style="text-align: center;">(1)</td> <td style="text-align: center;">(2)</td> <td style="text-align: center;">(3)</td> <td style="text-align: center;">(4)</td> <td style="text-align: center;">(5)</td> </tr> </table>	CW1010RS	T	16	07	0001	(1)	(2)	(3)	(4)	(5)	(1) Model name (2) Manufacturing plant (T: Taoyuan; W: Wujiang) (3) Year of production (16: year 2016) (4) Week of production (From 1 to 52) (5) Serial number (Production sequence of a week, starting from 0001)
CW1010RS	T	16	07	0001							
(1)	(2)	(3)	(4)	(5)							

### 1.2.2 Model explanation

#### ASDA-A3 servo drive

$\frac{ASD}{(1)} - \frac{A3}{(2)} - \frac{04}{(3)} \frac{21}{(4)} - \frac{L}{(5)}$

1

(1) Product name  
AC Servo Drive

(2) Series  
A3

(3) Rated output power:

Code	Spec.	Code	Spec.	Code	Spec.
01	100 W	07	750 W	20	2.0 kW
02	200 W	10	1.0 kW	30	3.0 kW
04	400 W	15	1.5 kW	-	-

(4) Input voltage and phase  
21: 220 V, single / three-phase  
23: 220 V, three-phase

(5) Model type:

Type	Pulse input	RS-485	CANopen	Full-closed loop control	Analog voltage control	DMCNET	E-CAM	STO
L	○	○	×	○	○	×	×	×
M *	○	○	○	○	○	×	○	○
F *	×	×	×	○	×	○	○	×

Note: Models with a \* mark are the ones to be launched.

**ECM-A3 series servo motor**

$$\frac{\text{ECM}}{(1)} - \frac{\text{A}}{(2)} \frac{\text{3}}{(3)} \frac{\text{H}}{(4)} - \frac{\text{C}}{(5)} \frac{\text{Y}}{(6)} \frac{\text{06}}{(7)} \frac{\text{04}}{(8)} \frac{\text{R}}{(9)} \frac{\text{S}}{(10)} \frac{\text{1}}{(11)}$$

1

(1) Product name

ECM: Electronic Communication Motor

(2) Servo type

A: High precision servo motor

(3) Series

3: A3 series

(4) Inertia

H: High inertia

L: Low inertia

(5) Rated voltage and speed

C: 200 V and 3,000 rpm

(6) Encoder type

Y: 24-bit absolute type encoder (resolution of single turn: 24-bit; resolution of multi-turn: 16-bit)

(7) Motor frame size

04: 40 mm

06: 60 mm

08: 80 mm

(8) Rated power output

Code	Spec.	Code	Spec.
0F	50 W	04	400 W
01	100 W	07	750 W
02	200 W		

(9) Type of shaft and oil seal

	w/o brake w/o oil seal	with brake w/o oil seal	w/o brake with oil seal	with brake with oil seal
Round shaft (with fixed screw holes)	-	-	C*	D*
Keyway (with fixed screw holes)	P*	Q*	R	S

Note: \* mark signifies that this type of motor is coming soon.

(10) Shaft diameter

S: Standard

7: 14 mm (specific)

(11) Special code

1: Standard products

**ECMC series servo motor**

ECM C – C W 13 08 R S  
 (1) (2) (3) (4) (5) (6) (7) (8)

(1) Product name

ECM: Electronic Communication Motor

(2) Servo type

C: High-precision AC servo motor (Suitable for CNC applications)

(3) Rated voltage and speed

C: 200 V and 3,000 rpm  
 E: 200 V and 2,000 rpm  
 F: 200 V and 1,500 rpm

(4) Encoder type

W: 22-bit Absolute type (resolution of single turn: 22-bit; multi-turn: 16-bit)

(5) Motor frame size

10: 100 mm  
 13: 130 mm  
 18: 180 mm

(6) Rated power output

Code	Spec.	Code	Spec.
08	850 W	18	1.8 kW
10	1.0 kW	20	2.0 kW
13	1.3 kW	30	3.0 kW
15	1.5 kW	-	-

(7) Type of shaft and oil seal

	w/o brake w/o oil seal	with brake w/o oil seal	w/o brake with oil seal	with brake with oil seal
Round shaft (with fixed screw holes)	-	-	C	D
Keyway (with fixed screw holes)	-	-	R	S

(8) Shaft diameter

S: Standard

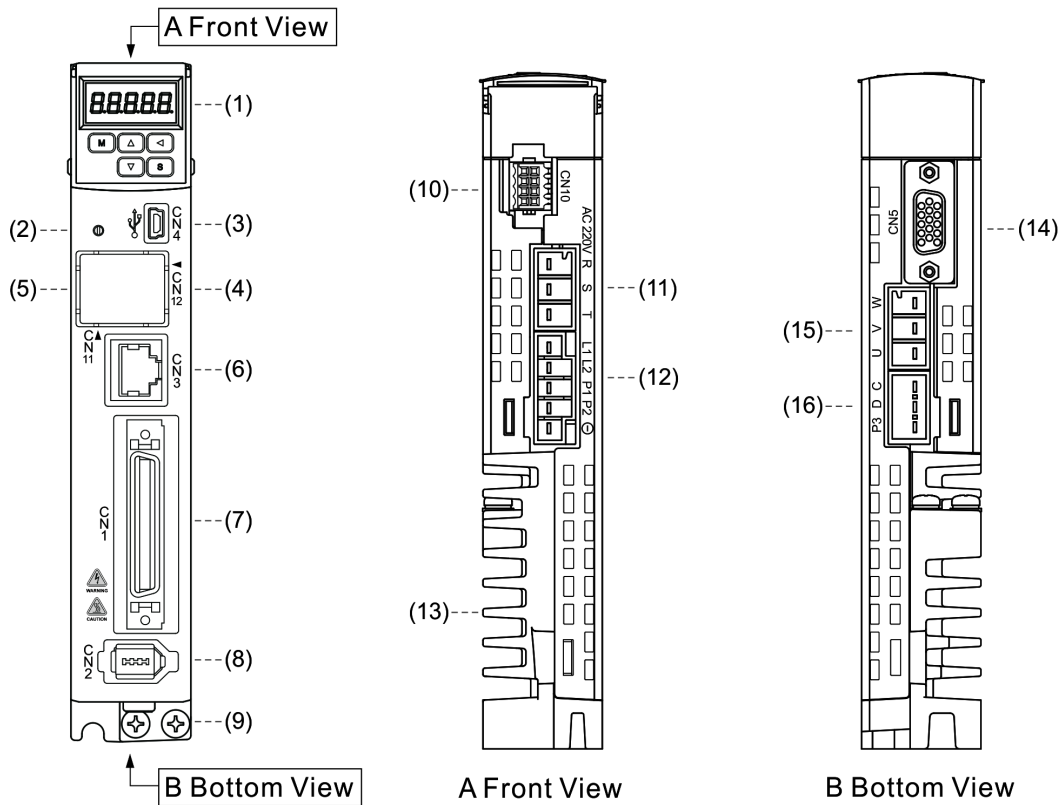
### 1.3 ASDA-A3 servo drive and motor

		Motor					Servo Drive		
Series	Power	Output (W)	Model number	Rated current (Arms)	Max. instantaneous current (A)	Model number	Continuous output current (Arms)	Max. instantaneous output current (A)	
Low inertia	ECM-A3L 3000 rpm	Single-/ Three-phase	50	ECM-A3L-C <sup>1</sup> 040F <sup>2</sup> <sup>3</sup> 1	0.67	2.62	ASD-A3-0121	0.9	3.54
			100	ECM-A3L-C <sup>1</sup> 0401 <sup>2</sup> <sup>3</sup> 1	0.89	3.5			
			200	ECM-A3L-C <sup>1</sup> 0602 <sup>2</sup> <sup>3</sup> 1	1.45	5.55	ASD-A3-0221	1.55	7.07
			400	ECM-A3L-C <sup>1</sup> 0604 <sup>2</sup> <sup>3</sup> 1	2.65	9.2	ASD-A3-0421	2.6	10.61
			400	ECM-A3L-C <sup>1</sup> 0804 <sup>2</sup> <sup>3</sup> 1	2.6	8.6			
			750	ECM-A3L-C <sup>1</sup> 0807 <sup>2</sup> <sup>3</sup> 1	5.1	15.9	ASD-A3-0721	5.1	21.21
Medium inertia	ECMC-C 3000 rpm	Single-/ Three-phase	1000	ECMC-C <sup>1</sup> 1010 <sup>2</sup> <sup>3</sup>	7.3	21.9	ASD-A3-1021	7.3	24.75
	ECMC-E 2000 rpm		Single-/ Three-phase	1000	ECMC-E <sup>1</sup> 1310 <sup>2</sup> <sup>3</sup>	5.6			
		1500		ECMC-E <sup>1</sup> 1315 <sup>2</sup> <sup>3</sup>	8.3	24.9	ASD-A3-1521	8.30	35.36
		2000		ECMC-E <sup>1</sup> 1320 <sup>2</sup> <sup>3</sup>	11.01	33	ASD-A3-2023	13.40	53.03
		2000		ECMC-E <sup>1</sup> 1820 <sup>2</sup> <sup>3</sup>	11.22	33.7			
		3000		ECMC-E <sup>1</sup> 1830 <sup>2</sup> <sup>3</sup>	16.1	48.3			
	ECMC-F 1500 rpm	Three-phase	3000	ECMC-F <sup>1</sup> 1830 <sup>2</sup> <sup>3</sup>	19.4	58.2	ASD-A3-3023	19.40	70.71
High inertia	ECM-A3H 3000 rpm	Single-/ Three-phase	50	ECM-A3H-C <sup>1</sup> 040F <sup>2</sup> <sup>3</sup> 1	0.67	2.68	ASD-A3-0121	0.9	3.54
			100	ECM-A3H-C <sup>1</sup> 0401 <sup>2</sup> <sup>3</sup> 1	0.9	3.52			
			200	ECM-A3H-C <sup>1</sup> 0602 <sup>2</sup> <sup>3</sup> 1	1.45	5.7	ASD-A3-0221	1.55	7.07
			400	ECM-A3H-C <sup>1</sup> 0604 <sup>2</sup> <sup>3</sup> 1	2.65	10.2	ASD-A3-0421	2.6	10.61
			400	ECM-A3H-C <sup>1</sup> 0804 <sup>2</sup> <sup>3</sup> 1	2.6	9.4			
			750	ECM-A3H-C <sup>1</sup> 0807 <sup>2</sup> <sup>3</sup> 1	4.5	16.6	ASD-A3-0721	5.1	21.21
	ECMC-F 1500 rpm	Single-/ Three-phase	850	ECMC-F <sup>1</sup> 1308 <sup>2</sup> <sup>3</sup>	7.1	19.4	ASD-A3-1021	7.3	24.75
			1300	ECMC-F <sup>1</sup> 1313 <sup>2</sup> <sup>3</sup>	12.6	38.6	ASD-A3-2023	13.40	53.03
			1800	ECMC-F <sup>1</sup> 1318 <sup>2</sup> <sup>3</sup>	13	36			

Note: In the servo motor model name, <sup>1</sup> signifies the encoder type; <sup>2</sup> signifies brake or keyway / oil seal type; <sup>3</sup> signifies the shaft diameter.

1

### 1.4 Description of the drive interface



No.	Description	No.	Description
(1)	7-segment display	(9)	Ground terminal: Connects to grounding wire of power supply and servo motor.
(2)	CHARGE: Power indicator	(10)	CN10 – STO (Safety Torque Off)
(3)	CN4 - Mini USB connector: Connects to PC	(11)	RST main circuit terminal: Connects to the commercial power source (AC200 ~ 230 V, 50 / 60 Hz)
(4) (5)	CN12, CN11: Reserved	(12)	L1c / L2c control circuit terminal: For single-/three-phase power supply (200 ~ 230 V <sub>AC</sub> , 50 / 60 Hz)
(6)	CN3 - RS-485 and high speed communication connector: Connects to controller and communication ports.	(13)	Heat sink: For securing the servo drive and heat dissipation.
(7)	CN1 - I/O signal interface: Connects to PLC and controls I/O	(14)	CN5 - Connector for transmitting feedback signals
(8)	CN2 - Encoder connector: Connects to the encoder	(15)	UVW motor power output: Connects to motor power connector (UVW). Do not connect it with power of the main circuit. Wrong wiring will damage the servo drive.
(16)	Regenerative resistor: <ul style="list-style-type: none"> <li>a. Apply external regenerative resistor: P3 and C contacts connect to the resistor; P3 and D contacts are open circuited.</li> <li>b. Apply built-in regenerative resistor: P3 and C contacts are open circuited; P3 and D contacts are short circuited.</li> <li>c. Apply external regenerative brake unit: P2 and ⊖ contacts connect to the brake unit; P3 &amp; C contacts and P3 &amp; D contacts are open circuited.</li> </ul>		



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1

# Installation

# 2

Please follow the instruction mentioned in this chapter during installation. Information about specification of circuit breaker, fuse, EMI filter selection, and selection of regenerative resistor will be illustrated.

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2.1	Ambient condition of storage	2-2
2.2	Ambient condition of installation	2-3
2.3	Mounting direction and space	2-4
2.4	Safety precautions for using motors	2-6
2.5	Specifications of circuit breaker and fuse	2-8
2.6	Ferrite Ring	2-8
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2.7.1	EMI Filters	2-11
2.8	Selection of regenerative resistor	2-13
2.9	The use of brake	2-18

## 2

Safety precautions:

If the connection between the servo drive and servo motor is over 20 meters, please thicken the UVW connecting wire and the encoder cable. Please refer to section 3.1.6 Selection of wire rods, for the specification when selecting the wire rods.

## 2.1 Ambient condition of storage

Before installation, this product has to be kept in the shipping carton. In order to retain the warranty coverage and for the maintenance, please follow the instructions below for storage, if the product is not in use temporarily:

- Store the product within an ambient temperature range of  $-20^{\circ}\text{C}$  to  $+65^{\circ}\text{C}$ .
- Store the product within a relative humidity range of 0% to 90% and a non-condensing environment.
- Avoid storing the product in the environment of corrosive gas.

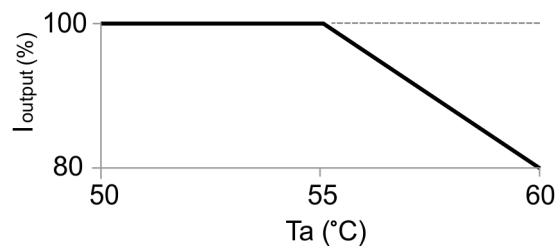
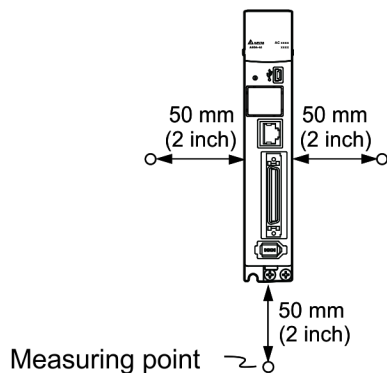
## 2.2 Ambient condition of installation



**A3 servo drive:** The ambient location should be free of over-heat device, water drop, vapor, dust and oily dust, corrosive and inflammable gas and liquid, airborne dust and metal particles, or vibration and electronic interference.

**Motor:** The ambient temperature of the motor is between 0°C and 40°C. The ambient conditions should be free of over-heat device, water drop, vapor, dust and oily dust, corrosive and inflammable gas and liquid, airborne dust and metal particles.

The ambient temperature of the servo drive should be between 0°C and 55°C. If the temperature is over 45°C, please place the product in a well-ventilated environment. During long-term operation, the ambient temperature should be under 45°C so that its performance can be ensured. If the product is installed in an electric box, make sure it is vertically mounted with a fan installed on the box. Allow 5 cm of clearance space beneath and both sides of the servo drive; its temperature shall be kept under 55°C and keep clear of the heat source. Make sure the size of the electric box and its ventilation condition will not overheat and endanger the internal electronic device. In addition, check if the machine's vibration will affect the electrical devices in the electric box.



I output (%) is the current output percentage % ; Ta is the operation temperature

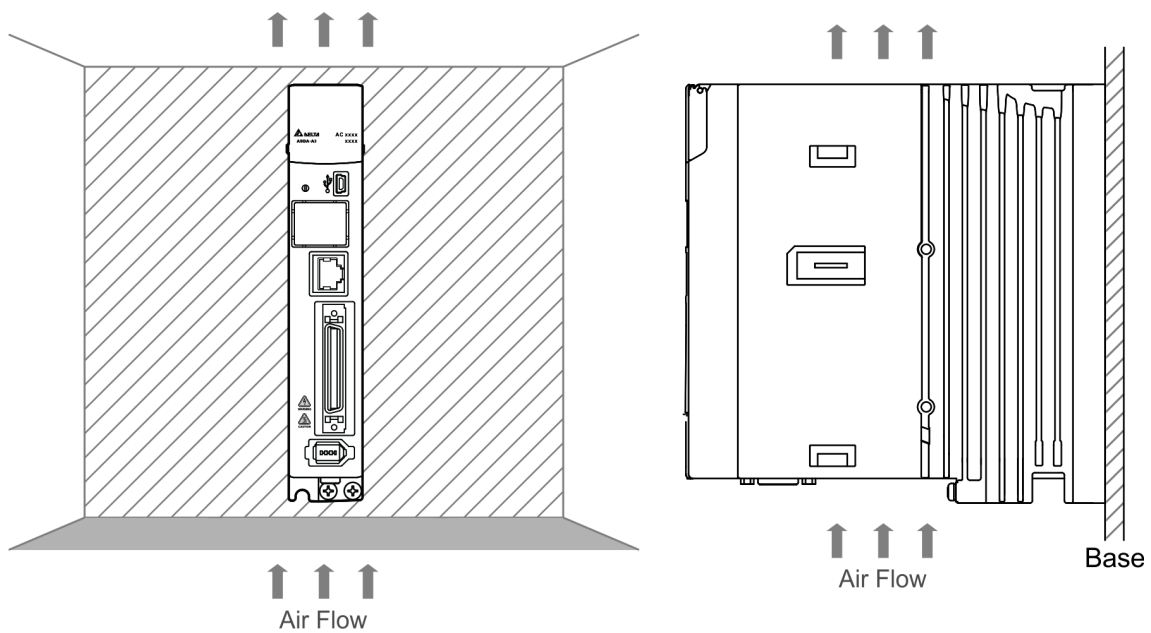
Note: The max. operation temperature of models of 750W (or above) is 60°C, but the output current will reduce as shown in the figure above; the max. operation temperature of models of 400W (or below) is 55°C

### 2.3 Mounting direction and space

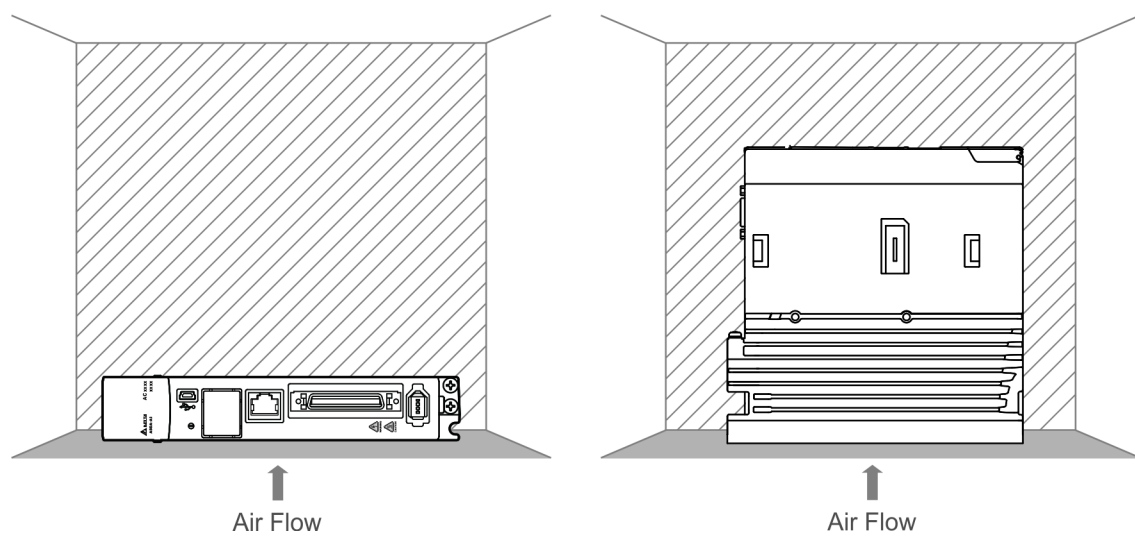
**Attention:**

- Mount the servo drive according to the illustration below. The base of heat sink has to be mounted vertically on the wall. Incorrect installation may result in a drive malfunction.
- For better ventilation and cooling, make sure sufficient space is given among the adjacent objects and wall; otherwise, product malfunction may occur.
- Do not obstruct the ventilation holes when mounting the servo drive. Correctly place it with the right direction or malfunction may occur.

2



Correct

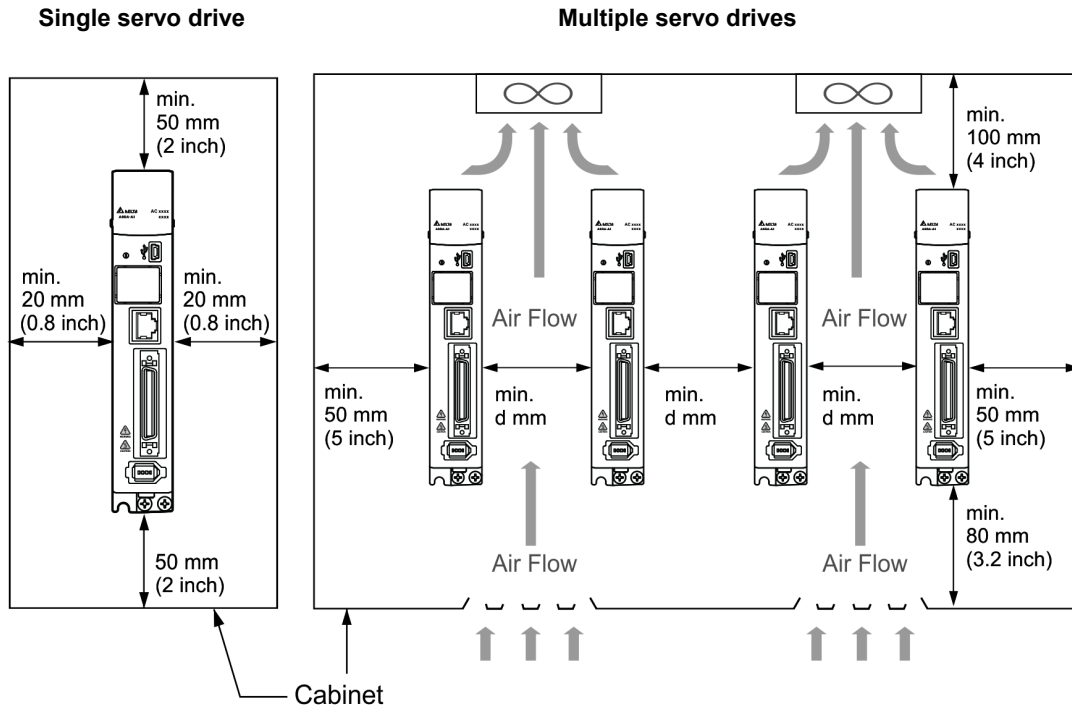


Incorrect

**Heat dissipation requirements:**

In order to have adequate air flow and better ventilation, please follow the suggested clearance value when installing one or more than one servo drives. (Refer to the following diagrams). Avoid position one servo drive above one another. Keep the bottom of the servo drive clear because the generated heat will rise and result in higher temperature of the drives mounted above.

Note: The diagram below is not in equal proportion. Please refer to the annotation.



Servo drive model	Cooling method	Operation temperature (Ta) corresponding to min. clearance (d) *Due to the assembly tolerance, the min. clearance of the servo drive is 1 mm.
ASD-A3-0121-□ ASD-A3-0221-□ ASD-A3-0421-□	Natural cooling	
ASD-A3-0721-□ ASD-A3-1021-□ ASD-A3-1521-□ ASD-A3-2021-□	Natural cooling & forced cooling	

Note: The max. operation temperature of models of 750W (or above) is 60 °C, but the output current will reduce as shown in the figure above; the max. operation temperature of models of 400 W (or below) is 55 °C.



## 2

## 2.4 Safety precautions for using motors

Delta AC servo motor is designed for industrial applications. Fully understanding the contents of motor specifications and operation manual is necessary. For your safety and correct usage, please carefully read the manual, specifications, and precautions of the motor before applying the motor to any equipment.

The safety precautions are as follows:

### Handling, mounting, and storage

- When removing or placing a servo motor, please hold the whole motor instead of pulling the cable or holding the shaft solely.
- Do not hit the motor shaft. Such force will damage the encoder that is attached at the rear side of shaft.
- The axial or radial load shall be kept within the allowable range mentioned in the specifications.
- The shaft of servo motor is neither water-proof nor oil-proof. Do not use, install, or store the servo motor in a humid environment which contains water drops, oil, corrosive gases, or liquids.
- The material of motor shaft is not rust-proof. Although the rust-proof oil has been applied to the shaft during manufacturing process, users have to check the shaft condition and apply the rust-proof oil every 3 months if the storage time is over 6 months.
- Ensure that the ambient environment for storing the servo motor conforms to the specifications mentioned in the instruction sheet.
- As a delicate encoder is attached to the motor, please take necessary measurements to avoid electric interference, vibration, and abnormal temperature change.

### Wiring

- If the current exceeds the max. current specified in the Specifications, the internal parts of the motor may lose the magneticity. Please contact the distributor or the local sales representative of Delta if this problem occurs.
- Please check that the motor wiring and voltage of brake are correct. And make sure the wiring of signal cable and power cable that connect to the encoder is correct. Incorrect wiring will lead to abnormal operation of motor, malfunction, or damage.
- To avoid capacitive coupling and noise, isolate the motor power cable from the encoder power cable and signal cable. Do not connect them to the same circuit.
- The AC servo motor shall be correctly grounded.

- The encoder connector shall not undergo any high-voltage component test as the encoder will be damaged.
- When the motor or brake is undergoing high-voltage component tests, please cut off the power supply of the controller. This kind of test shall be done only when necessary so as to keep the product lifespan.

### Operation

- The operation of AC servo motor is controlled by the servo drive. Do not directly connect the commercial type power source (100/200V, 50/60 Hz) to the circuit of the servo motor; otherwise, the motor cannot operate normally and thus permanent damage may occur.
- Observe the motor specifications when using the product. The motor's operation temperature shall not exceed the specified range.
- The material of motor shaft is not rust-proof. To ensure a longer motor life, please properly apply the rust-proof oil during operation period.
- The built-in brake is for clamping the motor. Do not use it for stopping the motor operation. Caution: The built-in brake is not a device for safely stopping the machine; please install another safety stopping device on the machine. When the built-in brake is clamping the motor, rotation backlash can still occur and the max. degree is 1 ~ 2°. When the motor with brake runs, the brake lining sometimes generates noise (swishing or clicking sound). It is caused by the structure of brake module instead of malfunction. And this noise will not affect the motor's function.
- If any smell, noise, smoke, vapor, or abnormal vibration is found, please stop the motor and turn off the power immediately.

### Others

- Delta servo motor has no frequent wear and tear parts.
- Do not disassemble the motor or change its parts or the warranty will be void.
- Do not disassemble the motor by yourself or permanent damage or malfunction of the motor may occur.
- Do not splash any water drop or oil drop on the product.

## 2

## 2.5 Specifications of circuit breaker and fuse

Servo drive model	Circuit breaker	Fuse (Class T)
ASD-A3-0121-□	5A	5A
ASD-A3-0221-□	5A	5A
ASD-A3-0421-□	10A	10A
ASD-A3-0721-□	10A	20A
ASD-A3-1021-□	15A	25A
ASD-A3-1521-□	20A	40A
ASD-A3-2023-□	30A	50A
ASD-A3-3023-□	30A	70A

Note:

- in the servo drive model name signifies model type.
- Operation mode: General.
- If the servo drive is equipped with residual-current circuit breaker for electricity leakage protection, to avoid wrong operation of the RCD, please select the one with sensitivity of at least 200 mA and with minimum 0.1 sec working time.
- Select Type B residual-current circuit breaker (with time delay) ONLY as the system ground wire may contain DC electricity.
- Please use the circuit breaker and fuse that comply with UL / CSA standard.

## 2.6 Ferrite Ring

The movable or round-shaped ferrite ring is usually made of Mn-Zn ferrite. The impedance of ferrite ring varies with frequencies. Normally, its impedance is relatively small to low-frequency signal; however, once the frequency of the signal is increased, the impedance may increase dramatically. With the characteristic of optimizing signal transmission and suppressing high-frequency noise, ferrite ring can perfectly tackle the high-frequency interference in power cable and signal cable.

Ferrite ring model	Applicable servo drive model
ASD-ACFC7K00	ASD-A3-4523-□, ASD-A3-5523-□, ASD-A3-7523-□, ASD-A3-1B23-□, ASD-A3-1F23-□
	ASD-A3-2043-□, ASD-A3-3043-□, ASD-A3-4543-□, ASD-A3-5543-□, ASD-A3-7543-□, ASD-A3-1B43-□, ASD-A3-1F43-□

Note: □ in the servo drive model name signifies model type.

### Installation precautions

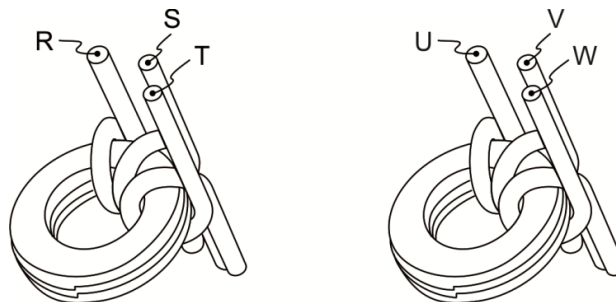
Ferrite ring is commonly applied as peripheral devices (such as controller) are interfered by noises from conduction and radiation when servo motor is in servo-on state. The parasitic capacitance between the cables in wiring panel and the grounding is small. As the frequency of the signal increases (Servo On), the resistance of the parasitic capacitance becomes small enough to let the common-mode current flow through. Normally, common-mode current only flows and leads to common-mode interference due to unstable circuit caused by poor connection between power circuit and grounding. If the common-mode current flows through the external cables, common-mode interference may also happen due to electrical interference caused by unstable electric potential.

Ferrite ring is able to cause eddy current losses to high-frequency signal and transform it into heat losses when suppressing common-mode interference. At that time, ferrite ring acts as a low-pass filter to effectively suppress high-frequency noise and ensure the stability of the circuit while the impedance to low-frequency signal is relatively small.

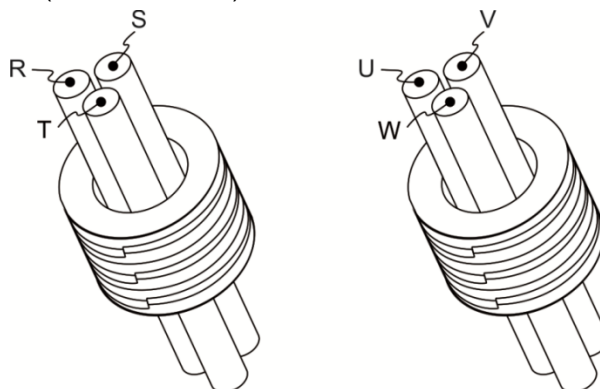
Winding wires onto ferrite ring for several times can increase inductance and the effect of filtering out high-frequency noise.

The suggested winding methods are as below:

1. For A3-220V model (4.5 kW ~ 7.5 kW)



2. For A3-220V model (11 kW ~ 15 kW)



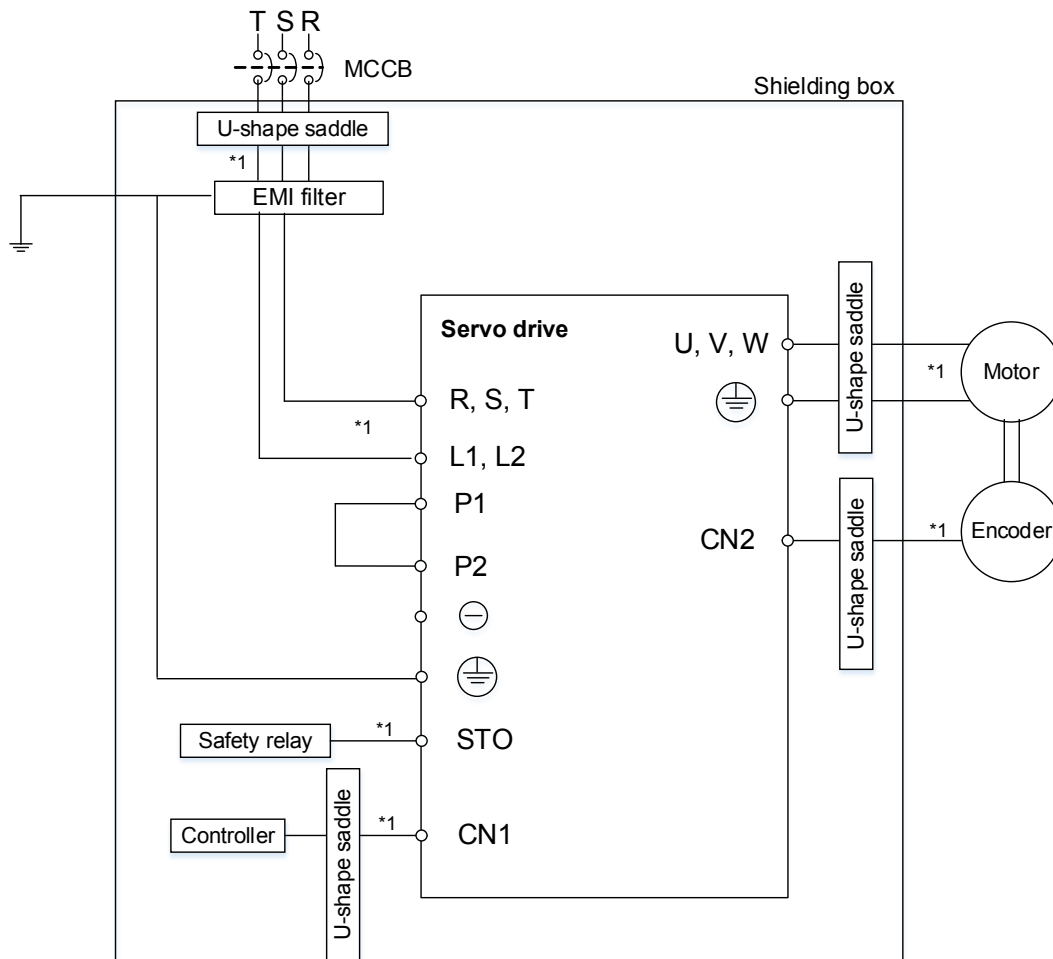
Note:

1. Please refer to section 3.1.4 for the selection of motor power cable.
2. Only motor power cable or power cable are allowed to run through ferrite ring. If needed, please prepare extra ferrite ring for grounding.
3. EMI filter may be required for absorbing radiation when longer motor power cable is used.

# 2

## 2.7 Installation requirement of EMC

This section illustrates the installation requirement for passing the EMC test. Please note that the EMC rating will vary based on the installation structure or wiring. Delta servo products are designed to conform to the specifications of the EMC test. Please refer to the following diagram for standard installation.



Note:

\*1. Please use shielded wires.

### 2.7.1 EMI filters

All electronic equipment (including servo drives) generates high or low frequency noise during operation, which will interfere with the peripheral equipment through conduction or radiation. With EMI filter and the correct installation, much interference can be eliminated. In order to have a better performance, using Delta's EMI filter to suppress the interference is recommended.

Power	Servo drive model	Recommended EMI filter		Foot print
		1PH	3PH	
100 W	ASD-A3-0121-□	RF007S21AA	RF022B43AA	N
200 W	ASD-A3-0221-□	RF007S21AA	RF022B43AA	N
400 W	ASD-A3-0421-□	RF007S21AA	RF022B43AA	N
750 W	ASD-A3-0721-□	RF007S21AA	RF037B43BA	N
1000 W	ASD-A3-1021-□	RF007S21AA	RF037B43BA	N
1500 W	ASD-A3-1521-□	RF015B21AA	RF037B43BA	N
2000 W	ASD-A3-2023-□	-	RF037B43BA	N
3000 W	ASD-A3-3023-□	-	RF037B43BA	N

Note: □ in the servo motor model name signifies the model type.

#### General precautions for installation

To ensure the best performance of EMI filter, apart from the instructions on installation and wiring of servo drive, please observe the precautions below:

1. The servo drive and EMI filter should be mounted on the same metal plate.
2. The wiring should be as short as possible.
3. The metal plate should be well grounded.

More specifications for mounting the servo drive is as follows.

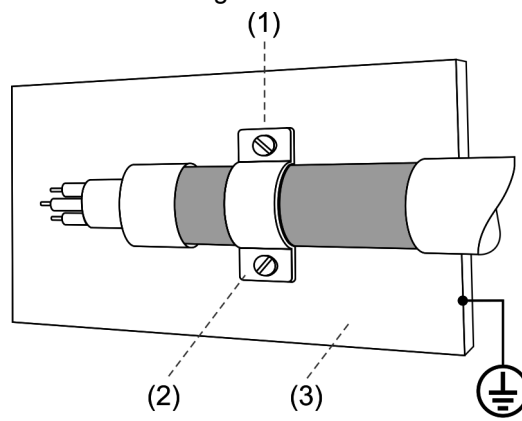
1. EN61000-6-4 (2001)
2. EN61800-3 (2004) PDS of category C2
3. EN55011+A2 (2007) Class A Group 1

## 2

**Motor cable selection and installation precautions**

The selection of motor cables (please refer to Appendix B Accessories) and installation will determine the performance of EMI filter. Please follow the precautions below.

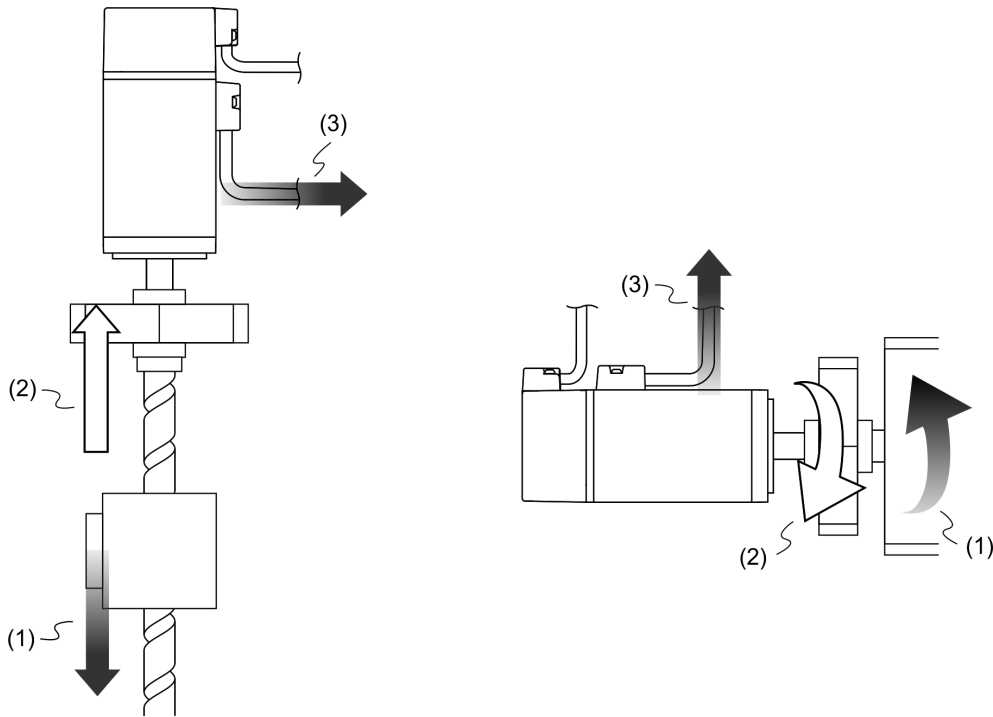
1. Use the cable that has braid shielding (The effect of double shielding is better)
2. The shield on both sides of the motor cable should be grounded with the shortest cable length and the largest contact area.
3. Remove the protective paint of the U-shape saddle and metal plate in order to ensure good contact. Please see the figure below.
4. It requires correct connection between the braided shielding of the motor cable and the metal plate. The braided shielding on both sides of the motor cable should be fixed by the U-shape saddle and metal plate. Please see the figure below for the correct connection.



- (1) The protective paint of the U-shape saddle and metal plate should be removed in order to ensure good contact.
- (2) U-shape saddle
- (3) Well-grounded metal plate

## 2.8 Selection of regenerative resistor

When the direction of torque is different from that of rotation, it means the energy generated will return to the servo drive from the load. This energy that is translated into electricity will be filled in the capacitance of DC Bus and thus the voltage becomes higher. When the voltage reaches a given value, this reversed electricity will be consumed by a regenerative resistor. The servo drive has a built-in regenerative resistor. Users can also use the external regenerative resistor if needed.



(1) Moving direction of the object; (2) Direction of torque; (3) Regenerative energy

The built-in regenerative resistor of ASDA-A3 is as follows:

Servo drive (kW)	Specification of built-in regenerative resistor		Capacity of built-in regenerative resistor (Watt)	Minimum allowable resistance (Connected to external resistor) (Ohm)
	Resistance (P1.052) (Ohm)	Capacity (P1.053) (Watt)		
0.1	-	-	-	60
0.2	-	-	-	60
0.4	100	40	20	60
0.75	100	40	20	60
1.0	100	40	20	30
1.5	100	40	20	30
2.0	20	80	40	15
3.0	20	80	40	15

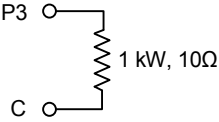
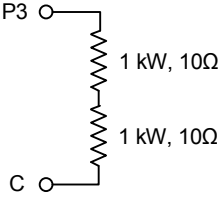
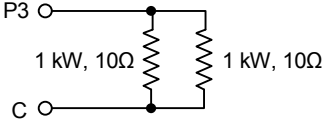


# 2

When the regenerative resistor exceeds the capacity of built-in regenerative resistor, an external regenerative resistor should be applied. Please pay special attention to the following when using the regenerative resistor.

1. Please correctly set up the resistance (P1.052) and capacity (P1.053) of regenerative resistor. Or it might influence the function performance.
2. When applying an external regenerative resistor, please note that its resistance has to be greater than the resistance of the built-in regenerative resistor. For general application, more than one resistor will be serial connected. If the value (from serial connected resistors) exceeds the setting range, users can reduce the value by parallel connecting the resistor. If users desire to connect it in parallel to increase the power of regenerative resistor, please make sure the capacitance meets the requirements.

See the following diagram and settings for serial / parallel connection of the regenerative resistors.

<p>Connect to one external regenerative resistor</p> 	<p>Settings:</p> <p>P1.052 = 10 (Ω)</p> <p>P1.053 = 1000 (W)</p>
<p>Connect to external regenerative resistors (serial connection)</p> 	<p>Settings:</p> <p>P1.052 = 20 (Ω)</p> <p>P1.053 = 2000 (W)</p>
<p>Connect to external regenerative resistors (parallel connection)</p> 	<p>Settings:</p> <p>P1.052 = 5 (Ω)</p> <p>P1.053 = 2000 (W)</p>

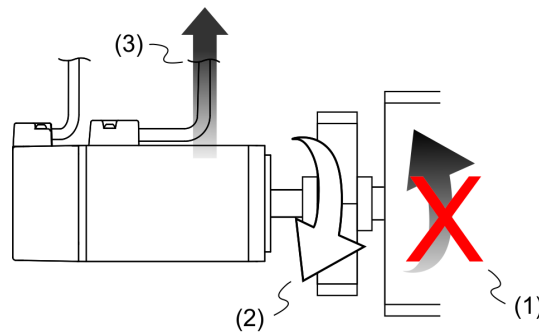
3. In natural environment, if the capacity of regenerative resistor (the average value) is within the rated capacity, the temperature of the capacitance will increase to 120°C or even higher (under the condition of regenerative energy continues to exist). For safety concerns, please apply the method of forced cooling in order to reduce the temperature of regenerative resistor. Or, it is suggested to use the regenerative resistor which is equipped with thermal switches. Please contact the distributors for load characteristics of the regenerative resistor.

When an external regenerative resistor is applied, the resistor should connect to P3, C terminal and the contact of P3, D terminal should be open circuited. It is recommended to choose the above mentioned resistance. For easy calculation of regenerative resistor capacity, except the energy consumed by IGBT, two ways are provided to select the capacity according to the selected linear motor or rotary motor.

**Rotary Motor:**

Selection of the regenerative power

(a) When there is no external torque



(1) Moving direction of the object; (2) Force direction of the motor;  
 (3) Regenerative power generated while the motor decelerates

If the motor is making reciprocate motion, the regenerative resistor will consume the spare energy. The regenerative resistor can be selected with two ways: calculation of the regenerative power and easy selection. Users can refer to the following table when calculating and selecting the required regenerative resistor.

Servo drive (kW)	Motor	Rotor inertia (× 10 <sup>-4</sup> kg.m <sup>2</sup> )	Generative power generated when the motor decelerates from 3000 rpm to 0 without load Eo (joule)	Max. regenerative power of the capacitance Ec (joule)
Low inertia	0.05 ECM-A3L-C1040F231	0.0231	0.11	8.42
	0.1 ECM-A3L-C10401231	0.0405	0.20	8.42
	0.2 ECM-A3L-C10602231	0.09	0.45	8.42
	0.4 ECM-A3L-C10604231	0.15	0.74	8.42
	0.4 ECM-A3L-C10804231	0.352	1.76	8.42
	0.75 ECM-A3L-C10807231	0.559	2.54	26.21
Medium inertia	1.0 ECMC-C1101023	2.65	13.1	26.21
	1.0 ECMC-E1131023	8.41	18.48	26.21
	1.5 ECMC-E1131523	11.2	24.62	26.21
	2.0 ECMC-E1132023	14.6	32.09	34.94
	2.0 ECMC-E1182023	34.7	76.26	34.94
	3.0 ECMC-E1183023	55	120.88	34.94

2

Servo drive (kW)	Motor	Rotor inertia (× 10 <sup>-4</sup> kg.m <sup>2</sup> )	Generative power generated when the motor decelerates from 3000 rpm to 0 without load Eo (joule)	Max. regenerative power of the capacitance Ec (joule)	
3.0	ECMC-F <sup>1</sup> 1830 <sup>2</sup> <sup>3</sup>	55	67.99	34.94	
High inertia	0.05	ECM-A3H-C <sup>1</sup> 040F <sup>2</sup> <sup>3</sup> 1	0.043	0.21	8.42
	0.1	ECM-A3H-C <sup>1</sup> 0401 <sup>2</sup> <sup>3</sup> 1	0.0742	0.37	8.42
	0.2	ECM-A3H-C <sup>1</sup> 0602 <sup>2</sup> <sup>3</sup> 1	0.25	1.24	8.42
	0.4	ECM-A3H-C <sup>1</sup> 0604 <sup>2</sup> <sup>3</sup> 1	0.45	2.23	8.42
	0.4	ECM-A3H-C <sup>1</sup> 0804 <sup>2</sup> <sup>3</sup> 1	0.914	4.55	8.42
	0.75	ECM-A3H-C <sup>1</sup> 0807 <sup>2</sup> <sup>3</sup> 1	1.51	7.47	26.21
	0.85	ECMC-F <sup>1</sup> 1308 <sup>2</sup> <sup>3</sup>	13.6	16.81	26.21
	1.3	ECMC-F <sup>1</sup> 1313 <sup>2</sup> <sup>3</sup>	20	24.73	26.21
	1.8	ECMC-F <sup>1</sup> 1318 <sup>2</sup> <sup>3</sup>	24.9	30.78	26.21

Note:

1. <sup>1</sup> in the servo motor model name signifies the encoder type.
2. <sup>2</sup> in the servo motor name signifies brake or keyway / oil seal type.
3. <sup>3</sup> in the servo motor model name signifies shaft diameter.
4. The \* mark signifies that the model is coming soon.

Assume that the load inertia is N times of the motor inertia, and when motor decelerates from 3000 rpm to 0, the regenerative power will be (N+1) × Eo and the regenerative resistor needs to consume (N+1) × Eo - Ec joule. Assume that the reciprocate operation cycle is T sec, then the required power of regenerative resistor = 2 × ( (N+1) × Eo - Ec ) / T. Calculation is as follows:

Step	What to do	Calculation and setting method
1	Set the capacity of the regenerative resistor to the maximum.	Set P1.053 to the maximum value
2	Set the operation cycle (T)	Manual input
3	Set the rotation speed (wr)	Manual input or read the status via P0.002
4	Set the load / motor inertia ratio (N)	Manual input or read the status via P0.002
5	Calculate the max. regenerative resistor (Eo)	$E_o = J \cdot \omega_r^2 / 182$
6	Set the regenerative power that can be absorbed by the capacitor (EC)	Refer to the table above
7	Calculate the required capacity of the regenerative resistor	$2 \times ( (N+1) \times E_o - E_c ) / T$

Example:

For the motor ECM-A3L-CY0604RS1 (400 W), the reciprocate motion cycle is T = 0.4 sec.  
Its maximum speed is 3000 rpm and the load inertia is 15 times of the motor inertia.

Servo drive (kW)	Motor	Rotary inertia J (× 10 <sup>-4</sup> kg.m <sup>2</sup> )	Generative power generated when the motor decelerates from 3000 rpm to 0 without load E <sub>0</sub> (joule)	Max. regenerative power of the capacitance E <sub>c</sub> (joule)
0.4	ECM-A3L-CY0604RS1	0.15	0.74	8.42

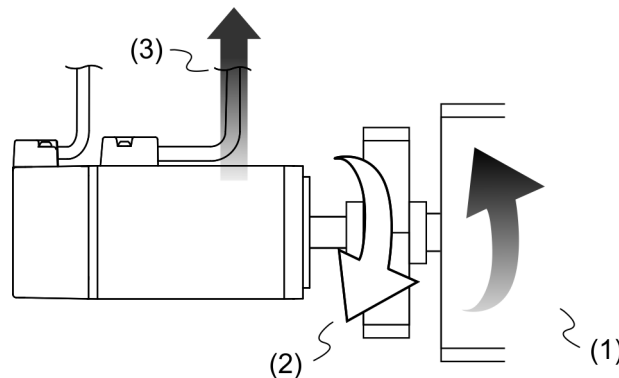
The max. regenerative power: E<sub>0</sub> = 0.74 joule (the result acquired from the table)

Set the regenerative power that can be absorbed by the capacitor; E<sub>c</sub> = 8.42 joule (the result acquired from the table).

$$\text{Required capacity of the regenerative resistor} = \frac{2 \times ((N+1) \times E_0 - E_c)}{T} = \frac{2 \times ((15+1) \times 0.74 - 8.42)}{0.4} = 17.1 \text{ W}$$

From the calculation above, the required power of regenerative resistance is 17.1 W, which is smaller than the dealing capacity. In this case, a built-in 40 W regenerative resistor will fulfill the need. In general, the built-in regenerative resistor can meet the requirement when the external load is not great.

(b) When there is external torque and the motor does the negative work.



(1) Moving direction of the object; (2) Force direction of the motor; (3) Regenerative power

Usually, the motor is for doing the positive work; the motor's torque direction is identical to rotation direction. However, in some occasion, the motor's torque direction is opposite to the rotation direction. This means the motor is doing the negative work and external power is inputting to the servo drive through the motor. For instance, if the external force direction is identical to the rotation direction (such as vertical downward motion of the mechanism), the servo system will output more power to counterbalance the excessive external load (the weight of vertical-mounted mechanism) in order to keep up with the specified target speed; meanwhile, considerable power will return to the servo drive. When DC Bus is full and cannot store more power, this power will be directed to the regenerative resistor to be consumed.

# 2

Example:

If a 400 W motor (ECM-A3L-CY0604RS1) is used and torque of the external load is +70% of the rated torque (1.27 N-m) with rotation speed up to 3000 rpm, the required external regenerative resistance will be:

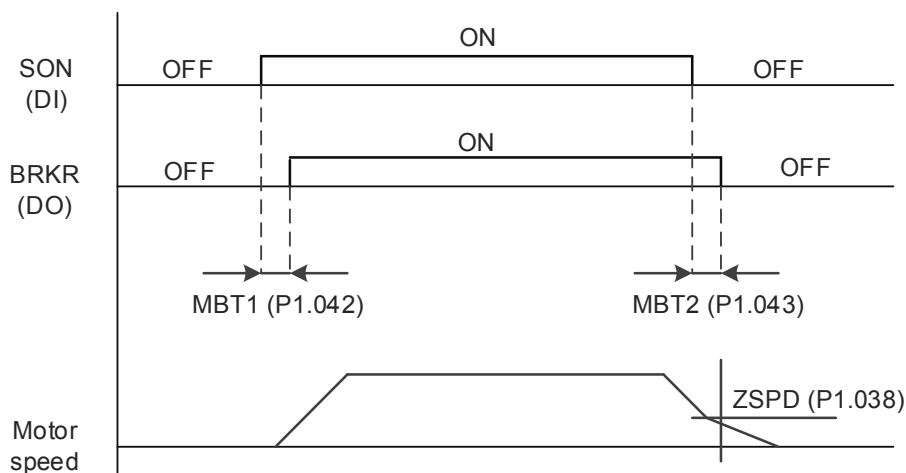
$$2 \times (0.7 \times 1.27) \times \left(\frac{3000 \times 2 \times \pi}{60}\right) = 558 \text{ W. So, a regenerative resistor of 560 W and } 40\Omega \text{ is selected.}$$

## 2.9 The use of brake

A brake is usually used for motions in Z-axis direction because of the gravity that causes the falling of mechanism. A brake can prevent the mechanism from falling off and greatly reduce motor's resistance output. It is because the motor lifespan could be reduced if it keeps outputting resistance and generating excessive heat. To avoid wrong operation, the brake can be enabled only when the servo is switched off.

How the servo drive controls the brake is via DO. If DO.BRKR is set to off, it means the brake is not operating and the motor is clamped. If DO.BRKR is set to on, it means the brake is operating and the motor can run freely. Users can use MBT1 (P1.042) and MBT2 (P1.043) to set the delay time.

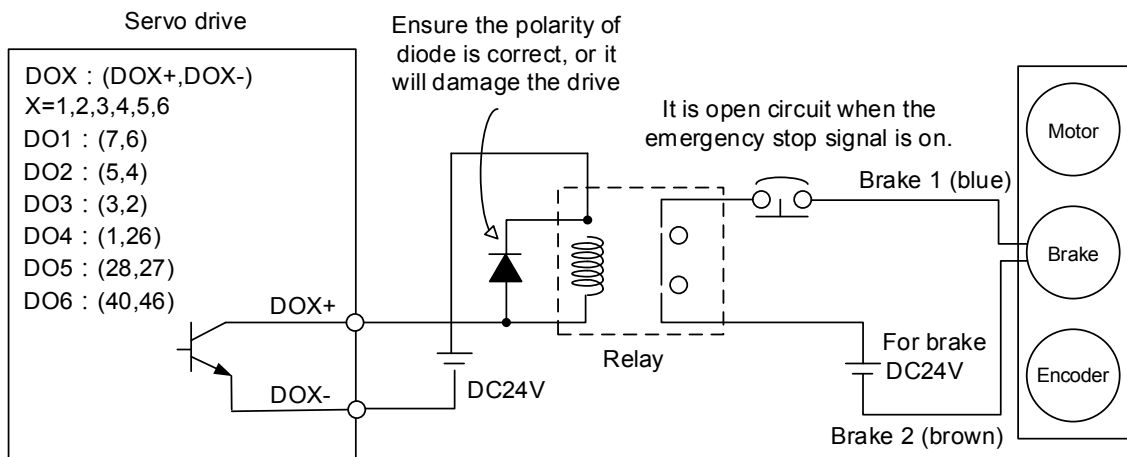
Timing diagram of brake control:



Output timing of the BRKR signal:

1. When the servo drive is off and the time set by P1.043 is up, but the motor speed is still higher than the setting speed of P1.038, DO.BRKR will be off. (The motor is clamped).
2. When the servo drive is off and the time set by P1.043 is not yet reached, but the motor speed is already lower than the setting speed of P1.038, DO.BRKR will be off. (The motor is clamped).

Wiring of the brake:

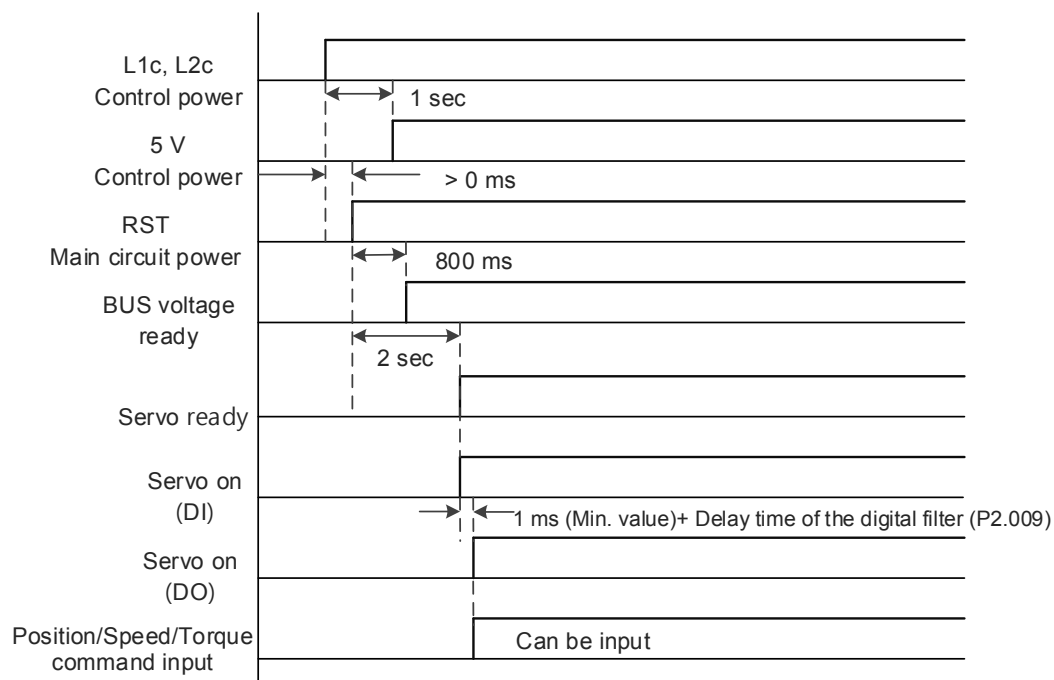


2

Note:

1. Please refer to Chapter 3 Wiring.
2. The brake signal controls the solenoid valve, providing power to the brake and enables the brake.
3. Please note that there is no polarity for the coil brake.

Timing diagram of control power and main power:



Calculation for the brake's rated current: (ECM-A3L-CY0604RS1 is used as an example here)

Power consumption of the brake (20°C) = 6.5 W (refer to Appendix A Motor specifications)

So, the brake's rated current =  $\frac{6.5 \text{ W}}{24 \text{ V}} = 0.27 \text{ A}$

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2

This chapter illustrates the electric circuit of power supply, connectors, and wiring for each mode of A3.

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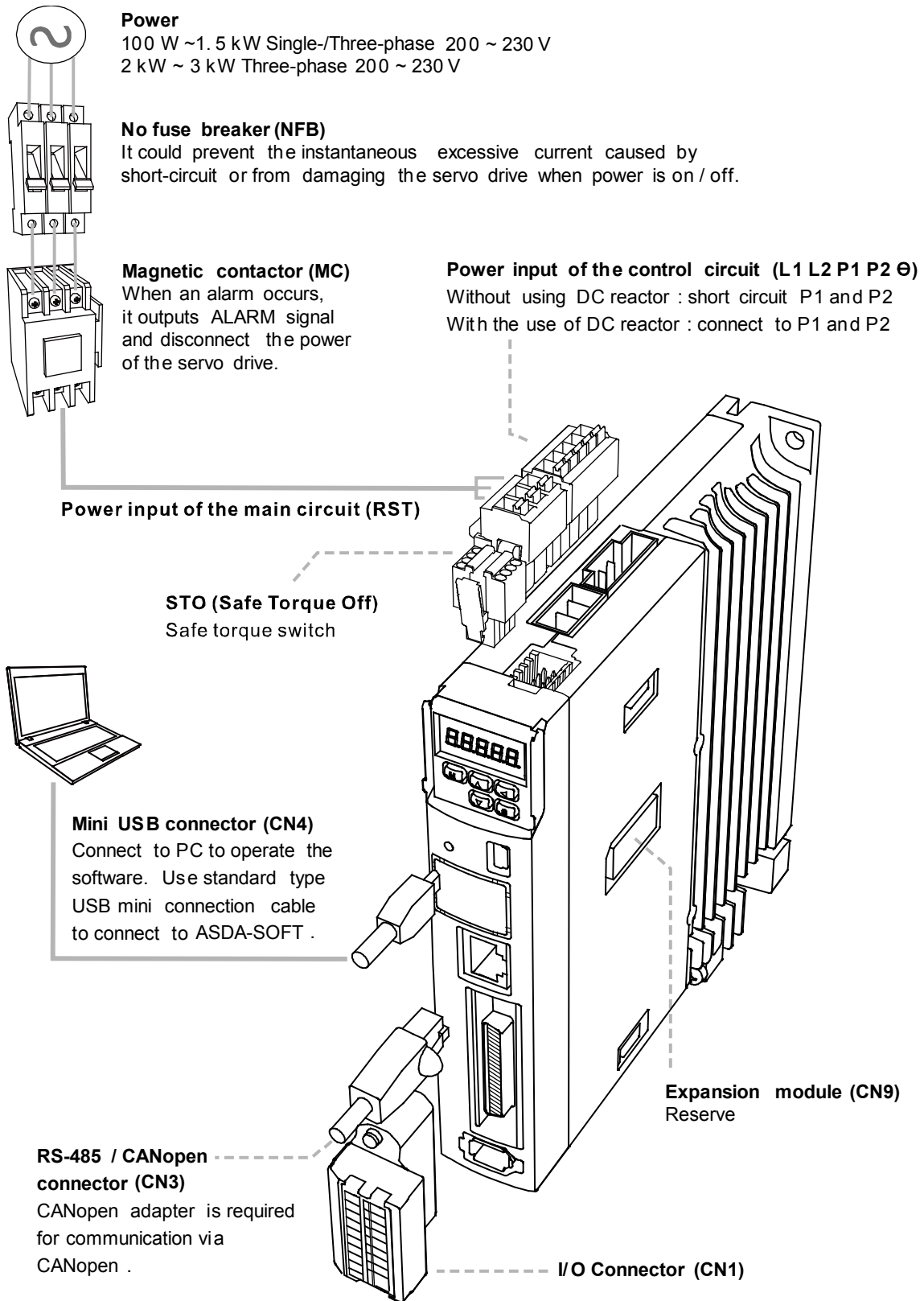
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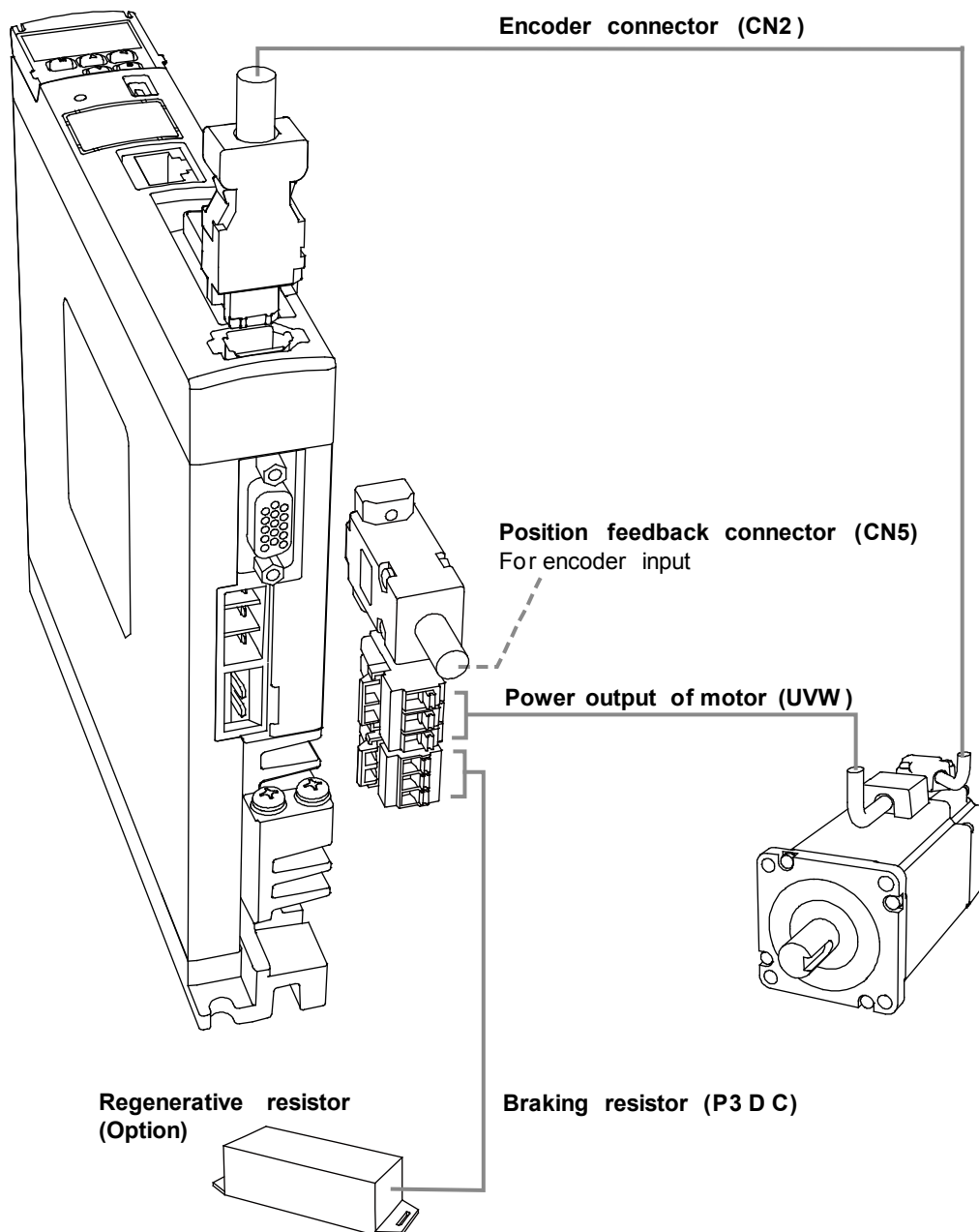
### 3.1 System connection

#### 3.1.1 Connecting to peripheral devices (connecting to Delta communication type of servo motor)



### Connecting to peripheral devices (connecting to Delta communication type of servo motor)







3



#### Installation safety precautions:

1. Make sure power and wiring among R, S, T, and L1, L2 are correct. Please refer to Appendix A Specifications of this user manual for voltage input to avoid any damage of the servo drive and danger.
2. Make sure the U, V, and W terminal block is correctly wired to avoid abnormal operation of the motor.
3. When applying the external regenerative resistor, the contact between P3 and D should be opened and the external regenerative resistor should connect to P3 and C. When applying the internal regenerative resistor, the contact between P3 and D should be short-circuited and the contact between P3 and C should be opened.
4. When an alarm occurs or the system is under emergency stop status, please use DO.ALARM or DI.WARN to disconnect the power of magnetic contactor (MC) so as to power off the servo drive.

## 3.1.2 Connectors and terminal blocks

Symbol	Name	Description													
L1, L2	Power input of the control circuit	Connect to single-phase AC power (Please refer to the specification of the model and input proper voltage.)													
P1, P2	Input of DC reactor	For harmonic suppression, if this function is not required, short-circuit P1 and P2.													
R, S, T	Power input of the main circuit	Connect to three-phase AC power (Please refer to the specification of the model and input proper voltage.)													
U, V, W FG	Motor power	Connect to the servo motor													
		<table border="1"> <thead> <tr> <th>Symbol</th> <th>Wire color</th> <th>Description</th> </tr> </thead> <tbody> <tr> <td>U</td> <td>Red</td> <td rowspan="3">Three-phase main power cable of the motor.</td> </tr> <tr> <td>V</td> <td>White</td> </tr> <tr> <td>W</td> <td>Black</td> </tr> <tr> <td>FG</td> <td>Green</td> <td>Connect to ground terminal  of the servo drive.</td> </tr> </tbody> </table>	Symbol	Wire color	Description	U	Red	Three-phase main power cable of the motor.	V	White	W	Black	FG	Green	Connect to ground terminal  of the servo drive.
		Symbol	Wire color	Description											
		U	Red	Three-phase main power cable of the motor.											
		V	White												
W	Black														
FG	Green	Connect to ground terminal  of the servo drive.													
P2, P3, D, C, 	Regenerative resistor terminal or braking unit	Use internal resistor	The contact between P3 and D end should be short-circuited; contact between P3 and C end should be opened.												
		Use external resistor	Connect P3 and C ends to the resistor and the contact between P3 and D end should be opened.												
		Use external braking unit	Connect the braking unit to P2 and  of the servo drive. Connection between P3 & D, and P3 & C should be opened.												
	Ground terminal	Connect to the ground wire of the power and servo motor.													
CN1	I/O connector (Optional)	Connect to the host controller. Please refer to section 3.3 for more information.													
CN2	Connector for encoder (Optional)	Connect to the encoder or conversion board. Please refer to section 3.4 for more information.													
CN3	Connector of RS-485 and CANopen (Optional)	For RS-485 and CANopen. Please refer to section 3.5 for more information.													
CN4	Mini USB connector (Optional)	Connect to PC or notebook. Please refer to section 3.6 for more information.													
CN5	Position feedback connector (Optional)	Connect to external linear scale or encoder for full-closed loop and motor feedback. Please refer to section 3.8 for more information.													
CN6	DMCNET connector (Optional)	For DMCNET communication. Please refer to section 3.8 for more information.													
CN9	Expansion module	Reserved													
CN10	STO	Connect to STO. Please refer to section 3.9 for more information.													
CN11	Reserved	Reserved													
CN12	Reserved	Reserved													

## 3

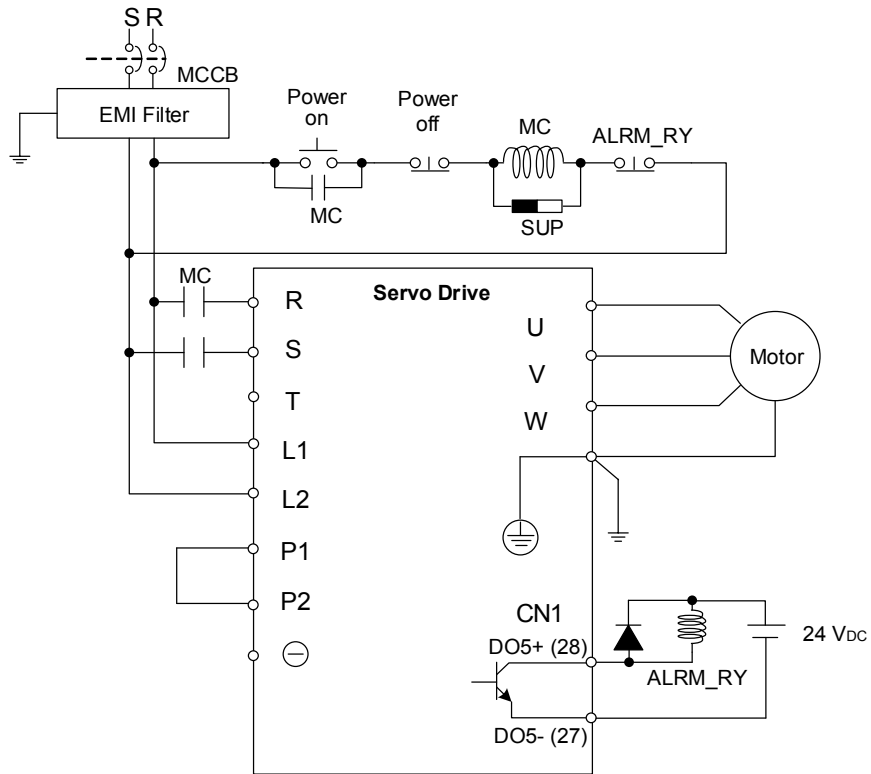
Pay special attention to the followings when wiring:

1. When the power is off, do not touch R, S, T and U, V, W since the capacitance inside the servo drive still contains huge amount of electric charge. Wait until the charging light is off.
2. Separate R, S, T and U, V, W from other wires. The interval should be at least 30 cm (11.8 inches).
3. If the connection cable for CN2 (encoder) or CN5 (position feedback) is not long enough, please use an AWG26 shielded twisted-pair cable which conforms to UL2464 specifications. If it is over 20 meters (65.62 ft), please choose a signal cable with diameter two times longer than AWG26 to avoid excessive signal attenuation.
4. When RS-485, CAN, and DMCNET are applied, please conduct the standard wiring with shielded twisted-pair cable to ensure the communication quality.
5. When selecting the wire rod, please refer to section 3.1.6.
6. Do not apply any external capacitors or it might damage the servo drive.

### 3.1.3 Wiring for power supply

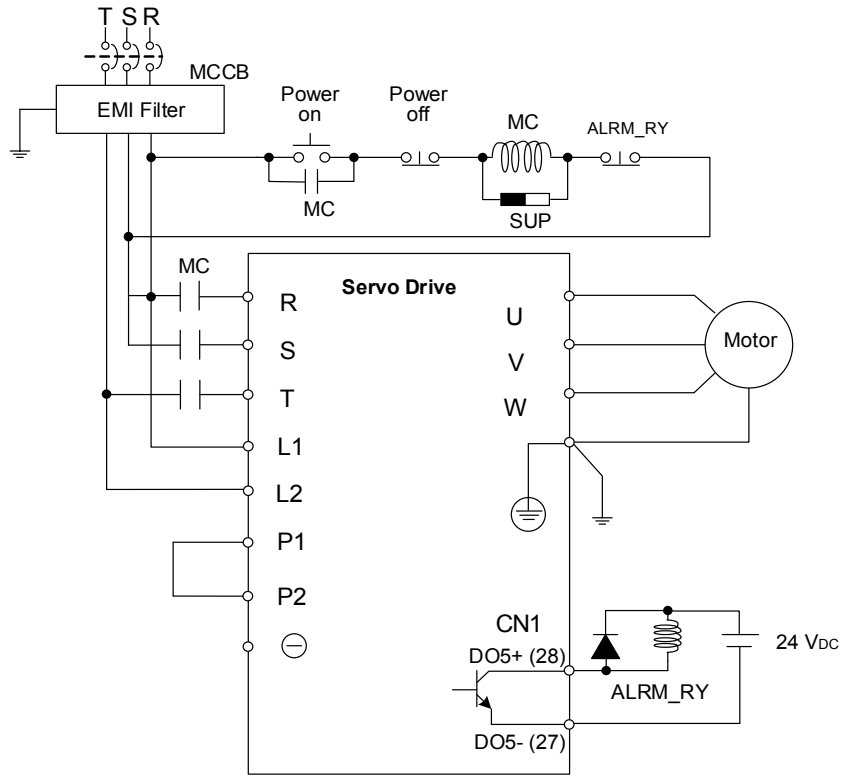
There are two types of wiring method for power supply, single-phase and three-phase. In the diagram below, Power On is normally open, Power Off and ALRM\_RY are normally closed. MC is power relay (magnetic contactor) and self-holding power and the contact of main power circuit.

- Wiring Method of Single-phase Power Supply (suitable for models of 1.5 kW and below)



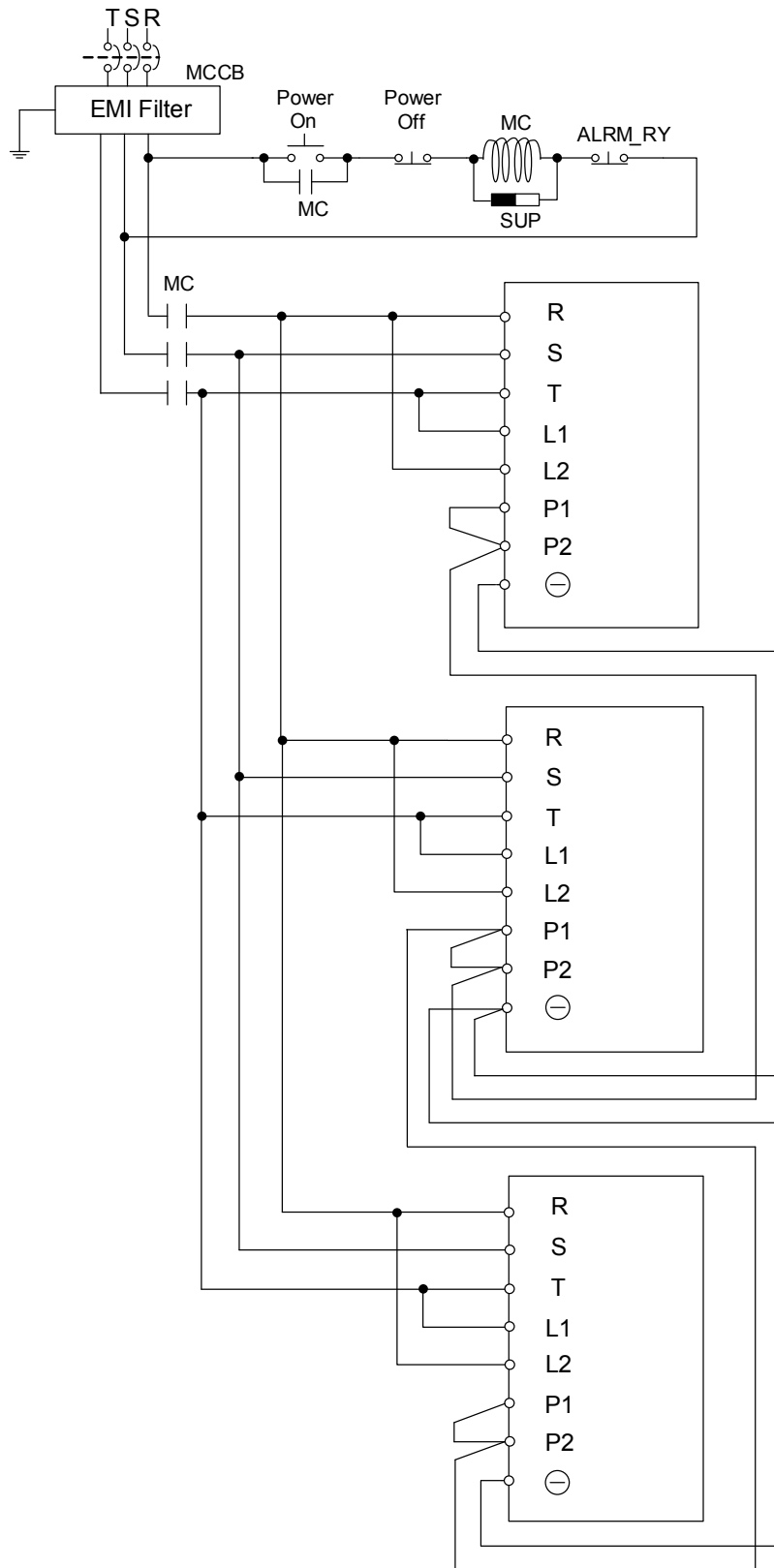
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■ Wiring Method of Three-phase Power Supply (suitable for all series)



- Connect multiple servo drives (serial connected)

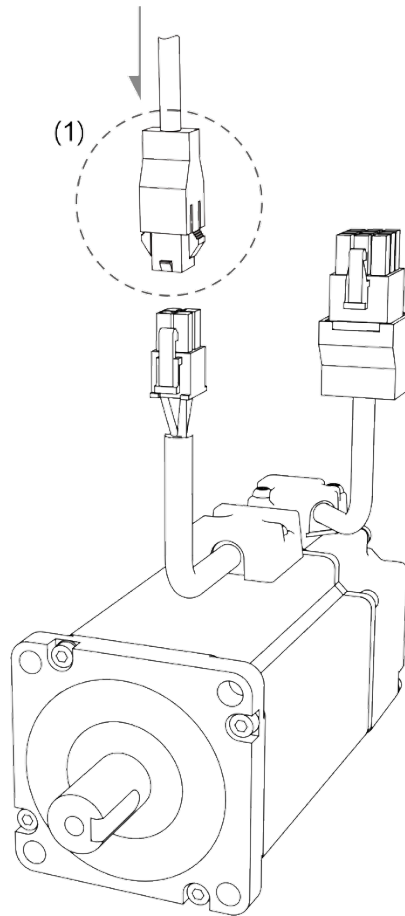
Common DC-BUS can increase the efficiency of regenerative power. For instance, while one of the axes is decelerating, the regenerative power can be supplied to other axes.





# 3

## 3.1.4 UVW connectors of ASDA-A3 servo drive



(1) Please refer to the following table for UVW connector specifications

Motor model	UVW connector					
ECM-A3 <sup>1</sup> -C <sup>2</sup> 040F (50W) ECM-A3 <sup>1</sup> -C <sup>2</sup> 0401 (100W) ECM-A3 <sup>1</sup> -C <sup>2</sup> 0602 (200W) ECM-A3 <sup>1</sup> -C <sup>2</sup> 0604 (400W) ECM-A3 <sup>1</sup> -C <sup>2</sup> 0804 (400W) ECM-A3 <sup>1</sup> -C <sup>2</sup> 0807 (750W)						
	Pin assignment					
	U (Red)	V (White)	W (Black)	CASE GROUND (Green)	BRAKE1 (Yellow)	BRAKE2 (Blue)
1	2	4	3	-	-	
ECM-A3 <sup>1</sup> -C <sup>2</sup> 040F (50W) ECM-A3 <sup>1</sup> -C <sup>2</sup> 0401 (100W) ECM-A3 <sup>1</sup> -C <sup>2</sup> 0602 (200W) ECM-A3 <sup>1</sup> -C <sup>2</sup> 0604 (400W) ECM-A3 <sup>1</sup> -C <sup>2</sup> 0804 (400W) ECM-A3 <sup>1</sup> -C <sup>2</sup> 0807 (750W)						
	U (Red)	V (White)	W (Black)	CASE GROUND (Green)	BRAKE1 (Yellow)	BRAKE2 (Blue)
	1	2	4	3	5	6

Motor model	UVW connector					
	Pin assignment					
	U (Red)	V (White)	W (Black)	CASE GROUND (Green)	BRAKE1 (Brown)	BRAKE2 (Blue)
	1	2	4	5	3	6
ECMC-F <sup>1</sup> 1308 (850 W) ECMC-C <sup>1</sup> 1010 (1000 W) ECMC-E <sup>1</sup> 1310 (1000 W) ECMC-F <sup>1</sup> 1313 (1300 W) ECMC-E <sup>1</sup> 1315 (1500 W) ECMC-F <sup>1</sup> 1318 (1800 W) ECMC-E <sup>1</sup> 1320 (2000 W)						
	Pin assignment					
	U (Red)	V (White)	W (Black)	CASE GROUND (Green)	BRAKE1 (Yellow)	BRAKE2 (Blue)
	F	I	B	E	G	H
ECMC-E <sup>1</sup> 1820 (2000 W) ECMC-E <sup>1</sup> 1830 (3000 W) ECMC-F <sup>1</sup> 1830 (3000 W)						
	Pin assignment					
	U (Red)	V (White)	W (Black)	CASE GROUND (Green)	BRAKE1 (Yellow)	BRAKE2 (Blue)
	D	E	F	G	A	B

Wire rod selection: Please use a 600 V PVC cable. If it is longer than 30 meters, refer to the voltage drop (wire impedance) to select the cable size. See section 3.1.6 for more information.

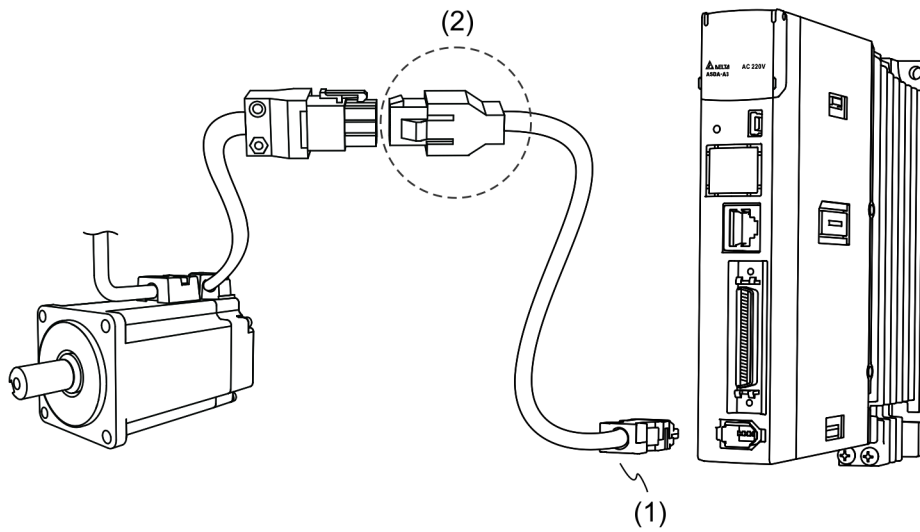
Note:

1. (□) in the motor model names represents brake or keyway / oil seal.
2. Coil of brake has no polarity. Its pin symbols are BRAKE 1 & BRAKE2.
3. Power supply for the brake is 24 Vdc. It is prohibited to share the same power supply with control signals.
4. (Δ) in the servo drive model represents the encoder type. When Δ = Y, the encoder type is absolute. (resolution of single turn: 24-bit; resolution of multi-turn: 16-bit)

### 3.1.5 Specification of encoder connector

#### Encoder connection (Diagram 1): Quick connector

3

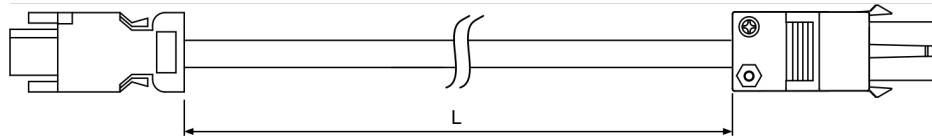


(1) CN2 connector (2) Quick connector (Male)

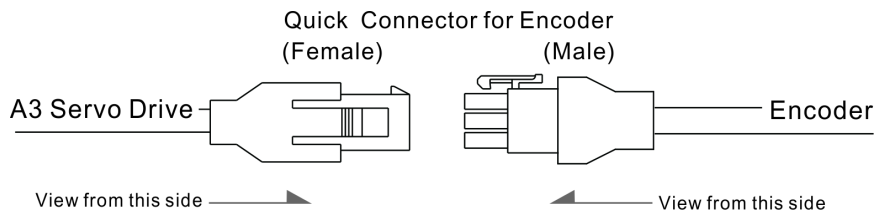
Note: The diagram shows the connection between the servo drive and the encoder, which is not drawn by actual scale. The specification is subject to change according to the selected servo drive and motor models.

Motor model	Quick connector (Male)
ECM-A3 <sup>1</sup> -C <sup>2</sup> 040F (50 W)	
ECM-A3 <sup>1</sup> -C <sup>2</sup> 0401 (100 W)	
ECM-A3 <sup>1</sup> -C <sup>2</sup> 0602 (200 W)	
ECM-A3 <sup>1</sup> -C <sup>2</sup> 0604 (400 W)	
ECM-A3 <sup>1</sup> -C <sup>2</sup> 0804 (400 W)	
ECM-A3 <sup>1</sup> -C <sup>2</sup> 0807 (750 W)	

Specifications and Pin assignment of incremental encoder connector:



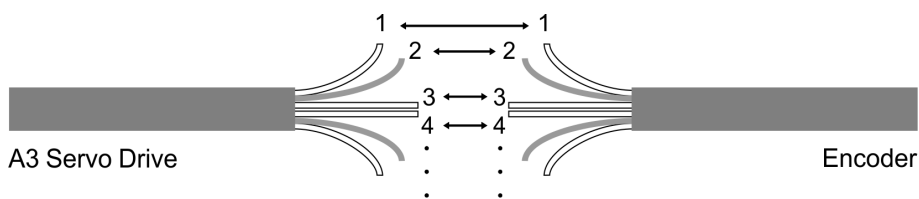
Title	Model name	L	
		mm	inch
1	ACS3-CAEN1003	3000 ± 100	118 ± 4
2	ACS3-CAEN1005	5000 ± 100	197 ± 4



1 White T+	2 Black Reserved	3 Reserved
4 White/Red T-	5 Red/Black Reserved	6 Reserved
7 Brown DC+5V	8 Blue GND	9 Shield

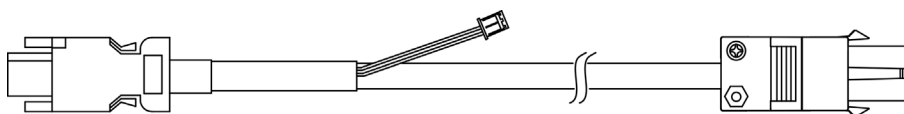
3 Reserved	2 Black Reserved	1 White T+
6 Reserved	5 Red/Black Reserved	4 White/Red T-
9 Shield	8 Blue GND	7 Brown DC+5V

The wire color of the ASDA-A3 servo drive is for reference only. Please refer to the actual object.



To directly wire the cores without housing, please wire them according to the corresponding core number. For example, connect core No. 1 of the servo drive to No. 1 of the motor encoder; connect core No. 2 of the servo drive to core No. 2 of the motor encoder and so on. Please number the cores of the servo drive in sequence and then connect them to the encoder.

Specification and Pin assignment of absolute encoder connector:

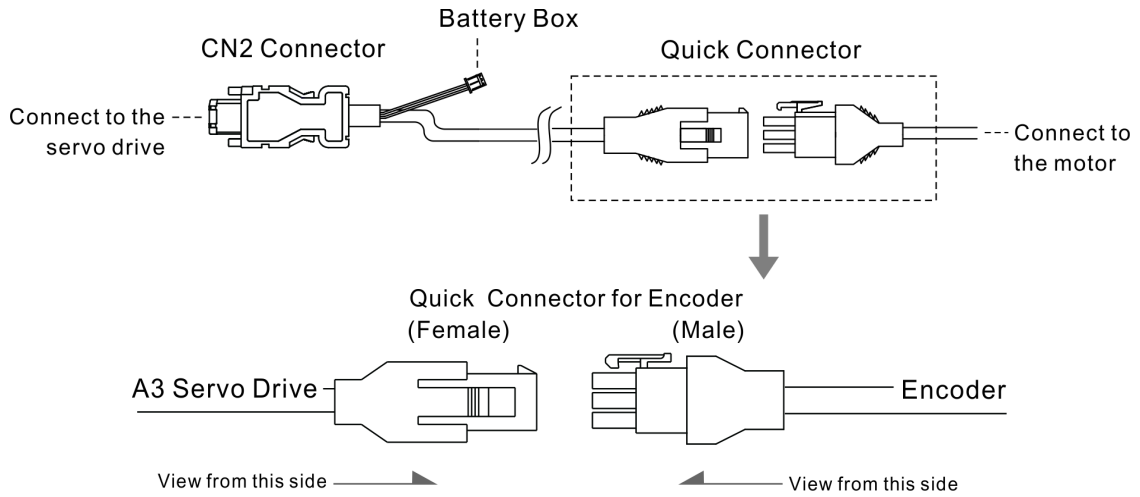


# 3

Model name	L	
	mm	inch
ACS3-CAEA1003	3000 ± 100	118 ± 4
ACS3-CAEA1005	5000 ± 100	197 ± 4

Connection method:

**Caution Please wire as instructed below. Incorrect wiring may cause battery explosion.**

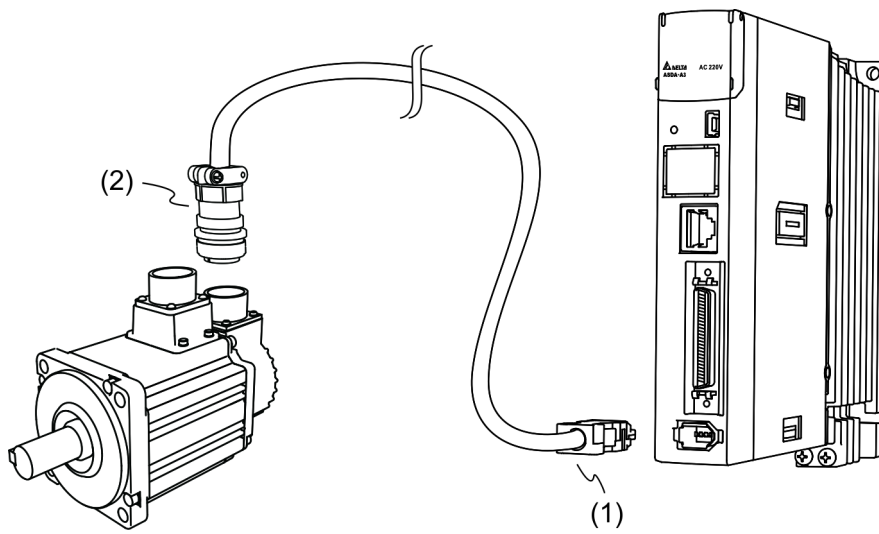


1	2	3
White T+	Red BAT+	Reserved
4	5	6
White/Red T-	Black BAT-	Reserved
7	8	9
Brown DC+5V	Blue GND	Shield

3	2	1
Reserved	Orange BAT+	White T+
6	5	4
Reserved	Gray BAT-	White/Red T-
9	8	7
Shield	Blue GND	Brown DC+5V

The wire color of the ASDA-A3 servo drive is for reference only. Please refer to the actual object.

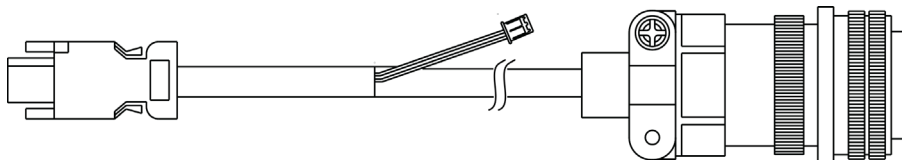
**Encoder connection (Diagram 2): Military connector**



(1) CN2 connector (2) Military encoder

Note: The diagram shows the connection between the servo drive and the encoder, which is not drawn by actual scale. The specification is subject to change according to the selected servo drive and motor models.

Motor model	Military connector
ECMC-F11308	
ECMC-C11010	
ECMC-E11310	
ECMC-E11315	
ECMC-E11320	
ECMC-F11313	
ECMC-F11318	
ECMC-E11820	
ECMC-E11830	
ECMC-F11830	

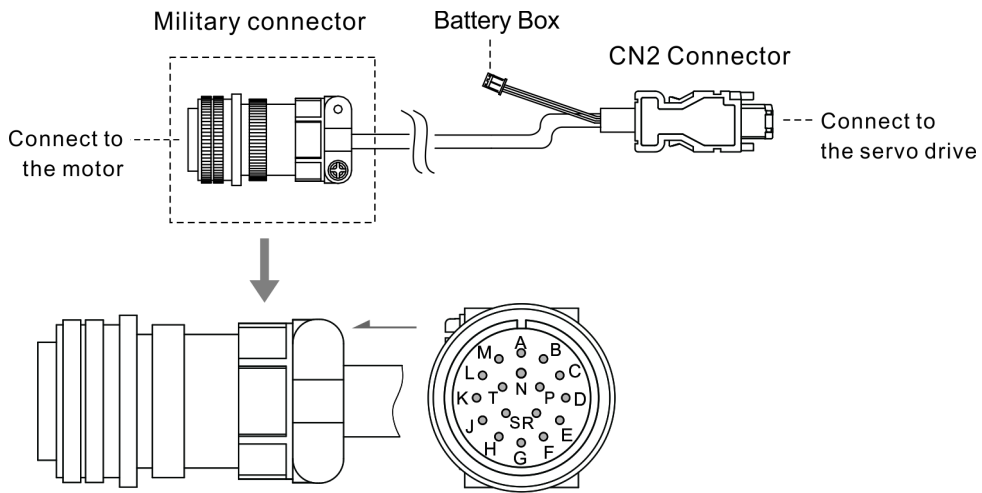


Model name	Straight	L	
		mm	inch
ACS3-CAEA3003	3106A-20-29S	3000 ± 100	118 ± 4
ACS3-CAEA3005	3106A-20-29S	5000 ± 100	197 ± 4

Connection method:

**Caution** Please wire as instructed below. Incorrect wiring may cause battery explosion.

3



Pin No.	Symbol	Color
A	T+	White
B	T-	White / Red
C	BAT+	Red
D	BAT-	Black
S	DC+5V	Brown
R	GND	Blue
L	BRAID SHIELD	-

Note: If an incremental type of encoder is applied, connecting BAT+ and BAT- is not required.

### 3.1.6 Selection of wire rods

Please access the requirements of doubling and see the recommended wire rods for connectors and signal wiring of ASDA-A3 listed below:

Note:

1. The shield should connect to the  $\oplus$  phase of SHIELD.
2. When wiring, please use the wire rods suggested in this section to avoid danger.

■ No doubling: Single wire for one terminal

Servo drive and corresponding servo motor		Power cable - wire diameter (AWG)				
		UVW	P3, C	L1, L2, R, S, T, P1, P2		
				Bare wire	Crimping	Terminal type / part name
ASD-A3-0121	ECM-A3 <sup>[1]</sup> -C <sup>[2]</sup> 040F	18 AWG	14 AWG	12 ~ 24 AWG	14 ~ 24 AWG	DN02512D(14AWG) DN01512D(16AWG) DN00712D(18 ~ 24AWG)
	ECM-A3 <sup>[1]</sup> -C <sup>[2]</sup> 0401					
ASD-A3-0221	ECM-A3 <sup>[1]</sup> -C <sup>[2]</sup> 0602			12 ~ 22 AWG	14 ~ 22 AWG	
ASD-A3-0421	ECM-A3 <sup>[1]</sup> -C <sup>[2]</sup> 0604			12 ~ 20 AWG	14 ~ 20 AWG	
	ECM-A3 <sup>[1]</sup> -C <sup>[2]</sup> 0804					
ASD-A3-0721	ECM-A3 <sup>[1]</sup> -C <sup>[2]</sup> 0807			12 ~ 16 AWG	14 ~ 16 AWG	DN02512D(14AWG) DN01512D(16AWG)

Note: [1] in the servo motor model represents inertia ratio of motor and [2] is the encoder type.

Servo drive and corresponding servo motor		Power cable - wire diameter (AWG)					
		UVW	P3, C	L1, L2, R, S, T, P1, P2			
				Bare wire	Crimping	Terminal type / part name	
ASD-A3-1021	ECMC-F <sup>[1]</sup> 1308	16 AWG	14 AWG	12 ~ 14 AWG	14 AWG	DN02512D	
	ECMC-C <sup>[1]</sup> 1010						
	ECMC-E <sup>[1]</sup> 1310						
ASD-A3-1521	ECMC-E <sup>[1]</sup> 1315	14 AWG	14 AWG	Single-phase: 14 AWG Three-phase: 12~14 AWG	Single-phase: N/A Three-phase: 14 AWG	Single-phase: N/A Three-phase: DN02512D	
ASD-A3-2023	ECMC-E <sup>[1]</sup> 1320			12 AWG	10 ~ 14 AWG	12 ~ 14 AWG	DN04012D (12AWG) DN02512D (14AWG)
	ECMC-F <sup>[1]</sup> 1313						
	ECMC-F <sup>[1]</sup> 1318						
ASD-A3-3023	ECMC-E <sup>[1]</sup> 1820	12 AWG	10 ~ 12 AWG	12 AWG	DN04012D		
	ECMC-E <sup>[1]</sup> 1830						
	ECMC-F <sup>[1]</sup> 1830						

Note: [1] in the servo motor model represents encoder type.



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Terminal illustration:



Crimping tool:

DNT13-010

■ Doubling: Two wires for one terminal

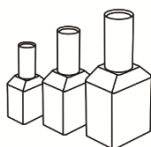
Servo drive and corresponding servo motor		Power cable - wire diameter (AWG)				
		UVW	P3, C	L1, L2, R, S, T, P1, P2		
				Bare wire	Crimping	Terminal type / part name
ASD-A3-0121	ECM-A3 <sup>[1]</sup> -C <sup>[2]</sup> 040F	18 AWG	14 AWG	16 ~ 24 AWG	16 ~ 24 AWG	DN01512B
	ECM-A3 <sup>[1]</sup> -C <sup>[2]</sup> 0401					
ASD-A3-0221	ECM-A3 <sup>[1]</sup> -C <sup>[2]</sup> 0602			16 ~ 22 AWG	16 ~ 22 AWG	
ASD-A3-0421	ECM-A3 <sup>[1]</sup> -C <sup>[2]</sup> 0604			16 ~ 20 AWG	16 ~ 20 AWG	
	ECM-A3 <sup>[1]</sup> -C <sup>[2]</sup> 0804					
ASD-A3-0721	ECM-A3 <sup>[1]</sup> -C <sup>[2]</sup> 0807			16 AWG	16 AWG	

Note: [1] in the servo motor model represents inertia ratio of motor and [2] is the encoder type.

Servo drive and corresponding servo motor		Power cable - wire diameter (AWG)				
		UVW	P3, C	L1, L2, R, S, T, P1, P2		
				Bare wire	Crimping	Terminal type / part name
ASD-A3-1021	ECMC-F <sup>[1]</sup> 1308	16 AWG	14 AWG	N/A	N/A	N/A
	ECMC-C <sup>[1]</sup> 1010					
	ECMC-E <sup>[1]</sup> 1310					
ASD-A3-1521	ECMC-E <sup>[1]</sup> 1315					
ASD-A3-2023	ECMC-E <sup>[1]</sup> 1320	14 AWG		16 ~ 20 AWG	16 ~ 20 AWG	DN02513B
	ECMC-F <sup>[1]</sup> 1313	12 AWG		14 AWG	14 AWG	
	ECMC-F <sup>[1]</sup> 1318					
	ECMC-E <sup>[1]</sup> 1820					
ASD-A3-3023	ECMC-E <sup>[1]</sup> 1830		N/A	N/A	N/A	
	ECMC-F <sup>[1]</sup> 1830					

Note: [1] in the servo motor model represents encoder type.

Terminal illustration:




Crimping tool:

DNT13-010

Servo drive model	Encoder cable - wire diameter mm <sup>2</sup> (AWG)			
	Size	Number	Specification	Standard length
ASD-A3-0121	0.13 (AWG26)	10 cores (4 pairs)	UL2464	3 m (9.84 ft)
ASD-A3-0221				
ASD-A3-0421				
ASD-A3-0721				
ASD-A3-1021				
ASD-A3-1521				
ASD-A3-2023				
ASD-A3-3023				

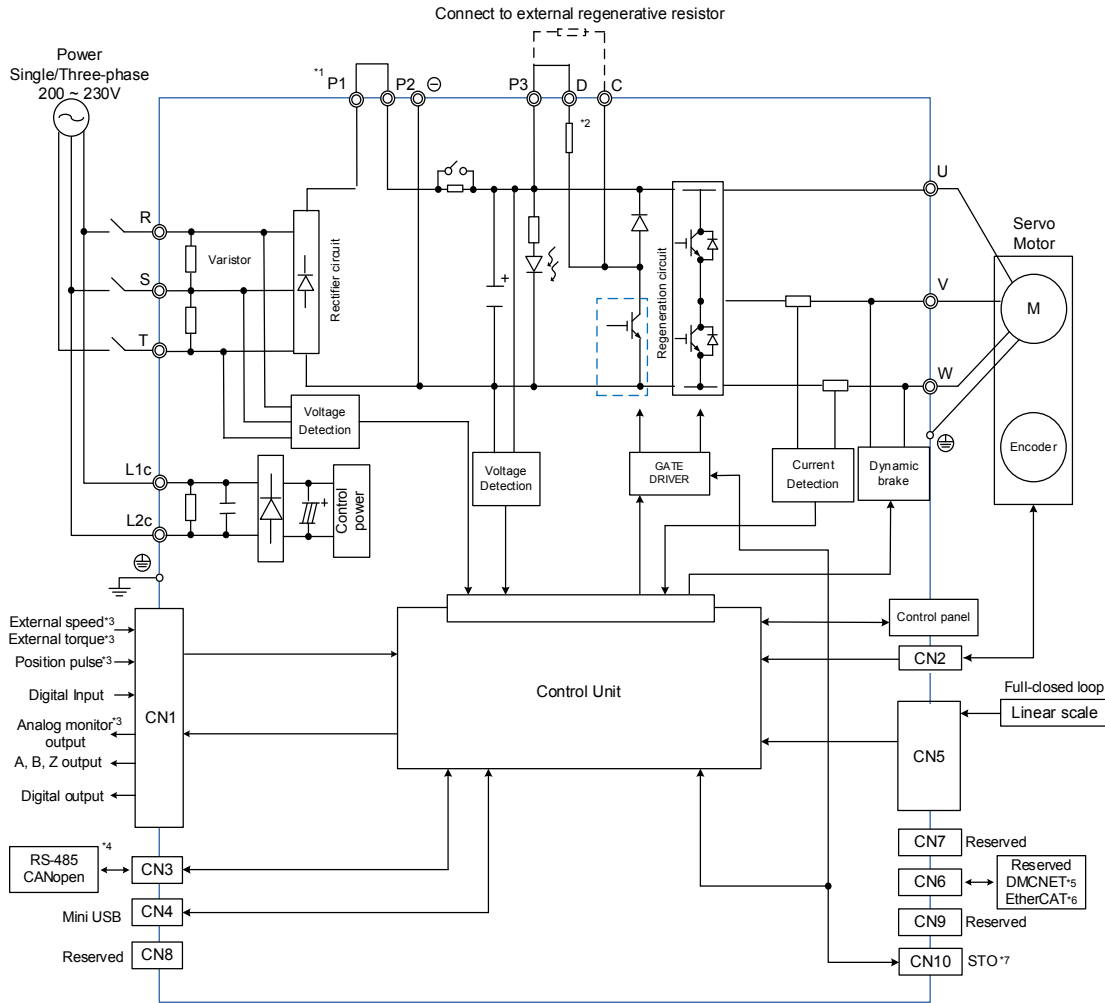
## Note:

1. Please use shielded twisted-pair cable for wiring of encoder to reduce the noise interference.
2. The shield should connect to the  phase of the SHIELD.
3. Please use the suggested wire rods mentioned above when wiring to avoid danger.

### 3.2 Wiring diagram of the servo system

#### Models of 400 W and below

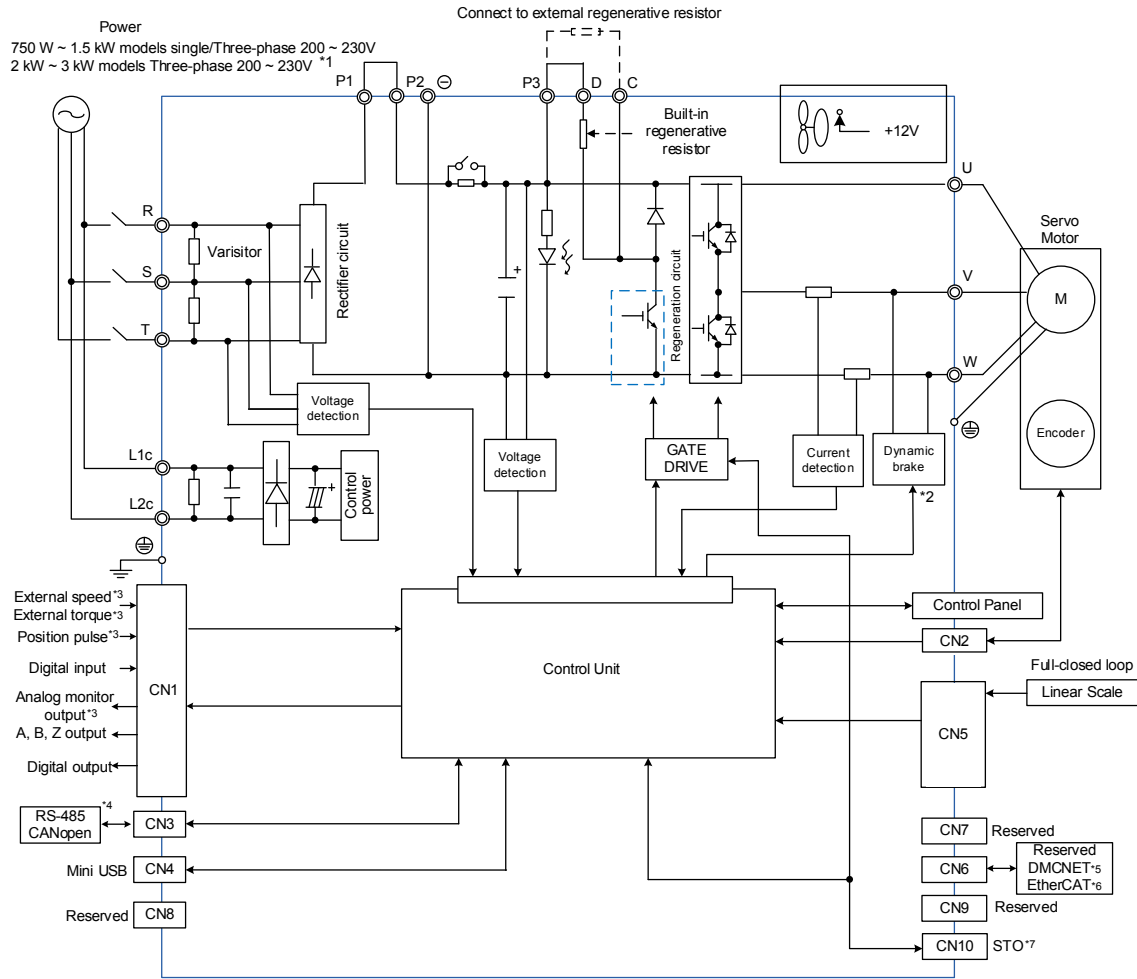
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**Note:**

- \*1: If DC reactor is not applied, short circuit P1 and P2 as illustrated in the diagram.
- \*2: Models of 200 W and below (without built-in regenerative resistor); models of 400 W have built-in regenerative resistor.
- \*3: Functions that are not provided by A3-F and A3-E.
- \*4: Serial communication (RS-485) is available for A3-L and A3-M; CANopen is for A3-M only.
- \*5: DMCNET is available on A3-F only.
- \*6: EtherCAT is available on A3-E only.
- \*7: STO function is only available on A3-M and A3-E.

Models of 750 W ~ 3 kW (with built-in regenerative resistor and fan)



Note:

- \*1: If DC reactor is not applied, short circuit P1 and P2 as illustrated in the diagram.
- \*2: The dynamic brakes of 2 kW ~ 3 kW models are three-phase and UVW is short-circuited.
- \*3: Functions that are not provided by A3-F and A3-E.
- \*4: Serial communication (RS-485) is available for A3-L and A3-M; CANopen is for A3-M only.
- \*5: DMCNET is available on A3-F only.
- \*6: EtherCAT is available on A3-E only.
- \*7: STO function is only available on A3-M and A3-E.

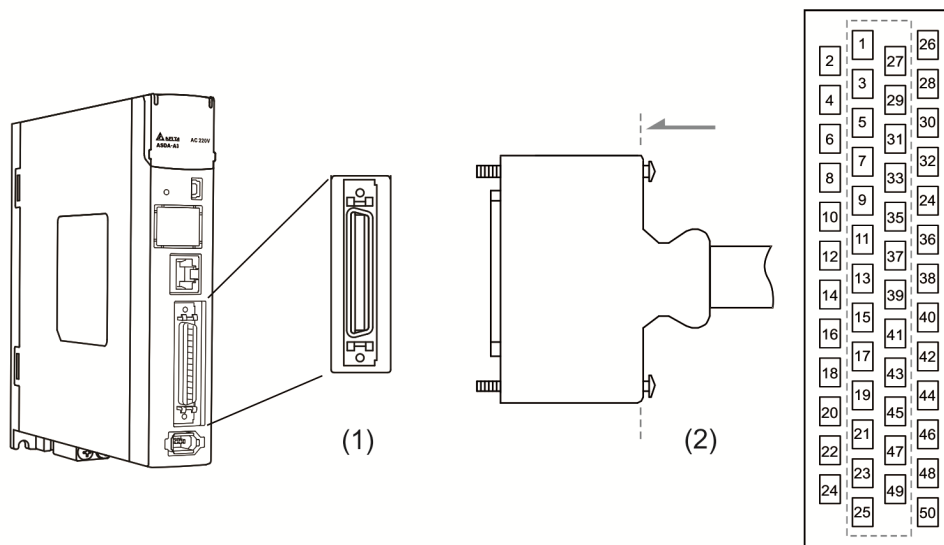
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### 3.3 Wiring for CN1 (I/O signal)

#### 3.3.1 CN1 I/O connector (for A3-L and A3-M series)

A3 provides 10 user-defined digital input (DI) points and 6 digital output (DO) points to achieve high flexible communication between the servo drive and the controller. For more information, please refer to section 3.3.5. In addition, differential type output signal of encoder A+, A-, B+, B-, Z+, and Z- are provided. Analog torque command input, analog speed/position command input, pulse position input are also available. The pin assignment and illustration are shown as follows:



(1) CN1 connector (Female) (2) CN1 connector (Male)

Pin assignment:

Pin	Signal	Function	Pin	Signal	Function	Pin	Signal	Function
1	DO4+	Digital output	18	T_REF	Analog torque input	35	PULL HI_S (Sign)	External power input of Sign pulse
2	DO3-	Digital output	19	GND	Analog input signal ground	36	SIGN	Position sign ( + )
3	DO3+	Digital output	20	NC	Not in use	37	/SIGN	Position sign ( - )
4	DO2-	Digital output	21	OA	Encoder A pulse output	38	DI10	Digital input
5	DO2+	Digital output	22	/OA	Encoder /A pulse output	39	PULL HI_P (Pulse)	External power input of pulse
6	DO1-	Digital output	23	/OB	Encoder /B pulse output	40	DO6-	Digital output
7	DO1+	Digital output	24	/OZ	Encoder /Z pulse output	41	/PULSE	Position pulse ( - )
8	DI4-	Digital input	25	OB	Encoder B pulse output	42	V_REF	Analog command input speed ( + )
9	DI1-	Digital input	26	DO4-	Digital output	43	PULSE	Position pulse ( + )
10	DI2-	Digital input	27	DO5-	Digital output	44	GND	Analog input signal ground
11	COM+	Power input (24 V $\pm$ 10%)	28	DO5+	Digital output	45	NC	Not in use
12	GND	Analog input signal ground	29	DI9-	Digital input	46	DO6+	Digital output
13	GND	Analog input signal ground	30	DI8-	Digital input	47	NC	Not in use
14	NC	Not in use	31	DI7-	Digital input	48	OCZ	Encoder Z pulse open-collector output
15	MON2	Analog monitor output 2	32	DI6-	Digital input	49	NC	Not in use
16	MON1	Analog monitor output 1	33	DI5-	Digital input	50	OZ	Encoder Z pulse line-driver output
17	NC	Not in use	34	DI3-	Digital input	-	-	-

Note: NC represents “No connection”, which is for internal use only. Do not connect it or it may damage the servo drive.

### 3.3.2 Signal explanation of connector CN1 (for A3-L and A3-M series)

The following details the signals listed in the previous section:

General signals:

Signal	Pin No.	Function	Wiring method (Refer to 3.3.3)	
Analog command (Input)	V_REF	42	(1) When motor speed command is set to -10 V ~ +10 V, it means the rotation speed is -3000 ~ +3000 r/min (default). The corresponding range can be set via parameters. (2) When motor position command is set to -10 V ~ +10 V, it means the range of the rotation position is -3 ~ +3 cycles (default).	C1
	T_REF	18	When motor torque command is set to -10 V ~ +10 V, it means the rated torque is -100% ~ +100%.	C1
Analog Monitor (output)	MON1 MON2	16 15	The operation status of motor can be displayed in the manner of analog voltage, such as speed and current. This servo drive provides 2 output channels. Users can select the data to be monitored via parameter P0.003. This signal is based on the power ground.	C2
Position Pulse (input)	PULSE /PULSE	43 41	Position pulse can be inputted by Line Driver (single-phase max. frequency 4 MHz) or open-collector (single-phase max. frequency 200 KHz). Three command types can be selected via P1.000, CW/CCW pulse, pulse and direction, and A/B pulse. If open collector type is applied when inputting position pulses, CN1 should be connected to an external power supply for pull high.	C3/C4
	SIGN /SIGN	36 37		
	PULL HI_P PULL HI_S	39 35		
Position Pulse (output)	OA /OA	21 22	Encoder signal output A, B, and Z (Line Driver).	C9/C10
	OB /OB	25 23		
	OZ /OZ	50 24		
	OCZ	48	Encoder Z pulse output (Open-collector).	C11
Power	COM+	11	NPN: COM+ is for DI input and requires external power supply (24 V ± 10%). PNP: COM+ is for DI voltage input (negative end) and also requires external power supply (24 V ± 10%).	-
	GND	12, 13, 19, 44	GND of analog signal and differential signal output	
Other	NC	14	No connection. This is for internal use only. Do not connect it, or it may damage the servo drive.	

As there are various operation modes available (refer to section 6.1) and the I/O configuration will vary from each mode, A3 provides user-defined I/O for users to set functions according to the application requirements. See chapter 8 and refer to Table 8.1 DI function setting and 8.2 DO function setting. The default DI/DO signal configuration for each operation mode has include the most commonly used functions and will meet the requirements for general applications.

See the default DI signal of each control mode below:

DI	Control mode								
	PT	PR	S/Sz	T/Tz	PT-S	PT-T	PR-S	PR-T	S-T
	Default signal	Default signal	Default signal	Default signal	Default signal	Default signal	Default signal	Default signal	Default signal
1	0x01	0x01	0x01	0x01	0x01	0x01	0x01	0x01	0x01
	SON	SON	SON	SON	SON	SON	SON	SON	SON
2	0x04	0x08	0x09	0x10	0x04	0x04	0x08	0x08	-
	CCLR	CTRG	TRQLM	SPDLM	CCLR	CCLR	CTRG	CTRG	
3	0x16	0x11	0x14	0x16	0x14	0x16	0x11	0x11	0x14
	TCM0	POS0	SPD0	TCM0	SPD0	TCM0	POS0	POS0	SPD0
4	0x17	0x12	0x15	0x17	0x15	0x17	0x12	0x12	0x15
	TCM1	POS1	SPD1	TCM1	SPD1	TCM1	POS1	POS1	SPD1
5	0x02	0x02	0x02	0x02	-	-	0x14	0x16	0x16
	ARST	ARST	ARST	ARST	-	-	SPD0	TCM0	TCM0
6	0x22	0x22	0x22	0x22	-	-	0x15	0x17	0x17
	NL	NL	NL	NL			SPD1	TCM1	TCM1
7	0x23	0x23	0x23	0x23	0x18	0x20	0x18	0x20	0x23
	PL	PL	PL	PL	S-P	T-P	S-P	T-P	PL
8	0x21	0x21	0x21	0x21	0x21	0x21	0x21	0x21	0x21
	EMGS	EMGS	EMGS	EMGS	EMGS	EMGS	EMGS	EMGS	EMGS
9	-	-	-	-	-	-	-	-	-
10	-	-	-	-	-	-	-	-	-

Note: Please refer to figure C7/C8 in 3.3.3 for wiring.



The default DO signal is explained as follows:

DO	PT/PR/Communication		Speed/Torque		Wiring method (refer to 3.3.3)
	Signal	Function	Signal	Function	
DO1	SRDY	Servo ready	SRDY	Servo ready	C5/C6
DO2	ZSPD	Zero speed of motor	ZSPD	Zero speed of motor	
DO3	HOME	Homing completed	TSPD	Target speed reached	
DO4	TPOS	Target position reached	TPOS	Target position reached	
DO5	ALRM	Servo alarm	ALRM	Servo alarm	
DO6	-	-	-	-	

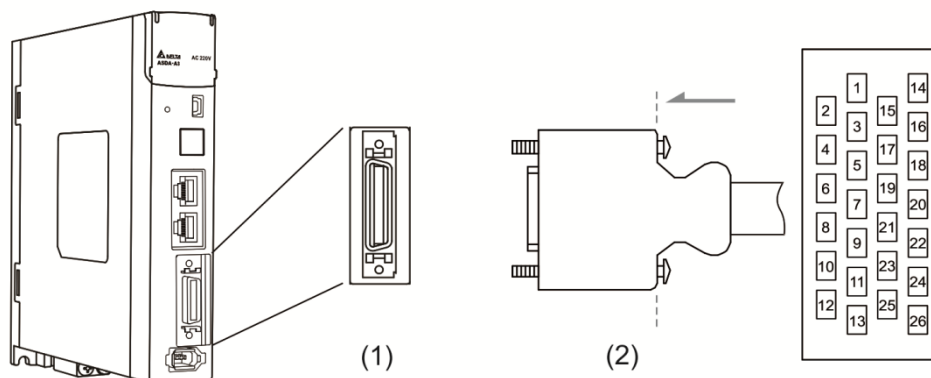
If the default DI/DO function cannot meet the application requirement, you can set the function of DI1 ~ 10 and DO1 ~ 6 via the corresponding parameters listed in the following table. That is, the DI/DO functions can be specified by setting DI or DO code to the corresponding parameters.

DI signal		Pin No.	Corresponded parameter	DI signal		Pin No.	Corresponded parameter
Standard DI	DI1-	9	P2.010	Standard DI	DI6-	32	P2.015
	DI2-	10	P2.011		DI7-	31	P2.016
	DI3-	34	P2.012		DI8-	30	P2.017
	DI4-	8	P2.013		DI9-	29	P2.036
	DI5-	33	P2.014		DI10-	38	P2.037

DO signal		Pin No.	Corresponded parameter	DO signal		Pin No.	Corresponded parameter
Standard DO	DO1+	7	P2.018	Standard DO	DO4+	1	P2.021
	DO1-	6			DO4-	26	
	DO2+	5	P2.019		DO5+	28	P2.022
	DO2-	4			DO5-	27	
	DO3+	3	P2.020		DO6+	46	P2.041
	DO3-	2			DO6-	40	

### 3.3.3 CN1 I/O connector (for A3-F series)

A3-F provides 7 user-defined digital input (DI) points and 4 digital output (DO) points to achieve high flexible communication between the servo drive and the controller. For more information, please refer to section 3.3.5. In addition, differential type output signal of encoder A+, A-, B+, B-, Z+, and Z- are provided. The pin assignment and illustration are shown as follows.



(1) CN1 connector (Female) (2) CN1 connector (Male)

Pin assignment:

Pin	Signal	Function	Pin	Signal	Function	Pin	Signal	Function
1	DO1+	Digital output	10	DI4-	Digital input	19	OB	Encoder B pulse output
2	DO1-	Digital output	11	DI5-	Digital input	20	/OB	Encoder /B pulse output
3	DO2+	Digital output	12	DI6-	Digital input	21	OZ	Encoder Z pulse output
4	DO2-	Digital output	13	DI7-	Digital input	22	/OZ	Encoder /Z pulse output
5	NC	Not in use	14	NC	Not in use	23	DO4+	Digital output
6	COM +	Power input (24 V $\pm$ 10%)	15	NC	Not in use	24	DO4-	Digital output
7	DI1-	Digital input	16	GND	Differential output signal	25	DO3+	Digital output
8	DI2-	Digital input	17	OA	Encoder A pulse output	26	DO3-	Digital output
9	DI3-	Digital input	18	/OA	Encoder /A pulse output	-	-	-

Note: NC represents "No connection", which is for internal use only. Do not connect it or it may damage the servo drive.

### 3.3.4 Signal explanation of connector CN1 (for A3-F series)

The following details the signals listed in the previous section:

General signals:

Signal		Pin No.	Function	Wiring method (Refer to 3.3.3)
Position Pulse (output)	OA	17	Encoder signal output A, B, and Z (Line Driver).	C9/C10
	/OA	18		
	OB	19		
	/OB	20		
	OZ	21		
	/OZ	22		
Power	COM+	6	NPN: COM+ is for DI input and requires external power supply (24 V ± 10%). PNP: COM+ is for DI voltage input (negative end) and also requires external power supply (24 V ± 10%).	-
	GND	16	GND of differential signal output	
Other	NC	14, 15	No connection. This is for internal use only. Do not connect it, or it may damage the servo drive.	

A3-F series servo drive provides user-defined I/O for users to set functions according to the application requirements. See chapter 8 and refer to Table 8.1 DI function setting and 8.2 DO function setting. The default DI/DO signal configuration for each operation mode has include the most commonly used functions and will meet the requirements for general applications.

See the default DI signal of each control mode below:

DI	Control mode	
	DMCNET	
	Default	Signal
1	0x00	-
2	0x00	-
3	0x00	-
4	0x24	ORGP
5	0x22	NL
6	0x23	PL
7	0x21	EMGS

Note: Please refer to figure C7/C8 in 3.3.3 for wiring.

See the default DO signal of each control mode below:

DO	DMCNET		Wiring method (Refer to 3.3.3)
	Signal	Function	
DO1	SRDY	Servo is ready.	C5/C6
DO2	-	-	
DO3	-	-	
DO4	ALRM	Alarm reset.	

If the default DI/DO function cannot meet the application requirement, the user-defined DI/DO functions can be specified by setting DI or DO code to the corresponding parameters.

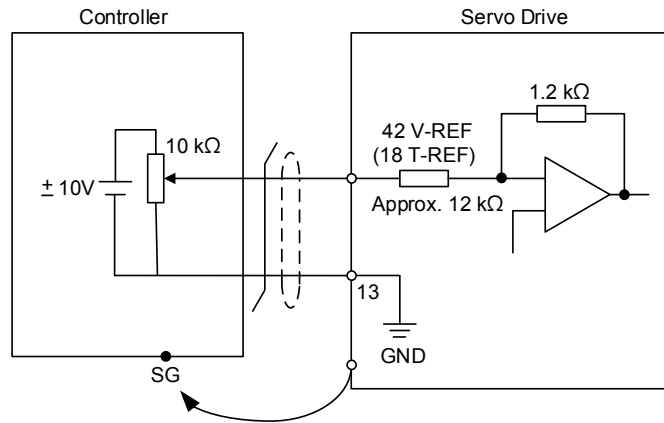
DI signal		Pin No.	Corresponded parameter	DI signal		Pin No.	Corresponded parameter
Standard DI	DI1-	7	P2.010	Standard DI	DI5-	11	P2.014
	DI2-	8	P2.011		DI6-	12	P2.015
	DI3-	9	P2.012		DI7-	13	P2.016
	DI4-	10	P2.013				

DO signal		Pin No.	Corresponded parameter	DO signal		Pin No.	Corresponded parameter
Standard DO	DO1+	1	P2.018	Standard DO	DO3+	25	P2.020
	DO1-	2			DO3-	26	
	DO2+	3	P2.019		DO4+	23	P2.021
	DO2-	4			DO4-	24	

### 3.3.5 Wiring diagrams (CN1)

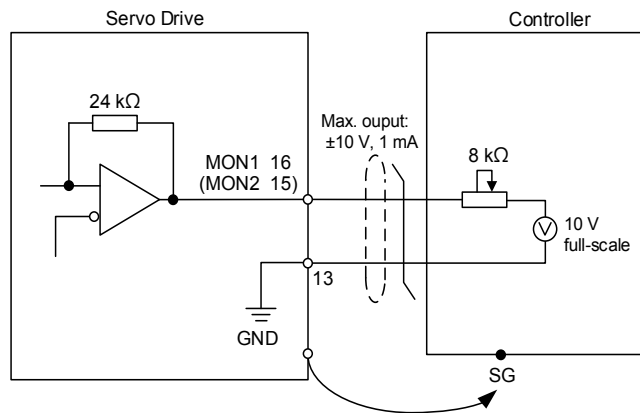
The valid voltage of speed analog command and torque analog command is between -10 V and +10 V. The command value that corresponds to the voltage range can be set via relevant parameters.

C1: Input of speed/torque (force) analog command



Note: It is not supported by A3-F.

C2: Output of analog monitoring command (MON1 and MON2)

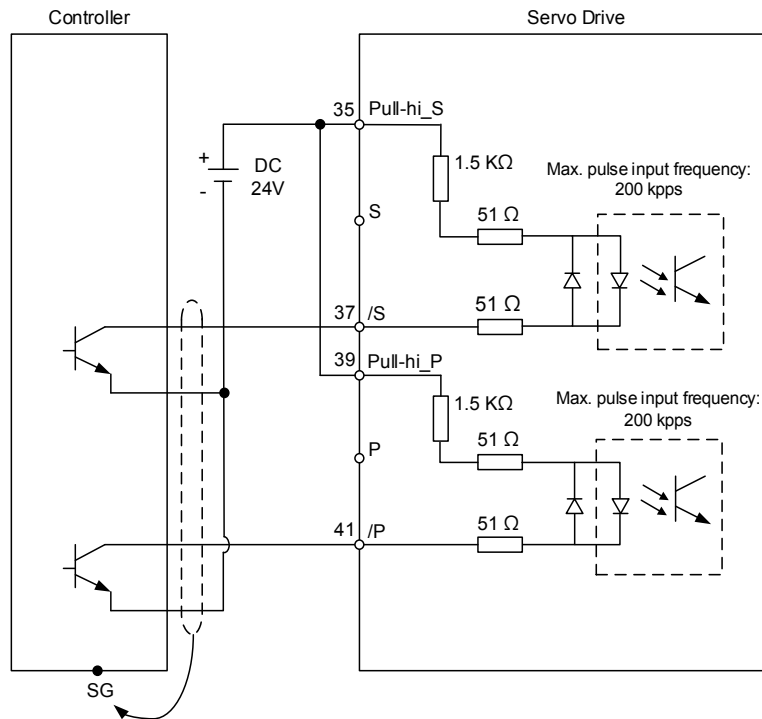


Note:

1. Please refer to parameter P2.112 [Bit 0] for the Max. voltage of analog output. 8 V or 10 V are suggested.
2. It is not supported by A3-F.

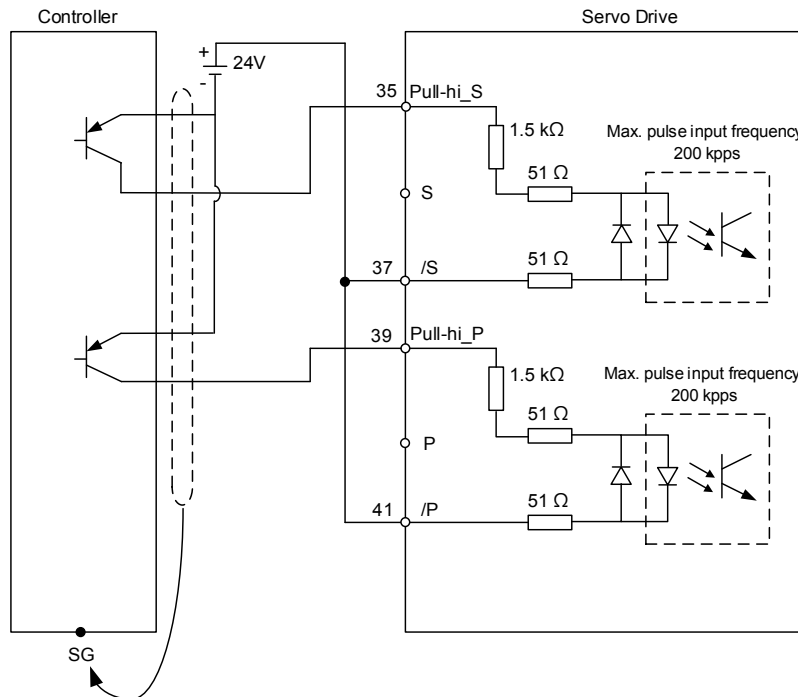
Pulse command can be input by the ways of open-collector or line driver. The maximum input pulse of Line driver is 4 mpps and 200 kpps for open-collector.

C3-1: The source of pulse input is open-collector NPN type equipment, which applies external power supply.



Note: It is not supported by A3-F.

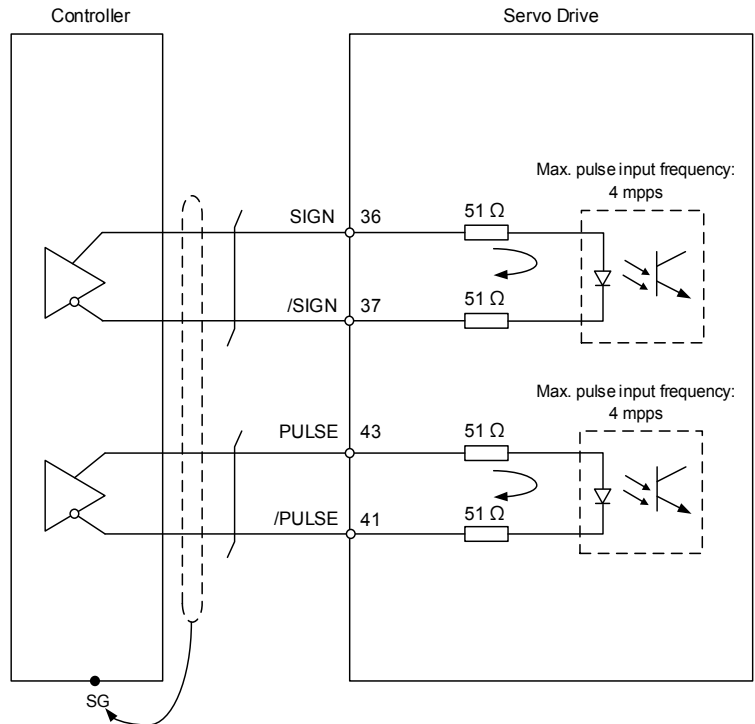
C3-2: The source of pulse input is open-collector PNP type equipment, which applies external power supply.



Note: It is not supported by A3-F.

C4: Pulse input (Line driver) can only apply 2.8 V ~ 3.6 V power system. Do not apply to 24 V power.

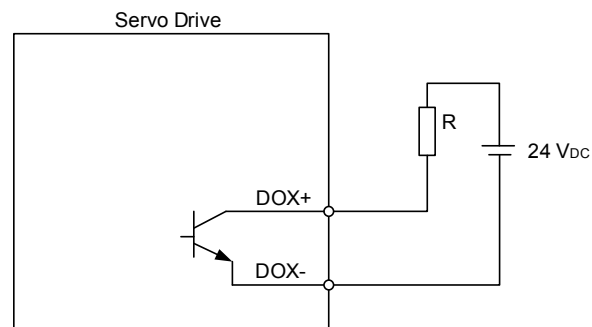
3



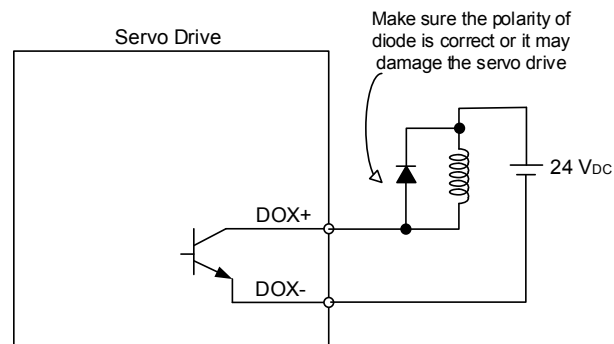
Note: It is not supported by A3-F.

When the drive connects to inductive load, the diode has to be installed. (Permissible current: below 40 mA; Surge current: below 100 mA; Max. voltage: 30 V)

C5: DO wiring - the servo drive applies external power supply and the resistor is general load.



C6: DO wiring - the servo drive applies external power supply and the resistor is inductive load.





# 3

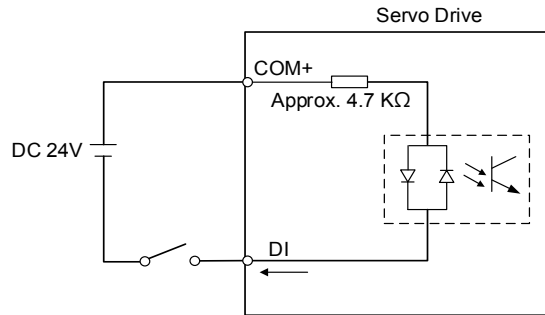
DI wiring - Input signals by relay or open-collector transistor.

Conditions of DI On/Off:

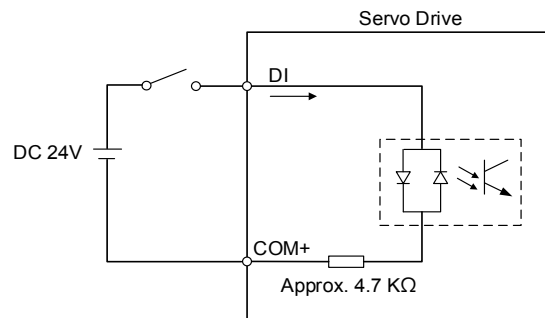
ON: 15 V ~ 24 V; Condition: Input current = 8 mA

OFF: below 5 V; The input current shall not be higher than 0.5 mA.

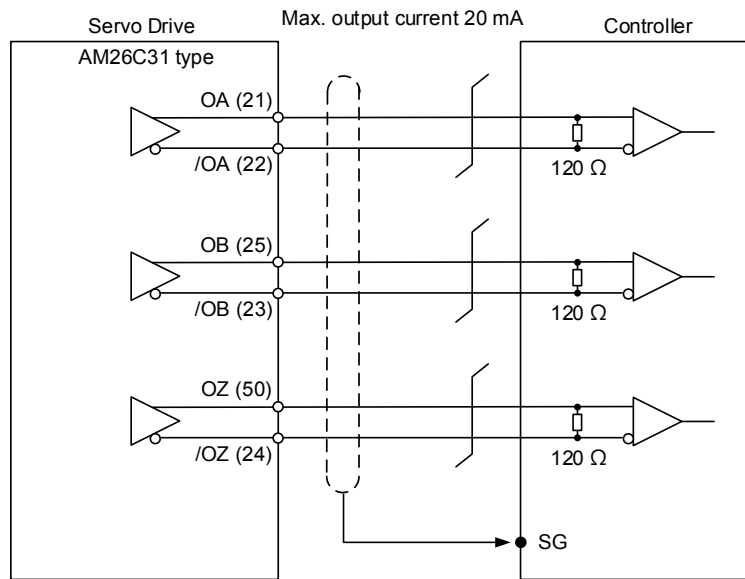
C7: NPN transistor (SINK mode)



C8: PNP transistor (SOURCE mode)



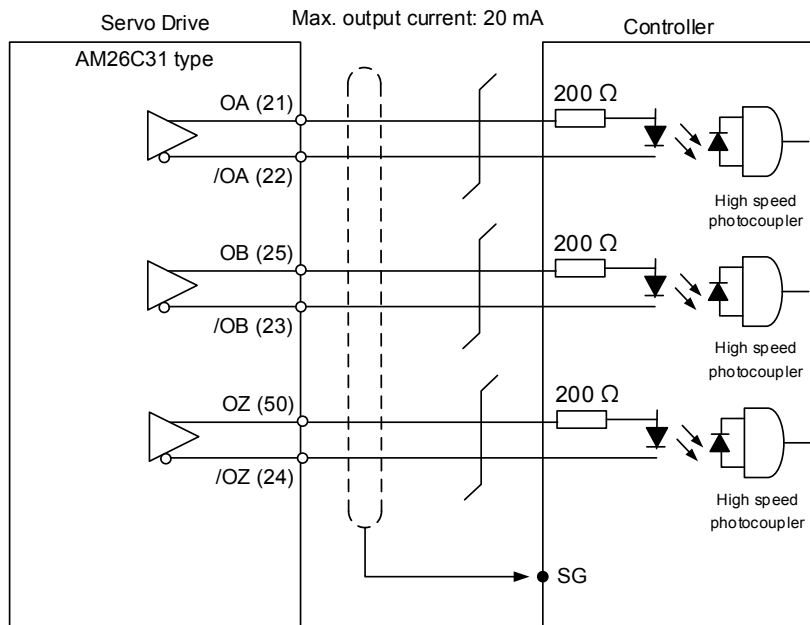
C9: Output of encoder position signal (Line driver)



Note:

1. Pins of A3-F: OA (17), /OA (18), OB (19), /OB (20), OZ (21), /OZ (22).
2. It is suggested to parallel connect two GND of the controller and servo drive when the voltage level among both differs from one another.

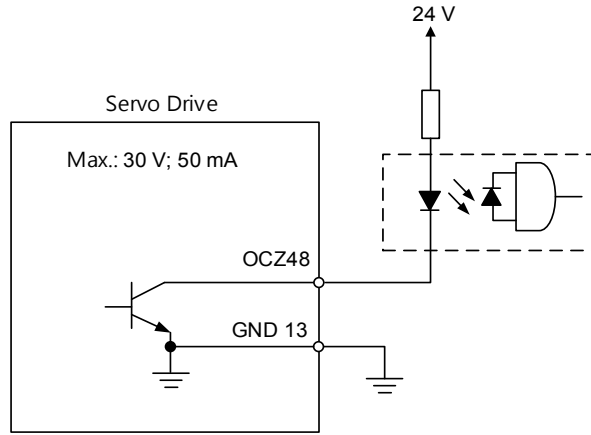
C10: Output of encoder position signal (Opto-isolator)



Note: Pins of A3-F: OA (17), /OA (18), OB (19), /OB (20), OZ (21), /OZ (22).

C11: Encoder OCZ output (open-collector Z pulse output)

3

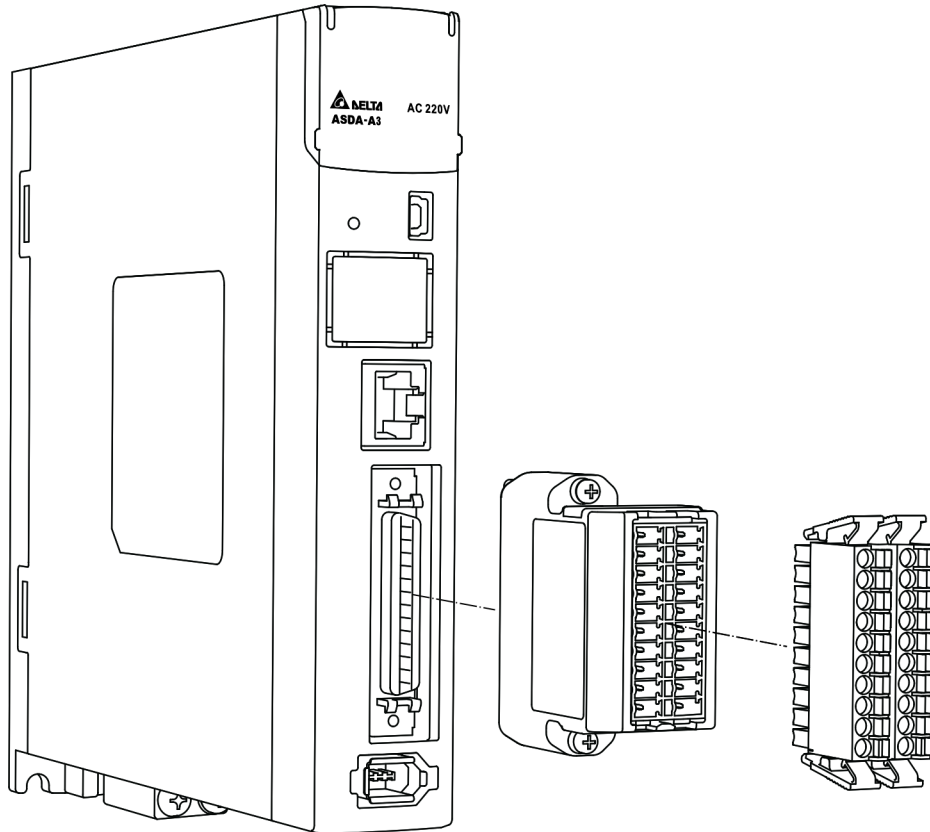


Note: It is not supported by A3-F.

### 3.3.6 Application: Using CN1 quick connector for wiring

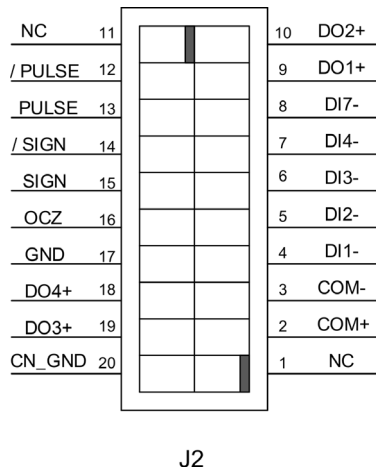
CN1 quick connector (ASD-IF-SC5020) is designed for easy wiring. It is applicable to ASDA-A3, ASDA-A2 and ASDA-A2R series servo drive and can satisfy the demand of different DI/O applications. It will be a good choice for those who do not want to weld the wire rods. Its spring terminal blocks prevent the vibration from loosening the leading wire. It is rather convenient and fast when wiring and construction. 5 digital inputs, 4 digital outputs, differential pulse command inputs and Z phase open-collector outputs are included.

Note: Please select the quick connector ASD-IF-SC2616 for A3-F series servo drive.

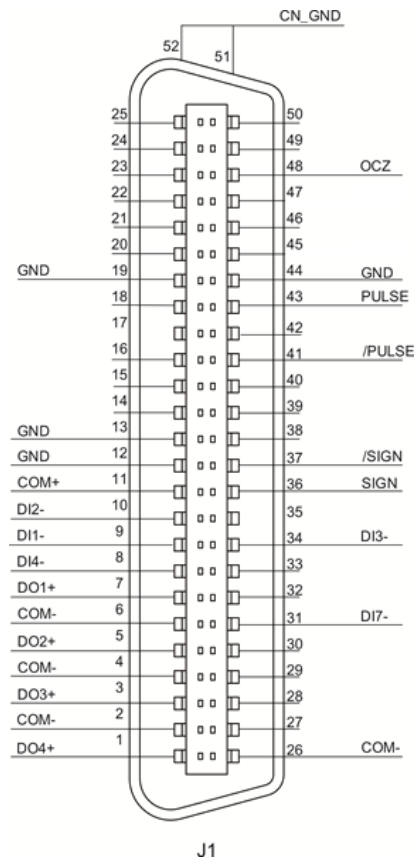


Pin assignment of CN1 quick connector (J2 and J1):

J2:



J1:



3

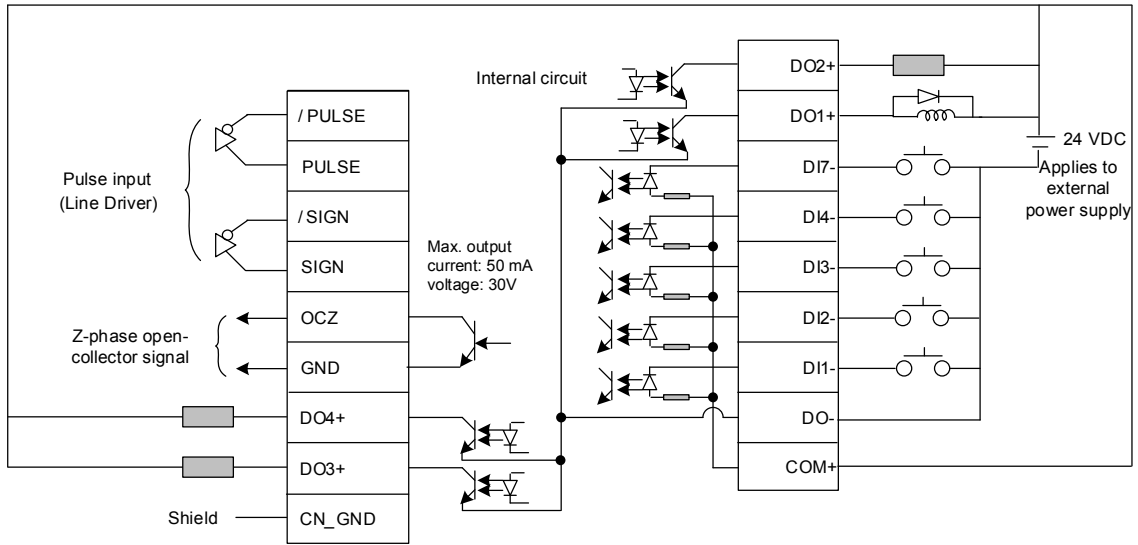
PIN	Signal
1	NC
2	COM+
3	DO-
4	DI1-
5	DI2-
6	DI3-
7	DI4-
8	DI7-
9	DO1+
10	DO2+
11	NC
12	/PULSE
13	PULSE
14	/SIGN
15	SIGN
16	OCZ
17	GND
18	DO4+
19	DO3+
20	CN_GND

PIN	Signal
17	NC
11	COM+
2, 4, 6, 26	DO-
9	DI1-
10	DI2-
34	DI3-
8	DI4-
31	DI7-
7	DO1+
5	DO2+
NC	NC
41	/PULSE
43	PULSE
37	/SIGN
36	SIGN
48	OCZ
12, 13, 19, 44	GND
1	DO4+
3	DO3+
51, 52	CN_GND

Note:

1. NC represents "No connection".
2. A3 does not support open-collector pulse command due to the configuration of pin definition.

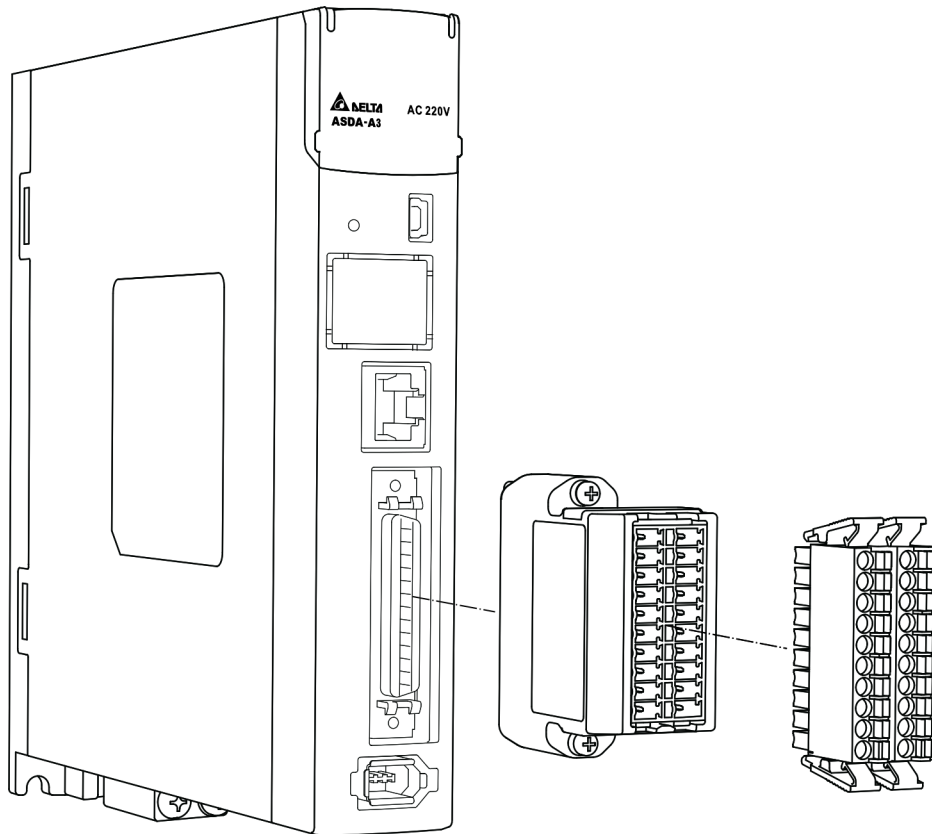
Wiring example:



3

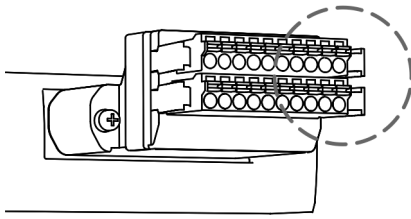
Wiring for CN1 quick connector and installation:

**Installation**

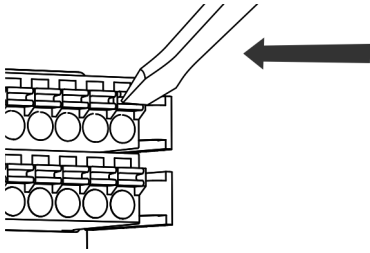


## Wiring

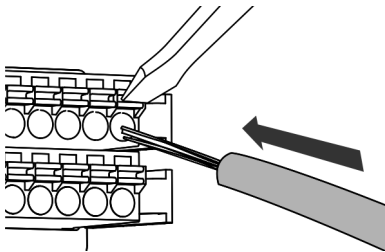
3



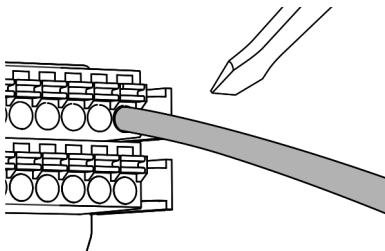
- (1) CN1 quick connector has multiple pins and springs. Please determine which pin is to be wired in advance.



- (2) Prepare a flathead screwdriver. Use it to press the spring down to open the pin.



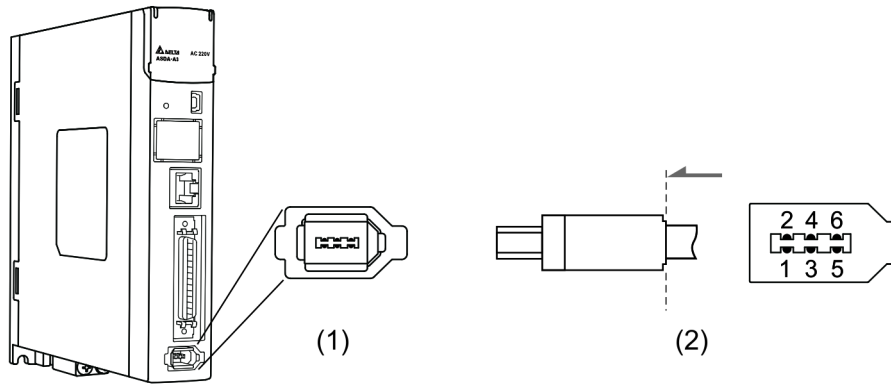
- (3) Insert the stripped core into the pin.



- (4) Withdraw the screwdriver and wiring is completed.

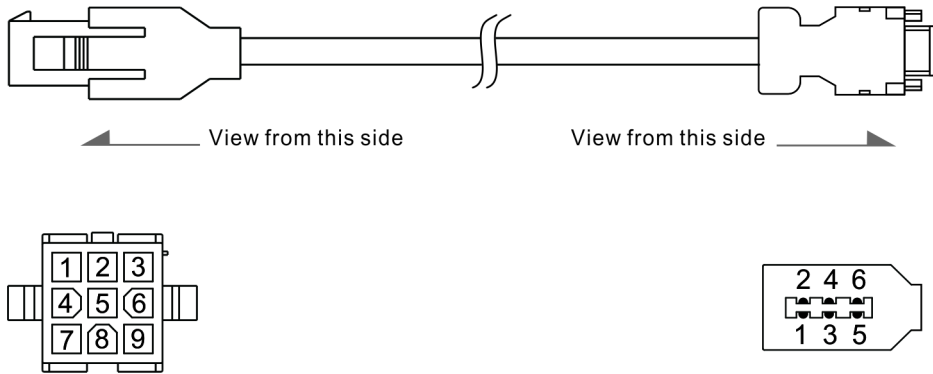
### 3.4 Wiring for CN2 encoder connector

The CN2 encoder signal connector is illustrated as follows:

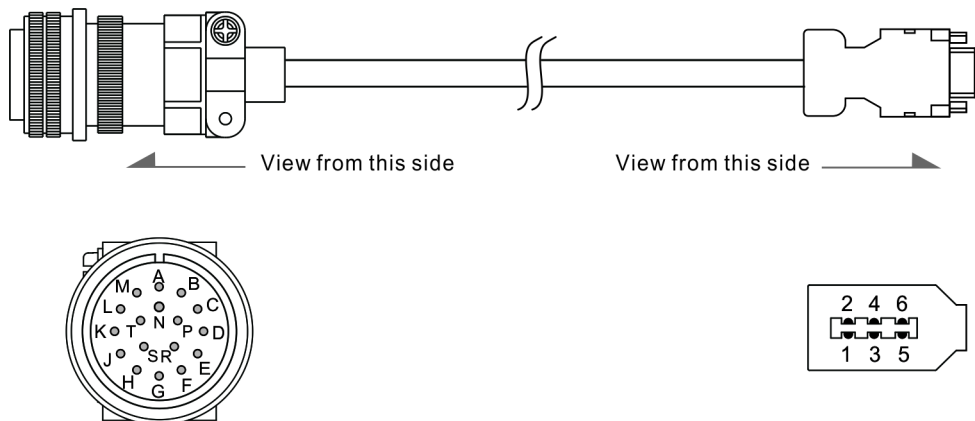


(1) CN2 connector (Female) (2) CN2 connector (Male)

Quick connector of both sides:



Military connector of both sides:





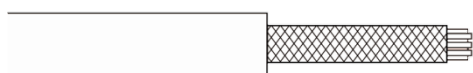
# 3

Pin assignment of CN2:

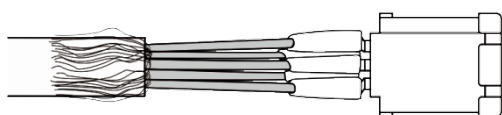
The end that connects to the encoder			The end that connects to the servo drive		
Military Connector	Quick Connector	Color	Pin No.	Symbol	Description
A	1	White	5	T+	Serial communication signal (+)
B	4	White / Red	6	T-	Serial communication signal (-)
S	7	Brown	1	+5V	+5 V power supply
R	8	Blue	2	GND	Power ground
L	9	-	Case	Shielding	Shielding

Note: When applying an absolute type encoder, the battery will directly supply the power to the encoder. Thus, wiring for CN2 of the servo drive is not required. Please refer to detailed wiring description in section 3.1.5 Specifications of encoder connector.

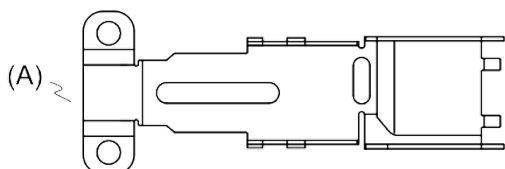
The shielding procedures of CN2 encoder connector are as followings:



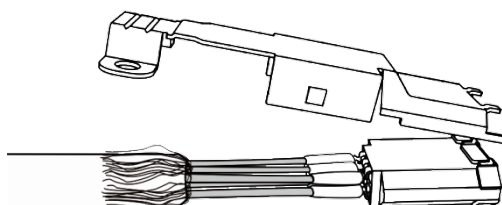
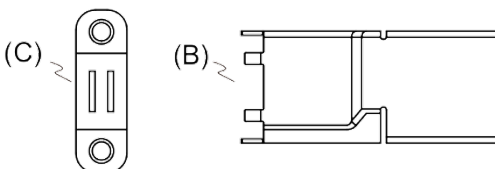
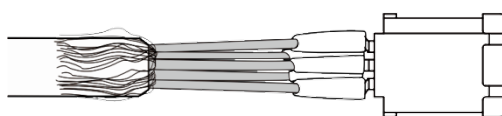
**Step 1:**  
Cut through the cable and expose the core wire which covers the metal core wires with shielding. The reserved core wire length should be 20 ~ 30 mm.



**Step 2:**  
Spread the metal core wires with shielding and fold them upside down in downward direction. Refer to CN2 pin assignment (see the table above) to connect the pins one by one.

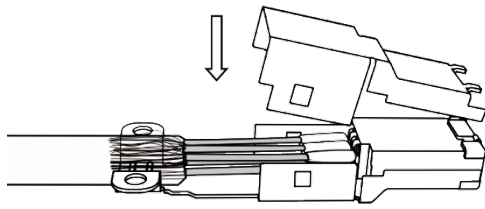


**Step 3:**  
Prepare the following items to assemble the connector:  
(A) Big metal case  
(B) Small metal case  
(C) Metal ring

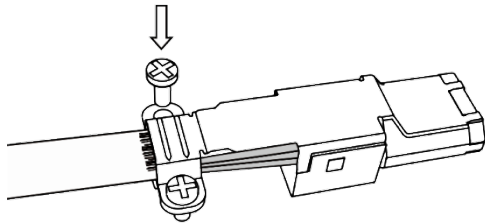


**Step 4:**  
Place the metal case to cover the exposed metal core wires. Make sure the wires are completely covered so as to achieve the purpose of shielding.

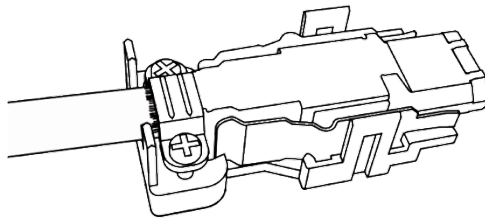
(continued)



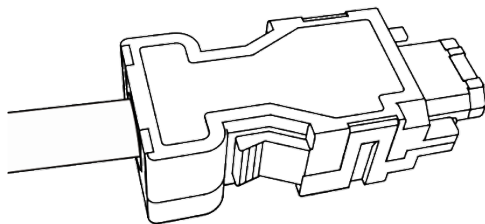
Step 5:  
Fasten the other side of the metal case.



Step 6:  
Tighten the screws of the metal case.



Step 7:  
Assemble one side of the plastic case.



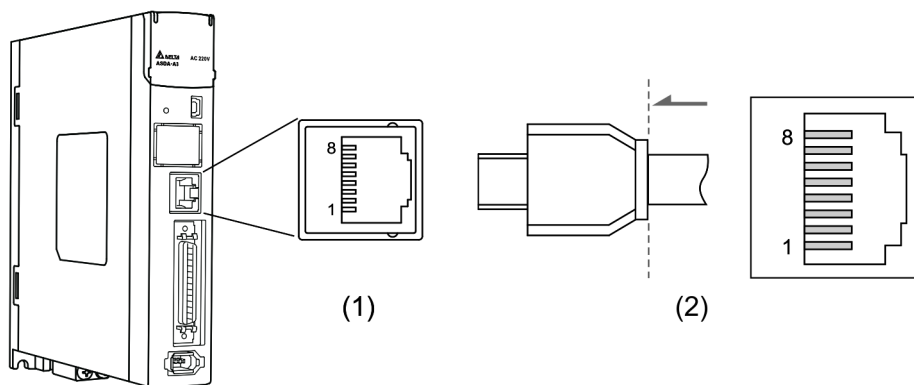
Step 8:  
Place and fasten the other side of the case and then it is completed.

3

### 3.5 Wiring for CN3 connector (RS-485 / high speed communication)

When the servo drive is connected to the PC via CN3, users can operate the servo drive, PLC, or HMI via MODBUS and assembly language. CN3 connector supports two commonly used communication interfaces, RS-485 and CAN. It enables multiple servo drives to connect simultaneously.

Note: RS-485 and high speed communication are not supported by A3-F.



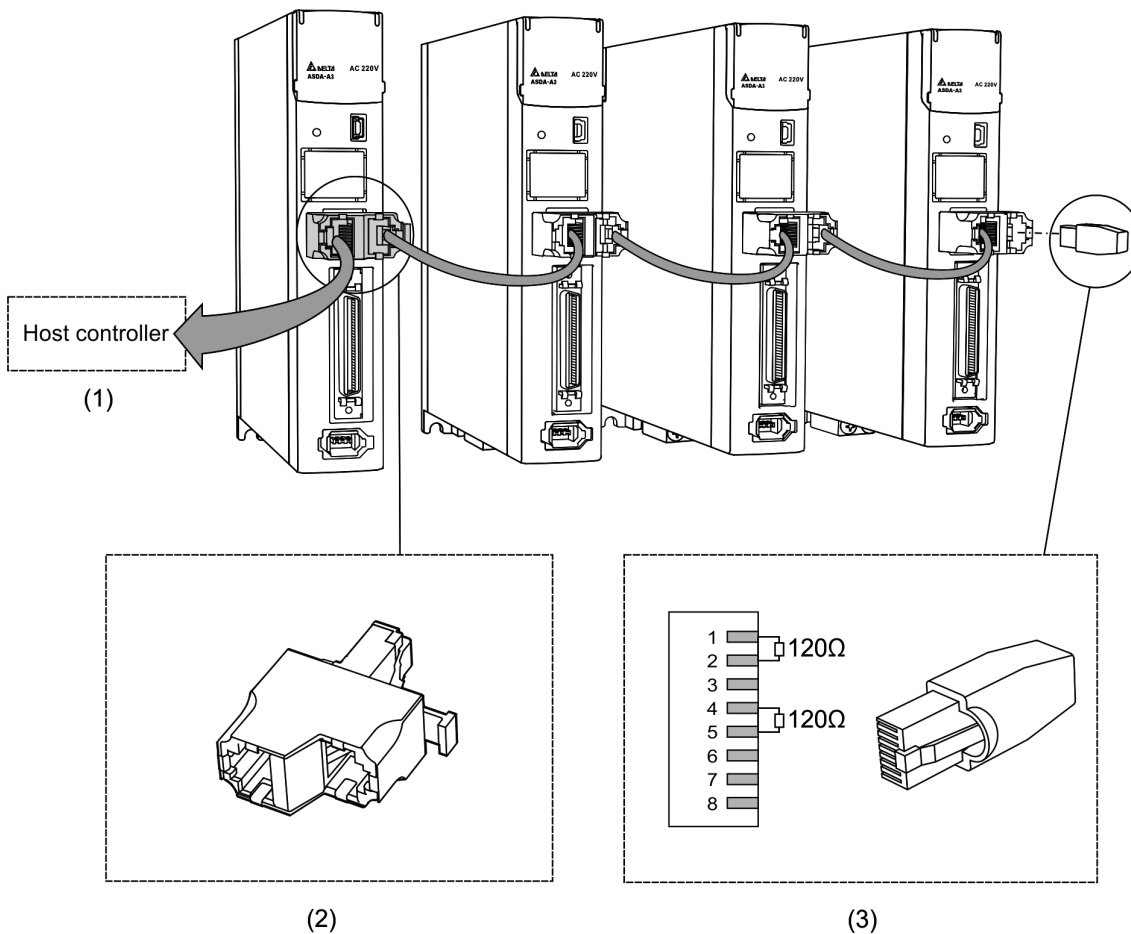
(1) CN3 connector (Female) (2) CN3 connector (Male)

Pin assignment:

Pin No.	Signal	Function
1	CAN_H	CAN_H bus line (dominant high)
2	CAN_L	CAN_L bus line (dominant low)
3, 7	GND_ISO	Signal GND
4	RS-485-	The servo drive transmits the data to differential terminal (-)
5	RS-485+	The servo drive transmits the data to differential terminal (+)
6, 8	-	-

Note: Please refer to Chapter 9 for the wiring of RS-485.

Connecting multiple servo drives:



(1) Connect to the controller / PLC

(2) Modbus/CAN connector (part name: ACS3-CNADC3)

(3) Wiring for CAN / RS-485 terminal resistor (part name: ACS3-CNTRC3)

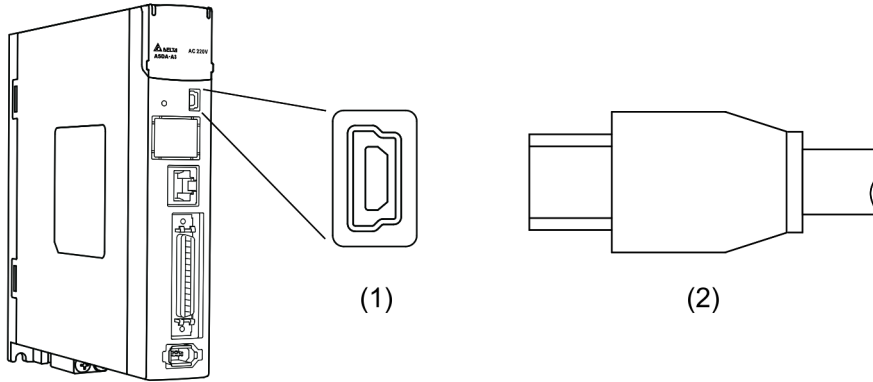
Note:

1. It supports up to 32 axes via RS-485 with the CANOpen cable length of up to 30 m. The communication quality and the connectable axes are determined by the controller's specifications, quality of wire rods, grounding, interference, and whether twisted-pair cable with shielding is used.
2. It is suggested to use a terminal resistor of 120 Ω (Ohm) and 0.5 W (or above)
3. To parallel connect multiple servo drives, please use CAN/RS-485 connectors, for one way in and the other way out, and put the terminal resistor in the last servo drive.

### 3.6 CN4 serial connector (Mini USB)

CN4 is a serial connector for connecting the PC and allows users to operate the servo drive with the software. This is a Type B Mini-USB that is compatible with USB 2.0

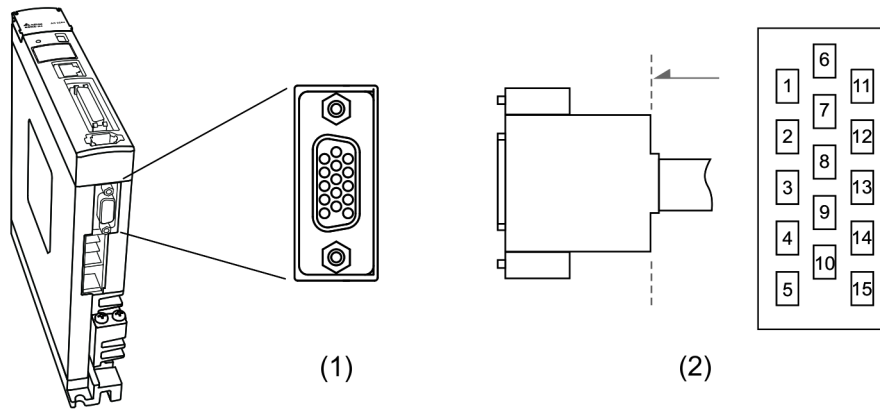
Note: When there is higher interference during operation, it is suggested to install USB isolator (Part number: ACS3-CAUC15 / ACS3-CAUC30)



(1) USB connector (Female) (2) USB connector (Female)

### 3.7 CN5 connector (for machine position feedback, applicable to full-closed loop)

CN5 connects to the external linear scale or encoder (A, B, and Z) and form a full-closed loop with the servo system.



Pin assignment:

Pin No.	Signal	Function
1	Opt_/Z	/Z phase input
2	Opt_/B	/B phase input
3	Opt_B	B phase input
4	Opt_A	A phase input
5	Opt_/A	/A phase input
6	GND	Encoder grounding
7	GND	Encoder grounding
8	+5V	Encoder power
9	Opt_Z	Z phase input
10	Reserved	Reserved
11	Reserved	Reserved
12	Reserved	Reserved
13	Reserved	Reserved
14	Reserved	Reserved
15	Reserved	Reserved

Note:

1. It only supports AB phase signal and the encoder of 5 V.
2. The max. single-phase pulse frequency is 1 MHz for encoder.

3

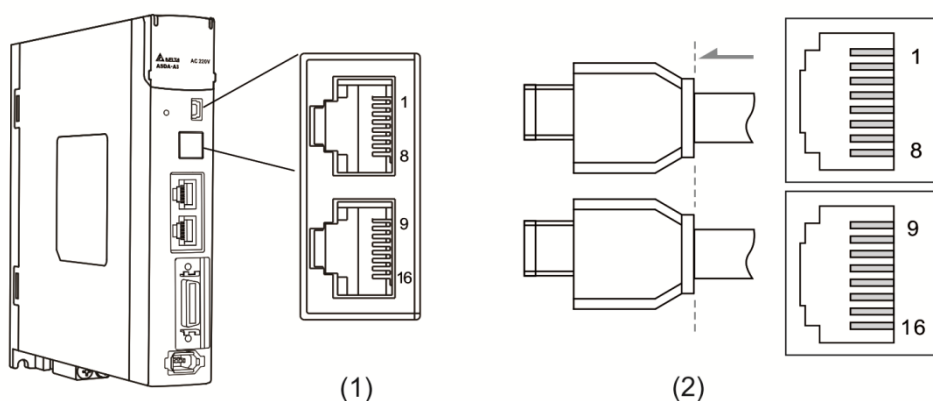
### 3.8 CN6 connector

#### 3.8.1 DMCNET communication connector for wiring

CN6 supports standard RJ45 connector, shielded cable. It can be used to connect to the host controller or motion control card. With Delta's DMCNET system, it can achieve position, torque and speed control as well as accessing or monitoring the servo status.

The station number of DMCNET can be set by P3.000. Its transmission rate can go up to 20 Mbps. Two connectors are provided for connecting multiple servo drives, with one way in and the other way out. Please remember to put the terminal resistor (150 Ω) in the last servo drive.

Note: DMCNET is supported by A3-F only.

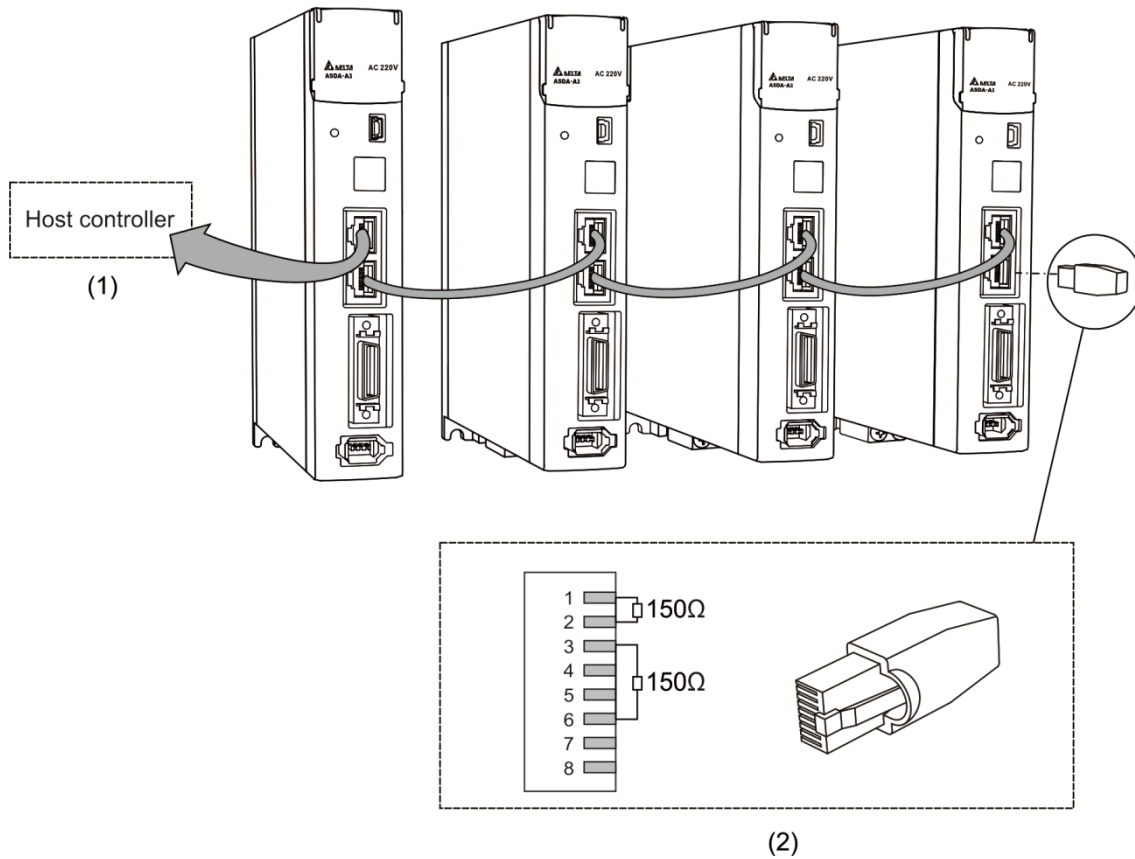


(1) CN6 connector (female) (2) CN6 connector (male)

Pin assignment:

Pin No.	Signal	Function
1, 9	DMCNET_1A	DMCNET Channel 1 bus line (+)
2, 10	DMCNET_1B	DMCNET Channel 1 bus line (-)
3, 11	DMCNET_2A	DMCNET Channel 2 bus line (+)
4, 12	-	-
5, 13	-	-
6, 14	DMCNET_2B	DMCNET Channel 2 bus line (-)
7, 15	-	-
8, 16	-	-

Connecting multiple servo drives:



(1) Connect to the controller / motion control card

(2) DMCNET terminal resistor (This is produced by Delta PLC department, please contact your local distributors for further ordering information).

Note:

1. It supports up to 12 axes and the cable length of up to 30 m.
2. It is suggested to use a terminal resistor of  $150\ \Omega$  (Ohm) and 0.5 W (or above).
3. To serial connect multiple servo drives, please use DMCNET connectors, for one way in and the other way out, and put the terminal resistor in the last servo drive.

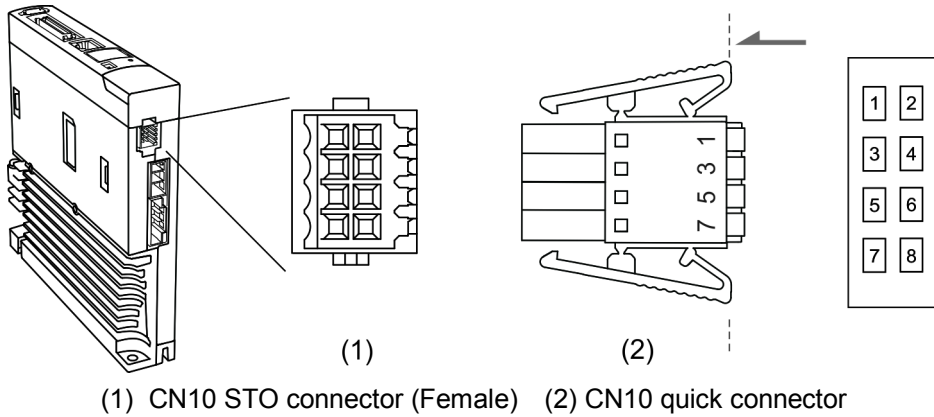


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### 3.9 CN10 STO connector (Safe torque off )

This connector provides STO function. More details will be provided in the next section.

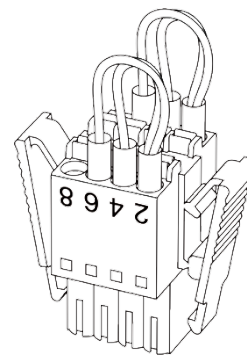
Note: STO function is supported by A3-M only.



Pin assignment:

Pin No.	Signal	Function
1	Reserved	Reserved
2	Reserved	Reserved
3	STO_A	STO input A+
4	/STO_A	STO input A-
5	STO_B	STO input B+
6	/STO_B	STO input B-
7	FDBK+	STO alarm output (+), BJT Output Max. rating: 80 VDC, 0.5 A
8	FDBK-	STO alarm output (-), BJT Output Max. rating: 80 VDC, 0.5 A

If STO function is used, you can plug in the STO connector that comes along with the servo drive. Wiring has been done as shown in the figure on the right. If this connector has been disassembled, refer to section 3.9 STO Function (Safe Torque Off) for wiring information.



## **3.10 STO function (Safe torque off)**

### **3.10.1 Introduction to STO**

Once the STO function is activated, the servo drive stops outputting current to the motor. Then the power supply and torque force are cut off.

### **3.10.2 The potential danger of STO**

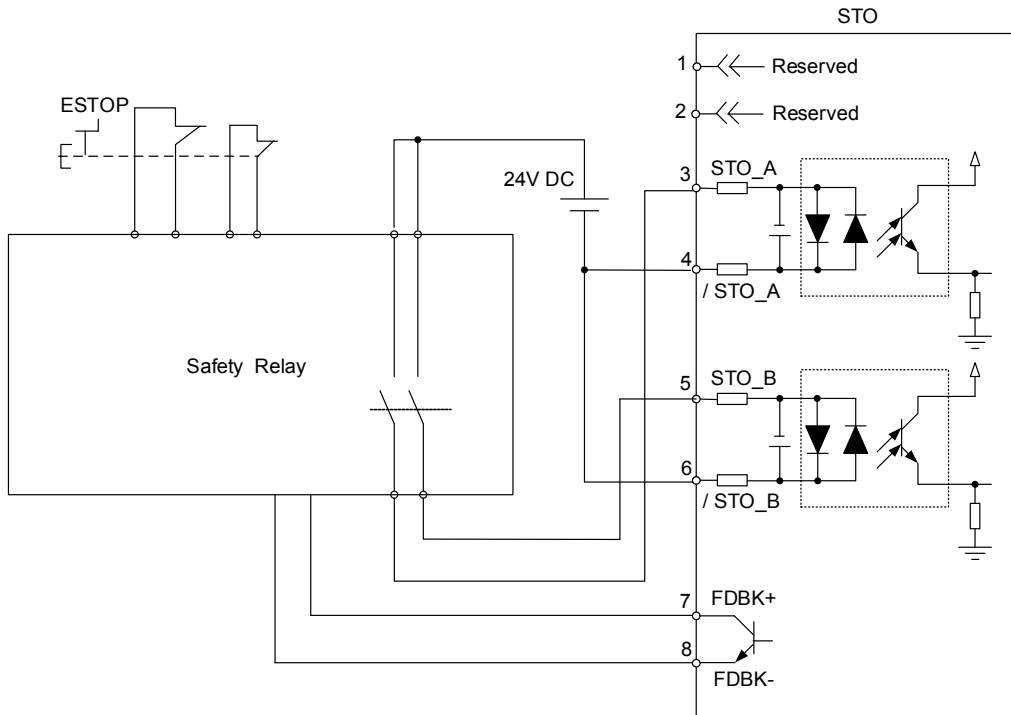
After the STO function is activated, the motor is not controlled by the servo motor. Thus, the potential danger of STO shall be taken into consideration when designing and wiring. Delta will not be liable for the mechanical damage and personnel injury if users fail to observe the following instructions:

1. For a safety circuit design, make sure the selected components conform to the safety specifications.
2. Read the safety instructions in STO-related user manual of the components you use before installation.
3. To avoid electric shock, do not touch the servo drive even when STO function is activated. Although the current outputted to the motor is cut off, there will be residual electricity since the power supply is not completely removed from the servo drive.
4. When STO function is enabled, the servo drive can no longer control the motor; it cannot stop or decelerate the motor.
5. After STO function is activated, the servo drive no longer controls the motor, but the motor can still be moved by other external force.

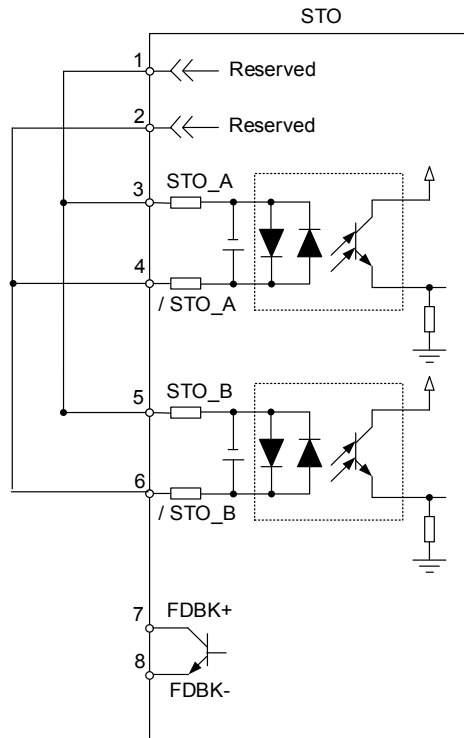
### 3.10.3 Wiring for STO

To use safety relay to trigger STO function, please conduct the wiring as shown in the following diagram:

3



If not using the STO function, users can short-circuit the connector or plug in the connector that has been wired (provided along with the servo drive).



### 3.10.4 How does STO function work?

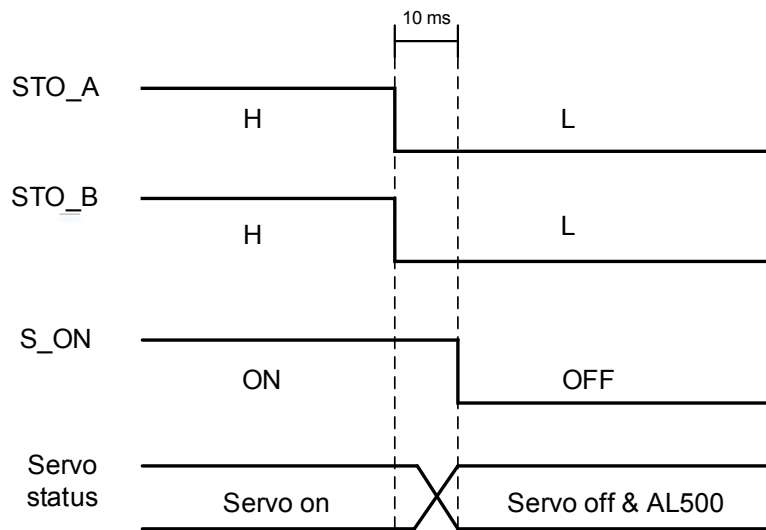
STO function is controlled by the motor current from two individual circuits. It cuts off the power supply to the motor when needed and the motor is now free of torque force. Table 1 elaborates how this function works.

Table 1: Actions description (ON = 24V; OFF = 0V)

Signal	Channel	Status of opto-isolator			
STO	STO_A ~/ STO_A	ON	ON	OFF	OFF
	STO_B ~/ STO_B	ON	OFF	ON	OFF
Servo Drive Output Status		Ready	Torque off (STO_B lost)	Torque off (STO_A lost)	Torque off (STO Mode)

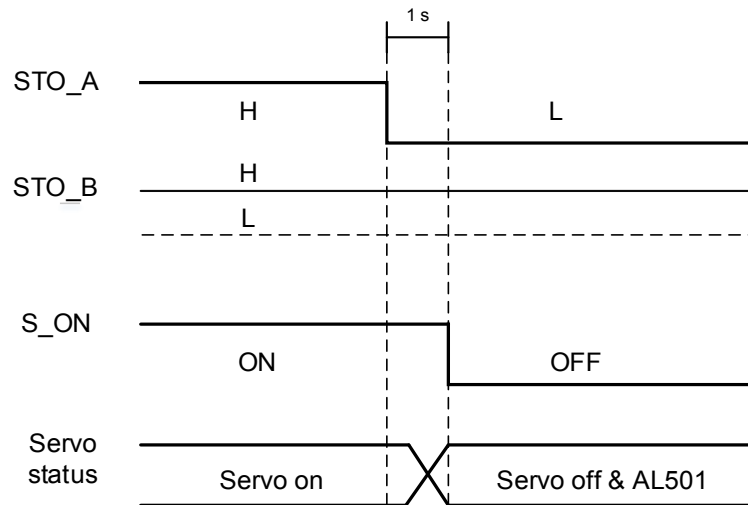
(1) Description of STO alarm:

See the diagram below. When the motor runs normally (SERVO ON), but STO\_A and STO\_B signals are both gone for 10 ms at the same time, AL500 will occur and the drive will be in the state of SERVO OFF.



When the motor runs normally (SERVO ON), but one of the safety signal source is gone for 1s, AL501 or AL502 will occur. Then, the servo drive will be in the state of SERVO OFF.

3



### 3.10.5 Related parameter of STO function

By setting parameter P2.093, users can determine the FDBK status (Pin FDBK+ and FDBK-) and whether FDBK will latch if STO alarm occurs. The setting of P2.093 is shown as follows:

$$P2.093 = \frac{XX}{(1)} \frac{1}{(2)(3)} 0$$

- (1) Not in use
- (2) 1: FDBK no latch  
2: FDBK latch
- (3) 0: Logic A  
1: Logic B  
2: Logic C  
3: Logic D

STO function description:

See the table below. Four logics (Logic A, B, C, and D) are presented to standardize the FDBK status when different STO alarm occurs. Users can select the corresponding logic according to the demands. (In this table, "Open" means FDBK+ and FDBK- of CN8 are open circuit. Take Logic C as an example, when AL500 occurs, FDBK+ and FDBK- of CN8 are short circuited.)

Servo drive status		FDBK status							
		Logic A		Logic B		Logic C		Logic D	
Parameter P2.093		XX10	XX20	XX11	XX21	XX12	XX22	XX13	XX23
FDBK behavior		No latch	latch	No latch	latch	No latch	Latch	No latch	latch
No STO alarm occurs		Open		Close		Open		Close	
Alarm occurs	AL500	Close		Open		Close		Open	
	AL501	Close		Open		Open		Close	
	AL502	Close		Open		Open		Close	
	AL503	Close		Open		Open		Close	

Note:

1. Open = open circuit; Close = short circuit
2. Please refer to Chapter 10 Alarms for more detail.

FDBK behavior (Latch /No Latch):

If FDBK is latched when STO alarm occurs, status of FDBK will remain even when the alarm has been cleared. Please note that when more than one alarm occurs, the drive panel will only display AL500.

■ Example of Latch:

If Logic C P2.093 = XX22 is set, the FDBK status will be close when safety signal is lost and AL005 occurs.

1. Since FDBK is selected as Latch, even when the safety signal is back to normal, FDBK status will remain close. Use the approaches below to reset:
  - (1) Reconnect the power supply. FDBK status returns to “open”.
  - (2) Do not reconnect the power supply. Instead, set P2.093 to XX12 to make FDBK status return to “open”. Then set P2.093 to XX22 again. This step is to set FDBK behavior to Latch.
2. After the FDBK status restores, alarms can be cleared by normal corrective actions. In this case, AL500 can be cleared by DI.Alm Reset.

■ Example of No Latch:

If Logic C P2.093 is set to XX12, the FDBK status will be “close” when the safety signal is lost and AL500 occurs.

1. Since FDBK is selected as No Latch, safety signals return to normal and the FDBK status automatically changes from short-circuited to normal when AL500 occurs. Setting P2.093 to XX12 again is not required.
2. After the FDBK status restores, alarms can be cleared by normal corrective actions. In this case, AL500 can be cleared by DI.Alm Reset.

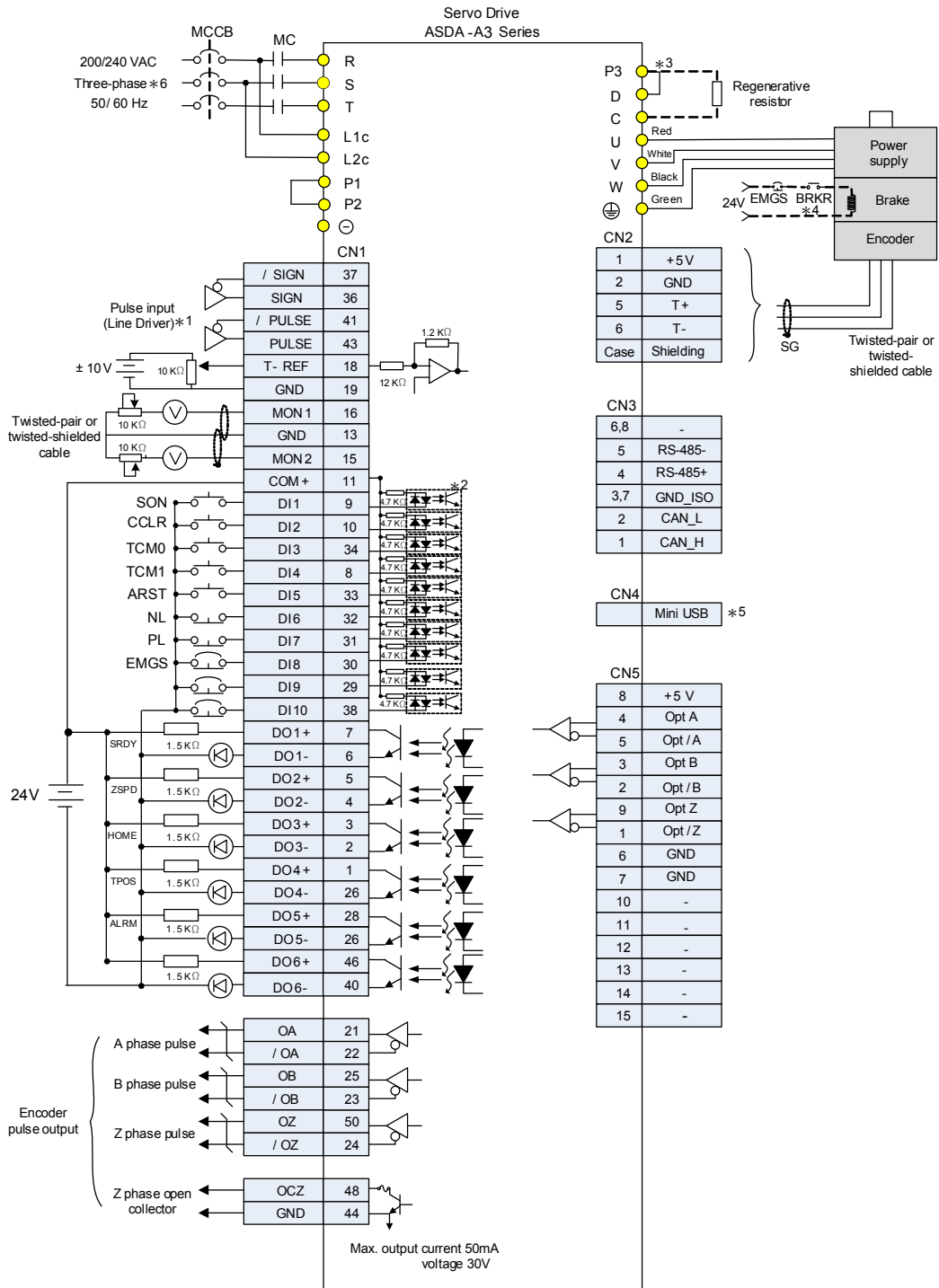
Relevant parameter (Please refer to Chapter 8 for detailed information):

Parameter	Function
P2.093	STO FDBK Control

### 3.11 Standard wiring example

#### 3.11.1 Position (PT) control mode

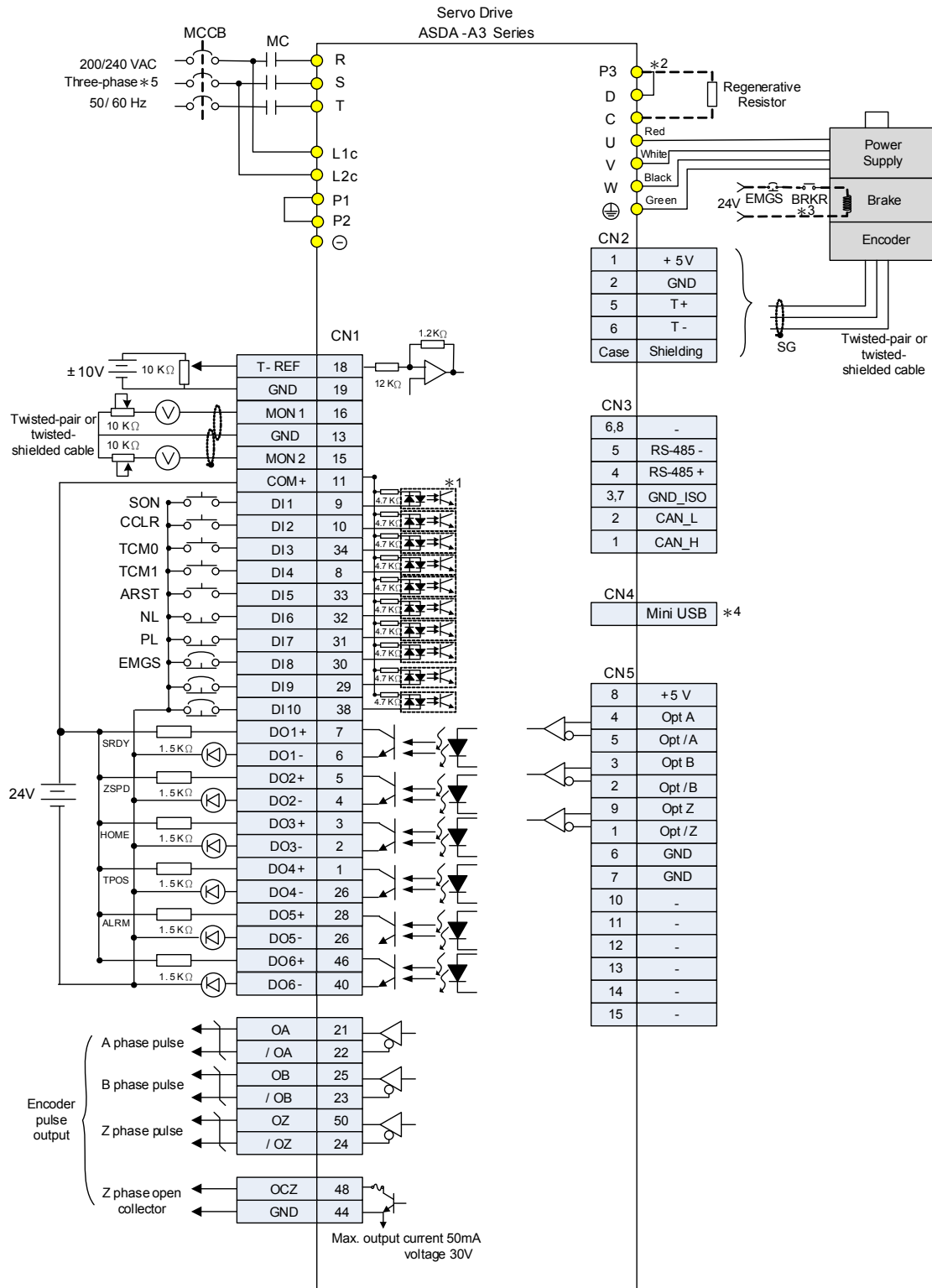
3



**Note:**

- \*1: Please refer to section 3.3.3 for C4 wiring diagram.
- \*2: Please refer to section 3.3.3 for wiring diagram C7 SINK / C8 SOURCE.
- \*3: Models of 200 W and below have no built-in brake resistor.
- \*4: Coil of brake has no polarity.
- \*5: Connect to Mini-USB (for PC communication).
- \*6: Models of 1.5 kW and below can apply single-phase power supply.

### 3.11.2 Position (PR) control mode

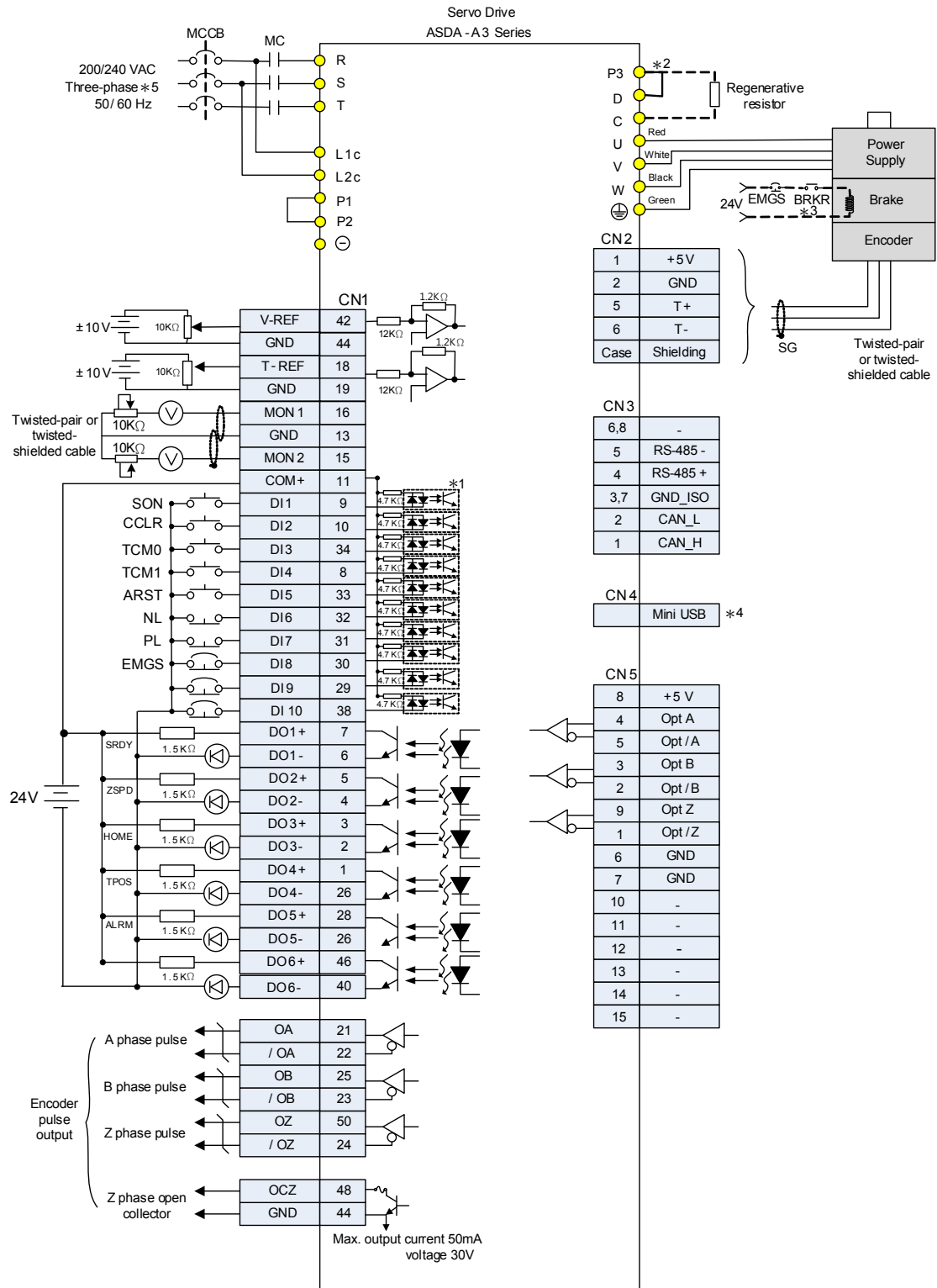


3



### 3.11.3 Speed control mode

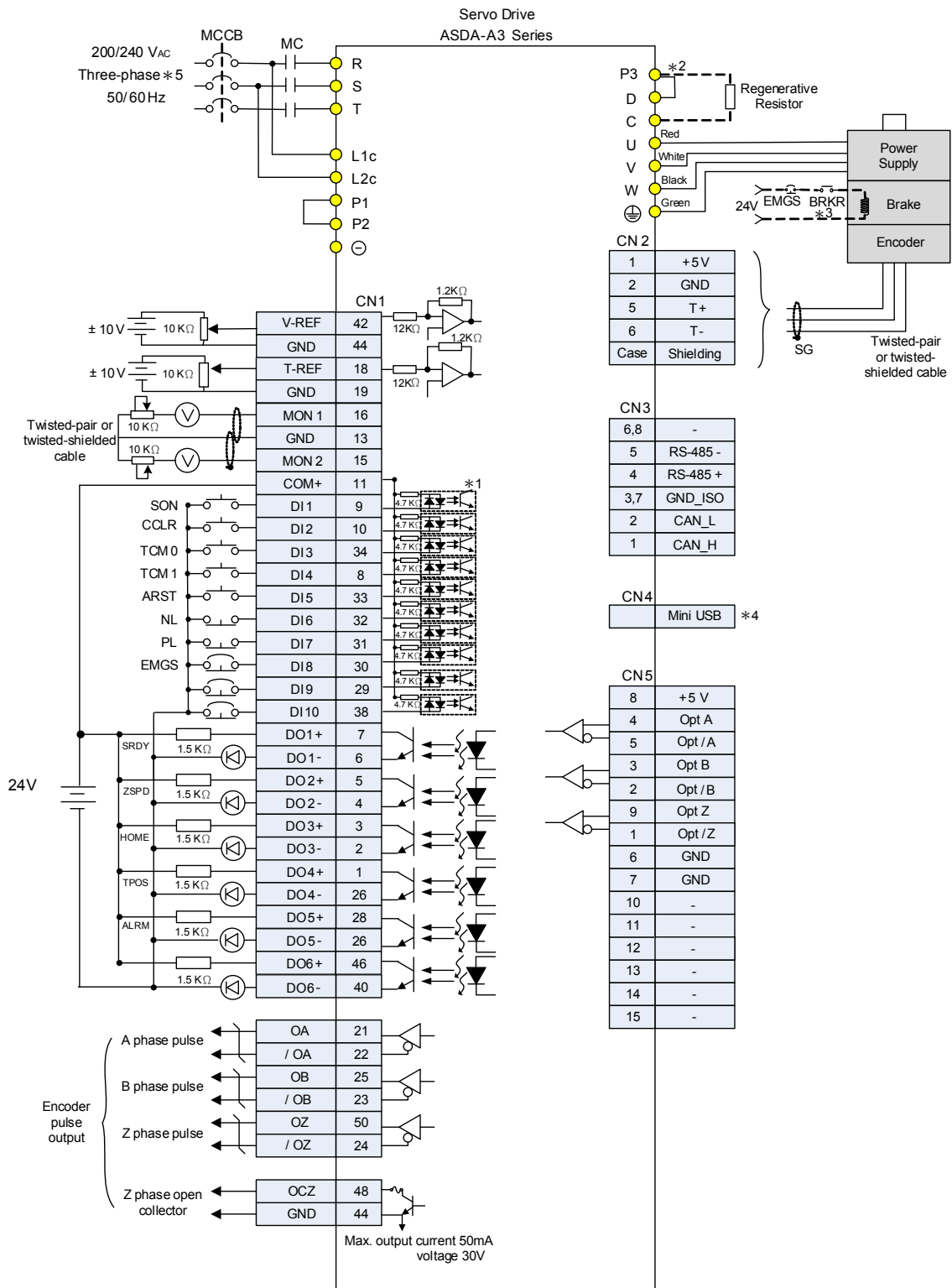
3



Note:

- \*1: Please refer to section 3.3.3 for wiring diagram C7 SINK / C8 SOURCE.
- \*2: Models of 200 W and below have no built-in brake resistor.
- \*3: Coil of brake has no polarity.
- \*4: Connect to Mini-USB (for PC communication).
- \*5: Models of 1.5 kW and below can apply single-phase power supply.

### 3.11.4 Torque control mode

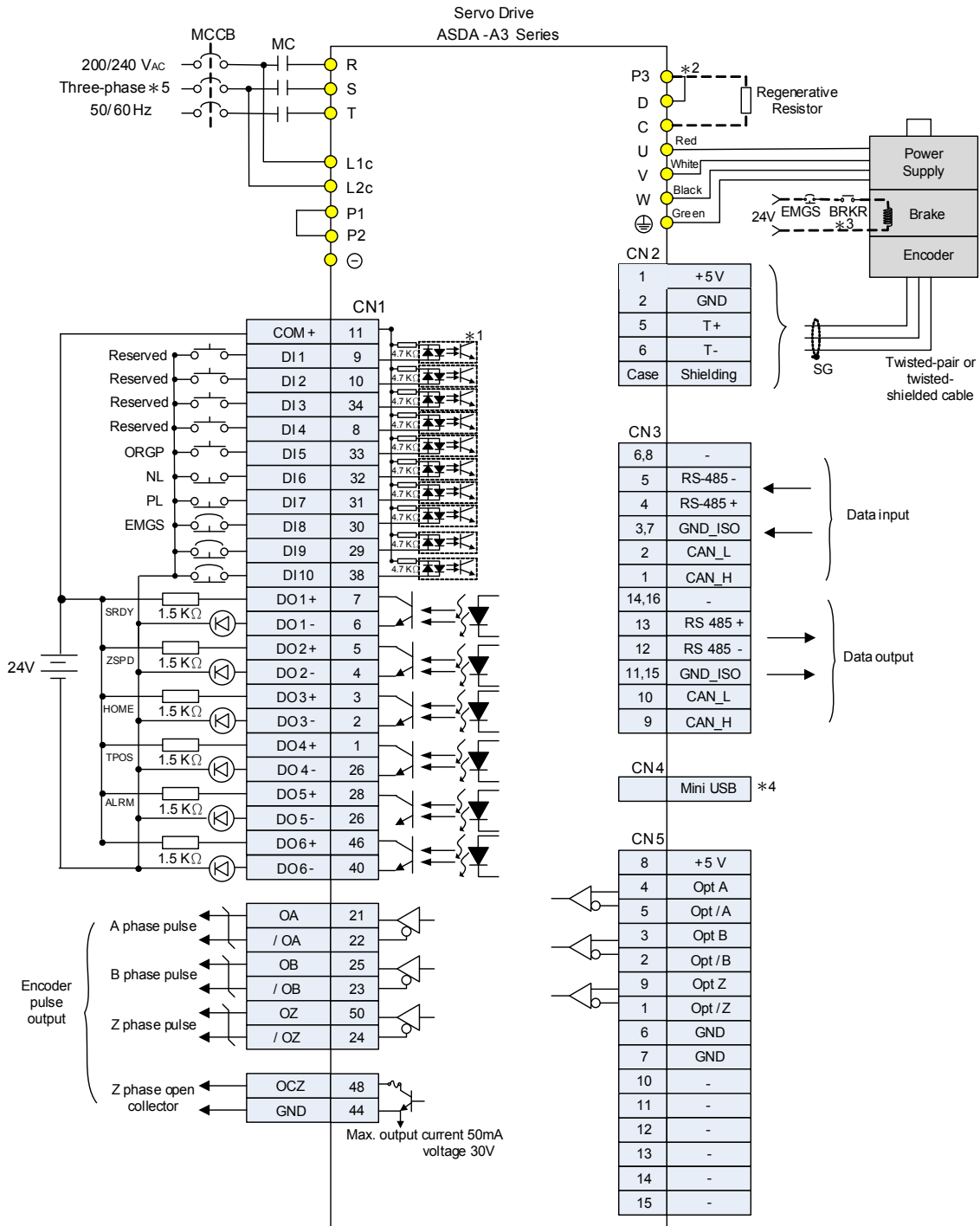


Note:

- \*1: Please refer to section 3.3.3 for wiring diagram C7 SINK / C8 SOURCE.
- \*2: Models of 200 W and below have no built-in brake resistor.
- \*3: Coil of brake has no polarity.
- \*4: Connect to Mini-USB (for PC communication).
- \*5: Models of 1.5 kW and below can apply single-phase power supply.

3

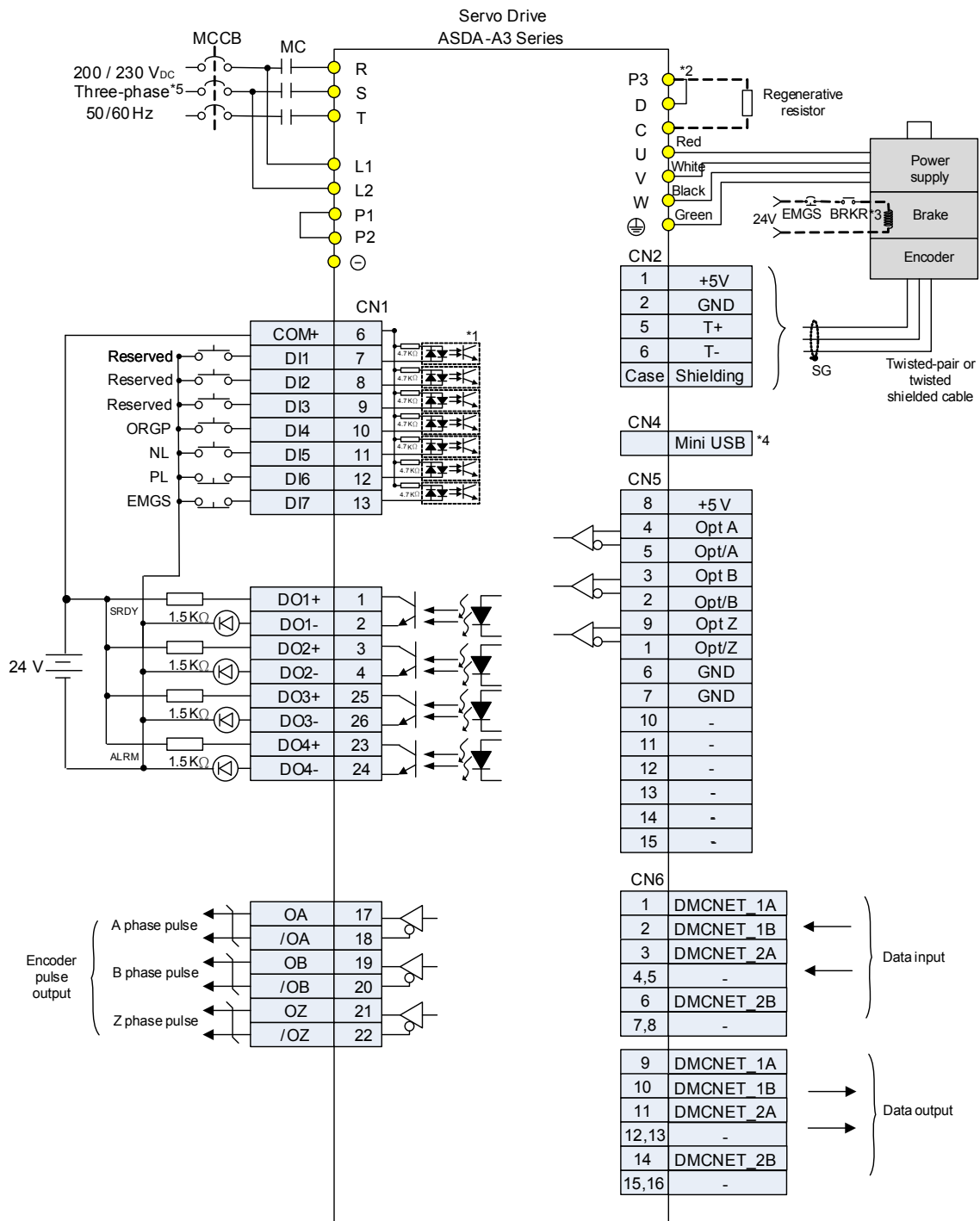
### 3.11.5 Communication mode (CANopen)



Note:

- \*1: Please refer to section 3.3.3 for wiring diagram C7 SINK / C8 SOURCE.
- \*2: Models of 200 W and below have no built-in brake resistor.
- \*3: Coil of brake has no polarity.
- \*4: Connect to Mini-USB (for PC communication).
- \*5: Models of 1.5 kW and below can apply single-phase power supply.

### 3.11.6 Communication mode (DMCNET)



3

**Note:**

- \*1: Please refer to section 3.3.3 for wiring diagram C7 SINK / C8 SOURCE.
- \*2: Models of 200 W and below have no built-in brake resistor.
- \*3: Coil of brake has no polarity.
- \*4: Connect to Mini-USB (for PC communication).
- \*5: Models of 1.5 kW and below can apply single-phase power supply.

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3

# Trial Operation and Panel Display

# 4

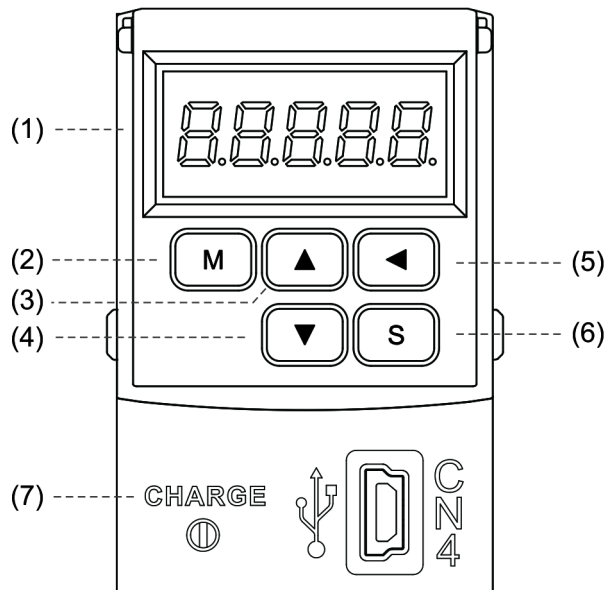
This chapter describes panel display of ASDA-A3 series servo drive, its operation and trial run.

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# 4

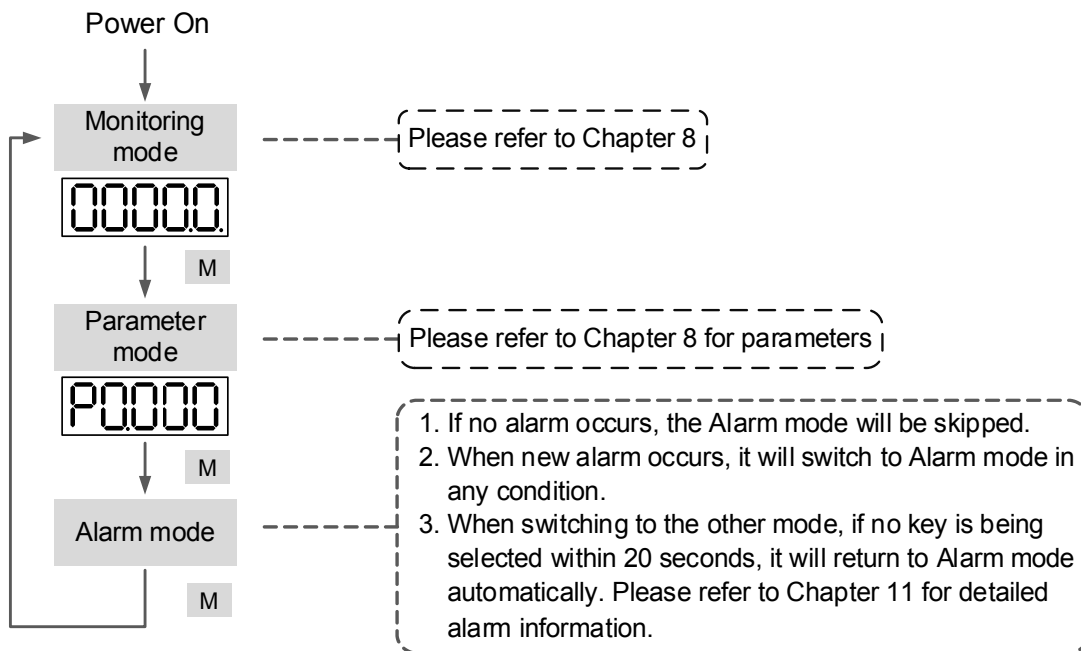
## 4.1 Panel description



- (1) Display: 5-digit, 7-segment LED displays the monitoring values, parameters and setting values.
- (2) MODE key: It is used to switch the display among Monitoring mode, Parameter mode and Alarm mode. In Editing mode, press the MODE key to switch to Parameter mode.
- (3) UP key: It is used to change monitoring code, parameter number and setting value.
- (4) DOWN key: It is used to change monitoring code, parameter number and setting value.
- (5) SHIFT key: In Parameter mode, this key can be used to change the group number. In Editing mode, moving the flashing bit to the left can adjust the higher setting bit. The display of high/low digit can be switched in Monitor mode.
- (6) SET key: It displays and stores the setting value. In Monitor mode, pressing the SET key can switch between decimal or hexadecimal display. In Parameter mode, pressing the SET key can enter Editing mode.
- (7) Charge LED: The Charge LED indicator is on when the power is applied to the circuit.

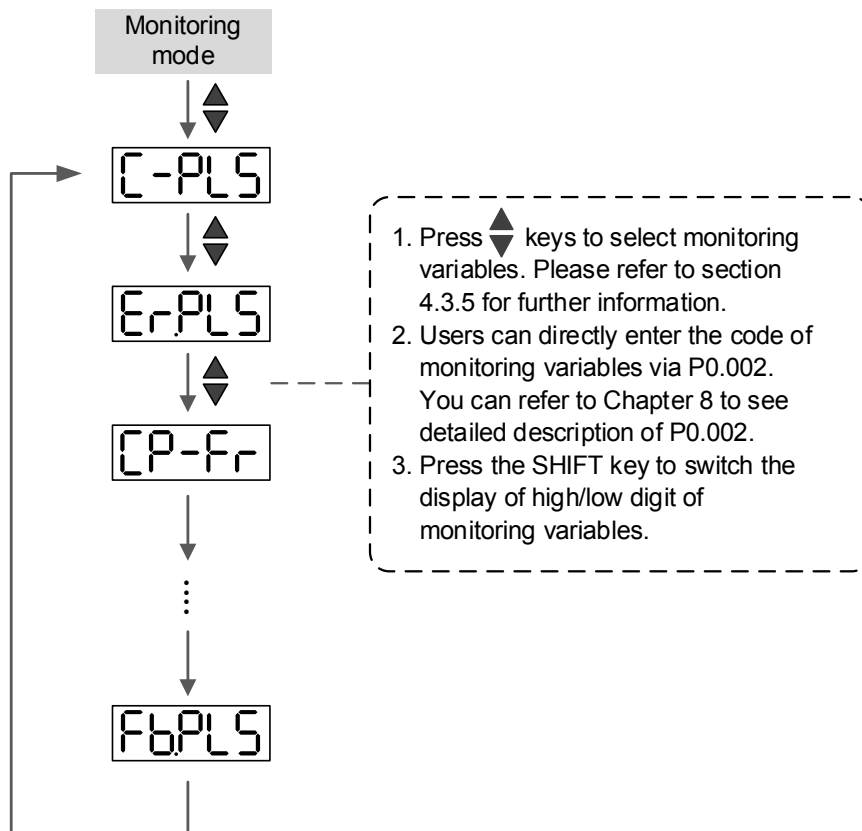
## 4.2 Parameter setting procedure

Switching modes:



Operating in each mode:

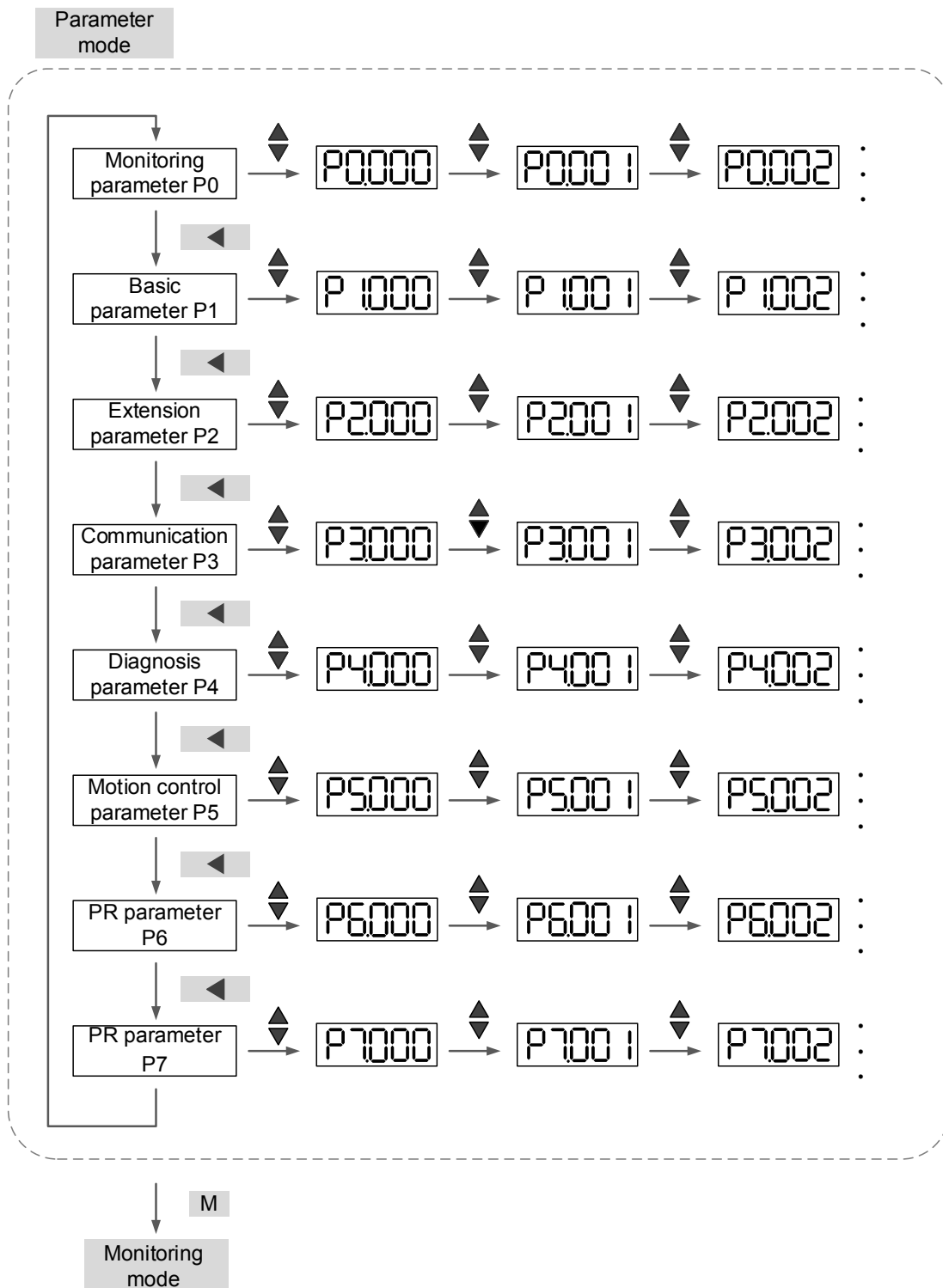
### Monitoring mode



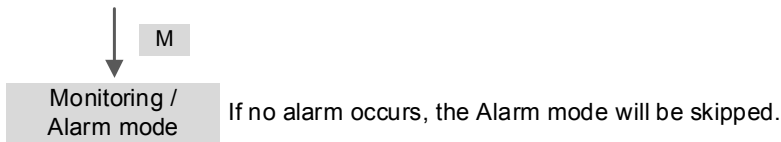
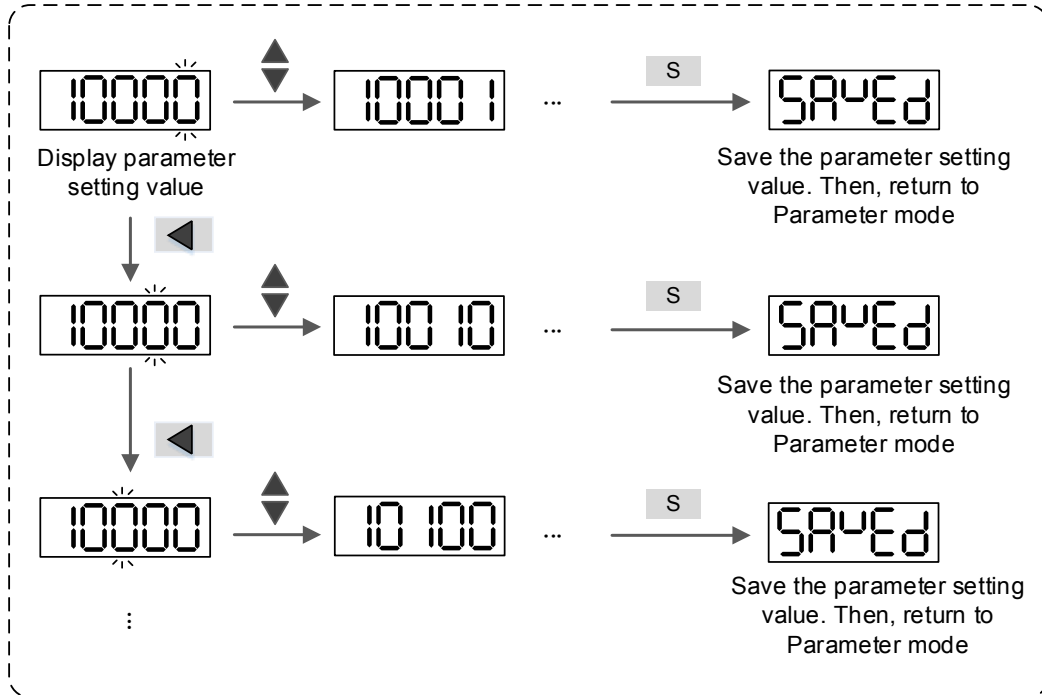
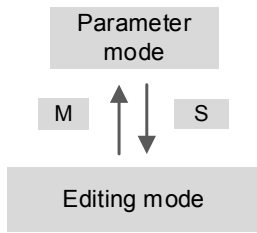


# 4

## Parameter mode



Editing mode




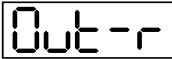
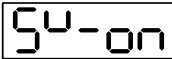
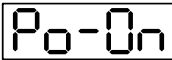


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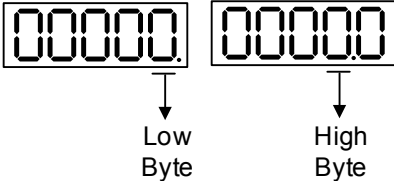
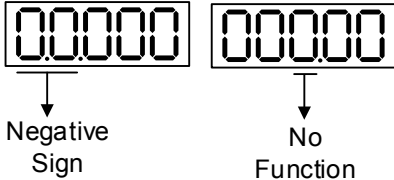
### 4.3 Status display

#### 4.3.1 Save the setting display


When parameter setting is completed, press the SET key to save. And the panel will display the status for one second.

Displayed symbol	Description
	Correctly saved the setting value. (Saved)
	Read-only and write-protected parameter. (Read-only)
	Entered the wrong password or no password has been inputted. (Locked)
	Incorrect setting value or input the reserved setting value. (Out of Range)
	It is not allowed to input the value when it is in servo on state. (Servo On).
	The parameter will be effective after re-power on the servo drive. (Power On)



#### 4.3.2 Display the decimal point

Displayed symbol	Description
	High byte / low byte indication: When the data is displayed in decimal 32 bits, it is for indicating the current high or low byte.
	Negative sign: When the data is displayed in decimal format, the two decimal points on the left represents the negative sign, whether it is showed in 16 or 32 bits. When it is showed in hexadecimal format, it only shows positive sign.

### 4.3.3 Alarm messages


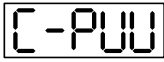
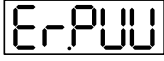


Displayed symbol	Description
	When an alarm occurs, the servo drive will show 'AL' as the alarm symbol and 'nnn' as the alarm code. For detailed information, please refer to Chapter 8 P0.001 Parameter Description, or Chapter 11 Troubleshooting.

### 4.3.4 Positive and negative sign setting

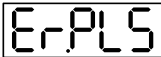



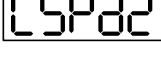
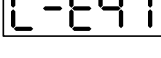
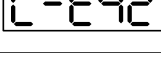

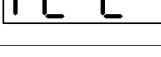
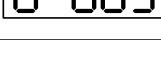
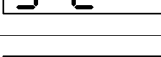
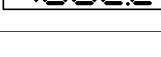
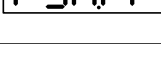
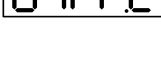
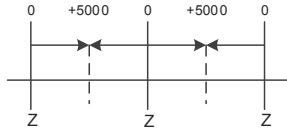


Displayed symbol	Description
	When entering the Editing mode, press the UP / DOWN key to change the displayed value. The SHIFT key can change the carry value that users wish to alter. (The carry value is flashing at the moment.)
	Press the SHIFT key for two seconds to switch between the positive (+) and negative (-) sign. If the parameter value is over the setting range after switching the positive or negative sign, then the value will be reset to the original setting value automatically.



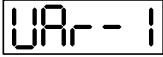

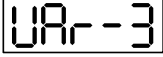
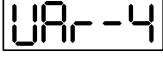
### 4.3.5 Monitoring display

When the drive is applied to the power, the display will show the monitoring displayed symbol for one second, and then enter Monitoring mode. In Monitoring mode, the UP / DOWN key can change the monitoring variable. Or, the user can directly change the setting of P0.002 to specify the monitoring code. When applying to the power, the monitoring code will be set as the setting value of P0.002. For example, the setting value of P0.002 is 4. When the drive applies to the power, it will display C-PLS monitoring sign first, and then show the input pulse number. See the details in the table below:

P0.002 setting value	Monitoring displayed symbol	Description	Unit
0		Motor feedback pulse number (after the scaling of electronic gear ratio) (User unit)	[user unit]
1		Input pulse number of pulse command (after the scaling of electronic gear ratio) (User unit)	[user unit]
2		The deviation between control command pulse and feedback pulse number (User unit)	[user unit]
3		Motor feedback pulse number (encoder unit) (1.28 million pulse/rev)	[pulse]
4		Input pulse number of pulse command (before the scaling of electronic gear ratio) (encoder unit)	[pulse]

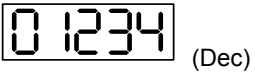
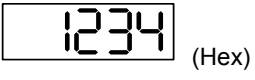
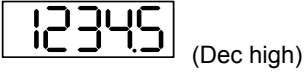
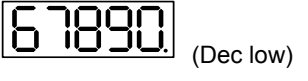
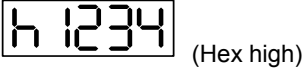

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P0.002 setting value	Monitoring displayed symbol	Description	Unit
5		Error pulse number (after the scaling of electronic gear ratio) (encoder unit)	[pulse]
6		Input frequency of pulse command	[kpps]
7		Motor speed	[rpm]
8		Speed command	[Volt]
9		Speed command	[rpm]
10		Torque command	[Volt]
11		Torque command	[%]
12		Average torque	[%]
13		Peak torque	[%]
14		Main circuit voltage	[Volt]
15		Load / Motor inertia ratio (Note: If it shows 13.0, it means the actual inertia is 13)	[1 times]
16		IGBT temperature	[°C]
17		Resonance frequency (Low byte is the first resonance and high byte is the second one)	[Hz]
18	 	The absolute pulse number of encoder Z phase equals the homing value, 0. It will be +5000 or -5000 pulses when the motor rotates in forward or reverse direction	-
19		Mapping parameter #1: shows the content of parameter P0.025 (specify the mapping target by P0.035)	-
20		Mapping parameter #2: shows the content of parameter P0.026 (specify the mapping target by P0.036)	-


P0.002 setting value	Monitoring displayed symbol	Description	Unit
21		Mapping parameter #3: shows the content of parameter P0.027 (specify the mapping target by P0.037)	-
22		Mapping parameter #4: shows the content of parameter P0.028 (specify the mapping target by P0.038)	-
23		Monitoring variable #1: shows the content of parameter P0.009 (specify the monitoring variable code by P0.017)	-
24		Monitoring variable #2: shows the content of parameter P0.010 (specify the monitoring variable code by P0.018)	-
25		Monitoring variable #3: shows the content of parameter P0.011 (specify the monitoring variable code by P0.019)	-
26		Monitoring variable #4: shows the content of parameter P0.012 (specify the monitoring variable code by P0.020)	-

4

Following table shows the panel display of 16-bit and 32-bit value:

Example of the displayed value	Description	
 (Dec)	16 bits	If the value is 1234, it displays 01234 (shows in decimal format).
 (Hex)		If the value is 0x1234, it displays 1234 (shows in hexadecimal format; the first digit does not show any).
 (Dec high)	32 bits	If the value is 1234567890, the display of the high byte is 1234.5 and displays 67890 as the low byte (shows in decimal format).
 (Dec low)		
 (Hex high)		If the value is 0x12345678, the display of the high byte is h1234 and displays L5678 as the low byte (shows in hexadecimal format).
 (Hex low)		

Following table shows the panel display of negative sign:

Example of the displayed value	Description
 (Dec)	If the value is -12345, it displays 1.2.345 (only shows in decimal format; there is no positive or negative sign for hexadecimal format display).

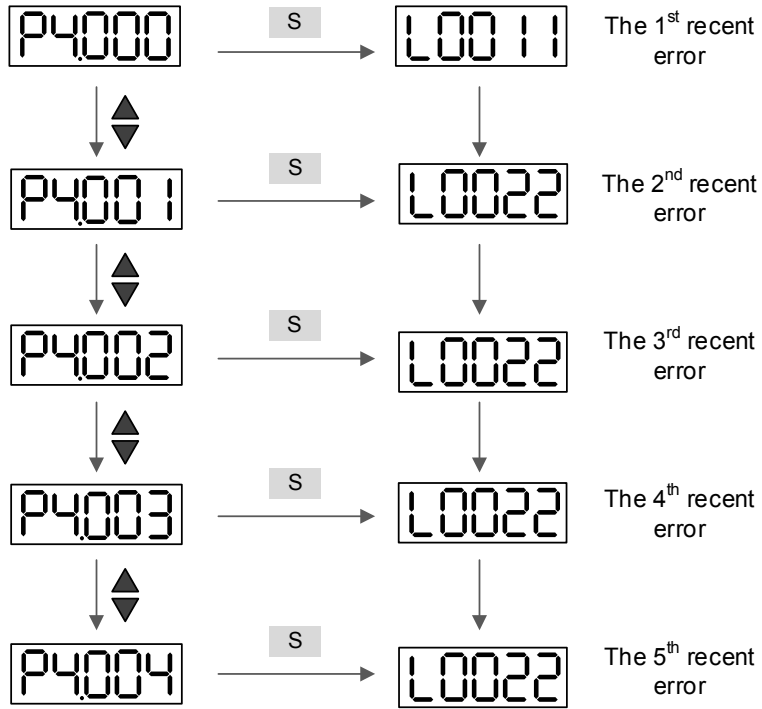
Note:

1. Dec means the value is displayed in decimal format; Hex represents hexadecimal format.
2. The above display is applicable in both Monitoring mode and Editing mode.
3. When all monitoring variable is 32 bits, high / low bit and the display (Dec/Hex) can be switched. According to the definition in Chapter 8, each parameter only supports one displaying method and cannot be switched.

### 4.4 General function

#### 4.4.1 Operation of fault record display

When it is in Parameter mode, select P4.000 ~ P4.004 and press the SET key to show the corresponding fault record.

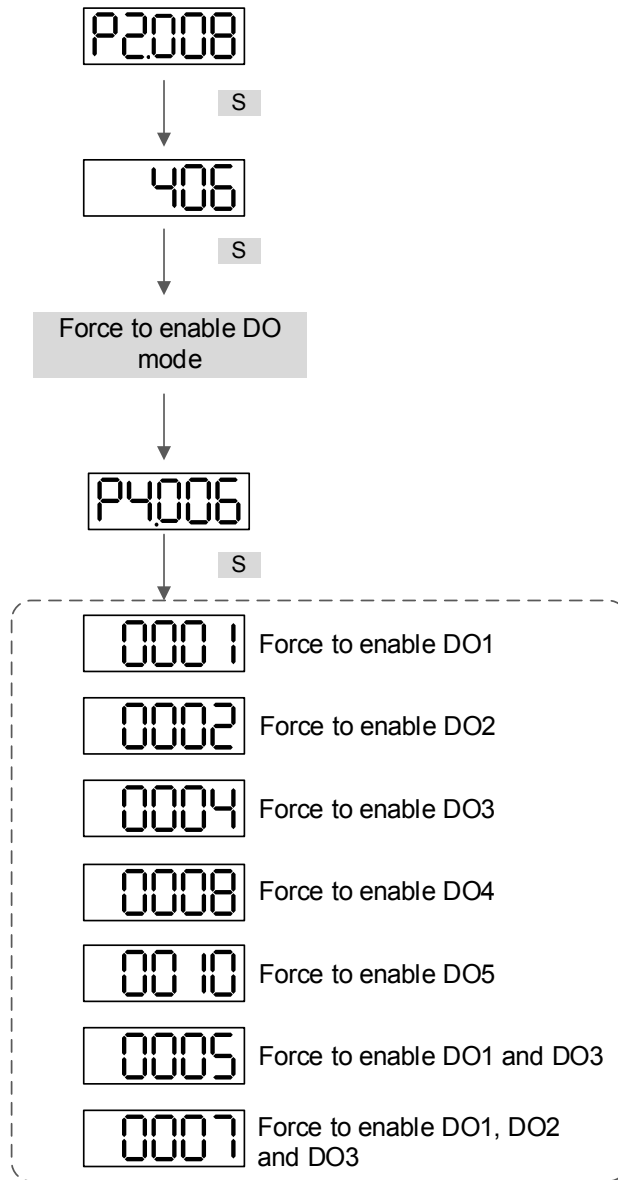




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4.4.2 Force DO on

Enter the Diagnosis mode by the following settings. Set P2.008 to 406 and enable the function of force DO on. Then, set the DO by binary method via P4.006. When the setting value is 2, it will force to enable DO2. When the setting value is 5, it will force to enable DO1 and DO3. No data is retained in this mode. It returns to the normal DO mode after re-power. Users can also set P2.008 to 400 to switch to the normal DO mode.

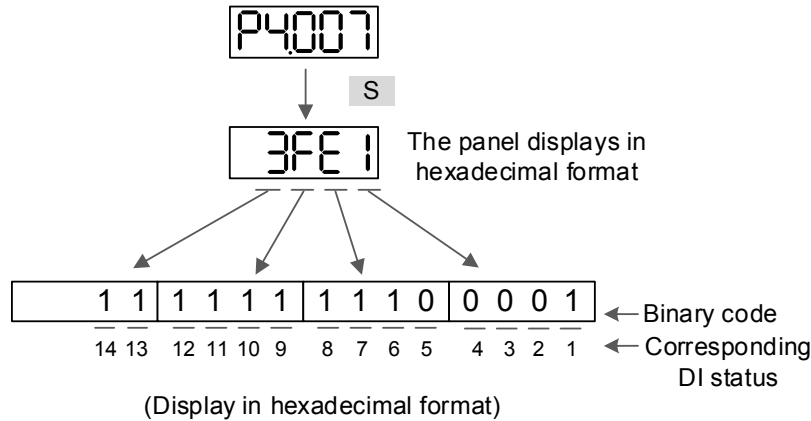


Note: P4.006 is displayed in hexadecimal format. Therefore, it will not show the fifth 0.

### 4.4.3 Digital input diagnosis operation

Enter the Diagnosis mode by the following setting methods. When DI1 ~ DI10 is triggered by the external output signal, the panel will show the corresponding signal. It is displayed by bit. When it shows 1, it means the DI is on.

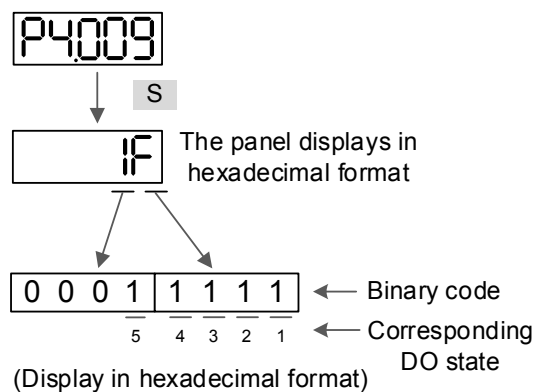
For example, if it shows 3FE1, E is in hexadecimal format, it will be 1110 when it transfers to binary format. Then, DI6 ~ DI8 is ON.



### 4.4.4 Digital output diagnosis operation

Enter the Diagnosis mode by the following setting methods. The output signal DO1 ~ DO5 is triggered and the corresponding signal will be shown on the panel. It is displayed by bit. When it shows 1, it means the DO is on.

For example, if it shows 1F, F is in hexadecimal format, it will be 1111 when it transfers to binary format. Then, DO1 ~ DO4 is on.



4

## 4.5 Trial run

This section can be divided into two parts. The first part introduces the inspection without load. And the second part describes the inspection when running the servo motor with load. To avoid danger, please operate the servo motor without load first.

### 4.5.1 Inspection without load

Please remove the load from the servo motor, including coupling on the shaft and accessories to avoid any damage to servo drive or mechanism. This is for avoiding the falling off of the disassembled parts of the motor shaft and indirectly causing personnel injury or equipment damage during operation. Please run the motor without load first to see if the servo motor can run during normal operation.

**Caution:** In order to prevent danger, it is strongly recommended to check if the motor can operate normally without load first. Then, operate the motor with load.

Please carefully check the following items before operation.

<p>Inspection before running the servo drive (not applied to the power)</p>	<ul style="list-style-type: none"> <li>■ Check if there is any obvious damage shown on its appearance.</li> <li>■ The splicing parts of the wiring terminal should be isolated.</li> <li>■ Make sure the wiring is correct to avoid damage or any abnormality.</li> <li>■ Check if the electric conductivity objects including sheet metal (such as screws) or inflammable objects are not inside the servo drive.</li> <li>■ Check if the control switch is in OFF status.</li> <li>■ Do not place the servo drive or external regenerative resistor on inflammable objects.</li> <li>■ To avoid the electromagnetic brake losing efficacy, please check if stop function and circuit break function can work normally.</li> <li>■ If the peripheral devices are interfered by electronic instruments, please reduce electromagnetic interference with devices.</li> <li>■ Please make sure the external voltage level of the servo drive is correct.</li> </ul>
<p>Inspection when running the servo drive (applied to the power)</p>	<ul style="list-style-type: none"> <li>■ The encoder cable should avoid excessive stress. When the motor is running, please make sure the cable is not frayed or overextended.</li> <li>■ Please contact Delta if the servo motor vibrates or has unusual noise during operation.</li> <li>■ Make sure the setting of the parameters is correct. Different machinery has different characteristic, please adjust the parameter according to the characteristic of each machinery.</li> <li>■ Please reset the parameter when the servo drive is in the status of SERVO OFF, or it may cause malfunction.</li> <li>■ When the machinery is operating, please contact Delta if there is no contact sound or other abnormal sound.</li> </ul>

	<ul style="list-style-type: none"> <li>■ Check if the power indicator and LED display works normally.</li> <li>■ 7.5 kW model is controlled by PWM. When the temperature is lower than 40 °C, the fan stops running.</li> </ul>
--	---

### 4.5.2 Apply power to A3 servo drive

Please follow the instructions below.

1. Make sure the wiring between the motor and servo drive is correct:
  - (1) U, V, W and FG have to connect to cable red, white, black and green respectively. If the wiring is incorrect, the motor cannot work normally. Please refer to section 3.1 ~ 3.2 for wiring.
  - (2) The encoder cable of the motor has correctly connected to CN2: If users only desire to carry out JOG function, connecting CN1 and CN3 is not needed. Please refer to Chapter 3.1 and 3.4 for the wiring of CN2.

**Caution:** Do not connect the power (R, S, T) to the output terminal (U, V, W) of A3 servo drive, or it may damage the servo drive.

2. Connect the power circuit of the servo drive:
 

220 V servo drive: Apply power to the servo drive. Please refer to Chapter 3.1.3 for power wiring.
3. Turn on the power:
 

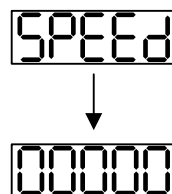
220 V servo drive supply: including control circuit (L1c, L2c) and main circuit (R, S, T) power.

When the power is on, the display of the servo drive will be:



The default of digital input (DI6 ~ DI8) are the signal of reverse inhibit limit (NL), forward inhibit limit (PL), and emergency stop (EMGS). If DI6 ~ DI8 is not used, adjusting the setting of P2.015 ~ P2.017 is a must, which can be set to 0 (disable this DI function) or modified to another function.

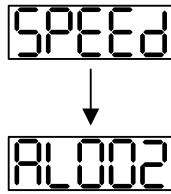
From the last setting, if the servo drive status displays parameter P0.002 setting as the motor speed (07), then the screen display will be:



When the panel displays no text, please check if the power of control circuit is under voltage.

4

- When the screen displays



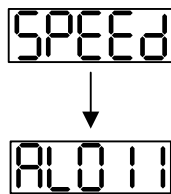
Warning of overvoltage:

It means the voltage input by the main circuit is higher than the rated range or a power input error has occurred (incorrect power system).

Corrective action:

1. Use the voltmeter to measure if the input voltage from the main circuit is within the range of rated voltage.
2. Use the voltmeter to check if the power system complies with the specifications.

- When the screen displays



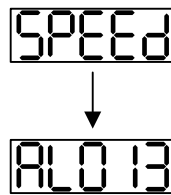
Warning of encoder error:

Check if the motor encoder is securely connected and the wiring is correct.

Corrective action:

1. Make sure the wiring is following the instructions in the user manual.
2. Check the encoder connector.
3. Check if the wiring is loose.
4. Check if the encoder is damaged.

- When screen displays



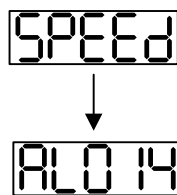
Warning of emergency stop:

Please check if any of the digital input DI1 ~ DI10 is set to emergency stop (EMGS).

Corrective action:

1. If not desire to set emergency stop (EMGS) as one of the digital input, make sure no digital input is set to emergency stop (EMGS) among DI1 ~ DI10. (That is to say, none of the parameters, P2.010 ~ P2.017, P2.036 and P2.037 is set to 21.)
2. If the function of emergency stop (EMGS) is needed and this DI is set as normally close (function code: 0x0021), please make sure this DI is always normally close. If not, please set this DI as normally open (function code: 0x0121).

- When screen displays



Warning of negative limit error:

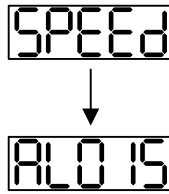
Please check if any of the digital input DI1 ~ DI8 is set to negative limit (NL) and that DI is on.

Corrective action:

1. If not desire to set negative limit (NL) as one of the digital input, make sure no digital input is set to negative limit (NL) among DI1 ~ DI10. (That is to say none of the parameters, P2.010 ~ P2.017, P2.036 and P2.037 is set to 22.)
2. If the function of negative limit (NL) is needed and this DI is set as normally close (function code: 0x0022), please make sure this DI is always normally close. If not, please set this DI as normally open (function code: 0x0122).

4

- When screen displays



Warning of positive limit error:

Please check if any of the digital input DI1 ~ DI10 is set to positive limit (PL) and that DI is on.

Corrective action:

1. If not desire to set positive limit (PL) as one of the digital input, make sure no digital input is set to positive limit (PL) among DI1 ~ DI10 (That is to say, none of the parameters, P2.010 ~ P2.017, P2.036 and P2.037 is set to 23.)
2. If the function of positive limit (PL) is needed and this DI is set as normally close (function code: 0x0023), please make sure this DI is always normally close. If not, please set this DI as normally open (function code: 0x0123).

- When screen displays



It represents the warning of over current. And the corrective actions are:

1. Check the connection between the motor and servo drive.
2. Check if the conducting wire is short circuited. Exclude short circuit and avoid metal conductors being exposed.

- When screen displays



It represents the warning of under voltage. And the corrective actions are:

1. Check if the wiring of main circuit input voltage is correct.
2. Use voltmeter to measure if the main circuit voltage is normal.
3. Use voltmeter to check if the power system complies with the specification.

Note: During power on or in servo on state (without issuing any command), if an alarm occurs or any abnormal display is shown, please contact the distributors.

### 4.5.3 Jog trial run without load

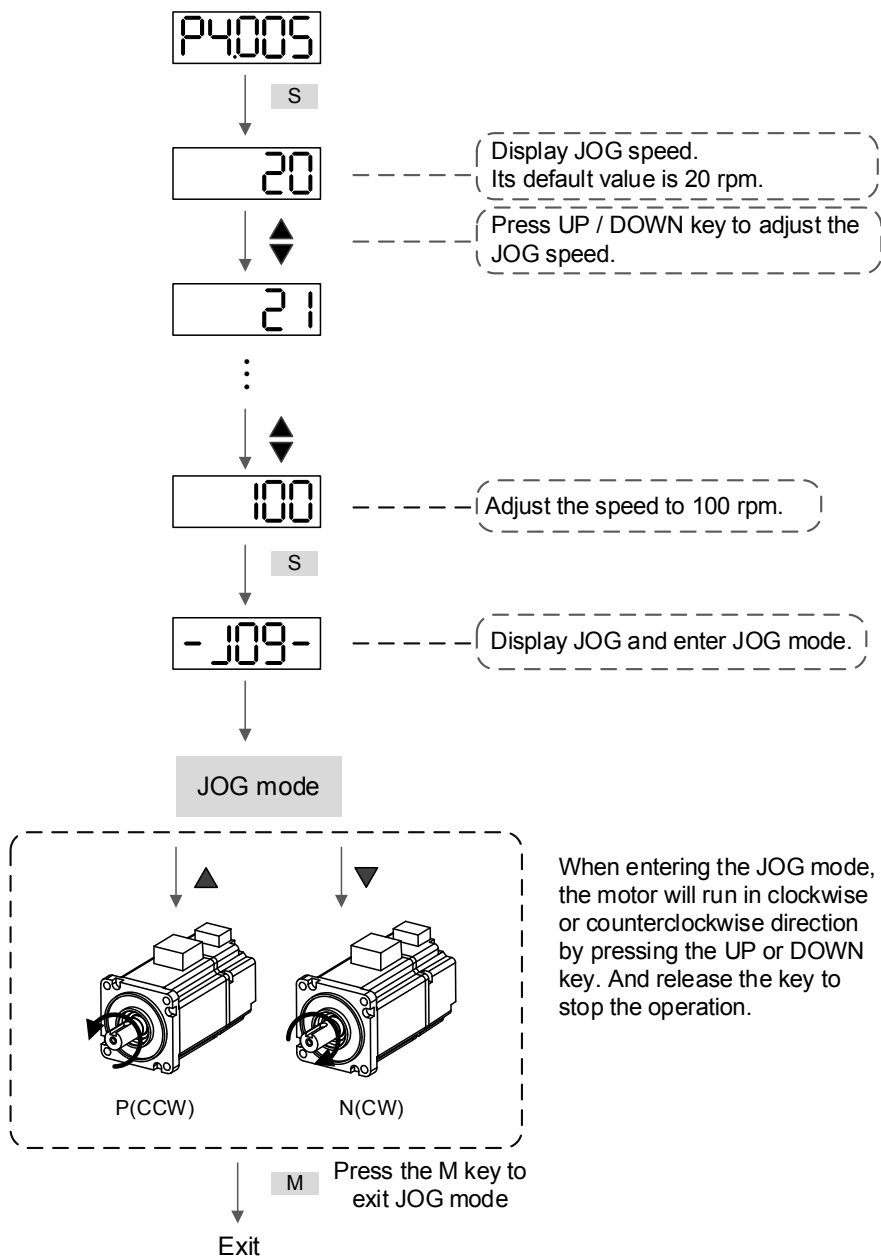
It is very convenient to test the motor and servo drive with the method of JOG trial run without load since the extra wiring is unnecessary. For safety reasons, it is recommended to set JOG at low speed. Please see the steps below:

Step 1: JOG trial run is available only when the servo drive is in servo on state. The drive can be forced to be in servo on state by setting parameter P2.030 to 1 or via the host controller.

Step 2: Set P4.005 to JOG speed (Unit: rpm). Press the S key to display the jog speed. The default is 20 rpm.

Step 3: Press the ▲ or ▼ key to adjust the jog speed. In the example, the speed is set to 100 rpm.

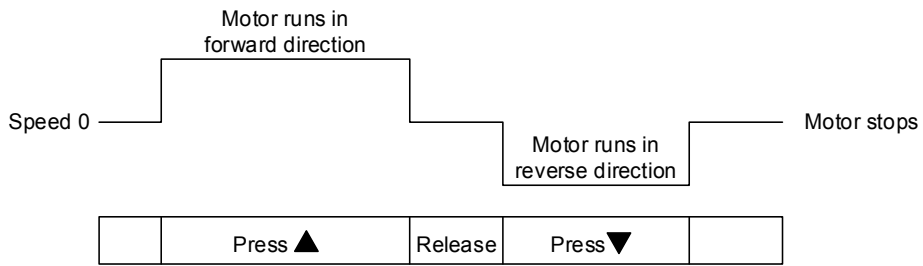
Step 4: Press the S key to display JOG and enter Jog mode.





4

Following shows the timing diagram of jog:



If the motor does not run, please check if the wiring between U,VW and encoder cable is correct.  
If the motor runs abnormally, please check if the U,V,W phase sequence is correct.

#### 4.5.4 Trial run without load (speed mode)

Before starting trial run without load, firmly secure the motor base to avoid danger caused by the reacting force generated during speed change.

Step 1: Set the control mode of the servo drive to speed mode. Set P1.001 to 2 as speed mode. Then, re-power on the servo drive.

Step 2: In speed mode, the digital input settings of trial run are as follows:

Digital input	Parameter setting value	Symbol	Function description	CN1 Pin No.
DI1	P2.010 = 101	SON	Servo is activated	DI1- = 9
DI2	P2.011 = 109	TRQLM	Torque limit	DI2- = 10
DI3	P2.012 = 114	SPD0	Speed selection	DI3- = 34
DI4	P2.013 = 115	SPD1	Speed selection	DI4- = 8
DI5	P2.014 = 102	ARST	Alarm reset	DI5- = 33
DI6	P2.015 = 0	-	DI disabled	-
DI7	P2.016 = 0	-	DI disabled	-
DI8	P2.017 = 0	-	DI disabled	-
DI9	P2.036 = 0	-	DI disabled	-
DI10	P2.037 = 0	-	DI disabled	-
VDI11	P2.038 = 0	-	DI disabled	-
VDI12	P2.039 = 0	-	DI disabled	-
VDI13	P2.040 = 0	-	DI disabled	-

The above table shows the settings that disable the function of negative limit (DI6), positive limit (DI7) and emergency stop (DI8). Thus, parameter P2.015 ~ P2.017 and P2.036 ~ P2.041 are set to 0 (Function disabled); the digital input of Delta's servo drive can be programmed by users.

When programming digital input, please refer to the description of DI code.

The default setting includes the function of negative limit, positive limit and emergency stop; therefore, if any alarm occurs after setting completed, please re-power on the servo drive or set DI5 to on to clear the error. Please refer to section 4.5.

4

The speed command selection is determined by SPD0 and SPD1. See the table below:

Speed command No.	DI signal of CN1		Command source	Content	Range
	SPD1	SPD0			
S1	0	0	External analog command	Voltage difference between V-REF and GND	-10v ~ +10v
S2	0	1	Internal register (Parameters)	P1.009	-60000 ~ 60000
S3	1	0		P1.010	-60000 ~ 60000
S4	1	1		P1.011	-60000 ~ 60000

0: It means the switch is open-circuit (off).

1: It means the switch is close-circuit (on).

The parameter setting range is from -60000 to 60000. Setting speed = Setting range x unit (0.1 rpm). For example: P1.009 = +30000; Setting speed = +30000 x 0.1 rpm = +3000 rpm.

Command setting of speed register:

Set parameter P1.009 to +30000.

Set parameter P1.010 to +1000.

Set parameter P1.011 to -30000.

Motor's running direction:

Input command	Rotation direction
+	CCW (forward direction)
-	CW (reverse direction)

Step 3:

1. Switch on DI1 and the drive is in servo on state.
2. Both DI3 (SPD0) and DI4 (SPD1), the speed command, are off, which means it currently executes S1 command. The motor rotates according to analog voltage command.
3. When DI3 (SPD0) is on, it means it currently executes S2 command (3000 rpm). The rotation speed is 3000 rpm.
4. When DI4 (SPD1) is on, it means it currently executes S3 command (100 rpm). The rotation speed is 100 rpm.
5. When both DI3 (SPD0) and DI4 (SPD1) are on, it means S4 command (-3000 rpm) is being executed. The rotation speed is -3000 rpm.
6. Steps 3, 4, and 5 can be repeatedly executed.
7. If users desire to stop the motor, switch off DI1 (Servo Off).

### 4.5.5 Trial run without load (position mode)

Before performing the test, firmly secure the motor base to avoid danger caused by the reacting force generated during speed change.

Step 1: Set the control mode of the servo drive to position mode. Then, set P1.001 to 1 as position mode. And re-power on the servo drive.

Step 2: In position mode, the digital input settings of trial run are as follows:

Digital input	Parameter setting value	Symbol	Function description	CN1 Pin No.
DI1	P2.010 = 101	SON	Servo is activated	DI1- = 9
DI2	P2.011 = 108	CTRG	Command triggered	DI2- = 10
DI3	P2.012 = 111	POS0	Position selection	DI3- = 34
DI4	P2.013 = 112	POS1	Position selection	DI4- = 8
DI5	P2.014 = 102	ARST	Alarm reset	DI5- = 33
DI6	P2.015 = 0	-	DI disabled	-
DI7	P2.016 = 0	-	DI disabled	-
DI8	P2.017 = 0	-	DI disabled	-
DI9	P2.036 = 0	-	DI disabled	-
DI10	P2.037 = 0	-	DI disabled	-
VDI11	P2.038 = 0	-	DI disabled	-
VDI12	P2.039 = 0	-	DI disabled	-
VDI13	P2.040 = 0	-	DI disabled	-

The above table shows the settings that disable the function of negative limit (DI6), positive limit (DI7) and emergency stop (DI8). Thus, parameter P2.015 ~ P2.017 and P2.036 ~ P2.041 are set to 0 (Disabled); the digital input of Delta's servo drive can be programmed by users. When programming digital input, please refer to the description of DI code.

The default setting includes the function of negative limit, positive limit and emergency stop; therefore, if any alarm occurs after setting completed, please re-power on the servo drive or set DI5 to on to clear the alarm. Please refer to Chapter 4.5.

4

Users can refer to section 3.10.2 for the wiring of Position (PR) control mode. Please see the table below for the 99 sets of PR and the position command (POS0 ~ POS6):

Position command	POS6	POS5	POS4	POS3	POS2	POS1	POS0	CTRG	Corresponding parameters
Homing	0	0	0	0		0	0	↑	P6.000
									P6.001
PR1	0	0		0	0	0	1	↑	P6.002
									P6.003
~									~
PR50	0	1	1	0	0	1	0	↑	P6.098
									P6.099
PR51	0	1	1	0	0	1	1	↑	P7.000
									P7.001
~									~
PR99	1	1	0	0	0	1	0	↑	P7.098
									P7.099

0: It means the switch is open-circuit (off).

1: It means the switch is close-circuit (on).

99 sets of PR (P6.000 ~ P7.099) can be set by users, which also can be set as absolute position commands.

# Tuning

# 5

You can find the information about auto tuning procedure and three tuning modes in this chapter. For advanced users, you may also tune the servo system by manual mode.

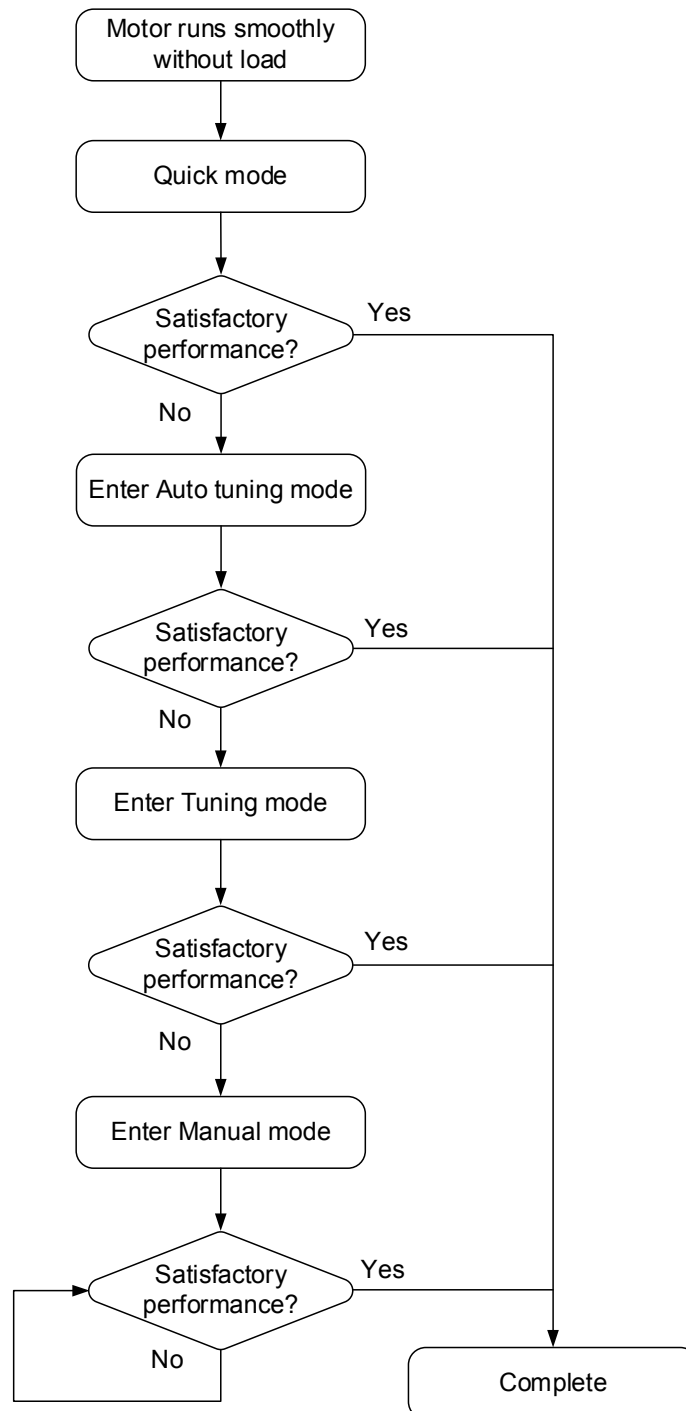
5.1	Tuning procedure and the applied mode .....	5-2
5.1.1	Flow chart of tuning procedure .....	5-2
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## 5.1 Tuning procedure and the applied mode

### 5.1.1 Flow chart of tuning procedure

5

Users can tune the servo drive by following flow chart below. Firstly, start from Auto tuning mode. If users are not satisfy with the system's performance, Tuning mode 1, 2, 3 or Manual mode are also available for tuning the servo system.



5.1.2 Tuning modes

P2.032 Setting value	Tuning mode	Inertia estimation	Parameter	
			Manual tuning	Auto tuning
0	Manual mode	Value of P1.037	P1.037, P2.000, P2.004, P2.006, P2.023, P2.024, P2.025, P2.043, P2.044, P2.045, P2.046, P2.049, P2.089, P2.098, P2.099, P2.101, P2.102 \	N/A
1	Tuning mode 1	Real-time estimation	P2.031	P1.037, P2.000, P2.004, P2.006, P2.023, P2.024, P2.025, P2.043, P2.044, P2.045, P2.046, P2.049, P2.089, P2.098, P2.099, P2.101, P2.102 \
2	Tuning mode 2	Value of P1.037	P1.037 P2.031	P2.000, P2.004, P2.006, P2.023, P2.024, P2.025, P2.043, P2.044, P2.045, P2.046, P2.049, P2.089, P2.098, P2.099, P2.101, P2.102 \
3	Tuning mode 3	Value of P1.037	P1.037 P2.031 P2.089	P2.000, P2.004, P2.006, P2.023, P2.024, P2.025, P2.043, P2.044, P2.045, P2.046, P2.049, P2.098, P2.099, P2.101, P2.102
4	Tuning mode 4	Restore default gain settings	-	-

Note: Please refer to the parameters list in section 5.3 Auto tuning.



## 5

## 5.2 Quick mode

Quick mode is the default mode of the servo drive. In most applications, users can start the servo drive once it is installed. Please note that the set gain related parameters are invalid when applying quick mode. Users can enable or disable the quick mode via P2.033. When switching to auto tuning mode, the quick mode will be disabled automatically.

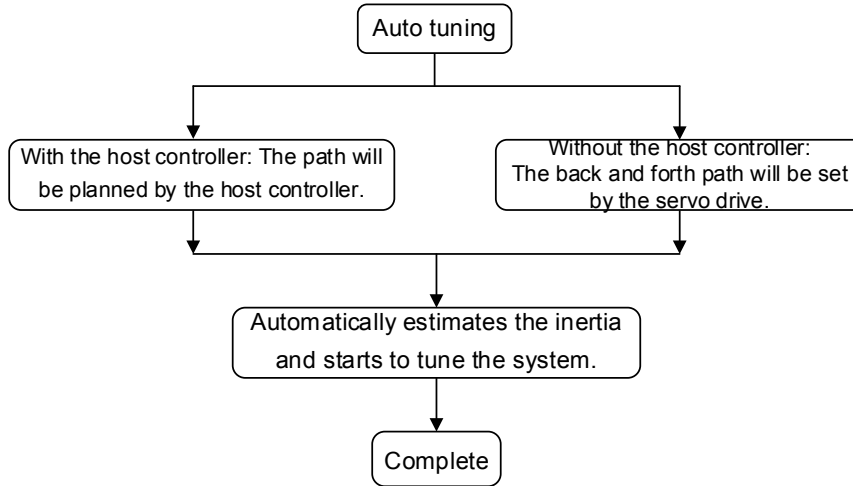
## 5.3 Auto tuning

Auto tuning function provided by ASDA-A3 enables the system to do real-time mechanism inertia estimation and upload the corresponding parameters for tuning the servo drive. Users can proceed auto tuning via ASDA-Soft (software) or the drive panel. Setting value of the parameters listed in the following table will change according to the result of auto tuning.

Gain related parameters		Filter and resonance suppression parameters	
Parameter No.	Function	Parameter No.	Function
P1.037	Inertia ratio and load weight ratio of servo motor	P1.025	Low-frequency vibration suppression (1)
P2.000	Position control gain	P1.026	Low-frequency vibration suppression gain (1)
P2.004	Speed control gain	P1.027	Low-frequency vibration suppression (2)
P2.006	Speed integral compensation	P1.028	Low-frequency vibration suppression gain (2)
P2.031	Level of frequency response	P2.023	Resonance suppression (Notch filter) (1)
P2.032	Gain tuning method	P2.024	Resonance suppression (Notch filter) attenuation rate (1)
P2.089	Command response gain	P2.025	Low-pass filter of resonance suppression
-	-	P2.043	Resonance suppression (Notch filter) (2)
-	-	P2.044	Resonance suppression (Notch filter) attenuation rate (2)
-	-	P2.045	Resonance suppression (Notch filter) (3)
-	-	P2.046	Resonance suppression (Notch filter) attenuation rate (3)
-	-	P2.049	Speed detection and jitter suppression
-	-	P2.098	Resonance suppression (Notch filter) (4)
-	-	P2.099	Resonance suppression (Notch filter) attenuation rate (4)
-	-	P2.101	Resonance suppression (Notch filter) (5)
-	-	P2.102	Resonance suppression (Notch filter) attenuation rate (5)

### 5.3.1 Flow chart of auto tuning

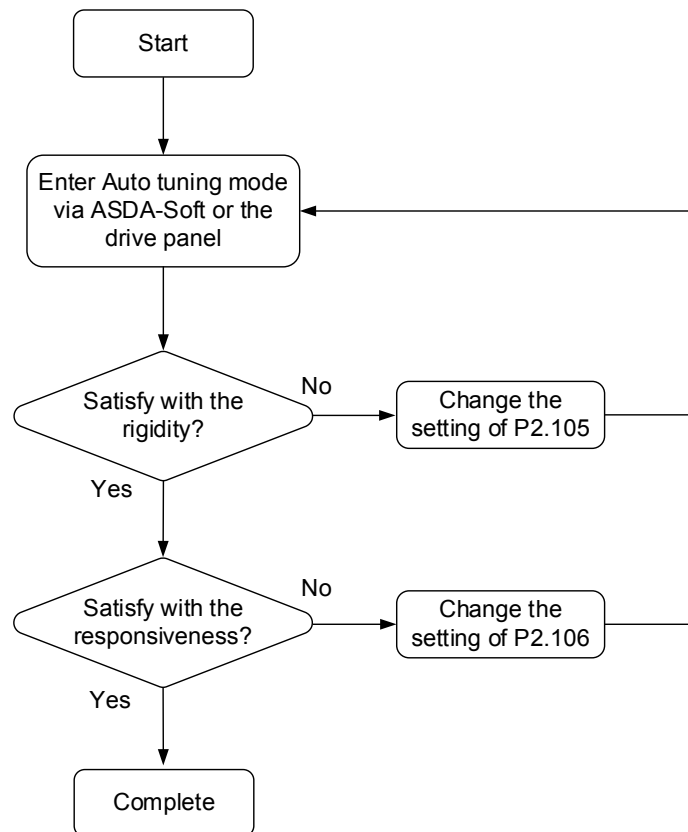
Users can complete auto tuning via the drive panel or ASDA-Soft. Through the auto tuning function, the A3 servo drive will help you find the most suitable parameters according to the machine characteristics for your system.



Note: When the running distance is configured by the host controller, make sure the delay time is added to the operation time. Otherwise, AL08C will occur and it cannot complete auto tuning.

P2.105 and P2.106 can be used to adjust the responsiveness and rigidity in auto tuning mode.

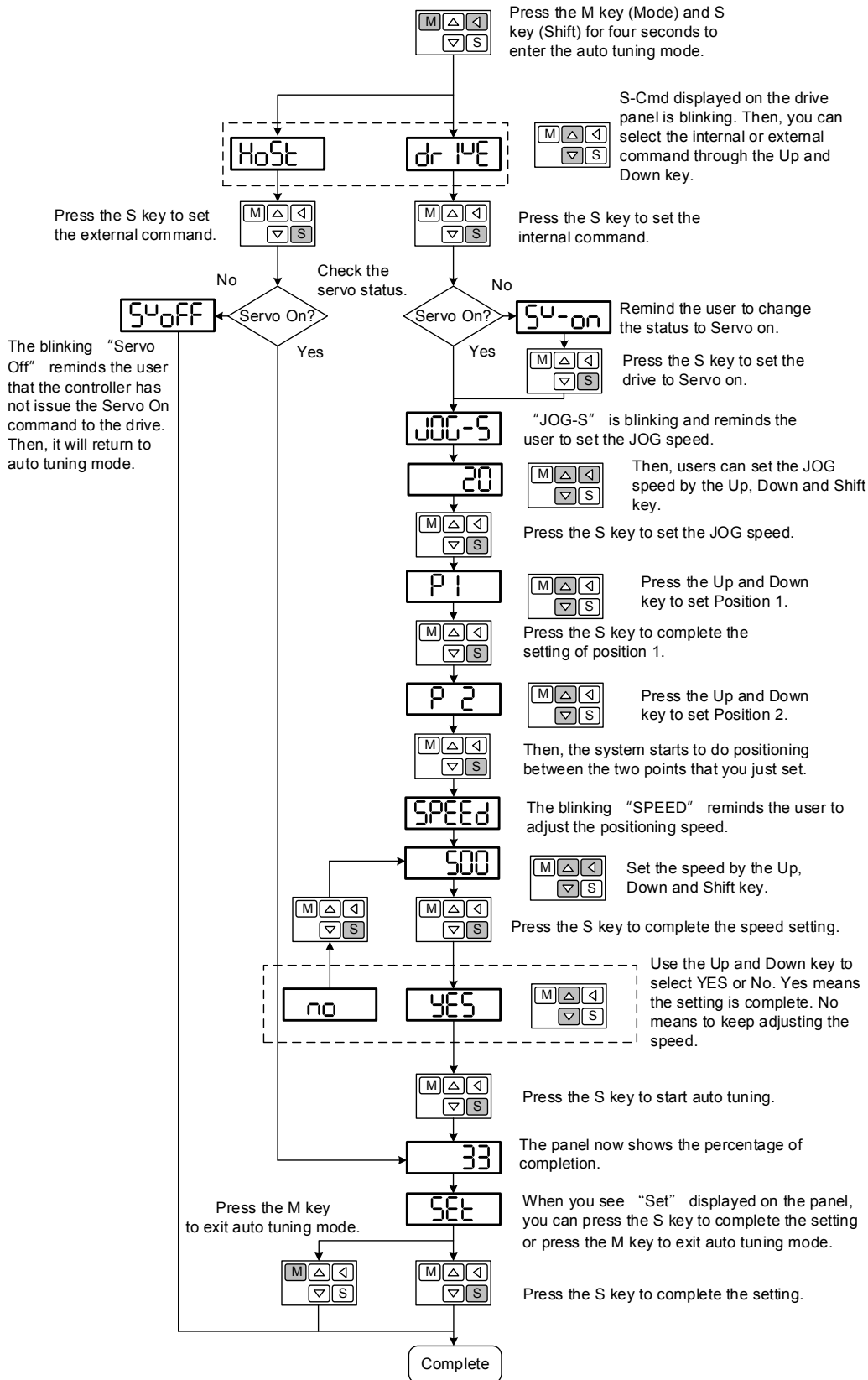
See the flow chart below.



### 5.3.2 Auto tuning via the drive panel

With the tuning procedure below, users can complete auto tuning via the drive panel. Make sure the switch of emergency stop, positive and negative limit can work properly before you start to tune the system.

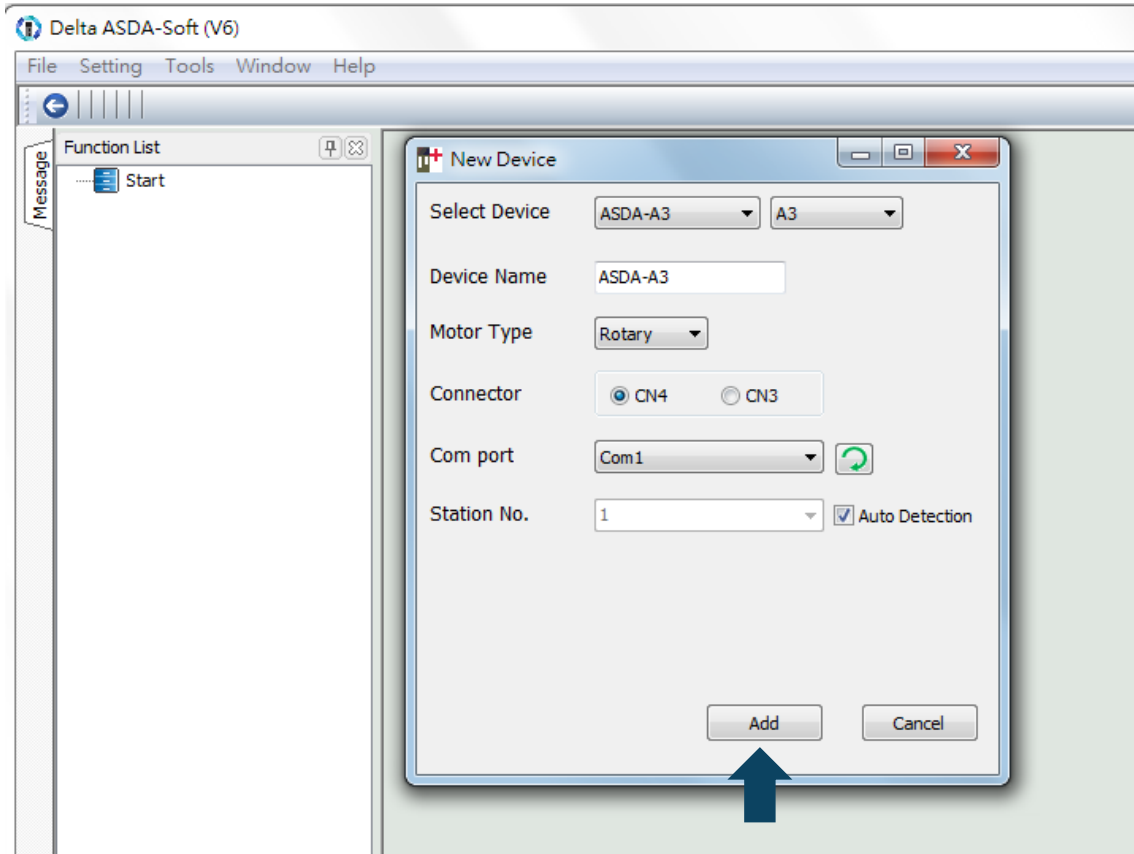
Flow chart for auto tuning:



5

### 5.3.3 Auto tuning via ASDA-Soft (software)

Apart from the drive panel, users can use ASDA-Soft to complete auto tuning. Please go to Delta’s website (<http://www.deltaww.com/>) to download ASDA-Soft for free. Install the software and open the executable file (.exe), then you will see the screen shown as below.

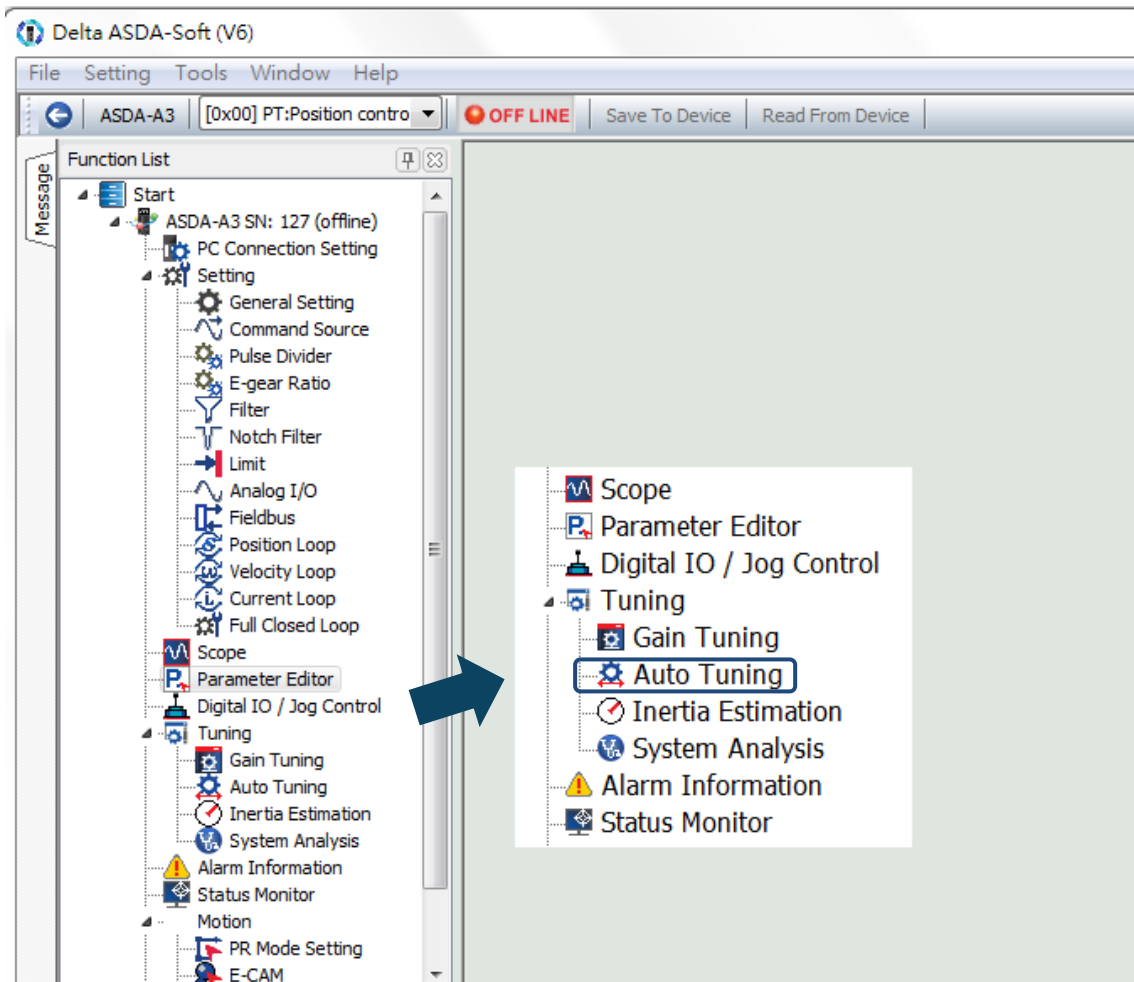


Make sure your A3 servo drive, servo motor and power are all well connected. Then, press **Add** and you can connect to the servo drive via ASDA-Soft.

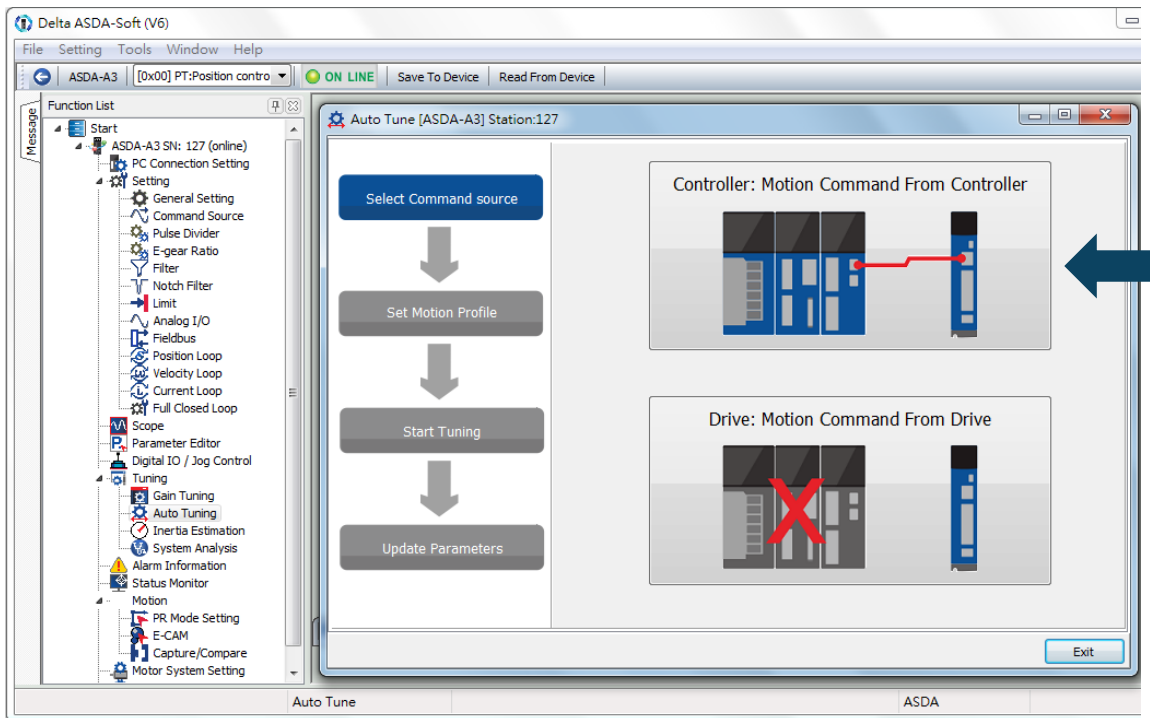
5

There are two types of auto-tuning procedure, which are determined by whether controller or servo drive is applied. Both procedures are described as follows.

- Auto-tuning with host controller: The host controller issues the command to drive the motor. Step 1: When the connection is created, the window will show as below. Click **Auto Tuning** from the tree view.



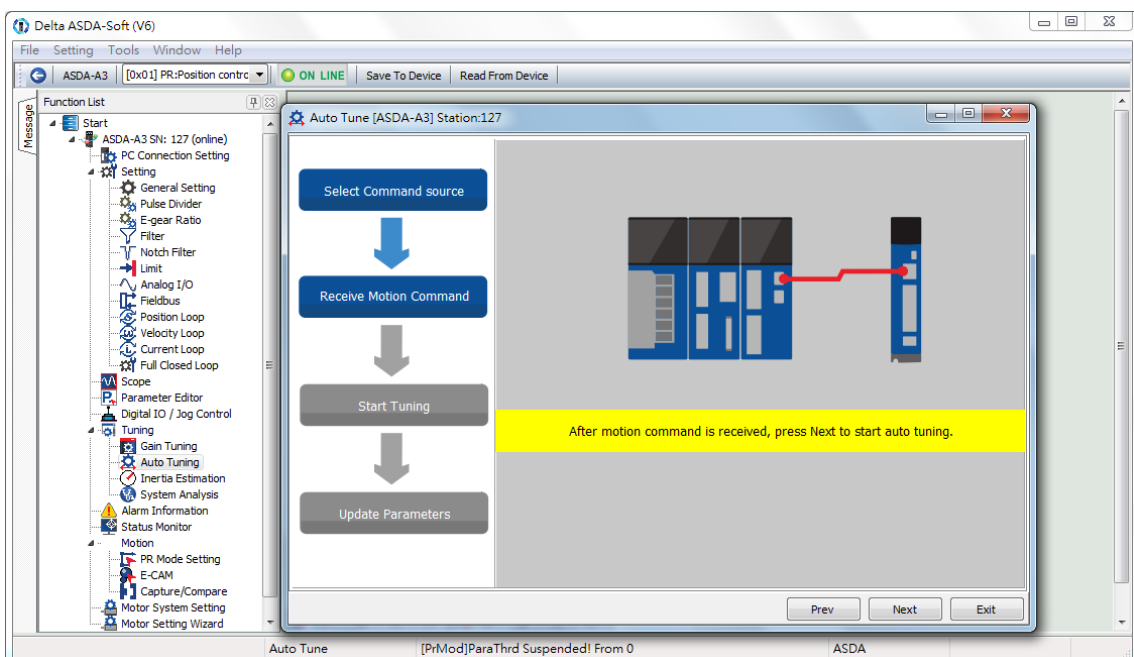
Step 2: Select “Controller: Motion Command From Controller” and make sure the motion/machining path is correctly set.



5

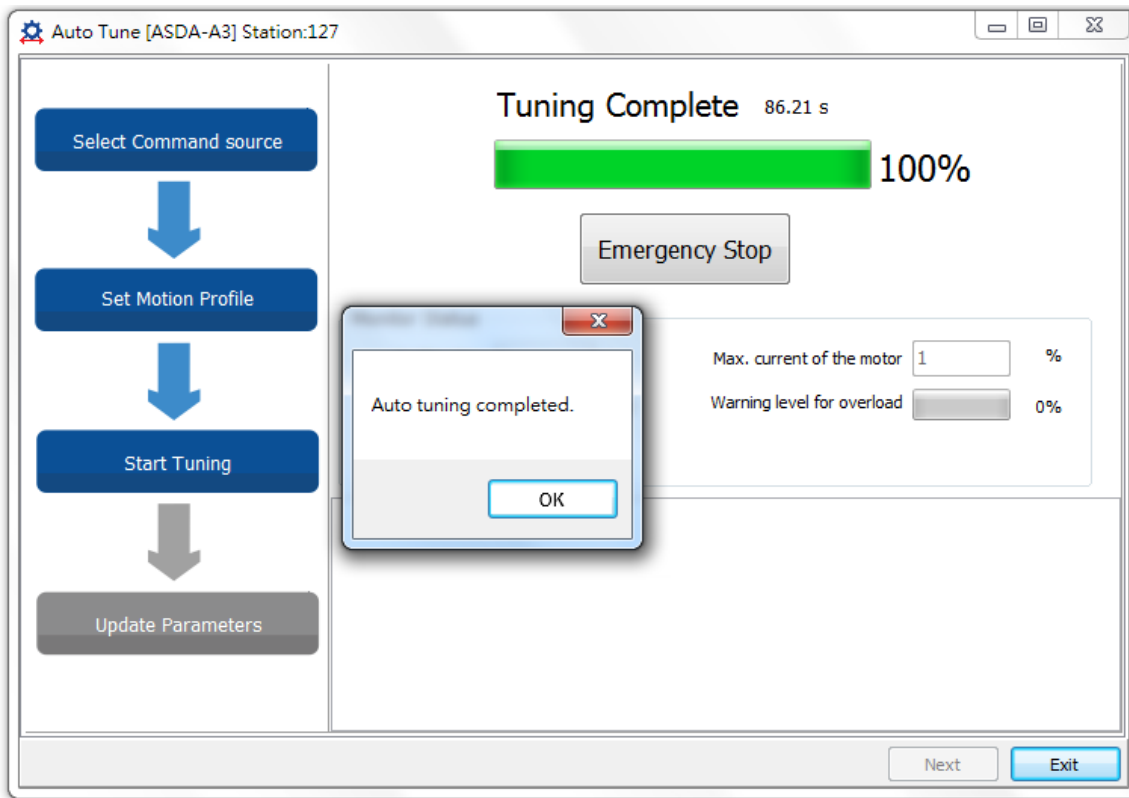
Suggestions: The motor should be set to operate at least one cycle in both forward and backward direction. It should reach the positions (forward and backward ones) not slower than 1000 ms with the running speed no less than 500 rpm.

Step 3: After the setting is done, please start to run the motor with the path you just set repeatedly. Before running the motor, make sure no one is standing close to the machinery. Then, click on **Next**.

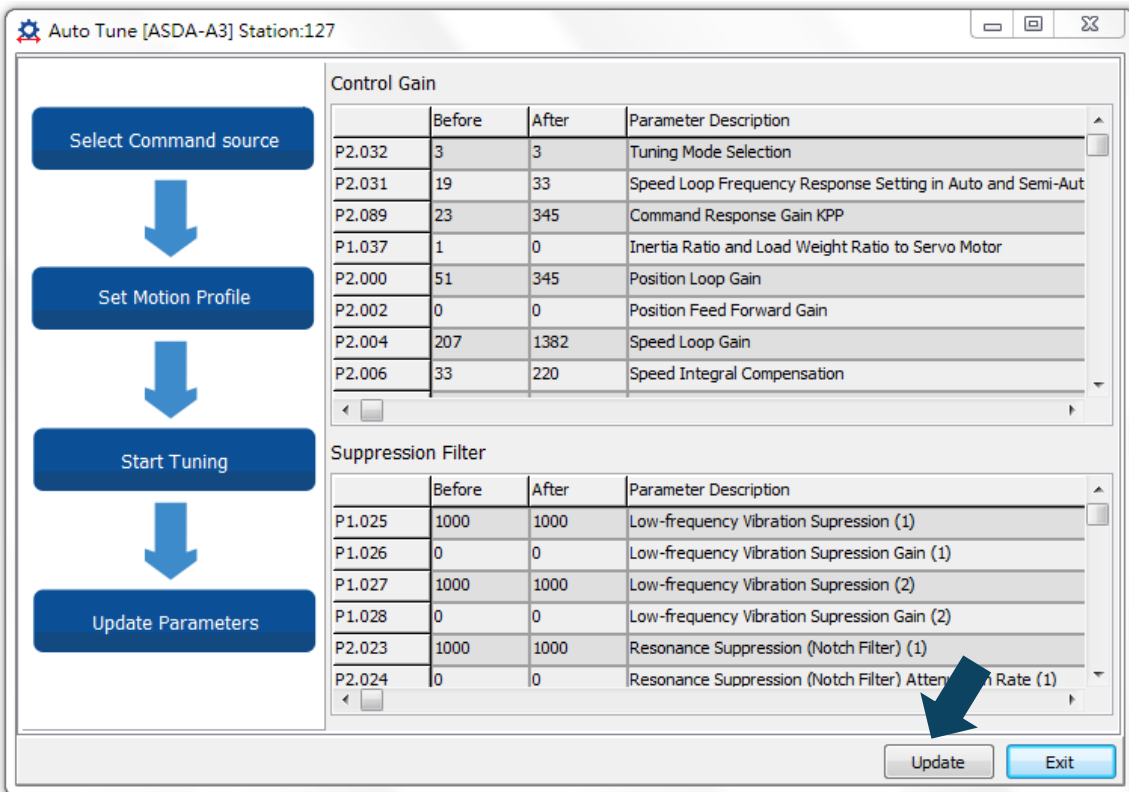


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Wait until the tuning progress bar reaches 100%. A window showing Auto tuning completed will pop up. Now, click on **OK**.

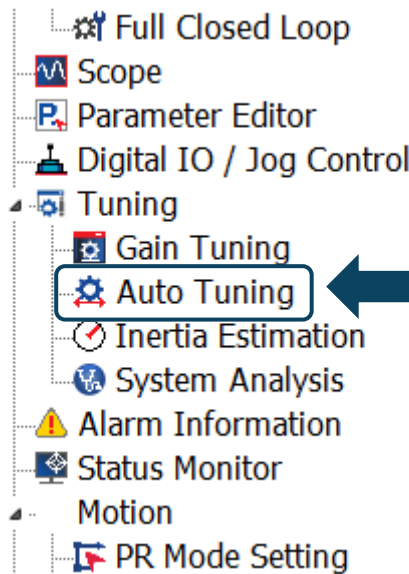


The screen will show a comparative table of before and after parameters being changed.

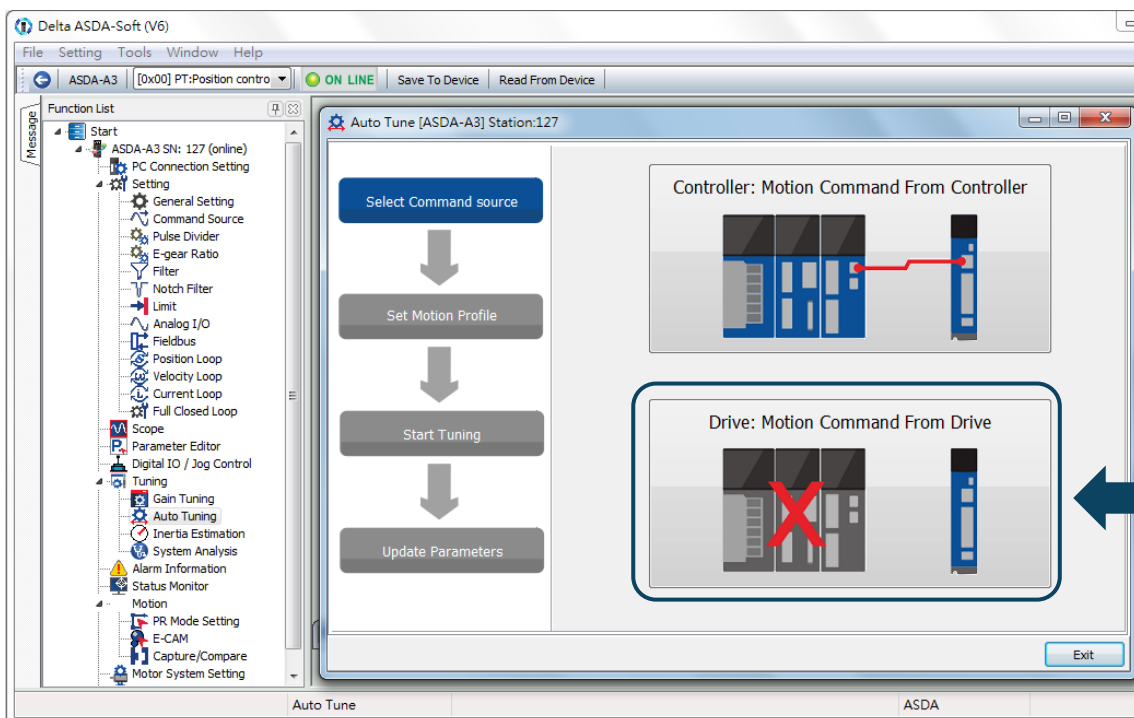


Please click on **Update** to complete auto tuning.

- Auto-tuning with servo drive: The servo drive issues the command to drive the motor.
- Step 1: When the connection is created, the window will show as below. Select **Auto Tuning** from the tree view.



Step 2: Select “Drive: Motion Command From Drive” to enter auto tuning procedure.



Please follow the steps below to complete the setting of motor running path:

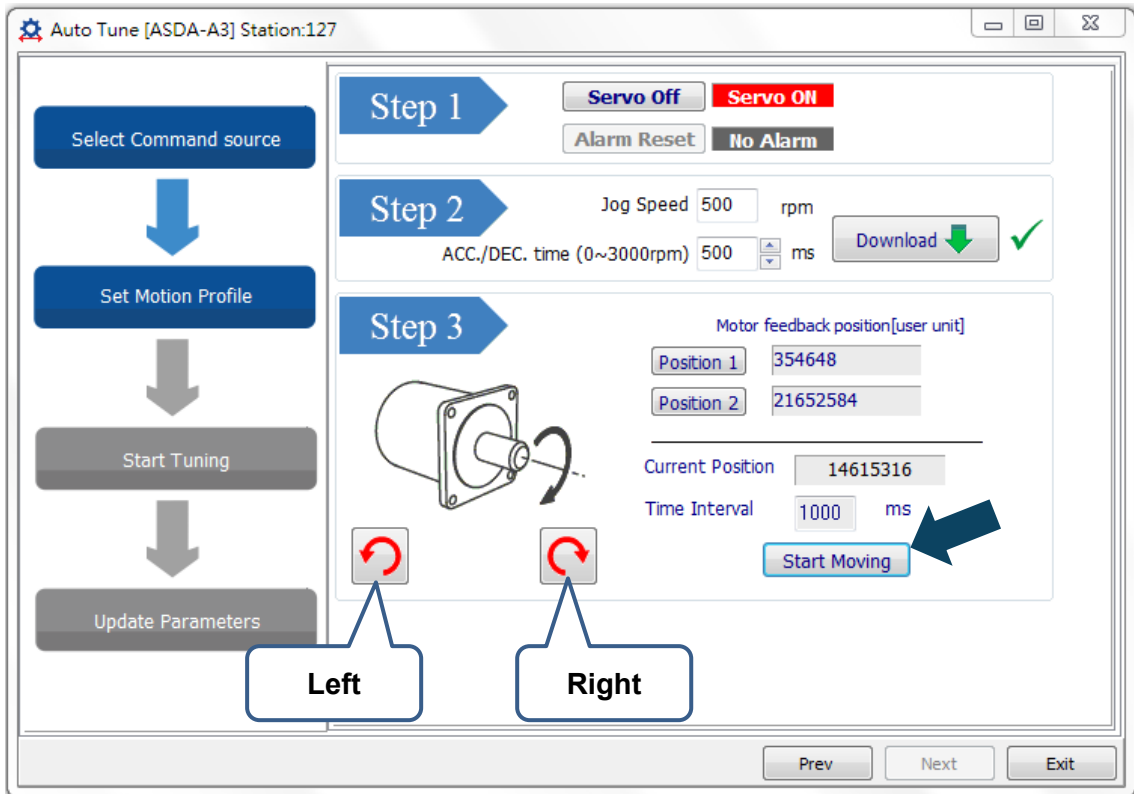
1. Firstly, set the system to Servo ON state.
2. Set the acceleration/deceleration time and jog speed. The default setting of acceleration/deceleration time is 500 ms. And the jog speed should be set to no less than 500 rpm. After the setting is done, please click on **Download**.



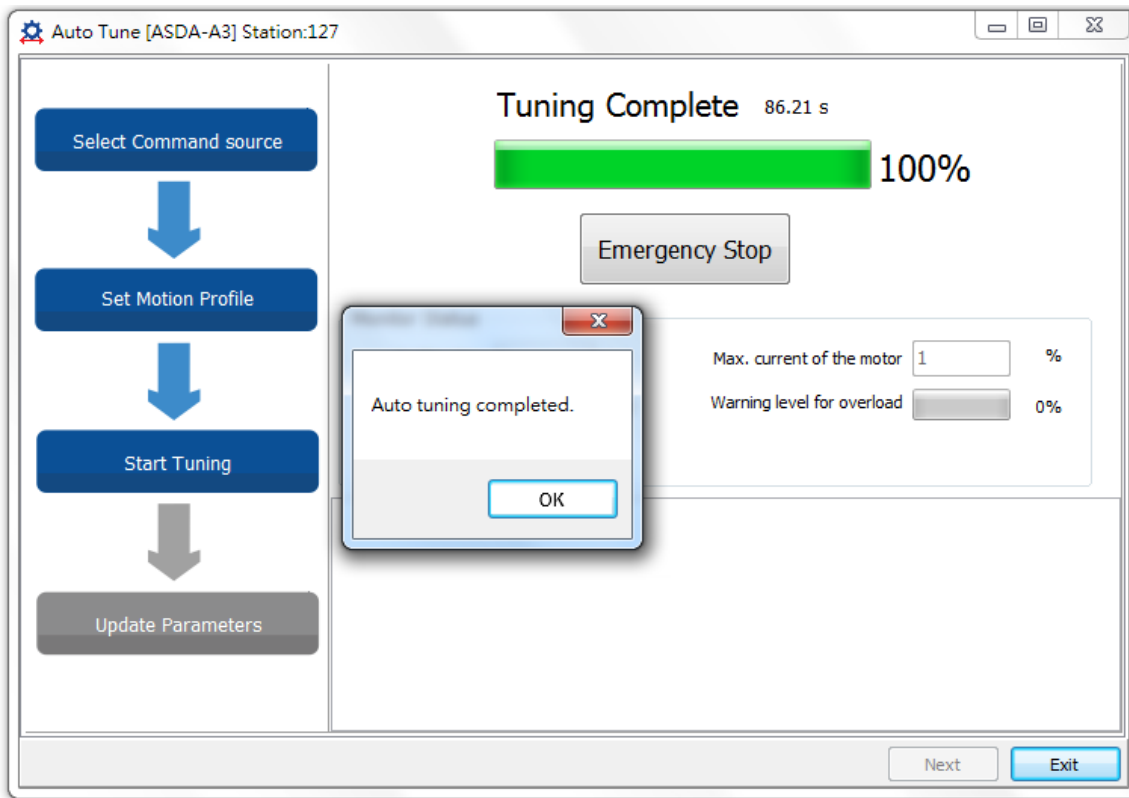
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- 3. When motor's running path is set, you can use the Left or Right key to run the motor to position 1 and 2. Then, click **Start Moving** to run between two positions. The motor will operate to position 1 and 2 in forward and backward directions.

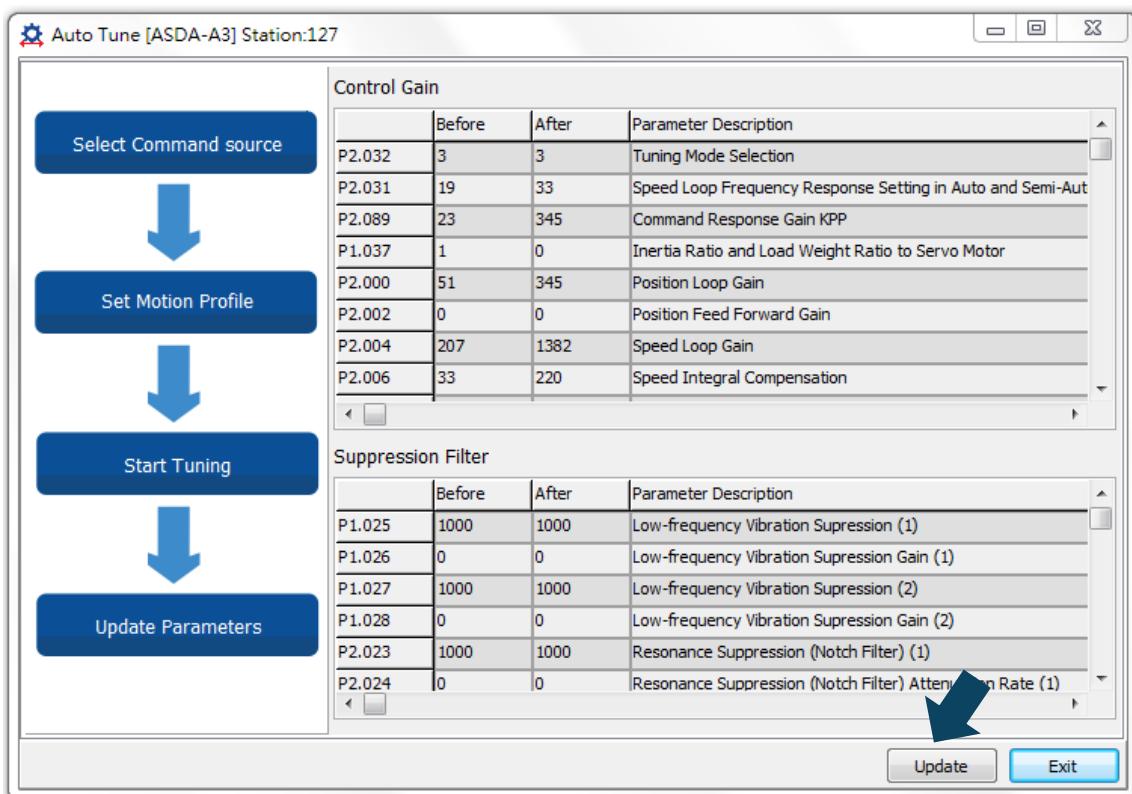
Before running the motor, make sure no one is standing close to the machinery.



Step 3: Wait until the tuning progress bar reaches 100%. A window showing Auto tuning completed will pop up. Now, click on **OK**.



The screen will show a comparative table of before and after parameters being changed.

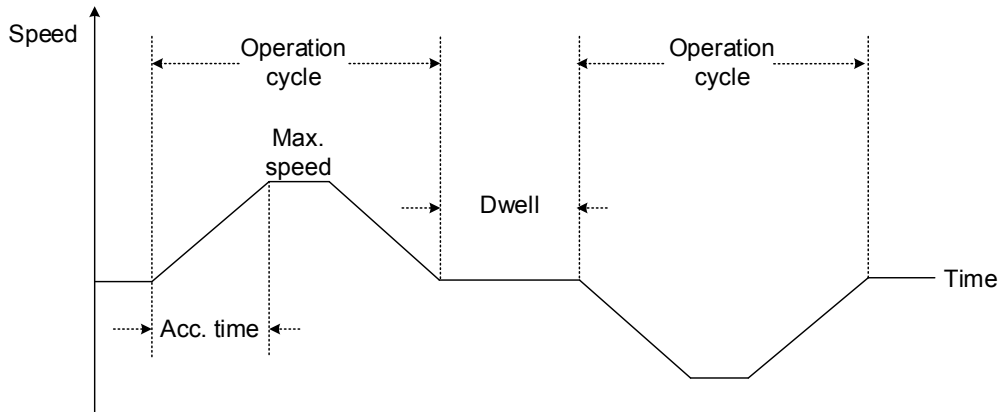


Please click on **Update** to complete auto tuning.

5

**5.3.4 Alarms related to auto tuning**

In auto tuning mode, it is vital to program the command path, including the operation cycle (such as acceleration, constant speed and deceleration) and dwell time. See the figure below. When any of the setting is not correct, the servo drive will stop and display the alarm. Please check the alarm causes and conduct corrective actions.

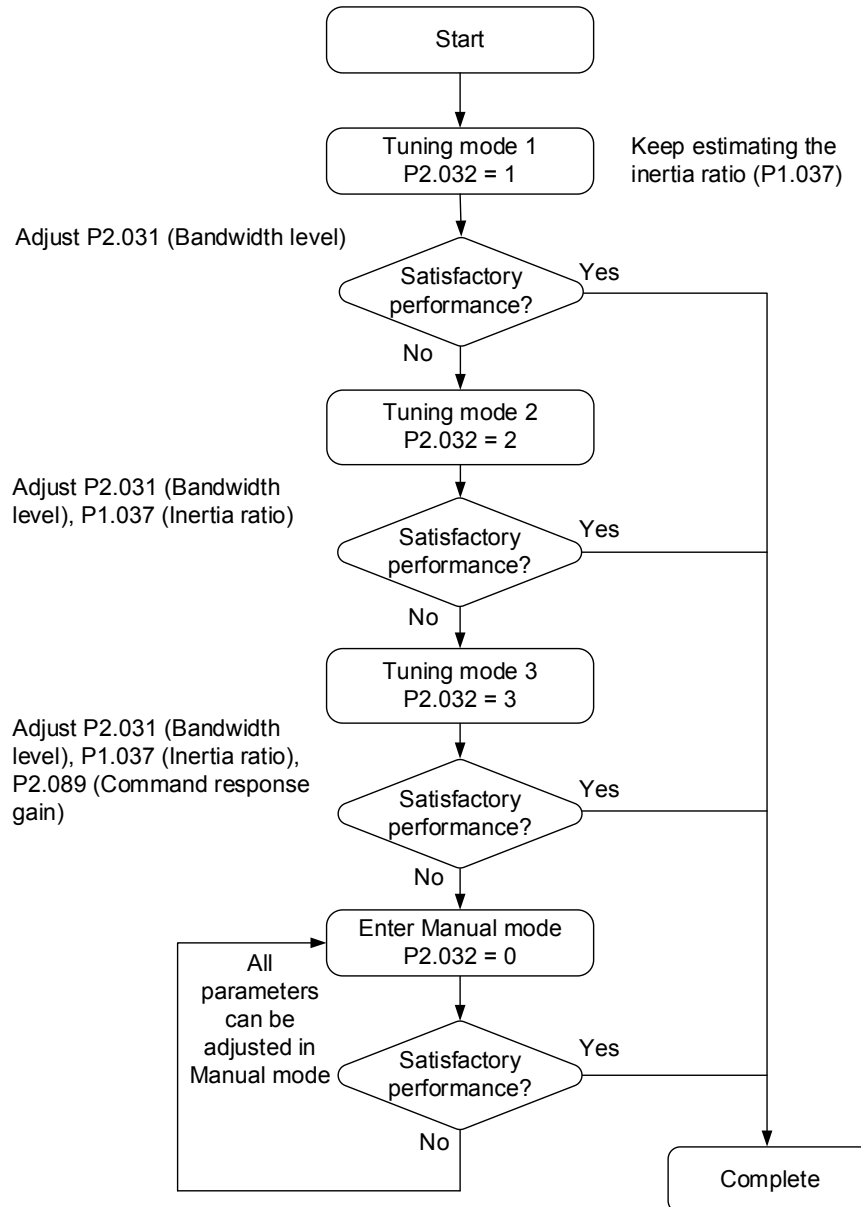


Display	Alarm name
AL08A	Auto tuning function – Command error
AL08B	Auto tuning function – Inertia estimation error
AL08C	Auto tuning function – Pause time is too short

## 5.4 Tuning mode

Apart from the auto tuning function mentioned above, there are three other tuning modes provided for users to fine tune the system. Users can easily complete tuning by increasing or decreasing frequency response bandwidth (P2.031). Please follow the tuning procedure in section 5.1.

### 5.4.1 Flow chart of tuning mode



5

### 5.4.2 Tuning mode 1

In this mode, the servo drive keeps estimating the mechanism inertia and updating the value of parameter P1.037.

P2.032 Setting value	Tuning mode	Inertia estimation	Parameter	
			Manual tuning	Auto tuning
1	Tuning mode 1	Real-time estimation	P2.031	P1.037, P2.000, P2.004, P2.006, P2.023, P2.024, P2.025, P2.043, P2.044, P2.045, P2.046, P2.049, P2.089, P2.098, P2.099, P2.101, P2.102

Requirements of inertia estimation:

1. Motor speed from 0 rpm to 3000 rpm needs to be within 1.5 second.
2. It is suggested to set the speed to 500 rpm or above. The lowest speed should be no less than 200 rpm.
3. The load inertia should be under 50 times of the motor inertia.
4. The change of the external force or inertia ratio cannot be too severe.

### 5.4.3 Tuning mode 2

When tuning mode 1 cannot meet your demand, you can try tuning mode 2 to tune the servo system. In tuning mode 2, the system will not automatically estimate the inertia. Users need to enter the correct mechanical inertia in parameter P1.037.

P2.032 Setting value	Tuning mode	Inertia estimation	Parameter	
			Manual tuning	Auto tuning
2	Tuning mode 2	Value of P1.037	P1.037 P2.031	P2.000, P2.004, P2.006, P2.023, P2.024, P2.025, P2.043, P2.044, P2.045, P2.046, P2.049, P2.089, P2.098, P2.099, P2.101, P2.102

Inertia estimation is applicable to most applications. However, when the mechanism does not comply with the requirements of inertia estimation, you have to enter the correct inertia ratio via setting parameter P1.037.

### 5.4.4 Tuning mode 3

If your demand cannot be met by tuning mode 1 and 2, please select tuning mode 3. Parameter P2.089 (Command Response Gain) is also provided in this mode. Users can increase the gain value to shorten the response and settling time of position command. However, if the value is set too high, overshoot might occur and cause machinery vibration. This function is only available when changing the command, such as the acceleration / deceleration application.

P2.032 Setting value	Tuning mode	Inertia estimation	Parameter	
			Manual tuning	Auto tuning
3	Tuning mode 3	Value of P1.037	P1.037 P2.031 P2.089	P2.000, P2.004, P2.006, P2.023, P2.024, P2.025, P2.043, P2.044, P2.045, P2.046, P2.049, P2.098, P2.099, P2.101, P2.102

5

### 5.4.5 Setting for frequency response bandwidth (stiffness)

Parameter P2.031 is provided for users to tune the servo system with an easier and user-friendly way. With the fixed inertia ratio, when increasing the bandwidth level (P2.031), the servo's bandwidth will be increased as well. If resonance occurs, please lower one or two bandwidth levels (you should adjust the bandwidth level according to the actual situation.). For instance, if the setting value of P2.031 was 30, the bandwidth level can be reduced to 28. When adjusting the value of this parameter, its corresponding parameters will be adjusted by the servo system, such as P2.000 and P2.004.

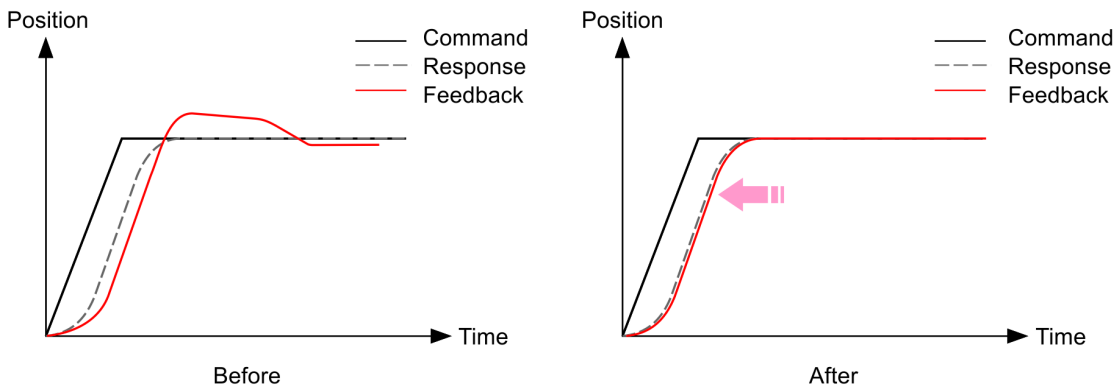
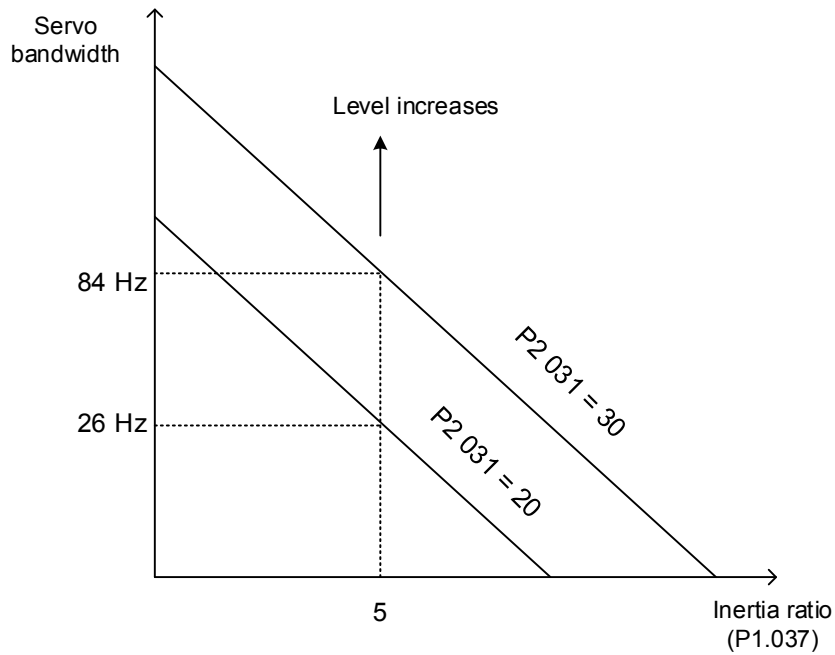


Figure 5.4.5.1 Adjust the bandwidth level

### 5.4.6 Gain response

Parameter P2.089 is used to adjust the response. Increasing the gain can minimize the deviation between the position command and command response in intermittent duty zone. When adjusting the setting value of P2.089, please enable the function of two degrees of freedom (set P2.094 to 0x1000).

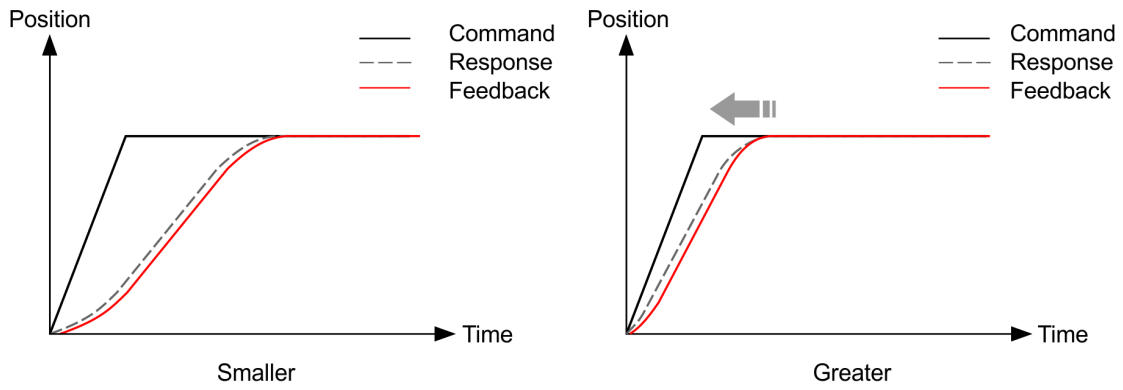


Figure 5.4.6.1 Adjust the gain response



## 5

## 5.5 Tuning in manual mode

The selection of position / speed response frequency should be determined by the machinery stiffness and application. Generally, for applications or machineries that require high speed and high precision, higher frequency response bandwidth is required. However, increasing the response bandwidth might cause resonance. Thus, machinery with higher stiffness will be used to tackle this problem. When the permitted resonance frequency is unknown, users could gradually increase the gain setting value to increase the frequency resonance bandwidth. Then, decrease the gain setting value until you hear the sound of resonance. The following are the descriptions about gain adjustment.

- Position control gain (KPP, parameter P2.000)

This parameter determines the response of position loop. The bigger the KPP value is, the higher response frequency of the position loop will be, and it will lower following error, position error and shorten the settling time. However, if the value is set too big, the machinery will vibrate or cause overshoot when positioning. The calculation of position loop frequency response is as follows:

$$\text{Frequency response bandwidth of position loop (Hz)} = \frac{KPP}{2\pi}$$

- Speed control gain (KVP, parameter P2.004)

This parameter determines the response of speed loop. The bigger the KVP value is, the higher response frequency of the speed loop and better following. However, if the value is set too big, it would easily cause machinery resonance. The response frequency of speed loop must be 4 ~ 6 times higher than the response frequency of position loop. Otherwise, the machinery might vibrate or causing overshoot when positioning. The calculation of speed loop frequency response is as follows:

$$\text{Frequency response bandwidth of speed loop} \\ f_v = \left( \frac{KVP}{2\pi} \right) \times \left[ \frac{(1 + P1 - 37/10)}{(1 + JL/JM)} \right] \text{Hz}$$

JM: Motor Inertia; JL: Load Inertia; P1.037: 0.1 (times)

When P1.037 (auto estimation or manually setting value) equals to the real inertia ratio (JL / JM), the real speed loop frequency response will be:

$$f_v = \left( \frac{KVP}{2\pi} \right) \text{Hz}$$

- Speed integral compensation (KVI, parameter P2.006)

The higher the KVI value is, the better capability of eliminating the deviation will be. However, if the value is set too high, it might easily cause vibration of machinery. It is suggested to set the value as follows:

$$KVI (P2.006) \leq 1.5 \times \text{Speed loop frequency response}$$

- Low-pass filter of resonance suppression (NLP, parameter P2.025)  
High value of inertia ratio will reduce the frequency response of speed loop. Therefore, the KVP value must be increased to maintain the response frequency. During the process of increasing KVP value, it might cause machinery resonance. Please use this parameter to eliminate the noise of resonance. The higher the value is, the better the capability of reducing high-frequency noise will be. However, if the value is set too big, it would cause the instability of speed loop and overshoot. It is suggested to set the value as follows:

$$\text{NLP (P2.025)} \leq \frac{10000}{6 \times \text{Speed loop frequency response (Hz)}}$$

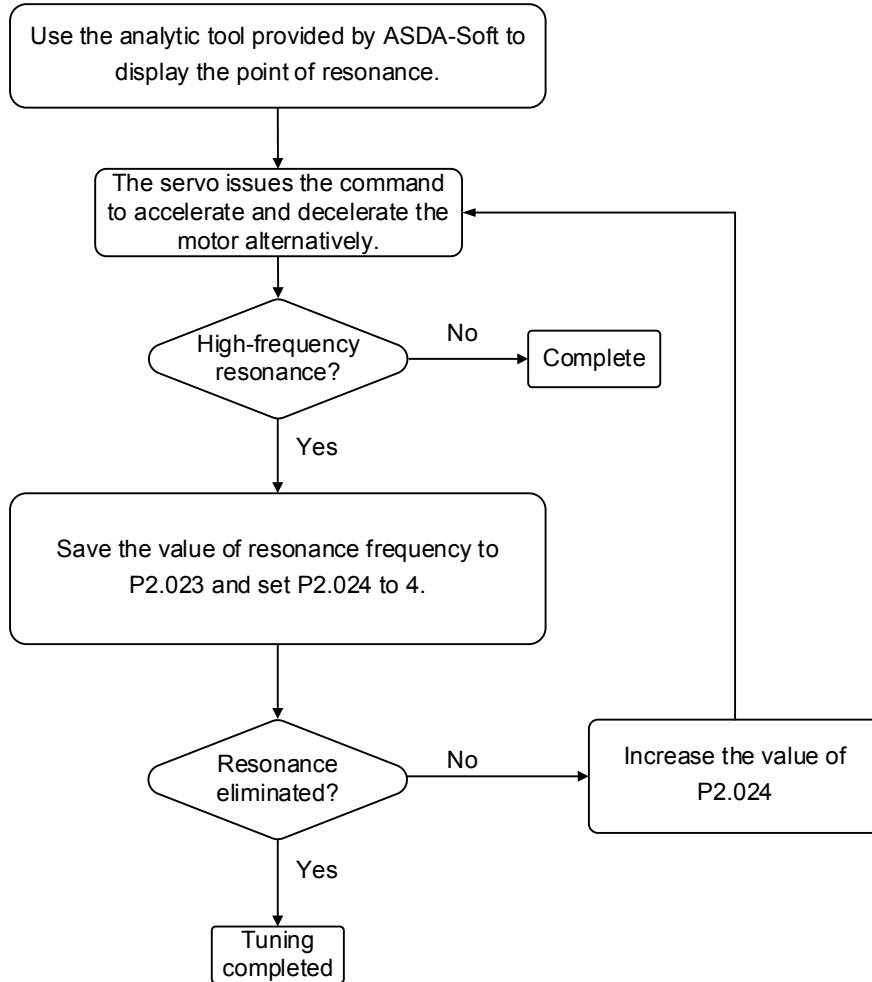
- Anti-interference gain (DST, parameter P2.026)  
This parameter is used to strengthen the ability of resisting external force and eliminate overshoot during acceleration / deceleration. Its default value is 0. Unless it is for fine-tuning, adjusting this value in manual mode is not suggested.
- Position feed forward gain (PFG, parameter P2.002)  
It can reduce the position error and shorten the settling time. However, if the value is set too big, it might cause overshoot. If the setting of e-gear ratio is bigger than 10, it might cause noise as well.

5

### 5.6 Mechanical resonance suppression

Five sets of notch filters are provided to suppress mechanical resonance. All five sets can be set to the auto resonance suppression (set by parameter P2.047) and manual adjustment.

Please see the following procedure for manual adjustment.



# Operation Mode

---

This chapter describes the operation structure of each control mode, including gain adjustment and filters. Position control is done by the external pulse and command from internal registers. In Speed mode and Torque mode, apart from the command from the internal register, the servo drive can also receive analog voltage input. In addition to Single mode, Dual mode is also available for meeting the application requirements.

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## 6.1 Selection of operation mode

This servo drive provides three basic operation modes, Position, Speed, and Torque. And available communication modes are CANopen, DMCNET and EtherCAT respectively. For basic operation mode, you can choose from Single mode, Dual, and Multi-mode. The following lists all the available modes.

Mode	Short name	Code	Description	
Single mode	Position mode (Terminal block input)	PT	00	The servo drive receives the position command and commands the motor to run to the target position. Position command is inputted from the terminal block and the signal type is pulse.
	Position mode (Register input)	PR	01	The servo drive receives the position command and commands the motor to run to the target position. Position commands are issued by internal registers (99 sets in total). Register number can be selected via DI signals or communication.
	Speed mode	S	02	The servo drive receives the speed command and commands the motor to run at the target speed. Speed command is issued from internal registers (3 sets in total) or via analog voltage (-10V ~ +10V) which is inputted from the terminal block. Command is selected via DI signals.
	Speed mode (No analog input)	Sz	04	The servo drive receives the speed command and commands the motor to run at the target speed. Speed command can only be issued from internal registers (3 sets in total) instead of external terminal block. Command is selected via DI signals.
	Torque mode	T	03	The servo drive receives the torque command and commands the motor to run with the target torque. Torque commands can be issued via internal registers (3 sets in total) as well as analog voltage (-10V ~ +10V) which is inputted through the terminal block. Command is selected via DI signals.
	Torque mode (No analog input)	Tz	05	The servo drive receives the torque command and commands the motor to run with the target torque. Torque command can only be issued via internal registers (3 sets in total). Command is selected via DI signals.
Dual mode	PT-S	06	PT and S mode can be switched by DI signals.	
	PT-T	07	PT and T mode can be switched by DI signals.	
	PR-S	08	PR and S mode can be switched by DI signals.	
	PR-T	09	PR and T mode can be switched by DI signals.	
	S-T	0A	S and T mode can be switched by DI signals.	
	-	0B	Reserved	
	Communication	0C	DMCNET mode CANopen mode EtherCAT mode	
PT-PR	0D	PT and PR mode can be switched by DI signals.		
Multi-mode	PT-PR-S	0E	PT, PR, and S mode can be switched by DI signals.	
	PT-PR-T	0F	PT, PR, and T mode can be switched by DI signals.	

6

Steps to switch the operation mode:

1. Switch the servo drive to Servo Off status. (This can be done by setting DI.SON to OFF.)
2. Set P1.001 and refer to the code listed above for mode selection.
3. When the setting is completed, power on the servo drive again.

The following sections describe the operation of each mode, including mode structure, command source, selection and process of command and gain adjustment.

## 6.2 Position mode

Two input modes for position control are available on ASDA-A3: External pulse (PT mode) and internal register (PR mode). In PT mode, A3 servo drive is able to receive pulse command of directions (motor runs forward or reverse). And the rotation angle of motor can be controlled by the input pulse. A3 can receive pulse command of up to 4 Mpps.

Users can also complete the position control by internal register (PR) without external pulse command. A3 provides 99 command registers with two input modes. Users may set the 99 registers first before switching the drive to servo-on state and set DI.POS0 ~ DI.POS6 of CN1 for the switch. Or, directly set the register values via communication.

### 6.2.1 Position command in PT mode

PT position command is the pulse input from terminal block. There are three pulse types and each type has positive / negative logic which can be set in parameter P1.000. Please refer to Chapter 8 for more detail.

Parameter	Function
P1.000	External pulse input type

### 6.2.2 Position command in PR mode

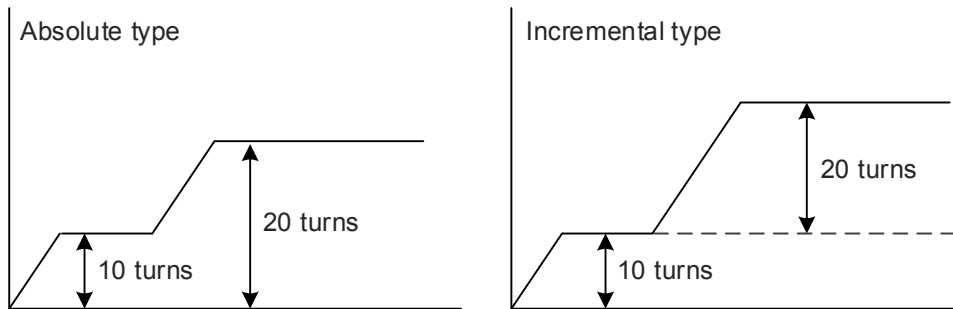
PR command source is selected by (P6.000, P6.001) ~ (P7.098, P7.099), which is the 99 built-in command registers. The position command is triggered by DI.CTRG (0x08). See the following table for more detail.

Position command	POS6	POS5	POS4	POS3	POS2	POS1	POS0	CTRG	Setting parameter
Homing	0	0	0	0	0	0	0	↑	P6.000 P6.001
P1	0	0	0	0	0	0	1	↑	P6.002 P6.003
~									~
P50	0	1	1	0	0	1	0	↑	P6.098 P6.099
P51	0	1	1	0	0	1	1	↑	P7.000 P7.001
~									~
P99	1	1	0	0	0	1	1	↑	P7.098 P7.099

State of POS0 ~ POS6: 0 signifies that DI is off; 1 signifies that DI is on.

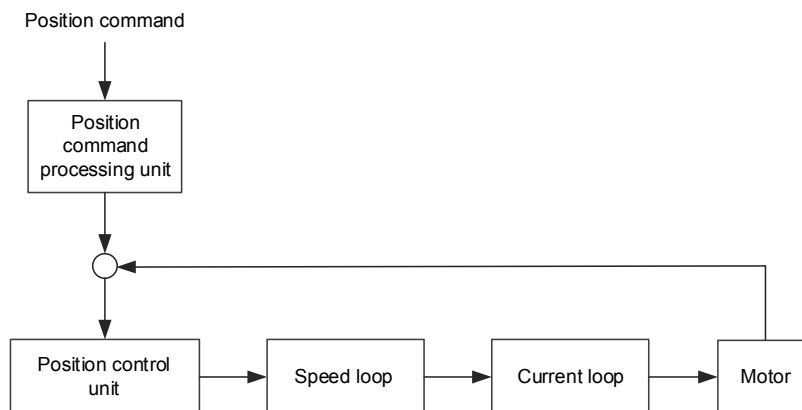
CTR $\uparrow$ : This signifies the moment that DI is switched from off to on.

The application of absolute type and incremental type register is rather extensive. It is more like a simple procedure control. Users can complete the cyclic operation by referring to the above table. For example, position command P1 is 10 turns and P2 is 20 turns. P1 is issued first and P2 comes after. The following diagram shows the difference of both.



### 6.2.3 Control structure of position mode

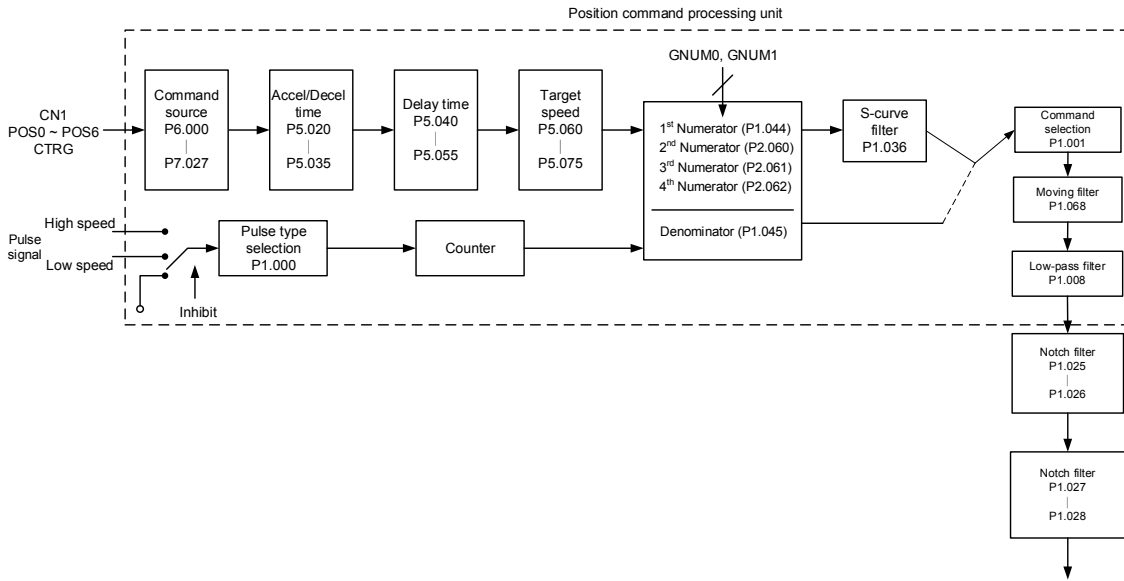
The basic control structure is shown as follows:





For better control, the pulse signals are processed by the position command processing unit. Structure is shown in the diagram below.

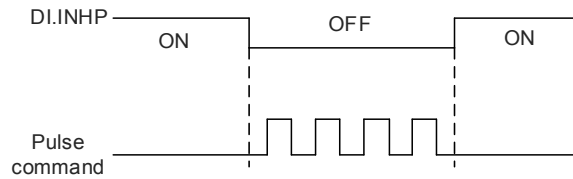
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The upper path of the above diagram is PR mode and the lower one is PT mode which could be selected by P1.001. E-Gear ratio can be set in both modes for adjusting positioning resolution. Moreover, either S-curve filter or low-pass filter can be used to smooth the command. More information is as follows.

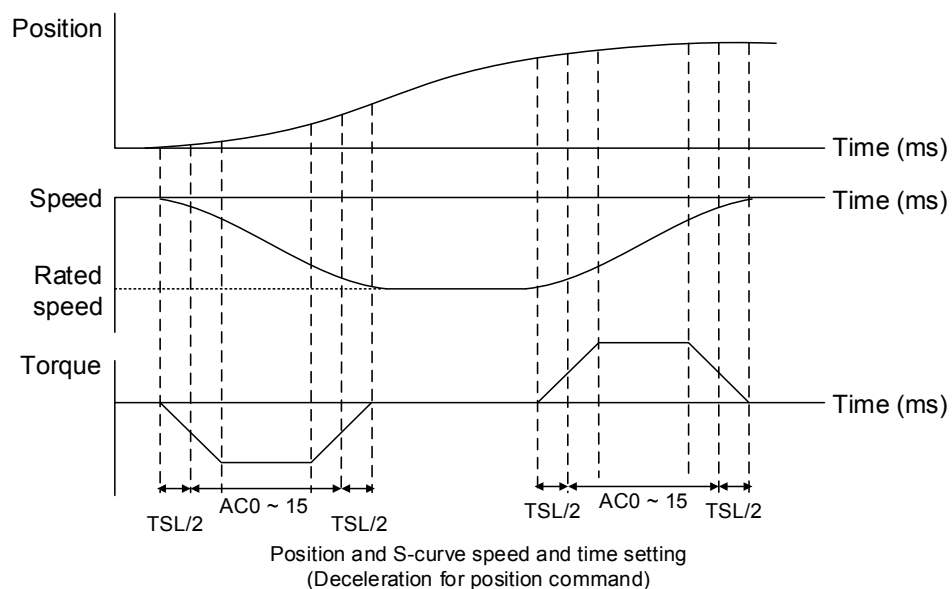
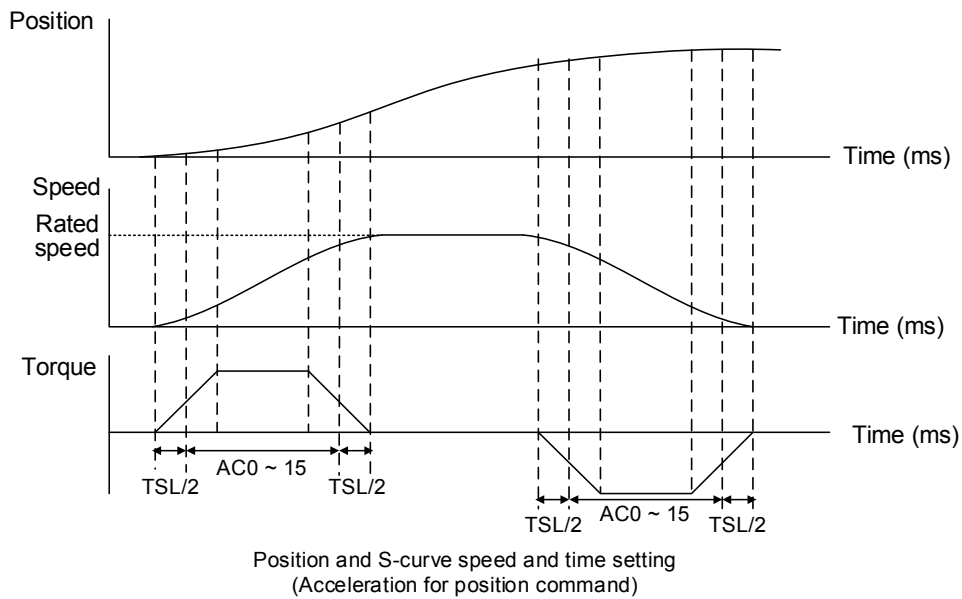
**Function of pulse command input inhibit (INHP)**

In PT mode, when DI.INHP is on, the servo will stop receiving external pulse command and the motor will stop running. As this function is only supported by DI 8, setting 0x45 (DI.INHP) to P2.017 (DI 8) is required.



### 6.2.4 S-curve filter (Position)

S-curve filter smooths the motion command in PR mode. With this filter, speed / acceleration can be continuous and jerk is reduced, and a smoother mechanical operation can be achieved. If the load inertia increases, the operation of the motor will be influenced by friction and inertia when it starts or stops rotating. Setting a larger acceleration / deceleration constant of S-curve (TSL) and acceleration / deceleration time in P5.020 ~ P5.035 can increase the smoothness of operation. When the position command source is pulse, its speed and angular acceleration are continuous, thus, S-curve filter is not a must.



Relevant parameters: Please refer to Chapter 8 for detailed description.

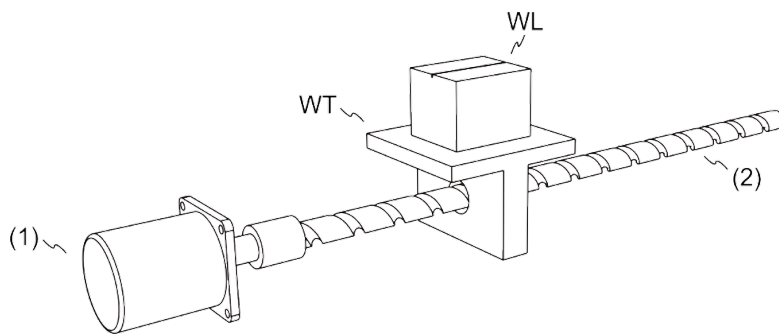
Parameter	Function
P1.036	Acceleration / deceleration constant of S-curve
P5.020 ~ P5.035	Acceleration / deceleration time (No#0 ~ 15)

6

6.2.5 Electronic gear ratio (E-Gear ratio)

Electronic gear ratio allows users to change the ratio of moving distance easily. Delta servo drive is set based on the resolution of the servo drive. Resolution of A3 is 24-bit, which means 16777216 pulses are generated per motor rotation. Regardless the encoder is 17-bit, 20-bit, or 22-bit, the E-Gear ratio is set according to 24-bit resolution of A3 servo drive.

When E-Gear ratio is 1, 16777216 pulses are generated per motor rotation; while the ratio is set to 0.5, then every two pulses from the command (controller) corresponds to one pulse of the motor. However, larger E-Gear ratio might create a sharp corner of the profile and lead to a high jerk. To solve this problem, you can apply S-curve acceleration / deceleration or low-pass filter to reduce the jerk. For example, if E-Gear ratio is set and the workpiece is moved at the speed of 1 μm/pulse, then it means the workpiece moves 1 μm per pulse.



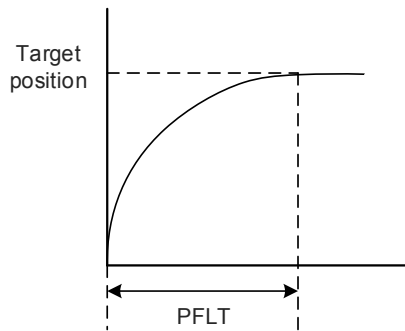
(1) Motor (2) Ball screw pitch: 3 mm (equals 3000 μm)  
 WL: Workpiece; WT: platform

	Gear Ratio	Moving distance per 1 pulse command
Electronic gear is not applied	$= \frac{1}{1}$	$= \frac{3000 \frac{\mu\text{m}}{\text{rev}}}{16777216 \frac{\text{Pulse}}{\text{rev}}} \times \frac{1}{1} = \frac{3000}{16777216}$ (Unit: $\frac{\mu\text{m}}{\text{Pulse}}$ )
Electronic gear is applied	$= \frac{16777216}{3000}$	$= \frac{3000 \frac{\mu\text{m}}{\text{rev}}}{16777216 \frac{\text{Pulse}}{\text{rev}}} \times \frac{16777216}{3000} = 1$ (Unit: $\frac{\mu\text{m}}{\text{Pulse}}$ )

Relevant parameters: Please refer to Chapter 8 for detailed description.

Parameters	Function
P1.044	E-Gear ratio (Numerator) (N1)
P1.045	E-Gear ratio (Denominator) (M)

### 6.2.6 Low-pass filter

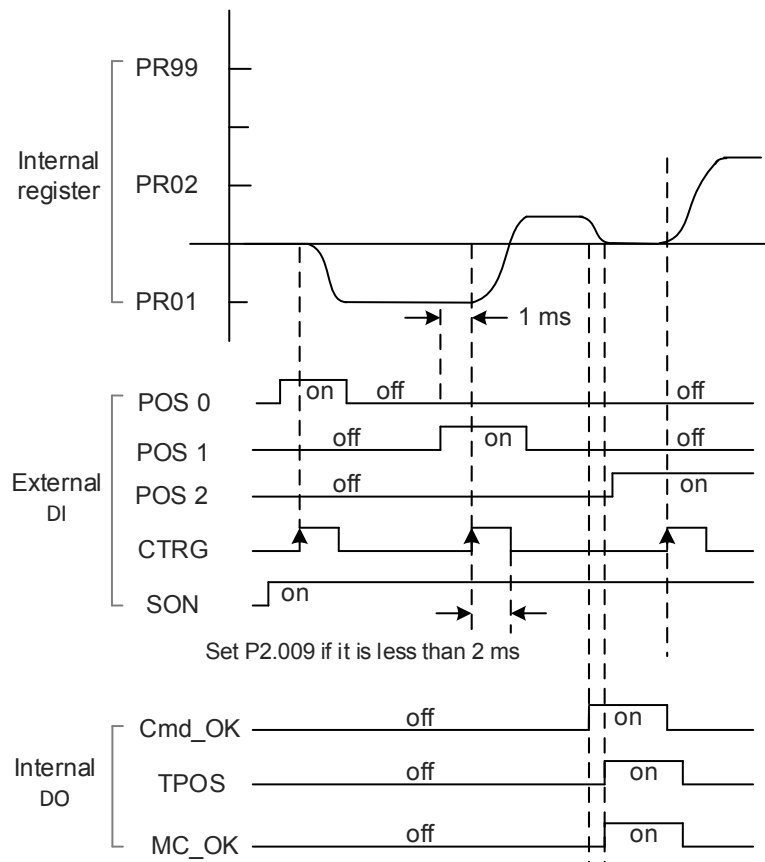


Relevant parameters: Please refer to Chapter 8 for detailed description.

Parameter	Function
P1.008	Smooth constant of position command (Low-pass filter)

### 6.2.7 Timing diagram of PR mode

In PR mode, the position command is issued via DI signal (POS0 ~ POS6 and CTRG) of CN1. Please refer to Section 6.2.2 for information about DI signal and its selected register. Followings are the timing diagrams.



Note: Cmd\_OK is on when PR command is completed; TPOS is on when the error is smaller than value set by P1.054; MC\_OK is on when Cmd\_OK and TPOS are both on.

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### 6.2.8 Gain adjustment of position loop

There are two types of gain adjustment for position loop: auto and manual.

■ Auto adjustment:

A3 servo drive provides auto tuning function which allows users to complete the gain adjustment easily. Please refer to Chapter 5 Tuning for detailed description.

■ Manual adjustment:

Before setting the position control unit, users have to manually set the speed control unit (P2.004 and P2.006) since a speed loop is included in the position loop. Then, set the position loop gain (P2.000) and position feed forward gain (P2.002).

Description of proportional gain and feed forward gain:

1. Proportional gain: Larger gain will increase the response bandwidth of position loop.
2. Feed forward gain: To reduce the deviation of phase delay.

Please note that the position loop bandwidth should not be larger than the speed loop bandwidth.

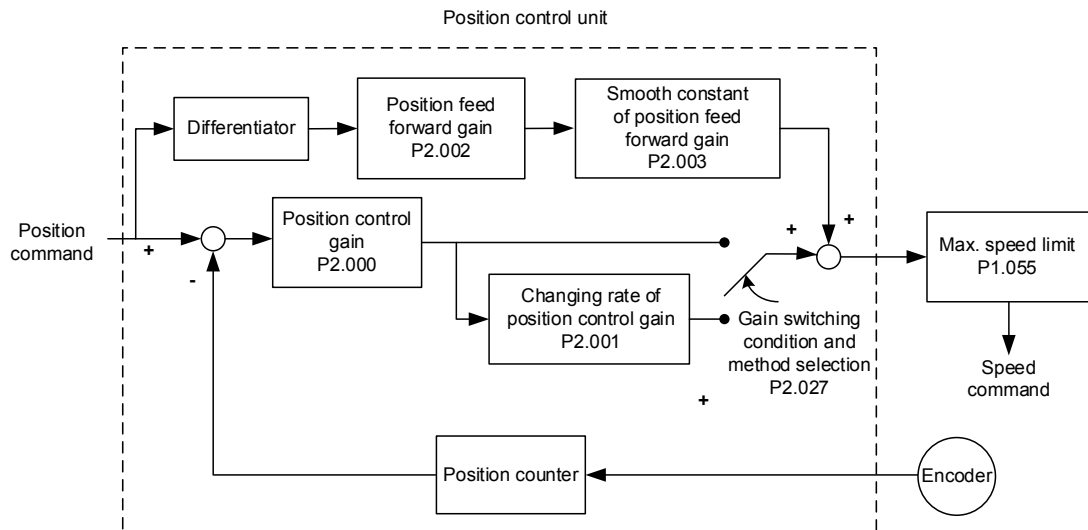
Calculation:  $f_p \leq \frac{f_v}{4}$  (fv: response bandwidth of speed loop (Hz); fp: response bandwidth of position loop (Hz).)

$$KPP = 2 \times \pi \times f_p$$

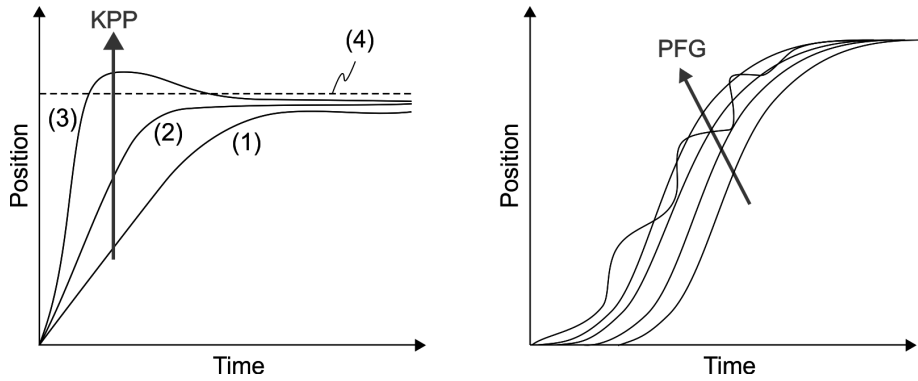
Example: If the desired position bandwidth is 20 Hz, then KPP (P2.000) should be adjusted to 125. ( $2 \times \pi \times 20 \text{ Hz} = 125$ )

Relevant parameters: Please refer to Chapter 8 for detailed description.

Parameter	Function
P2.000	Position control gain
P2.002	Position feed forward gain



When the value of KPP (P2.000) is set too large, the bandwidth of position loop will be increased and the phase margin is reduced. Meanwhile, the motor rotor rotates and vibrates in forward and reverse directions. In this case, KPP has to be decreased until the rotor stops vibrating. When the external torque interrupts, the over-low KPP cannot meet the demand of reducing position error. In this case, increasing position feed forward gain; PFG (P2.002) can effectively reduce the following error.



Actual position curve will change from (1) to (3) with the increase of KPP value; (4) stands for position command.

# 6

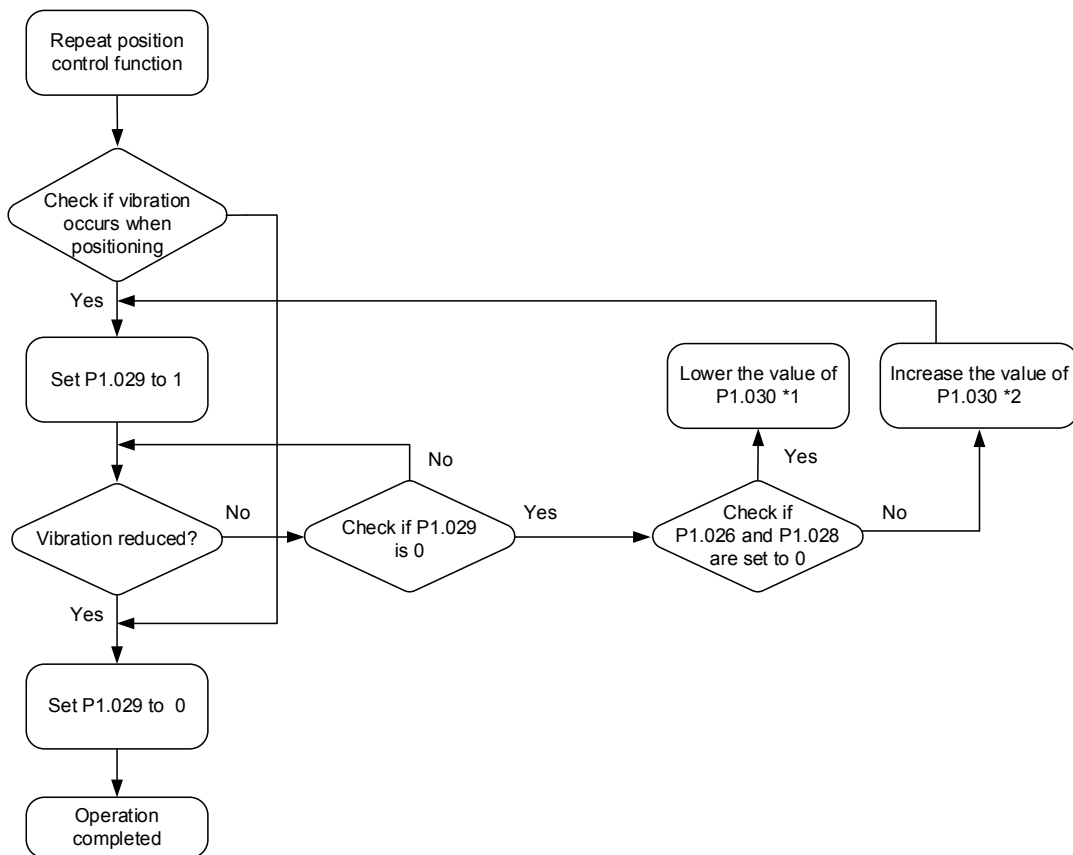
## 6.2.9 Low-frequency vibration suppression in Position mode

If the mechanism's rigidity is too low, the vibration of transmission part will persist even when the motor stops running after positioning command is executed completely. The function of low-frequency vibration suppression can reduce the vibration of mechanism. The suppression range is between 1.0 Hz and 100.0 HZ. Both manual setting and auto setting are available.

### Auto setting function

If you have difficulty in finding out the frequency of resonance, you can enable the function of auto low-frequency vibration suppression, which searches the specific frequency of resonance occurrence. If P1.029 is set to 1, the system will disable this function automatically and starts to search the vibration frequency. When the detected frequency remains at the same level, P1.029 will be set to 0 automatically and set the first frequency in P1.025 and set P1.026 to 1. The second frequency will be set in P1.027 and then set P1.028 to 1. If P1.029 is automatically reset to 0, but low-frequency vibration persists, please check if the function of P1.026 or P1.028 is enabled. If the values of P1.026 and P1.028 are both 0, it means no frequency has been detected. Please lower the value of P1.030 and set P1.029 to 1 so as to search the vibration frequency again. Please note that when the detection level is set too small, noise might be regarded as low-frequency vibration.

Flowchart of auto low-frequency vibration suppression:



Note:

1. When the values of P1.026 and P1.028 are 0, it means the frequency cannot be found. It is probably because the detection level is set too high so that the low-frequency vibration is not detected.
2. When the values of P1.026 or P1.028 are greater than 0 and the vibration is not reduced, it is probably because the detection level is set too low, and the system regards noise or other frequency as low-frequency vibration.
3. When the procedure of auto suppression is done, but the vibration persists, you can manually set P1.025 or P1.027 to suppress the vibration if the low frequency is identified.

Relevant parameters: Please refer to Chapter 8 for detailed description.

Parameter	Function
P1.029	Auto low-frequency vibration suppression mode setting
P1.030	Low-frequency vibration detection

P1.030 is to set the range to detect the magnitude of low-frequency vibration. When the frequency is not detected, it is probably because the value of P1.030 is set too big and exceeds the range. In this case, it is suggested to decrease the value of P1.030. Please note that if the value is too small, the system might regard noise as vibration frequency. You can also use Scope to observe the range of position error (pulse) between upper and lower magnitude of the curve to adjust the value of P1.030.

### Manual Setting

There are two sets of low-frequency vibration suppression. One is parameter P1.025 ~ P1.026 and the other is parameter P1.027 ~ P1.028. These two sets of low-frequency vibration suppression can be used to reduce two different frequency vibrations. Parameter P1.025 and P1.027 are used to suppress the low-frequency vibration. The function works only when the low-frequency vibration setting is close to the real vibration frequency. Parameter P1.026 and P1.028 are used to set the response after frequency filtering. The bigger the setting values of P1.026 and P1.028 are, the better response will be. However, if the value is set too big, the motor might not operate smoothly. The default values of parameter P1.026 and P1.028 are 0, which means the two filters are disabled.

Relevant parameters: Please refer to Chapter 8 for detailed description.

Parameter	Function
P1.025	Low-frequency vibration suppression (1)
P1.026	Low-frequency vibration suppression gain (1)
P1.027	Low-frequency vibration suppression (2)
P1.028	Low-frequency vibration suppression gain (2)



6

### 6.3 Speed mode

This servo drive includes two types of command input: analog and register. Analog command controls the motor speed by external voltage. Regarding command register input, it controls the speed by two ways. One is to set different speed values in three command registers and to switch the speed by using DI.SPD0 and DI.SPD1 of CN1. Another way is to change the value of register by communication. In order to deal with the problem of non-continuous speed when switching registers, S-curve acceleration / deceleration setting is provided. In close-loop system, this servo drive adopts gain adjustment and integrated PI controller and two modes (manual and auto) for selection.

Manual mode is for manual parameter setting. In this mode, all auto or auxiliary function will be disabled. The gain adjustment function provides different modes for users to estimate load inertia and tune the bandwidth as well as responsiveness. In addition, the parameter values set by users will be regarded as the default.

#### 6.3.1 Selection of speed command

There are two types of speed command source: analog voltage and internal register (parameters). Users can select the source by using DI signal of CN1. See as follows for the command source selection:

Speed command	CN1 DI signal		Command source			Content	Range
	SPD1	SPD0					
S1	0	0	Mode	S	External analog signal	Voltage difference between V-REF and GND	-10V ~ +10V
				Sz	N/A	Speed command is 0	0
S2	0	1	Register parameters			P1.009	-60000 ~ 60000
S3	1	0				P1.010	-60000 ~ 60000
S4	1	1				P1.011	-60000 ~ 60000

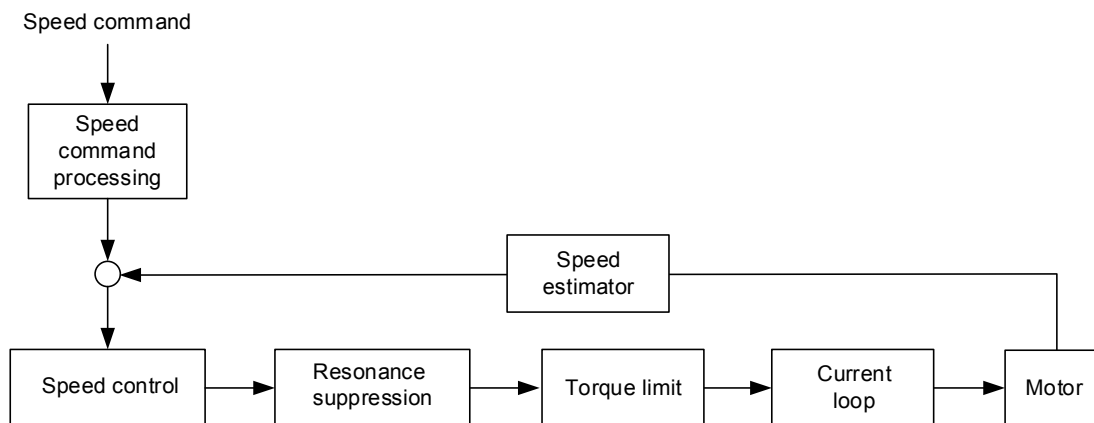
- Status of SPD0 ~ SPD1: 0 signifies that DI is off; 1 signifies that DI is on.
- When both SPD0 and SPD1 are 0, if it is in Sz mode, the command will be 0. Thus, if speed command of analog voltage type is not required, Sz mode can be applied to tackle the problem of zero drift of voltage. If it is in S mode, the command will be the voltage deviation between V-REF and GND. The range of input voltage is between -10V and +10V and its corresponding speed is adjustable (P1.040).
- When one of SPD0 and SPD1 is not 0, the speed command is issued by the internal register. The command will be activated once the status of SPD0 ~ SPD1 is changed. There is no need to use CTRG for triggering.

- The setting range of parameters (internal register) is between -60000 and 60000. Setting value = setting range x unit (0.1 rpm). For example, if P1.009 = +30000, then rotation speed = +30000 x 0.1 rpm = +3000 rpm

The speed command can be issued in speed mode (S or Sz) as well as in torque mode (T or Tz) for setting the speed limit.

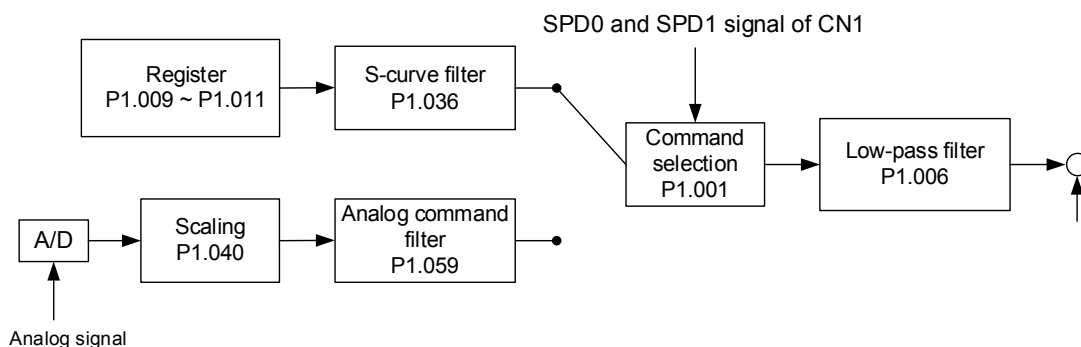
### 6.3.2 Control structure of speed mode

Diagram of basic control structure is shown as follows:



The speed command processing unit is to select the command source (See Section 6.3.1), including the scaling (P1.040) setting for rotation speed and S-curve setting for smoothing the speed. The speed control unit manages the gain parameters of the servo drive and calculates the current command for servo motor in time. The resonance suppression unit is to suppress the resonance of mechanism.

Here firstly introduce the function of speed command unit. Its structure is shown as below.



The upper path is the processing path of command issued by the register while the lower one is the processing path of external analog command. The command is selected according to the status of SPD0, SPD1 and P1.001 (S or Sz). In this condition, S-curve and low-pass filter are applied for the purpose of achieving a smoother response.

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6.3.3 Smooth speed command

S-curve filter

During the process of acceleration or deceleration, S-curve filter applies the three-stage acceleration curve and tailors a smoother motion trajectory performance. It is for avoiding jerk (the differentiation of acceleration), resonance as well as noise caused by abrupt speed variation. Users can use acceleration constant of S-curve (TACC) to adjust the slope changed by acceleration; deceleration constant of S-curve (TDEC) to adjust the slope changed by deceleration; and acceleration / deceleration constant of S-curve (TSL) to improve the status of motor activation and stop. This device can calculate the total time for executing the command. T (m) signifies the operation time and S (rpm) signifies the absolute speed command, which is the absolute value of initial speed minus end speed.

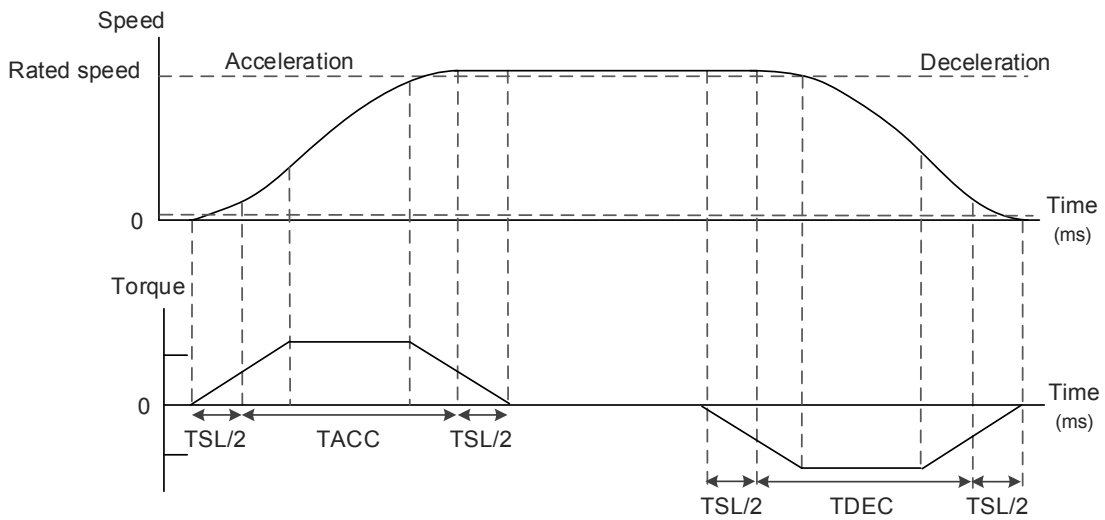


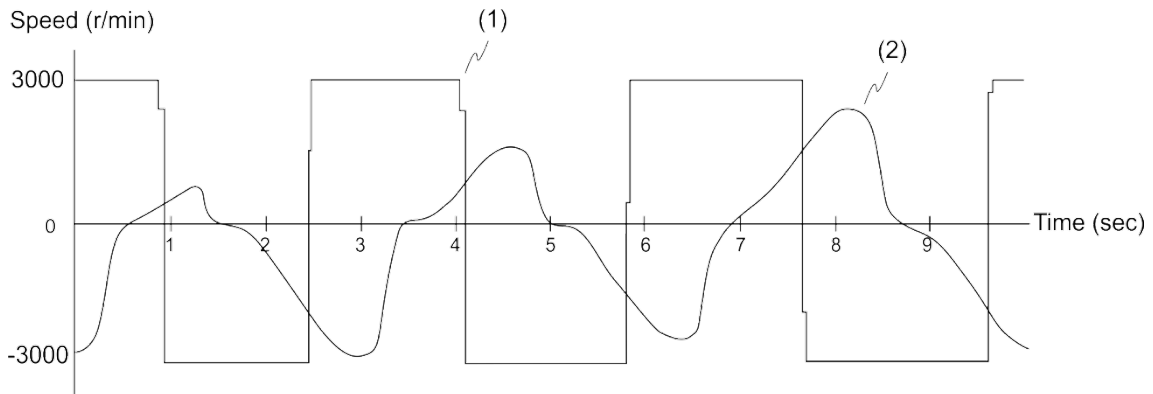
Figure 6.3.3.1 S-curve and time setting

Relevant parameters: Refer to Chapter 8 for more information.

Parameter	Function
P1.034	Acceleration constant of S-curve
P1.035	Deceleration constant of S-curve
P1.036	Acceleration / deceleration constant of S-curve

**Analog speed command filter**

Analog speed command filter provided by ASDA-A3 helps to stable the motor operation when the analog input signal (speed) changes rapidly.



(1) Analog speed command (2) Motor torque

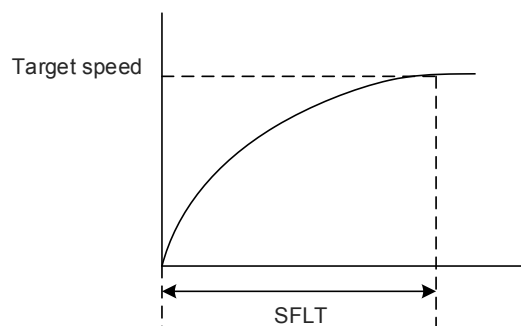
Analog speed command filter smooth the analog input command. Its time program is the same as S-curve filter at normal speed. Also, the speed curve and the acceleration curve are both continuous. The above is the curve of speed command and motor torque when analog speed command filter is applied. In the diagram above, the slopes of speed command in acceleration and deceleration are different. You can adjust the time setting (P1.034, P1.035, and P1.036) according to the actual application to improve the performance.

**Low-pass filter for commands**

It is usually used to filter out unwanted high-frequency response or noise so that the speed will become smoother.

Relevant parameters: Refer to Chapter 8 for more information.

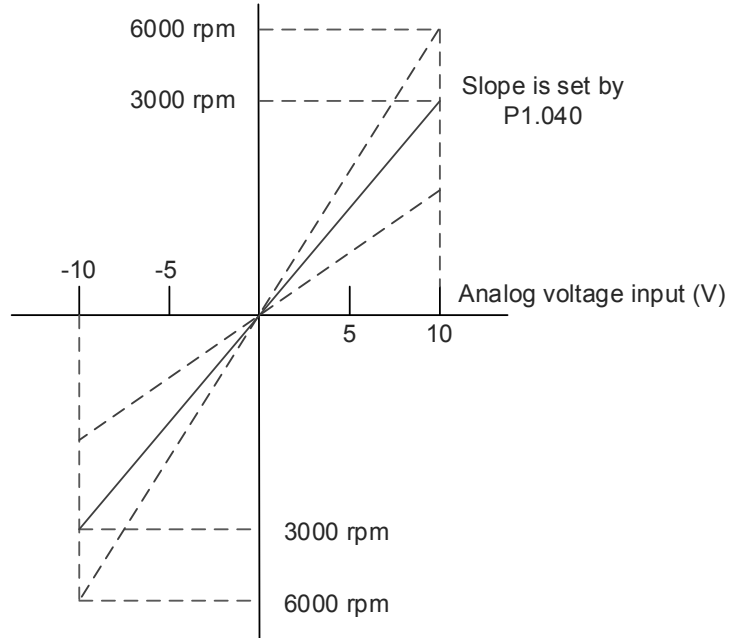
Parameter	Function
P1.006	Smooth constant of speed command (Low-pass filter)



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**6.3.4 Scaling of analog command**

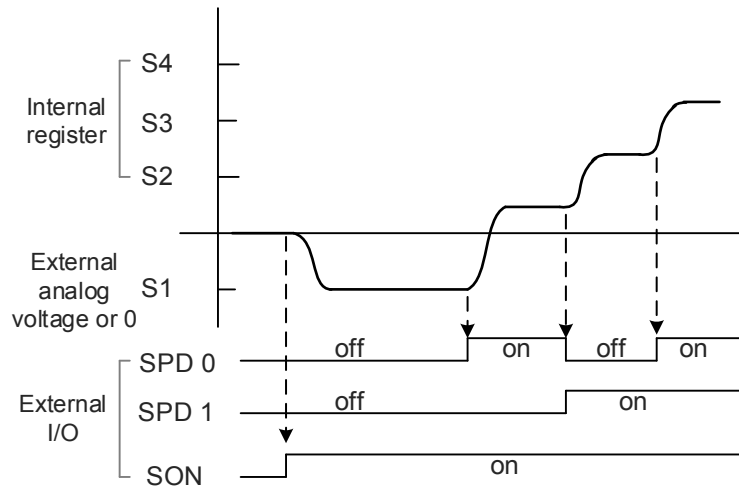
The motor's speed command is determined by the analog voltage difference between V\_REF and VGND. Use parameter P1.040 (Max. rotation speed of analog speed command) to adjust the slope of speed and its range.



Relevant parameters: Refer to Chapter 8 for more information.

Parameter	Function
P1.040	Max. rotation speed of analog speed command

### 6.3.5 Timing diagram of speed mode



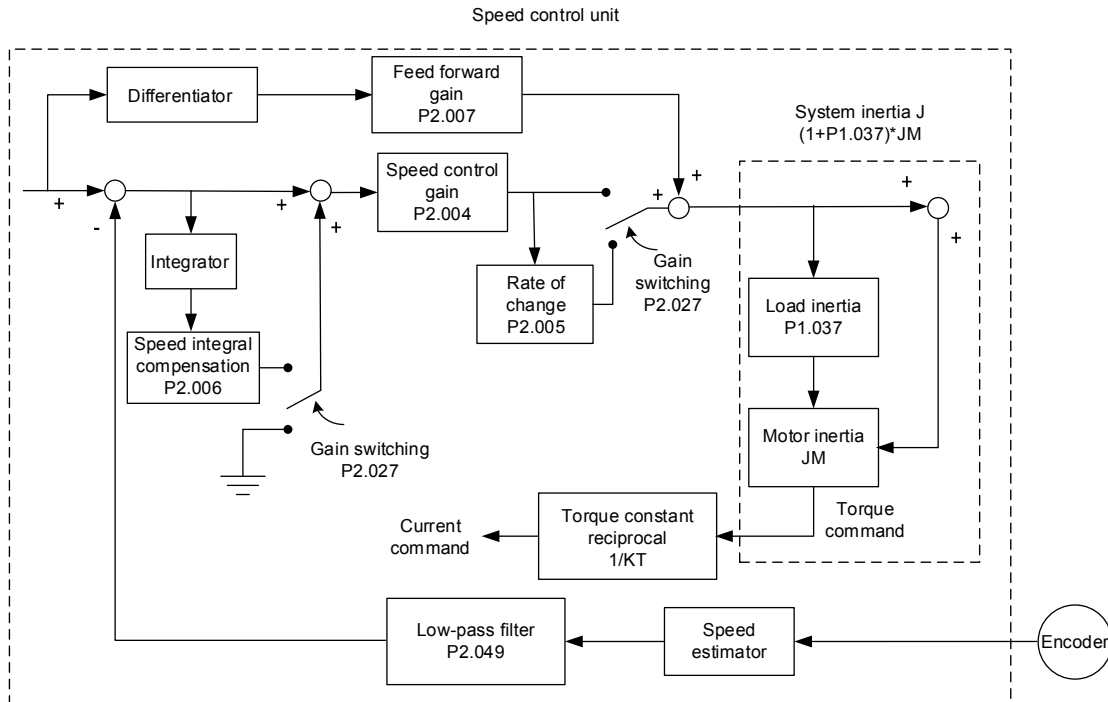
Note:

1. "Off" signifies the contact is open while "On" signifies the contact is closed.
2. When it is in Sz mode, the speed command S1 = 0; when it is in S mode, the speed command S1 is the external analog voltage input.
3. In servo-on state, the command is selected according to the state of SPD0 ~ SPD1.

### 6.3.6 Gain adjustment of speed loop

Structure of speed control unit is as follows:

6



In the speed control unit, different types of gain can be adjusted. Users can adjust manually or use the three gain adjustment modes provided.

**Manual:** All parameter settings are completed by users. Auto and auxiliary functions are disabled.

**Gain adjustment mode:** Please refer to Chapter 5 Auto tuning.

**Manual mode**

When P2.032 is set to 0, Speed loop gain (P2.004), Integral compensation P2.006, and Feed forward gain (P2.007) are set by users. More detail about adjusting the gains is as follows:

**Speed loop gain:** The higher the gain is the bigger bandwidth of speed loop response will be.

**Integral gain:** Increasing this gain will increase the low frequency rigidity and reduce the steady-state error. However, phase margin will be smaller. If this gain is set too high, the system stability will be reduced.

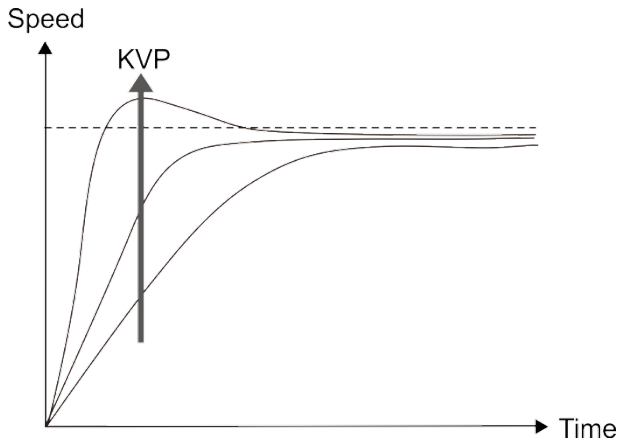
**Feed forward gain:** Diminish the deviation of phase delay.

**Relevant parameters:** Refer to Chapter 8 for more information.

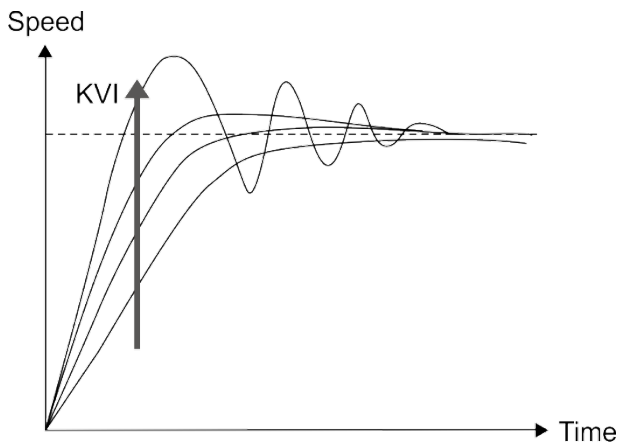
Parameter	Function
P2.004	Speed control gain (KVP)
P2.006	Speed integral compensation (KVI)
P2.007	Speed feed forward gain (KVF)

Theoretically, stepping response can be used to explain proportional gain (KVP), integral gain (KVI), and feed forward gain (KVF). Here, the frequency domain and time domain are used to illustrate the basic principle.

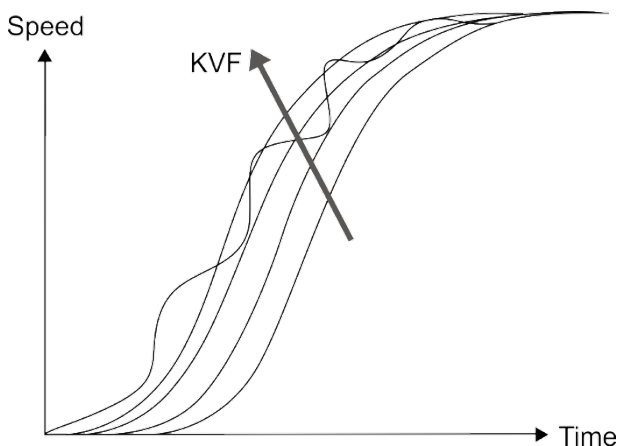
**Frequency domain**



The higher the KVP value is, the bigger the bandwidth will be. The time of rising will also be shorter. However, if the value is set too big, the phase margin will be too small. The effect is not as good as KVI regarding the steady-state error but for better following effect.



The higher the KVI value is, the bigger the low frequency gain will be. It shortens the time for becoming zero steady-state error. However, it shows no significant help to reduce the following error.



The closer the KVF value is to 1, the more complete the forward compensation will be. Following error will thus become very small. But, a KVF value that is set too big will also cause vibration.



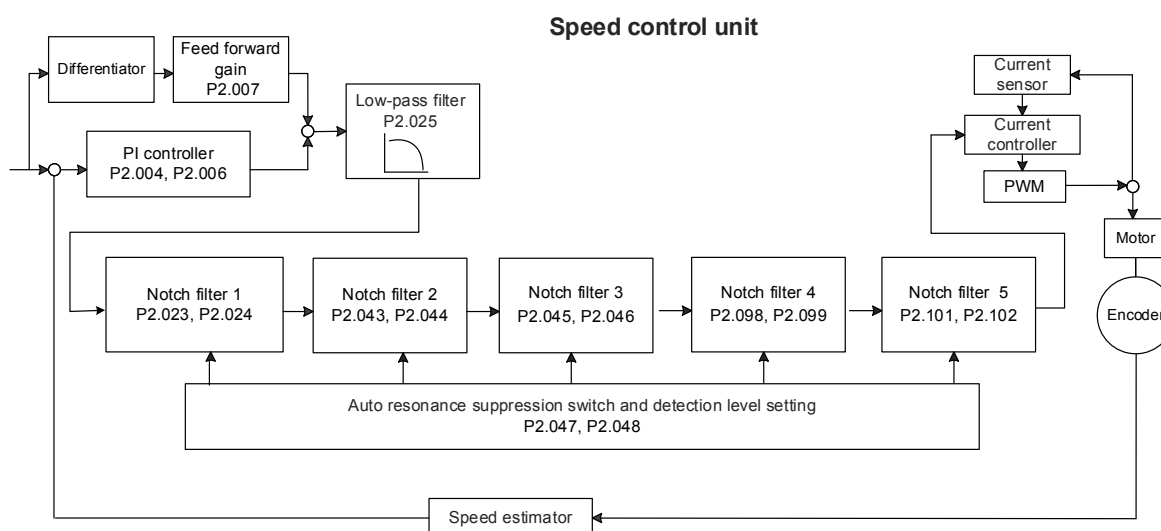
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## 6.3.7 Resonance suppression unit

When resonance occurs, it is probably because the stiffness of the control system is too high or the response is too fast. Eliminating these two factors might improve the situation. In addition, low-pass filter (parameter P2.025) and notch filter (parameter P2.023, P2.024, P2.043 ~ P2.046, P2.095 ~ P2.103) are provided to suppress the resonance if the control parameters remains unchanged.

Relevant parameters: Refer to Chapter 8 for more information.

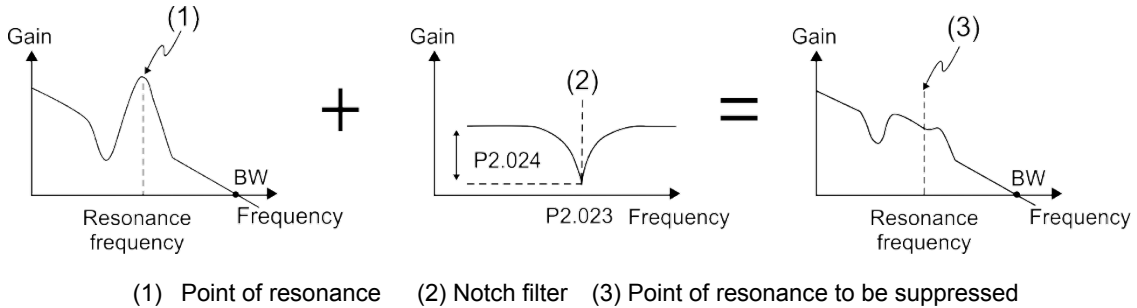
Parameter	Function
P2.023	Resonance suppression (Notch filter) (1)
P2.024	Resonance suppression (Notch filter) attenuation rate (1)
P2.043	Resonance suppression (Notch filter) (2)
P2.044	Resonance suppression (Notch filter) attenuation rate (2)
P2.045	Resonance suppression (Notch filter) (3)
P2.046	Resonance suppression (Notch filter) attenuation rate (3)
P2.095	Resonance suppression (Notch filter) width (1)
P2.096	Resonance suppression (Notch filter) width (2)
P2.097	Resonance suppression (Notch filter) width (3)
P2.098	Resonance suppression (Notch filter) (4)
P2.099	Resonance suppression (Notch filter) attenuation rate (4)
P2.100	Resonance suppression (Notch filter) width (4)
P2.101	Resonance suppression (Notch filter) (5)
P2.102	Resonance suppression (Notch filter) attenuation rate (5)
P2.103	Resonance suppression (Notch filter) width (5)
P2.025	Low-pass filter of resonance suppression



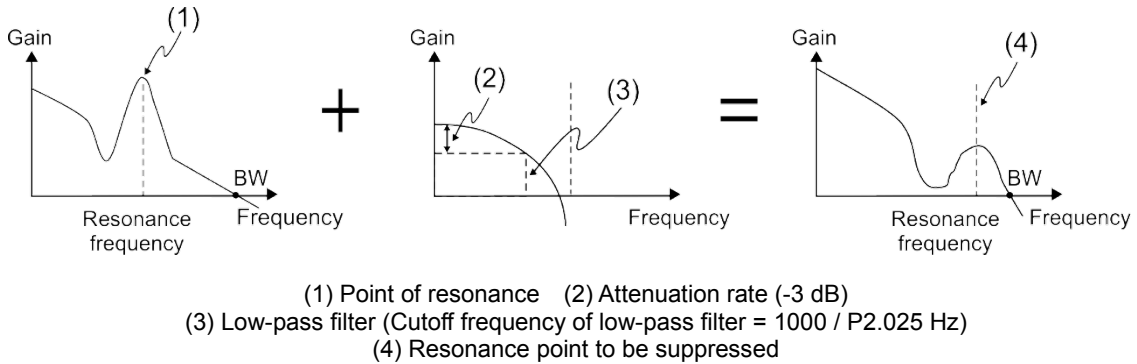
A3 provides two types of resonance suppression, one is Notch filter and the other is low-pass filter. See the following diagrams for the results of suppression.

The system open-loop gain with resonance:

■ Notch Filter



■ Low-pass filter

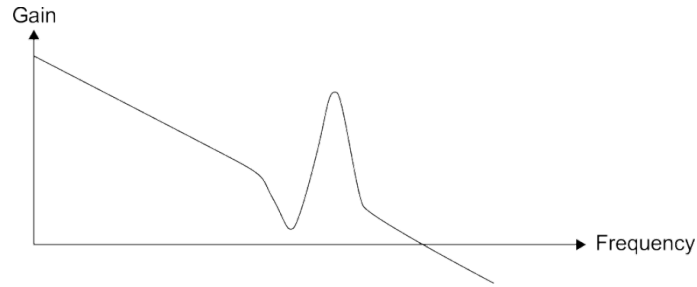


To conclude from the above two examples, if the value of P2.025 is increased from 0, the bandwidth (BW) will become smaller. Although it solves the problem of resonance, it also reduces the response bandwidth and phase margin and thus the system becomes unstable.

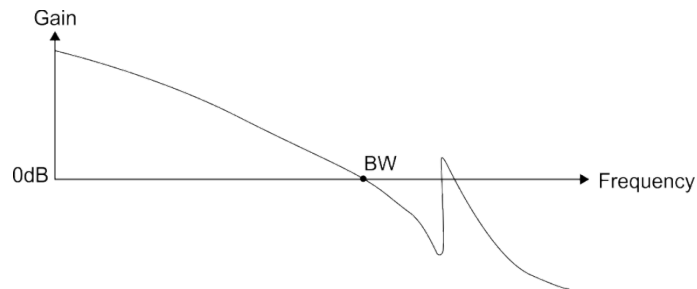
If the resonance frequency is known, you can eliminate the suppression by using the Notch filter, which is better than the low-pass filter in this condition. If the resonance frequency drifts along with time or other causes and the drifting amount is too great, using notch filter is not suggested.

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The following figure shows the system open-loop gain with resonance suppression.



When the value of P2.025 is increased from 0, BW becomes smaller. Although it solves the problem of resonance frequency, the response bandwidth and phase margin are reduced. Also, the system becomes unstable.



If the resonance frequency is given, the Notch filter can eliminate the resonance directly. Frequency of Notch filter is 50 ~ 5000 Hz and the suppression strength is 0 ~ 32 dB. If the frequency meets this condition, using low-pass filter to reduce the resonance is suggested.

## 6.4 Torque mode

Torque control mode (T or Tz) is suitable for torque control applications, such as printing machine, winding machine, etc. There are two kinds of command source: analog input and register. Analog command input uses external voltage to control the torque of the motor while register uses the internal parameters (P1.012 ~ P1.014) as the torque command.

### 6.4.1 Selection of torque command

External analog voltage and parameters are the two types of torque command source. They are selected by CN1's DI signal. See the table below for more detail.

Torque command	DI signal of CN1		Command source		Content	Range	
	TCM1	TCM0					
T1	0	0	Mode	T	External analog command	Voltage difference between T-REF and GND	-10V ~ +10V
				Tz	N/A	Torque command is 0	0
T2	0	1	Parameters		P1.012	-300% ~ 300%	
T3	1	0			P1.013	-300% ~ 300%	
T4	1	1			P1.014	-300% ~ 300%	

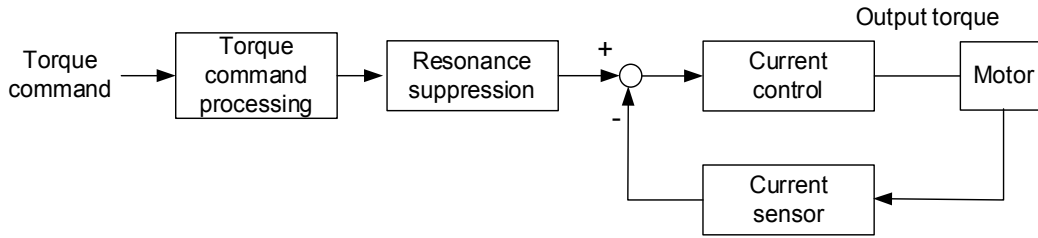
- State of TCM0 ~ TCM1: 0 signifies that the circuit is open (DI is off); 1 signifies that the circuit is closed (DI is on).
- When TCM0 = TCM1 = 0, if it is in Tz mode, then the command is 0. Thus, if there is no need to use analog voltage as torque command, Tz mode is applicable and can avoid the problem of zero drift. If it is in T mode, the command will be the voltage difference between T-REF and GND. Its input voltage range is -10V ~ +10V, which means the corresponding torque is adjustable (P1.041).
- When either one of TCM0 or TCM1 is not 0, parameters become the source of torque command. The command will be executed after TCM0 ~ TCM1 are changed. There is no need to use CTRG for triggering.

The torque command can be used in torque mode (T or Tz) and speed mode (S or Sz). When it is in speed mode, it can be regarded as the command input of torque limit.

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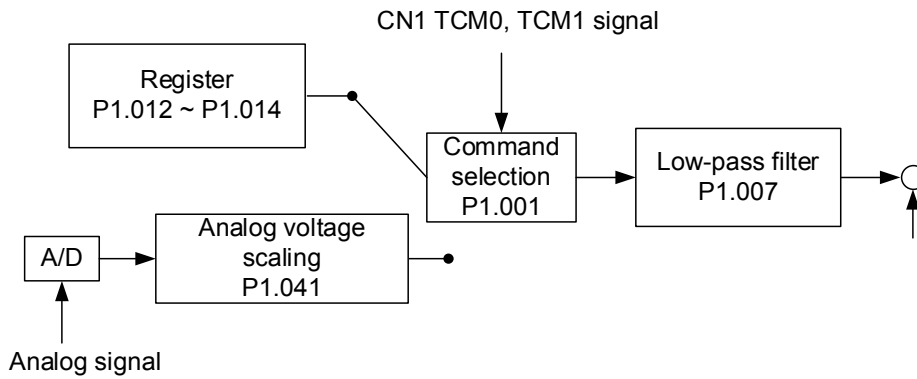
6.4.2 Control structure of torque mode

The following diagram shows the basic control structure of Torque mode:



The torque command unit is to specify the torque command source (mentioned in Section 6.4.1), including the scaling of analog voltage (P1.041) and S-curve setting. The current control unit manages the gain parameters of the servo drive and calculates the current for servo motor in time; this can only set by commands.

The structure of torque command unit is as the follows.

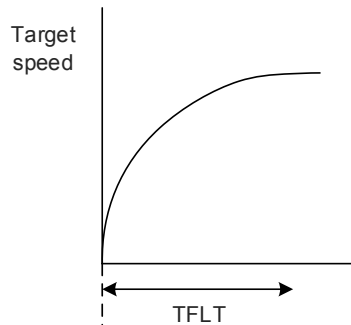


The upper path is the command from register while the lower one is external analog command. The command is selected according to the status of TCM0, TCM1, and P1.001 (T or Tz). The torque can be adjusted by the analog voltage scaling (P1.041) and the response can be smoothed by the low-pass filter (P1.007).

### 6.4.3 Smooth torque command

Relevant parameters: Refer to Chapter 8 for more information.

Parameter	Function
P1.007	Smooth constant of torque command (Low-pass filter)

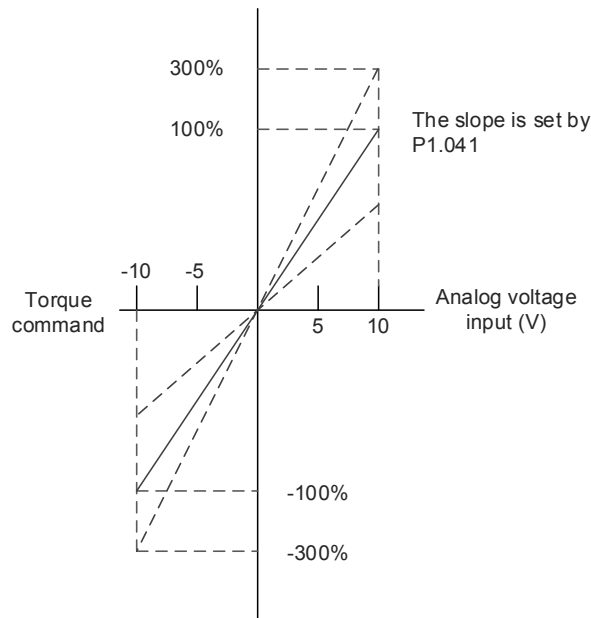


### 6.4.4 Scaling of analog command

The motor torque command is controlled by the analog voltage difference between T\_REF and GND. And the torque slope and its range can be adjusted by parameter P1.041.

The example is as follows:

1. If P1.041 is set to 100 and the external input voltage is 10V, the torque command is 100% of the rated torque.
2. If P1.041 is set to 300 and the external input voltage is 10V, the torque command is 300% of the rated torque.

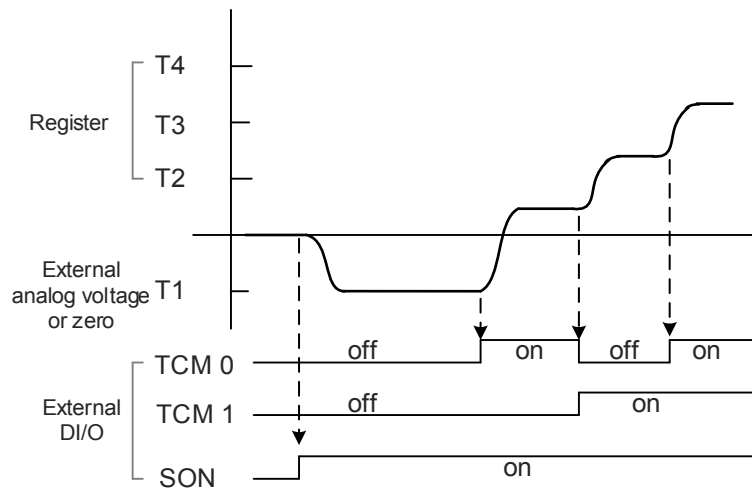


Relevant parameters: Refer to Chapter 8 for more information.

Parameter	Function
P1.041	Max. output of analog torque limit

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6.4.5 Timing diagram in torque mode



Note:

1. Off signifies the contact is open while on signifies the contact is closed.
2. When it is in Tz mode, the torque command T1 = 0; when it is in T mode, the torque command T1 is the external analog voltage input.
3. In servo-on state, the command is selected according to the state of TCM0 ~ TCM1.

## 6.5 Dual mode

Apart from single mode for position, speed, and torque control, 8 dual / multiple modes are also provided for operation (See section 6.1).

Mode	Short name	Setting code	Description
Dual mode	PT-S	06	PT and S can be switched via DI signal, S_P.
	PT-T	07	PT and T can be switched via DI signal, T_P.
	PR-S	08	PR and S can be switched via DI signal, S_P.
	PR-T	09	PR and T can be switched via DI signal, T_P.
	S-T	0A	S and T can be switched via DI signal, S_T.
	PT-PR	0D	PT and PR can be switched via DI signal, PT_PR.
Multiple mode	PT-PR-S	0E	PT, PR, and S can be switched via DI signal, S_P and PT_PR.
	PT-PR-T	0F	PT, PR, and T can be switched via DI signal, T_P and PT_PR.

Sz and Tz dual mode is not provided here. For avoiding occupying too many digital inputs in dual mode, speed and torque mode can apply external analog voltage as the command source so as to reduce the use of DI points (SPD0, SPD1 or TCM0, TCM1). In addition, position mode can use pulse input to reduce the use of DI points (POS0, POS1, POS2, POS3, POS4, POS5, and POS6). Please refer to Section 3.3.2 for table of DI/O default value in each mode.

DI/O signals in correspondence with the PINs are defined as above, users can refer to Section 3.3.4 if you desire to change the settings.



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**6.5.1 Speed / position dual mode**

There are PT-S and PR-S in speed / position dual mode. The command source of the former comes from external pulse while the latter comes from internal parameters (P6.000 ~ P7.027). Speed command can be issued by external analog voltage or internal parameters (P1.009 ~ P1.011). The switch of speed / position mode is controlled by DI.S-P (0x18) signal; switch of PT and PR for position mode is controlled by DI.PT-PR (0x2B). Thus, both position and speed commands in PR-S mode are selected by DI signal. The timing diagram is shown as below.

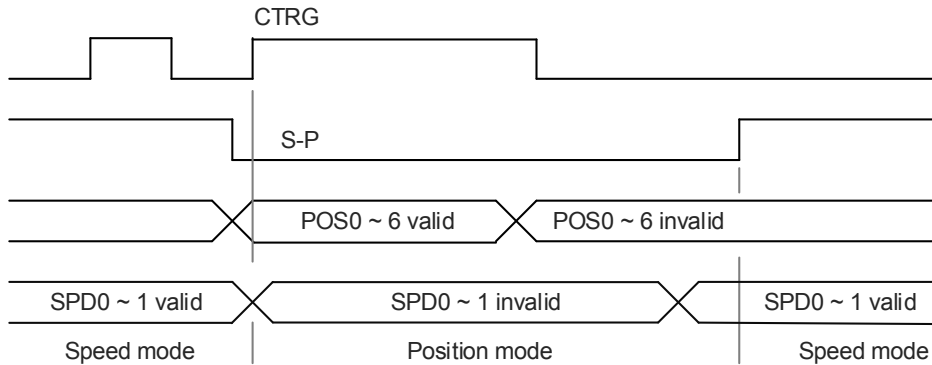


Figure 6.5.1.1 Speed / position dual mode

In speed mode (DI.S-P is on), the speed command is selected via DI.SPD0 and DI.SPD1. DI.CTRG is not working at the moment. When switching to position mode (DI.S-P is off), since position command has not been issued (needs to wait for the rising edge of DI.CTRG), the motor stops. The position command is determined by DI.POS0 ~ DI.POS6 and triggered by the rising edge of DI.CTRG. When DI.S-P is on, it resumes to the speed mode. Please refer to the introduction of single mode for DI signal and the selected command of each mode.

### 6.5.2 Speed / torque dual mode

Speed / torque dual mode includes S-T mode only. The speed command comes from the external analog voltage and internal parameters (P1.009 ~ P1.011), which are selected via DI.SPD0 ~ DI.SPD1. Similarly, the source of torque command could be external analog voltage or internal parameters (P1.012 ~ P1.014) and is selected via DI.TCM0 ~ DI.TCM1. The switch of speed / torque mode is controlled by DI.S-T (0x19) signal. The timing diagram is shown as below.

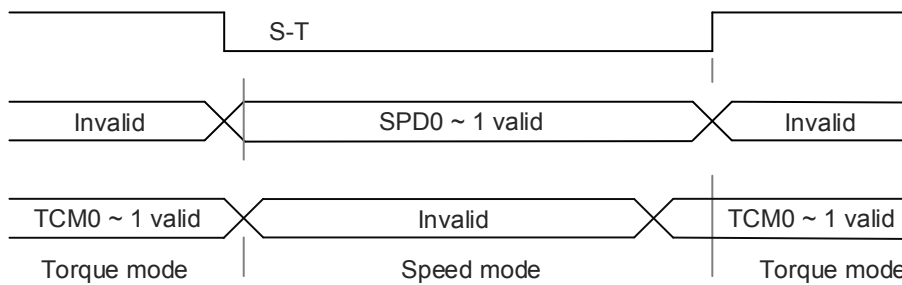


Figure 6.5.2.1 Speed / torque dual mode

In torque mode (DI.S-T is on), the torque command is selected via DI.TCM0 and DI.TCM1. When switching to speed mode (DI.S-T is off), the torque command is selected via DI.SPD0 and DI.SPD1. The motor operates according to the speed command. When DI.S-T is ON, it resumes to the torque mode. Please refer to the introduction of single mode for DI signal and the selected command of each mode.

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**6.5.3 Torque / position dual mode**

There are PT-T and PR-T in torque / position dual mode. The command source of the former comes from external pulse while the latter comes from internal parameters (P6.000 ~ P7.027). Torque command could be issued by external analog voltage or internal parameters (P1.012 ~ P1.014). The switch of torque / position mode is controlled by DI.T-P (0x20) signal. PT and PR in position mode are selected by DI.PT-PR (0x2B). Thus, both position and torque commands in PR-T mode are selected by DI signal. The timing diagram is shown as below.

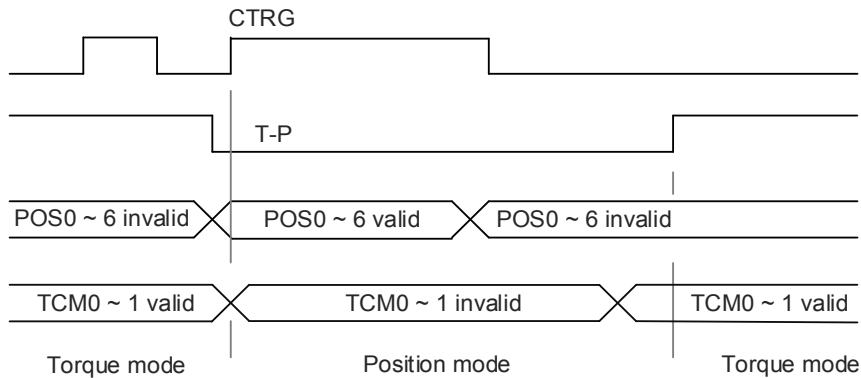


Figure 6.5.3.1 Torque / position dual mode

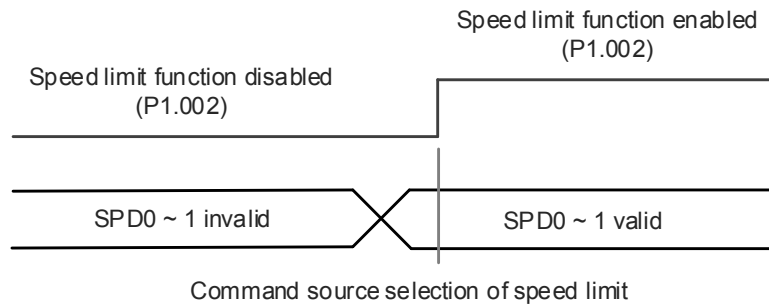
In torque mode (DI.T-P is on), the torque command is selected via DI.TCM0 and DI.TCM1. DI.CTRG is not working at the moment. When switching to position mode (DI.T-P is off), since position command has not been issued (needs to wait for the rising edge of DI.CTRG), the motor stops. The position command is determined by DI.POS0 ~ DI.POS6 and triggered by rising edge of DI.CTRG. When DI.T-P is on, it resumes to torque mode. Please refer to the introduction of single mode for DI signal and the selected command of each mode.

## 6.6 Others

### 6.6.1 Applying speed limit

The maximum speed in each mode is determined by the internal parameter (P1.055), no matter it is in position, speed, or torque mode. The issuing method of speed limit command and speed command is identical. The command source can be external analog voltage or internal parameter (P1.009 ~ P1.011). Please refer to Section 6.3.1 for descriptions.

Speed limit is applicable only in torque mode (T) for controlling the motor's maximum speed. If using external analog voltage in torque mode, DI signals will be available and can be set to SPD0 ~ SPD1 for motor speed limit selection (internal parameters). If not, users can use analog voltage input as the speed limit command. When P1.002 (Disable / enable speed limit function) is set to 1, the speed limit function is enabled. See the following timing diagram.

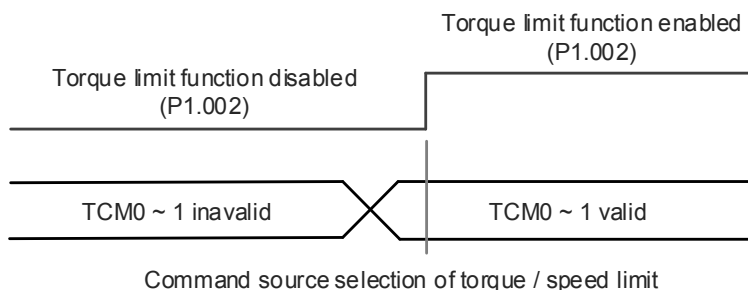


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## 6.6.2 Applying torque limit

The issuing method of torque limit command and torque command is identical. The command source can be external analog voltage or internal parameters (P1.012 ~ P1.014). Please refer to Section 6.4.1 for descriptions.

Torque limit can be used in position mode (PT, PR) or speed mode (S). It is used for limiting the motor torque output. When the command in position mode is issued by external pulse or the command in speed mode is issued by external analog voltage, DI signals are available and can be set to TCM0 ~ TCM1 for determining the torque limit command (internal parameters). If not enough DI signal is available, torque limit command can be issued by analog voltage. When the torque limit function (P1.002) is set to 1, the torque limit function is enabled. See the timing diagram below.



## 6.6.3 Analog monitoring

Users could observe the needed voltage signal via analog monitoring.

Two analog channels are provided by the servo drive and locate in terminal 15 and 16 of CN1.

Please refer to Chapter 8 for more information about the relevant parameters.

Parameter	Function
P0.003	Analog output monitoring
P1.003	Polarity setting of encoder pulse output
P1.004	MON1 analog monitor output proportion
P1.005	MON2 analog monitor output proportion
P4.020	Offset adjustment value of analog monitor output (Ch1)
P4.021	Offset adjustment value of analog monitor output (Ch2)

Example:

To specify motor speed 1000 rpm which corresponds to analog output 8V with the maximum speed of 5000 rpm. The setting is as follows:

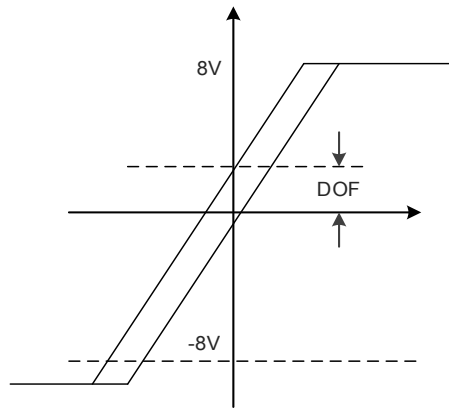
$$P1.004 = \frac{\text{Required speed}}{\text{Max. speed}} \times 100\% = \frac{1000 \text{ RPM}}{5000 \text{ RPM}} \times 100\% = 20\%$$

You can acquire the corresponding voltage output for the current motor speed via the formula below.

Motor speed	Mon1 Analog monitoring output
300 rpm	$MON1 = 8V \times \frac{\text{Current speed}}{\text{Max. speed} \times \frac{P1.004}{100}} \times 100\% = 8V \times \frac{300 \text{ RPM}}{5000 \text{ RPM} \times \frac{20}{100}} \times 100\% = 2.4V$
900 rpm	$MON1 = 8V \times \frac{\text{Current speed}}{\text{Max. speed} \times \frac{P1.004}{100}} \times 100\% = 8V \times \frac{900 \text{ RPM}}{5000 \text{ RPM} \times \frac{20}{100}} \times 100\% = 7.2V$

Voltage drift:

When voltage drift occurs, the voltage level defined as zero voltage will be different from the set zero point. To tackle this problem, DOF1 (P4.020) and DOF2 (P4.021) can be used to calibrate the offset voltage output.



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6

# Description of Motion Control

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This chapter introduces internal motion commands in PR mode of ASDA-A3. In this mode, commands are composed based on the internal command of the servo drive. Various motion commands are available on ASDA-A3, including homing, speed, position, parameter writing, arithmetic operation, and jump. Other motion control functions such as high-speed position capture (Capture), high-speed position compare (Compare), and E-Cam are also provided. You will find detailed description of each command type in the following sections.

7.1	PR mode description .....	7-2
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## 7.1 PR mode description

In PR mode, the internal of servo drive will generate motion commands. Apart from the basic arithmetic operation commands, all settings are saved in the parameter file of servo drive. Thus changing parameter values will change PR commands simultaneously. ASDA-A3 provides 100 sets of path setting, which include homing method, position command, speed command, jump command, write command, index positioning command, and arithmetic operation commands.

Except arithmetic operations, the property and corresponding data of each PR path are both set by parameters. Information of all PR parameters can be found in description of Group 6 and 7 of Chapter 8. For example, PR#1 path is defined by two parameters, P6.002 and P6.003. P6.002 is for specifying the property of PR#1, such as the PR command type, determining whether to interrupt and whether to auto-execute the next PR. And P6.003 is subject to change based on the property set by P6.002. If P6.002 is set to a speed command, then P6.003 is for specifying the target speed. While P6.002 is set to a jump command, then P6.003 is for setting the target PR to be jumped to. Regarding PR#2, the setting parameters are P6.004 and P6.005 and they work the same way as P6.002 and P6.003 and so do the rest of PR paths. See Figure 7.1.1.

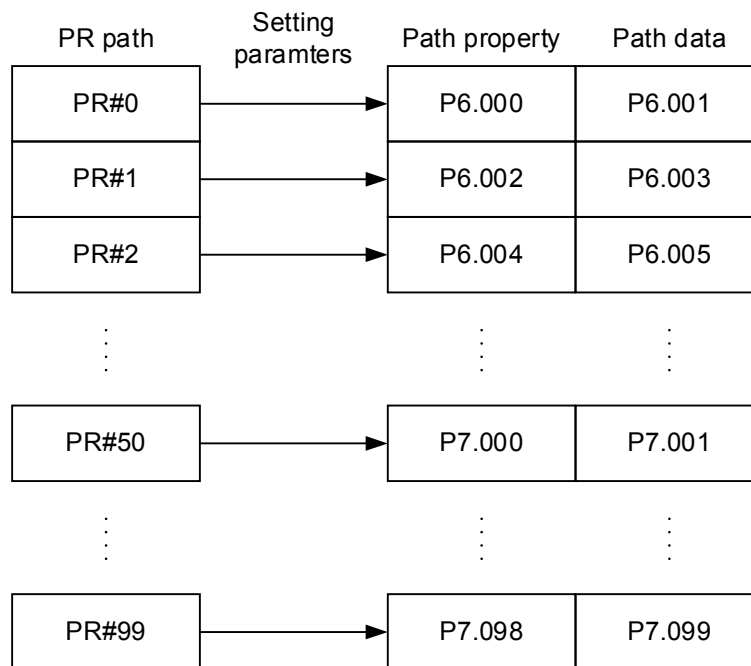


Figure 7.1.1 Setting parameters for each PR path

In ASDA-Soft software, select the PR to be edited in PR mode, the corresponding setting parameters will be shown at the top of the window. Refer to the example in Figure 7.1.2. If PR#1 is selected, P6.002 and P6.003 will show at the top in the editing section. Take P6.002 and P6.003 in Table 7.1.1 for example. The setting property and its data content will differ in accordance with the motion command type. For more information about motion control mode, please refer to Section 7.1.3.

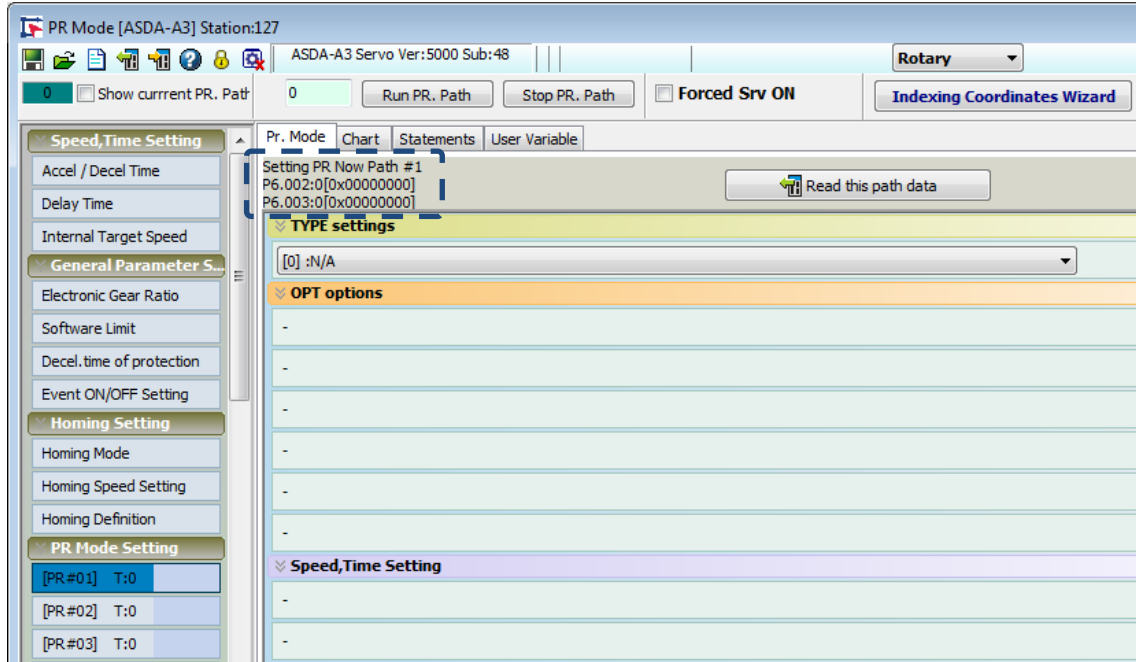


Figure 7.1.2 PR mode setting interface of ASDA-Soft

Table 7.1.1 Example of PR#1 property and data content

PR#1 \ BIT	31 ~ 28	27 ~ 24	23 ~ 20	19 ~ 16	15 ~ 12	11 ~ 8	7 ~ 4	3 ~ 0
P6.002								TYPE
P6.003	Data content (32-bit)							

Note:

TYPE: Control command mode

TYPE No.	Command mode
1	SPEED: Speed control
2	SINGLE: Positioning control. Stop once positioning is completed.
3	AUTO: Positioning control. Execute the next PR path once positioning is completed.
7	JUMP: Jump to the specified path.
8	WRITE: Write parameters to the specified path.
0xA	INDEX: Index positioning control
0xB	STATEMENT: Statement / arithmetic operations

ASDA-Soft version V6 provides editing interface with PR diagrams. See Figure 7.1.3. It is easier to set PR paths with ASDA-Soft, which includes setting options of command triggering, command types and others. Arithmetic operations and statement have to be set via the software.

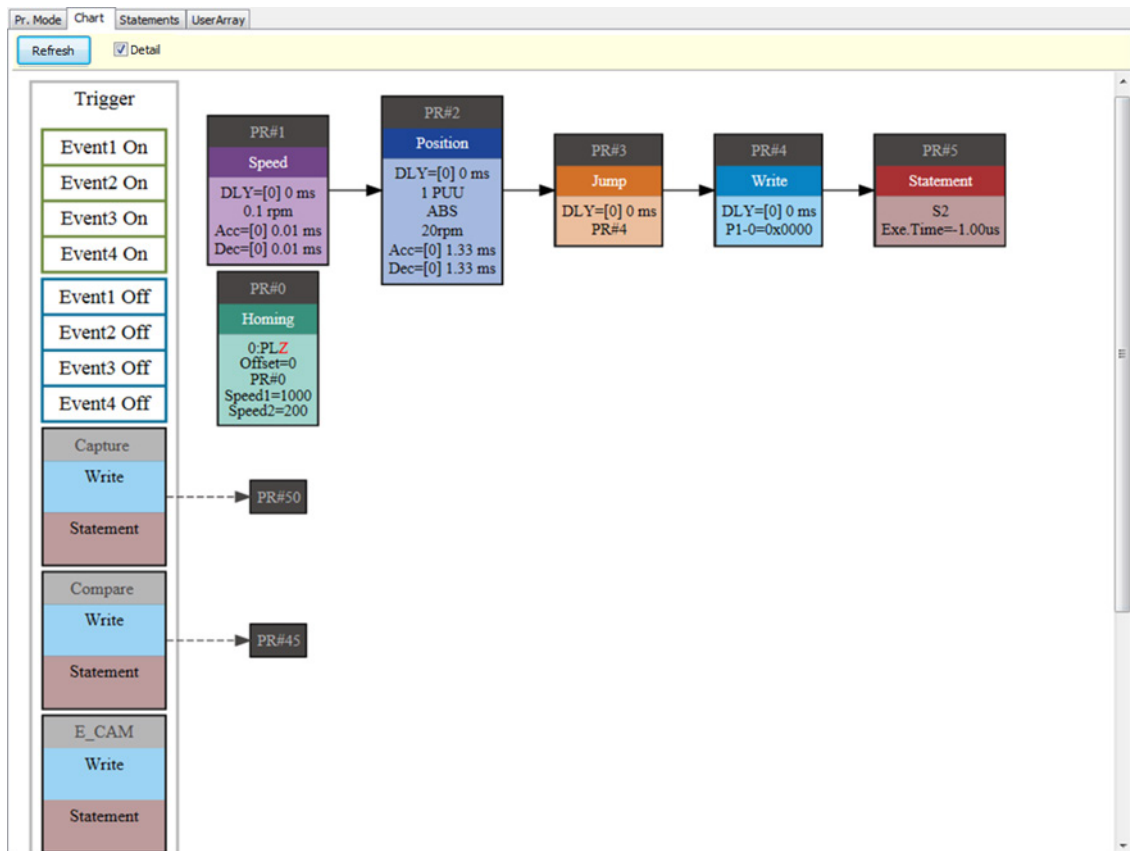


Figure 7.1.3 PR diagram display in ASDA-Soft

### 7.1.1 Shared PR parameters

ASDA-A3 provides 16 acceleration / deceleration time settings (P5.020 ~ P5.035), 16 delay time settings (P5.040 ~ P5.055), and 16 target speed settings (P5.060 ~ P5.075) for users to set the PR paths as shown in Figure 7.1.1.1. If a given setting which is used by multiple PR paths is changed, then all PR paths applying this setting will be changed as well. Please be aware of this issue when setting PR paths so as to avoid any danger or damage to the machine. For example, if multiple PR commands apply the target speed setting of P5.060, when value of P5.060 is changed, those PR commands' target speed will also be modified. ASDA-Soft software also provides user-friendly setting screen for this shared PR parameter function. See Figure 7.1.1.2. In these data, the acceleration / deceleration time is set based on the duration for motor to accelerate from 0 to 3000 rpm or decelerate from 3000 rpm to 0. For instance, if acceleration time is set to 50 ms, then the target speed of motion command is 3000 rpm, the required duration is 50 ms. If target speed of the motion command is 1500 rpm, then the acceleration time will be 25 ms. The acceleration / deceleration time is a fixed slope, and the slope will not change with the modification of parameter values.

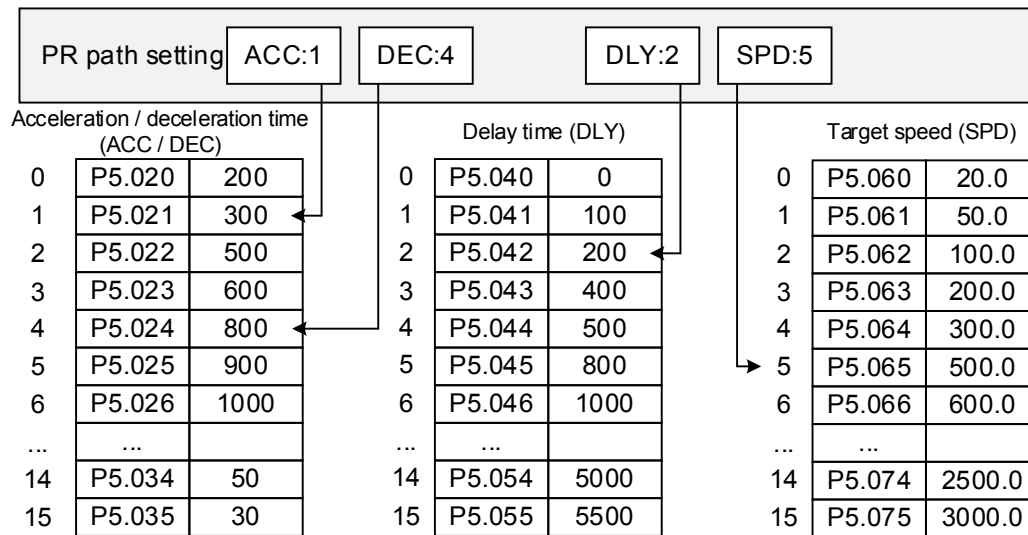


Figure 7.1.1.1 Shared parameter data of PR paths

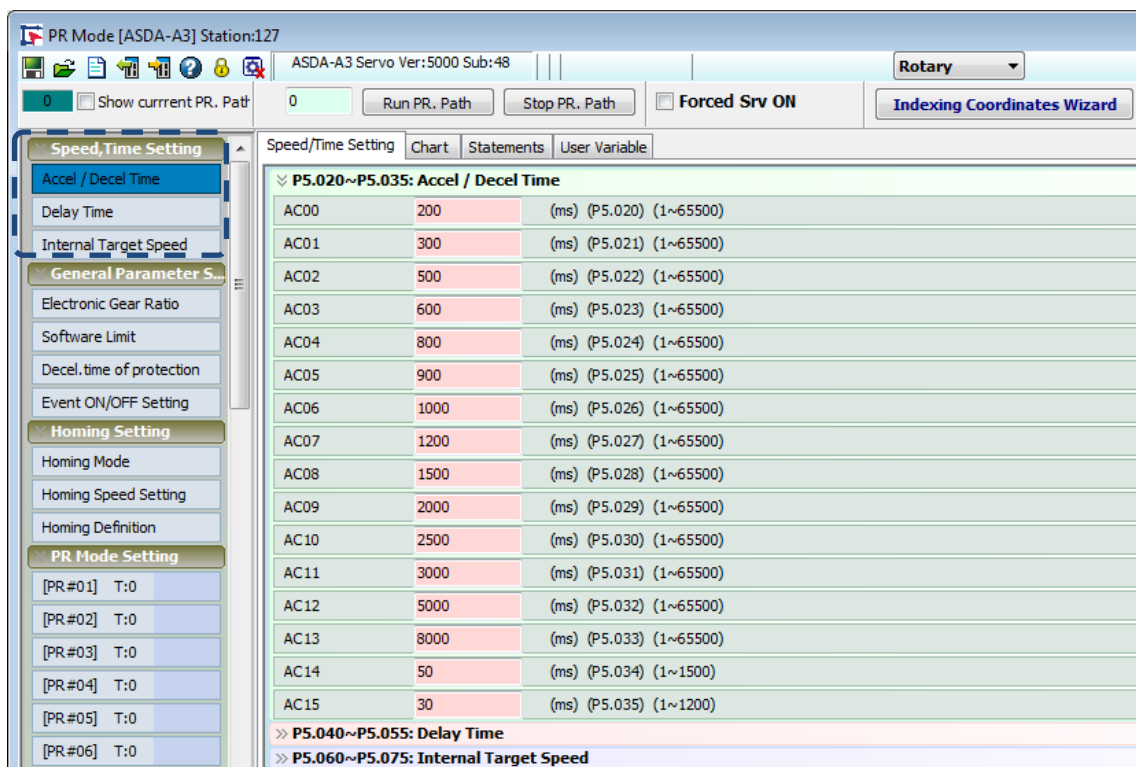


Figure 7.1.1.2 Setting interface of shared PR parameter data in ASDA-Soft

## 7.1.2 Monitoring variables of PR mode

PR mode provides four monitoring variables for users to monitor the servo command and feedback: command position (PUU), PR command end register, feedback position (PUU), and position error (PUU). More details are described as follows:

1. Command position (PUU): Monitoring variable code 001. Target position of the motion command generated per scan cycle during servo operation (updated every 1 ms), simplified as Cmd\_O (Command Operation).
2. PR command end register: Monitoring variable code 064. Target position of the PR command, simplified as Cmd\_E (Command End). When a command is triggered, the servo drive will calculate the target position and then update it to PR command end register.
3. Feedback position (PUU): Monitoring variable code 000. Feedback position (coordinates) of the motor, simplified as Fb\_PUU (Feedback PUU).
4. Position error (PUU): Monitoring variable code 002. Deviation between command position (PUU) and feedback position (PUU), simplified as Err\_PUU (Error PUU).

How these four monitoring variables work is shown in Figure 7.1.2.1. After the servo issues a position command, the servo can set the position of Cmd\_E once the target position data is acquired. The motor will operate to the target position based on the PR path setting. And Cmd\_O will calculate the amount of command deviation in each fixed cycle and issue it to the servo drive, which is regarded as a dynamic command. Fb\_PUU is motor's feedback position and Err\_PUU is the deviation of Cmd\_O minus Fb\_PUU.

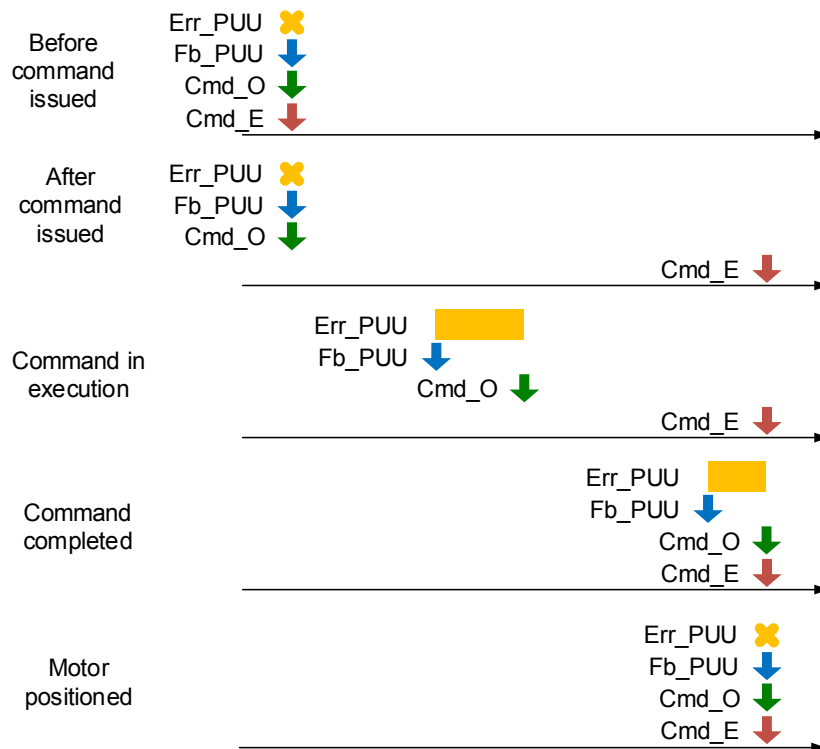


Figure 7.1.2.1 Timing diagram of PR mode monitoring variables

The detailed command behavior of each stage is illustrated in Figure 7.1.2.2. Cmd\_E is the endpoint specified by the command; its setting is completed once the PR path is triggered. Fb\_PUU is the feedback position, which is motor's actual position. Section this motion command and take one of them as example, Cmd\_O is the target of this command section and Err\_PUU is the deviation between target position and feedback position.

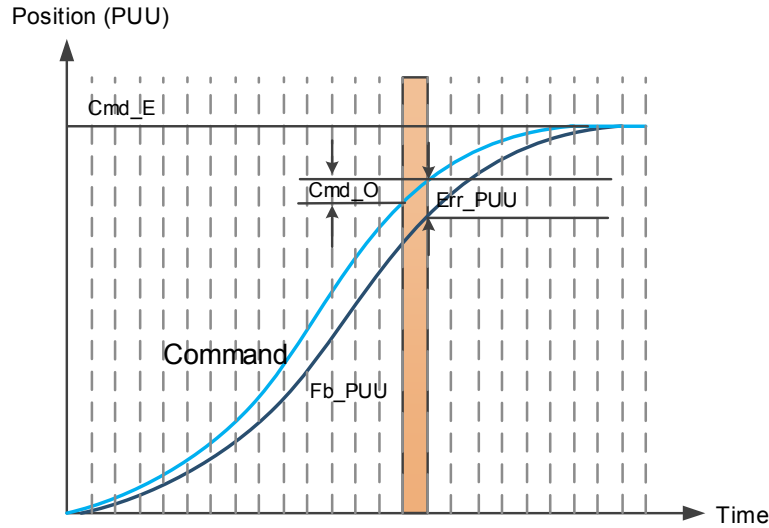


Figure 7.1.2.2 Monitoring variables status when executing a command in PR mode

Users can use digital input (DI) and digital output (DO) to monitor PR paths. By triggering the motion command with DI.CTRG [0x08], the servo drive will operate based on the command from the internal register. Once the execution is completed, DO.Cmd\_OK [0x15] is on. And when motor reaches its target position, DO.TPOS [0x05] is on. Then, after PR position command completes and motor reaches the target position, both DO signals are on and the servo will output MC\_OK [0x17] signal to signify that this PR path is completed. The operation is as shown in Figure 7.1.2.3 (Please refer to Table 8.2).

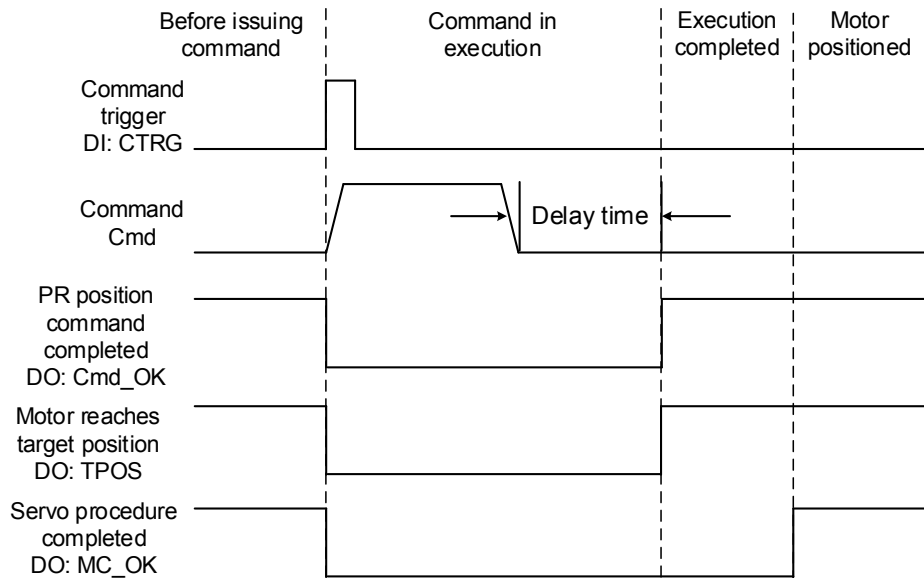


Figure 7.1.2.3 Operation of DI/DO signals in PR mode

### 7.1.3 Motion control commands

ASDA-A3 provides 100 path settings which include homing methods, speed, position, path jumping, parameter writing, index positioning, and arithmetic operations, 7 command types in total. The following sections will detail each command type .

#### Homing methods

ASDA-A3 provides 11 homing methods in PR mode. They include home sensor, limit, or crash point and come with sub-selections such as whether to refer to Z pulse and limit signal as the trigger, with more than 30 combinations available. Homing method is specified by P5.004 and homing definition is determined by P6.000. Function of each bit is as follows.

P5.004	Homing methods		Address: 0508H 0509H
Default:	0x0	Control mode:	PR
Unit:	-	Setting range:	0 ~ 0x128
Format:	HEX	Data size:	16-bit

Settings:

0000
U Z Y X

X	Homing method	Z	Limit setting
Y	Z pulse setting	U	Reserved

Definition of each setting value:

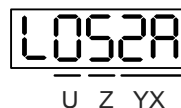
W	Z	Y	X
Reserved	Limit setting	Z pulse setting	Homing method
	0 ~ 1	0 ~ 2	0 ~ 8
	-	Y = 0: Return to Z pulse Y = 1: Go forward to Z pulse Y = 2: Do not look for Z pulse	X = 0: Homing in forward direction and regard PL as homing origin X = 1: Homing in reverse direction and regard NL as homing origin
	-		X = 2: Homing in forward direction, ORG: OFF→ON as homing origin X = 3: Homing in reverse direction, ORG: OFF→ON as homing origin
-	When encounter limit: Z = 0: Shows error Z = 1: Reverse direction	Y = 0: Return to Z pulse Y = 1: Go forward to Z pulse Y = 2: Do not look for Z pulse	X = 4: Look for Z pulse in forward direction and regard it as homing origin

W	Z	Y	X
			X = 5: Look for Z pulse in reverse direction and regard it as homing origin
			X = 6: Homing in forward direction, ORG: ON→OFF as homing origin
			X = 7: Homing in reverse direction, ORG: ON→OFF as homing origin
			X = 8: Define current position as the origin
		Y = 0: Return to Z pulse Y = 1: Do not look for Z pulse	X = 9: Look for the collision point in forward direction and regard it as the origin X = A: Look for the collision point in reverse direction and regard it as the origin

P6.000	Homing definition		Address: 0600H 0601H
Default:	0x00000000	Control mode:	PR
Unit:	-	Setting range:	0x00000000 ~ 0xFFFFFFFF3F
Format:	HEX	Data size:	32-bit

Settings:

Homing definition:



	D	C	B	A	U	Z	YX
A				DEC2: Deceleration time selection of second homing			YX PATH: Path type
B				DLY: Select 0 ~ F for delay time		Z	ACC: Select 0 ~ F for acceleration time
C				N/A		U	DEC1: Deceleration time selection of first homing
D				BOOT		-	-

- YX: PATH: Path type  
0x0: Stop: Homing complete and stop.  
0x1 ~ 0x63: Auto: Homing complete and execute the specified path (Path#1 ~ Path#99).
- Z: ACC: Select 0 ~ F for acceleration time  
0 ~ F: Corresponds to P5.020 ~ P5.035
- U: DEC1: Deceleration time selection of first homing  
0 ~ F: Corresponds to P5.020 ~ P5.035
- A: DEC2: Deceleration time selection of second homing  
0 ~ F: Corresponds to P5.020 ~ P5.035



## 7

- B: DLY: Select 0 ~ F for delay time  
0 ~ F: Corresponds to P5.040 ~ P5.055
- D: BOOT: When the drive is powered on, whether to search for origin.  
0: Do not execute homing  
1: Execute homing automatically (Servo switches to on status for the first time after applying to power)

Apart from the above mentioned definitions, related settings of homing also include:

1. P5.004 Homing methods.
2. P5.005 ~ P5.006 Speed setting of searching for origin.
3. P6.001: ORG\_DEF is the coordinate of the origin and may not be 0. This function is used as a traversal of the coordinate.

Note:

1. After the origin is found (Sensor or Z); it has to decelerate to stop. The stop position will exceed the origin for a short distance:

If returning to the origin is not needed, set PATH to 0;

If returning to the origin is needed, set PATH to a non-zero value and set PABS = ORG\_DEF.

Example:

Upon completion of P6.000 = 0x1, automatically execute Path#1

Set from absolute position (ABS) to 0 as the route of Path#1 (set P6.002 & P6.003).

2. If the origin is found (sensor or Z), and it is desired to move an offset S and define the coordinate as P after moving, then PATH = non-zero and set ORG\_DEF = P - S, and this absolute position command = P.

In PR homing mode of ASDA-A3, function for setting the origin offset is provided. You can define any point on the coordinate axis as the reference origin, which is not necessary to be 0. Once the reference origin is defined, coordinate system of the motion axis can be created. See Figure 7.1.3.1. Coordinate of the setting reference origin is 2000 (P6.001 = 2000). The motor will pass by the reference origin and then stop at coordinate 1477. As the coordinate system has been created, the system will automatically calculate the position of 0 point. As soon as PR motion command is issued, the motor will be able to run to any specified position.

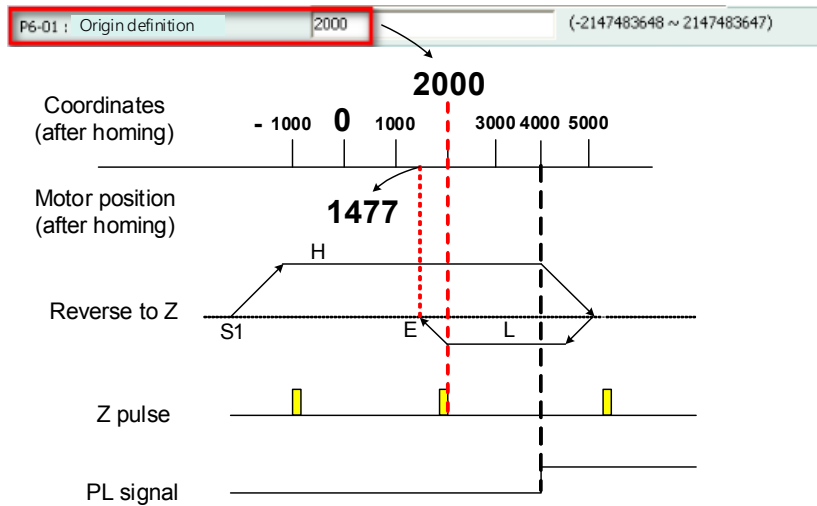


Figure 7.1.3.1 Origin definition

P6.001	Origin definition		Address: 0602H 0603H	
Default:	0	Control mode:	PR	
Unit:	-	Setting range:	-2147483648 ~ +2147483647	
Format:	DEC	Data size:	32-bit	

Settings:

Origin definition.

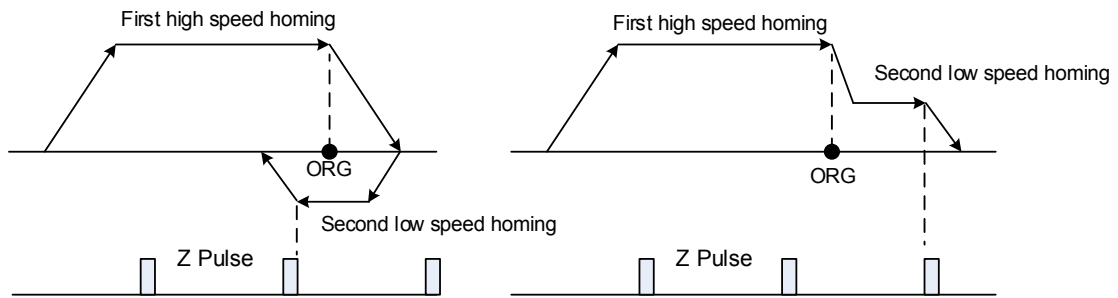
Homing procedure goes through two stages: high speed and low speed. When homing starts, the motor is in high speed stage, looking for the reference point (such as limit switch and ORG signal) at high speed. Once the servo detects the reference point, the motor starts to run at low speed so as to find the reference point accurately (such as Z pulse). And speed of the two stages are defined by P5.005 and P5.006.

P5.005	First speed setting of high speed homing			Address: 050AH 050BH	
Operation interface:	Panel / software	Communication	Control mode:	PR (Set with P5.004)	
Default:	100.0	1000	Data size:	32-bit	
Unit:	1 rpm (rotary motor)* 10 <sup>-6</sup> m/s (linear motor)*	0.1 rpm (rotary motor)* 10 <sup>-6</sup> m/s (linear motor)*			
Setting range:	0.1 ~ 6000.0 (rotary motor)* 0.1 ~ 1599999.9 (linear motor)*	1 ~ 60000 (rotary motor)* 1 ~ 15999999 (linear motor)*			
Format:	DEC	DEC	-	-	
Example:	1.5 = 1.5 rpm	15 = 1.5 rpm	-	-	

Settings:

The first speed setting of high speed homing.

7



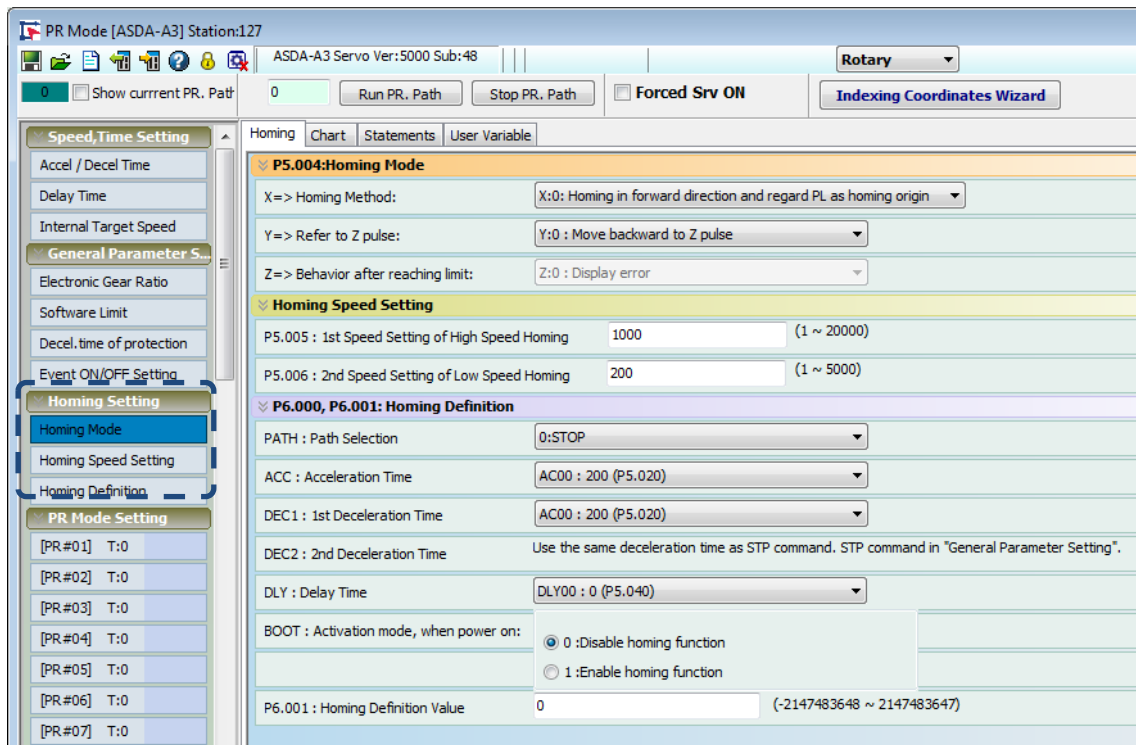
Note: Rotary motor is the abbreviation for permanent-magnet synchronous rotary motor; linear motor is the abbreviation for permanent-magnet synchronous linear motor.

P5.006	Second speed setting of low speed homing			Address: 050CH 050DH
Operation interface:	Panel / software	Communication	Control mode:	PR (Set with P5.004)
Default:	20.0	200	Data size:	32-bit
Unit:	1 rpm (rotary motor)* 10 <sup>-6</sup> m/s (linear motor)*	0.1 rpm (rotary motor)* 10 <sup>-6</sup> m/s (linear motor)*		
Setting range:	0.1 ~ 6000.0 (rotary motor)* 0.1 ~ 1599999.9 (linear motor)*	1 ~ 60000 (rotary motor)* 1 ~ 1599999 (linear motor)*		
Format:	DEC	DEC	-	-
Example:	1.5 = 1.5 rpm	150 = 1.5 rpm	-	-

Settings: The second speed setting of low speed homing.

Note: Rotary motor is the abbreviation for permanent-magnet synchronous rotary motor; linear motor is the abbreviation for permanent-magnet synchronous linear motor.

The settings mentioned above can be done through PR mode homing setting screen in ASDA-Soft software. Settings of homing methods, homing definition, and homing speed are all included. Please see Figure 7.1.3.2.



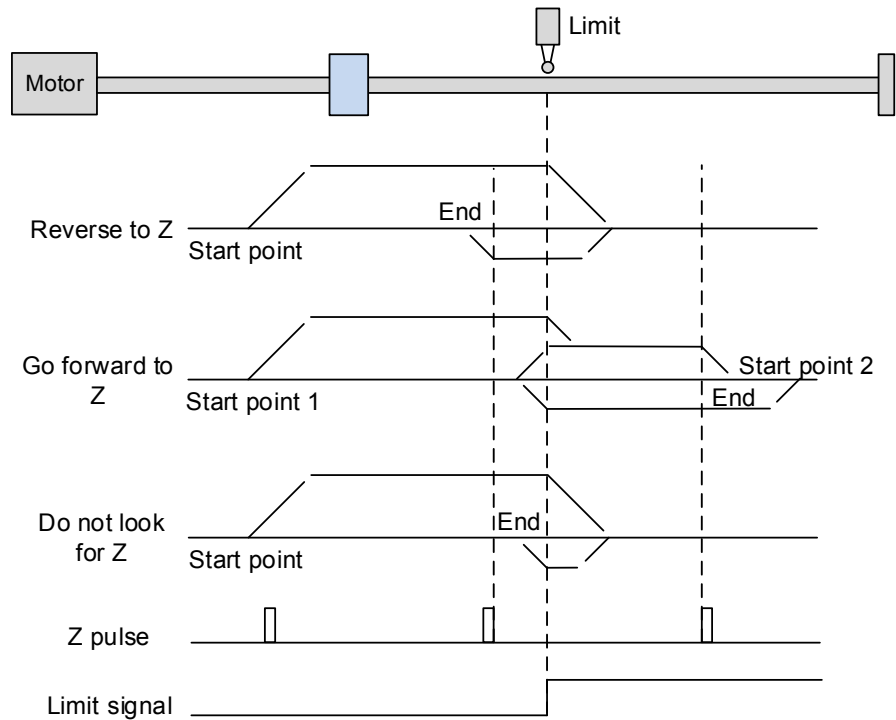
7

Figure 7.1.3.2 Homing setting in ASDA-Soft

The following describes homing methods supported by ASDA-A3. They can be categorized into 6 types based on their reference points.

1. Referring to the limit: This homing method regards the positive or negative limit as the reference point. When the limit is detected, you can set whether to look for Z pulse and use it as the homing reference point. Change of starting position will not change the searching result. ASDA-A3 will always look for the setting reference point so as to complete the coordinate reset.

## 7

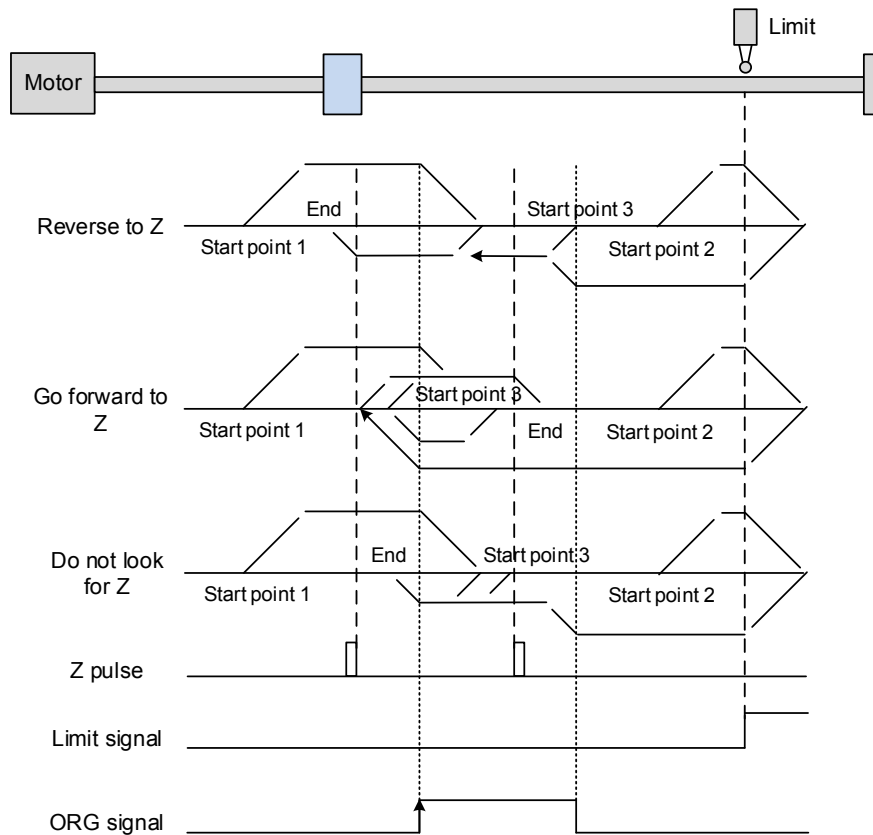


In the example of looking for Z pulse in the figure above, the servo motor will operate at high speed (first setting speed) and start to decelerate once it reaches the limit (rising-edge triggers the signal). Then, the motor switches to low speed (second setting speed) to look for Z pulse. While Z pulse is found, the motor decelerates and stops; homing procedure is completed.

If the setting is to look for Z and the limit signal remains untriggered (Low, Start point 1), the servo motor will operate at high speed (first setting speed) and then start to decelerate once it reaches the limit (rising-edge triggers the signal). Then, the motor switches to low speed (second setting speed) to look for Z pulse. While Z pulse is found, the motor decelerates and stops, completing the homing procedure. If the setting is to look for Z pulse and the limit signal is triggered (High, Start point 2), the servo motor will return to look for the rising-edge trigger signal at low speed (second setting speed). Once it is found, the servo motor starts to look for Z pulse and decelerates to stop when Z pulse is found. Then, the homing is completed. In conclusion, the origin will be at the same position after homing with the same setting condition regardless where the starting point is.

If the setting is not to look for Z pulse, the servo motor will firstly operate at high speed (first setting speed) and then starts to decelerate to stop once rising-edge limit signal is triggered. Then, the motor changes to low speed (second setting speed) to look for rising-edge signal and once it is found, the motor will decelerate to stop. Then, homing is completed.

- Referring to the rising-edge signal of the home sensor: This is to regard the rising-edge of the home sensor (ORG) signal as the reference point. When the home sensor detects the signal, option of using Z pulse as the reference point of the origin is available.



7

In the figure above, example of reversing to look for Z pulse, if the home sensor signal of the start position is untriggered (Low, Start point 1), the servo motor will operate at high speed (first setting speed) before it reaches the rising-edge of ORG signal. Then, it starts to decelerate, switching to low speed (second setting speed) and reversing to look for Z pulse. Once Z pulse is found, the servo will decelerate to stop and homing is complete.

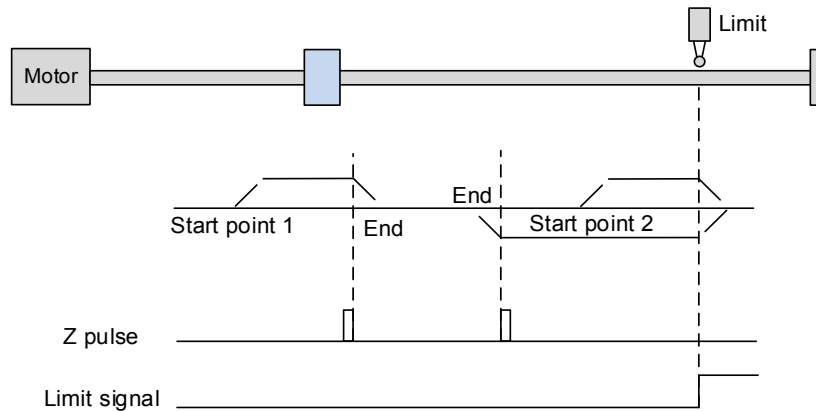
If the ORG signal at the start point is untriggered and the current position is relatively closer to the limit switch (Start point 2), the servo motor will operate at high speed (first setting speed). And when it reaches the limit switch, you can set whether to show error or reverse the running direction. When setting to reverse the rotation direction, the servo motor will keep rotating in reverse direction. Once the motor reaches the limit switch, it changes to low speed (second setting speed) and operates until the ORG signal switches to low. Next, it starts to look for Z pulse; once it is found, the motor decelerates to stop and homing is completed.

If the ORG signal is triggered (High, Start point 3), the motor will reverse with low speed (second setting speed) and after ORG signal switches to low, it then returns to look for Z pulse. Once Z pulse is found, homing is completed.

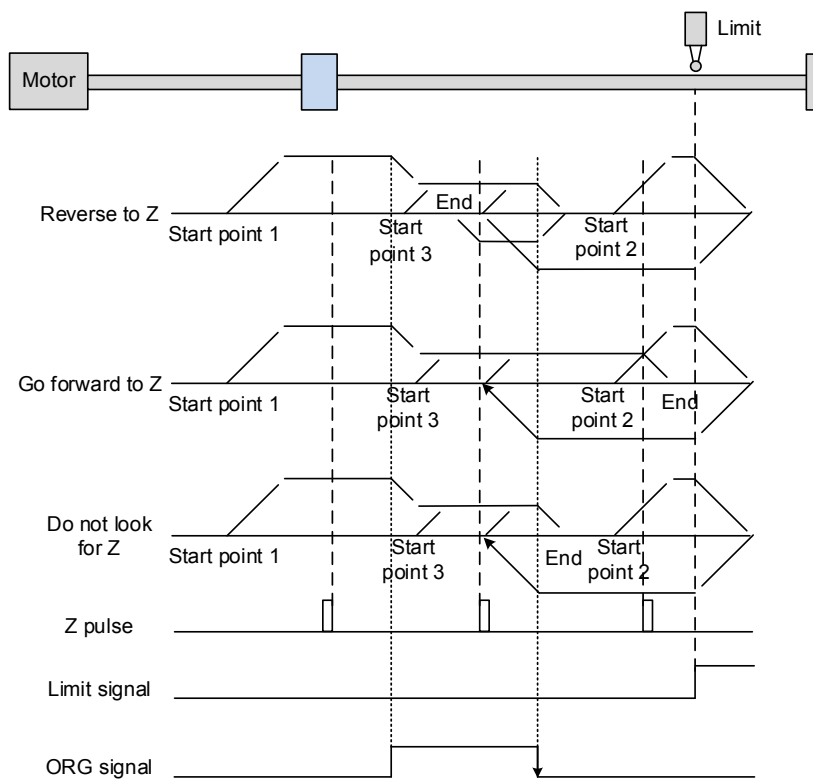
If the setting is to look for Z pulse or not to look for Z pulse in forward direction, which is similar to the first setting mentioned above, (going in reverse direction or not to look for Z), please refer to the timing diagram above.

# 7

- Referring to Z pulse: Regard the Z pulse as the reference origin. One Z pulse is generated per rotation of the motor. This method is only suitable when the operation is kept within one motor rotation.



- Referring to the falling-edge of ORG signal: It is to regard the falling-edge signal of the home sensor as the reference origin. After ORG signal is detected, you can set whether to use Z pulse as the reference origin.



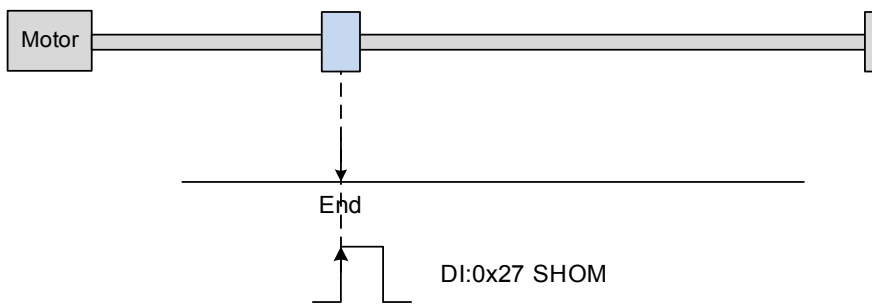
See the above example of looking for Z. If ORG signal is untriggered at the start point (Low, Start point 1), the servo motor will run at high speed (first setting speed) before reaching the rising edge of the ORG signal. Then it decelerates and switches to low speed until the ORG signal is off (Low). Next, it reverses to look for Z pulse and decelerates to stop once Z pulse is found, which means homing is completed.

If ORG signal is untriggered at the start point and is closer to the limit switch (Start point 2), the motor will run at high speed (first setting speed) and when it reaches the limit switch, you can set whether to show error or reverse the running direction. If setting to reverse direction, the motor operates in reverse direction to reach the ORG signal. Once reached, it decelerates and runs at low speed (second setting speed) until reaching the falling edge of ORG signal. Then, it reverses to look for Z pulse. When found, the servo decelerates to stop and homing completes.

If ORG signal is triggered at the start point (High, Start point 3), the servo motor operates at low speed (second setting speed) in forward direction until ORG signal switches to Low. Finally, it reverses to look for Z pulse and decelerates to stop to complete homing.

If the setting is to look for Z pulse or not to look for Z pulse in forward direction, which is similar to the first setting mentioned above, (going in reverse direction or not to look for Z), please refer to the timing diagram above.

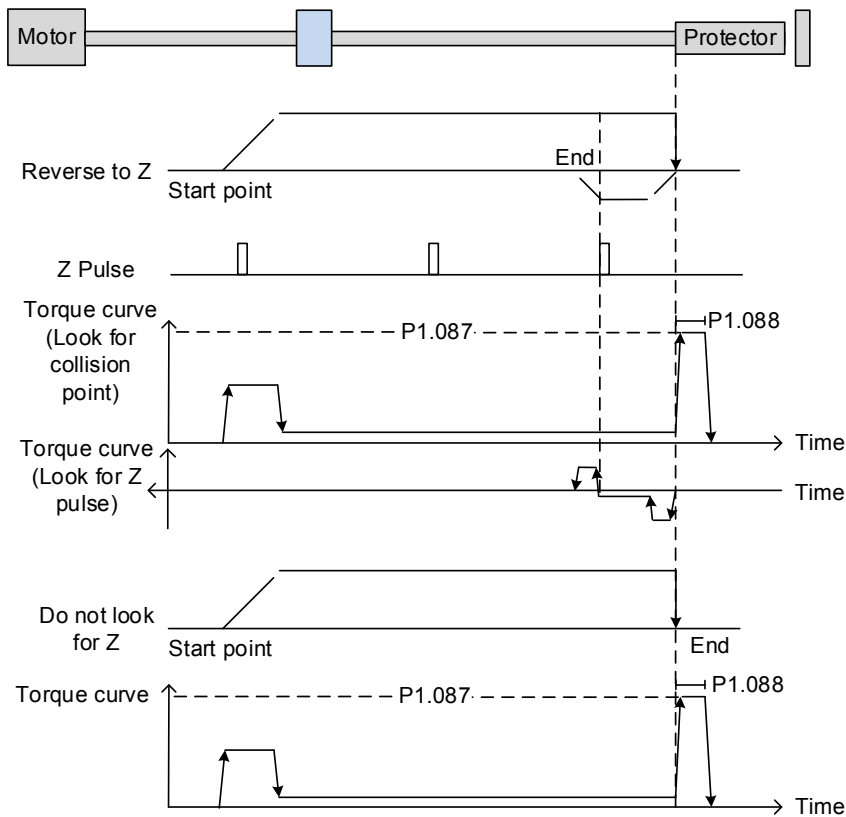
- 5. Regarding current position as the origin: Use motor's current position as the reference origin. As long as the homing procedure is triggered and the motor remains still, coordinate positioning is completed.





6. Torque limit homing: It is to regard motor's stop position as the origin by referring to the limit on the mechanism, torque level setting (P1.087), and retaining time (P1.088). In this mode, you can also set whether to use Z pulse as the origin.

7



In the example of looking for Z pulse shown in the figure above, the motor starts to run at the high speed (first setting speed). Then, the servo outputs greater current to resist the external force once it touches the collision protector. When the motor torque reaches the setting limit (P1.087) and the outputting duration is longer than the time setting (P1.088), it will run in reverse direction to look for the Z pulse at low speed (second setting speed). Once it is found, the motor decelerates to stop and homing is complete.

If the setting is not to look for Z pulse, the servo motor will run at high speed (first setting speed) before it touches the collision protector. Then, it outputs a greater current to resist the external force. When the motor torque reaches the setting limit (P1.087) and the outputting duration is longer than the time setting (P1.088), the motor will stop and homing is complete.

Following is the parameters of torque limit (P1.087) and torque limit time setting (P1.088):

<b>P1.087</b>	<b>Torque limit setting</b>		<b>Address: 01AEH 01AFH</b>
Default:	1	Control mode:	PR
Unit:	%	Setting range:	1 ~ 300
Format:	DEC	Data size:	16-bit

Settings:

This torque limit setting is only for torque limit homing mode. As shown in the following diagram, when homing command is triggered, the motor will run in one direction until it reaches the collision protector. After reaching the collision protector, the servo drive will output a larger motor current in order to counter the external force which is the collision protector. Servo drive uses the motor current and torque limit time as the conditions for determining homing. Then it will run in the opposite direction to find Z pulse.

<b>P1.088</b>	<b>Torque limit time setting</b>		<b>Address: 01B0H 01B1H</b>
Default:	2000	Control mode:	PR
Unit:	ms	Setting range:	2 ~ 2000
Format:	DEC	Data size:	16-bit

Settings:

Torque limit time setting in torque limit homing mode. Please refer to P1.087 for the timing diagram of torque limit homing mode.

As mentioned in Section 7.1.2, PR mode provides four monitoring variables for users to observe servo commands and feedback status, which are Command position PUU (Cmd\_O), PR command end register (Cmd\_E), Feedback position PUU (Fb\_PUU), and Position error PUU (Err\_PUU). Before homing completes, the command end register (Cmd\_E) cannot be calculated because coordinate system can only be created after homing is completed and the target position remains unknown after homing command is issued. This is why the status of each monitoring variables are different during homing. In homing's default setting, contents of Cmd\_E and Cmd\_O are identical. After the reference origin in the coordinate system is found, content of Cmd\_E will be set to the coordinate of the reference origin. However, once the reference origin is found, it requires a given distance for motor to decelerate to stop. Meanwhile, Cmd\_O will carry on issuing commands. If no other PR commands are issued after homing, different from position command, content of the final command position (Cmd\_O) and command end position (Cmd\_E) will be different. See Figure 7.1.3.3.

## 7

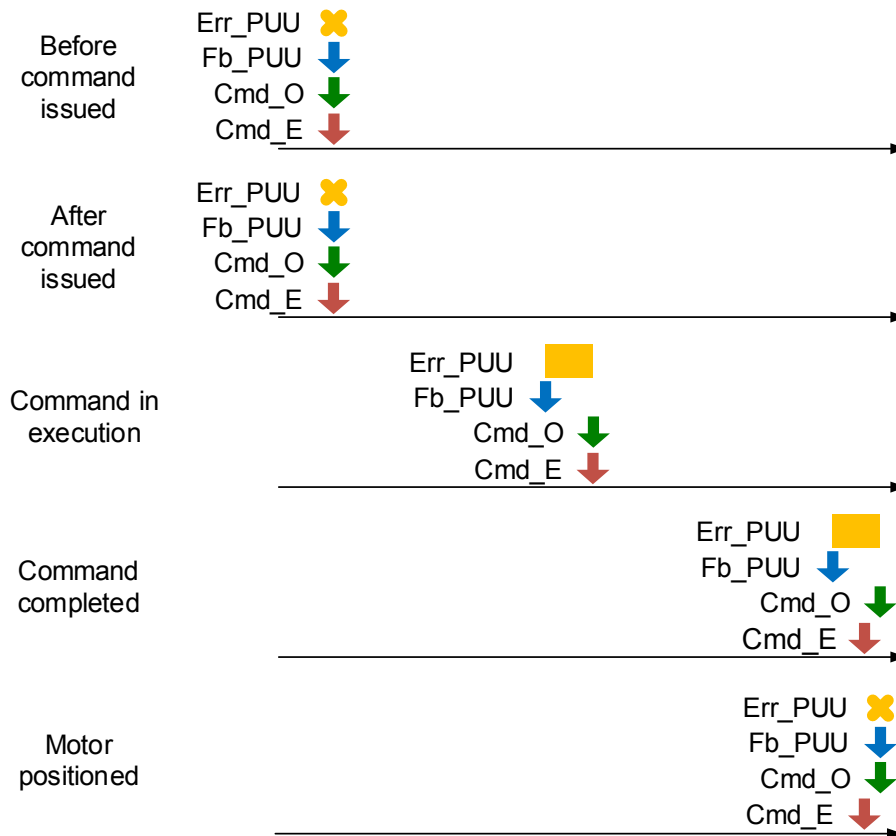


Figure 7.1.3.3 Homing mode and monitoring variables

### Speed command

PR mode of ASDA-A3 provides speed control function. Parameters available for PR speed settings are acceleration / deceleration time, delay time, and target speed. The speed command can easily be set through PR mode setting screen in ASDA-Soft software. See Figure 7.1.3.4.

INS is an interrupt command which can interrupt the previous motion command. Please refer to Section 7.1.6 for more details. AUTO is a command for automatically loading the next PR path. It executes the next PR path directly when the current one completes. In addition, the target speed can be set with two unit options, which are 0.1 rpm and 1 PPS ranging from -6000 rpm ~ 6000 rpm. ACC/DEC acceleration / deceleration time is selected by the shared PR parameters. The required duration for accelerating from 0 to the target speed is calculated and shown by the software. DLY is the delay time that is determined by the shared PR parameters; it is to delay the command, in other words, the delay time is the time counted after the target speed command completes.

See Figure 7.1.3.5 for PR mode speed control. Table 7.1.3.1 shows the bit function when speed control is in operation.

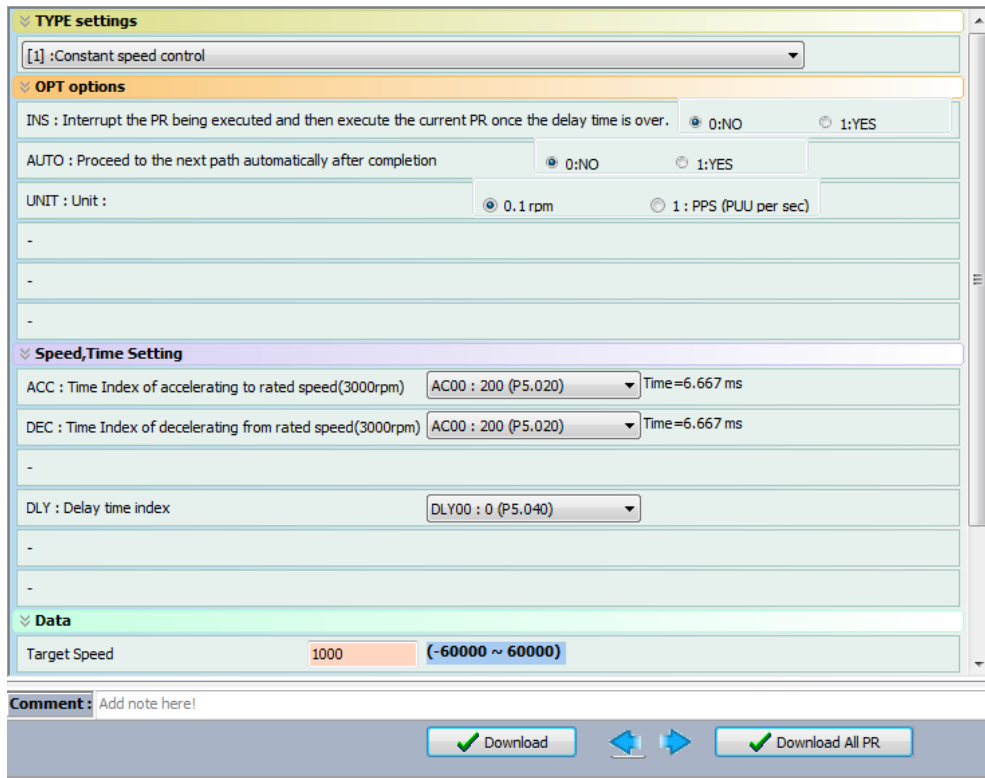


Figure 7.1.3.4 PR mode speed setting screen in ASDA-Soft

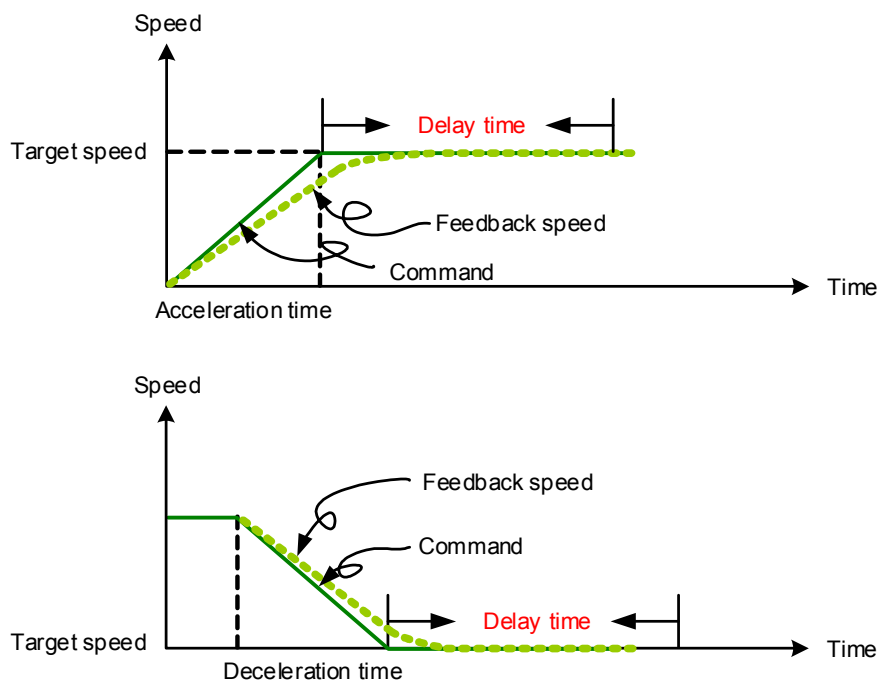


Figure 7.1.3.5 Parameters of PR mode speed control

Table 7.1.3.1 Bit function of PR speed control

PR parameters	D	C	B	A	U	Z	Y	X
Command type	-	-	DLY	-	DEC	ACC	OPT	1
Data Content	Target speed [0.1 rpm / PPS]							

Note:

1. Y OPT: option

	BIT	3	2	1	0
Command type		-	UNIT	AUTO	INS

INS: Interrupt command; it interrupts the previous motion command.

AUTO: Automatically load the next PR command when the current one is completed.

UNIT: Speed unit selection; 0 signifies 0.1 rpm and 1 signifies PPS.

2. Z, U: ACC / DEC: No. of acceleration / deceleration time; it is set by P5.020 ~ P5.035.
3. B: DLY: Delay time; it is set by P5.040 ~ P5.055.

### Position command

Position control function is also available in PR mode of ASDA-A3. There are two command types: Mode 2 and Mode 3. Mode 2 command signifies that it will stop once command is completed. Mode 3 command signifies that the next PR path will automatically be executed. Their setting methods are identical and can be completed via ASDA-Soft. See Figure 7.1.3.6.

In the screenshot, INS stands for interrupt command which interrupts the previous motion command. OVLP stands for overlap command, which allows the next PR command to overlap the command that is currently being executed when decelerating. If this function is applied, setting the delay time to 0 is suggested (Please refer to Section 7.1.6). ACC / DEC is the acceleration / deceleration time determined by the shared PR parameters. The required duration to accelerate from 0 to the target speed will be calculated and shown by the software. SPD is the target speed specified by the share PR parameters. You can set whether it should times 0.1. DLY is the delay time specified by the shared PR parameters; it is defined by the command, in other words, once the target position is reached, the delay time starts counting. The position command is user-defined and its unit is PUU.

Position command of PR mode is illustrated in Figure 7.1.3.7. Table 7.1.3.2 lists bit functions of position control.

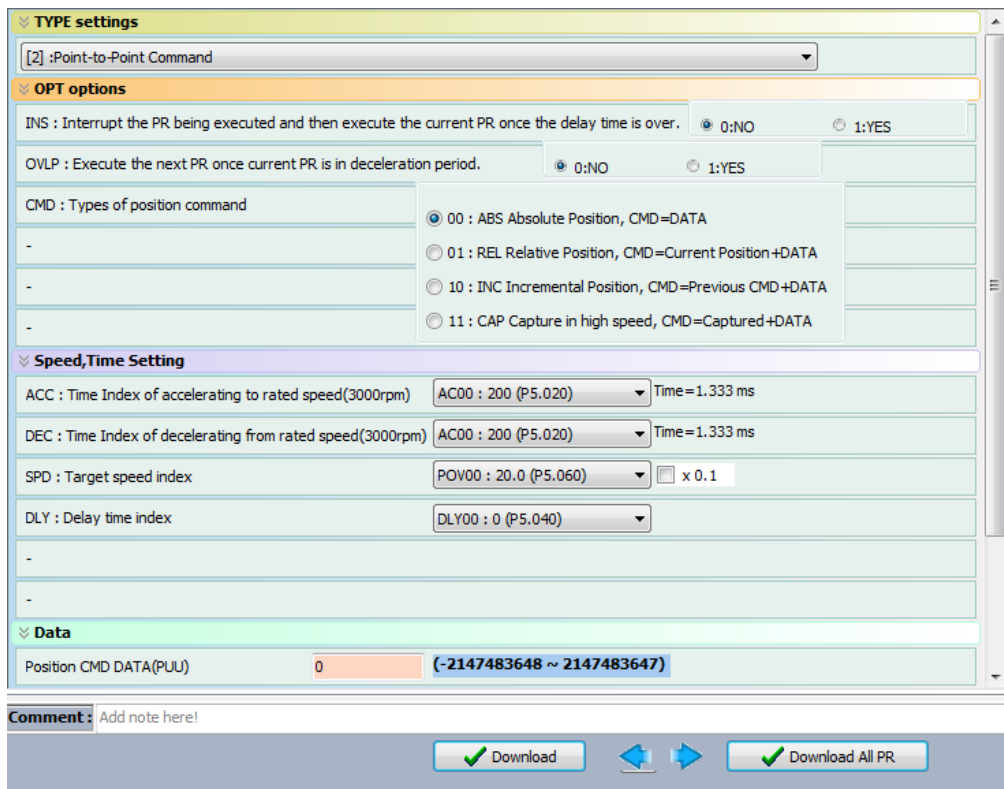


Figure 7.1.3.6 PR mode position setting interface of ASDA-Soft

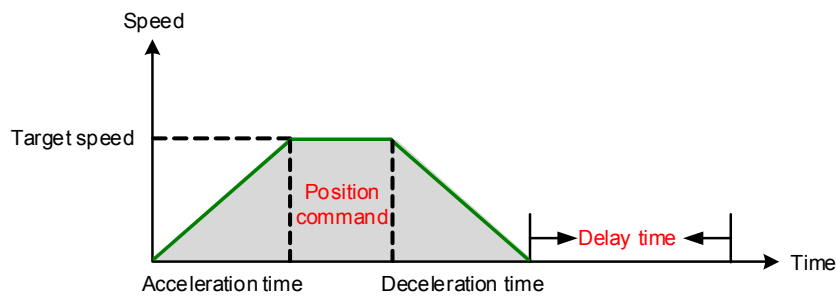


Figure 7.1.3.7 Parameters of PR mode position setting

## 7

There are four types of position commands for PR mode on ASDA-A3. Users can choose the position command according to the requirements. Functions of each type are described in the examples here. Please note that the condition in these examples is that a position command is still being executed and another type of command is inserted. To see how the position commands are combined and the definition of these commands, please see Figure 7.1.3.8.

1. Absolute position command (ABS): When it is issued, the target position value equals the absolute command value. In the figure, an ABS command which value is 60000 PUU is inserted in the previous PR path with setting target position 60000 PUU on the coordinate axis.
2. Relative position command (REL): When it is issued, the target position value will be motor's current position value plus position command value. In the figure, a REL command which value is 60000 PUU is inserted in the previous PR path. The target position will be motor's current position (20000 PUU) plus the relative position command (60000 PUU), which is equivalent to 80000 PUU in the coordinate system. And the target position specified by the original command will be omitted.
3. Incremental command (INC): When it is issued, the target position is the previous target position value plus the current position command value. In the example below, an INC command which value is 60000 PUU is inserted in the previous PR path. The target position is the previous target position value 30000 PUU plus the relative position command 60000 PUU, which equals 90000 PUU. The previous destination specified by the previous command will be combined to the new one.
4. High-speed position capturing command (CAP): When it is issued, the target position will be the last position acquired by the Capture function plus position command value. Please refer to Section 7.2.2 for high-speed position capturing function. In the following example, a high-speed capturing command which value is 60000 PUU is inserted in the previous PR path. The target position value will be the captured position value 10000 PUU plus relative command 60000 PUU, which equals 70000 PUU. And the target position specified by the original command will be omitted.

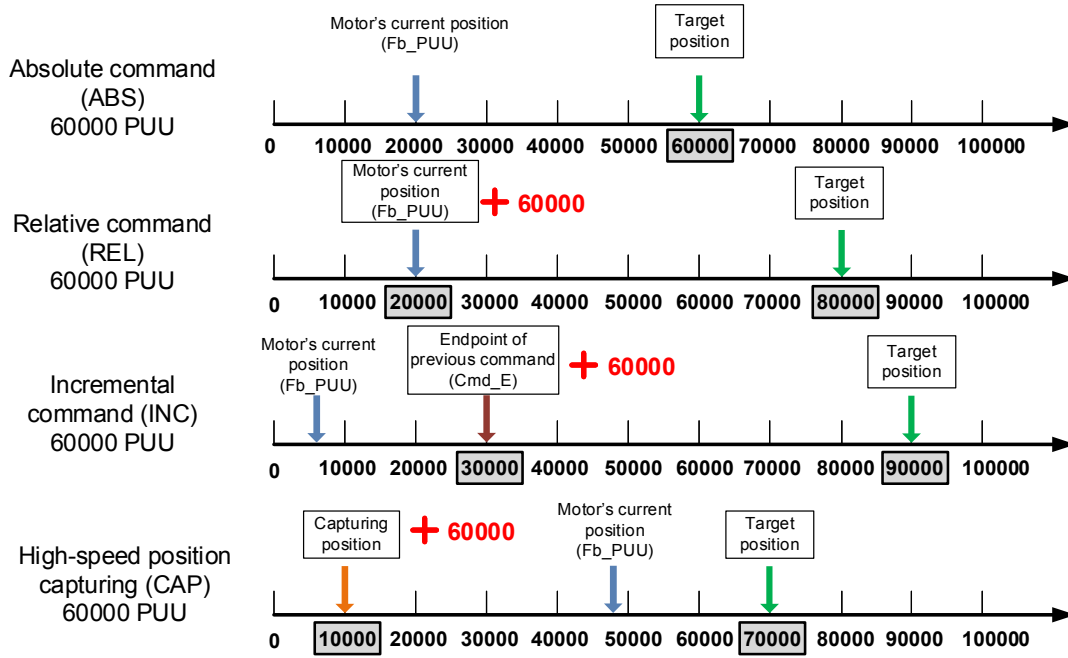


Figure 7.1.3.8 Four types of position command

Table 7.1.3.2 Bit functions of parameters of PR mode position control

PR parameters	D	C	B	A	U	Z	Y	X
Command type	-	-	DLY	SPD	DEC	ACC	OPT	2 or 3
Data content	Target position [PUU]							

Note:

1. Y: OPT: option

BIT	3	2	1	0	Description
Command type	CMD		OVLP	INS	-
Data content	0	0	-	-	ABS (absolute positioning)
	0	1			REL (relative positioning)
	1	0			INC (incremental positioning)
	1	1			CAP (high-speed position capturing)

INS: Interrupt command; it interrupts the previous motion command.

OVLP: Allow overlapping of the next command

CMD: Position command selection

2. Z, U: ACC / DEC: No. of acceleration / deceleration time; acceleration / deceleration time set by P5.020 ~ P5.035.

3. A: SPD: Internal target speed number; the target speed set by P5.060 ~ P5.075.

4. B: DLY: Delay time; delay time set by P5.040 ~ P5.055.



**Jump command**

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ASDA-A3 provides jump function in PR mode. It can call any PR paths or form PR paths into a loop, as shown in Figure 7.1.3.9. You can specify the PR path No. to be jumped to through PR mode setting screen in ASDA-Soft (see Figure 7.1.3.10). Among the options, INS stands for an interrupt command which interrupts the previous motion command. You can find more information in Section 7.1.6. DLY is the delay time determined by shared PR parameters. Once a jump command is issued, the servo drive will start counting the delay time. Available target PR number is PR#00 ~ PR#99. Table 7.1.3.3 shows functions of each bit when a jump command is applied.

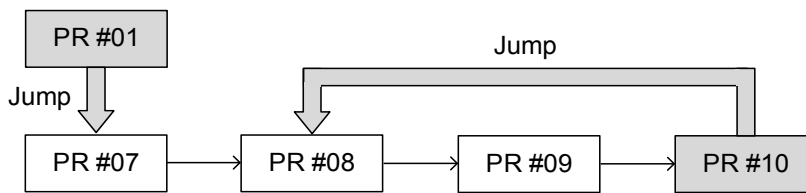


Figure 7.1.3.9 Jump command in PR mode

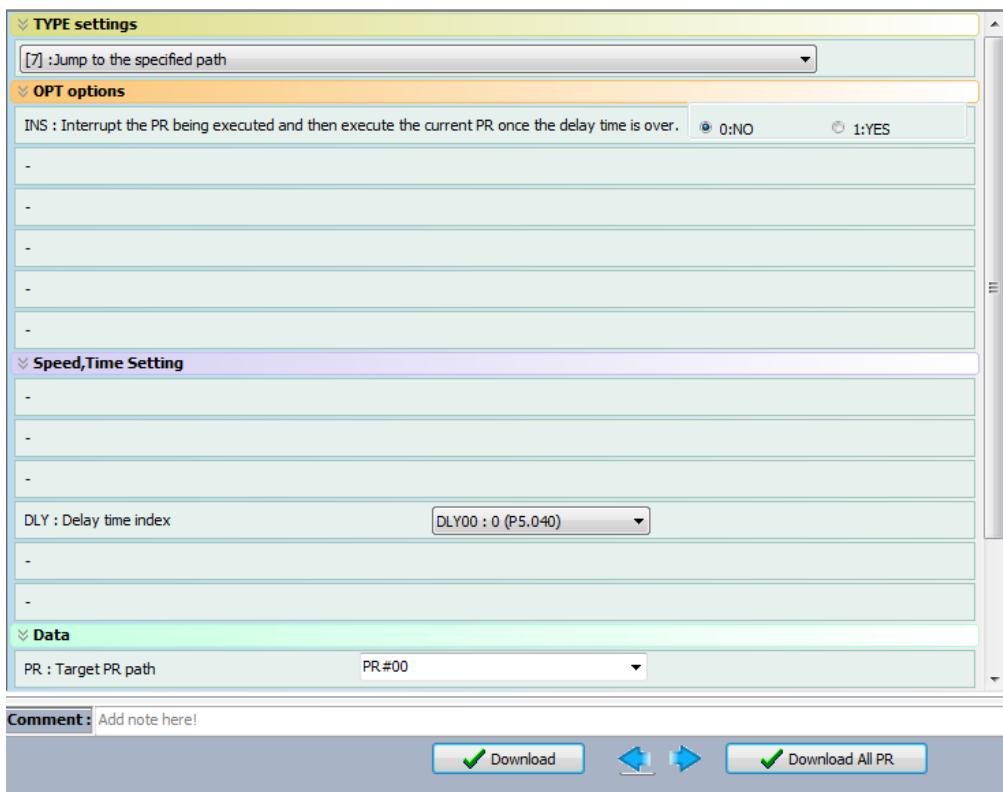


Figure 7.1.3.10 Using PR mode jump command through ASDA-Soft

Table 7.1.3.3 Bit function of PR jump command

PR parameters	D	C	B	A	U	Z	Y	X
Command type	-	-	DLY	-	-	-	OPT	7
Data content	Jump to target PR path (0 ~ 99)							

Note:

1. Y: OPT: option

BIT	3	2	1	0
Command type	-	-	-	INS

INS: Interrupt command; it interrupts the previous motion command.

2. B: DLY: Delay time, which is set by P5.040 ~ P5.055.

### Write command

In PR mode, write command is provided. It can write constants, parameters, data arrays, and monitoring variables to the specified parameters or data arrays. Users can write the parameter to a specified path by using the PR mode setting screen of ASDA-Soft. INS is an interrupt command, which can interrupt the previous motion command. Refer to Section 7.1.6 for more details. AUTO command signifies that the next PR will be loaded automatically; once current PR completes, the next one will be automatically executed. ROM command is to write parameters to both RAM and EEPROM at the same time. Non-volatile function is also available. However, frequent usage will shorten the life of EEPROM. DLY is the delay time selected by shared PR parameters. Once a jump command is issued, the servo drive will start calculating the delay time. Table 7.1.3.4 shows the bit function when a write command is used.

Writing target	Data source
Parameter	Constant
Data array	Parameter
-	Data array
-	Monitoring variables

7

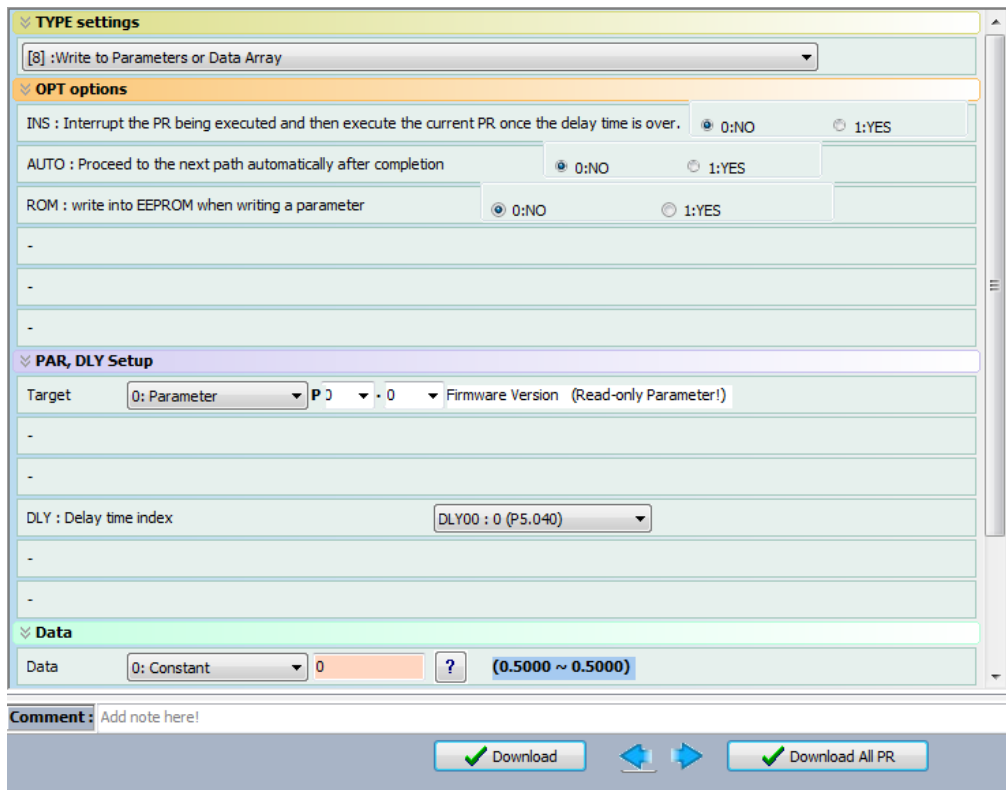


Figure 7.1.3.11 Using PR write command in ASDA-Soft

Table 7.1.3.4 Bit function of PR write command

PR parameters	D	C	B	A	U	Z	Y	X
Command type	0	SOUR_DEST	DLY	DESTINATION			OPT	8
Data content	SOURCE							

Note:

1. Y: OPT: option

	BIT	3	2	1	0
Command type		-	ROM	AUTO	INS

INS: Interrupt command; it interrupts the previous motion command.

AUTO: Once current PR is completed, automatically load the next command.

ROM: Write data to EEPROM at the same time. This function can only write parameters.

2. B: DLY: Delay time, which is set by P5.040 ~ P5.055.

## 3. C: SOUR\_DEST: Data source and data format to be written.

BIT	3	2	1	0	Description	
Command type	SOUR		-	DEST	Data source	Writing target
Data content	0	0	0	0	Constant	Parameter
	0	1		0	Parameter	Parameter
	1	0		0	Data array	Parameter
	1	1		0	Monitoring variable	Parameter
	0	0		1	Constant	Data array
	0	1		1	Parameter	Data array
	1	0		1	Data array	Data array
	1	1		1	Monitoring variable	Data array

## 4. Z, U, A: DESTINATION: Destination

	A	U	Z
Target: Parameter	Parameter group	Parameter number	
Target: Data array	Data array number		

## 5. SOURCE: Data source setting

	D	C	B	A	U	Z	Y	X
Data source: Constant	Constant data							
Data source: Parameter	-					Parameter group	Parameter number	
Data source: Data array	-					Data array number		
Data source: Monitoring variable	-						Monitoring variable number	

### Index position command

PR mode also provides index position command, which creates an index coordinate system. This command positions the motor within the range of indexing coordinate. Unlike other feedback position in global coordinate system, it is able to divide the total moving distance of one index into number of paths required by users (see Figure 7.1.3.12). Please refer to chapter 10 if absolute position or position counter overflows due to index positioning command. Users can start the quick setting by the **Index Coordinates Setting Wizard** in the PR screen of ASDA-Soft (see Figure 7.1.3.13). As shown in the example, the start PR path is set to 1 and path number is set to 8 and total moving distance is 80000 PUU. Clicking on OK, the software will automatically write position command 0 PUU to PR#01 and 10000 PUU to PR#02 and 20000 PUU to PR#03 and so on to PR#08. When index position reaches 80000 PUU, it auto restores to 0 PUU. In addition, users can modify the index position in each PR path according to the requirements, as shown in Figure 7.1.3.14. Among the options, INS stands for interrupt command, which interrupts the previous motion command (refer to section 7.1.6.). OVLP stands for overlap command, which allows the next PR command to overlap the current one during deceleration. If

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this OVLP is used, setting the delay time to 0 is suggested (refer to section 7.1.6.). DIR sets the rotation direction with options of forward (always runs forward), backward (always runs backward), and shortest distance. The movement is illustrated in Figure 7.1.3.15. S\_LOW is the speed unit with available options of 0.1 rpm or 0.01 rpm. The option AUTO will automatically load the next PR path; when current PR completes, the next PR path will be auto-executed. ACC / DEC is the acceleration / deceleration time setting determined by shared PR parameters. SPD is the target speed set by the PR shared parameters. DLY is the delay time defined by the command from controller; meaning when motor reaches the target position, the servo drive will start counting the delay time. Position command is the target position of each index segment. Please note that the setting range shall be smaller than the total index moving distance (P2.052). Table 7.1.3.5 shows the bit function for index position control. If using the index function, please execute homing in order to create the coordinate system thus origin of the motor's feedback position and that of the motor's index position can be identical. If homing is not executed, AL237 will occur.

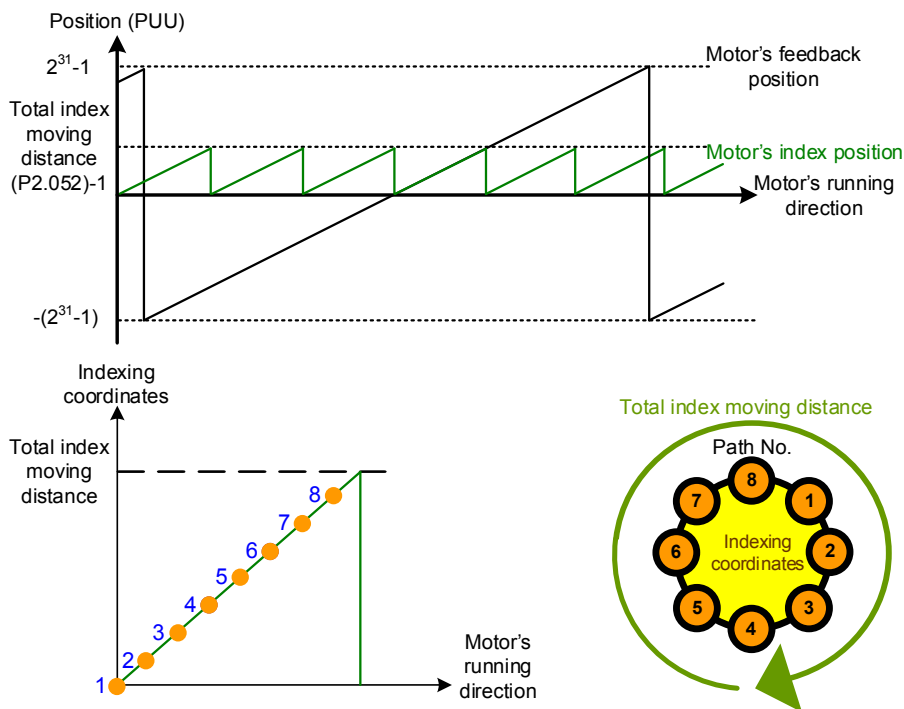


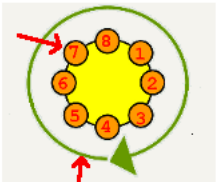
Figure 7.1.3.12 PR mode indexing coordinates

### Index Coordinates Setting Wizard

Start of PR Path :    set the interval between two paths

Knife numbers (Path Size) :

P2-52 Indexing Coordinates Scale (PUU) :

Knife numbers (Path Size) 

P2-52 Indexing Coordinates Scale (PUU)

INS : Interrupt the previous path  
 0 : NO  1 : YES

OVLP : It is allowed to overlap the next PR. When overlapping, please set DLY to 0:  
 0 : NO  1 : YES

DIR : Moving Direction  
 0:Always move forward (forward rotation)  
 1:Always move reverse (reverse rotation)  
 2:The shortest distance

S\_LOW : speed unit  
 0 : 0.1 r/min  1 : 0.01 r/min

ACC : Time Index of accelerating to rated speed(3000rpm)  ▾

DEC : Time Index of decelerating from rated speed(3000rpm)  ▾

SPD : Target speed index  ▾

DLY : Delay time index  ▾

Calculate Electronic Gear Ratio

Gear A   P1-44=

Gear B   P1-45=

Click OK to download all index parameters and P2-52

Figure 7.1.3.13 Indexing Coordinates Setting Wizard of PR mode

TYPE settings  
 ▾

OPT options

INS : Interrupt the PR being executed and then execute the current PR once the delay time is over.  0:NO  1:YES

OVLP : Execute the next PR once current PR is in deceleration period.  0:NO  1:YES

DIR : Moving Direction  
 0:Forward (Always move forward)  
 1:Reverse (Always move reverse)  
 2:The shortest distance

S\_LOW : speed unit  0 : 0.1 r/min  1 : 0.01 r/min

AUTO : Proceed to the next path automatically after completion  0:NO  1:YES

Speed,Time Setting

ACC : Time Index of accelerating to rated speed(3000rpm)  ▾

DEC : Time Index of decelerating from rated speed(3000rpm)  ▾

SPD : Target speed index  ▾

DLY : Delay time index  ▾

Data

Data   ▾

Comment : Add note here!

Figure 7.1.3.14 Setting screen of PR mode index position in ASDA-Soft

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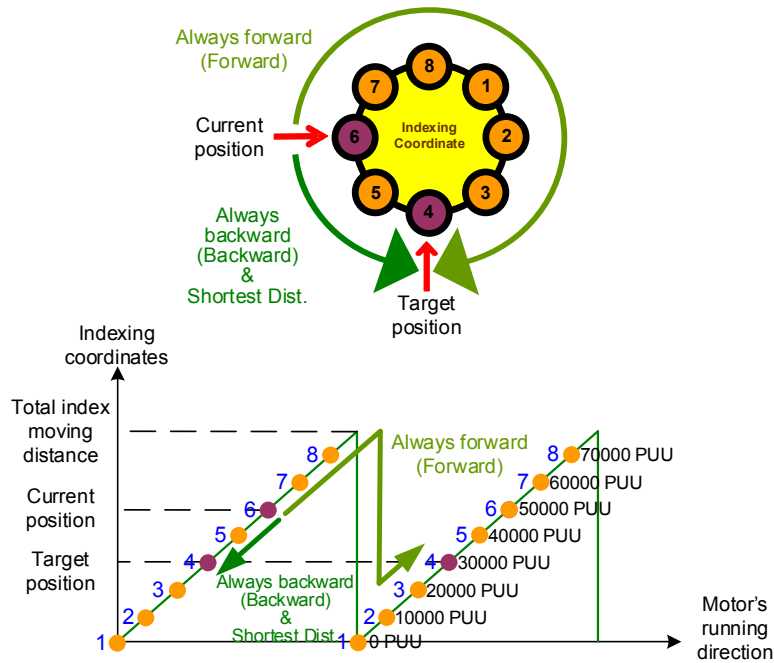


Figure 7.1.3.15 Motor's operation direction and indexing coordinates

Table 7.1.3.5 Bit function of Index position command

PR parameters	BIT	D	C	B	A	U	Z	Y	X
Command type		-	OPT2	DLY	SPD	DEC	ACC	OPT	0xA
Data content		Index position command [PUU](0 ~ P2.052-1)							

Note:

1. Y: OPT: option

BIT	3	2	1	0	Description
Command type	DIR		OVLP	INS	-
Data content	0	0	-	-	Always goes forward (Forward)
	0	1			Always goes backward (Backward)
	1	0			Shortest distance
	1	1			-

INS: Interrupt command; it interrupts the previous motion command.

OVLP: Allow overlapping of the next command

2. C: OPT2: Option 2

BIT	3	2	1	0
Command type	-	AUTO	-	S_LOW

S\_LOW: Speed unit options, 0 stands for 0.1 rpm and 1 for 0.01 rpm.

AUTO: Automatically load the next PR command when the current one is completed.

3. Z, U: ACC / DEC: No. of acceleration / deceleration time set by P5.020 ~ P5.035.

4. A: SPD: Delay time, which is set by P5.060 ~ P5.075.

5. B: DLY: Delay time, which is set by P5.040 ~ P5.055.

### Arithmetic operations

In PR mode, ASDA-A3 provides arithmetic operations commands, including addition, subtraction, multiplication, division, OR, AND, MOD, and logic condition. Available operands are user variable, parameter, data array, monitoring variable, and constant. Among them, user variable is the register only for four arithmetic operations. It is user-defined, offering 64 sets of user variables with each data size of 32 bits. And data size of each constant is also 32-bit. After all arithmetic operation commands are executed, users can set a jump condition in the path so that it will jump to different PR path and then carry on the next one or stop once operation is done and it can also serve as a loop function. The arithmetic operation commands support negative numbers operations but not floating points. Negative numbers are calculated by Two's compliment. Figure 7.1.3.16 is the arithmetic operations setting screen in ASDA-Soft. Arithmetic operations must be set via ASDA-Soft. To avoid error occurrences, do not use the panel or RS-485 to do the setting. Once setting is complete, click on **Download All PR** to write all PR paths to the servo drive.

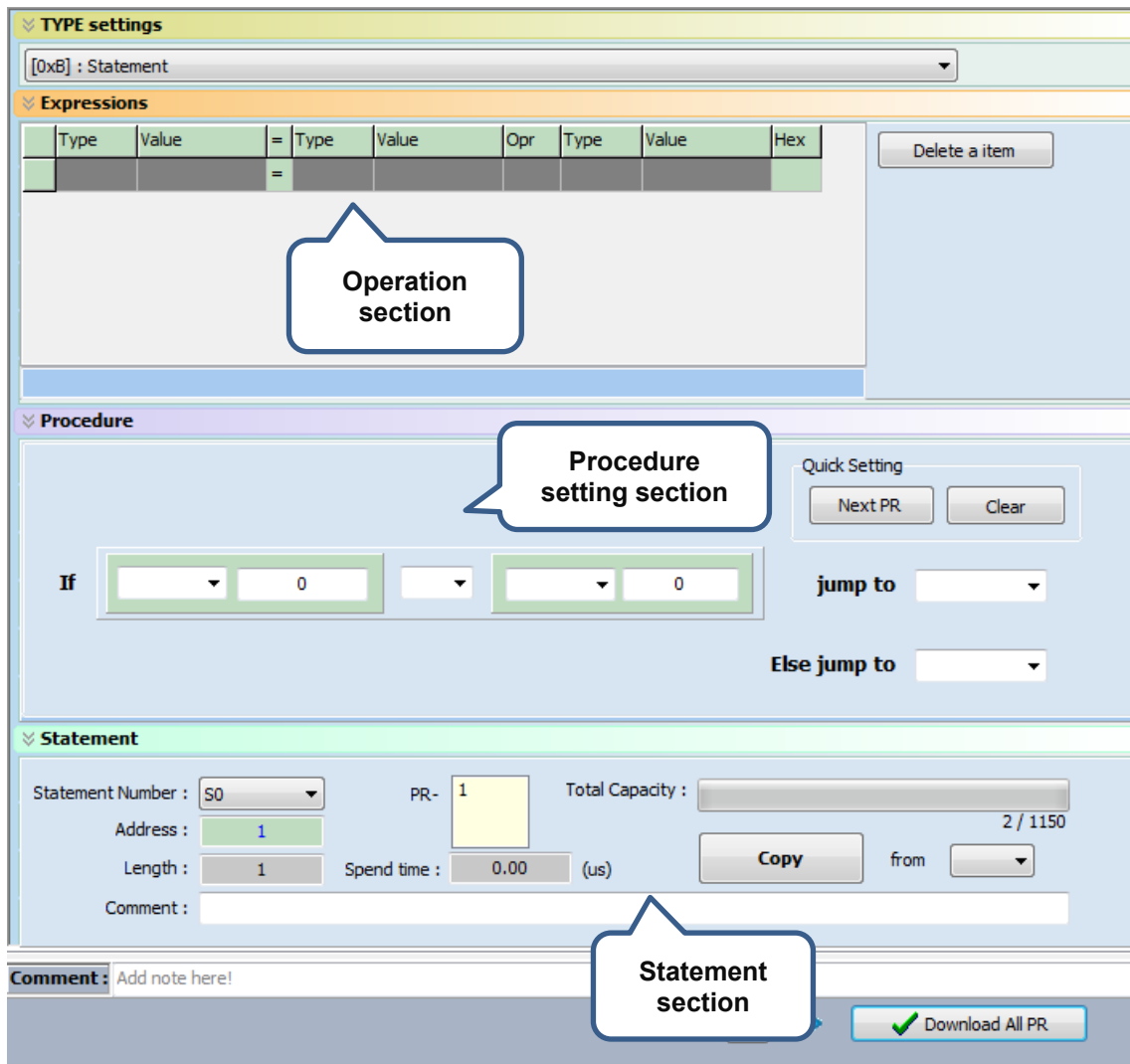


Figure 7.1.3.16 Setting screen of PR arithmetic operations in ASDA-Soft



1. Operation section: Supports addition, subtraction, multiplication, division, AND, OR, and MOD operation as well as logical operations for multiple data. Table 7.1.3.6 shows the supported operators and calculation data with selectable data format DEC and HEX.

Table 7.1.3.6 Description of each field in the operation section

Data to be written	=	Calculation data	Operator	Calculation data
User variable (User[0-63])		User variable (User[0-63])	Addition (+) Subtraction (-) Multiplication (*) Division (/) Obtain remainder (%) And (&) Or ( )	User variable (User[0-63])
		Constant (Constant)		
Parameter (PX.XXX)		Data array (Arr[0-799])		Constant (Constant)
Data array (Arr[0-799])		Parameter (PX.XXX)		Data array (Arr[0-799])
		Monitoring variable (Mon[*])		

2. Procedure setting section: Uses the IF statement to determine whether the user-defined condition is fulfilled. If true, jump to the next specified PR path; if false, jump to the other specified PR path. If users click on **Next PR** in Quick Setting, the software will automatically input the condition and then jump to the next PR path. If this section is left blank, then the PR procedure will stop once the basic operation is done. See Table 7.1.3.7 for data formats and operators.

Table 7.1.3.7 Field description of procedure setting section

Data format	Operator	Data format
User variable (User[0-63])	Greater than (>) Greater than or equal to (≥) Less than (<) Less than or equal to (≤) Equal to (=) Not equal to (≠)	User variable (User[0-63])
Constant (Constant)		
Data array (Arr[0-799])		Constant (Constant)
Parameter (PX.XXX)		Data array (Arr[0-799])
Monitoring variable (Mon[*])		

- Statement section: This section includes statements and memory capacity. Statements are for saving the data in basic operation section and procedure settings section. Data in basic operation section and procedure setting section of the same statement will always remain identical and can be shared by multiple PR paths. If data in those two sections are different, then this data will be saved to another statement. The required time for executing the statement is shown in the time field. "Total Capacity" shows the servo drive's memory capacity; basic operations cannot be done if no memory space is available. Interface of the Statements management is shown in Figure 7.1.3.17. The upper section displays all statements and the lower displays operations in each statement and settings.

The screenshot shows the 'Statements' management interface in ASDA-Soft. At the top, there are tabs for 'Pr. Mode', 'Chart', 'Statements', and 'User Variable'. The 'Statements' tab is selected, and a blue arrow points to it. Below the tabs, the text 'Statement information :' is followed by a table with the following data:

	Name	Look	Address	Length	Time	PR#	Comment
1	S0	V	1	12	2.45	1, 3, 5,	
2	S1	X	13	1	0.00	2	
3	S2	X	14	1	0.00	4,	

Below the table, there are control buttons: 'Add', 'Delete', 'Copy To', and 'Select All' (with a checked checkbox). There is also a 'Select [S0]' field and a 'To' dropdown menu.

Underneath, the 'Statements programs list :' section contains a table with the following data:

0	S0	START					
1	Px.xxx	P0.000	=	User[*]	0		
2	IF	User[*]>0	True ->	PR#11	False ->	PR#12	

Figure 7.1.3.17 Interface of Statement in ASDA-Soft

### 7.1.4 Presentation of PR procedure

In PR mode, there are seven types of commands. To understand how PR procedure works quickly, ASDA-Soft presents the execution order and calling sequence of all PR procedures. First, symbols and contents in the PR figure will be illustrated. It includes five parts: number, execution type, command type, next PR command, and command data. See Figure 7.1.4.1.

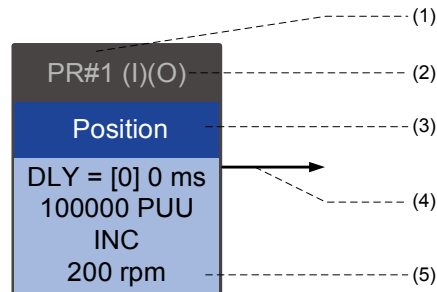


Figure 7.1.4.1 Presentation of PR

- (1) Number: The PR number, ranging from PR#0 to PR#99, 100 sets of PR paths.
- (2) Command execution (property): (B) Execute homing once power on; (O) Command overlap; (R) Write data to EEPROM; (I) Command interrupt.
- (3) Command type: There are six types of PR procedure commands, including homing, speed, position, writing, jumping, and arithmetic operations. The color displayed in this section will vary based on the command types.
- (4) Next procedure command: If it is followed by a PR command, the arrow points to the specified PR path.
- (5) Command information: Displays the details of this PR path and the displaying color changes with the information types.

The following illustrates each command type and its presentation.

**Homing methods**

In the presentation of homing methods, PR#0 always signifies homing procedure, which is marked as “Homing”. See Figure 7.1.4.2.

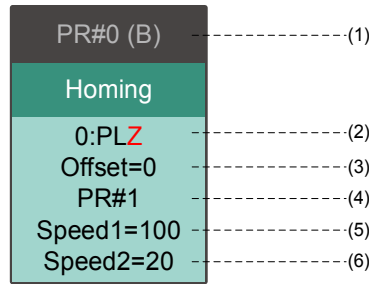


Figure 7.1.4.2 Presentation of homing methods

- (1) Activation mode (Boot): To execute homing once the servo is on, it displays (B); if homing is not required, then no information is displayed.
- (2) Method selection: Homing methods and Z pusle setting are shown in the table below. Characters in red means the motor’s position after homing completed; F signifies running forward; R signifies running reversely; ORG signifies origin; CUR signifies current position; BUMP represents the collision point.

Homing methods	Y = 0: Reverse to look for Z pulse Y = 1: Go forward to look for Z pulse	Y = 2: Do not look for Z pulse
X = 0: Homing in forward direction and regard PL as the homing origin	0: PLZ	0: PL
X = 1: Homing in reverse direction and regard NL as the homing origin	1: NLZ	1: NL
X = 2: Homing in forward direction and regard ORG (when it switches from off to on state) as the homing origin	2: F_ORGZ	2: F_ORG
X = 3: Homing in reverse direction and regard ORG (when it switches from off to on state) as the homing origin	3: R_ORGZ	3: R_ORG
X = 4: Look for Z pulse in forward direction and regard it as the homing origin	4: F_Z	
X = 5: Look for Z pulse in reverse direction and regard it as the homing origin	5: R_Z	
X = 6: Homing in forward direction and regard ORG (when it switches from on to off state) as the homing origin	6: F_ORGZ	6: F_ORG
X = 7: Homing in reverse direction and regard ORG (when it switches from on to off state) as the homing origin	7: R_ORGZ	7: R_ORG
X = 8: Regard the current point as the origin	8: CUR	
X = 9: Look for collision point in forward direction and regard it as the origin	9: F_BUMPZ	9: F_BUMP
X = A: Look for collision point in reverse direction and regard it as the origin	A: R_BUMPZ	A: R_BUMP

- (3) Offset: Origin offset, P6.001
- (4) Path: Next PR path to be executed after homing
- (5) Homing at high speed (first setting speed): First homing speed, P5.005.
- (6) Homing at low speed (second setting speed): Second homing speed, P5.006.

**Speed command**

Speed command can be applied in any PR paths (PR#1 ~ PR#99). It is marked as “Speed”. Find more details in Figure 7.1.4.3.

7

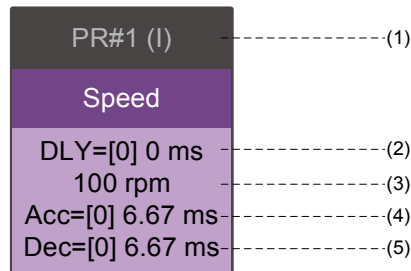


Figure 7.1.4.3 Presentation of speed command

- (1) Command execution type: A speed command can interrupt (INS) the previous PR path. If interrupt function is enabled, it displays (I); if not, no information is displayed.
- (2) Delay time (DLY): Determined by shared PR parameters. It is defined by command from the controller; the servo drive starts counting the delay time once target speed is reached.
- (3) Target speed: The set target speed.
- (4) Acceleration time (ACC): Determined by shared PR parameters; duration to reach the target speed from stop.
- (5) Deceleration time (DEC): Determined by shared PR parameters; duration to decelerate from target speed to stop.

**Position command**

Position command can be applied in any PR paths (PR#1 ~ PR#99). It is marked as “Position”, which includes options of “Stop once position control completed” and “Load the next path once position control completed”. The only difference is that the latter will show an arrow pointing to the next PR. More details can be found in Figure 7.1.4.4.

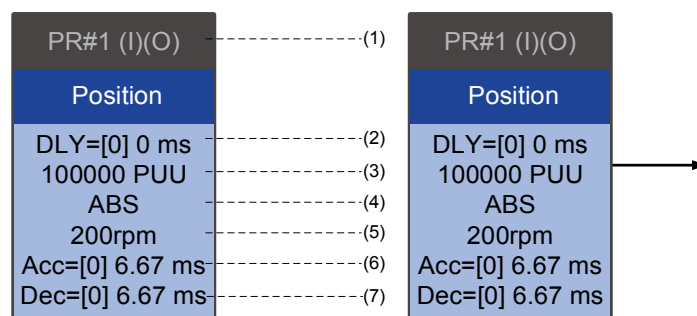


Figure 7.1.4.4 Presentation of position command

- (1) Command execution type: A position command can interrupt (INS) the previous PR path. If interrupt function is enabled, it displays (I); if not, no information is displayed. Position command can overlap (OVL) the next PR path. If delay time is set to 0 when this function is enabled, it displays (O); if overlap function is not used, no information is displayed.

- (2) Delay time (DLY): Determined by shared PR parameters. It is defined by command from the controller; the servo drive starts counting the delay time once target position is reached.
- (3) Target position: The set target position.
- (4) Position command type: If an absolute positioning command is used, it shows “ABS”; relative positioning is marked as “REL”; incremental positioning is “INC”; high speed position capture is “CAP”.
- (5) Target speed: Determined by shared PR parameters.
- (6) Acceleration time (ACC): Determined by shared PR parameters; duration to reach the target speed from stop.
- (7) Deceleration time (DEC): Determined by shared PR parameters; duration to decelerate from target speed to stop.

### Jump command

Jump command can be applied in any PR paths (PR#1 ~ PR#99). It is marked as “Jump” and followed by an arrow pointing to the next PR path. See Figure 7.1.4.5 for detailed information.

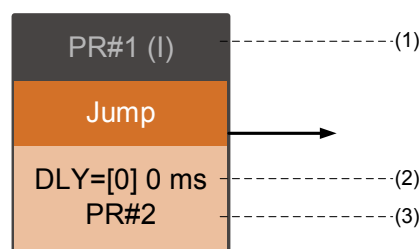


Figure 7.1.4.5 Presentation of jump command

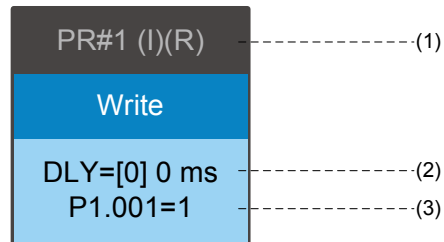
- (1) Command execution type: Jump command can interrupt (INS) the previous PR path. If interrupt function is enabled, it displays (I); if not, no information is displayed.
- (2) Delay time (DLY): Determined by shared PR parameters.
- (3) Target PR number: The set target PR number.

## Write command

Write command can be applied in any PR paths (PR#1 ~ PR#99). It is marked as "Write".

See more details in Figure 7.1.4.6.

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7.1.4.6 Presentation of write command

- (1) Command execution type: A write command can interrupt (INS) the previous PR path. If interrupt function is enabled, it displays (I); if not, no information is displayed. Users can determine whether to write the data to EEPROM. If writing data to EEPROM is required, it shows (R); if not, no information is displayed.
- (2) Delay time (DLY): Determined by shared PR parameters.
- (3) Writing target and data source: Corresponding data is shown in the table below. Please note that constants can be written in DEC or HEX format.

Writing target	Data source
Parameter (PX.XXX)	Constant
Data array (Arr[#])	Parameter (PX.XXX)
-	Data array (Arr[#])
-	Monitoring variable (Mon[#])

### Indexing position command

Indexing position command can be applied in any PR paths (PR#1 ~ PR#99). Number of PR paths is determined by the index number. It is marked as "Index Position". You can find more details in Figure 7.1.4.7.

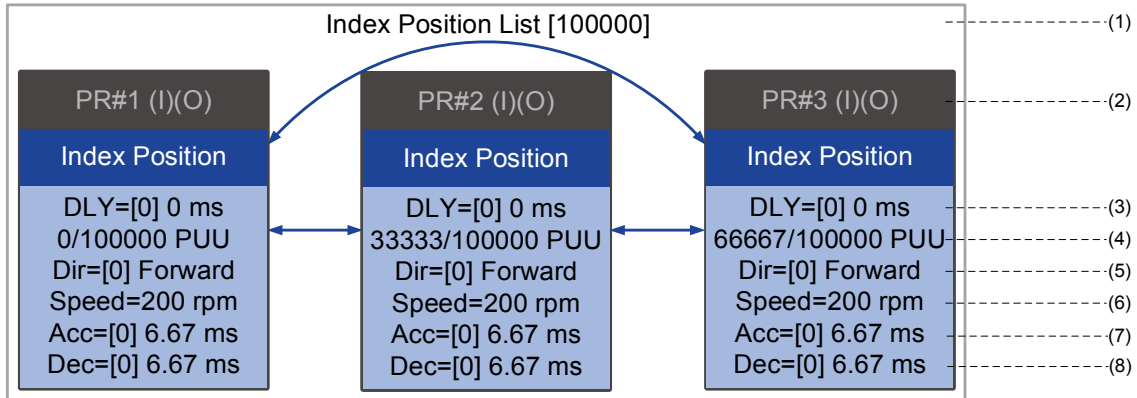


Figure 7.1.4.7 Presentation of indexing position command

- (1) Indexing position command section: Number of the index position. It shows the total moving distance at the top using double arrows to show that the motor can run reciprocally between each target position in each PR path.
- (2) Command execution type: A position command can interrupt (INS) the previous PR path. If interrupt function is enabled, it displays (I); if not, no information is displayed. Position command can overlap (OVLP) the next PR path. If delay time is set to 0 when this function is enabled, it displays (O); if overlap function is not used, no information is displayed.
- (3) Delay time (DLY): Determined by shared PR parameters. It is defined by command from the controller; the servo drive starts counting the delay time once target position is reached.
- (4) Position command: Numerator signifies the set position of this PR path; denominator is the total moving distance of this indexing position command, which is set by P2.052.
- (5) Rotation direction (Dir): Available options are "Rotation forward (Forward)", "Rotation reversely (Reverse)" and "Rotation with the shortest distance (Shortest)".
- (6) Target speed: Determined by shared PR parameters.
- (7) Acceleration time (ACC): Determined by shared PR parameters; duration to reach the target speed from stop.
- (8) Deceleration time (DEC): Determined by shared PR parameters; duration to decelerate from target speed to stop.



### Arithmetic operation

Arithmetic operations and statements can be employed in any PR paths (PR#1 ~ PR#99). It is marked as "Statement". When condition fulfilled, an arrow pointing to the next PR path is presented with a solid line; if condition unfulfilled, an arrow pointing to the next PR is displayed with a dotted line. Or, you can choose to execute the next PR path and stop it once execution completed. The detailed information about arithmetic operation is shown in Figure 7.1.4.8.

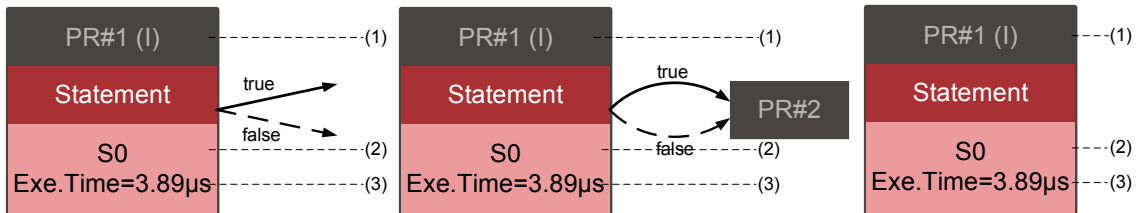


Figure 7.1.4.8 Presentation of arithmetic operation

- (1) Command execution type: An arithmetic operation command can interrupt (INS) the previous PR path. If interrupt function is enabled, it displays (I); if not, no information is displayed.
- (2) Statement number: Displays the statement number used in the PR path.
- (3) Execution time (Exe. Time): The time required for executing the arithmetic operation.

### 7.1.5 Trigger method of PR command

ASDA-A3 provides 6 types of PR triggering methods. They are DI-triggered, event-triggered, P5.007-triggered, Capture-triggered (high-speed position capturing), Compare-triggered (high-speed position comparing), and E-Cam-triggered. Users can choose the most suitable triggering method according to the applications and requirements.

#### Digital input (DI) triggering

Users can choose the PR path to be executed by using internal registers (position command Bit0 ~ Bit6) and use a command to trigger the selected PR path. Before using DI-triggering commands, you will have to define the 8 sets of DI functions, which are [0x11]POS0, [0x12]POS1, [0x13]POS2, [0x1A]POS3, [0x1B]POS4, [0x1C]POS5, [0x1E]POS6, and [0x08]CTRG (refer to Table 8.1). And this can also be set in the I/O setting screen of ASDA-Soft, as shown in Figure 7.1.5.1.

Digital Input(DI) : ASDA-A3 Servo:Pr Mode	Status	Enable
DI1:[0x01]Servo On	Off	<input type="checkbox"/> On/Off
DI2:[0x08]Command triggered	Off	<input type="checkbox"/> On/Off
DI3:[0x11]Internal position command selection 1~99 Bit0	Off	<input type="checkbox"/> On/Off
DI4:[0x12]Internal position command selection 1~99 Bit1	Off	<input type="checkbox"/> On/Off
DI5:[0x13]Internal position command selection 1~99 Bit2	Off	<input type="checkbox"/> On/Off
DI6:[0x1A]Internal position command selection 1~99 Bit3	Off	<input type="checkbox"/> On/Off
DI7:[0x1B]Internal position command selection 1~99 Bit4	Off	<input type="checkbox"/> On/Off
DI8:[0x1C]Internal position command selection 1~99 Bit5	Off	<input type="checkbox"/> On/Off
DI9:[0x1E]Internal position command selection 1~99 Bit6	Off	<input type="checkbox"/> On/Off
DI10:[0x00]Disabled	Off	<input type="checkbox"/> On/Off
DI11:[0x00]Disabled	Off	<input type="checkbox"/> On/Off
DI12:[0x00]Disabled	Off	<input type="checkbox"/> On/Off
DI13:[0x00]Disabled	Off	<input type="checkbox"/> On/Off

Figure 7.1.5.1 I/O setting screen of ASDA-Soft

Select the PR number to be executed based on the on / off status of DI.POS0 ~ 6 and use DI.CTRG to trigger the specified PR path. See Figure 7.1.5.1 for operation example.

Table 7.1.5.1 Use DI to select the PR path to be triggered

Position command	POS	POS	POS	POS	POS	POS	POS	CTRG	Parameter
	6	5	4	3	2	1	0		
Homing	0	0	0	0	0	0	0	↑	P6.000 P6.001
PR#1	0	0	0	0	0	0	1	↑	P6.002 P6.003
~									
PR#50	0	1	1	0	0	1	0	↑	P6.098 P6.099
PR#51	0	1	1	0	0	1	1	↑	P7.000 P7.001
~									
PR#99	1	1	0	0	0	1	1	↑	P7.098 P7.099

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In addition, there are two sets of DI for special functions, [0x27] homing enabling and [0x46] motor stop. If the former is triggered, the servo drive will execute homing based on the homing setting. If the latter is triggered, the servo drive will stop the motor. You can use the I/O setting screen in ASDA-Soft to complete the setting, as shown in Figure 7.1.5.2.

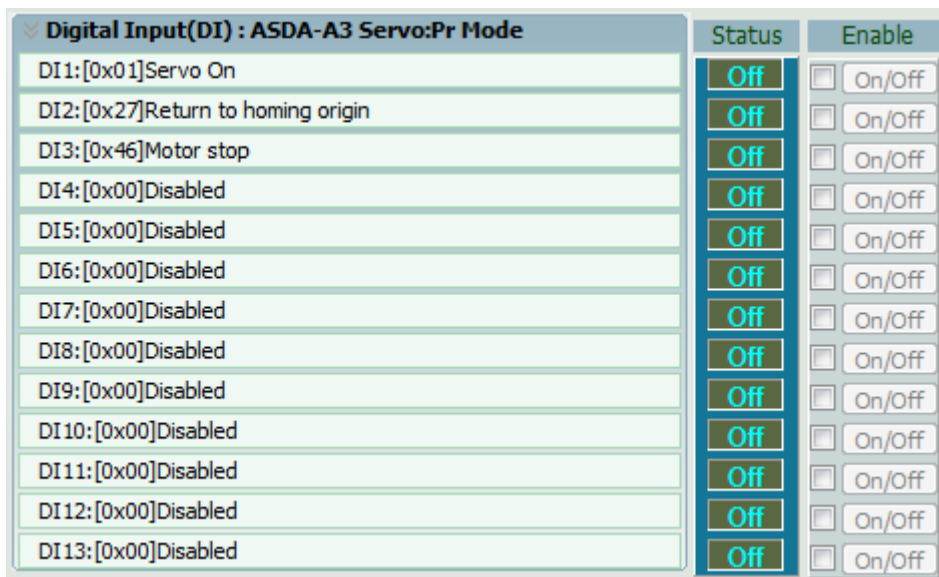


Figure 7.1.5.2 I/O setting screen of ASDA-Soft

**Event triggering**

Users can use event-triggered command 1 ~ 4 to execute the specified PR path. Two types of event triggering are selectable: rising-edge trigger and falling-edge trigger. Range of PR path numbers that can be specified is from 51 ~ 63 (see example in Figure 7.1.5.3). Before using event-trigger for PR command, users have to define DI functions, which are [0x39] event-trigger command 1, [0x3A] event-trigger command 2, [0x3B] event-trigger command 3, and [0x3C] event-trigger command 4 (see Table 8.1). Users can use ASDA-Soft to complete the I/O settings as shown in Figure 7.1.5.4.

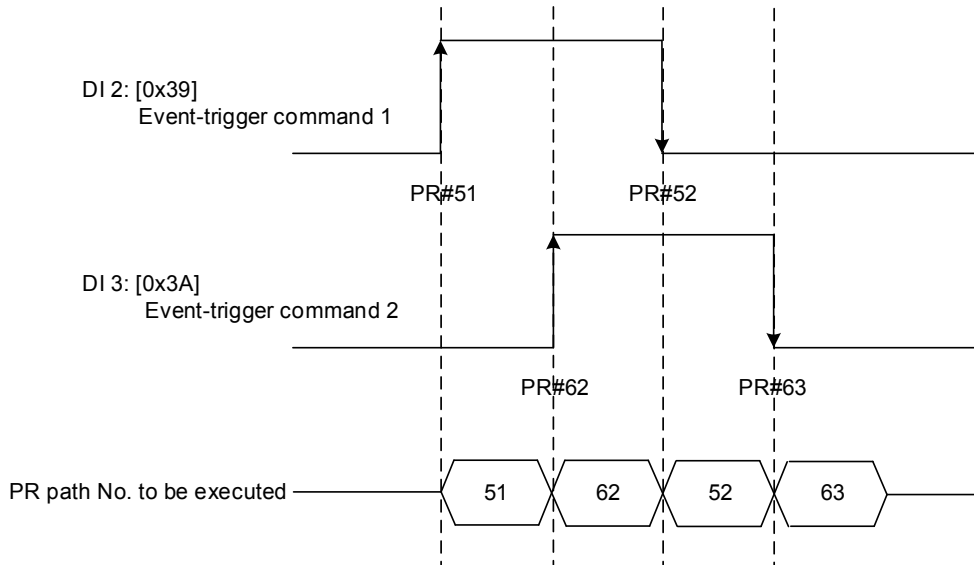


Figure 7.1.5.3 Example of Event triggering timing diagram

Digital Input(DI) : ASDA-A3 Servo:Pr Mode		Status	Enable
DI1:[0x01]	Servo On	Off	<input type="checkbox"/> On/Off
DI2:[0x39]	Event trigger command 1	Off	<input type="checkbox"/> On/Off
DI3:[0x3A]	Event trigger command 2	Off	<input type="checkbox"/> On/Off
DI4:[0x3B]	Event trigger command 3	Off	<input type="checkbox"/> On/Off
DI5:[0x3C]	Event trigger command 4	Off	<input type="checkbox"/> On/Off
DI6:[0x00]	Disabled	Off	<input type="checkbox"/> On/Off
DI7:[0x00]	Disabled	Off	<input type="checkbox"/> On/Off
DI8:[0x00]	Disabled	Off	<input type="checkbox"/> On/Off
DI9:[0x00]	Disabled	Off	<input type="checkbox"/> On/Off
DI10:[0x00]	Disabled	Off	<input type="checkbox"/> On/Off
DI11:[0x00]	Disabled	Off	<input type="checkbox"/> On/Off
DI12:[0x00]	Disabled	Off	<input type="checkbox"/> On/Off
DI13:[0x00]	Disabled	Off	<input type="checkbox"/> On/Off

Figure 7.1.5.4 I/O setting screen of ASDA-Soft

Rising-edge trigger of PR path can be set by P5.098 while falling-edge trigger can be set by P5.099. Please refer to Chapter 8 for more details. Users can use ASDA-Soft to set the event trigger of PR (see Figure 7.1.5.5).

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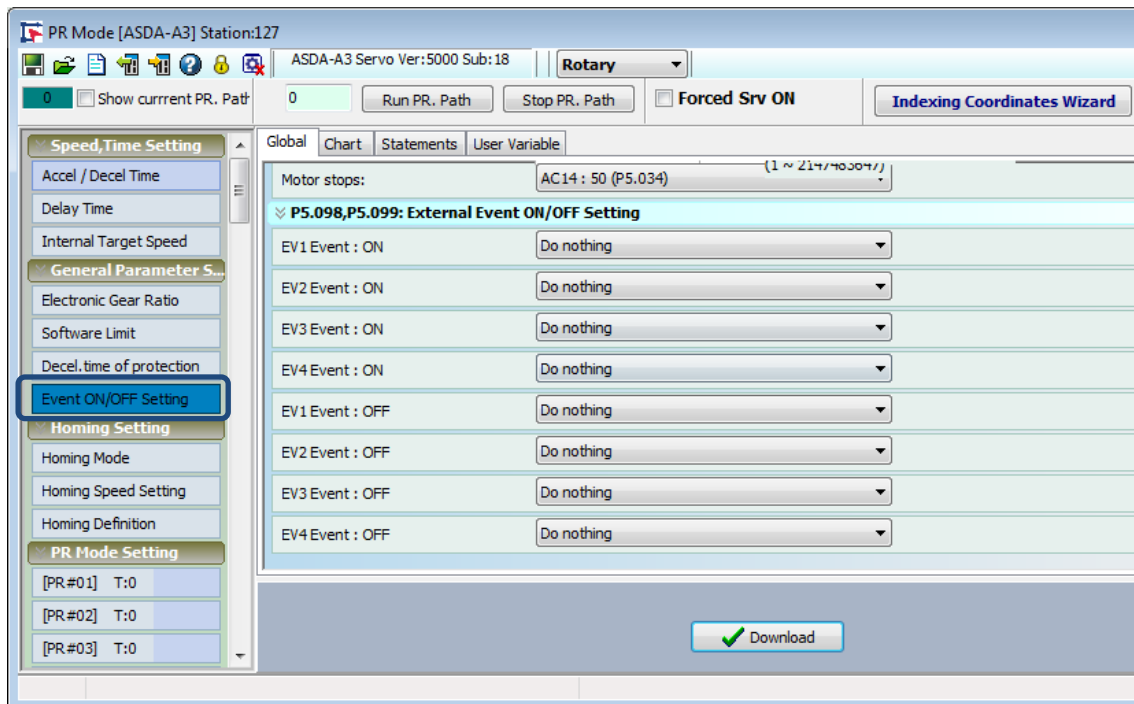


Figure 7.1.5.5 Event On/Off setting screen in ASDA-Soft

### PR command trigger register (P5.007)

Users can write the PR number to be executed in P5.007 and the servo drive will execute the specified PR path. If writing 0 to PR command trigger register, the servo drive will execute homing. If writing 1 ~ 99 to PR command trigger register, the servo drive will execute the specified PR path. Writing 1000, the servo drive will stop executing PR commands. You can find more information in description of P5.007 in Chapter 8.

### Special trigger method

Users can use high-speed position capturing (Capture), high-speed position comparing (Compare), and E-Cam function to trigger the specified PR path. While the capturing completes, you can set Bit3 of P5.039.X to determine whether to trigger PR#50 by, or set Bit12 of P5.059.U to determine whether to trigger PR#45 once the last data is compared. If E-Cam disengagement setting is 2, 4, or 6, use P5.088.BA to write the PR path number. Please refer to Section 7.2 for Capture, Compare, and E-Cam functions.

Triggering method	Setting bit	Trigger PR path
High-speed position capturing (Capture)	P5.039.X Bit3	PR#50
High-speed position comparing (Compare)	P5.059.U Bit0	PR#45
E-Cam	P5.088.BA	User-defined

### 7.1.6 PR procedure execution flow

ASDA-A3 will update the command status every 1 ms. Figure 7.1.6.1 illustrates the PR procedure execution flow and how the servo drive deals with PR commands. Once a PR procedure is triggered, it will go through three units, which are PR queue, PR executor, and motion command generator.

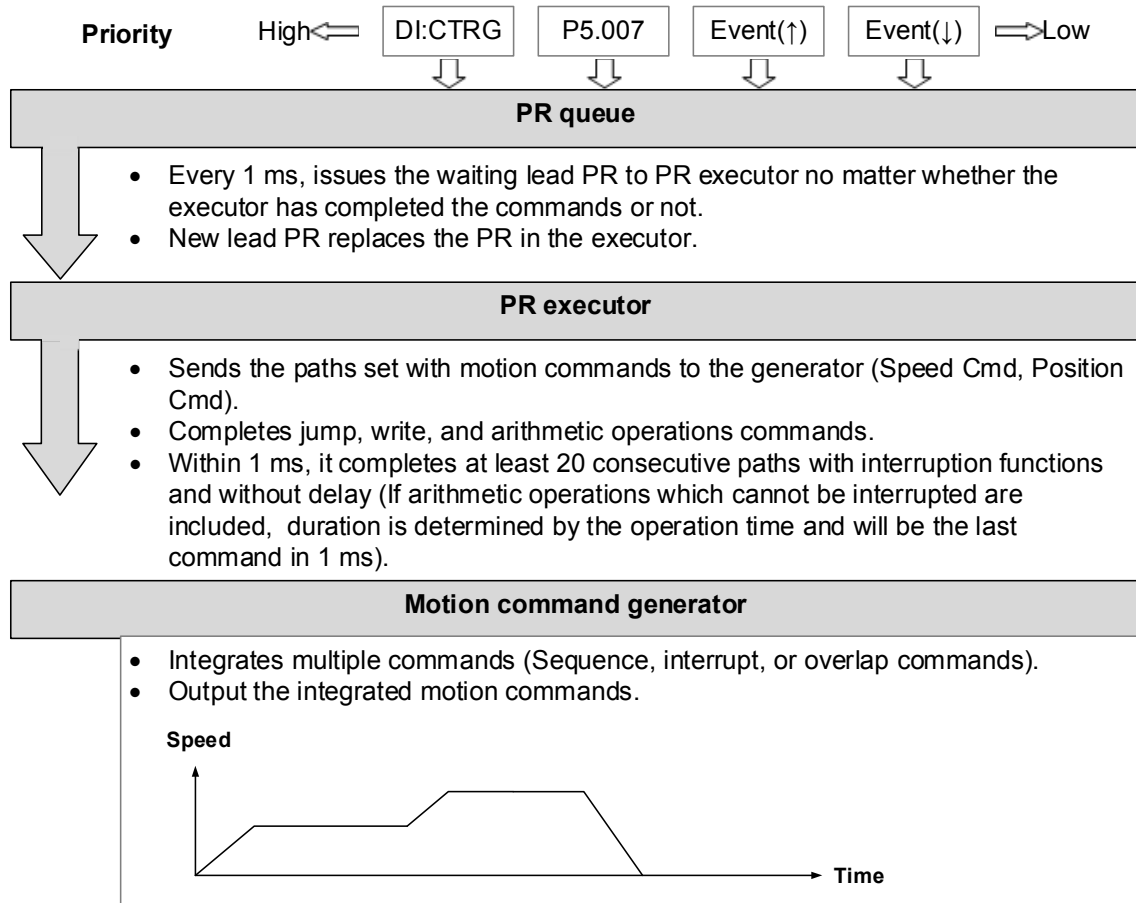


Figure 7.1.6.1 PR arrangement procedure of ASDA-A3

#### ■ Trigger mechanism

The trigger mechanism is as mentioned in Section 7.1.5. There are three trigger methods. A PR procedure will be executed as long as a trigger signal is output. When two different trigger methods are used for one PR procedure within the same ms, the priority is as follows: DI trigger (DI.CTRG) > PR command trigger register (P5.007) > Rising-edge event trigger (Event ↑) > Falling-edge event trigger (Event ↓). Within this ms, commands with higher priority will be executed first and then the lower is arranged in the next ms. If three trigger commands are generated in the same ms, the third will not be issued to the PR queue.

## 7

**■ PR queue**

The triggered PR path is the lead PR. The PR group it leads will go into the PR queue to wait for the arrangement. In each ms, the servo drive will send the lead PR and the PR group it leads to the PR executor no matter whether a PR path is being executed. Therefore, as long as a PR path is triggered, the PR queue collects it and sends it to the executor.

**■ PR executor**

Once the PR executor receives the lead PR and its PR group, the PR group in execution will be replaced immediately. If a PR group includes motion commands, such as speed commands and position commands, then the PR executor will send them to the motion command generator. PR paths with write or jump commands will be completed at the moment when PR executor is read thus they will not enter the generator. The arithmetic operations commands will be executed when entering the PR executor; however, the execution time varies with the computing duration and the next command cannot interrupt. In PR executor, it can consecutively complete at least 20 PR paths with interrupt commands (INS) without delay time setting within 1 ms. If there is a PR path that hasn't been completed within 1 ms and a new PR group has been sent to the executor by the queue, the new PR group will then replace the previous. In other words, instead of executing the PR group that hasn't been completed, the executor will start executing the new ones. However, if a new PR group hasn't been sent to the executor yet, the executor will continue to execute the unfinished PR path.

**■ Motion command generator**

Motion commands include speed command and position command. The PR executor will send this type of command to the motion command generator. This generator has a buffer for temporarily storing the next motion command and all motion commands are integrated here. Motion commands can be executed as soon as they enter the generator. If other motion command (with interrupt setting) also enters the generator, it will be integrated with the current command in the generator and the integration is based on the setting. The setting includes whether multiple motion commands are sequence commands and whether it is set with overlap or interrupt function; all integration varies with each PR path setting.

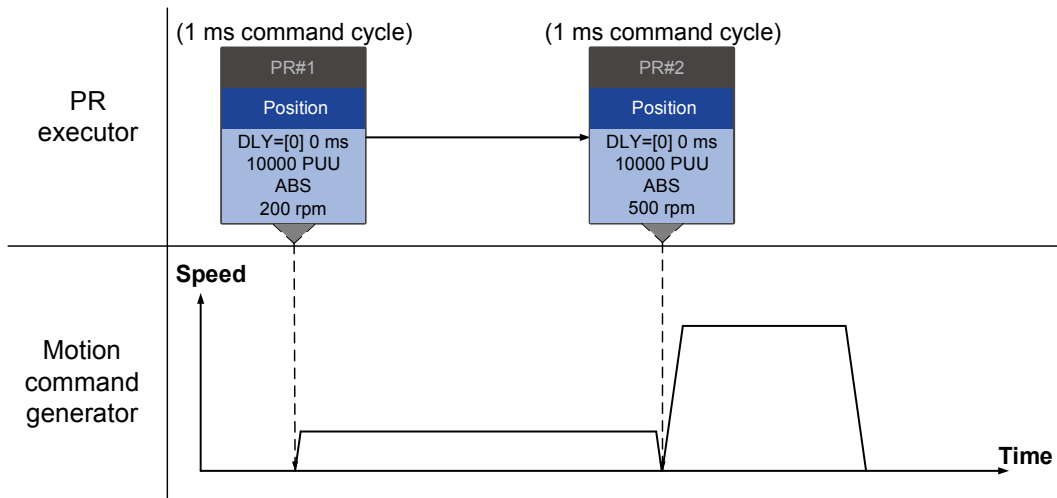
**Sequence command**

Configurable commands in PR path are motion commands, which are position and speed commands. Sequence command is a motion command without an overlap or interrupt function. The following command will start to be executed only after the delay set in the previous is over. Regarding position command, delay time starts to count after target position is reached; for speed command, delay time counting starts after target speed is reached.

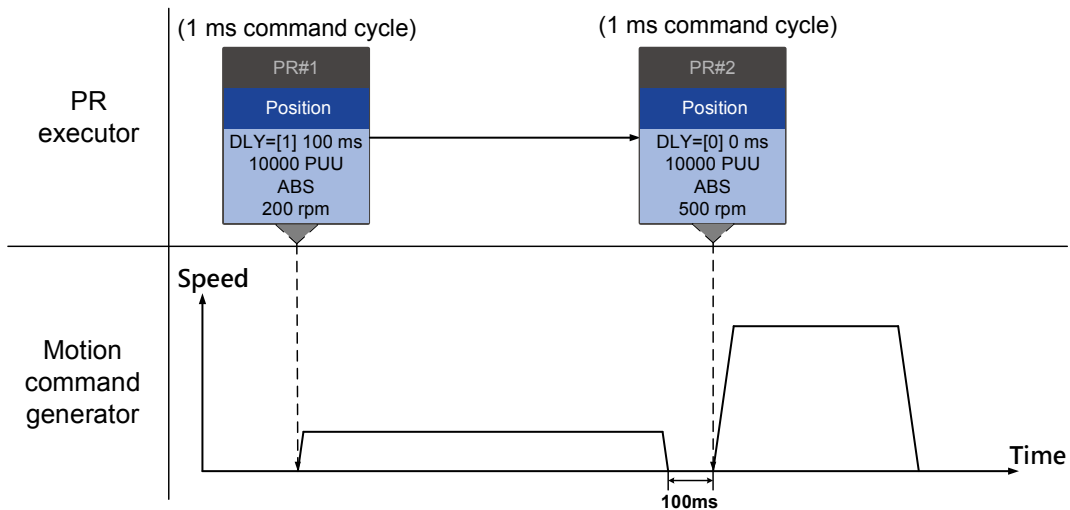
■ Position command ► Position command

When the PR executor receives two position commands consecutively, as they are not set with interrupt or overlap functions, the PR executor will issue the first position command to the motion command generator and the generator will start the first part of position control. After the first position command completes, if no delay time is set, the PR executor will issue the second position command for the generator to start the second part of position control (see Figure 7.1.6.2(a)).

If the first position command is set with a delay, the PR executor starts counting the delay time right after the motor reaches the target position. Then, it issues the second position command to the generator for the second part of position control as shown in Figure 7.1.6.2 (b).



(a) Position command without delay



(b) Position command with delay

Figure 7.1.6.2 Sequence position command

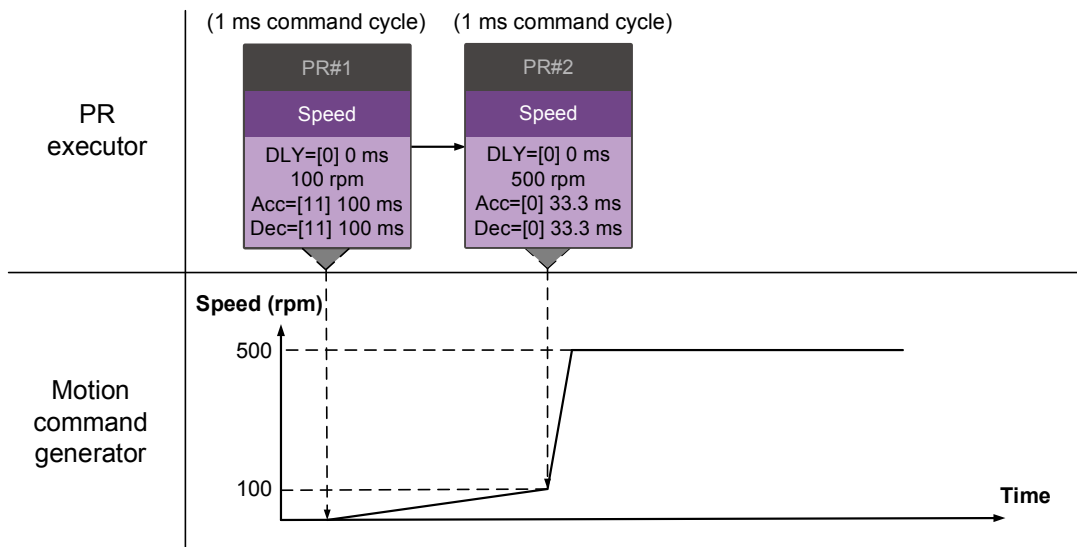


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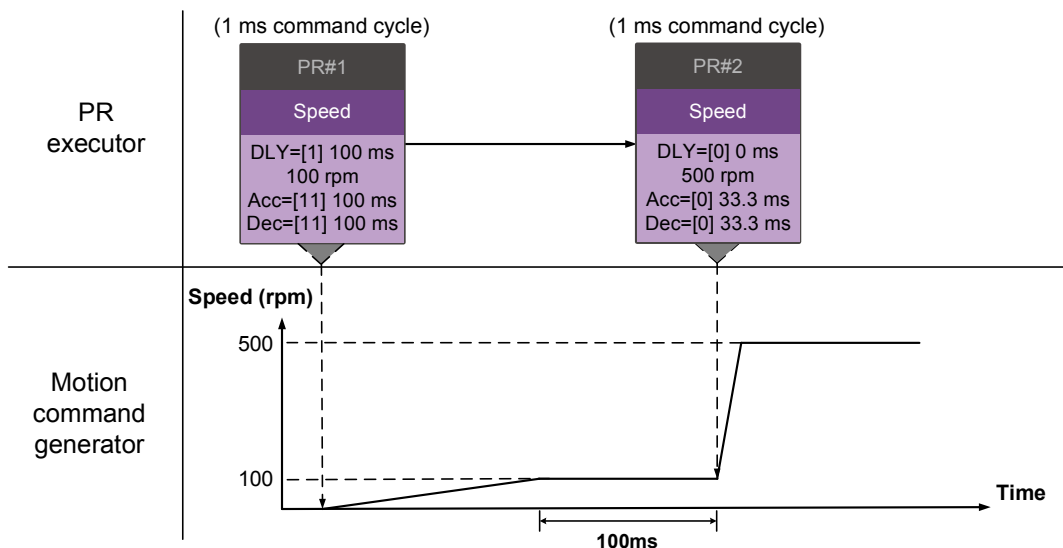
■ Speed command ▶ Speed command

When the PR executor receives two speed commands consecutively, as they are not set with interrupt or overlap functions, the PR executor will issue the first speed command to the motion command generator and the generator will start the first part of speed control. After the first speed command completes, if no delay time is set, the PR executor will issue the second speed command to the generator to start the second part of speed control (see Figure 7.1.6.3(a)).

If the first speed command is set with a delay, the PR executor starts counting the delay time right after the motor reaches the target speed. Then, it issues the second speed command to the generator for the second part of speed control as shown in Figure 7.1.6.3 (b).



(a) Speed command without delay



(b) Speed command with delay

Figure 7.1.6.3 Speed sequence command

■ Multiple commands

The PR queue updates commands every 1 ms. If it is a motion command, the PR queue issues the next command to the generator only after the previous completes. For jump or write commands, they are executed in the PR queue immediately.

As shown in Figure 7.1.6.4, in the first ms, the PR queue receives a position command and it issues this command to the motion command generator, allowing the generator to execute it. In the second ms, the PR queue receives a write command and executes it immediately. In the third ms, the PR queue receives a jump command and executes it right away as well. So, these two commands are not sent to the motion command generator; the PR queue and the generator can execute commands individually. In the fourth ms, the PR queue receives a position command. After the first position command is completed, the PR executor will issue it to the generator and the generator starts executing it promptly.

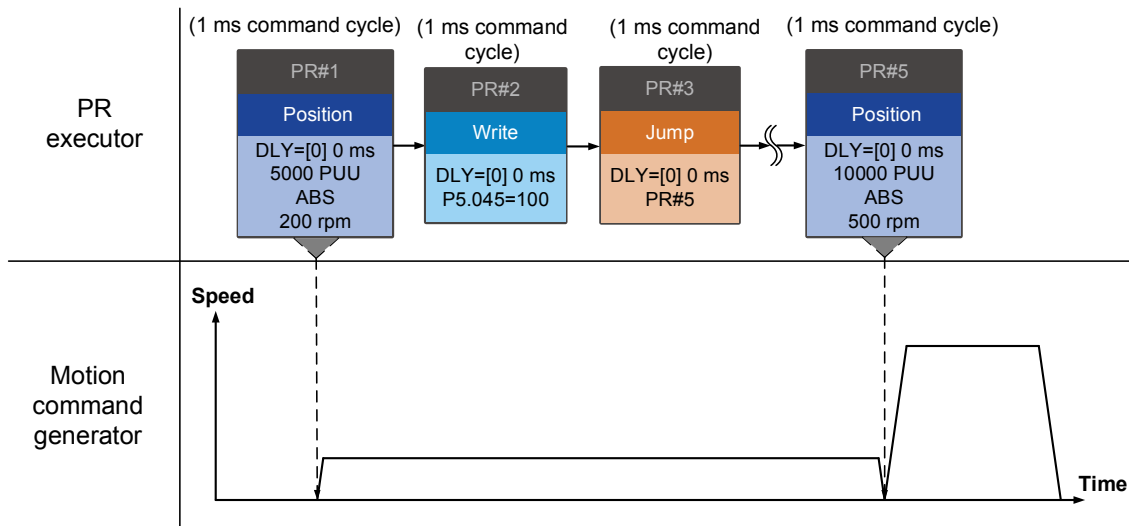


Figure 7.1.6.4 Sequence command – Multiple commands

### Command interruption

7 Interruption (INS) is an action that a command in execution being replaced or integrated. Results of interruption differ based on the command types. The way it works is that the latter command replaces the previous. There are two types of interruption: internal and external, as shown in Figure 7.1.6.5.

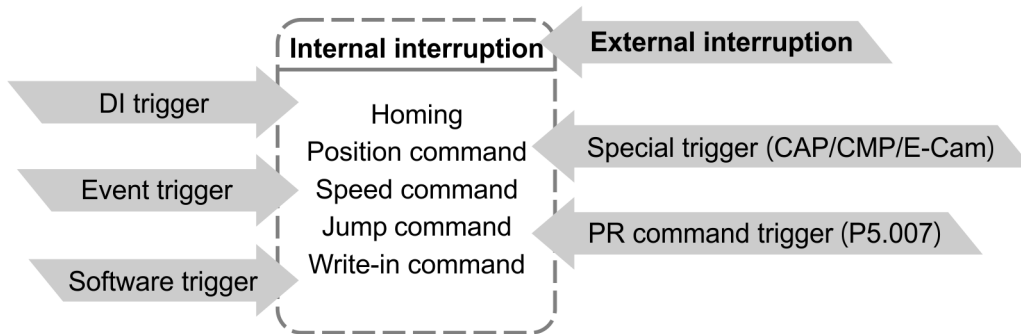


Figure 7.1.6.5 Internal and external interruption

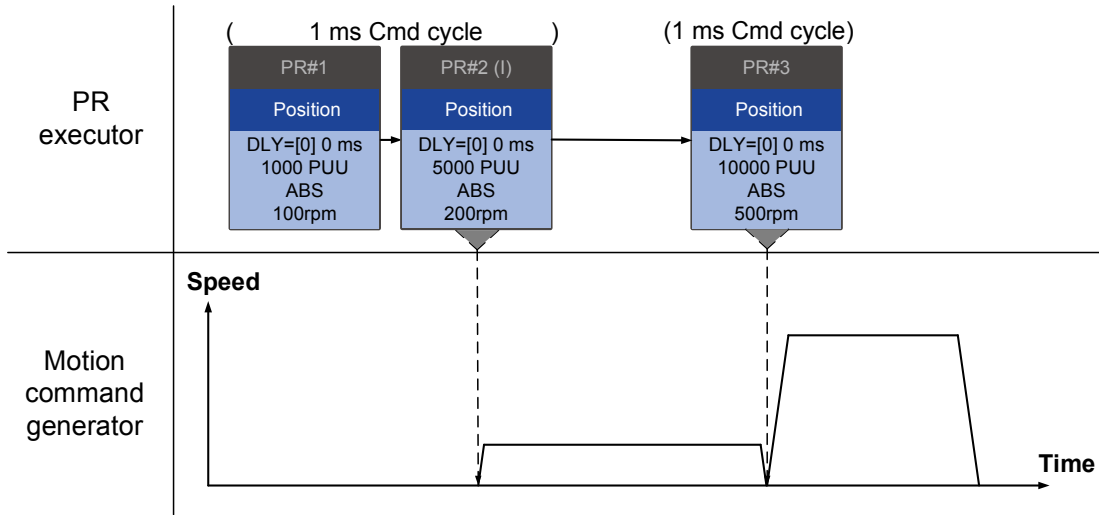
#### 1. Internal Interruption

For a series of PR paths, if one PR path is set with AUTO (auto-execute the next path), the system will carry on to the next path after the current is read. (If the current is set with a delay, the next path will be read after delay time is over.) Meanwhile, if the next path is set with an interrupt function, which has a higher execution priority, the servo drive will immediately execute the interrupt command. It replaces the un-executed part in the previous path with the latter or integrates the commands in execution of the previous.

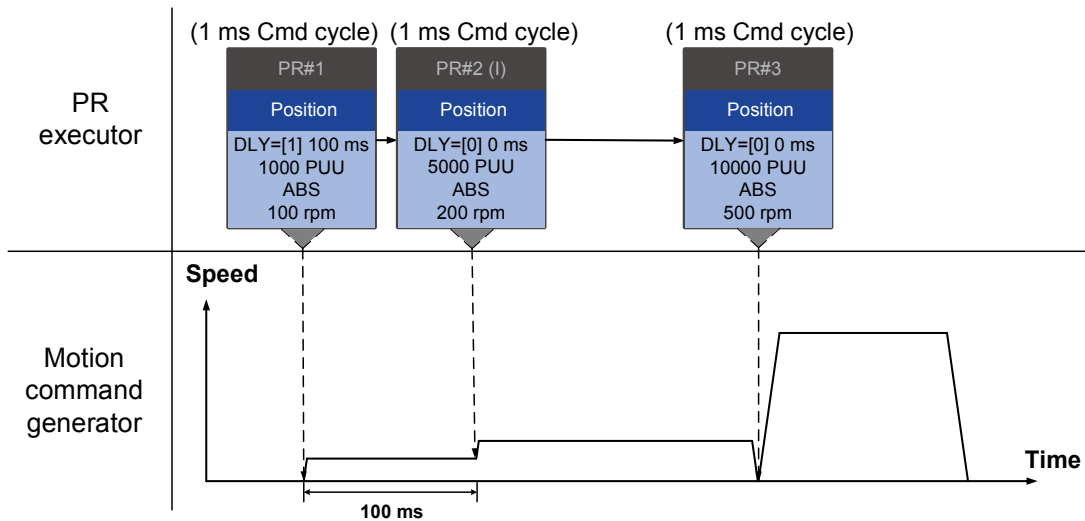
##### ■ Position command ► Position command (I) ► Position command

When the PR executor consecutively receives three position commands with interruption set in the second command, the executor will regard the first and the second as one PR group. As the first position command is unexecuted, the executor will replace the first with the second. It only issues the second to the motion command generator for execution. After the second is completed, the executor issues the third to the generator (see Figure 7.1.6.6 (a)).

If the first is set with a delay, then the PR executor will issue the first to the generator and then start counting the delay time. After the delay is over, it then issues the second and the generator starts the second part of position control. While the first is still being executed, it will be integrated with the second. The integration is slightly different from what described in Section 7.1.3. Please refer to the note below. Once the second is completed, the executor will issue the third to the generator for execution (see Figure 7.1.6.6 (b)).



(a) Position command without delay



(b) Position command with delay

Figure 7.1.6.6 Internal interruption - Position command

Note: Integration for internal interrupt position command is slightly different from what described in section 7.1.3. The way REL and INC commands work is the identical. The target position is the previous target position plus the current. See the example below. The rest of the integration method is the same as mentioned in section 7.1.3.

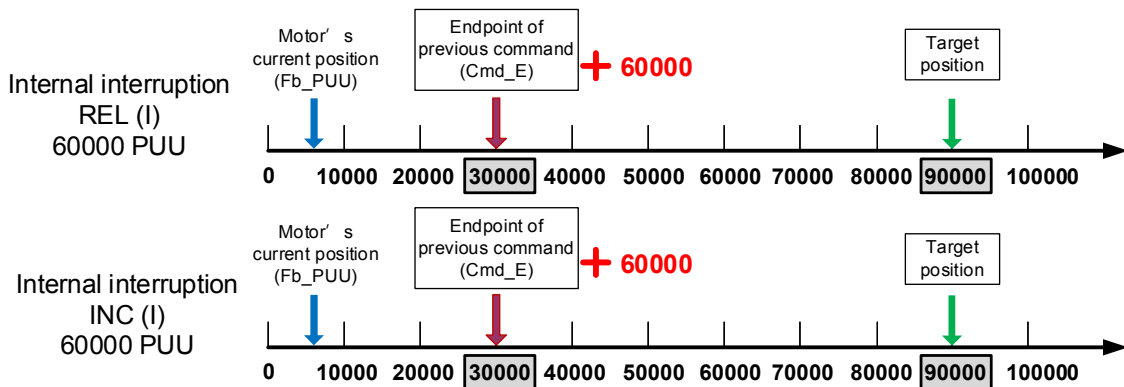


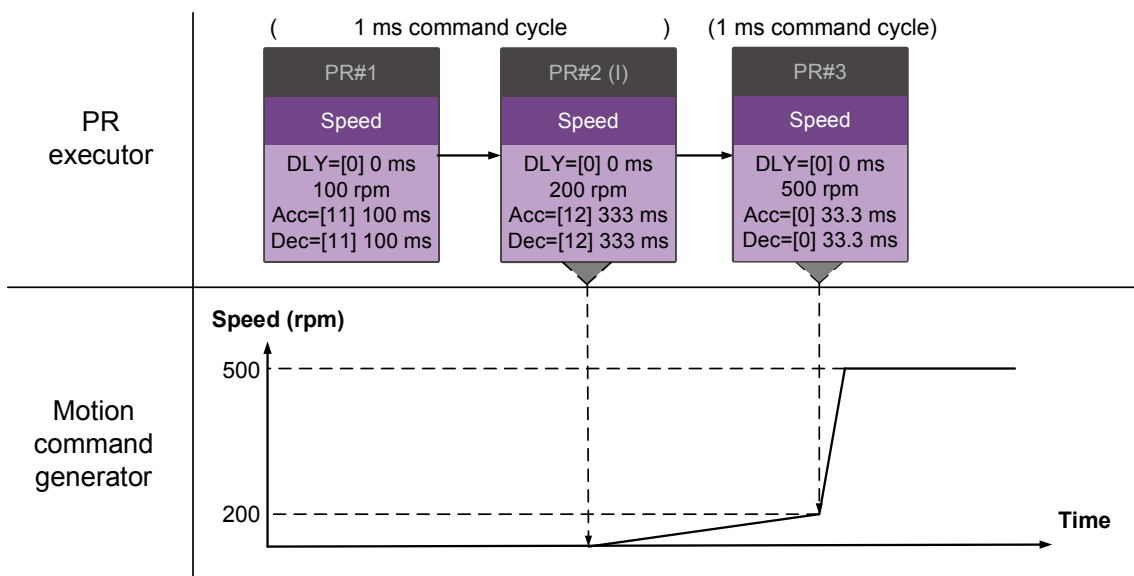
Figure 7.1.6.7 Example of relative and incremental position command for internal interruption

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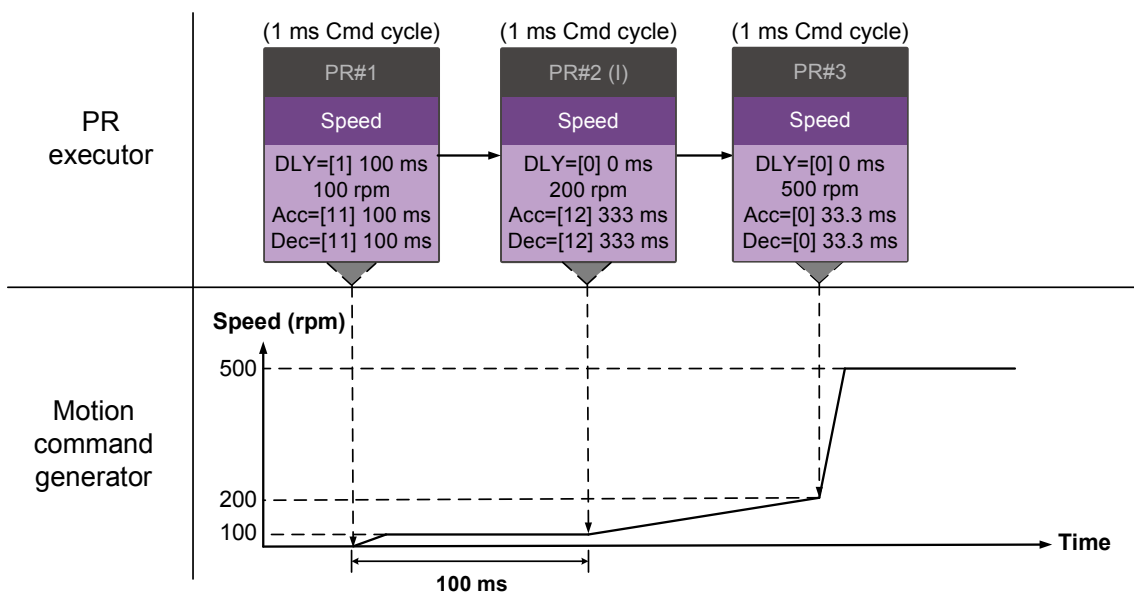
■ Speed command ► Speed command (I) ► Speed command

When the PR executor consecutively receives three speed commands with interruption set in the second command, the executor will regard the first and the second as one PR group. As the first speed command is unexecuted, the executor will replace the first with the second. It only issues the second to the motion command generator for execution. After the second is completed, the executor issues the third to the generator (see Figure 7.1.6.8 (a)).

If the first is set with a delay, then the PR executor will issue the first to the generator and then start counting the delay time. After the delay is over, it then issues the second and the generator starts the second part of speed control. While the first is still being executed, it will be integrated with the second. Once the second is completed, the executor will issue the third to the generator for execution (see Figure 7.1.6.8 (b)).



(a) Speed command without delay



(b) Speed command with delay

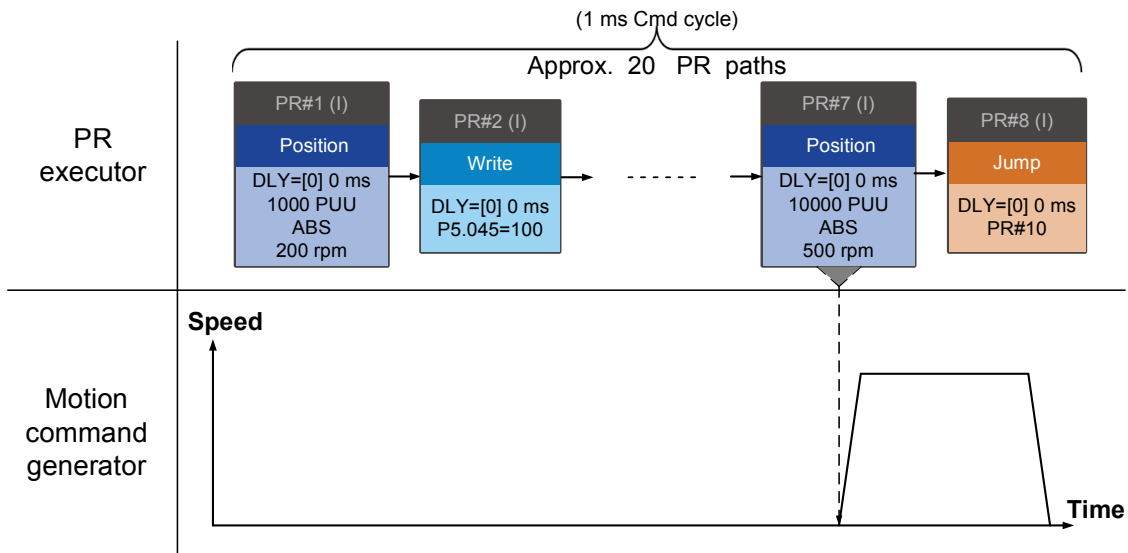
Figure 7.1.6.8 Internal interruption – Speed command

■ Multiple interrupt commands

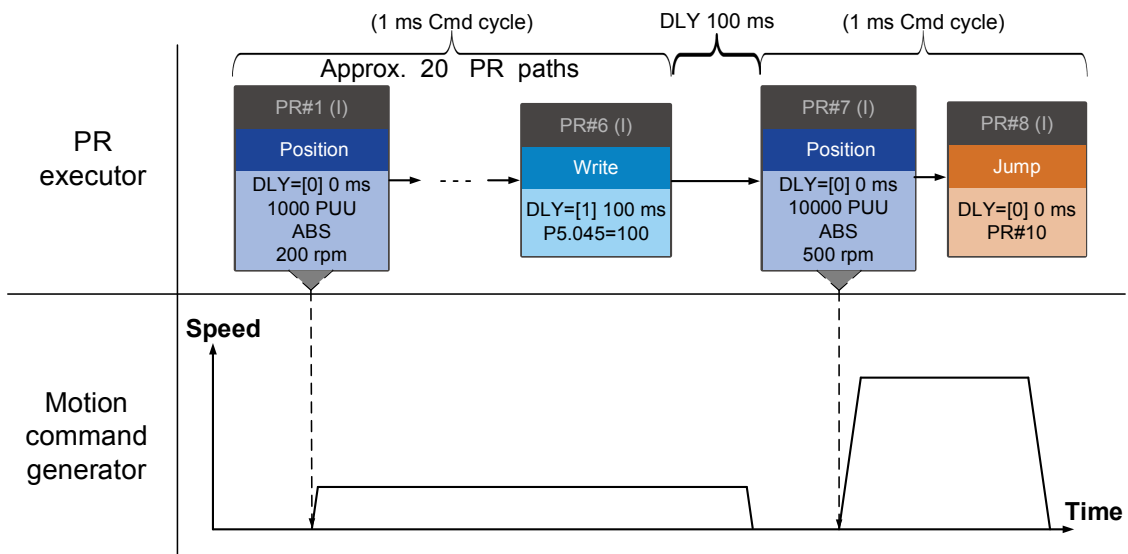
The PR queue updates once every 1 ms. If all PR paths are set with interrupt function, the queue can read at least 20 PR paths in 1 ms and these paths are called a PR group.

If this PR group has multiple motion commands, the PR queue will only issue the last command it receives to the motion command generator for execution. Therefore, in the same PR group, only one PR path with motion command is executed. The latter motion command directly replaces the former, whereas jump and write commands are executed once received by the PR queue (see Figure 7.1.6.9 (a)).

If one of the PR paths is set with a delay, the PR queue will schedule all paths on the basis of this PR path. The prior path(s) set with a delay is regarded as the first PR group and that follows is regarded as the second PR group. Thus, this PR procedure can execute up to two PR paths with motion commands, as shown in Figure 7.1.6.9 (b).



(a) Multiple commands without delay



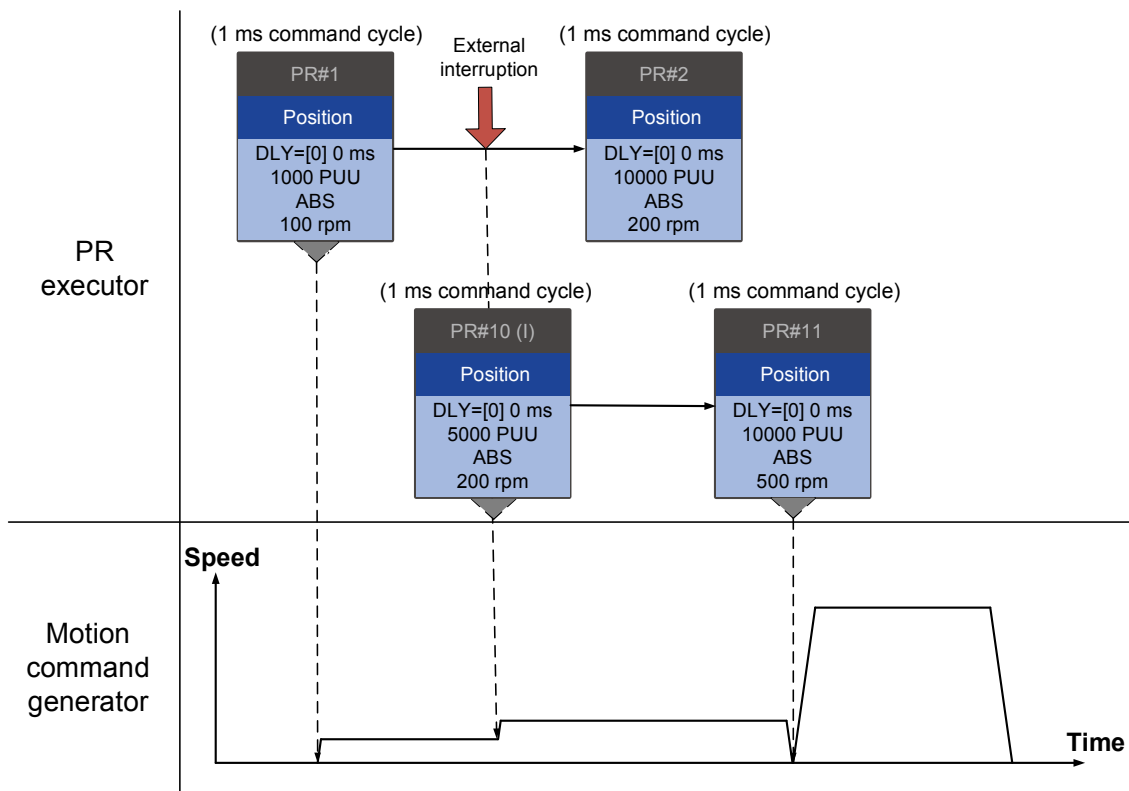
(b) Multiple commands with delay

Figure 7.1.6.9 Internal interruption – Multiple commands

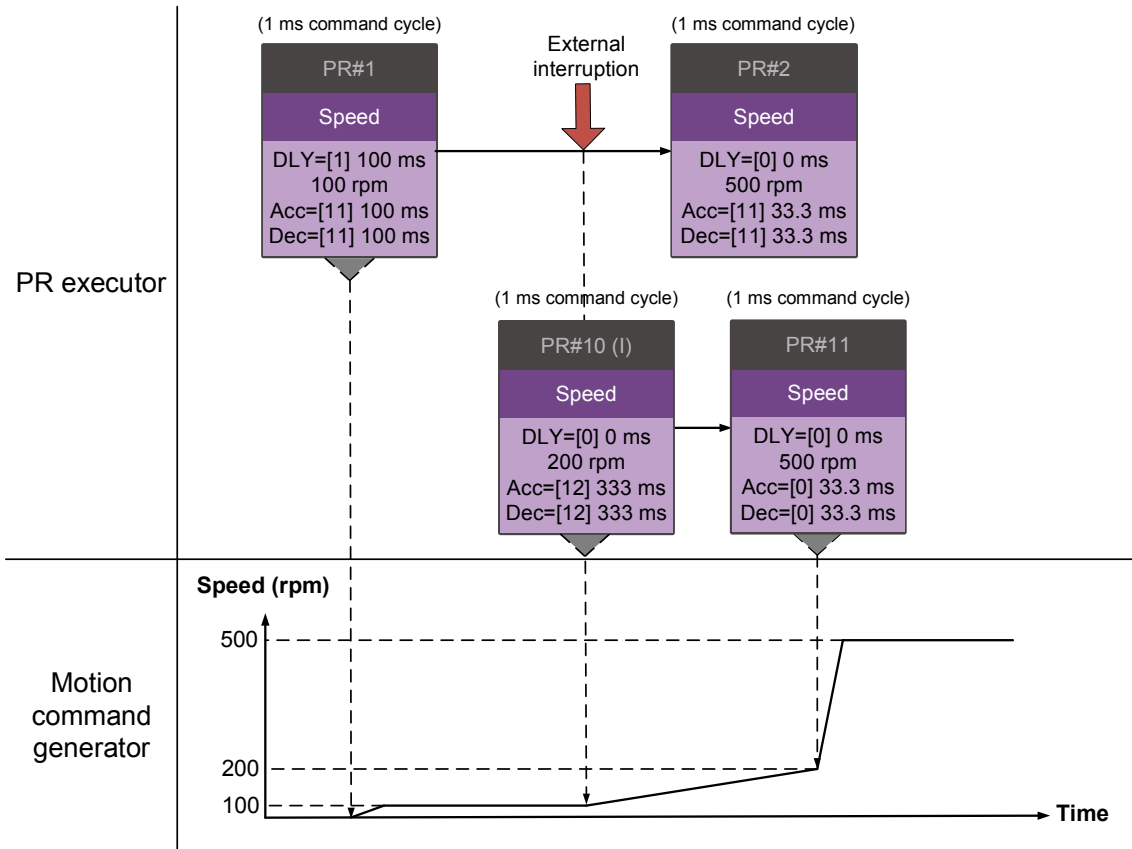
2. External Interruption

If external interruption is applied, it uses PR command trigger method to execute another PR path (Refer to Section 7.1.5 for PR trigger methods.). When the PR queue receives a PR path with interrupt function, this path will be issued to the motion command generator immediately and change the path in execution. And whether a delay is set will not change the result of external interruption. That is, once the PR queue receives an external interruption command, the motion commands in the latter part will be executed by the generator and integrated with the previous. Procedure of external interruption is as shown in Figure 7.1.6.10 (a).

If a PR path with external interruption enters the PR executor, the executor will issue this position command promptly to the generator so that the motor can run in accordance. The motor will refer to the setting that integrates with the former motion commands when running. Ways of integration are as mentioned in Section 7.1.3. Similarly, external interruption with application of speed commands and position commands work the same way and so do the applications of multiple commands. See Figure 7.1.6.10(b) for example.



(a) External interruption – Position command



(b) External interruption – Speed command

Figure 7.1.6.10 External interruption

**Overlap command**

If an overlap function is set in the previous position command; it allows the next command to be executed while the previous is decelerating thus achieving a continuous motion. When an overlap command is used, the set delay time is still effective. The delay time starts to count from command's start point; however, in order to have the commands transit smoothly, setting the delay time of the previous to 0 is suggested. In addition, if deceleration time of the previous is identical to acceleration time of the next, the transition between commands can be very smooth and discontinuous speed during transition can be avoided (see Figure 7.1.6.11). The calculation is as follows.

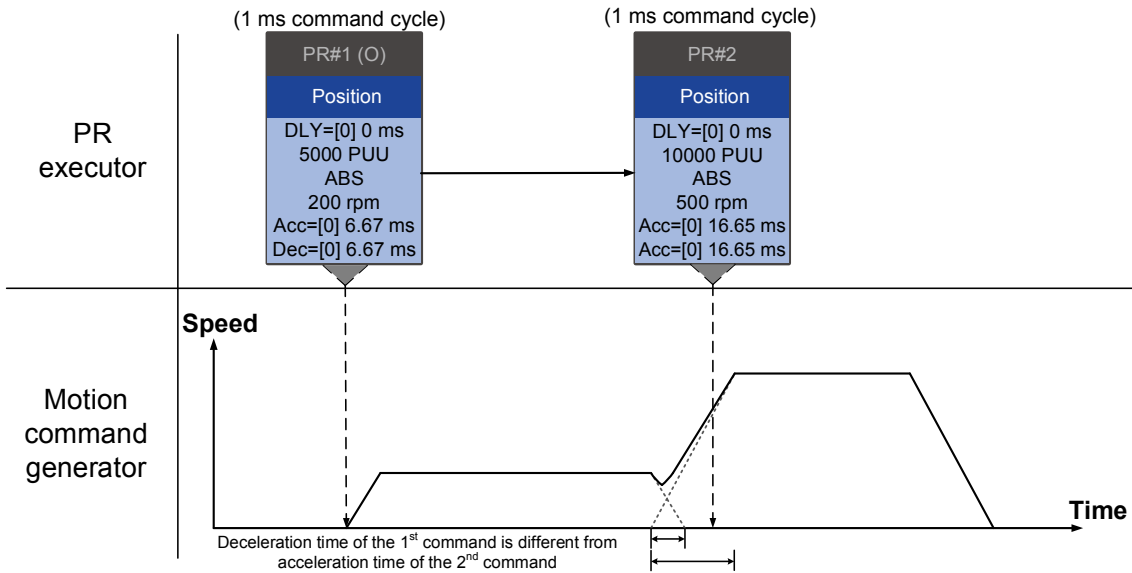
$$\frac{1st\ target\ speed\ (Spd1)}{3000} \times Deceleration\ time\ (Dec)$$

$$= \frac{2nd\ target\ speed\ (Spd2)}{3000} \times Acceleration\ time\ (Acc)$$

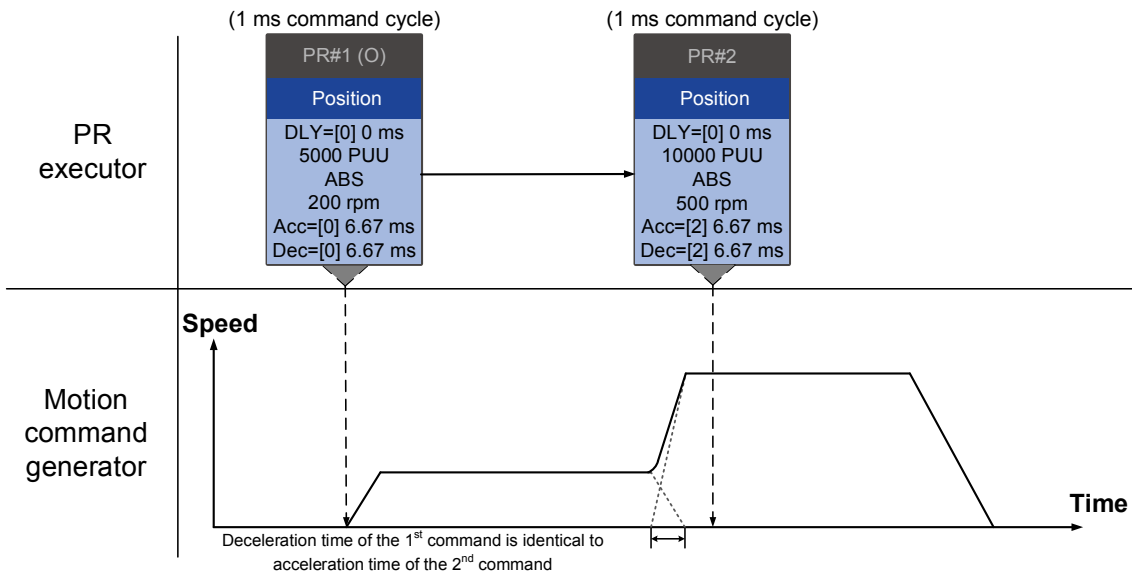
An interrupt command has a higher priority over an overlap command. Thus, when overlap function is set in the current position command and the next motion command is set to apply the interrupt function, only interrupt function will be carried out.



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(a) Overlap command - Acceleration and deceleration time are different



(b) Overlap command - Acceleration and deceleration time are identical

Figure 7.1.6.11 Overlap command

**Arithmetic operations (Statement)**

Arithmetic operations commands can be regarded as combinations of write commands and jump commands. Thus, the execution priority is the same as these two types of commands, which are executed by PR executor. Arithmetic operations commands can interrupt the previous command but cannot be interrupted by the latter. This is for ensuring that all arithmetic operations are completed before the PR paths enter the PR queue. In other words, for a series of PR paths with both arithmetic operations and interrupt functions, only the arithmetic operations commands of this PR path will be executed in the first ms. And the rest will be arranged to the PR queue in the next ms.

Therefore, the target jump PR number specified by the path with arithmetic operations is executed in the next ms (see Figure 7.1.6.12). If users have input the triggering parameter in Statement section, such as PR command trigger register (P5.007), which has the highest execution priority (regarded as external interruption), after the arithmetic operations are done, the path specified by PR command trigger register will be executed in the next ms. And logic condition commands will not be executed (see Figure 7.1.6.13).

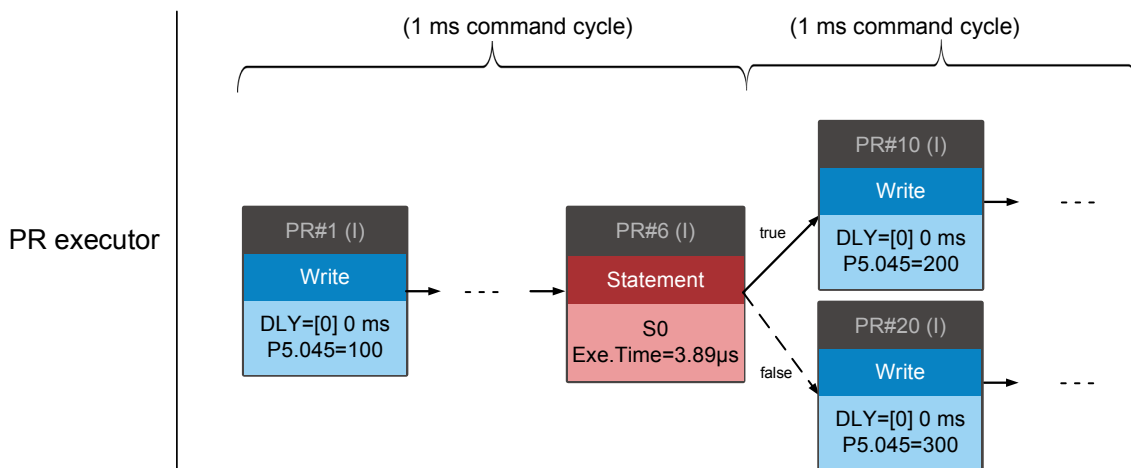


Figure 7.1.6.12 Multiple commands with arithmetic operations

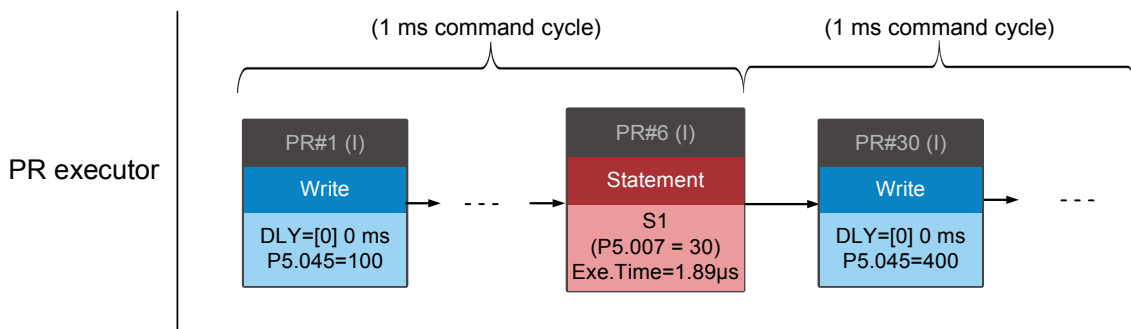


Figure 7.1.6.13 Writing trigger command in Statement section

## 7.2 Application of motion control

Applications of motion control of ASDA-A3 include high-speed position capture (Capture), high-speed position comparing (Compare), and E-Cam. Regarding high-speed position capturing, it is to employ digital input (DI7) to capture motor's feedback position instantly and store this position in the data array. For high-speed position comparing, it is to write the specified position of motor to the data array and output a high-speed digital signal (DO4) once the motor feedback position reaches this specified position. The purpose of E-Cam is to create an E-Cam curve according to the correlation between Master and Slave, and the curve will be stored in the data array. The slave axis will refer to the master axis' position and operate to the position specified by E-Cam. More details about the setting and how it works can be found in the following sections.

### 7.2.1 Data array

Data array can store up to 800 data (0 ~ 799) with each data size of 32-bit. It can be used to store the high-speed captured data and high-speed compared data as well as E-Cam curves. Users have to segment the space for these three functions as their individual spaces are not restricted in the default setting. This way data being overwritten or changed incorrectly can be avoided. You can set P2.008 to 30 and then 35 or use ASDA-Soft to write the data to EEPROM, otherwise, the data will not remain after power off. A user-friendly setting screen is also provided in ASDA-Soft for reading / writing the data array.

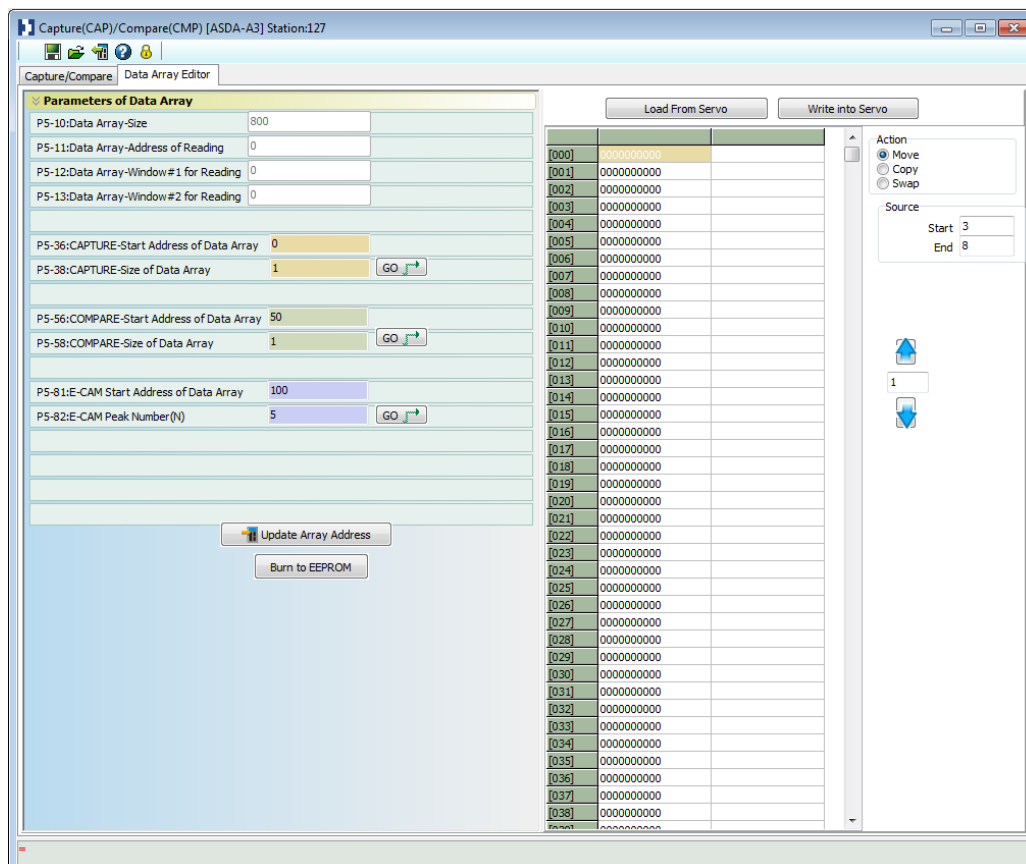


Figure 7.2.1.1 Data array setting screen in ASDA-Soft

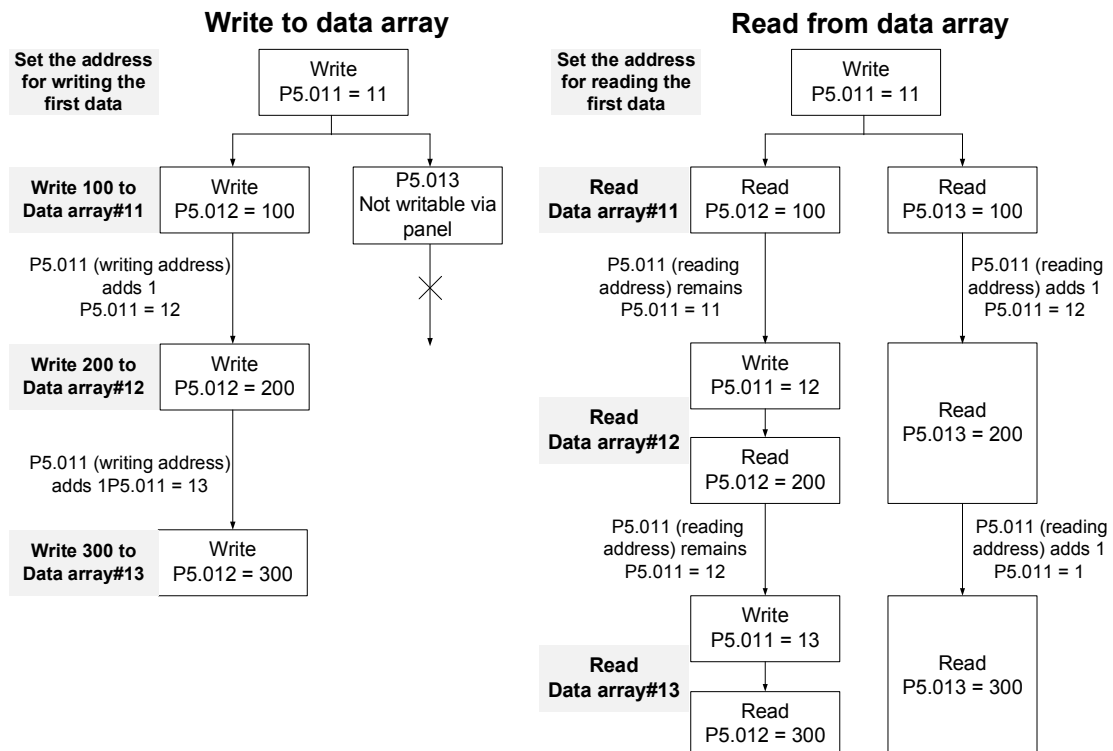
With two channels provided, users can use panel, communication, or ASDA-Soft to read data from or write data to the data array. Channel 1 can be set by P5.011, P5.012, and P5.013. P5.011 specifies the address for reading / writing of data array. P5.012 and P5.013 are the windows of reading / writing. Both can be used to read / write, but the behaviors after reading / writing differ. Please refer to Table 7.2.1.1. Channel 2 can be set by P5.011, P5.100 ~ 103. P5.011 sets the address for reading / writing of data array. P5.100 can read data from or write data to the data array address following the address set by P5.011. P5.012 and P5.103 work the same way. If the address number has reached the max. 799, then the address will remain 799 instead of adding up. You can find more details in Table 7.2.1.2.

Table 7.2.1.1 Channel 1 – reading / writing of data array

Parameter	Description		
P5.011 Address of reading / writing	Specify the address for reading from or writing to the data array		
Window for reading / writing	by	Behavior after reading	Behavior after writing
P5.012 Window#1 for reading / writing	Panel	Value of P5.011 will not add 1	Value of P5.011 adds 1
	Communication / ASDA-Soft	Value of P5.011 adds 1	Value of P5.011 adds 1
P5.013 Window#2 for reading / writing	Panel	Value of P5.011 adds 1	Cannot be written via drive panel
	Communication / ASDA-Soft	Value of P5.011 adds 1	Value of P5.011 adds 1

- Example: When using drive panel or communication for reading from or writing to data array, input values to the data array address in sequence as follows: Data array#11 = 100, Data array#12 = 200, Data array#13 = 300. Then, they will be read in sequence.

1. Read / write via panel:



## 2. Read / write via communication:

Reading / writing via communication requires Modbus. Users can apply communication command 0x10 to write consecutively, 0x06 to write single data, and 0x03 to read consecutively. Firstly, use a consecutive writing command to write 100 to Data array #11, 200 to Data array #12, and 300 to Data array #13. When reading, apply single data writing command to set the start address as Data array #11, then use consecutive reading command to read P5.011 ~ P5.013 (Data array #11 and #12). It means the number of reading times is 2, so value of P5.011 will add 2 and Data array #13 will then be read.

Write to the data array									
Packet	Communication Cmd	Start Address	Data size	P5.011		P5.012		P5.013	
				Low bit	High bit	Low bit	High bit	Low bit	High bit
1	0x10	P5.011	6 words	11	0	100	0	200	0
2	0x10	P5.011	6 words	13	0	300	0	0	0
Read data array									
Packet	Communication Cmd	Start Address	Data size	P5.011		P5.012		P5.013	
				Low-bit	High-bit	Low bit	High bit	Low bit	High bit
4	0x06	P5.011	-	11	0	-	-	-	-
5	0x03	P5.011	6 words	11	0	100	0	200	0
6	0x03	P5.011	6 words	13	0	300	0	0	0

Table 7.2.1.2 Channel 1 – reading / writing of data array

Parameter	Description	Example 1		Example 2	
P5.011 Read / write address	Specify the address for reading from or writing to the data array	200		797	
Parameter	Description	Example 1		Example 2	
		Address	Content	Address	Content
P5.100 Window #3 for reading / writing	Read from or write to the address specified by P5.011.	200	1234	797	5678
P5.101 Data array - Window #4 for reading / writing	Read from or write to the first address following the address specified by P5.011.	201	2345	798	6789
P5.102 Data array - Window #5 for reading / writing	Read from or write to the second address following the address specified by P5.011.	202	3456	799	7890
P5.103 Data array - Window #6 for reading / writing	Read from or write to the third address following the address specified by P5.011.	203	4567	x	0

## 7.2.2 High-speed position capturing function (Capture)

High-speed position capturing function (simplified as CAP) is to use the external-triggered high speed digital input DI7 (with execution time 5  $\mu$ s only) to capture the position data of the motion axis and store it in the data array for further motion control. As the Capture function is carried out by the hardware, there will be no lag in the software and it is able to capture the motion axis' position accurately. While the Capture function is enabled, the servo drive will input a DI7 signal as the signal of capturing, which is not user-defined.

Flow chart of high-speed position capturing is shown in Figure 7.2.2.1. The relevant setting is as follows. P5.036 stores the start position for capturing in the data array; if it is not set, the default start position is #0. P5.038 sets the capturing amount. The amount has to be greater than 0 otherwise Capture function is invalid. P1.019.X enables the cycle mode. When the last data is captured, the capturing amount will be cleared to 0 (P5.038 = 0), and the next cycle will start automatically referring to the set capturing amount. However, the start capturing position is still determined by P5.036; that is, the captured data in previous cycle will be replaced by the data captured in the next cycle. P5.039 is for enabling / disabling the Capture function and other settings. See more information in the following table. To capture multiple data, you can use P1.020 to set the masking range for capturing. The purpose is to prevent the same position data being captured repeatedly; capturing for more than one time is not allowed in the masked area. Capture function can be set via ASDA-Soft, as shown in figure 7.2.2.2.

P5.039	bit	Function	Description
X	0	Enable Capture function	When P5.038 > 0 and bit 0 = 1, the capturing starts and DO.CAP_OK is off. Each time a data is captured, value of P5.038 minus 1. When P5.038 = 0, it means the capturing is finished, DO.CAP_OK is on, and bit 0 is cleared to 0. If bit 0 is already 1, the written value must not be 1; you have to write 0 to disable the Capture function.
	1	Reset position when first data is captured	If bit 1 = 1, after the first data is captured, set Capture axis' position as the value of P5.076.
	2	Enable Compare function after first data is captured	If bit 2 = 1, when the first data is captured, the Compare function is enabled (P5.059.X bit 0 = 1 and P5.058 resets to the previous setting amount). If Compare function is already enabled, then this bit function is invalid.
Y	3	Execute PR#50 after the last data is captured	If bit 3 = 1, execute PR#50 once all data are captured.
	-	Source of Capture axis	0: Disabled 1: Auxiliary encoder (CN5) 2: Pulse command (CN1) 3: Main encoder of motor (CN2)
	Z	Trigger logic	0: NO (Normally open) 1: NC (Normally closed)
U	-	Minimum trigger interval (ms)	-

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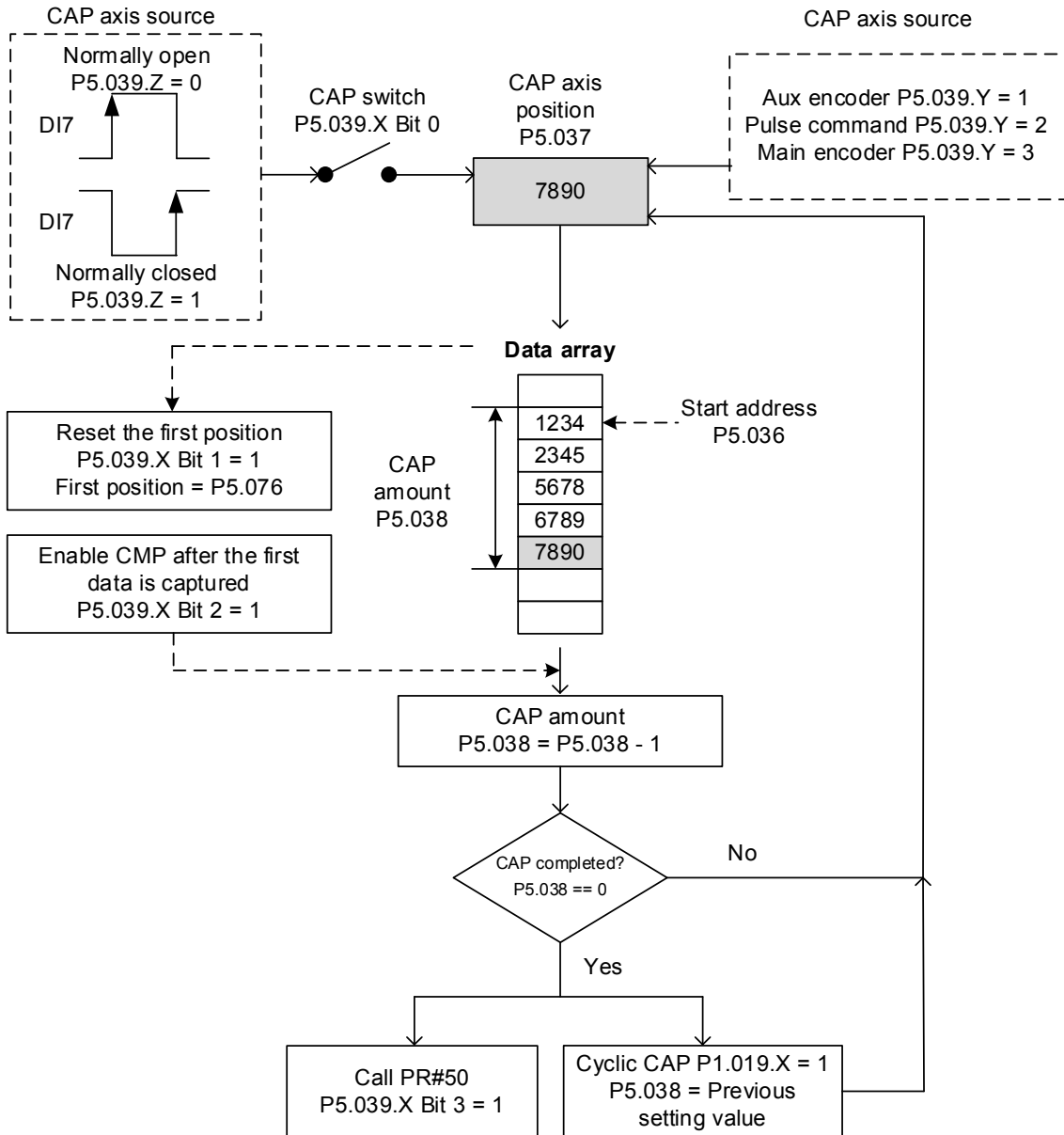


Figure 7.2.2.1 Flow chart of high-speed position capturing

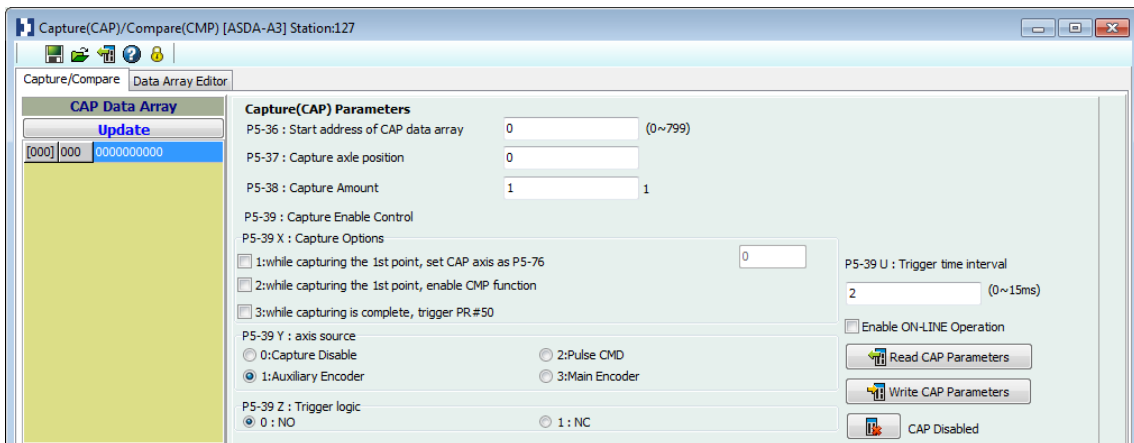


Figure 7.2.2.2 Capture function operation screen in ASDA-Soft

To use motion commands with the Capture function, using PR path programming is suggested. Users can use write commands to set the high-speed position capturing function, as well as executing motion commands once setting completed. See example in Figure 7.2.2.3. PR#1 confirms that the Capture function is disabled (P5.039.X Bit 0 = 0). PR#2 sets the start position of data array to #100. PR#3 sets the capturing amount as 3. PR#4 sets the capturing axis' position to 0 for the first capture point. PR#5 sets the cyclic capture mode with delay time of 1 ms to ensure the next PR path can be executed with the Capture function. PR#6 enables the Capture function and resets the first point; and once completed, carry on executing PR#50. It selects motor's encoder as the capturing axis, applying 'normally closed' contact as trigger logic with trigger interval of 2 ms. PR#7 sets the speed command at 50 rpm. PR#50 sets the capture position command as 50000 PUU; once command is completed, carry on to PR#51 with the speed command setting at 50 rpm.

From Figure 7.2.2.4, you will find that after DI7 is triggered, the capturing axis will be reset to 0 and the data stored in data array #100 because the reset function of the first point is enabled and P5.076 is set to 0. At the moment DI7 is triggered the second and third time, the position data will be written to the data array #101 and #102. Once the first capture cycle is completed, DO: [0x16]CAP will be on and then PR#50 (high speed position capture command) and PR#51 (motion with fixed speed) will be executed. Then, the servo drive will carry on executing the next cycle; meanwhile, DO: CAP is off when procedure is completed and set the capturing amount to 3. When DI7 is triggered for the fourth time, the capture axis' position will not be reset; the position data of the capturing axis will be written to #100 again. Therefore, the data written in the previous cycle will be replaced. At the moment DI7 is triggered the fifth and sixth time, the position of capturing axis will be stored in data array #101 and #102. As soon as the second capture cycle is finished, DO: [0x16]CAP is on and then PR#50 (high speed position capture command) and PR#51 (motion with fixed speed) will be executed.

When applying cyclic capture mode (P1.019.X = 1), the reset function is only valid for the first cycle. For the setting of carrying on executing PR path is valid for every cycle; in other words, every time a cycle ends, PR#50 will be executed. The first position data captured in every cycle will be written to the data array set by P5.036 and then other data will be written in sequence. So, position data written in the previous cycle will always be replaced by that of the next cycle.



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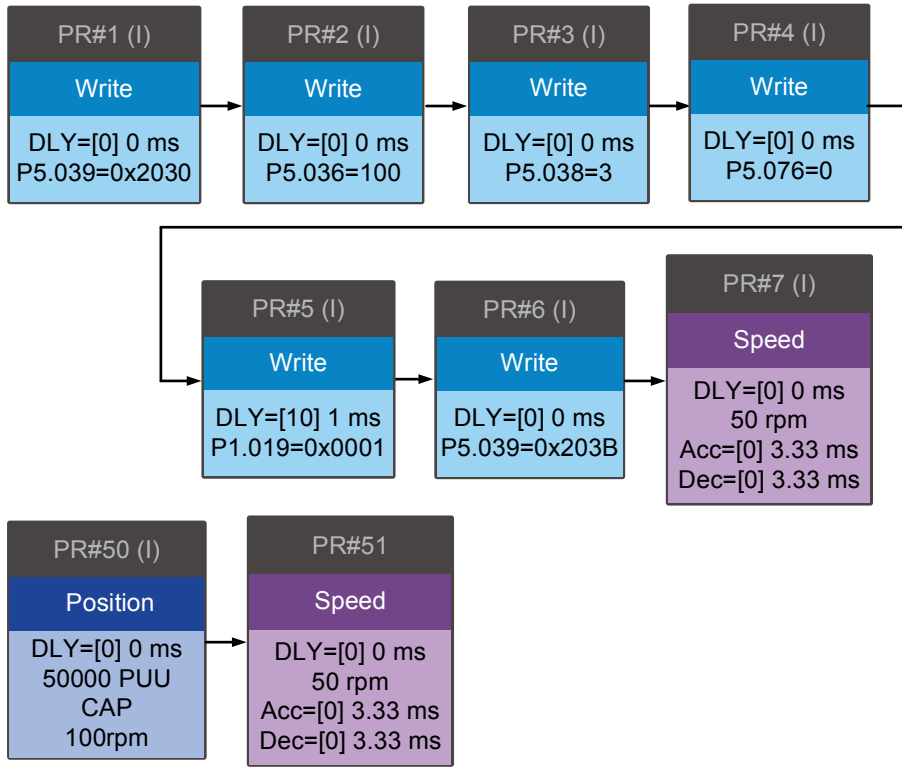


Figure 7.2.2.3 PR path with application of high-speed capture function

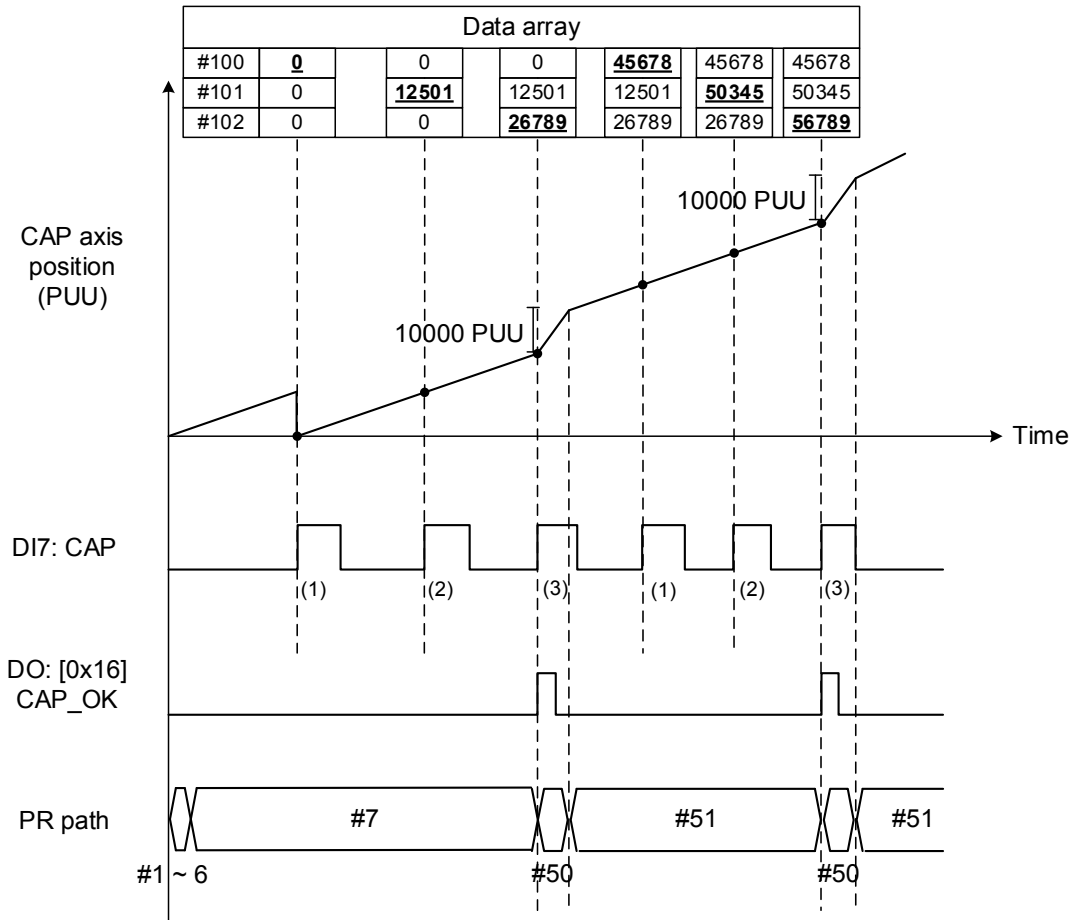


Figure 7.2.2.4 Application example of high-speed capturing function

### 7.2.3 High-speed position comparing function (Compare)

The concept of high-speed position comparing (simplified as CMP) is to compare the instant position of the motion axis with the value saved in data array. When the compare condition is fulfilled, DO4 (with execution time 5  $\mu$ s only), a high-speed digital signal will be output immediately for motion control. As this function is carried out by the hardware, no lag will be in the software and the comparing is more accurate on high speed motion axes. When Compare function is enabled, the servo drive will employ DO4 to force output a signal, which is not user-defined.

As shown in Figure 7.2.3.1 Flow chart of setting Compare function, P5.056 stores the start position of the data array for comparing, which default is #50 in data array. And users have to write the position data to be compared to the data array beforehand. P5.058, data size to be compared, has to be greater than 0, or the function is invalid. P5.059 is the switch of the Compare function and for other settings. You can find more information in the table below. Please note that when the comparing source is the encoder, pulse resolution of the comparing axis is set by P1.046 (numerator) and P1.097 (denominator) with default value of 2500 and 0 respectively; that is, the moving distance of the comparing axis is 10000 PUU per rotation of motor. Comparing position in data array can be shifted with the setting of P1.023 (non-volatile) and P1.024 (volatile). P1.024 can be reset to 0 once the shift has been done and this function can be enabled by P1.019.Z. The Compare function can also be set through ASDA-Soft, as shown in Figure 7.2.3.2.

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P5.059	bit	Function	Description
X	0	Enable high-speed position compare function	When P5.058 is greater than 0 and bit 0 is set to 1, the comparing starts. Value of P5.058 decreases 1 every time a point in data array is compared. When P5.058 becomes 0, bit 0 will be automatically cleared to 0. If bit 0 is 1, the new value to be written cannot be 1; you can only write 0 to disable the Compare function.
	1	Cycle mode	If bit 1 is set to 1 and all compare procedure is completed, P5.058 will reset to the setting value and then compare procedure will start again.
	2	Enable Capture function after data compared	If bit 2 is 1, after all comparing is done, enable the Capture function (Set P5.039.X bit 0 to 1, and set the previous value to P5.038 as the data size to be captured); if Capture function has been enabled, then this function is invalid.
	3	Reset position of the comparing axis to 0	If bit 3 is 1, set P5.057 to 1 once comparing is completed, the position of comparing axis will be cleared to 0.
Y	-	Source setting of comparing axis	0: Capturing axis 1: Auxiliary encoder (CN5) 2: Pulse command (CN1) 3: Encoder of the motor (CN2) If capturing axis is selected, source of the capturing axis (P5.039.Y) cannot be changed. If encoder of the motor is selected, pulse resolution is determined by P1.046 (Encoder pulse number output setting) and P1.097.
Z	-	Trigger logic	0: NO (normally open); 1 : NC (normally closed)
U	-	Trigger PR path	If bit 0 is set to 1, PR#45 will be triggered once the last data is compared.
CBA	-	Pulse output duration (ms)	-

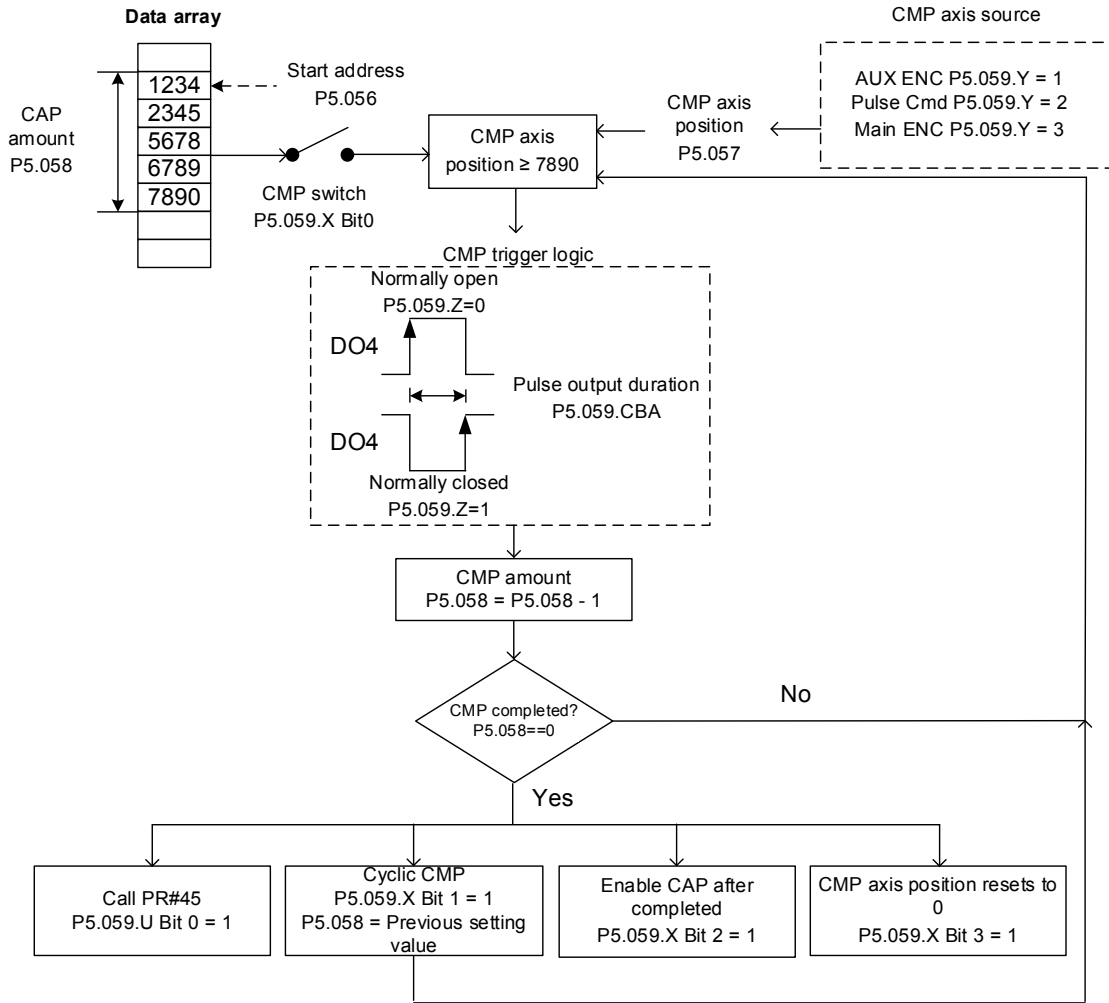


Figure 7.2.3.1 Flow chart of high-speed position compare function

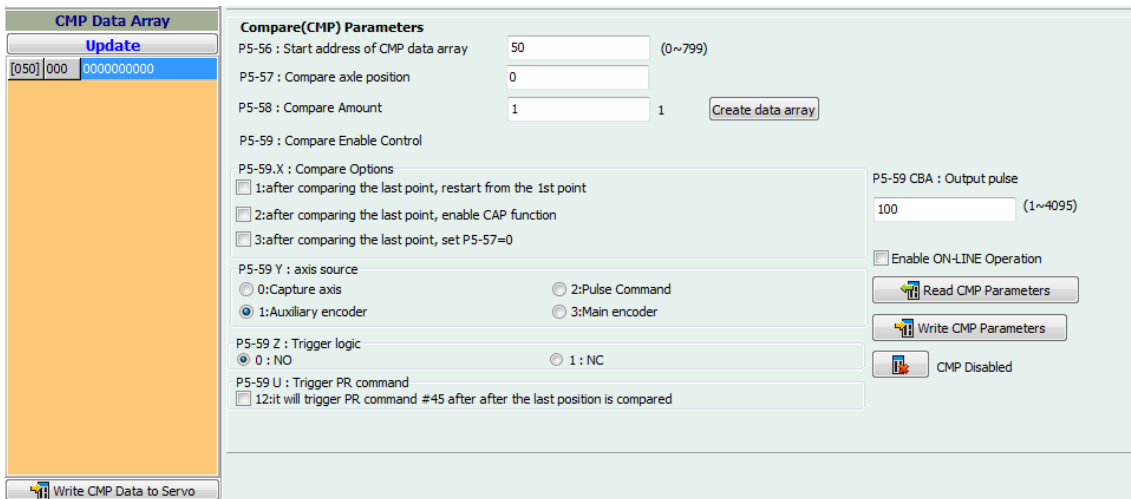


Figure 7.2.3.2 Operation screen of Compare function in ASDA-Soft

## 7

To use motion command with the Compare function, using PR path programming is suggested. Users can use write commands to edit contents of data array and set the high-speed position compare function, as well as executing the motion command once setting completed. As demonstrated in Figure 7.2.3.3, set the numerator (P1.046) and denominator (P1.097) of the encoder's pulse output, which default is based on the comparing axis runs 10000 pulses per rotation of motor. PR#1 ~ 3 use write commands to edit data array #50 ~ 52. PR#4 confirms that the Compare function is disabled (P5.039.X Bit 0 = 0). PR#5 sets the start position to #50. PR#6 sets the comparing amount to 3 and set a delay of 1 ms to ensure the PR path with the use of Compare function can be executed. PR#7 enables the Compare function in cycle mode which will clear comparing axis to 0 after compare completed and execute PR#45. It selects encoder of the motor as the capturing axis, setting 'normally closed' as the trigger logic with pulse output duration of 100 ms. PR#8 sets the speed command to 50 rpm. PR#45 sets the incremental command to 50000 PUU and then carries on to PR#46, keeping the speed command setting of 50 rpm.

From Figure 7.2.3.4, you will find when the comparing axis runs to 20000 pulses, it is identical to content of data array #50 and the first DO4 is on. When the comparing axis runs to 30000 pulses, it is identical to content of data array #51 and the second DO4 is on. While comparing axis runs to 40000 pulses, it is identical to content of data array #52 and the third DO4 is on. Once the first cycle completes, the comparing axis resets to 0 and starts to execute PR#45 (incremental command 50000 PUU), which is equivalent to motor's half turn. Therefore, the comparing axis outputs 5000 pulses, and after completing the position command will carry on to execute the speed command. Then, the next comparing cycle starts. Same as the first cycle, the comparing axis outputs DO4 signal at 20000, 30000, and 40000 pulses respectively and then it resets to 0 and PR#45 is executed.

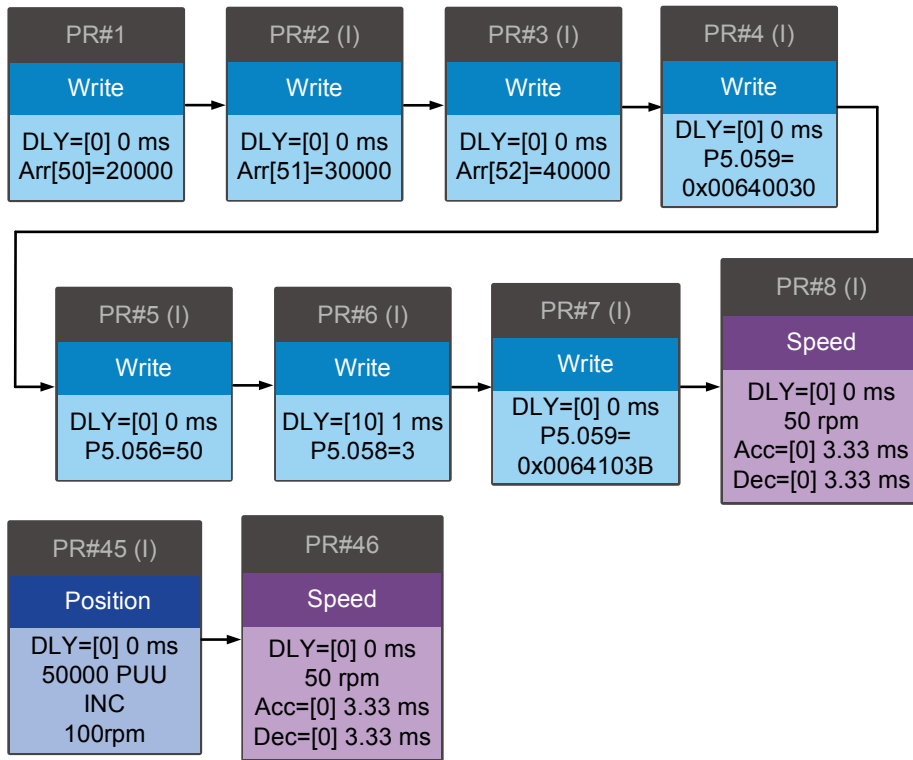


Figure 7.2.3.3 PR path with application of Compare function

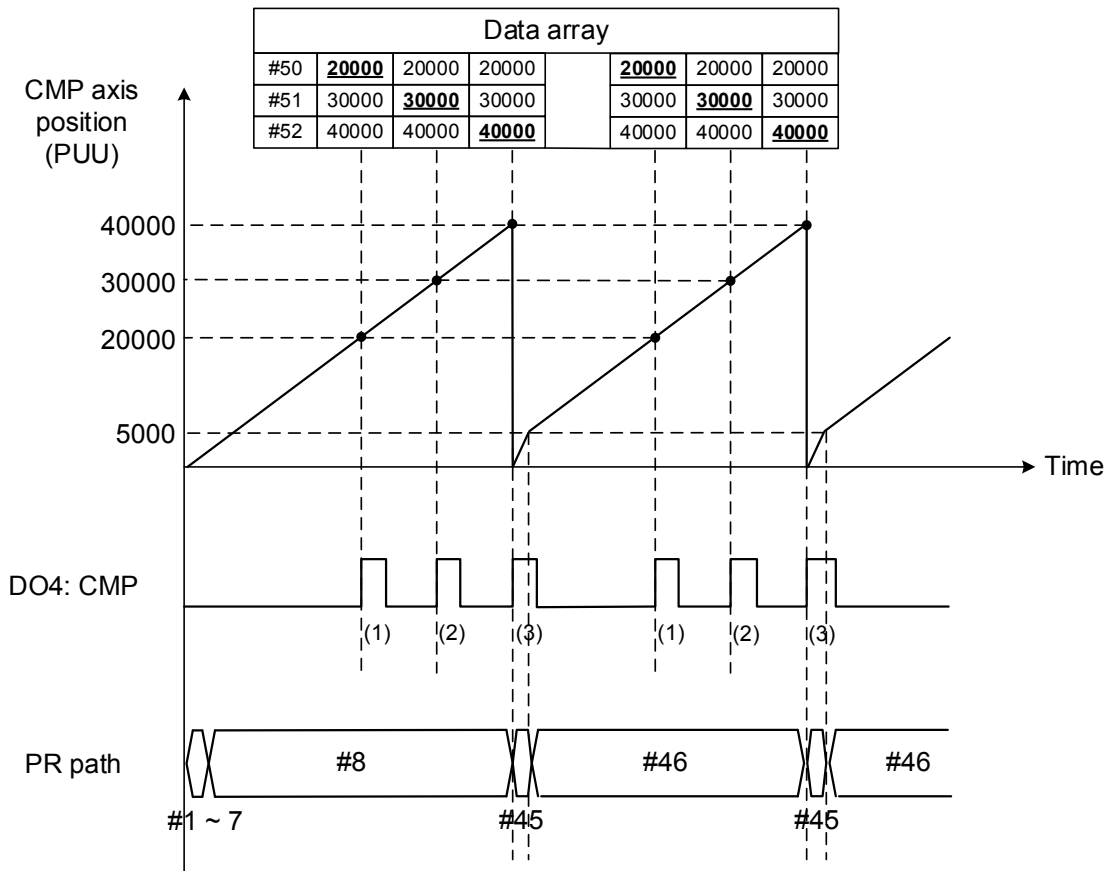


Figure 7.2.3.4 Application of Compare function

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# Parameters

# 8

This chapter introduces the parameter settings of this servo drive, as well as the assignments of digital input (DI) and digital output (DO). Users can use different parameters to set the function of the drive.

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## 8

## 8.1 Definition of parameters

Servo drive parameters are divided into several groups. The first character after the start code P is the group character and the following three characters are the parameter character. As for the communication address, it is the combination of group number along with the three-digit number in hexadecimal. The definition of parameter groups is as follows:

Group 0: Monitoring parameters	(Example: P0.xxx)
Group 1: Basic parameters	(Example: P1.xxx)
Group 2: Extension parameters	(Example: P2.xxx)
Group 3: Communication parameters	(Example: P3.xxx)
Group 4: Diagnosis parameters	(Example: P4.xxx)
Group 5: Motion control parameters	(Example: P5.xxx)
Group 6: PR parameters	(Example: P6.xxx)
Group 7: PR parameters	(Example: P7.xxx)

### Control mode description:

- PT: Position control (command input by terminal block)
- PR: Position control (command issued by internal register)
- S: Speed control
- T: Torque control
- DMC: DMCNET control

### Special symbol description:

Icon of parameter property	Description
★	Read-only parameter. Can only read the status. For example, P0.000, P0.010, P4.000, etc.
▲	Parameter cannot be set when servo is in On status. For example, P1.000 and P1.046.
•	Parameter settings will become valid after re-powering. For example, P1.000 and P3.000.
■	Restore to default parameter value after power off. For example, P2.031 and P3.006.

## 8.2 List of parameters

### Monitor and general output setting parameters

Parameter No.	Function	Default value	Unit	Control mode			
				PT	PR	S	T
P0.000★	Firmware version	Factory setting	-	O	O	O	O
P0.001■	Servo drive current displayed alarm code (7-segment display)	-	-	O	O	O	O
P0.002	Servo drive status display	00	-	O	O	O	O
P0.003	Analog output monitoring	01	-	O	O	O	O
P0.008★	Servo drive total operation time	0	hour	-	-	-	-
P0.009★	Status monitoring register 1	-	-	O	O	O	O
P0.010★	Status monitoring register 2	-	-	O	O	O	O
P0.011★	Status monitoring register 3	-	-	O	O	O	O
P0.012★	Status monitoring register 4	-	-	O	O	O	O
P0.013★	Status monitoring register 5	-	-	O	O	O	O
P0.017	Select content displayed by status monitoring register 1	0	-	-	-	-	-
P0.018	Select content displayed by status monitoring register 2	0	-	-	-	-	-
P0.019	Select content displayed by status monitoring register 3	0	-	-	-	-	-
P0.020	Select content displayed by status monitoring register 4	0	-	-	-	-	-
P0.021	Select content displayed by status monitoring register 5	0	-	-	-	-	-
P0.025	Mapping parameter# 1	-	-	O	O	O	O
P0.026	Mapping parameter# 2	-	-	O	O	O	O
P0.027	Mapping parameter# 3	-	-	O	O	O	O
P0.028	Mapping parameter# 4	-	-	O	O	O	O
P0.029	Mapping parameter# 5	-	-	O	O	O	O
P0.030	Mapping parameter# 6	-	-	O	O	O	O
P0.031	Mapping parameter# 7	-	-	O	O	O	O
P0.032	Mapping parameter# 8	-	-	O	O	O	O
P0.035	Target setting of mapping parameter P0.025	-	-	O	O	O	O
P0.036	Target setting of mapping parameter P0.026	-	-	O	O	O	O
P0.037	Target setting of mapping parameter P0.027	-	-	O	O	O	O
P0.038	Target setting of mapping parameter P0.028	-	-	O	O	O	O

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**Monitor and general output setting parameters (continued)**

Parameter No.	Function	Default value	Unit	Control mode			
				PT	PR	S	T
P0.039	Target setting of mapping parameter P0.029	-	-	O	O	O	O
P0.040	Target setting of mapping parameter P0.030	-	-	O	O	O	O
P0.041	Target setting of mapping parameter P0.031	-	-	O	O	O	O
P0.042	Target setting of mapping parameter P0.032	-	-	O	O	O	O
P0.046★	Servo drive digital output (DO) status display	0	-	O	O	O	O
P1.101	Analog monitor output voltage 1	0	mV	O	O	O	O
P1.102	Analog monitor output voltage 2	0	mV	O	O	O	O

- (★) Read-only register. Can only read the status. For example, P0.000, P0.010, P4.000, etc.  
 (▲) Parameter cannot be set when servo is in On status. For example, P1.000 and P1.046.  
 (●) Parameter settings will become valid after re-powering. For example, P1.001 and P3.000.  
 (■) Parameter does not memorize setting value after power off. For example, P2.031 and P3.006.

**Filter and resonance suppression parameters**

Parameter No.	Function	Default value	Unit	Control mode			
				PT	PR	S	T
P1.006	Smooth constant of speed command (Low-pass filter)	0	ms	-	-	O	-
P1.007	Smooth constant of torque command (Low-pass filter)	0	ms	-	-	-	O
P1.008	Smooth constant of position command (Low-pass filter)	0	10 ms	O	O	-	-
P1.025	Low-frequency vibration suppression frequency (1)	1000	0.1 Hz	O	O	-	-
P1.026	Low-frequency vibration suppression gain (1)	0	-	O	O	-	-
P1.027	Low-frequency vibration suppression frequency (2)	1000	0.1 Hz	O	O	-	-
P1.028	Low-frequency vibration suppression gain (2)	0	-	O	O	-	-
P1.029	Auto low-frequency vibration suppression setting	0	-	O	O	-	-
P1.030	Low-frequency vibration detection	500	pulse	O	O	-	-
P1.034	Acceleration constant of S-curve	200	ms	-	-	O	-
P1.035	Deceleration constant of S-curve	200	ms	-	-	O	-
P1.036	Acceleration / deceleration constant of S-curve	0	ms	-	O	O	-
P1.062	Percentage of friction compensation	0	%	O	O	O	O
P1.063	Constant of friction compensation	1	ms	O	O	O	O
P1.068	Position command moving filter	4	ms	O	O	-	-
P1.075	Low-pass filter time constant of full- and half-closed loop control	100	ms	O	O	-	-
P1.089	First set of vibration elimination - Anti-resonance frequency	4000	0.1 Hz	O	O	-	-
P1.090	First set of vibration elimination - Resonance frequency	4000	0.1 Hz	O	O	-	-
P1.091	First set of vibration elimination - Resonance difference	10	0.1 dB	O	O	-	-

## Filter and resonance suppression parameters (continued)

Parameter No.	Function	Default value	Unit	Control mode			
				PT	PR	S	T
P1.092	Second set of vibration elimination - Anti-resonance frequency	4000	0.1 Hz	O	O	-	-
P1.093	Second set of vibration elimination - Resonance frequency	4000	0.1 Hz	O	O	-	-
P1.094	Second set of vibration elimination - Resonance difference	10	0.1 dB	O	O	-	-
P2.023	Resonance suppression (Notch filter) (1)	1000	Hz	O	O	O	O
P2.024	Resonance suppression (Notch filter) attenuation rate (1)	0	-dB	O	O	O	O
P2.043	Resonance suppression (Notch filter) (2)	1000	Hz	O	O	O	O
P2.044	Resonance suppression (Notch filter) attenuation rate (2)	0	-dB	O	O	O	O
P2.045	Resonance suppression (Notch filter) (3)	1000	Hz	O	O	O	O
P2.046	Resonance suppression (Notch filter) attenuation rate (3)	0	-dB	O	O	O	O
P2.047	Auto resonance suppression mode setting	1	-	O	O	O	O
P2.048	Auto resonance detection level	100	-	O	O	O	O
P2.025	Low-pass filter of resonance suppression	1.0 (panel / software)	1 ms (panel / software)	O	O	O	O
		10 (communication)	0.1 ms (communication)				
P2.049	Speed detection filter and jitter suppression	0	-	O	O	O	O
P2.095	Resonance suppression (Notch filter) width (1)	5	-	O	O	O	O
P2.096	Resonance suppression (Notch filter) width (2)	5	-	O	O	O	O
P2.097	Resonance suppression (Notch filter) width (3)	5	-	O	O	O	O
P2.098	Resonance suppression (Notch filter) (4)	1000	Hz	O	O	O	O
P2.099	Resonance suppression (Notch filter) attenuation rate (4)	0	-dB	O	O	O	O
P2.100	Resonance suppression (Notch filter) width (4)	5	-	O	O	O	O
P2.101	Resonance suppression (Notch filter) (5)	1000	Hz	O	O	O	O
P2.102	Resonance suppression (Notch filter) attenuation rate (5)	0	-dB	O	O	O	O
P2.103	Resonance suppression (Notch filter) width (5)	5	-	O	O	O	O

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## Gain and switching parameters

Parameter No.	Function	Default value	Unit	Control mode			
				PT	PR	S	T
P1.037	Load inertia ratio and load weight ratio to servo motor	6.0 (panel / software)	1 times (panel / software)	O	O	O	O
		60 (communication)	0.1 times (communication)				
P2.000	Position control gain	35	rad/s	O	O	-	-
P2.001	Changing rate of position control gain	100	%	O	O	-	-
P2.002	Position feed forward gain	50	%	O	O	-	-
P2.003	Smooth constant of position feed forward gain	5	ms	O	O	-	-
P2.004	Speed control gain	500	rad/s	O	O	O	O
P2.005	Changing rate of speed control gain	100	%	O	O	O	O
P2.006	Speed integral compensation	100	rad/s	O	O	O	O
P2.007	Speed feed forward gain	0	%	O	O	O	O
P2.026	Anti-interference gain	0	rad/s	O	O	O	O
P2.027	Gain switching condition and method selection	0	-	O	O	O	O
P2.028	Gain switching time constant	10	10 ms	O	O	O	O
P2.029	Gain switching condition	16777216	pulse kpps rpm	O	O	O	O
P2.031	Response bandwidth level	19	Hz	O	O	O	O
P2.032	Gain adjustment mode	1	-	O	O	O	O
P2.053	Position integral compensation	0	rad/s	O	O	O	O
P2.089	Command responsiveness gain	25	rad/s	O	O	-	-
P2.094▲	Special bit register 3	0x1000	-	O	O	O	-
P2.104	P/PI torque switching command condition	200	[%]	O	O	O	-
P2.105	Automatic gain adjustment level 1	11	-	O	O	-	-
P2.106	Automatic gain adjustment level 2	2000	-	O	O	-	-
P2.112▲	Special bit register 4	0x0008	-	O	O	O	-

- (★) Read-only register. Can only read the status. For example, P0.000, P0.010, P4.000, etc.
- (▲) Parameter cannot be set when servo is in On status. For example, P1.000 and P1.046.
- (●) Parameter settings will become valid after re-powering. For example, P1.001 and P3.000.
- (■) Parameter does not memorize setting value after power off. For example, P2.031 and P3.006.

**Position control parameters**

Parameter No.	Function	Default value	Unit	Control mode			
				PT	PR	S	T
P1.001●	Input settings of control mode and control command	0	pulse r/min N-M	O	O	O	O
P1.002▲	Speed and torque limit settings	0	-	O	O	O	O
P1.003	Polarity setting of encoder pulse output	0	-	O	O	O	O
P1.012 ~ P1.014	Internal torque limit 1 ~ 3	100	%	O	O	O	-
P1.044▲	E-Gear ratio (Numerator) (N1)	16777216	pulse	O	-	-	-
P1.045▲	E-Gear ratio (Denominator) (M)	100000	pulse	O	-	-	-
P1.046▲	Encoder pulse number output setting	2500	pulse	O	O	O	O
P1.055	Max. speed limit	Same as the rated speed of each model	rpm	O	O	O	O
P1.097▲	Encoder output denominator	0	-	O	O	O	O
P5.003	Deceleration time of auto protection	EEEEFFFF	-	O	O	O	O
P5.020 ~ P5.035	Acceleration / deceleration time	200 ~ 30	ms	O	-	-	-
P5.016	Axis position - Motor encoder	0	PUU	O	O	O	O
P5.017	Axis position - Auxiliary encoder	0	pulse	O	O	O	O
P5.018	Axis position - Pulse command	0	pulse	O	O	O	O

**Position control parameters - External pulse control command (PT mode)**

Parameter No.	Function	Default value	Unit	Control mode			
				PT	PR	S	T
P1.000▲	External pulse input type	0x1042	-	O	-	-	-
P2.060	E-Gear ratio (Numerator) (N2)	16777216	pulse	O	-	-	-
P2.061	E-Gear ratio (Numerator) (N3)	16777216	pulse	O	-	-	-
P2.062	E-Gear ratio (Numerator) (N4)	16777216	pulse	O	-	-	-

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## Position control parameters - Internal register control command (PR mode)

Parameter No.	Function	Default value	Unit	Control mode			
				PT	PR	S	T
P5.008	Forward software limit	+2 <sup>31</sup>	PUU	-	O	-	-
P5.009	Reverse software limit	-2 <sup>31</sup>	PUU	-	O	-	-
P6.002 ~ P7.099 ~	Internal position command 1 ~ 99	0	-	-	O	-	-
P5.060 ~ P5.075 ~	Internal position command controls the movement speed settings from 0 ~ 15	20 ~ 3000 (panel / software)	1 rpm (panel / software)	-	O	-	-
		200 ~ 30000 (communication)	0.1 rpm (communication)				
P5.004	Homing methods	0	-	-	O	-	-
P5.005	First speed setting of high speed homing	100 (panel / software)	1 rpm (panel / software)	-	O	-	-
		1000 (communication)	0.1 rpm (communication)				
P5.006	Second speed setting of low speed homing	20 (panel / software)	1 rpm (panel / software)	-	O	-	-
		200 (communication)	0.1 rpm (communication)				
P5.007	Trigger position command (PR mode only)	0	-	-	O	-	-
P5.040 ~ P5.055 ~	Delay time after position reached	0 ~ 5500	ms	-	O	-	-
P5.098	PR# triggered by event rising-edge	0	-	-	O	-	-
P5.099	PR# triggered by event falling-edge	0	-	-	O	-	-
P5.015	PATH#1 ~ PATH#2 Volatile setting	0x0	-	-	O	-	-

- (★) Read-only register. Can only read the status. For example, P0.000, P0.010, P4.000, etc.
- (▲) Parameter cannot be set when servo is in On status. For example, P1.000 and P1.046.
- (●) Parameter settings will become valid after re-powering. For example, P1.001 and P3.000.
- (■) Parameter does not memorize setting value after power off. For example, P2.031 and P3.006.

**Speed control parameters**

Parameter No.	Function	Default value	Unit	Control mode			
				PT	PR	S	T
P1.001●	Input settings of control mode and control command	0	pulse rpm N-M	O	O	O	O
P1.002▲	Speed and torque limit settings	0	-	O	O	O	O
P1.003	Polarity setting of encoder pulse output	0	-	O	O	O	O
P1.046▲	Encoder pulse number output setting	2500	pulse	O	O	O	O
P1.055	Max. speed limit	rated	rpm	O	O	O	O
P1.009 ~ P1.011	Internal speed command 1 ~ 3	1000 ~ 3000	0.1 rpm	-	-	O	O
P1.012 ~ P1.014	Internal torque limit 1 ~ 3	100	%	O	O	O	O
P1.040	Max. rotation speed of analog speed command	3000	rpm	-	-	O	O
P1.041	Max. output of analog torque limit	100	%	O	O	O	O
P1.076	Max. speed setting of encoder output (OA, OB)	5500	rpm	O	O	O	O

**Torque control parameters**

Parameter No.	Function	Default value	Unit	Control mode			
				PT	PR	S	T
P1.001●	Input settings of control mode and control command	0	pulse rpm N-M	O	O	O	O
P1.002▲	Speed and torque limit settings	0	-	O	O	O	O
P1.003	Polarity setting of encoder pulse output	0	-	O	O	O	O
P1.046▲	Encoder pulse number output setting	2500	pulse	O	O	O	O
P1.055	Max. speed limit	rated	rpm	O	O	O	O
P1.009 ~ P1.011	Internal speed limit 1 ~ 3	1000 ~ 3000	0.1 rpm	-	-	O	O
P1.012 ~ P1.014	Internal torque command 1 ~ 3	100	%	O	O	O	O
P1.040	Max. rotation speed of analog speed command	3000	rpm	-	-	O	O
P1.041▲	Max. output of analog torque limit	100	%	O	O	O	O

**Planning of digital input / output pin and output setting parameters**

Parameter No.	Function	Default value	Unit	Control mode			
				PT	PR	S	T
P0.053	Extensive range compare DO output – Filter time	0	ms	O	O	O	O
P0.054	General range compare DO output - First lower limit	0	-	O	O	O	O



## Planning of digital input / output pin and output setting parameters (continued)

Parameter No.	Function	Default value	Unit	Control mode			
P0.055	General range compare DO output - First upper limit	0	-	○	○	○	○
P2.009	Response filter time of DI	2	ms	○	○	○	○
P2.010	DI1 functional planning	101	-	○	○	○	○
P2.011	DI2 functional planning	104	-	○	○	○	○
P2.012	DI3 functional planning	116	-	○	○	○	○
P2.013	DI4 functional planning	117	-	○	○	○	○
P2.014	DI5 functional planning	102	-	○	○	○	○
P2.015	DI6 functional planning	022	-	○	○	○	○
P2.016	DI7 functional planning	023	-	○	○	○	○
P2.017	DI8 functional planning	021	-	○	○	○	○
P2.018	DO1 functional planning	101	-	○	○	○	○
P2.019	DO2 functional planning	103	-	○	○	○	○
P2.020	DO3 functional planning	109	-	○	○	○	○
P2.021	DO4 functional planning	105	-	○	○	○	○
P2.022	DO5 functional planning	7	-	○	○	○	○
P2.036	DI9 functional planning	0	-	○	○	○	○
P2.037	DI10 functional planning	0	-	○	○	○	○
P2.038	VDI11 functional planning	0	-	○	○	○	○
P2.039	VDI12 functional planning	0	-	○	○	○	○
P2.040	VDI13 functional planning	0	-	○	○	○	○
P2.041	DO6 functional planning	0	-	○	○	○	○
P1.038	Zero speed range setting	10.0 (panel / software)	1 rpm (panel / software)	○	○	○	○
		100 (communication)	0.1 rpm (communication)				
P1.039	Target speed detection level	3000	rpm	○	○	○	○
P1.042	Enable delay time of magnetic brake	0	ms	○	○	○	○
P1.043	Disable delay time of magnetic brake	0	ms	○	○	○	○
P1.047	Speed reached (DO.SP_OK) range	10	rpm	-	○	-	○
P1.054	Range of position reached	167772	pulse	○	-	-	○
P1.056	Motor output overload warning level	120	%	○	○	○	○

- (★) Read-only register. Can only read the status. For example, P0.000, P0.010, P4.000, etc.
- (▲) Parameter cannot be set when servo is in On status. For example, P1.000 and P1.046.
- (●) Parameter settings will become valid after re-powering. For example, P1.001 and P3.000.
- (■) Parameter does not memorize setting value after power off. For example, P2.031 and P3.006.

## Communication parameters

Parameter No.	Function	Default value	Unit	Control mode			
				PT	PR	S	T
P3.000●	Address setting	0x7F	-	O	O	O	O
P3.001●	Transmission speed	0x0203	Bps	O	O	O	O
P3.002	Communication protocol	6	-	O	O	O	O
P3.003	Communication error handling	0	-	O	O	O	O
P3.004	Communication timeout setting	0	sec	O	O	O	O
P3.005	Communication mechanism	0	-	O	O	O	O
P3.006■	Control switch of digital input (DI)	0	-	O	O	O	O
P3.007	Communication response delay time	0	1 ms	O	O	O	O
P3.009	Communication synchronize setting	0x5055 (CANopen)	-	-	-	-	-
		0x3511 (DMCNET)	-	-	-	-	
P3.010	CANopen / DMCNET protocol setting	1	-	-	-	-	-
P3.011	CANopen / DMCNET options	0	-	-	-	-	-
P3.012	CANopen / DMCNET support settings	0	-	-	-	-	-

## Diagnosis parameters

Parameter No.	Function	Default value	Unit	Control mode			
				PT	PR	S	T
P4.000★	Fault record (N)	0	-	O	O	O	O
P4.001★	Fault record (N-1)	0	-	O	O	O	O
P4.002★	Fault record (N-2)	0	-	O	O	O	O
P4.003★	Fault record (N-3)	0	-	O	O	O	O
P4.004★	Fault record (N-4)	0	-	O	O	O	O
P4.005	Servo motor JOG control	20	rpm	O	O	O	O
P4.006▲■	Digital output register (readable and writable)	0	-	O	O	O	O
P4.007	Multi-function of digital input	0	-	O	O	O	O
P4.008★	Input status of servo drive panel (read-only)	-	-	O	O	O	O
P4.009★	Digital output status display (read-only)	-	-	O	O	O	O
P4.010▲	Adjustment function selection	0	-	O	O	O	O
P4.011	Analog speed input (1) offset adjustment	Factory setting	-	O	O	O	O
P4.012	Analog speed input (2) offset adjustment	Factory setting	-	O	O	O	O

## Diagnosis parameters (continued)

Parameter No.	Function	Default value	Unit	Control mode			
				PT	PR	S	T
P4.013	Analog torque input (1) offset adjustment	Factory setting	-	O	O	O	O
P4.014	Analog torque input (2) offset adjustment	Factory setting	-	O	O	O	O
P4.015	Current encoder (V1 phase) offset adjustment	Factory setting	-	O	O	O	O
P4.016	Current encoder (V2 phase) offset adjustment	Factory setting	-	O	O	O	O
P4.017	Current encoder (W1 phase) offset adjustment	Factory setting	-	O	O	O	O
P4.018	Current encoder (W2 phase) offset adjustment	Factory setting	-	O	O	O	O
P4.019	IGBT NTC adjustment level (cannot reset)	Factory setting	-	O	O	O	-
P4.020	Offset adjustment value of analog monitor output (Ch1)	0	mV	O	O	O	O
P4.021	Offset adjustment value of analog monitor output (Ch2)	0	mV	O	O	O	O
P4.022	Analog speed input OFFSET	0	mV	O	O	O	O
P4.023	Analog torque input OFFSET	0	mV	O	O	O	O

- (★) Read-only register. Can only read the status. For example, P0.000, P0.010, P4.000, etc.
- (▲) Parameter cannot be set when servo is in On status. For example, P1.000 and P1.046.
- (●) Parameter settings will become valid after re-powering. For example, P1.001 and P3.000.
- (■) Parameter does not memorize setting value after power off. For example, P2.031 and P3.006.

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## 8.3 Description of parameters

### P0.xxx Monitoring parameters

<b>P0.000★</b>	<b>Firmware version</b>		<b>Address: 0000H 0001H</b>
Default:	Factory setting	Control mode:	All
Unit:	-	Setting range:	-
Format:	DEC	Data size:	16-bit

Settings:

Shows the firmware version of the servo drive.

<b>P0.001■</b>	<b>Alarm code display of drive (Seven-segment display)</b>		<b>Address: 0002H 0003H</b>
Default:	-	Control mode:	All
Unit:	-	Setting range:	0X0000: Alarm Clear (same as DI.ARST). 0x0001~0xFFFF: Displays the alarm code (not writable).
Format:	HEX	Data size:	16-bit

Settings:

For the list of alarms, please refer to Section 11.1 Alarm list.

<b>P0.002</b>	<b>Drive status display</b>		<b>Address: 0004H 0005H</b>
Default:	0	Control mode:	All
Unit:	-	Setting range:	-300 ~ 127
Format:	DEC	Data size:	16-bit

Settings:

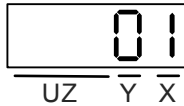
The panel displays partial of the parameter settings. Input the monitoring variable to P0.002 to view the changes of variables from the panel. For the list of monitoring variables, please refer to Table 8.3

Description of monitoring variables.

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<b>P0.003</b>	<b>Analog output monitoring</b>		<b>Address: 0006H 0007H</b>	
Default:	0x0000	Control mode:	All	
Unit:	-	Setting range:	0 ~ 77	
Format:	HEX	Data size:	16-bit	

Settings:



- X: MON2
- Y: MON1
- UZ: Reserved

MON1 and MON2 Setting Value	Description	MON1 and MON2 Setting Value	Description
0	Motor speed (+/- 8 volts / Max. speed)	4	Torque command (+/- 8 volts / Max. torque command)
1	Motor torque (+/- 8 volts / Max. torque)	5	VBUS voltage (+/- 8 volts / 450V)
2	Pulse command frequency (+8 volts / 4.5 Mpps)	6	Reserved
3	Speed command (+/- 8 volts / Max. speed command)	7	Reserved

Note: Please refer to parameters P1.004 and P1.005 for the proportional setting of analog output voltage.

For example: When P0.003 is set to 01 (MON1 is the analog output of motor speed; MON2 is the analog output of motor torque)

$$\text{MON1 output voltage} = 8 \times \frac{\text{Motor speed}}{(\text{Max. speed} \times \frac{P1.004}{100})} \text{ (Unit: volts)}$$

$$\text{MON2 output voltage} = 8 \times \frac{\text{Motor torque}}{(\text{Max. torque} \times \frac{P1.005}{100})} \text{ (Unit: volts)}$$

<b>P0.004 ~ P0.007</b>	<b>Reserved</b>
------------------------	-----------------

<b>P0.008★</b>	<b>Total on time of the servo drive</b>		<b>Address: 0010H 0011H</b>	
Default:	0	Control mode:	All	
Unit:	hour	Setting range:	0 ~ 65535	
Format:	DEC	Data size:	16-bit	

Settings:

Displays the total on time of the servo drive. The unit is by hour and duration less than 1 hour will not be recorded. The recorded hours will be saved when servo off.

4052A

D C B A

L052A

U Z Y X

DCBA	Servo on time	UZYX	Servo power applied time
h	High bit	L	Low bit

<b>P0.009★■</b>	<b>Status monitoring register 1</b>		<b>Address: 0012H 0013H</b>	
Default:	0	Control mode:	All	
Unit:	-	Setting range:	-	
Format:	DEC	Data size:	32-bit	

Settings:

The value to be monitored can be set by P0.017 via the drive panel or communication (Please refer to P0.002). To obtain the status data, the communication port must read the communication address. For example, if P0.017 is set to 3, when accessing P0.009, it will obtain the total feedback pulse number of the motor encoder. If accessing the data via MODBUS communication, two 16-bit data (0012H and 0013H) will be read as one 32-bit data. (0013H : 0012H) = (Hi-word : Low-word). Set P0.002 to 23, and the panel will display VAR-1 to show the content of P0.009.

<b>P0.010★■</b>	<b>Status monitoring register 2</b>		<b>Address: 0014H 0015H</b>	
Default:	-	Control mode:	All	
Unit:	-	Setting range:	-	
Format:	DEC	Data size:	32-bit	

Settings:

The value to be monitored can be set by P0.018 via the drive panel or communication (Please refer to P0.002). To obtain the status data, the communication port must read the communication address. Set P0.002 to 24, and the panel will display VAR-2 to show the content of P0.010.

## 8

<b>P0.011★■</b>	<b>Status monitoring register 3</b>		<b>Address: 0016H 0017H</b>	
Default:	-	Control mode:	All	
Unit:	-	Setting range:	-	
Format:	DEC	Data size:	32-bit	

## Settings:

The value to be monitored can be set by P0.019 via the drive panel or communication (Please refer to P0.002). To obtain the status data, the communication port must read the communication address.

Set P0.002 to 25, and the panel will display VAR-3 to show the content of P0.011.

<b>P0.012★■</b>	<b>Status monitoring register 4</b>		<b>Address: 0018H 0019H</b>	
Default:	-	Control mode:	All	
Unit:	-	Setting range:	-	
Format:	DEC	Data size:	32-bit	

## Settings:

The value to be monitored can be set by P0.020 via the drive panel or communication (Please refer to P0.002). To obtain the status data, the communication port must read the communication address.

Set P0.002 to 26, and the panel will display VAR-3 to show the content of P0.012.

<b>P0.013★■</b>	<b>Status monitoring register 5</b>		<b>Address: 001AH 001BH</b>	
Default:	-	Control mode:	All	
Unit:	-	Setting range:	-	
Format:	DEC	Data size:	32-bit	

## Settings:

The value to be monitored can be set by P0.021 via the drive panel or communication (Please refer to P0.002). To obtain the status data, the communication port must read the communication address.

<b>P0.014 ~ P0.016</b>	<b>Reserved</b>

<b>P0.017</b>	<b>Select content displayed by status monitoring register 1</b>		<b>Address: 0022H 0023H</b>	
Default:	0	Control mode:	All	
Unit:	-	Setting range:	0 ~ 127	
Format:	DEC	Data size:	16-bit	

## Settings:

Please refer to table 8.3 for the setting value.

For example, if P0.017 is set to 07, then reading P0.009 means to read the motor speed (rpm).

<b>P0.018</b>	<b>Select content displayed by status monitoring register 2</b>		<b>Address: 0024H 0025H</b>	
Default:	0	Control mode:	All	
Unit:	-	Setting range:	0 ~ 127	
Format:	DEC	Data size:	16-bit	

Settings:

Please refer to table 8.3 for the setting value.

<b>P0.019</b>	<b>Select content displayed by status monitoring register 3</b>		<b>Address: 0026H 0027H</b>	
Default:	0	Control mode:	All	
Unit:	-	Setting range:	0 ~ 127	
Format:	DEC	Data size:	16-bit	

Settings:

Please refer to table 8.3 for the setting value.

<b>P0.020</b>	<b>Select content displayed by status monitoring register 4</b>		<b>Address: 0028H 0029H</b>	
Default:	0	Control mode:	All	
Unit:	-	Setting range:	0 ~ 127	
Format:	DEC	Data size:	16-bit	

Settings:

Please refer to table 8.3 for the setting value.

<b>P0.021</b>	<b>Select content displayed by status monitoring register 5</b>		<b>Address: 002AH 002BH</b>	
Default:	0	Control mode:	All	
Unit:	-	Setting range:	0 ~ 127	
Format:	DEC	Data size:	16-bit	

Settings:

Please refer to table 8.3 for the setting value.

<b>P0.022 ~ P0.024</b>	<b>Reserved</b>			
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## 8

<b>P0.025■</b>	<b>Mapping parameter #1</b>		<b>Address: 0032H 0033H</b>
Default:	-	Control mode:	All
Unit:	-	Setting range:	Determined by the corresponding parameter of P0.035
Format:	HEX	Data size:	32-bit

Settings:

Users can continuously read and write parameters that are not in the same group faster. P0.035 can be used to specify the mapping parameter number via the panel or communication. The content of the parameter that is specified by P0.035 will be shown in P0.025. Please refer to P0.035 for parameter settings.

<b>P0.026■</b>	<b>Mapping parameter #2</b>		<b>Address: 0034H 0035H</b>
Default:	-	Control mode:	All
Unit:	-	Setting range:	Determined by the corresponding parameter of P0.036
Format:	HEX	Data size:	32-bit

Settings:

The setting is same as P0.025, and the mapping target is set by P0.036.

<b>P0.027■</b>	<b>Mapping parameter #3</b>		<b>Address: 0036H 0037H</b>
Default:	-	Control mode:	All
Unit:	-	Setting range:	Determined by the corresponding parameter of P0.037
Format:	HEX	Data size:	32-bit

Settings:

The setting is same as P0.025, and the mapping target is set by P0.037.

<b>P0.028■</b>	<b>Mapping parameter #4</b>		<b>Address: 0038H 0039H</b>
Default:	-	Control mode:	All
Unit:	-	Setting range:	Determined by the corresponding parameter of P0.038
Format:	HEX	Data size:	32-bit

Settings:

The setting is same as P0.025, and the mapping target is set by P0.038.

<b>P0.029■</b>	<b>Mapping parameter #5</b>		<b>Address: 003AH 003BH</b>
Default:	-	Control mode:	All
Unit:	-	Setting range:	Determined by the corresponding parameter of P0.039
Format:	HEX	Data size:	32-bit

Settings:

The setting is same as P0.025, and the mapping target is set by P0.039.

<b>P0.030■</b>	<b>Mapping parameter #6</b>		<b>Address: 003CH 003DH</b>
Default:	-	Control mode:	All
Unit:	-	Setting range:	Determined by the corresponding parameter of P0.040
Format:	HEX	Data size:	32-bit

Settings:

The setting is same as P0.025, and the mapping target is set by P0.040.

<b>P0.031■</b>	<b>Mapping Parameter #7</b>		<b>Address: 003EH 003FH</b>
Default:	-	Control mode:	All
Unit:	-	Setting range:	Determined by the corresponding parameter of P0.041
Format:	HEX	Data size:	32-bit

Settings:

The setting is same as P0.025, and the mapping target is set by P0.041.

<b>P0.032■</b>	<b>Mapping parameter #8</b>		<b>Address: 0040H 0041H</b>
Default:	-	Control mode:	All
Unit:	-	Setting range:	Determined by the corresponding parameter of P0.042
Format:	HEX	Data size:	32-bit

Settings:

The setting is same as P0.025, and the mapping target is set by P0.042.

<b>P0.033 ~ P0.034</b>	<b>Reserved</b>		
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<b>P0.035</b>	<b>Target setting of mapping parameter P0.025</b>		<b>Address: 0046H 0047H</b>
Default:	-	Control mode:	All
Unit:	-	Setting range:	Determined by the communication address of the parameter group
Format:	HEX	Data size:	32-bit

Settings:

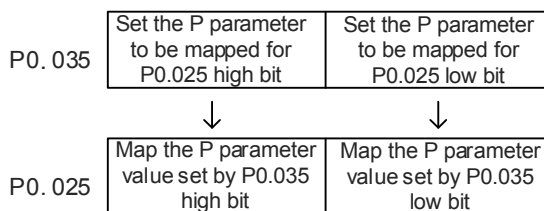
The setting format of high-bit parameter (PH) and low-bit parameter (PL):



BA	Hexadecimal code of parameter index	YX	Hexadecimal code of parameter index
C	Hexadecimal code of parameter group	Z	Hexadecimal code of parameter group
D	N/A	U	N/A
h	High-bit	L	Low-bit

Select the data block to access the parameter corresponded with register 1. The mapping content is 32 bits wide and can map to two 16-bit parameters or one 32-bit parameter.

P0.035: (Mapping parameter: P0.035; Mapping content: P0.025)

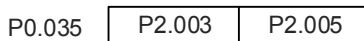


1. When PH ≠ PL, it means the content of P0.025 includes two 16-bit parameters.

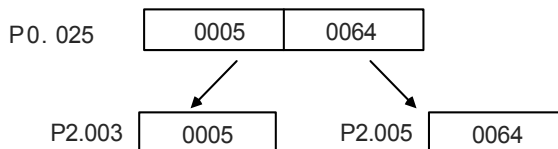
Example: Target: Set P2.003 to 0 via the mapping parameter and set P2.005 to 100.

Setting: Set the P0.035 high bit as 0203 (P2.003) and low bit as 0205 (P2.005).

Thus, P0.035 = 0x02030205.



Write: In the mapping content, set P0.025 to 0x00050064, and the value of P2.003 and P2.005 will be:

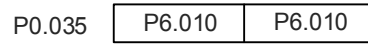


2. When PH = PL = P, it means P0.025 has one 32-bit parameter.

Example: Target: Set P6.010 to 0x00050064 via the mapping parameter.

Setting: Set the high bit / low bit of P0.035 to 060A (P6.010).

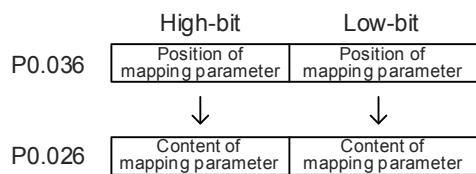
Thus, P6.010 = 0x060A060A.



Write: In the mapping content, set P0.025 to 0x00050064 and P6.010 will change immediately.

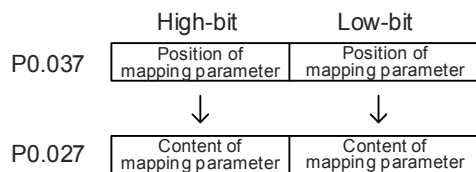
P0.036	Target setting of mapping parameter P0.026		Address: 0048H 0049H
Default:	-	Control mode:	All
Unit:	-	Setting range:	Determined by the communication address of the parameter group
Format:	HEX	Data size:	32-bit

Settings:



P0.037	Target setting of mapping parameter P0.027		Address: 004AH 004BH
Default:	-	Control mode:	All
Unit:	-	Setting range:	Determined by the communication address of the parameter group
Format:	HEX	Data size:	32-bit

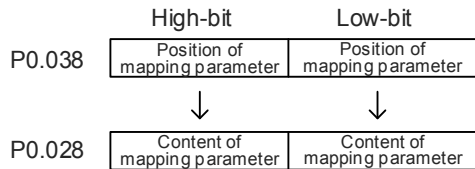
Settings:



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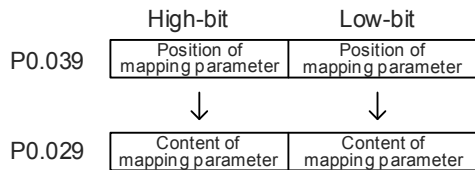
<b>P0.038</b>	<b>Target setting of mapping parameter P0.028</b>		<b>Address: 004CH 004DH</b>
Default:	-	Control mode:	All
Unit:	-	Setting range:	Determined by the communication address of the parameter group
Format:	HEX	Data size:	32-bit

Settings:



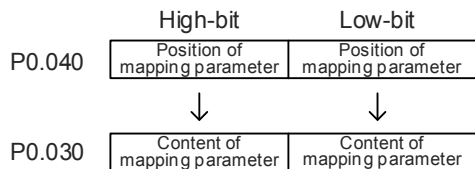
<b>P0.039</b>	<b>Target setting of mapping parameter P0.029</b>		<b>Address: 004EH 004FH</b>
Default:	-	Control mode:	All
Unit:	-	Setting range:	Determined by the communication address of the parameter group
Format:	HEX	Data size:	32-bit

Settings:



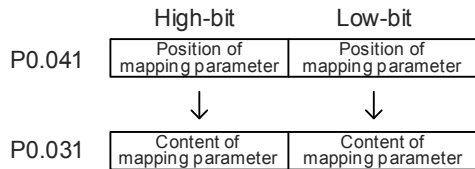
<b>P0.040</b>	<b>Target setting of mapping parameter P0.030</b>		<b>Address: 0050H 0051H</b>
Default:	-	Control mode:	All
Unit:	-	Setting range:	Determined by the communication address of the parameter group
Format:	HEX	Data size:	32-bit

Settings:



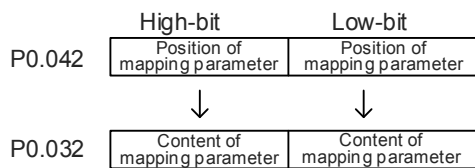
<b>P0.041</b>	<b>Target setting of mapping parameter P0.031</b>		<b>Address: 0052H 0053H</b>
Default:	-	Control mode:	All
Unit:	-	Setting range:	Determined by the communication address of the parameter group
Format:	HEX	Data size:	32-bit

Settings:



<b>P0.042</b>	<b>Target setting of mapping parameter P0.032</b>		<b>Address: 0054H 0055H</b>
Default:	-	Control mode:	All
Unit:	-	Setting range:	Determined by the communication address of the parameter group
Format:	HEX	Data size:	32-bit

Settings:



<b>P0.043</b>	<b>Reserved</b>		
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<b>P0.044★■</b>	<b>Status monitoring register (for PC software)</b>		<b>Address: 0058H 0059H</b>
Default:	0	Control mode:	All
Unit:	-	Setting range:	Determined by the communication address of the parameter group
Format:	DEC	Data size:	32-bit

Settings:

Same as P0.009

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<b>P0.045■</b>	<b>Status monitoring register content selection (for PC software)</b>		<b>Address: 005AH 005BH</b>	
Default:	0	Control mode:	All	
Unit:	-	Setting range:	0 ~ 127	
Format:	DEC	Data size:	16-bit	

Settings:

Same as P0.017

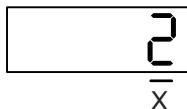
<b>P0.046★■</b>	<b>Servo drive digital output (DO) status display</b>		<b>Address: 005CH 005DH</b>	
Default:	0x0000	Control mode:	All	
Unit:	-	Setting range:	0x00 ~ 0xFF	
Format:	HEX	Data size:	16-bit	

Settings:

Bit	Function	Bit	Function
0	SRDY (servo ready)	8	HOME (homing completed)
1	SON (servo activated)	9	OLW (early warning for motor overload)
2	ZSPD (zero speed)	10	WARN (This DO is on when servo warning, CW, CCW, EMGS, undervoltage, communication error, etc. occurs.)
3	TSPD (target speed reached)	11	Reserved
4	TPOS (target position reached)	12	Reserved
5	TQL (torque limit is activated)	13	Reserved
6	ALRM (servo alarm)	14	Reserved
7	BRKR (magnetic brake control output)	15	Reserved

<b>P0.049■</b>	<b>Update encoder absolute position parameter</b>		<b>Address: 0062H 0063H</b>	
Default:	0x0000	Control mode:	All	
Unit:	-	Setting range:	0x00 ~ 0x02	
Format:	HEX	Data size:	16-bit	

Settings:



- X: command processing

0: N/A

1: Update the encoder data of P0.050 ~ P0.052

2: Update P0.050 ~ P0.052 and clear the position error. When the command takes effect, the motor's current position will be set as the terminal point of the position command.

<b>P0.050★■</b>	<b>Absolute coordinate system status</b>		<b>Address: 0064H 0065H</b>	
Default:	0x0000	Control mode:	All	
Unit:	-	Setting range:	0x00 ~ 0x1F	
Format:	HEX	Data size:	16-bit	

Settings:

Bit	7	6	5	4	3	2	1	0
Bit	15	14	13	12	11	10	9	8

Bit 0: 1 means absolute position is lost; 0 means normal.

Bit 1: 1 means battery is undervoltage; 0 means normal.

Bit 2: 1 means absolute multi-turn is overflowing; 0 means normal.

Bit 3: 1 means PUU is overflowing; 0 means normal.

Bit 4: 1 means absolute coordinate has not been set; 0 means normal.

Bit 5 ~ Bit 15: reserved (0).

<b>P0.051★■</b>	<b>Encoder absolute position - Multi-turn</b>		<b>Address: 0066H 0067H</b>	
Default:	0	Control mode:	All	
Unit:	rev	Setting range:	-32768 ~ +32767	
Format:	DEC	Data size:	32-bit	

Settings:

When P2.070 [Bit 1] is set to read the pulse number, this parameter represents the turns of the encoder (absolute position). When P2.070 [Bit 1] is set to read the PUU number, this parameter becomes invalid and displays 0.

<b>P0.052★■</b>	<b>Encoder absolute position - Pulse number or PUU within single turn</b>		<b>Address: 0068H 0069H</b>	
Default:	0	Control mode:	All	
Unit:	Pulse or PUU	Setting range:	0 ~ 16777216-1 (pulse) -2147483648 ~ 2147483647 (PUU)	
Format:	DEC	Data size:	32-bit	

Settings:

When bit 1 of P2.070 is set to 1 to read the pulse number, this parameter represents the pulse number of the encoder's absolute position within single turn. When bit 1 of P2.070 is set to 0 to read the PUU number, this parameter represents the motor absolute position in PUU.



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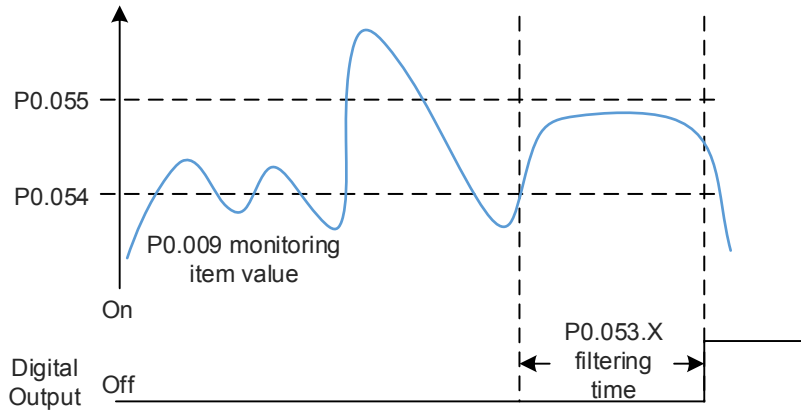
<b>P0.053</b>	<b>General range compare DO output - Filter time</b>		<b>Address: 006AH 006BH</b>
Default:	0x0000	Control mode:	All
Unit:	ms	Setting range:	0x0000 ~ 0x000F
Format:	HEX	Data size:	16-bit

Settings:



- X: First filter time
- Y ~ U: Reserved

Example of the first filter:



<b>P0.054</b>	<b>General range compare DO output - First lower limit</b>		<b>Address: 006CH 006DH</b>
Default:	0	Control mode:	All
Unit:	-	Setting range:	-2147483648 ~ +2147483647
Format:	DEC	Data size:	32-bit

Settings:

Whenever the P0.009 monitoring item value changes from outside to within the set range or vice versa, it will only output after the filter time set by P0.053.X.

<b>P0.055</b>	<b>General range compare DO output - First upper limit</b>		<b>Address: 006EH 006FH</b>
Default:	0	Control mode:	All
Unit:	-	Setting range:	-2147483648 ~ +2147483647
Format:	DEC	Data size:	32-bit

Settings:

Whenever the P0.009 monitoring item value changes from outside to within the set range or vice versa, it will only output after the filter time set by P0.053.X.

<b>P0.056 ~ P0.062</b>	<b>Reserved</b>
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<b>P0.063</b>	<b>Duration of voltage exceeding 400V</b>		<b>Address: 007EH 007FH</b>
Default:	0	Control mode:	All
Unit:	ms	Setting range:	0x00000000 ~ 0x7FFFFFFF
Format:	DEC	Data size:	32-bit

Settings:

Records the accumulative time when the voltage of servo drive exceeding 400V.

<b>P0.064 ~ P0.068</b>	<b>Reserved</b>
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**P1.xxx Basic parameters**

<b>P1.000 ▲</b>	<b>External pulse input type</b>		<b>Address: 0100H 0101H</b>	
Default:	0x0002	Control mode:	PT	
Unit:	-	Setting range:	0x0000 ~ 0x11F2	
Format:	HEX	Data size:	16-bit	

Settings:



X	Command source	Z	Logic type	UY	Filter width
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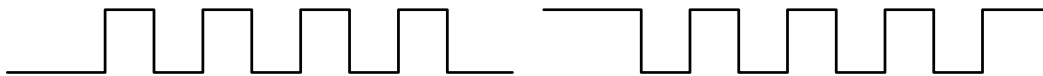
- X: Command source
  - 0: AB phase pulse (4x)
  - 1: Clockwise and counterclockwise pulse
  - 2: Pulse + symbol
  - Others: Reserved
- Z: Logic type
  - 0: Positive logic
  - 1: Negative logic

Digital circuits use 0 and 1 to represent the voltage level of high and low. In positive logic, 1 represents high voltage and 0 represents low voltage; in negative logic, 1 represents low voltage and 0 represents high voltage.

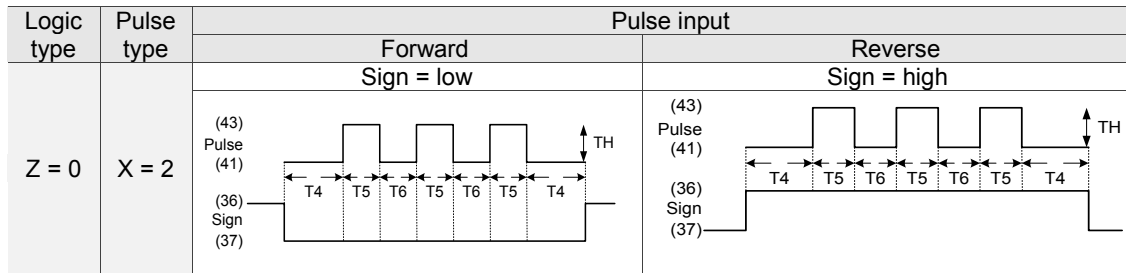
For example:

Positive logic

Negative logic



Logic type	Pulse type	Pulse input	
		Forward	Reverse
Z = 0	X = 0	Pulse phase lead	Pulse phase lag
Z = 1	X = 1		



Pulse specification	Max. input frequency	Min. allowed time width					
		T1	T2	T3	T4	T5	T6
Differential signal	4 Mpps	62.5 ns	125 ns	250 ns	200 ns	125 ns	125 ns
Open-collector	200 Kpps	1.25 μs	2.5 μs	5 μs	5 μs	2.5 μs	2.5 μs

Pulse specification	Max. input frequency	Voltage	Forward current
Differential signal	4 Mpps	5V	< 25 mA
Open-collector	200 kpps	24V (Max.)	< 25 mA

■ UY: Filter width setting

If the pulse frequency is too high causing the pulse width smaller than the filter width setting, this pulse will be filtered out as noise. Thus, the filter width should be set smaller than the actual pulse width. It is suggested to set the filter width as 4 times smaller than the actual pulse width.

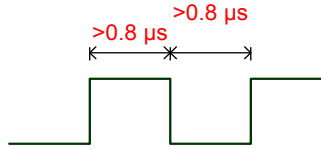
Y setting value	U = 0 Unit: μs (kHz)	U = 1 Unit: μs (kHz)
0	No filter function	No filter function
1	2 (250)	0.2 (2500)
2	3 (166)	0.3 (1666)
3	4 (125)	0.4 (1250)
4	5 (100)	0.5 (1000)
5	6 (83)	0.6 (833)
6	7 (71)	0.7 (714)
7	8 (62)	0.8 (625)
8	9 (55)	0.9 (555)
9	10 (50)	1 (500)
A	11 (45)	1.1 (454)
B	12 (41)	1.2 (416)
C	13 (38)	1.3 (384)
D	14 (35)	1.4 (357)
E	15 (33)	1.5 (333)

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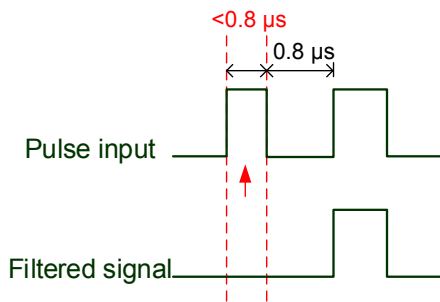
For example:

When U is set to 1 and Y is set to 1 (filter width is 0.2  $\mu\text{s}$ ),

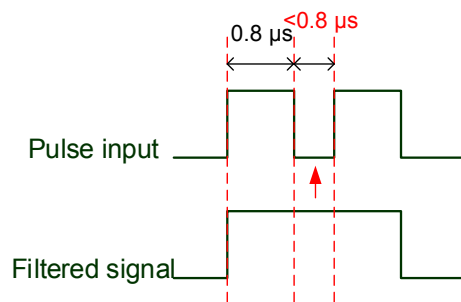
When the high and low duty width of the command pulse are both larger than 0.8  $\mu\text{s}$  (filter width is four times of 0.2  $\mu\text{s}$ ), then this can ensure the pulse command will not be filtered out.



When the high or low duty width of the pulse is smaller than the filter width, then it will be filtered out.



If this first pulse width is shorter than 0.8  $\mu\text{s}$ , it may be filtered, and thus two input pulses will be regarded as one pulse. If this pulse width is shorter than 0.2  $\mu\text{s}$ , it will be filtered.



If this low level pulse width is shorter than 0.8  $\mu\text{s}$ , it may be filtered, and thus two input pulses will be regarded as one pulse. If this low level pulse width is shorter than 0.2  $\mu\text{s}$ , it will be filtered.

If the user use 125 ns (4 Mpps) input pulse, it is suggested to set the filter setting value Y to 0 as no filter function.

Note: When the signal is the high-speed pulse specification of 4 Mpps and the setting value of the filter is 0, then the pulse will not be filtered.

<b>P1.001●</b>	<b>Input settings of control mode and control command</b>		<b>Address: 0102H 0103H</b>
Default:	0x0000 (Model: A3-M, A3-L) 0x000B (Model: A3-F)	Control mode:	All
Unit:	P (pulse); S (rpm); T (N-M)	Setting range:	0x0000 ~ 0x111F
Format:	HEX	Data size:	16-bit

Settings:



YX	Control mode setting	Z	Direction control	U	DIO setting value control
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■ YX: Control mode setting

Mode	PT	PR	S	T	Sz	Tz
00	▲					
01		▲				
02			▲			
03				▲		
04					▲	
05						▲
Dual mode						
06	▲		▲			
07	▲			▲		
08		▲	▲			
09		▲		▲		
0A			▲	▲		
0B	DMCNET mode					
0C	CANopen mode					
Multi-mode						
0E	▲	▲	▲			
0F	▲	▲		▲		

PT: Position control mode; its command source is inputted from external pulse and external analog voltage (\*coming soon).

PR: Position control mode; its command source is inputted from 64 sets of internal register which can be selected by DI.POS0 ~ DI.POS6. And multiple homing methods are also available.

S: Speed control mode; its command source is from external analog voltage and internal register which can be selected by DI.SPD0 and DI.SPD1.

T: Torque control mode; its command source is from external analog voltage and internal register which can be selected by DI.TCM0 and DI.TCM1.

## 8

Sz: Speed control mode; its command source is from zero speed and internal speed register which can be selected by DI.SPD0 and DI.SPD1.

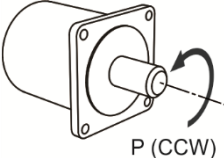
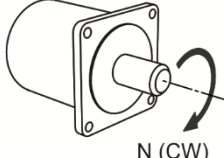
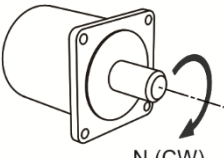
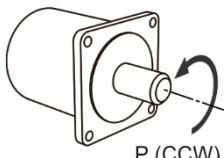
Tz: Torque control mode; its command source is from zero torque and internal torque register which can be selected by DI.TCM0 and DI.TCM1.

Dual mode: Can switch the mode via external DI. For example, DI.S-P can be used to switch the dual mode of PT/S (control mode setting: 06). Please refer to Table 8.1 for further information.

Multi-mode: Can switch the mode via external DI. For example, DI.S-P and PT-PR can be used to switch the multi-mode of PT/PR/S (control mode setting: 12). Please refer to table 8.1 for further information.

CANopen mode: Its command source is from external fieldbus controller, which issues the command to the servo drive via communication.

■ Z: Direction control

	Z = 0	Z = 1
Forward direction	 P (CCW)	 N (CW)
Reverse direction	 N (CW)	 P (CCW)

■ U: DIO setting value control

0: When switching modes, DIO setting (P2.010 ~ P2.022) remains the same value

1: When switching modes, DIO setting (P2.010 ~ P2.022) will be reset to the default of each mode.

<b>P1.002 ▲</b>	<b>Speed and torque limit settings</b>		<b>Address: 0104H 0105H</b>
Default:	0x0000	Control mode:	All
Unit:	-	Setting range:	00 ~ 11
Format:	HEX	Data size:	16-bit

Settings:



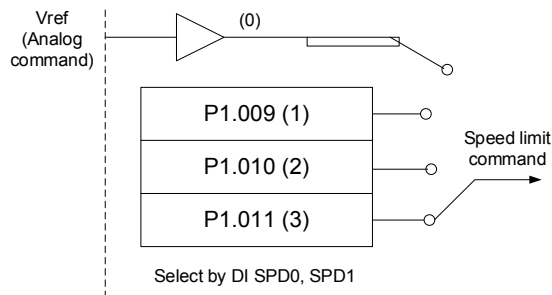
X	Disable / enable speed limit function	Y	Disable / enable torque limit function	UZ	Reserved
---	---------------------------------------	---	--	----	----------

■ X: Disable / enable speed limit function

0: Disable speed limit function

1: Enable speed limit function (only available in T / Tz mode)

See the diagram below for speed limit setting:

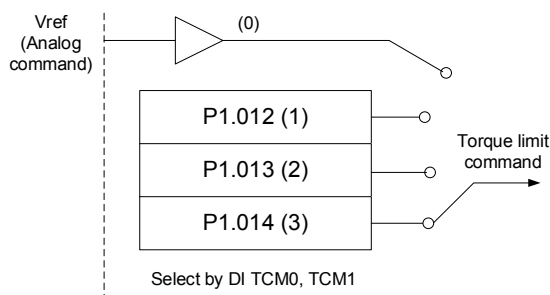


■ Y: Disable / enable torque limit function

0: Disable torque limit function

1: Enable torque limit function

See the diagram below for torque limit setting:



When using torque limit function, users could use this parameter to set its value to 1 to limit the torque permanently without occupying one DI setting. Additionally, users could enable or disable the limit function via DI.TRQLM, which is more flexible, but would need to occupy one DI setting. Torque limit function can be enabled by either P1.002 or DI.

■ UZ: Not in use



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<b>P1.003</b>	<b>Polarity setting of encoder pulse output</b>			<b>Address: 0106H 0107H</b>
Default:	0x0000	Control mode:	All	
Unit:	-	Setting range:	0 ~ 13	
Format:	HEX	Data size:	16-bit	

Settings:



X	Polarity of monitor analog output	Y	Polarity of encoder pulse output	UZ	Reserved
---	-----------------------------------	---	----------------------------------	----	----------

- X: Polarity of monitor analog output
  - 0: MON1(+), MON2(+)
  - 1: MON1(+), MON2(-)
  - 2: MON1(-), MON2(+)
  - 3: MON1(-), MON2(-)
- Y: Polarity of encoder pulse output
  - 0: Pulse output in forward direction
  - 1: Pulse output in reverse direction
- UZ: Reserved

<b>P1.004</b>	<b>MON1 analog monitor output proportion</b>			<b>Address: 0108H 0109H</b>
Default:	100	Control mode:	All	
Unit:	% (full scale)	Setting range:	0 ~ 100	
Format:	DEC	Data size:	16-bit	

Settings:

Please refer to P0.003 for analog output selection setting.

Example 1:

If the requirement is for the motor to run at 1000 rpm which corresponds to 8V, and its max. speed is 5000 rpm, the setting will be as follows:

$$P1.004 = \frac{\text{Required speed}}{\text{Max. speed}} \times 100\% = \frac{1000 \text{ RPM}}{5000 \text{ RPM}} \times 100\% = 20\%$$

Users can refer to the following example for motor's current speed and relative voltage output:

Motor speed	MON1 analog monitor output
300 rpm	MON1 = 8V × $\frac{\text{Current Speed}}{\text{Max. speed} \times \frac{P1.004}{100}} \times 100\% = 8V \times \frac{300 \text{ RPM}}{5000 \text{ RPM} \times \frac{20}{100}} \times 100\% = 2.4V$
900 rpm	MON1 = 8V × $\frac{\text{Current Speed}}{\text{Max. speed} \times \frac{P1.004}{100}} \times 100\% = 8V \times \frac{900 \text{ RPM}}{5000 \text{ RPM} \times \frac{20}{100}} \times 100\% = 7.2V$

<b>P1.005</b>	<b>MON2 analog monitor output proportion</b>		<b>Address: 010AH 010BH</b>	
Default:	100	Control mode:	All	
Unit:	% (full scale)	Setting range:	0 ~ 100	
Format:	DEC	Data size:	16-bit	

Settings:

Please refer to P0.004 for analog output setting.

<b>P1.006</b>	<b>Smooth constant of speed command (Low-pass filter)</b>		<b>Address: 010CH 010DH</b>	
Default:	0	Control mode:	S / Sz	
Unit:	ms	Setting range:	0 ~ 1000	
Format:	DEC	Data size:	16-bit	

Settings:

0: Disable this function

<b>P1.007</b>	<b>Smooth constant of torque command (Low-pass filter)</b>		<b>Address: 010EH 010FH</b>	
Default:	0	Control mode:	T / Tz	
Unit:	ms	Setting range:	0 ~ 1000	
Format:	DEC	Data size:	16-bit	

Settings:

0: Disable this function

<b>P1.008</b>	<b>Smooth constant of position command (Low-pass filter)</b>		<b>Address: 0110H 0111H</b>	
Default:	0	Control mode:	PT / PR	
Unit:	10 ms	Setting range:	0 ~ 1000	
Format:	DEC	Data size:	16-bit	
Example:	11 = 110 ms			

Settings:

0: Disable this function

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<b>P1.009</b>	<b>Internal speed command 1 / Internal speed limit 1</b>		<b>Address: 0112H 0113H</b>
Default:	1000	Control mode:	S / Sz: Internal speed command 1 T / Tz: Internal speed limit 1
Unit:	0.1 rpm (rotary motor)* 10 <sup>-6</sup> m/s (linear motor)*	Setting range:	-60000 ~ +60000 (rotary motor)* -15999999 ~ 15999999 (linear motor)*
Format:	DEC	Data size:	32-bit
Example:	Internal speed command: 120 = 12 rpm Internal speed limit: Positive and negative values are identical. Please refer to the following descriptions.		

Settings:

Internal speed command 1: Setting of the first internal speed command.

Internal speed limit 1: Setting of the first internal speed limit.

Example of inputting internal speed limit:

Speed limit setting value of P1.009	Valid speed range	Speed limit in forward direction	Speed limit in reverse direction
1000	-100 ~ 100 rpm	100 rpm	-100 rpm
-1000			

Note: Rotary motor is the abbreviation for permanent-magnet synchronous rotary motor; linear motor is the abbreviation for permanent-magnet synchronous linear motor.

<b>P1.010</b>	<b>Internal speed command 2 / Internal speed limit 2</b>		<b>Address: 0114H 0115H</b>
Default:	2000	Control mode:	S / Sz: Internal speed command 2 T / Tz: Internal speed limit 2
Unit:	0.1 rpm (rotary motor)* 10 <sup>-6</sup> m/s (linear motor)*	Setting range:	-60000 ~ +60000 (rotary motor)* -15999999 ~ 15999999 (linear motor)*
Format:	DEC	Data size:	32-bit
Example:	Internal speed command: 120 = 12 rpm Internal speed limit: Positive and negative values are identical. Please refer to the following descriptions.		

Settings:

Internal speed command 2: Second internal speed command setting; internal speed limit 2: Second internal speed limit setting.

Example of inputting internal speed limit:

Speed limit setting value of P1.010	Valid speed range	Speed limit in forward direction	Speed limit in reverse direction
1000	-100 ~ 100 rpm	100 rpm	-100 rpm
-1000			

Note: Rotary motor is the abbreviation for permanent-magnet synchronous rotary motor; linear motor is the abbreviation for permanent-magnet synchronous linear motor.

P1.011	Internal speed command 3 / internal speed limit 3		Address: 0116H 0117H
Default:	3000	Control mode:	S / Sz: Internal speed command 3 T / Tz: Internal speed limit 3
Unit:	0.1 rpm (rotary motor)* 10 <sup>-6</sup> m/s (linear motor)*	Setting range:	-60000 ~ +60000 (rotary motor)* -15999999 ~ 15999999 (linear motor)*
Format:	DEC	Data size:	32-bit
Example:	Internal speed command: 120 = 12 rpm Internal speed limit: Positive and negative values are identical. Please refer to the following descriptions.		

Settings:

Internal speed command 3: Third internal speed command setting; internal speed limit 3: Third internal speed limit setting.

Example of inputting internal speed limit:

Speed limit setting value of P1.011	Valid speed range	Speed limit in forward direction	Speed limit in reverse direction
1000	-100 ~ 100 rpm	100 rpm	-100 rpm
-1000			

Note: Rotary motor is the abbreviation for permanent-magnet synchronous rotary motor; linear motor is the abbreviation for permanent-magnet synchronous linear motor.

P1.012	Internal torque command 1 / internal torque limit 1		Address: 0118H 0119H
Default:	100	Control mode:	T / Tz: Internal torque command 1 PT / PR / S / Sz: Internal torque limit 1
Unit:	%	Setting range:	-400 ~ +400
Format:	DEC	Data size:	16-bit
Example:	Internal torque command: 30 = 30% Internal torque limit: Positive and negative values are identical. Please refer to the following descriptions.		

Settings:

Internal torque command 1: First internal torque command setting; internal torque limit 1: First internal torque limit setting.

Example of inputting internal torque limit:

Torque limit setting value of P1.012	Valid torque range	Torque limit in forward direction	Torque limit in reverse direction
30	-30 ~ 30%	30%	-30%
-30			

## 8

<b>P1.013</b>	<b>Internal torque command 2 / internal torque limit 2</b>		<b>Address: 011AH 011BH</b>
Default:	100	Control mode:	T / Tz: Internal torque command 2 PT / PR / S / Sz: Internal torque limit 2
Unit:	%	Setting range:	-400 ~ +400
Format:	DEC	Data size:	16-bit
Example:	Internal torque command: 30 = 30% Internal torque limit: Positive and negative values are identical. Please refer to the following descriptions.		

Settings:

Internal torque command 2: Second internal torque command setting; internal torque limit 2: Second internal torque limit setting.

Example of inputting internal torque limit:

Torque limit setting value of P1.013	Valid torque range	Torque limit in forward direction	Torque limit in reverse direction
30	-30 ~ 30%	30%	-30%
-30			

<b>P1.014</b>	<b>Internal torque command 3 / internal torque limit 3</b>		<b>Address: 011CH 011DH</b>
Default:	100	Control mode:	T / Tz: Internal torque command 3 PT / PR / S / Sz: Internal torque limit 3
Unit:	%	Setting range:	-400 ~ +400
Format:	DEC	Data size:	16-bit
Example:	Internal torque command: 30 = 30% Internal torque limit: Positive and negative values are identical. Please refer to the following descriptions.		

Settings:

Internal torque command 3: Third internal torque command setting; internal torque limit 3: Third internal torque limit setting.

Example of inputting internal torque limit:

Torque limit setting value of P1.014	Valid torque range	Torque limit in forward direction	Torque limit in reverse direction
30	-30 ~ 30%	30%	-30%
-30			

<b>P1.015 ~ P1.018</b>	<b>Reserved</b>
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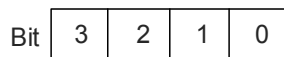
<b>P1.019</b>	<b>Capture / Compare additional function settings</b>		<b>Address: 0126H 0127H</b>
Default:	0x0000	Control mode:	ALL
Unit:	-	Setting range:	0x0000 ~ 0x0101
Format:	HEX	Data size:	16-bit

Settings:



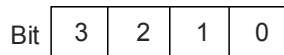
X	Additional function of Capture	Z	Additional function of Compare
Y	Reserved	U	Reserved

- X: Additional function of Capture



Bit	Function	Description
0	Cycle mode	Set this bit to 0 to disable this function; Set this bit to 1 to enable this function. If enabled, the E-Cam alignment correction will be conducted when DI.ALGN ON.
1 ~ 3	Reserved	-

- Z: Additional function of compare



Bit	Function	Description
0	P1.024 is reset to 0 automatically	Set this bit to 0 to disable this function; Set this bit to 1, and P1.024 will be reset to 0 automatically, but it will only take effect once and reset to 0. Or else the value of P1.024 will remain.
1 ~ 3	Reserved	-

<b>P1.020</b>	<b>Capture - Masking range setting</b>		<b>Address: 0128H 0129H</b>
Default:	0	Control mode:	ALL
Unit:	Pulse unit of capture source	Setting range:	0 ~ +100000000
Format:	DEC	Data size:	32-bit

Settings:

When Capture function is enabled and set to capture multiple points (P5.038 > 1), it will stop receiving the DI captured signal within this range once the data is captured. The DI captured signal received within this range will not be recognized. This function can be used to avoid noise being regarded as effective signals within non-capture range. Masking range is defined as follows: (CAP\_DATA-P1.020, CAP\_DATA+P1.020).

## 8

<b>P1.021 ~ P1.022</b>	<b>Reserved</b>
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<b>P1.023</b>	<b>Compare - Data translation setting (non-volatile)</b>		<b>Address: 012EH 012FH</b>
Default:	0	Control mode:	ALL
Unit:	Pulse unit of compare source	Setting range:	-10000000 ~ +100000000
Format:	DEC	Data size:	32-bit

Settings:

When using Compare function, you may add the translation value to the data array value for comparison as the actual comparison data:

$$\text{CMP\_DATA} = \text{DATA\_ARRAY[*]} + \text{P1.023} + \text{P1.024}$$

For example:

If the data array for comparison is  $\text{DATA\_ARRAY}[100] = 2000$  ;  $\text{P1.023} = 40$

Then the actual comparison value is  $= 2000 + 40 = 2040$ .

Note:

1. This parameter is non-volatile.
2. P1.024: After the value becomes effective, if P1.019.Z [Bit0 = 1], then it automatically resets.
3. CMP\_DATA can be observed via the monitoring variable V25h (037).

<b>P1.024</b>	<b>Compare - Data translation setting (Reset automatically)</b>		<b>Address: 0130H 0131H</b>
Default:	0	Control mode:	ALL
Unit:	Pulse unit of compare source	Setting range:	-32768 ~ +32767
Format:	DEC	Data size:	16-bit

Settings:

When using Compare function, you may add the translation value to the data array value for comparison as the actual comparison data:

$$\text{CMP\_DATA} = \text{DATA\_ARRAY[*]} + \text{P1.023} + \text{P1.024}$$

Note:

1. This parameter is volatile.
2. After the parameter is effective, if P1.019.Z [Bit0 = 1], then it automatically resets.
3. CMP\_DATA can be observed via the monitoring variable V25h (037).

<b>P1.025</b>	<b>Low-frequency vibration suppression frequency (1)</b>		<b>Address: 0132H 0133H</b>
Default:	1000	Control mode:	PT / PR
Unit:	0.1 Hz	Setting range:	10 ~ 1000
Format:	DEC	Data size:	16-bit
Example:	150 = 15 Hz		

Settings:

For setting the value of the first low-frequency vibration suppression frequency. When P1.026 is set to 0, the first low-frequency vibration suppression filter will be disabled.

<b>P1.026</b>	<b>Low-frequency vibration suppression gain (1)</b>		<b>Address: 0134H 0135H</b>
Default:	0	Control mode:	PT / PR
Unit:	-	Setting range:	0 ~ 9
Format:	DEC	Data size:	16-bit

Settings:

Set P1.026 to 0: Disable the first low-frequency vibration suppression filter. To set the gain of the first low-frequency vibration suppression, increasing the setting value can improve the position response, but if the value is set too big, the motor may not operate smoothly. It is suggested to set the value to 1.

<b>P1.027</b>	<b>Low-frequency vibration suppression frequency (2)</b>		<b>Address: 0136H 0137H</b>
Default:	1000	Control mode:	PT / PR
Unit:	0.1 Hz	Setting range:	10 ~ 1000
Format:	DEC	Data size:	16-bit
Example:	150 = 15 Hz		

Settings:

For setting the value of the second low-frequency vibration suppression frequency. When P1.028 is set to 0, the second low-frequency vibration suppression filter will be disabled.

<b>P1.028</b>	<b>Low-frequency vibration suppression gain (2)</b>		<b>Address: 0138H 0139H</b>
Default:	0	Control mode:	PT / PR
Unit:	-	Setting range:	0 ~ 9
Format:	DEC	Data size:	16-bit

Settings:

Set P1.028 to 0: Disable the second low-frequency vibration suppression filter. To set the gain of the second low-frequency vibration suppression, increasing the setting value can improve the position response, but if the value is set too big, the motor may not operate smoothly. It is suggested to set the value to 1.



8

<b>P1.029</b>	<b>Auto low-frequency vibration suppression mode setting</b>			<b>Address: 013AH 013BH</b>
Default:	0	Control mode:	PT / PR	
Unit:	-	Setting range:	0 ~ 1	
Format:	DEC	Data size:	16-bit	

Settings:

0: Disable auto low-frequency vibration detection function

1: Disable function automatically after vibration suppression (Value will reset to 0 automatically)

Description of auto mode setting:

When the value is set to 1, it is in auto mode for vibration suppression. When the vibration cannot be detected or the vibration frequency is stable, the parameter will be reset to 0 and the frequency for vibration suppression will be saved to P1.025 automatically.

<b>P1.030</b>	<b>Low-frequency vibration detection</b>			<b>Address: 013CH 013DH</b>
Default:	500	Control mode:	PT / PR	
Unit:	Pulse	Setting range:	1 ~ 8000	
Format:	DEC	Data size:	16-bit	

Settings:

When enabling auto suppression (P1.029 = 1), it will automatically search the detection level. The lower the value is, the more sensitive the detection will be, but it may also easily misjudge noise or regard other low-frequency vibration as frequency to be suppressed. If the value is high, it is less likely to misjudge, but if the vibration of the mechanism is small, it may not detect the frequency of low-frequency vibration.

<b>P1.031</b>	<b>Reserved</b>
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<b>P1.032</b>	<b>Motor stop mode</b>			<b>Address: 0140H 0141H</b>
Default:	0x0000	Control mode:	All	
Unit:	-	Setting range:	0 ~ 20	
Format:	HEX	Data size:	16-bit	

Settings:



U Z Y X

X	Reserved	Y	Dynamic brake operation options	UZ	Reserved
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- Y: Options for using the dynamic brake when the servo is off or an alarm (including EMGS) occurs

0: Use dynamic brake

1: Motor free run

2: Use dynamic brake first. Then, let the motor run free after the speed is slower than the value set by P1.038

When the motor reaches PL (CCWL) or NL (CWL), please refer to P5.003 for setting the deceleration time. If the setting time is 1 ms, the motor stops instantaneously.

8

<b>P1.033</b>	<b>Reserved</b>
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<b>P1.034</b>	<b>Acceleration constant of S-curve</b>		<b>Address: 0144H 0145H</b>
Default:	200	Control mode:	S / Sz
Unit:	ms	Setting range:	1 ~ 65500
Format:	DEC	Data size:	16-bit

Settings:

Acceleration constant:

P1.034, P1.035, and P1.036, the acceleration time of speed command from zero to the rated speed, can all be set individually. When using an internal command, if P1.036 is set to 0, it still has acceleration / deceleration of trapezoid-curve; when using an analog command, P1.036 will have to be set to bigger than 0 to form acceleration / deceleration of trapezoid-curve.

<b>P1.035</b>	<b>Deceleration constant of S-curve</b>		<b>Address: 0146H 0147H</b>
Default:	200	Control mode:	S / Sz
Unit:	ms	Setting range:	1 ~ 65500
Format:	DEC	Data size:	16-bit

Settings:

Deceleration constant:

P1.034, P1.035, and P1.036, the deceleration time of speed command from the rated speed to zero, can all be set individually. When using an internal command, if P1.036 is set to 0, it still has acceleration / deceleration of trapezoid-curve; when using an analog command, P1.036 will have to be set to bigger than 0 to form acceleration / deceleration of trapezoid-curve.

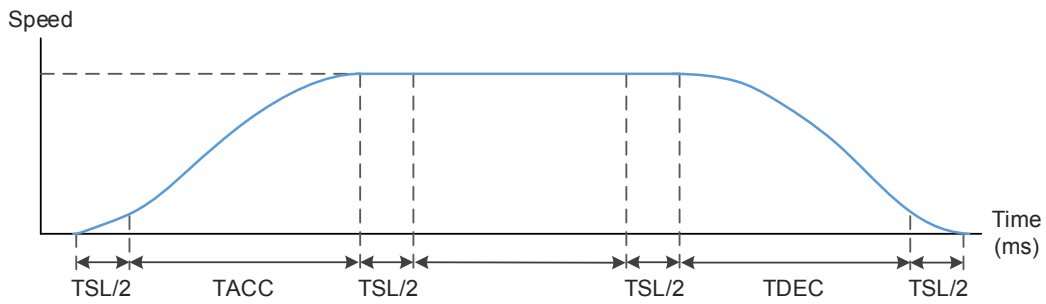
<b>P1.036</b>	<b>Acceleration / deceleration constant of S-curve</b>		<b>Address: 0148H 0149H</b>
Default:	0	Control mode:	PR / S / Sz
Unit:	ms	Setting range:	0 ~ 65500
Format:	DEC	Data size:	16-bit

Settings:

Set P1.036 to 0: Disable this function.

8

Acceleration / deceleration constant of S-curve:



P1.034: Set the acceleration time of acceleration / deceleration of trapezoid-curve.

P1.035: Set the deceleration time of acceleration / deceleration of trapezoid-curve.

P1.036: Set the smoothing time of S-curve acceleration / deceleration.

P1.034, P1.035, and P1.036 can all be set individually. Even if P1.036 is set to 0, it still has acceleration / deceleration of trapezoid-curve.

Provides following error compensation function:

	P1.036 = 0	P1.036 = 1	P1.036 > 1
Smoothing function of S-curve	Disable	Disable	Enable
Following error compensation function	Disable	Enable	Determine by P2.068.X

P1.037	Load inertia ratio and load weight ratio to servo motor			Address: 014AH 014BH
Operation interface:	Panel / software	Communication	Control mode:	All
Default:	6.0	60	Data size:	16-bit
Unit:	1 times	0.1 times	-	-
Setting range:	0.0 ~ 200.0 (rotary motor)* 0.0 ~ 1633 (linear motor)*	0 ~ 2000 (rotary motor)* 0 ~ 1633 (linear motor)*		
Format:	One decimal	DEC	-	-
Example:	1.5 = 1.5 times	15 = 1.5 times	-	-

Settings:

Inertia ratio to servo motor (rotary motor): (J\_load / J\_motor)

J\_motor: Rotor inertia of the servo motor.

J\_load: Total equivalent inertia of external mechanical load.

Note: Rotary motor is the abbreviation for permanent-magnet synchronous rotary motor; linear motor is the abbreviation for permanent-magnet synchronous linear motor.

<b>P1.038</b>	<b>Zero speed range setting</b>			<b>Address: 014CH 014DH</b>	
Operation interface:	Panel / software	Communication	Control mode:	All	
Default:	10.0	100	Data size:	16-bit	
Unit:	1 rpm	0.1 rpm	-	-	
Setting range:	0.0 ~ 200.0	0 ~ 2000	-	-	
Format:	One decimal	DEC	-	-	
Example:	1.5 = 1.5 rpm	15 = 1.5 rpm	-	-	

Settings:

Setting the range of outputting zero-speed signal (ZSPD). When the forward / reverse speed of the motor is slower than the setting value, the zero-speed signal will be set up and the digital output will be enabled.

<b>P1.039</b>	<b>Target speed detection level</b>			<b>Address: 014EH 014FH</b>	
Default:	3000		Control mode:	ALL	
Unit:	rpm		Setting range:	0 ~ 30000 (rotary motor)* 0 ~ 15999 (linear motor)*	
Format:	DEC		Data size:	16-bit	

Settings:

When the target speed is reached, DO (TSPD) is enabled. When the forward / reverse speed of the motor is faster than the setting value, the target speed is reached and the digital output will be enabled.

Note: Rotary motor is the abbreviation for permanent-magnet synchronous rotary motor; linear motor is the abbreviation for permanent-magnet synchronous linear motor.

<b>P1.040</b>	<b>Max. rotation speed of analog speed command</b>			<b>Address: 0150H 0151H</b>	
Default:	3000		Control mode:	T / Tz	
Unit:	rpm		Setting range:	0 ~ 5000	
Format:	DEC		Data size:	32-bit	

Settings:

Max. rotation speed of analog speed command:

Speed mode:

$$\text{Speed control command} = \frac{\text{Input voltage} \times \text{Setting value}}{10}$$

Set the rotation speed corresponding to 10V (max. voltage) for analog speed command. If the setting is 2000, and the external voltage input is 5V, then the speed control command is 1000 rpm.

$$\text{Speed control command} = \frac{5V \times 2000 \text{ r/min}}{10} = 1000 \text{ rpm}$$

8

Torque mode:

$$\text{Speed limit command} = \frac{\text{Input voltage} \times \text{Setting value}}{10}$$

Set the rotation speed limit corresponding to 10V (max. voltage) for analog speed limit. If the setting is

2000, and the external voltage input is 5V, then the speed limit command =  $\frac{5V \times 2000 \text{ r/min}}{10} = 1000 \text{ rpm}$

P1.041 ▲	Max. output of analog torque command		Address: 0152H 0153H
Default:	100	Control mode:	All
Unit:	%	Setting range:	-1000 ~ 1000
Format:	DEC	Data size:	16-bit

Settings:

Max. output of analog torque command:

Torque mode:

$$\text{Torque control command} = \frac{\text{Input voltage} \times \text{P1.041}}{10} \text{ (Unit: \%)}$$

Set the torque corresponding to 10V (max. voltage) for analog torque command.

If the default setting is 100, and the external voltage input is 10V, then the torque control command is 100% rated torque. If the external voltage input is 5V, then the torque control command is 50% rated torque.

When external analog input is 10V, torque control command =  $\frac{10V \times 100}{10} = 100\%$ ;

When external analog input is 5V, torque control command =  $\frac{5V \times 100}{10} = 50\%$

Example:

If P1.041 = 10

When external analog input is 10V, torque control command =  $\frac{10V \times 10}{10} = 10\%$ ;

When external analog input is 5V, torque control command =  $\frac{5V \times 10}{10} = 5\%$

In speed, PT, PR modes:

Torque limit command =  $\frac{\text{Input voltage} \times \text{Setting value}}{10}$  (Unit: %)

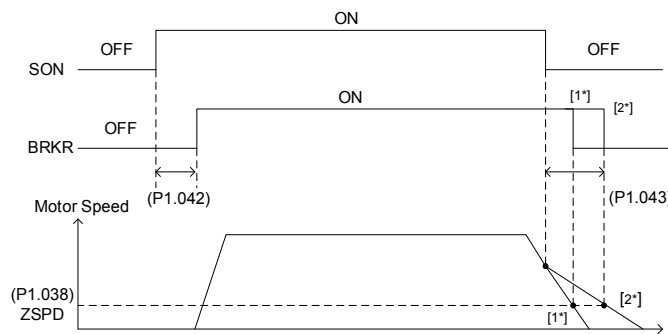
Set the torque limit corresponding to 10V (max. voltage) for analog torque limit.

Torque limit command =  $\frac{10V \times 100}{10} = 100\%$

<b>P1.042</b>	<b>Enable delay time of magnetic brake</b>		<b>Address: 0154H 0155H</b>
Default:	0	Control mode:	All
Unit:	ms	Setting range:	0 ~ 1000
Format:	DEC	Data size:	16-bit

Settings:

Set the delay time from servo on status to magnetic brake signal (DO:0x08, BRKR) activation.



<b>P1.043</b>	<b>Disable delay time of magnetic brake</b>		<b>Address: 0156H 0157H</b>
Default:	0	Control mode:	All
Unit:	ms	Setting range:	-1000 ~ 1000
Format:	DEC	Data size:	16-bit

Settings:

Set the delay time from servo off status to magnetic brake signal (DO:0x08, BRKR) deactivation. For detailed diagram, please refer to P1.042.

Note:

1. If the delay time specified by P1.038 is not over yet and the motor speed is slower than the value of P1.038, the magnetic brake signal (BRKR) will be deactivated.
2. If the delay time specified by P1.038 is up and the motor speed is faster than the value of P1.038, the magnetic brake signal (BRKR) will be deactivated.
3. If P1.043 is set to a negative value and the servo is off due to alarm (except for AL022) or emergency stop, this setting will not function which is equivalent to setting the delay time as 0.

<b>P1.044 ▲</b>	<b>E-Gear ratio (Numerator) (N1)</b>		<b>Address: 0158H 0159H</b>
Default:	16777216	Control mode:	PT / PR
Unit:	Pulse	Setting range:	1 ~ (2 <sup>29</sup> -1)
Format:	DEC	Data size:	32-bit

Settings:

For E-Gear ratio setting, please refer to Section 6.2.5. Please refer to P2.060 ~ P2.062 for multiple E-Gear ratio (numerator) setting.

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Note:

1. Do not change the setting value in servo on state.
2. During communication mode (DMCNET/CANopen/EtherCAT), if the drive is re-powered, its E-Gear ratio will be set according to the communication protocol default value. Restoring to the default value will result in the reconstruction of the absolute coordinate system, thus users will need to re-do the homing procedure. If restoring to the default value is not desired, please set P3.012 to 1. For detailed setting, please refer to P3.012.

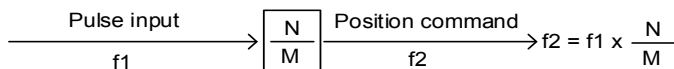
P1.045 ▲	E-Gear ratio (Denominator) (M)		Address: 015AH 015BH
Default:	100000	Control mode:	PT / PR
Unit:	Pulse	Setting range:	1 ~ (2 <sup>31</sup> -1)
Format:	DEC	Data size:	32-bit

Settings:

If the setting is incorrect, the servo motor is prone to sudden unintended acceleration.

Please follow setting instructions as below.

Setting of pulse input:



Command pulse input range:  $1 / 4 < N \times M < 262144$ .

For E-Gear ratio setting, please refer to Section 6.2.5.

Note:

1. Do not change the setting value in servo on state.
2. During communication mode (DMCNET / CANopen / EtherCAT), if the drive is re-powered, its E-Gear ratio will be set according to the communication protocol default value. Restoring to the default value will result in the reconstruction of the absolute coordinate system, thus users will need to re-do the homing procedure. If restoring to the default value is not desired, please set P3.012.Z to 1. For detailed setting, please refer to P3.012.

P1.046 ▲	Encoder pulse number output setting		Address: 015CH 015DH
Default:	2500	Control mode:	All
Unit:	Pulse	Setting range:	20 ~ 320000
Format:	DEC	Data size:	32-bit

Settings:

The number of single-phase pulse output per revolution; the max. output frequency of the hardware is 19.8 MHz.

Note: The following circumstances may result in exceeding the max. allowable output pulse frequency of the drive, and AL018 will occur:

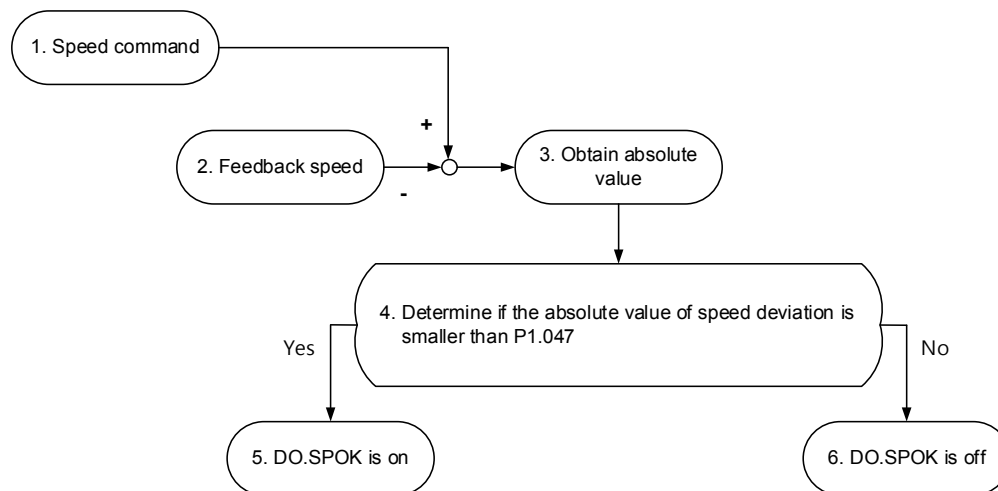
1. Encoder error
2. The motor speed is faster than P1.076
3.  $\frac{\text{Motor speed}}{60} \times P1.046 \times 4 > 19.8 \times 10^6$

P1.047	Speed reached (DO.SP_OK) range		Address: 015EH 015FH	
Default:	10	Control mode:	S / Sz	
Unit:	rpm	Setting range:	0 ~ 300	
Format:	DEC	Data size:	16-bit	

Settings:

When the error between speed command and motor feedback speed is less than this parameter, the digital output DO.SP\_OK (DO code 0x19) is ON.

Diagram:



1. Speed command: Command inputted by the user (without acceleration / deceleration), not the command from the front end speed circuit. Its source is from the register.
2. Feedback speed: The actual speed of the motor which has been filtered.
3. Obtain the absolute value.
4. Determine whether the absolute value of speed error is smaller than the parameter value:  
If the parameter is set to 0, the output is always OFF. If smaller, the DO output is on, otherwise off.

P1.048	Speed reached (DO.SP_OK) operation selection		Address: 0160H 0161H	
Default:	0x0000	Control mode:	PR	
Unit:	-	Setting range:	0x0000 ~ 0x0011	
Format:	HEX	Data size:	16-bit	

Settings:

Control selection of digital output DO.MC\_OK (DO code: 0x17).



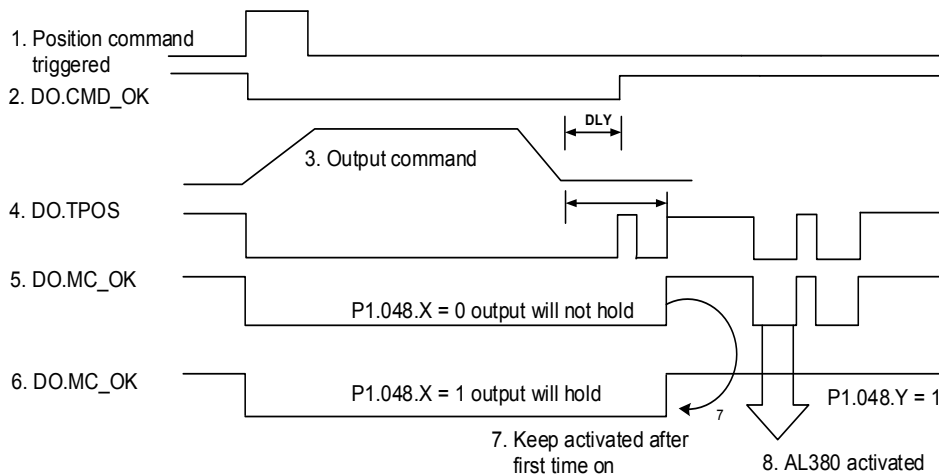
8



X	DO output hold option	Y	Position deviation alarm AL380 option	UZ	Reserved
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- X: DO output hold option
  - 0: Output status will not hold
  - 1: Output status will hold
- Y: Position deviation alarm AL380 option
  - 0: AL380 not functioning
  - 1: AL380 functioning

Diagram:



Description:

1. Command triggered: New PR command is effective. Command 3 starts to output and clear signals 2, 4, 5, and 6 simultaneously. Command triggering source: DI.CTRG, DI.EV1/EV2, P5.007 (triggered via software), etc.
2. DO.CMD\_OK: Command 3 is completely outputted and can set the delay time (DLY).
3. Command output: Output the profile of position command according to the setting of acceleration / deceleration.
4. DO.TPOS: Position error of the servo drive is within the range set by P1.054.
5. DO.MC\_OK: Position command output and servo positioning completed which is DO.CMD\_OK and DO.TPOS are both on.
6. DO.MC\_OK (remains digital output status): Same as 5. However, once this DO is on, its status will hold regardless of the signal 4 status.
7. Can only select one of signal 5 or 6 to output and it is specified by P1.048.X.
8. Position deviation: When number 7 happens, if signal 4 (or 5) is off, it means the position is deviated and AL380 can be triggered. This alarm may be set via P1.048.Y.

<b>P1.049</b>	<b>Accumulative time of speed reached</b>			<b>Address: 0162H 0163H</b>
Default:	0	Control mode:	S / Sz	
Unit:	ms	Setting range:	0 ~ 65535	
Format:	DEC	Data size:	16-bit	

Settings:

In speed mode, when the error between speed command and motor feedback speed is less than the range set by P1.047, and reaches the time set by P1.049, the digital output DO.SP\_OK (DO code 0x19) is on. If the error exceeds the range set by P1.047 at any time, it will recalculate the duration.

<b>P1.050 ~ P1.051</b>	<b>Reserved</b>
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<b>P1.052</b>	<b>Regenerative resistor value</b>			<b>Address: 0168H 0169H</b>
Default:	Determined by the model. Please refer to the following table	Control mode:	All	
Unit:	Ohm	Setting range:	Please refer to the note below	
Format:	DEC	Data size:	16-bit	

Settings:

Model	Default (Ω)	Model	Default (Ω)
1.5 kW or below	100	2 kW ~ 3 kW (included)	20

Please refer to the instruction of P1.053 for the setting value when connecting regenerative resistor with different method.

Note:

Setting range for 220V

Model	Setting range	Model	Setting range
400 W or below	20 ~ 750	2 kW ~ 3 kW	10 ~ 750
750 W ~ 1.5 kW	20 ~ 750	-	-

<b>P1.053</b>	<b>Regenerative resistor capacity</b>			<b>Address: 016AH 016BH</b>
Default:	Determined by the model. Please refer to the following table	Control mode:	All	
Unit:	Watt	Setting range:	0 ~ 6000	
Format:	DEC	Data size:	16-bit	

Settings:

Model	Default (Watt)	Model	Default (Watt)
200 W or below	0	2 kW ~ 3 kW (included)	80
400 W ~ 1.5 kW	40	-	-

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Setting value when connecting regenerative resistor with different method as follows:

External regenerative resistor	Setting
	Setting: P1.052 = 10 (Ω) P1.053 = 1000 (W)
	Setting: P1.052 = 20 (Ω) P1.053 = 2000 (W)
	Setting: P1.052 = 5 (Ω) P1.053 = 2000 (W)

P1.054	Range of position reached	Address: 016CH 016DH
Default:	167772	Control mode: PT / PR
Unit:	Pulse	Setting range: 0 ~ 16777216
Format:	DEC	Data size: 32-bit

Settings:

In position (PT) mode, when the deviation pulse number is smaller than the setting range of P1.054, DO.TPOS is on.

In position register (PR) mode, when the deviation between the target position and the actual motor position is smaller than the setting range of P1.054, DO.TPOS is on. Take a rotary motor for example, if P1.054 = 167772 and the deviation is less than 167772 pulses, which equals to 0.01 turns (167772/16777216 = 0.01), then DO.TPOS is on.

P1.055	Max. speed limit	Address: 016EH 016FH
Default:	Same as the rated speed of each model	Control mode: All
Unit:	rpm	Setting range: 10 ~ max.speed
Format:	DEC	Data size: 16-bit

Settings:

Setting the max. speed of the servo motor. Default is the rated speed.

<b>P1.056</b>	<b>Motor output overload warning level</b>		<b>Address: 0170H 0171H</b>
Default:	120	Control mode:	All
Unit:	%	Setting range:	0 ~ 120
Format:	DEC	Data size:	16-bit

Settings:

When the setting value is 0 ~ 100, and the servo motor continuously outputs load that is higher than the setting proportion (P1.056), the pre-warning for overload (DO is set to 10, OLW) will occur. If the setting value is over 100, this function will be disabled.

<b>P1.057</b>	<b>Motor crash protection (torque percentage)</b>		<b>Address: 0172H 0173H</b>
Default:	0	Control mode:	All
Unit:	%	Setting range:	0 ~ 300
Format:	DEC	Data size:	16-bit

Settings:

Setting the protection level (for the percentage of rated torque, setting the value to 0 is to disable the function; setting the value to 1 or above is to enable the function).

<b>P1.058</b>	<b>Motor crash protection (protection time)</b>		<b>Address: 0174H 0175H</b>
Default:	1	Control mode:	All
Unit:	ms	Setting range:	1 ~ 1000
Format:	DEC	Data size:	16-bit

Settings:

Setting the protection time: When reaching the protection level and after exceeding the protection time, AL030 will occur.

Note: This function is only suitable for non-contactable application, such as electric discharge machines.

(Please setup P1.037 correctly)

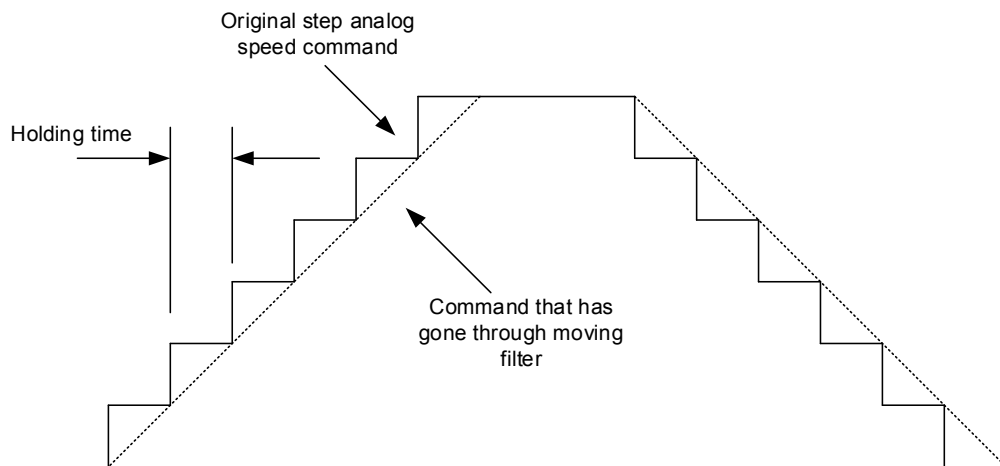
<b>P1.059</b>	<b>Speed command - moving filter</b>			<b>Address: 0176H 0177H</b>
Operation interface:	Panel / software	Communication	Control mode:	S
Default:	0.0	0	Data size:	16-bit
Unit:	1 ms	0.1 ms	-	-
Format:	One decimal	DEC	-	-
Setting range:	0.0 ~ 4.0	0 ~ 40	-	-
Example:	1.5 = 1.5 ms	15 = 1.5 ms	-	-

Settings:

0: Disable moving filter

P1.006 is low-pass filter and P1.059 is moving filter. The difference between both is that moving filter can smooth the command in the beginning and end of the step command; while low-pass filter can only smooth the command in the end.

Therefore, it is suggested that if the speed loop receives the command from the controller for forming the position control loop, then low-pass filter can be used. If it is only for the speed control, then moving filter can be used for better smoothing.



<b>P1.060 ~ P1.061</b>	<b>Reserved</b>
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<b>P1.062</b>	<b>Percentage of friction compensation</b>		<b>Address: 017CH 017DH</b>
Default:	0	Control mode:	PT / PR / S / Sz
Unit:	%	Setting range:	0 ~ 100
Format:	DEC	Data size:	16-bit

Settings:

The level of friction compensation (for the percentage of rated torque, setting the value to 0 is to disable the function; setting the value to 1 or above is to enable the function).

<b>P1.063</b>	<b>Constant of friction compensation</b>		<b>Address: 017EH 017FH</b>
Default:	1	Control mode:	PT / PR / S / Sz
Unit:	ms	Setting range:	1 ~ 1000
Format:	DEC	Data size:	16-bit

Settings:

Set up smoothing constant of friction compensation.

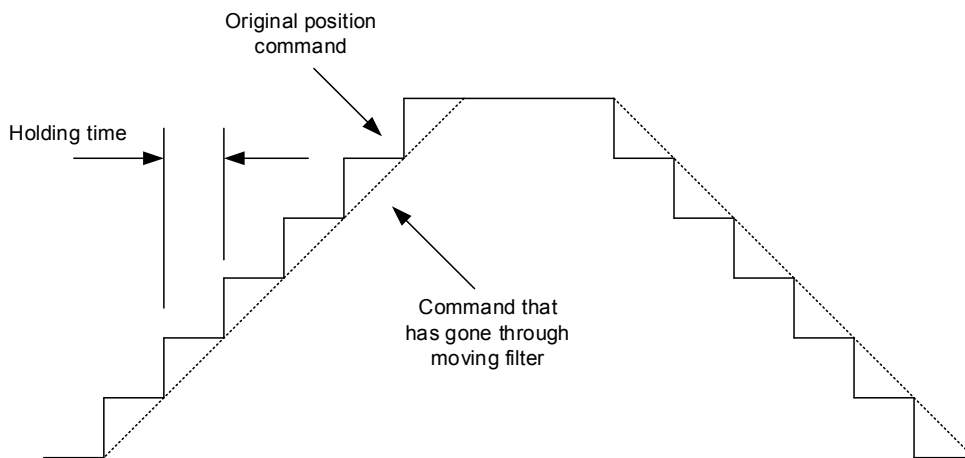
<b>P1.064 ~ P1.067</b>	<b>Reserved</b>
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<b>P1.068</b>	<b>Position command moving filter</b>		<b>Address: 0188H 0189H</b>
Default:	4	Control mode:	PT / PR
Unit:	ms	Setting range:	0 ~ 100
Format:	DEC	Data size:	16-bit

Settings:

0: Disable this function

Moving filter can activate the smooth function in the beginning and ending of step command, but it will delay the command.



<b>P1.069 ~ P1.071</b>	<b>Reserved</b>
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<b>P1.072</b>	<b>Resolution of linear scale for full-closed loop control</b>		<b>Address: 0190H 0191H</b>
Default:	5000	Control mode:	PT
Unit:	pulse / rev	Setting range:	200 ~ 1280000
Format:	DEC	Data size:	32-bit

Settings:

A/B pulse corresponded to full-closed loop when motor runs a cycle (after quadruple frequency).

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<b>P1.073</b>	<b>Error protection range for full-closed loop control</b>		<b>Address: 0192H 0193H</b>
Default:	30000	Control mode:	PT
Unit:	Pulse (based on the feedback of full-closed loop)	Setting range:	1 ~ (2 <sup>31</sup> -1)
Format:	DEC	Data size:	32-bit

Settings:

When the deviation is excessive between the A/B Counter of linear scale and feedback position of encoder, it may be a result of the connector being loose or other mechanism problems. When the deviation is greater than the setting value of P1.073, AL040, excessive deviation of full closed-loop position control will occur.

<b>P1.074</b>	<b>Full-closed loop control of linear scale</b>		<b>Address: 0194H 0195H</b>
Default:	0x0000	Control mode:	PT
Unit:	-	Setting range:	0000h ~ F132h
Format:	HEX	Data size:	16-bit

Settings:



X	Full-closed loop control switch	Z	Positive / negative direction selection of linear scale feedback
Y	Selection of OA / OB / OZ output source	U	Linear scale filter function

- X: Full-closed loop / Gantry function switch
  - 0: Disable full-closed loop / Gantry function
  - 1: Enable full-closed loop function
  - 2: Enable synchronous control function
- Y: Selection of OA / OB / OZ output source
  - 0: Motor encoder is the output source
  - 1: Encoder of linear scale is the output source
  - 2: CN1 pulse command is the output source
  - 3: Reserved
- Z: Positive / negative direction selection of linear scale feedback
  - 0: Positive direction when A phase leads B phase of linear scale
  - 1: Positive direction when B phase leads A phase of linear scale
- U: Linear scale filter function
  - 0: Bypass
  - 1: 6.66 M

- 2: 1.66 M
- 3: 833 K
- 4: 416 K
- 5 ~ F: Reserved

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P1.075	Low-pass filter time constant of full- / half-closed loop control		Address: 0196H 0197H
Default:	100	Control mode:	PT
Unit:	ms	Setting range:	0 ~ 1000
Format:	DEC	Data size:	16-bit

Settings:

When the stiffness of mechanical system between full- and half-closed loops is insufficient, users can set up the proper time constant to enhance the stability of the system. That is, temporarily creating the half-closed loop effect, and after stabilizing, full-closed loop effect is created. When the stiffness is sufficient, set to bypass.

Set the value to 0 to disable the low-pass filter (bypass) function.

If the stiffness of mechanical system is stiffer, decrease the setting value of P1.075, or set the value to 0 to disable. If the stiffness of mechanical system is softer, increase the setting value of P1.075.

P1.076 ▲	Max. speed setting of encoder output (OA, OB)		Address: 0198H 0199H
Default:	5500	Control mode:	All
Unit:	rpm	Setting range:	0 ~ 6000
Format:	DEC	Data size:	16-bit

Settings:

Input the actual max. speed value of the motor as the reference value for activating the smooth function.

When the value is set to 0, the smooth function is disabled.

P1.077 ~ P1.080	Reserved
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P1.081	Second set of max. rotation speed of analog speed command		Address: 01A2H 01A3H
Default:	Motor rated speed	Control mode:	S / T
Unit:	rpm / 10V	Setting range:	0 ~ 50000
Format:	DEC	Data size:	32-bit

Settings:

Please refer to the description of P1.040.



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<b>P1.082</b>	<b>Filter switching time between P1.040 and P1.081</b>		<b>Address: 01A4H 01A5H</b>	
Default:	0	Control mode:	S	
Unit:	ms	Setting range:	0 ~ 1000 (0: Disable this function)	
Format:	DEC	Data size:	16-bit	

Settings:

0: Disable filter switching time

<b>P1.083</b>	<b>Abnormal analog input voltage level</b>		<b>Address: 01A6H 01A7H</b>	
Default:	0	Control mode:	S	
Unit:	ms	Setting range:	0 ~ 12000 (0: Disable this function)	
Format:	DEC	Data size:	16-bit	

Settings:

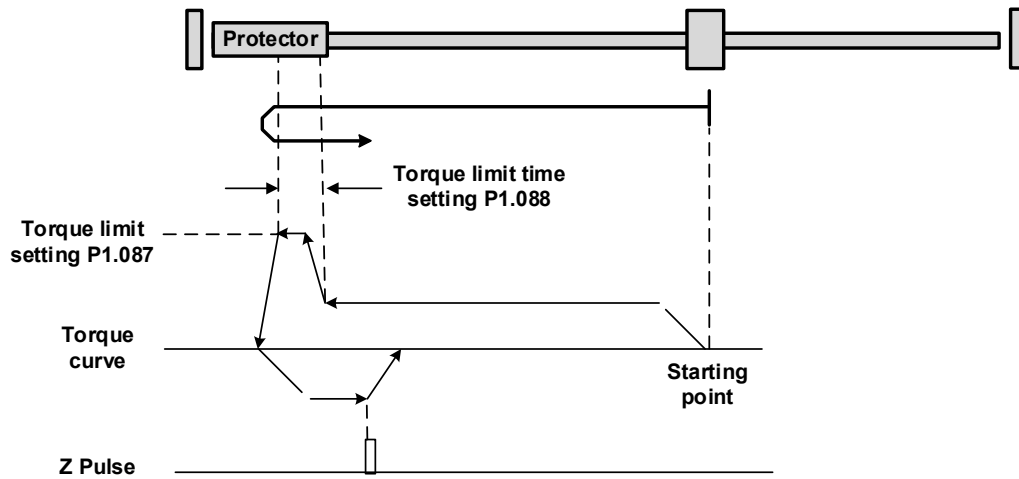
When analog input voltage is over 50 ms, AL042 will occur. The compared level for this parameter is the original analog input voltage which has not been added by an offset value via P4.022, analog speed input offset.

<b>P1.084 ~ P1.086</b>	<b>Reserved</b>

<b>P1.087</b>	<b>Torque limit setting</b>		<b>Address: 01AEH 01AFH</b>	
Default:	1	Control mode:	PR	
Unit:	%	Setting range:	1 ~ 300	
Format:	DEC	Data size:	16-bit	

Settings:

This torque limit setting is only for torque limit homing mode. As shown in the following diagram, when homing command is triggered, the motor will run in one direction until it reaches the collision protector. After reaching the collision protector, the servo drive will output a larger motor current in order to counter the external force which is the collision protector. Servo drive uses the motor current and torque limit time as the conditions for determining homing. Then it will run in the opposite direction to find Z pulse.



P1.088	Torque limit time setting			Address: 01B0H 01B1H
Default:	2000	Control mode:	PR	
Unit:	ms	Setting range:	2 ~ 2000	
Format:	DEC	Data size:	16-bit	

Settings:

Torque limit time setting in torque limit homing mode. Please refer to P1.087 for the timing diagram of torque limit homing mode.

P1.089	First set of vibration elimination - Anti-resonance frequency			Address: 01B2H 01B3H
Default:	4000	Control mode:	PT / PR	
Unit:	0.1 Hz	Setting range:	10 ~ 4000	
Format:	DEC	Data size:	16-bit	

Settings:

Anti-resonance frequency for the first set of low frequency vibration elimination.

This function is for use in flexible mechanism with low rigidity. The characteristic of flexible mechanism is when the target position is reached, due to lack of rigidity, the mechanism vibrates and will need more time to become stable. A3 provides two sets of vibration elimination. The first set is P1.089 ~ P1.091, and the second set is P1.092 ~ P1.094. The vibration elimination setting value must be obtained through the system module within the system analysis, and needs to enable the low-frequency analysis options. For details, please refer to the ASDA-Soft Software user manual.

Vibration elimination takes effect only when the two-degree-of-freedom function P2.094 [Bit 12] is enabled. After enabling the vibration elimination function, turn on the first set of vibration elimination via P2.094 [Bit8], and the second set via P2.094 [Bit9].

Example:

1. Set P2.094 = 0x11□□ to enable the first set.
2. Set P2.094 = 0x12□□ to enable the second set.
3. Set P2.094 = 0x13□□ to enable the first and second set.

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<b>P1.090</b>	<b>First set of vibration elimination - Resonance frequency</b>		<b>Address: 01B4H 01B5H</b>	
Default:	4000	Control mode:	PT / PR	
Unit:	0.1 Hz	Setting range:	10 ~ 4000	
Format:	DEC	Data size:	16-bit	

Settings:

Anti-resonance frequency for the first set of low frequency vibration elimination.

<b>P1.091</b>	<b>First set of vibration elimination - Resonance difference</b>		<b>Address: 01B6H 01B7H</b>	
Default:	10	Control mode:	PT / PR	
Unit:	0.1 dB	Setting range:	10 ~ 4000	
Format:	DEC	Data size:	16-bit	

Settings:

Attenuation rate for the first set of low frequency vibration elimination.

<b>P1.092</b>	<b>Second set of vibration elimination - Anti-resonance frequency</b>		<b>Address: 01B8H 01B9H</b>	
Default:	4000	Control mode:	PT / PR	
Unit:	0.1 Hz	Setting range:	10 ~ 4000	
Format:	DEC	Data size:	16-bit	

Settings:

Setup method same as first set of vibration elimination P1.089.

<b>P1.093</b>	<b>Second set of vibration elimination - Resonance frequency</b>		<b>Address: 01BAH 01BBH</b>	
Default:	4000	Control mode:	PT / PR	
Unit:	0.1 Hz	Setting range:	10 ~ 4000	
Format:	DEC	Data size:	16-bit	

Settings:

Anti-resonance frequency for the second set of low frequency vibration elimination.

<b>P1.094</b>	<b>Second set of vibration elimination - Resonance difference</b>		<b>Address: 01BCH 01BDH</b>	
Default:	10	Control mode:	PT / PR	
Unit:	0.1 dB	Setting range:	10 ~ 4000	
Format:	DEC	Data size:	16-bit	

Settings:

Attenuation rate for the second set of low frequency vibration elimination.

<b>P1.095 ~ P1.096</b>	<b>Reserved</b>			
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P1.097 ▲	Encoder output denominator		Address: 01C2H 01C3H	
Default:	0	Control mode:	All	
Unit:	-	Setting range:	0 ~ 160000	
Format:	DEC	Data size:	32-bit	

Settings:

When P1.097 = 0, OA/OB pulse output will only refer to the setting of P1.046.

Example 1:

When P1.097 = 0; P1.046 = 2500

OA/OB output is P1.046 multiplied by 4 times the frequency, which is 10,000 pulse.

When P1.097 has been set (value is not 0), OA/OB pulse output needs to be calculated via the numerator and denominator of P1.046 and P1.097, then convert into 4 times the frequency.

Example 1:

When P1.097 = 5; P1.046 = 2500

$$\text{OA/OB output} = \frac{2500}{5} = 500 \text{ pulse}$$

Example 2:

When P1.097 = 7; P1.046 = 2500

$$\text{OA/OB output} = \frac{2500}{7} = 357.142857 \text{ pulse}$$

P1.098	Disconnection detection protection (UVW) response time		Address: 01C4H 01C5H	
Default:	0	Control mode:	ALL	
Unit:	ms	Setting range:	0, 100 ~ 800	
Format:	DEC	Data size:	16-bit	

Settings:

When the disconnection detection protection (UVW) function (P2.065.bit9 = 1) is enabled, this parameter can select the response time of the detection mode. Set P1.098 to 0 to apply the servo's default response time.

When P1.098 is not set to 0, the setting range should be between 100 ~ 800 to set the detection response time.

Note:

1. If speeding up the response time is needed, it is recommended to set this parameter.
2. When servo is on and has not started running, it is recommended to set this parameter if detecting disconnection is needed.

P1.099 ~ P1.100	Reserved			
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<b>P1.101■</b>	<b>Analog monitor output voltage 1</b>		<b>Address: 01CAH 01CBH</b>
Default:	0	Control mode:	ALL
Unit:	mV	Setting range:	-10000 ~ 10000
Format:	DEC	Data size:	16-bit

Settings:

When 6 is selected for the monitor source of P0.003[YX], then the analog monitor output voltage will refer to the set voltage value of P1.101.

<b>P1.102■</b>	<b>Analog monitor output voltage 2</b>		<b>Address: 01CCH 01CDH</b>
Default:	0	Control mode:	ALL
Unit:	mV	Setting range:	-10000 ~ 10000
Format:	DEC	Data size:	16-bit

Settings:

When 7 is selected for the monitor source of P0.003[YX], then the analog monitor output voltage will refer to the set voltage value of P1.102.

**P2.xxx Extension parameters**

<b>P2.000</b>	<b>Position control gain</b>		<b>Address: 0200H 0201H</b>	
Default:	35	Control mode:	PT / PR	
Unit:	rad/s	Setting range:	0 ~ 2047	
Format:	DEC	Data size:	16-bit	

## Settings:

When the value of position control gain is increased, the position response can be enhanced and the position error can be reduced. However, if the value is set too big, it may easily cause vibration and noise.

<b>P2.001</b>	<b>Changing rate of position control gain</b>		<b>Address: 0202H 0203H</b>	
Default:	100	Control mode:	PT / PR	
Unit:	%	Setting range:	10 ~ 500	
Format:	DEC	Data size:	16-bit	

## Settings:

Switch the changing rate of position control gain according to the gain switching condition.

<b>P2.002</b>	<b>Position feed forward gain</b>		<b>Address: 0204H 0205H</b>	
Default:	50	Control mode:	PT / PR	
Unit:	%	Setting range:	0 ~ 100	
Format:	DEC	Data size:	16-bit	

## Settings:

If the position control command is changed smoothly, increasing the gain value can reduce the position following error. If not changed smoothly, decreasing the gain value can reduce mechanical vibration.

This gain parameter is disabled when the two-degree-of-freedom function is on (P2.094 [Bit 12] = 1).

<b>P2.003</b>	<b>Smooth constant of position feed forward gain</b>		<b>Address: 0206H 0207H</b>	
Default:	5	Control mode:	PT / PR	
Unit:	ms	Setting range:	2 ~ 100	
Format:	DEC	Data size:	16-bit	

## Settings:

If the position control command is changed smoothly, decreasing the smooth constant value can reduce the position following error. If not changed smoothly, increasing the smooth constant value can reduce mechanical vibration.

## 8

<b>P2.004</b>	<b>Speed control gain</b>		<b>Address: 0208H 0209H</b>	
Default:	500	Control mode:	All	
Unit:	rad/s	Setting range:	0 ~ 8191	
Format:	DEC	Data size:	16-bit	

Settings:

Increase the value of speed control gain can enhance the speed response. However, if the value is set too big, it may easily cause vibration and noise.

<b>P2.005</b>	<b>Changing rate of speed control gain</b>		<b>Address: 020AH 020BH</b>	
Default:	100	Control mode:	All	
Unit:	%	Setting range:	10 ~ 500	
Format:	DEC	Data size:	16-bit	

Settings:

Switch the changing rate of speed control gain according to the gain switching condition.

<b>P2.006</b>	<b>Speed integral compensation</b>		<b>Address: 020CH 020DH</b>	
Default:	100	Control mode:	All	
Unit:	%	Setting range:	0 ~ 1023	
Format:	DEC	Data size:	16-bit	

Settings:

Increasing the value of integral speed control can enhance speed response and reduce the deviation of speed control. However, if the value is set too big, it may easily cause vibration and noise.

<b>P2.007</b>	<b>Speed feed forward gain</b>		<b>Address: 020EH 020FH</b>	
Default:	0	Control mode:	All	
Unit:	%	Setting range:	0 ~ 100	
Format:	DEC	Data size:	16-bit	

Settings:

If the speed control command is changed smoothly, increasing the gain value can reduce the speed following error. If not changed smoothly, decreasing the gain value can reduce mechanical vibration.

<b>P2.008■</b>	<b>Special parameter write-in function</b>		<b>Address: 0210H 0211H</b>	
Default:	0	Control mode:	All	
Unit:	-	Setting range:	0 ~ 65535	
Format:	DEC	Data size:	16-bit	

Settings:

Special parameter write-in function:

Code	Function
10	Reset parameter (Re-power on after reset)
20	P4.010 is writable
22	P4.011 ~ P4.021 are writable
30, 35	Save the data of Compare, Capture, and E-Cam
406	Enable forced DO mode
400	When forced DO mode is enabled, it can switch back to the normal DO mode.

Note: A3-L does not support E-Cam function.

P2.009	DI response filter time	Address: 0212H 0213H	
Default:	2	Control mode:	All
Unit:	ms	Setting range:	0 ~ 20
Format:	DEC	Data size:	16-bit

Settings:

When the environmental interference is big, increasing the setting value can enhance the control stability.

However, if the value is set too big, it will impact the response time.

P2.010	DI1 functional planning	Address: 0214H 0215H	
Default:	0x0101	Control mode:	All
Unit:	_	Setting range:	0 ~ 0x015F (last two codes are DI codes)
Format:	HEX	Data size:	16-bit

Settings:



U Z YX

- YX: Input function selection  
Please refer to Table 8.1
- Z: Input contact: a or b contact
  - 0: Set this input contact as normally closed (b contact)
  - 1: Set this input contact as normally open (a contact)
- U: Not in use

When parameters are modified, please re-start the servo drive to ensure it can function normally.

P3.006 is used to set how digital signal is input, through external terminal block or communication parameter P4.007.



## 8

<b>P2.011</b>	<b>DI2 functional planning</b>		<b>Address: 0216H 0217H</b>
Default:	0x0104	Control mode:	All
Unit:	-	Setting range:	0 ~ 0x015F (last two codes are DI codes)
Format:	HEX	Data size:	16-bit

Settings:

Please refer to the description of P2.010.

<b>P2.012</b>	<b>DI3 functional planning</b>		<b>Address: 0218H 0219H</b>
Default:	0x0116	Control mode:	All
Unit:	-	Setting range:	0 ~ 0x015F (last two codes are DI codes)
Format:	HEX	Data size:	16-bit

Settings:

Please refer to the description of P2.010.

<b>P2.013</b>	<b>DI4 functional planning</b>		<b>Address: 021AH 021BH</b>
Default:	0x0117	Control mode:	All
Unit:	-	Setting range:	0 ~ 0x015F (last two codes are DI codes)
Format:	HEX	Data size:	16-bit

Settings:

Please refer to the description of P2.010.

<b>P2.014</b>	<b>DI5 functional planning</b>		<b>Address: 021CH 021DH</b>
Default:	0x0102	Control mode:	All
Unit:	-	Setting range:	0 ~ 0x015F (last two codes are DI codes)
Format:	HEX	Data size:	16-bit

Settings:

Please refer to the description of P2.010.

<b>P2.015</b>	<b>DI6 functional planning</b>		<b>Address: 021EH 021FH</b>
Default:	0x0022	Control mode:	All
Unit:	-	Setting range:	0 ~ 0x015F (last two codes are DI codes)
Format:	HEX	Data size:	16-bit

Settings:

Please refer to the description of P2.010.

P2.016	DI7 functional planning		Address: 0220H 0221H
Default:	0x0023	Control mode:	All
Unit:	-	Setting range:	0 ~ 0x015F (last two codes are DI codes)
Format:	HEX	Data size:	16-bit

Settings:

Please refer to the description of P2.010.

P2.017	DI8 functional planning		Address: 0222H 0223H
Default:	0x0022	Control mode:	All
Unit:	-	Setting range:	0 ~ 0x015F (last two codes are DI codes)
Format:	HEX	Data size:	16-bit

Settings:

Please refer to the description of P2.010.

P2.018	DO1 functional planning		Address: 0224H 0225H
Default:	0x0101	Control mode:	All
Unit:	-	Setting range:	0 ~ 0x013F (last two codes are DO code)
Format:	HEX	Data size:	16-bit

Settings:



U Z YX

- YX: Output function selection  
Please refer to Table 8.2.
- Z: Output contact: a or b contact
  - 0: Set this output contact as normally closed (b contact)
  - 1: Set this output contact as normally open (a contact)
- U: Not in use

When parameters are modified, please re-start the servo drive to ensure it can function normally.

P2.019	DO2 functional planning		Address: 0226H 0227H
Default:	0x0103	Control mode:	All
Unit:	-	Setting range:	0 ~ 0x013F (last two codes are DO code)
Format:	HEX	Data size:	16-bit

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Settings:

Please refer to the description of P2.018.

<b>P2.020</b>	<b>DO3 functional planning</b>		<b>Address: 0228H 0229H</b>
Default:	0x0109	Control mode:	All
Unit:	-	Setting range:	0 ~ 0x013F (last two codes are DO code)
Format:	HEX	Data size:	16-bit

Settings:

Please refer to the description of P2.018.

<b>P2.021</b>	<b>DO4 functional planning</b>		<b>Address: 022AH 022BH</b>
Default:	0x0105	Control mode:	All
Unit:	-	Setting range:	0 ~ 0x013F (last two codes are DO code)
Format:	HEX	Data size:	16-bit

Settings:

Please refer to the description of P2.018.

<b>P2.022</b>	<b>DO5 functional planning</b>		<b>Address: 022CH 022DH</b>
Default:	0x0007	Control mode:	All
Unit:	-	Setting range:	0 ~ 0x013F (last two codes are DO code)
Format:	HEX	Data size:	16-bit

Settings:

Please refer to the description of P2.018.

<b>P2.023</b>	<b>Resonance suppression (Notch filter) (1)</b>		<b>Address: 022EH 022FH</b>
Default:	1000	Control mode:	All
Unit:	Hz	Setting range:	50 ~ 5000
Format:	DEC	Data size:	16-bit

Settings:

The first setting value of resonance frequency. If P2.024 is set to 0, this function is disabled. P2.043 and P2.044 are the second resonance suppression (Notch filter).

P2.024	Resonance suppression (Notch filter) attenuation rate (1)			Address: 0230H 0231H
Default:	0	Control mode:	All	
Unit:	-dB	Setting range:	0 ~ 40	
Format:	DEC	Data size:	16-bit	

Settings:

This is the first resonance suppression (Notch filter) attenuation rate. When this parameter is set to 0, notch filter function will be disabled. For example, if the value of attenuation rate is set to 5, then it would be -5 dB.

P2.025	Low-pass filter of resonance suppression			Address: 0232H 0233H
Operation interface:	Panel / software	Communication	Control mode:	All
Default:	1.0	10	Data size:	16-bit
Unit:	1 ms	0.1 ms	-	-
Setting range:	0.0 ~ 100.0	0 ~ 1000	-	-
Format:	One decimal	DEC	-	-
Example:	1.5 = 1.5 ms	15 = 1.5 ms	-	-

Settings:

Set the time constant for the low-pass filter of resonance suppression. When the value is set to 0, the function of low-pass filter is disabled.

P2.026	Anti-interference gain			Address: 0234H 0235H
Default:	0	Control mode:	All	
Unit:	rad/s	Setting range:	0 ~ 1023	
Format:	DEC	Data size:	16-bit	

Settings:

Increasing the value of this parameter can increase the damping of speed loop. It is suggested to set the value of P2.026 to equal the value of P2.006. Please follow the principles below for adjusting P2.026:

1. In speed mode, increasing the value of this parameter can reduce speed overshoot.
2. In position mode, decreasing the value of this parameter can reduce position overshoot.

P2.027	Gain switching condition and method selection			Address: 0236H 0237H
Default:	0x0000	Control mode:	All	
Unit:	-	Setting range:	0000h ~ 0x0018	
Format:	HEX	Data size:	16-bit	

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Settings:



X	Gain switching condition	Y	Gain switching method	UZ	Reserved
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■ X: Gain switching condition

0: Disable gain switching function	5: Signal of gain switching (GAINUP) is OFF
1: Signal of gain switching (GAINUP) is ON	6: In position control mode, position error is smaller than the value of P2.029
2: In position control mode, position error is bigger than the value of P2.029	7: Frequency of position command is smaller than the value of P2.029
3: Frequency of position command is bigger than the value of P2.029	8: Rotation speed of servo motor is slower than the value of P2.029
4: Rotation speed of servo motor is faster than the value of P2.029	

■ Y: Gain switching method

0: Gain rate switching

1: Integrator switching (P controller switch to PI controller)

Setting value	Control mode P	Control mode S	switching
0	P2.000 x 100% P2.004 x 100%	P2.004 x 100%	Before switching
	P2.000 x P2.001 P2.004 x P2.005	P2.004 x P2.005	After switching
1	P2.006 x 0%; P2.026 x 0%		Before switching
	P2.006 x 100%; P2.026 x 100%		After switching

■ UZ: Not in use

P2.028	Gain switching time constant			Address: 0238H 0239H
Default:	10	Control mode:	All	
Unit:	ms	Setting range:	0 ~ 1000	
Format:	DEC	Data size:	16-bit	
Example:	15 = 150 ms			

Settings:

For switching the smooth gain. Set this parameter to 0 to disable this function.

P2.029	Gain switching condition			Address: 023AH 023BH
Default:	16777216	Control mode:	All	
Unit:	pulse; kpps; rpm	Setting range:	0 ~ 50331648	
Format:	DEC	Data size:	32-bit	

Settings:

The setting of gain switching (pulse error, kpps, rpm) is determined by the selection of gain switching condition (P2.027).

<b>P2.030</b>	<b>Auxiliary function</b>		<b>Address: 023CH 023DH</b>	
Default:	0	Control mode:	All	
Unit:	-	Setting range:	-8 ~ +8	
Format:	DEC	Data size:	16-bit	

Settings:

Setting value	Function
0	Disable all functions described below
1	Switch servo to on state
2 ~ 4	(Reserved)
5	This setting does not retain the parameter settings after power off. When there is no need to save the data, this setting can avoid parameters continuously writing into EEPROM and shortening the lifetime of EEPROM. Setting this parameter is required when using communication control.
6	This setting will enable simulation mode (command simulation). In this mode, the external Servo On signal cannot work and the DSP Error (variable 0x6F) is regarded as 0. P0.001 only shows the external error code (positive/negative limit, emergency stop, etc). DO.Ready is on, command is accepted in each mode and can be observed via scope software. However, the motor will not operate. The aim is to examine command accuracy.
7	High-speed oscilloscope, disable Time-Out function (for PC software).
8	Back up all parameters (current value) to EEPROM, and the value will remain after re-powering. The panel displays 'to.rom' during execution. (It can also be executed when servo is on.)
-1, -5, -6, -7	Disable the functions of 1, 5, 6, and 7.
-2 ~ -4, -8	(Reserved)

Note: Please set the value to 0 in normal operation. The value returns to 0 automatically after re-powering.

<b>P2.031</b>	<b>Frequency response level</b>		<b>Address: 023EH 023FH</b>	
Default:	0x0016	Control mode:	All	
Unit:	-	Setting range:	1 ~ 50	
Format:	HEX	Data size:	16-bit	

Settings:

In gain adjustment mode (P2.032), users can adjust the servo frequency via the frequency response level parameter (P2.031). When the frequency response level (P2.031) is increased, the servo frequency is increased as well. Please refer to Chapter 5 for adjustment details.

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<b>P2.032</b>	<b>Gain adjustment mode</b>		<b>Address: 0240H 0241H</b>
Default:	0x0001	Control mode:	All
Unit:	-	Setting range:	0 ~ 4
Format:	HEX	Data size:	16-bit

Settings:

The servo drive provides three gain adjustment modes for users to do fine tuning. Users only need to increase or decrease the frequency response level (P2.031) to tune the machine. Gain adjustment mode must be operated when the simple mode is off (P2.033 U = 0). It is suggested to tune the machine according to the tuning procedure in Section 5.1.

Setting value	Adjustment mode	Inertia estimation	Parameter	
			Manual	Auto
0	Manual	Fixed set value of P1.037	P1.037, P2.000, P2.004, P2.006, P2.023, P2.024, P2.025, P2.043, P2.044, P2.045, P2.046, P2.049, P2.089, P2.098, P2.099, P2.101, P2.102	N/A
1	Gain adjustment mode 1	Real-time estimation	P2.031	P1.037, P2.000, P2.004, P2.006, P2.023, P2.024, P2.025, P2.043, P2.044, P2.045, P2.046, P2.049, P2.089, P2.098, P2.099, P2.101, P2.102
2	Gain adjustment mode 2	Fixed set value of P1.037	P1.037 P2.031	P2.000, P2.004, P2.006, P2.023, P2.024, P2.025, P2.043, P2.044, P2.045, P2.046, P2.049, P2.089, P2.098, P2.099, P2.101, P2.102
3	Gain adjustment mode 3 (Only two-degree-of-freedom function is enabled)	Fixed set value of P1.037	P1.037 P2.031 P2.089	P2.000, P2.004, P2.006, P2.023, P2.024, P2.025, P2.043, P2.044, P2.045, P2.046, P2.049, P2.098, P2.099, P2.101, P2.102
4	Gain adjustment mode 4	Reset to gain default value		

Note: When the two-degree-of-freedom function is turned off (P2.094 [Bit 12] = 0), the effect of gain adjustment mode 3 is equivalent to gain adjustment mode 2, so setting P2.089 is invalid.

<b>P2.033</b>	<b>Reserved</b>
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<b>P2.034</b>	<b>Warning condition for speed command error</b>		<b>Address: 0244H 0245H</b>
Default:	5000	Control mode:	S / Sz
Unit:	rpm	Setting range:	1 ~ 30000 (rotary motor) 1 ~ 15999 (linear motor)
Format:	DEC	Data size:	16-bit

Settings:

In speed mode, this parameter sets the error between the command speed and feedback speed.

If the error is greater than this set value, AL007 will occur.

<b>P2.035</b>	<b>Warning condition for excessive deviation of position command</b>		<b>Address: 0246H 0247H</b>
Default:	50331648	Control mode:	PT / PR
Unit:	pulse	Setting range:	1 ~ 1677721600
Format:	DEC	Data size:	32-bit

Settings:

In position mode, this parameter sets the error between the command position and feedback position.

If the error is greater than this set value, AL009 will occur.

<b>P2.036</b>	<b>DI9 functional planning</b>		<b>Address: 0248H 0249H</b>
Default:	0x0000	Control mode:	All
Unit:	-	Setting range:	0 ~ 0x015F (last two codes are DI codes)
Format:	HEX	Data size:	16-bit

Settings:

Please refer to the description of P2.010.

<b>P2.037</b>	<b>DI10 functional planning</b>		<b>Address: 024AH 024BH</b>
Default:	0x0000	Control mode:	All
Unit:	-	Setting range:	0 ~ 0x015F (last two codes are DI codes)
Format:	HEX	Data size:	16-bit

Settings:

Please refer to the description of P2.010.

<b>P2.038</b>	<b>VDI11 functional planning</b>		<b>Address: 024CH 024DH</b>
Default:	0x0000	Control mode:	All
Unit:	-	Setting range:	0 ~ 0x015F (last two codes are DI codes)
Format:	HEX	Data size:	16-bit



Settings:

Please refer to the description of P2.010. Virtual digital input is suitable for applications of communication triggering or when DI points are insufficient. Users can set the DI that will be in immediate use once power on as normally closed contact for virtual digital input, such as servo on.

<b>P2.039</b>	<b>VDI12 functional planning</b>		<b>Address: 024EH 024FH</b>
Default:	0x0000	Control mode:	All
Unit:	-	Setting range:	0 ~ 0x015F (last two codes are DI codes)
Format:	HEX	Data size:	16-bit

Settings:

Please refer to the description of P2.038.

<b>P2.040</b>	<b>VDI13 functional planning</b>		<b>Address: 0250H 0251H</b>
Default:	0x0000	Control mode:	All
Unit:	-	Setting range:	0 ~ 0x015F (last two codes are DI codes)
Format:	HEX	Data size:	16-bit

Settings:

Please refer to the description of P2.038.

<b>P2.041</b>	<b>DO6 functional planning</b>		<b>Address: 0252H 0253H</b>
Default:	0x0000	Control mode:	All
Unit:	-	Setting range:	0 ~ 0x013F (last two codes are DO code)
Format:	HEX	Data size:	16-bit

Settings:

Please refer to the description of P2.018.

<b>P2.042</b>	<b>Reserved</b>

<b>P2.043</b>	<b>Resonance suppression (Notch filter) (2)</b>		<b>Address: 0256H 0257H</b>
Default:	1000	Control mode:	All
Unit:	Hz	Setting range:	50 ~ 5000
Format:	DEC	Data size:	16-bit

Settings:

The second setting value of resonance frequency. If P2.044 is set to 0, this function is disabled.

<b>P2.044</b>	<b>Resonance suppression (Notch filter) attenuation rate (2)</b>		<b>Address: 0258H 0259H</b>
Default:	0	Control mode:	All
Unit:	-dB	Setting range:	0 ~ 40
Format:	DEC	Data size:	16-bit

Settings:

The second resonance suppression (notch filter) attenuation rate. When this parameter is set to 0, the notch filter function is disabled. If the value of attenuation rate is set to 5, then it would be -5 dB.

<b>P2.045</b>	<b>Resonance suppression (Notch filter) (3)</b>		<b>Address: 025AH 025BH</b>
Default:	1000	Control mode:	All
Unit:	Hz	Setting range:	50 ~ 5000
Format:	DEC	Data size:	16-bit

Settings:

The third setting value of resonance frequency. If P2.046 is set to 0, this function is disabled.

<b>P2.046</b>	<b>Resonance suppression (Notch filter) attenuation rate (3)</b>		<b>Address: 025CH 025DH</b>
Default:	0	Control mode:	All
Unit:	-dB	Setting range:	0 ~ 40
Format:	DEC	Data size:	16-bit

Settings:

The third resonance suppression (notch filter) attenuation rate. When this parameter is set to 0, the notch filter function is disabled. If the value of attenuation rate is set to 5, then it would be -5 dB.

<b>P2.047</b>	<b>Auto resonance suppression mode setting</b>		<b>Address: 025EH 025FH</b>
Default:	1	Control mode:	All
Unit:	-	Setting range:	0x0000 ~ 0x01F2
Format:	DEC	Data size:	16-bit

Settings:



U Z Y X

X	Auto resonance suppression function	Z	Fixed resonance suppression parameter
Y	Fixed resonance suppression parameter	U	Reserved

- X: Auto resonance suppression function

0: Disable auto resonance suppression. After the function is disabled, the existing resonance

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suppression parameter values will be fixed.

1: Auto resonance suppression. When the servo determines it's stable, including resonance are suppressed, no other resonance, no other interference source that will affect the operation, and other factors, the servo will automatically save the data of resonance suppression, and the value returns to 0. If it is unstable, re-power on or set to 1 again for servo to re-estimate.

■ Y: Fixed resonance suppression parameter

In auto resonance suppression, users can set the Notch filters requiring manual resonance suppression.

Bit	3	2	1	0
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Bit	Function	Description
0	Notch 1 auto / manual setting	0: Auto resonance suppression 1: Manually set the first set of resonance suppression
1	Notch 2 auto / manual setting	0: Auto resonance suppression 1: Manually set the second set of resonance suppression
2	Notch 3 auto / manual setting	0: Auto resonance suppression 1: Manually set the third set of resonance suppression
3	Notch 4 auto / manual setting	0: Auto resonance suppression 1: Manually set the forth set of resonance suppression

■ Z: Fixed resonance suppression parameter

In auto resonance suppression, users can set the Notch filters requiring manual resonance suppression.

Bit	3	2	1	0
-----	---	---	---	---

Bit	Function	Description
0	Notch 5 auto / manual setting	0: Auto resonance suppression 1: Manually set the fifth set of resonance suppression

Example: If the user set P2.047 = 0x0021, when auto resonance suppression function is enabled, the servo will search for the point of resonance and suppress it. When Y is set to 2, user will manually set the second set of resonance suppression. Thus, if the servo finds 2 resonance points, the servo will write data of the 1<sup>st</sup> point to the 1<sup>st</sup> set of resonance suppression parameters. Then, data of the 2<sup>nd</sup> point will be written to the 3<sup>rd</sup> set of resonance suppression parameters. That is, the 2<sup>nd</sup> set will be skipped.

<b>P2.048</b>	<b>Auto resonance detection level</b>			<b>Address: 0260H 0261H</b>
Default:	100	Control mode:	All	
Unit:	-	Setting range:	1 ~ 1000	
Format:	DEC	Data size:	16-bit	

Settings:

The smaller the parameter value is, the more sensitive to resonance. If the set value of P2.048 is bigger, the resonance sensitivity becomes lower; on the other hand, if the set value of P2.048 is smaller, the resonance sensitivity becomes higher.

<b>P2.049</b>	<b>Speed detection filter and jitter suppression</b>			<b>Address: 0262H 0263H</b>
Operation interface:	Panel / software	Communication	Control mode:	All
Default:	1.0	10	Data size:	16-bit
Unit:	1 ms	0.1 ms	-	-
Setting range:	0.0 ~ 100.0	0 ~ 1000	-	-
Format:	One decimal	DEC	-	-
Example:	1.5 = 1.5 ms	15 = 1.5 ms	-	-

Settings:

For setting the filter of speed estimation.

<b>P2.050</b>	<b>Pulse clear mode</b>			<b>Address: 0264H 0265H</b>
Default:	0x0000		Control mode:	PT
Unit:	-		Setting range:	0 ~ 1
Format:	HEX		Data size:	16-bit

Settings:

Please refer to Table 8.1 for digital input setting. When setting digital input (DI) as CCLR, the function of pulse clear is effective. If this DI is on, the accumulative position error will be cleared to 0.

0: CCLR is rising-edge triggered.

1: CCLR is action-level triggered.

<b>P2.051</b>	<b>Reserved</b>

## 8

<b>P2.052 ▲</b>	<b>Indexing coordinates scale</b>		<b>Address: 0268H 0269H</b>	
Default:	1000000000	Control mode:	All	
Unit:	PUU	Setting range:	0 ~ 1000000000	
Format:	DEC	Data size:	32-bit	

Settings:

This parameter is used to set the scale of the indexing coordinates, indexing command position, and indexing feedback position. If the setting value is too small, it may cause the error of indexing coordinates.

Range of setting value of P2.052:

$$P2.052 > 1.05 \times \text{Max. motor speed (rpm)} \times \frac{16777216}{60000} \times \frac{P1.045}{P1.044}$$

$$P2.052 > 146.8 \times \text{Max. motor speed (rpm)} \times \frac{P1.045}{P1.044}$$

<b>P2.053</b>	<b>Position integral compensation</b>		<b>Address: 026AH 026BH</b>	
Default:	0	Control mode:	All	
Unit:	rad/s	Setting range:	0 ~ 1023	
Format:	DEC	Data size:	16-bit	

Settings:

Increasing the value of position control integral can reduce the position steady-state error, but if the value is set too big, it may easily cause position overshoot and noise.

<b>P2.054 ▲</b>	<b>Gain of synchronous speed control</b>		<b>Address: 026CH 026DH</b>	
Default:	0	Control mode:	All	
Unit:	rad/s	Setting range:	0 ~ 8191	
Format:	DEC	Data size:	16-bit	

Settings:

When increasing the value of synchronous speed control, it can enhance the speed following of two motors. However, if the value is set too big, it may easily cause vibration and noise.

<b>P2.055 ▲</b>	<b>Synchronous speed integral compensation</b>		<b>Address: 026EH 026FH</b>	
Default:	0	Control mode:	All	
Unit:	rad/s	Setting range:	0 ~ 1023	
Format:	DEC	Data size:	16-bit	

Settings:

When increasing the value of synchronous speed integral compensation, it can enhance the speed following and reduce the speed error between two motors. However, if the value is set too big, it may easily cause vibration and noise.

<b>P2.056 ▲</b>	<b>Synchronous position integral compensation</b>		<b>Address: 0270H 0271H</b>	
Default:	0	Control mode:	All	
Unit:	rad/s	Setting range:	0 ~ 1023	
Format:	DEC	Data size:	16-bit	

Settings:

When increasing the value of synchronous speed integral compensation, it can enhance the speed following and reduce the speed error between two motors. However, if the value is set too big, it may easily cause vibration and noise. It is suggested to set the value same as P2.006.

<b>P2.057 ▲</b>	<b>Synchronous control bandwidth</b>		<b>Address: 0272H 0273H</b>	
Default:	0	Control mode:	All	
Unit:	Hz	Setting range:	0 ~ 1023	
Format:	DEC	Data size:	16-bit	

Settings:

If users do not know how to set P2.054 ~ P2.056, you may set the value of synchronous control bandwidth instead as the value will correspond to P2.054 ~ P2.056.

1. When the synchronous control bandwidth is greater than the servo bandwidth, the synchronous following is better.
2. When the servo bandwidth is greater than the synchronous control bandwidth, the following of single-axis motion is better.

However, when the servo bandwidth plus the synchronous control bandwidth (P2.057) is greater than the system's allowable bandwidth, it will cause system resonance.

Note: When increasing the bandwidth of speed loop and synchronous control, the response of P2.025 must be faster than the setting of both bandwidths. Therefore, P2.025 should decrease as needed.

<b>P2.058</b>	<b>Low-pass filter of synchronous speed error</b>		<b>Address: 0274H 0275H</b>	
Default:	0	Control mode:	All	
Unit:	0.1 ms	Setting range:	0 ~ 1000	
Format:	DEC	Data size:	16-bit	
Example:	15 = 1.5 ms			

Settings:

When synchronous control is affected by low resolution, and thus noise (less sharp and rough sound) is generated, you may set the low-pass filter suppression. This filter must be faster than the setting of the synchronous control bandwidth.

<b>P2.059</b>	<b>Reserved</b>

8

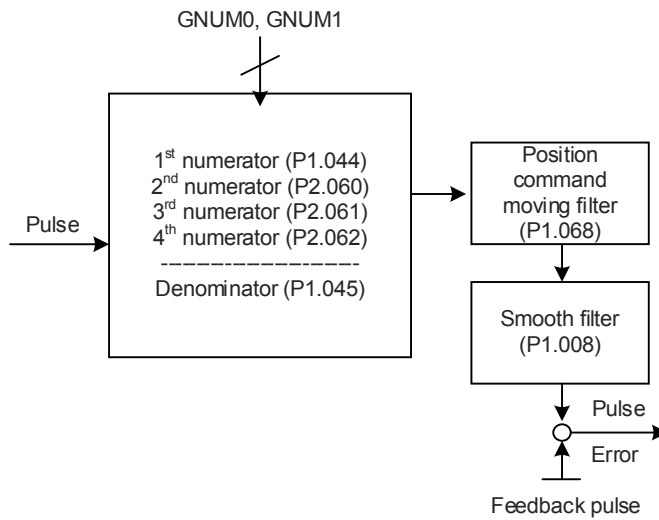
<b>P2.060</b>	<b>E-Gear ratio (Numerator) (N2)</b>		<b>Address: 0278H 0279H</b>
Default:	16777216	Control mode:	PT
Unit:	pulse	Setting range:	1 ~ (2 <sup>29</sup> -1)
Format:	DEC	Data size:	32-bit

Settings:

The numerator of E-Gear ratio can be selected via DI.GNUM0 and DI.GNUM1 (Please refer to Table 8.1).

If DI.GNUM0 and DI.GNUM1 are not defined, P1.044 is the default numerator of E-Gear ratio.

Please switch DI.GNUM0 and DI.GNUM1 during stop status to avoid mechanical vibration.



<b>P2.061</b>	<b>E-Gear ratio (Numerator) (N3)</b>		<b>Address: 027AH 027BH</b>
Default:	16777216	Control mode:	PT
Unit:	pulse	Setting range:	1 ~ (2 <sup>29</sup> -1)
Format:	DEC	Data size:	32-bit

Settings:

Please refer to the description of P2.060.

<b>P2.062</b>	<b>E-Gear ratio (Numerator) (N4)</b>		<b>Address: 027CH 027DH</b>
Default:	16777216	Control mode:	PT
Unit:	pulse	Setting range:	1 ~ (2 <sup>29</sup> -1)
Format:	DEC	Data size:	32-bit

Settings:

Please refer to the description of P2.060.

<b>P2.063 ~ P2.064</b>	<b>Reserved</b>
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<b>P2.065</b>	<b>Special bit register</b>		<b>Address: 0282H 0283H</b>
Default:	0	Control mode:	PT / PR / S / Sz
Unit:	-	Setting range:	0 ~ 0xFFFF
Format:	-	Data size:	-

Settings:

Bit	7	6	5	4	3	2	1	0
Bit	15	14	13	12	11	10	9	8

Bit 0 ~ Bit 2, Bit 4, Bit 5, Bit 7, and Bit 14: Reserved, please set to 0.

Bit 3: Determine mechanism of regenerative energy consumption

0: Determined by the servo internal algorithm; 1: Determined by the DC bus voltage.

Bit 6: In PT mode, pulse error (pulse frequency is too high) protection function.

0: Enable pulse error protection function; 1: Disable pulse error protection function.

Bit 8: U, V, W wiring error detection function.

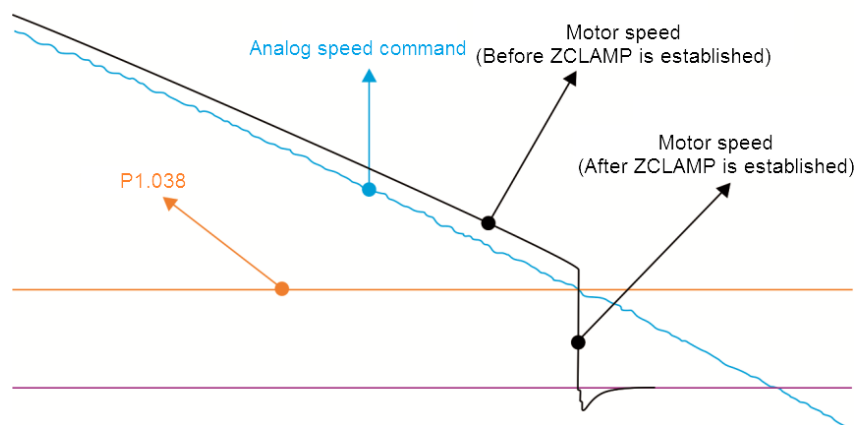
1: Enable U, V, W wiring error detection function.

Bit 9: U, V, W wiring cut-off detection function.

1: Enable U, V, W wiring cut-off detection function.

Bit 10: ZCLAMP function selection. When the following conditions are met, the ZCLAMP function will be enabled. Condition 1: Speed mode; Condition 2: DI.ZCLAMP is on; Condition 3: Motor speed is slower than the value of P1.038.

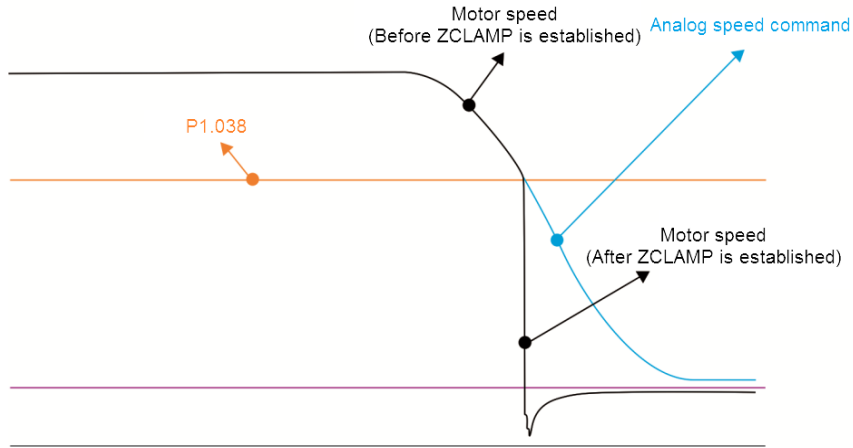
0: Command source is analog voltage. ZCLAMP function will use the analog speed command without acceleration / deceleration to determine if this function should be enabled. The motor will be clamped at the position where ZCLAMP conditions are met.



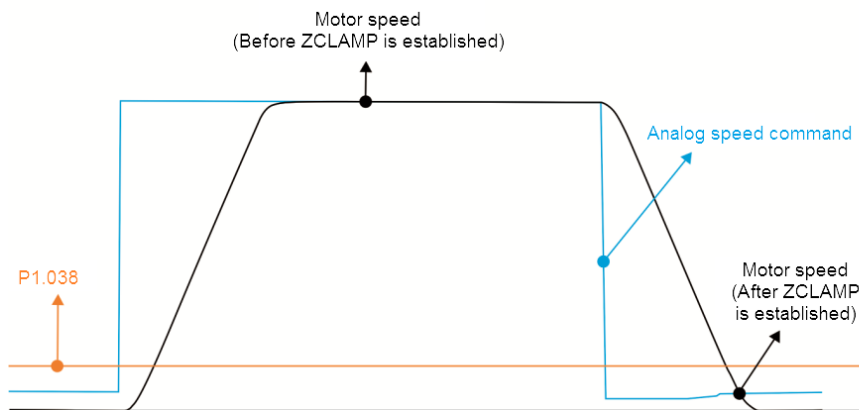
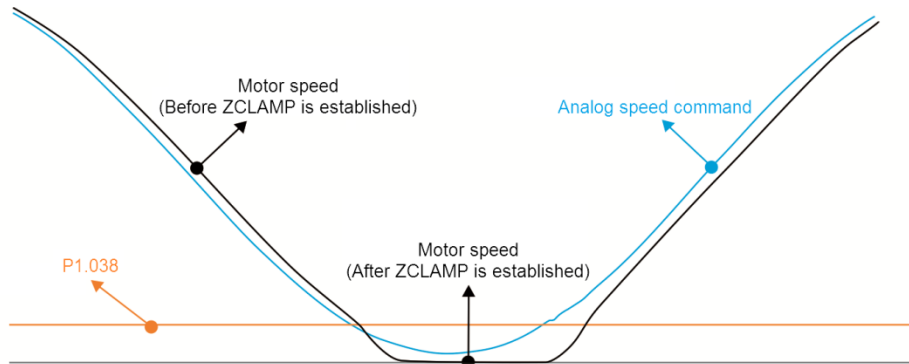
0: Command source is register. ZCLAMP function will use the register speed command with acceleration / deceleration to determine if this function should be enabled. The motor will be clamped at the position where ZCLAMP conditions are met.



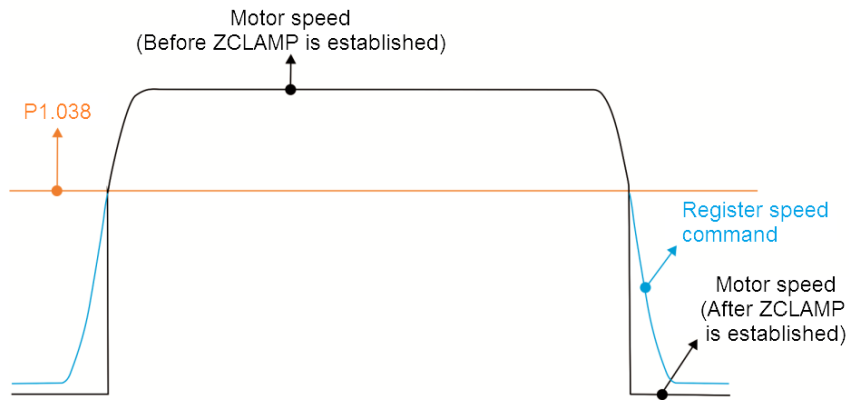
8



1: Command source is analog voltage. ZCLAMP function will use the analog speed command without acceleration / deceleration to determine if this function is enabled. When ZCLAMP conditions are met, the motor speed decelerates to 0 rpm by S-curve deceleration. If not, the motor follows the analog speed command through S-curve.



1: Command source is register. ZCLAMP function will use the register speed command with acceleration / deceleration to determine if this function should be enabled. When ZCLAMP conditions are met, the motor speed will be set to 0 rpm.



Bit 11: Enable pulse inhibit function

0: Disable NL / PL pulse inhibit function. In PT mode, the external position pulse command will be input to the servo drive in any condition.

1: Enable NL / PL pulse inhibit function. In PT mode, if NL exists, the external NL pulse will be inhibited to input to the servo drive and PL pulse command will be accepted. In PT mode, if PL exists, the external PL pulse will be inhibited to input to the servo drive and NL pulse command will be accepted.

Note: In DMCNET mode, if NL and PL both exist, both pulse commands will be inhibited to input to the servo drive.

Bit 12: Loss phase detection function

0: Enable loss phase (AL022) detection; 1: Disable loss phase (AL022) detection.

Bit 13: Encoder output error detection function

0: Enable encoder output error (AL018) detection function; 1: Disable encoder output error (AL018) detection function.

Bit 15: Friction compensation mode selection

0: If the speed is slower than the value of P1.038, the compensation value remains; 1: If the speed is slower than the value of P1.038, the compensation value will become 0.

P2.066	Special bit register 2			Address: 0284H 0285H
Default:	0x0000	Control mode:	PT / PR / S / Sz	
Unit:	-	Setting range:	0x0000 ~ 0x182F	
Format:	HEX	Data size:	16-bit	

Settings:

Bit	7	6	5	4	3	2	1	0
Bit	15	14	13	12	11	10	9	8

Bit 0 ~ 1, Bit 3, Bit 6 ~ 8, Bit 10 ~ 15: Reserved

Bit 2: Cancel low-voltage error latch function

0: Enable low-voltage error latch function; the error will not be cleared automatically.

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1: Disable low-voltage error latch function; the error will be cleared automatically.

Bit 4: Disable AL044 detection (Warning of servo function overload).

0: Enable AL044 detection; 1: Disable AL044 detection.

Bit 5: Enable AL041 disconnection detection of linear scale (only when the full-closed loop control function is activated).

0: Enable AL041 detection; 1: Disable AL041 detection.

Bit 9: Set AL003 as a warning or an alarm

0: Set AL003 as WARN; 1: Set AL003 as ALM.

<b>P2.067</b>	<b>Reserved</b>
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P2.068	Following error compensation switch			Address: 0288H 0289H
Default:	0x00000000	Control mode:	All	
Unit:	-	Setting range:	0x00000000 ~ 0x00002101	
Format:	HEX	Data size:	32-bit	

Settings:



A	Reserved	X	Following error compensation switch
B	Reserved	Y	Reserved
C	Reserved	Z	DI.STP triggering method
D	Reserved	U	Speed unit in speed mode
H	High bit	L	Low bit

- X: Following error compensation switch (Functions under the condition of P1.036 > 1)
  - 0: Disable following error compensation
  - 1: Enable following error compensation
- Y: Reserved
- Z: DI.STP triggering method
  - 0: DI.STP is rising-edge triggered
  - 1: DI.STP is level triggered
- U: Reserved

<b>P2.069●</b>	<b>Absolute encoder setting</b>		<b>Address: 028AH 028BH</b>	
Default:	0x0000	Control mode:	All	
Unit:	-	Setting range:	0 ~ 1	
Format:	HEX	Data size:	16-bit	

Settings:



X	Set up operation mode	Z	Index coordinates function setting when overflow occurs
Y	Y: Pulse command setting when absolute position is lost	U	Reserved

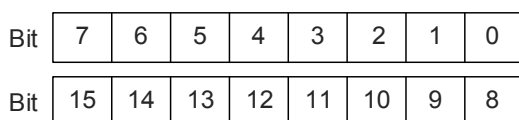
- X: Set up operation mode
  - 0: Incremental type; an absolute type motor can be operated as an incremental type
  - 1: Absolute type (It is only applicable to absolute type motor. If it is applied to incremental type motor, AL069 will occur)
- Y: Pulse command setting when absolute position is lost
  - 0: When AL060 or AL06A occurs, it cannot accept pulse command
  - 1: When AL060 or AL06A occurs, it can accept pulse command
- Z: Index coordinates function setting when overflow occurs
  - 0: Index coordinates are lost when overflows
  - 1: Index coordinates will not be affected by overflow, but absolute coordinates will not remain
- U: Reserved

Note:

1. This function is coming soon.
2. This setting is effective only after the servo drive is re-powered on.

<b>P2.070</b>	<b>Read data selection</b>		<b>Address: 028CH 028DH</b>	
Default:	0x0000	Control mode:	All	
Unit:	-	Setting range:	0x00 ~ 0x07	
Format:	HEX	Data size:	16-bit	

Settings:



Bit 0: DI/DO data unit setting.

- 0: PUU;
- 1: Pulse.

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Bit 1: Communication data unit setting.

- 0: PUU;
- 1: Pulse.

Bit 2: Overflow warning setting.

- 0: Overflow warning, including AL289 (PUU) and AL062 (pulse);
- 1: No overflow warning.

Bit 3 ~ Bit15: Reserved, set to 0.

<b>P2.071</b>	<b>Absolute position homing</b>			<b>Address: 028EH 028FH</b>
Default:	0x0	Control mode:	All	
Unit:	-	Setting range:	0 ~ 1	
Format:	HEX	Data size:	16-bit	

Settings:

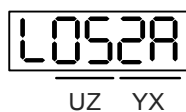
When P2.071 is set to 1, the current absolute position of the encoder will be set as home position.

Clearing function can be enabled by setting P2.008 to 271.

<b>P2.072</b>	<b>Reserved</b>
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<b>P2.073</b>	<b>E-Cam alignment - operation setting</b>			<b>Address: 0292H 0293H</b>
Default:	0x00000000	Control mode:	PR	
Unit:	-	Setting range:	0x00000000 ~ 0x5F3F6F5F	
Format:	HEX	Data size:	32-bit	

Settings:



BA	PR number	YX	Range of filter (0 ~ 95%)
DC	Masking range setting (0 ~ 95%)	UZ	Max. allowable correction rate (0 ~ 100%)
h	High bit	L	Low bit

- YX: Range of filter (0 ~ 95%)

When DI.ALGN is triggered, E-Cam alignment function is enabled. The system will detect the current E-Cam position. When the error between current E-Cam position and the previous alignment position is less than the parameter's setting range (%), filter function is enabled.

Otherwise, the system will use the new position to do the alignment.

YX	00	01 ~ 5F
Function	Filter disabled	Error   <= (1~YX)%: Filter enabled

Note: Using filter will allow the alignment to be more stable and reduce position error caused by DI noise and thus the operation can be smoother.

- UZ: Max. allowable correction rate (0 ~ 100%)

When alignment correction is enabled, the limitation of max. allowable correction rate (C) is defined as follows:

$$| C | \leq (P5.084 / P5.083) \times P2.073.UZ \%$$

Note: When the alignment error is too big, correcting this error in one time may cause motor vibration or overloading. Using this parameter can divide the alignment correction into several stages to smooth the process, but it may need more time to complete the alignment correction.

- BA: PR number (PR#0 ~ PR#99)

After each alignment is done, the shortage of pulse numbers of slave axis will be stored in a specified PR. Using this PR can compensate the slave position at the appropriate timing. If BA is set to 0, the shortage of pulse numbers will not be stored in PR.

Note: The format of this parameter is HEX. Thus, to set PR#11, write 0B in BA.

- DC: Masking range setting (0 ~ 95%)

When DI.ALGN is triggered, the next alignment action will be allowed after the increasing pulse numbers of master axis is greater than the distance (M) masking.

$$M \geq (P5.084 / P5.083) \times P2.073.DC \%$$

Note:

1. This masking function only allows increasing pulse input, and will not work for decreasing pulse input.
2. E-Cam function is not supported by model A3-L.

P2.074	E-Cam alignment - DI delay time setting		Address: 0294H 0295H
Default:	0.000	Control mode:	PR
Unit:	ms (minimum scale is $\mu$ s)	Setting range:	-25.000 ~ +25.000 (includes 3 decimal places)
Format:	DEC	Data size:	16-bit

Settings:

This parameter can offset the alignment target to resolve DI delay. The setting is as follows.

$$P2.074 = P2.009 \text{ (DI response filter time)} + \text{sensor's delay time}$$

Note: E-Cam function is not supported by model A3-L.



<b>P2.075</b>	<b>E-Cam alignment - alignment target position</b>		<b>Address: 0296H 0297H</b>
Default:	0	Control mode:	PR
Unit:	Pulse unit of master axis	Setting range:	0 ~ (P5.084 / P5.083) -1
Format:	DEC	Data size:	32-bit

Settings:

Set the alignment target position for E-Cam alignment (master axis pulse).

Note:

1. E-Cam function is not supported by model A3-L.
2. When the input value is within the setting range, but due to the changes in P5.084 or P5.083 causing the value to exceed the setting range, this parameter will be reset to 0 automatically.

<b>P2.076</b>	<b>E-Cam alignment - control switch</b>		<b>Address: 0298H 0299H</b>
Default:	0x0000	Control mode:	PR
Unit:	-	Setting range:	0x0000 ~ 0x6FF7
Format:	HEX	Data size:	16-bit

Settings:



X	E-Cam alignment control	UZ	Alignment forward direction allowable rate (0 ~ 100%)
Y	Filter intensity (0 ~ F)	-	-

- X: E-Cam alignment control

Bit	3	2	1	0
-----	---	---	---	---

Bit	Function	Description
0	Enable alignment	Set this bit to 0 to disable this function; set this bit to 1 to enable this function. If enabled, the E-Cam alignment correction will be executed when DI.ALGN ON.
1	Trigger PR immediately	Set this bit to 1 to enable this function. When E-Cam alignment is executing, the correction is stored in the PR data specified by P2.073 which triggers the PR immediately. Set this bit to 0 to disable this function. When E-Cam alignment is executing, it will not trigger PR immediately to compensate the correction. Users will need to use the PR (P5.088.BA) when E-Cam disengages to execute.
2	Position of the mark	Set this bit to 0: If the mark is on the master axis, the position of the mark will not be affected when aligning. Set this bit to 1: If the mark is on the slave axis, the position of the mark will be affected when aligning.
3	Reserved	-

- Y: Filter intensity (0 ~ F)

Indicates average of 2<sup>Y</sup> (setting value), set to 0 to disable the filter. When the value of Y increases, the correction is slower which can avoid large amount of correction during E-Cam adjustment. This can also avoid disturbance caused by sensor noise for a smoother operation. Setting P2.076 too big will cause the alignment not able to work properly. The recommended value is 3.

Example: When the filter intensity setting value is 3, the actual filter intensity = 2<sup>3</sup> = 8

- UZ: Alignment forward direction allowable rate (0 ~ 100%)

Setting value	Alignment direction	Setting value	Alignment direction
0	Backward alignment only	80	Forward 80%, backward 20%
30	Forward 30%, backward 70%	>=100	Forward alignment only
50	Alignment with the shortest distance	-	-

Note: E-Cam function is not supported by model A3-L.

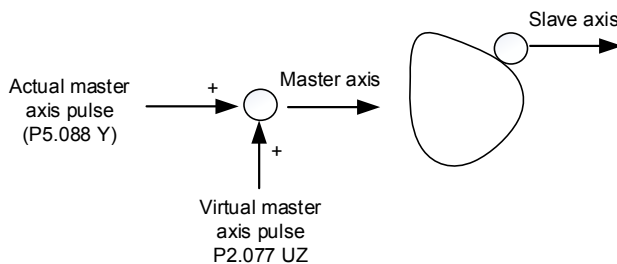
P2.077	E-Cam master axis – pulse masking setting		Address: 029AH 029BH
Default:	0x0000	Control mode:	PR
Unit:	-	Setting range:	0x0000 ~ 0xFF7D
Format:	HEX	Data size:	16-bit

Settings:



X	Pulse masking function of master axis / Continuous operation of master axis / JOG function of master axis	UZ	Alignment forward direction allowable rate (0 ~ 100%)
Y	Masking pulse adjusting lead setting		

- X: Pulse masking function of master axis / Continuous operation of master axis / JOG function of master axis



X	Function	Actual master axis pulse	Virtual pulse	Description
0	Function disabled	Receive actual master axis pulse	N/A	E-Cam is driven by the actual master axis pulse.
1	Stops operation	Receive actual master axis pulse		E-Cam stops operating, but the masked master pulse will continue to be stored in the internal variable.
2	Continuous forward running	Masked	Virtual pulse function	The source of the E-Cam master axis is the virtual pulse frequency (unit: kpps) set by P2.077.UZ. This function will continue to operate. To stop, set X to 1.



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X	Function	Actual master axis pulse	Virtual pulse	Description
3	Continuous reverse running		enabled	The source of the E-Cam master axis is the virtual pulse number (unit: pulse) set by P2.077.UZ. It will only refer to the pulse number set by UZ during JOG operation.
4	Forward JOG			
5	Reverse JOG			
6 ~ 8	-	-	-	Reserved
9	Pulse masking of master axis	Receive actual master axis pulse	N/A	E-Cam driven by the actual master pulse and the pulse record will be stored in the internal variables.
A	Continuous forward running		Virtual pulse function enabled	The source of the E-Cam master axis is the frequency transmitted by the actual master axis (P5.088 Y) plus the virtual pulse frequency (unit: kpps) set by P2.077.UZ. This function will continue to operate. To stop, set X to 9.
B	Continuous reverse running			
C	Forward JOG			
D	Reverse JOG			
				The source of the E-Cam master axis is the pulse transmitted by the actual master axis (P5.088 Y) plus the virtual pulse number (unit: pulse) set by P2.077.UZ. This function is often used during JOG operation.

■ Y: Masking pulse adjusting lead setting

Bit	Function	Description
0	Function disabled	Virtual pulse number is not written to P5.087 (Initial lead).
1	Write the lead	Write the virtual pulse number to P5.087 (Initial lead).
2	Write to ROM	Set the virtual pulse number to P5.087 (Initial lead) and write this value to EEPROM.
3		
4	Plus one cycle	Write the virtual pulse number plus pulse number of one cycle (P5.084 / P5.083) to P5.087 (Initial lead)
5		
6	Plus one cycle and write to ROM	Write the virtual pulse number plus pulse number of one cycle (P5.084 / P5.083) to P5.087 (Initial lead). Then, write this value to EEPROM.
7		
8 ~ 15	Reserved	-

■ UZ: Pulse data when master axis performs continuous forward / reverse running or JOG function.

Setting example:

Initiate masking ▶ UZYX = 0x0001

Continuous forward running at 20 kpps ▶ UZYX = 0x1402

Continuous reverse running at 32 kpps ▶ UZYX = 0x2003

Forward JOG for 255 pulses ▶ UZYX = 0xFF04

Reverse JOG for 18 pulses ▶ UZYX = 0x1205

Complete and adjust for lead ▶ UZYX = 0x0020 (Write to EEPROM)

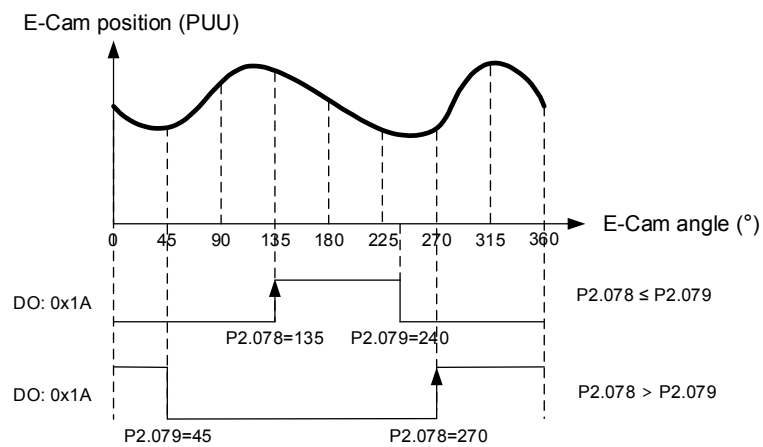
Disable this function ▶ UZYX = 0x0000

Note: E-Cam function is not supported by model A3-L.

<b>P2.078</b>	<b>E-Cam: DO.CAM_Area#2 rising-edge phase setting</b>	<b>Address: 029CH 029DH</b>	
Default:	270	Control mode:	PR
Unit:	degree	Setting range:	0 ~ 360
Format:	DEC	Data size:	16-bit

Settings:

Relevance between DO.CAM\_Area2 and parameters are as follows. When E-cam is not engaged, this signal is always off.



Note: E-Cam function is not supported by model A3-L.

<b>P2.079</b>	<b>E-Cam: DO.CAM_Area#2 falling-edge phase setting</b>	<b>Address: 029EH 029FH</b>	
Default:	360	Control mode:	PR
Unit:	degree	Setting range:	0 ~ 360
Format:	DEC	Data size:	16-bit

Settings:

Please refer to P2.078 for relevance between DO.CAM\_Area2 and parameters.

Note: E-Cam function is not supported by model A3-L.

<b>P2.080 ~ P2.088</b>	<b>Reserved</b>
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## 8

<b>P2.089</b>	<b>Command responsiveness gain</b>		<b>Address: 02B2H 02B3H</b>
Default:	25	Control mode:	PT / PR
Unit:	rad/s	Setting range:	1 ~ 2000
Format:	DEC	Data size:	16-bit

Settings:

Increasing this gain will speed up the responsiveness of the position command and shorten the tuning time. But when the gain is too large, it will cause position overshoot leading to machine jitter.

<b>P2.090 ~ P2.092</b>	<b>Reserved</b>
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<b>P2.093</b>	<b>STO FDBK control</b>		<b>Address: 02BAH 02BBH</b>
Default:	0x0010	Control mode:	All
Unit:	rad/s	Setting range:	0x0010 ~ 0x0023
Format:	HEX	Data size:	16-bit

Settings:



U Z Y X

- X: Logic selection
  - 0: Logic A
  - 1: Logic B
  - 2: Logic C
  - 3: Logic D
- Y: FDBK action
  - 1: FDBK no latch
  - 2: FDBK latch
- Z: Reserved
- U: Reserved

P2.094 ▲	Special bit register 3		Address: 02BCH 02BDH	
Default:	0x1000	Control mode:	PT / PR / S / Sz	
Unit:	-	Setting range:	0x0000 ~ 0xF3A6	
Format:	HEX	Data size:	16-bit	

Settings:

Bit	7	6	5	4	3	2	1	0
-----	---	---	---	---	---	---	---	---

Bit	15	14	13	12	11	10	9	8
-----	----	----	----	----	----	----	---	---

Bit	Function	Description
Bit 15 ~ 13	Reserved	-
Bit 12	Two-degree-of-freedom function	0: Disable two-degree-of-freedom function 1: Enable two-degree-of-freedom function
Bit 11 ~ 10	Reserved	-
Bit 9	Second set of vibration elimination	0: Disable second set of vibration elimination 1: Enable second set of vibration elimination (P1.092 ~ P1.094) Vibration elimination takes effect only when the two-degree-of-freedom function P2.094 [Bit 12] is enabled.
Bit 8	First set of vibration elimination	0: Disable first set of vibration elimination 1: Enable first set of vibration elimination (P1.089 ~ P1.091) Vibration elimination takes effect only when the two-degree-of-freedom function P2.094 [Bit 12] is enabled.
Bit 7 ~ 6	Reserved	-
Bit 5	Cancel AL016 IGBT overheat alarm	0: Enable AL016 IGBT overheat alarm 1: Disable AL016 IGBT overheat alarm
Bit 4	Dynamic brake options	0: Disable new dynamic brake 1: Enable new dynamic brake, and will be forced to use DC Bus voltage to determine the timing of regenerative energy loss
Bit 3 ~ 0	Reserved	-

P2.095	Resonance suppression (Notch filter) width (1)		Address: 02BEH 02BFH	
Default:	5	Control mode:	All	
Unit:	-	Setting range:	1 ~ 10	
Format:	DEC	Data size:	16-bit	

Settings:

The first setting value of resonance width. If P2.023 is set to 0, this function is disabled. P2.023, P2.024, and P2.095 are the first set of resonance suppression (Notch filter).

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<b>P2.096</b>	<b>Resonance suppression (Notch filter) width (2)</b>		<b>Address: 02C0H 02C1H</b>	
Default:	5	Control mode:	All	
Unit:	-	Setting range:	1 ~ 10	
Format:	DEC	Data size:	16-bit	

Settings:

The second setting value of resonance width. If P2.023 is set to 0, this function is disabled. P2.023, P2.024, and P2.095 are the first set of resonance suppression (Notch filter).

<b>P2.097</b>	<b>Resonance suppression (Notch filter) width (3)</b>		<b>Address: 02C2H 02C3H</b>	
Default:	5	Control mode:	All	
Unit:	-	Setting range:	1 ~ 10	
Format:	DEC	Data size:	16-bit	

Settings:

The third setting value of resonance width. If P2.023 is set to 0, this function is disabled. P2.023, P2.024, and P2.095 are the first set of resonance suppression (Notch filter).

<b>P2.098</b>	<b>Resonance suppression (Notch filter) (4)</b>		<b>Address: 02C4H 02C5H</b>	
Default:	1000	Control mode:	All	
Unit:	Hz	Setting range:	50 ~ 5000	
Format:	DEC	Data size:	16-bit	

Settings:

The fourth setting value of resonance frequency. If P2.099 is set to 0, this function is disabled. P2.098, P2.099, and P2.100 are the fourth set of resonance suppression (Notch filter).

<b>P2.099</b>	<b>Resonance suppression (Notch filter) attenuation rate (4)</b>		<b>Address: 02C6H 02C7H</b>	
Default:	0	Control mode:	All	
Unit:	-dB	Setting range:	0 ~ 40	
Format:	DEC	Data size:	16-bit	

Settings:

The fourth resonance suppression (Notch filter) attenuation rate. When this parameter is set to 0, the notch filter function is disabled. For example, if the value of attenuation rate is set to 5, then it would be -5 dB.

<b>P2.100</b>	<b>Resonance suppression (Notch filter) width (4)</b>		<b>Address: 02C8H 02C9H</b>	
Default:	5	Control mode:	All	
Unit:	-	Setting range:	1 ~ 10	
Format:	DEC	Data size:	16-bit	

Settings:

The fourth setting value of resonance width. If P2.099 is set to 0, this function is disabled. P2.098, P2.099, and P2.100 are the fourth set of resonance suppression (Notch filter).

<b>P2.101</b>	<b>Resonance suppression (Notch filter) (5)</b>		<b>Address: 02CAH 02CBH</b>	
Default:	1000	Control mode:	All	
Unit:	Hz	Setting range:	50 ~ 5000	
Format:	DEC	Data size:	16-bit	

Settings:

The fifth setting value of resonance frequency. If P2.102 is set to 0, this function is disabled. P2.101, P2.102, and P2.103 are the fifth set of resonance suppression (Notch filter).

<b>P2.102</b>	<b>Resonance suppression (Notch filter) attenuation rate (5)</b>		<b>Address: 02CCH 02CDH</b>	
Default:	0	Control mode:	All	
Unit:	-dB	Setting range:	0 ~ 40	
Format:	DEC	Data size:	16-bit	

Settings:

The fifth resonance suppression (Notch filter) attenuation rate. When this parameter is set to 0, the notch filter function is disabled. For example, if the value of attenuation rate is set to 5, then it would be -5 dB.

<b>P2.103</b>	<b>Resonance suppression (Notch filter) width (5)</b>		<b>Address: 02CEH 02CFH</b>	
Default:	5	Control mode:	All	
Unit:	-	Setting range:	1 ~ 10	
Format:	DEC	Data size:	16-bit	

Settings:

The fifth setting value of resonance width. If P2.102 is set to 0, this function is disabled. P2.101, P2.102, and P2.103 are the fifth set of resonance suppression (Notch filter).

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P2.104	P/PI torque switching command condition		Address: 02D0H 02D1H
Default:	200	Control mode:	PT / PR / S / Sz
Unit:	[%]	Setting range:	1 ~ 800
Format:	DEC	Data size:	16-bit

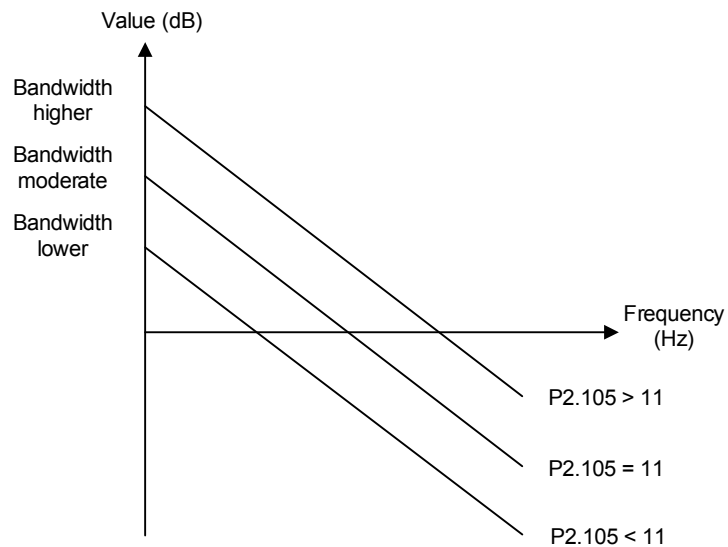
Settings:

When the torque command exceeds value of P2.104, the speed controller gain is switched from PI to P to reduce response overshoot.

P2.105	Automatic gain adjustment level 1		Address: 02D2H 02D3H
Default:	11	Control mode:	PT / PR
Unit:	-	Setting range:	1 ~ 21
Format:	DEC	Data size:	16-bit

Settings:

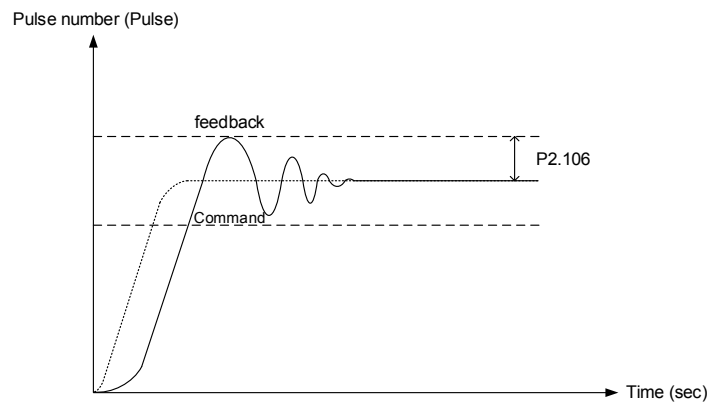
This parameter is used to adjust the bandwidth when auto-tuning. If the value is larger, the bandwidth after auto-tuning is higher, but the bandwidth margin may be insufficient, causing machine jitter; if the value is smaller, the bandwidth after auto-tuning is lower, but the response is slower.



<b>P2.106</b>	<b>Automatic gain adjustment level 2</b>		<b>Address: 02D4H 02D5H</b>
Default:	2000	Control mode:	PT / PR
Unit:	Pulse number	Setting range:	1 ~ 50331648
Format:	DEC	Data size:	16-bit

Settings:

This parameter is used to adjust the maximum allowable overshoot when auto-tuning. The overshoot range is set according to the user or machine. If the value is larger, the maximum overshoot allowed by auto-tuning will be greater, but the response will be faster. If the value is smaller, the maximum overshoot allowed by auto-tuning will be smaller, but the response will be slower.



<b>P2.107 ~ P2.111</b>	<b>Reserved</b>
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<b>P2.112 ▲</b>	<b>Special bit register 4</b>		<b>Address: 02E0H 02E1H</b>
Default:	0x000C	Control mode:	PT / PR / S / Sz
Unit:	-	Setting range:	0x0000 ~ 0x001F
Format:	HEX	Data size:	16-bit

Settings:

Bit	7	6	5	4	3	2	1	0
Bit	15	14	13	12	11	10	9	8

Bit	Function	Description
Bit 15 ~ 4	Reserved	-
Bit 3	Auto gain adjustment mode	0: Reserved 1: Cycle adjustment
Bit 2	Reserved	-
Bit 1	Enable AL089	0: Disable AL089 1: Enable AL089
Bit 0	Max. voltage of analog output monitoring	Analog output monitoring, ±8V or ±10V 0: ±8V 1: ±10V

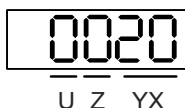


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**P3.xxx Communication parameters**

P3.000	Address setting		Address: 0300H 0301H	
Default:	0x7F	Control mode:	All	
Unit:	-	Setting range:	0x01 ~ 0x7F	
Format:	HEX	Data size:	16-bit	

Settings:



YX	Communication address setting	UZ	Reserved
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When using RS-485 to communicate, one servo drive can only set one address. Duplicate address setting will cause abnormal communication. This address represents the absolute address of the servo drive in the communication network. It is also applicable to RS-485, CANopen, and DMCNET. When the communication address setting of MODBUS is set to 0xFF, the servo drive will automatically receive and reply data regardless of the address. However, P3.000 cannot be set to 0xFF.

P3.001	Transmission speed		Address: 0302H 0303H	
Default:	0x0203	Control mode:	All	
Unit:	Bps	Setting range:	0x000 ~ 0x3405	
Format:	HEX	Data size:	16-bit	

Settings:



Transmission speed setting is divided into U, Z, Y, and X (hexadecimal):

	U	Z	Y	X
Communication port	DMCNET	CANopen / DMCNET	-	RS-485
Range	0 ~ 3	0 ~ 4	0	0 ~ 5

■ Definition of X setting value

0: 4800	1: 9600	2: 19200
3: 38400	4: 57600	5: 115200

■ Definition of Z setting value<sup>\*3</sup>

0: 125 Kbit/s	1: 250 Kbit/s	2: 500 Kbit/s
3: 800 Kbit/s	4: 1.0 Mbit/s	-

■ Definition of U setting value

0: Use Delta's controller, such as PLC or HMI

3: Use Delta's motion card

Note:

1. If this parameter is set via CANopen, only Z can be set and the others remain.
2. The communication speed of USB is 1.0 Mbit/s only and is unchangeable.
3. After Z value is set, re-power to take effect.

<b>P3.002</b>	<b>Communication protocol</b>		<b>Address: 0304H 0305H</b>
Default:	0x6	Control mode:	All
Unit:	Bps	Setting range:	0 ~ 8
Format:	HEX	Data size:	16-bit

Settings:

Definition of each setting value:

0: 7, N, 2 (MODBUS, ASCII)	1: 7, E, 1 (MODBUS, ASCII)	2: 7, O, 1 (MODBUS, ASCII)
3: 8, N, 2 (MODBUS, ASCII)	4: 8, E, 1 (MODBUS, ASCII)	5: 8, O, 1 (MODBUS, ASCII)
6: 8, N, 2 (MODBUS, RTU)	7: 8, E, 1 (MODBUS, RTU)	8: 8, O, 1 (MODBUS, RTU)

<b>P3.003</b>	<b>Communication error handling</b>		<b>Address: 0306H 0307H</b>
Default:	0x0	Control mode:	All
Unit:	-	Setting range:	0 ~ 1
Format:	HEX	Data size:	16-bit

Settings:

Definition of each setting value:

- 0: Displays warning and motor continues operating.
- 1: Displays warnig and motor decelerates to stop. (Deceleration time is set in P5.003.B)

<b>P3.004</b>	<b>Communication timeout setting</b>		<b>Address: 0308H 0309H</b>
Default:	0x0	Control mode:	All
Unit:	sec	Setting range:	0 ~ 20
Format:	DEC	Data size:	16-bit

Settings:

If the setting value is not 0, enable communication timeout immediately. If it is set to 0, this function is disabled.

<b>P3.005★</b>	<b>Reserved</b>
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<b>P3.006</b>	<b>Control switch of digital input (DI)</b>		<b>Address: 030CH 030DH</b>
Default:	0x0	Control mode:	All
Unit:	-	Setting range:	0x0000 ~ 0x1FFF
Format:	HEX	Data size:	16-bit

Settings:

Source of DI controls the switch. Each bit of this parameter determines one input source of DI signal: Bit0 ~ Bit9 correspond to DI1 ~ DI10. Bit10 ~ Bit12 correspond to VDI11 ~ VDI13. The setting of bit is as follows:

0: DI status is controlled by the external hardware.

1: DI status is controlled by P4.007.

For the functional planning of DI, please refer to:

DI1 ~ DI8: P2.010 ~ P2.017

DI9 ~ DI10: P2.036 ~ P2.037

VDI11 ~ VDI13: P2.038 ~ P2.040

<b>P3.007</b>	<b>Communication response delay time</b>		<b>Address: 030EH 030FH</b>
Default:	0	Control mode:	All
Unit:	0.5 ms	Setting range:	0 ~ 1000
Format:	DEC	Data size:	16-bit

Settings:

Delay the time of communication response from servo drive to controller.

<b>P3.008</b>	<b>Reserved</b>
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<b>P3.009</b>	<b>Communication synchronize setting</b>		<b>Address: 0312H 0313H</b>
Default:	0x5055 (CANopen) 0x3511 (DMCNET)	Control mode:	CANopen / DMCNET
Unit:	-	Setting range:	Shown as below
Format:	HEX	Data size:	16-bit

Settings:

The synchronous setting is divided into E, T, D, and M (hexadecimal):

Digit	E	T	D	M
Function	Range of synchronous error	Target value	Deadband	-
Range	1 ~ 9	0 ~ 9	0 ~ F	-

The slave of communication synchronizes with the master via SYNC. Definition is as follows:

M: Reserved.

D: Set the size of deadband (Unit: usec). If the deviation between the SYNC reaching time and the target value does not exceed the deadband, correction is not needed.

T: Target value of SYNC arrival time. Standard value is 500 usec, but the target value should be used.

Target value = 400 + 10 x T. For example, if T = 5, the target value will be 450.

E: If the deviation between SYNC arrival time and the target value is smaller than the range, it means the synchronization is successful. (Unit: 10 μs).

P3.010	CANopen / DMCNET protocol setting		Address: 0314H 0315H
Default:	0x1	Control mode:	CANopen / DMCNET
Unit:	-	Setting range:	0x0000 ~ 0xFFFF
Format:	HEX	Data size:	16-bit

Settings:

Communication protocol setting is divided into U, Z, Y, and X (hexadecimal):

Bit	U	Z	Y	X
Function	PDO alarm will be cleared automatically or not	Torque source limited	-	-
Range	0 ~ 1	0 ~ 1	-	-

Definition is as follows:

X: Reserved.

Y: Reserved.

Z: Torque source limited (Only functions in mode B).

0: Torque source limited to communication commands.

1: Torque source limited to DI commands.

U\*1: 0: If PDO error occurs, it must be cleared by AlarmReset.

1: If PDO error disappears, it will automatically clear the alarm.

Note: The current firmware does not have this feature. It is expected to have this feature added in the near future.

P3.011	CANopen / DMCNET options		Address: 0316H 0317H
Default:	0x0	Control mode:	CANopen / DMCNET
Unit:	-	Setting range:	Shown as below
Format:	HEX	Data size:	16-bit

Settings:



Communication setting is divided into X, Y, Z, and U (hexadecimal):

Digit	U	Z	Y	X
Function	Undefined	Undefined	Undefined	Parameter is saved in EEPROM or not
Range	0 ~ 1	0 ~ F	0 ~ F	0 ~ 1

Definition is as follows:



X: 1: When writing parameters via CANopen / DMCNET PDO, parameters will be saved in EEPROM;  
 0: parameters will not be saved in EEPROM.

Y: Undefined

Z: Undefined

U: Undefined

Note: If X is set to 1 and write parameters via DMCNET PDO continuously, it will shorten the lifetime of EEPROM.

P3.012	CANopen / DMCNET support settings		Address: 0318H 0319H
Default:	0x0	Control mode:	CANopen / DMCNET
Unit:	-	Setting range:	0x0000 ~ 0x0111
Format:	HEX	Data size:	16-bit

Settings:



Digit	U	Z	Y	X
Function	Reserved	Load in CANopen / DMCNET values	Reserved	Reserved
Range	-	0 ~ 1	-	-
Control mode	-	CANopen mode 0x0B=0x0C DMCNET mode 0x0B	-	-

There are X and Y settings (Hexadecimal) for CANopen Quick Stop mode, which is only suitable in CANopen control mode 0x0B (Set P1.001 to b)

X: Reserved

Y: Reserved

Z: P parameters are overwritten by the CANopen / DMCNET parameters

Z = 0: When re-powering on the servo drive or resetting the communication, P parameters in the following table will load in the values in CANopen / DMCNET mode.

Z = 1: When re-powering on the servo drive or resetting the communication, P parameters in the following table will remain as the same settings and will not load in the values in CANopen / DMCNET mode.

CANopen mode:

Variables during initialization	P3.012.Z = 0	P3.012.Z = 1	Note
P1.032	0x0010	EEPROM	
P2.035	50331648	EEPROM	
P1.047	100	EEPROM	
P1.049	0	EEPROM	
P1.038	100	EEPROM	
Home offset	0	EEPROM	Used in HM mode
P1.044	1	EEPROM	

Variables during initialization	P3.012.Z = 0	P3.012.Z = 1	Note
P1.045	1	EEPROM	

DMCNET mode:

Variables during initialization	P3.012.Z = 0	P3.012.Z = 1	Note
P1.032	0x0010	EEPROM	
P2.035	50331648	EEPROM	
P1.047	100	EEPROM	
P1.049	0	EEPROM	
P1.038	100	EEPROM	
Home offset	0	Undefined	Used in HM mode
Acc	200	Undefined	Used in PV, PP mode
Dec	200	Undefined	Used in PV, PP mode
Torque slope	200	Undefined	Used in PT mode
P1.044	1	EEPROM	
P1.045	1	EEPROM	

Methods to write parameters to EEPROM (even when power is off):

SDO: When setting parameters, they will be stored in EEPROM.

PDO: Please refer to the setting of P3.011 X. (X = 1: When setting parameters via PDO, parameters will be stored in EEPROM; X = 0: When setting parameters via PDO, parameters will not be stored in EEPROM.)

Note: In CANopen mode, when using the function of OD 1010 Store Parameter and P3.012 Z = 0, the default value will be different from the value shown above. Please refer to CANopen Standard for further information.

<b>P3.013 ~ P3.038</b>	<b>Reserved</b>
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## 8

**P4.xxx Diagnosis parameters**

<b>P4.000★</b>	<b>Fault record (N)</b>			<b>Address: 0400H 0401H</b>
Default:	0x0	Control mode:	All	
Unit:	-	Setting range:	-	
Format:	HEX	Data size:	32-bit	

Settings:

The last abnormal status record.

Low word (LXXXX): Display alarm number.

High word (hYYYY): Display the error code corresponding to CANopen / DMCNET.

<b>P4.001★</b>	<b>Fault record (N-1)</b>			<b>Address: 0402H 0403H</b>
Default:	0x0	Control mode:	All	
Unit:	-	Setting range:	-	
Format:	HEX	Data size:	32-bit	

Settings:

The second to last abnormal status record.

Low word (LXXXX): Display alarm number.

High word (hYYYY): Display the error code corresponding to CANopen / DMCNET.

<b>P4.002★</b>	<b>Fault record (N-2)</b>			<b>Address: 0404H 0405H</b>
Default:	0x0	Control mode:	All	
Unit:	-	Setting range:	-	
Format:	HEX	Data size:	32-bit	

Settings:

The third to last abnormal status record.

Low word (LXXXX): Display alarm number.

High word (hYYYY): Display the error code corresponding to CANopen / DMCNET.

<b>P4.003★</b>	<b>Fault record (N-3)</b>			<b>Address: 0406H 0407H</b>
Default:	0x0	Control mode:	All	
Unit:	-	Setting range:	-	
Format:	HEX	Data size:	32-bit	

Settings:

The fourth to last abnormal status record.

Low word (LXXXX): Display alarm number.

High word (hYYYY): Display the error code corresponding to CANopen / DMCNET.

<b>P4.004★</b>	<b>Fault record (N-4)</b>		<b>Address: 0408H 0409H</b>	
Default:	0x0	Control mode:	All	
Unit:	-	Setting range:	-	
Format:	HEX	Data size:	32-bit	

Settings:

The fifth to last abnormal status record.

Low word (LXXXX): Display alarm number.

High word (hYYYY): Display the error code corresponding to CANopen / DMCNET.

<b>P4.005</b>	<b>Servo motor JOG control</b>		<b>Address: 040AH 040BH</b>	
Default:	20	Control mode:	All	
Unit:	rpm	Setting range:	0 ~ 5000 (rotary motor) 0 ~ 50000 (linear motor)	
Format:	DEC	Data size:	16-bit	

Settings:

Three control methods are as follows:

1. Operation test:

After the JOG speed is set by P4.005, the panel will display the JOG symbol. Pressing the UP key can control JOG operation in positive direction; pressing the DOWN key can control negative direction. Stop pressing to stop JOG operation. If there is any error in this setting, then the motor cannot operate. The maximum JOG speed is the maximum speed of the servo motor.

2. DI control:

If the DI is set to JOGU and JOGD (refer to Table 8.1), then the JOG operation in positive or negative direction can be controlled via this DI.

3. Communication control:

1 ~ 5000: JOG speed	4998: JOG operation in positive direction
4999: JOG operation in negative direction	0: Stop operation

Note: When writing via communication and the frequency is high, please set P2.030 to 5.

<b>P4.006▲■</b>	<b>Digital output register (readable and writable)</b>		<b>Address: 040CH 040DH</b>	
Default:	0x0	Control mode:	All	
Unit:	-	Setting range:	0 ~ 0xFFFF	
Format:	HEX	Data size:	16-bit	



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Settings:

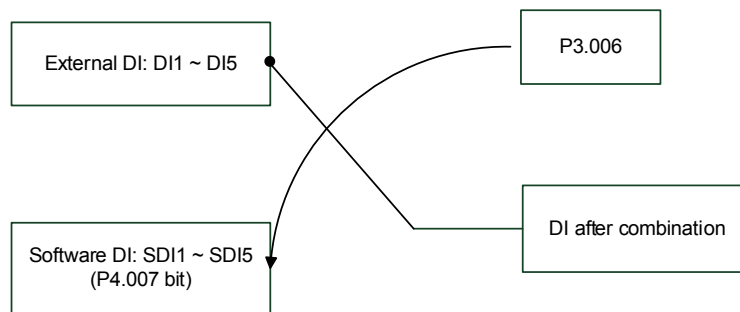
bit 00: Corresponds to DO code = 0x30	bit 08: Corresponds to DO code = 0x38
bit 01: Corresponds to DO code = 0x31	bit 09: Corresponds to DO code = 0x39
bit 02: Corresponds to DO code = 0x32	bit 10: Corresponds to DO code = 0x3A
bit 03: Corresponds to DO code = 0x33	bit 11: Corresponds to DO code = 0x3B
bit 04: Corresponds to DO code = 0x34	bit 12: Corresponds to DO code = 0x3C
bit 05: Corresponds to DO code = 0x35	bit 13: Corresponds to DO code = 0x3D
bit 06: Corresponds to DO code = 0x36	bit 14: Corresponds to DO code = 0x3E
bit 07: Corresponds to DO code = 0x37	bit 15: Corresponds to DO code = 0x3F

If P2.018 is set to 0x0130, then the output of DO#1 is the bit 0 status of P4.006, and so forth. DO Code (0x30 ~ 0x3F) can be set via communication DO, and then write into P4.006.

P4.007	Multi-function of digital input		Address: 040EH 040FH
Default:	0x0	Control mode:	All
Unit:	-	Setting range:	0 ~ 3FFF
Format:	HEX	Data size:	16-bit

Settings:

The source of DI input signal can be external terminal (DI1 ~ DI5) or software SDI1 ~ SDI5 (corresponding to Bit 0 ~ 4 of P4.007), which is determined by P3.006. The corresponding bit of P3.006 is 1, which means the source is software SDI (P4.007); if the corresponding bit is 0, then the source is hardware DI. See the figure below:



Read parameters: Shows the DI status after combining external DI and software DI.

Write parameters: Writes the software SDI status. (This function is the same regardless of using the panel or communication to set the parameter)

For example: The value of reading P4.007 is 0x0011 means DI1 and DI5 are ON; the value of writing P4.007 is 0x0011 means software SDI1 and SDI5 are ON. Please refer to P2.010 ~ P2.014 for the function program of digital input pin (DI1 ~ DI5).

<b>P4.008★</b>	<b>Input status of servo drive panel (read-only)</b>		<b>Address: 0410H 0411H</b>	
Default:	-	Control mode:	All	
Unit:	-	Setting range:	(Read-only)	
Format:	HEX	Data size:	16-bit	

Settings:

Use this communication parameter to read and check if the five keys, MODE, UP, DOWN, SHIFT, and SET can function normally.

<b>P4.009★</b>	<b>Digital output status display (read-only)</b>		<b>Address: 0412H 0413H</b>	
Default:	-	Control mode:	All	
Unit:	-	Setting range:	0 ~ 0x1F	
Format:	HEX	Data size:	16-bit	

Settings:

There is no difference whether reading by panel or communication.

<b>P4.010■</b>	<b>Adjustment function selection</b>		<b>Address: 0414H 0415H</b>	
Default:	0	Control mode:	All	
Unit:	-	Setting range:	0 ~ 6	
Format:	DEC	Data size:	16-bit	

Settings:

0: Reserved	4: Execute current encoder (W phase) offset adjustment
1: Execute analog speed input offset adjustment	5: Execute 1 ~ 4 offset adjustment
2: Execute analog torque input offset adjustment	6: Execute IGBT ADC adjustment
3: Execute current encoder (V phase) offset adjustment	7 ~ 14: Reserved

Note: Adjustment function needs to be enabled by setting P2.008. When adjusting, the external analog voltage wiring connecting to the torque needs to be removed completely and must be in servo off status.

<b>P4.011</b>	<b>Analog speed input (1) offset adjustment</b>		<b>Address: 0416H 0417H</b>	
Default:	Factory setting	Control mode:	All	
Unit:	-	Setting range:	0 ~ 32767	
Format:	DEC	Data size:	16-bit	

Settings:

Manually adjust the offset. Adjustment function needs to be enabled by setting P2.008. It is not suggested to adjust the auxiliary adjustment as this parameter cannot be reset.

## 8

<b>P4.012</b>	<b>Analog speed input (2) offset adjustment</b>		<b>Address: 0418H 0419H</b>
Default:	Factory setting	Control mode:	All
Unit:	-	Setting range:	0 ~ 32767
Format:	DEC	Data size:	16-bit

Settings:

Manually adjust the offset. Adjustment function needs to be enabled by setting P2.008. It is not suggested to adjust the auxiliary adjustment as this parameter cannot be reset.

<b>P4.013</b>	<b>Analog torque input (1) offset adjustment</b>		<b>Address: 041AH 041BH</b>
Default:	Factory setting	Control mode:	All
Unit:	-	Setting range:	0 ~ 32767
Format:	DEC	Data size:	16-bit

Settings:

Manually adjust the offset. Adjustment function needs to be enabled by setting P2.008. It is not suggested to adjust the auxiliary adjustment as this parameter cannot be reset.

<b>P4.014</b>	<b>Analog torque input (2) offset adjustment</b>		<b>Address: 041CH 041DH</b>
Default:	Factory setting	Control mode:	All
Unit:	-	Setting range:	0 ~ 32767
Format:	DEC	Data size:	16-bit

Settings:

Manually adjust the offset. Adjustment function needs to be enabled by setting P2.008. It is not suggested to adjust the auxiliary adjustment as this parameter cannot be reset.

<b>P4.015</b>	<b>Current encoder (V1 phase) offset adjustment</b>		<b>Address: 041EH 041FH</b>
Default:	Factory setting	Control mode:	All
Unit:	-	Setting range:	0 ~ 32767
Format:	DEC	Data size:	16-bit

Settings:

Manually adjust the offset. Adjustment function needs to be enabled by setting P2.008. It is not suggested to adjust the auxiliary adjustment as this parameter cannot be reset.

<b>P4.016</b>	<b>Current encoder (V2 phase) offset adjustment</b>		<b>Address: 0420H 0421H</b>
Default:	Factory setting	Control mode:	All
Unit:	-	Setting range:	0 ~ 32767
Format:	DEC	Data size:	16-bit

## Settings:

Manually adjust the offset. Adjustment function needs to be enabled by setting P2.008. It is not suggested to adjust the auxiliary adjustment as this parameter cannot be reset.

<b>P4.017</b>	<b>Current encoder (W1 phase) offset adjustment</b>		<b>Address: 0422H 0423H</b>
Default:	Factory setting	Control mode:	All
Unit:	-	Setting range:	0 ~ 32767
Format:	DEC	Data size:	16-bit

## Settings:

Manually adjust the offset. Adjustment function needs to be enabled by setting P2.008. It is not suggested to adjust the auxiliary adjustment as this parameter cannot be reset.

<b>P4.018</b>	<b>Current encoder (W2 phase) offset adjustment</b>		<b>Address: 0424H 0425H</b>
Default:	Factory setting	Control mode:	All
Unit:	-	Setting range:	0 ~ 32767
Format:	DEC	Data size:	16-bit

## Settings:

Manually adjust the offset. Adjustment function needs to be enabled by setting P2.008. It is not suggested to adjust the auxiliary adjustment as this parameter cannot be reset.

<b>P4.019</b>	<b>IGBT NTC adjustment level (cannot reset)</b>		<b>Address: 0426H 0427H</b>
Default:	Factory setting	Control mode:	All
Unit:	-	Setting range:	1 ~ 4
Format:	DEC	Data size:	16-bit

## Settings:

Please cool down the drive to 25 °C when adjusting.

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<b>P4.020</b>	<b>Offset adjustment value of analog monitor output (Ch1)</b>		<b>Address: 0428H 0429H</b>	
Default:	0	Control mode:	All	
Unit:	mV	Setting range:	-800 ~ 800	
Format:	DEC	Data size:	16-bit	

Settings:

Offset adjustment value (cannot reset).

<b>P4.021</b>	<b>Offset adjustment value of analog monitor output (Ch2)</b>		<b>Address: 042AH 042BH</b>	
Default:	0	Control mode:	All	
Unit:	mV	Setting range:	-800 ~ 800	
Format:	DEC	Data size:	16-bit	

Settings:

Offset adjustment value (cannot reset).

<b>P4.022</b>	<b>Analog speed input offset</b>		<b>Address: 042CH 042DH</b>	
Default:	0	Control mode:	S	
Unit:	mV	Setting range:	-5000 ~ 5000	
Format:	DEC	Data size:	16-bit	

Settings:

Manually adjust the offset.

<b>P4.023</b>	<b>Analog torque input offset</b>		<b>Address: 042EH 042FH</b>	
Default:	0	Control mode:	T	
Unit:	mV	Setting range:	-5000 ~ 5000	
Format:	DEC	Data size:	16-bit	

Settings:

Manually adjust the offset.

<b>P4.024</b>	<b>Level of undervoltage error</b>		<b>Address: 0430H 0431H</b>	
Default:	160	Control mode:	All	
Unit:	V (rms)	Setting range:	140 ~ 190	
Format:	DEC	Data size:	16-bit	

Settings:

When the voltage of DC BUS is lower than  $P4.024 * \sqrt{2}$ , the undervoltage alarm occurs.

**P5.xxx Motion setting parameters**

<b>P5.000★■</b>	<b>Firmware subversion</b>			<b>Address: 0500H 0501H</b>
Default:	Factory setting	Control mode:	All	
Unit:	-	Setting range:	-	
Format:	DEC	Data size:	32-bit	

Settings:

The low bit is the subversion of the firmware.

<b>P5.001 ~ P5.002</b>	<b>Reserved</b>
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<b>P5.003</b>	<b>Deceleration time of auto-protection</b>			<b>Address: 0506H 0507H</b>
Default:	0xEEEEFEFF	Control mode:	All	
Unit:	-	Setting range:	0x00000000 ~ 0xFFFFFFFF	
Format:	HEX	Data size:	32-bit	

Settings:

The parameter setting is divided into D, C, B, A, W, Z, Y, X (hexadecimal), including:

- Deceleration time when activating auto-protection function: OVF (DO.0x11, position command / feedback overflows), CTO (communication timeout AL020), SPL, SNL, PL, NL
- Deceleration time of stop command: STP

Digit	D	C	B	A	W	Z	Y	X
Function	STP	PFQS	CTO	OVF	SNL	SPL	N	PL
Range	0 ~ F	0 ~ F	0 ~ F	0 ~ F	0 ~ F	0 ~ F	0 ~ F	0 ~ F

0 ~ F is used to indexing the deceleration time of P5.020 ~ P5.035. For example: If X is set to A, then the deceleration time of PL is determined by P5.030.

<b>P5.004</b>	<b>Homing methods</b>			<b>Address: 0508H 0509H</b>
Default:	0x0	Control mode:	PR	
Unit:	-	Setting range:	0 ~ 0x128	
Format:	HEX	Data size:	16-bit	

Settings:



X	Homing method	Z	Limit setting
Y	Z pulse setting	U	Reserved

Definition of each setting value:

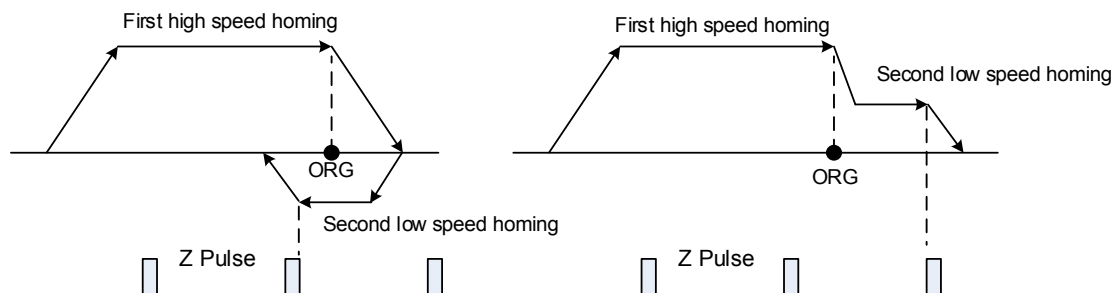
W	Z	Y	X
Reserved	Limit setting	Z pulse setting	Homing method
	0 ~ 1	0 ~ 2	0 ~ 8
	-	Y = 0: Return to Z pulse Y = 1: Go forward to Z pulse Y = 2: Do not look for Z pulse	X = 0: Homing in forward direction and regard PL as homing origin
	-		X = 1: Homing in reverse direction and regard NL as homing origin
	When encounter limit: Z = 0: Shows error Z = 1: Reverse direction	Y = 0: Return to Z pulse Y = 1: Go forward to Z pulse Y = 2: Do not look for Z pulse	X = 2: Homing in forward direction, ORG: OFF→ON as homing origin
			X = 3: Homing in reverse direction, ORG: OFF→ON as homing origin
			X = 4: Look for Z pulse in forward direction and regard it as homing origin
			X = 5: Look for Z pulse in reverse direction and regard it as homing origin
			X = 6: Homing in forward direction, ORG: ON→OFF as homing origin
			X = 7: Homing in reverse direction, ORG: ON→OFF as homing origin
			X = 8: Define current position as the origin
		Y = 0: Return to Z pulse Y = 1: Do not look for Z pulse	X = 9: Look for the collision point in forward direction and regard it as the origin
			X = A: Look for the collision point in reverse direction and regard it as the origin

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P5.005	First speed setting of high speed homing			Address: 050AH 050BH
Operation interface:	Panel / software	Communication	Control mode:	PR (Set with P5.004)
Default:	100.0	1000	Data size:	32-bit
Unit:	1 rpm (rotary motor)* 10 <sup>-6</sup> m/s (linear motor)*	0.1 rpm (rotary motor)* 10 <sup>-6</sup> m/s (linear motor)*		
Setting range:	0.1 ~ 6000.0 (rotary motor)* 0.1 ~ 1599999.9 (linear motor)*	1 ~ 60000 (rotary motor)* 1 ~ 15999999 (linear motor)*		
Format:	DEC	DEC	-	-
Example:	1.5 = 1.5 rpm	15 = 1.5 rpm	-	-

Settings:

The first speed setting of high speed homing.



Note: Rotary motor is the abbreviation for permanent-magnet synchronous rotary motor; linear motor is the abbreviation for permanent-magnet synchronous linear motor.

P5.006	Second speed setting of low speed homing			Address: 050CH 050DH
Operation interface:	Panel / software	Communication	Control mode:	PR (Set with P5.004)
Default:	20.0	200	Data size:	32-bit
Unit:	1 rpm (rotary motor)* 10 <sup>-6</sup> m/s (linear motor)*	0.1 rpm (rotary motor)* 10 <sup>-6</sup> m/s (linear motor)*		
Setting range:	0.1 ~ 6000.0 (rotary motor)* 0.1 ~ 1599999.9 (linear motor)*	1 ~ 60000 (rotary motor)* 1 ~ 15999999 (linear motor)*		
Format:	DEC	DEC	-	-
Example:	1.5 = 1.5 rpm	150 = 1.5 rpm	-	-

Settings: The second speed setting of low speed homing.

Note: Rotary motor is the abbreviation for permanent-magnet synchronous rotary motor; linear motor is the abbreviation for permanent-magnet synchronous linear motor.

P5.007	Trigger position command (PR mode only)		Address: 050EH 050FH
Default:	0	Control mode:	PR
Unit:	-	Setting range:	0 ~ 1000
Format:	DEC	Data size:	16-bit



Settings:

Set P5.007 to 0 to start homing

Set P5.007 to 1 ~ 99 to execute the specified PR procedure which is the same as using DI.CTRG+POSn.

It is prohibited to set P5.007 to 100 ~ 999 as the value exceeds the valid range.

Example: To trigger PR#2

Method 1	Trigger via DI: Position command register select 1 ~ 64 Bit1 (DI:0x12) + Trigger command (DI:0x08)
Method 2	Via P5.007: Set P5.007 to 2 to start executing PR#2

Write in 1000 to execute stop command which is the same as DI.STOP.

When reading P5.007, if the command is incomplete, the drive will read the current command (1 ~ 99);

if the command is completed, the drive will read the current command +10000; if the command is

completed, DO.TPOS is on, and motor position reached, the drive will read the current command +20000.

Commands triggered by DI are also applicable.

Example:

If the reading value is 3, it means PR#3 is incomplete; if the reading value is 10003, it means PR#3

completed issuing, but the motor has not reached the target position yet; if the reading value is 20003,

it means PR#3 completed issuing and the motor has reached the target position.

P5.008	Forward software limit		Address: 0510H 0511H
Default:	2147483647	Control mode:	PR
Unit:	PUU	Setting range:	-2147483648 ~ +2147483647
Format:	DEC	Data size:	32-bit

Settings:

In PR mode, if the motor rotates in forward direction and its feedback position exceeds the setting value of P5.008, AL283 will occur.

P5.009	Reverse software limit		Address: 0512H 0513H
Default:	2147483647	Control mode:	PR
Unit:	PUU	Setting range:	-2147483648 ~ +2147483647
Format:	DEC	Data size:	32-bit

Settings:

In PR mode, if the motor rotates in reverse direction and its feedback position exceeds the setting value of P5.009, AL285 will occur.

<b>P5.010★■</b>	<b>Data array - Data size</b>		<b>Address: 0514H 0515H</b>	
Default:	-	Control mode:	All	
Unit:	-	Setting range:	Read-only	
Format:	DEC	Data size:	16-bit	

Settings:

Data size (N x 32 bits) means size N of data array.

<b>P5.011■</b>	<b>Data array - Address of reading / writing</b>		<b>Address: 0516H 0517H</b>	
Default:	0	Control mode:	All	
Unit:	-	Setting range:	0 ~ (Value set by P5.010 minus 1)	
Format:	DEC	Data size:	16-bit	

Settings:

Specify the address in the data array when reading / writing data. Please refer to Chapter 7 for detailed instructions.

<b>P5.012■</b>	<b>Data array - Window #1 for reading / writing</b>		<b>Address: 0518H 0519H</b>	
Default:	0	Control mode:	All	
Unit:	-	Setting range:	-2147483648 ~ +2147483647	
Format:	DEC	Data size:	32-bit	

Settings:

Window #1: When reading the parameter via panel, the value set by P5.011 will not add 1, but if reading / writing by other methods will add 1. Please refer to Chapter 7 Data array for detailed instructions.

<b>P5.013■</b>	<b>Data array - Window #2 for reading / writing</b>		<b>Address: 051AH 051BH</b>	
Default:	0	Control mode:	All	
Unit:	-	Setting range:	-2147483648 ~ +2147483647	
Format:	DEC	Data size:	32-bit	

Settings:

Window #2: When reading and writing the parameter via panel or communication, the value set by P5.011 will add 1, but panel is write-protected. Please refer to Chapter 7 Data array for detailed instructions.

<b>P5.014</b>	<b>Reserved</b>
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<b>P5.015</b>	<b>PATH#1 ~ PATH#2 Volatile setting</b>		<b>Address: 051EH 051FH</b>
Default:	0x0	Control mode:	All
Unit:	-	Setting range:	0x0 ~ 0x0011
Format:	HEX	Data size:	16-bit

Settings:

This parameter allows users to write data to target continuously via communication.



X	PATH#1 Volatile setting	UZ	Reserved
Y	PATH#2 Volatile setting		Reserved

- X: PATH#1 Volatile setting
  - 0: Non-volatile
  - 1: Volatile
- Y: PATH#2 Volatile setting
  - 0: Non-volatile
  - 1: Volatile

<b>P5.016</b>	<b>Axis position - Motor encoder</b>		<b>Address: 0520H 0521H</b>
Default:	0	Control mode:	All
Unit:	PUU	Setting range:	-2147483648 ~ +2147483647
Format:	DEC	Data size:	32-bit

Settings:

Read: Feedback position of the motor encoder, which is the monitoring variable 000 (00h) + offset value.

Write: Any value can be written into the parameter and will neither change monitoring variable 000 (00h) nor affect the positioning coordinate system. It is only for observation when adjusting the offset value.

<b>P5.017</b>	<b>Axis position - Auxiliary encoder</b>		<b>Address: 0522H 0523H</b>
Default:	0	Control mode:	All
Unit:	Pulse number	Setting range:	-2147483648 ~ +2147483647
Format:	DEC	Data size:	32-bit

Settings:

Pulse counts of the auxiliary encoder (linear scale).

<b>P5.018</b>	<b>Axis position - Pulse command</b>		<b>Address: 0524H 0525H</b>	
Default:	0	Control mode:	All	
Unit:	Pulse number	Setting range:	-2147483648 ~ +2147483647	
Format:	DEC	Data size:	32-bit	

Settings:

Pulse counts of the pulse command.

<b>P5.019</b>	<b>E-Cam curve scaling</b>		<b>Address: 0526H 0527H</b>	
Default:	1.000000	Control mode:	PR	
Unit:	0.000001 times, which is 1 / (10 <sup>6</sup> )	Setting range:	-2147.000000 ~ +2147.000000	
Format:	DEC	Data size:	32-bit	
Example:	1100000 = 1.1 times			

Settings:

This parameter is used to magnify / minify the E-Cam table without changing its setting value.

Example: The data in the table is 0, 10, 20, 30, 40, 20, magnification x 2.000000 equals the data: 0, 20, 40, 60, 80, 40, magnification x 1.000000.

Enable the operation of E-Cam with the same pulse frequency of the master axis. Magnify the magnification will enlarge the route of E-Cam operation and the speed will be magnified as well.

Note:

1. E-Cam function is not supported by model A3-L.
2. This parameter can be set at any time, but the timing it becomes effective is determined by P5.088.X[Bit2].

<b>P5.020</b>	<b>Acceleration / deceleration time (Number #0)</b>		<b>Address: 0528H 0529H</b>	
Default:	200	Control mode:	PR	
Unit:	ms	Setting range:	1 ~ 65500	
Format:	DEC	Data size:	16-bit	

Settings:

The setting time of acceleration / deceleration in PR mode, which is the duration to accelerate from 0 to 3000 rpm.

<b>P5.021</b>	<b>Acceleration / deceleration time (Number #1)</b>		<b>Address: 052AH 052BH</b>	
Default:	300	Control mode:	PR	
Unit:	ms	Setting range:	1 ~ 65500	
Format:	DEC	Data size:	16-bit	

Settings:

Please refer to P5.020 for the setting of acceleration / deceleration time in PR mode.

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<b>P5.022</b>	<b>Acceleration / deceleration time (Number #2)</b>		<b>Address: 052CH 052DH</b>	
Default:	500	Control mode:	PR	
Unit:	ms	Setting range:	1 ~ 65500	
Format:	DEC	Data size:	16-bit	

Settings:

Please refer to P5.020 for the setting of acceleration / deceleration time in PR mode.

<b>P5.023</b>	<b>Acceleration / deceleration time (Number #3)</b>		<b>Address: 052EH 052FH</b>	
Default:	600	Control mode:	PR	
Unit:	ms	Setting range:	1 ~ 65500	
Format:	DEC	Data size:	16-bit	

Settings:

Please refer to P5.020 for the setting of acceleration / deceleration time in PR mode.

<b>P5.024</b>	<b>Acceleration / deceleration time (Number #4)</b>		<b>Address: 0530H 0531H</b>	
Default:	800	Control mode:	PR	
Unit:	ms	Setting range:	1 ~ 65500	
Format:	DEC	Data size:	16-bit	

Settings:

Please refer to P5.020 for the setting of acceleration / deceleration time in PR mode.

<b>P5.025</b>	<b>Acceleration / deceleration time (Number #5)</b>		<b>Address: 0532H 0533H</b>	
Default:	900	Control mode:	PR	
Unit:	ms	Setting range:	1 ~ 65500	
Format:	DEC	Data size:	16-bit	

Settings:

Please refer to P5.020 for the setting of acceleration / deceleration time in PR mode.

<b>P5.026</b>	<b>Acceleration / deceleration time (Number #6)</b>		<b>Address: 0534H 0535H</b>	
Default:	1000	Control mode:	PR	
Unit:	ms	Setting range:	1 ~ 65500	
Format:	DEC	Data size:	16-bit	

Settings:

Please refer to P5.020 for the setting of acceleration / deceleration time in PR mode.

<b>P5.027</b>	<b>Acceleration / deceleration time (Number #7)</b>		<b>Address: 0536H 0537H</b>
Default:	1200	Control mode:	PR
Unit:	ms	Setting range:	1 ~ 65500
Format:	DEC	Data size:	16-bit

Settings:

Please refer to P5.020 for the setting of acceleration / deceleration time in PR mode.

<b>P5.028</b>	<b>Acceleration / deceleration time (Number #8)</b>		<b>Address: 0538H 0539H</b>
Default:	1500	Control mode:	PR
Unit:	ms	Setting range:	1 ~ 65500
Format:	DEC	Data size:	16-bit

Settings:

Please refer to P5.020 for the setting of acceleration / deceleration time in PR mode.

<b>P5.029</b>	<b>Acceleration / deceleration time (Number #9)</b>		<b>Address: 053AH 053BH</b>
Default:	2000	Control mode:	PR
Unit:	ms	Setting range:	1 ~ 65500
Format:	DEC	Data size:	16-bit

Settings:

Please refer to P5.020 for the setting of acceleration / deceleration time in PR mode.

<b>P5.030</b>	<b>Acceleration / deceleration time (Number #10)</b>		<b>Address: 053CH 053DH</b>
Default:	2500	Control mode:	PR
Unit:	ms	Setting range:	1 ~ 65500
Format:	DEC	Data size:	16-bit

Settings:

Please refer to P5.020 for the setting of acceleration / deceleration time in PR mode.

<b>P5.031</b>	<b>Acceleration / deceleration time (Number #11)</b>		<b>Address: 053EH 053FH</b>
Default:	3000	Control mode:	PR
Unit:	ms	Setting range:	1 ~ 65500
Format:	DEC	Data size:	16-bit

Settings:

Please refer to P5.020 for the setting of acceleration / deceleration time in PR mode.

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<b>P5.032</b>	<b>Acceleration / deceleration time (Number #12)</b>		<b>Address: 0540H 0541H</b>
Default:	5000	Control mode:	PR
Unit:	ms	Setting range:	1 ~ 65500
Format:	DEC	Data size:	16-bit

Settings:

Please refer to P5.020 for the setting of acceleration / deceleration time in PR mode.

<b>P5.033</b>	<b>Acceleration / deceleration time (Number #13)</b>		<b>Address: 0542H 0543H</b>
Default:	8000	Control mode:	PR
Unit:	Ms	Setting range:	1 ~ 65500
Format:	DEC	Data size:	16-bit

Settings:

Please refer to P5.020 for the setting of acceleration / deceleration time in PR mode.

<b>P5.034</b>	<b>Acceleration / deceleration time (Number #14)</b>		<b>Address: 0544H 0545H</b>
Default:	50	Control mode:	PR
Unit:	ms	Setting range:	1 ~ 1500
Format:	DEC	Data size:	16-bit

Settings:

The default value of this parameter is smaller (short deceleration time), and it is used for deceleration time setting of auto protection.

<b>P5.035</b>	<b>Acceleration / deceleration time (Number #15)</b>		<b>Address: 0546H 0547H</b>
Default:	30	Control mode:	PR
Unit:	ms	Setting range:	1 ~ 1200
Format:	DEC	Data size:	16-bit

Settings:

The default value of this parameter is smaller (short deceleration time), and it is used for deceleration time setting of auto protection.

<b>P5.036</b>	<b>CAPTURE - Start address of data array</b>		<b>Address: 0548H 0549H</b>
Default:	0	Control mode:	All
Unit:	-	Setting range:	0 ~ (Value set by P5.010 minus 1)
Format:	DEC	Data size:	16-bit

Settings:

The first data CAPTURE obtained is saved in the address of data array. Please note that this parameter is only writable when CAPTURE stops (please refer to P5.039).

<b>P5.037</b>	<b>CAPTURE - Axis position</b>		<b>Address: 054AH 054BH</b>
Default:	0	Control mode:	All
Unit:	-	Setting range:	-2147483648 ~ +2147483647
Format:	DEC	Data size:	32-bit

Settings:

Displays the axis position of CAPTURE pulse source. Please note that this parameter is only writable when CAPTURE stops (please refer to P5.039). If the source is the main encoder, this parameter is write-protected and the CAPTURE axis position is the feedback position of the motor (monitoring variable 00h).

<b>P5.038</b>	<b>CAPTURE - Number of capturing times</b>		<b>Address: 054CH 054DH</b>
Default:	1	Control mode:	All
Unit:	-	Setting range:	1 ~ (Value set by P5.010 minus value set by P5.036)
Format:	DEC	Data size:	16-bit

Settings:

When CAPTURE stops, it indicates the number of data expected to be captured (readable and writable). When CAPTURE activates, it indicates the remaining number of data that has not been captured (read-only); each time it captures one data, the value of P5.038 will minus one until the value is 0 indicating capturing is completed.

Note:

1. The total number of data of COMPARE, CAPTURE, and E-Cam cannot exceed 800.
2. A3L does not support E-Cam function.



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<b>P5.039</b>	<b>CAPTURE - Activate CAP control</b>		<b>Address: 054EH 054FH</b>
Default:	0x2010	Control mode:	All
Unit:	-	Setting range:	0x0000 ~ 0xF13F
Format:	HEX	Data size:	16-bit

Settings:



X	Capture setting	Z	Triggering logic
Y	Axis source of Capture	U	Trigger minimum interval

■ X: Capture setting

bit	3	2	1	0
X function	Execute PR when finishing capturing	After capturing the first data, activate COMPARE	Reset position after first data	Activate CAPTURE
Description	Execute PR # 50 when finishing CAPTURE	Invalid when COMPARE is activated	After capturing the first data, reset the position coordinate	Starts to capture when set to 1; after finishing capturing, this bit is cleared automatically

■ Y: Axis source of Capture

0: CAPTURE is not working

1: AUX ENC (CN5)

2: Pulse command (CN1)

3: Main encoder (CN2)

Note: When the source of COMPARE is CAPTURE axis, the source Y of CAPTURE cannot be changed.

■ Z: Triggering logic

0: NO (Normally open)

1: NC (Normally closed)

■ U: Trigger minimum interval (Unit: ms)

Note: Please refer to Chapter 7 for detailed instructions.

<b>P5.040</b>	<b>Delay time after position reached (Number #0)</b>		<b>Address: 0550H 0551H</b>
Default:	0	Control mode:	PR
Unit:	ms	Setting range:	0 ~ 32767
Format:	DEC	Data size:	16-bit

Settings:

The first delay time of PR mode.

<b>P5.041</b>	<b>Delay time after position reached (Number #1)</b>		<b>Address: 0552H 0553H</b>
Default:	100	Control mode:	PR
Unit:	ms	Setting range:	0 ~ 32767
Format:	DEC	Data size:	16-bit

Settings:

The second delay time of PR mode.

<b>P5.042</b>	<b>Delay time after position reached (Number #2)</b>		<b>Address: 0554H 0555H</b>
Default:	200	Control mode:	PR
Unit:	ms	Setting range:	0 ~ 32767
Format:	DEC	Data size:	16-bit

Settings:

The third delay time of PR mode.

<b>P5.043</b>	<b>Delay time after position reached (Number #3)</b>		<b>Address: 0556H 0557H</b>
Default:	400	Control mode:	PR
Unit:	ms	Setting range:	0 ~ 32767
Format:	DEC	Data size:	16-bit

Settings:

The fourth delay time of PR mode.

<b>P5.044</b>	<b>Delay time after position reached (Number #4)</b>		<b>Address: 0558H 0559H</b>
Default:	500	Control mode:	PR
Unit:	ms	Setting range:	0 ~ 32767
Format:	DEC	Data size:	16-bit

Settings:

The fifth delay time of PR mode.

<b>P5.045</b>	<b>Delay time after position reached (Number #5)</b>		<b>Address: 055AH 055BH</b>
Default:	800	Control mode:	PR
Unit:	ms	Setting range:	0 ~ 32767
Format:	DEC	Data size:	16-bit

Settings:

The sixth delay time of PR mode.

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<b>P5.046</b>	<b>Delay time after position reached (Number #6)</b>		<b>Address: 055CH 055DH</b>	
Default:	1000	Control mode:	PR	
Unit:	ms	Setting range:	0 ~ 32767	
Format:	DEC	Data size:	16-bit	

Settings:

The seventh delay time of PR mode.

<b>P5.047</b>	<b>Delay time after position reached (Number #7)</b>		<b>Address: 055EH 055FH</b>	
Default:	1500	Control mode:	PR	
Unit:	ms	Setting range:	0 ~ 32767	
Format:	DEC	Data size:	16-bit	

Settings:

The eighth delay time of PR mode.

<b>P5.048</b>	<b>Delay time after position reached (Number #8)</b>		<b>Address: 0560H 0561H</b>	
Default:	2000	Control mode:	PR	
Unit:	ms	Setting range:	0 ~ 32767	
Format:	DEC	Data size:	16-bit	

Settings:

The ninth delay time of PR mode.

<b>P5.049</b>	<b>Delay time after position reached (Number #9)</b>		<b>Address: 0562H 0563H</b>	
Default:	2500	Control mode:	PR	
Unit:	ms	Setting range:	0 ~ 32767	
Format:	DEC	Data size:	16-bit	

Settings:

The tenth delay time of PR mode.

<b>P5.050</b>	<b>Delay time after position reached (Number #10)</b>		<b>Address: 0564H 0565H</b>	
Default:	3000	Control mode:	PR	
Unit:	ms	Setting range:	0 ~ 32767	
Format:	DEC	Data size:	16-bit	

Settings:

The eleventh delay time of PR mode.

<b>P5.051</b>	<b>Delay time after position reached (Number #11)</b>		<b>Address: 0566H 0567H</b>	
Default:	3500	Control mode:	PR	
Unit:	ms	Setting range:	0 ~ 32767	
Format:	DEC	Data size:	16-bit	

Settings:

The twelfth delay time of PR mode.

<b>P5.052</b>	<b>Delay time after position reached (Number #12)</b>		<b>Address: 0568H 0569H</b>	
Default:	4000	Control mode:	PR	
Unit:	ms	Setting range:	0 ~ 32767	
Format:	DEC	Data size:	16-bit	

Settings:

The thirteenth delay time of PR mode.

<b>P5.053</b>	<b>Delay time after position reached (Number #13)</b>		<b>Address: 056AH 056BH</b>	
Default:	4500	Control mode:	PR	
Unit:	ms	Setting range:	0 ~ 32767	
Format:	DEC	Data size:	16-bit	

Settings:

The fourteenth delay time of PR mode.

<b>P5.054</b>	<b>Delay time after position reached (Number #14)</b>		<b>Address: 056CH 056DH</b>	
Default:	5000	Control mode:	PR	
Unit:	ms	Setting range:	0 ~ 32767	
Format:	DEC	Data size:	16-bit	

Settings:

The fifteenth delay time of PR mode.

<b>P5.055</b>	<b>Delay time after position reached (Number #15)</b>		<b>Address: 056EH 056FH</b>	
Default:	5500	Control mode:	PR	
Unit:	ms	Setting range:	0 ~ 32767	
Format:	DEC	Data size:	16-bit	

Settings:

The sixteenth delay time of PR mode.

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<b>P5.056</b>	<b>COMPARE - Start address of data array</b>		<b>Address: 0570H 0571H</b>	
Default:	50	Control mode:	All	
Unit:	-	Setting range:	0 ~ (Value of P5.010 minus 1)	
Format:	DEC	Data size:	16-bit	

Settings:

The address of data array which saves the first COMPARE data. Please note that this parameter is only writable when COMPARE stops (please refer to P5.059).

<b>P5.057</b>	<b>COMPARE - Axis position</b>		<b>Address: 0572H 0573H</b>	
Default:	0	Control mode:	All	
Unit:	Pulse applied by COMPARE axis	Setting range:	-2147483648 ~ +2147483647	
Format:	DEC	Data size:	32-bit	

Settings:

Displays the axis position of COMPARE pulse source. Please note that this parameter is only writable when COMPARE stops (please refer to P5.059).

Note:

1. This parameter is write-protected when the source of COMPARE axis is the CAPTURE axis (P5.059.Y = 0).
2. When the COMPARE axis source is the main encoder, P5.057 is also write-protected. The pulse resolution is determined by P1.046. When P5.059.Y is set to the main encoder, this parameter is set to the feedback position of the motor (monitoring variable 00h). When the motor feedback position is redefined due to homing or CAPTURE, it will be different from the parameter. In this case, set P5.059.Y to 0, then set P5.059.Y to 3, and the parameter will be reset to the motor feedback position.

<b>P5.058</b>	<b>COMPARE - Compare amount</b>		<b>Address: 0574H 0575H</b>	
Default:	1	Control mode:	All	
Unit:	-	Setting range:	1 ~ (Value set by P5.010 minus value set by P5.056)	
Format:	DEC	Data size:	16-bit	

Settings:

When COMPARE is not in operation, the parameter indicates the number of data expected to be compared (readable and writable). When COMPARE is in operation, the parameter indicates the remaining number of data to be compared. Each time it compares one data, the value of P5.058 will minus one until the value is 0 indicating comparing is completed (read-only).

<b>P5.059</b>	<b>COMPARE - Activate CMP control</b>		<b>Address: 0576H 0577H</b>
Default:	0x00640010	Control mode:	All
Unit:	-	Setting range:	0x00010000 ~ 0x0FFF313F
Format:	HEX	Data size:	32-bit

Settings:

**4052A**  
D CBA

**L0020**  
U Z Y X

CBA	Duration of pulse output, Unit: 1 ms	X	COMPARE setting
D	N/A	Y	COMPARE axis source
-	-	Z	Triggering logic
-	-	U	Trigger PR
h	High bit	L	Low bit

■ X: COMPARE setting

bit	3	2	1	0
X function	Compare axis position returns to 0	After finishing comparing, activate CAPTURE	Cycle mode	Activate COMPARE
Description	As soon as the last data is compared, Compare axis position (P5.057) returns to 0	Invalid when CAPTURE is activated	Does not stop	Starts to compare when set to 1; after finishing comparing, this bit is cleared automatically

■ Y: COMPARE axis source

0: When selecting CAPTURE AXES, the source of CAP cannot be changed

1: AUX ENC (CN5)

2: Pulse command (CN1)

3: Main encoder (CN2)

Note: When the source of COMPARE is CAPTURE axis, the source Y of CAPTURE cannot be changed.

■ Z: Triggering logic

0: NO (Normally open)

1: NC (Normally closed)

■ U: Trigger PR

bit	3	2	1	0
U function	-	-	-	Trigger PR
Description	-	-	-	When this bit is set to 1, PR#45 will be triggered after the last compare is completed

■ CBA: Duration of pulse output, Unit: 1 ms

Note: Please refer to Chapter 7 for detailed instructions.

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<b>P5.060</b>	<b>Target speed setting #0</b>			<b>Address: 0578H 0579H</b>
Operation interface:	Panel / software	Communication	Control mode:	PR
Default:	20.0	200	Data size:	16-bit
Unit:	1 rpm (rotary motor)* 10 <sup>-6</sup> m/s (linear motor)*	0.1 rpm (rotary motor)* 10 <sup>-6</sup> m/s (linear motor)*		
Setting range:	0.0 ~ 6000.0 (rotary motor)* 0.0 ~ 1599999.9 (linear motor)*	0 ~ 60000 (rotary motor)* 0 ~ 15999999 (linear motor)*		
Format:	DEC		-	-
Example:	15 = 15 rpm	150 = 15 rpm	-	-

Settings:

First target speed of PR mode.

Note: Rotary motor is the abbreviation for permanent-magnet synchronous rotary motor; linear motor is the abbreviation for permanent-magnet synchronous linear motor.

<b>P5.061</b>	<b>Target speed setting #1</b>			<b>Address: 057AH 057BH</b>
Operation interface:	Panel / software	Communication	Control mode:	PR
Default:	50.0	500	Data size:	16-bit
Unit:	1 rpm (rotary motor)* 10 <sup>-6</sup> m/s (linear motor)*	0.1 rpm (rotary motor)* 10 <sup>-6</sup> m/s (linear motor)*		
Setting range:	0.0 ~ 6000.0 (rotary motor)* 0.0 ~ 1599999.9 (linear motor)*	0 ~ 60000 (rotary motor)* 0 ~ 15999999 (linear motor)*		
Format:	DEC		-	-
Example:	1 = 1 rpm	10 = 1 rpm	-	-

Settings:

Second target speed of PR mode.

Note: Rotary motor is the abbreviation for permanent-magnet synchronous rotary motor; linear motor is the abbreviation for permanent-magnet synchronous linear motor.

<b>P5.062</b>	<b>Target speed setting #2</b>			<b>Address: 057CH 057DH</b>
Operation interface:	Panel / software	Communication	Control mode:	PR
Default:	100.0	1000	Data size:	16-bit
Unit:	1 rpm (rotary motor)* 10 <sup>-6</sup> m/s (linear motor)*	0.1 rpm (rotary motor)* 10 <sup>-6</sup> m/s (linear motor)*		
Setting range:	0.0 ~ 6000.0 (rotary motor)* 0.0 ~ 1599999.9 (linear motor)*	0 ~ 60000 (rotary motor)* 0 ~ 15999999 (linear motor)*		
Format:	DEC		-	-
Example:	1 = 1 rpm	10 = 1 rpm	-	-

Settings:

Third target speed of PR mode.

Note: Rotary motor is the abbreviation for permanent-magnet synchronous rotary motor; linear motor is the abbreviation for permanent-magnet synchronous linear motor.

<b>P5.063</b>	<b>Target speed setting #3</b>			<b>Address: 057EH 057FH</b>
Operation interface:	Panel / software	Communication	Control mode:	PR
Default:	200.0	2000	Data size:	16-bit
Unit:	1 rpm (rotary motor)* 10 <sup>-6</sup> m/s (linear motor)*	0.1 rpm (rotary motor)* 10 <sup>-6</sup> m/s (linear motor)*		
Setting range:	0.0 ~ 6000.0 (rotary motor)* 0.0 ~ 1599999.9 (linear motor)*	0 ~ 60000 (rotary motor)* 0 ~ 15999999 (linear motor)*		
Format:	DEC	-	-	-
Example:	1 = 1 rpm	10 = 1 rpm	-	-

Settings:

Fourth target speed of PR mode.

Note: Rotary motor is the abbreviation for permanent-magnet synchronous rotary motor; linear motor is the abbreviation for permanent-magnet synchronous linear motor.

<b>P5.064</b>	<b>Target speed setting #4</b>			<b>Address: 0580H 0581H</b>
Operation interface:	Panel / software	Communication	Control mode:	PR
Default:	300.0	3000	Data size:	16-bit
Unit:	1 rpm (rotary motor)* 10 <sup>-6</sup> m/s (linear motor)*	0.1 rpm (rotary motor)* 10 <sup>-6</sup> m/s (linear motor)*		
Setting range:	0.0 ~ 6000.0 (rotary motor)* 0.0 ~ 1599999.9 (linear motor)*	0 ~ 60000 (rotary motor)* 0 ~ 15999999 (linear motor)*		
Format:	DEC	-	-	-
Example:	1 = 1 rpm	10 = 1 rpm	-	-

Settings:

Fifth target speed of PR mode.

Note: Rotary motor is the abbreviation for permanent-magnet synchronous rotary motor; linear motor is the abbreviation for permanent-magnet synchronous linear motor.

<b>P5.065</b>	<b>Target speed setting #5</b>			<b>Address: 0582H 0583H</b>
Operation interface:	Panel / software	Communication	Control mode:	PR
Default:	500.0	5000	Data size:	16-bit
Unit:	1 rpm (rotary motor)* 10 <sup>-6</sup> m/s (linear motor)*	0.1 rpm (rotary motor)* 10 <sup>-6</sup> m/s (linear motor)*		
Setting range:	0.0 ~ 6000.0 (rotary motor)* 0.0 ~ 1599999.9 (linear motor)*	0 ~ 60000 (rotary motor)* 0 ~ 15999999 (linear motor)*		
Format:	DEC	-	-	-
Example:	1 = 1 rpm	10 = 1 rpm	-	-

Settings:

Sixth target speed of PR mode.

Note: Rotary motor is the abbreviation for permanent-magnet synchronous rotary motor; linear motor is the abbreviation for permanent-magnet synchronous linear motor.



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<b>P5.066</b>	<b>Target speed setting #6</b>			<b>Address: 0584H 0585H</b>
Operation interface:	Panel / software	Communication	Control mode:	PR
Default:	600.0	6000	Data size:	16-bit
Unit:	1 rpm (rotary motor)* 10 <sup>-6</sup> m/s (linear motor)*	0.1 rpm (rotary motor)* 10 <sup>-6</sup> m/s (linear motor)*		
Setting range:	0.0 ~ 6000.0 (rotary motor)* 0.0 ~ 1599999.9 (linear motor)*	0 ~ 60000 (rotary motor)* 0 ~ 15999999 (linear motor)*		
Format:	DEC	-	-	-
Example:	1 = 1 rpm	10 = 1 rpm	-	-

Settings:

Seventh target speed of PR mode.

Note: Rotary motor is the abbreviation for permanent-magnet synchronous rotary motor; linear motor is the abbreviation for permanent-magnet synchronous linear motor.

<b>P5.067</b>	<b>Target speed setting #7</b>			<b>Address: 0586H 0587H</b>
Operation interface:	Panel / software	Communication	Control mode:	PR
Default:	800.0	8000	Data size:	16-bit
Unit:	1 rpm (rotary motor)* 10 <sup>-6</sup> m/s (linear motor)*	0.1 rpm (rotary motor)* 10 <sup>-6</sup> m/s (linear motor)*		
Setting range:	0.0 ~ 6000.0 (rotary motor)* 0.0 ~ 1599999.9 (linear motor)*	0 ~ 60000 (rotary motor)* 0 ~ 15999999 (linear motor)*		
Format:	DEC	-	-	-
Example:	1 = 1 rpm	10 = 1 rpm	-	-

Settings:

Eighth target speed of PR mode.

Note: Rotary motor is the abbreviation for permanent-magnet synchronous rotary motor; linear motor is the abbreviation for permanent-magnet synchronous linear motor.

<b>P5.068</b>	<b>Target speed setting #8</b>			<b>Address: 0588H 0589H</b>
Operation interface:	Panel / software	Communication	Control mode:	PR
Default:	1000.0	10000	Data size:	16-bit
Unit:	1 rpm (rotary motor)* 10 <sup>-6</sup> m/s (linear motor)*	0.1 rpm (rotary motor)* 10 <sup>-6</sup> m/s (linear motor)*		
Setting range:	0.0 ~ 6000.0 (rotary motor)* 0.0 ~ 1599999.9 (linear motor)*	0 ~ 60000 (rotary motor)* 0 ~ 15999999 (linear motor)*		
Format:	DEC	-	-	-
Example:	1 = 1 rpm	10 = 1 rpm	-	-

Settings:

Ninth target speed of PR mode.

Note: Rotary motor is the abbreviation for permanent-magnet synchronous rotary motor; linear motor is the abbreviation for permanent-magnet synchronous linear motor.

<b>P5.069</b>	<b>Target speed setting #9</b>			<b>Address: 058AH 058BH</b>
Operation interface:	Panel / software	Communication	Control mode:	PR
Default:	1300.0	13000	Data size:	16-bit
Unit:	1 rpm (rotary motor)* 10 <sup>-6</sup> m/s (linear motor)*	0.1 rpm (rotary motor)* 10 <sup>-6</sup> m/s (linear motor)*		
Setting range:	0.0 ~ 6000.0 (rotary motor)* 0.0 ~ 1599999.9 (linear motor)*	0 ~ 60000 (rotary motor)* 0 ~ 15999999 (linear motor)*		
Format:	DEC	-	-	-
Example:	1 = 1 rpm	10 = 1 rpm	-	-

Settings:

Tenth target speed of PR mode.

Note: Rotary motor is the abbreviation for permanent-magnet synchronous rotary motor; linear motor is the abbreviation for permanent-magnet synchronous linear motor.

<b>P5.070</b>	<b>Target speed setting #10</b>			<b>Address: 058CH 058DH</b>
Operation interface:	Panel / software	Communication	Control mode:	PR
Default:	1500.0	15000	Data size:	16-bit
Unit:	1 rpm (rotary motor)* 10 <sup>-6</sup> m/s (linear motor)*	0.1 rpm (rotary motor)* 10 <sup>-6</sup> m/s (linear motor)*		
Setting range:	0.0 ~ 6000.0 (rotary motor)* 0.0 ~ 1599999.9 (linear motor)*	0 ~ 60000 (rotary motor)* 0 ~ 15999999 (linear motor)*		
Format:	DEC	-	-	-
Example:	1 = 1 rpm	10 = 1 rpm	-	-

Settings:

Eleventh target speed of PR mode.

Note: Rotary motor is the abbreviation for permanent-magnet synchronous rotary motor; linear motor is the abbreviation for permanent-magnet synchronous linear motor.

<b>P5.071</b>	<b>Target speed setting #11</b>			<b>Address: 058EH 058FH</b>
Operation interface:	Panel / software	Communication	Control mode:	PR
Default:	1800.0	18000	Data size:	16-bit
Unit:	1 rpm (rotary motor)* 10 <sup>-6</sup> m/s (linear motor)*	0.1 rpm (rotary motor)* 10 <sup>-6</sup> m/s (linear motor)*		
Setting range:	0.0 ~ 6000.0 (rotary motor)* 0.0 ~ 1599999.9 (linear motor)*	0 ~ 60000 (rotary motor)* 0 ~ 15999999 (linear motor)*		
Format:	DEC	-	-	-
Example:	1 = 1 rpm	10 = 1 rpm	-	-

Settings:

Twelfth target speed of PR mode.

Note: Rotary motor is the abbreviation for permanent-magnet synchronous rotary motor; linear motor is the abbreviation for permanent-magnet synchronous linear motor.

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<b>P5.072</b>	<b>Target speed setting #12</b>			<b>Address: 0590H 0591H</b>
Operation interface:	Panel / software	Communication	Control mode:	PR
Default:	2000.0	20000	Data size:	16-bit
Unit:	1 rpm (rotary motor)* 10 <sup>-6</sup> m/s (linear motor)*	0.1 rpm (rotary motor)* 10 <sup>-6</sup> m/s (linear motor)*		
Setting range:	0.0 ~ 6000.0 (rotary motor)* 0.0 ~ 1599999.9 (linear motor)*	0 ~ 60000 (rotary motor)* 0 ~ 15999999 (linear motor)*		
Format:	DEC	-	-	-
Example:	1 = 1 rpm	10 = 1 rpm	-	-

Settings:

Thirteenth target speed of PR mode.

Note: Rotary motor is the abbreviation for permanent-magnet synchronous rotary motor; linear motor is the abbreviation for permanent-magnet synchronous linear motor.

<b>P5.073</b>	<b>Target speed setting #13</b>			<b>Address: 0592H 0593H</b>
Operation interface:	Panel / software	Communication	Control mode:	PR
Default:	2300.0	23000	Data size:	16-bit
Unit:	1 rpm (rotary motor)* 10 <sup>-6</sup> m/s (linear motor)*	0.1 rpm (rotary motor)* 10 <sup>-6</sup> m/s (linear motor)*		
Setting range:	0.0 ~ 6000.0 (rotary motor)* 0.0 ~ 1599999.9 (linear motor)*	0 ~ 60000 (rotary motor)* 0 ~ 15999999 (linear motor)*		
Format:	DEC	-	-	-
Example:	1 = 1 rpm	10 = 1 rpm	-	-

Settings:

Fourteenth target speed of PR mode.

Note: Rotary motor is the abbreviation for permanent-magnet synchronous rotary motor; linear motor is the abbreviation for permanent-magnet synchronous linear motor.

<b>P5.074</b>	<b>Target speed setting #14</b>			<b>Address: 0594H 0595H</b>
Operation interface:	Panel / software	Communication	Control mode:	PR
Default:	2500.0	25000	Data size:	16-bit
Unit:	1 rpm (rotary motor)* 10 <sup>-6</sup> m/s (linear motor)*	0.1 rpm (rotary motor)* 10 <sup>-6</sup> m/s (linear motor)*		
Setting range:	0.0 ~ 6000.0 (rotary motor)* 0.0 ~ 1599999.9 (linear motor)*	0 ~ 60000 (rotary motor)* 0 ~ 15999999 (linear motor)*		
Format:	DEC	-	-	-
Example:	1 = 1 rpm	10 = 1 rpm	-	-

Settings:

Fifteenth target speed of PR mode.

Note: Rotary motor is the abbreviation for permanent-magnet synchronous rotary motor; linear motor is the abbreviation for permanent-magnet synchronous linear motor.

<b>P5.075</b>	<b>Target speed setting #15</b>			<b>Address: 0596H 0597H</b>
Operation interface:	Panel / software	Communication	Control mode:	PR
Default:	3000.0	30000	Data size:	16-bit
Unit:	1 rpm (rotary motor)* 10 <sup>-6</sup> m/s (linear motor)*	0.1 rpm (rotary motor)* 10 <sup>-6</sup> m/s (linear motor)*		
Setting range:	0.0 ~ 6000.0 (rotary motor)* 0.0 ~ 1599999.9 (linear motor)*	0 ~ 60000 (rotary motor)* 0 ~ 1599999 (linear motor)*		
Format:	DEC	-	-	-
Example:	1 = 1 rpm	10 = 1 rpm	-	-

Settings:

Sixteenth target speed of PR mode.

Note: Rotary motor is the abbreviation for permanent-magnet synchronous rotary motor; linear motor is the abbreviation for permanent-magnet synchronous linear motor.

<b>P5.076</b>	<b>CAPTURE - Reset position after first data</b>			<b>Address: 0598H 0599H</b>
Default:	0	Control mode:	All	
Unit:	Unit applied by Capture source	Setting range:	-1073741824 ~ +1073741823	
Format:	DEC	Data size:	32-bit	

Settings:

If position reset function is enabled (P5.039.X [Bit1] = 1), after the first position data is captured, the servo will reset the coordinates of the first point, which is defined by this parameter.

<b>P5.077</b>	<b>E-Cam: Position of capture synchronous axis (SYNC CAP AXES)</b>			<b>Address: 059AH 059BH</b>
Default:	0	Control mode:	All	
Unit:	Pulse	Setting range:	-2147483648 ~ +2147483647	
Format:	DEC	Data size:	32-bit	

Settings:

The position of this axis will synchronize with CAP signal. Thus, when CAP operates every two times, the moving distance of this axis is the value of P5.078. (There is no accumulative error and only operates in single-way.) The capture synchronous axis can be the position source of Master.

Note: A3-L does not support E-Cam function.

<b>P5.078</b>	<b>E-Cam: Interval between each synchronous capture action</b>			<b>Address: 059CH 059DH</b>
Default:	100	Control mode:	All	
Unit:	Pulse	Setting range:	10 ~ 100000000	
Format:	DEC	Data size:	32-bit	

## 8

Settings:

Interval between two capturing actions. The new value can only be written into the parameter when CAPTURE is not in operation (P5.039.X0 set to 0).

Note: A3-L does not support E-Cam function.

<b>P5.079</b>	<b>E-Cam: Following error of synchronous capture axis</b>		<b>Address: 059EH 059FH</b>
Default:	0	Control mode:	All
Unit:	Pulse	Setting range:	-2147483648 ~ +2147483647
Format:	DEC	Data size:	32-bit

Settings:

When capture synchronous axis is operating, the synchronous error should be 0. This parameter shows this error value. Please see following for more information:

Synchronous error equals output value of synchronous axis minus setting value of synchronous axis or the accumulative amount of P5.077 minus (P5.078 x Number of capturing times). Each time when capturing a data, the synchronous axis will operate and this parameter will update once. This parameter can be written as well. It indicates the offset of synchronous axis. When the synchronous capture axis is regarded as the master of rotary shear, modifying this parameter can shift the cutting position to the left / right.

Note: A3-L does not support E-Cam function.

<b>P5.080</b>	<b>E-Cam: Max. correction rate of synchronous capture axis</b>		<b>Address: 05A0H 05A1H</b>
Default:	10	Control mode:	All
Unit:	%	Setting range:	0 ~ 90
Format:	DEC	Data size:	16-bit

Settings:

This parameter limits the percentage (%) of synchronous adjustment.

Correction rate = Pulse number output by synchronous axis / Pulse number input by synchronous axis  
 $(100 - P5.080) \% < \text{Correction rate} < (100 + P5.080) \%$

When the correction rate is bigger, the synchronous error becomes 0 faster, but the speed change is more drastic. Whereas, when the correction rate is smaller, the synchronous error becomes 0 slower, but the speed change is smoother. In the application of rotary shear, after adjusting the synchronous error of P5.079, the bigger the parameter value is, the faster the cutting position reaches the target position. However, the speed will not be synchronized.

Note: A3-L does not support E-Cam function.

<b>P5.081</b>	<b>E-Cam: Start address of data array</b>		<b>Address: 05A2H 05A3H</b>	
Default:	100	Control mode:	PR	
Unit:	-	Setting range:	0 ~ (800 minus value set by P5.082)	
Format:	DEC	Data size:	16-bit	

## Settings:

The first data of E-Cam table is saved in the address of data array. This parameter can be set at any time, but will be effective only at the point when pre-engaged changes to engaged.

Note: A3-L does not support E-Cam function.

<b>P5.082</b>	<b>E-Cam: Area number N</b>		<b>Address: 05A4H 05A5H</b>	
Default:	5	Control mode:	PR	
Unit:	-	Setting range:	5 ~ 720	
Format:	DEC	Data size:	16-bit	

## Settings:

Indicates the E-Cam curve is divided into N areas, and the table should include N+1 data. This parameter is only writable when E-Cam stops (please refer to P5.088.X [Bit0] = 0). Its setting range must be smaller than or equal to P5.010 minus P5.081, and P5.082 x P5.084 must be smaller than or equal to 2147483647.

Note: A3-L does not support E-Cam function.

<b>P5.083</b>	<b>E-Cam: Master gear ratio setting - Cycle number (M)</b>		<b>Address: 05A6H 05A7H</b>	
Default:	1	Control mode:	PR	
Unit:	-	Setting range:	1 ~ 32767	
Format:	DEC	Data size:	16-bit	

## Settings:

When receiving pulse number defined by P5.084 from the master axis, E-Cam will rotate the cycle number defined by P5.083 (One cycle of E-Cam = Rotate from 0° ~ 360°). This parameter is only writable when E-Cam stops (please refer to P5.088.X [Bit0] = 0).

Note: A-3L does not support E-Cam function.

<b>P5.084</b>	<b>E-Cam: Master gear ratio setting - Pulse number (P)</b>		<b>Address: 05A8H 05A9H</b>	
Default:	3600	Control mode:	PR	
Unit:	-	Setting range:	10 ~ 1073741823	
Format:	DEC	Data size:	32-bit	

## 8

## Settings:

When receiving pulse number defined by P5.084 from the master axis, E-Cam will rotate the cycle number defined by P5.083 (One cycle of E-Cam = Rotate from 0° ~ 360°). This parameter can be modified at any time. Its setting range must be P5.082 x P5.083 smaller than or equal to P5.084, and P5.082 x P5.084 must be smaller than or equal to 2147483647.

Note: A3-L does not support E-Cam function.

<b>P5.085</b>	<b>E-Cam: Engaged area number</b>		<b>Address: 05AAH 05ABH</b>
Default:	0	Control mode:	PR
Unit:	-	Setting range:	0 ~ (Setting value of P5.082 minus 1)
Format:	DEC	Data size:	16-bit

## Settings:

The area number of E-Cam when E-Cam engaged (Area number in E-Cam table).

Note: A3-L does not support E-Cam function.

<b>P5.086</b>	<b>E-Cam: Master axis position</b>		<b>Address: 05ACH 05ADH</b>
Default:	0	Control mode:	PR
Unit:	-	Setting range:	-2147483648 ~ +2147483647
Format:	DEC	Data size:	32-bit

## Settings:

Position counter of the E-Cam Master. This parameter is only writable when E-Cam stops (please refer to P5.088.X [Bit0] =0).

Note: A3-L does not support E-Cam function.

<b>P5.087</b>	<b>E-Cam: Lead pulse before engaged</b>		<b>Address: 05AEH 05AFH</b>
Default:	0	Control mode:	PR
Unit:	Unit applied by master axis	Setting range:	-1073741824 ~ +1073741823
Format:	DEC	Data size:	32-bit

## Settings:

When the engaging condition of E-Cam (P5.088.Z) is met, the pulse number from the master axis has to exceed the setting value of this parameter for the E-Cam to fully engage. This parameter can be written via virtual master pulse function (refer to description of P2.077).

Note: A3-L does not support E-Cam function.

<b>P5.088</b>	<b>E-Cam: Activate E-Cam control</b>		<b>Address: 05B0H 05B1H</b>
Default:	0x00000000	Control mode:	PR
Unit:	-	Setting range:	0x0 ~ 0x203FF257
Format:	HEX	Data size:	32-bit

Settings:

Format of this parameter: (High word h) S0BA : (Low word L) UZYX



BA	PR path to be executed	X	Activation setting of E-Cam function
C	Reserved	Y	Command source
D	E-Cam status display	Z	Engaging condition
-	-	U	Disengaging condition

Definition as follows:

- X: E-Cam command

Description of each bit:

Bit	Function	Description
0	E-Cam activation	0: E-Cam is disabled 1: E-Cam is enabled (Relevant parameters cannot be modified once E-Cam is enabled)
1	E-Cam does not disengage when servo is off	0: When the servo is stopped by alarm or servo is off, the clutch will disengage 1: When the servo stops because of alarm or servo is off, the clutch can remain in engaged status. When the servo switches to on again, E-Cam can operate directly. It can return to the correct E-Cam position by macro #D.
2	P5.019 is effective immediately	0: P5.019 is effective after next engagement 1: P5.019 is effective immediately
3	Reserved	-

- Y: Command source

0: Capture axis

1: Auxiliary encoder

2: Pulse command

3: PR command

4: Time axis (1 ms)

5: Synchronous capture axis (P5.077)

6: Analog channel 1 (Virtual axis, Unit: 1M pulse/s per 10V)



## 8

- Z: Engaging time
  - 0: Immediately
  - 1: Trigger DI.CAM
  - 2: Any one position data is captured
- U: Disengaging condition (2, 4, and 6 cannot be selected at the same time)

U	Disengage condition	Action after disengaged
0	Never disengage	-
1	DI.CAM OFF	In <b>stop</b> status
2	Master axis reaches the setting value of P5.089 (Sign indicates the direction)	In <b>stop</b> status
6	Same as 2, but the speed remains when disengaging and the engaged length will slightly exceed P5.089. This is suitable for the application of calling the next PR position command right after disengaged.	
4	Master axis exceeds the setting value of P5.089 (Sign indicates the direction)	Return to <b>pre-engaged</b> status Lead pulse is P5.092
8	When U = 1, 2 or 6: Disable E-Cam after disengaged	Set X to 0
	When U = 4: Avoid jittering when it returns to pre-engaged status	N/A

- BA: Auto execute the specified PR path
 

When disengaging condition (P5.088.U = 2, 4, 6) is met, a PR 00 ~ 3F (hexadecimal; 00 means no action) will be executed automatically.
- C: Reserved
- D: Display engage status (Read-only)
  - 0: Stop status
  - 1: Engage status
  - 2: Pre-engage status

Note: A3-L does not support E-Cam function.

P5.089	E-Cam: Data of disengaging time		Address: 05B2H 05B3H
Default:	0	Control mode:	PR
Unit:	Unit applied by master axis	Setting range:	-1073741824 ~ +1073741823
Format:	DEC	Data size:	32-bit

Settings:

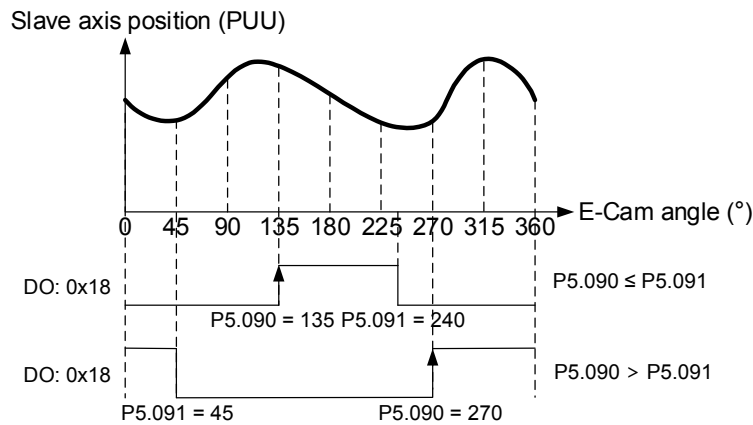
When pulse number of the master axis reaches the value set by P5.089, the clutch will disengage based on the disengage timing setting (P5.088.U).

Note: A3-L does not support E-Cam function.

<b>P5.090</b>	<b>E-Cam: DO.CAM_Area rising-edge phase setting</b>		<b>Address: 05B4H 05B5H</b>	
Default:	270	Control mode:	PR	
Unit:	Degree	Setting range:	0 ~ 360	
Format:	DEC	Data size:	16-bit	

Settings:

See the correlation between DO.CAM\_Area and parameters in the figure below. When E-Cam is disengaged, DO.CAM\_Area is always off.



Note: A3-L does not support E-Cam function.

<b>P5.091</b>	<b>E-Cam: DO.CAM_Area falling-edge phase setting</b>		<b>Address: 05B6H 05B7H</b>	
Default:	360	Control mode:	PR	
Unit:	Degree	Setting range:	0 ~ 360	
Format:	DEC	Data size:	16-bit	

Settings:

Please refer to P5.090 for the correlation between DO.CAM\_Area and parameters.

Note: A3-L does not support E-Cam function.

<b>P5.092</b>	<b>E-Cam: Pre-engaged length of each cycle</b>		<b>Address: 05B8H 05B9H</b>	
Default:	0	Control mode:	PR	
Unit:	Unit applied by master axis	Setting range:	-2147483648 ~ +2147483647	
Format:	DEC	Data size:	32-bit	

Settings:

This parameter goes with the selection of P5.088.U = 4 (E-Cam disengages if exceeded moving distance): After disengaging, it does not enter the stop status, but instead the pre-engaged status.

The lead pulse is determined by this parameter. The pulse number from the master axis has to exceed the setting value of this parameter for the E-Cam to engage once more.

Note: A3-L does not support E-Cam function.



<b>P5.093</b>	<b>Motion control macro command: Command parameter #4</b>		<b>Address: 05BAH 05BBH</b>
Default:	0	Control mode:	All
Unit:	-	Setting range:	0x00000000 ~ 0xFFFFFFFF
Format:	HEX	Data size:	32-bit

Settings:

Before issuing the macro command, the relevant parameters #4 must be set in advance. The function of the parameter is determined by the macro command. Not every macro command has to set this parameter.

Note: A3-L does not support E-Cam function and macros with E-Cam settings.

<b>P5.094</b>	<b>Motion control macro command: Command parameter #3</b>		<b>Address: 05BCH 05BDH</b>
Default:	0	Control mode:	All
Unit:	-	Setting range:	-2147483648 ~ +2147483647
Format:	DEC	Data size:	32-bit

Settings:

Before issuing the macro command, the relevant parameters #3 must be set in advance. The function of the parameter is determined by the macro command. Not every macro command has to set this parameter.

Note: A3-L does not support E-Cam function and macros with E-Cam settings.

<b>P5.095</b>	<b>Motion control macro command: Command parameter #2</b>		<b>Address: 05BEH 05BFH</b>
Default:	0	Control mode:	All
Unit:	-	Setting range:	-2147483648 ~ +2147483647
Format:	DEC	Data size:	32-bit

Settings:

Before issuing the macro command, the relevant parameters #2 must be set in advance. The function of the parameter is determined by the macro command. Not every macro command has to set this parameter.

Note: A3-L does not support E-Cam function and macros with E-Cam settings.

<b>P5.096</b>	<b>Motion control macro command: Command parameter #1</b>		<b>Address: 05C0H 05C1H</b>
Default:	0	Control mode:	All
Unit:	-	Setting range:	-2147483648 ~ +2147483647
Format:	DEC	Data size:	32-bit

Settings:

Before issuing the macro command, the relevant parameters # 1 must be set in advance. The function of the parameter is determined by the macro command. Not every macro command has to set this parameter.

Note: A3-L does not support E-Cam function and macros with E-Cam settings.

P5.097	Motion control macro command:		Address: 05C2H 05C3H
	Issue command / Executing result		
Default:	0	Control mode:	All
Unit:	-	Setting range:	0~0x099F
Format:	HEX	Data size:	16-bit

Settings:

Write-in: Used to issue macro command (0CBAh).

Read: Used to examine the execution result of macro command (If successful, the result will be returned to 1CBAh).

If the command issues 0001, 1001h will be returned if successful; and Fxxxh if failed (depending on the command description). If issuing a command that is not supported, the failure code F001h will be returned.

Provided command code is as follows:

Command code 0003h	Motion parameter protection: password setting, protection activation.
Macro parameters	P5.093 = Parameter write-protected level (0 ~ 1) (0: No protection, 1: Enable protection) P5.094 = Protection level of data array (-1 ~ 7) 0: Password protection of all data array 1: Password protection of data array #100 ~ #799 2: Password protection of data array #200 ~ #799 3: Password protection of data array #300 ~ #799 4: Password protection of data array #400 ~ #799 5: Password protection of data array #500 ~ #799 6: Password protection of data array #600 ~ #799 7: No password protection of data array P5.095 = Set new password (1 ~ 16777215) P5.096 = Confirm new password (1 ~ 16777215)  Note: P5.095 must equal to P5.096 to be successfully set and the password must be set within the allowable range.

This function can only be executed prior to activating the parameter protection function. When the protection function has been activated, the failure code will be sent back if this function is executed repeatedly.

Failure code F031h	Protection function has been activated and cannot be set repeatedly
Failure code F032h	Wrong password setting: P5.095 does not equal to P5.096
Failure code F033h	Password setting exceeds the allowable range (1 ~ 16777215)
Failure code F034h	Protection level P5.094 exceeds the allowable range (-1 ~ 7)
Failure code F035h	Protection level P5.093 exceeds the allowable range (0 ~ 1)
Success code 1003h	-

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Command code 0004h	Motion parameter protection: unlock protection
Macro parameters	P5.096 = Enter password (1 ~ 16777215)

This function can only be executed when the parameter protection function has been activated. When the protection function has been unlocked, the failure code will be sent back if this function is executed repeatedly. If the wrong password is entered, failure code Ennn will be sent back. nnn indicates the remaining attempts to enter the password. The number will minus one after each failed attempt. When the number displays 0, it indicates the maximum failed password attempts has been exceeded and is locked for good.

Failure code F041h	Protection function is unlocked and cannot be unlocked repeatedly
Failure code F043h	Password setting exceeds the allowable range (1 ~ 16777215)
Failure code F044h	Exceeded maximum failed password attempts: Lock for good. Can only be unlocked by resetting the parameter (P2.008 = 10), but all parameters will reset to the default value.
Failure code Ennnh	Incorrect password setting: Failed to unlock nnn: Remaining attempts to enter the password. The number will minus one after each failed attempt. When the number displays 0, it is locked and will not allow further attempts.
Success code 1004h	-

Command code 0006h	Build up E-Cam table: Flying shear, including synchronous area (7 areas)
General parameters	P5.081 = Address of table (Data array) P5.082 = 7 (This macro is fixed to 7 areas, 8 points) P1.044 and P1.045 = E-Gear ratio (must be set up in advance)
Macro parameters	P5.094 = A (Deceleration ratio: Numerator) x C (Count of cutting) P5.095 = B (Deceleration ratio: Denominator) P5.096 = 1000000 x R x V Note: R (Cutting ratio) = L (Target cutting length) / ℓ (Perimeter of cutter) Allowable cutting ratio: (0.3 ~ 2.5) times V (Speed factor) = Target cutting speed / Speed of delivered product V = 1.0: When cutting, the speed of cutter is same as the delivered product V = 1.1: When cutting, the speed of cutter is 10% faster than the delivered product V = 0.9: When cutting, the speed of cutter is 10% slower than the delivered product

This macro will calculate the data of E-Cam table according to the above parameters, and store them in the data array specified by P5.081. Parameters listed above are relevant to the E-Cam table calculation. In order to execute this macro, please correctly set up the parameters prior to the execution.

After this macro is executed, if the above parameters have been modified, the E-Cam table has to be recreated and this macro will have to be executed again. Data in E-Cam table will be changed after executing this macro; thus, do not execute when E-Cam is in engaged status.

In E-Cam application, parameters (such as P5.083 and P5.084) irrelevant to this macro are not listed here. Users should setup parameters according to the actual application. Please refer to sections about E-Cam in Chapter 7. After executing this macro, E-Cam table will not be saved to EEPROM automatically.

Failure code F061h	When creating the table, E-Cam is in engaged status. To issue this command, E-Cam needs to disengage first.
Failure code F062h	Setting value of P5.094 exceeds the range: (1 ~ 65535)
Failure code F063h	Setting value of P5.095 exceeds the range: (1 ~ 65535)
Failure code F064h	Setting value of P5.096 exceeds the range: (300000 ~ 2500000)
Failure code F065h	Address specified by P5.081 is too long and the space of data array is insufficient.
Failure code F066h	Setting value of P5.082 must be set to 7. Otherwise the command cannot be executed.
Failure code F067h	Data calculation error. Please decrease the setting value of P1.044 and P1.045, but maintain the same proportion will do.

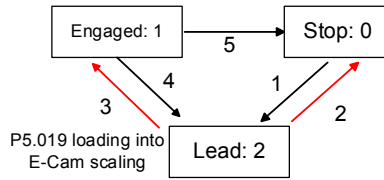
Command code 0007h	Build up E-Cam table: Rotary shear (multi-degree of freedom)
General parameters	P5.081 = Address of table (Data array) P5.082 = N (30 ~ 72) (Area number of E-Cam) P1.044 and P1.045 = E-Gear ratio (must be set up in advance).
Macro parameters	P5.093.H16 (high 16-bit) = S P5.093.L16 (low 16-bit) = W Note: S (curve level) = 1 ~ 4 levels; W (degree of waiting area) = -1 ~ 170 degrees (W = -1 is available in firmware version V1.038 (sub29) or later versions) P5.094 = Y (degree of synchronous area) = 0 ~ 330 degrees P5.095.H16 (high 16-bit) = A x C P5.095.L16 (low 16-bit) = B Note: A (Deceleration ratio: Numerator), C (Count of cutting) B (Deceleration ratio: Denominator) P5.096 = 1000000 x R x V Note: R (Cutting ratio) = L (Target cutting length) / ℓ (Length of cutter) Allowable cutting ratio: (0.05 ~ 5.0) times V (Speed factor) = Target cutting speed / Speed of delivered product V = 1.0: When cutting, the speed of cutter is same as the delivered product V = 1.1: When cutting, the speed of cutter is 10% faster than the delivered product V = 0.9: When cutting, the speed of cutter is 10% slower than the delivered product Note: $W' = 180 + 360/N - 360/R + Y/2$ P5.093.L16 < W', E-Cam table is in error (Failure code F07Ah) P5.093.L16 = W', initial speed is 0 in E-Cam table P5.093.L16 > W', initial speed > 0 in E-Cam table

This macro will calculate the data of E-Cam table according to the above parameters, and store them in the data array specified by P5.081. Parameters listed above are relevant to the E-Cam table calculation. In order to execute this macro, please correctly set up the parameters prior to the execution. After this macro is executed, if the above parameters have been modified, the E-Cam table has to be recreated and this macro will have to be executed again. Data in E-Cam table will be changed after executing this macro; thus, do not execute when E-Cam is in engaged status. In E-Cam application, parameters (such as P5.083 and P5.084) irrelevant to this macro are not listed here. Users should setup parameters according to the actual application. Please refer to sections about E-Cam. After executing this macro, E-Cam table will not be saved to EEPROM automatically.

Failure code F071h	When creating the table, E-Cam is in engaged status. To issue this command, E-Cam needs to disengage first.
Failure code F072h	Degree of synchronous area of P5.094 exceeds the range: (0 ~ 330)
Failure code F073h	Curve level of P5.093.H16 exceeds the range: (1 ~ 4)
Failure code F074h	Degree of waiting area of P5.093.L16 exceeds the range: (0 ~ 170)
Failure code F075h	Setting value of P5.096 exceeds the range: (50000 ~ 5000000)
Failure code F076h	Area number of E-Cam of P5.082 exceeds the range: (30 ~ 72)
Failure code F077h	Address specified by P5.081 is too long and the space of data array is insufficient.
Failure code F078h	Data calculation error. Please decrease the setting value of P1.044 and P1.045, but maintain the same proportion will do.
Failure code F079h	Acceleration degree is too small; thus, please decrease the value of waiting area (W), synchronous area (Y), or curve level (S).
Failure code F07Ah	Waiting area is too small; thus, please increase the value of waiting area (W) or decrease the value of synchronous area (Y).

Command code 0008h	E-Cam curve scaling (P5.019) is effective immediately.
Macro parameters	N/A

This macro can be triggered when E-Cam is engaged, and P5.019 will become effective immediately. Normally, E-Cam scaling is only loaded into the system by P5.019 at the point when E-Cam engages (see below transition 3). It cannot be changed in engaged condition. E-Cam scaling can only be changed after one E-Cam cycle so as to ensure the E-Cam can return to the original position without accumulative error.



If necessary in the application, there are two ways to change the setting of E-Cam curve scaling immediately:

- P5.088.X2 = 1:** When E-Cam is engaged, set up this bit at the same time, then each change of P5.019 will be enabled immediately.
- Use macro #8:** Each time when this macro command is triggered, function of P5.019 will be enabled immediately. However, if the value of P5.019 is changed and this macro is not triggered, then function of P5.019 will not be enabled immediately. This macro command has to be triggered again to enable function of P5.019.

Failure code	N/A
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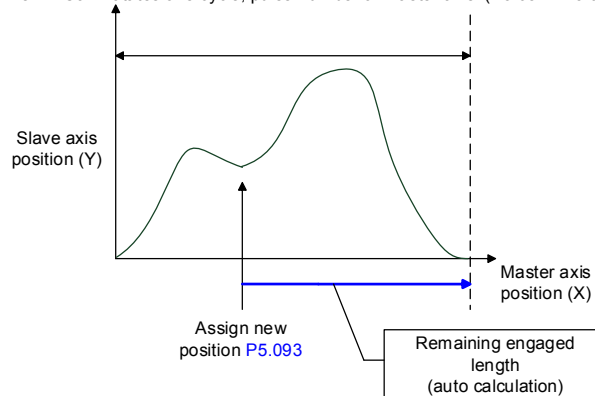
Command code 000Ch	Change position X where E-Cam is engaged: E-Cam disengages after rotating one cycle in forward direction.
General parameters	N/A
Macro parameters	P5.093 = New engaged position X, Unit: Pulse number of master axis. Monitoring variable 062(3Eh): Displays the current engaged position (X) of master axis.

This macro command can change the engaged position immediately even when E-Cam is engaged. It will automatically calculate the remaining engaged length so that E-Cam will disengage after rotating one cycle (360°) in forward direction. However, P5.088.U will have to be set to 2, 4, 6, otherwise, E-Cam will not disengage.

E-Cam will disengage when alarm occurs or power supply is cut off. If users desire E-Cam to re-engage at the last disengaged position and continue its remaining cycle, it is recommended to record the last disengaged position (X) and resume the operation by this macro command. Please note that when E-Cam is disengaged, the servo position might shift slightly and therefore, causing position error when E-Cam re-engages.

Engaged direction is in forward direction (Master axis operates in forward direction):

When E-Cam rotates one cycle, pulse number of master axis: (P5.084 / P5.083)



Note: When using this macro command, it is recommended to execute the macro command prior to operating the master axis.

Failure code F0C1h	When executing this macro command, E-Cam is not in engaged status. Engaged position can only be modified when E-Cam is engaged.
Failure code F0C2h	Setting value of P5.093 is in error. The value cannot be less than 0; it should be $\geq 0$ .
Failure code F0C3h	Setting value of P5.093 is in error. The value has to be less than the value of (P5.084 / P5.083).

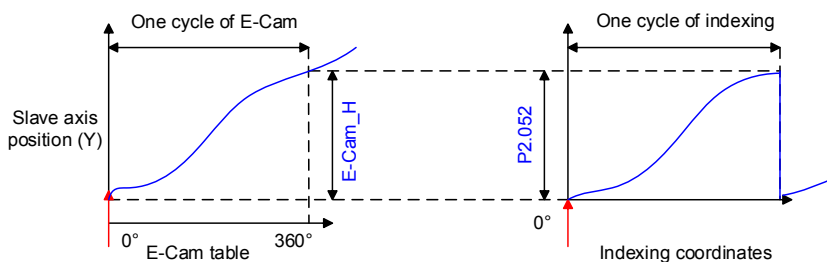
Command code 000Dh	Calculate the error between E-Cam and indexing coordinates for PR positioning.
General parameters	N/A
Macro parameters	<p>P5.093.Low_Word = DCBA : UZYX (8 digits, HEX)                  YX (PR number) = 0 ~ 0X3F (Invalid when value is set to 0)                  Value of UZ has to be set to 0                  BA (Function of P5.095): 0 (Use avoid point); 1 (Use allowable forward rate)                  DC (Inhibit reverse rotation): 0 (Invalid), 1 (Inhibit reverse rotation)</p> <p>P5.095: Avoid point (Cannot pass this point) = 0 ~ 100 (%) of E-Cam cycle or allowable forward rate 0 ~ 100 (%)</p>

Monitoring variable 091(5Bh): Displays the current indexing coordinate position (PUU).

When E-Cam is engaged and the motor is stopped due to servo off or alarm occurs, it would cause position error between the actual position and E-Cam position. After re-servo On, this macro command can be used to calculate the correction value and write the value into the specified PR for incremental positioning, so that the motor can return to the ideal E-Cam position.

When using this macro command:

1. Set P5.088.X1 to 1 to keep E-Cam engaged when servo off and continue to calculate E-Cam position.
2. Height of indexing coordinate and E-Cam coordinate should be the same: P2.052 = ECAM\_H (Moving distance when E-Cam operates one cycle).
3. E-Cam table scaling P5.019 must be 1.0 time.
4. When E-Cam is engaged for the first time, 0 degree of E-cam table should aim at 0 degree of indexing coordinate. This alignment can be achieved by executing homing.
5. This macro command can only be applied to periodic cycle and when each cycle starts from the same position.

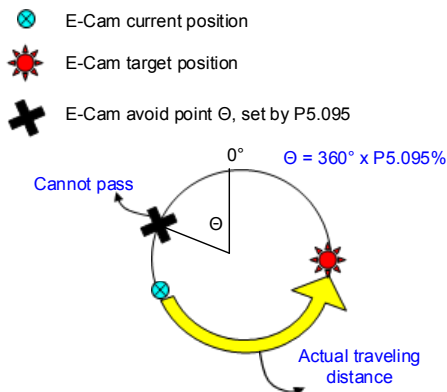


Note:

1. ECAM\_H (Height of E-Cam table) = E-Cam table (Last point minus first point)
2. Indexing coordinate = Remainder of (Absolute coordinate / P2.052)
3. Use PR command via incremental positioning control

Due to the cyclic operation of E-Cam, the motor will travel to the specified position either in forward or reverse direction. However, the moving distance is usually different between both. Thus, the position of avoid point can be used to determine whether to operate in forward or reverse direction.

**\*Avoid point:** The point that cannot be passed when executing macro PR positioning. Please see below for details.





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(Continued)

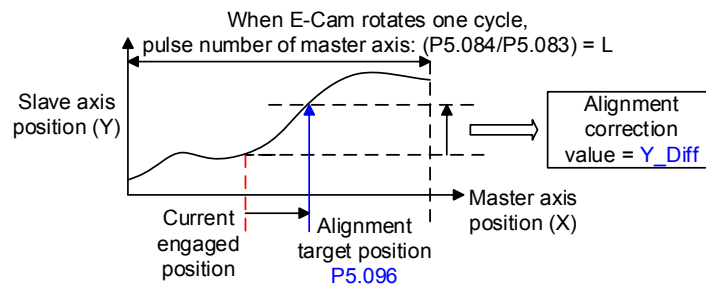
Failure code F0D1h	When executing this macro command, E-Cam is not in engaged status. E-Cam should be engaged.
Failure code F0D2h	P5.093.YX (PR number) exceeds the range: 1 ~ 0x3F
Failure code F0D3h	P5.095 (allowable forward rate) exceeds the range: 0 ~ 100 (%)
Failure code F0D5h	Position correction value does not exist. This macro command might be triggered twice.
Failure code F0D6h	At the point when servo switches to on state again, E-Cam is not engaged.
Failure code F0D7h	Height (Y axis) of E-Cam table does not equal to the value of P2.052.
Failure code F0D8h	E-Cam table scaling does not equal to 1.
Failure code F0D9h	Setting values of P5.093.BA and P5.095 exceed the range: 0 ~ 1.
Failure code F0DAh	P5.093.DC (reverse inhibit) exceeds the range: 0 ~ 1.
Failure code F0DBh	Function of reverse inhibit has failed. Do not use macro command #D, #10h consecutively.

Command code 000Eh	Perform E-Cam alignment immediately and write the correction value into the specified PR.
Macro parameters	<p>P5.093 = DCBA : UZYX (8 digits, HEX)                  YX (PR number) = 0 ~ 0x3F (Invalid when value is set to 0).                  UZ (Max. allowable correction rate) = 0 ~ 0x64 (%)                  A (Trigger specified PR directly) = 1: On, 0: Off                  DCB = Must be set to 0.                  P5.094 (DI delay time compensation) = -25000 ~ +25000 (Unit: usec).                  P5.095 (allowable forward rate) = 0 ~ 100 (%)                  P5.096 (target position of alignment X) (Unit: pulse number of master axis) = 0 ~ (P5.084/P5.083) - 1.</p>

Monitoring variable 062(3Eh): Displays the current engaged position (X) of master axis.

This macro command can move the engaged position to the **alignment target position X** when E-Cam is engaged, and write the **alignment correction value** into the specified PR. This macro command is used: During E-Cam operation (E-Cam is engaged), if desire to quickly align the E-Cam position with the mechanical referral point, sensor can be used to trigger DI.EVx to execute this macro command.

After E-Cam alignment is completed, the engaged position will move to the new position. The excessive or insufficient moving distance after E-Cam operates one cycle is called **alignment correction value** which will be written into the PR specified by P5.093.YX. PR incremental command can be used to execute this alignment correction so that the slave axis position of E-Cam will remain and offset the phase of E-Cam to align with the referral position of machine. For some applications when PR is not needed, set value of P5.093.YX to 0. Please note that PR can only be executed when triggered by the host controller. This macro command is only for setting the value.



\*P5.093.UZ is able to limit the max. correction rate. The alignment target position ★ will be different from P5.096.

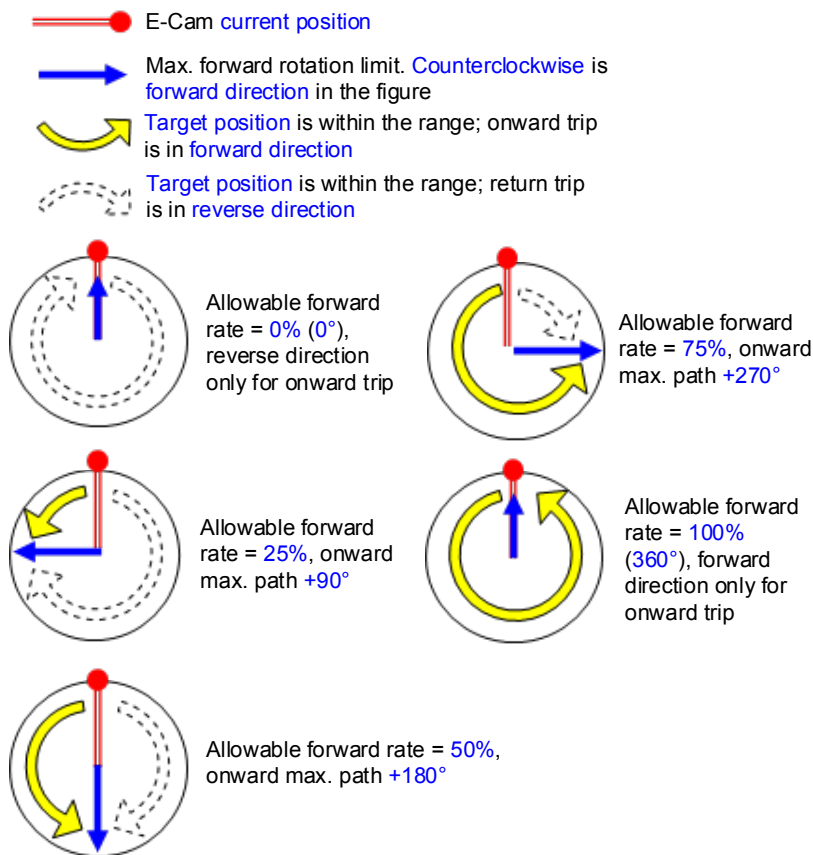
$$| \text{Alignment target position } \star - \text{Current engaged position} | / L \leq P5.093.UZ \%$$

\*DI time delay compensation can be set via P5.094 to correct the error caused by different speed of motion.

Due to cyclic operation, when E-Cam moves from current position to the target position, it can either rotate in forward or reverse position. However, the moving distance is usually different between both. Thus, the allowable forward rate can be used to determine whether to operate in forward or reverse rotation.

(Continued)

\***Allowable forward rate:** The allowable max. proportion of **forward path**. Please see below for details.



Failure code F0E1h	When executing this macro command, E-Cam is not in engaged status. E-Cam has to be engaged to execute alignment correction.
Failure code F0E2h	P5.093.YX (PR number) exceeds the range: 0 ~ 0x3F
Failure code F0E3h	P5.093.UZ (Max. alignment correction rate) exceeds the range: 0 ~ 0x64 (%)
Failure code F0E4h	P5.094 (DI delay time compensation) exceeds the range: -10000 ~ +10000
Failure code F0E5h	P5.095 (allowable forward rate) exceeds the range: 0 ~ 100 (%)
Failure code F0E6h	P5.096 (alignment target position) exceeds the range: 0 ~ (P5.084/P5.083) - 1

Command code 000Fh	Calculate the moving distance between current and target position of E-Cam for PR positioning.
General parameters	N/A
Macro parameters	P5.093.Low_Word = UZYX (4 digits, HEX) YX (PR number of onward trip) = 0 ~ 0X3F (Invalid when value is set to 0). UX (PR number of return trip) = 0 ~ 0X3F (Invalid when value is set to 0). P5.093.Hi_Word = Must be set to 0. P5.095 (allowable forward rate) = 0 ~ 100 (%) P5.096 (target position X) (Unit: pulse number of master axis) = 0 ~ (P5.084 / P5.083) - 1.

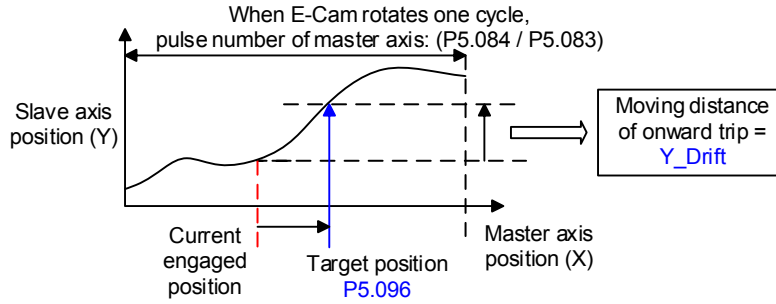
Monitoring variable 062(3Eh): Displays the current engaged position (X) of master axis.

When E-Cam is engaged, this macro command calculates the moving distance between **current** and **target engaged position (X)** and writes into the specified PR.

This macro command is used: During E-Cam operation, if users desire to move the slave axis to the specified position when master axis stops but still in engaged status. This macro command can calculate the correct **moving distance (Y\_Drift) of onward trip** for PR incremental command.

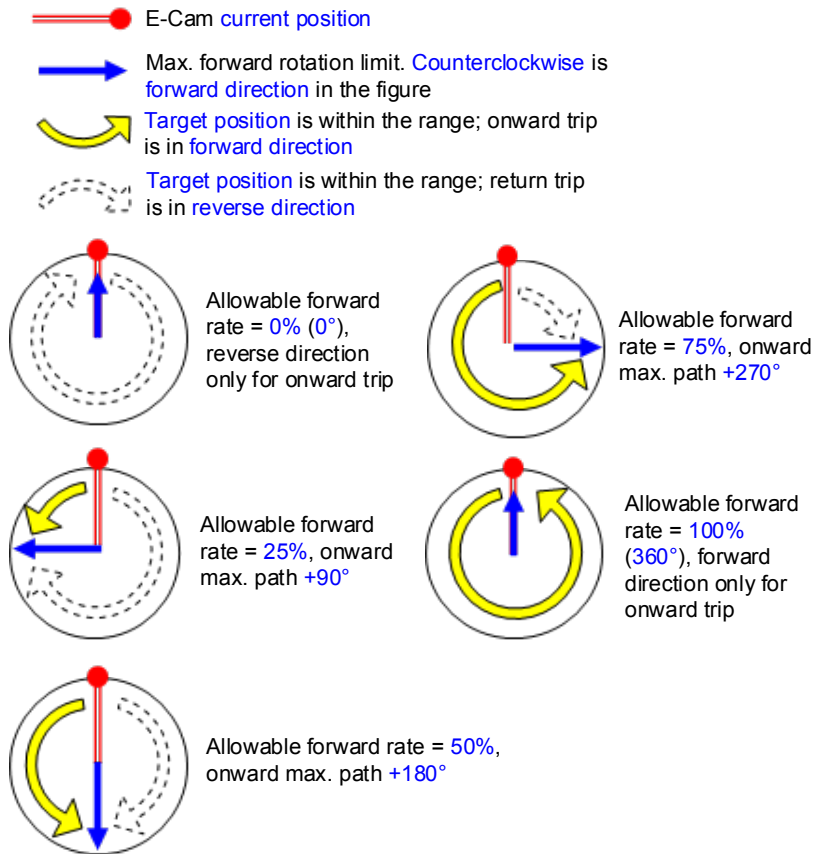
(Continued)

When master axis resumes operation, use another PR for the **moving distance of return trip** (-Y\_Drift) to return to the original position (**moving distance of onward trip + moving distance of return trip = 0**). E-Cam position remains the same.



Note: Regardless of onward trip or return trip, use PR command via incremental positioning control. Due to cyclic operation, when E-Cam moves from current position to the target position, it can either rotate in forward or reverse position. However, the moving distance is usually different between both. Thus, the allowable forward rate can be used to determine whether to operate in forward or reverse rotation.

\***Allowable forward rate:** The allowable max. proportion of **forward path**. Please see below for details.



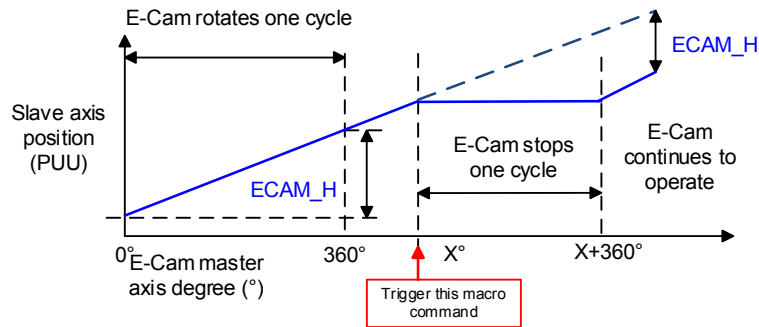
Failure code F0F1h	When executing this macro command, E-Cam is not in engaged status. Engaged position can only be modified when E-Cam is engaged.
Failure code F0F2h	P5.093.YX (PR number of onward trip) exceeds the range: 0 ~ 0x3F
Failure code F0F3h	P5.093.UZ (PR number of return trip) exceeds the range: 0 ~ 0x3F
Failure code F0F5h	P5.095 (allowable forward rate) exceeds the range: 0 ~ 100 (%)
Failure code F0F6h	P5.096 (target position) exceeds the range: 0 ~ (P5.084/P5.083) - 1

Command code 0010h	E-Cam pauses for one cycle and resumes operation at next cycle.
General parameters	N/A
Macro parameters	P5.093 must be set to 0.

After E-Cam is engaged, this macro command can pause the slave axis for one cycle of distance regardless of the current E-Cam degree. The following conditions have to be met when using this macro command:

1. E-Cam must be in engaged status.
2. E-Cam must be the forward operation curve (including straight line) so it can pause.

As shown in the figure below, by triggering this macro command, E-Cam will pause for one cycle regardless of the degree (X) where E-Cam currently is.



Note:

1.  $ECAM\_H$  (E-Cam pause distance) = E-Cam table (Last point minus first point) x P5.019 (Effective scaling).
2. This function is accumulative. If the command is triggered for N times consecutively, it will pause the E-Cam for N cycles. Please note that the **accumulated pause distance** cannot exceed ( $>2^{31}$ ), otherwise the macro command will be disabled.
3. When E-Cam resumes operation, the **accumulated pause distance** will be cleared to 0.

Failure code F101h	When executing this macro command, E-Cam is not in engaged status. E-Cam should be engaged.
Failure code F102h	Setting value of P5.093 is incorrect: Must be set to 0.
Failure code F103h	E-Cam must operate in forward direction. Please check the E-Cam table and make sure P5.019 > 0.
Failure code F104h	Accumulated pause distance exceeds $2^{31}$ . Do not execute this macro command consecutively.

Note: A3L does not support E-Cam function.

P5.098	PR# triggered by event rising-edge		Address: 05C4H 05C5H
Default:	0x0	Control mode:	PR
Unit:	-	Setting range:	0x0000 ~ 0xDDDD
Format:	HEX	Data size:	16-bit

Settings:



X	PR triggered by EV1 rising-edge	Z	PR triggered by EV3 rising-edge
Y	PR triggered by EV2 rising-edge	U	PR triggered by EV4 rising-edge

- X: PR triggered when EV1 is on
- 0: No action
- 1 ~ D: Execute PR# 51 ~ 63

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- Y: PR triggered when EV2 is on
  - 0: No action
  - 1 ~ D: Execute PR# 51 ~ 63
- Z: PR triggered when EV3 is on
  - 0: No action
  - 1 ~ D: Execute PR# 51 ~ 63
- U: PR triggered when EV4 is on
  - 0: No action
  - 1 ~ D: Execute PR# 51 ~ 63

<b>P5.099</b>	<b>PR# triggered by event falling-edge</b>		<b>Address: 05C6H 05C7H</b>
Default:	0x0	Control mode:	PR
Unit:	-	Setting range:	0x0000 ~ 0xDDDD
Format:	HEX	Data size:	16-bit

Settings:



X	PR triggered by EV1 falling-edge	Z	PR triggered by EV3 falling-edge
Y	PR triggered by EV2 falling-edge	U	PR triggered by EV4 falling-edge

- X: PR triggered when EV1 is off
  - 0: No action
  - 1 ~ D: Execute PR# 51 ~ 63
- Y: PR triggered when EV2 is off
  - 0: No action
  - 1 ~ D: Execute PR# 51 ~ 63
- Z: PR triggered when EV3 is off
  - 0: No action
  - 1 ~ D: Execute PR# 51 ~ 63
- U: PR triggered when EV4 is off
  - 0: No action
  - 1 ~ D: Execute PR# 51 ~ 63

<b>P5.100■</b>	<b>Data array - Window #3 for reading / writing</b>		<b>Address: 05C8H 05C9H</b>
Default:	0	Control mode:	All
Unit:	-	Setting range:	-2147483648 ~ +2147483647
Format:	DEC	Data size:	32-bit

Settings:

Window #3: When reading / writing the parameter by any method, the value set by P5.011 will not add 1.  
Please refer to Chapter 7 Data array for detailed instructions.

<b>P5.101■</b>	<b>Data array - Window #4 for reading / writing</b>		<b>Address: 05CAH 05CBH</b>
Default:	0	Control mode:	All
Unit:	-	Setting range:	-2147483648 ~ +2147483647
Format:	DEC	Data size:	32-bit

Settings:

Window #4: When reading / writing the parameter by any method, the value set by P5.011 will not add 1.  
Please refer to Chapter 7 Data array for detailed instructions.

<b>P5.102■</b>	<b>Data array - Window #5 for reading / writing</b>		<b>Address: 05CCH 05CDH</b>
Default:	0	Control mode:	All
Unit:	-	Setting range:	-2147483648 ~ +2147483647
Format:	DEC	Data size:	32-bit

Settings:

Window #5: When reading / writing the parameter by any method, the value set by P5.011 will not add 1.  
Please refer to Chapter 7 Data array for detailed instructions.

<b>P5.103■</b>	<b>Data array - Window #6 for reading / writing</b>		<b>Address: 05CEH 05CFH</b>
Default:	0	Control mode:	All
Unit:	-	Setting range:	-2147483648 ~ +2147483647
Format:	DEC	Data size:	32-bit

Settings:

Window #6: When reading / writing the parameter by any method, the value set by P5.011 will not add 1.  
Please refer to Chapter 7 Data array for detailed instructions.

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**P6.xxx PR parameters**

P6.000	Homing definition		Address: 0600H 0601H
Default:	0x00000000	Control mode:	PR
Unit:	-	Setting range:	0x00000000 ~ 0xFFFFFFFF3F
Format:	HEX	Data size:	32-bit

Settings:

Homing definition:



A	DEC2: Deceleration time selection of second homing	YX	PATH: Path type
B	DLY: Select 0 ~ F for delay time	Z	ACC: Select 0 ~ F for acceleration time
C	N/A	U	DEC1: Deceleration time selection of first homing
D	BOOT	-	-

- YX: PATH: Path type  
 0x0: Stop: Homing complete and stop.  
 0x1 ~ 0x63: Auto: Homing complete and execute the specified path (Path#1 ~ Path#99).
- Z: ACC: Select 0 ~ F for acceleration time  
 0 ~ F: Corresponds to P5.020 ~ P5.035
- U: DEC1: Deceleration time selection of first homing  
 0 ~ F: Corresponds to P5.020 ~ P5.035
- A: DEC2: Deceleration time selection of second homing  
 0 ~ F: Corresponds to P5.020 ~ P5.035
- B: DLY: Select 0 ~ F for delay time  
 0 ~ F: Corresponds to P5.040 ~ P5.055
- D: BOOT: When the drive is powered on, whether to search for origin.  
 0: Do not execute homing  
 1: Execute homing automatically (Servo switches to on status for the first time after applying to power)

Apart from the above mentioned definitions, related settings of homing also include:

1. P5.004 Homing methods.
2. P5.005 ~ P5.006 Speed setting of searching for origin.
3. P6.001: ORG\_DEF is the coordinate of the origin and may not be 0. This function is used as a traversal of the coordinate.

Note:

1. After the origin is found (Sensor or Z); it has to decelerate to stop. The stop position will exceed the origin for a short distance:

If returning to the origin is not needed, set PATH to 0;

If returning to the origin is needed, set PATH to a non-zero value and set PABS = ORG\_DEF.

Example:

Upon completion of P6.000 = 0x1, automatically execute Path#1

Set from absolute position (ABS) to 0 as the route of Path#1 (set P6.002 & P6.003).

2. If the origin is found (sensor or Z), and it is desired to move an offset S and define the coordinate as P after moving, then PATH = non-zero and set ORG\_DEF = P - S, and this absolute position command = P.

P6.001	Origin definition		Address: 0602H 0603H	
Default:	0	Control mode:	PR	
Unit:	-	Setting range:	-2147483648 ~ +2147483647	
Format:	DEC	Data size:	32-bit	

Settings:

Origin definition.

P6.002	PATH#1 definition		Address: 0604H 0605H	
Default:	0x00000000	Control mode:	PR	
Unit:	-	Setting range:	0x00000000 ~ 0xFFFFFFFF	
Format:	HEX	Data size:	32-bit	

Settings:

Format of this parameter: (High word h) DCBA : (Low word L) UZYX



A	SPD, Target speed index* <sup>1</sup>	X	TYPE, Path type
B	DLY, Delay time index	Y	OPT, Option
C	AUTO* <sup>1</sup>	Z	ACC, Acceleration time index* <sup>1</sup>
D	Reserved	U	DEC, Deceleration time index* <sup>1</sup>



Definition is as follows:

■ YX

Y: OPT, Option				X: TYPE, Path type
BIT 3	BIT 2	BIT 1	BIT 0	
-	UNIT	AUTO	INS	1: SPEED, Constant speed control.
CMD		OVLP	INS	2: SINGLE, Positioning control. It will stop once finished.
				3: AUTO, Positioning control. It will load in next path automatically once finished.
-	-	-	INS	7: JUMP, Jump to the specified path.
-	ROM	AUTO	INS	8: Write specified parameter to specified path.
DIR		OVLP	INS	A: Indexing position control.
-	-	-	-	Statement / arithmetic operation

TYPE, Path type: When executing 1 ~ 3, it can be interrupted and stopped by DO.STP (stop) and software limit

INS: When executing this path, it interrupts previous path

OVLP: Allows overlapping of the next path. Overlapping is not allowed in speed mode.

When overlapping in position mode, DLY has no function

AUTO: Once current PR path is finished, next path will be loaded in automatically

CMD: Please refer to Chapter 7 PR command description.

■ UZ

U: DEC, Deceleration time	Z: ACC, Acceleration time	Corresponding parameters	Default value (ms)
0	0	P5.020	200
1	1	P5.021	300
2	2	P5.022	500
3	3	P5.023	600
4	4	P5.024	800
5	5	P5.025	900
6	6	P5.026	1000
7	7	P5.027	1200
8	8	P5.028	1500
9	9	P5.029	2000
10	10	P5.030	2500
11	11	P5.031	3000
12	12	P5.032	5000
13	13	P5.033	8000
14	14	P5.034	50
15	15	P5.035	30

■ A: SPD, Target speed index

A	Corresponding parameters	Default value (ms)
0	P5.060	20
1	P5.061	50
2	P5.062	100
3	P5.063	200
4	P5.064	300
5	P5.065	500
6	P5.066	600
7	P5.067	800
8	P5.068	1000
9	P5.069	1300
10	P5.070	1500
11	P5.071	1800
12	P5.072	2000
13	P5.073	2300
14	P5.074	2500
15	P5.075	3000

■ B: DLY, Delay time index

B	Corresponding parameters	Default value (ms)
0	P5.040	0
1	P5.041	100
2	P5.042	200
3	P5.043	400
4	P5.044	500
5	P5.045	800
6	P5.046	1000
7	P5.047	1500
8	P5.048	2000
9	P5.049	2500
10	P5.050	3000
11	P5.051	3500
12	P5.052	4000
13	P5.053	4500
14	P5.054	5000
15	P5.055	5500

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- C: AUTO: Once current PR path is finished, next path will be loaded in automatically

This function is only enabled when X = A indexing position control.

Description of each bit:

Bit 2	AUTO	0: Disable auto function 1: Once current PR path is finished, next path will be loaded in automatically
Bit 0 ~ 1	Reserved	-

Note: The parameter format definition [C, A, U, Z] will be different from the above table when the path type is [7] write the specified parameter to the specified path and [8] statement / arithmetic operation. Please refer to Chapter 7 for detailed instructions.

<b>P6.003</b>	<b>PATH#1 data</b>	<b>Address: 0606H 0607H</b>	
Default:	0	Control mode:	PR
Unit:	-	Setting range:	-2147483648 ~ +2147483647
Format:	DEC	Data size:	32-bit

Settings:

P6.002 defines the property of the target point; P6.003 defines the target position of P6.002 or the target path to be jumped to.

<b>P6.004</b>	<b>PATH#2 definition</b>	<b>Address: 0608H 0609H</b>	
Default:	0x00000000	Control mode:	PR
Unit:	-	Setting range:	0x00000000 ~ 0xFFFFFFFF
Format:	HEX	Data size:	32-bit

Settings:

Please refer to the description of P6.002.

<b>P6.005</b>	<b>PATH#2 data</b>	<b>Address: 060AH 060BH</b>	
Default:	0	Control mode:	PR
Unit:	-	Setting range:	-2147483648 ~ +2147483647
Format:	DEC	Data size:	32-bit

Settings:

Please refer to the description of P6.003.

<b>P6.006</b>	<b>PATH#3 definition</b>		<b>Address: 060CH 060DH</b>	
Default:	0x00000000	Control mode:	PR	
Unit:	-	Setting range:	0x00000000 ~ 0xFFFFFFFF	
Format:	HEX	Data size:	32-bit	

Settings:

Please refer to the description of P6.002.

<b>P6.007</b>	<b>PATH#3 data</b>		<b>Address: 060EH 060FH</b>	
Default:	0	Control mode:	PR	
Unit:	-	Setting range:	-2147483648 ~ +2147483647	
Format:	DEC	Data size:	32-bit	

Settings:

Please refer to the description of P6.003.

<b>P6.008</b>	<b>PATH#4 definition</b>		<b>Address: 0610H 0611H</b>	
Default:	0x00000000	Control mode:	PR	
Unit:	-	Setting range:	0x00000000 ~ 0xFFFFFFFF	
Format:	HEX	Data size:	32-bit	

Settings:

Please refer to the description of P6.002.

<b>P6.009</b>	<b>PATH#4 data</b>		<b>Address: 0612H 0613H</b>	
Default:	0	Control mode:	PR	
Unit:	-	Setting range:	-2147483648 ~ +2147483647	
Format:	DEC	Data size:	32-bit	

Settings:

Please refer to the description of P6.003.

<b>P6.010</b>	<b>PATH#5 definition</b>		<b>Address: 0614H 0615H</b>	
Default:	0x00000000	Control mode:	PR	
Unit:	-	Setting range:	0x00000000 ~ 0xFFFFFFFF	
Format:	HEX	Data size:	32-bit	

Settings:

Please refer to the description of P6.002.

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<b>P6.011</b>	<b>PATH#5 data</b>		<b>Address: 0616H 0617H</b>	
Default:	0	Control mode:	PR	
Unit:	-	Setting range:	-2147483648 ~ +2147483647	
Format:	DEC	Data size:	32-bit	

Settings:

Please refer to the description of P6.003.

<b>P6.012</b>	<b>PATH#6 definition</b>		<b>Address: 0618H 0619H</b>	
Default:	0x00000000	Control mode:	PR	
Unit:	-	Setting range:	0x00000000 ~ 0xFFFFFFFF	
Format:	HEX	Data size:	32-bit	

Settings:

Please refer to the description of P6.002.

<b>P6.013</b>	<b>PATH#6 data</b>		<b>Address: 061AH 061BH</b>	
Default:	0	Control mode:	PR	
Unit:	-	Setting range:	-2147483648 ~ +2147483647	
Format:	DEC	Data size:	32-bit	

Settings:

Please refer to the description of P6.003.

<b>P6.014</b>	<b>PATH#7 definition</b>		<b>Address: 061CH 061DH</b>	
Default:	0x00000000	Control mode:	PR	
Unit:	-	Setting range:	0x00000000 ~ 0xFFFFFFFF	
Format:	HEX	Data size:	32-bit	

Settings:

Please refer to the description of P6.002.

<b>P6.015</b>	<b>PATH#7 data</b>		<b>Address: 061EH 061FH</b>	
Default:	0	Control mode:	PR	
Unit:	-	Setting range:	-2147483648 ~ +2147483647	
Format:	DEC	Data size:	32-bit	

Settings:

Please refer to the description of P6.003.

<b>P6.016</b>	<b>PATH#8 definition</b>		<b>Address: 0620H 0621H</b>	
Default:	0x00000000	Control mode:	PR	
Unit:	-	Setting range:	0x00000000 ~ 0xFFFFFFFF	
Format:	HEX	Data size:	32-bit	

Settings:

Please refer to the description of P6.002.

<b>P6.017</b>	<b>PATH#8 data</b>		<b>Address: 0622H 0623H</b>	
Default:	0	Control mode:	PR	
Unit:	-	Setting range:	-2147483648 ~ +2147483647	
Format:	DEC	Data size:	32-bit	

Settings:

Please refer to the description of P6.003.

<b>P6.018</b>	<b>PATH#9 definition</b>		<b>Address: 0624H 0625H</b>	
Default:	0x00000000	Control mode:	PR	
Unit:	-	Setting range:	0x00000000 ~ 0xFFFFFFFF	
Format:	HEX	Data size:	32-bit	

Settings:

Please refer to the description of P6.002.

<b>P6.019</b>	<b>PATH#9 data</b>		<b>Address: 0626H 0627H</b>	
Default:	0	Control mode:	PR	
Unit:	-	Setting range:	-2147483648 ~ +2147483647	
Format:	DEC	Data size:	32-bit	

Settings:

Please refer to the description of P6.003.

<b>P6.020</b>	<b>PATH#10 definition</b>		<b>Address: 0628H 0629H</b>	
Default:	0x00000000	Control mode:	PR	
Unit:	-	Setting range:	0x00000000 ~ 0xFFFFFFFF	
Format:	HEX	Data size:	32-bit	

Settings:

Please refer to the description of P6.002.

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<b>P6.021</b>	<b>PATH#10 data</b>		<b>Address: 062AH 062BH</b>	
Default:	0	Control mode:	PR	
Unit:	-	Setting range:	-2147483648 ~ +2147483647	
Format:	DEC	Data size:	32-bit	

Settings:

Please refer to the description of P6.003.

<b>P6.022</b>	<b>PATH#11 definition</b>		<b>Address: 062CH 062DH</b>	
Default:	0x00000000	Control mode:	PR	
Unit:	-	Setting range:	0x00000000 ~ 0xFFFFFFFF	
Format:	HEX	Data size:	32-bit	

Settings:

Please refer to the description of P6.002.

<b>P6.023</b>	<b>PATH#11 data</b>		<b>Address: 062EH 062FH</b>	
Default:	0	Control mode:	PR	
Unit:	-	Setting range:	-2147483648 ~ +2147483647	
Format:	DEC	Data size:	32-bit	

Settings:

Please refer to the description of P6.003.

<b>P6.024</b>	<b>PATH#12 definition</b>		<b>Address: 0630H 0631H</b>	
Default:	0x00000000	Control mode:	PR	
Unit:	-	Setting range:	0x00000000 ~ 0xFFFFFFFF	
Format:	HEX	Data size:	32-bit	

Settings:

Please refer to the description of P6.002.

<b>P6.025</b>	<b>PATH#12 data</b>		<b>Address: 0632H 0633H</b>	
Default:	0	Control mode:	PR	
Unit:	-	Setting range:	-2147483648 ~ +2147483647	
Format:	DEC	Data size:	32-bit	

Settings:

Please refer to the description of P6.003.

<b>P6.026</b>	<b>PATH#13 definition</b>		<b>Address: 0634H 0635H</b>	
Default:	0x00000000	Control mode:	PR	
Unit:	-	Setting range:	0x00000000 ~ 0xFFFFFFFF	
Format:	HEX	Data size:	32-bit	

Settings:

Please refer to the description of P6.002.

<b>P6.027</b>	<b>PATH#13 data</b>		<b>Address: 0636H 0637H</b>	
Default:	0	Control mode:	PR	
Unit:	-	Setting range:	-2147483648 ~ +2147483647	
Format:	DEC	Data size:	32-bit	

Settings:

Please refer to the description of P6.003.

<b>P6.028</b>	<b>PATH#14 definition</b>		<b>Address: 0638H 0639H</b>	
Default:	0x00000000	Control mode:	PR	
Unit:	-	Setting range:	0x00000000 ~ 0xFFFFFFFF	
Format:	HEX	Data size:	32-bit	

Settings:

Please refer to the description of P6.002.

<b>P6.029</b>	<b>PATH# 14 data</b>		<b>Address: 063AH 063BH</b>	
Default:	0	Control mode:	PR	
Unit:	-	Setting range:	-2147483648 ~ +2147483647	
Format:	DEC	Data size:	32-bit	

Settings:

Please refer to the description of P6.003.

<b>P6.030</b>	<b>PATH#15 definition</b>		<b>Address: 063CH 063DH</b>	
Default:	0x00000000	Control mode:	PR	
Unit:	-	Setting range:	0x00000000 ~ 0xFFFFFFFF	
Format:	HEX	Data size:	32-bit	

Settings:

Please refer to the description of P6.002.



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<b>P6.031</b>	<b>PATH#15 data</b>		<b>Address: 063EH 063FH</b>	
Default:	0	Control mode:	PR	
Unit:	-	Setting range:	-2147483648 ~ +2147483647	
Format:	DEC	Data size:	32-bit	

Settings:

Please refer to the description of P6.003.

<b>P6.032</b>	<b>PATH#16 definition</b>		<b>Address: 0640H 0641H</b>	
Default:	0x00000000	Control mode:	PR	
Unit:	-	Setting range:	0x00000000 ~ 0xFFFFFFFF	
Format:	HEX	Data size:	32-bit	

Settings:

Please refer to the description of P6.002.

<b>P6.033</b>	<b>PATH#16 data</b>		<b>Address: 0642H 0643H</b>	
Default:	0	Control mode:	PR	
Unit:	-	Setting range:	-2147483648 ~ +2147483647	
Format:	DEC	Data size:	32-bit	

Settings:

Please refer to the description of P6.003.

<b>P6.034</b>	<b>PATH#17 definition</b>		<b>Address: 0644H 0645H</b>	
Default:	0x00000000	Control mode:	PR	
Unit:	-	Setting range:	0x00000000 ~ 0xFFFFFFFF	
Format:	HEX	Data size:	32-bit	

Settings:

Please refer to the description of P6.002.

<b>P6.035</b>	<b>PATH#17 data</b>		<b>Address: 0646H 0647H</b>	
Default:	0	Control mode:	PR	
Unit:	-	Setting range:	-2147483648 ~ +2147483647	
Format:	DEC	Data size:	32-bit	

Settings:

Please refer to the description of P6.003.

<b>P6.036</b>	<b>PATH#18 definition</b>		<b>Address: 0648H 0649H</b>
Default:	0x00000000	Control mode:	PR
Unit:	-	Setting range:	0x00000000 ~ 0xFFFFFFFF
Format:	HEX	Data size:	32-bit

Settings:

Please refer to the description of P6.002.

<b>P6.037</b>	<b>PATH#18 data</b>		<b>Address: 064AH 064BH</b>
Default:	0	Control mode:	PR
Unit:	-	Setting range:	-2147483648 ~ +2147483647
Format:	DEC	Data size:	32-bit

Settings:

Please refer to the description of P6.003.

<b>P6.038</b>	<b>PATH#19 definition</b>		<b>Address: 064CH 064DH</b>
Default:	0x00000000	Control mode:	PR
Unit:	-	Setting range:	0x00000000 ~ 0xFFFFFFFF
Format:	HEX	Data size:	32-bit

Settings:

Please refer to the description of P6.002.

<b>P6.039</b>	<b>PATH#19 data</b>		<b>Address: 064EH 064FH</b>
Default:	0	Control mode:	PR
Unit:	-	Setting range:	-2147483648 ~ +2147483647
Format:	DEC	Data size:	32-bit

Settings:

Please refer to the description of P6.003.

<b>P6.040</b>	<b>PATH#20 definition</b>		<b>Address: 0650H 0651H</b>
Default:	0x00000000	Control mode:	PR
Unit:	-	Setting range:	0x00000000 ~ 0xFFFFFFFF
Format:	HEX	Data size:	32-bit

Settings:

Please refer to the description of P6.002.

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<b>P6.041</b>	<b>PATH#20 data</b>		<b>Address: 0652H 0653H</b>	
Default:	0	Control mode:	PR	
Unit:	-	Setting range:	-2147483648 ~ +2147483647	
Format:	DEC	Data size:	32-bit	

Settings:

Please refer to the description of P6.003.

<b>P6.042</b>	<b>PATH#21 definition</b>		<b>Address: 0654H 0655H</b>	
Default:	0x00000000	Control mode:	PR	
Unit:	-	Setting range:	0x00000000 ~ 0xFFFFFFFF	
Format:	HEX	Data size:	32-bit	

Settings:

Please refer to the description of P6.002.

<b>P6.043</b>	<b>PATH#21 data</b>		<b>Address: 0656H 0657H</b>	
Default:	0	Control mode:	PR	
Unit:	-	Setting range:	-2147483648 ~ +2147483647	
Format:	DEC	Data size:	32-bit	

Settings:

Please refer to the description of P6.003.

<b>P6.044</b>	<b>PATH#22 definition</b>		<b>Address: 0658H 0659H</b>	
Default:	0x00000000	Control mode:	PR	
Unit:	-	Setting range:	0x00000000 ~ 0xFFFFFFFF	
Format:	HEX	Data size:	32-bit	

Settings:

Please refer to the description of P6.002.

<b>P6.045</b>	<b>PATH#22 data</b>		<b>Address: 065AH 065BH</b>	
Default:	0	Control mode:	PR	
Unit:	-	Setting range:	-2147483648 ~ +2147483647	
Format:	DEC	Data size:	32-bit	

Settings:

Please refer to the description of P6.003.

<b>P6.046</b>	<b>PATH#23 definition</b>		<b>Address: 065CH 065DH</b>	
Default:	0x00000000	Control mode:	PR	
Unit:	-	Setting range:	0x00000000 ~ 0xFFFFFFFF	
Format:	HEX	Data size:	32-bit	

Settings:

Please refer to the description of P6.002.

<b>P6.047</b>	<b>PATH#23 data</b>		<b>Address: 065EH 065FH</b>	
Default:	0	Control mode:	PR	
Unit:	-	Setting range:	-2147483648 ~ +2147483647	
Format:	DEC	Data size:	32-bit	

Settings:

Please refer to the description of P6.003.

<b>P6.048</b>	<b>PATH#24 definition</b>		<b>Address: 0660H 0661H</b>	
Default:	0x00000000	Control mode:	PR	
Unit:	-	Setting range:	0x00000000 ~ 0xFFFFFFFF	
Format:	HEX	Data size:	32-bit	

Settings:

Please refer to the description of P6.002.

<b>P6.049</b>	<b>PATH#24 data</b>		<b>Address: 0662H 0663H</b>	
Default:	0	Control mode:	PR	
Unit:	-	Setting range:	-2147483648 ~ +2147483647	
Format:	DEC	Data size:	32-bit	

Settings:

Please refer to the description of P6.003.

<b>P6.050</b>	<b>PATH#25 definition</b>		<b>Address: 0664H 0665H</b>	
Default:	0x00000000	Control mode:	PR	
Unit:	-	Setting range:	0x00000000 ~ 0xFFFFFFFF	
Format:	HEX	Data size:	32-bit	

Settings:

Please refer to the description of P6.002.

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<b>P6.051</b>	<b>PATH#25 data</b>		<b>Address: 0666H 0667H</b>	
Default:	0	Control mode:	PR	
Unit:	-	Setting range:	-2147483648 ~ +2147483647	
Format:	DEC	Data size:	32-bit	

Settings:

Please refer to the description of P6.003.

<b>P6.052</b>	<b>PATH#26 definition</b>		<b>Address: 0668H 0669H</b>	
Default:	0x00000000	Control mode:	PR	
Unit:	-	Setting range:	0x00000000 ~ 0xFFFFFFFF	
Format:	HEX	Data size:	32-bit	

Settings:

Please refer to the description of P6.002.

<b>P6.053</b>	<b>PATH#26 data</b>		<b>Address: 066AH 066BH</b>	
Default:	0	Control mode:	PR	
Unit:	-	Setting range:	-2147483648 ~ +2147483647	
Format:	DEC	Data size:	32-bit	

Settings:

Please refer to the description of P6.003.

<b>P6.054</b>	<b>PATH#27 definition</b>		<b>Address: 066CH 066DH</b>	
Default:	0x00000000	Control mode:	PR	
Unit:	-	Setting range:	0x00000000 ~ 0xFFFFFFFF	
Format:	HEX	Data size:	32-bit	

Settings:

Please refer to the description of P6.002.

<b>P6.055</b>	<b>PATH#27 data</b>		<b>Address: 066EH 066FH</b>	
Default:	0	Control mode:	PR	
Unit:	-	Setting range:	-2147483648 ~ +2147483647	
Format:	DEC	Data size:	32-bit	

Settings:

Please refer to the description of P6.003.

<b>P6.056</b>	<b>PATH#28 definition</b>		<b>Address: 0670H 0671H</b>	
Default:	0x00000000	Control mode:	PR	
Unit:	-	Setting range:	0x00000000 ~ 0xFFFFFFFF	
Format:	HEX	Data size:	32-bit	

Settings:

Please refer to the description of P6.002.

<b>P6.057</b>	<b>PATH#28 data</b>		<b>Address: 0672H 0673H</b>	
Default:	0	Control mode:	PR	
Unit:	-	Setting range:	-2147483648 ~ +2147483647	
Format:	DEC	Data size:	32-bit	

Settings:

Please refer to the description of P6.003.

<b>P6.058</b>	<b>PATH#29 definition</b>		<b>Address: 0674H 0675H</b>	
Default:	0x00000000	Control mode:	PR	
Unit:	-	Setting range:	0x00000000 ~ 0xFFFFFFFF	
Format:	HEX	Data size:	32-bit	

Settings:

Please refer to the description of P6.002.

<b>P6.059</b>	<b>PATH#29 data</b>		<b>Address: 0676H 0677H</b>	
Default:	0	Control mode:	PR	
Unit:	-	Setting range:	-2147483648 ~ +2147483647	
Format:	DEC	Data size:	32-bit	

Settings:

Please refer to the description of P6.003.

<b>P6.060</b>	<b>PATH#30 definition</b>		<b>Address: 0678H 0679H</b>	
Default:	0x00000000	Control mode:	PR	
Unit:	-	Setting range:	0x00000000 ~ 0xFFFFFFFF	
Format:	HEX	Data size:	32-bit	

Settings:

Please refer to the description of P6.002.

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<b>P6.061</b>	<b>PATH#30 data</b>		<b>Address: 067AH 067BH</b>	
Default:	0	Control mode:	PR	
Unit:	-	Setting range:	-2147483648 ~ +2147483647	
Format:	DEC	Data size:	32-bit	

Settings:

Please refer to the description of P6.003.

<b>P6.062</b>	<b>PATH#31 definition</b>		<b>Address: 067CH 067DH</b>	
Default:	0x00000000	Control mode:	PR	
Unit:	-	Setting range:	0x00000000 ~ 0xFFFFFFFF	
Format:	HEX	Data size:	32-bit	

Settings:

Please refer to the description of P6.002.

<b>P6.063</b>	<b>PATH#31 data</b>		<b>Address: 067EH 067FH</b>	
Default:	0	Control mode:	PR	
Unit:	-	Setting range:	-2147483648 ~ +2147483647	
Format:	DEC	Data size:	32-bit	

Settings:

Please refer to the description of P6.003.

<b>P6.064</b>	<b>PATH#32 definition</b>		<b>Address: 0680H 0681H</b>	
Default:	0x00000000	Control mode:	PR	
Unit:	-	Setting range:	0x00000000 ~ 0xFFFFFFFF	
Format:	HEX	Data size:	32-bit	

Settings:

Please refer to the description of P6.002.

<b>P6.065</b>	<b>PATH#32 data</b>		<b>Address: 0682H 0683H</b>	
Default:	0	Control mode:	PR	
Unit:	-	Setting range:	-2147483648 ~ +2147483647	
Format:	DEC	Data size:	32-bit	

Settings:

Please refer to the description of P6.003.

<b>P6.066</b>	<b>PATH#33 definition</b>		<b>Address: 0684H 0685H</b>	
Default:	0x00000000	Control mode:	PR	
Unit:	-	Setting range:	0x00000000 ~ 0xFFFFFFFF	
Format:	HEX	Data size:	32-bit	

Settings:

Please refer to the description of P6.002.

<b>P6.067</b>	<b>PATH#33 data</b>		<b>Address: 0686H 0687H</b>	
Default:	0	Control mode:	PR	
Unit:	-	Setting range:	-2147483648 ~ +2147483647	
Format:	DEC	Data size:	32-bit	

Settings:

Please refer to the description of P6.003.

<b>P6.068</b>	<b>PATH#34 definition</b>		<b>Address: 0688H 0689H</b>	
Default:	0x00000000	Control mode:	PR	
Unit:	-	Setting range:	0x00000000 ~ 0xFFFFFFFF	
Format:	HEX	Data size:	32-bit	

Settings:

Please refer to the description of P6.002.

<b>P6.069</b>	<b>PATH#34 data</b>		<b>Address: 068AH 068BH</b>	
Default:	0	Control mode:	PR	
Unit:	-	Setting range:	-2147483648 ~ +2147483647	
Format:	DEC	Data size:	32-bit	

Settings:

Please refer to the description of P6.003.

<b>P6.070</b>	<b>PATH#35 definition</b>		<b>Address: 068CH 068DH</b>	
Default:	0x00000000	Control mode:	PR	
Unit:	-	Setting range:	0x00000000 ~ 0xFFFFFFFF	
Format:	HEX	Data size:	32-bit	

Settings:

Please refer to the description of P6.002.



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<b>P6.071</b>	<b>PATH#35 data</b>		<b>Address: 068EH 068FH</b>	
Default:	0	Control mode:	PR	
Unit:	-	Setting range:	-2147483648 ~ +2147483647	
Format:	DEC	Data size:	32-bit	

Settings:

Please refer to the description of P6.003.

<b>P6.072</b>	<b>PATH#36 definition</b>		<b>Address: 0690H 0691H</b>	
Default:	0x00000000	Control mode:	PR	
Unit:	-	Setting range:	0x00000000 ~ 0xFFFFFFFF	
Format:	HEX	Data size:	32-bit	

Settings:

Please refer to the description of P6.002.

<b>P6.073</b>	<b>PATH#36 data</b>		<b>Address: 0692H 0693H</b>	
Default:	0	Control mode:	PR	
Unit:	-	Setting range:	-2147483648 ~ +2147483647	
Format:	DEC	Data size:	32-bit	

Settings:

Please refer to the description of P6.003.

<b>P6.074</b>	<b>PATH#37 definition</b>		<b>Address: 0694H 0695H</b>	
Default:	0x00000000	Control mode:	PR	
Unit:	-	Setting range:	0x00000000 ~ 0xFFFFFFFF	
Format:	HEX	Data size:	32-bit	

Settings:

Please refer to the description of P6.002.

<b>P6.075</b>	<b>PATH#37 data</b>		<b>Address: 0696H 0697H</b>	
Default:	0	Control mode:	PR	
Unit:	-	Setting range:	-2147483648 ~ +2147483647	
Format:	DEC	Data size:	32-bit	

Settings:

Please refer to the description of P6.003.

<b>P6.076</b>	<b>PATH#38 definition</b>		<b>Address: 0698H 0699H</b>	
Default:	0x00000000	Control mode:	PR	
Unit:	-	Setting range:	0x00000000 ~ 0xFFFFFFFF	
Format:	HEX	Data size:	32-bit	

Settings:

Please refer to the description of P6.002.

<b>P6.077</b>	<b>PATH#38 data</b>		<b>Address: 069AH 069BH</b>	
Default:	0	Control mode:	PR	
Unit:	-	Setting range:	-2147483648 ~ +2147483647	
Format:	DEC	Data size:	32-bit	

Settings:

Please refer to the description of P6.003.

<b>P6.078</b>	<b>PATH#39 definition</b>		<b>Address: 069CH 069DH</b>	
Default:	0x00000000	Control mode:	PR	
Unit:	-	Setting range:	0x00000000 ~ 0xFFFFFFFF	
Format:	HEX	Data size:	32-bit	

Settings:

Please refer to the description of P6.002.

<b>P6.079</b>	<b>PATH#39 data</b>		<b>Address: 069EH 069FH</b>	
Default:	0	Control mode:	PR	
Unit:	-	Setting range:	-2147483648 ~ +2147483647	
Format:	DEC	Data size:	32-bit	

Settings:

Please refer to the description of P6.003.

<b>P6.080</b>	<b>PATH#40 definition</b>		<b>Address: 06A0H 06A1H</b>	
Default:	0x00000000	Control mode:	PR	
Unit:	-	Setting range:	0x00000000 ~ 0xFFFFFFFF	
Format:	HEX	Data size:	32-bit	

Settings:

Please refer to the description of P6.002.

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<b>P6.081</b>	<b>PATH#40 data</b>		<b>Address: 06A2H 06A3H</b>	
Default:	0	Control mode:	PR	
Unit:	-	Setting range:	-2147483648 ~ +2147483647	
Format:	DEC	Data size:	32-bit	

Settings:

Please refer to the description of P6.003.

<b>P6.082</b>	<b>PATH#41 definition</b>		<b>Address: 06A4H 06A5H</b>	
Default:	0x00000000	Control mode:	PR	
Unit:	-	Setting range:	0x00000000 ~ 0xFFFFFFFF	
Format:	HEX	Data size:	32-bit	

Settings:

Please refer to the description of P6.002.

<b>P6.083</b>	<b>PATH#41 data</b>		<b>Address: 06A6H 06A7H</b>	
Default:	0	Control mode:	PR	
Unit:	-	Setting range:	-2147483648 ~ +2147483647	
Format:	DEC	Data size:	32-bit	

Settings:

Please refer to the description of P6.003.

<b>P6.084</b>	<b>PATH#42 definition</b>		<b>Address: 06A8H 06A9H</b>	
Default:	0x00000000	Control mode:	PR	
Unit:	-	Setting range:	0x00000000 ~ 0xFFFFFFFF	
Format:	HEX	Data size:	32-bit	

Settings:

Please refer to the description of P6.002.

<b>P6.085</b>	<b>PATH#42 data</b>		<b>Address: 06AAH 06ABH</b>	
Default:	0	Control mode:	PR	
Unit:	-	Setting range:	-2147483648 ~ +2147483647	
Format:	DEC	Data size:	32-bit	

Settings:

Please refer to the description of P6.003.

<b>P6.086</b>	<b>PATH#43 definition</b>		<b>Address: 06ACH 06ADH</b>	
Default:	0x00000000	Control mode:	PR	
Unit:	-	Setting range:	0x00000000 ~ 0xFFFFFFFF	
Format:	HEX	Data size:	32-bit	

Settings:

Please refer to the description of P6.002.

<b>P6.087</b>	<b>PATH#43 data</b>		<b>Address: 06AEH 06AFH</b>	
Default:	0	Control mode:	PR	
Unit:	-	Setting range:	-2147483648 ~ +2147483647	
Format:	DEC	Data size:	32-bit	

Settings:

Please refer to the description of P6.003.

<b>P6.088</b>	<b>PATH# 44 definition</b>		<b>Address: 06B0H 06B1H</b>	
Default:	0x00000000	Control mode:	PR	
Unit:	-	Setting range:	0x00000000 ~ 0xFFFFFFFF	
Format:	HEX	Data size:	32-bit	

Settings:

Please refer to the description of P6.002.

<b>P6.089</b>	<b>PATH#44 data</b>		<b>Address: 06B2H 06B3H</b>	
Default:	0	Control mode:	PR	
Unit:	-	Setting range:	-2147483648 ~ +2147483647	
Format:	DEC	Data size:	32-bit	

Settings:

Please refer to the description of P6.003.

<b>P6.090</b>	<b>PATH# 45 definition</b>		<b>Address: 06B4H 06B5H</b>	
Default:	0x00000000	Control mode:	PR	
Unit:	-	Setting range:	0x00000000 ~ 0xFFFFFFFF	
Format:	HEX	Data size:	32-bit	

Settings:

Please refer to the description of P6.002.

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<b>P6.091</b>	<b>PATH#45 data</b>		<b>Address: 06B6H 06B7H</b>	
Default:	0	Control mode:	PR	
Unit:	-	Setting range:	-2147483648 ~ +2147483647	
Format:	DEC	Data size:	32-bit	

Settings:

Please refer to the description of P6.003.

<b>P6.092</b>	<b>PATH#46 definition</b>		<b>Address: 06B8H 06B9H</b>	
Default:	0x00000000	Control mode:	PR	
Unit:	-	Setting range:	0x00000000 ~ 0xFFFFFFFF	
Format:	HEX	Data size:	32-bit	

Settings:

Please refer to the description of P6.002.

<b>P6.093</b>	<b>PATH#46 data</b>		<b>Address: 06BAH 06BBH</b>	
Default:	0	Control mode:	PR	
Unit:	-	Setting range:	-2147483648 ~ +2147483647	
Format:	DEC	Data size:	32-bit	

Settings:

Please refer to the description of P6.003.

<b>P6.094</b>	<b>PATH#47 definition</b>		<b>Address: 06BCH 06BDH</b>	
Default:	0x00000000	Control mode:	PR	
Unit:	-	Setting range:	0x00000000 ~ 0xFFFFFFFF	
Format:	HEX	Data size:	32-bit	

Settings:

Please refer to the description of P6.002.

<b>P6.095</b>	<b>PATH#47 data</b>		<b>Address: 06BEH 06BFH</b>	
Default:	0	Control mode:	PR	
Unit:	-	Setting range:	-2147483648 ~ +2147483647	
Format:	DEC	Data size:	32-bit	

Settings:

Please refer to the description of P6.003.

<b>P6.096</b>	<b>PATH#48 definition</b>		<b>Address: 06C0H 06C1H</b>	
Default:	0x00000000	Control mode:	PR	
Unit:	-	Setting range:	0x00000000 ~ 0xFFFFFFFF	
Format:	HEX	Data size:	32-bit	

Settings:

Please refer to the description of P6.002.

<b>P6.097</b>	<b>PATH#48 data</b>		<b>Address: 06C2H 06C3H</b>	
Default:	0	Control mode:	PR	
Unit:	-	Setting range:	-2147483648 ~ +2147483647	
Format:	DEC	Data size:	32-bit	

Settings:

Please refer to the description of P6.003.

<b>P6.098</b>	<b>PATH#49 definition</b>		<b>Address: 06C4H 06C5H</b>	
Default:	0x00000000	Control mode:	PR	
Unit:	-	Setting range:	0x00000000 ~ 0xFFFFFFFF	
Format:	HEX	Data size:	32-bit	

Settings:

Please refer to the description of P6.002.

<b>P6.099</b>	<b>PATH#49 data</b>		<b>Address: 06C6H 06C7H</b>	
Default:	0	Control mode:	PR	
Unit:	-	Setting range:	-2147483648 ~ +2147483647	
Format:	DEC	Data size:	32-bit	

Settings:

Please refer to the description of P6.003.

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## P7.xxx PR parameters

P7.000	PATH#50 definition		Address: 0700H 0701H
Default:	0x00000000	Control mode:	PR
Unit:	-	Setting range:	0x00000000 ~ 0xFFFFFFFF
Format:	HEX	Data size:	32-bit

Settings:

Please refer to the description of P6.002.

P7.001	PATH#50 data		Address: 0702H 0703H
Default:	0	Control mode:	PR
Unit:	-	Setting range:	-2147483648 ~ +2147483647
Format:	DEC	Data size:	32-bit

Settings:

Please refer to the description of P6.003.

P7.002	PATH#51 definition		Address: 0704H 0705H
Default:	0x00000000	Control mode:	PR
Unit:	-	Setting range:	0x00000000 ~ 0xFFFFFFFF
Format:	HEX	Data size:	32-bit

Settings:

Please refer to the description of P6.002.

P7.003	PATH#51 data		Address: 0706H 0707H
Default:	0	Control mode:	PR
Unit:	-	Setting range:	-2147483648 ~ +2147483647
Format:	DEC	Data size:	32-bit

Settings:

Please refer to the description of P6.003.

P7.004	PATH#52 definition		Address: 0708H 0709H
Default:	0x00000000	Control mode:	PR
Unit:	-	Setting range:	0x00000000 ~ 0xFFFFFFFF
Format:	HEX	Data size:	32-bit

Settings:

Please refer to the description of P6.002.

<b>P7.005</b>	<b>PATH#52 data</b>		<b>Address: 070AH 070BH</b>	
Default:	0	Control mode:	PR	
Unit:	-	Setting range:	-2147483648 ~ +2147483647	
Format:	DEC	Data size:	32-bit	

Settings:

Please refer to the description of P6.003.

<b>P7.006</b>	<b>PATH#53 definition</b>		<b>Address: 070CH 070DH</b>	
Default:	0x00000000	Control mode:	PR	
Unit:	-	Setting range:	0x00000000 ~ 0xFFFFFFFF	
Format:	HEX	Data size:	32-bit	

Settings:

Please refer to the description of P6.002.

<b>P7.007</b>	<b>PATH#53 data</b>		<b>Address: 070EH 070FH</b>	
Default:	0	Control mode:	PR	
Unit:	-	Setting range:	-2147483648 ~ +2147483647	
Format:	DEC	Data size:	32-bit	

Settings:

Please refer to the description of P6.003.

<b>P7.008</b>	<b>PATH#54 definition</b>		<b>Address: 0710H 0711H</b>	
Default:	0x00000000	Control mode:	PR	
Unit:	-	Setting range:	0x00000000 ~ 0xFFFFFFFF	
Format:	HEX	Data size:	32-bit	

Settings:

Please refer to the description of P6.002.

<b>P7.009</b>	<b>PATH#54 data</b>		<b>Address: 0712H 0713H</b>	
Default:	0	Control mode:	PR	
Unit:	-	Setting range:	-2147483648 ~ +2147483647	
Format:	DEC	Data size:	32-bit	

Settings:

Please refer to the description of P6.003.



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<b>P7.010</b>	<b>PATH#55 definition</b>		<b>Address: 0714H 0715H</b>	
Default:	0x00000000	Control mode:	PR	
Unit:	-	Setting range:	0x00000000 ~ 0xFFFFFFFF	
Format:	HEX	Data size:	32-bit	

Settings:

Please refer to the description of P6.002.

<b>P7.011</b>	<b>PATH#55 data</b>		<b>Address: 0716H 0717H</b>	
Default:	0	Control mode:	PR	
Unit:	-	Setting range:	-2147483648 ~ +2147483647	
Format:	DEC	Data size:	32-bit	

Settings:

Please refer to the description of P6.003.

<b>P7.012</b>	<b>PATH#56 definition</b>		<b>Address: 0718H 0719H</b>	
Default:	0x00000000	Control mode:	PR	
Unit:	-	Setting range:	0x00000000 ~ 0xFFFFFFFF	
Format:	HEX	Data size:	32-bit	

Settings:

Please refer to the description of P6.002.

<b>P7.013</b>	<b>PATH#56 data</b>		<b>Address: 071AH 071BH</b>	
Default:	0	Control mode:	PR	
Unit:	-	Setting range:	-2147483648 ~ +2147483647	
Format:	DEC	Data size:	32-bit	

Settings:

Please refer to the description of P6.003.

<b>P7.014</b>	<b>PATH#57 definition</b>		<b>Address: 071CH 071DH</b>	
Default:	0x00000000	Control mode:	PR	
Unit:	-	Setting range:	0x00000000 ~ 0xFFFFFFFF	
Format:	HEX	Data size:	32-bit	

Settings:

Please refer to the description of P6.002.

<b>P7.015</b>	<b>PATH#57 data</b>		<b>Address: 071EH 071FH</b>	
Default:	0	Control mode:	PR	
Unit:	-	Setting range:	-2147483648 ~ +2147483647	
Format:	DEC	Data size:	32-bit	

Settings:

Please refer to the description of P6.003.

<b>P7.016</b>	<b>PATH#58 definition</b>		<b>Address: 0720H 0721H</b>	
Default:	0x00000000	Control mode:	PR	
Unit:	-	Setting range:	0x00000000 ~ 0xFFFFFFFF	
Format:	HEX	Data size:	32-bit	

Settings:

Please refer to the description of P6.002.

<b>P7.017</b>	<b>PATH#58 data</b>		<b>Address: 0722H 0723H</b>	
Default:	0	Control mode:	PR	
Unit:	-	Setting range:	-2147483648 ~ +2147483647	
Format:	DEC	Data size:	32-bit	

Settings:

Please refer to the description of P6.003.

<b>P7.018</b>	<b>PATH#59 definition</b>		<b>Address: 0724H 0725H</b>	
Default:	0x00000000	Control mode:	PR	
Unit:	-	Setting range:	0x00000000 ~ 0xFFFFFFFF	
Format:	HEX	Data size:	32-bit	

Settings:

Please refer to the description of P6.002.

<b>P7.019</b>	<b>PATH#59 data</b>		<b>Address: 0726H 0727H</b>	
Default:	0	Control mode:	PR	
Unit:	-	Setting range:	-2147483648 ~ +2147483647	
Format:	DEC	Data size:	32-bit	

Settings:

Please refer to the description of P6.003.

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<b>P7.020</b>	<b>PATH#60 definition</b>		<b>Address: 0728H 0729H</b>	
Default:	0x00000000	Control mode:	PR	
Unit:	-	Setting range:	0x00000000 ~ 0xFFFFFFFF	
Format:	HEX	Data size:	32-bit	

Settings:

Please refer to the description of P6.002.

<b>P7.021</b>	<b>PATH#60 data</b>		<b>Address: 072AH 072BH</b>	
Default:	0	Control mode:	PR	
Unit:	-	Setting range:	-2147483648 ~ +2147483647	
Format:	DEC	Data size:	32-bit	

Settings:

Please refer to the description of P6.003.

<b>P7.022</b>	<b>PATH#61 definition</b>		<b>Address: 072CH 072DH</b>	
Default:	0x00000000	Control mode:	PR	
Unit:	-	Setting range:	0x00000000 ~ 0xFFFFFFFF	
Format:	HEX	Data size:	32-bit	

Settings:

Please refer to the description of P6.002.

<b>P7.023</b>	<b>PATH#61 data</b>		<b>Address: 072EH 072FH</b>	
Default:	0	Control mode:	PR	
Unit:	-	Setting range:	-2147483648 ~ +2147483647	
Format:	DEC	Data size:	32-bit	

Settings:

Please refer to the description of P6.003.

<b>P7.024</b>	<b>PATH#62 definition</b>		<b>Address: 0730H 0731H</b>	
Default:	0x00000000	Control mode:	PR	
Unit:	-	Setting range:	0x00000000 ~ 0xFFFFFFFF	
Format:	HEX	Data size:	32-bit	

Settings:

Please refer to the description of P6.002.

<b>P7.025</b>	<b>PATH#62 data</b>		<b>Address: 0732H 0733H</b>	
Default:	0	Control mode:	PR	
Unit:	-	Setting range:	-2147483648 ~ +2147483647	
Format:	DEC	Data size:	32-bit	

Settings:

Please refer to the description of P6.003.

<b>P7.026</b>	<b>PATH#63 definition</b>		<b>Address: 0734H 0735H</b>	
Default:	0x00000000	Control mode:	PR	
Unit:	-	Setting range:	0x00000000 ~ 0xFFFFFFFF	
Format:	HEX	Data size:	32-bit	

Settings:

Please refer to the description of P6.002.

<b>P7.027</b>	<b>PATH#63 data</b>		<b>Address: 0736H 0737H</b>	
Default:	0	Control mode:	PR	
Unit:	-	Setting range:	-2147483648 ~ +2147483647	
Format:	DEC	Data size:	32-bit	

Settings:

Please refer to the description of P6.003.

<b>P7.028</b>	<b>PATH#64 definition</b>		<b>Address: 0738H 0739H</b>	
Default:	0x00000000	Control mode:	PR	
Unit:	-	Setting range:	0x00000000 ~ 0xFFFFFFFF	
Format:	HEX	Data size:	32-bit	

Settings:

Please refer to the description of P6.002.

<b>P7.029</b>	<b>PATH#64 data</b>		<b>Address: 073AH 073BH</b>	
Default:	0	Control mode:	PR	
Unit:	-	Setting range:	-2147483648 ~ +2147483647	
Format:	DEC	Data size:	32-bit	

Settings:

Please refer to the description of P6.003.

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<b>P7.030</b>	<b>PATH#65 definition</b>		<b>Address: 073CH 073DH</b>	
Default:	0x00000000	Control mode:	PR	
Unit:	-	Setting range:	0x00000000 ~ 0xFFFFFFFF	
Format:	HEX	Data size:	32-bit	

Settings:

Please refer to the description of P6.002.

<b>P7.031</b>	<b>PATH#65 data</b>		<b>Address: 073EH 073FH</b>	
Default:	0	Control mode:	PR	
Unit:	-	Setting range:	-2147483648 ~ +2147483647	
Format:	DEC	Data size:	32-bit	

Settings:

Please refer to the description of P6.003.

<b>P7.032</b>	<b>PATH#66 definition</b>		<b>Address: 0740H 0741H</b>	
Default:	0x00000000	Control mode:	PR	
Unit:	-	Setting range:	0x00000000 ~ 0xFFFFFFFF	
Format:	HEX	Data size:	32-bit	

Settings:

Please refer to the description of P6.002.

<b>P7.033</b>	<b>PATH#66 data</b>		<b>Address: 0742H 0743H</b>	
Default:	0	Control mode:	PR	
Unit:	-	Setting range:	-2147483648 ~ +2147483647	
Format:	DEC	Data size:	32-bit	

Settings:

Please refer to the description of P6.003.

<b>P7.034</b>	<b>PATH#67 definition</b>		<b>Address: 0744H 0745H</b>	
Default:	0x00000000	Control mode:	PR	
Unit:	-	Setting range:	0x00000000 ~ 0xFFFFFFFF	
Format:	HEX	Data size:	32-bit	

Settings:

Please refer to the description of P6.002.

<b>P7.035</b>	<b>PATH#67 data</b>		<b>Address: 0746H 0747H</b>	
Default:	0	Control mode:	PR	
Unit:	-	Setting range:	-2147483648 ~ +2147483647	
Format:	DEC	Data size:	32-bit	

Settings:

Please refer to the description of P6.003.

<b>P7.036</b>	<b>PATH#68 definition</b>		<b>Address: 0748H 0749H</b>	
Default:	0x00000000	Control mode:	PR	
Unit:	-	Setting range:	0x00000000 ~ 0xFFFFFFFF	
Format:	HEX	Data size:	32-bit	

Settings:

Please refer to the description of P6.002.

<b>P7.037</b>	<b>PATH#68 data</b>		<b>Address: 074AH 074BH</b>	
Default:	0	Control mode:	PR	
Unit:	-	Setting range:	-2147483648 ~ +2147483647	
Format:	DEC	Data size:	32-bit	

Settings:

Please refer to the description of P6.003.

<b>P7.038</b>	<b>PATH#69 definition</b>		<b>Address: 074CH 074DH</b>	
Default:	0x00000000	Control mode:	PR	
Unit:	-	Setting range:	0x00000000 ~ 0xFFFFFFFF	
Format:	HEX	Data size:	32-bit	

Settings:

Please refer to the description of P6.002.

<b>P7.039</b>	<b>PATH#69 data</b>		<b>Address: 074EH 074FH</b>	
Default:	0	Control mode:	PR	
Unit:	-	Setting range:	-2147483648 ~ +2147483647	
Format:	DEC	Data size:	32-bit	

Settings:

Please refer to the description of P6.003.

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<b>P7.040</b>	<b>PATH#70 definition</b>		<b>Address: 0750H 0751H</b>	
Default:	0x00000000	Control mode:	PR	
Unit:	-	Setting range:	0x00000000 ~ 0xFFFFFFFF	
Format:	HEX	Data size:	32-bit	

Settings:

Please refer to the description of P6.002.

<b>P7.041</b>	<b>PATH#70 data</b>		<b>Address: 0752H 0753H</b>	
Default:	0	Control mode:	PR	
Unit:	-	Setting range:	-2147483648 ~ +2147483647	
Format:	DEC	Data size:	32-bit	

Settings:

Please refer to the description of P6.003.

<b>P7.042</b>	<b>PATH#71 definition</b>		<b>Address: 0754H 0755H</b>	
Default:	0x00000000	Control mode:	PR	
Unit:	-	Setting range:	0x00000000 ~ 0xFFFFFFFF	
Format:	HEX	Data size:	32-bit	

Settings:

Please refer to the description of P6.002.

<b>P7.043</b>	<b>PATH#71 data</b>		<b>Address: 0756H 0757H</b>	
Default:	0	Control mode:	PR	
Unit:	-	Setting range:	-2147483648 ~ +2147483647	
Format:	DEC	Data size:	32-bit	

Settings:

Please refer to the description of P6.003.

<b>P7.044</b>	<b>PATH#72 definition</b>		<b>Address: 0758H 0759H</b>	
Default:	0x00000000	Control mode:	PR	
Unit:	-	Setting range:	0x00000000 ~ 0xFFFFFFFF	
Format:	HEX	Data size:	32-bit	

Settings:

Please refer to the description of P6.002.

<b>P7.045</b>	<b>PATH#72 data</b>		<b>Address: 075AH 075BH</b>	
Default:	0	Control mode:	PR	
Unit:	-	Setting range:	-2147483648 ~ +2147483647	
Format:	DEC	Data size:	32-bit	

Settings:

Please refer to the description of P6.003.

<b>P7.046</b>	<b>PATH#73 definition</b>		<b>Address: 075CH 075DH</b>	
Default:	0x00000000	Control mode:	PR	
Unit:	-	Setting range:	0x00000000 ~ 0xFFFFFFFF	
Format:	HEX	Data size:	32-bit	

Settings:

Please refer to the description of P6.002.

<b>P7.047</b>	<b>PATH#73 data</b>		<b>Address: 075EH 075FH</b>	
Default:	0	Control mode:	PR	
Unit:	-	Setting range:	-2147483648 ~ +2147483647	
Format:	DEC	Data size:	32-bit	

Settings:

Please refer to the description of P6.003.

<b>P7.048</b>	<b>PATH#74 definition</b>		<b>Address: 0760H 0761H</b>	
Default:	0x00000000	Control mode:	PR	
Unit:	-	Setting range:	0x00000000 ~ 0xFFFFFFFF	
Format:	HEX	Data size:	32-bit	

Settings:

Please refer to the description of P6.002.

<b>P7.049</b>	<b>PATH#74 data</b>		<b>Address: 0762H 0763H</b>	
Default:	0	Control mode:	PR	
Unit:	-	Setting range:	-2147483648 ~ +2147483647	
Format:	DEC	Data size:	32-bit	

Settings:

Please refer to the description of P6.003.



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<b>P7.050</b>	<b>PATH#75 definition</b>		<b>Address: 0764H 0765H</b>	
Default:	0x00000000	Control mode:	PR	
Unit:	-	Setting range:	0x00000000 ~ 0xFFFFFFFF	
Format:	HEX	Data size:	32-bit	

Settings:

Please refer to the description of P6.002.

<b>P7.051</b>	<b>PATH#75 data</b>		<b>Address: 0766H 0767H</b>	
Default:	0	Control mode:	PR	
Unit:	-	Setting range:	-2147483648 ~ +2147483647	
Format:	DEC	Data size:	32-bit	

Settings:

Please refer to the description of P6.003.

<b>P7.052</b>	<b>PATH#76 definition</b>		<b>Address: 0768H 0769H</b>	
Default:	0x00000000	Control mode:	PR	
Unit:	-	Setting range:	0x00000000 ~ 0xFFFFFFFF	
Format:	HEX	Data size:	32-bit	

Settings:

Please refer to the description of P6.002.

<b>P7.053</b>	<b>PATH#76 data</b>		<b>Address: 076AH 076BH</b>	
Default:	0	Control mode:	PR	
Unit:	-	Setting range:	-2147483648 ~ +2147483647	
Format:	DEC	Data size:	32-bit	

Settings:

Please refer to the description of P6.003.

<b>P7.054</b>	<b>PATH#77 definition</b>		<b>Address: 076CH 076DH</b>	
Default:	0x00000000	Control mode:	PR	
Unit:	-	Setting range:	0x00000000 ~ 0xFFFFFFFF	
Format:	HEX	Data size:	32-bit	

Settings:

Please refer to the description of P6.002.

<b>P7.055</b>	<b>PATH#77 data</b>		<b>Address: 076EH 076FH</b>	
Default:	0	Control mode:	PR	
Unit:	-	Setting range:	-2147483648 ~ +2147483647	
Format:	DEC	Data size:	32-bit	

Settings:

Please refer to the description of P6.003.

<b>P7.056</b>	<b>PATH#78 definition</b>		<b>Address: 0770H 0771H</b>	
Default:	0x00000000	Control mode:	PR	
Unit:	-	Setting range:	0x00000000 ~ 0xFFFFFFFF	
Format:	HEX	Data size:	32-bit	

Settings:

Please refer to the description of P6.002.

<b>P7.057</b>	<b>PATH#78 data</b>		<b>Address: 0772H 0773H</b>	
Default:	0	Control mode:	PR	
Unit:	-	Setting range:	-2147483648 ~ +2147483647	
Format:	DEC	Data size:	32-bit	

Settings:

Please refer to the description of P6.003.

<b>P7.058</b>	<b>PATH#79 definition</b>		<b>Address: 0774H 0775H</b>	
Default:	0x00000000	Control mode:	PR	
Unit:	-	Setting range:	0x00000000 ~ 0xFFFFFFFF	
Format:	HEX	Data size:	32-bit	

Settings:

Please refer to the description of P6.002.

<b>P7.059</b>	<b>PATH#79 data</b>		<b>Address: 0776H 0777H</b>	
Default:	0	Control mode:	PR	
Unit:	-	Setting range:	-2147483648 ~ +2147483647	
Format:	DEC	Data size:	32-bit	

Settings:

Please refer to the description of P6.003.

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<b>P7.060</b>	<b>PATH#80 definition</b>		<b>Address: 0778H 0779H</b>	
Default:	0x00000000	Control mode:	PR	
Unit:	-	Setting range:	0x00000000 ~ 0xFFFFFFFF	
Format:	HEX	Data size:	32-bit	

Settings:

Please refer to the description of P6.002.

<b>P7.061</b>	<b>PATH#80 data</b>		<b>Address: 077AH 077BH</b>	
Default:	0	Control mode:	PR	
Unit:	-	Setting range:	-2147483648 ~ +2147483647	
Format:	DEC	Data size:	32-bit	

Settings:

Please refer to the description of P6.003.

<b>P7.062</b>	<b>PATH#81 definition</b>		<b>Address: 077CH 077DH</b>	
Default:	0x00000000	Control mode:	PR	
Unit:	-	Setting range:	0x00000000 ~ 0xFFFFFFFF	
Format:	HEX	Data size:	32-bit	

Settings:

Please refer to the description of P6.002.

<b>P7.063</b>	<b>PATH#81 data</b>		<b>Address: 077EH 077FH</b>	
Default:	0	Control mode:	PR	
Unit:	-	Setting range:	-2147483648 ~ +2147483647	
Format:	DEC	Data size:	32-bit	

Settings:

Please refer to the description of P6.003.

<b>P7.064</b>	<b>PATH#82 definition</b>		<b>Address: 0780H 0781H</b>	
Default:	0x00000000	Control mode:	PR	
Unit:	-	Setting range:	0x00000000 ~ 0xFFFFFFFF	
Format:	HEX	Data size:	32-bit	

Settings:

Please refer to the description of P6.002.

<b>P7.065</b>	<b>PATH#82 data</b>		<b>Address: 0782H 0783H</b>	
Default:	0	Control mode:	PR	
Unit:	-	Setting range:	-2147483648 ~ +2147483647	
Format:	DEC	Data size:	32-bit	

Settings:

Please refer to the description of P6.003.

<b>P7.066</b>	<b>PATH#83 definition</b>		<b>Address: 0784H 0785H</b>	
Default:	0x00000000	Control mode:	PR	
Unit:	-	Setting range:	0x00000000 ~ 0xFFFFFFFF	
Format:	HEX	Data size:	32-bit	

Settings:

Please refer to the description of P6.002.

<b>P7.067</b>	<b>PATH#83 data</b>		<b>Address: 0786H 0787H</b>	
Default:	0	Control mode:	PR	
Unit:	-	Setting range:	-2147483648 ~ +2147483647	
Format:	DEC	Data size:	32-bit	

Settings:

Please refer to the description of P6.003.

<b>P7.068</b>	<b>PATH#84 definition</b>		<b>Address: 0788H 0789H</b>	
Default:	0x00000000	Control mode:	PR	
Unit:	-	Setting range:	0x00000000 ~ 0xFFFFFFFF	
Format:	HEX	Data size:	32-bit	

Settings:

Please refer to the description of P6.002.

<b>P7.069</b>	<b>PATH#84 data</b>		<b>Address: 078AH 078BH</b>	
Default:	0	Control mode:	PR	
Unit:	-	Setting range:	-2147483648 ~ +2147483647	
Format:	DEC	Data size:	32-bit	

Settings:

Please refer to the description of P6.003.

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<b>P7.070</b>	<b>PATH#85 definition</b>		<b>Address: 078CH 078DH</b>	
Default:	0x00000000	Control mode:	PR	
Unit:	-	Setting range:	0x00000000 ~ 0xFFFFFFFF	
Format:	HEX	Data size:	32-bit	

Settings:

Please refer to the description of P6.002.

<b>P7.071</b>	<b>PATH#85 data</b>		<b>Address: 078EH 078FH</b>	
Default:	0	Control mode:	PR	
Unit:	-	Setting range:	-2147483648 ~ +2147483647	
Format:	DEC	Data size:	32-bit	

Settings:

Please refer to the description of P6.003.

<b>P7.072</b>	<b>PATH#86 definition</b>		<b>Address: 0790H 0791H</b>	
Default:	0x00000000	Control mode:	PR	
Unit:	-	Setting range:	0x00000000 ~ 0xFFFFFFFF	
Format:	HEX	Data size:	32-bit	

Settings:

Please refer to the description of P6.002.

<b>P7.073</b>	<b>PATH#86 data</b>		<b>Address: 0792H 0793H</b>	
Default:	0	Control mode:	PR	
Unit:	-	Setting range:	-2147483648 ~ +2147483647	
Format:	DEC	Data size:	32-bit	

Settings:

Please refer to the description of P6.003.

<b>P7.074</b>	<b>PATH#87 definition</b>		<b>Address: 0794H 0795H</b>	
Default:	0x00000000	Control mode:	PR	
Unit:	-	Setting range:	0x00000000 ~ 0xFFFFFFFF	
Format:	HEX	Data size:	32-bit	

Settings:

Please refer to the description of P6.002.

<b>P7.075</b>	<b>PATH#87 data</b>		<b>Address: 0796H 0797H</b>	
Default:	0	Control mode:	PR	
Unit:	-	Setting range:	-2147483648 ~ +2147483647	
Format:	DEC	Data size:	32-bit	

Settings:

Please refer to the description of P6.003.

<b>P7.076</b>	<b>PATH#88 definition</b>		<b>Address: 0798H 0799H</b>	
Default:	0x00000000	Control mode:	PR	
Unit:	-	Setting range:	0x00000000 ~ 0xFFFFFFFF	
Format:	HEX	Data size:	32-bit	

Settings:

Please refer to the description of P6.002.

<b>P7.077</b>	<b>PATH#88 data</b>		<b>Address: 079AH 079BH</b>	
Default:	0	Control mode:	PR	
Unit:	-	Setting range:	-2147483648 ~ +2147483647	
Format:	DEC	Data size:	32-bit	

Settings:

Please refer to the description of P6.003.

<b>P7.078</b>	<b>PATH#89 definition</b>		<b>Address: 079CH 079DH</b>	
Default:	0x00000000	Control mode:	PR	
Unit:	-	Setting range:	0x00000000 ~ 0xFFFFFFFF	
Format:	HEX	Data size:	32-bit	

Settings:

Please refer to the description of P6.002.

<b>P7.079</b>	<b>PATH#89 data</b>		<b>Address: 079EH 079FH</b>	
Default:	0	Control mode:	PR	
Unit:	-	Setting range:	-2147483648 ~ +2147483647	
Format:	DEC	Data size:	32-bit	

Settings:

Please refer to the description of P6.003.

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<b>P7.080</b>	<b>PATH#90 definition</b>		<b>Address: 07A0H 07A1H</b>	
Default:	0x00000000	Control mode:	PR	
Unit:	-	Setting range:	0x00000000 ~ 0xFFFFFFFF	
Format:	HEX	Data size:	32-bit	

Settings:

Please refer to the description of P6.002.

<b>P7.081</b>	<b>PATH#90 data</b>		<b>Address: 07A2H 07A3H</b>	
Default:	0	Control mode:	PR	
Unit:	-	Setting range:	-2147483648 ~ +2147483647	
Format:	DEC	Data size:	32-bit	

Settings:

Please refer to the description of P6.003.

<b>P7.082</b>	<b>PATH#91 definition</b>		<b>Address: 07A4H 07A5H</b>	
Default:	0x00000000	Control mode:	PR	
Unit:	-	Setting range:	0x00000000 ~ 0xFFFFFFFF	
Format:	HEX	Data size:	32-bit	

Settings:

Please refer to the description of P6.002.

<b>P7.083</b>	<b>PATH#91 data</b>		<b>Address: 07A6H 07A7H</b>	
Default:	0	Control mode:	PR	
Unit:	-	Setting range:	-2147483648 ~ +2147483647	
Format:	DEC	Data size:	32-bit	

Settings:

Please refer to the description of P6.003.

<b>P7.084</b>	<b>PATH#92 definition</b>		<b>Address: 07A8H 07A9H</b>	
Default:	0x00000000	Control mode:	PR	
Unit:	-	Setting range:	0x00000000 ~ 0xFFFFFFFF	
Format:	HEX	Data size:	32-bit	

Settings:

Please refer to the description of P6.002.

<b>P7.085</b>	<b>PATH#92 data</b>		<b>Address: 07AAH 07ABH</b>	
Default:	0	Control mode:	PR	
Unit:	-	Setting range:	-2147483648 ~ +2147483647	
Format:	DEC	Data size:	32-bit	

Settings:

Please refer to the description of P6.003.

<b>P7.086</b>	<b>PATH#93 definition</b>		<b>Address: 07ACH 07ADH</b>	
Default:	0x00000000	Control mode:	PR	
Unit:	-	Setting range:	0x00000000 ~ 0xFFFFFFFF	
Format:	HEX	Data size:	32-bit	

Settings:

Please refer to the description of P6.002.

<b>P7.087</b>	<b>PATH#93 data</b>		<b>Address: 07AEH 07AFH</b>	
Default:	0	Control mode:	PR	
Unit:	-	Setting range:	-2147483648 ~ +2147483647	
Format:	DEC	Data size:	32-bit	

Settings:

Please refer to the description of P6.003.

<b>P7.088</b>	<b>PATH#94 definition</b>		<b>Address: 07B0H 07B1H</b>	
Default:	0x00000000	Control mode:	PR	
Unit:	-	Setting range:	0x00000000 ~ 0xFFFFFFFF	
Format:	HEX	Data size:	32-bit	

Settings:

Please refer to the description of P6.002.

<b>P7.089</b>	<b>PATH#94 data</b>		<b>Address: 07B2H 07B3H</b>	
Default:	0	Control mode:	PR	
Unit:	-	Setting range:	-2147483648 ~ +2147483647	
Format:	DEC	Data size:	32-bit	

Settings:

Please refer to the description of P6.003.



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<b>P7.090</b>	<b>PATH#95 definition</b>		<b>Address: 07B4H 07B5H</b>	
Default:	0x00000000	Control mode:	PR	
Unit:	-	Setting range:	0x00000000 ~ 0xFFFFFFFF	
Format:	HEX	Data size:	32-bit	

Settings:

Please refer to the description of P6.002.

<b>P7.091</b>	<b>PATH#95 data</b>		<b>Address: 07B6H 07B7H</b>	
Default:	0	Control mode:	PR	
Unit:	-	Setting range:	-2147483648 ~ +2147483647	
Format:	DEC	Data size:	32-bit	

Settings:

Please refer to the description of P6.003.

<b>P7.092</b>	<b>PATH#96 definition</b>		<b>Address: 07B8H 07B9H</b>	
Default:	0x00000000	Control mode:	PR	
Unit:	-	Setting range:	0x00000000 ~ 0xFFFFFFFF	
Format:	HEX	Data size:	32-bit	

Settings:

Please refer to the description of P6.002.

<b>P7.093</b>	<b>PATH#96 data</b>		<b>Address: 07BAH 07BBH</b>	
Default:	0	Control mode:	PR	
Unit:	-	Setting range:	-2147483648 ~ +2147483647	
Format:	DEC	Data size:	32-bit	

Settings:

Please refer to the description of P6.003.

<b>P7.094</b>	<b>PATH#97 definition</b>		<b>Address: 07BCH 07BDH</b>	
Default:	0x00000000	Control mode:	PR	
Unit:	-	Setting range:	0x00000000 ~ 0xFFFFFFFF	
Format:	HEX	Data size:	32-bit	

Settings:

Please refer to the description of P6.002.

<b>P7.095</b>	<b>PATH#97 data</b>		<b>Address: 07BEH 07BFH</b>	
Default:	0	Control mode:	PR	
Unit:	-	Setting range:	-2147483648 ~ +2147483647	
Format:	DEC	Data size:	32-bit	

Settings:

Please refer to the description of P6.003.

<b>P7.096</b>	<b>PATH#98 definition</b>		<b>Address: 07C0H 07C1H</b>	
Default:	0x00000000	Control mode:	PR	
Unit:	-	Setting range:	0x00000000 ~ 0xFFFFFFFF	
Format:	HEX	Data size:	32-bit	

Settings:

Please refer to the description of P6.002.

<b>P7.097</b>	<b>PATH#98 data</b>		<b>Address: 07C2H 07C3H</b>	
Default:	0	Control mode:	PR	
Unit:	-	Setting range:	-2147483648 ~ +2147483647	
Format:	DEC	Data size:	32-bit	

Settings:

Please refer to the description of P6.003.

<b>P7.098</b>	<b>PATH#99 definition</b>		<b>Address: 07C4H 07C5H</b>	
Default:	0x00000000	Control mode:	PR	
Unit:	-	Setting range:	0x00000000 ~ 0xFFFFFFFF	
Format:	HEX	Data size:	32-bit	

Settings:

Please refer to the description of P6.002.

<b>P7.099</b>	<b>PATH#99 data</b>		<b>Address: 07C6H 07C7H</b>	
Default:	0	Control mode:	PR	
Unit:	-	Setting range:	-2147483648 ~ +2147483647	
Format:	DEC	Data size:	32-bit	

Settings:

Please refer to the description of P6.003.

Table 8.1 Description of digital input (DI)

Setting value: 0x01			
DI name	Description of digital input (DI)	Triggering method	Control mode
SON	When this DI is on, servo is activated (Servo On).	Level triggered	ALL

Setting value: 0x02			
DI name	Description of digital input (DI)	Triggering method	Control mode
ARST	After the alarm has been cleared, the drive will show that the alarm has been cleared when this DI is on.	Rising-edge triggered	ALL

Setting value: 0x03			
DI name	Description of digital input (DI)	Triggering method	Control mode
GAINUP	In speed and position mode, when this DI is on (P2.027 set to 1), the gain will switch to the original gain multiply the switching rate.	Level triggered	PT, PR, S

Setting value: 0x04			
DI name	Description of digital input (DI)	Triggering method	Control mode
CCLR	Clear pulse counter and setting of parameter P2.050. Set DI.CCLR to 0 to clear position pulse deviation (applicable to PT mode). When this DI is on, the accumulative pulse deviation of the drive will be cleared to 0.	Rising-edge triggered, level triggered	PT, PR

Setting value: 0x05			
DI name	Description of digital input (DI)	Triggering method	Control mode
ZCLAMP	<p>When the speed is slower than the setting of zero speed (P1.038), motor stops operating when this DI is on.</p> <p>Speed command</p> <p>Setting value of P1.038 (zero speed)</p> <p>ZCLAMP input signal</p> <p>OFF</p> <p>ON</p> <p>Motor speed</p> <p>Setting value of P1.038 (zero speed)</p> <p>Time</p>	Level triggered	S

Setting value: 0x06			
DI name	Description of digital input (DI)	Triggering method	Control mode
CMDINV	In speed mode, input command will be set to reverse direction when this DI is on.	Level triggered	S, T

Setting value: 0x08			
DI name	Description of digital input (DI)	Triggering method	Control mode
CTRG	In PR mode, after selecting the PR command (POS0 ~ 6), motor will operate according to the command issued by the register when this DI is on.	Rising-edge triggered	PR

**Setting value: 0x09**

DI name	Description of digital input (DI)	Triggering method	Control mode
TRQLM	In speed and position mode, motor torque will be limited when this DI is on, and source of the torque limit command will be the internal register or analog voltage.	Level triggered	PT, PR, S

**Setting value: 0x0A**

DI name	Description of digital input (DI)	Triggering method	Control mode
CTRY	After this DI is on, it will temporarily disable the monitoring function of gantry (synchronous motion) when P1.074 = 2 (gantry function enabled). The axis that receives this DI will stop calculating or monitoring the deviation of the two axes.	Rising-edge triggered	PT

**Setting value: 0x0C**

DI name	Description of digital input (DI)	Triggering method	Control mode
VPL	<p>Latch function of analog position command. If this DI is on, position of the motor will be held at the current position when DI is triggered. During DI on, the motor will not operate even when there is a change of analog command. When this DI is off, the motor will complete the command that is changed during the time when DI is on.</p>	Level triggered	PT

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Setting value: 0x0D			
DI name	Description of digital input (DI)	Triggering method	Control mode
VPL	<p>Clear function of analog position command. If this DI is on, position of the motor will be held at the current position when DI is triggered. Despite the change of analog command during DI on, the motor will remain at the current position even when the DI is off. However, the position that the motor remains at will correspond to the new analog command. Thus, the analog input command will redefine the coordinate system of the motor.</p> <p>When DI is off, motor is still, but its coordinate will be redefined</p> <p>Motor position (Turn)</p> <p>Motor position when DI is triggered</p> <p>Voltage when DI is triggered</p> <p>When DI is on, all input command is cleared</p> <p>Analog input command (V)</p>	Level triggered	PT

Setting value: 0x10			
DI name	Description of digital input (DI)	Triggering method	Control mode
SPDLM	In torque mode, motor speed will be limited when this DI is on, and the limited speed command will be the internal register or analog voltage command.	Level triggered	T

Setting value: 0x11, 0x12, 0x13, 0x1A, 0x1B, 0x1C, 0x1E										
DI name	Description of digital input (DI)								Triggering method	Control mode
POS0 POS1 POS2 POS3 POS4 POS5 POS6	PR command selection (1 ~ 99)									
	Position command	POS 6	POS 5	POS 4	POS 3	POS 2	POS 1	POS 0	CTRG	Corresponding parameter
	Homing	0	0	0	0	0	0	0	↑	P6.000 P6.001
	PR 1	0	0	0	0	0	0	1	↑	P6.002 P6.003
	~									
	PR 50	0	1	1	0	0	1	0	↑	P6.098 P6.099
	PR 51	0	1	1	0	0	1	1	↑	P7.000 P7.001
	~									
	PR 99	1	1	0	0	0	1	1	↑	P7.098 P7.099

Setting value: 0x1D			
DI name	Description of digital input (DI)	Triggering method	Control mode
ABSE	When DI.ABSE is on, it is in absolute mode and can enable the functions of DI.ABSQ, DI.ABSC, DI.ABSR, DI.ABSD, and DI.ABSC at the same time. When DI.ABSE is on, the functions of DI4, DO2, and DO3 will no longer be the ones assigned by the parameter. Function of DI4 will be DI.ASDQ, DO2 will be DI.ABSR, and DO3 will be DI.ABSD. In addition, DI pins of DI.ABSC can be assigned by parameters.	Level triggered	All

Setting value: 0x1F			
DI name	Description of digital input (DI)	Triggering method	Control mode
ABSC	When DI.ABSC is on, number of turns data stored in absolute encoder will be cleared. But this DI is only valid when DI.ABSE is on.	Rising-edge triggered	All

Setting value: When DI.ABSE is on, the DI.ABSQ inputted by DI4 will replace the DI4 function assigned by P2.013			
DI name	Description of digital input (DI)	Triggering method	Control mode
ABSQ always inputted by DI4	During I/O transmission, handshaking signal will be sent by the controller. When DI.ABSQ is off, it indicates the controller issues the request; when DI.ABSQ is on, it indicates the controller has processed the ABSQ signal. This DI is only valid when DI.ABSE is on. Please refer to diagram 10.3.4 for detailed description.	Rising- and falling-edge triggered	All

Setting value: 0x14, 0x15										
DI name	Description of digital input (DI)						Triggering method	Control mode		
SPD0 SPD1	Register speed command selection (1 ~ 4)							Level triggered	S	
	Speed command number	DI signal of CN1		Command source		Content	Range			
		SPD1	SPD0	Mode	Sz	N/A	Speed command is 0			0
	S2	0	1	Register parameter		P1.009	+/- 6000 rpm (rotary) +/- 15999999 (linear)			
	S3	1	0			P1.010	+/- 6000 rpm (rotary) +/- 15999999 (linear)			
S4	1	1	P1.011			+/- 6000 rpm (rotary) +/- 15999999 (linear)				
Note: Rotary is the abbreviation for permanent-magnet synchronous rotary motor; linear is the abbreviation for permanent-magnet synchronous linear motor										

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Setting value: 0x16, 0x17								
DI name	Description of digital input (DI)						Triggering method	Control mode
TCM0 TCM1	Register torque command selection (1 ~ 4)							
	Torque command number	DI signal of CN1		Command source			Content	Range
		TCM1	TCM0					
	T1	0	0	Mode	Tz	N/A	Torque command is 0	0
	T2	0	1	Register parameter			P1.012	+/- 300%
T3	1	0	P1.013				+/- 300%	
T4	1	1	P1.014				+/- 300%	
						Level triggered	T	

Setting value: 0x18				
DI name	Description of digital input (DI)		Triggering method	Control mode
S-P	In position and speed mode, if DI is off, it is in speed mode; if DI is on, it is in position mode. (In PT / PR / S mode, PT or PR are selected via DI.PT-PR (0x2B).)		Level triggered	Dual mode

Setting value: 0x19				
DI name	Description of digital input (DI)		Triggering method	Control mode
S-T	In speed and torque mode, if DI is off, it is in speed mode; if DI is on, it is in torque mode.		Level triggered	Dual mode

Setting value: 0x20				
DI name	Description of digital input (DI)		Triggering method	Control mode
T-P	In position and torque mode, if DI is off, it is in torque mode; if DI is on, it is in position mode. (In PT / PR / T mode, PT or PR are selected via DI.PT-PR (0x2B).)		Level triggered	Dual mode

Setting value: 0x21				
DI name	Description of digital input (DI)		Triggering method	Control mode
EMGS	When this DI is on, motor stops urgently.		Level triggered	All

Setting value: 0x22				
DI name	Description of digital input (DI)		Triggering method	Control mode
NL (CWL)	Reverse inhibit limit (contact b)		Level triggered	All

Setting value: 0x23				
DI name	Description of digital input (DI)		Triggering method	Control mode
PL (CCWL)	Forward inhibit limit (contact b)		Level triggered	All

Setting value: 0x24				
DI name	Description of digital input (DI)		Triggering method	Control mode
ORGP	During homing, servo will regard the position when this DI is triggered as the homing origin. (Please refer to the setting of P5.004.)		Rising- and falling-edge triggered	PR

Setting value: 0x27				
DI name	Description of digital input (DI)		Triggering method	Control mode
SHOM	During homing, function of searching the origin will be activated when this DI is on. (Please refer to the setting of P5.004.)		Rising-edge triggered	PR

Setting value: 0x2B			
DI name	Description of digital input (DI)	Triggering method	Control mode
PT-PR	When selecting PT-PR dual mode or PT-PR-S multiple mode, command source can be selected via this DI. If this DI is off, it is in PT mode; if this DI is on, it is in PR mode.	Level triggered	Dual mode

Setting value: 0x35			
DI name	Description of digital input (DI)	Triggering method	Control mode
ALGN	When E-Cam alignment function is enabled (P2.076.bit0 = 1 & P2.076.bit1 = 1), it will execute alignment correction once this DI is on.	Rising-edge triggered	PR

Setting value: 0x36			
DI name	Description of digital input (DI)	Triggering method	Control mode
CAM	E-Cam engaging control (Please refer to the setting of P5.088 U, Z value).	Rising- and falling-edge triggered	PR

Setting value: 0x37			
DI name	Description of digital input (DI)	Triggering method	Control mode
JOGU	When this DI is on, motor will jog in forward direction.	Level triggered	All

Setting value: 0x38			
DI name	Description of digital input (DI)	Triggering method	Control mode
JOGD	When this DI is on, motor will jog in reverse direction.	Level triggered	All

Setting value: 0x39			
DI name	Description of digital input (DI)	Triggering method	Control mode
EV1	Event trigger command #1 (Please refer to the setting of P5.098 and P5.099).	Rising- and falling-edge triggered	PR

Setting value: 0x3A			
DI name	Description of digital input (DI)	Triggering method	Control mode
EV2	Event trigger command #2 (Please refer to the setting of P5.098 and P5.099).	Rising- and falling-edge triggered	PR

Setting value: 0x3B			
DI name	Description of digital input (DI)	Triggering method	Control mode
EV3	Event trigger command #3 (Please refer to the setting of P5.098 and P5.099).	Rising- and falling-edge triggered	PR

Setting value: 0x3C			
DI name	Description of digital input (DI)	Triggering method	Control mode
EV4	Event trigger command #4 (Please refer to the setting of P5.098 and P5.099).	Rising- and falling-edge triggered	PR



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Setting value: 0x43, 0x44			
DI name	Description of digital input (DI)	Triggering method	Control mode
GNUM0 GNUM1	<p>E-Gear ratio (Numerator) selection 0 E-Gear ratio (Numerator) selection 1 GNUM0, GNUM1</p>	Level triggered	PT

Setting value: 0x45			
DI name	Description of digital input (DI)	Triggering method	Control mode
INHP	In position mode, external pulse input command has no function when this DI is on. (Note: This function has to be set to DI8 to ensure the instantaneity of pulse inhibition)	Level triggered	PT

Setting value: 0x46			
DI name	Description of digital input (DI)	Triggering method	Control mode
STP	Motor stops.	Rising-edge triggered	PR

Setting value: 0x47			
DI name	Description of digital input (DI)	Triggering method	Control mode
PFQS	This DI is used to set the emergency stop of deceleration time. The setting of deceleration time is same as P5.003. If this DI is triggered, AL35F will occur and the motor will start decelerating. When the speed reaches 0, AL3CF will occur and servo is off. Please reset alarm to switch the drive to servo on state.	Rising-edge triggered	PT, PR, T, S

Note: When P2.010 ~ P2.017, P2.036 ~ P2.040 are set to 0, input function is disabled.

**Table 8.2 Description of digital output (DO)**

Setting value: 0x01			
DO name	Description of digital output (DO)	Triggering method	Control mode
SRDY	When the control and main circuit power is applied to the drive, this DO is on if no alarm occurs.	Level triggered	All
Setting value: 0x02			
DO name	Description of digital output (DO)	Triggering method	Control mode
SON	<p>When the servo is activated (Servo On), this DO is on if no alarm occurs.</p> <p>When servo is on as soon as power is applied, the time difference between DO.SRDY and DO.SON</p> <p>DO.SRDY OFF ON</p> <p>DO.SON OFF ON</p> <p>Approx. 300 ns</p>	Level triggered	All
Setting value: 0x03			
DO name	Description of digital output (DO)	Triggering method	Control mode
ZSPD	When the motor speed is slower than the setting of zero speed (P1.038), this DO is on.	Level triggered	All
Setting value: 0x04			
DO name	Description of digital output (DO)	Triggering method	Control mode
TSPD	When the motor speed is faster than the target speed setting (P1.039), this DO is on.	Level triggered	All
Setting value: 0x05			
DO name	Description of digital output (DO)	Triggering method	Control mode
TPOS	When the deviation pulse number is smaller than the position range setting (setting value of P1.054), this DO is on.	Level triggered	PT, PR
Setting value: 0x06			
DO name	Description of digital output (DO)	Triggering method	Control mode
TQL	When it is in torque limit, this DO is on.	Level triggered	All (Except for T and Tz)
Setting value: 0x07			
DO name	Description of digital output (DO)	Triggering method	Control mode
ALRM	When an alarm occurs, this DO is on. (Except for forward / reverse limit, communication error, undervoltage, and fan error)	Level triggered	All

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Setting value: 0x08			
DO name	Description of digital output (DO)	Triggering method	Control mode
BRKR	<p>When the signal of magnetic brake control is outputted, please adjust the settings of parameters P1.042 and P1.043.</p>	Level triggered	All

Setting value: 0x09			
DO name	Description of digital output (DO)	Triggering method	Control mode
HOME	<p>When homing is completed, it means the position coordinate system and position counter are defined and this DO is on. When applying to power, this DO is off; when homing is completed, this DO is on. During operation, this DO is on until the position counter overflows (including command or feedback). Then, this DO turns off. When homing command is triggered, this DO is off; after homing is completed, this DO is on.</p>	Level triggered	PR

Setting value: 0x0D			
DO name	Description of digital output (DO)	Triggering method	Control mode
ABSW	When there are alarms regarding the absolute encoder, this DO is on.	-	All

Setting value: 0x0E			
DO name	Description of digital output (DO)	Triggering method	Control mode
IDXD	Indexing coordinate is defined. When homing is completed, indexing coordinate is defined as well.	-	PR

Setting value: 0x10			
DO name	Description of digital output (DO)	Triggering method	Control mode
OLW	<p>This DO is on when the overload level setting is reached.  <math>t_{OL}</math> = Overload allowable time of the servo x Setting of overload warning level (P1.056). When the overload accumulative time exceeds <math>t_{OL}</math>, it will output overload pre-warning (OLW). However, if the overload accumulative time exceeds the overload allowable time of the servo, it will output overload error (ALRM).                      For example: The setting value of overload pre-warning is 60%. (P1.056 = 60)                      When the output average load of the servo drive is 200% and the output time exceeds 8 seconds, the overload alarm (AL006) will occur.  <math>t_{OL}</math> = Duration of the output average load of the servo is 200% x Parameter setting of overload warning level = 8 sec x 60% = 4.8 sec                      Result: When the output average load of the servo drive is 200% for over <math>t_{OL}</math> = 4.8 seconds, this overload warning DO is on (DO code is set to 10). If the duration exceeds 8 seconds, then the overload alarm (AL006) occurs and will output overload error (ALRM).</p>	Level triggered	All

Setting value: 0x11			
DO name	Description of digital output (DO)	Triggering method	Control mode
WARN	Warning outputs (forward / reverse limit, communication error, undervoltage, and fan error).	Level triggered	All

Setting value: 0x12			
DO name	Description of digital output (DO)	Triggering method	Control mode
OVF	Position command / feedback overflows.	Level triggered	PT, PR

Setting value: 0x13			
DO name	Description of digital output (DO)	Triggering method	Control mode
SNL (SCWL)	Software limit (reverse limit).	Level triggered	PR

Setting value: 0x14			
DO name	Description of digital output (DO)	Triggering method	Control mode
SPL (SCCWL)	Software limit (forward limit).	Level triggered	PR

Setting value: 0x15			
DO name	Description of digital output (DO)	Triggering method	Control mode
Cmd_OK	When position command is completed and entered DMCNET mode, this DO is on. When the position command is executing, this DO is off; after the command is completed, this DO is on. This DO only indicates the command is completed, but the motor positioning may not be completed yet. Please refer to DO.TPOS.	Level triggered	PR

Setting value: 0x16			
DO name	Description of digital output (DO)	Triggering method	Control mode
CAP_OK	Capture procedure is completed.	Level triggered	All

Setting value: 0x17			
DO name	Description of digital output (DO)	Triggering method	Control mode
MC_OK	When DO.Cmd_OK and DO.TPOS are both on, then this DO is on. Please refer to P1.048.	Level triggered	PR

Setting value: 0x18			
DO name	Description of digital output (DO)	Triggering method	Control mode
CAM_AREA	Master position of the E-Cam locates in the setting area.	Level triggered	PR

Setting value: 0x19			
DO name	Description of digital output (DO)	Triggering method	Control mode
SP_OK	Motor speed reaches target speed: In speed mode, when the deviation between the speed feedback and the command is smaller than the setting value of P1.047, this DO is on.	Level triggered	S, Sz

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Setting value: 0x2C			
DO name	Description of digital output (DO)	Triggering method	Control mode
Zon1	When the value of the item monitored by P0.009 ranges between the setting value of P0.054 and P0.055, then this DO is on.	-	All

Setting value: When DI.ABSE is on, DI.ABSR triggered by DO2 will replace the DO2 assigned by P2.019			
DO name	Description of digital output (DO)	Triggering method	Control mode
ABSR always outputted by DO2	When DO.ABSR is off, it indicates servo drive can receive request issued by DI.ABSQ; when DO.ABSR is on, it indicates after receiving the request, the data has been prepared and the ABSD data is valid so that the controller can access the ABSD data. This output is only valid when DI.ABSE is on. Please refer to diagram 10.3.6. for detailed description.	Level triggered	All

Setting value: When DI.ABSE is on, DI.ABSD triggered by DO3 will replace the DO3 assigned by P2.020			
DO name	Description of digital output (DO)	Triggering method	Control mode
ABSD always outputted by DO3	DO pin of ABS data. The data is valid when DO.ABSR is on. This output is only valid when DI.ABSE is on. Please refer to diagram 10.3.6.1 for detailed description.	Level triggered	All

Setting value: 0x30			
DO name	Description of digital output (DO)	Triggering method	Control mode
SPO_0	Output bit 00 of P4.006.	Level triggered	All

Setting value: 0x31			
DO name	Description of digital output (DO)	Triggering method	Control mode
SPO_1	Output bit 01 of P4.006.	Level triggered	All

Setting value: 0x32			
DO name	Description of digital output (DO)	Triggering method	Control mode
SPO_2	Output bit 02 of P4.006.	Level triggered	All

Setting value: 0x33			
DO name	Description of digital output (DO)	Triggering method	Control mode
SPO_3	Output bit 03 of P4.006.	Level triggered	All

Setting value: 0x34			
DO name	Description of digital output (DO)	Triggering method	Control mode
SPO_4	Output bit 04 of P4.006.	Level triggered	All

Setting value: 0x35			
DO name	Description of digital output (DO)	Triggering method	Control mode
SPO_5	Output bit 05 of P4.006.	Level triggered	All

Setting value: 0x36			
DO name	Description of digital output (DO)	Triggering method	Control mode
SPO_6	Output bit 06 of P4.006.	Level triggered	All

Setting value: 0x37			
DO name	Description of digital output (DO)	Triggering method	Control mode
SPO_7	Output bit 07 of P4.006.	Level triggered	All

Setting value: 0x38			
DO name	Description of digital output (DO)	Triggering method	Control mode
SPO_8	Output bit 08 of P4.006.	Level triggered	All

Setting value: 0x39			
DO name	Description of digital output (DO)	Triggering method	Control mode
SPO_9	Output bit 09 of P4.006.	Level triggered	All

Setting value: 0x3A			
DO name	Description of digital output (DO)	Triggering method	Control mode
SPO_A	Output bit 10 of P4.006.	Level triggered	All

Setting value: 0x3B			
DO name	Description of digital output (DO)	Triggering method	Control mode
SPO_B	Output bit 11 of P4.006.	Level triggered	All

Setting value: 0x3C			
DO name	Description of digital output (DO)	Triggering method	Control mode
SPO_C	Output bit 12 of P4.006.	Level triggered	All

Setting value: 0x3D			
DO name	Description of digital output (DO)	Triggering method	Control mode
SPO_D	Output bit 13 of P4.006.	Level triggered	All

Setting value: 0x3E			
DO name	Description of digital output (DO)	Triggering method	Control mode
SPO_E	Output bit 14 of P4.006.	Level triggered	All

Setting value: 0x3F			
DO name	Description of digital output (DO)	Triggering method	Control mode
SPO_F	Output bit 15 of P4.006.	Level triggered	All

Note: When P2.018 ~ P2.022 are set to 0, output function is disabled.

**Table 8.3 Description of monitoring variables**

Description of monitoring variables:

Item	Description
Monitoring code	Each monitoring variable has a code, and users can use P0.002 to set the code and monitor the variable.
Format	Each monitoring variable is stored in the 32-bit format (long integer) of the drive.
Category	Basic variables / expansion variables: 1. Basic variables: Variables (P0.002 = 0 ~ 26) within the cycle; in monitoring mode, the variables that can be found by using the UP / DOWN keys on the panel. 2. Expansion variables: Variables other than basic variables. (P0.002 = 27 ~ 127)
Monitoring method	Panel display / mapping: 1. Panel display: Monitor via panel 2. Mapping: Monitor variables or parameters via mapping parameters
Panel display	1. Use the MODE key to switch to the monitor mode and press the UP / DOWN keys to select the variable to be monitored. 2. Input the variable code to be monitored into P0.002 and start monitoring. Press the SHIFT key on the panel to switch between high and low digit display; Press the SET key on the panel to switch between decimal and hexadecimal display.
Mapping	1. Parameters that support monitoring variable mapping: For the operation of P0.009 ~ P0.013, please refer to Section 8.3 Description of parameters. 2. By using the mapping parameters, monitoring variables can be read by the communication. 3. The value of the mapping parameter (P0.009 ~ P0.013) is the content of the basic variables (17h, 18h, 19h, 1Ah). To monitor P0.009, set P0.017 to the status value to read (please refer to P0.002); users may read the data specified by P0.017 via communication or monitor panel (set P0.002 to 23). When the panel displays "VAR-1", it indicates the content value of P0.009.

The property code of each monitoring variable is described as follows:

Property	Description
<b>B</b>	BASE: Basic variables, can be selected via the UP / DOWN keys on the panel.
<b>D1 D2</b>	Decimal place displayed on panel: <b>D1</b> indicates display 1 decimal place, <b>D2</b> indicates display 2 decimal places.
<b>Dec</b>	Only decimal display is available on the panel, and it is unable to switch to hexadecimal display by pressing the SET key.
<b>Hex</b>	Only hexadecimal display is available on the panel, and it is unable to switch to decimal display by pressing the SET key.

Monitoring variables are described in the following according to the code sequence:

Code	Variable name / property	Description
000 (00h)	Feedback position (PUU) <b>B</b>	Current feedback position of the motor encoder. Unit: Pulse of User Unit (PUU).
001 (01h)	Position command (PUU) <b>B</b>	Current coordinate of position command. Unit: Pulse of User Unit (PUU). PT mode: Number of pulse commands received by the drive. PR mode: Absolute coordinates of the position command.
002 (02h)	Position deviation (PUU) <b>B</b>	Deviation between position command and feedback position. Unit: Pulse of User Unit (PUU).
003 (03h)	Feedback position (pulse) <b>B</b>	Current feedback position of the motor encoder. Unit: Encoder unit (pulse).
004 (04h)	Position command (pulse) <b>B</b>	Current coordinate of position command. Unit: Encoder unit (pulse). That is, the command after passing E-Gear.
005 (05h)	Position deviation (pulse) <b>B</b>	Deviation between position command and feedback position. Unit: Encoder unit (pulse).
006 (06h)	Pulse command frequency <b>B</b>	Frequency of pulse command received by the drive. Unit: Kpps. Applicable to PT / PR mode.

Code	Variable name / property	Description
007 (07h)	Speed feedback B D1 Dec	Current motor speed. Unit: 0.1 rpm. This value has gone through low-pass filter which is more stable.
008 (08h)	Speed command (analog) B D2 Dec	Speed command inputted via analog channel. Unit: 0.01 Volt.
009 (09h)	Speed command (integrated) B	Integrated speed command. Unit: 1 rpm. Source includes analog, register, or position loop.
010 (0Ah)	Torque command (analog) B D2 Dec	Torque command inputted via analog channel. Unit: 0.01 Volt.
011 (0Bh)	Torque command (integrated) B	Integrated torque command. Unit: percentage (%). Source includes analog, register, or speed loop.
012 (0Ch)	Average load rate B	Average load rate outputted by the drive. Unit: percentage (%).
013 (0Dh)	Peak load rate B	Max. load rate outputted by the drive. Unit: percentage (%).
014 (0Eh)	DC Bus voltage B	Rectified capacitor voltage. Unit: Volt.
015 (0Fh)	Load inertia ratio B D1 Dec	Ratio of the load inertia to the motor inertia. Unit: 0.1 times.
016 (10h)	IGBT temperature B	Temperature of IGBT. Unit: ° C .
017 (11h)	Resonance frequency B Dec	Resonance frequency of the system consists of two groups of frequencies: F1 and F2 When monitoring from the panel, press the SHF key to switch between F1 and F2: F2 displays zero decimal places, F1 displays 1 decimal place. When reading by communication (mapping parameter): Low word displays frequency F2. High word displays frequency F1.
018 (12h)	Z phase offset B Dec	Offset value between motor position and Z phase, range: -5000 ~ +5000. Where it overlaps with Z phase, the value is 0; the greater the value, the greater the offset.
019 (13h)	Mapping parameter content #1 B	Return to the value of P0.025 which is mapped by P0.035.
020 (14h)	Mapping parameter content #2 B	Return to the value of P0.026 which is mapped by P0.036.
021 (15h)	Mapping parameter content #3 B	Return to the value of P0.027 which is mapped by P0.037.
022 (16h)	Mapping parameter content #4 B	Return to the value of P0.028 which is mapped by P0.038.
023 (17h)	Mapping monitoring variable #1 B	Return to the value of P0.009 which is mapped by P0.017.
024 (18h)	Mapping monitoring variable #2 B	Return to the value of P0.020 which is mapped by P0.018.
025 (19h)	Mapping monitoring variable #3 B	Return to the value of P0.011 which is mapped by P0.019.
026 (1Ah)	Mapping monitoring variable #4 B	Return to the value of P0.012 which is mapped by P0.020.
028 (1Ch)	Alarm code	Alarm code in DMCNET mode. (Applicable to A3-F)
029 (1Dh)	Auxiliary encoder feedback (PUU)	Position feedback inputted by the auxiliary encoder (CN5). (Applicable to A3-F)



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Code	Variable name / property	Description
030 (1Eh)	Auxiliary encoder position deviation (PUU)	Position deviation between the position feedback and command of the auxiliary encoder (CN5). (Applicable to A3-F)
031 (1Fh)	Main / auxiliary encoder position deviation (PUU)	Feedback position deviation between main encoder and auxiliary encoder. (Applicable to A3-F)
035 (23h)	Indexing coordinate command	Current command of the indexing coordinates. Unit: Pulse of User Unit (PUU).
037 (25h)	Compare data of COMPARE	The actual compare data is the COMPARE data plus a specified value: $CMP\_DATA = DATA\_ARRAY[*] + P1.023 + P1.024$ .
038 (26h)	Voltage level of the battery	Voltage level of the battery in an absolute encoder. To display the voltage level, the absolute encoder setting (P2.069) must be enabled.
039 (27h)	DI status (Integrated) Hex	Integrated DI status of the drive. Each bit corresponds to one DI channel. Source includes: Hardware channel / P4.007 which is determined by P3.006.
040 (28h)	DO status (Hardware) Hex	Actual status outputted by the DO hardware. Each bit corresponds to one DI channel.
041 (29h)	Status of the drive	Return P0.046. Please refer to the description of this parameter.
043 (2Bh)	CAP data capturing	The latest data captured by CAP hardware. Note: CAP could continuously capture multiple points.
048 (30h)	Auxiliary encoder CNT	Pulse counts inputted by the auxiliary encoder (CN5).
049 (31h)	Pulse command CNT	Pulse counts inputted by the pulse command (CN1).
050 (32h)	Speed command (integrated) D1 Dec	Integrated speed command. Unit: 0.1 rpm. Source includes analog, register, or position loop.
051 (33h)	Speed feedback (immediate) D1 Dec	Current actual motor speed. Unit: 0.1 rpm.
053 (35h)	Torque command (integrated) D1 Dec	Integrated torque command. Unit: 0.1%. Source includes analog, register, or speed loop.
054 (36h)	Torque feedback D1 Dec	Current actual motor torque. Unit: 0.1%.
055 (37h)	Current feedback D2 Dec	Current actual motor current. Unit: 0.01 ampere (Amp).
056 (38h)	DC Bus voltage D1 Dec	Rectified capacitor voltage. Unit: 0.1 Volt.
059 (3Bh)	Pulse of E-Cam master axis (accumulative)	Accumulative pulse number of E-Cam master axis. Same as P5.086. A3-L does not support E-Cam function.
060 (3Ch)	Pulse of E-Cam master axis (incremental)	Incremental pulse number of E-Cam master axis. The increment per ms. A3-L does not support E-Cam function.
061 (3Dh)	Pulse of E-Cam master axis (lead pulse)	The lead pulse of E-Cam master axis which is used to determine the engaging condition. When disengaged: lead pulse = P5.087 or P5.092; when the value is 0, E-Cam will engage. When engaged: lead pulse = P5.089; when the value is 0, it will disengage. A3-L does not support E-Cam function.
062 (3Eh)	Position of E-Cam master axis	Position of the E-Cam which represents the master axis pulse, and can be used to observe the phase of the E-cam. Unit: Same as the master axis pulse; when the incremental pulse number of the master axis is P, E-Cam will rotate M cycles ( $P5.083 = M$ , $P5.084 = P$ ). A3-L does not support E-Cam function.

Code	Variable name / property	Description
063 (3Fh)	Position of E-Cam slave axis	Position of the E-Cam slave axis and can be observed from the E-Cam table. Unit: PUU A3-L does not support E-Cam function.
064 (40h)	Endpoint register of PR command	In PR mode, the endpoint of position command (Cmd_E).
065 (41h)	Output register of PR command	In PR mode, the accumulative output of position command.
067 (43h)	PR target speed	Target speed specified in the PR path. Unit: PPS (Pulse Per Second).
072 (48h)	Speed command (analog) B D1 Dec	Speed command inputted via analog channel. Unit: 0.1 rpm.
081 (51h)	Capture synchronous axis Incremental pulse input	When capture synchronous axis is enabled, the received pulse number between two captures can be used to measure the actual distance of Mark.
084 (54h)	Capture synchronous axis Pulse number of synchronous deviation	When capture synchronous axis is enabled, the accumulative deviation between the actual output pulse and the target pulse. If synchronization is reached, this value is close to 0.
091 (5Bh)	Indexing coordinate feedback	Immediate feedback position of the indexing coordinates. Unit: Pulse of User Unit (PUU).
096 (60h)	Drive firmware version Dec	Includes 2 versions: DSP and CPLD When monitoring from the panel, press the SHF key to switch between DSP and CPLD: DSP displays zero decimal places, CPLD displays 1 decimal place. When reading by communication (mapping parameter): Low word returns DSP version number. High word returns CPLD version number.
111 (6Fh)	Error code of the servo drive	Error code of the servo drive: Control loop of the servo only, not including the motion controller.
112 (70h)	CANopen SYNC TS (unfiltered)	The time the servo drive receives SYNC signal (TimeStamp) Unit: usec
113 (71h)	CANopen SYNC TS (filtered)	The time the servo drive receives SYNC signal and has gone through low-pass filter. Unit: usec
116 (74h)	Deviation between position and Z phase of auxiliary encoder (pulse)	Deviation between the current position of auxiliary encoder and Z phase position of auxiliary encoder. (Applicable to A3-F)
120 (78h)	Communication error rate	When this value continues to accumulate, it indicates that the communication is interfered. In an interference-free environment, this value should be a fixed value.
123 (7Bh)	Value returned when monitoring by panel	Monitoring value displayed when returned to the monitoring panel.

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8

# MODBUS Communication

# 9

This chapter provides description of MODBUS which is used for setting, reading and writing general parameters via communication. For motion control network, please refer to the related documentations of DMCNET, CANopen and EtherCAT. Information about structures of ASCII, RTU and TCP mode is also provided in this chapter.

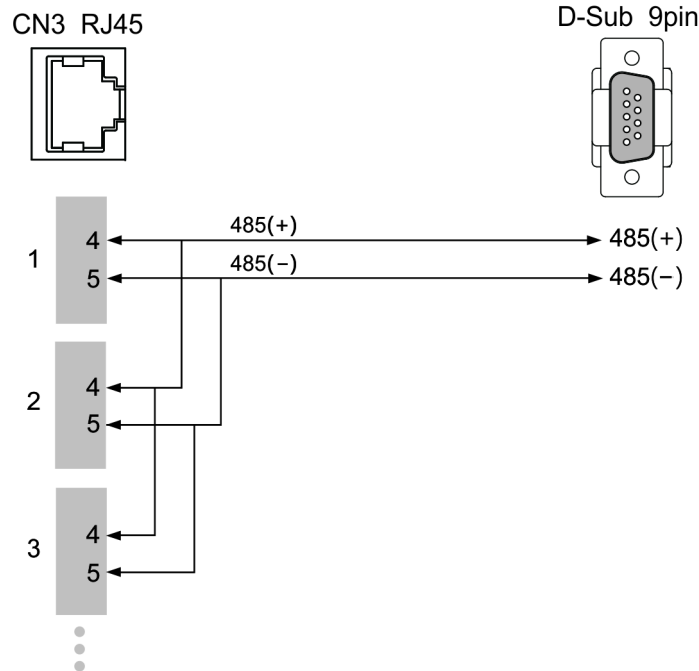
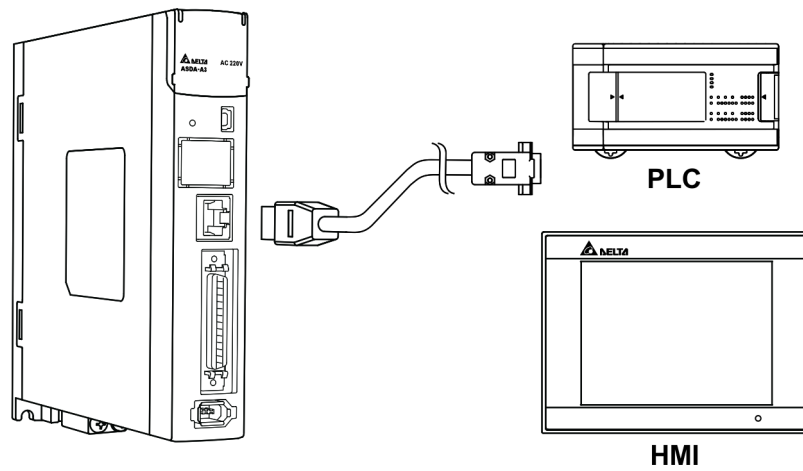
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### 9.1 RS-485 communication interface (hardware)

ASDA-A3 series servo drive supports RS-485 serial communication which can be used to access and change parameters of the servo system. See the description of wiring as follows:



Note:

1. The cable length should be 100 meters when the servo drive is installed in less-noise environment. If the transmission speed is over 38400 bps, it is suggested to use 15 meters cable to ensure data transmission accuracy.
2. Numbers on the above figure represent the pin number of each connector.
3. Please apply 12 V<sub>DC</sub> for the power supply.
4. When using RS-485 communication, it can connect up to 32 servo drives. To connect more servo drives, repeater can be installed to expand the connected servo drive numbers up to 127.
5. Please refer to Chapter 3, Wiring for CN3 pin assignment.

## 9.2 RS-485 communication parameters setting

The must-set parameters for one servo drive connection are: P3.000 (Address setting), P3.001 (Transmission speed) and P3.002 (Communication protocol). P3.003 (Communication error disposal), P3.004 (Communication timeout setting), P3.006 (Control switch of digital input (DI) and P3.007 (Communication delay time) are optional settings.

Relevant parameters: Please refer to Chapter 8 for detailed description.

Parameter	Function
P3.000	Address setting
P3.001	Transmission speed
P3.002	Communication protocol

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### 9.3 MODBUS communication protocol

There are two modes of MODBUS network communication: ASCII (American Standard Code for Information Interchange) and RTU (Remote Terminal Unit). Users could set all communication protocol (ASCII and RTU) via P3.002. ASDA-A3 servo drive also supports functions of accessing data (03H), writing one character (06H) and writing multiple characters (10H). Please refer to the following descriptions.

**Code Description**

**ASCII mode:**

In ASCII mode, data are transmitted in ASCII (American Standard Code for Information Interchange) format. For instance, when transmitting data 64H between two stations (Master and Slave), the master will send 36H to represent “6” and 34H to represent “4”.

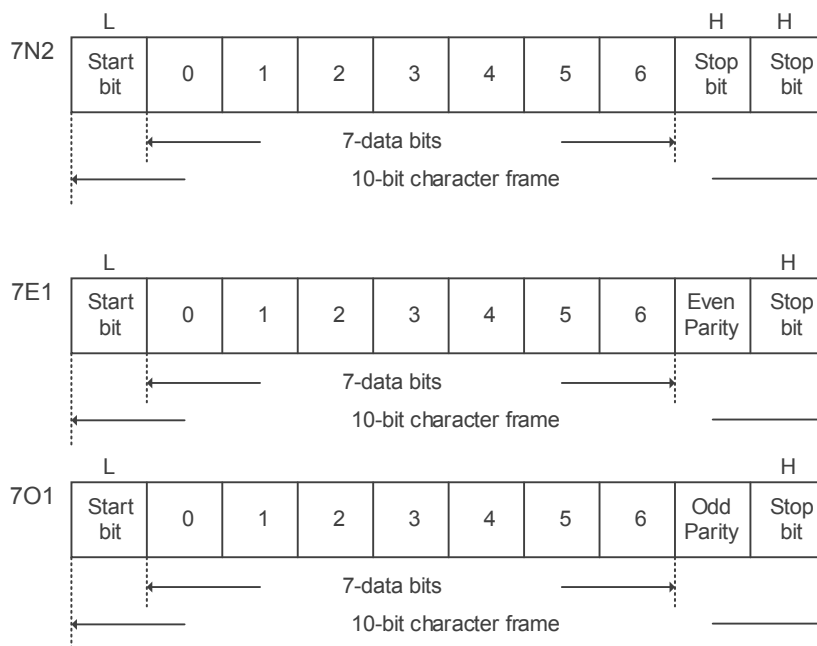
ASCII code for digits 0 to 9 and characters A to F are as follows:

Character	'0'	'1'	'2'	'3'	'4'	'5'	'6'	'7'
ASCII code	30H	31H	32H	33H	34H	35H	36H	37H
Character	'8'	'9'	'A'	'B'	'C'	'D'	'E'	'F'
ASCII code	38H	39H	41H	42H	43H	44H	45H	46H

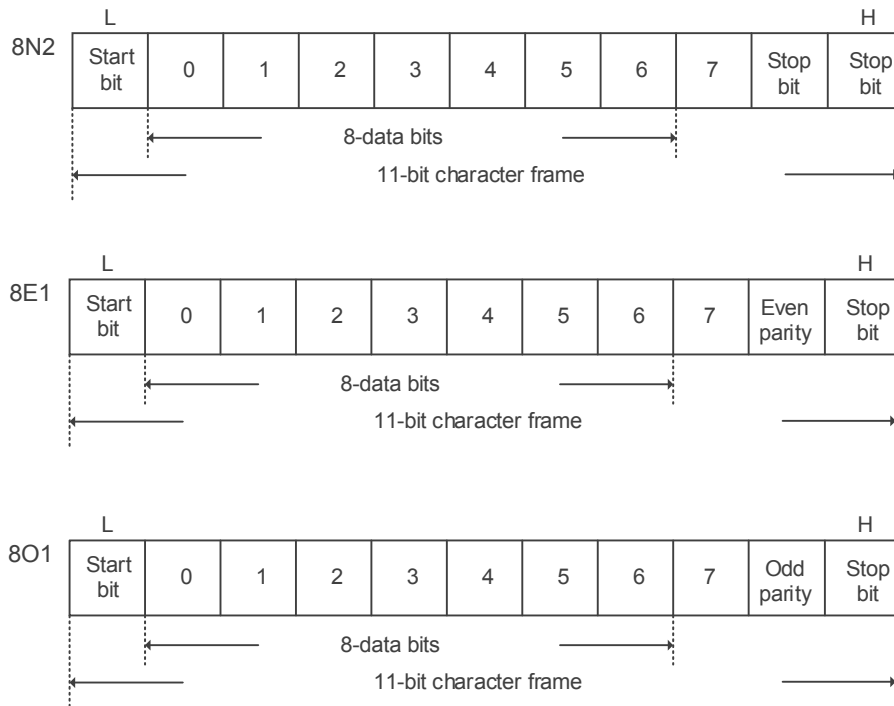
**RTU mode:**

Every 8-bit data consists of two 4-bit characters (hexadecimal). If data 64H is transmitted between two stations, it will be transmitted directly, which is more efficient than ASCII mode. Characters will be encoded into the following framing and transmitted in serial. The checking method of different bit is as follows.

10-bit character frame (for 7-bit character)



11-bit character frame (for 8-bit character)



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**Communication data structure**

Definitions of data frame for two modes are as below:

ASCII mode:

Start	Start character ":" (3AH)
Slave Address	Communication address: 1 byte consists of 2 ASCII codes
Function	Function code: 1 byte consists of 2 ASCII codes
Data (n-1)	Data content: n word = 2n-byte consists of n x 4 ASCII codes, n ≤ 10
.....	
Data (0)	
LRC	Error check: 1 byte consists of 2 ASCII codes
End 1	End code 1: (0DH)(CR)
End 0	End code 0 : (0AH)(LF)

The start character of communication in ASCII mode is colon ":" (ASCII code: 3AH). ADR comprises two characters in ASCII code. The end code is CR (Carriage Return) and LF (Line Feed). The communication address, function code, data content and error checking LRC (Longitudinal Redundancy Check), etc. are between the start character and end code.

RTU mode:

Start	A silent interval of more than 10 ms
Slave Address	Communication address: 1 byte
Function	Function code: 1 byte
Data (n-1)	Data content: n-word = 2n-byte, n ≤ 10
.....	
Data (0)	
CRC	Error check: 1 byte
End 1	A silent interval of more than 10 ms

The start and the end of the communication in RTU (Remote Terminal Unit) mode are silent intervals. The communication address, function code, data content and error checking CRC (Cyclical Redundancy Check), etc. are between the start and the end.

Example 1: function code 03H, accessing multiple words:

The master issues command to the 1<sup>st</sup> slave and reads continuous 2 words starting from the start data address 0200H. In the response message from the slave, the content of start data address 0200H is 00B1H, and the content of the 2<sup>nd</sup> data address is 1F40H. The maximum allowable data in one single access is 10. The calculation of LRC and CRC will be described here.

ASCII mode:

Command Message (Master):

Start	':'
Slave Address	'0'
	'1'
Function	'0'
	'3'
Start Data Address	'0'
	'2'
	'0'
	'0'
Data Number (Word)	'0'
	'0'
	'2'
	'0'
LRC Check	'F'
	'8'
End 1	(0DH)(CR)
End 0	(0AH)(LF)

Response Message (Slave):

Start	':'
Slave Address	'0'
	'1'
Function	'0'
	'3'
Data Number (In byte)	'0'
	'4'
Content of Start Data Address 0200H	'0'
	'0'
	'B'
Content of Second Data Address 0201H	'1'
	'F'
	'4'
LRC Check	'0'
	'E'
End 1	(0DH)(CR)
End 0	(0AH)(LF)

RTU mode:

Command Message (Master):

Slave Address	01H
Function	03H
Start Data Address	02H (High)
	00H (Low)
Data Number (In word)	00H
	02H
CRC Check Low	C5H (Low)
CRC Check High	B3H (High)

Response Message (Slave):

Slave Address	01H
Function	03H
Data Number (In byte)	04H
Content of Start Data Address 0200H	00H (High)
	B1H (Low)
Content of Second Data Address 0201H	1FH (High)
	40H (Low)
CRC Check Low	A3H (Low)
CRC Check High	D4H (High)

Note: Before and after transmission in RTU mode, 10 ms of silent interval is needed.

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Example 2: function code 06H, writing single word:

The master issues command to the 1<sup>st</sup> slave and writes data 0064H to address 0200H. The slave sends response message to the master after writing is completed. The calculation of LRC and CRC will be described in the following section.

ASCII mode:

Command Message (Master):

Start	':
Slave Address	'0'
	'1'
Function	'0'
	'6'
Start Data Address	'0'
	'2'
	'0'
	'0'
Data Content	'0'
	'0'
	'6'
	'4'
LRC Check	'9'
	'3'
End 1	(0DH)(CR)
End 0	(0AH)(LF)

Response Message (Slave):

Start	':
Slave Address	'0'
	'1'
Function	'0'
	'6'
Start Data Address	'0'
	'2'
	'0'
	'0'
Data Content	'0'
	'0'
	'6'
	'4'
LRC Check	'9'
	'3'
End 1	(0DH)(CR)
End 0	(0AH)(LF)

RTU mode:

Command Message (Master):

Address	01H
Slave Function	06H
Start Data Address	02H (High)
	00H (Low)
Data Content	00H (High)
	64H (Low)
CRC Check Low	89H (Low)
CRC Check High	99H (High)

Response Message (Slave):

Address	01H
Slave Function	06H
Start Data Address	02H (High)
	00H (Low)
Data Content	00H (High)
	64H (Low)
CRC Check Low	89H (Low)
CRC Check High	99H (High)

Note: Before and after transmission in RTU mode, 10 ms of silent interval is needed.

Example 3: function code10H, writing multiple words:

The master issues command to the 1<sup>st</sup> slave and writes data 0BB8H and 0000H to the start data address 0112H. That is to say, 0BB8H is written into 0112H and 0000H is written into 0113H. The maximum allowable data in one single access is 8. The slave sends the response message to the master after the writing is completed. The calculation of LRC and CRC will be described here.

ASCII mode:

Command Message (Master):

Start	':'
Slave Address	'0'
	'1'
Function	'1'
	'0'
Start Data Address	'0'
	'1'
	'1'
	'2'
Data Number (In Word)	'0'
	'0'
	'0'
	'2'
Data Number (In Byte)	'0'
	'4'
Content of the 1st Data	'0'
	'B'
	'B'
Content of the 2nd Data	'8'
	'0'
	'0'
	'0'
LRC Check	'1'
	'3'
End 1	(0DH)(CR)
End 0	(0AH)(LF)

Response Message (Slave):

Start	':'
Slave Address	'0'
	'1'
Function	'1'
	'0'
Start Data Address	'0'
	'1'
	'1'
	'2'
Data Number	'0'
	'0'
	'0'
	'2'
LRC Check	'D'
	'A'
End 1	(0DH)(CR)
End 0	(0AH)(LF)

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RTU mode:

Command Message (Master):

Slave Address	01H
Function	10H
Start Data Address	01H (High)
	12H (Low)
Data Number (In Word)	00H (High)
	02H (Low)
Data Number (In Byte)	04H
Content of the 1st Data	0BH (High)
	B8H (Low)
Content of the 2nd Data	00H (High)
	00H (Low)
CRC Check Low	FCH (Low)
CRC Check High	EBH (High)

Response Message (Slave):

Slave Address	01H
Function	10H
Start Data Address	01H (High)
	12H (Low)
Data Number (In Word)	00H (High)
	02H (Low)
CRC Check Low	E0H (Low)
CRC Check High	31H (High)

Note: Before and after transmission in RTU mode, 10 ms of silent interval is needed.

**LRC and CRC transmission error check**

The error check of ASCII mode is LRC (Longitudinal Redundancy Check) and CRC (Cyclical Redundancy Check) is for RTU mode. See the details below.

LRC (ASCII mode):

Start	':
Slave Address	'7'
	'F'
Function	'0'
	'3'
Start Data Address	'0'
	'5'
	'C'
	'4'
Data Number	'0'
	'0'
	'0'
	'1'
LRC Check	'B'
	'4'
End 1	(0DH)(CR)
End 0	(0AH)(LF)

The calculation of LRC is to add up all the byte, round down the carry and take 2's complement.

For example:

7FH + 03H + 05H + C4H + 00H + 01H = 14CH, round down carry 1 and take 4CH.

2's complement of 4CH is B4H.

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CRC (RTU mode):

The calculation description of CRC value is as the follows:

Step 1: Load a 16-bit register of FFFFH, which is called "CRC" register.

Step 2: (The low byte of CRC register) XOR (The first byte of command), and save the result in CRC register.

Step 3: Check the least significant bit (LSB) of CRC register. If the bit is 0, right move one bit; If the bit is 1, then right move one bit and (CRC register) XOR (A001H). Repeat this step for 8 times.

Step 4: Repeat the procedure from step 2 to step 3 until all byte is processed. The content of CRC register is the CRC value.

After calculating the CRC value, fill in the low word of CRC value in command message, and then the high word. For example, if the result of CRC calculation is 3794H, 94H should be filled in low word and 37H in high word which is shown as below:

ARD	01H
CMD	03H
Start Data Address	01H (High)
	01H (Low)
Data Number (In word)	00H (High)
	02H (Low)
CRC Check Low	94H (Low)
CRC Check High	37H (High)

**Example of CRC program:**

Calculate CRC value in C language. This function needs two parameters:

```

unsigned char* data;
unsigned char length
// The function returns the CRC value as a type of unsigned integer.
unsigned int crc_chk(unsigned char* data, unsigned char length) {
    int j;
    unsigned int reg_crc=0xFFFF;

    while( length-- ) {
        reg_crc ^= *data++;
        for (j=0; j<8; j++ ) {
            if( reg_crc & 0x01 ) { /*LSB(bit 0 ) = 1 */
                reg_crc = (reg_crc >> 1)^0xA001;
            } else {
                reg_crc = (reg_crc>>1);
            }
        }
    }
    return reg_crc;
}

```

**Example of PC communication program:**

```

#include<stdio.h>
#include<dos.h>
#include<conio.h>
#include<process.h>
#define PORT 0x03F8      /* the address of COM 1 */
#define THR 0x0000
#define RDR 0x0000
#define BRDL 0x0000
#define IER 0x0001
#define BRDH 0x0001
#define LCR 0x0003
#define MCR 0x0004
#define LSR 0x0005
#define MSR 0x0006
unsigned char rdat[60];
/* read 2 data from address 0200H of ASD with address 1 */
unsigned char
tdat[60]={':', '0', '1', '0', '3', '0', '2', '0', '0', '0', '0', '2', 'F', '8', '\r', '\n'};
void main() {
    int I;
    outportb(PORT+MCR,0x08);          /* interrupt enable */
    outportb(PORT+IER,0x01);         /* interrupt as data in */
    outportb(PORT+LCR,( inportb(PORT+LCR) | 0x80 ) );
    /* the BRDL/BRDH can be access as LCR.b7 == 1 */
    outportb(PORT+BRDL,12);
}

```



## 9

```
outportb(PORT+BRDH,0x00);
outportb(PORT+LCR,0x06);          /* set prorocol
                                   <7,E,1> = 1AH,    <7,0,1> = 0AH
                                   <8,N,2> = 07H    <8,E,1> = 1BH
                                   <8,0,1> = 0BH          */

for( I = 0; I<=16; I++ ) {
    while( !(inportb(PORT+LSR) & 0x20) ); /* wait until THR empty */
    outportb(PORT+THR,tdat[I]);          /* send data to THR */
}
I = 0;
while( !kbhit() ) {
    if( inportb(PORT+LSR)&0x01 ) { /* b0=1, read data ready */
        rdat[I++] = inportb(PORT+RDR); /* read data from RDR */
    }
}
}
```

## 9.4 Setting and accessing of communication parameters

For parameter details, please refer to Chapter 8 for the descriptions of parameters can be written or read via communication.

Parameters of ASDA-A3 servo drive are divided into eight groups: Group 0 (Monitoring parameters), Group 1 (Basic parameters), Group 2 (Extension parameters), Group 3 (Communication parameters), Group 4 (Diagnosis parameters), Group 5 (Motion control parameters), Group 6 and Group 7 (PR parameters).

### Set parameters via communication:

Parameters can be set via communication:

Group 0, except (P0.000 ~ P0.001), (P0.008 ~ P0.013) and (P0.046).

Group 1

Group 2

Group 3

Group 4, except (P4.000 ~ P4.004) and (P4.008 ~ P4.009).

Group 5, except (P5.010, (P5.016) and (P5.076).

Group 6

Group 7

### Please note that:

(P3.001) While changing to a new communication speed, the next data will be written in the new transmission speed after the new value is set.

(P3.002) While changing to a new communication protocol, the next data will be written with the new communication protocol after the new value is set.

(P4.005) Jog control parameters. Please refer to Chapter 8 for detailed description.

(P4.006) Force DO contact control. This parameter can be used to test DO (Digital Output) contact. Set P4.006 to 1, 2, 4, 8, 16, and 32 to test DO1, DO2, DO3, DO4, DO5 and DO6 respectively. Then, set P4.006 to 0 to complete the test.

(P4.010) Calibration functions. Please set P2.008 to 20 (14H in hexadecimal format) first to enable this function.

(P4.011 ~ P4.021) These parameters are for adjusting the hardware offset. However, it is not suggested to change the setting again since the adjustment is complete before delivery. If it is necessary, you should set P2.008 to 22 (16H in hexadecimal format) first.

### Accessing parameters via communication:

Parameters can be read via communication: Group 0 ~ Group 7.

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9

# Absolute System

# 10

This chapter introduces the application of absolute servo system, including the wiring and installation of absolute type encoder, setting steps and operation when initializing absolute position for the first time.

---

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# 10

**Note**

A complete absolute servo system should include ASDA-A3 servo drive, absolute motor, and a backup battery box. With the battery that supplies power to the system, the encoder is able to work even when power is off. Moreover, absolute type encoder can continuously record the motor's actual position anytime even when the motor shaft is rotated after power off. The absolute servo system must work with absolute motor. If it is arranged with an incremental type motor and the related parameters of absolute system are enabled, AL069 will occur.

**When using an absolute motor, as soon as it applies to the power, the motor speed should not exceed 250 rpm. When operating with the battery, make sure the maximum speed does not exceed 200 rpm.**

Check if your motor is absolute type. See the model name below:

**ECM-A3 series servo motor**

ECM - A3 □ - □ Y □ □ □ □ □ □ □ □  
 └ Y: Absolute motor

**ECMC series servo motor**

ECMA - □ W □ □ □ □ □ □ □ □  
 └ W: Absolute motor

Install the battery on the encoder cable properly. One servo drive uses one single battery box; two servo drives can share one dual battery box. Please use Delta's encoder cable for connecting to the battery box. See the following descriptions for the specifications of battery box and its accessories.

## 10.1 Battery box (Absolute type) and wiring rods

### 10.1.1 Specifications

#### Precautions

Please carefully read through the following safety precautions. Use batteries in accordance with the specification so as to avoid damages or dangers.



- The installation location shall have no water drop, corrosive gas, and inflammable gas.
- Correctly place the battery into the battery box to avoid short circuiting.
- Do not short circuit the positive electrode and negative electrode of the battery; or install the battery in reverse direction.
- It is suggested to use new batteries only. This is for avoiding losing electric energy or shortening the lifetime of new batteries.
- Please follow the instructions when conducting wiring for the battery box, or danger may occur.



- Do not place the battery in a high-temperature environment (over 100°C) or it might result in fire or explosion.
- The batteries are non-rechargeable. Do not charge the batteries or it might result in explosion.
- Do not directly weld on the surface of the battery.

#### Battery specifications

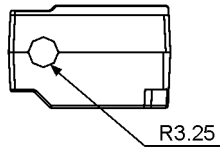
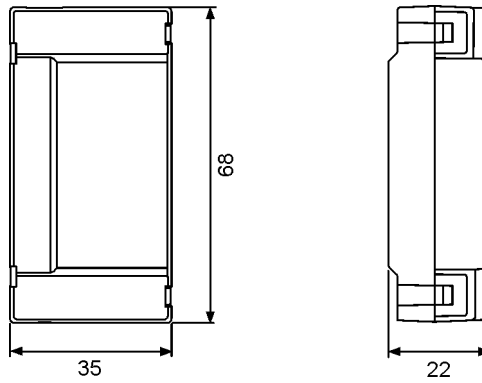
Item	Li/SOCI2 Cylindrical Battery
Type	ER14505
Delta part number	ASD-CLBT0100
International standard size	AA
Standard voltage	3.6V
Standard capacity	2700 mAh
Maximum continuous discharge current	100 mA
Maximum pulse current	200 mA
Dimensions (D x H)	14.5 x 50.5 mm
Weight	Approx. 19 g
Operating temperature	-40 ~ +85°C

### 10.1.2 Battery box dimensions

Single battery box

Delta part number: ASD-MDBT0100

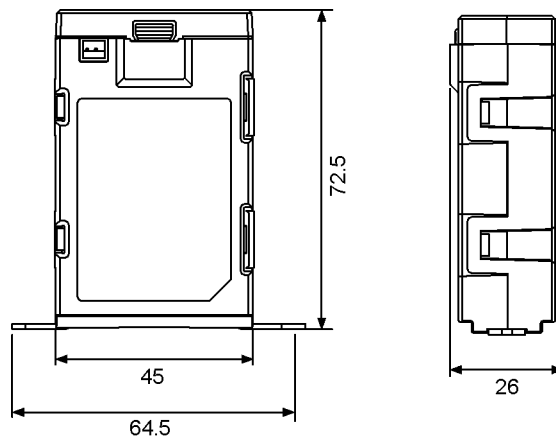
10



Unit : mm  
Weight: 44 g

Dual battery box

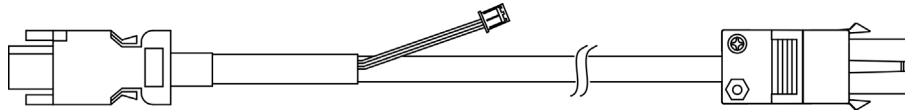
Delta part number: ASD-MDBT0200



### 10.1.3 Connection cable for absolute encoder

#### A. Quick connector

Delta part number: ACS3-CAEA1003, ACS3-CAEA1005

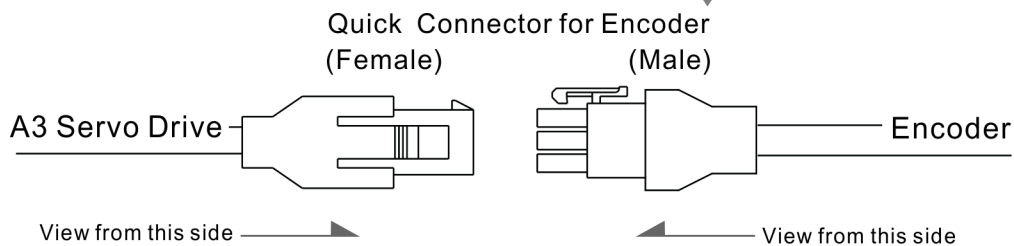
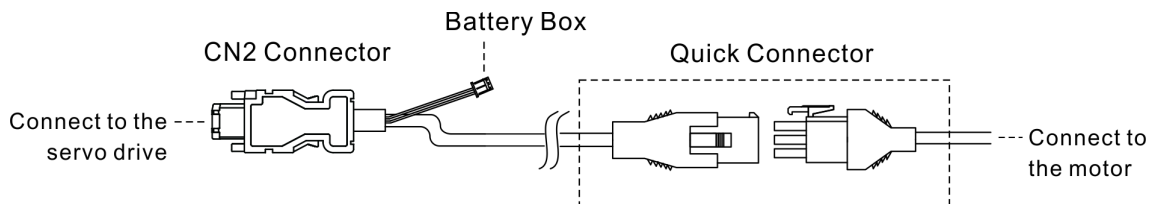


10

Title	Model name	L	
		mm	inch
1	ACS3-CAEA1003	3000 ± 100	118 ± 4
2	ACS3-CAEA1005	5000 ± 100	197 ± 4

Connection method:

**Note** Please follow the instructions below when conducting wiring. Wrong wiring might result in explosion.



1 White T+	2 Red BAT+	3 Reserved
4 White/Red T-	5 Black BAT-	6 Reserved
7 Brown +5 V <sub>DC</sub>	8 Black/Black &White GND	9 Shield

3 Reserved	2 Orange BAT+	1 White T+
6 Reserved	5 Gray BAT-	4 White/Red T-
9 Shield	8 Blue GND	7 Brown +5 V <sub>DC</sub>

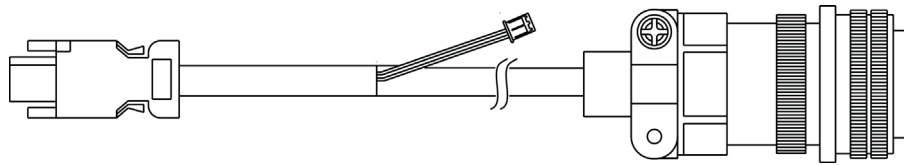
The wire color of the servo drive is for reference only. Please refer to the real object.



10

**B. Military connector**

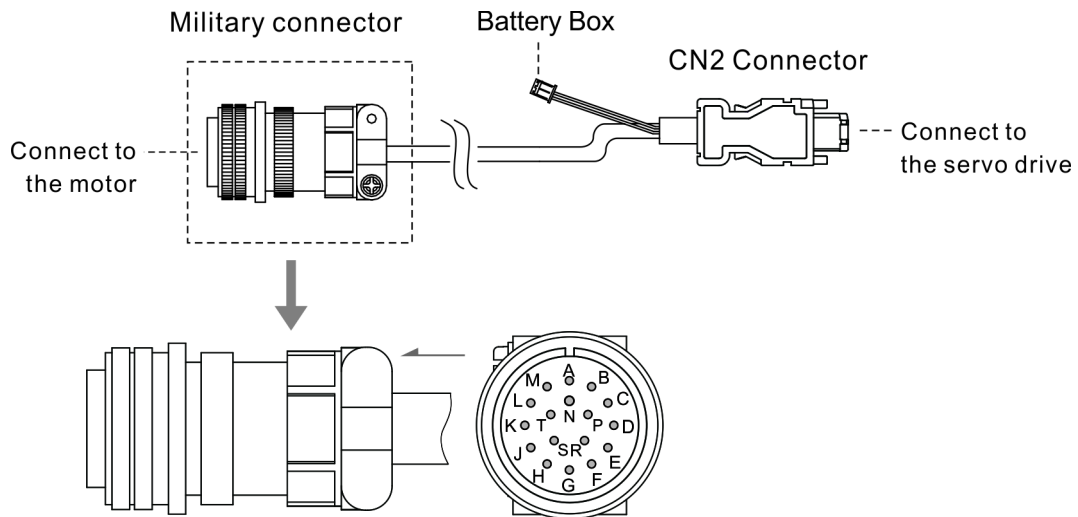
Delta part number: ACS3-CAEA3003, ACS3-CAEA3005



Title	Model name	L	
		mm	inch
1	ACS3-CAEA3003	3000 ± 100	118 ± 4
2	ACS3-CAEA3005	5000 ± 100	197 ± 4

Connection method:

**Note** Please follow the instructions below when conducting wiring. Wrong wiring might result in explosion.

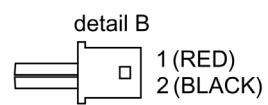
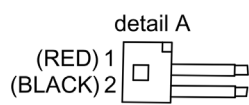
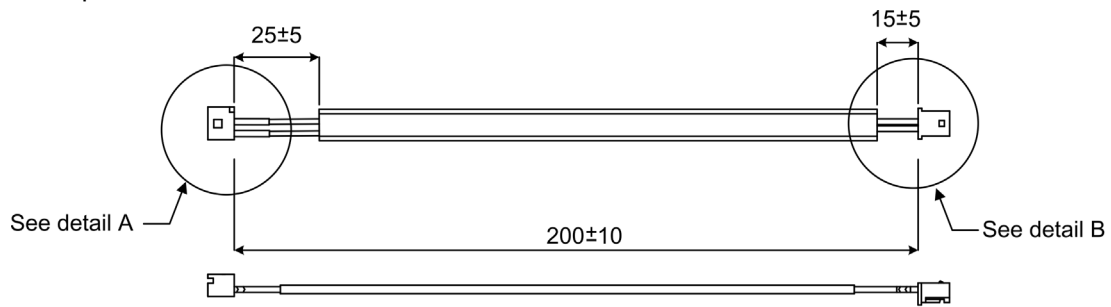


Pin No.	Terminal	Color
A	T+	White
B	T-	White/Red
C	BAT+	Red
D	BAT-	Black
S	+5 V <sub>DC</sub>	Brown
R	GND	Blue
L	BRAID SHIELD	-

### 10.1.4 Battery box cable

**Battery box cable AW (Battery connection cable to the encoder; Unit: mm)**

Delta part number: 3864573700



Unit: mm

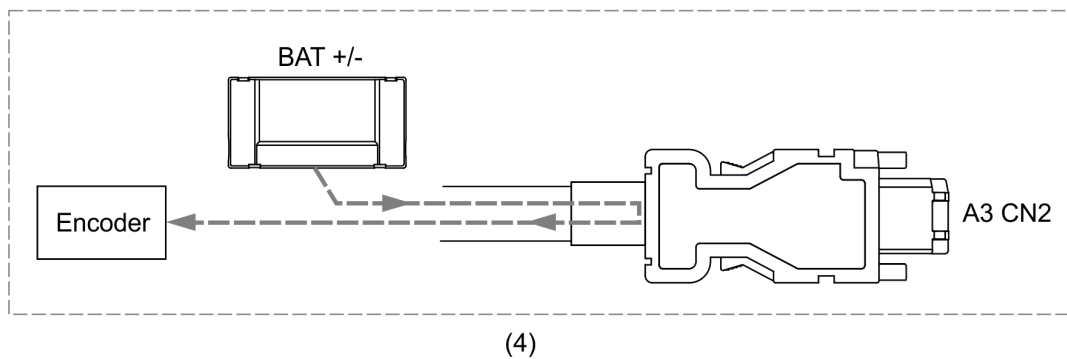
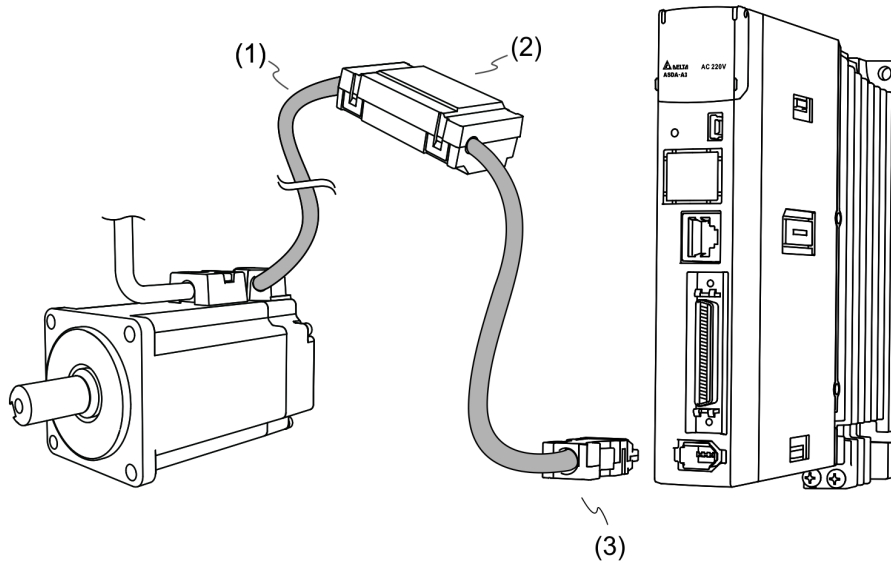
10

# 10

## 10.2 Installation

### 10.2.1 Install battery box in servo system

#### Single battery box (standard wiring)



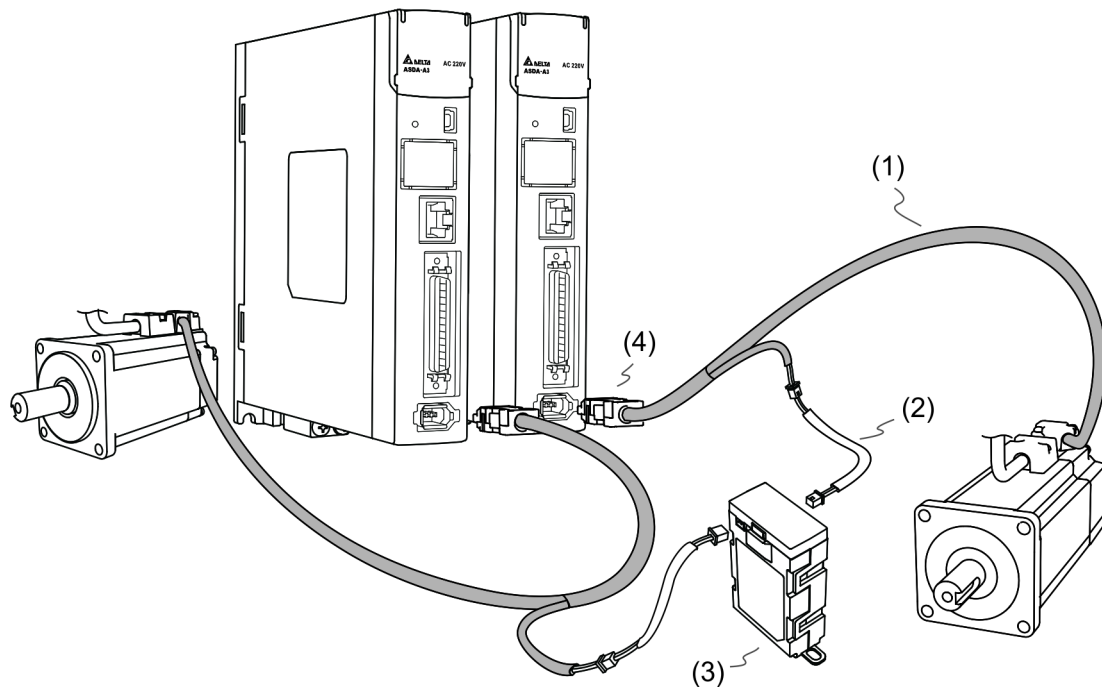
(1) Encoder cable; (2) Single battery box (absolute type); (3) CN2 connector; (4) Battery box wiring

Pin assignment of CN2:

The end that connects to the encoder			The end that connects to the servo drive		
Military connector	Quick connector	Color	Pin No.	Symbol	Description
A	1	White	5	T+	Serial communication signal (+)
B	4	White/Red	6	T-	Serial communication signal (-)
S	7	Brown	1	+5V	Power +5V
R	8	Blue	2	GND	Power ground
L	9	-	Case	Shielding	Shielding

Note: When applying an absolute type encoder, the battery will directly supply the power to the encoder. Thus, wiring for CN2 of the servo drive is not required. Please refer to detailed wiring description in section 3.1.5 Specifications of encoder connector.

## Dual battery box (connects to CN2)



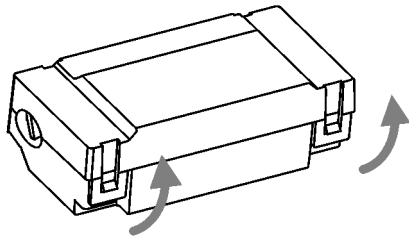
(1) Encoder cable; (2) Battery box cable AW; (3) Dual battery box (absolute type); (4) CN2 connector

10

## 10.2.2 How to install and replace a battery

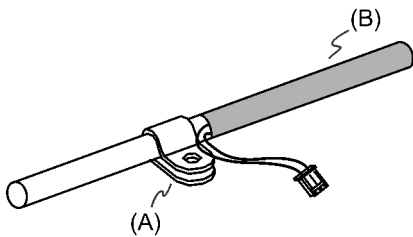
### Single battery box

10



Step 1:

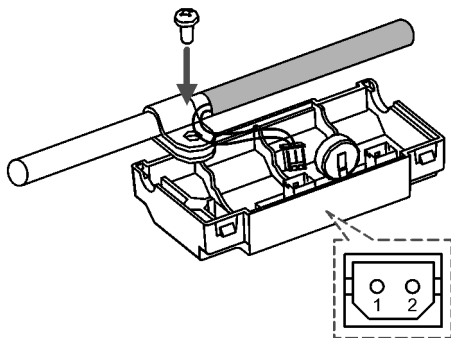
Loosen the hooks on both sides to open the lid of battery box.



Step 2:

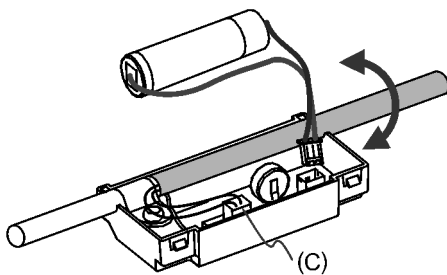
Put the metal clip on connection cable. Please note that the metal clip should be put close to the heat shrink.

(A) Metal clip; (B) Heat shrink



Step 3:

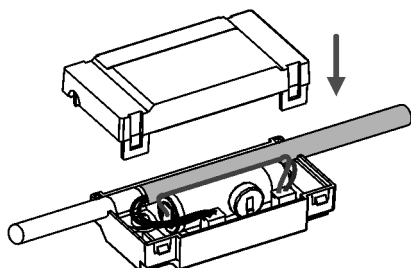
Plug in the connection cable and tighten the screw.



Step 4:

Install a new battery and connect it to the cable.

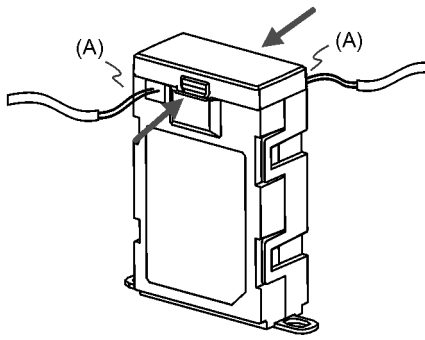
(C) Please replace the battery when the power is still supplied to the servo drive. Do not remove the power cable, otherwise it might cause data lost.



Step 5:

Place the cable into the box and cover the lid.

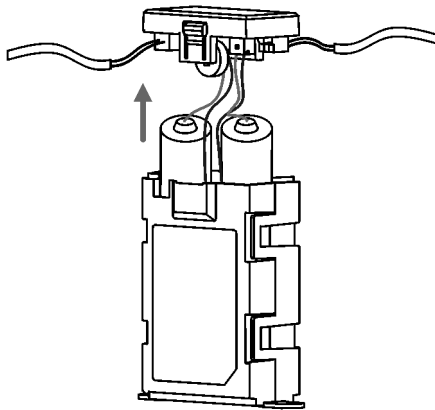
## Dual battery box



## Step 1:

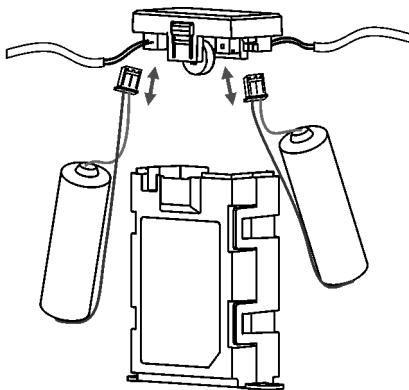
Loosen the hooks on both sides to open the lid of battery box.

(A) Please replace the batteries when the power is still supplied to the servo drive. Do not remove the power cable, otherwise it might cause data lost.



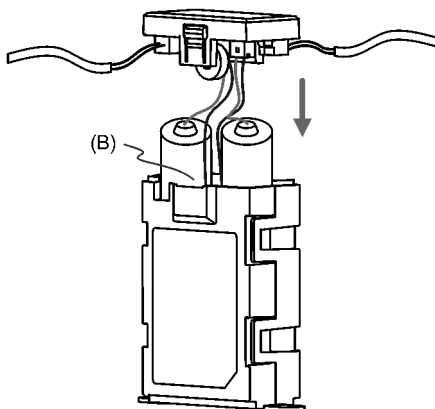
## Step 2:

Lift the cover and pull out the batteries.



## Step 3:

Disconnect the connector and remove the old batteries. Then, replace with the new ones and reconnect the connection cables. Place the new batteries within ten minutes so as to avoid data loss.

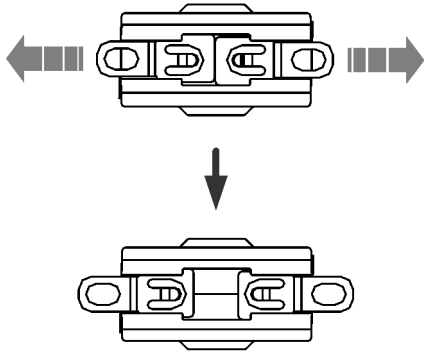


## Step 4:

Cover the lid.

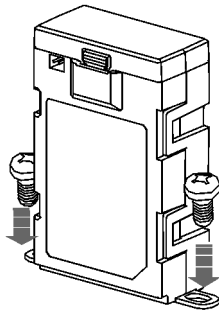
(B) Place the cables toward the inner side of the box so that batteries can be both placed inside the box.

10



Step 5:

Pull the circlips at the bottom of the battery box.



Step 6:

Tighten the screw to secure the battery box.

Note: To avoid data lost, please replace the battery when any of the circumstances happens mentioned hereunder: 1. Servo drive shows alarm AL061, which means the voltage is too low (please refer to Chapter 11 for further information). 2. Users can use P0.002 (monitoring variable 26h) to check the battery power. When it displays 31, it means the voltage is under 3.1V. When the voltage is under 2.7V, motor's position record might be lost and will require homing procedure after installing a new battery. Thus, it is recommended to replace the battery when the power is still supplied to the servo drive.

## 10.3 System initialization and operation procedures

### 10.3.1 System initialization

After the servo system resumes operation, the host controller can acquire the motor's current absolute position via communication (such as RS-485) or DI/DO. Delta's absolute system provides two kinds of position value for the host controller: pulse and PUU.

AL060 will occur when the absolute system is enabled for the first time. This is because the coordinate system has not been created. The alarm will be cleared when the setting of coordinate system is complete. Not enough battery power or the failure of power supply will lead to coordinate system loss and the occurrence of AL060. In absolute system, when the motor's rotating number exceeds the range from -32768 to 32767, AL062 will occur. In terms of PUU, the position value should be between -2147483648 and 2147483647, or AL289 will occur.

Apart from the alarms mentioned above, P2.070 can be used to set Delta's absolute servo system. You can choose not to show AL062 and AL289 when the absolute coordinate system overflows (the cycle number exceeds the range between -32768 and 32767 or PUU exceeds the range from -2147483648 to 2147483647). This is for the system that uses incremental command to operate in single direction.

Parameter (P2.070) setting:

1. Initialize the absolute coordinates. When the setting of the coordinates is complete, AL06A (or AL060) will be cleared automatically. Two ways are provided for the host controller to initialize the coordinates: DI (please refer to Section 10.3.4) or parameter setting (please refer to Section 10.3.5).
2. When the system is re-powered on, users can access absolute position for the host controller via DI/DO (please refer to Section 10.3.6) or communication (please refer to Section 9.2.6). Through the setting of P2.070, the host controller can select the accessing value, either PUU (please refer to Section 10.3.3) or the pulse value of 16777216 within one single turn (please refer to Section 10.3.2).



# 10

## 10.3.2 Pulse number

When the motor is running in clockwise direction, the counting number will be defined as negative; when the motor runs in counterclockwise direction, the counting number will be regarded as positive. And the range of turns is between -32768 and +32767. AL062 will occur once the cycle number exceeds the range. To clear the alarm, the coordinate system has to be re-initialized. If P2.070 has been set to ignore the over-range warning, then the system will not show any error. If the system operates in counterclockwise direction and reaches 32767 turns, the value will be -32768 once it reaches the target position in the next cycle. And the value will keep increasing to -32768, -32767, -32766, and so on. When the system operates in clockwise direction, the value turns to 32767 in the next cycle when reaching -32768.

In addition, there are 16777216 pulses (0 ~ 16777215) in one rotation. Please pay attention to the motor's running direction. Users can read the cycle number and pulse number via communication or DI/DO. Pulse number = m (cycle number) x 16777216 + pulse number (0 ~ 16777215). The conversion between pulse number and PUU are as follows:

When the rotation direction is defined as CCW in P1.001, then the PUU number = pulse number  $\times \frac{P1.045}{P1.044} + P6.001$ .

When the rotation direction is defined as CW in P1.001, then the PUU number = (-1)  $\times$  pulse number  $\times \frac{P1.045}{P1.044} + P6.001$ .

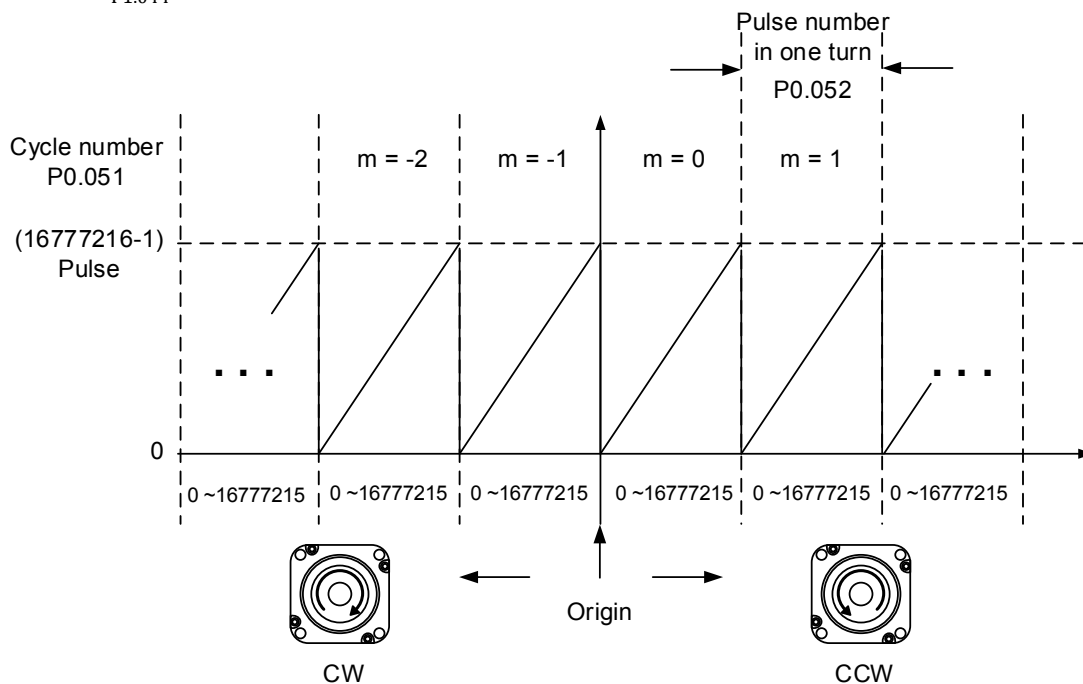


Figure 10.3.2.1 Absolute position of PUU counting

### 10.3.3 PUU number

PUU number is a 32-bit absolute data with positive and negative signs. When the motor is running in forward direction, the PUU number will increase; when it is in reverse direction, the PUU number will decrease. The forward direction does not mean the motor is running in clockwise direction. It should be defined by P1.001.Z. Range of the maximum counting number is from -32768 to +32767. AL062 will occur when the cycle number exceeds the range (overflows). If the PUU number exceeds the range between -2147483648 and 2147483647, the position counter overflows and AL289 occurs. Users have to re-initialize the system to clear alarms (AL062 or AL289). Users can determine whether to show AL062 and AL289 or not when the position overflows via P2.070. When reaching the max. PUU number in forward direction, the value will change from 2147483647 to -2147483648, -2147483647, and 2147483647. However, the value changes in the other way around when it operates in reverse direction. See the following examples:

**Example 1:**

When P1.044 = 16777216 and P1.045 = 100000, the motor needs 100000 PUU to run a cycle. And  $2147483647 \div 100000 \approx 21474.8$ . Thus, once the motor runs over 21474.8 (< 32767) cycles in forward direction, AL289 occurs.

**Example 2:**

When P1.044 = 16777216 and P1.045 = 10000, the motor needs 10000 PUU to run a cycle. And  $2147483647 \div 10000 \approx 214748.3$ . Thus, once the motor runs over 32767 (< 214748.3) cycles in forward direction, AL062 occurs.

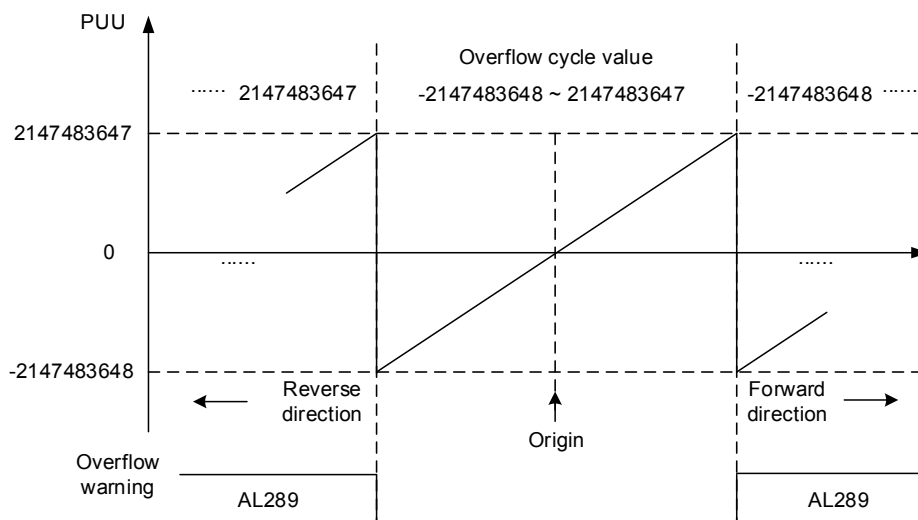


Figure 10.3.3.1 Absolute position of PUU counting

Note: After initializing the absolute coordinate system, any change to P1.001.Z or E-Gear ratio (P1.044 and P1.045) will change the original setting of absolute coordinate system. If the setting of the above parameters is changed, please re-initialize the coordinate system.

# 10

### 10.3.4 Initialize the absolute coordinate via DI/DO

When the servo system is controlled by the host controller, the absolute coordinate system shall be reset by DI/DO. To initialize the coordinate system, set DI.ABSE to on and switch DI.ABSC from off to on. Then, the pulse number will be set to 0 and the PUU number will be set as the setting value of P6.001. Please refer to the following diagram for detailed descriptions.

((1), (2), and (3) represent the required delay time from triggering DI.ABSE and DI.ABSC to enabling the function.)

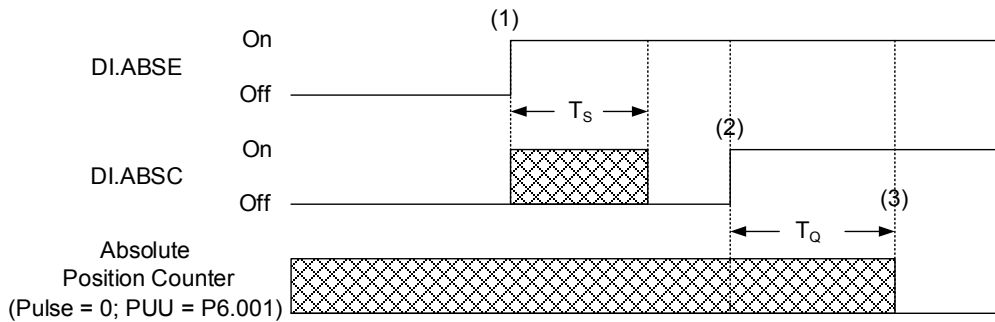


Figure 10.3.4.1 Timing diagram of initializing the absolute coordinate system by DI/DO

The following table describes the  $T_S$  and  $T_Q$  delay time after triggering DI.ABSE and DI. ABSC.

	$T_{S(ms)}$	$T_{Q(ms)}$
Min ( $T_S, T_Q$ )	Setting value of P2.009 + 2	
Max	P2.009 + 10	

Description:

1. When DI.ABSE turns on, it has to wait for  $T_S$  delay time before proceeding to the next step.
2. After reaching  $T_S$ , the host controller can start to reset the coordinate system. When DI.ABSC turns on and remains the status for the time of  $T_Q$ , then the pulse number of absolute coordinate system will be set to zero. Also, PUU number will be set as the setting value of P6.001.

### 10.3.5 Initialize the absolute coordinate via parameters

Users can set P2.071 to 1 to initialize the coordinates via the panel or communication. As soon as P2.071 is set to 1, the absolute system will be reset. Since the write-in function of P2.071 is protected by P2.008, users have to set P2.008 to 271 first. That is to say, the sequence should be: Set P2.008 to 271, then set P2.071 to 1.

### 10.3.6 Read the absolute position via DI/DO

Set P2.070 Bit 0 to 0 so that users can read the PUU number via DI/DO. See the descriptions below:

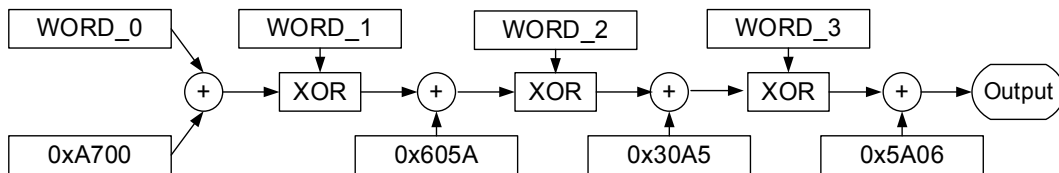
Bit 79 ~ Bit 64	Bit 63 ~ Bit 32	Bit 31 ~ Bit 16	Bit 15 ~ Bit 0
Check Sum	Encoder PUU -2147483648 ~ 2147483647	0	Encoder status (P0.050)

Set P2.070 Bit 0 to 1 so that users can read the pulse number via DI/DO. See the descriptions below:

Bit 79 ~ Bit 64	Bit 63 ~ Bit 32	Bit 31 ~ Bit 16	Bit 15 ~ Bit 0
Check Sum	Pulse number in one rotation 0 ~ 16777215 (=16777216-1)	Encoder turn -32768 ~ +32767	Encoder status

Description:

$$\text{Check Sum} = ((((((\text{WORD}_0 + 0xA700) \text{ XOR } \text{WORD}_1) + 0x605A) \text{ XOR } \text{WORD}_2) + 0x30A5) \text{ XOR } \text{WORD}_3) + 0x5A06)$$



Note:

1. This algorithm has no positive or negative sign.
2. 0xA700, 0x605A, 0x30A5, and 0x5A06 are the constants of hexadecimal format.
3. WORD\_0: encoder status (Bit 15 ~ 0)  
 WORD\_1: encoder turn (Bit 31 ~ 16)  
 WORD\_2: encoder pulse number (Bit 47 ~ 32)  
 WORD\_3: encoder pulse number (Bit 63 ~ 48)

Users can read the pulse number or PUU number with DI/DO and P2.070 setting. See the timing diagram below:

# 10

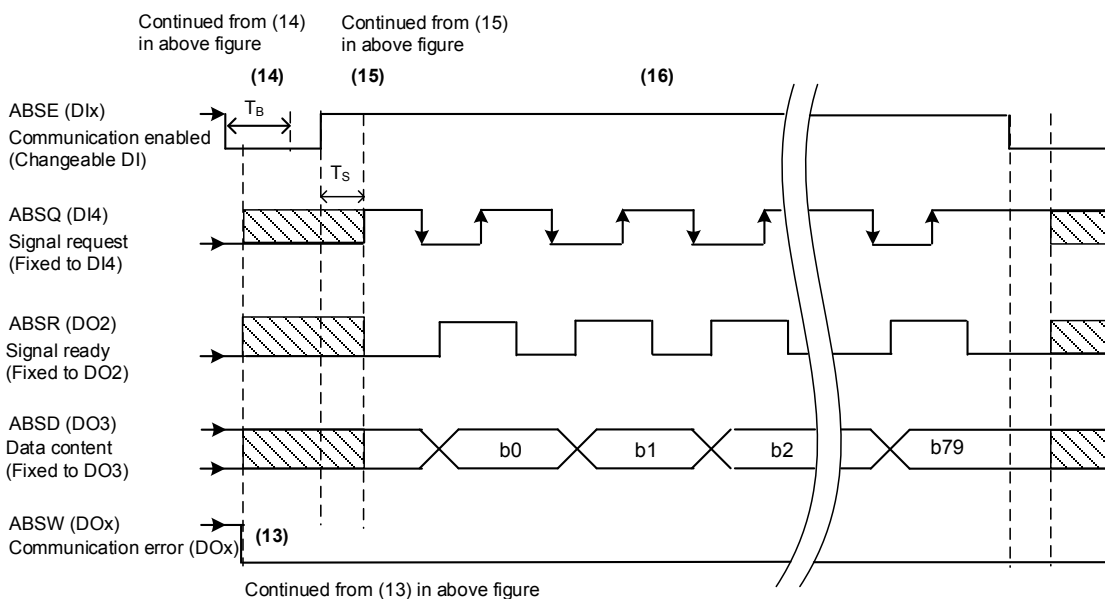
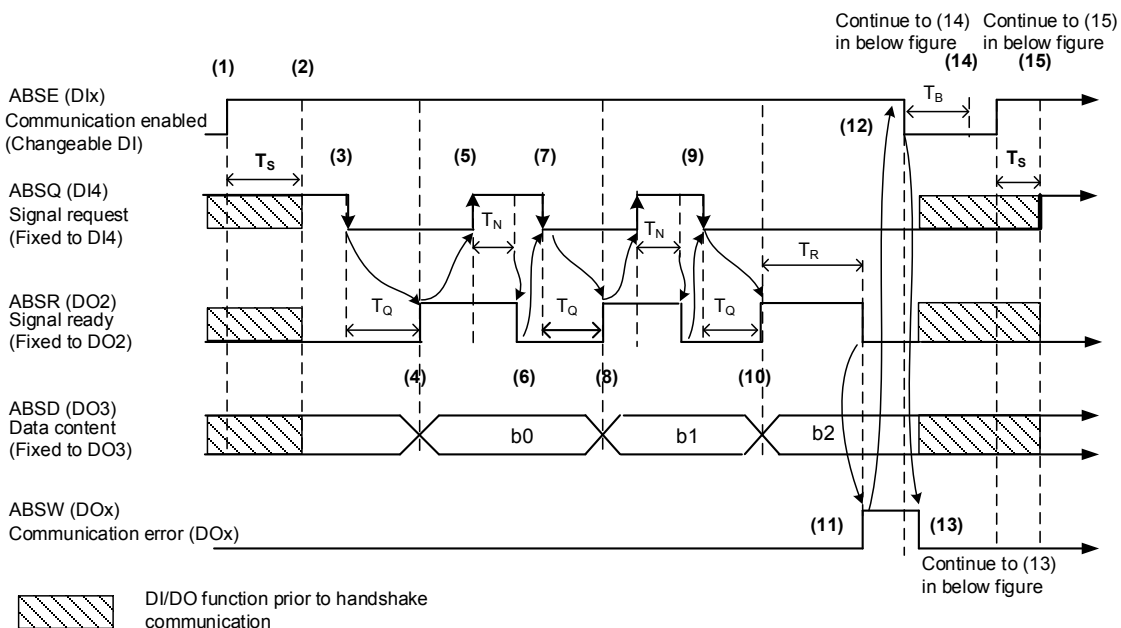


Figure 10.3.6.1 Timing diagram - use DI/DO to read the absolute position

The following table explains the delay time when reading the absolute position via DI/DO.

	$T_R(ms)$	$T_S(ms)$	$T_Q(ms)$	$T_{Nms}$	$T_B(ms)$
Min	-	P2.009 + 2			
Max	200	P2.009 + 10			

## Descriptions:

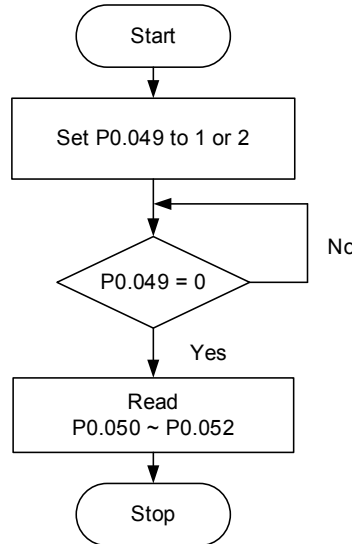
- (1) When it starts handshake communication, ABSE signal will be triggered.
- (2) After the  $T_S$  delay time (make sure the signal is on), functions of DI4, DO2, and DO3 will be switched to ABSQ, ABSR, and ABSD respectively. If DI4 is in high level before, it will remain in high-level status when switched to ABSQ function (logic high-level signal). DI4, DO2, and DO3 are dual-function DI/DO. That is to say, DI4, DO2, and DO3 share the same DI with ABSQ, ABSR, and ABSD. Please pay special attention when switching functions. Or, users can set the DI/DO to 0 to disable the dual-function of DI/DO.
- (3) When DI4 is set to high level and switched to the function of ABSQ after the  $T_S$  delay time, if the host controller set this signal to low level, it will be regarded as the data accessing command.
- (4) After the  $T_Q$  time, the handshaking data is ready and the absolute position is sent to ABSD, the servo drive will turn on the signal of ABSR. Now, the host controller can access the data. If the host controller still cannot detect the ABSR status (turning to high level) after the max.  $T_Q$  time (Please refer to Figure 10.3.6.1), it might result from communication error.
- (5) Once the ABSR signal turns to high level, the host controller accesses the data. Then, ABSQ signal will be set to high level for notifying the servo drive that data is read.
- (6) When ABSQ is in high level, ABSR signal will be set to low level after the  $T_N$  time. This is for sending the data of the next bit.
- (7) When ABSR is in low level, ABSQ will be set to low level and the servo drive needs to send the data for the next bit.
- (8) Repeat step (3) ~ (4). Send the absolute position to ABSD for the next bit communication.
- (9) Repeat step (5) ~ (7). The host controller had read and received the data.
- (10) The third bit data is ready.
- (11) After the  $T_R$  waiting time, if the host controller has not read the data and turned on ABSQ signal, the servo drive will send the ABSW signal (communication error) and stop handshake communication.
- (12) When the host controller receives the communication error signal, ABSE will be set to low level and prepare to start handshake communication again.
- (13) ABSW will resume to low level after the servo drive receives ABSE signal.
- (14) Host controller resumes communication after  $T_B$  time.
- (15) Now, repeat step (1).
- (16) If no error occurs, the host controller completes 80 bits (0 ~ 79) of handshake communication with the servo drive. Then, DI4, DO2, and DO3 resume their original functions.

Note: If ABSE is set to low level first and then high level, but ABSW does not resume to high level, it means some other errors exist. Please check if it is the warning of absolute position lost, low voltage level of the battery, or absolute position overflows. A new communication cycle can be restarted after those errors are cleared.

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## 10.3.7 Read the absolute position via communication

Users can access the data of absolute type encoder through two communication methods: instant accessing and parameter accessing. Instant accessing means to read the motor's feedback position as soon as the servo is applied to the power. When you set the status monitoring register 1 as motor's feedback pulse number (P0.017 = 0), you can access the motor's current position by reading P0.009. Parameter accessing means the motor's position will be stored in parameters temporarily. Then, once P0.049 is set via communication, the encoder's status, absolute position (cycle number), and pulse number (or PUU) will be stored in P0.050, P0.051, and P0.052 respectively. Users can choose to read pulse number or PUU through the setting of P2.070 Bit 1. As the motor stands still, it still slightly moves forward and backward. When P0.049 is set to 1, it will read the exact position where the motor stops without changing anything. On the other hand, when P0.049 is set to 2, the motor's current position will be updated to the servo drive (which means to clear the position error). For example, the motor's current position is at 20000, but it stays around 19999 and 20001. When issuing the command to read the motor's position when motor stops at 20001, the motor's position will be updated to 20001. After all position is updated to P0.050 ~ P0.052, P0.049 will be reset to 0 automatically. Then, the controller can access the value of P0.050 ~ P0.052. P0.050 shows the status of absolute type of encoder. When it shows absolute position lost or overflow, the accessed absolute position is invalid. Users have to re-do homing and initialize the coordinate.



## 10.4 List of absolute type parameters, DI/DO, and alarms

Relevant parameters (Please refer to Chapter 8 for detailed information):

Parameter	Function
P0.002	Servo drive status display
P0.049	Update encoder absolute position parameter
P0.050	Absolute coordinate system status
P0.051	Encoder absolute position - Multi-turn
P0.052	Encoder absolute position - Pulse number or PUU within single turn
P2.069	Absolute encoder setting
P2.070	Read data selection
P2.071	Absolute position homing

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Relevant DI/DO (Please refer to Chapter 8 for detailed information):

Setting value	DI name	Setting value	DO name
0x1D	ABSE	When DI.ABSE is on, ABSR will be outputted by DO2, which is no longer configured by P2.019.	ABSR always outputted by DO2
When DI.ABSE is on, ABSQ will be inputted by DI4, which is no longer configured by P2.013.	ABSQ always inputted by DI4	When DI.ABSE is on, ABSD will be outputted by DO3, which is no longer configured by P2.012.	ABSD always outputted by DO3
0x1F	ABSC	0x0D	ABSW



Relevant alarms (Please refer to Chapter 11 for detailed information):

Display	Alarm name
AL060	The absolute position is lost
AL061	Encoder under voltage
AL062	Multi-turn of absolute encoder overflows
AL069	Wrong motor type
AL072	Encoder overspeed
AL073	Encoder memory error
AL074	Single-turn position error of absolute encoder
AL075	Position error of absolute encoder
AL077	Computing error of the encoder
AL079	Parameter setting error of the encoder
AL07B	Encoder memory busy
AL07C	Command for clearing absolute position is issued when motor is over 200 rpm
AL07D	Motor stops operating when AL07C is not cleared and servo is not re-power on
AL07E	Clearing procedure error of the encoder
AL289	Feedback position counter overflows

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# Troubleshooting

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This chapter provides alarm descriptions and corrective actions that can be used for troubleshooting.

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General type .....	11-7
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Alarms can be categorized into four types: General, STO, Communication, and Motion control.

See detailed information below:

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**General type:** Alarms caused by hardware or encoder signal error.

**STO type:** Alarms caused by STO error.

**Communication type:** Alarms caused by CANopen or DMCNET error.

**Motion control type:** Alarms caused by motion control command (in PR mode).

AL.nnn is the alarm format on the 7-segment display.



## 11.1 Alarm list

### General type:

Display	Alarm name	Error type		Servo state	
		ALM	WARN	ON	OFF
AL001	Overcurrent	○			○
AL002	Overvoltage	○			○
AL003	Undervoltage		○		○
AL004	Motor combination error	○			○
AL005	Regeneration error	○			○
AL006	Overload	○			○
AL007	Excessive deviation of speed command	○			○
AL008	Abnormal pulse command	○			○
AL009	Excessive deviation of position command	○			○
AL011	Encoder error	○			○
AL012	Adjustment error	○			○
AL013	Emergency stop		○		○
AL014	Reverse limit error		○	○	
AL015	Forward limit error		○	○	
AL016	IGBT overheat	○			○
AL017	Abnormal EEPROM	○			○
AL018	Abnormal signal output	○			○
AL019	Serial communication error	○			○
AL020	Serial communication timeout		○	○	
AL022	RST leak phase		○		○
AL023	Early warning for overload		○	○	
AL024	Encoder initial magnetic field error	○			○
AL025	Internal error of the encoder	○			○
AL026	Unreliable internal data of the encoder	○			○
AL027	The internal of the motor is in error	○			○
AL028	Encoder voltage error or the internal of the encoder is in error	○			○
AL029	Gray code error	○			○
AL030	Motor crash error	○			○
AL031	Incorrect wiring of motor power cable (UVW) or disconnection	○			○
AL034	Internal communication of the encoder is in error	○			○
AL035	Encoder temperature exceeds the protective range	○			○

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General type (continued):

Display	Alarm name	Error type		Servo state	
		ALM	WARN	ON	OFF
AL040	Excessive deviation of full closed-loop position control	○			○
AL041	Communication of linear scale is cut off	○			○
AL042	Analog input voltage is too high	○			○
AL044	Warning of servo function overload		○	○	
AL045	E-Gear ratio setting error	○			○
AL060	Absolute position is lost		○	○	
AL061	Encoder undervoltage		○	○	
AL062	Multi-turn of absolute encoder overflows		○	○	
AL067	Encoder temperature warning		○	○	
AL068	Absolute data transmitted via I/O is in error		○	○	
AL069	Wrong motor type	○			○
AL06A	Absolute position is not initialized		○	○	
AL070	Encoder did not complete the command issued by servo drive		○	○	
AL072	Encoder overspeed	○			○
AL073	Encoder memory error	○			○
AL074	Single-turn position error of absolute encoder	○			○
AL075	Position error of absolute encoder	○			○
AL077	Computing error of the encoder	○			○
AL079	Parameter setting error of the encoder	○			○
AL07B	Encoder memory busy	○			○
AL07C	Command for clearing absolute position is issued when motor is over 200 rpm		○	○	
AL07D	Motor stops operating when AL07C is not cleared and servo is not re-power on	○			○
AL07E	Clearing procedure error of the encoder	○			○
AL07F	Encoder version error	○			○
AL083	Servo drive outputs excessive current	○			○
AL085	Regenerative resistor setting error	○			○
AL086	Input voltage is too high	○			○
AL088	Warning of servo function overload	○			○
AL089	Current detection is interfered		○	○	
AL08A	Auto-tuning function - Command error		○	○	
AL08B	Auto-tuning function - Inertia estimation error		○	○	
AL08C	Auto-tuning function - Pause time is too short		○	○	

**General type (continued):**

Display	Alarm name	Error type		Servo state	
		ALM	WARN	ON	OFF
<b>AL095</b>	Regenerative resistor disconnected		○	○	
<b>AL099</b>	DDPROM must be updated	○			○
<b>AL521</b>	Parameter of vibration suppression is in error	○			○

Note: If the servo drive shows an alarm that is not included in this table, please contact the local distributor or technician.

**STO type:**

Display	Alarm name	Error type		Servo state	
		ALM	WARN	ON	OFF
<b>AL500</b>	STO function is enabled	○			○
<b>AL501</b>	STO_A lost (Signal loss or signal error)	○			○
<b>AL502</b>	STO_B lost (Signal loss or signal error)	○			○
<b>AL503</b>	STO_error	○			○

Note: If the servo drive shows an alarm that is not included in this table, please contact the local distributor or technician.

**Communication type:**

Display	Alarm name	Error type		Servo state	
		ALM	WARN	ON	OFF
<b>AL111</b>	Buffer overflow occurs when receiving CANopen SDO	○		○	
<b>AL112</b>	Buffer overflow occurs when receiving CANopen PDO	○		○	
<b>AL121</b>	Object's index does not exist when CANopen PDO is received	○		○	
<b>AL122</b>	Object's sub-index does not exist when CANopen PDO is received	○		○	
<b>AL123</b>	Data size error occurs when accessing CANopen PDO	○		○	
<b>AL124</b>	Data range error occurs when accessing CANopen PDO	○		○	
<b>AL125</b>	CANopen object is read-only and write-protected	○		○	
<b>AL126</b>	The specified object does not support PDO mapping	○		○	
<b>AL127</b>	CANopen PDO is write-protected when servo is on	○		○	
<b>AL128</b>	Error occurs when reading CANopen PDO from EEPROM	○		○	
<b>AL129</b>	Error occurs when writing CANopen PDO to EEPROM	○		○	
<b>AL130</b>	Accessing address of EEPROM is out of range when using CANopen PDO	○		○	
<b>AL131</b>	CRC of EEPROM calculation error occurs when using CANopen PDO	○		○	
<b>AL132</b>	Parameter is write-prohibited when using CANopen PDO	○		○	
<b>AL180</b>	CANopen heartbeat or NodeGuarding error	○			○
<b>AL185</b>	CAN Bus hardware error	○			○

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**Communication type (continued):**

Display	Alarm name	Error type		Servo state	
		ALM	WARN	ON	OFF
<b>AL186</b>	CAN Bus off	○		○	
<b>AL201</b>	Error occurs when loading CANopen data	○			○
<b>AL301</b>	CANopen synchronization failure		○	○	
<b>AL302</b>	Synchronization signal of CANopen is sent too soon		○	○	
<b>AL303</b>	CANopen SYNC signal timeout		○	○	
<b>AL304</b>	CANopen IP command is invalid		○	○	
<b>AL305</b>	SYNC period error		○	○	
<b>AL401</b>	NMT reset command is received when servo is on	○			○

Note: If the servo drive shows an alarm that is not included in this table, please contact the local distributor or technician.

**Motion control type:**

Display	Alarm name	Error type		Servo state	
		ALM	WARN	ON	OFF
<b>AL207</b>	Parameter group of PR#8 is out of range		○	○	
<b>AL209</b>	Parameter number of PR#8 is out of range		○	○	
<b>AL213</b>	Parameter setting of PR#8 is in error		○	○	
<b>AL215</b>	Write parameters: Read-only		○	○	
<b>AL217</b>	Write parameters: Parameter locked		○	○	
<b>AL231</b>	The setting of monitoring item of PR#8 is out of range		○	○	
<b>AL235</b>	Absolute positioning command error		○	○	
<b>AL237</b>	Indexing coordinate is undefined		○	○	
<b>AL283</b>	Software positive limit		○	○	
<b>AL285</b>	Software negative limit		○	○	
<b>AL289</b>	Feedback position counter overflows		○	○	
<b>AL380</b>	Position offset alarm of DO.MC_OK		○	○	
<b>AL3F1</b>	Absolute index coordinate undefined	○			○
<b>AL400</b>	Index coordinate error	○			○
<b>AL404</b>	Value of PR Special Filter setting is too big	○			○
<b>AL555</b>	Malfunction of the system	○			○
<b>AL809</b>	PR arithmetic operation parameter error or secondary platform error	○			○

Note: If the servo drive shows an alarm that is not included in this table, please contact the local distributor or technician.

## 11.2 Causes and corrective actions

General type:

<b>AL001 Overcurrent</b>	
Trigger condition and causes	<p>Condition: Main circuit current is over 1.5 times of the max. instantaneous current of motor.</p> <p>Causes:</p> <ol style="list-style-type: none"> <li>1. Motor has a short-circuit or fault to ground (frame).</li> <li>2. Motor wiring is wrong.</li> <li>3. IGBT is abnormal.</li> <li>4. Parameter setting is wrong.</li> <li>5. Control command setting is wrong.</li> </ol>
Checking methods and corrective actions	<ol style="list-style-type: none"> <li>1. Check the connection between motor and servo drive and make sure the wire is not short-circuited. Do not expose the metal part of the wiring. Check if you have followed the wiring sequence of motor and servo drive described in this manual.</li> <li>2. If the temperature of heat sink is abnormal, please send the servo drive back to the distributor or contact Delta. Check if the setting value is far greater than the default. It is suggested to reset to the factory default settings and then modify the value step by step.</li> <li>3. Check if the target torque/speed/position commanded varies greatly. If so, please modify the changing rate of the command or enable the filter.</li> </ol>
How to clear the alarm?	DI.ARST

<b>AL002 Overvoltage</b>	
Trigger condition and causes	<p>Condition: Main circuit voltage exceeds the rated value.</p> <p>Causes:</p> <ol style="list-style-type: none"> <li>1. The input voltage of main circuit is higher than the rated voltage.</li> <li>2. Wrong power input (wrong power system).</li> <li>3. Malfunction of the servo drive hardware.</li> </ol>
Checking methods and corrective actions	<ol style="list-style-type: none"> <li>1. Use a voltmeter to check if the input voltage of the main circuit is within the rated range (refer to Appendix A Specifications). Apply the right voltage source or serial connect the regulator. Use a voltmeter to check if the power system complies with the specifications. If not, apply the right voltage source or serial connect the transformer.</li> <li>2. Check if the input voltage of the main circuit is within the rated range. If issue persists, please send the servo drive back to the distributor or contact Delta.</li> </ol>
How to clear the alarm?	DI.ARST

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<b>AL003 Under voltage</b>	
Trigger condition and causes	<p>Condition: Voltage of the main circuit is below the rated value. Default of AL003 is defined as a warning. To define it as an alarm, set P2.066 [Bit 9].</p> <p>Causes:</p> <ol style="list-style-type: none"> <li>1. The input voltage of main circuit is lower than the permissible rated value.</li> <li>2. No power is supplied to the main circuit.</li> <li>3. Wrong power input (wrong power system).</li> </ol>
Checking methods and corrective actions	<ol style="list-style-type: none"> <li>1. Check that the voltage wiring is correct and the input voltage for the main circuit is normal.</li> <li>2. Re-power on the servo drive and use a voltmeter to check the main circuit voltage.</li> <li>3. Use a voltmeter to check if the power system complies with the specifications. Check if right voltage source is applied or transformer is serial connected.</li> </ol>
How to clear the alarm?	<p>AL003 will be cleared according to the setting of P2.066 [Bit2]</p> <ol style="list-style-type: none"> <li>1. If P2.066 [Bit2] is set to 0, use DI.ARST to clear the alarm after the voltage range is back to normal.</li> <li>2. If P2.066 [Bit2] is set to 1, the alarm will be cleared automatically once the voltage range is back to normal.</li> </ol>

<b>AL004 Motor combination error</b>	
Trigger condition and causes	<p>Condition: Wrong motor is applied to the servo drive.</p> <p>Causes:</p> <ol style="list-style-type: none"> <li>1. Motor combination error (The servo drive connects to the wrong motor.)</li> <li>2. The encoder is loose.</li> <li>3. Encoder is damaged.</li> </ol>
Checking methods and corrective actions	<ol style="list-style-type: none"> <li>1. Apply the right motor.</li> <li>2. Check and re-install the encoder connector.</li> <li>3. If the encoder (motor) is abnormal, please replace the motor.</li> </ol>
How to clear the alarm?	<p>Re-power on the servo drive.</p>

<b>AL005 Regeneration error</b>	
Trigger condition and causes	<p>Condition: An error has occurred during regeneration.</p> <p>Causes:</p> <ol style="list-style-type: none"> <li>1. Selected a wrong regeneration resistor or the external regeneration resistor is not connected.</li> <li>2. P1.053 (Regenerative resistor capacity) is not set to 0 when the regenerative resistor is not applied.</li> <li>3. Parameter setting error (P1.052, P1.053).</li> </ol>
Checking methods and corrective actions	<ol style="list-style-type: none"> <li>1. Re-calculate the value for regenerative resistor and reset the value of P1.052 and P1.053. If the alarm cannot be cleared, please send the servo drive back to Delta.</li> <li>2. Set P1.053 to 0 if regenerative resistor is not used.</li> <li>3. Correctly set parameters of regenerative resistor, (P1.052) and (P1.053 Regenerative resistor capacity).</li> </ol>
How to clear the alarm?	DI.ARST

<b>AL006 Overload</b>	
Trigger condition and causes	<p>Condition: Overload of motor and servo drive.</p> <p>Causes:</p> <ol style="list-style-type: none"> <li>1. The load is over the rated range and the servo drive is in a persistent overload condition.</li> <li>2. The setting of the control system parameter is inappropriate.</li> <li>3. Incorrect wiring of motor and encoder.</li> <li>4. Encoder malfunction.</li> </ol>
Checking methods and corrective actions	<ol style="list-style-type: none"> <li>1. Set P0.002 to 11 to monitor the servo drive status. Check if the average torque [%] is continuously over 100%. If so, please increase the motor capacity or reduce the load. (Refer to Appendix A Load and operation time for more detail.)</li> <li>2. (A) Check if there is any mechanical vibration. (B) Acceleration/deceleration constant is set too big.</li> <li>3. Check if the wiring of UVW and encoder cables is correct.</li> <li>4. Send the servo drive back to distributors or contact Delta.</li> </ol>
How to clear the alarm?	DI.ARST

<b>AL007 Excessive speed deviation</b>	
Trigger condition and causes	<p>Condition: Deviation of the speed command and the feedback speed exceeds the allowable range (P2.034).</p> <p>Causes:</p>

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	<ol style="list-style-type: none"> <li>1. A drastic change in speed.</li> <li>2. Inappropriate setting of P2.034.</li> </ol>
Checking methods and corrective actions	<ol style="list-style-type: none"> <li>1. Use the signal detector to check if the input analog voltage signal is normal. If not, adjust the signal changing rate or enable the filter function.</li> <li>2. Check and make sure the setting value of P2.034 (Condition of over-speed warning) is proper.</li> </ol>
How to clear the alarm?	DI.ARST

**AL008 Abnormal pulse command**

Trigger condition and causes	<p>Condition: The input frequency of the pulse command is over the allowable value of the hardware interface.</p> <p>Cause: The pulse command frequency is higher than the rated input frequency.</p>
Checking methods and corrective actions	Use the scope to check if the input frequency is higher than the rated one. And correctly set the input pulse frequency.
How to clear the alarm?	DI.ARST

**AL009 Excessive deviation of position command**

Trigger condition and causes	<p>Condition: Deviation of position command and feedback exceeds the allowable range (P2.035).</p> <p>Causes:</p> <ol style="list-style-type: none"> <li>1. The max. position deviation is set too small.</li> <li>2. Gain value is set too small.</li> <li>3. Torque limit is set too low.</li> <li>4. Excessive external load.</li> <li>5. Improper setting of E-gear ratio.</li> </ol>
Checking methods and corrective actions	<ol style="list-style-type: none"> <li>1. Check the setting value of the max. deviation (P2.035 Warning condition of excessive position deviation).</li> <li>2. Check if the gain value is proper for the application.</li> <li>3. Check if the torque limit setting is proper for the application.</li> <li>4. Check the external load. Reduce the external load or re-evaluate the motor capacity if necessary.</li> <li>5. Check if the settings of P1.044 and P1.045 are appropriate for the application and set the correct values.</li> </ol>
How to clear the alarm?	DI.ARST

AL011 Encoder error	
Trigger condition and causes	<p>Condition: The encoder produces abnormal pulses.</p> <p>Causes:</p> <ol style="list-style-type: none"> <li>1. Encoder wiring is wrong.</li> <li>2. Encoder connector is loose.</li> <li>3. Poor wiring of the encoder.</li> <li>4. Connection of the encoder is cut off due to interference.</li> <li>5. Encoder is damaged.</li> </ol>
Checking methods and corrective actions	<ol style="list-style-type: none"> <li>1. Check if the wiring follows the instructions in the user manual. If not, conduct the wiring again.</li> <li>2. Check if CN2 connector and the encoder connector are loose. If so, reconnect the connectors.</li> <li>3. Check both the connection between the encoder and CN2 of the servo drive to see if there is any poor wiring or damaged wires. If so, please replace the connector and cable.</li> <li>4. Please check the communication error status by setting P0.002 to -80. If the value continuously increases, it means interference occurs. Please check the following: <ul style="list-style-type: none"> <li>■ Make sure the servo motor is well grounded. Please connect the ground of UVW connector (Green) to the heat sink of the servo drive.</li> <li>■ Check if the connection of encoder signal cable is normal. Make sure to separate the encoder signal cable from the main power circuit cable so that interference can be avoided.</li> <li>■ Use shielded cable for the encoder.</li> </ul> </li> <li>5. If all corrective actions are done but the issue persists, please replace the motor.</li> </ol>
How to clear the alarm?	Re-power on the servo drive.

AL012 Adjustment error	
Trigger condition and causes	<p>Condition: The calibration value exceeds the allowable value during electric calibration.</p> <p>Causes:</p> <ol style="list-style-type: none"> <li>1. The analog input contact is not set to zero correctly.</li> <li>2. The detection device is damaged.</li> </ol>
Checking methods and corrective actions	<ol style="list-style-type: none"> <li>1. Check if the voltage of the analog input contact is the same as the ground voltage.</li> <li>2. Reset the power supply. If the issue persists, please send the servo</li> </ol>

	drive back to the distributor or contact Delta.
How to clear the alarm?	Remove the connection cable of CN1 and then execute auto calibration.

**AL013 Emergency stop**

Trigger condition and causes	The emergency stop button is pressed.
Checking methods and corrective actions	Check the emergency stop state and make sure it is off.
How to clear the alarm?	This alarm can be cleared by DI.EMGS.

**AL014 Reverse limit error**

Trigger condition and causes	Condition: Reverse limit switch is triggered. Causes: 1. Reverse limit switch is triggered. 2. Servo system is instable.
Checking methods and corrective actions	1. Check the reverse limit switch and make sure it is off. 2. Check the parameter setting and load inertia. If the setting is wrong, please modify the parameter value or re-estimate the motor capacity.
How to clear the alarm?	Reset the alarm or switch the servo drive off.

**AL015 Forward limit error**

Trigger condition and causes	Condition: Forward limit switch is activated. Causes: 1. Forward limit switch is activated. 2. Servo system is instable.
Checking methods and corrective actions	1. Check the forward limit switch and make sure it is off. 2. Check the parameter setting and load inertia. If the setting is wrong, please modify the parameter value or re-estimate the motor capacity.
How to clear the alarm?	Reset the alarm or switch the servo drive off.

**AL016 IGBT overheat**

Trigger condition and causes	Condition: Temperature of IGBT is too high. Causes: 1. The load is over the rated range and the servo drive is in a persistent overload condition. 2. Motor has a short-circuit or fault to ground (frame).
Checking methods and corrective actions	1. Check if the motor is overloaded or over current. Then, try to increase

	<p>the motor's capacity or reduce the load.</p> <p>2. Check if the wiring of servo drive output is correct.</p>
How to clear the alarm?	DI.ARST

**AL017 Abnormal EEPROM**

Trigger condition and causes	<p>Condition: Error occurs when DSP accesses EEPROM.</p> <p>Causes:</p> <ol style="list-style-type: none"> <li>Parameter write-in error or the setting value exceeds the permissible range. This error occurs when parameters are restored to the default and servo drive type is wrong.</li> <li>Data in ROM is damaged or there is no data in ROM. It occurs when the system is in servo-on status. If this alarm occurs, please send the servo drive back to the distributor or contact Delta.</li> </ol>
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Checking methods and corrective actions	<p>Press the SHIFT key on the panel and "EXGAB" will be displayed.</p> <p>X = 1, 2, 3</p> <p>G = Group No. of the parameter</p> <p>AB = Parameter No. in hexadecimal format</p> <p>If the panel displays E320A, it signifies parameter P2.010; if E3610 is displayed, it signifies P6.016. Please check the setting of the displayed parameter.</p> <ol style="list-style-type: none"> <li>Press the SHIFT key to display the parameter code; If this alarm occurs when power is supplied to the drive, it means a given parameter value has exceeded the range. You can modify the value and then re-power on. If the error occurs during normal operation, it means an error occurred when writing the parameter.</li> <li>Press the SHIFT key on the panel and E100X displays. If this alarm occurs while parameters are being restored to default, it means the servo model type setting is incorrect. Please correct it.</li> <li>Press the SHIFT key on the panel and the servo drive displays E0001; If this alarm occurs while power is being supplied, it is usually because the data in ROM is damaged or no data is in it. Please send it back to the distributor or Delta.</li> </ol>
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How to clear the alarm?	<p>If this alarm occurs when the drive is started, please reset the parameters and then re-power on. If the alarm occurs during operation, please reset the alarm.</p>
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AL018 Abnormal encoder signal output	
Trigger condition and causes	<p>Condition: Output frequency of the encoder is higher than the rated output frequency of the hardware.</p> <p>Causes:</p> <ol style="list-style-type: none"> <li>1. Pulse resolution of the encoder is set too high.</li> <li>2. Interference occurrence or cable damage causing communication error.</li> <li>3. Encoder error.</li> </ol>
Checking methods and corrective actions	<ol style="list-style-type: none"> <li>1. The setting of P1.076 and P1.046 should follow the requirements:                      P1.076 &gt; motor speed and  <math display="block">\frac{\text{Motor speed}}{60} \times P1 - 46 \times 4 &lt; 19.8 \times 10^6</math> </li> <li>2. Please check the communication error status by setting P0.002 to -80. If the value continuously increases, it means interference occurs. Please check the following:                     <ol style="list-style-type: none"> <li>(A) Make sure the servo motor is properly grounded and connect UVW connector (color green) to the heat sink of the servo drive.</li> <li>(B) Check if the connection of encoder signal cable is normal. Make sure to separate the encoder signal cable from the main power circuit cable so that interference can be avoided.</li> <li>(C) Use shielded cable for the encoder.</li> </ol> </li> <li>3. Check the error log (P4.000 ~ P4.005) and see if an alarm has occurred (AL011, AL024, AL025, and AL026). Apply the checking methods and corrective actions to clear the alarm if any of them occurs.</li> </ol>
How to clear the alarm?	<ol style="list-style-type: none"> <li>1. DI.ARST</li> <li>2. Please send the product to the distributor or Delta.</li> </ol>

AL019 Serial communication error	
Trigger condition and causes	<p>Condition: RS-485 communication error.</p> <p>Causes:</p> <ol style="list-style-type: none"> <li>1. Improper setting of communication parameters.</li> <li>2. Incorrect communication address.</li> <li>3. Incorrect communication value.</li> </ol>
Checking methods and corrective actions	<ol style="list-style-type: none"> <li>1. Check the setting value of communication parameter. Then, correctly set P3.003 and P3.004 or restore the value to default.</li> <li>2. Check and correctly set the communication address.</li> <li>3. Check and correctly set the accessing value.</li> </ol>
How to clear the alarm?	DI.ARST

<b>AL020 Serial communication timeout</b>	
Trigger condition and causes	<p>Condition: RS-485 communication error.</p> <p>Causes:</p> <ol style="list-style-type: none"> <li>1. Improper setting of the timeout parameters (P5.003).</li> <li>2. Servo drive has not received the communication command for a long time (Please refer to P5.003).</li> </ol>
Checking methods and corrective actions	<ol style="list-style-type: none"> <li>1. Check and make sure the setting value of communication timeout parameter is correct.</li> <li>2. Check if the communication cable is loose or broken and correctly wired.</li> </ol>
How to clear the alarm?	DI.ARST

<b>AL022 RST leak phase</b>	
Trigger condition and causes	<p>Condition: RST power cable is loose or no power is applied. The default setting of AL022 is a warning. To set AL022 as an alarm, you can set P2.066 [Bit 12] to complete the setting.</p> <p>Cause: RST leak phase.</p>
Checking methods and corrective actions	<p>Check if RST power cable is loose or no power is applied. This alarm occurs when 1.5 kW (or below) A3 servo drive is not connected to the three-phase power supply; for 2 kW (or above) A3 servo drive, the alarm occurs when one single phase is not connected to the power supply. Correctly connect the power to the servo drive. If the issue persists, please send your A3 servo drive back to the distributor or contact Delta.</p>
How to clear the alarm?	DI.ARST

<b>AL023 Early warning for overload</b>	
Trigger condition and causes	Early warning for overload
Checking methods and corrective actions	<ol style="list-style-type: none"> <li>1. Check if your servo drive is overloaded and refer to the corrective actions of AL006 for troubleshooting.</li> <li>2. Check if the value of P1.056 is set too small. If yes, please increase the value, which should be over 100 for disabling the warning function.</li> </ol>
How to clear the alarm?	DI.ARST



<b>AL024 Encoder initial magnetic field error</b>	
Trigger condition and causes	Condition: The magnetic field of the encoder U, V, W signal is in error. Cause: The initial magnetic field of the encoder is in error (Signal U, V, W of the encoder magnetic field is in error.)
Checking methods and corrective actions	<ol style="list-style-type: none"> <li>1. Make sure the servo motor is properly grounded and connect UVW connector (color green) to the heat sink of the servo drive.</li> <li>2. Make sure the encoder cable is separated from the power supply or high-current cable to avoid interference.</li> <li>3. Use shielded cable for the encoder.</li> </ol> <p>If the issue persists, please send your servo drive back to the distributor or contact Delta.</p>
How to clear the alarm?	Re-power on the servo drive.

<b>AL025 Internal error of the encoder</b>	
Trigger condition and causes	Condition: Internal memory and counter of the encoder are in error. Causes: <ol style="list-style-type: none"> <li>1. Internal error of the encoder (Internal memory and counter are in error).</li> <li>2. When applying to the power, the motor rotates because of inertia of mechanism or other causes.</li> </ol>
Checking methods and corrective actions	<ol style="list-style-type: none"> <li>1. (A) Make sure the servo motor is properly grounded and connect UVW connector (color green) to the heat sink of A3 servo drive. (B) Make sure the encoder cable is separated from the power supply or high-current cable to avoid interference. (C) Use shielded cable for the encoder.</li> <li>2. Make sure the motor shaft stays still when power is on.</li> </ol>
How to clear the alarm?	Re-power on the servo drive.

<b>AL026 Unreliable internal data of the encoder</b>	
Trigger condition and causes	Condition: Internal data error occurs for three times continuously. Causes: <ol style="list-style-type: none"> <li>1. External interference.</li> <li>2. Malfunction of encoder hardware.</li> </ol>

<p>Checking methods and corrective actions</p>	<p>To tackle the interference, check the following descriptions:</p> <ol style="list-style-type: none"> <li>1. Make sure the servo motor is properly grounded and connect UVW connector (color green) to the heat sink of A3 servo drive.</li> <li>2. Make sure the encoder cable is separated from the power supply or the high-current cable to avoid interference.</li> <li>3. Use shielded cable for the encoder.</li> <li>4. Set P0.002 to -80 by using the panel to monitor the communication error status. If the value is greater than 0 and the value increases continuously, please check descriptions of 1. ~ 3. again. If the value is 0, send the motor back to the distributor or contact Delta.</li> </ol>
<p>How to clear the alarm?</p>	<p>Re-power on the servo drive.</p>

**AL027 Internal of the motor is in error**

<p>Trigger condition and causes</p>	<p>Condition: Encoder reset error. Cause: Encoder reset.</p>
<p>Checking methods and corrective actions</p>	<ol style="list-style-type: none"> <li>1. Check if the encoder cable is firmly connected.</li> <li>2. Check if the power supply for the encoder is stable and make sure to use shielded cable.</li> <li>3. Check if the operation temperature is over 95°C. Identify the cause for the rising temperature and do not start the operation before the temperature lowers to the allowable range.</li> </ol> <p>If issue persists, please send your servo drive back to the distributor or contact Delta.</p>
<p>How to clear the alarm?</p>	<p>Re-power on the servo drive.</p>

**AL028 Encoder voltage error or internal error**

<p>Trigger condition and causes</p>	<p>Condition: Charging circuit of the servo drive is not removed and the battery voltage is higher than the specification (&gt;3.8V) or encoder signal is in error. Causes:</p> <ol style="list-style-type: none"> <li>1. Voltage level of the battery is too high.</li> <li>2. Internal error of the encoder.</li> </ol>
<p>Checking methods and corrective actions</p>	<ol style="list-style-type: none"> <li>1. Follow the checking procedure for overvoltage/overcurrent and troubleshoot. Then, AL028 will be cleared automatically.             <ul style="list-style-type: none"> <li>(A) Check the charging circuit of the servo drive. Avoid wrong wiring; if Pin 1 (5V) of CN2 is connected to BAT+, it means the power (5V) of the servo drive is being charged to the battery.</li> <li>(B) Check if the battery is correctly installed. (Voltage &gt; 3.8V)</li> </ul> </li> <li>2. Make sure the encoder is absolute type. Check and remove the cause</li> </ol>

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	<p>for the alarm. If the issue persists, please send your servo drive back to the distributor or contact Delta.</p> <p>(A) Make sure the servo motor is properly grounded and connect UVW connector (color green) to the heat sink of servo drive.</p> <p>(B) Make sure the encoder cable is separated from the power supply or high-current cable to avoid interference.</p> <p>(C) Use shielded cable for the encoder. If issue persists, please send your servo drive back to the distributor or contact Delta.</p>
How to clear the alarm?	Re-power on the servo drive.

<b>AL029 Gray code error</b>	
Trigger condition and causes	Absolute position error.
Checking methods and corrective actions	Power on the servo drive again to operate the motor. Then, check if the alarm occurs again. If issue persists, please replace the encoder.
How to clear the alarm?	Re-power on the servo drive.

<b>AL030 Motor crash error</b>	
Trigger condition and causes	<p>Condition: When the motor hits the device, the torque reaches the setting value of P1.057 and lasts for the time set by P1.058.</p> <p>Causes:</p> <ol style="list-style-type: none"> <li>1. Check if the function of motor crash protection (P1.057) is enabled. If so, please set P1.057 to 0.</li> <li>2. Check if value of P1.057 is set too small and the time set by P1.058 is too short. Please set P1.057 according to the actual torque. Improper setting might inadvertently trigger the signal or lose the protection function.</li> </ol>
Checking methods and corrective actions	Re-power on the servo drive to operate the motor and check if the alarm occurs again. If issue persists, please replace the encoder.
How to clear the alarm?	DI.ARST

<b>AL031 Incorrect wiring of motor power cable or disconnection</b>	
Trigger condition and causes	<p>Condition: Incorrect wiring or disconnection of power cable U, V, W, and GND.</p> <p>Causes:</p> <p>Incorrect wiring or disconnection of motor power cable U, V, W. (The switch of cut-off detection is set by P2.065 Bit 9, which default is set to disable.)</p>

Checking methods and corrective actions	Check if the motor power cable (U, V, W, GND) is firmly connected. Please conduct wiring and ground properly by following the instructions mentioned in the user manual.
How to clear the alarm?	Re-power on the servo drive.

#### AL034 Internal communication of the encoder is in error

Trigger condition and causes	Condition: <ol style="list-style-type: none"> <li>1. Internal communication of absolute type encoder is in error.</li> <li>2. Internal part of other type of encoder is in error.</li> </ol> Cause: Internal communication of the encoder is in error.
Checking methods and corrective actions	<ol style="list-style-type: none"> <li>1. Check the battery wiring. Then, wire it again and re-power on the system.</li> <li>2. Internal communication error of absolute type encoder occurs. Please replace the motor.</li> </ol>
How to clear the alarm?	Re-power on the servo drive.

#### AL035 Encoder temperature exceeds the protective range

Trigger condition and causes	Condition: Encoder temperature is over the Max. 100°C. Cause: Encoder temperature is over 100°C.
Checking methods and corrective actions	Set P0.002 to 120d in order to read the temperature and check if it is below 100°C. If the encoder temperature is higher than 100°C, please improve heat dissipation or reduce operation load. If the temperature difference between the motor and the displayed one is over 30°C, please send the motor back to the distributor.
How to clear the alarm?	After the temperature detector shows a temperature below 100°C, please re-power on the servo drive.

#### AL040 Excessive deviation of full closed-loop position control

Trigger condition and causes	Excessive deviation of full closed-loop position control
Checking methods and corrective actions	<ol style="list-style-type: none"> <li>1. Check the setting of P1.073. If the value is too small, please set a bigger value.</li> <li>2. Make sure the connector is firmly connected and there is no problem in connecting the mechanism.</li> </ol>
How to clear the alarm?	DI.ARST

<b>AL041 Communication of linear scale is cut off</b>	
Trigger condition and causes	Communication of linear scale is cut off.
Checking methods and corrective actions	Make sure the wiring of linear scale is normal.
How to clear the alarm?	DI.ARST

<b>AL042 Analog input voltage is too high</b>	
Trigger condition and causes	Analog input voltage for the speed command is higher than the level specified by P1.083.
Checking methods and corrective actions	Check if the voltage source for the speed command is normal. Check the setting value of P1.083 and set it to 0 when this function is not required.
How to clear the alarm?	DI.ARST

<b>AL044 Warning of servo function overload</b>	
Trigger condition and causes	Condition: When the motor controlling function of servo drive is overloaded, the motion control function will be affected and thus PR or E-Cam operation will be in error. Cause: Warning of servo function overload.
Checking methods and corrective actions	1. Check if the filter is enabled and see if enabling the filter is necessary. 2. Set P2.066 Bit4 to 1 and this alarm will be disabled.
How to clear the alarm?	1. Disable the filter that is not required, such as low-pass filter (P1.006 ~ P1.008), Moving Filter (P1.068), low-frequency vibration suppression (P1.025 ~ P1.028), vibration elimination (elasticity compensation) (P1.089 ~ P1.094), and Notch filter (5 sets). 2. Set P2.066 Bit4 to 1 and re-power on the servo drive.

<b>AL045 E-Gear ratio setting error</b>	
Trigger condition and causes	Condition: When setting of E-Gear ratio exceeds the range (1/50 ~ 25600), this alarm will occur once the servo drive is re-powered on. Cause: When the servo drive is powered on, E-Gear ratio setting is in error.
Checking methods and corrective actions	Check if the setting of E-gear ratio is within the allowable range (1/50 ~ 25600). Adjust to the proper value and then re-power on the servo drive.
How to clear the alarm?	Once the setting value is corrected, re-power on the servo drive.

<b>AL060 Absolute position is lost</b>	
Trigger condition and causes	<p>Condition: Losing the record of revolution number because of low battery voltage or cutting off of the power.</p> <p>Causes:</p> <ol style="list-style-type: none"> <li>1. Voltage level of the battery is too low.</li> <li>2. The battery is replaced when the control power of the servo drive is off.</li> <li>3. The battery is not installed when the absolute function is enabled.</li> <li>4. Poor connection or disconnection of the battery power circuit.</li> </ol>
Checking methods and corrective actions	<ol style="list-style-type: none"> <li>1. Check if the battery voltage is below 2.8V; execute homing once the battery is changed. Please refer to Chapter 10 Absolute servo system for more detail about initializing absolute coordinate system.</li> <li>2. Do not change or remove the battery when A3 servo drive's control power is off. To execute homing again, please refer to Chapter 10 for absolute coordinate initialization.</li> <li>3. Please follow the instructions below:               <ul style="list-style-type: none"> <li>(A) Install the battery.</li> <li>(B) Check the connection between the battery power source and servo drive.</li> <li>(C) Check the encoder wiring.</li> </ul> </li> <li>4. Connect or correct the wiring so that the battery power can be supplied to the encoder and execute homing again.               <ul style="list-style-type: none"> <li>(A) Check the encoder wiring.</li> <li>(B) Check the connection between the battery box and servo drive.</li> </ul> </li> </ol>
How to clear the alarm?	Re-power on the servo drive.

<b>AL061 Encoder undervoltage</b>	
Trigger condition and causes	<p>Condition: Voltage level of the absolute type encoder battery is lower than the allowable value (3.1V).</p> <p>Cause: Voltage level of the battery is too low.</p>
Checking methods and corrective actions	<ol style="list-style-type: none"> <li>1. Check the panel to see if the battery voltage is less than 3.1V.</li> <li>2. Measure the battery voltage and see if it is less than 3.1V.</li> </ol> <p>If undervoltage, replace the battery when the control power is on.</p>
How to clear the alarm?	The alarm will be cleared automatically.

<b>AL062 Multi-turn of absolute encoder overflows</b>	
Trigger condition and causes	Condition: The multi-turn of absolute encoder exceeds the range: -32768 ~ +32767.

	Cause: Motor's rotation cycle exceeds the range.
Checking methods and corrective actions	Check if the motor's operation turn is within the range between -32768 and +32767. If not, please execute homing again.
How to clear the alarm?	Re-power on the servo drive.

**AL067 Encoder temperature warning**

Trigger condition and causes	Condition: The encoder temperature is over 85°C (warning level), but still under 100°C, which is within the protective range. Cause: Encoder temperature warning (85°C ~ 100°C).
Checking methods and corrective actions	Set P0.002 to 120d and check if the encoder temperature is identical to the motor. If the encoder temperature is too high, please improve the heat dissipation or reduce operation load. If the temperature difference between the encoder and motor is over 30°C, please send the motor back to the distributor.
How to clear the alarm?	Re-power on the servo drive.

**AL068 Absolute data transmitted via I/O is in error**

Trigger condition and causes	Condition: The sequence is wrong when reading the absolute position via DIO. Causes: 1. Time sequence is wrong. 2. Reading timeout.
Checking methods and corrective actions	1. Correct the time sequence for reading the data via DIO: (A) DI.ABSQ switches to off after DO.ABSR is off. (B) DI.ABSQ switches to on after DO.ABSR is on. 2. Check the duration from DO.ABSR switches to on state to the time that DI.ABSQ becomes on and see if this duration is over 200 ms. The correct procedure should be: When DO.ABSR switches to on state and after the bit data of absolute position is ready, read DO.ABSD within 200 ms and switch DI.ABSQ to on. Then, inform the servo drive that the data reading has been completed.
How to clear the alarm?	Re-power on the servo drive.

**AL069 Wrong motor type / Absolute position is not initialized**

Trigger condition and causes	Incremental type motor does not support absolute function.
Checking methods and corrective actions	<ol style="list-style-type: none"> <li>1. Check to see if your servo motor is applied with an incremental type or absolute type encoder.</li> <li>2. Check the setting of P2.069 and correctly set the value. Set P2.069 to 0 if absolute function is not used.</li> </ol>
How to clear the alarm?	Set P2.069 to 0 and then re-power on the servo drive.

**AL06A Absolute position is lost**

Trigger condition and causes	<p>Condition:</p> <ol style="list-style-type: none"> <li>1. Motor in use for the first time.</li> <li>2. When power supply of the servo drive is cut off and the battery has run out so as the absolute position is lost, or the battery has been replaced.</li> </ol> <p>Cause: The motor is used for the first time or the absolute position is lost due to change of battery.</p>
Checking methods and corrective actions	Check if the absolute position is initialized (See more detail in Section 10.3.1).
How to clear the alarm?	This alarm will be cleared once the initialization of the absolute position is completed.

**AL070 Encoder does not complete the command issued by servo drive**

Trigger condition and causes	Command is not completed when the barcode is written to the encoder.
Checking methods and corrective actions	Check if the wiring is correct or firmly connected. If not, please correctly conduct the wiring again.
How to clear the alarm?	Re-power on the servo drive.

**AL072 Encoder overspeed**

Trigger condition and causes	<p>When encoder is powered by the servo drive: over 8800 rpm;</p> <p>When encoder is powered by the battery: over 10000 rpm.</p>
Checking methods and corrective actions	<ol style="list-style-type: none"> <li>1. Check if the motor is well grounded; make sure the grounding of the power cable is connected to the heat sink of the servo drive.</li> <li>2. Make sure the encoder cable is separated from the power supply or high-current cable to avoid interference.</li> <li>3. Use shielded cable for the encoder and pull out the shielded mesh for grounding.</li> </ol>



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	<p>4. Check the motor speed and make sure it is within the rated range. If issue persists, please send your servo drive back to the distributor or contact Delta.</p>
How to clear the alarm?	Re-power on the servo drive.

**AL073 Encoder memory error**

Trigger condition and causes	An error has occurred when the encoder is reading / writing data in EEPROM.
Checking methods and corrective actions	<ol style="list-style-type: none"> <li>1. Check if the motor is well grounded; make sure the grounding of the power cable is connected to the heat sink of the servo drive.</li> <li>2. Make sure the encoder cable is separated from the power supply or high-current cable to avoid interference.</li> <li>3. Use shielded cable for the encoder and pull out the shielded mesh for grounding.</li> <li>4. Check the motor speed and make sure it is within the rated range. If issue persists, please send your servo drive back to the distributor or contact Delta.</li> </ol>
How to clear the alarm?	Re-power on the servo drive.

**AL074 Single turn position error of absolute encoder**

Trigger condition and causes	Position error of single turn of the encoder.
Checking methods and corrective actions	<ol style="list-style-type: none"> <li>1. Check if the motor is well grounded; make sure the grounding of the power cable is connected to the heat sink of the servo drive.</li> <li>2. Make sure the encoder cable is separated from the power supply or high-current cable to avoid interference.</li> <li>3. Use shielded cable for the encoder and pull out the shielded mesh for grounding.</li> <li>4. Check the motor speed and make sure it is within the rated range. If issue persists, please send your servo drive back to the distributor or contact Delta.</li> </ol>
How to clear the alarm?	Re-power on the servo drive.

<b>AL075 Position error of absolute encoder</b>	
Trigger condition and causes	Absolute position of the encoder is in error.
Checking methods and corrective actions	<ol style="list-style-type: none"> <li>1. Check if the motor is well grounded; make sure the grounding of the power cable is connected to the heat sink of the servo drive.</li> <li>2. Make sure the encoder cable is separated from the power supply or high-current cable to avoid interference.</li> <li>3. Use shielded cable for the encoder and pull out the shielded mesh for grounding.</li> <li>4. Check the motor speed and make sure it is within the rated range.</li> </ol> <p>If issue persists, please send your servo drive back to the distributor or contact Delta.</p>
How to clear the alarm?	Re-power on the servo drive.

<b>AL077 Internal error of the encoder</b>	
Trigger condition and causes	Internal error of the encoder (Internal computing error).
Checking methods and corrective actions	<ol style="list-style-type: none"> <li>1. Check if the motor is well grounded; make sure the grounding of the power cable is connected to the heat sink of the servo drive.</li> <li>2. Make sure the encoder cable is separated from the power supply or high-current cable to avoid interference.</li> <li>3. Use shielded cable for the encoder and pull out the shielded mesh for grounding.</li> <li>4. Check the motor speed and make sure it is within the rated range.</li> </ol> <p>If issue persists, please send your servo drive back to the distributor or contact Delta.</p>
How to clear the alarm?	Re-power on the servo drive.

<b>AL079 Encoder parameter error</b>	
Trigger condition and causes	The encoder is not re-powered on after the parameter is written, so the parameter setting remains invalid.
Checking methods and corrective actions	Check if the parameter is written to the encoder. If so, please re-power on the encoder to validate the setting.
How to clear the alarm?	Re-power on the servo drive.

<b>AL07B Encoder memory is busy</b>	
Trigger condition and causes	Encoder memory is busy.
Checking methods and corrective actions	<ol style="list-style-type: none"> <li>1. Check if the motor is well grounded; make sure the grounding of the power cable is connected to the heat sink of the servo drive.</li> <li>2. Make sure the encoder cable is separated from the power supply or high-current cable to avoid interference.</li> <li>3. Use shielded cable for the encoder and pull out the shielded mesh for grounding.</li> <li>4. Check the motor speed and make sure it is within the rated range.</li> </ol> <p>If issue persists, please send your servo drive back to the distributor or contact Delta.</p>
How to clear the alarm?	Re-power on the servo drive.

<b>AL07C Command of clearing absolute position is issued when motor speed is over 200 rpm</b>	
Trigger condition and causes	The command of clearing absolute position is issued when motor speed is over 200 rpm.
Checking methods and corrective actions	<p>Check if a command for clearing the absolute position is issued while motor speed is over 200 rpm. If so, follow the procedure for clearing absolute position to clear this alarm.</p> <p>Do not issue a command for clearing absolute position when motor is over 200 rpm.</p>
How to clear the alarm?	Re-power on the servo drive.

<b>AL07D Servo drive is re-powered on before AL07C is cleared; the motor stops operating</b>	
Trigger condition and causes	AL07C occurs and is not cleared before the servo drive is re-powered on, thus the motor stops operating.
Checking methods and corrective actions	Use DI.ARST to clear the alarm. Once this alarm is cleared, AL07C will occur. Please follow the checking and troubleshoot methods to clear the alarm.
How to clear the alarm?	Re-power on the servo drive.

<b>AL07E Clearing procedure error of the encoder</b>	
Trigger condition and causes	Times of clearing procedure error of the encoder exceed the limit.
Checking methods and corrective actions	If the issue persists, set P0.002 to -81 to check the communication quality of the encoder. If communication is normal, use DI.ARST to clear this alarm.
How to clear the alarm?	Re-power on the servo drive.

<b>AL07F Encoder version error</b>	
Trigger condition and causes	The encoder version read by the servo drive is wrong.
Checking methods and corrective actions	N/A
How to clear the alarm?	Replace the motor immediately.

<b>AL083 Servo drive outputs excessive current</b>	
Trigger condition and causes	<p>Condition: During general operation, this alarm will be triggered while the servo drive outputs current that is over the allowable level specified by the firmware. This alarm is triggered to protect IGBT from being overheated or burned because of the high current.</p> <p>Causes:</p> <ol style="list-style-type: none"> <li>1. UVW cable is short-circuited.</li> <li>2. Motor wiring is wrong.</li> <li>3. GND of analog signal of the servo drive is interfered.</li> </ol>
Checking methods and corrective actions	<ol style="list-style-type: none"> <li>1. Check the connection between the motor power cable and its connector. If its metal wire is exposed or the wire is torn, the UVW cable will be short-circuited. In this kind of circumstances, please replace the UVW cable and avoid the metal conductor being exposed.</li> <li>2. Refer to Chapter 3 Wiring and check the following:             <ol style="list-style-type: none"> <li>(A) If Delta standard power cable is not used, make sure the wiring sequence of UVW is correct.</li> <li>(B) Make sure the wiring of UVW between the servo drive and the motor is correctly connected.</li> </ol> </li> <li>3. Check if the GND of analog signal is mistakenly connected to other ground signal (Wrong connection will cause interference). DO NOT use a common ground for the analog signal and GND. Follow the wiring instructions mentioned in Chapter 3.</li> </ol>
How to clear the alarm?	DI.ARST

**AL085 Regeneration setting error**

Trigger condition and causes	Condition: Regeneration control is in error. Cause: Regenerative resistor is not operating, but the generative voltage remains 400V for a period of time.
Checking methods and corrective actions	Check the connection of the regenerative resistor, re-calculate the value for regenerative resistor, and reset the value of P1.052 and P1.053. If the alarm has not been cleared, please send the servo drive back to Delta.
How to clear the alarm?	DI.ARST

**AL086 Input voltage is too high**

Trigger condition and causes	Condition: When the servo drive detects no regenerative power, but other regenerative energy (such as interference) is input to the servo drive, or voltage input is higher than the permissible rated voltage. Causes: 1. Other energy (such as interference) is input to the servo drive or input voltage of power is higher than the permissible rated value. 2. Malfunction of the servo drive hardware.
Checking methods and corrective actions	1. Use voltmeter to measure if the input voltage of the power source is within the permissible rated value (See the servo drive specifications). If the voltage exceeds the rated value, please remove the interference source. 2. If the voltmeter detects that the voltage input of the main circuit is within the permissible rated range, but the issue persists, then it can be determined as malfunction of the servo drive.
How to clear the alarm?	1. Use the correct voltage source or serial connect the voltage regulator. 2. Send the servo drive back to the distributor or contact Delta.

**AL088 Warning of servo function overload**

Trigger condition and causes	Condition: Too many motor control functions on the servo drive are enabled. Cause: Warning of servo function overload.
Checking methods and corrective actions	Check the enabled filter and see if using this filter is necessary.
How to clear the alarm?	Disable the filter that is not required, such as low-pass filter (P1.006 ~ P1.008), Moving filter (P1.068), low-frequency vibration suppression (P1.025 ~ P1.028), vibration elimination (elasticity compensation) (P1.089 ~ P1.094), and Notch filter (5 sets).

<b>AL089 Current detection is interfered</b>	
Trigger condition and causes	Condition: Current detection is interfered. Cause: Current detection in the servo drive is affected by external interference source.
Checking methods and corrective actions	Check the environment around the servo drive to see if there is any interference source.
How to clear the alarm?	<ol style="list-style-type: none"> <li>1. Remove or keep clear of the interference source.</li> <li>2. Set P2.112 [Bit 1] to 0 will disable AL089.</li> <li>3. If the issue persists, please send the servo drive back to the distributor or contact Delta.</li> </ol>

<b>AL08A Auto-tuning function - Command error</b>	
Trigger condition and causes	Condition: No command is issued when the servo drive starts the auto-tuning procedure. Causes: <ol style="list-style-type: none"> <li>1. When command source is the controller, no command is issued by the controller or position register.</li> <li>2. When command source is the servo drive, position 1 and 2 specify the same position.</li> <li>3. Signal cable is not connected or mistakenly connected so that the servo drive cannot receive the command.</li> </ol>
Checking methods and corrective actions	<ol style="list-style-type: none"> <li>1. Make sure a command has been issued.</li> <li>2. Make sure the wiring between the controller and servo drive is correct.</li> </ol>
How to clear the alarm?	DI.ARST

<b>AL08B Auto-tuning function - Inertia estimation error</b>	
Trigger condition and causes	Condition: Inertia estimation error occurs when the servo drive starts the auto-tuning procedure. Causes: <ol style="list-style-type: none"> <li>1. Acceleration/deceleration time is too long.</li> <li>2. Rotation speed is too slow.</li> <li>3. Inertia of mechanism is set too big.</li> <li>4. Inertia variation is too drastic.</li> </ol>
Checking methods and corrective actions	<ol style="list-style-type: none"> <li>1. The acceleration/deceleration time for motor to rotate from 0 rpm to 3000 rpm has to be within 1.5 sec.</li> <li>2. The slowest speed has to be no less than 200 rpm; above 500 rpm is suggested.</li> </ol>

	<ol style="list-style-type: none"> <li>3. The load inertia has to be no more than 50 times of the motor inertia.</li> <li>4. Avoid applications that require drastic variation of inertia.</li> </ol>
How to clear the alarm?	DI.ARST

**AL08C Auto-tuning function - Pause time is too short**

Trigger condition and causes	<p>Condition: The pause time is set too short when controller is used as the command source in the auto-tuning procedure. The auto-tuning algorithm requires enough time to perform calculation. The tuning result will be affected if pause time is set too short.</p> <p>Cause: Pause time set in the cycle is too short.</p>
Checking methods and corrective actions	<ol style="list-style-type: none"> <li>1. For reciprocating motion between two points, pausing is required on the return, which has to be longer than 1 sec.</li> <li>2. For rotation in single direction, pause time is required when the motor rotates certain cycles (&gt; 2 cycles).</li> </ol>
How to clear the alarm?	DI.ARST

**AL095 Regenerative resistor disconnected**

Trigger condition and causes	<p>Setting value of P1.053 (Capacity of regenerative resistor) is not 0 and external regenerative resistor or brake is not connected. Only servo drives of 5.5 kW or above that have built-in regenerative resistors will show this alarm.</p>
Checking methods and corrective actions	<ol style="list-style-type: none"> <li>1. If the regenerative brake is required, please connect the regenerative resistor; once connected, make sure the setting of P1.053 is correct.</li> <li>2. If the regenerative brake is not used, set P1.053 (capacity of regenerative resistor) to 0.</li> </ol> <p>If the issue persists, please send the servo drive back to the distributor or contact Delta.</p>
How to clear the alarm?	DI.ARST

**AL099 DSP firmware update**

Trigger condition and causes	EEPROM is not reset after DSP firmware is updated.
Checking methods and corrective actions	Check if the firmware is updated. Set P2.008 to 30 first and then set to 28. Next, re-power on the servo drive.
How to clear the alarm?	Set P2.008 to 30 and then 28. And re-power on the servo drive.

<b>AL521 Vibration elimination parameter error</b>	
Trigger condition and causes	<p>Condition: The input parameter value of vibration elimination (elasticity compensation) is not appropriate.</p> <p>Causes:</p> <ol style="list-style-type: none"> <li>1. The value of vibration suppression (elasticity compensation) set by users is not proper.</li> <li>2. The Bode plot is in error due to other variables while the operation system is analyzing the program.</li> </ol>
Checking methods and corrective actions	Perform system analysis again and set the parameter value of vibration elimination.
How to clear the alarm?	<ol style="list-style-type: none"> <li>1. Perform system analysis again and set the parameter value of vibration elimination</li> <li>2. If the issue persists, please disable the vibration elimination function P2.094 [Bit 8] &amp; [Bit 9].</li> </ol>



**STO type:**

<b>AL500 STO function is enabled</b>	
Trigger condition and causes	Safe torque off function (STO) is enabled.
Checking methods and corrective actions	Safe torque off function (STO) is enabled. Please check the activation causes.
How to clear the alarm?	<ol style="list-style-type: none"> <li>1. Use DI.ARST or 0x6040.Fault Reset, or set P0.001 to 0.</li> <li>2. If STO is not used, plug the short circuit device into CN10 or wiring to short circuit the block. Follow the instructions in Section 3.9.3 for the wiring of STO.</li> </ol>

<b>AL501 STO_A loss (signal loss or signal error)</b>	
Trigger condition and causes	Loss of STO_A signal or STO_A and STO_B signals are not synchronized for more than 1 sec.
Checking methods and corrective actions	Make sure the wiring of STO_A is correct.
How to clear the alarm?	Re-power on the servo drive.

<b>AL502 STO_B loss (signal loss or signal error)</b>	
Trigger condition and causes	Loss of STO_B signal or STO_A and STO_B signals are not synchronized for more than 1 sec.
Checking methods and corrective actions	Make sure the wiring of STO_B is correct.
How to clear the alarm?	Re-power on the servo drive.

<b>AL503 STO self-diagnostic error</b>	
Trigger condition and causes	An error occurs when STO self-diagnosis is carried out.
Checking methods and corrective actions	Make sure the wiring of STO_A and STO_B is correct.
How to clear the alarm?	If the wiring is correct, it might be the STO circuit that causes the error. Please contact the distributor.

**Communication Type:**

<b>AL111 Buffer overflow occurs receiving CANopen SDO</b>	
Trigger condition and causes	SDO Rx Buffer overflow (receives more than two SDOs within 1 ms).
Checking methods and corrective actions	Check if the servo drive (Master) receives or sends more than one SDO within 1 ms.
How to clear the alarm?	NMT: Reset node or 0x6040.Fault Reset.

<b>AL112 Buffer overflow occurs when receiving CANopen PDO</b>	
Trigger condition and causes	PDO Rx Buffer overflow (receives more than two PDOs of COBID within 1 ms)
Checking methods and corrective actions	Check if the servo drive (Master) receives or sends more than one PDO of COBID within 1 ms.
How to clear the alarm?	NMT: Reset node or 0x6040.Fault Reset.

<b>AL121 Object's index does not exist when CANopen PDO is received</b>	
Trigger condition and causes	When the servo drive receives the PDO from the controller, the specified object's index number is incorrect so that the servo drive cannot identify it.
Checking methods and corrective actions	<ol style="list-style-type: none"> <li>1. Check if the object's index for PDO mapping of the controller is correct.</li> <li>2. If the index number is correct, it means this specified object is not supported by the servo drive. Please check if using this object is necessary or you can find other substitute object.</li> </ol>
How to clear the alarm?	NMT: Reset node or 0x6040.Fault Reset.

<b>AL122 Object's sub-index does not exist when CANopen PDO is received</b>	
Trigger condition and causes	When the servo drive receives the PDO from the controller, the specified object's sub-index number is incorrect so that the servo drive cannot identify it.
Checking methods and corrective actions	<ol style="list-style-type: none"> <li>1. Check if the object's sub-index for PDO mapping of the controller is correct.</li> <li>2. If the sub-index number is correct, it means this specified object is not supported by the servo drive. Please check if using this object is necessary or you can find other substitute object.</li> </ol>
How to clear the alarm?	NMT: Reset node or 0x6040.Fault Reset.

<b>AL123 Data size error occurs when CANopen PDO is received</b>	
Trigger condition and causes	Data length in the message does not match with the specified object.
Checking methods and corrective actions	Check if the data length for PDO mapping was changed when the servo drive receives or sends PDO.
How to clear the alarm?	NMT: Reset node or 0x6040.Fault Reset.

<b>AL124 Data range error occurs when CANopen PDO is received</b>	
Trigger condition and causes	The data value in the message is over the range of the specified object.
Checking methods and corrective actions	Check if the written range is wrong when the servo drive receives or sends PDO.
How to clear the alarm?	NMT: Reset node or 0x6040.Fault Reset.

<b>AL125 CANopen object is read-only and write-protected</b>	
Trigger condition and causes	The specified object in the message is read-only and write-protected.
Checking methods and corrective actions	Check if the object for the PDO mapping is read-only.
How to clear the alarm?	NMT: Reset node or 0x6040.Fault Reset.

<b>AL126 Specified object does not support PDO mapping</b>	
Trigger condition and causes	The specified object in the message does not support PDO mapping.
Checking methods and corrective actions	Check if the specified object allows PDO mapping when PDO is receiving or sending.
How to clear the alarm?	NMT: Reset node or 0x6040.Fault Reset.

<b>AL127 CANopen PDO is write-protected when servo drive is on</b>	
Trigger condition and causes	The specified object in the message is write-protected when servo drive is on.
Checking methods and corrective actions	Make sure no PDO is written in when servo drive is on.
How to clear the alarm?	NMT: Reset node or 0x6040.Fault Reset.

<b>AL128 Error occurs when reading CANopen PDO from EEPROM</b>	
Trigger condition and causes	An error occurs when loading the default value via ROM at start-up. All objects of CAN returns to the default value automatically.
Checking methods and corrective actions	When PDO is receiving or sending, check if the error occurs because the specified object reads EEPROM.
How to clear the alarm?	NMT: Reset node or 0x6040.Fault Reset.

<b>AL129 Error occurs when writing CANopen PDO to EEPROM</b>	
Trigger condition and causes	An error occurs when saving the current parameter value into ROM.
Checking methods and corrective actions	When PDO is receiving or sending, check if the error occurs because the specified object is written into EEPROM.
How to clear the alarm?	NMT: Reset node or 0x6040.Fault Reset.

<b>AL130 Accessing address of EEPROM is out of range when using CANopen PDO</b>	
Trigger condition and causes	The quantity of the data in the ROM is over the allowable space specified by the firmware. It is probably because the firmware has been updated, but the data in the ROM is stored by the old version.
Checking methods and corrective actions	Check if the address of EEPROM will exceed the range because of the specified object during PDO receiving or sending.
How to clear the alarm?	NMT: Reset node or 0x6040.Fault Reset.

<b>AL131 CRC of EEPROM calculation error occurs when using CANopen PDO</b>	
Trigger condition and causes	The data in ROM is damaged; all CANopen objects are automatically restored to default values.
Checking methods and corrective actions	Check if the specified object would cause CRC calculation error in EEPROM when PDO is being received or sent. (Usually, this alarm is caused by error of DSP.)
How to clear the alarm?	NMT: Reset node or 0x6040.Fault Reset.

<b>AL132 Parameter is write-prohibited when using CANopen PDO</b>	
Trigger condition and causes	When using CAN object to write data to the parameter, the parameter is currently write-prohibited.
Checking methods and corrective actions	Please refer to the specified parameter description to write data to the parameter.
How to clear the alarm?	NMT: Reset node or 0x6040.Fault Reset.

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<b>AL180 Heartbeat or NodeGuarding error</b>	
Trigger condition and causes	CANopen communication is cut off resulting in Heartbeat or NodeGuarding error.
Checking methods and corrective actions	<ol style="list-style-type: none"> <li>1. Check if the CANopen communication is normal.</li> <li>2. Check if the wiring (connection) is correct.</li> </ol>
How to clear the alarm?	NMT: Reset node or 0x6040.Fault Reset.

<b>AL185 CAN Bus hardware error</b>	
Trigger condition and causes	<p>Condition: CAN Bus is cut off or Rx/Tx Counter error occurs for more than 128 times.</p> <p>Cause: CAN Bus hardware error.</p>
Checking methods and corrective actions	<ol style="list-style-type: none"> <li>1. Check if the communication cable for CAN Bus is complete.</li> <li>2. Check the communication quality; using common grounding and shielded cable are suggested.</li> </ol>
How to clear the alarm?	NMT: Reset node or 0x6040.Fault Reset.

<b>AL186 CAN Bus Off</b>	
Trigger condition and causes	Transmission error of CAN data.
Checking methods and corrective actions	<ol style="list-style-type: none"> <li>1. Check if the cable is well connected and whether there is any noise inference. Replace the communication cable or eliminate the noise if necessary.</li> <li>2. Excessive number of the slave stations and the communication cycle is too short. Please lengthen the communication cycle.</li> </ol>
How to clear the alarm?	NMT: Reset node or 0x6040.Fault Reset.

<b>AL201 Error occurs when loading CANopen data</b>	
Trigger condition and causes	Condition: An error has occurred when loading data from EEPROM. Cause: Initialization error of CANopen data.
Checking methods and corrective actions	<ol style="list-style-type: none"> <li>1. If the alarm is cleared after re-powering on the servo drive, it means the error occurs at the moment when reading the data.</li> <li>2. If the issue persists after re-powering on the servo drive, it means the data of EEPROM is damaged and you need to write in the correct value again. See the following methods:                     <ul style="list-style-type: none"> <li>(A) To write in the default value, set P2.008 to 30 and then 28, or use CANopen object 0x1011 to complete the setting.</li> <li>(B) To write in the current value, set CANopen object 0x1010 to complete the setting. (Please refer to CANopen technical guide for ASDA-A2)</li> </ul> </li> </ol>
How to clear the alarm?	DI.ARST or CANopen 0x1011 Restore default parameter

<b>AL301 CANopen synchronization failure</b>	
Trigger condition and causes	Condition: The servo drive fails to synchronize with the controller in CANopen IP mode. Cause: CANopen synchronization failure.
Checking methods and corrective actions	<ol style="list-style-type: none"> <li>1. Make sure the communication between the servo drive and the controller is good.</li> <li>2. After eliminating foreseeable problems, allow the controller to re-send the SYNC signal and ensure that it is sent successfully.</li> <li>3. Modify the setting of P3.009 (Setting the default value is suggested.)</li> </ol>
How to clear the alarm?	NMT: Reset node or 0x6040.Fault Reset.

<b>AL302 Synchronization signal of CANopen is sent too soon</b>	
Trigger condition and causes	Condition: When using CANopen, the synchronization signal is received too soon. Cause: The synchronization signal of CANopen is sent too fast.
Checking methods and corrective actions	<ol style="list-style-type: none"> <li>1. Make sure the setting of synchronization cycle (0x1006) is identical to that of the controller.</li> <li>2. Modify the setting of P3.009. (Using default value is suggested.)</li> <li>3. Ensure a correct time sequence of sending packets from the controller. A drift or delay in packet sending time will lead to synchronization failure.</li> </ol>
How to clear the alarm?	NMT: Reset node or 0x6040.Fault Reset.

<b>AL303 CANopen synchronization signal timeout</b>	
Trigger condition and causes	Condition: In CANopen IP mode, the synchronization with the controller failed. Cause: Timeout of CANopen synchronization signal.
Checking methods and corrective actions	<ol style="list-style-type: none"> <li>1. Make sure the communication quality is good.</li> <li>2. Make sure the setting of synchronization cycle (0x1006) is identical to that of the controller.</li> <li>3. Modify the setting of P3.009. (Using default value is suggested.)</li> <li>4. Ensure a correct time sequence of sending packets from the controller. A drift or delay in packet sending time will lead to synchronization failure.</li> </ol>
How to clear the alarm?	NMT: Reset node or 0x6040.Fault Reset.

<b>AL304 Invalid command of CANopen IP</b>	
Trigger condition and causes	Condition: Command cannot be sent when it is in CANopen IP mode. Cause: Command of CANopen IP is invalid.
Checking methods and corrective actions	The computing time of IP mode takes too long. Please disable USB monitoring function.
How to clear the alarm?	NMT: Reset node or 0x6040.Fault Reset.

<b>AL305 SYNC period error</b>	
Trigger condition and causes	Condition: CANopen 301 Obj 0x1006 Data Error Cause: SYNC period is in error.
Checking methods and corrective actions	Check the content of 0x1006. If it is smaller than or equal to 0, the alarm will occur.
How to clear the alarm?	NMT: Reset node or 0x6040.Fault Reset.

<b>AL401 NMT reset command is received when servo is on</b>	
Trigger condition and causes	NMT reset command is received when servo drive is on.
Checking methods and corrective actions	Check if the NMT reset command is received when servo drive is on. Use NMT.reset or 0x6040.Fault Reset.
How to clear the alarm?	DI.ARST

**Motion control type:**

<b>AL207 Parameter group of PR#8 is out of range</b>	
Trigger condition and causes	Condition: Parameter group of PR#8, P_Group, is out of range. Cause: The group of PR#8 command source is exceeds the range.
Checking methods and corrective actions	Writing parameter via PR procedure: The parameter group of command source exceeds the range. Please check the setting.
How to clear the alarm?	DI.ARST or set P0.001 to 0.

<b>AL209 Parameter number of PR#8 is out of range</b>	
Trigger condition and causes	Condition: Parameter number of PR#8 is out of range. Cause: Parameter number is out of range.
Checking methods and corrective actions	Writing parameter via PR procedure: Parameter number of PR#8 is out of range. Please check the setting.
How to clear the alarm?	DI.ARST or set P0.001 to 0.

<b>AL213 Parameter setting of PR#8 is in error</b>	
Trigger condition and causes	Condition: When using PR#8 to write in parameters, the setting of parameter value is incorrect. Cause: Parameter setting of PR#8 is in error.
Checking methods and corrective actions	Make sure the parameter value set by users is within the setting range.
How to clear the alarm?	DI.ARST or set P0.001 to 0.

<b>AL215 Write parameters: Read-only</b>	
Trigger condition and causes	Condition: Write parameters via PR procedure: The parameter is read-only. Cause: An error has occurred when writing in PR#8.
Checking methods and corrective actions	The specified parameter is read-only.
How to clear the alarm?	DI.ARST or set P0.001 to 0.



<b>AL217 Write parameters: Parameter locked</b>	
Trigger condition and causes	Condition: Write parameters via PR procedure: The parameter is write-protected when the servo drive is on or its value exceeds the range. Condition: An error has occurred when writing in PR#8.
Checking methods and corrective actions	Please write in the parameters when the servo drive is off and make sure the setting value is within the range.
How to clear the alarm?	Modify the PR command and the parameter.

<b>AL231 Setting of monitoring item of PR#8 is out of range</b>	
Trigger condition and causes	Condition: The setting of monitoring item of PR#8, Sys_Var, exceeds the range. Cause: The setting of monitoring item is out of range.
Checking methods and corrective actions	Please check the code range when writing in the monitoring code and make sure it is within the allowable range.
How to clear the alarm?	Reset the alarm or set P0.001 to 0.

<b>AL235 Absolute positioning command error</b>	
Trigger condition and causes	Condition: Execute a position command after the feedback position counter overflows. Cause: Feedback position counter overflows.
Checking methods and corrective actions	Incremental system: When the motor keeps operating in one direction, this will ultimately lead to overflow of position feedback register (FB_PUU). Thus, the coordinate system cannot display the correct position. Issuing a positioning command at this moment will result in error. Please use the scope to check if the feedback position has overflowed and execute homing procedure. Absolute system: This error will occur when issuing the absolute positioning command in the following situations: 1. Feedback position register (FB_PUU) overflows. 2. Setting of P1.001.Z is changed, but homing has not been completed yet. 3. E-Gear ratio (P1.044 and P1.045) is changed, but homing has not been completed yet. 4. Function of returning to original point is triggered, but homing has not been completed yet. 5. When AL060 or AL062 occurs, please use the scope to check if the feedback position has overflowed. Check the situations of 1 ~ 4

	mentioned above and carry out homing procedure.
How to clear the alarm?	Perform homing procedure.

#### AL237 Indexing coordinate is undefined

Trigger condition and causes	Use the indexing function and execute positioning command before the start point of indexing coordinate is defined. Thus, the servo drive cannot identify this coordinate system.
Checking methods and corrective actions	Check if the indexing coordinate has been defined: <ol style="list-style-type: none"> <li>1. Perform homing procedure prior to using the indexing function.</li> <li>2. After alarm occurs, use DI.ARST or set P0.001 to 0 to clear it.</li> <li>3. This alarm can also be cleared when servo is switched to on.</li> </ol>
How to clear the alarm?	DI.ARST or set P0.001 to 0.

#### AL283 Software positive limit

Trigger condition and causes	Condition: The target position specified by the command exceeds the software positive limit. Cause: Reaching the software positive limit
Checking methods and corrective actions	When the software positive limit function is enabled, the occurrence of this alarm is determined by the command instead of the feedback position. Thus it may occur while the actual position is still within the allowable range. As a command is issued before the feedback is received, you can set a proper deceleration time to satisfy the application requirement. Please see description of P5.003 for more detail.
How to clear the alarm?	NMT: Reset node or 0x6040.Fault Reset

#### AL285 Software negative limit

Trigger condition and causes	Condition: Target position specified by the command is smaller than the software positive limit. Cause: The software negative limit is triggered.
Checking methods and corrective actions	The software negative limit is determined by the position command instead of the actual feedback position because the command is sent before the feedback is received. That is, the actual position may have not reached the limit while the limit protection has been triggered. So, setting a proper deceleration time can help tackle this issue. Please refer to the description of P5.003.
How to clear the alarm?	NMT: Reset node or 0x6040.Fault Reset.

**AL289 Feedback position counter overflows**

Trigger condition and causes	Feedback position counter overflows.
Checking methods and corrective actions	<ol style="list-style-type: none"> <li>1. Please set the gear ratio according to the total traveling distance of the absolute type motor and the actual application requirement so as to avoid the overflowing of feedback position counter.</li> <li>2. If P2.069.Z is set to 1 (index coordinate overflow-proof function), please set P2.070 bit 2 to 1.</li> </ol>
How to clear the alarm?	NMT: Reset node or 0x6040.Fault Reset.

**AL380 Position offset alarm of DO.MC\_OK**

Trigger condition and causes	DO.MC_OK is on and then becomes off.
Checking methods and corrective actions	Please refer to description of P1.048. After DO.MC_OK is on, DO.MC_OK becomes off because DO.TPOS turns off. It might be an external force causing position deviation of the motor after positioning is completed. This alarm can be disabled by setting P1.048.Y to 0.
How to clear the alarm?	DI.ARST or set P0.001 to 0.

**AL3F1 Absolute index coordinate undefined**

Trigger condition and causes	<p>Condition: In communication mode (CANopen, DMCNET, and EtherCAT), an absolute positioning command is issued before absolute coordinate system is created.</p> <p>Causes:</p> <ol style="list-style-type: none"> <li>1. The absolute coordinate system is not created.</li> <li>2. Overflow occurs as the motor keeps rotating in the same direction.</li> </ol>
Checking methods and corrective actions	<ol style="list-style-type: none"> <li>1. Create an absolute coordinate system.</li> <li>2. Set the origin again.</li> </ol>
How to clear the alarm?	Set the origin again.

<b>AL400 Index coordinate error</b>	
Trigger condition and causes	Condition: $P1.044 \times P2.052 \times 4$ has to be less than $2^{31}$ . Cause: Value of P2.052 is set too small so as to cause the index coordinate error.
Checking methods and corrective actions	Check if the value of P2.052 is within the allowable setting range. If the setting value is too small, index coordinate will occur. Please re-adjust the value of P2.052.
How to clear the alarm?	DI.ARST

<b>AL404 Value of PR special filter setting is too big</b>	
Trigger condition and causes	Condition: The setting value of PR special filter (P1.022) is set too big so that the following error exceeds the range. Cause: Following error of internal position exceeds the allowable range.
Checking methods and corrective actions	Check the setting of P1.022. If the value is set too big, the following error will exceed the allowable range faster. Please set a proper value to P1.022.
How to clear the alarm?	DI.ARST

<b>AL555 System failure</b>	
Trigger condition and causes	DSP processing error.
Checking methods and corrective actions	If this alarm occurs, please send the servo drive directly back to Delta without making any modification.
How to clear the alarm?	N/A

<b>AL809 PR Arithmetic operation parameter error or the secondary platform error</b>	
Trigger condition and causes	Condition: An error has occurred when the servo drive is decoding the motion command. Cause: The PR arithmetic operation parameters have to be compiled by ASDA-Soft before being downloaded to the servo drive. Directly editing the PR arithmetic operation parameters through the panel or controller without the compilation of ASDA-Soft will trigger AL809.
Checking methods and corrective actions	<ol style="list-style-type: none"> <li>1. Make sure you edit PR arithmetic operation parameters through ASDA-Soft software. Do not directly modify these parameters via the panel or controller.</li> <li>2. If this alarm occurs when it is not in PR mode, please save the parameter file and contact the distributor.</li> </ol>

11

	<p>3. For advanced users, you can save the scope screenshot when the alarm occurs. Set P5.007 and P0.001 for the two channels to monitor the status and save the scope.</p>
<p>How to clear the alarm?</p>	<p>Re-power on the servo drive.</p>

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## A.1 ASDA-A3 series servo drive

### A.1.1 Specification of ASDA-A3 servo drive

A



ASDA-A3		100 W	200 W	400 W	750 W	1 kW	1.5 kW	2 kW	3 kW	
		01	02	04	07	10	15	20	30	
Power	Phase / Voltage	Single-phase / Three-phase 220 V <sub>AC</sub>						Three-phase 220 V <sub>AC</sub>		
	Permissible voltage	Single-phase / Three-phase 200 ~ 230 V <sub>AC</sub> , -15% ~ 10%						Three-phase 200 ~ 230 V <sub>AC</sub> , -15% ~ 10%		
	Input current (3 PH) Unit: Arms	0.67	1.34	2.67	5.01	6.68	10.02	13.36	20.05	
	Input current (1 PH) Unit: Arms	1.16	2.31	4.63	8.68	11.57	17.36	-	-	
	Continuous output current Unit: Arms	0.9	1.55	2.6	5.1	7.3	8.3	13.4	19.4	
	Max. instantaneous output current: Arms	3.54	7.07	10.61	21.21	24.75	35.36	53.03	70.71	
Cooling method		Natural cooling			Fan cooling					
Encoder resolution		24-bit (16777216 p/rev)								
Main circuit control		SVPWM control								
Control mode		Manual / Auto								
Regenerative resistor		N/A			Built-in					
Position control mode	Pulse type (except DMCNET mode)	Pulse + Direction, A phase + B phase, CCW pulse + CW pulse								
	Max. input pulse frequency (except DMCNET mode)	Pulse + Direction: 4 Mpps; CCW pulse + CW pulse: 4 Mpps; A phase + B phase: single-phase 4 Mpps; Open collector: 200 Kpps								
	Command source	External pulse (except DMCNET mode) / Register								
	Smoothing strategy	Low-pass and P-curve filter								
	E-Gear ratio	E-gear ratio: N/M multiple (1 / 4 < N / M < 262144) N: 1 ~ 536870911 / M: 1 ~ 2147483647								
	Torque limit	Parameter settings								
Feed forward compensation		Parameter settings								
Speed control mode	Analog command input (except DMCNET mode)	Voltage range	0 ~ ±10 V <sub>DC</sub>							
		Resolution	15-bit							
		Input resistance	1 MΩ							
		Time constant	25 μs							
	Speed control range *1		1: 6000							
	Command source		External analog command (except DMCNET mode) / Register							
	Smoothing strategy		Low-pass and S-curve filter							
Torque limit		Parameter settings / Analog input (except DMCNET mode)								
Bandwidth		Maximum 3.1 kHz (closed-loop)								

ASDA-A3		100 W	200 W	400 W	750 W	1 kW	1.5 kW	2 kW	3 kW
		01	02	04	07	10	15	20	30
	Speed accuracy <sup>*2</sup>	±0.01% at 0 to 100% load fluctuation							
		±0.01% at ±10% power fluctuation							
		±0.01% at 0 °C to 50 °C ambient temperature fluctuation							
Torque control mode	Analog command input (except DMCNET mode)	Voltage range	0 ~ ±10 V <sub>DC</sub>						
		Input resistance	1 MΩ						
		Time constant	25 μs						
	Command source	External analog command (except DMCNET mode) / Register							
	Smoothing strategy	Low-pass filter							
	Speed limit	Parameter settings / Analog input (except DMCNET mode)							
Digital input / output	Analog monitor output		Monitor signal can be set by parameters (voltage output range: ± 8V); resolution:10-bit						
	Input		<p>Servo on, Fault reset, Gain switch, Pulse clear, Zero clamp, Command input reverse control, Internal position command trigger, Torque limit, Speed limit, Internal position command selection, Motor stop, Speed command selection, Speed / position mode switching, Speed/torque mode switching, Torque / position mode switching, PT / PR command switching, Emergency stop, Positive / negative limit, Original point, Forward/reverse operation torque limit, Homing activated, E-CAM engage, Forward/reverse JOG input, Event trigger, E-Gear N selection, Pulse input prohibition</p> <p>*DMCNET mode is not included for the DI mentioned above. When applying DMCNET mode, it is suggested to use communication for DI input. Its DI only supports emergency stop, forward / reverse limit and homing.</p>						
	Output		<p>A, B, Z line driver output</p> <p>Servo on, Servo ready, Zero speed, Target speed reached, Target position reached, Torque limiting, Servo alarm, Brake control, Homing completed, Early warning for overload, Servo warning, Position command overflows, Software negative limit (reverse direction), Software positive limit (forward direction), Internal position command completed, Capture procedure completed, Servo procedure completed, Master position area of E-CAM</p>						
Protective function		<p>Over current, Overvoltage, Under voltage, Overheat, Regeneration error, Overload, Excessive speed deviation, Excessive position deviation, Encoder error, Adjustment error, Emergency stop, Negative / positive limit error, Excessive deviation of full-closed loop control, Serial communication error, Rst leak phase, Serial communication timeout, Short-circuit protection of terminal U, V, W and CN1, CN2, CN3</p>							





A

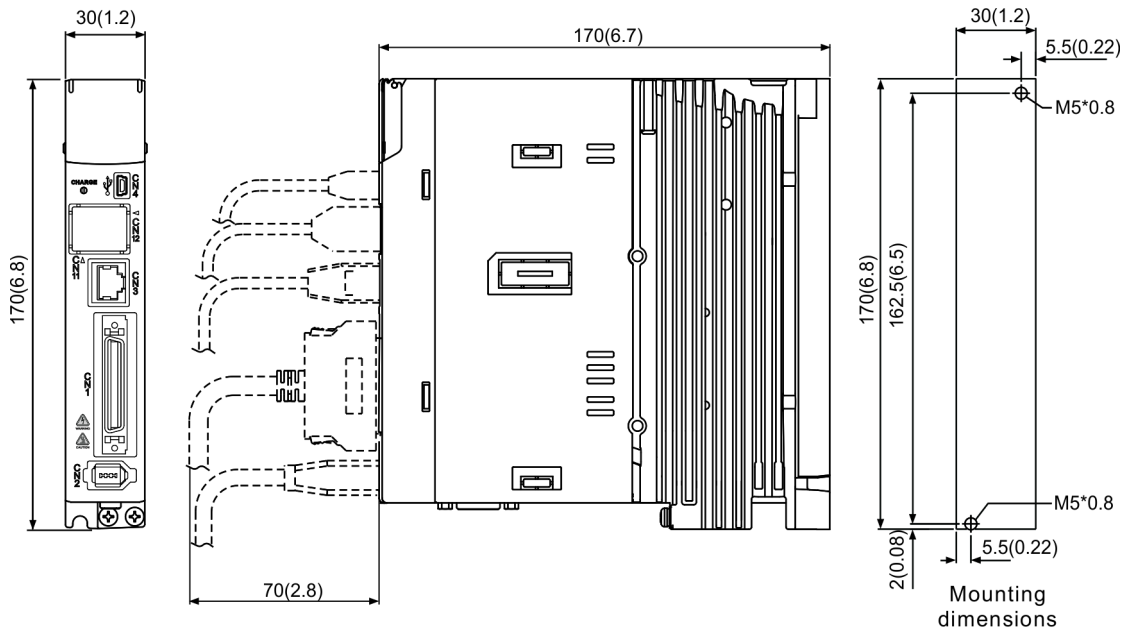
ASDA-A3		100 W	200 W	400 W	750 W	1 kW	1.5 kW	2 kW	3 kW
		01	02	04	07	10	15	20	30
Communication interface		RS-485 / CANopen / USB							
Environment	Installation site	Indoors (avoid direct sunlight), no corrosive fog (avoid fume, flammable gas and dust)							
	Altitude	Altitude 1000 m or lower above sea level							
	Atmospheric pressure	86 kPa ~ 106 kPa							
	Operating temperature	0°C ~ 55°C (If operating temperature is above 45°C, forced cooling will be required)							
	Storage temperature	-20°C ~ 65°C							
	Humidity	Under 0 ~ 90% RH (non-condensing)							
	Vibrating	9.80665m/s <sup>2</sup> (1 G) less than 20 Hz, 5.88 m/s <sup>2</sup> (0.6 G) 20 to 50 Hz							
	IP rating	IP20							
	Power system	TN system <sup>*3</sup>							
	Approvals	IEC/EN 61800-5-1, UL 508C  							

Note:

- \*1 When it is in rated load, the speed ratio is: the minimum speed (smooth operation) / rated speed.
- \*2 When the command is the rated speed, the velocity correction ratio is: (rotational speed with no load – rotational speed with full load) / rated speed.
- \*3 TN system: The neutral point of the power system connects to the ground directly. The exposed metal components connect to the ground via the protective earth conductor.
- \*4 Please apply to a single-phase three-wire power system for single-phase power model.

### A.1.2 Dimensions of the servo drive

#### 100 W / 200 W

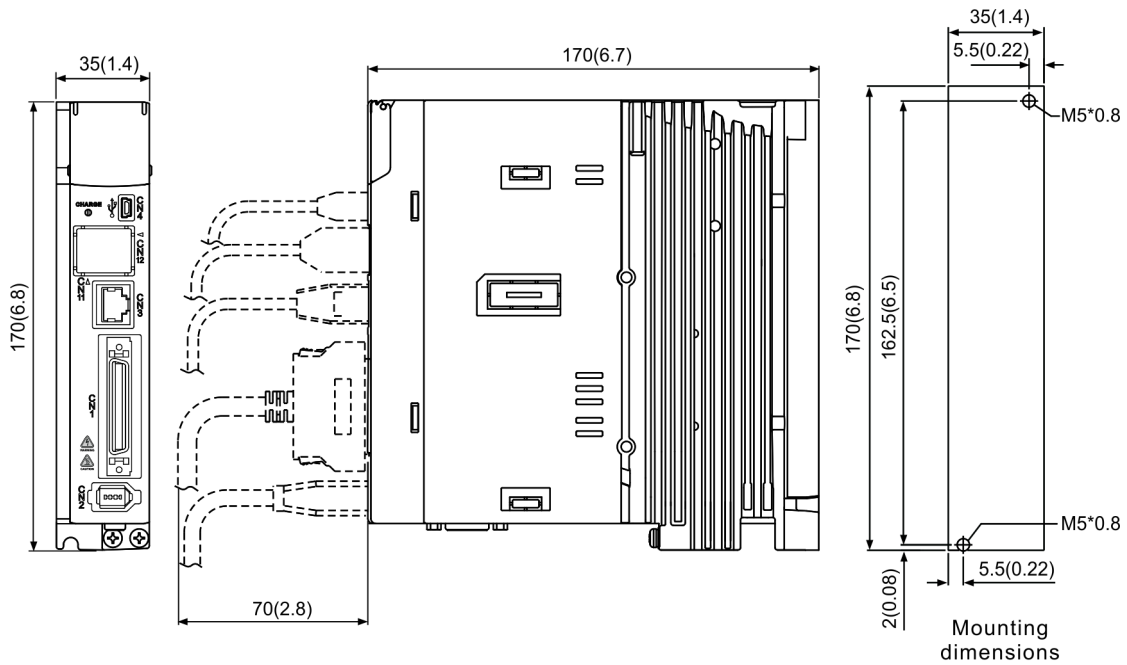


- ⊕ ⊕ SCREW: M4x0.7
- ⊕ ⊕ Mounting screw torque: 14 (kgf-cm)

Unit: mm (inch)

Weight	0.84 kgf (1.85 lbf)
--------	---------------------

#### 400 W



- ⊕ ⊕ SCREW: M4x0.7
- ⊕ ⊕ Mounting screw torque: 14 (kgf-cm)

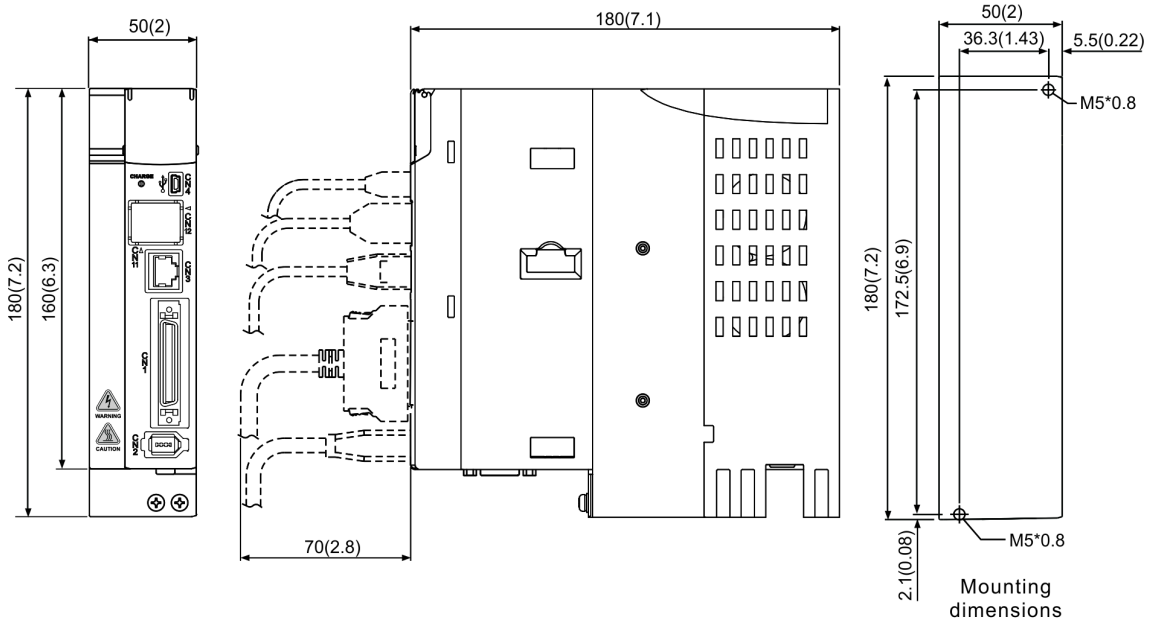
Unit: mm (inch)

Weight	0.92 kgf (2.03 lbf)
--------	---------------------

A

**750 W / 1 kW / 1.5 kW**

A

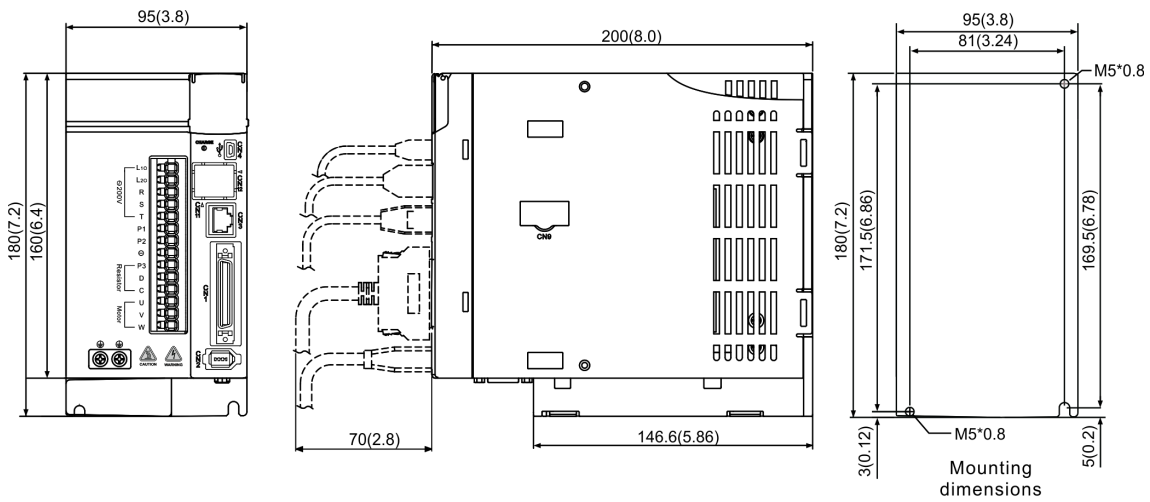


- ⊕ ⊖ SCREW: M4x0.7
- ⊗ ⊗ Mounting screw torque: 14 (kgf-cm)

Unit: mm (inch)

Weight	1.3 kgf (2.87 lbf)
--------	--------------------

**2 kW / 3 kW**



- ⊕ ⊖ SCREW: M4x0.7
- ⊗ ⊗ Mounting screw torque: 14 (kgf-cm)

Unit: mm (inch)

Weight	2.7 kgf (5.95 lbf)
--------	--------------------

Note: Dimensions and weights of the servo drive may be updated without prior notice.

## A.2 ECM-A3 series servo motor

### ECM-A3 series servo motor

$$\frac{\text{ECM}}{(1)} - \frac{\text{A}}{(2)} \frac{\text{3}}{(3)} \frac{\text{H}}{(4)} - \frac{\text{C}}{(5)} \frac{\text{Y}}{(6)} \frac{\text{06}}{(7)} \frac{\text{04}}{(8)} \frac{\text{R}}{(9)} \frac{\text{S}}{(10)} \frac{\text{1}}{(11)}$$

# A

(1) Product name

ECM: Electronic Commutation Motor

(2) Motor type

A: AC Servo Motor

(3) Name of the Series

3: A3 series

(4) Inertia type

H: high inertia

L: low inertia

(5) Rated voltage and speed

C: Rated voltage: 200V; Speed: 3,000 rpm

(6) Encoder type

Y: Absolute type (resolution of single turn: 24-bit; multi-turn: 16-bit)

(7) Motor frame size

04: 40 mm

06: 60 mm

08: 80 mm

(8) Rated power output

Number	Spec.	Number	Spec.
0F	50 W	04	400 W
01	100 W	07	750 W
02	200 W	-	-

A

(9) Shaft type and oil seal

	w/o brake w/o oil seal	with brake w/o oil seal	w/o brake with oil seal	with brake with oil seal
Round shaft (with fixed screw holes)	-	-	C*	D*
Keyway (with fixed screw holes)	P*	Q*	R	S

Note: \* signifies that the motor model is coming soon.

(10) Shaft diameter

S: standard

7: specific (14 mm)

(11) Special code


1: Standard

## A.2.1 ECM-A3L low inertia series servo motor

ECM-A3L	040F	0401	0602	0604	0804	0807
Rated power (kW)	0.05	0.1	0.2	0.4	0.4	0.75
Rated torque (N-m) <sup>*1</sup>	0.159	0.32	0.64	1.27	1.27	2.39
Max. torque (N-m)	0.557	1.12	1.92	3.82	3.82	7.17
Rated speed (rpm)	3000					
Max. speed (rpm)	6000					
Rated current (A)	0.67	0.89	1.45	2.65	2.6	5.1
Max. instantaneous current (A)	2.62	3.5	5.0	8.5	8.6	15.9
Power rating (kW/s)	10.9	25.3	45.5	107.5	45.4	111.4
Rotor inertia ( $\times 10^{-4}$ kg.m <sup>2</sup> )	0.0231	0.0405	0.09	0.15	0.355	0.513
Mechanical constant (ms)	1.31	0.817	0.64	0.41	0.68	0.40
Torque constant-KT (N-m/A)	0.237	0.36	0.44	0.48	0.49	0.469
Voltage constant-KE (mV/(rpm))	9.28	13.6	16.4	18.0	17.9	17
Armature resistance (Ohm)	11.9	9.47	4.9	2.27	1.6	0.6
Armature inductance (mH)	18.6	16.2	18.52	10.27	10.6	4.6
Electric constant (ms)	1.56	1.71	3.78	4.52	6.63	7.67
Insulation class	Class A (UL), Class B (CE)					
Insulation resistance	> 100 M $\Omega$ · DC 500 V					
Insulation strength	1.8k Vac, 1 sec					
Weight (w/o brake) (kg)	0.38	0.5	1.1	1.4	2.05	2.8
Weight (with brake) (kg)	0.68	0.8	1.6	1.9	2.85	3.6
Max. radial loading (N)	78	78	245	245	392	392
Max. axial loading (N)	54	54	74	74	147	147
Power rating (kW/s) (with brake)	10.3	24.5	37.24	89.6	41.0	95.4
Rotor inertia ( $\times 10^{-4}$ kg.m <sup>2</sup> ) (with brake)	0.0246	0.0418	0.12	0.18	0.393	0.599
Mechanical constant (ms) (with brake)	1.39	0.826	0.88	0.47	0.75	0.47
Brake holding torque [Nt-m (min)] <sup>*2</sup>	0.32	0.32	1.3	1.3	2.5	2.5
Brake power consumption (at 20°C)[W]	7.3	7.3	7.2	7.2	8.4	8.4
Brake release time [ms (Max)]	5	5	20	20	20	20
Brake pull-in time [ms (Max)]	25	25	50	50	70	70
Vibration grade ( $\mu$ m)	V15					
Operating temperature (°C)	0°C ~ 40°C					

A

A

ECM-A3L	040F	0401	0602	0604	0804	0807
Storage temperature (°C)	-10°C ~ 80°C					
Operating humidity	20 ~ 90%RH (non-condensing)					
Storage humidity	20 ~ 90%RH (non-condensing)					
Vibration capacity	2.5 G					
IP rating	IP67 (when waterproof connectors are used, or when an oil seal is used to be fitted to the rotating shaft (an oil seal model is used))					
Approvals						

Note:

\*1 The rated torque is the continuous permissible torque between 0 ~ 40°C operating temperature which is suitable for the following heat sink dimension.

ECM-A3L\_\_ 04 / 06 / 08: 250 mm x 250 mm x 6 mm

Material: Aluminum - F40, F60, F80


2. The built-in brake of the servo motor is for clamping purpose. Do not use it to decelerate or stop the operation.

## A.2.2 ECM-A3H high inertia series servo motor

ECM-A3H	040F	0401	0602	0604	0804	0807
Rated power (kW)	0.05	0.1	0.2	0.4	0.4	0.75
Rated torque (N-m) <sup>*1</sup>	0.159	0.32	0.64	1.27	1.27	2.39
Max. torque (N-m)	0.557	1.12	2.24	4.45	4.44	8.36
Rated speed (rpm)	3000					
Max. speed (rpm)	6000					
Rated current (A)	0.67	0.9	1.45	2.65	2.6	4.5
Max. instantaneous current (A)	2.68	3.52	5.4	9.9	9.4	16.6
Power rating (kW/s)	5.89	13.8	16.4	35.8	17.5	37.8
Rotor inertia ( $\times 10^{-4}$ kg.m <sup>2</sup> )	0.043	0.0742	0.25	0.45	0.92	1.51
Mechanical constant (ms)	2.49	1.38	1.37	0.96	1.31	0.91
Torque constant-KT (N-m/A)	0.241	0.356	0.44	0.48	0.49	0.53
Voltage constant-KE (mV/(rpm))	9.54	13.2	16.4	17.2	17.9	18.7
Armature resistance (Ohm)	12.5	8.34	3.18	1.68	1.19	0.57
Armature inductance (mH)	13.3	11	8.15	4.03	4.2	2.2
Electric constant (ms)	1.07	1.32	2.14	2.40	3.53	3.86
Insulation class	Class A (UL), Class B (CE)					
Insulation resistance	> 100 M $\Omega$ · DC 500 V					
Insulation strength	1.8k Vac, 1 sec					
Weight (w/o brake) (kg)	0.38	0.5	1.1	1.4	2.05	2.8
Weight (with brake) (kg)	0.68	0.8	1.6	1.9	2.85	3.6
Max. radial loading (N)	78	78	245	245	392	392
Max. axial loading (N)	54	54	74	74	147	147
Power rating (kW/s) (with brake)	5.68	13.6	15.17	34.32	15.1	34.4
Rotor inertia ( $\times 10^{-4}$ kg.m <sup>2</sup> ) (with brake)	0.0446	0.0755	0.28	0.48	1.07	1.66
Mechanical constant (ms) (with brake)	2.58	1.4	1.52	1.01	1.53	1
Brake holding torque [Nt-m (min)] *2	0.32	0.32	1.3	1.3	2.5	2.5
Brake power consumption (at 20°C)[W]	7.3	7.3	7.2	7.2	8.4	8.4
Brake release time [ms (Max)]	5	5	20	20	20	20
Brake pull-in time [ms (Max)]	25	25	50	50	70	70
Vibration grade ( $\mu$ m)	V15					
Operating temperature (°C)	0°C ~ 40°C					

A



ECM-A3H	040F	0401	0602	0604	0804	0807
Storage temperature (°C)	-10°C ~ 80°C					
Operating humidity	20 ~ 90%RH (non-condensing)					
Storage humidity	20 ~ 90%RH (non-condensing)					
Vibration capacity	2.5 G					
IP rating	IP67 (when waterproof connectors are used, or when an oil seal is used to be fitted to the rotating shaft (an oil seal model is used))					
Approvals						

## Note:

\*1 The rated torque is the continuous permissible torque between 0 ~ 40°C operating temperature which is suitable for the following heat sink dimension.

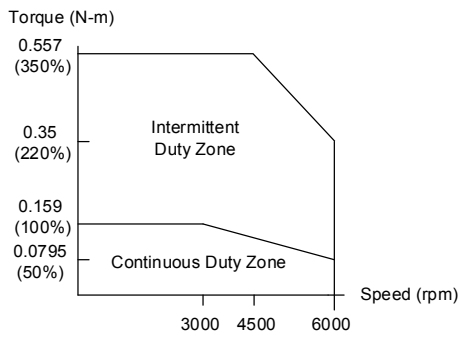
ECM-A3L\_\_ 04 / 06 / 08: 250 mm x 250 mm x 6 mm

Material: Aluminum - F40, F60, F80

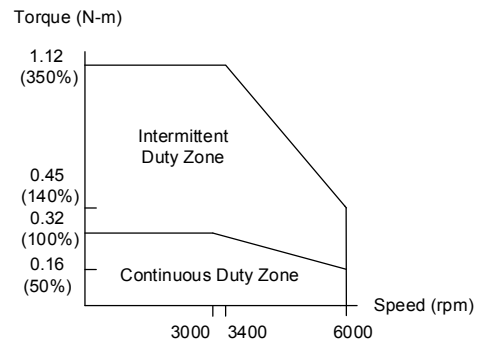
2. The built-in brake of the servo motor is for clamping purpose. Do not use it to decelerate or stop the operation.

### A.2.3 Torque features (T-N curves)

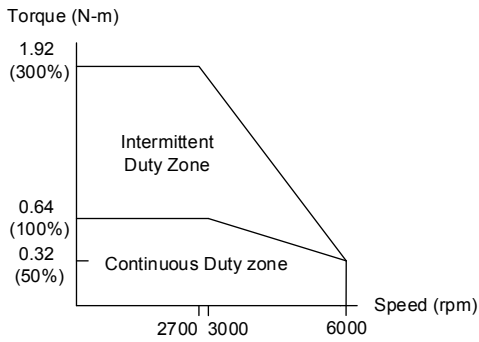
A



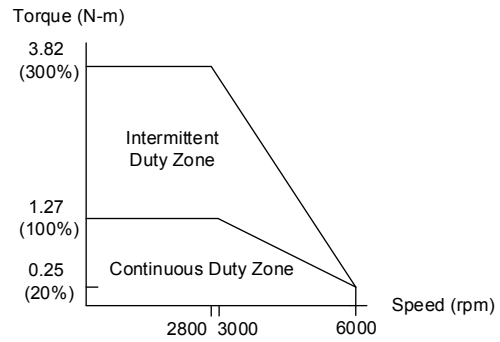
ECM-A3L-C-Δ040F□S1



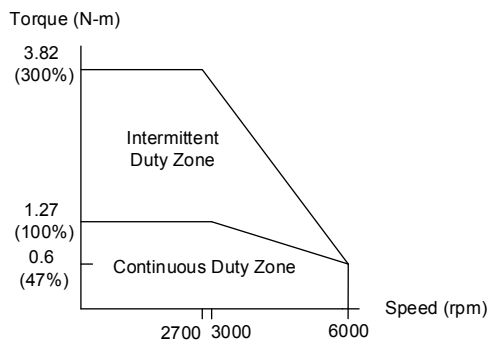
ECM-A3L-C-Δ0401□S1



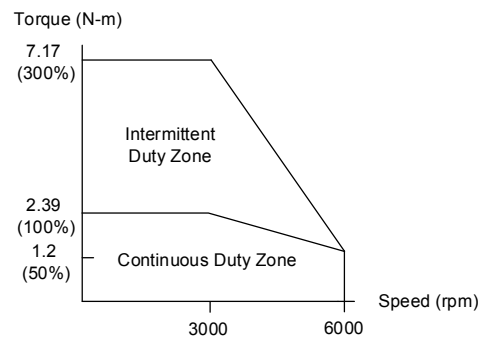
ECM-A3L-C-Δ0602□S1



ECM-A3L-C-Δ0604□S1

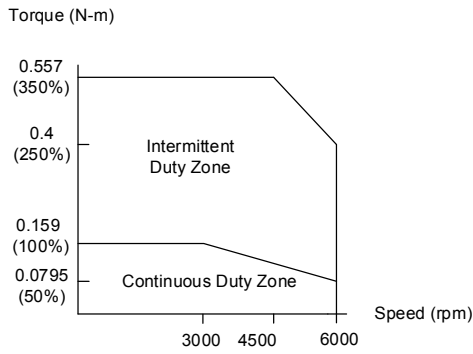


ECM-A3L-C-Δ0804□S1

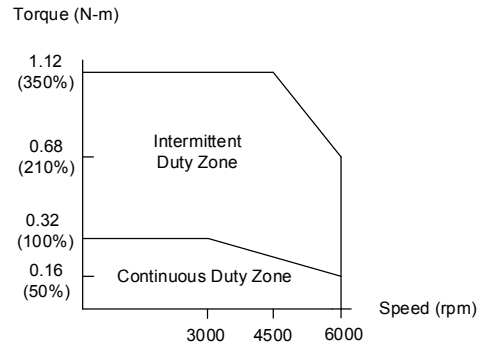


ECM-A3L-C-Δ0807□S1

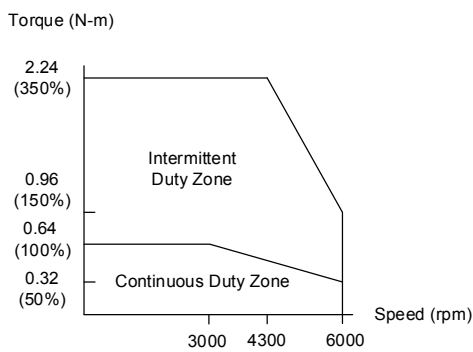
A



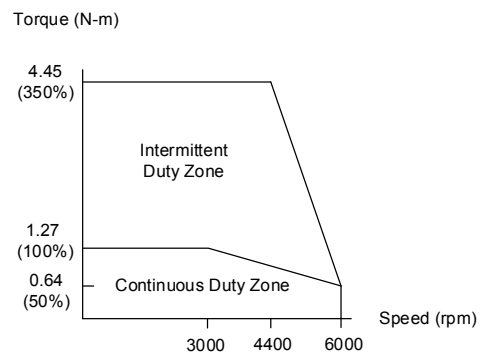
ECM-A3H-CΔ040F□S1



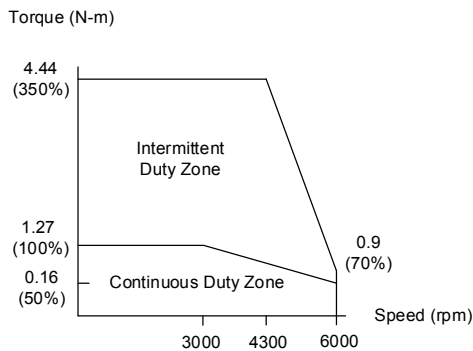
ECM-A3H-CΔ0401□S1



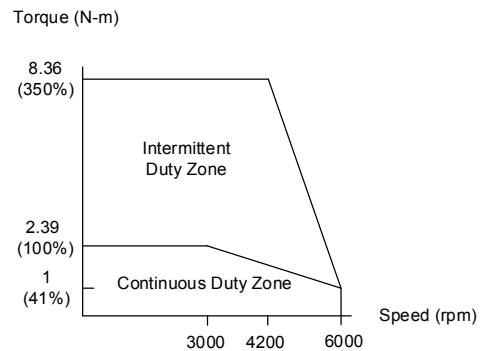
ECM-A3H-CΔ0602□S1



ECM-A3H-CΔ0604□S1



ECM-A3H-CΔ0804□S1



ECM-A3H-CΔ0807□S1

Note: Δ in motor model name represents encoder type; □ represents shaft type and oil seal.

### A.2.4 Overload features

#### Definition of overload protection

The overload protection is to prevent the motor from overheating.

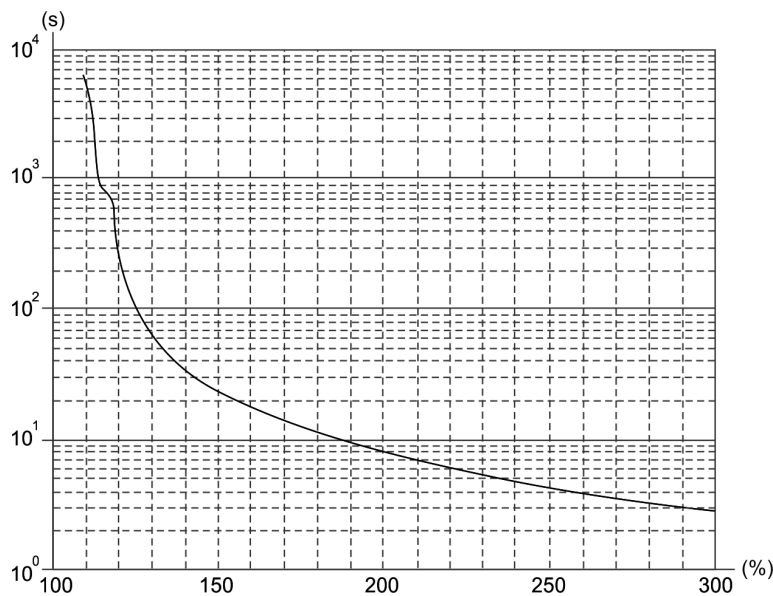
#### Causes of overload

1. The motor's rated torque exceeds the range and the operation time is too long.
2. The inertia ratio is set too big and the motor frequently accelerates / decelerates.
3. Connection error between power cable and encoder wiring.
4. Error of servo gain setting causes resonance of the motor.
5. The motor with brake operates without releasing the brake.



#### Graph of load and operating time

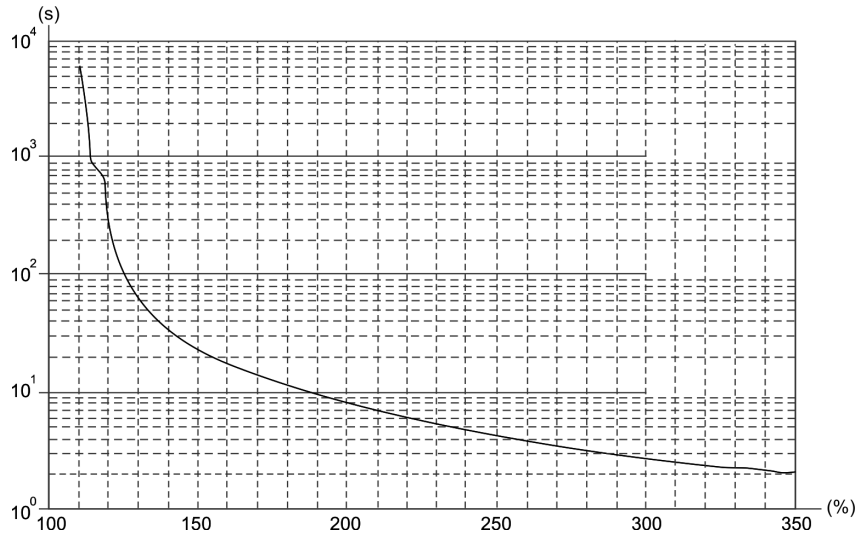
##### Low inertia (ECM-A3L series)



Load	Operating time
120%	263.8 s
140%	35.2 s
160%	17.6 s
180%	11.2 s
200%	8 s
220%	6.1 s
240%	4.8 s
260%	3.9 s
280%	3.3 s
300%	2.8 s

High inertia (ECM-A3H series)

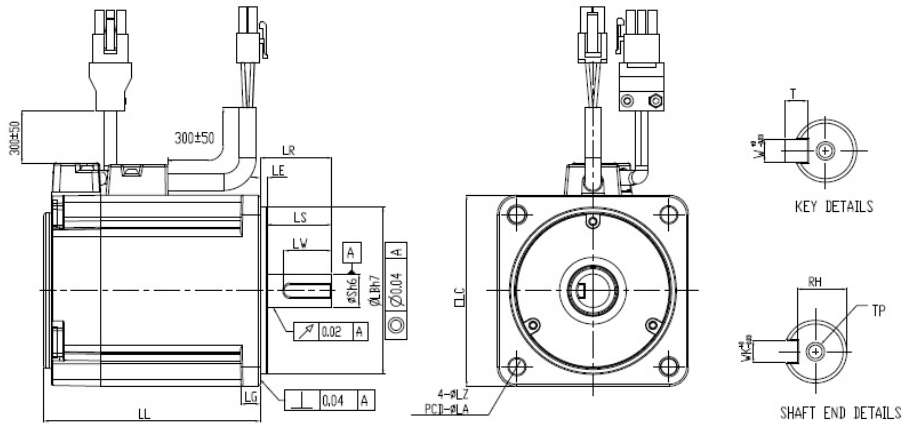
A



Load	Operating time
120%	263.8 s
140%	35.2 s
160%	17.6 s
180%	11.2 s
200%	8 s
220%	6.1 s
240%	4.8 s
260%	3.9 s
280%	3.3 s
300%	2.8 s
350%	2.1 s

### A.2.5 Dimensions of ECM-A3L/A3H series servo motor

Motor frame size: 80 mm and below



Model	C1040F2S3	C104012S3	C106022S3	C106042S3	C10804273	C108072S3
LC	40	40	60	60	80	80
LZ	4.5	4.5	5.5	5.5	6.6	6.6
LA	46	46	70	70	90	90
S	8 <sup>(+0/-0.009)</sup>	8 <sup>(+0/-0.009)</sup>	14 <sup>(+0/-0.011)</sup>	14 <sup>(+0/-0.011)</sup>	14 <sup>(+0/-0.011)</sup>	19 <sup>(+0/-0.013)</sup>
LB	30 <sup>(+0/-0.021)</sup>	30 <sup>(+0/-0.021)</sup>	50 <sup>(+0/-0.025)</sup>	50 <sup>(+0/-0.025)</sup>	70 <sup>(+0/-0.030)</sup>	70 <sup>(+0/-0.030)</sup>
LL (w/o brake)	70.6	85.3	84	106	93.7	115.8
LL (with brake)	105.4	120.1	117.6	139.7	131.2	153.2
LS	21.5	22.5	27	27	27	37
LR	25	25	30	30	30	40
LE	2.5	2.5	3	3	3	3
LG	5	5	7.5	7.5	8	8
LW	16	16	20	20	20	25
RH	6.2	6.2	11	11	11	15.5
WK	3	3	5	5	5	6
W	3	3	5	5	5	6
T	3	3	5	5	5	6
TP	M3 Depth 6	M3 Depth 6	M4 Depth 8	M4 Depth 8	M4 Depth 8	M6 Depth 10

Note: [1] in motor model name represents encoder type; [2] represents shaft type and oil seal; [3] represents special code.

### A.3 ECMC series servo motor

#### ECMC series servo motor

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ECM C - C W 13 08 R S  
 (1) (2) (3) (4) (5) (6) (7) (8)

(1) Product name

ECM: Electronic Commutation Motor

(2) Motor type

C: High-Precision AC Servo Motor (recommended for CNC applications)

(3) Series

C: Rated voltage: 200V; Speed: 3,000 rpm

E: Rated voltage: 200V; Speed: 2,000 rpm

F: Rated voltage: 200V; Speed: 1,500 rpm

(4) Encoder type

W: Absolute type (resolution of single turn: 22-bit; multi-turn: 16-bit)

(5) Motor frame size

10: 100 mm

13: 130 mm

18: 180 mm

(6) Rated power output

Number	Spec.	Number	Spec.
08	850 W	18	1.8 kW
10	1.0 kW	20	2.0 kW
13	1.3 kW	30	3.0 kW
15	1.5 kW	-	-

## (7) Shaft type and oil seal

	w/o brake w/o oil seal	with brake w/o oil seal	w/o brake with oil seal	with brake with oil seal
Round shaft (with fixed screw holes)	-	-	C	D
Keyway (with fixed screw holes)	P	Q	R	S

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## (8) Shaft diameter


S: standard



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**A.3.1 ECMC series servo motor with frame size 100 ~ 180**

ECMC	C110	E113			F113			E118		F118
	10	10	15	20	08	13	18	20	30	30
	Medium inertia				High inertia			Medium inertia		
Rated power (kW)	1.0	1.0	1.5	2.0	0.85	1.3	1.8	2.0	3.0	3.0
Rated torque (N-m) <sup>*1</sup>	3.18	4.77	7.16	9.55	5.41	8.34	11.48	9.55	14.32	19.10
Max. torque (N-m)	9.54	14.3	21.5	28.7	13.8	23.3	28.7	28.7	43	57.3
Rated speed (rpm)	3000	2000			1500			2000		1500
Max. speed (rpm)	5000	3000			3000			3000		3000
Rated current (A)	7.3	5.6	8.3	11.01	7.1	12.6	13	11.22	16.1	19.4
Max. instantaneous current (A)	21.9	16.8	24.9	33	19.4	38.6	36	33.7	48.3	58.2
Power rating (kW/s)	38.1	27.1	45.9	62.5	21.52	34.78	53	26.3	37.3	66.4
Rotor inertia (× 10 <sup>-4</sup> kg.m <sup>2</sup> )	2.65	8.41	11.2	14.6	13.6	20	24.9	34.7	55	55
Mechanical constant (ms)	0.74	1.51	1.10	0.96	2.43	1.62	1.7	1.62	1.06	1.28
Torque constant-KT (N-m/A)	0.44	0.85	0.87	0.87	0.76	0.66	0.88	0.85	0.89	0.98
Voltage constant-KE (mV/(rpm))	16.8	31.9	31.8	31.8	29.2	24.2	32.2	31.4	32.0	35
Armature resistance (Ohm)	0.20	0.47	0.26	0.174	0.38	0.124	0.185	0.119	0.052	0.077
Armature inductance (mH)	1.81	5.99	4.01	2.76	4.77	1.7	2.6	2.84	1.38	1.27
Electric constant (ms)	9.3	12.9	15.3	15.9	12.6	13.7	14.1	23.9	26.4	16.5
Insulation class	Class A (UL), Class B (CE)									
Insulation resistance	> 100 MΩ, DC 500 V									
Insulation strength	1.8k Vac, 1 sec									
Weight (w/o brake) (kg)	4.3	7.0	7.5	7.8	8.6	9.4	10.5	13.5	18.5	18.5
Weight (with brake) (kg)	4.7	8.4	8.9	9.2	10	10.8	11.9	17.5	22.5	22.5
Max. radial loading (N)	490							1176	1470	
Max. axial loading (N)	98							490		
Power rating (kW/s) (with brake)	30.4	24.9	43.1	57.4	19.8	32.7	50.3	24.1	35.9	63.9
Rotor inertia (× 10 <sup>-4</sup> kg.m <sup>2</sup> ) (with brake)	3.33	9.14	11.9	15.9	14.8	21.3	26.2	37.76	57.1	57.1
Mechanical constant (ms) (with brake)	0.93	1.64	1.19	1.05	2.65	1.73	1.79	1.77	1.10	1.33
Brake holding torque [Nt-m (min)] *2	8	10						25		
Brake power consumption (at 20°C)[W]	18.7	19						20.4		
Brake release time [ms (Max)]	10									
Brake pull-in time [ms (Max)]	70									

ECMC	C $\square$ 10	E $\square$ 13			F $\square$ 13			E $\square$ 18		F $\square$ 18
	10	10	15	20	08	13	18	20	30	30
	Medium inertia				High inertia			Medium inertia		
Vibration grade ( $\mu$ m)	V15									
Operating temperature ( $^{\circ}$ C)	0 $^{\circ}$ C ~ 40 $^{\circ}$ C (32 $^{\circ}$ F ~ 104 $^{\circ}$ F)									
Storage temperature ( $^{\circ}$ C)	-10 $^{\circ}$ C ~ 80 $^{\circ}$ C (-14 $^{\circ}$ F ~ 176 $^{\circ}$ F)									
Operating humidity	20 ~ 90%RH (non-condensing)									
Storage humidity	20 ~ 90%RH (non-condensing)									
Vibration capacity	2.5 G									
IP rating	IP65 (when waterproof connectors are used, or when an oil seal is used to be fitted to the rotating shaft (an oil seal model is used))									
Approvals										

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## Note:

1.  $\square$  in motor model names represents encoder type.

\*2 The rated torque is the continuous permissible torque between 0 ~ 40 $^{\circ}$ C operating temperature which is suitable for the following heat sink dimension.

ECMA-\_\_ 10 : 300 mm x 300 mm x 12 mm

ECMA-\_\_ 13 : 400 mm x 400 mm x 20 mm

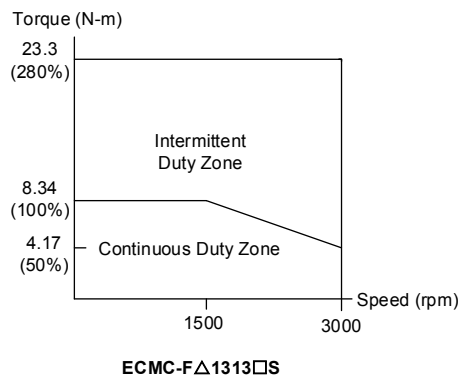
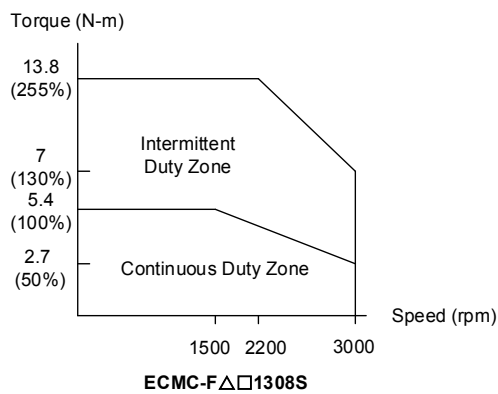
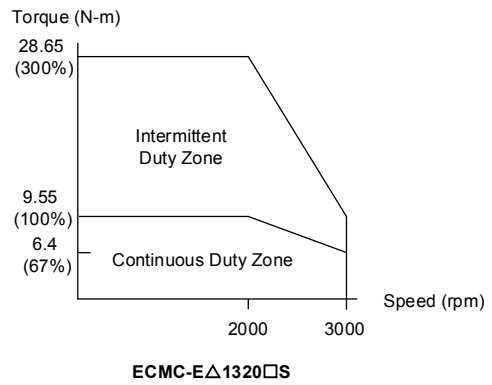
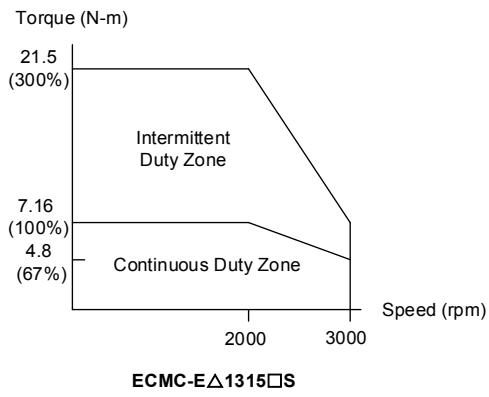
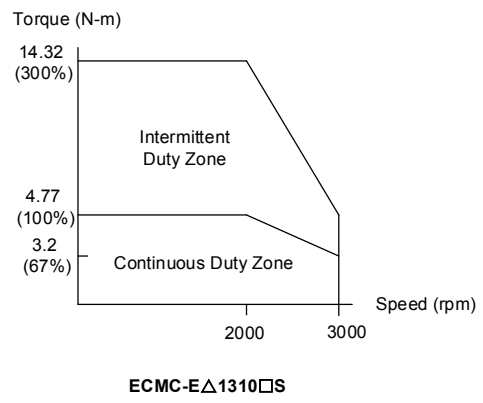
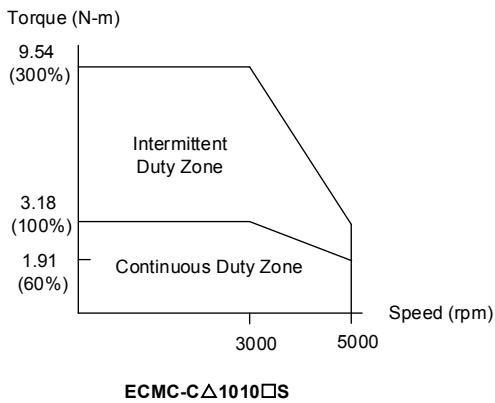
ECMA-\_\_ 18 : 550 mm x 550 mm x 30 mm

Material: Aluminum – F100, F130, F180

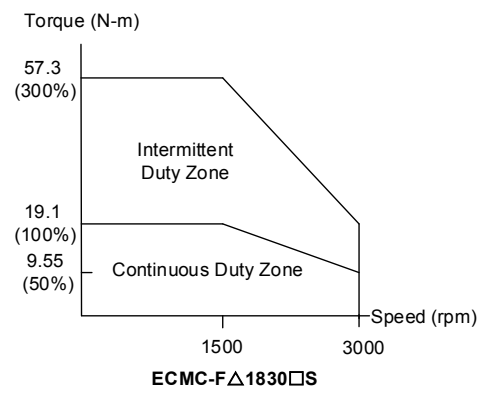
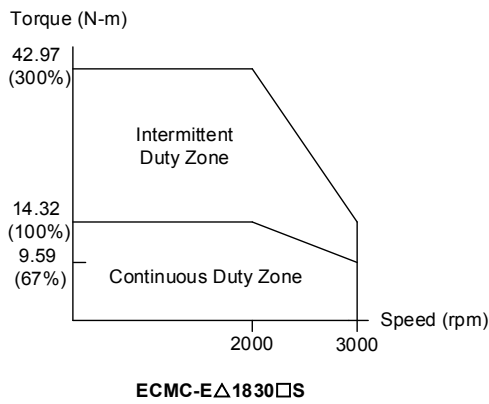
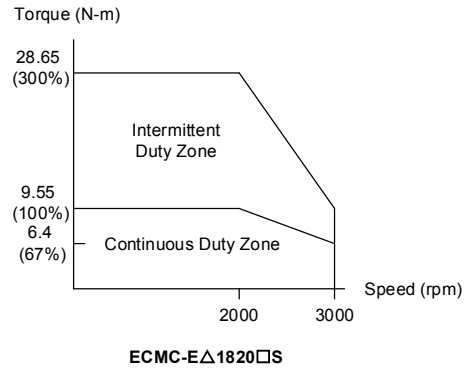
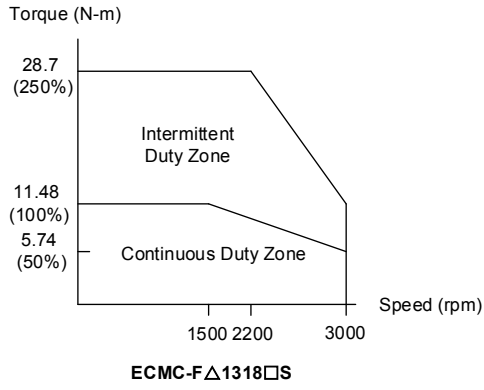
3. The built-in brake of the servo motor is for clamping purpose. Do not use it to decelerate or stop the operation.

### A.3.2 Torque features (T-N curves)

A



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Note: Δ in motor model name represents encoder type; □ represents shaft type and oil seal.

### A.3.3 Overload features

#### Definition of overload protection

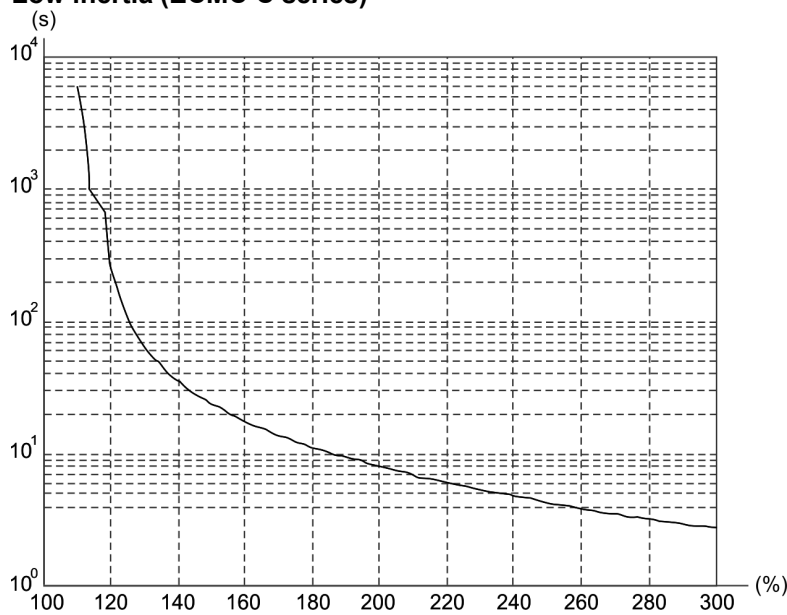
The overload protection is to prevent the motor from overheating.

#### Causes of overload

1. The motor's rated torque exceeds the range and the operation time is too long.
2. The inertia ratio is set too big and the motor frequently accelerates / decelerates.
3. Connection error between power cable and encoder wiring.
4. Error of servo gain setting causes resonance of the motor.
5. The motor with brake operates without releasing the brake.

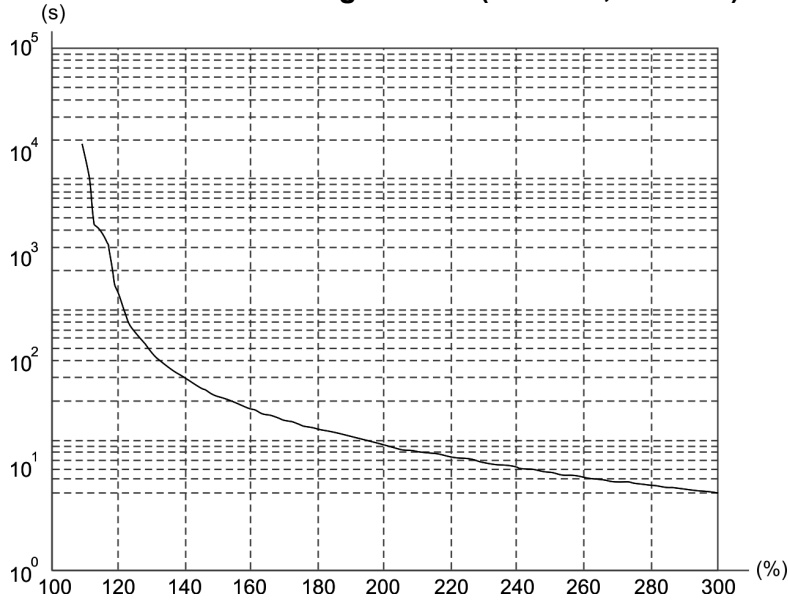
#### Graph of load and operating time

##### Low inertia (ECMC C series)



Load	Operating time
120%	263.8 s
140%	35.2 s
160%	17.6 s
180%	11.2 s
200%	8 s
220%	6.1 s
240%	4.8 s
260%	3.9 s
280%	3.3 s
300%	2.8 s

Medium and medium-high inertia (ECMC E, F series)



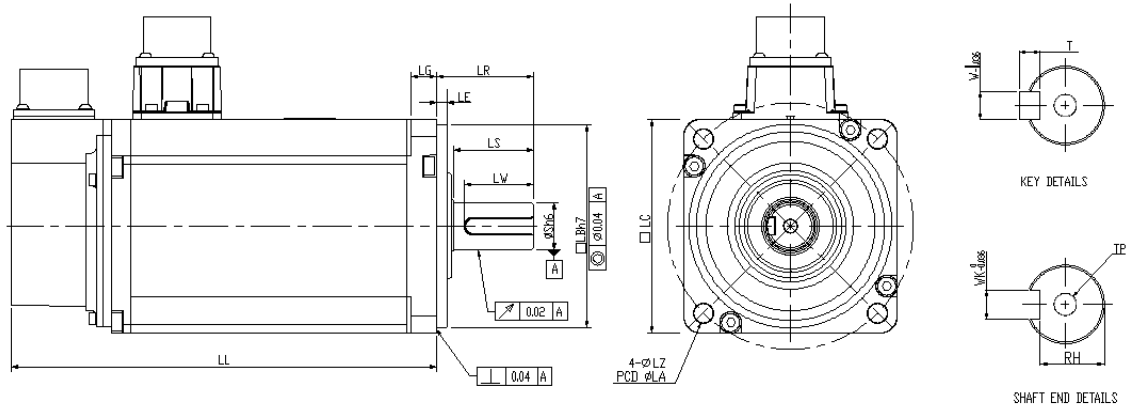
Load	Operating time
120%	527.6 s
140%	70.4 s
160%	35.2 s
180%	22.4 s
200%	16 s
220%	12.2 s
240%	9.6 s
260%	7.8 s
280%	6.6 s
300%	5.6 s

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### A.3.4 Dimensions of ECMC series servo motor

Motor frame size: 100 mm / 130 mm / 180 mm

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Model	C□1010□S	E□1310□S	E□1315□S	E□1320□S	F□1308□S	F□1313□S	F□1318□S
LC	100	130	130	130	130	130	130
LZ	9	9	9	9	9	9	9
LA	115	145	145	145	145	145	145
S	22 <sup>(+0/-0.013)</sup>	22 <sup>(+0/-0.013)</sup>	22 <sup>(+0/-0.013)</sup>	22 <sup>(+0/-0.013)</sup>	22 <sup>(+0/-0.013)</sup>	22 <sup>(+0/-0.013)</sup>	22 <sup>(+0/-0.013)</sup>
LB	95 <sup>(+0/-0.035)</sup>	110 <sup>(+0/-0.035)</sup>	110 <sup>(+0/-0.035)</sup>	110 <sup>(+0/-0.035)</sup>	110 <sup>(+0/-0.035)</sup>	110 <sup>(+0/-0.035)</sup>	110 <sup>(+0/-0.035)</sup>
LL (w/o brake)	153.3	147.5	167.5	187.5	152.5	187.5	202
LL (with brake)	192.5	183.5	202	216	181	216	230.7
LS	37	47	47	47	47	47	47
LR	45	55	55	55	55	55	55
LE	5	6	6	6	6	6	6
LG	12	11.5	11.5	11.5	11.5	11.5	11.5
LW	32	36	36	36	36	36	36
RH	18	18	18	18	18	18	18
WK	8	8	8	8	8	8	8
W	8	8	8	8	8	8	8
T	7	7	7	7	7	7	7
TP	M6 Depth 20	M6 Depth 20	M6 Depth 20	M6 Depth 20	M6 Depth 20	M6 Depth 20	M6 Depth 20

Note: □ in motor model name represents encoder type; □ represents shaft type and oil seal.

Model	E <sup>1</sup> 1820 <sup>2</sup> <sup>3</sup>	E <sup>1</sup> 1830 <sup>2</sup> <sup>3</sup>	F <sup>1</sup> 1830 <sup>2</sup> <sup>3</sup>
LC	180	180	180
LZ	13.5	13.5	13.5
LA	200	200	200
S	35 <sup>(<sup>+0</sup><sub>-0.016</sub>)</sup>	35 <sup>(<sup>+0</sup><sub>-0.016</sub>)</sup>	35 <sup>(<sup>+0</sup><sub>-0.016</sub>)</sup>
LB	114.3 <sup>(<sup>+0</sup><sub>-0.035</sub>)</sup>	114.3 <sup>(<sup>+0</sup><sub>-0.035</sub>)</sup>	114.3 <sup>(<sup>+0</sup><sub>-0.035</sub>)</sup>
LL (w/o brake)	169	202.1	202.1
LL (with brake)	203.1	235.3	235.3
LS	73	73	73
LR	79	79	79
LE	4	4	4
LG	20	20	20
LW	63	63	63
RH	30	30	30
WK	10	10	10
W	10	10	10
T	8	8	8
TP	M12 Depth 25	M12 Depth 25	M12 Depth 25

Note: <sup>1</sup> in motor model name represents encoder type; <sup>2</sup> represents shaft type and oil seal; <sup>3</sup> represents special code.

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A

# Accessories

# Appendix

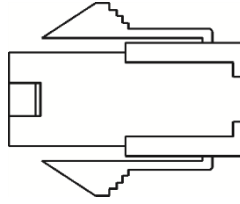
# B

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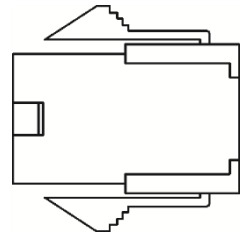
B.1	Power connector	B-2
B.2	Power cable	B-3
B.3	Encoder cable (Incremental type)	B-7
B.4	Encoder cable (Absolute type)	B-8
B.5	Battery box cable AW	B-9
B.6	Battery box (Absolute type)	B-9
B.7	I/O signal connector	B-10
B.8	Terminal block module	B-11
B.9	CANopen communication cable	B-11
B.10	CANopen distribution box	B-12
B.11	Ferrite ring	B-12
B.12	A3 / A2 conversion cable	B-13
B.13	A3 CN3 RS-485 / CANOpen connector	B-14
B.14	A3 CN3 RS-485 / CANOpen terminal resistor	B-14
B.15	CN4 Mini USB module	B-15
B.16	Optional accessories	B-16

## B.1 Power connector

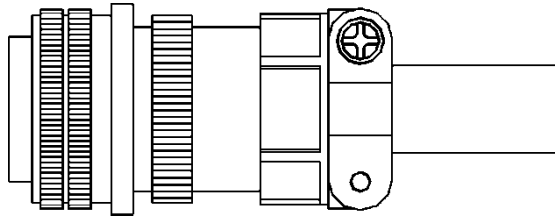
Delta part number: ASDBCAPW0000 (for 200V servo drives)



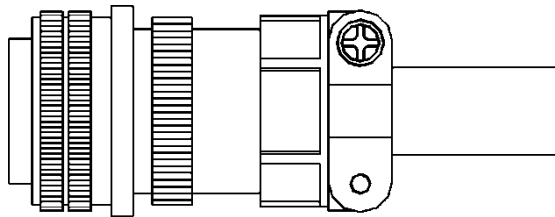
Delta part number: ASDBCAPW0100 (for 200V servo drives with brake contact)



Delta part number: ASD-CAPW1000



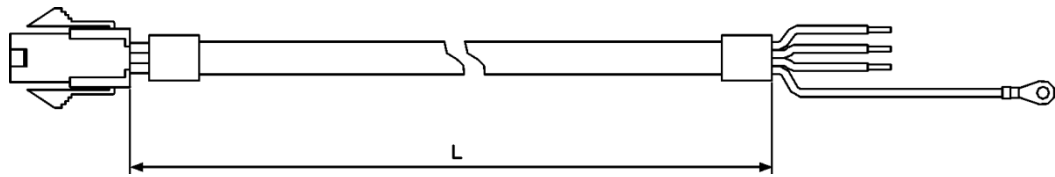
Delta part number: ASD-CAPW2000



# B

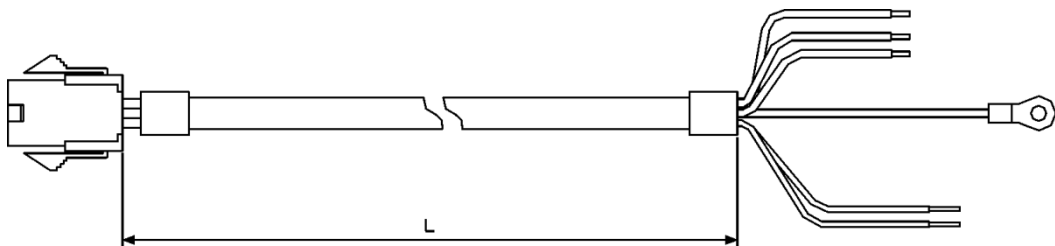
## B.2 Power cable

Delta part number: ACS3-CAPW1103, ACS3-CAPW1105 (for 200V series servo drives)



Part No.	L	
	mm	inch
ACS3-CAPW1103	3000 ± 100	118 ± 4
ACS3-CAPW1105	5000 ± 100	197 ± 4

Delta part number: ACS3-CAPW2103, ACS3-CAPW2105 (for 200V series servo drives and comes with a brake cable)

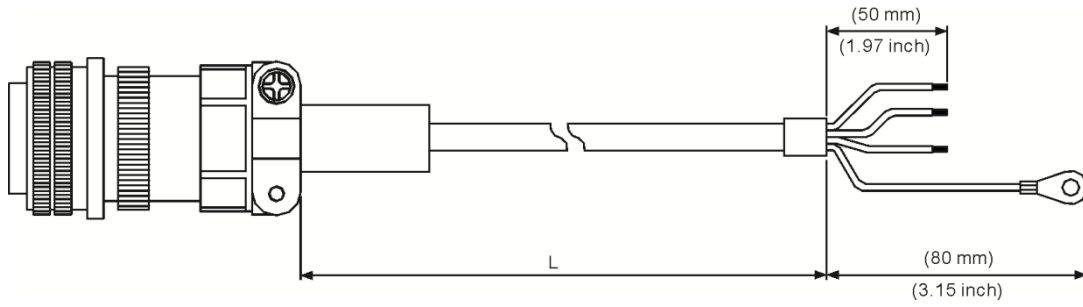


Part No.	L	
	mm	inch
ACS3-CAPW2103	3000 ± 100	118 ± 4
ACS3-CAPW2105	5000 ± 100	197 ± 4

B

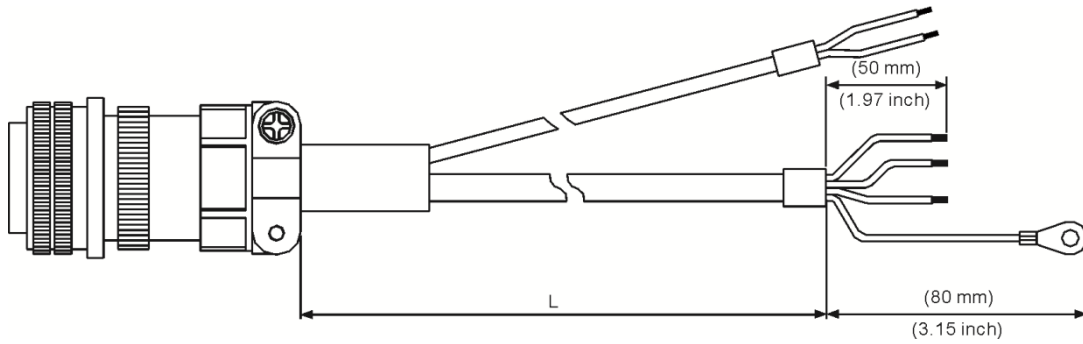
B

Delta part number: ACS3-CAPW1203, ACS3-CAPW1205



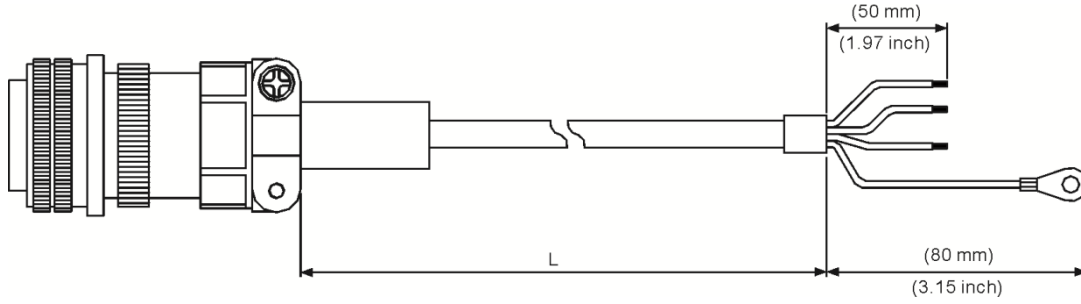
Part No.	Straight	L	
		mm	inch
ACS3-CAPW1203	3106A-20-18S	3000 ± 100	118 ± 4
ACS3-CAPW1205	3106A-20-18S	5000 ± 100	197 ± 4

Delta part number: ACS3-CAPW2203, ACS3-CAPW2205 (with brake cable)



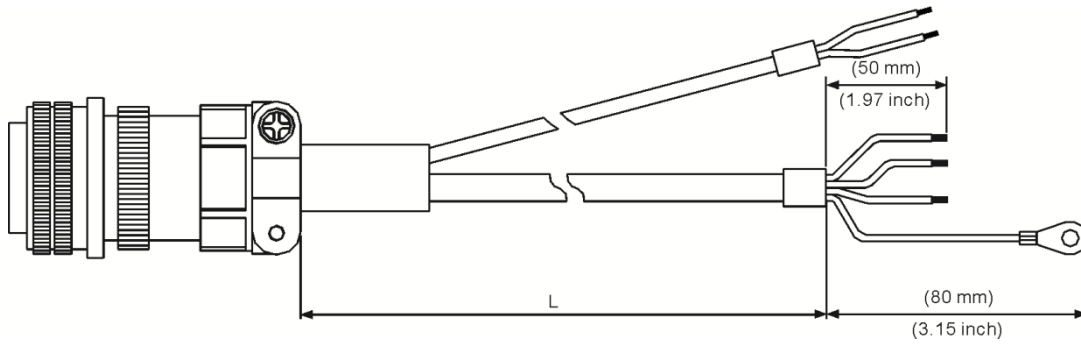
Part No.	Straight	L	
		mm	inch
ACS3-CAPW2203	3106A-20-18S	3000 ± 100	118 ± 4
ACS3-CAPW2205	3106A-20-18S	5000 ± 100	197 ± 4

Delta part number: ACS3-CAPW1303, ACS3-CAPW1305



Part No.	Straight	L	
		mm	inch
ACS3-CAPW1303	3106A-20-18S	3000 ± 100	118 ± 4
ACS3-CAPW1305	3106A-20-18S	5000 ± 100	197 ± 4

Delta part number: ACS3-CAPW2303, ACS3-CAPW2305 (with brake cable)

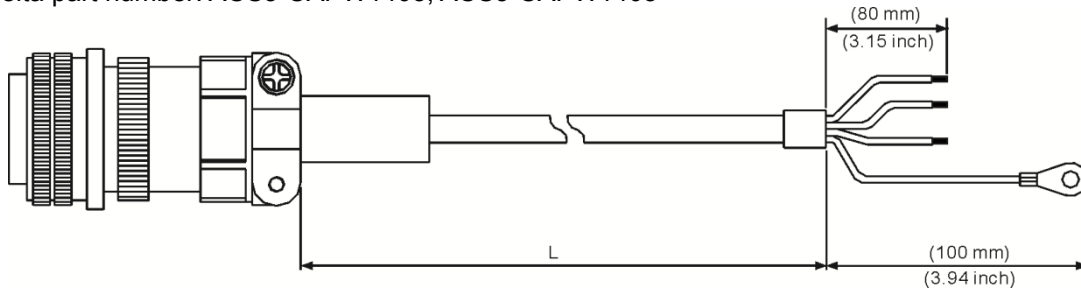


Part No.	Straight	L	
		mm	inch
ACS3-CAPW2303	3106A-20-18S	3000 ± 100	118 ± 4
ACS3-CAPW2305	3106A-20-18S	5000 ± 100	197 ± 4

B

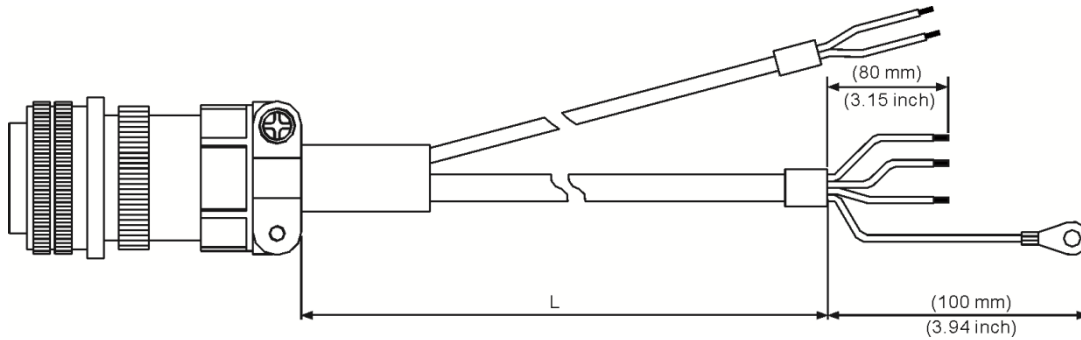
B

Delta part number: ACS3-CAPW1403, ACS3-CAPW1405



Part No.	Straight	L	
		mm	inch
ACS3-CAPW1403	3106A-24-11S	3000 ± 100	118 ± 4
ACS3-CAPW1405	3106A-24-11S	5000 ± 100	197 ± 4

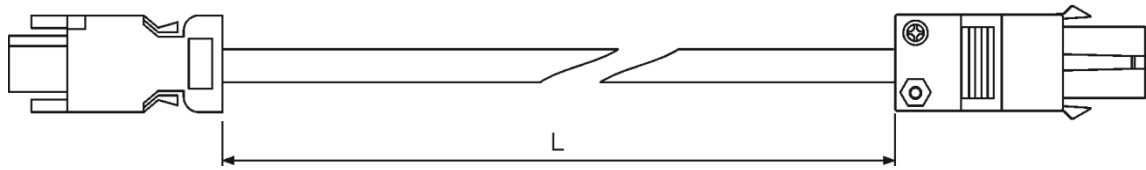
Delta part number: ACS3-CAPW2403, ACS3-CAPW2405 (with brake cable)



Part No.	Straight	L	
		mm	Inch
ACS3-CAPW2403	3106A-24-11S	3000 ± 100	118 ± 4
ACS3-CAPW2405	3106A-24-11S	5000 ± 100	197 ± 4

### B.3 Encoder cable (Incremental type)

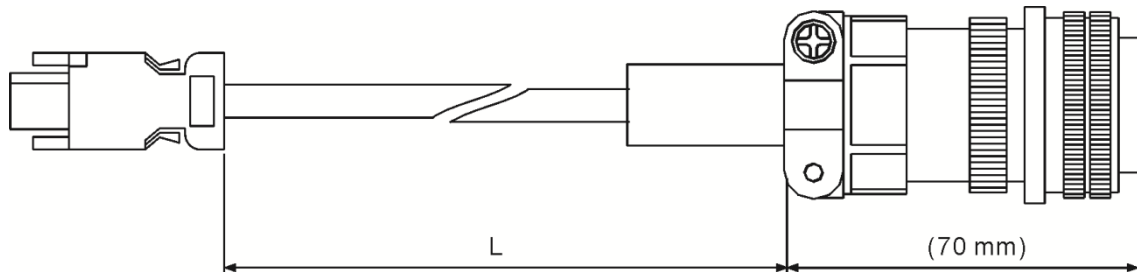
Delta part number: ACS3-CAEN1003, ACS3-CAEN1005



B

Part No.	L	
	mm	inch
ACS3-CAEN1003	3000 ± 100	118 ± 4
ACS3-CAEN1005	5000 ± 100	197 ± 4

Delta part number: ACS3-CAEN3003, ACS3-CAEN3005



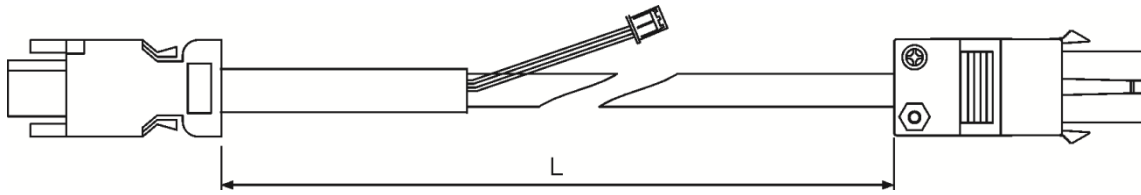
Part No.	Straight	L	
		mm	inch
ACS3-CAEN3003	3106A-20-29S	3000 ± 100	118 ± 4
ACS3-CAEN3005	3106A-20-29S	5000 ± 100	197 ± 4



### B.4 Encoder cable (Absolute type)

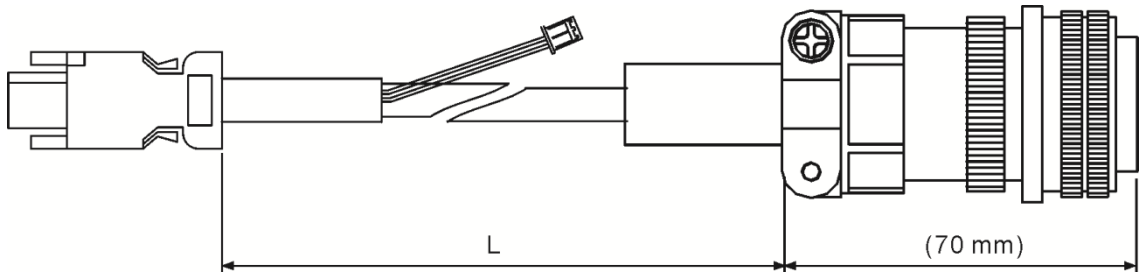
Delta part number: ACS3-CAEA1003, ACS3-CAEA1005

B



Model name	L	
	mm	inch
ACS3-CAEA1003	3000 ± 100	118 ± 4
ACS3-CAEA1005	5000 ± 100	197 ± 4

Delta part number: ACS3-CAEA3003, ACS3-CAEA3005

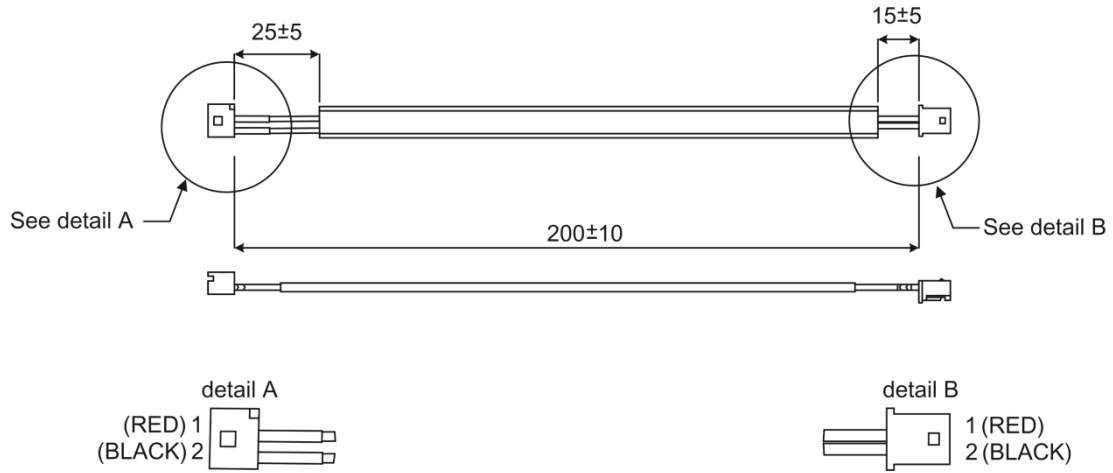


Model name	Straight	L	
		mm	inch
ACS3-CAEA3003	3106A-20-29S	3000 ± 100	118 ± 4
ACS3-CAEA3005	3106A-20-29S	5000 ± 100	197 ± 4

### B.5 Battery box cable AW

Battery box cable that connects to the encoder

Delta part number: 3864573700

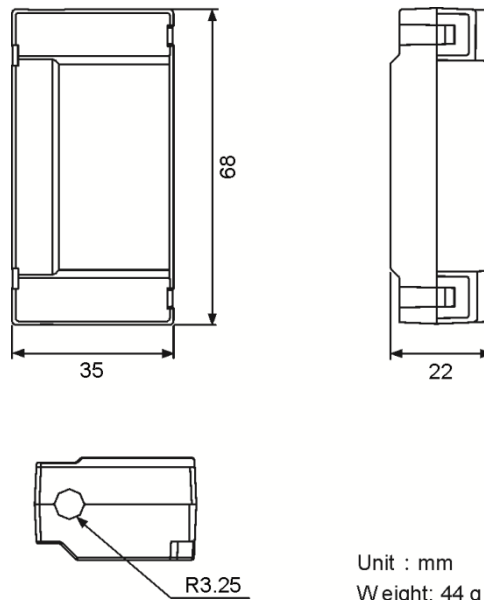


Unit: mm

### B.6 Battery box (Absolute type)

Single battery box

Delta part number: ASD-MDBT0100

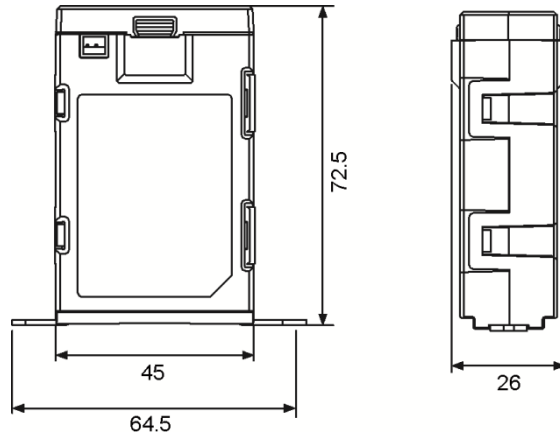


B

Dual battery box

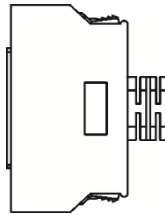
Delta part number: ASD-MDBT0200

B



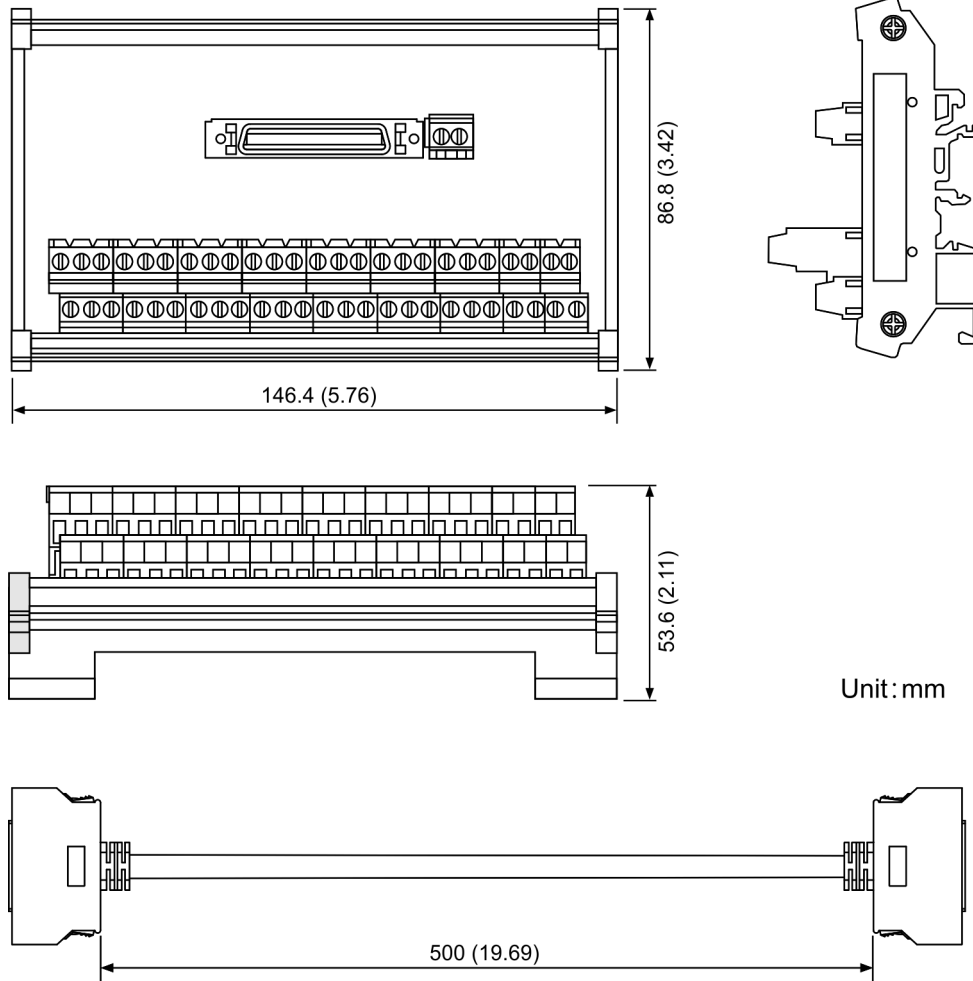
### B.7 I/O signal connector

Delta part number: ACS3-CNADC150



### B.8 Terminal block module

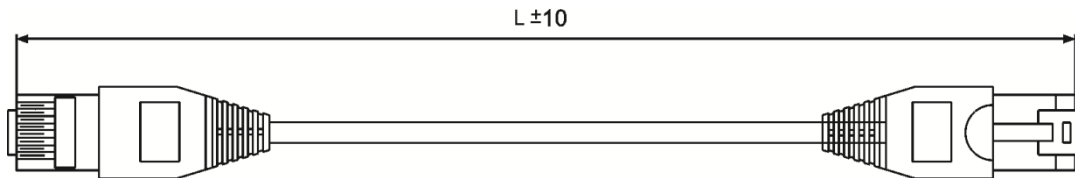
Delta part number: ACS3-MDTB5000



Unit: mm

### B.9 CANopen communication cable

Delta part number: UC-CMC030-01A, UC-CMC050-01A



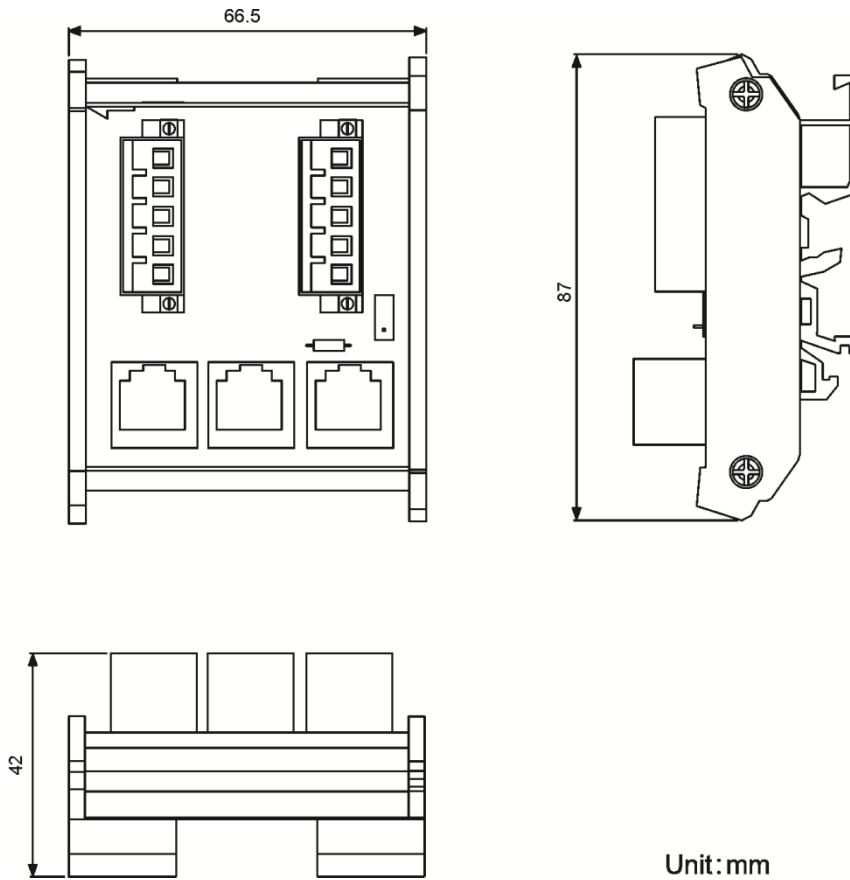
Part No.	L	
	mm	inch
UC-CMC030-01A	300 ± 10	11 ± 0.4
UC-CMC050-01A	500 ± 10	19 ± 0.4

Note: Please refer to Delta PLC/HMI Cable Selection Guide for cables of other length.

### B.10 CANopen distribution box

Delta part number: TAP-CN03

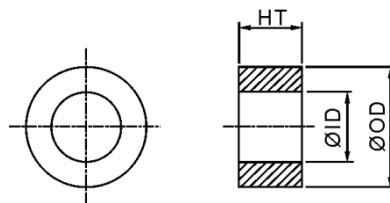
B



Unit: mm

### B.11 Ferrite ring

Delta part number: ASD-ACFC7K00

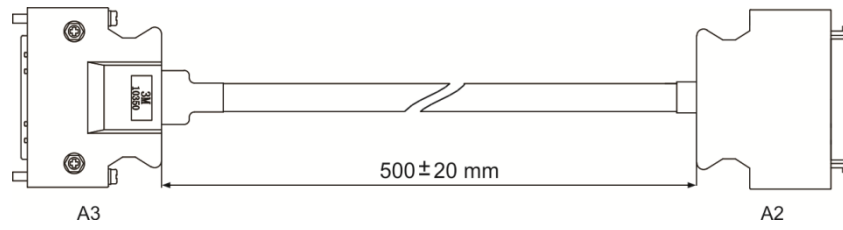


Model name	Outer diameter	Inner diameter	Height
ASD-ACFC7K00	68.0 ± 0.6	44.0 ± 0.6	13.5 ± 0.5

### B.12 A3 / A2 conversion cable

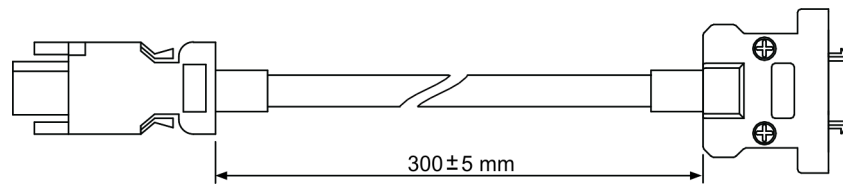
A3 / A2\_CN1\_conversion cable

Delta part number: 3081709800



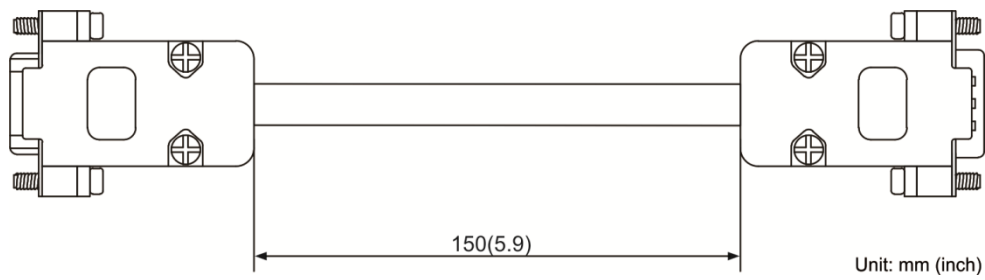
A3 / A2\_CN2\_conversion cable

Delta part number: 3081709600



A3 / A2\_CN5\_conversion cable

Delta part number: 3081709700

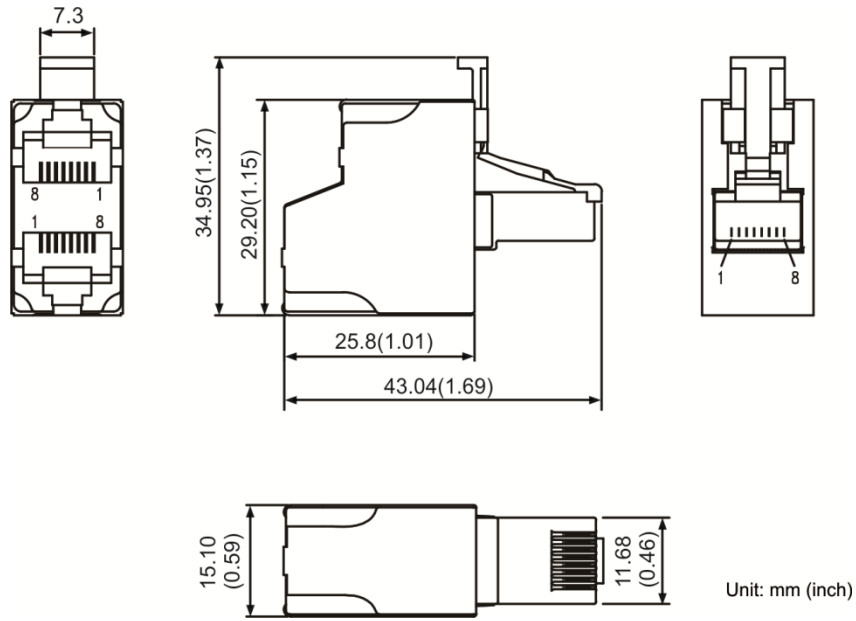


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### B.13 A3 CN3 RS-485 / CANOpen connector

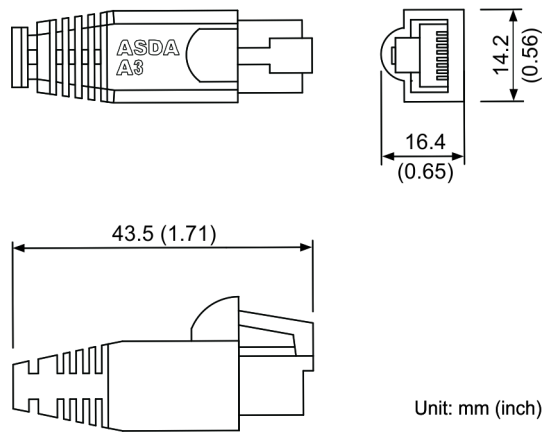
Delta part number: ACS3-CNADC3RC

B



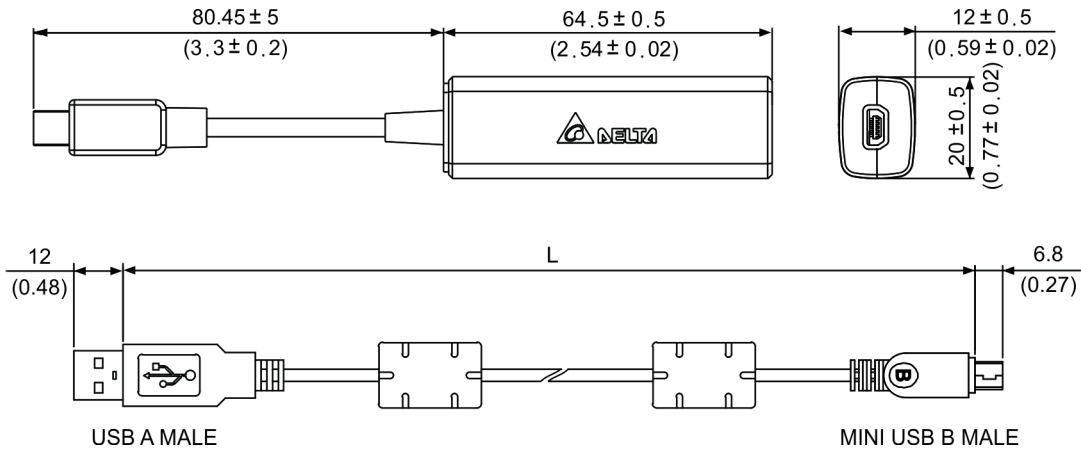
### B.14 A3 CN3 RS-485 / CANOpen terminal resistor

Delta part number: ACS3-CNADC3TR



### B.15 CN4 Mini USB module

Delta part number: UC-PRG015-01B, UC-PRG030-01B



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Part No.	L	
	mm	inch
UC-PRG015-01B	1500 ± 100	59 ± 4
UC-PRG030-01B	3000 ± 100	118 ± 4



## B.16 Optional accessories

### 100 W servo drive and 50 W / 100 W low / high inertia servo motor

Servo drive	ASD-A3-0121-□
Motor model name	ECM-A3L-CΔ040F□S1, ECM-A3L-CΔ0401□S1, ECM-A3H-CΔ040F□S1, ECM-A3H-CΔ0401□S1
Motor power cable (without brake)	ACS3-CAPW110X
Power connector (without brake)	ASDBCAPW0000
Motor power cable (with brake)	ACS3-CAPW210X
Power connector (with brake)	ASDBCAPW0100
Encoder cable (Incremental type)	ACS3-CAEN100X
Encoder cable (Absolute type)	ACS3-CAEA100X
Encoder connector	MEC-TAXX09S

(X = 3 indicates that the cable length is 3 m; X = 5 indicates that the cable length is 5 m)

### 200 W servo drive and 200 W low / high inertia servo motor

Servo drive	ASD-A3-0221-□
Motor model name	ECM-A3L-CΔ0602□S1, ECM-A3H-CΔ0602□S1
Motor power cable (without brake)	ACS3-CAPW110X
Power connector (without brake)	ASDBCAPW0000
Motor power cable (with brake)	ACS3-CAPW210X
Power connector (with brake)	ASDBCAPW0100
Encoder cable (Incremental type)	ACS3-CAEN100X
Encoder cable (Absolute type)	ACS3-CAEA100X
Encoder connector	MEC-TAXX09S

(X = 3 indicates that the cable length is 3 m; X = 5 indicates that the cable length is 5 m)

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**400 W servo drive and 400 W low / high inertia servo motor**

Servo drive	ASD-A3-0421-□
Motor model name	ECM-A3L-CΔ0604□S1, ECM-A3L-CΔ0804□S1, ECM-A3H-CΔ0604□S1, ECM-A3H-CΔ0804□S1
Motor power cable (without brake)	ACS3-CAPW110X
Power connector (without brake)	ASDBCAPW0000
Motor power cable (with brake)	ACS3-CAPW210X
Power connector (with brake)	ASDBCAPW0100
Encoder cable (Incremental type)	ACS3-CAEN100X
Encoder cable (Absolute type)	ACS3-CAEA100X
Encoder connector	MEC-TAXX09S

(X = 3 indicates that the cable length is 3 m; X = 5 indicates that the cable length is 5 m)

**750 W servo drive and 750 W low / high inertia servo motor**

Servo drive	ASD-A3-0721-□
Motor model name	ECM-A3L-CΔ0807□S1, ECM-A3H-CΔ0807□S1
Motor power cable (without brake)	ACS3-CAPW110X
Power connector (without brake)	ASDBCAPW0000
Motor power cable (with brake)	ACS3-CAPW210X
Power connector (with brake)	ASDBCAPW0100
Encoder cable (Incremental type)	ACS3-CAEN100X
Encoder cable (Absolute type)	ACS3-CAEA100X
Encoder connector	MEC-TAXX09S

(X = 3 indicates that the cable length is 3 m; X = 5 indicates that the cable length is 5 m)

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**1 kW servo drive and 1 kW medium inertia / 850 W high inertia servo motor**

Servo drive	ASD-A3-1021-□
Motor model name	ECMC-CW1010□S, ECMC-EW1310□S, ECMC-FW1308□S
Motor power cable (without brake)	ACS3-CAPW120X
Motor power cable (with brake)	ACS3-CAPW220X
Power connector	ASD-CAPW1000
Encoder cable (Incremental type)	ACS3-CAEN300X
Encoder cable (Absolute type)	ACS3-CAEA300X
Encoder connector	MEC-TA0917S

(X = 3 indicates that the cable length is 3 m; X = 5 indicates that the cable length is 5 m)

**1.5 kW servo drive and 1.5 kW medium inertia servo motor**

Servo drive	ASD-A3-1521-□
Motor model name	ECMC-CW1315□S
Motor power cable (without brake)	ACS3-CAPW120X
Motor power cable (with brake)	ACS3-CAPW220X
Power connector	ASD-CAPW1000
Encoder cable (Incremental type)	ACS3-CAEN300X
Encoder cable (Absolute type)	ACS3-CAEA300X
Encoder connector	MEC-TA0917S

(X = 3 indicates that the cable length is 3 m; X = 5 indicates that the cable length is 5 m)

**2 kW servo drive and 2 kW medium inertia and 1.3 kW / 1.8 kW high inertia servo motor**

Servo drive	ASD-A3-2023-□
Motor model name	ECMC-EW1320□S, ECMC-FW1313□S, ECMC-FW1318□S
Motor power cable (without brake)	ACS3-CAPW130X
Motor power cable (with brake)	ACS3-CAPW230X
Power connector	ASD-CAPW1000
Encoder cable (Incremental type)	ACS3-CAEN300X
Encoder cable (Absolute type)	ACS3-CAEA300X
Encoder connector	MEC-TA0917S

(X = 3 indicates that the cable length is 3 m; X = 5 indicates that the cable length is 5 m)

**2 kW servo drive and 2 kW medium inertia servo motor**

Servo drive	ASD-A3-2023-□
Motor model name	ECMC-EW1820□S
Motor power cable (without brake)	ACS3-CAPW140X
Motor power cable (with brake)	ACS3-CAPW240X
Power connector	ASD-CAPW2000
Encoder cable (Incremental type)	ACS3-CAEN300X
Encoder cable (Absolute type)	ACS3-CAEA300X
Encoder connector	MEC-TA0917S

(X = 3 indicates that the cable length is 3 m; X = 5 indicates that the cable length is 5 m)

**3 kW servo drive and 3 kW medium inertia servo motor**

Servo drive	ASD-A3-3023-□
Motor model name	ECMC-EW1830□S, ECMC-FW1830□S
Motor power cable (without brake)	ACS3-CAPW140X
Motor power cable (with brake)	ACS3-CAPW240X
Power connector	ASD-CAPW2000
Encoder cable (Incremental type)	ACS3-CAEN300X
Encoder cable (Absolute type)	ACS3-CAEA300X
Encoder connector	MEC-TA0917S

(X = 3 indicates that the cable length is 3 m; X = 5 indicates that the cable length is 5 m)

**Note:**

1. (□) at the end of the servo drive model names represents the ASDA-A3 model number. For actual model name, please refer to the ordering information of the product that you purchased.
2. (Δ) in motor model names represents encoder type. Please refer to Chapter 1 for further information.
3. (□) in motor model names represents brake or keyway / oil seal.

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# Revision History

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Release date	Version	Chapter	Revision contents
April, 2017	V1.0 (First edition)		

For relevant information about [ASDA-A3], please refer to:

(1) ASDA-A2 User Manual (issued on 9<sup>th</sup> February, 2017)

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