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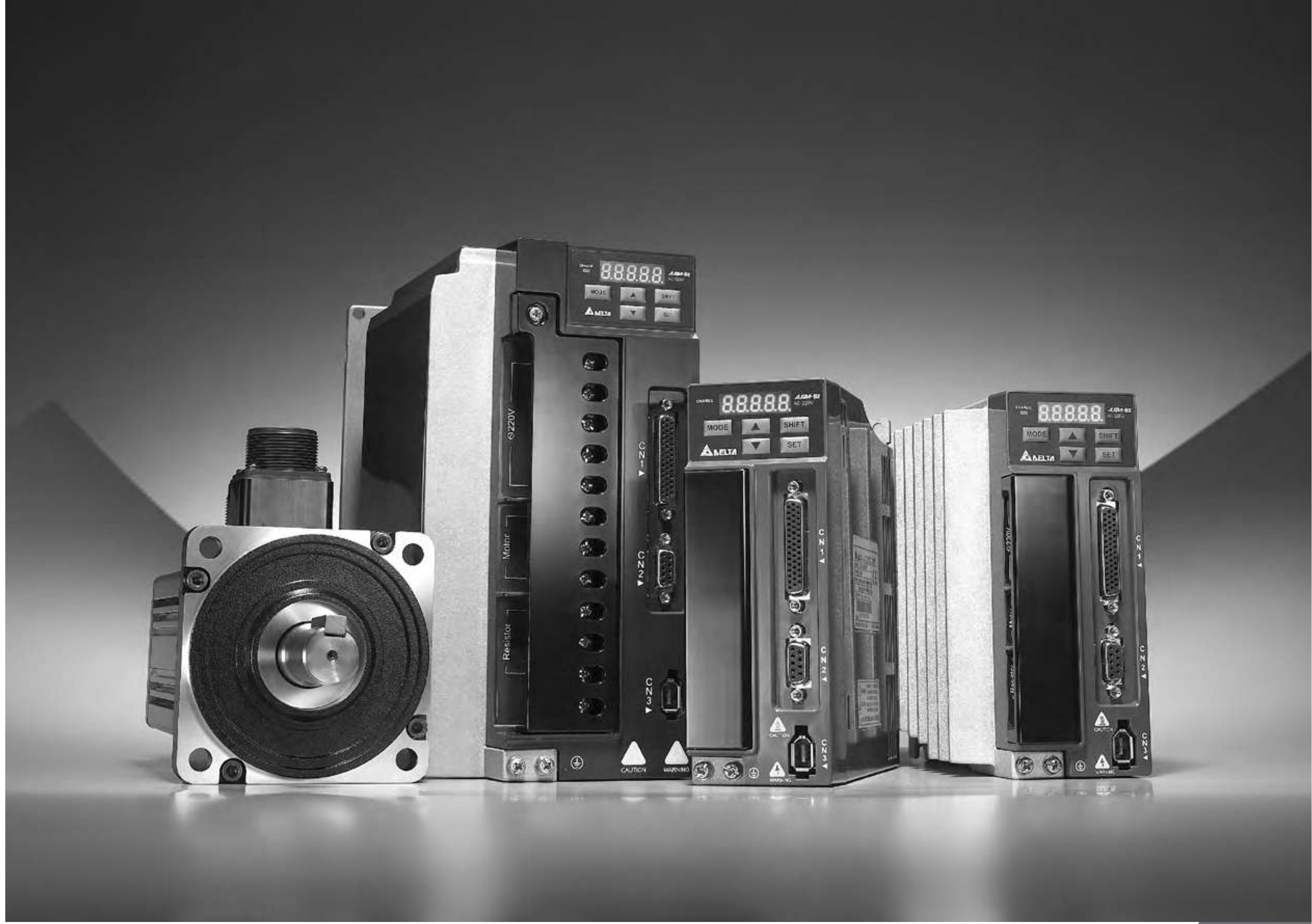
Version: V1.0
DELTA_ASDA-B2_M_EN_20130906

Delta Standard AC Servo Drive for General Purpose Applications **ASDA-B2** Series User Manual



Delta Standard AC Servo Drive for General Purpose Applications
ASDA-B2 Series User Manual

www.delta.com.tw/ia

Preface

Thank you very much for purchasing DELTA's AC servo products.

This manual will be helpful in the installation, wiring, inspection, and operation of Delta AC servo drive and motor. Before using the product, please read this user manual to ensure correct use.

You should thoroughly understand all safety precautions (DANGERS, WARNINGS and STOPS) before proceeding with the installation, wiring and operation. If you do not understand please contact your local Delta sales representative. Place this user manual in a safe location for future reference.

🕮 Using This Manual

■ Contents of this manual

This manual is a user guide that provides the information on how to install, operate and maintain ASDA-B2 series AC servo drives and ECMA series AC servo motors. The contents of this manual include the following topics:

- Installation of AC servo drives and motors
- Configuration and wiring
- Trial run steps
- Control functions and adjusting methods of AC servo drives
- Parameter settings
- Communication protocol
- Inspection and maintenance
- Troubleshooting
- Application examples

■ Who should use this manual

This manual is intended for the following users:

- Those who are responsible for designing
- Those who are responsible for installing or wiring
- Those who are responsible for operating or programming
- Those who are responsible for maintaining or troubleshooting

- **Important precautions**

  Before using the product, please read this user manual thoroughly to ensure correct use. Store this manual in a safe and handy place for quick reference whenever necessary. Always observe the following precautions:

  - Do not use the product in a potentially explosive environment.
  - Install the product in a clean and dry location free from corrosive and inflammable gases or liquids.
  - Do not connect commercial power to the U, V, W terminals. Failure to observe this precaution will cause severe damage to the Servo drive.
  - Ensure that the motor and drive are correctly connected to a ground. The grounding method must comply with the electrical standard of the country (Please refer to NFPA 70: National Electrical Code, 2005 Ed.).
  - Do not disconnect the AC servo drive and motor while the power is ON.
  - Do not attach, modify or remove wiring while power is applied to the AC servo drive.
  - Before starting the operation with a mechanical system connected, make sure the emergency stop equipment can be energized and work at any time.
  - Do not touch the drive heat sink or the servo motor during operation, this may cause serious personnel injury.

PLEASE READ PRIOR TO INSTALLATION FOR SAFETY.

Carefully note and observe the following safety precautions when receiving, inspecting, installing, operating, maintaining and troubleshooting. The following words, DANGER, WARNING and STOP are used to mark safety precautions when using the Delta’s servo product. **Failure to observe these precautions may void the warranty!**

ASDA-B2 series drives are open type servo drives and must be installed in an NEMA enclosure such as a protection control panel during operation to comply with the requirements of the international safety standards. They are provided with precise feedback control and high-speed calculation function incorporating DSP (Digital Signal Processor) technology, and intended to drive three-phase permanent magnet synchronous motors (PMSM) to achieve precise positioning by means of accurate current output generated by IGBT (Insulated Gate Bipolar Transistor).

ASDA-B2 series drives can be used in industrial applications and for installation in an end-use enclosure that do not exceed the specifications defined in the ASDA-B2 series user manual (Drives, cables and motors are for use in a suitable enclosure with a minimum of a UL50 type 1 or NEMA 250 Type 1 rating).

The words, DANGER, WARNING and STOP, have the following meaning:

DANGER	**Indicates a potentially hazardous situation and if not avoided, may result in serious injury or death.**
WARNING	**Indicates a potentially hazardous situation and if not avoided, may result in minor to moderate injury or serious damage to the product.**
STOP	**Indicates an improper action that it is not recommended. Doing so may cause damage or malfunction.**

Unpacking Check

DANGER

- ***Please ensure that both the servo drive and motor are correctly matched for size (power rating). Failure to observe this precaution may cause fire, seriously damage to the drive / motor or cause personal injury.***

Installation

DANGER

- ***Do not install the product in a location that is outside the stated specification for the drive and motor. Failure to observe this caution may result in electric shock, fire, or personal injury.***

Wiring

DANGER

- ***Connect the ground terminals to a class-3 ground (Ground resistance should not exceed 100 Ω). Improper grounding may result in electric shock or fire.***
- ***Do not connect any power supplies to the U, V, W terminals. Failure to observe this precaution may result in serious injury, damage to the drive or fire.***
- ***Ensure that all screws, connectors and wire terminations are secure on the power supply, servo drive and motor. Failure to observe this caution may result in damage, fire or personal injury.***

Operation

WARNING

- ***Before starting the operation with a mechanical system connected, change the drive parameters to match the user-defined parameters of the mechanical system. Starting the operation without matching the correct parameters may result in servo drive or motor damage, or damage to the mechanical system.***
- ***Ensure that the emergency stop equipment or device is connected and working correctly before operating the motor that is connected to a mechanical system.***

STOP

- ***Do not approach or touch any rotating parts (e.g. shaft) while the motor is running. Failure to observe this precaution may cause serious personal injury.***

DANGER

- ***In order to prevent accidents, the initial trial run for servo motor should be conducted under no load conditions (separate the motor from its couplings and belts).***
- ***For the initial trial run, do not operate the servo motor while it is connected to its mechanical system. Connecting the motor to its mechanical system may cause damage or result in personal injury during the trail run. Connect the servo motor once it has successfully completed a trail run.***
- ***Caution: Please perform trial run without load first and then perform trial run with load connected. After the servo motor is running normally and regularly without load, then run servo motor with load connected. Ensure to perform trial run in this order to prevent unnecessary danger.***

- ***Do not touch either the drive heat sink or the motor during operation as they may become hot and personal injury may result.***

Maintenance and Inspection

STOP

- ***Do not touch any internal or exposed parts of servo drive and servo motor as electrical shock may result.***
- ***Do not remove the operation panel while the drive is connected to an electrical power source otherwise electrical shock may result.***
- ***Wait at least 10 minutes after power has been removed before touching any drive or motor terminals or performing any wiring and/or inspection as an electrical charge may still remain in the servo drive and servo motor with hazardous voltages even after power has been removed.***
- ***Do not disassemble the servo drive or motor as electric shock may result.***
- ***Do not connect or disconnect wires or connectors while power is applied to the drive and motor.***
- ***Only qualified personnel who have electrical knowledge should conduct maintenance and inspection.***

Main Circuit Wiring

WARNING

- ***Install the encoder cables in a separate conduit from the motor power cables to avoid signal noise. Separate the conduits by 30cm (11.8inches) or more.***
- ***Use multi-stranded twisted-pair wires or multi-core shielded-pair wires for signal, encoder (PG) feedback cables. The maximum length of command input cable is 3m (9.84ft.) and the maximum length of encoder (PG) feedback cables is 20m (65.62ft.).***
- ***As a charge may still remain in the drive with hazardous voltages even after power has been removed, be sure to wait at least 10 minutes after power has been removed before performing any wiring and/or inspection.***

STOP

- ***It is not recommended to frequently power the drive on and off. Do not turn the drive off and on more than once per minute as high charging currents within the internal capacitors may cause damage.***

Main Circuit Terminal Wiring

WARNING

- ***Please perform the wiring after the terminal blocks are all removed from the drive.***
- ***Insert only one wire into one terminal on the terminal block.***
- ***When inserting wires, please ensure that the conductors are not shorted to adjacent terminals or wires.***
- ***Ensure to double check the wiring before applying power to the drive.***
- ***If the wiring is in error, perform the wiring again with proper tools. Never use force to remove the terminals or wires. Otherwise, it may result in malfunction or damage.***

NOTE

1) In this manual, actual measured values are in metric units. Dimensions in (imperial units) are for reference only. Please use metric units for precise measurements.
2) The content of this manual may be revised without prior notice. Please consult our distributors or download the most updated version at http://www.delta.com.tw/industrialautomation.

Table of Contents

About this Manual…

User Information

Be sure to store this manual in a safe place.

Due to constantly growing product range, technical improvement, alteration or changed texts, figures and diagrams, we reserve the right to make information changes within this manual without prior notice.

Coping or reproducing any part of this manual, without written consent of Delta Electronics Inc. is prohibited.

Technical Support and Service

You are welcome to contact our Technical Support Team at the below numbers or visit our web site (http://www.delta.com.tw/industrialautomation/) if you need technical support, service, information, or if you have any questions in the use of this product. We look forward to serving your needs and are willing to offer our best support and service to you.

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Chapter 1 Unpacking Check and Model Explanation

1.1 Unpacking Check

After receiving the AC servo drive, please check for the following:

- **Ensure that the product is what you have ordered.**

  Verify the part number indicated on the nameplate corresponds with the part number of your order (Please refer to Section 1.2 for details about the model explanation).

- **Ensure that the servo motor shaft rotates freely.**

  Rotate the motor shaft by hand; a smooth rotation will indicate a good motor. However, a servo motor with an electromagnetic brake can not be rotated manually.

- **Check for damage.**

  Inspect the unit to insure it was not damaged during shipment.

- **Check for loose screws.**

  Ensure that all necessary screws are tight and secure.

If any items are damaged or incorrect, please inform the distributor whom you purchased the product from or your local Delta sales representative.

A complete and workable AC servo system should include the following parts:

Part I : Delta standard supplied parts

(1) Servo drive
(2) Servo motor
(3) 5 PIN Terminal Block (for L1c, L2c, R, S, T)
(4) 3 PIN Terminal Block (for U, V, W)
(5) 4 PIN Terminal Block (for P⊕, D, C, ⊖)
(6) One operating lever (for wire to terminal block insertion)
(7) One jumper bar (installed at pins P⊕ and D of the 3 PIN Terminal Block for P⊕, D, C)
(8) Instruction Sheets

Part II : Optional parts (Refer to Appendix A)

(1) One power cable, which is used to connect servo motor to U, V, W terminals of servo drive. This power cable includes a green grounding cable. Please connect the green grounding cable to the ground terminal of the servo drive.

(2) One encoder cable, which is used to connect the encoder of servo motor to the CN2 terminal of servo drive.

(3) CN1 Connector: 4 PIN Connector (3M type analog product)

(4) CN2 Connector: 9 PIN Connector (3M type analog product)

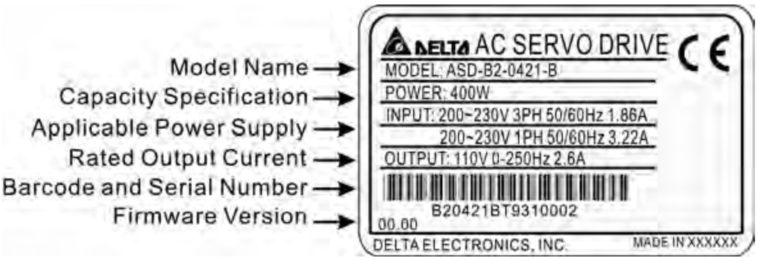
(5) CN3 Connector: 6 PIN Connector (IEEE1394 analog product)

1.2 Model Explanation

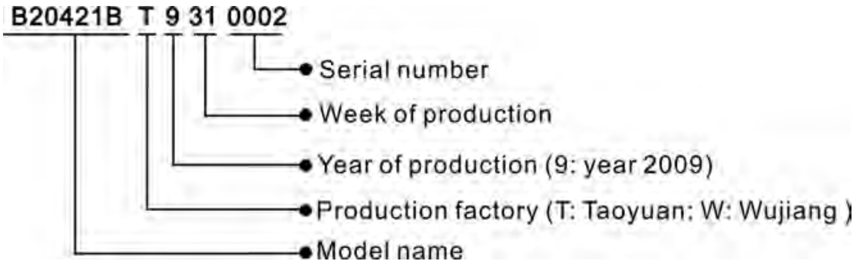
1.2.1 Nameplate Information

ASDA-B2 Series Servo Drive

- Nameplate Explanation

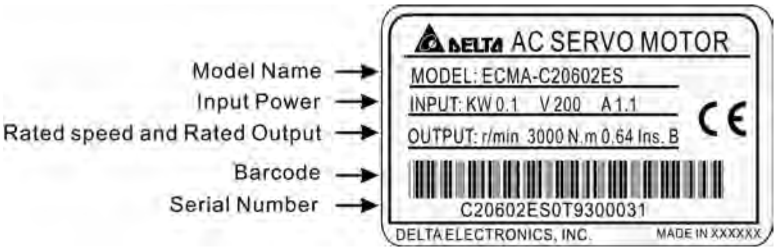


- Serial Number Explanation

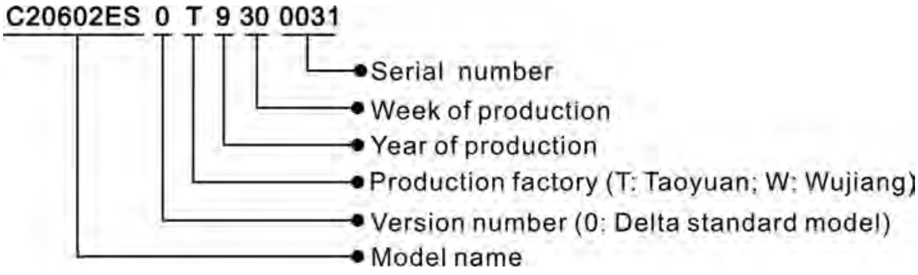

B20421B T 9 31 0002
Serial number
Week of production
Year of production (9: year 2009)
Production factory (T: Taoyuan; W: Wujiang)
Model name

ASMT Series Servo Motor

- Nameplate Explanation

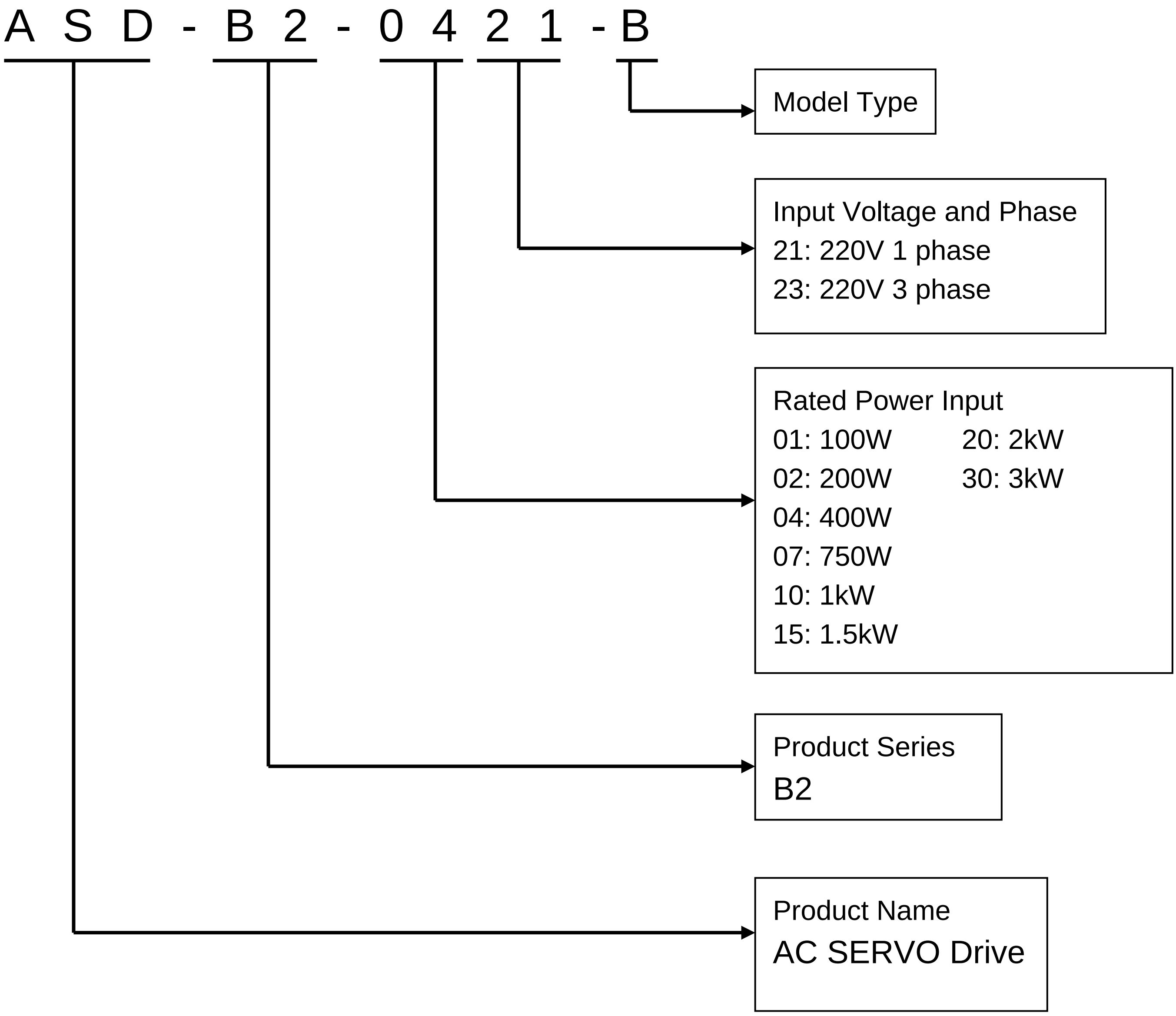


- Serial Number Explanation


C20602ES 0 T 9 30 0031
Serial number
Week of production
Year of production
Production factory (T: Taoyuan; W: Wujiang)
Version number (0: Delta standard model)
Model name

1.2.2 Model Name Explanation

ASDA-B2 Series Servo Drive



Model Type

Input Voltage and Phase
21: 220V 1 phase
23: 220V 3 phase

Rated Power Input
01: 100W
02: 200W
04: 400W
07: 750W
10: 1kW
15: 1.5kW
20: 2kW
30: 3kW

Product Series
B2

Product Name
AC SERVO Drive

ECMA Series Servo Motor

E C M A - C 1 0 6 0 2 E S

Standard Shaft Diameter: S
Specific Shaft Diameter: 3=42mm, 7=14mm

Type of Shaft Diameter 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)	A	B	C	D
Keyway	E	F	G	H
Keyway (with fixed screw holes)	P	Q	R	S

Rated Power Output
01:100W 05:500W 10:1.0kW
02:200W 06:600W 15:1.5kW
03:300W 07:700W 20:2.0kW
04:400W 09:900W 30:3.0kW

Motor Frame Size
04:40mm 09:86mm 18:180mm
06:60mm 10:100mm
08:80mm 13:130mm

Name of the Series
Rated Voltage and Rated Speed
C = 220V/3,000 rpm; **E** = 220V/2,000 rpm;
F = 220V/1,500 rpm; **G** = 220V/1,000 rpm;
Encoder Type
1: Incremental, 20-bit
2: Incremental, 17-bit
M: Magnetic encoder, 13-bit

Servo Type
A: AC Servo

Product Name
ECM: Electronic Commutation Motor

1.3 Servo Drive and Servo Motor Combinations

The table below shows the possible combination of Delta ASDA-B2 series servo drives and ECMA series servo motors. The boxes (☐) in the model names are for optional configurations. (Please refer to Section 1.2 for model explanation)

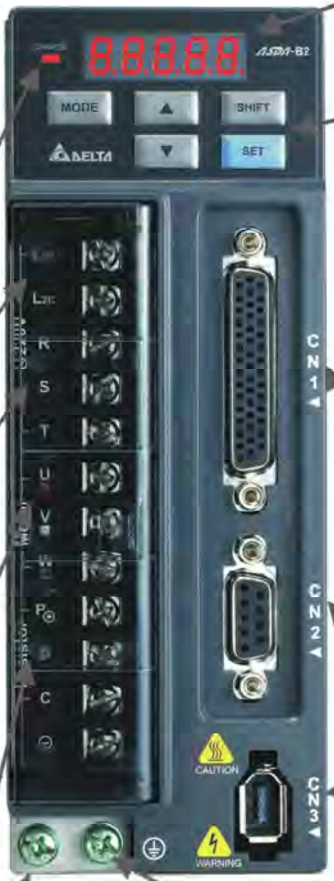
Power	Servo Drive	Servo Motor
100W	ASD-B2-0121-☐	ECMA-C20401☐S（S=8mm）
200W	ASD-B2-0221-☐	ECMA-C20602☐S（S=14mm）
400W	ASD-B2-0421-☐	ECMA-C20604☐S (S=14mm) ECMA-CM0604☐S (S=14mm) ECMA-C20804☐7 (7=14mm) ECMA-E21305☐S (S=22mm) ECMA-G21303☐S (S=22mm)
750W	ASD-B2-0721-☐	ECMA-C20807☐S (S=19mm) ECMA-C20907☐S (S=16mm) ECMA-G21306☐S (S=22mm) ECMA-GM1306☐S (S=22mm)
1000W	ASD-B2-1021-☐	ECMA-C21010☐S (S=22mm) ECMA-C20910☐S (S=16mm) ECMA-E21310☐S (S=22mm) ECMA-G21309☐S (S=22mm) ECMA-GM1309☐S (S=22mm)
1500W	ASD-B2-1521-☐	ECMA-E21315☐S (S=22mm)
2000W	ASD-B2-2023-☐	ECMA-C21020☐S (S=22mm) ECMA-E21320☐S (S=22mm) ECMA-E21820☐S (S=35mm)
3000W	ASD-B2-3023-☐	ECMA-E21830☐S (S=35mm) ECMA-F21830☐S (S=35mm)

The servo drives shown in the above table are designed for use in combination with the specific servo motors. Check the specifications of the drives and motors you want to use.

Also, please ensure that both the servo drive and motor are correctly matched for size (power rating). If the power of motor and drive is not within the specifications, the drive and motor may overheat and servo alarm would be activated. For the detail specifications of servo drives and motors, please refer to Chapter 11 “Specifications”.

The drives shown in the above table are designed according to the three multiple of rated current of motors shown in the above table. If the drives which are designed according to the six multiple of rated current of motors are needed, please contact our distributors or your local Delta sales representative.

1.4 Servo Drive Features



Charge LED
A lit LED indicates that either power is connected to the servo drive OR a residual charge is present in the drive's internal power components.
DO NOT TOUCH ANY ELECTRICAL CONNECTIONS WHILE THIS LED IS LIT.
(Please refer to the Safety Precautions on page i).

Control Circuit Terminal (L1c, L2c)
Used to connect 200~230Vac, 50/60Hz single-phase VAC supply.

Main Circuit Terminal (R, S, T)
Used to connect 200~230V, 50/60Hz commercial power supply.

Servo Motor Output (U, V, W)
Used to connect servo motor. Never connect the output terminal to main circuit power. The AC servo drive may be destroyed beyond repair if incorrect cables are connected to the output terminals.

Internal / External Regenerative Resistor Terminal
1) When using an external regenerative resistor, connect P and C to the regenerative resistor and ensure that the circuit between P and D is open.
2) When using theinternal regenerative resistor, ensure that the circuit between P and D is closed and the circuit between P and C is open.

Heatsink
Used to secure servo drive and for heat dissipation.

LED Display
The 5-digit, 7 segment LED displays the servo status or fault codes.

Operation Panel
Used function keys to perform status display, monitor and diagnostic, function and parameter setting.
Function Keys:
MODE : Press this key to select/change mode.
SHIFT : Shift Key has several functions: moving the cursor and indexing through the parameter groups Press this key to shift cursor to the left.
UP : Press this key to increase values on the display.
DOWN : Press this key to decrease values on the display.
SET : Press this key to store data.

I/O Interface
Used to connect Host Controller (PLC) or control I/O signal.

Encoder Connector:
The connector which connects to the servo motor encoder.

Serial Communication Interface
For RS-485 / 232 serial communication.
Used to connect personal computer or other controllers.

Ground Terminal

1.5 Control Modes of Servo Drive

The Delta Servo provides six single and five dual modes of operation.

Their operation and description is listed in the following table.

Mode		Code	Description
Single Mode	External Position Control	P	External Position control mode for the servo motor is achieved via an external pulse command.
	Speed Control	S	(External / Internal) Speed control mode for the servo motor can be achieved via parameters set within the controller or from an external analog -10 ~ +10 V_{DC} command. Control of the internal speed mode is via the Digital Inputs (DI). (A maximum of three speeds can be stored internally).
	Internal Speed Control	Sz	Internal Speed control mode for the servo motor is only achieved via parameters set within the controller. Control of the internal speed mode is via the Digital Inputs (DI). (A maximum of three speeds can be stored internally).
	Torque Control	T	(External / Internal) Torque control mode for the servo motor can be achieved via parameters set within the controller or from an external analog -10 ~ +10 V_{DC} command. Control of the internal torque mode is via the Digital Inputs (DI). (A maximum of three torque levels can be stored internally).
	Internal Torque Control	Tz	Internal Torque control mode for the servo motor is only achieved via parameters set within the controller. Control of the internal torque mode is via the Digital Inputs (DI). (A maximum of three torque levels can be stored internally).
Dual Mode		S-P	Either S or P control mode can be selected via the Digital Inputs (DI)
		T-P	Either T or P control mode can be selected via the Digital Inputs (DI)
		S-T	Either S or T control mode can be selected via the Digital Inputs (DI)

The above control modes can be accessed and changed via parameter P1-01. Enter the new control mode via P1-01 then switch the main power to the servo drive OFF then ON. The new control mode will only be valid after the drives main power is switched OFF then ON. Please see safety precautions on page iii (switching drive off/on multiple times).

Chapter 2 Installation and Storage

2.1 Installation Notes

Please pay close attention to the following installation notes:

- Do not bend or strain the connection cables between servo drive and motor.
- When mounting the servo drive, make sure to tighten all screws to secure the drive in place.
- If the servo motor shaft is coupled directly to a rotating device ensure that the alignment specifications of the servo motor, coupling, and device are followed. Failure to do so may cause unnecessary loads or premature failure to the servo motor.
- If the length of cable connected between servo drive and motor is more than 20m, please increase the wire gauge of the encoder cable and motor connection cable (connected to U, V, W terminals).
- Make sure to tighten the screws for securing motor.

2.2 Storage Conditions

The product should be kept in the shipping carton before installation. In order to retain the warranty coverage, the AC servo drive should be stored properly when it is not to be used for an extended period of time. Some storage suggestions are:

- Store in a clean and dry location free from direct sunlight.
- Store within an ambient temperature range of -20°C to +65°C (-4°F to 149°F).
- Store within a relative humidity range of 0% to 90% and non-condensing.
- Do not store in a place subjected to corrosive gases and liquids.
- Store in original packaging and placed on a solid surface.

2.3 Installation Conditions

Operating Temperature

ASDA-B2 Series Servo Drive : 0°C to 55°C (32°F to 131°F)

ECMA Series Servo Motor : 0°C to 40°C (32°F to 104°F)

The ambient temperature of servo drive should be under 45°C (113°F) for long-term reliability.

If the ambient temperature of servo drive is greater than 45°C (113°F), please install the drive in a well-ventilated location and do not obstruct the airflow for the cooling fan.

Caution

The servo drive and motor will generate heat. If they are installed in a control panel, please ensure sufficient space around the units for heat dissipation.

Pay particular attention to vibration of the units and check if the vibration has impacted the electric devices in the control panel. Please observe the following precautions when selecting a mounting location. ***Failure to observe the following precautions may void the warranty!***

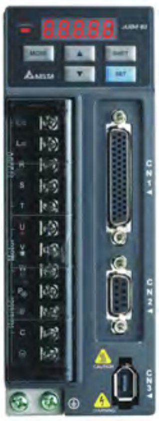
- Do not mount the servo drive or motor adjacent to heat-radiating elements or in direct sunlight.
- Do not mount the servo drive or motor in a location subjected to corrosive gases, liquids, airborne dust or metallic particles.
- Do not mount the servo drive or motor in a location where temperatures and humidity will exceed specification.
- Do not mount the servo drive or motor in a location where vibration and shock will exceed specification.
- Do not mount the servo drive or motor in a location where it will be subjected to high levels of electromagnetic radiation.

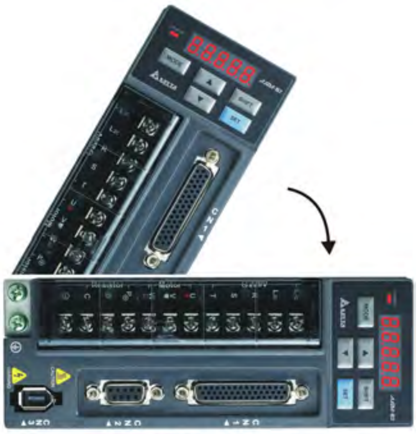
2.4 Installation Procedure and Minimum Clearances

Installation Procedure

Incorrect installation may result in a drive malfunction or premature failure of the drive and or motor. Please follow the guidelines in this manual when installing the servo drive and motor.

The ASDA-B2 servo drives should be mounted perpendicular to the wall or in the control panel. In order to ensure the drive is well ventilated, ensure that the all ventilation holes are not obstructed and sufficient free space is given to the servo drive. Do not install the drive in a horizontal position or malfunction and damage will occur.


Correct


Incorrect

Drive Mounting

The ASDA-B2 servo drives must be back mounted vertically on a dry and solid surface such as a NEMA enclosure. A minimum spacing of two inches must be maintained above and below the drive for ventilation and heat dissipation. Additional space may be necessary for wiring and cable connections. Also, as the drive conducts heat away via the mounting, the mounting plane or surface should not conduct heat into the drive from external sources

Motor Mounting

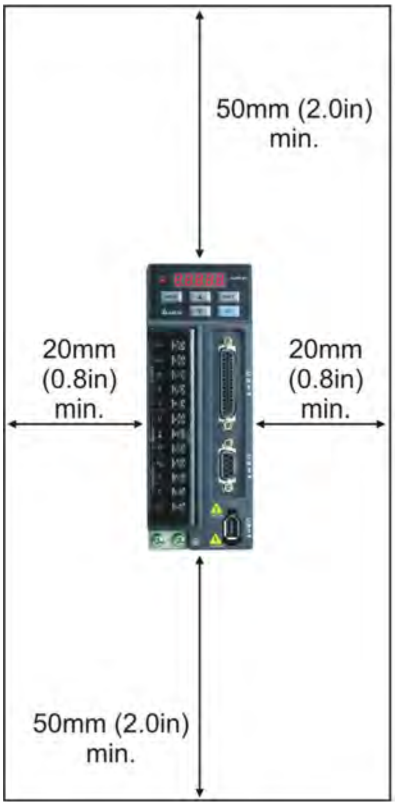
The ECMA servo motors should be mounted firmly to a dry and solid mounting surface to ensure maximum heat transfer for maximum power output and to provide a good ground.

For the dimensions and weights specifications of servo drive or motor, please refer to Chapter 11 “Specifications".

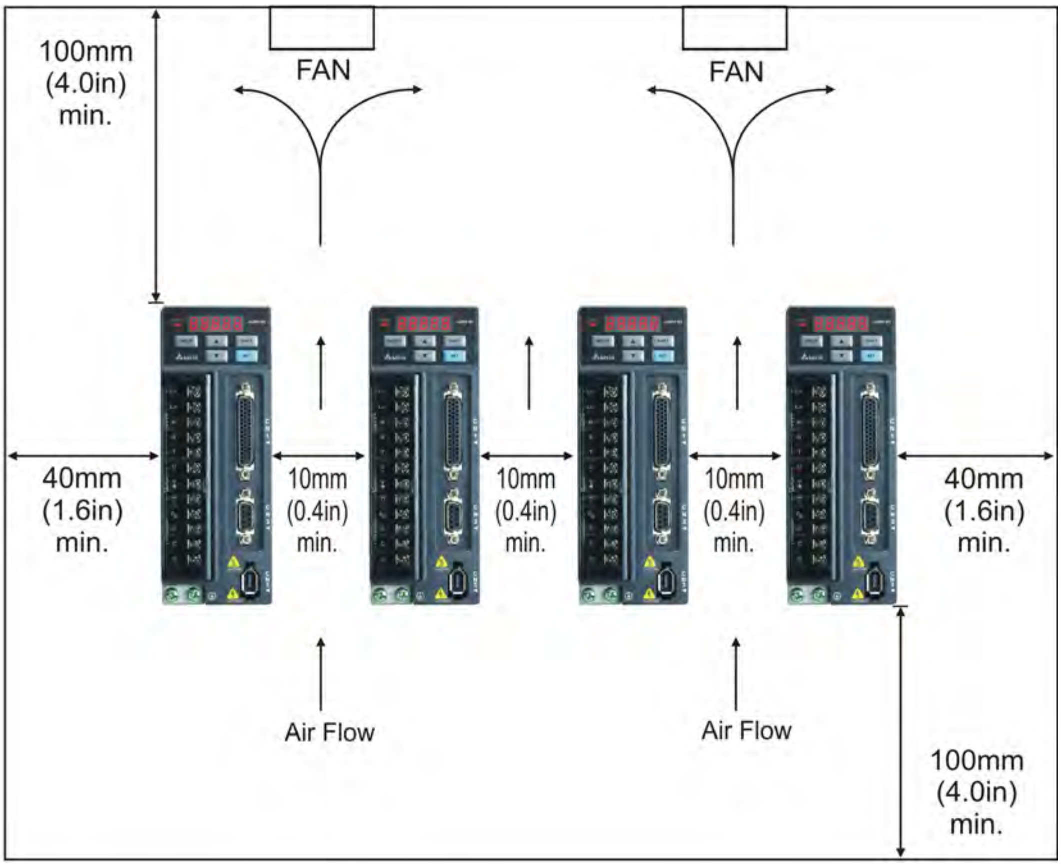
Minimum Clearances

Install a fan to increase ventilation to avoid ambient temperatures that exceed the specification. When installing two or more drives adjacent to each other please follow the clearances as shown in the following diagram.

■ Minimum Clearances



■ Side by Side Installation



2.5 Circuit Interrupter and Fuse Current Recommended Value

WARNING

- ***Caution: Please use circuit interrupter and fuse which are recognized by and comply with the UL or CSA standards.***

Servo Drive Model	Recommended Breaker	Recommended Fuse (Class T)
Operation Mode	General	General
ASD-B2-0121-B	5A	5A
ASD-B2-0221-B	5A	6A
ASD-B2-0421-B	10A	10A
ASD-B2-0721-B	10A	20A
ASD-B2-1021-B	15A	25A
ASD-B2-1521-B	20A	40A
ASD-B2-2023-B	30A	50A
ASD-B2-3023-B	30A	70A

NOTE

1) When using a GFCI (Ground Fault Circuit Interrupter), select a current sensor with sensitivity of equal to or more than 200mA, and not less than 0.1-second detection time to avoid nuisance tripping.

2.6 EMI Filter Selection

AC Servo Drive - EMI Filter Cross Reference

Item	Power	Servo Drive Model	EMI Filter Model		FootPrint
			1PH	3PH	
1	100W	ASD-B2-0121-B	RF007S21AA	RF022M43AA	N
2	200W	ASD-B2-0221-B	RF007S21AA	RF022M43AA	N
3	400W	ASD-B2-0421-B	RF007S21AA	RF022M43AA	N
4	750W	ASD-B2-0721-B	RF007S21AA	RF022M43AA	N
5	1000W	ASD-B2-1021-B	RF015B21AA	RF075M43BA	N
6	1500W	ASD-B2-1521-B	RF015B21AA	RF075M43BA	N
7	2000W	ASD-B2-2023-B	-	RF037B43BA	N
8	3000W	ASD-B2-3023-B	-	RF037B43BA	N

Installation

All electrical equipment, including AC servo drives, will generate high-frequency/low-frequency noise and will interfere with peripheral equipment by radiation or conduction when in operation. By using an EMI filter with correct installation, much of the interference can be eliminated. It is recommended to use Delta’s EMI filter to have the best interference elimination performance.

We assure that it can comply with following rules when AC servo drive and EMI filter are installed and wired according to user manual:

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

General Precaution

To ensure the best interference elimination performance when using Delta’s EMI filter, please follow the guidelines in this user manual to perform wiring and/or installation. In addition, please also observe the following precautions:

- EMI filter and AC servo drive should be installed on the same metal plate.
- Please install AC servo drive on same footprint with EMI filter or install EMI filter as close as possible to the AC servo drive.
- All wiring should be as short as possible.
- Metal plate should be grounded.
- The cover of EMI filter and AC servo drive or grounding should be fixed on the metal

plate and the contact area should be as large as possible.

Choose Suitable Motor Cable and Precautions

Improper installation and choice of motor cable will affect the performance of EMI filter. Be sure to observe the following precautions when selecting motor cable.

- Use the cable with shielding (double shielding is the best).
- The shielding on both ends of the motor cable should be grounded with the minimum length and maximum contact area.
- Remove any paint on metal saddle for good ground contact with the plate and shielding (Please refer to Figure 1 below).
- The connection between the metal saddle and the shielding on both ends of the motor cable should be correct and well installed. Please refer to Figure 2 on next page for correct wiring method.

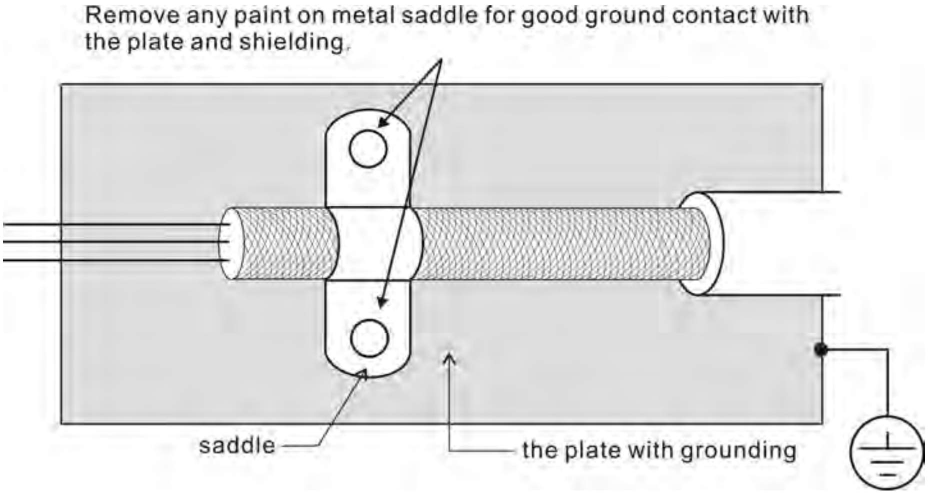
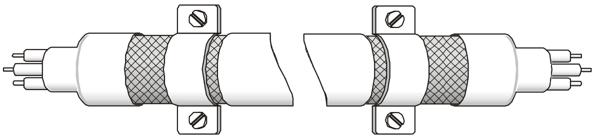
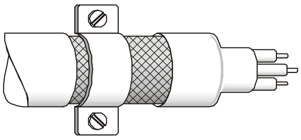

Remove any paint on metal saddle for good ground contact with the plate and shielding.
saddle
the plate with grounding

Figure 1



Saddle on both ends



Saddle on one end

Figure 2

2.7 Regenerative Resistor

Built-in Regenerative Resistor

When the output torque of servo motor in reverse direction of motor rotation speed, it indicates that there is a regenerative power returned from the load to the servo drive. This power will be transmitted into the capacitance of DC Bus and result in rising voltage. When the voltage has risen to some high voltage, the servo system need to dissipate the extra energy by using a regenerative resistor. ASDA-B2 series servo drive provides a built-in regenerative resistor and the users also can connect to external regenerative resistor if more regenerative capacity is needed.

The following table shows the specifications of the servo drive's built-in regenerative resistor and the amount of regenerative power (average value) that it can process.

Built-in Regenerative Resistor Specifications				
Servo Drive (kW)	Resistance (Ohm) (parameter P1-52)	Capacity (Watt) (parameter P1-53)	Regenerative Power processed by built-in regenerative resistor (Watt) *[1]	Min. Allowable Resistance (Ohm)
0.1	-	-	-	60
0.2	-	-	-	60
0.4	100	60	30	60
0.75	100	60	30	60
1.0	40	60	30	30
1.5	40	60	30	30
2.0	20	100	50	15
3.0	20	100	50	15

*1 Regenerative Power Calculation: The amount of regenerative power (average value) that can be processed is rated at 50% of the capacity of the servo drive's built-in regenerative resistor. The regenerative power calculation method of external regenerative resistor is the same.

When the regenerative power exceeds the processing capacity of the servo drive, install an external regenerative resistor. Please pay close attention on the following notes when using a regenerative resistor.

1. Make sure that the settings of resistance (parameter P1-52) and capacity (parameter P1-53) is set correctly.
2. When the users want to install an external regenerative resistor, ensure that its resistance value is the same as the resistance of built-in regenerative resistor. If combining multiple small-capacity regenerative resistors in parallel to increase the regenerative resistor capacity, make sure that the resistance value of the regenerative resistor should comply with the specifications listed in the above table.
3. In general, when the amount of regenerative power (average value) that can be

processed is used at or below the rated load ratio, the resistance temperature will increase to 120°C or higher (on condition that when the regeneration continuously occurred). For safety reasons, forced air cooling is good way that can be used to reduce the temperature of the regenerative resistors. We also recommend the users to use the regenerative resistors with thermal switches. As for the load characteristics of the regenerative resistors, please check with the manufacturer.

External Regenerative Resistor

When using external regenerative resistor, connect it to P and C, and make sure the circuit between P and D is open. We recommend the users should use the external regenerative resistor that the resistance value following the above table (Built-in Regenerative Resistor Specifications). We ignore the dissipative power of IGBT (Insulated Gate Bipolar Transistor) in order to let the users easily calculate the capacity of regenerative resistor. In the following sections, we will describe Regenerative Power Calculation Method and Simple Calculation Method for calculating the regenerative power capacity of external regenerative resistors.

(1) Regenerative Power Calculation Method

(a) Without Load

When there is no external load torque, if the servo motor repeats operation, the returned regenerative power generated when braking will transmitted into the capacitance of DC bus. After the capacitance voltage exceeds some high value, regenerative resistor can dissipate the remained regenerative power. Use the table and procedure described below to calculate the regenerative power.

Servo Drive (kW)		Servo Motor	Rotor Inertia J (× 10^{-4}kg.m^2)	Regenerative power from empty load 3000r/min to stop Eo (joule)	Max. regenerative power of capacitance Ec(joule)
Low Inertia	0.1	ECMA-C20401□□	0.037	0.18	3
	0.2	ECMA-C20602□□	0.177	0.87	4
	0.4	ECMA-C20604□□ ECMA-C20804□□	0.277 0.68	1.37 3.36	8
	0.75	ECMA-C20807□□	1.13	5.59	14
	1.0	ECMA-C21010□□	2.65	13.1	18
	2.0	ECMA-C21020□□	4.45	22.0	21
Medium Inertia	0.4	ECMA-E21305□□	8.17	40.40	8
	1.0	ECMA-E21310□□	8.41	41.59	18
	1.5	ECMA-E21315□□	11.18	55.28	18
	2.0	ECMA-E21320□□ ECMA-E21820□□	14.59 34.68	72.15 171.50	21

Servo Drive (kW)		Servo Motor	Rotor Inertia J (× 10^{-4}kg.m^2)	Regenerative power from empty load 3000r/min to stop Eo (joule)	Max. regenerative power of capacitance Ec(joule)
	3.0	ECMA-E21830□□	54.95	271.73	28
		ECMA-F21830□□	54.95	271.73	28
High Inertia	0.4	ECMA-G21303□□	8.17	40.40	8
	0.75	ECMA-G21306□□	8.41	41.59	14
	1.0	ECMA-G21309□□	11.18	55.29	18

Eo = J x wr^2/182 (joule), Wr : r/min

If the load inertia is N × motor inertia, the regenerative power will be (N+1) x E0 when servo motor brakes from 3000r/min to 0. Then, the regenerative resistor can dissipate: (N+1) x E0 - Ec (joule). If the time of repeat operation cycle is T sec, then the regenerative power = 2 x ((N+1) x E0 - Ec) / T.

The calculating procedure is as follows:

Step	Procedure	Equation and Setting Method
1	Set the capacity of regenerative resistor to the maximum	Change the value of P1-53 to maximum
2	Set the operation cycle T	Input by the users
3	Set motor speed wr	Input by the users or read via P0-02 Drive State Display
4	Set load/motor inertia ratio N	Input by the users or read via P0-02 Drive State Display
5	Calculate the max. regenerative power Eo	Eo = J x wr^2/182
6	Set the regenerative power Ec that can be absorbed	Refer to the table above
7	Calculate the required regenerative power capacity	2 x (N+1) x Eo - Ec) / T

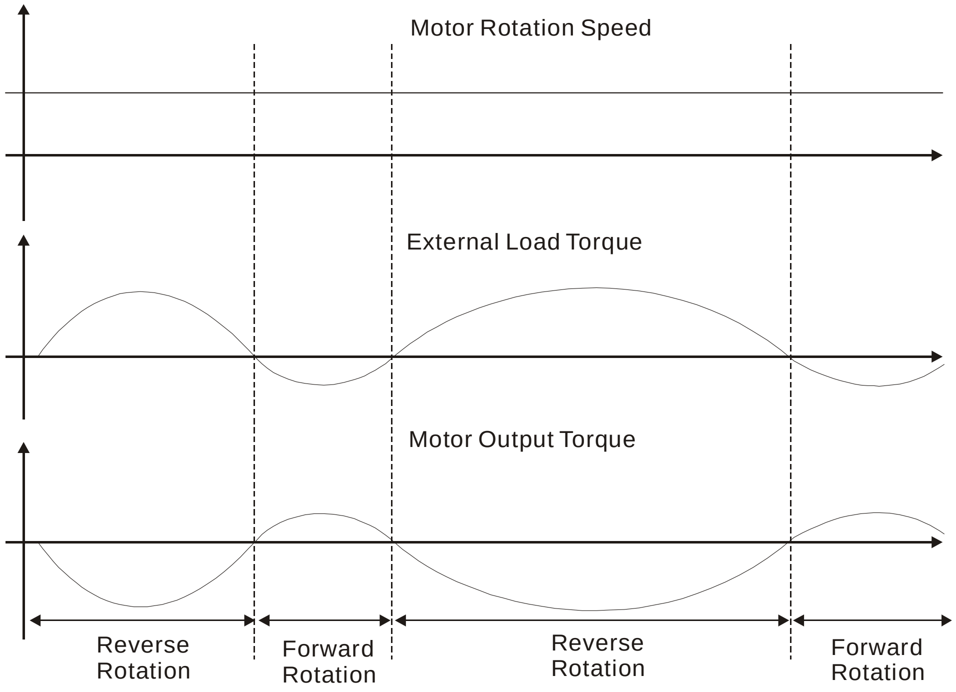
For example:

If we use 400W servo drive, the time of repeat operation cycle is T = 0.4 sec, max. motor speed is 3000r/min, the load inertia = 7 × motor inertia, then the necessary the power of regenerative resistor = 2 x ((7+1) × 1.68 - 8) / 0.4 = 27.2W. If the calculation result is smaller than regenerative power, we recommend the users to use the built-in 60W regenerative resistor. Usually the built-in regenerative resistor provided by ASDA-B2 series can meet the requirement of general application when the external load inertia is not excessive.

The users can see when the capacity of regenerative resistor is too small, the accumulated power will be larger and the temperature will also increase. The fault, ALE05 may occur if the temperature is over high. The following figure shows the actual operation of regenerative resistor.

(b) With Load

When there is an external load torque, servo motor is in reverse rotation when external load greater than motor torque. Servo motor is usually in forward rotation and the motor torque output direction is the same as the rotation direction. However, there is still some special condition. If the motor output torque is in the reverse direction of rotation, the servo motor is also in the reverse direction of rotation. The external power is input into the servo drive through servo motor. The figure below is an example. The users can see the motor is in forward rotation at constant speed when a sudden external load torque change and great power is transmitted to regenerative resistor rapidly.



External load torque in reverse direction: TL x Wr TL : External load torque

For the safety, we strongly recommend the users should select the proper resistance value according to the load.

For example:

When external load torque is a +70% rated torque and rotation speed reaches 3000r/min, if using 400W servo drive (rated torque: 1.27Nt-m), then the users need to connect a external regenerative resistor which power is 2 x (0.7 x 1.27) x (3000 x 2 x π/ 60) = 560W, 40Ω.

(2) Simple Calculation Method

The users can select the adequate regenerative resistors according to the allowable frequency required by actual operation and the allowable frequency when the servo motor runs without load. The allowable frequency when the servo motor run without load is the maximum frequency that can be operated during continuous operation when servo motor accelerate from 0r/min to rated speed and decelerate from rated speed down to 0r/min. The allowable frequencies when the servo motor run without load are summarized in the following table.

Allowable Frequencies for Servo Motor Running Without Load (times/min) When Using Built-in Regenerative Resistor								
Motor Capacity ECMA Series	600W	750W	900W	1.0kW	1.5kW	2.0kW	2.0kW	3.0kW
	06	07	09	10	15	20	20	30
ECMA☐☐C	-	312	-	137	-	83 (F100)		-
ECMA☐☐E	-	-	-	42	32	24 (F130)	10 (F180)	11
ECMA☐☐G	42	-	31	-	-	-	-	-

When the servo motor runs with load, the allowable frequency will change according to the changes of the load inertia and rotation speed. Use the following equation to calculate the allowable frequency.

$$\text{Allowable frequency} = \frac{\text{Allowable frequency when servo motor run without load}}{m+1} \times \left(\frac{\text{Rated speed}}{\text{Operating speed}}\right)^2 \frac{\text{times}}{\text{min.}}$$

m = load/motor inertia ratio

The users can select the adequate regenerative resistors according to the allowable frequency by referring to the table below:

Allowable Frequencies for Servo Motor Running Without Load (times/min) When Using External Regenerative Resistor							
Motor Capacity	ECMA☐☐C						
	100W	200W	400W (F60)	400W (F80)	750W	1.0kW	2.0kW
Regenerative Resistor	01	02	04	04	07	10	20
200W 80Ω	32793	6855	4380	1784	1074	458	273
400W 40Ω	-	-	-	-	-	916	545
1kW 30Ω	-	-	-	-	-	-	1363

Allowable Frequencies for Servo Motor Running Without Load (times/min) When Using External Regenerative Resistor						
Motor Capacity Regenerative Resistor	ECMA□□E					
	0.5kW	1kW	1.5kW	2.0kW	2.0kW	3.0kW
	05	1.0	15	20	20	30
200W 80Ω	149	144	109	83	35	22
400W 40Ω	-	289	217	166	70	44
1kW 30Ω	-	-	-	416	175	110

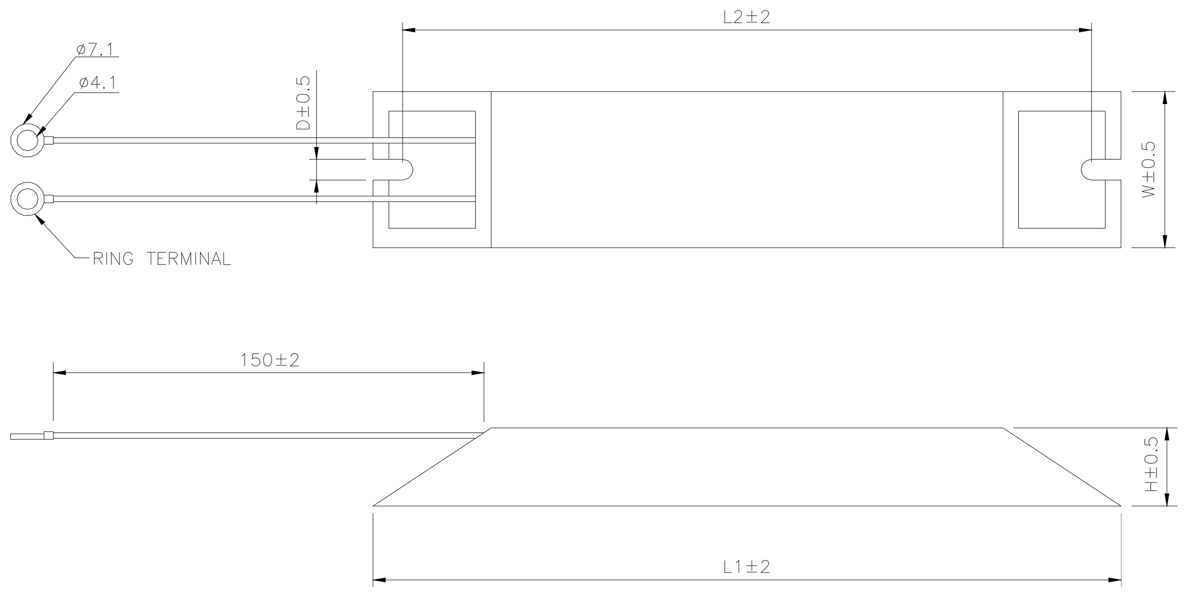
Allowable Frequencies for Servo Motor Running Without Load (times/min) When Using External Regenerative Resistor			
Motor Capacity Regenerative Resistor	ECMA□□G		
	0.3kW	0.6kW	0.9kW
	03	06	09
200W 80Ω	149	144	109
400W 40Ω	-	-	217

When the regenerative resistor capacity is not enough, the users can connect to multiple the same capacity regenerative resistors in parallel to increase it.

Dimensions

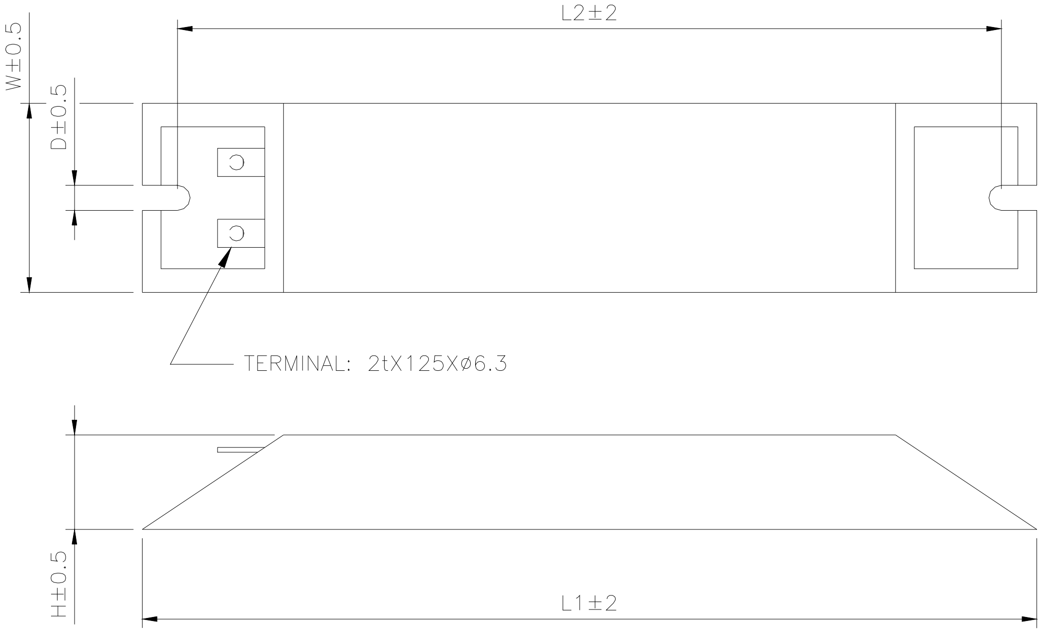
Delta Part Number : BR400W040 (400W 40Ω)

L1	L2	H	D	W	MAX. WEIGHT(g)
265	250	30	5.3	60	930



Delta Part Number : BR1K0W020 (1kW 20Ω)

L1	L2	H	D	W	MAX. WEIGHT(g)
400	385	50	5.3	100	2800



NOTE

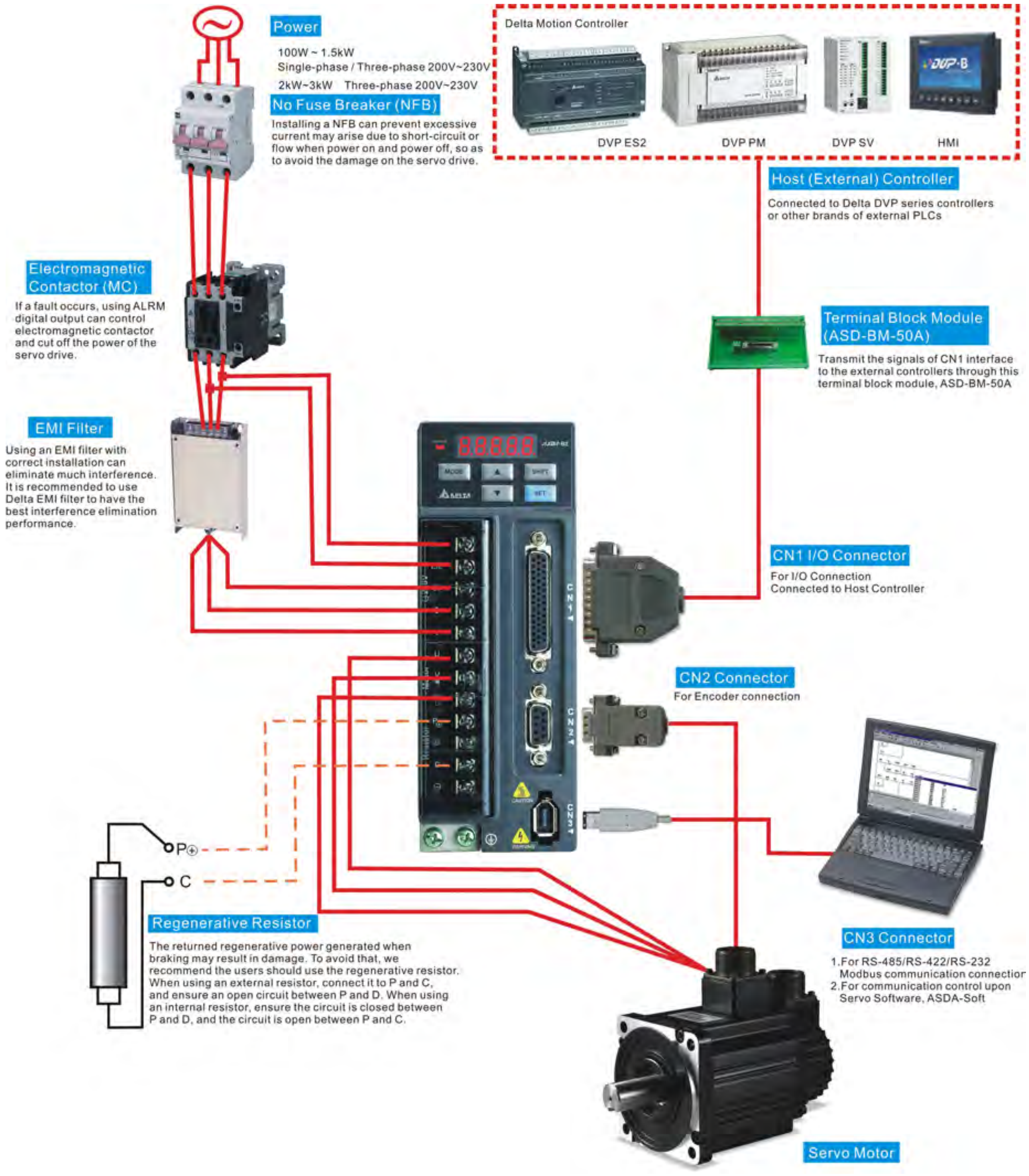
1) Regarding the selection of regenerative resistor, please refer to the table of regenerative resistor specifications described in Appendix A.

Chapter 3 Connections and Wiring

This chapter provides information on wiring ASDA-B2 series products, the descriptions of I/O signals and gives typical examples of wiring diagrams.

3.1 Connections

3.1.1 Connecting to Peripheral Devices


Power
100W ~ 1.5kW
Single-phase / Three-phase 200V~230V
2kW~3kW Three-phase 200V~230V
No Fuse Breaker (NFB)
Installing a NFB can prevent excessive current may arise due to short-circuit or flow when power on and power off, so as to avoid the damage on the servo drive.
Delta Motion Controller
DVP ES2
DVP PM
DVP SV
HMI
Host (External) Controller
Connected to Delta DVP series controllers or other brands of external PLCs
Electromagnetic Contactor (MC)
If a fault occurs, using ALRM digital output can control electromagnetic contactor and cut off the power of the servo drive.
Terminal Block Module (ASD-BM-50A)
Transmit the signals of CN1 interface to the external controllers through this terminal block module, ASD-BM-50A
EMI Filter
Using an EMI filter with correct installation can eliminate much interference. It is recommended to use Delta EMI filter to have the best interference elimination performance.
CN1 I/O Connector
For I/O Connection
Connected to Host Controller
CN2 Connector
For Encoder connection
P⊕
C
Regenerative Resistor
The returned regenerative power generated when braking may result in damage. To avoid that, we recommend the users should use the regenerative resistor. When using an external resistor, connect it to P and C, and ensure an open circuit between P and D. When using an internal resistor, ensure the circuit is closed between P and D, and the circuit is open between P and C.
CN3 Connector
1.For RS-485/RS-422/RS-232 Modbus communication connection
2.For communication control upon Servo Software, ASDA-Soft
Servo Motor

3.1.2 Servo Drive Connectors and Terminals

<table>
<tr><th>Terminal Identification</th><th>Terminal Description</th><th colspan="3">Notes</th></tr>
<tr><td><b>L1c, L2c</b></td><td>Control circuit terminal</td><td colspan="3">Used to connect single-phase AC control circuit power. (Control circuit uses the same voltage as the main circuit.)</td></tr>
<tr><td><b>R, S, T</b></td><td>Main circuit terminal</td><td colspan="3">Used to connect single-phase or three-phase AC main circuit power depending on connecting servo drive model.</td></tr>
<tr><td rowspan="6"><b>U, V, W</b>
<b>FG (⏚)</b></td><td rowspan="6">Servo motor output</td><td colspan="3">Used to connect servo motor</td></tr>
<tr><td>Terminal Symbol</td><td>Wire Color</td><td>Description</td></tr>
<tr><td>U</td><td>Red</td><td rowspan="3">Connecting to three-phase motor main circuit cable.</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>Connecting to ground terminal (⏚) of the servo drive.</td></tr>
<tr><td rowspan="3"><b>P⊕, D, C, ⊖</b></td><td rowspan="3">Regenerative resistor terminal or braking unit</td><td>Internal resistor</td><td colspan="2">Ensure the circuit is closed between P⊕ and D, and the circuit is open between P⊕ and C.</td></tr>
<tr><td>External resistor</td><td colspan="2">Connect regenerative resistor to P⊕ and C, and ensure an open circuit between P⊕ and D.</td></tr>
<tr><td>External braking unit</td><td colspan="2">Connect braking unit to P⊕ and ⊖, and ensure an open circuit between P⊕ and D, and P⊕ and C.
(N terminal is built in L1c, L2c, ⊖, and R, S, T.)
P⊕ : Connecting to (+) terminal of V_BUS voltage.
⊖ : Connecting to (-) terminal of V_BUS voltage.</td></tr>
<tr><td><b>⏚ two places</b></td><td>Ground terminal</td><td colspan="3">Used to connect grounding wire of power supply and servo motor.</td></tr>
</table>

Terminal Identification	Terminal Description	Notes
CN1	I/O connector	Used to connect external controllers. Please refer to section 3.3 for details.
CN2	Encoder connector	Used to connect encoder of servo motor. Please refer to section 3.4 for details.

Terminal Identification	Terminal Description	Notes		
		Terminal Symbol	Wire Color	PIN No.
		T+	Blue	4
		T-	Blue/Black	5
		Reserved	-	3
		Reserved	-	2
		Reserved	-	1
		Reserved	-	9
		+5V	Red / Red & White	8
		GND	Black / Black & White	6, 7
CN3	Communication connector	Used to connect PC or keypad. Please refer to section 3.5 for details.		
CN4	Reserved connector	Reserved		
CN5	Analog voltage output terminal	Used to monitor the operation status. The drive provides two channels, MON1 and MON2 to output the analog voltage data. Output voltage is reference to the power ground (GND).		

NOTE

1) U, V ,W , CN1, CN2, CN3 terminals provide short circuit protection.

Wiring Notes

Please observe the following wiring notes while performing wiring and touching any electrical connections on the servo drive or servo motor.

1. Ensure to check if the power supply and wiring of the "power" terminals (R, S, T, L1c, L2c, U, V, & W) is correct.
2. Please use shielded twisted-pair cables for wiring to prevent voltage coupling and eliminate electrical noise and interference.
3. As a residual hazardous voltage may remain inside the drive, please do not immediately touch any of the "power" terminals (R, S, T, L1c, L2c, U, V, & W) and/or the cables connected to them after the power has been turned off and the charge LED is lit. (Please refer to the Safety Precautions on page ii).
4. The cables connected to R, S, T and U, V, W terminals should be placed in separate conduits from the encoder or other signal cables. Separate them by at least 30cm (11.8 inches).
5. If the encoder cable is too short, please use a twisted-shield signal wire with grounding conductor. The wire length should be 20m (65.62ft.) or less. For lengths greater than 20m (65.62ft.), the wire gauge should be doubled in order to lessen any signal attenuation. Regarding the specifications of 20m (65.62ft.) encoder cable, please choose wire gauge AWG26, UL2464 metal braided shield twisted-pair cable.
6. As for motor cable selection, please use the 600V PTFE wire and the wire length should be less than 98.4ft. (30m). If the wiring distance is longer than 30m (98.4ft.), please choose the adequate wire size according to the voltage.
7. The shield of shielded twisted-pair cables should be connected to the SHIELD end (terminal marked ⏚) of the servo drive.
8. For the connectors and cables specifications, please refer to section 3.1.6 for details.

3.1.3 Wiring Methods

For servo drives from 100W to 1.5kW the input power can be either single or three-phase. However, single -phase connections are for servo drives 1.5kW and below only.

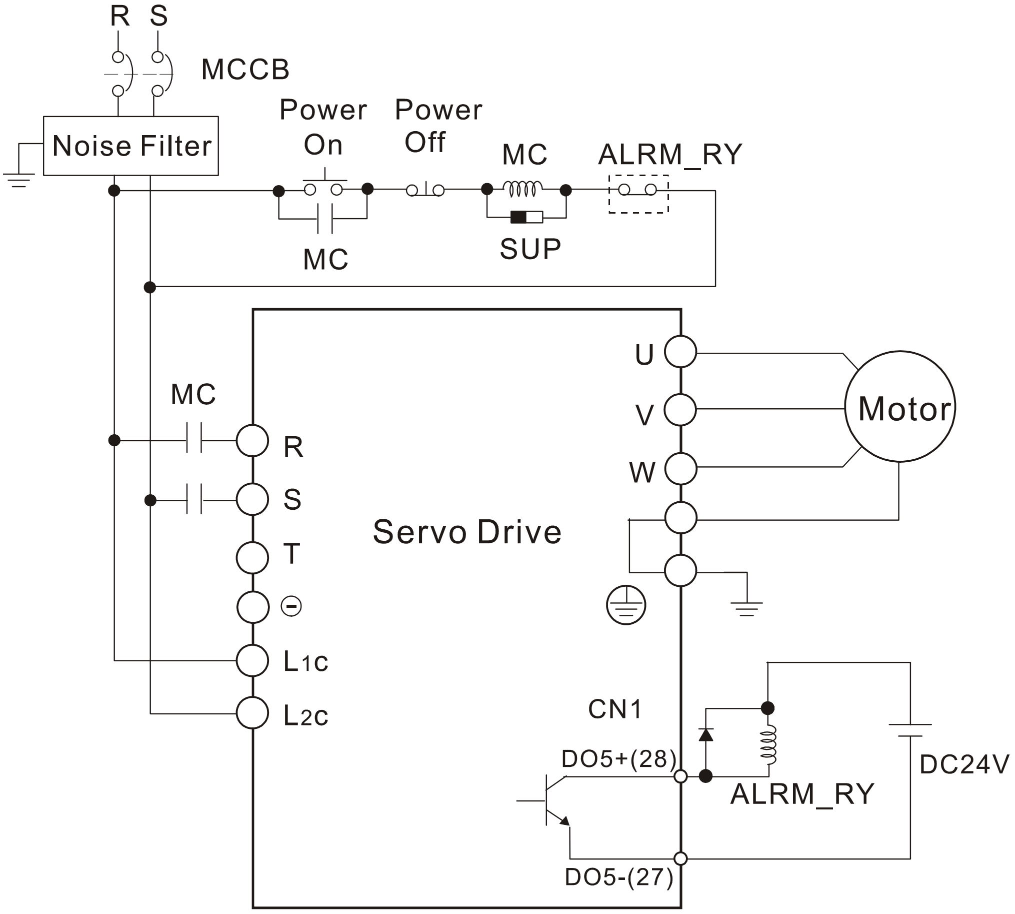
In the wiring diagram figures 3.2& 3.3:

Power ON : contact “a” (normally open)

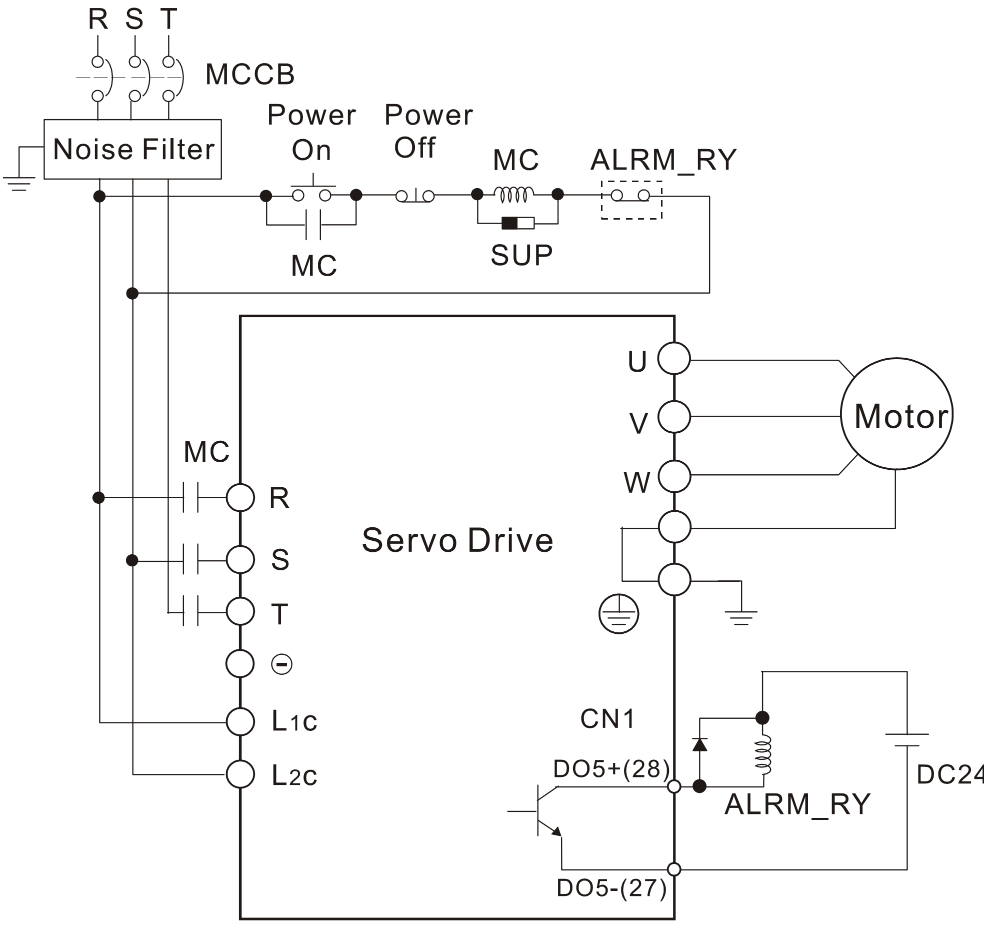
Power OFF : contact “b” (normally closed)

MC: coil of electromagnetic contactor, self-holding power, contact of main circuit power

- **Single-Phase Power Supply (1.5kW and below)**

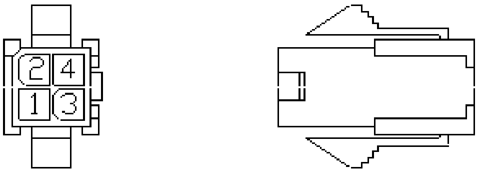
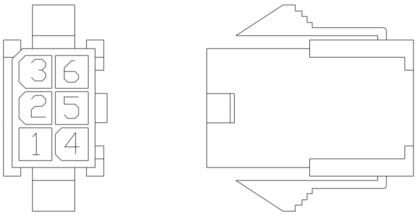
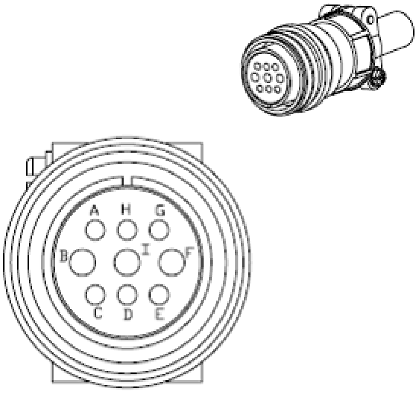
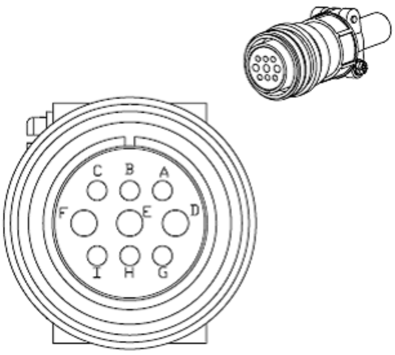


■ Three-Phase Power Supply (all models)



3.1.4 Motor Power Cable Connector Specifications

The boxes (☐) in the model names are for optional configurations. (Please refer to section 1.2 for model explanation.)

Motor Model Name	U, V, W / Electromagnetic Brake Connector	Terminal Identification
ECMA-C△0401☐S (100W) ECMA-C△0602☐S (200W) ECMA-C△0604☐S (400W) ECMA-CM0604PS (400W) ECMA-C△0804☐7 (400W) ECMA-C△0807☐S (750W) ECMA-C△0907☐S (750W) ECMA-C△0910☐S (1000W)	 HOUSING: JOWLE (C4201H00-2*2PA)	A
ECMA-C△0602☐S (200W) ECMA-C△0604☐S (400W) ECMA-CM0604PS (400W) ECMA-C△0804☐7 (400W) ECMA-C△0807☐S (750W) ECMA-C△0907☐S (750W) ECMA-C△0910☐S (1000W)	 HOUSING: JOWLE (C4201H00-2*3PA)	B
ECMA-G△1303☐S (300W) ECMA-E△1305☐S (500W) ECMA-G△1306☐S (600W) ECMA-GM1306PS (600W) ECMA-G△1309☐S (900W) ECMA-GM1309PS (900W) ECMA-C△1010☐S (1000W) ECMA-E△1310☐S (1000W) ECMA-E△1315☐S (1500W) ECMA-C△1020☐S (2000W) ECMA-E△1320☐S (2000W)	 3106A-20-18S	C
ECMA-E△1820☐S (2000W) ECMA-E△1830☐S (3000W) ECMA-F△1830☐S (3000W)	 3106A-24-11S	D

Terminal Identification	U (Red)	V (White)	W (Black)	CASE GROUND (Green)	BRAKE1 (Blue)	BRAKE2 (Brown)
A	1	2	3	4	-	-
B	1	2	4	5	3	6
C	F	I	B	E	G	H
D	D	E	F	G	A	B

When selecting the wire rod, please choose 600V PVC cable and the length should not longer than 30m. If the length exceeds 30m, please take the received voltage into consideration when selecting the wire size. Please refer to Section 3.1.6 for wire rod selection.

NOTE

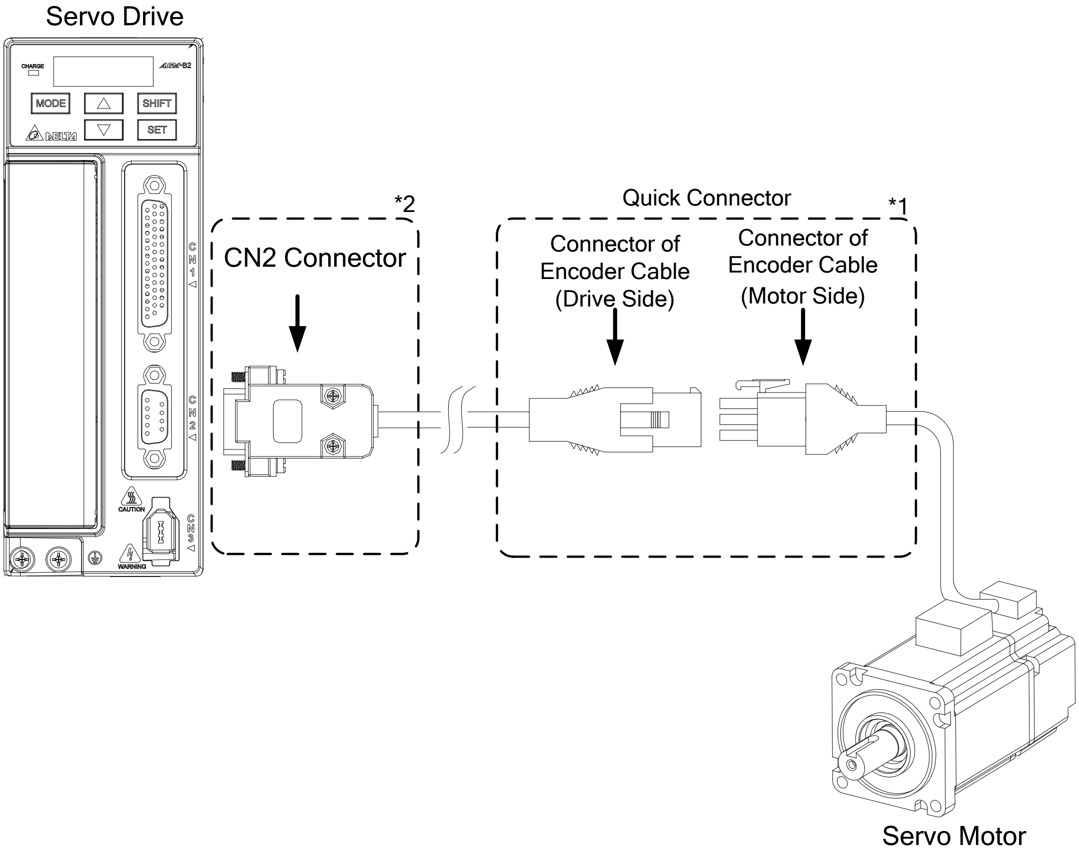
1) The coil of brake has no polarity. The names of terminal identification are BRAKE1 (Blue) and BRAKE2 (Brown).

2) The power supply for brake is DC24V. Never use it for VDD, the +24V source voltage.

3) Box, (☐) in servo motor model represents brake or keyway / oil seal.

3.1.5 Encoder Connector Specifications

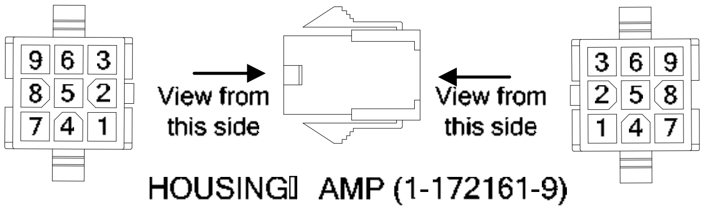
Encoder Cable Connection (Diagram 1)


Servo Drive
*2
CN2 Connector
Quick Connector
*1
Connector of Encoder Cable (Drive Side)
Connector of Encoder Cable (Motor Side)
Servo Motor

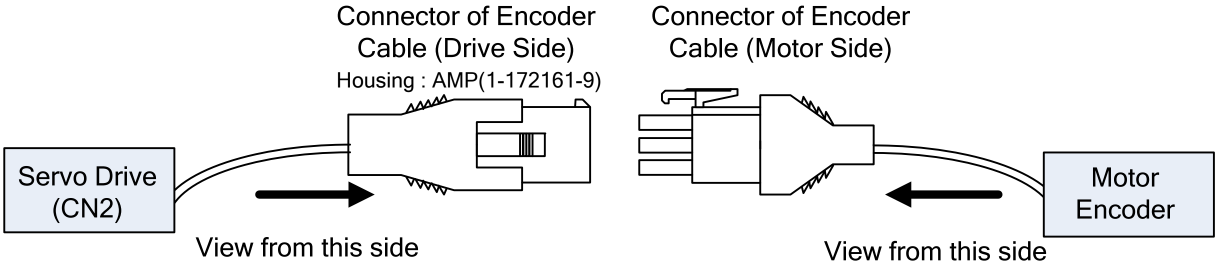
NOTE The scale of the objects does not match the dimensions as shown in the drawing above. For different models of AC servo drives and motors, the connection cables may differ.

1) Please refer to the descriptions of “Terminal Identification of Encoder Connector” on page 3-10.
2) Please refer to section 3.4 for the descriptions of “Encoder Connector CN2”.

The boxes (☐) in the model names are for optional configurations (keyway, brake and oil seal). (Please refer to section 1.2 for model explanation.)

Motor Model Name	Encoder Connector
ECMA-C20401☐S (100W) ECMA-C20602☐S (200W) ECMA-C20604☐S (400W) ECMA-CM0604PS (400W) ECMA-C20804☐7 (400W) ECMA-C20807☐S (750W) ECMA-C20907☐S (750W) ECMA-C20910☐S (1000W)	 9 6 3 8 5 2 7 4 1 View from this side View from this side 3 6 9 2 5 8 1 4 7 HOUSING: AMP (1-172161-9)

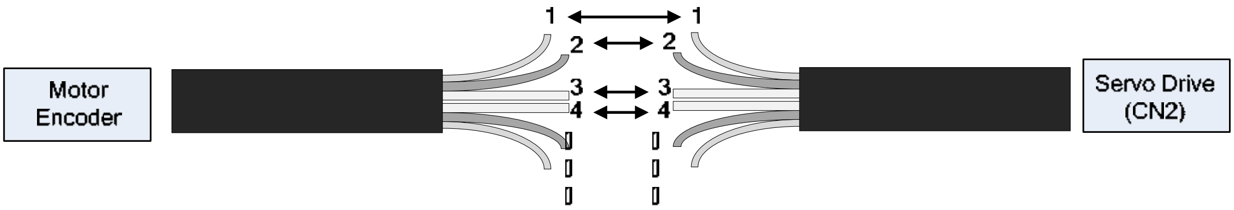
Terminal Identification of Encoder Connector


Connector of Encoder Cable (Drive Side)
Housing : AMP(1-172161-9)
Connector of Encoder Cable (Motor Side)
Servo Drive (CN2)
Motor Encoder
View from this side
View from this side

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

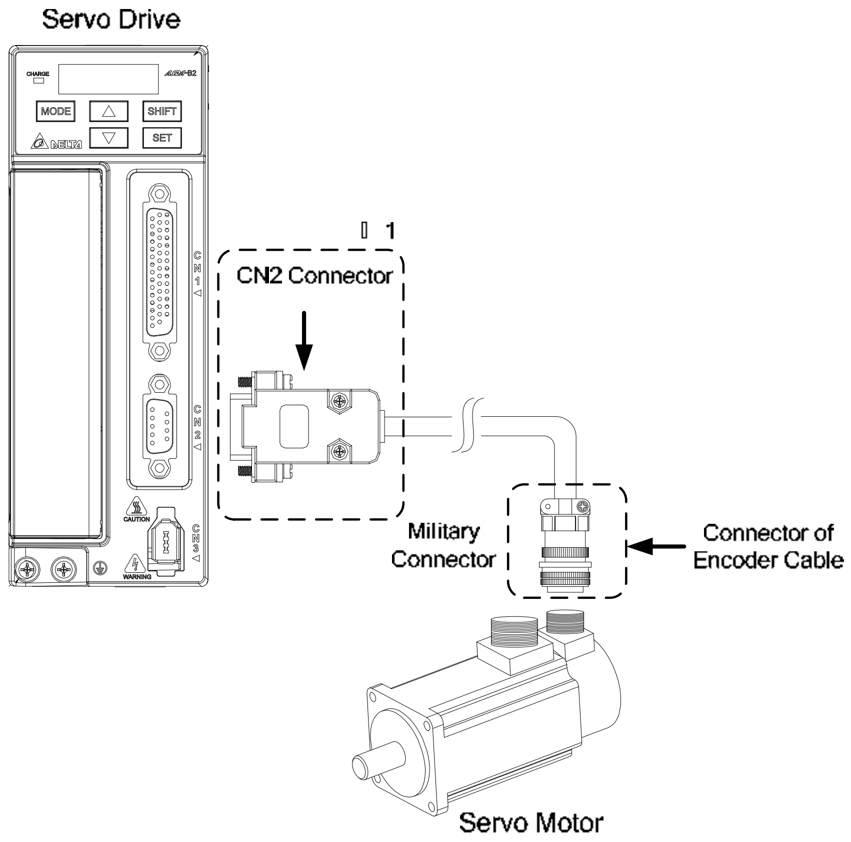
3 (Reserved)	2 Black (Reserved)	1 White T+
6 (Reserved)	5 Red/Black (Reserved)	4 White/Red T-
9 Shield	8 Blue GND	7 Brown DC+5V

The core color of the drive encoder connector is for reference only. For the actual core color, please refer to the actual purchased product.



If the users do not use the connector (without housing) and connect the cores from the cable for wiring, please follow the terminal identification and core number of encoder connector shown in the above table to complete the wiring. The users need to connect core #1 to core #1, core #2 to core #2 and so on. To ease connection and to avoid wiring error, it is recommended to number the cores first in accordance with the terminal identification and then conducting the wiring.

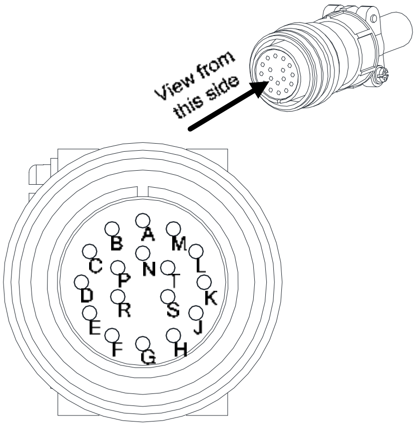
Encoder Cable Connection (Diagram 2)



NOTE The scale of the objects does not match the dimensions as shown in the drawing above. For different models of AC servo drives and motors, the connection cables may differ.

1) Please refer to section 3.4 for the descriptions of "Encoder Connector CN2".

The boxes (☐) in the model names are for optional configurations (keyway, brake and oil seal). (Please refer to section 1.2 for model explanation.)

<table>
<tr><th>Motor Model Name</th><th colspan="2">Encoder Connector</th></tr>
<tr><td>ECMA-G21303☐S (300W)
ECMA-E21305☐S (500W)
ECMA-G21306☐S (600W)
ECMA-GM1306PS (600W)
ECMA-G21309☐S (900W)
ECMA-GM1309PS (900W)
ECMA-C21010☐S (1000W)
ECMA-E21310☐S (1000W)
ECMA-E21315☐S (1500W)
ECMA-C21020☐S (2000W)
ECMA-E21320☐S (2000W)
ECMA-E21820☐S (2000W)
ECMA-E21830☐S (3000W)
ECMA-F21830☐S (3000W)</td>
<td>

3106A-20-29S Military Connector</td>
<td>
<table>
<tr><th>Pin No.</th><th>Terminal Identification</th><th>Color</th></tr>
<tr><td>A</td><td>T+</td><td>Blue</td></tr>
<tr><td>B</td><td>T -</td><td>Blue& Black</td></tr>
<tr><td>S</td><td>DC+5V</td><td>Red/Red &White</td></tr>
<tr><td>R</td><td>GND</td><td>Black/ Black& White</td></tr>
<tr><td>L</td><td>BRAID SHIELD</td><td>–</td></tr>
</table>
</td></tr>
</table>

Please select shielded multi-core and the shielded cable should connect to the SHIELD end. Please refer to the description of Section 3.1.6.

NOTE Box, (☐) in servo motor model represents brake or keyway / oil seal.

3.1.6 Cable Specifications for Servo Drive

The recommended wire rods are shown as the following table:

Servo Drive and Servo Motor		Power Cable - Wire Gauge AWG (mm^2)			
		L1c, L2c	R, S, T	U, V, W	P⊕, C
ASD-B2-0121-☐	ECMA-C20401☐S	1.3 (AWG16)	2.1 (AWG14)	0.82 (AWG18)	2.1 (AWG14)
ASD-B2-0221-☐	ECMA-C20602☐S	1.3 (AWG16)	2.1 (AWG14)	0.82 (AWG18)	2.1 (AWG14)
ASD-B2-0421-☐	ECMA-C20604☐S	1.3 (AWG16)	2.1 (AWG14)	0.82 (AWG18)	2.1 (AWG14)
	ECMA-CM0604PS	1.3 (AWG16)	2.1 (AWG14)	0.82 (AWG18)	2.1 (AWG14)
	ECMA-C20804☐7	1.3 (AWG16)	2.1 (AWG14)	0.82 (AWG18)	2.1 (AWG14)
	ECMA-E21305☐S	1.3 (AWG16)	2.1 (AWG14)	0.82 (AWG18)	2.1 (AWG14)
	ECMA-G21303☐S	1.3 (AWG16)	2.1 (AWG14)	0.82 (AWG18)	2.1 (AWG14)
ASD-B2-0721-☐	ECMA-C20807☐S	1.3 (AWG16)	2.1 (AWG14)	0.82 (AWG18)	2.1 (AWG14)
	ECMA-C20907☐S	1.3 (AWG16)	2.1 (AWG14)	0.82 (AWG18)	2.1 (AWG14)
	ECMA-G21306☐S	1.3 (AWG16)	2.1 (AWG14)	0.82 (AWG18)	2.1 (AWG14)
	ECMA-GM1306PS	1.3 (AWG16)	2.1 (AWG14)	0.82 (AWG18)	2.1 (AWG14)
ASD-B2-1021-☐	ECMA-C21010☐S	1.3 (AWG16)	2.1 (AWG14)	1.3 (AWG16)	2.1 (AWG14)
	ECMA-C20910☐S	1.3 (AWG16)	2.1 (AWG14)	1.3 (AWG16)	2.1 (AWG14)
	ECMA-E21310☐S	1.3 (AWG16)	2.1 (AWG14)	1.3 (AWG16)	2.1 (AWG14)
	ECMA-G21309☐S	1.3 (AWG16)	2.1 (AWG14)	1.3 (AWG16)	2.1 (AWG14)
	ECMA-GM1309PS	1.3 (AWG16)	2.1 (AWG14)	1.3 (AWG16)	2.1 (AWG14)
ASD-B2-1521-☐	ECMA-E21315☐S	1.3 (AWG16)	2.1 (AWG14)	1.3 (AWG16)	2.1 (AWG14)
ASD-B2-2023-☐	ECMA-C21020☐S	1.3 (AWG16)	2.1 (AWG14)	2.1 (AWG14)	2.1 (AWG14)
	ECMA-E21320☐S	1.3 (AWG16)	2.1 (AWG14)	2.1 (AWG14)	2.1 (AWG14)
	ECMA-E21820☐S	1.3 (AWG16)	2.1 (AWG14)	3.3 (AWG12)	2.1 (AWG14)
ASD-B2-3023-☐	ECMA-E21830☐S	1.3 (AWG16)	2.1 (AWG14)	3.3 (AWG12)	2.1 (AWG14)
	ECMA-F21830☐S	1.3 (AWG16)	2.1 (AWG14)	3.3 (AWG12)	2.1 (AWG14)

Encoder Cable

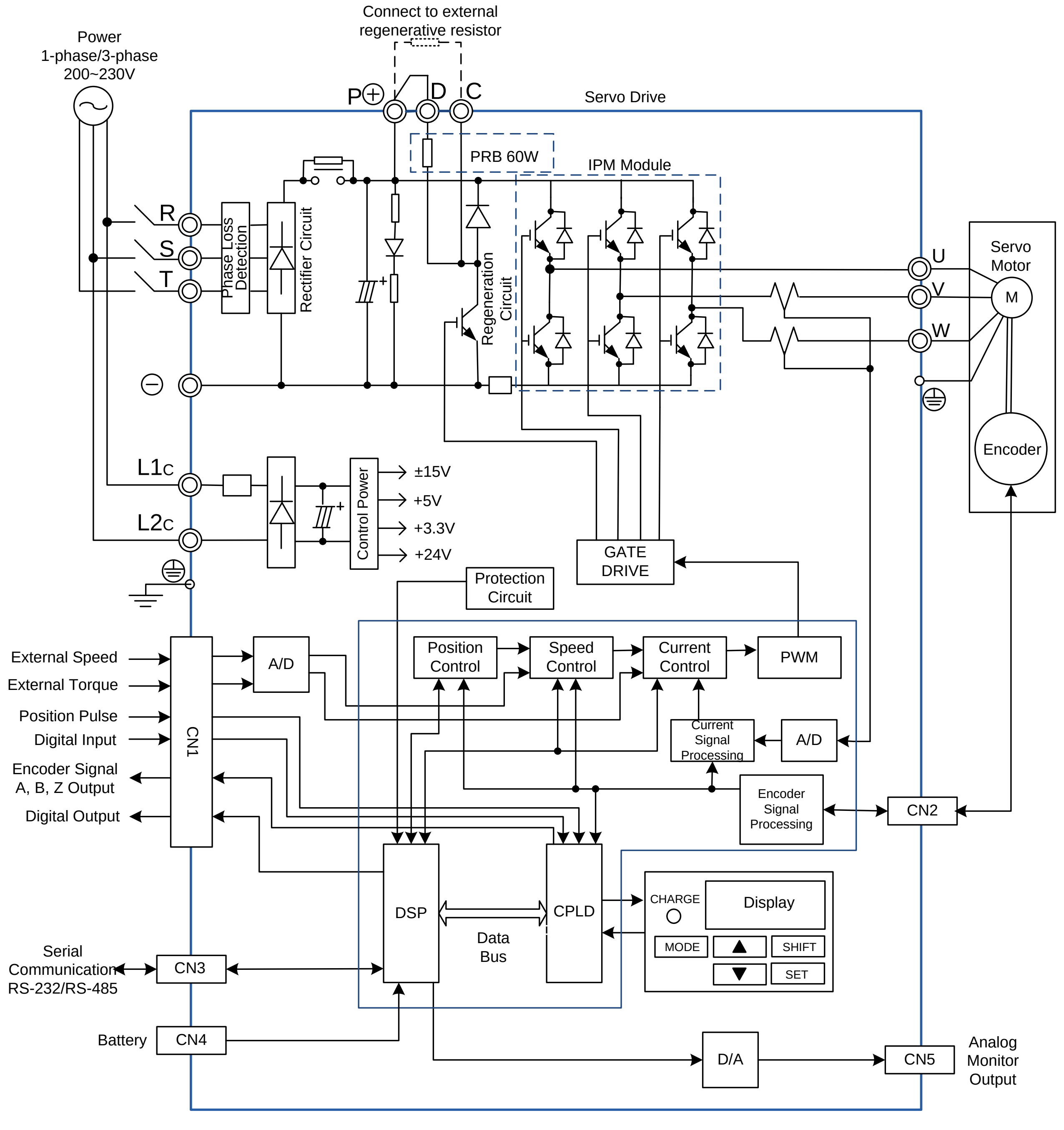
Servo Drive	Encoder Cable - Wire Gauge AWG (mm^2)			
	Wire Size	Core Number	UL Rating	Standard Wire Length
ASD-B2-0121-☐	0.13 (AWG26)	10 core (4 pair)	UL2464	3m (9.84ft.)
ASD-B2-0221-☐	0.13 (AWG26)	10 core (4 pair)	UL2464	3m (9.84ft.)
ASD-B2-0421-☐	0.13 (AWG26)	10 core (4 pair)	UL2464	3m (9.84ft.)
ASD-B2-0721-☐	0.13 (AWG26)	10 core (4 pair)	UL2464	3m (9.84ft.)
ASD-B2-1021-☐	0.13 (AWG26)	10 core (4 pair)	UL2464	3m (9.84ft.)
ASD-B2-1521-☐	0.13 (AWG26)	10 core (4 pair)	UL2464	3m (9.84ft.)
ASD-B2-2023-☐	0.13 (AWG26)	10 core (4 pair)	UL2464	3m (9.84ft.)
ASD-B2-3023-☐	0.13 (AWG26)	10 core (4 pair)	UL2464	3m (9.84ft.)

NOTE

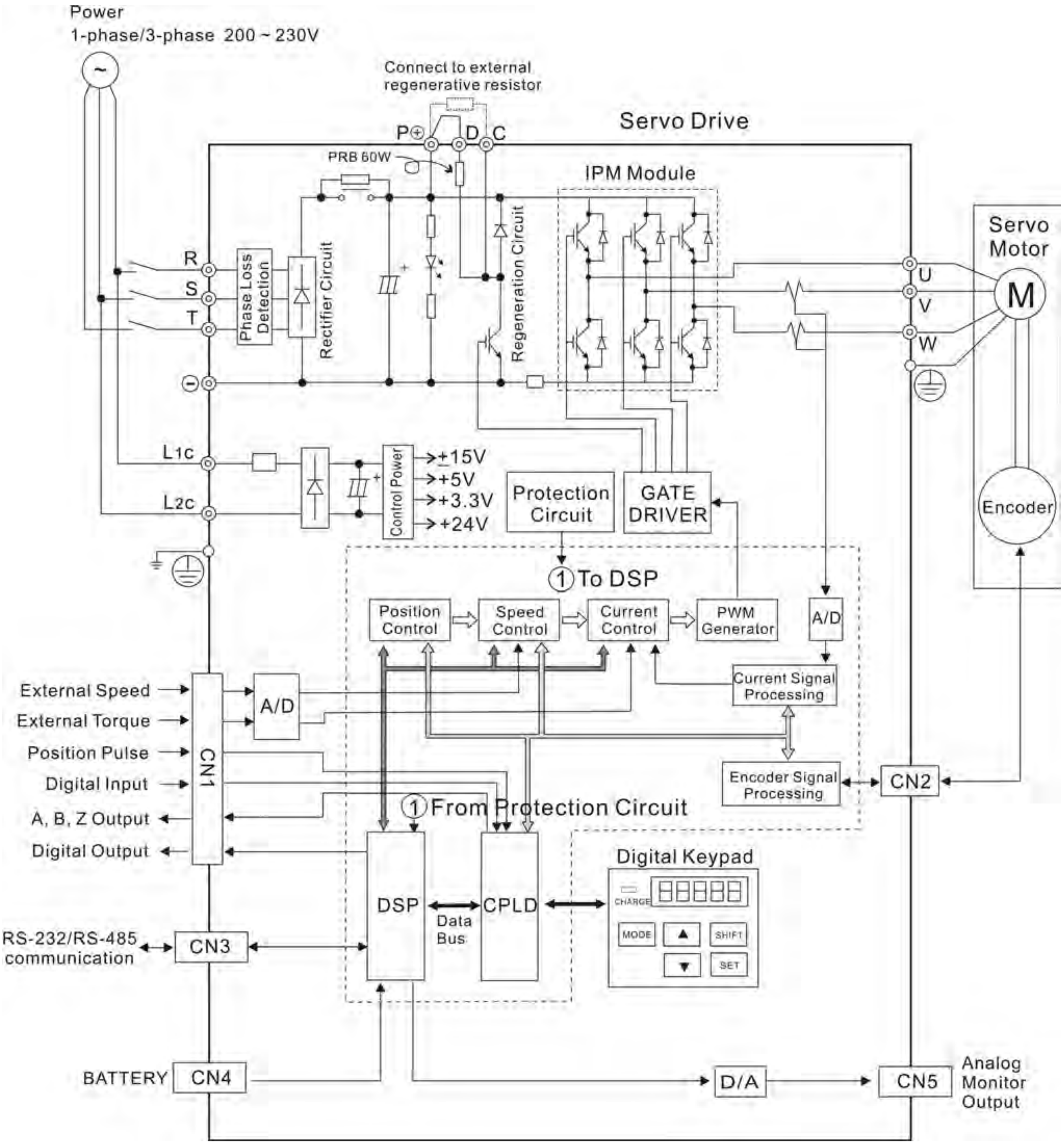
1) Please use shielded twisted-pair cables for wiring to prevent voltage coupling and eliminate electrical noise and interference.
2) The shield of shielded twisted-pair cables should be connected to the SHIELD end (terminal marked ⏚) of the servo drive.
3) In order to prevent fire hazard and accidents, please form the wiring by following the cable specifications outlined above.
4) The boxes (☐) at the ends of the servo drive model names represent the model type of ASDA-B2 series. For the actual model name, please refer to the ordering information of the actual purchased product.
5) The boxes (☐) in the servo motor model names are for optional configurations (keyway, brake and oil sea).

3.2 Basic Wiring

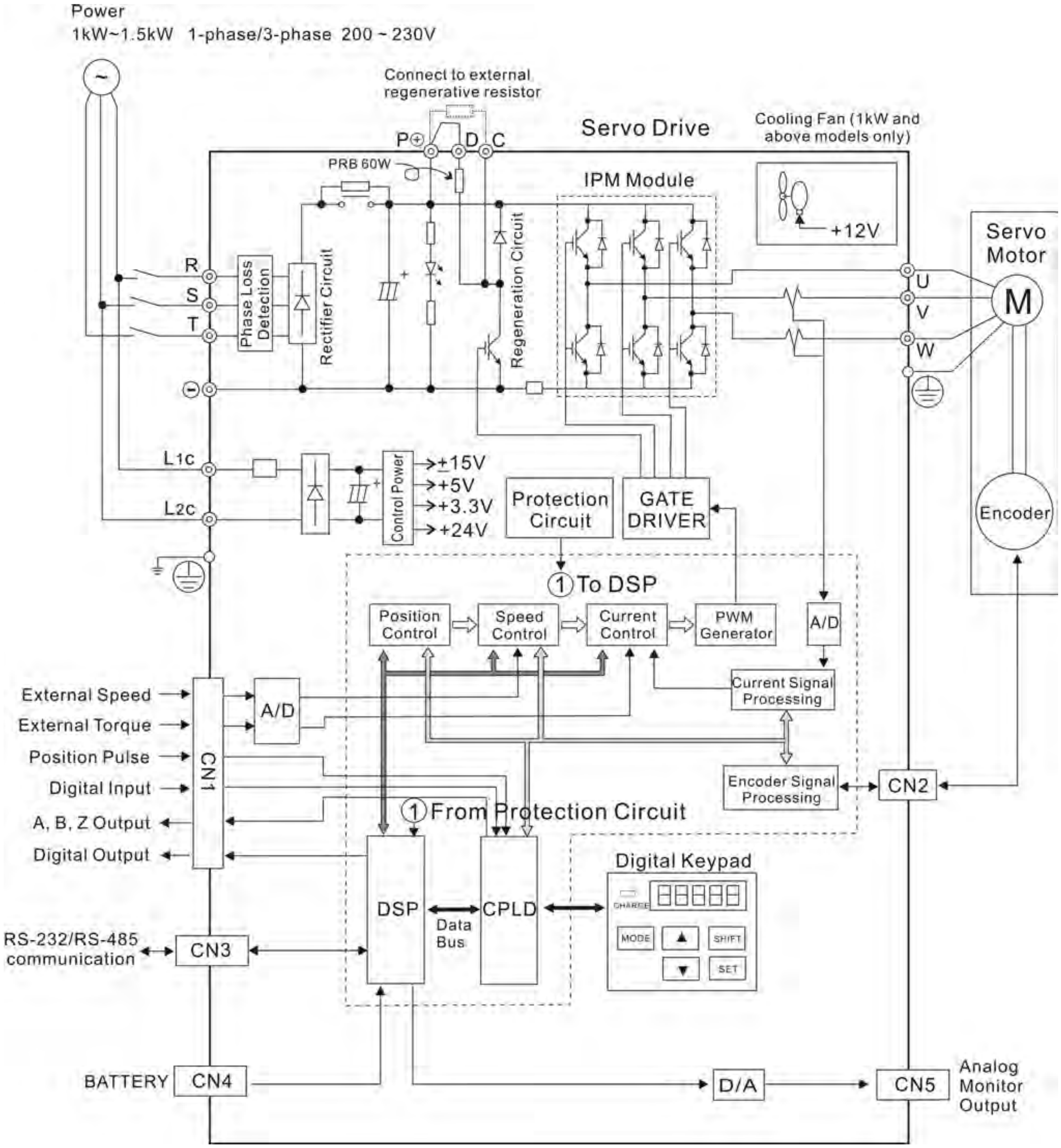
3.2.1 400W and below models (with built-in regenerative resistor, but without cooling fan)



3.2.2 750W model (with built-in regenerative resistor, but without cooling fan)

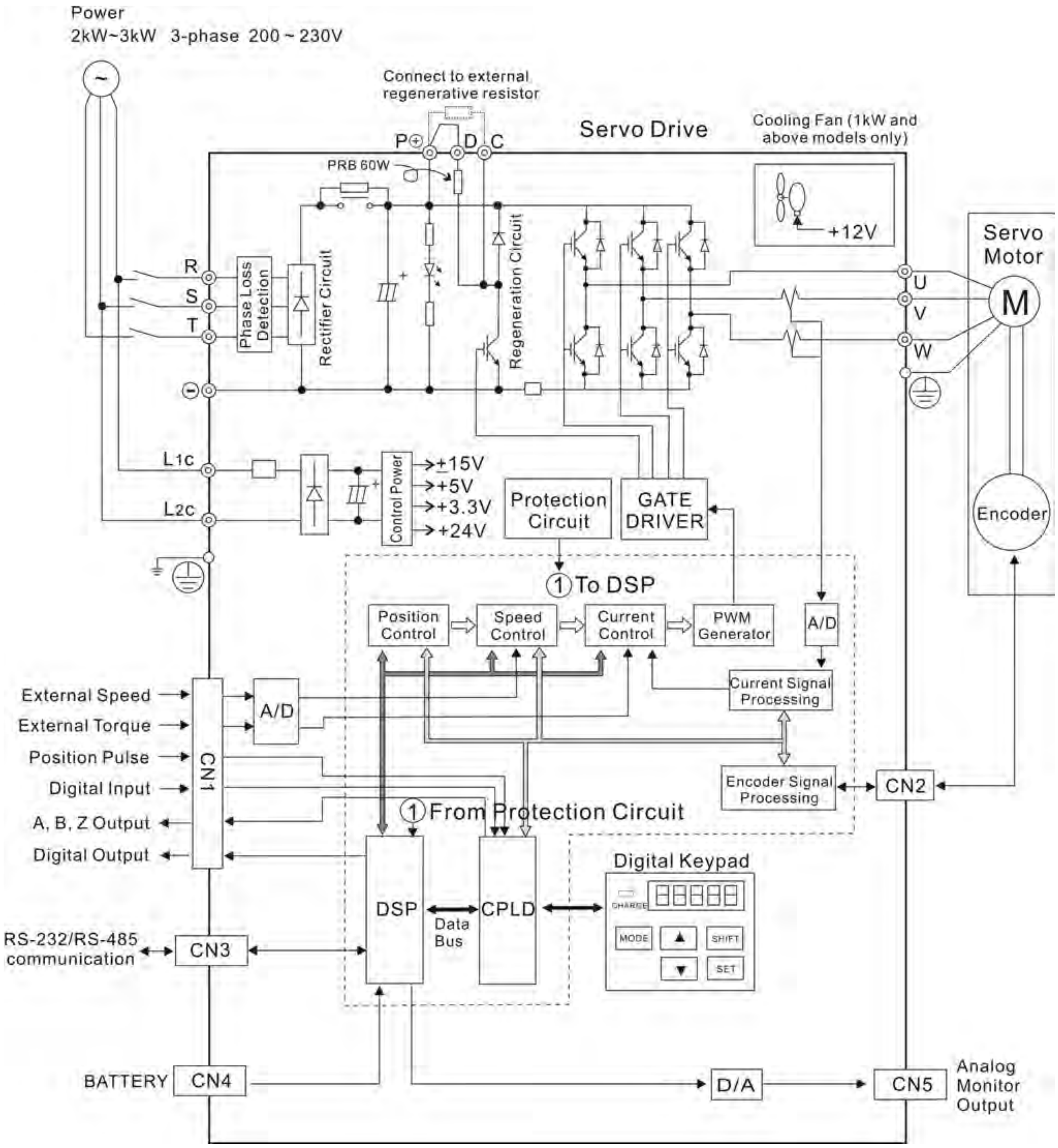


3.2.3 1kW~1.5kW models (with built-in regenerative resistor and cooling fan)



3.2.4 2kW~3kW models

(with built-in regenerative resistor and cooling fan)



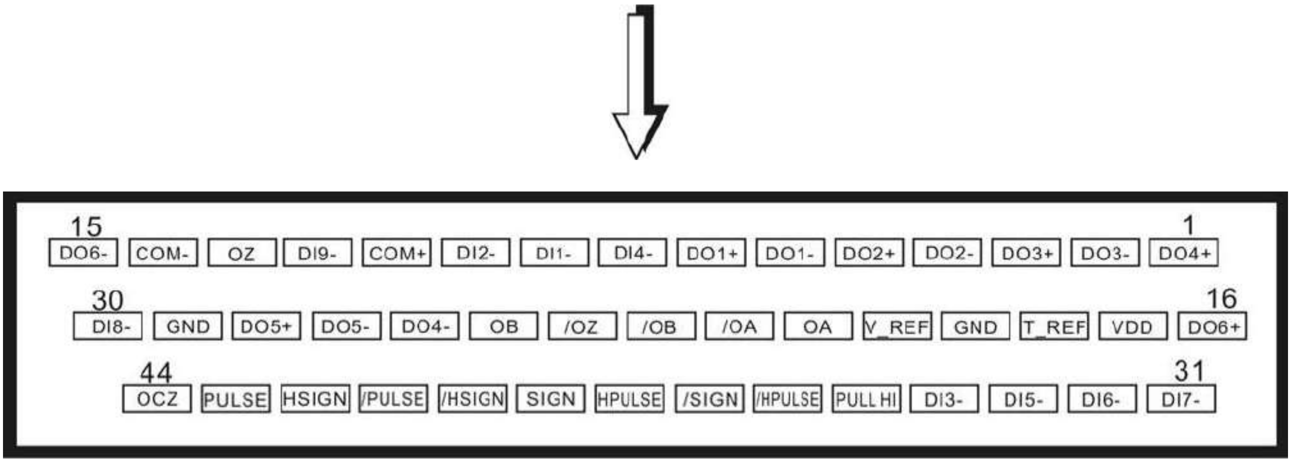
3.3 Input / Output Interface Connector - CN1

3.3.1 I/O Signal (CN1) Connector Terminal Layout

In order to have a more flexible communication with the master, 6 programmable Digital Outputs (DO) and 9 programmable Digital Inputs (DI) are provided. The setting of 9 digital inputs and 6 digital outputs of each axis provided by ASDA-B2, which are parameter P2-10~P2-17, P2-36 and parameter P2-18~P2-22, P2-37 respectively. In addition, the differential output encoder signal, A+, A-, B+, B-, Z+ and Z-, input of analog torque command, analog speed/position command and pulse position command are also provided. The followings are the pin diagrams.

Side View

Rear View


15 DO6- COM- OZ DI9- COM+ DI2- DI1- DI4- DO1+ DO1- DO2+ DO2- DO3+ DO3- DO4+ 1
30 DI8- GND DO5+ DO5- DO4- OB /OZ /OB /OA OA V_REF GND T_REF VDD DO6+ 16
44 OCZ PULSE HSIGN /PULSE /HSIGN SIGN HPULSE /SIGN /HPULSE PULL HI DI3- DI5- DI6- DI7- 31

CN1 Terminal Signal Identification

1	DO4+	Digital output
2	DO3-	Digital output
3	DO3+	Digital output
4	DO2-	Digital output
5	DO2+	Digital output
6	DO1-	Digital output
7	DO1+	Digital output
8	DI4-	Digital input
9	DI1-	Digital input
10	DI2-	Digital input
11	COM+	Power input (12~24V)
12	DI9-	Digital input
13	OZ	Encoder Z pulse Line-driver output
14	COM-	VDD(24V) power ground
15	DO6-	Digital output

16	DO6+	Digital output
17	VDD	+24V power output (for external I/O)
18	T_REF	Analog torque Input
19	GND	Analog input signal ground
20	V_REF	Analog speed input (+)
21	OA	Encoder A pulse output
22	/OA	Encoder /A pulse output
23	/OB	Encoder /B pulse output
24	/OZ	Encoder /Z pulse output
25	OB	Encoder B pulse output
26	DO4-	Digital output
27	DO5-	Digital output
28	DO5+	Digital output
29	GND	Analog input signal ground
30	DI8-	Digital input

31	DI7-	Digital input
32	DI6-	Digital input
33	DI5-	Digital input
34	DI3-	Digital input
35	PULL HI	Pulse applied power
36	/HPULSE	High-speed position pulse (-)
37	/SIGN	Position sign (-)
38	HPULSE	High-speed position pulse (+)
39	SIGN	Position sign (+)
40	/HSIGN	High-speed position sign (-)
41	/PULSE	Pulse input (-)
42	HSIGN	High-speed position sign (+)
43	PULSE	Pulse input (+)
44	OCZ	Encoder Z pulse Line-driver output

3.3.2 Signals Explanation of Connector CN1

General Signals

Signal		Pin No	Details	Wiring Diagram (Refer to 3.3.3)
Analog Signal Input	V_REF	20	1. Motor speed command: -10V to +10V, corresponds to -3000 ~ +3000 r/min speed command (Factory default setting). 2. Motor speed command: -10V to +10V, corresponds to -3 ~ +3 rotations position command (Factory default setting).	C1
	T_REF	18	Motor torque command: -10V to +10V, corresponds to -100% to +100% rated torque command.	C1
Position Pulse Input	PULSE /PULSE SIGN /SIGN PULL HI	43 41 39 37 35	The drive can accept two different types of pulse inputs: Line Driver (The max. input frequency is 500kHz) and Open Collector (The max. input frequency is 200kHz). Three different pulse commands can be selected via parameter P1-00. Quadrature, CW + CCW pulse & Pulse / Direction. Should an Open Collector type of pulse be used this terminal must be connected to an external power supply to be lulled high.	C3/C4
High-speed Position Pulse Input	HPULSE /HPULSE HSIGN /HSIGN	38 36 42 40	The drive can accept two different types of high-speed pulse inputs: +5V input and Line-driver input. The max. input frequency is 4MHz. Three different pulse commands can be selected via parameter P1-00. They are A phase + B phase (Quadrature), CW pulse + CCW pulse, and Pulse + Direction.	C4-2
Position Pulse Output	OA /OA	21 22	Encoder signal output A, B, Z (Line-driver output). The motor encoder signals are available through these terminals.	C13/C14
	OB /OB	25 23		
	OZ /OZ	13 24		
	OCZ	44	Encoder signal output Z (Open-collector output).	-
Power	VDD	17	VDD is the +24V source voltage provided by the drive. Maximum permissible current 500mA.	-
	COM+ COM-	11 14	COM+ is the common voltage rail of the Digital Input and Digital Output signals. Connect VDD to COM+ for source mode. For external applied power sink mode (+12V to +24V), the positive terminal should be connected to COM+ and the negative to COM-.	
	GND	19	The polarity of VDD is with respect to Ground (GND).	

There are numerous operation mode of this servo drive (please refer to Chapter 6.1). Each operation mode needs different I/O signal. In order to use the terminal in a more efficient way, the selection of I/O signal has to be programmable. That is to say, users can choose the desired DI/DO signal to meet the demand. Basically, the default setting of DI/DO signal has already have the appropriate function which can satisfy the demand of normal application.

Users have to select the operation mode based on the needs first (please refer to Chapter 6.1 for the introduction of each mode) and refer to the following DI/DO table to know the corresponding default setting of DI/DO signal and Pin No of the selected mode in order to conduct the wiring.

The table below lists the default setting of DI/DO signal function and pin No:

The explanation of DO signal default setting is as the followings.

DO Signal	Assigned Control Mode	Pin No. (Default)		Details	Wiring Diagram (Refer to 3.3.3)
		+	-		
SRDY	ALL	7	6	SRDY is activated when the servo drive is ready to run. All fault and alarm conditions, if present, have been cleared.	C5/C6/C7/C8
SON	Not assigned	-	-	Servo ready (SRDY) is "ON" where the servo is ready to run, NO fault / alarm exists.	
ZSPD	ALL	5	4	ZSPD is activated when the drive senses the motor is equal to or below the Zero Speed Range setting as defined in parameter P1-38.	
TSPD	ALL (except PT)	-	-	TSPD is activated once the drive has detected the motor has reached the Target Rotation Speed setting as defined in parameter P1-39.	
TPOS	PT, PT-S, PT-T	1	26	1. When the drive is in PT mode, TPOS will be activated when the position error is equal and below the setting value of P1-54.	
TQL	Not assigned	-	-	TQL is activated when the drive has detected that the motor has reached the torques limits.	
ALRM	ALL	28	27	ALRM is activated when the drive has detected a fault condition. (However, when Reverse limit error, Forward limit error, Emergency stop, Serial communication error, and Undervoltage these fault occur, WARN is activated first.)	
BRKR	ALL	-	-	BRKR is the control terminal of motor brake.	
OLW	ALL	-	-	OLW is activated when the servo drive has detected that the motor has reached the output overload level .	

WARN	ALL	-	-	Servo warning output. WARN is activated when the drive has detected Reverse limit error, Forward limit error, Emergency stop, Serial communication error, and Undervoltage these fault conditions.	
S_CMP	S, Sz	-	-	SP_CMP will be activated when the speed error is equal and below the setting value of P1-47.	

NOTE

1) PINS 3 & 2 can TSPD when control mode S is selected.

2) The DO signals that do not have pin numbers in Tables 3.B are not default DO signals. If the users want to use these non-default DO signals, the users need to change the settings of parameters P2-18 ~ P2-22. The “state” of the output function may be turned ON or OFF as it will be dependant on the settings of parameters P2-18 ~ P2-22. Please refer to section 3.3.3 for details.

DI Signals

DI Signal	Assigned Control Mode	Pin No. (Default)	Details	Wiring Diagram (Refer to 3.3.3)
SON	ALL	9	Servo On. Switch servo to "Servo Ready".	C9/C10 C11/C12
ARST	ALL	33	A number of Faults (Alarms) can be cleared by activating ARST.	
GAINUP	ALL	-	Gain switching	
CCLR	PT	10	When CCLR is activated the setting is parameter P2-50 Pulse Clear Mode is executed.	
ZCLAMP	ALL	-	When this signal is On and the motor speed value is lower than the setting value of P1-38, it is used to lock the motor in the instant position while ZCLAMP is On.	
CMDINV	T, S	-	When this signal is On, the motor is in reverse rotation.	C9/C10 C11/C12
TRQLM	S, Sz	10	ON indicates the torque limit command is valid.	
SPDLM	T, Tz	10	ON indicates the speed limit command is valid.	
STOP	-	-	Motor stop.	
SPD0	S, Sz,	34	Select the source of speed command:	

<table>
<tr><td>SPD1</td><td>PT-S, S-T</td><td>8</td><td><table><tr><th>SPD1</th><th>SPD0</th><th>Parameter</th></tr><tr><td>OFF</td><td>OFF</td><td>S mode: analog input
Sz mode: 0</td></tr><tr><td>OFF</td><td>ON</td><td>P1-09</td></tr><tr><td>ON</td><td>OFF</td><td>P1-10</td></tr><tr><td>ON</td><td>ON</td><td>P1-11</td></tr></table></td><td></td></tr>
<tr><td>TCM0</td><td>PT, T, Tz, PT-T</td><td>34</td><td rowspan="2">Select the source of torque command:<table><tr><th>TCM1</th><th>TCM0</th><th>Parameter</th></tr><tr><td>OFF</td><td>OFF</td><td>T mode: analog input
Tz mode: 0</td></tr><tr><td>OFF</td><td>ON</td><td>P1-12</td></tr><tr><td>ON</td><td>OFF</td><td>P1-13</td></tr><tr><td>ON</td><td>ON</td><td>P1-14</td></tr></table></td><td rowspan="2"></td></tr>
<tr><td>TCM1</td><td>S-T</td><td>8</td></tr>
<tr><td>S-P</td><td>PT-S</td><td>31</td><td>Speed / Position mode switching
OFF: Speed, ON: Position</td><td></td></tr>
<tr><td>S-T</td><td>S-T</td><td>31</td><td>Speed / Torque mode switching
OFF: Speed, ON: Torque</td><td></td></tr>
<tr><td>T-P</td><td>PT-T</td><td>31</td><td>Torque / Position mode switching
OFF: Torque, ON: Position</td><td></td></tr>
<tr><td>EMGS</td><td>ALL</td><td>30</td><td>It should be contact “b” and normally ON or a fault (ALRM) will display.</td><td></td></tr>
<tr><td>NL(CWL)</td><td>PT, S, T
Sz, Tz</td><td>32</td><td>Reverse inhibit limit. It should be contact “b” and normally ON or a fault (ALRM) will display.</td><td></td></tr>
<tr><td>PL(CCWL)</td><td>PT, S, T
Sz, Tz</td><td>31</td><td>Forward inhibit limit. It should be contact “b” and normally ON or a fault (ALRM) will display.</td><td></td></tr>
<tr><td>TLLM</td><td>Not assigned</td><td>-</td><td>Reverse operation torque limit (Torque limit function is valid only when P1-02 is enabled)</td><td></td></tr>
<tr><td>TRLM</td><td>Not assigned</td><td>-</td><td>Forward operation torque limit (Torque limit function is valid only when P1-02 is enabled)</td><td></td></tr>
<tr><td>JOGU</td><td>ALL</td><td>-</td><td>Forward JOG input. When JOGU is activated, the motor will JOG in forward direction.</td><td></td></tr>
<tr><td>JOGD</td><td>ALL</td><td>-</td><td>Reverse JOG input. When JOGD is activated, the motor will JOG in reverse direction.</td><td></td></tr>
<tr><td>GNUM0</td><td>PT, PT-S</td><td>-</td><td>Electronic gear ratio (Numerator) selection 0 [See P2-60~P2-62]</td><td></td></tr>
<tr><td>GNUM1</td><td>PT, PT-S</td><td>-</td><td>Electronic gear ratio (Numerator) selection 1 [See P2-60~P2-62]</td><td></td></tr>
</table>

INHP	PT, PT-S	-	Pulses inhibit input. When the drive is in position mode, if INHP is activated, the external pulse input command is not valid.	C9/C10 C11/C12

NOTE

1) The DI signals that do not have pin numbers in Tables 3.C are not default DI signals. If the users want to use these non-default DI signals, the users need to change the settings of parameters P2-10 ~ P2-17. The “state” of the output function may be turned ON or OFF as it will be dependant on the settings of parameters P2-10 ~ P2-17. Please refer to section 3.3.3 for details.

The default DI and DO signals in different control mode are listed in the following table 3.F and table 3.G. Although the content of the table 3.F and table 3.G do not provide more information than the table 3.B and table 3.C above, as each control mode is separated and listed in different row, it is easy for user to view and can avoid confusion. However, the Pin number of each signal can not be displayed in the table 3.F and table 3.G.

Table 3.1 Default DI signals and Control modes

Signal	DI Code	Function	PT	S	T	Sz	Tz	PT-S	PT-T	S-T
SON	0x01	Servo On	DI1	DI1	DI1	DI1	DI1	DI1	DI1	DI1
ARST	0x02	Reset	DI5	DI5	DI5	DI5	DI5			
GAINUP	0x03	Gain switching in speed and position mode								
CCLR	0x04	Pulse clear	DI2					DI2	DI2	
ZCLAMP	0x05	Low speed CLAMP								
CMDINV	0x06	Command input reverse control								
Reserved	0x07	Reserved								
Reserved	0x08	Reserved								
TRQLM	0x09	Torque limit enabled		DI2		DI2				
SPDLM	0x10	Speed limit enabled			DI2		DI2			
STOP	0x46	Motor stop								
SPD0	0x14	Speed command selection 0		DI3		DI3		DI3		DI3
SPD1	0x15	Speed command selection 1		DI4		DI4		DI4		DI4
TCM0	0x16	Torque command selection 0	DI3		DI3		DI3		DI3	DI5

Signal	DI Code	Function	PT	S	T	Sz	Tz	PT-S	PT-T	S-T
TCM1	0x17	Torque command selection 1	DI4		DI4		DI4		DI4	DI6
S-P	0x18	Position / Speed mode switching (OFF: Speed, ON: Position)						DI7		
S-T	0x19	Speed / Torque mode switching (OFF: Speed, ON: Torque)								DI7
T-P	0x20	Torque / Position mode switching (OFF: Torque, ON: Position)							DI7	
Reserved	0x2C	Reserved								
Reserved	0x2D	Reserved								
EMGS	0x21	Emergency stop	DI8	DI8	DI8	DI8	DI8	DI8	DI8	DI8
NL(CWL)	0x22	Reverse inhibit limit	DI6	DI6	DI6	DI6	DI6			
PL(CCWL)	0x23	Forward inhibit limit	DI7	DI7	DI7	DI7	DI7			
Reserved	0x24	Reserved								
TLLM	0x25	Reverse operation torque limit								
TRLM	0x26	Forward operation torque limit								
Reserved	0x27	Reserved								
Reserved	0x36	Reserved								
JOGU	0x37	Forward JOG input								
JOGD	0x38	Reverse JOG input								
GNUM0	0x43	Electronic gear ratio (Numerator) selection 0								
GNUM1	0x44	Electronic gear ratio (Numerator) selection 1								
INHP	0x45	Pulse inhibit input								

NOTE

1) For Pin numbers of DI1~DI8 signals, please refer to section 3.3.1.

Table 3.2 Default DO signals and Control modes

Signal	DO Code	Function	PT	S	T	Sz	Tz	PT-S	PT-T	S-T
SRDY	0x01	Servo ready	DO1	DO1	DO1	DO1	DO1	DO1	DO1	DO1
SON	0x02	Servo On								

Signal	DO Code	Function	PT	S	T	Sz	Tz	PT-S	PT-T	S-T
ZSPD	0x03	Zero speed	DO2	DO2	DO2	DO2	DO2	DO2	DO2	DO2
TSPD	0x04	Speed reached		DO3	DO3	DO3	DO3	DO3	DO3	DO3
TPOS	0x05	Positioning completed	DO4					DO4	DO4	
TQL	0x06	Reached torques limits								
ALRM	0x07	Servo alarm output (Servo fault)	DO5	DO5	DO5	DO5	DO5	DO5	DO5	DO5
BRKR	0x08	Electromagnetic brake		DO4	DO4	DO4	DO4			
OLW	0x10	Output overload warning								
WARN	0x11	Servo warning output								
SNL(SCWL)	0x13	Reverse software limit								
SPL(SCCWL)	0x14	Forward software limit								
SP_OK	0x19	Speed reached output								

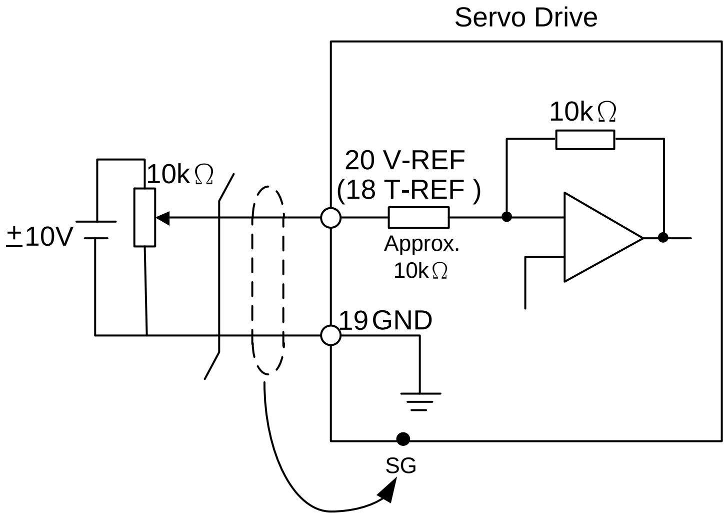
NOTE

1) For Pin numbers of DO1~DO6 signals, please refer to section 3.3.1.

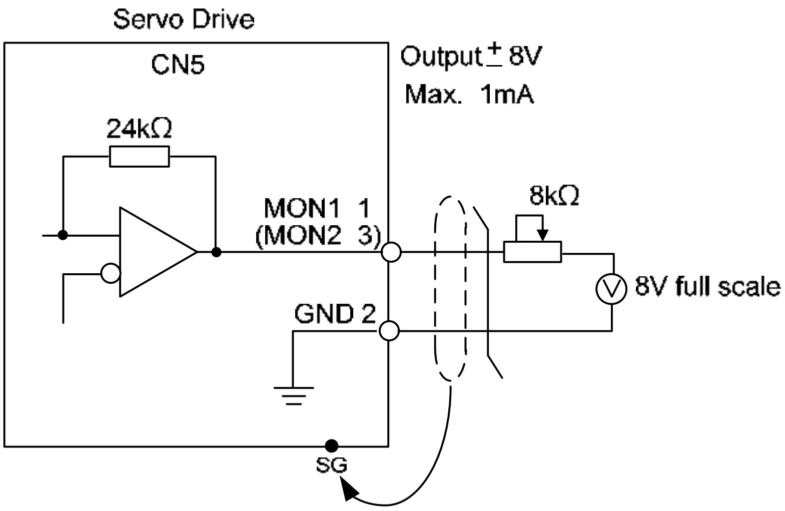
3.3.3 Wiring Diagrams of I/O Signals (CN1)

The valid voltage range of analog input command in speed and torque mode is -10V ~+10V. The command value can be set via relevant parameters.

C1: Speed / Torque analog signal input

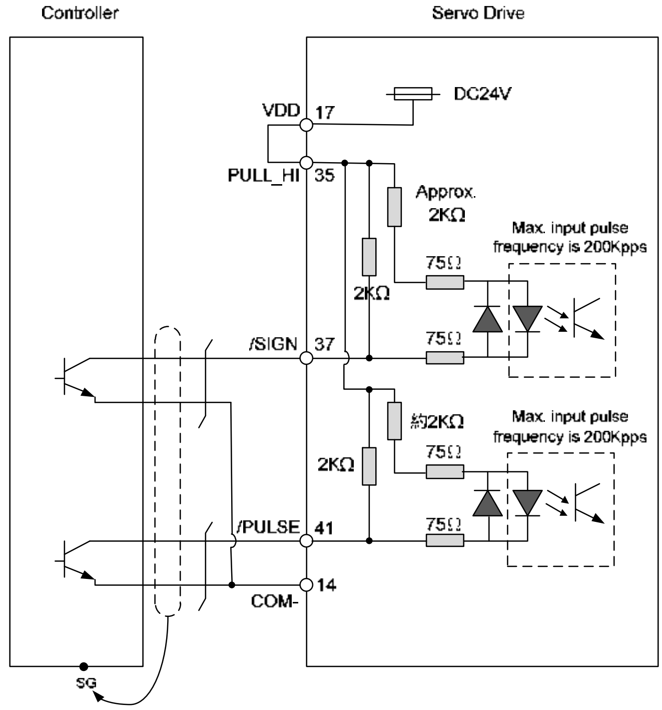


C2: Analog monitor output (MON1, MON2)

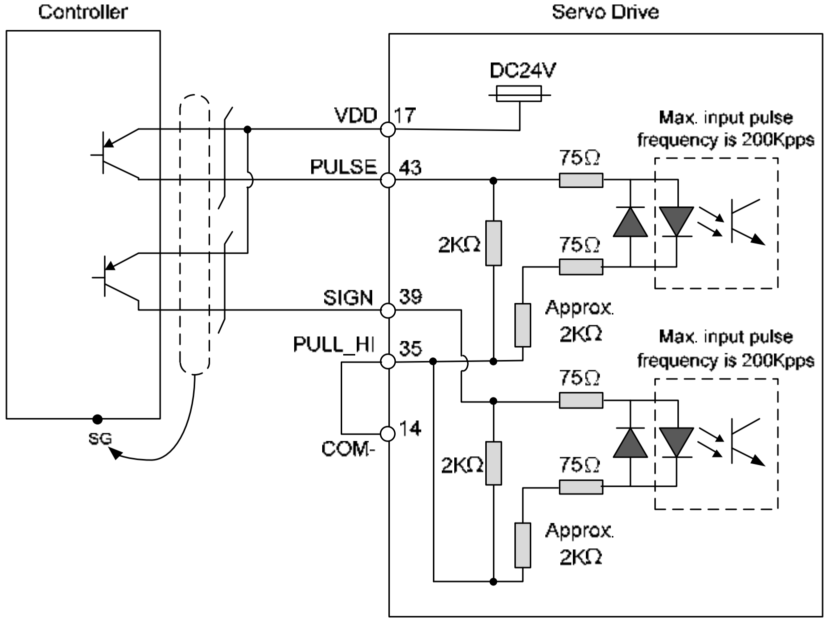


There are two kinds of pulse inputs, Line driver input and Open-collector input. Max. input pulse frequency of Line driver input is 500kpps and max. input pulse frequency of Open-collector input is 200kpps.

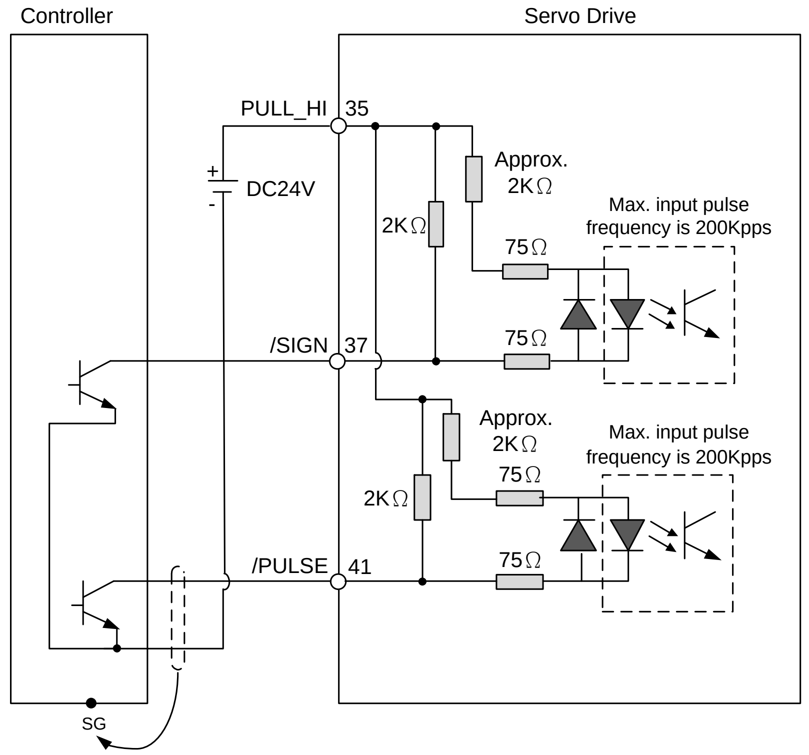
C3-1: The source of pulse input is open-collector NPN equipment which applies the internal power of the servo drive.



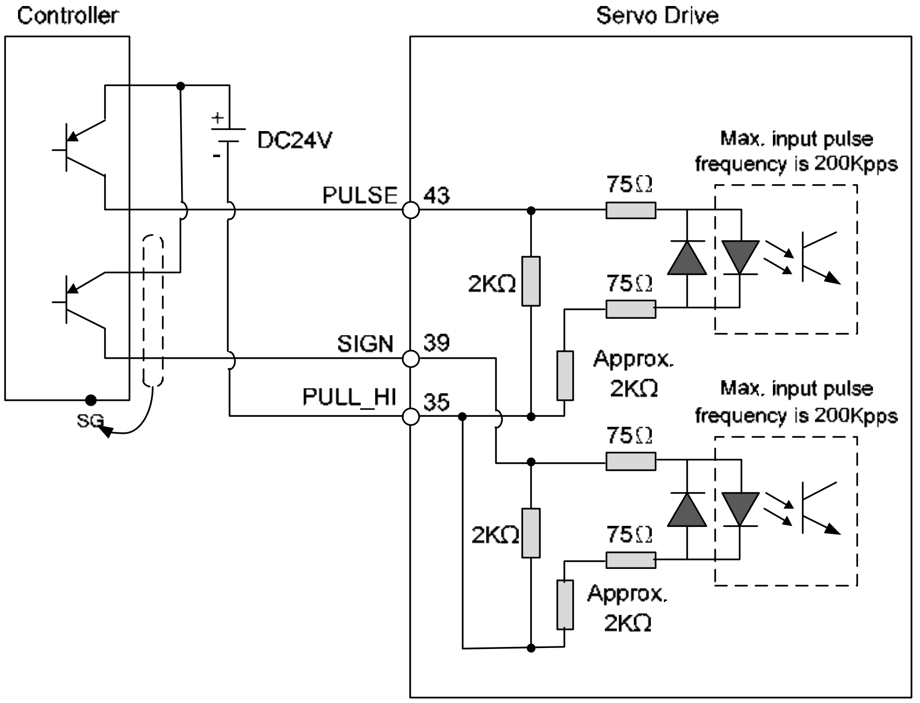
C3-2: The source of pulse input is open-collector PNP equipment which applies the internal power of the servo drive.



C3-3: The source of pulse input is open-collector NPN equipment which applies the external power of the servo drive.



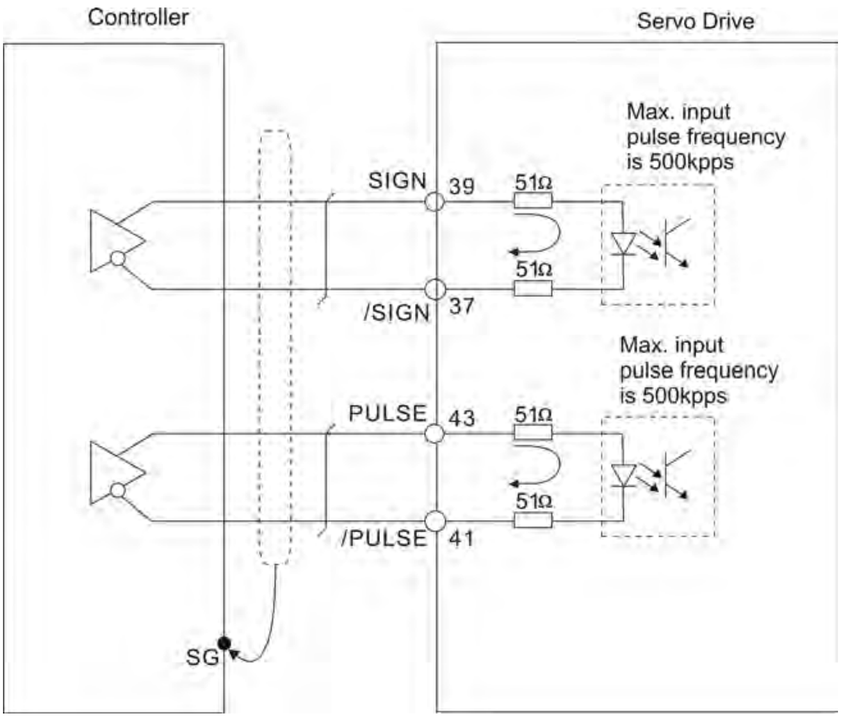
C3-4: The source of pulse input is open-collector PNP equipment which applies the external power of the servo drive.



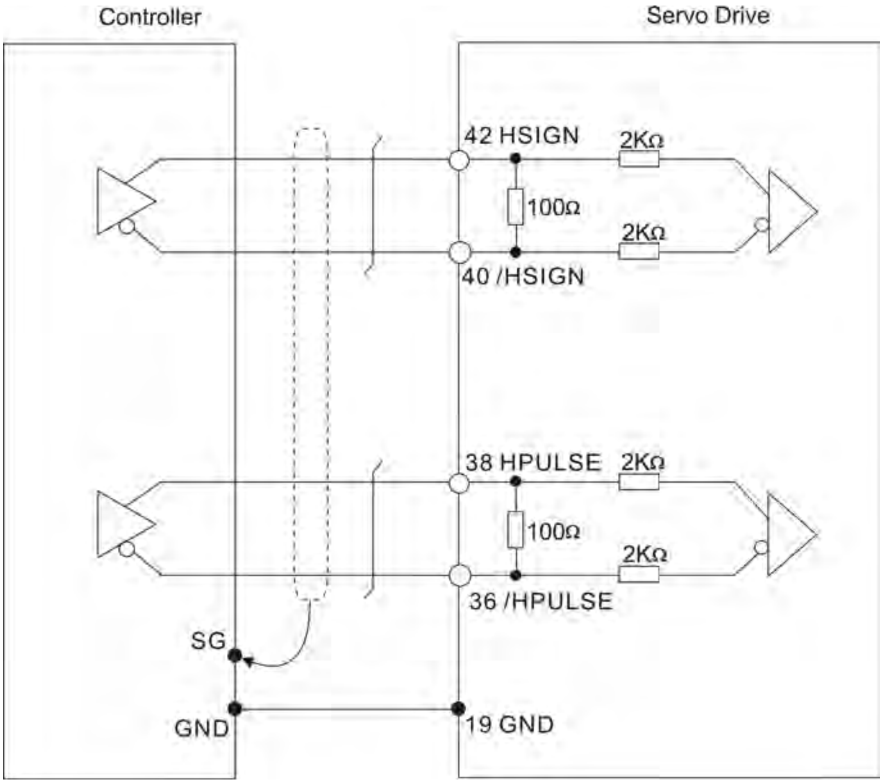
WARNING

- ***Caution: Do not apply to dual power or it may damage the servo drive.***

C4-1: Pulse input (Line driver) It requires 5V power supply only. Never apply a 24V power supply.



C4-2: High-speed pulse input (Line driver). It requires 5V power supply only. Never apply a 24V power supply.

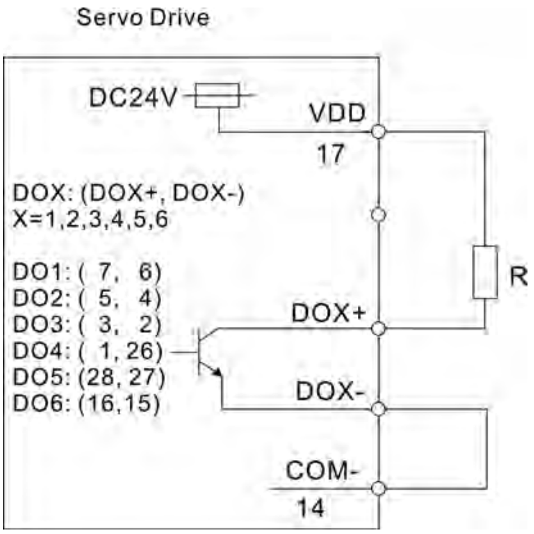


WARNING

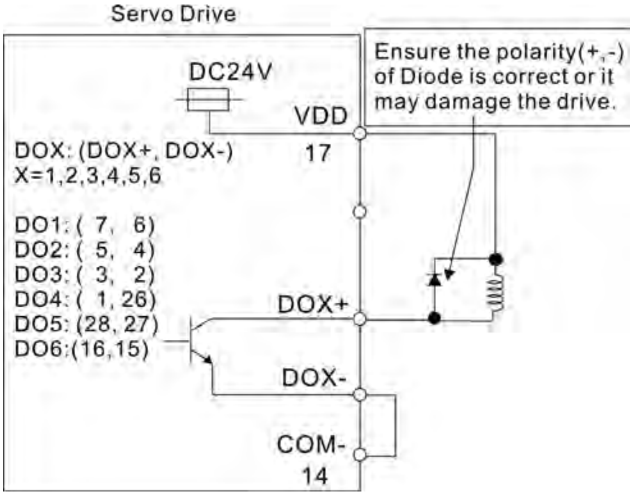
- ***Caution: The high-speed pulse input interface is not an isolated input interface. To prevent noise and interference, ensure that the ground terminal of the controller and the servo drive should be connected to each other.***

Be sure to connect a diode when the drive is applied to inductive load.
(Permissible current: 40mA, Instantaneous peak current: max. 100mA)

C5: Wiring of DO signal, for the use of internal power supply, general load

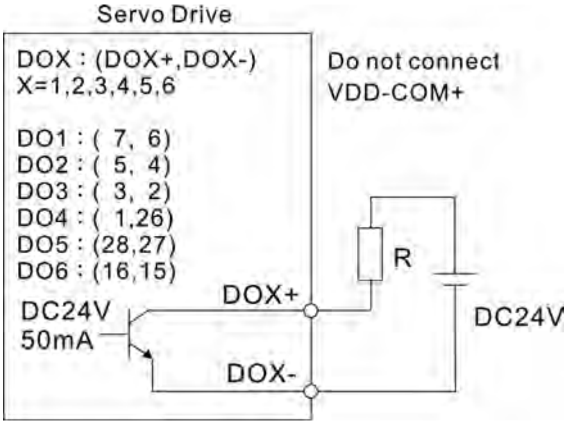


C6: Wiring of DO signal, for the use of internal power supply, inductive load



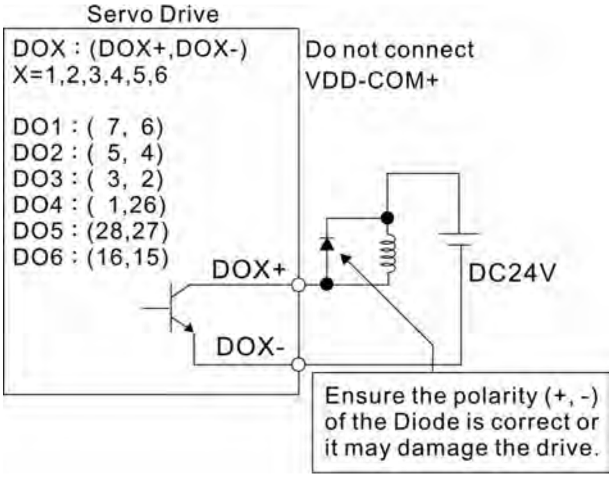
Ensure the polarity(+,-) of Diode is correct or it may damage the drive.

C7: Wiring of DO signal, for the use of external power supply, general load



Do not connect VDD-COM+

C8: Wiring of DO signal, for the use of external power supply, inductive load



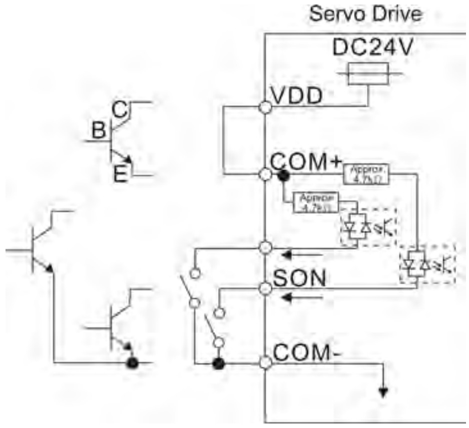
Do not connect VDD-COM+

Ensure the polarity (+, -) of the Diode is correct or it may damage the drive.

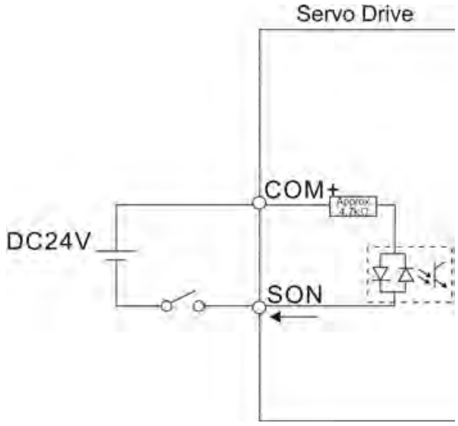
Use a relay or open-collector transistor to input signal.

NPN transistor with multiple emitter fingers (SINK Mode)

C9: Wiring of DI signal, for the use of internal power supply

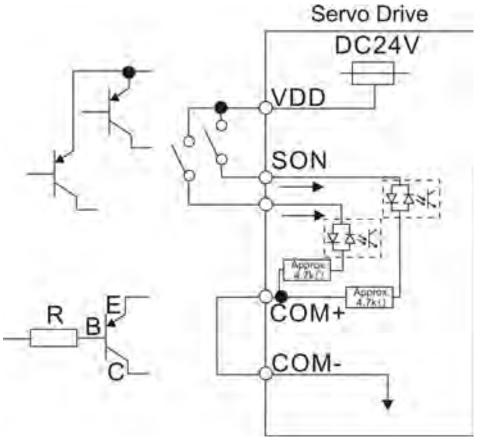


C10: Wiring of DI signal, for the use of external power supply

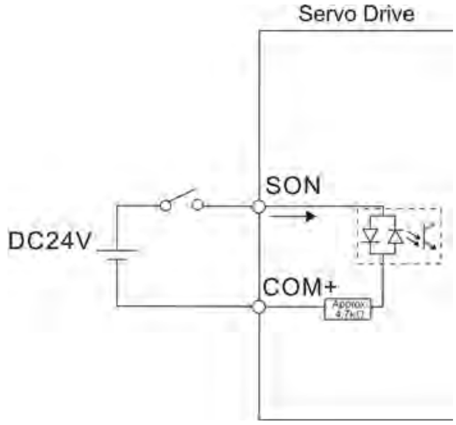


PNP transistor with multiple emitter fingers (SOURCE Mode)

C11: Wiring of DI signal, for the use of internal power supply



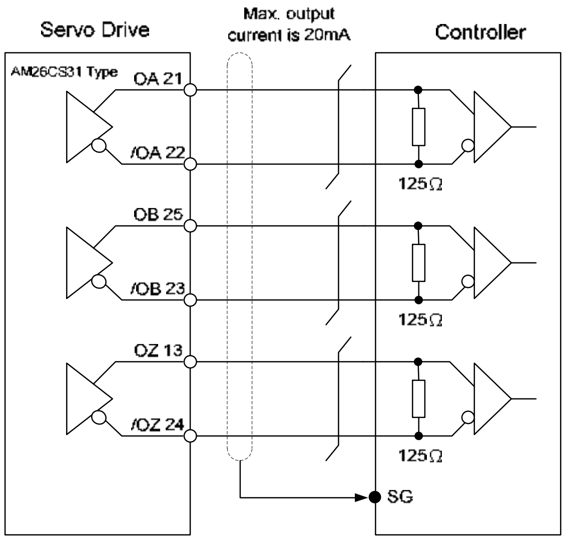
C12: Wiring of DI signal, for the use of external power supply



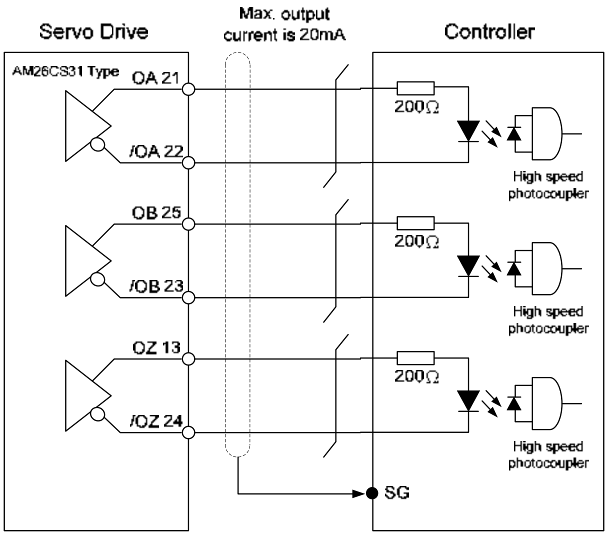
WARNING

- ***Caution: Do not apply to dual power or it may damage the servo drive.***

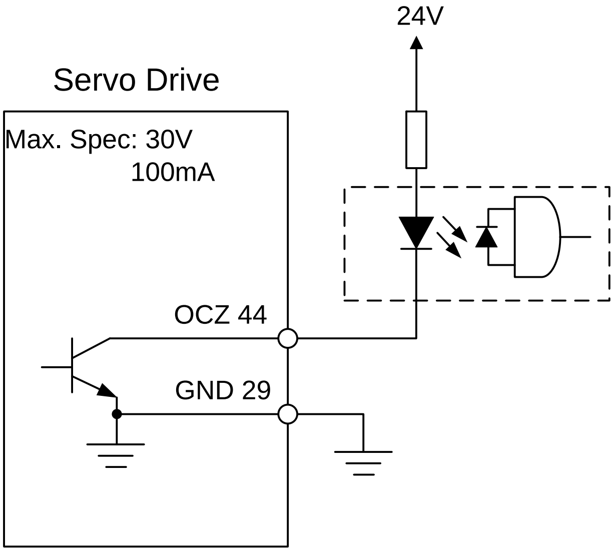
C13: Encoder output signal (Line driver)



C14: Encoder output signal (Photocoupler)



C15: Encoder OCZ output (Open-collector Z-pulse output)



3.3.4 User-defined DI and DO signals

If the default DI and DO signals could not be able to fulfill users' requirements, there are still user-defined DI and DO signals. The setting method is easy and they are all defined via parameters. The user-defined DI and DO signals are defined via parameters P2-10 to P2-17 P2-36 and P2-18 to P2-22 and P-37. Please refer to the following Table 3.H for the settings.

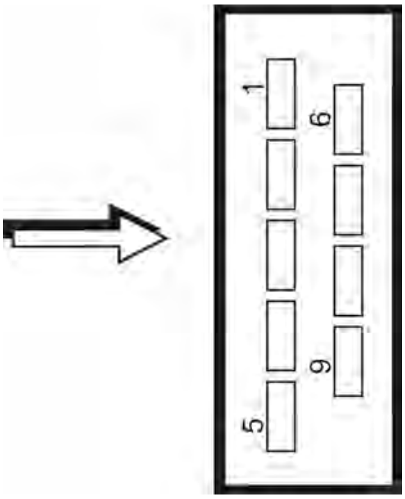
Table 3.H User-defined DI and DO signals

Signal Name		Pin No.	Parameter
DI	DI1-	CN1-9	P2-10
	DI2-	CN1-10	P2-11
	DI3-	CN1-34	P2-12
	DI4-	CN1-8	P2-13
	DI5-	CN1-33	P2-14
	DI6-	CN1-32	P2-15
	DI7-	CN1-31	P2-16
	DI8-	CN1-30	P2-17
	DI9	CN1-12	P2-36

Signal Name		Pin No.	Parameter
DO	DO1+	CN1-7	P2-18
	DO1-	CN1-6	
	DO2+	CN1-5	P2-19
	DO2-	CN1-4	
	DO3+	CN1-3	P2-20
	DO3-	CN1-2	
	DO4+	CN1-1	P2-21
	DO4-	CN1-26	
	DO5+	CN1-28	P2-22
	DO5-	CN1-27	
	DO6+	CN1-16	P2-37
	DO6-	CN1-15	

3.4 Encoder Connector CN2

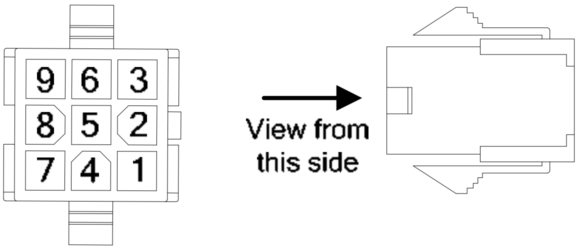
(1) The layout of CN2 Drive Connector



Side View

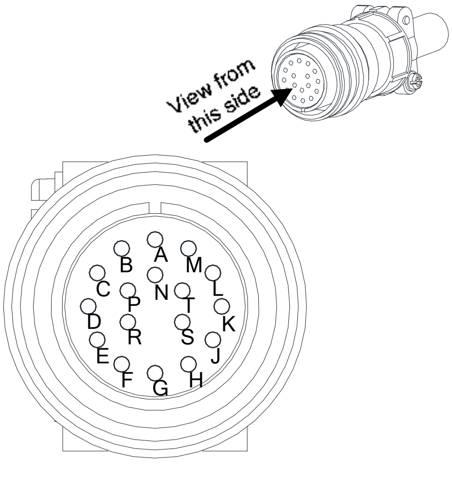
Rear View

(2) The layout of CN2 Motor Connector



HOUSING AMP (1-172161-9)

Quick Connector



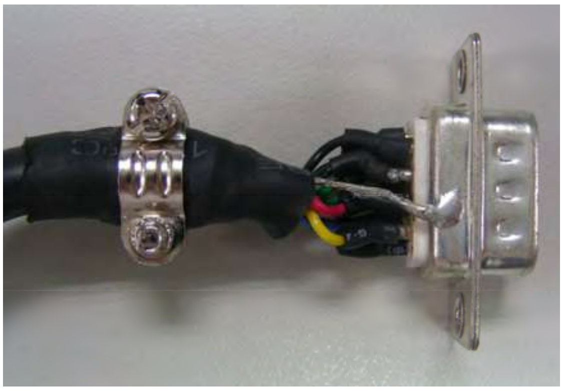
3106A-20-29S

Military Connector

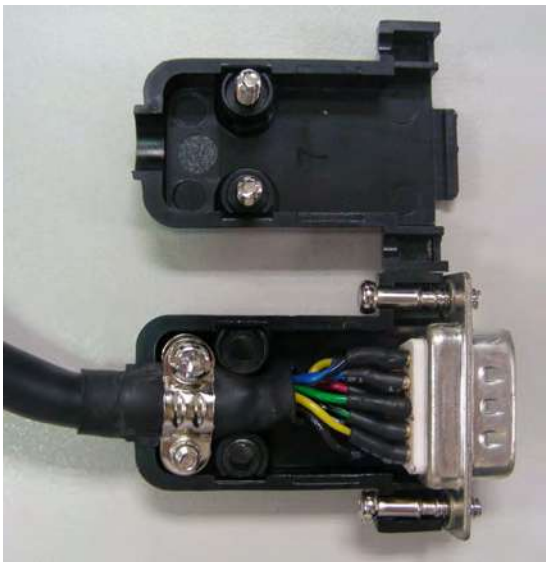
CN2 Terminal Signal Identification

Drive Connector			Motor Connector		
PIN No.	Terminal Identification	Description	Military Connector	Quick Connector	Color
4	T+	Serial communication signal input / output (+)	A	1	Blue
5	T-	Serial communication signal input / output (-)	B	4	Blue & Black
-	-	Reserved	-	-	-
-	-	Reserved	-	-	-
8	+5V	+5V power supply	S	7	Red / Red & White
7, 6	GND	Ground	R	8	Black / Black & White
Shell	Shielding	Shielding	L	9	-

Using the encoder cable with shielding (double shielding is the best) is able to prevent voltage coupling and eliminate the noise and interference from other electrical sources. Be sure to observe the following steps to complete the shielding surrounding the encoder cable.



(1) Solder the centre cores on the metal part of the connector adequately for good ground contact with the plate and shielding.



(2) Trim the ends of the cores and install the cores with shielding into the plastic case of the connector as shown in the figure.

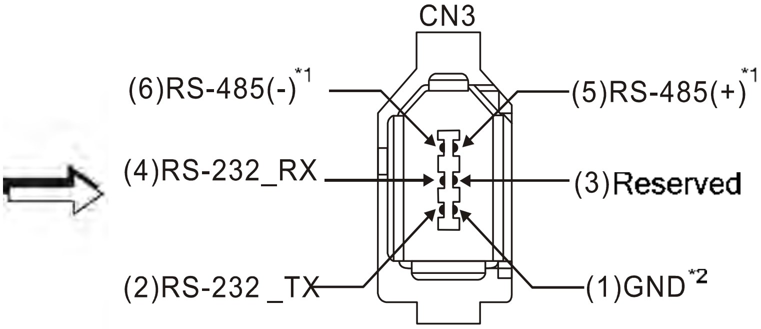
(3) Tighten the screws to complete the shielding.

3.5 Serial Communication Connector CN3

CN3 Terminal Layout and Identification

The servo drive can be connected to a PC or controller via a serial communication connector. Users can operate the servo drive through PC software supplied by Delta (contact to the dealer). The communication connector/port of Delta servo drive can provide three common serial communication interfaces: RS-232 and RS-485 connection. RS-232 is mostly be used but is somewhat limited. The maximum cable length for an RS-232 connection is 15 meters (50 feet). Using RS-485 interface can allow longer distance for transmission and support multiple drives to be connected simultaneously.

CN3 Port (Female)



Side View

Rear View

Please read carefully the following note. Improper wiring may cause damage or injury!

CN3 Terminal Signal Identification

PIN No.	Signal Name	Terminal Identification	Description
1	Grounding	GND	Ground
2	RS-232 data transmission	RS-232_TX	For data transmission of the servo drive. Connected to the RS-232 interface of PC.
3	-	-	Reserved
4	RS-232 data receiving	RS-232_RX	For data receiving of the servo drive. Connected to the RS-232 interface of PC.
5	RS-485 data transmission	RS-485(+)	For data transmission of the servo drive (differential line driver + end)
6	RS-485 data transmission	RS-485(-)	For data transmission of the servo drive (differential line driver - end)

NOTE

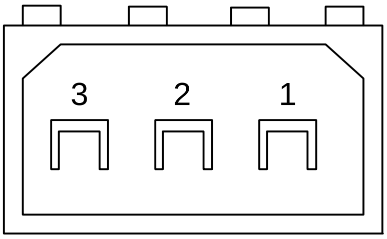
1) For the connection of RS-485, please refer to section 8.1 in Chapter 8.
2) There are two kinds of IEEE1394 communication cables available on the market. If the user uses one kind of cable, which its GND terminal (Pin 1) and its shielding is short-circuited, the communication may be damaged. Never connect the case of the terminal to the ground of this kind of communication cable.

3.6 Analog Monitor Output Connector - CN5

Analog Monitor Output Connector CN5 is used to monitor the motor operation status. Motor characteristics such as speed and current can be represented by analog voltages. The drive provides two channels (MON1 and MON2) which can be configured with the parameter P0-03 to output the desired characteristics.

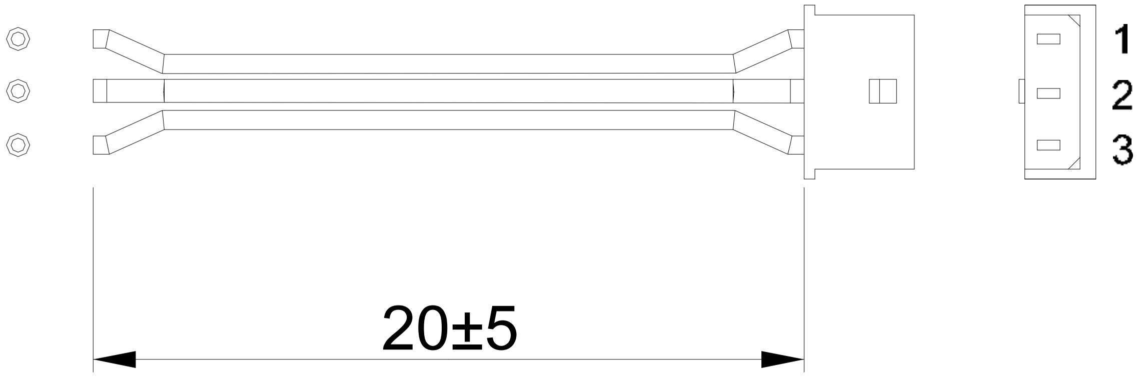
Please refer to the parameter P0-03 for monitoring commands and P1-04 / P1-05 for scaling factors. Output voltage is reference to the power ground (GND).

CN5 Terminal Layout and Identification



CN5

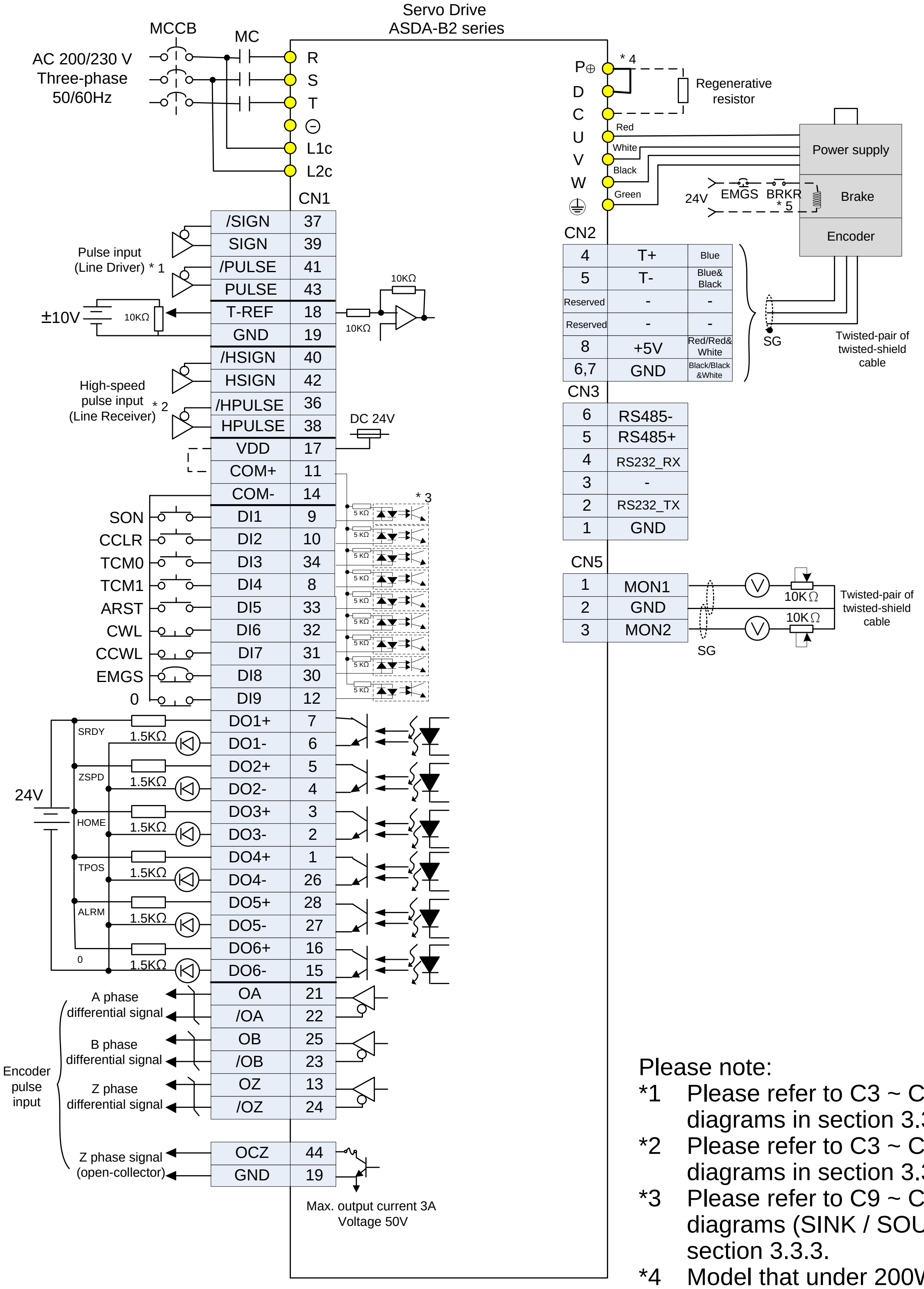
Signal Cable for CN5 Connector



PIN No.	Signal Name	Description	Color	Wiring Diagram (Refer to 3.3.3)
1	MON1	Monitor analog data 1	Red	C2
2	GND	Ground	White	
3	MON2	Monitor analog data 2	Black	

3.7 Standard Connection Example

3.7.1 Position (PT) Control Mode



Please note:

*1 Please refer to C3 ~ C4 wiring diagrams in section 3.3.3.

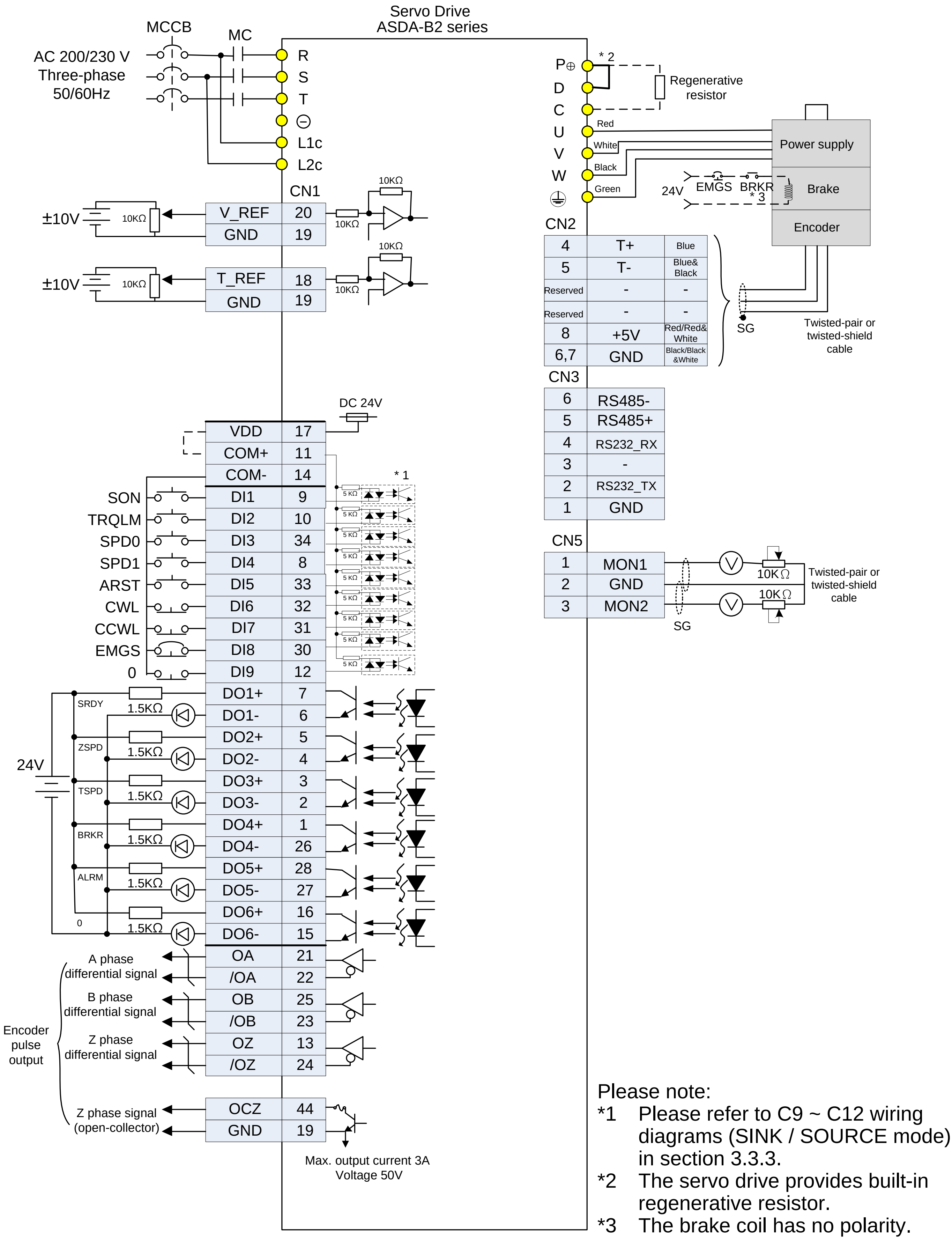
*2 Please refer to C3 ~ C4 wiring diagrams in section 3.3.3.

*3 Please refer to C9 ~ C12 wiring diagrams (SINK / SOURCE mode) in section 3.3.3.

*4 Model that under 200W has no built-in regenerative resistor.

*5 The brake coil has no polarity.

3.7.2 Speed Control Mode



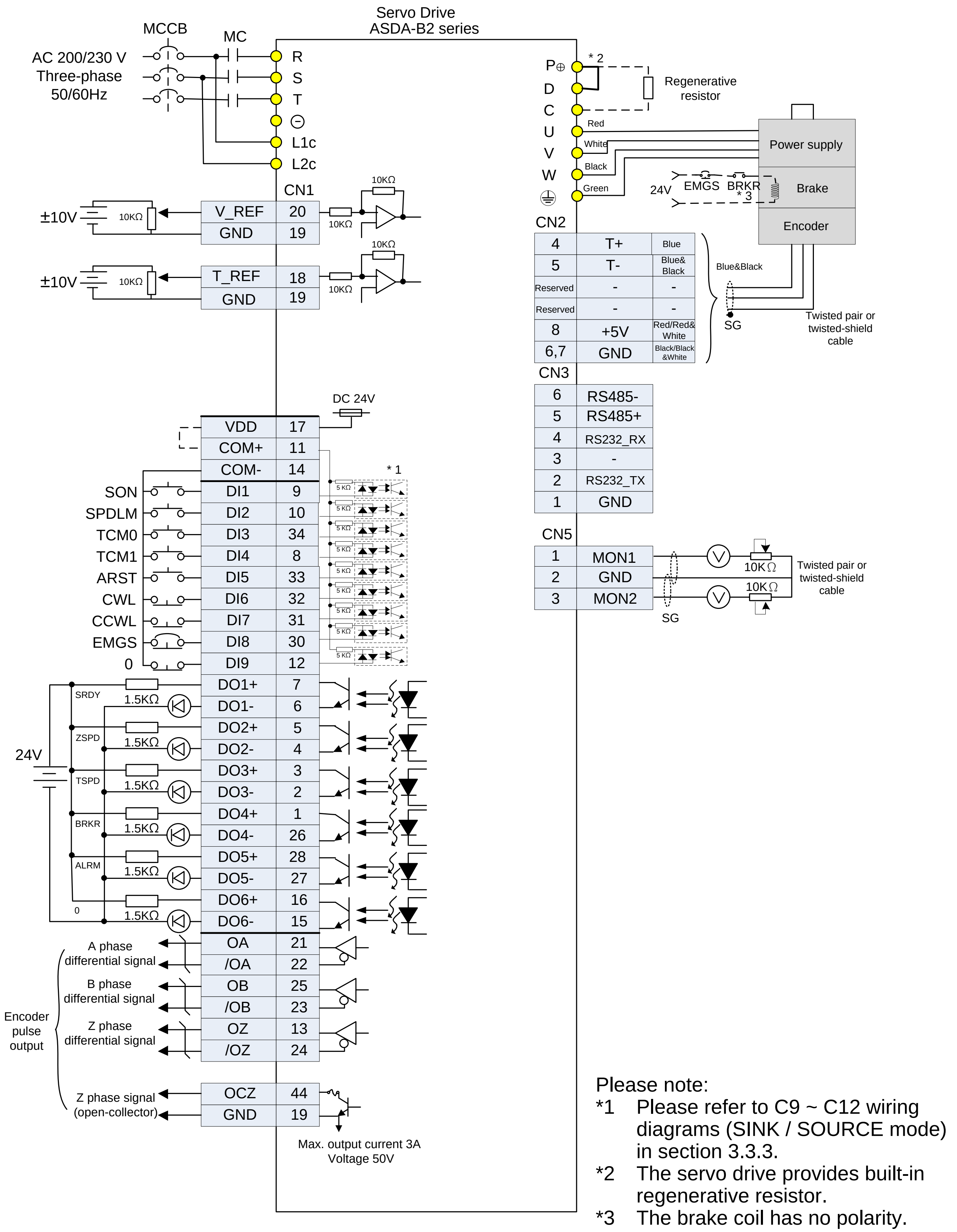
Please note:

*1 Please refer to C9 ~ C12 wiring diagrams (SINK / SOURCE mode) in section 3.3.3.

*2 The servo drive provides built-in regenerative resistor.

*3 The brake coil has no polarity.

3.7.3 Torque Control Mode



Please note:

*1 Please refer to C9 ~ C12 wiring diagrams (SINK / SOURCE mode) in section 3.3.3.

*2 The servo drive provides built-in regenerative resistor.

*3 The brake coil has no polarity.

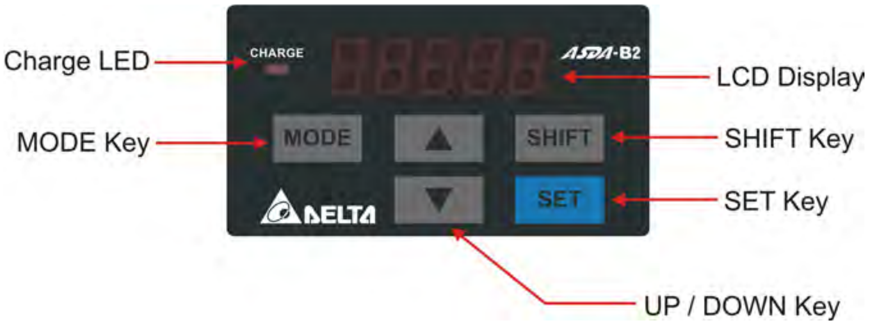
Chapter 4 Display and Operation

This chapter describes the basic operation of the digital keypad and the features it offers.

4.1 Description of the Digital Keypad

The digital keypad includes the display panel and function keys. The Figure 4.1 shows all of the features of the digital keypad and an overview of their functions.

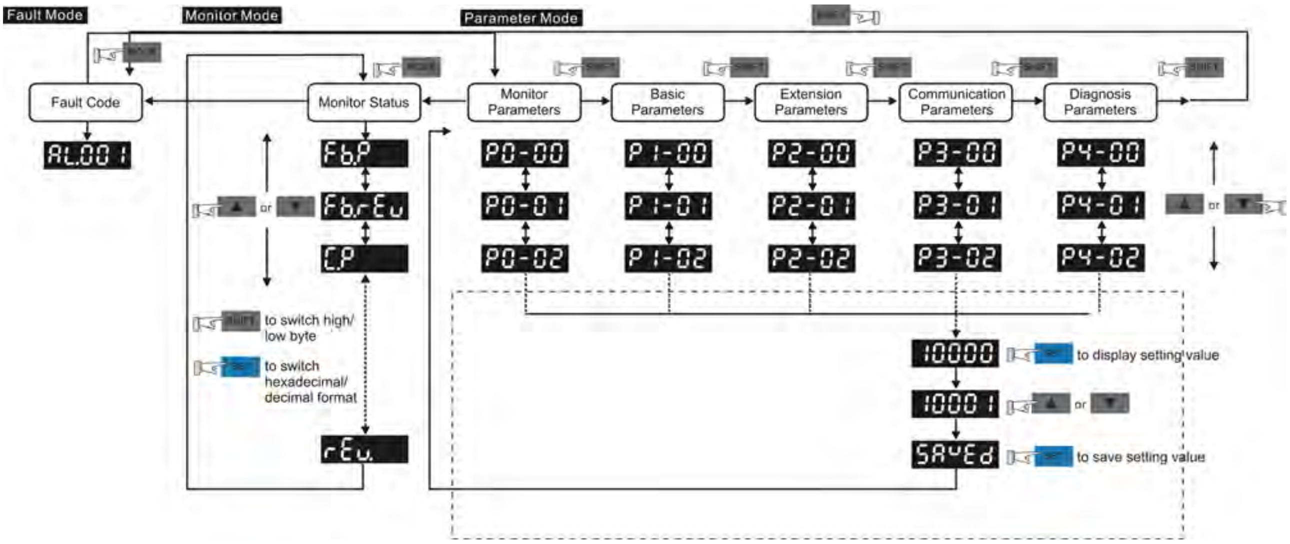
Figure 4.1



Name	Function
LCD Display	The LCD Display (5-digit, 7-step display panel) shows the monitor codes, parameter settings and operation values of the AC servo drive.
Charge LED	The Charge LED lights to indicate the power is applied to the circuit.
MODE Key	MODE Key. Pressing MODE key can enter or exit different parameter groups, and switch between Monitor mode and Parameter mode.
SHIFT Key	SHIFT Key. Pressing SHIFT key can scrolls through parameter groups. After a parameter is selected and its value displayed, pressing SHIFT key can move the cursor to the left and then change parameter settings (blinking digits) by using arrow keys.
UP and DOWN Key	UP and DOWN arrow Key. Pressing the UP and DOWN arrow key can scroll through and change monitor codes, parameter groups and various parameter settings.
SET Key	SET Key. Pressing the SET key can display and save the parameter groups, the various parameter settings. In monitor mode, pressing SET key can switch decimal or hexadecimal display. In parameter mode, pressing SET key can enter into parameter setting mode. During diagnosis operation, pressing SET key can execute the function in the last step. (The parameter settings changes are not effective until the SET key is pressed.)

4.2 Display Flowchart

Figure 4.2 Keypad Operation



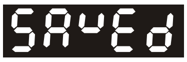
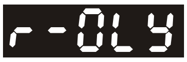
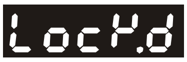
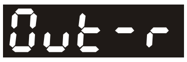
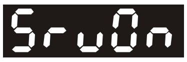
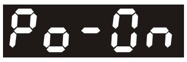
1. When the power is applied to the AC servo drive, the LCD display will show the monitor function codes for approximately one second, then enter into the monitor mode.
2. In monitor mode, pressing MODE key can enter into parameter mode. In parameter mode, pressing MODE key can return to monitor mode.
3. No matter working in which mode, when an alarm occurs, the system will enter into fault mode immediately. In fault mode, pressing MODE key can switch to other modes. In other modes, if no key is pressed for over 20 seconds, the system will return to fault mode automatically.
4. In monitor mode, pressing UP or DOWN arrow key can switch monitor parameter code. At this time, monitor display symbol will display for approximately one second.
5. In monitor mode, pressing MODE key can enter into parameter mode, pressing the SHIFT key can switch parameter group and pressing UP or DOWN arrow key can change parameter group code.
6. In parameter mode, the system will enter into the setting mode immediately after the Set key is pressed. The LCD display will display the corresponding setting value of this parameter simultaneously. Then, users can use UP or DOWN arrow key to change parameter value or press MODE key to exit and return back to the parameter mode.
7. In parameter setting mode, the users can move the cursor to left by pressing the SHIFT key and change the parameter settings (blinking digits) by pressing the UP or DOWN arrow key.
8. After the setting value change is completed, press SET key to save parameter settings or execute command.

9. When the parameter setting is completed, LCD display will show the end code “SAVED“ and automatically return back to parameter mode.

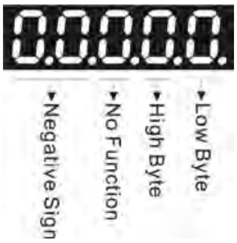
4.3 Status Display

4.3.1 Save Setting Display

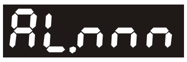
After the SET key is pressed, LCD display will show the following display messages for approx. one second according to different status.

Display Message	Description
	The setting value is saved correctly. [Saved)
	This parameter is read only. Write-protected. (Read-Only)
	Invalid password or no password was input. (Locked)
	The setting value is error or invalid. (Out of Range)
	The servo system is running and it is unable to accept this setting value to be changed. (Servo On)
	This parameter is valid after restarting the drive. (Power On)

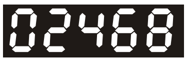
4.3.2 Decimal Point Display

Display Message	Description
 0.0.0.0.0. Negative Sign No Function High Byte Low Byte	High/Low byte display. When the data is a decimal 32-bit data, these two digits are used to show if the display is high byte or low byte. Negative value display. When the data is displayed in decimal format, the most left two digits represent negative sign no matter it is a 16-bit or 32-bit data. If the data is displayed in hexadecimal format, it is a positive value always and no negative sign is displayed.

4.3.3 Fault Message Display

Display Message	Description
	When the AC servo drive has a fault, LCD display will display “ALnnn”. “AL” indicates the alarm and “nnn” indicates the drive fault code. For the list of drive fault code, please refer to parameter P0-01 or refer to Chapter 11 (Troubleshooting).

4.3.4 Polarity Setting Display

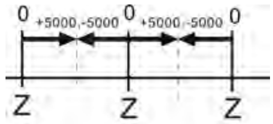
Display Message	Description
	Positive value display. When entering into parameter setting mode, pressing UP or DOWN arrow key can increase or decrease the display value. SHIFT key is used to change the selected digit (The selected digit will blink).

Display Message	Description
2.4.680	Negative value display. Continuously press SHIFT key for two seconds and then the positive(+) or negative(-) sign can be switched. When the setting value exceeds its setting range, the positive(+) and negative(-) sign can not be switched. (The negative value display is for a decimal negative value only. There is no negative value display for a hexadecimal negative value.)

4.3.5 Monitor Setting Display

When the AC servo drive is applied to power, the LCD display will show the monitor function codes for approximately one second and then enter into the monitor mode. In monitor mode, in order to change the monitor status, the users can press UP or DOWN arrow key or change parameter P0-02 directly to specify the monitor status. When the power is applied, the LCD display will show ASDA-B2 first and then display the monitor status depending on the setting value of P0-02. For example, if the setting value of P0-02 is 4 when the power is applied, the monitor function will be input pulse number of pulse command. After ASDA-B2 shows on the LCD display, the C-PLS monitor codes will display next and then the pulse number will display after.

P0-02 Setting	Display Message	Description	Unit
0	Fb.PUU	Motor feedback pulse number (after electronic gear ratio is set)	[user unit]
1	C-PUU	Input pulse number of pulse command (after electronic gear ratio is set)	[user unit]
2	Er.PUU	Position error counts between control command pulse and feedback pulse	[user unit]
3	Fb.PLS	Motor feedback pulse number (encoder unit, 1600000 pulse/rev)	[pulse]
4	C-PLS	Input pulse number of pulse command (before electronic gear ratio is set) (encoder unit)	[pulse]
5	Er.PLS	Position error counts (after electronic gear ratio is set) (encoder unit)	[pulse]
6	CP-Fr	Input frequency of pulse command	[Kpps]
7	SPEEd	Motor rotation speed	[r/min]
8	CSPd1	Speed input command	[Volt]
9	CSPd2	Speed input command	[r/min]
10	C-t91	Torque input command	[Volt]

P0-02 Setting	Display Message	Description	Unit
11	C-tq2	Torque input command	[%]
12	AuG-L	Average load	[%]
13	PE-L	Peak load	[%]
14	V buS	Main circuit voltage	[Volt]
15	J-L	Ratio of load inertia to Motor inertia (Please note that if the display is 130, it indicates that the actual inertia is 13.0)	[0.1times]
16	IGbt.t	IGBT temperature	[^{o}C]
17	rSn.Fr	Resonance frequency (The low byte is the first resonance point and the high byte is the second resonance point.)	[Hz]
18	dIFF.2  0 +5000 -5000 0 +5000 -5000 0 Z Z Z	Absolute pulse number relative to encoder (use Z phase as home). The value of Z phase home point is 0, and it can be the value from -5000 to +5000 pulses.	-

The following table lists the display examples of monitor value:

Display Message	Description	
01234 (Dec.)	16-bit Data	Decimal display. When the actual value is 1234, the display is 01234.
1234 (Hex.)		Hexadecimal display. When the actual value is 0x1234, the display is 1234.
1234.5 (Dec. High Byte) 67890. (Dec. Low Byte)	32-bit Data	Decimal display. When the actual value is 1234567890, the display of high byte is 1234.5 and the display of low byte is 67890.
h1234 (Hex. High Byte) L5678 (Hex. Low Byte)		Hexadecimal display. When the actual value is 0x12345678, the display of high byte is h1234 and the display of low byte is L5678.
1.2.345	Negative value display. When the actual value is -12345, the display is 1.2.345. (The negative value display is displayed to indicate a decimal negative value. There is no negative value display for a hexadecimal negative value.)	

NOTE

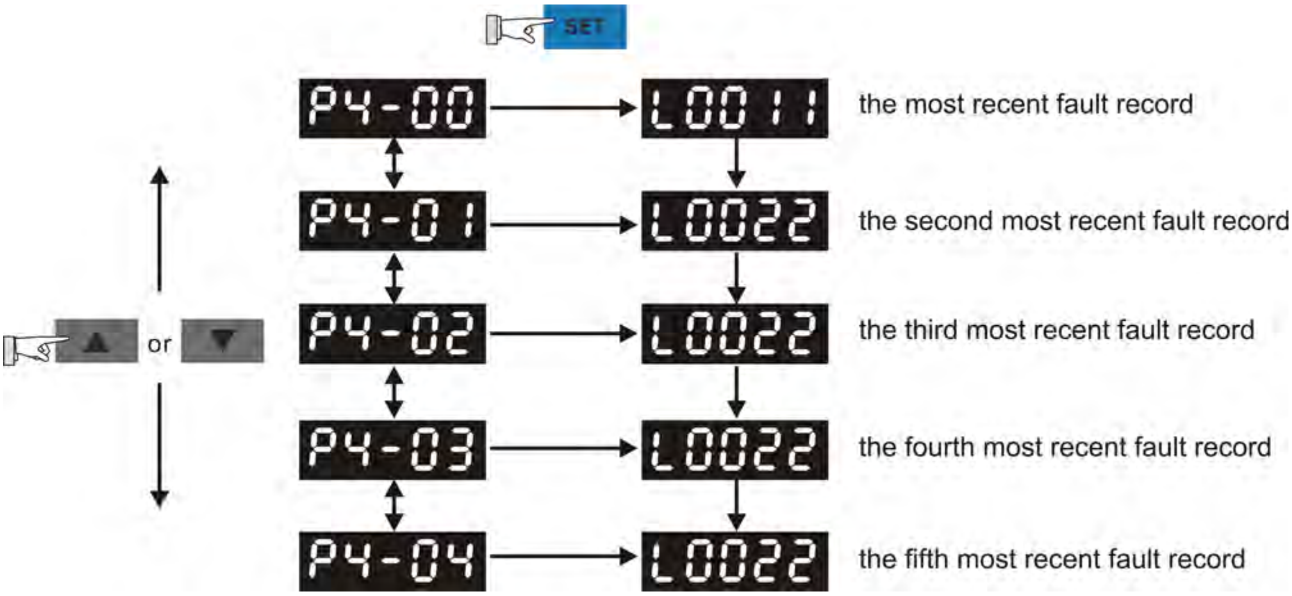
1) Dec. represents Decimal display and Hex. represents Hexadecimal display.
2) The above display methods are both available in monitor mode and parameter setting mode.
3) All monitor variables are 32-bit data. The users can switch to high byte or low byte and display format (Dec. or Hex.) freely. Regarding the parameters listed in Chapter 8, for each parameter, only one kind of display format is available and cannot be changed.

4.4 General Function Operation

4.4.1 Fault Code Display Operation

After entering the parameter mode P4-00 to P4-04 (Fault Record), press SET key to display the corresponding fault code history for the parameter.

Figure 4.3


SET
or
P4-00
P4-01
P4-02
P4-03
P4-04
L0011
L0022
L0022
L0022
L0022
the most recent fault record
the second most recent fault record
the third most recent fault record
the fourth most recent fault record
the fifth most recent fault record

4.4.2 JOG Operation

After entering parameter mode P4-05, the users can follow the following steps to perform JOG operation. (Please also refer to Figure 4.4).

Step1. Press the SET key to display the JOG speed. (The default value is 20 r/min).

Step2. Press the UP or DOWN arrow keys to increase or decrease the desired JOG speed. (This also can be undertaken by using the SHIFT key to move the cursor to the desired unit column (the effected number will blink) then changed using the UP and DOWN arrow keys. The example display in Figure 4.4 is adjusted as 100 r/min.)

Step3. Press the SET key when the desired JOG speed is set. The Servo Drive will display "JOG".

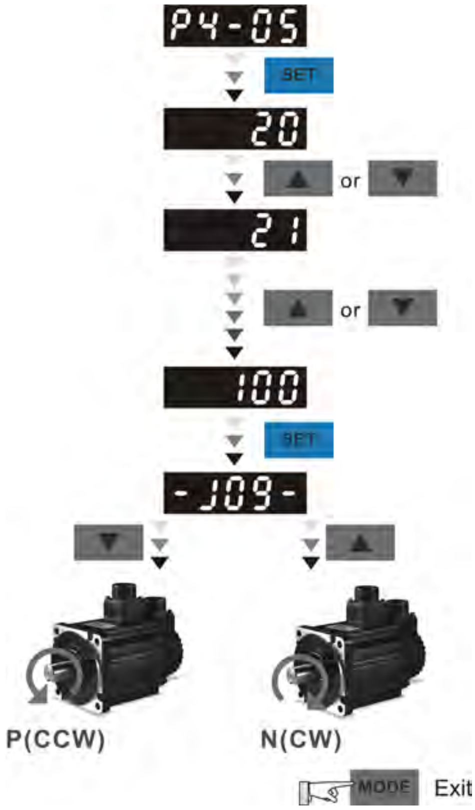
Step4. Press the UP or DOWN arrow keys to jog the motor either CCW or CW. The motor will only rotate while the arrow key is activated.

Step5. To change JOG speed again, press the MODE key. The servo Drive will display "P4 - 05". Press the SET key and the JOG speed will displayed again. Refer back to #2 and #3 to change speed.

NOTE

1) JOG operation is effective only when Servo On (when the servo drive is enabled).

Figure 4.4

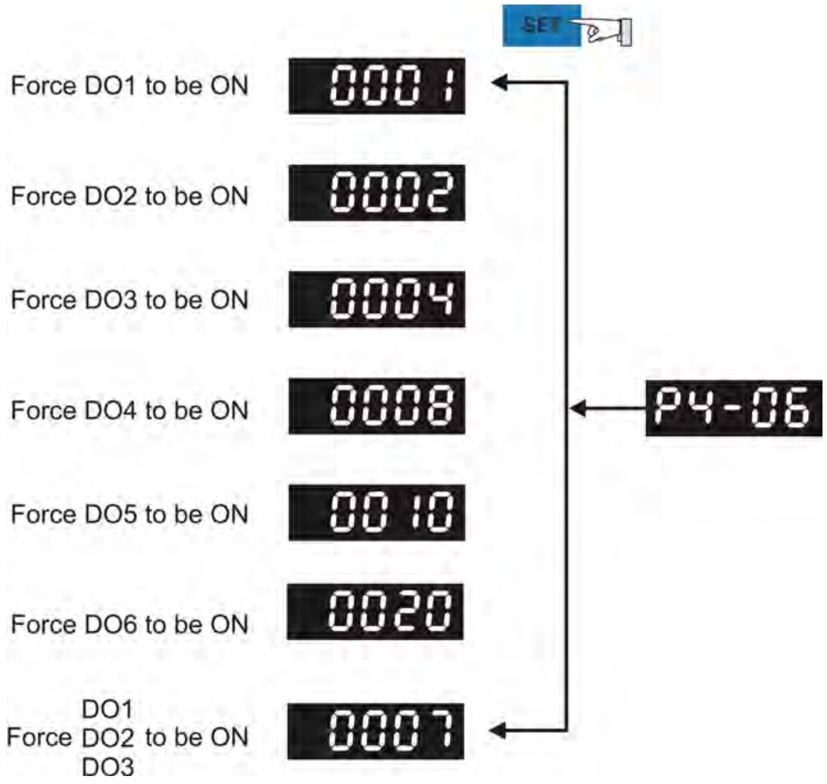


4.4.3 Force Output Control Operation

For testing, the digital outputs can be forced to be activated (ON) or inactivated (OFF) by using parameter P2-08 and P4-06. First, set P2-08 to 406 to enable the force output control function and then using P4-06 to force the digital outputs to be activated. Follow the setting method in Figure 4.5 to enter into Force Output Control operation mode. When P4-06 is set to 2, the digital output, DO2 is activated. When P4-06 is set to 7, the digital outputs, DO1, DO2 and DO3 are both activated. The parameter setting value of P4-06 is not retained when power is off. After re-power the servo drive, all digital outputs will return to the normal status. If P2-08 is set to 400, it also can switch the Force Output Control operation mode to normal Digital Output (DO) Control operation mode.

The DO function and status is determined by P2-18 to P2-22. This function is enabled only when Servo Off (the servo drive is disabled).

Figure 4.5



NOTE

1) As the display of P4-06 is hexadecimal, 0(zero) of the fifth digit will not show on the LED display.

4.4.4 DI Diagnosis Operation

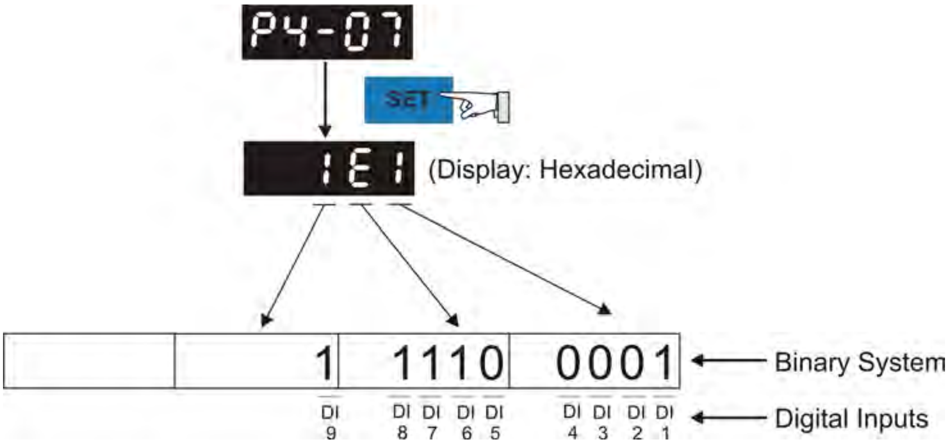
Following the setting method in Figure 4.6 can perform DI diagnosis operation (parameter P4-07, Input Status). According to the ON and OFF status of the digital inputs DI1 to DI9, the corresponding status will display on the servo drive LED display. When the Bit is set to “1”, it means that the corresponding digital input signal is ON. (Please also refer to Figure 4.6)

For example:

Suppose that the servo drive LED display is “1E1”.

“E” is hexadecimal, which is equal to “1110” in binary system, and it means that the digital inputs DI6 ~ DI8 are ON.

Figure 4.6



(Hexadecimal Display)

4.4.5 DO Diagnosis Operation

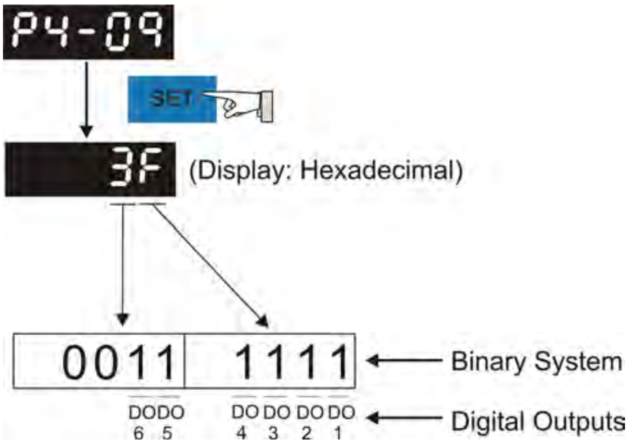
Following the setting method in Figure 4.7 can perform DO diagnosis operation (parameter P4-09, Output Status Display). According to the ON and OFF status of the digital outputs DO1 to DO6, the corresponding status will display on the servo drive LED display. When the Bit is set to “1”, it means that the corresponding digital output signal is ON. (Please also refer to Figure 4.7)

For example:

Suppose that the servo drive LED display is “3F”.

“F” is hexadecimal, which is equal to “1111” in binary system, and it means that the digital outputs DO1 ~ DO4 are ON.

Figure 4.7



(Hexadecimal Display)

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Chapter 5 Trial Run and Tuning Procedure

This chapter, which is divided into two parts, describes trial run for servo drive and motor. One part is to introduce the trial run without load, and the other part is to introduce trial run with load. Ensure to complete the trial run without load first before performing the trial run with load.

5.1 Inspection without Load

In order to prevent accidents and avoid damaging the servo drive and mechanical system, the trial run should be performed under no load condition (no load connected, including disconnecting all couplings and belts). Do not run servo motor while it is connected to load or mechanical system because the unassembled parts on motor shaft may easily disassemble during running and it may damage mechanical system or even result in personnel injury. After removing the load or mechanical system from the servo motor, if the servo motor can runs normally following up the normal operation procedure (when trial run without load is completed), then the users can connect to the load and mechanical system to run the servo motor.

DANGER

- ***In order to prevent accidents, the initial trial run for servo motor should be conducted under no load conditions (separate the motor from its couplings and belts).***
- ***Caution: Please perform trial run without load first and then perform trial run with load connected. After the servo motor is running normally and regularly without load, then run servo motor with load connected. Ensure to perform trial run in this order to prevent unnecessary danger.***

After power in connected to AC servo drive, the charge LED will light and it indicates that AC servo drive is ready. Please check the followings before trial run:

Inspection before operation (Control power is not applied)

- Inspect the servo drive and servo motor to insure they were not damaged.
- To avoid an electric shock, be sure to connect the ground terminal of servo drive to the ground terminal of control panel.

- Before making any connection, wait 10 minutes for capacitors to discharge after the power is disconnected, alternatively, use an appropriate discharge device to discharge.
- Ensure that all wiring terminals are correctly insulated.
- Ensure that all wiring is correct or damage and or malfunction may result.
- Visually check to ensure that there are not any unused screws, metal strips, or any conductive or inflammable materials inside the drive.
- Never put inflammable objects on servo drive or close to the external regenerative resistor.
- Make sure control switch is OFF.
- If the electromagnetic brake is being used, ensure that it is correctly wired.
- If required, use an appropriate electrical filter to eliminate noise to the servo drive.
- Ensure that the external applied voltage to the drive is correct and matched to the controller.

Inspection during operation (Control power is applied)

- Ensure that the cables are not damaged, stressed excessively or loaded heavily. When the motor is running, pay close attention on the connection of the cables and notice that if they are damaged, frayed or over extended.
- Check for abnormal vibrations and sounds during operation. If the servo motor is vibrating or there are unusual noises while the motor is running, please contact the dealer or manufacturer for assistance.
- Ensure that all user-defined parameters are set correctly. Since the characteristics of various machinery equipment are different, in order to avoid accident or cause damage, do not adjust the parameter abnormally and ensure the parameter setting is not an excessive value.
- Ensure to reset some parameters when the servo drive is off (Please refer to Chapter 7). Otherwise, it may result in malfunction.
- If there is no contact sound or there be any unusual noises when the relay of the servo drive is operating, please contact your distributor for assistance or contact with Delta.
- Check for abnormal conditions of the power indicators and LED display. If there is any abnormal condition of the power indicators and LED display, please contact your distributor for assistance or contact with Delta.

5.2 Applying Power to the Drive

The users please observe the following steps when applying power supply to the servo drive.

1. Please check and confirm the wiring connection between the drive and motor is correct.
    1) Terminal U, V, W and FG (frame ground) must connect to Red, White, Black and Green cables separately (U: Red, V: White, W: Black, FG: Green). If not connect to the specified cable and terminal, then the drive cannot control motor. The motor grounding lead, FG must connect to grounding terminal. For more information of cables, please refer to section 3.1.
    2) Ensure to connect encoder cable to CN2 connector correctly. If the users only desire to execute JOG operation, it is not necessary to make any connection to CN1 and CN3 connector. For more information of the connection of CN2 connector, please refer to Section 3.1 and 3.4.

DANGER

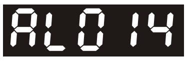
➢ ***Do not connect the AC input power (R, S, T) to the (U, V, W) output terminals. This will damage the AC servo drive.***

2. Main circuit wiring

   Connect power to the AC servo. For three-phase input power connection and single-phase input power connection, please refer to Section 3.1.3.

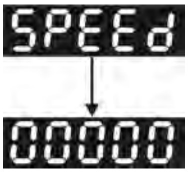
3. Turn the Power On

   The Power includes control circuit power (L1c, L2c) and main circuit power (R, S, T). When the power is on, the normal display should be shown as the following figure:



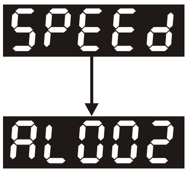
   As the default settings of digital input signal, DI6, DI7 and DI8 are Reverse Inhibit Limit (NL), Forward Inhibit Limit (PL) and Emergency Stop (EMGS) respectively, if the users do not want to use the default settings of DI6~DI8, the users can change their settings by using parameters P2-15 to P2-17 freely. When the setting value of parameters P2-15 to P2-17 is 0, it indicates the function of this DI signal is disabled. For more information of parameters P2-15 to P2-17, please refer to Chapter 7 “Parameters”.

   If the parameter P0-02 is set as motor speed (06), the normal display should be shown as the following figure:



   If there is no text or character displayed on the LED display, please check if the voltage of the control circuit terminal (L1c and L2c) is over low.

1) When display shows:



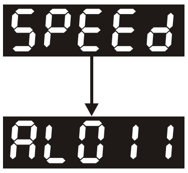
Over voltage:

The main circuit voltage has exceeded its maximum allowable value or input power is error (Incorrect power input).

Corrective Actions:

- ■ Use voltmeter to check whether the input voltage falls within the rated input voltage.
- ■ Use voltmeter to check whether the input voltage is within the specified limit.

2) When display shows:



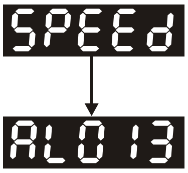
Encoder error:

Check if the wiring is correct. Check if the encoder wiring (CN2) of servo motor is loose or incorrect.

Corrective Actions:

- ■ Check if the users perform wiring recommended in the user manual.
- ■ Examine the encoder connector and cable.
- ■ Inspect whether wire is loose or not.
- ■ Check if the encoder is damaged.

3) When display shows:



Emergency stop activated:

Please check if any of digital inputs DI1~DI9 signal is set to “Emergency Stop” (EMGS).

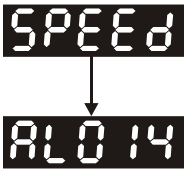
Corrective Actions:

- ■ If it does not need to use “Emergency Stop (EMGS)” as input signal, the users only need to confirm that if all of the digital inputs DI1~DI8 are not set to

“Emergency Stop (EMGS)”. (The setting value of parameter P2-10 to P2-17 and P2-36 is not set to 21.)

- If it is necessary to use “Emergency Stop (EMGS)” as input signal, the users only need to confirm that which of digital inputs DI1~DI9 is set to “Emergency Stop (EMGS)” and check if the digital input signal is ON (It should be activated).

4) When display shows:



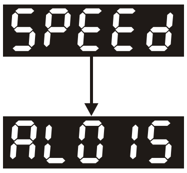
Reverse limit switch error:

Please check if any of digital inputs DI1~DI9 signal is set to “Reverse inhibit limit (NL)” and check if the signal is ON or not.

Corrective Actions:

- If it does not need to use “Reverse inhibit limit (NL)” as input signal, the users only need to confirm that if all of the digital inputs DI1~DI9 are not set to “Reverse inhibit limit (NL)”. (The setting value of parameter P2-10 to P2-17 and P2-36 is not set to 22.)
- If it is necessary to use “Reverse inhibit limit (NL)” as input signal, the users only need to confirm that which of digital inputs DI1~DI9 is set to “Reverse inhibit limit (NL)” and check if the digital input signal is ON (It should be activated).

5) When display shows:



Forward limit switch error:

Please check if any of digital inputs DI1~DI9 signal is set to “Forward inhibit limit (PL)” and check if the signal is ON or not.

Corrective Actions:

- If it is no need to use “Forward inhibit limit (PL)” as input signal, the users only need to confirm that if all of the digital inputs DI1~DI9 are not set to “Forward inhibit limit (PL)”. (The setting value of parameter P2-10 to P2-17 and P2-36 is not set to 23.)

- If it is necessary to use “Forward inhibit limit (PL)” as input signal, the users only need to confirm that which of digital inputs DI1~DI9 is set to “Forward inhibit limit (PL)” and check if the digital input signal is ON (It should be activated).

When “Digital Input 1 (DI1)” is set to Servo On (SON), if DI1 is set to ON (it indicates that Servo On (SON) function is enabled) and the following fault message shows on the display:

6) When display shows:

Overcurrent:

Corrective Actions:

- Check the wiring connections between the servo drive and motor.
- Check if the circuit of the wiring is closed.
- Remove the short-circuited condition and avoid metal conductor being exposed.

7) When display shows:

Undervoltage:

Corrective Actions:

- Check whether the wiring of main circuit input voltage is normal.
- Use voltmeter to check whether input voltage of main circuit is normal.
- Use voltmeter to check whether the input voltage is within the specified specification.

NOTE

---

1) If there are any unknown fault codes and abnormal display when applying power to the drive or servo on is activated (without giving any command), please inform the distributor or contact with Delta for assistance.

5.3 JOG Trial Run without Load

It is very convenient to use JOG trial run without load to test the servo drive and motor as it can save the wiring. The external wiring is not necessary and the users only need to connect the digital keypad to the servo drive. For safety, it is recommended to set JOG speed at low speed. Please refer to the following steps to perform JOG trial run without load.

STEP 1: Turn the drive ON through software. Ensure that the setting value of parameter P2-30 should be set to 1 (Servo On).

STEP 2: Set parameter P4-05 as JOG speed (unit: r/min). After the desired JOG speed is set, and then press SET key, the drive will enter into JOG operation mode automatically

STEP 3: The users can press UP and DOWN key to change JOG speed and press SHIFT key to adjust the digit number of the displayed value.

STEP 4: Pressing SET key can determine the speed of JOG operation.

STEP 5: Pressing UP key and the servo motor will run in CCW direction. After releasing UP key, the motor will stop running.

STEP 6: Pressing DOWN key and the servo motor will run in CW direction. After releasing DOWN key, the motor will stop running.

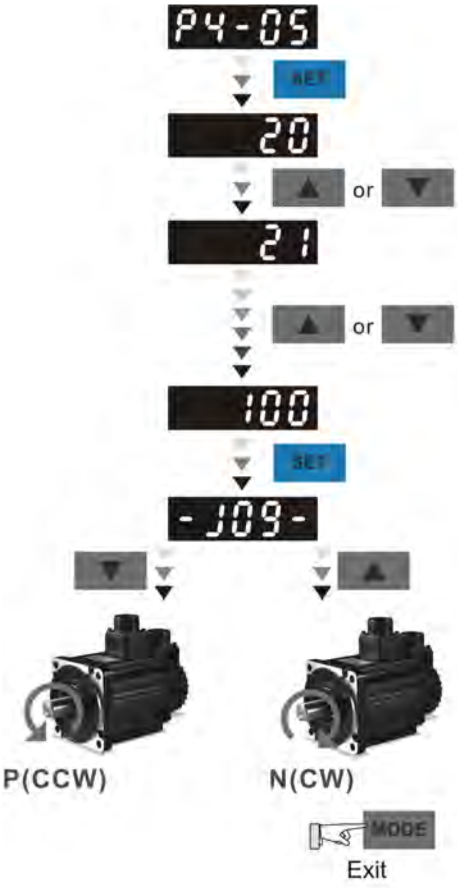
N (CW) and P(CCW) Definition:

CCW (Counterclockwise): when facing the servo motor shaft, CCW is reverse running.

CW (Clockwise): when facing the servo motor shaft, CW is forward running.

STEP 7: When pressing MODE key, it can exit JOG operation mode.

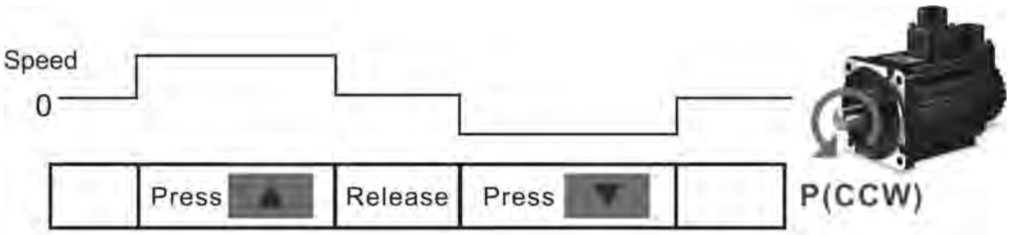
In the example below, the JOG speed is adjusted from 20r/min (Default setting) to 100r/min.



Pressing ▲ key and the servo motor will run in P(CCW) direction. After releasing UP key, the motor will stop running.

Pressing ▼ key and the servo motor will run in N(CW) direction. After releasing DOWN key, the motor will stop running.

P(CCW) and N(CW) Definition:
P(CCW, Counterclockwise): when facing the servo motor shaft, P is running in counterclockwise direction.
N(CW, Clockwise): when facing the servo motor shaft, N is running in clockwise direction.



If the servo motor does not rotate, please check if the wiring of U, V, W terminals and encoder is correct or not.

If the servo motor does not rotate properly, please check if the phase of U, V, W cables is connected correctly.

5.4 Speed Trial Run without Load

Before speed trial run, fix and secure the motor as possible to avoid the danger from the reacting force when motor speed changes.

STEP 1:

Set the value of parameter P1-01 to 02 and it is speed (S) control mode. After selecting the operation mode as speed (S) control mode, please restart the drive as P1-01 is effective only after the servo drive is restarted (after switching power off and on).

STEP 2:

In speed control mode, the necessary Digital Inputs are listed as follows:

Digital Input	Parameter Setting Value	Sign	Function Description	CN1 PIN No.
DI1	P2-10=101	SON	Servo On	DI1-=9
DI2	P2-11=109	TRQLM	Torque limit enabled	DI2-=10
DI3	P2-12=114	SPD0	Speed command selection	DI3-=34
DI4	P2-13=115	SPD1	Speed command selection	DI4-=8
DI5	P2-14=102	ARST	Reset	DI5-=33
DI6	P2-15=0	Disabled	This DI function is disabled	-
DI7	P2-16=0	Disabled	This DI function is disabled	-
DI8	P2-17=0	Disabled	This DI function is disabled	-
DI9	P2-36=0	Disabled	This DI function is disabled	-

By default, DI6 is the function of reverse inhibit limit, DI7 is the function of forward inhibit limit and DI6 is the function of emergency stop (DI8), if the users do not set the setting value of parameters P2-15 to P2-17 and P2-36 to 0 (Disabled), the faults (ALE13, 14 and 15) will occur (For the information of fault messages, please refer to Chapter 10). Therefore, if the users do not need to use these three digit inputs, please set the setting value of parameters P2-15 to P2-17 and P2-36 to 0 (Disabled) in advance.

All the digital inputs of Delta ASDA-B2 series are user-defined, and the users can set the DI signals freely. Ensure to refer to the definitions of DI signals before defining them (For the description of DI signals, please refer to Table 7.A in Chapter 7). If any alarm code displays after the setting is completed, the users can restart the drive or set DI5 to be activated to clear the fault. Please refer to section 5.2.

The speed command is selected by SPD0, SPD1. Please refer to the following table:

Speed Command No.	DI signal of CN1		Command Source	Content	Range
	SPD1	SPD0			
S1	0	0	External analog command	Voltage between V-REF and GND	-10V ~ +10V
S2	0	1	Internal parameter	P1-09	-50000 ~ 50000
S3	1	0		P1-10	-50000 ~ 50000
S4	1	1		P1-11	-50000 ~ 50000

0: indicates OFF (Normally Open); 1: indicates ON (Normally Closed)

The range of internal parameter is from -50000 to 50000.

Setting value of speed command = Setting range x unit (0.1 r/min).

For example:

If P1-09 is set to +30000, the setting value of speed command = +30000 x 0.1 r/min = +3000 r/min.

The settings of speed command:

P1-09 is set to 30000
P1-10 is set to 1000
P1-11 is set to -30000

Input value command	Rotation direction
+	CW
-	CCW

STEP 3:

1. The users can use DI1 to enable the servo drive (Servo ON).
2. If DI3 (SPD0) and DI4 (SPD1) are OFF both, it indicates S1 command is selected. At this time, the motor is operating according to external analog command.
3. If only DI3 is ON (SPD0), it indicates S2 command (P1-09 is set to 3000) is selected, and the motor speed is 3000r/min at this time.
4. If only DI4 is ON (SPD1), it indicates S3 command (P1-10 is set to 100) is selected, and the motor speed is 100r/min at this time.
5. If DI3 (SPD0) and DI4 (SPD1) are ON both, it indicates S4 command (P1-11 is set to -3000) is selected, and the motor speed is -3000r/min at this time.
6. Repeat the action of (3), (4), (5) freely.
7. When the users want to stop the speed trial run, use DI1 to disable the servo drive (Servo OFF).

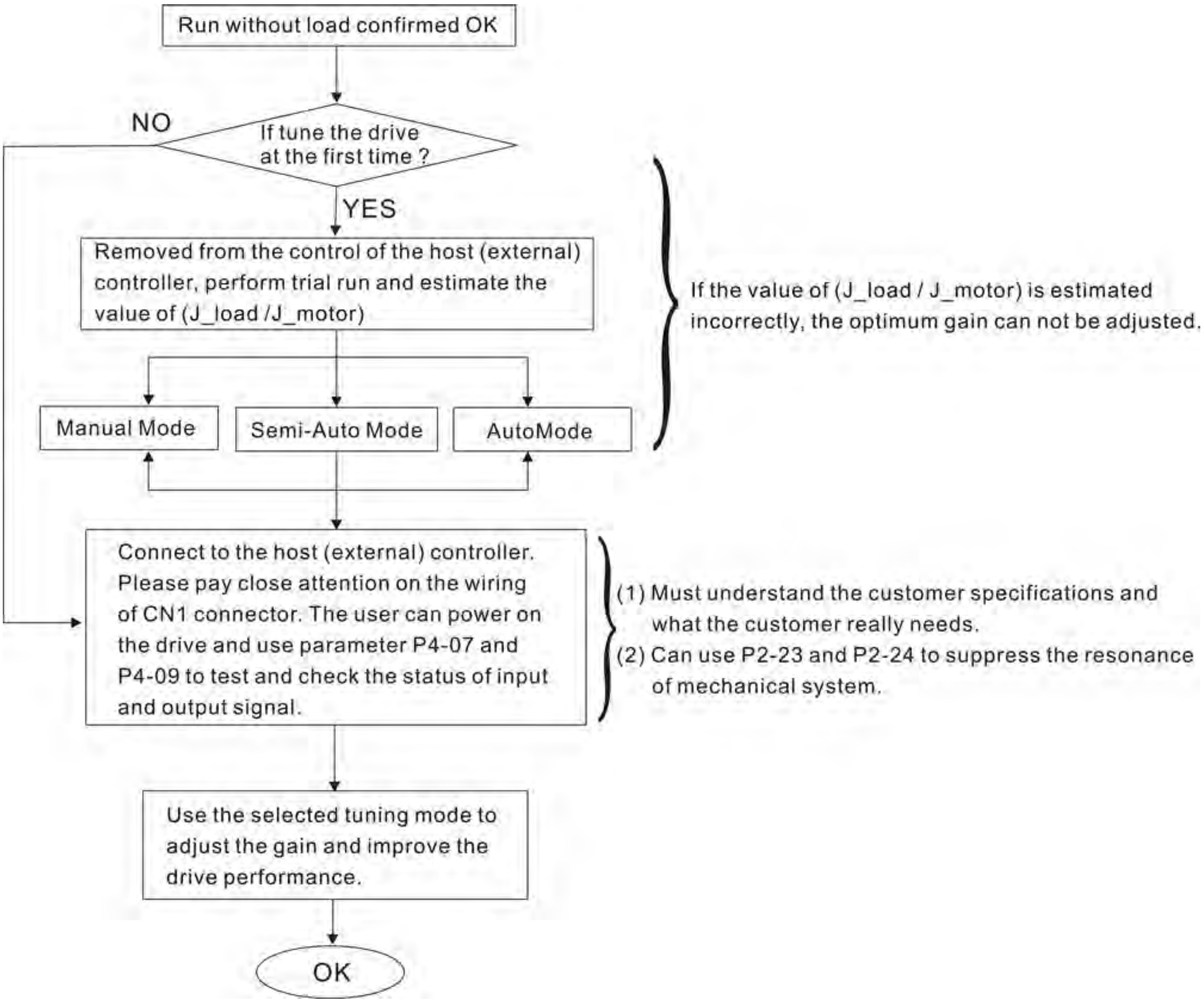
5.5 Tuning Procedure

Estimate the ratio of Load Inertia to Servo Motor Inertia (J_load /J_motor): JOG Mode

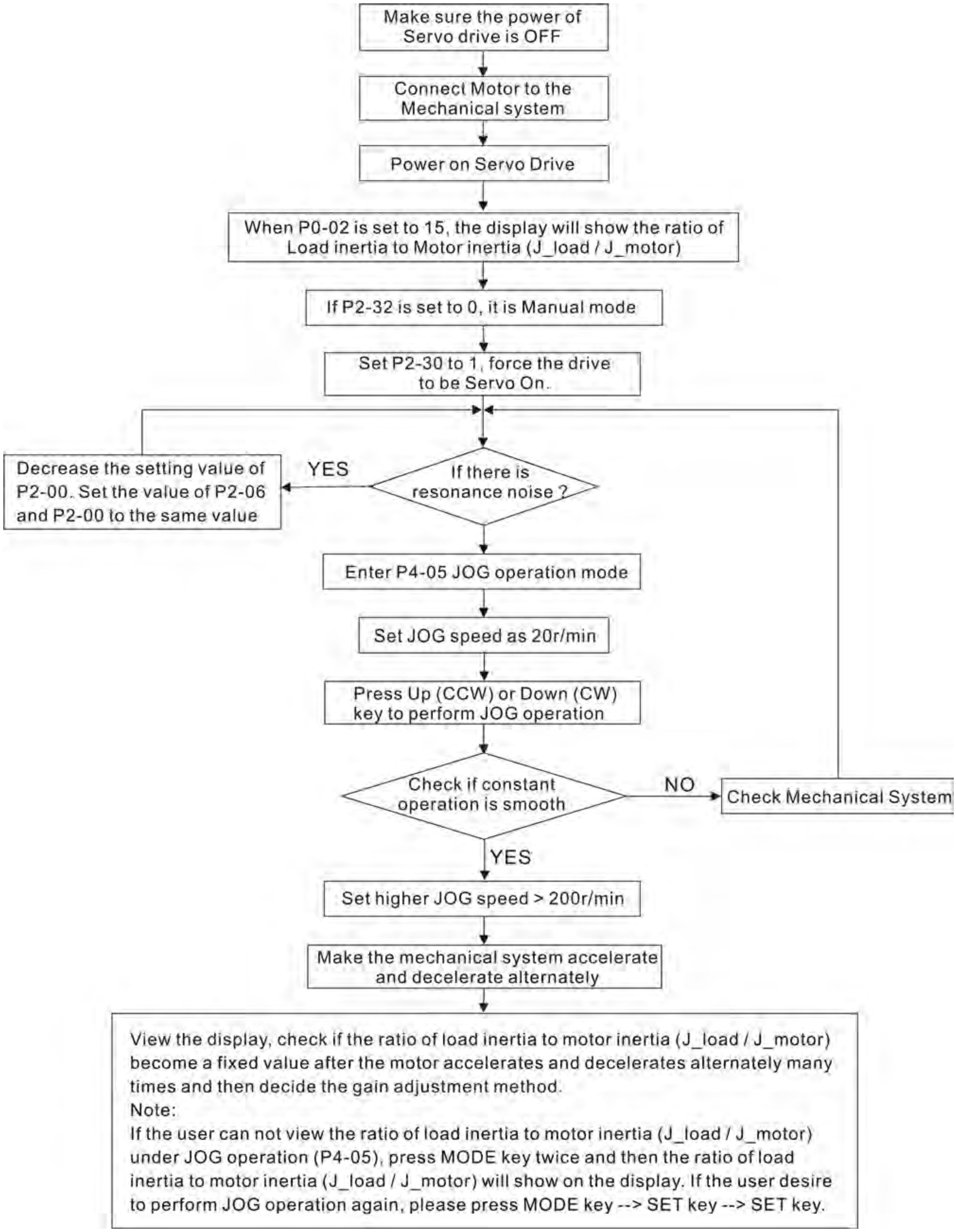
Tuning Procedure	Display
1. After wiring is completed, when power in connected to the AC servo drive, the right side display will show on the LCD display.	AL014
2. Press MODE key to enter into parameter mode.	P0-00
3. Press SHIFT key twice to select parameter group.	P2-00
4. Press UP key to view each parameter and select parameter P2-17.	P2-17
5. Press SET key to display the parameter value as shown on the right side.	21
6. Press SHIFT key twice to change the parameter values. Use UP key to cycle through the available settings and then press SET key to determine the parameter settings.	121
7. Press UP key to view each parameter and select parameter P2-30.	P2-30
8. Press SET key to display the parameter value as shown on the right side.	0
9. Select parameter value 1. Use UP key to cycle through the available settings.	1
10. At this time, the servo drive is ON and the right side display will appear next.	0
11. Press DOWN key three times to select the ratio of Load Inertia to Servo Motor Inertia (J_load /J_motor).	JL
12. Display the current ratio of Load Inertia to Servo Motor Inertia (J_load /J_motor). (5.0 is default setting.)	1.0
13. Press MODE key to select parameter mode.	P2-30
14. Press SHIFT key twice to select parameter group.	P4-00
15. Press UP key to select user parameter P4-05.	P4-05
16. Press SET key and JOG speed 20r/min will be displayed. Press UP and DOWN key to increase and decrease JOG speed. To press SHIFT key one time can add one digit number.	20 ↓ 200
17. Select desired JOG speed, press SET key and it will show the right side display.	-JOG-
18. Pressing UP key is forward rotation and pressing DOWN key is reverse rotation.	
19. Execute JOG operation in low speed first. After the machine is running smoothly, then execute JOG operation in high speed.	

Tuning Procedure	Display
20. The ratio of Load Inertia to Servo Motor Inertia (J_load /J_motor) cannot be shown in the display of JOG parameter P4-05 operation. Please press MODE key twice continuously and the users can see the ratio of Load Inertia to Servo Motor Inertia (J_load /J_motor). Then, execute JOG operation again, press MODE key once and press SET key twice to view the display on the keypad. Check if the value of J_load /J_motor is adjusted to a fixed value and displayed on the keypad after acceleration and deceleration repeatedly.	

5.5.1 Tuning Flowchart


Run without load confirmed OK
NO
If tune the drive at the first time ?
YES
Removed from the control of the host (external) controller, perform trial run and estimate the value of (J_load /J_motor)
If the value of (J_load / J_motor) is estimated incorrectly, the optimum gain can not be adjusted.
Manual Mode
Semi-Auto Mode
AutoMode
Connect to the host (external) controller. Please pay close attention on the wiring of CN1 connector. The user can power on the drive and use parameter P4-07 and P4-09 to test and check the status of input and output signal.
(1) Must understand the customer specifications and what the customer really needs.
(2) Can use P2-23 and P2-24 to suppress the resonance of mechanical system.
Use the selected tuning mode to adjust the gain and improve the drive performance.
OK

5.5.2 Load Inertia Estimation Flowchart


Make sure the power of Servo drive is OFF
Connect Motor to the Mechanical system
Power on Servo Drive
When P0-02 is set to 15, the display will show the ratio of Load inertia to Motor inertia (J_load / J_motor)
If P2-32 is set to 0, it is Manual mode
Set P2-30 to 1, force the drive to be Servo On.
Decrease the setting value of P2-00. Set the value of P2-06 and P2-00 to the same value
YES
If there is resonance noise ?
Enter P4-05 JOG operation mode
Set JOG speed as 20r/min
Press Up (CCW) or Down (CW) key to perform JOG operation
Check if constant operation is smooth
NO
Check Mechanical System
YES
Set higher JOG speed > 200r/min
Make the mechanical system accelerate and decelerate alternately

View the display, check if the ratio of load inertia to motor inertia (J_load / J_motor) become a fixed value after the motor accelerates and decelerates alternately many times and then decide the gain adjustment method.

Note:

If the user can not view the ratio of load inertia to motor inertia (J_load / J_motor) under JOG operation (P4-05), press MODE key twice and then the ratio of load inertia to motor inertia (J_load / J_motor) will show on the display. If the user desire to perform JOG operation again, please press MODE key --> SET key --> SET key.

5.5.3 Auto Mode Tuning Flowchart

Set P2-32 to 1 (1: Auto Mode [Continuous adjustment])

The servo drive will continuously estimate the system inertia, save the measured load inertia value automatically and memorized in P1-37 every 30 minutes by referring to the frequency response settings of P2-31.

P2-31 : Auto Mode Stiffness Setting (Default setting: 80)

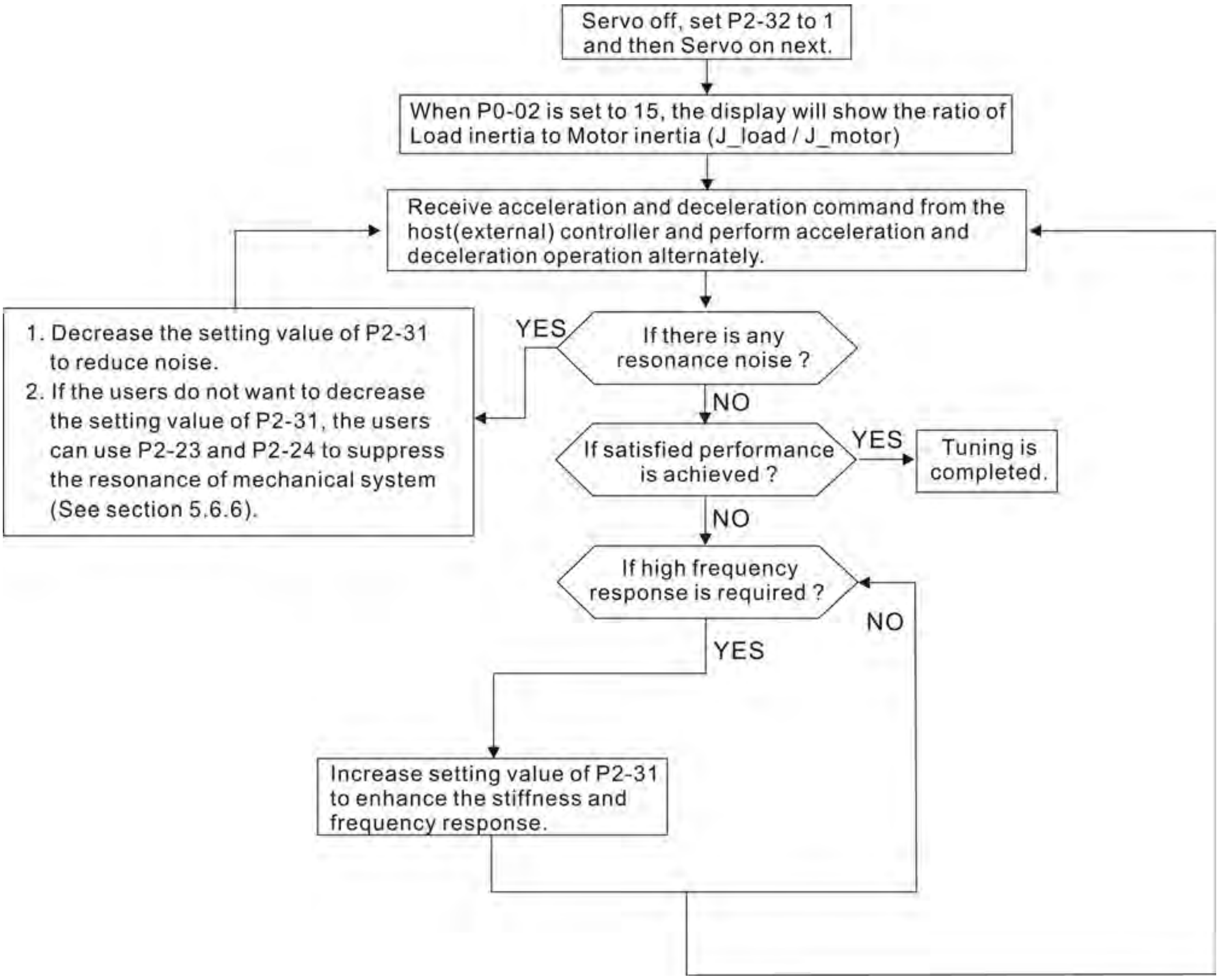
In Auto mode and Semi-Auto mode, the speed loop frequency response settings are as follows:

1 ~ 50Hz : Low stiffness and low frequency response

51 ~ 250Hz : Medium stiffness and medium frequency response

251 ~ 550Hz : High stiffness and high frequency response

Adjust P2-31: Increase the setting value of P2-31 to enhance the stiffness or reduce the noise. Continuously perform the adjustment until the satisfactory performance is achieved.


Servo off, set P2-32 to 1 and then Servo on next.
When P0-02 is set to 15, the display will show the ratio of Load inertia to Motor inertia (J_load / J_motor)
Receive acceleration and deceleration command from the host(external) controller and perform acceleration and deceleration operation alternately.
If there is any resonance noise ?
YES
1. Decrease the setting value of P2-31 to reduce noise.
2. If the users do not want to decrease the setting value of P2-31, the users can use P2-23 and P2-24 to suppress the resonance of mechanical system (See section 5.6.6).
NO
If satisfied performance is achieved ?
YES
Tuning is completed.
NO
If high frequency response is required ?
NO
YES
Increase setting value of P2-31 to enhance the stiffness and frequency response.

5.5.4 Semi-Auto Mode Tuning Flowchart

Set P2-32 to 2 (2: Semi-Auto Mode [Non-continuous adjustment])

The servo drive will continuously perform the adjustment for a period of time. After the system inertia becomes stable, it will stop estimating the system inertia, save the measured load inertia value automatically, and memorized in P1-37. When switching from other modes, such as Manual Mode or Auto Mode, to Semi-Auto Mode, the servo drive will perform continuous adjustment for estimating the load inertia (P1-37) again. The servo drive will refer to the frequency response settings of P2-31 when estimating the system inertia.

P2-31 : Auto Mode Stiffness Setting (Default setting: 80)

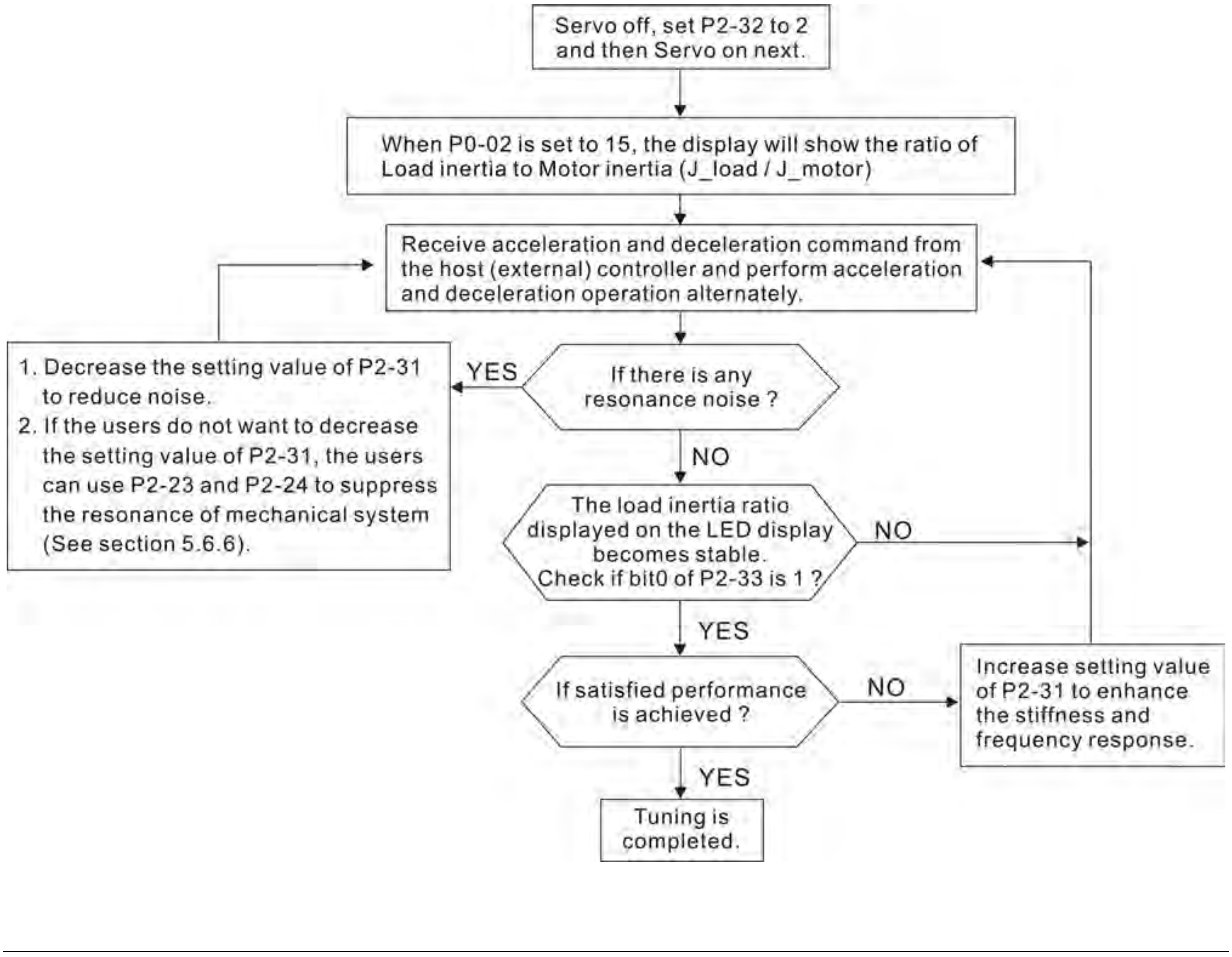
In Auto mode and Semi-Auto mode, the speed loop frequency response settings are as follows:

1 ~ 50Hz : Low stiffness and low frequency response

51 ~ 250Hz : Medium stiffness and medium frequency response

251 ~ 550Hz : High stiffness and high frequency response

Adjust P2-31: Increase the setting value of P2-31 to enhance the frequency response or reduce the noise. Continuously perform the adjustment until the satisfactory performance is achieved.


Servo off, set P2-32 to 2 and then Servo on next.
When P0-02 is set to 15, the display will show the ratio of Load inertia to Motor inertia (J_load / J_motor)
Receive acceleration and deceleration command from the host (external) controller and perform acceleration and deceleration operation alternately.
If there is any resonance noise ?
YES
1. Decrease the setting value of P2-31 to reduce noise.
2. If the users do not want to decrease the setting value of P2-31, the users can use P2-23 and P2-24 to suppress the resonance of mechanical system (See section 5.6.6).
NO
The load inertia ratio displayed on the LED display becomes stable. Check if bit0 of P2-33 is 1 ?
NO
YES
If satisfied performance is achieved ?
NO
Increase setting value of P2-31 to enhance the stiffness and frequency response.
YES
Tuning is completed.

NOTE

1) When bit0 of P2-33 is set to 1, it indicates that the system inertia estimation of semi-auto mode has been completed and the measured load inertia value is saved and memorized in P1-37 automatically.

2) If reset bit0 of P2-33 to 0, it will start estimating the system inertia again.

5.5.5 Limit of Load Inertia Estimation

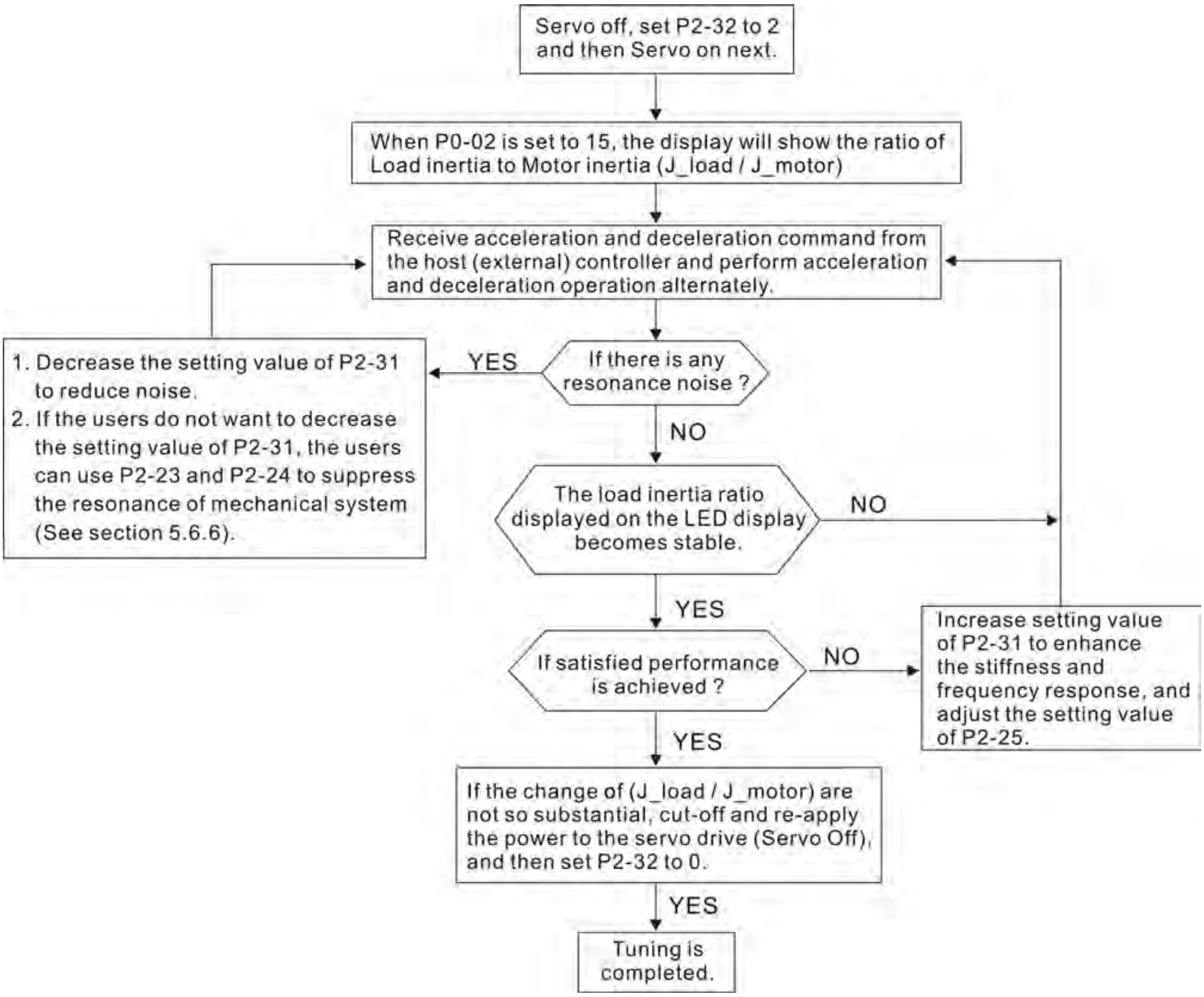
The accel. / decel. time for reaching 2000r/min must be below 1 second.

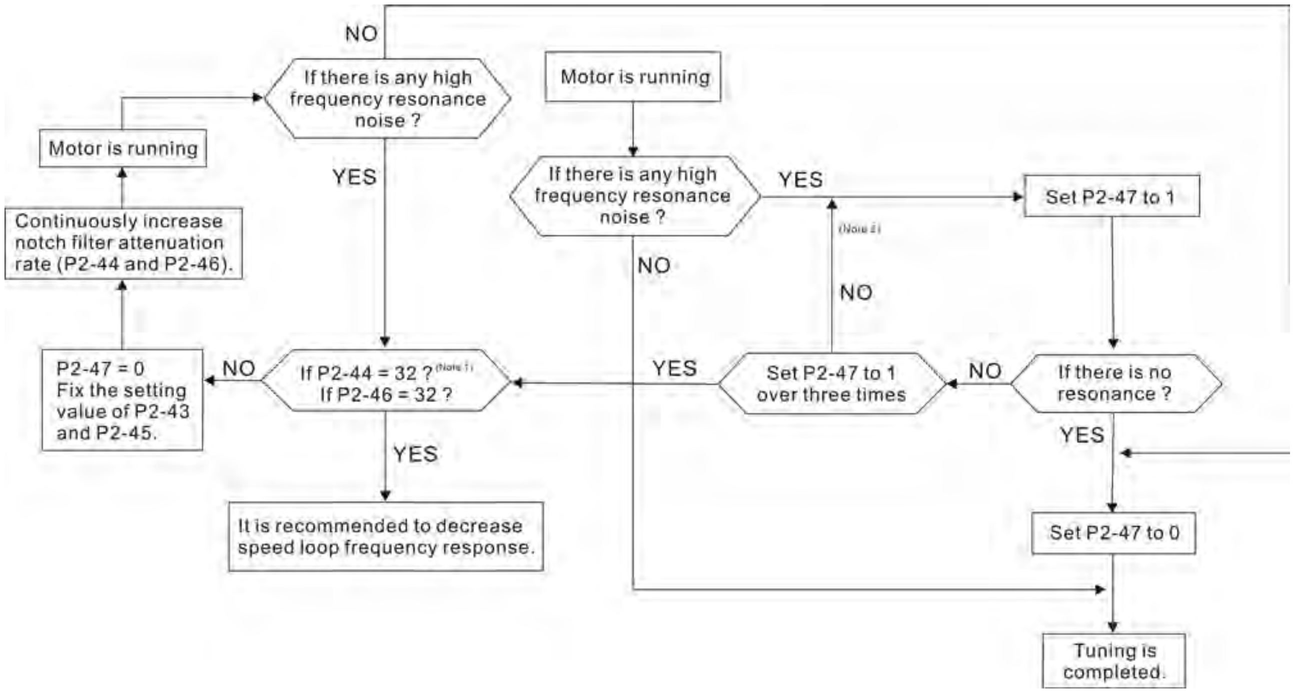
The rotation speed must be above 200r/min.

The load inertia must be 100 multiple or less of motor inertia.

The change of external force and the inertia ratio can not be too much.

In Auto Mode (P2-32 is set to 1), the measured load inertia value will be saved automatically and memorized in P1-37 every 30 minutes. In Semi-Auto Mode, it will stop estimating the load inertia after a period of continuous adjustment time when the system inertia becomes stable. The measured load inertia value will be saved automatically and memorized in P1-37 when load inertia estimation is stopped.


Servo off, set P2-32 to 2 and then Servo on next.
When P0-02 is set to 15, the display will show the ratio of Load inertia to Motor inertia (J_load / J_motor)
Receive acceleration and deceleration command from the host (external) controller and perform acceleration and deceleration operation alternately.
If there is any resonance noise ?
YES
1. Decrease the setting value of P2-31 to reduce noise.
2. If the users do not want to decrease the setting value of P2-31, the users can use P2-23 and P2-24 to suppress the resonance of mechanical system (See section 5.6.6).
NO
The load inertia ratio displayed on the LED display becomes stable.
NO
YES
If satisfied performance is achieved ?
NO
Increase setting value of P2-31 to enhance the stiffness and frequency response, and adjust the setting value of P2-25.
YES
If the change of (J_load / J_motor) are not so substantial, cut-off and re-apply the power to the servo drive (Servo Off), and then set P2-32 to 0.
YES
Tuning is completed.


NO
If there is any high frequency resonance noise ?
Motor is running
Motor is running
YES
Continuously increase notch filter attenuation rate (P2-44 and P2-46).
If there is any high frequency resonance noise ?
YES
Set P2-47 to 1
(Note 2)
NO
NO
P2-47 = 0
Fix the setting value of P2-43 and P2-45.
NO
If P2-44 = 32 ? (Note 1)
If P2-46 = 32 ?
YES
Set P2-47 to 1 over three times
NO
If there is no resonance ?
YES
YES
It is recommended to decrease speed loop frequency response.
Set P2-47 to 0
Tuning is completed.

NOTE

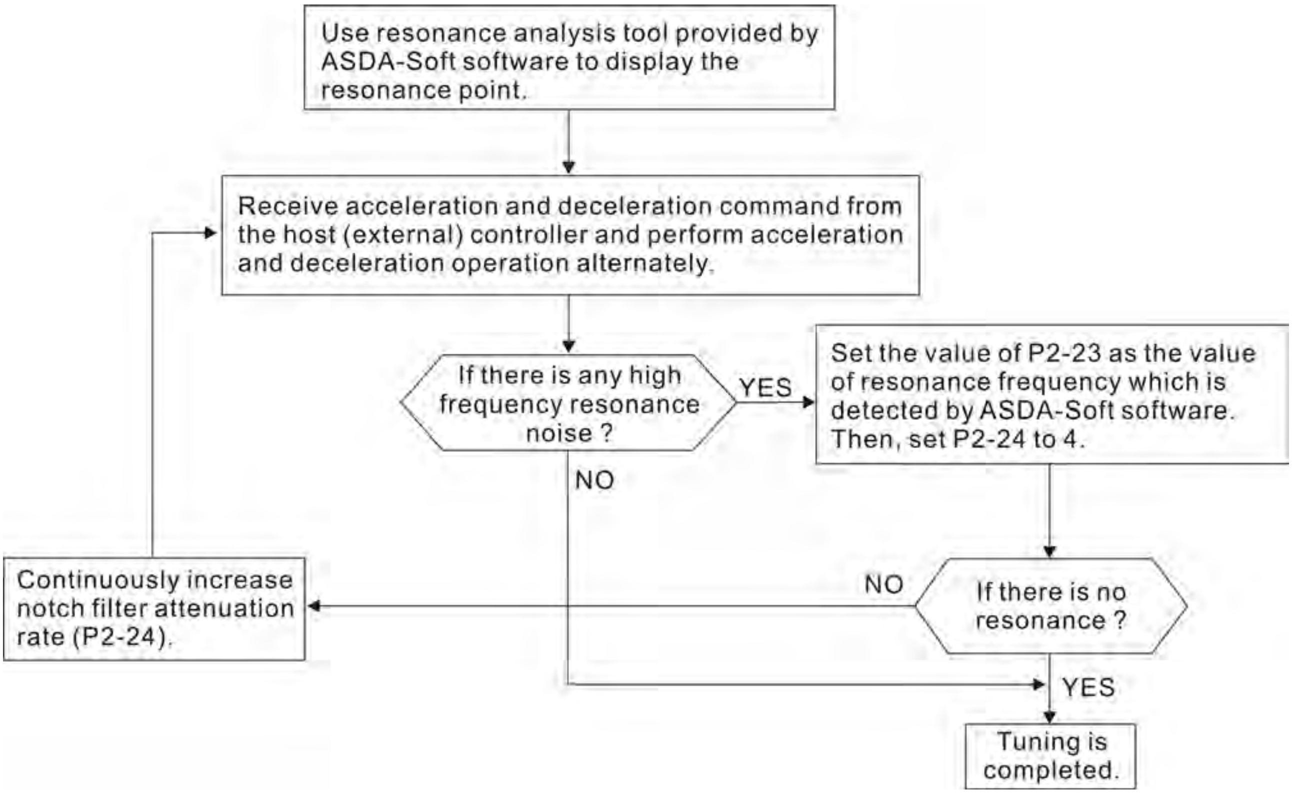
1) Parameters P2-44 and P2-46 are used to set notch filter attenuation rate. If the resonance can not be suppressed when the setting values of P2-44 and P2-46 are set to 32bB (the maximum value), please decrease the speed loop frequency response. After setting P2-47, the users can check the setting values of P2-44 and P2-46. If the setting value of P2-44 is not 0, it indicates that one resonance frequency exists in the system and then the users can read P2-43, i.e. the frequency (unit is Hz) of the resonance point. When there is any resonance point in the system, its information will be shown in P2-45 and P2-46 as P2-43 and P2-44.

2) If the resonance conditions are not improved when P2-47 is set to 1 for over three times, please adjust notch filters (resonance suppression parameters) manually to or eliminate the resonance.

5.5.6 Mechanical Resonance Suppression Method

In order to suppress the high frequency resonance of the mechanical system, ASDA-B2 series servo drive provides three notch filters (resonance suppression parameters) for resonance suppression. Two notch filters can be set to suppress the resonance automatically. If the users do not want to suppress the resonance automatically, these two notch filter can also be set to or eliminate the resonance manually.

Please refer to the following flowchart for manual adjustment.


Use resonance analysis tool provided by ASDA-Soft software to display the resonance point.
Receive acceleration and deceleration command from the host (external) controller and perform acceleration and deceleration operation alternately.
If there is any high frequency resonance noise ?
YES
Set the value of P2-23 as the value of resonance frequency which is detected by ASDA-Soft software. Then, set P2-24 to 4.
NO
Continuously increase notch filter attenuation rate (P2-24).
NO
If there is no resonance ?
YES
Tuning is completed.

5.5.7 Relationship between Tuning Modes and Parameters

Tuning Mode	P2-32	AutoSet Parameter	User-defined Parameter	Gain Value
Manual Mode	0(Default setting)	None	P1-37 (Ratio of Load Inertia to Servo Motor Inertia [J_load / J_motor]) P2-00 (Proportional Position Loop Gain) P2-04 (Proportional Speed Loop Gain) P2-06 (Speed Integral Compensation) P2-25 (Low-pass Filter Time Constant of Resonance Suppression) P2-26 (External Anti-Interference Gain)	Fixed
Auto Mode [Continuous Adjustment]	1	P1-37 P2-00 P2-02 P2-04 P2-06 P2-25 P2-26 P2-49	P2-31 (Auto Stiffness and Frequency response Level)	Continuous Adjusting (every 30 minutes)
Semi-Auto Mode [Non-continuous Adjustment]	2	P1-37 P2-00 P2-02 P2-04 P2-06 P2-25 P2-26 P2-49	P2-31 (Auto Stiffness and Frequency response Level)	Non-continuous Adjusting (stop after a period of time)

When switching mode #1 to #0, the setting value of P2-00, P2-02, P2-04, P2-06, P2-25, P2-26 and P2-49 will change to the value that measured in #1 auto-tuning mode.

When switching mode #2 to #0, the setting value of P2-00, P2-02, P2-04, P2-06, P2-25, P2-26 and P2-49 will change to the value that measured in #2 semi-auto tuning mode.

5.5.8 Gain Adjustment in Manual Mode

The position and speed responsiveness selection is depending on and determined by the the control stiffness of machinery and conditions of applications. Generally, high reponsiveness is essential for the high frequency positioning control of mechanical facilities and the applications of high precision process system. However, the higher responsiveness may easily result in the resonance of machinery system. Therefore, for the applications of high responsiveness, the machinery system with control stiffness is needed to avoid the resonance. Especially when adjusting the responsiveness of unfamiliar machinery system, the users can gradually increase the gain setting value to improve responsiveness untill the resonance occurs, and then decrease the gain setting value. The relevant parameters and gain adjusting methods are described as follows:

- KPP, Parameter P2-00 Proportional Position Loop Gain

  This parameter is used to determine the responsiveness of position loop (position loop gain). It could be used to increase stiffness, expedite position loop response and reduce position error. When the setting value of KPP is higher, the response to the position command is quicker, the position error is less and the settling time is also shorter. However, if the setting value is over high, the machinery system may generate vibration or noise, or even overshoot during positioning. The position loop responsiveness is calculated as follows:

  $$\text{Position Loop Frequency Response (Hz)} = \frac{\text{KPP}}{2\pi}$$

- KVP, Parameter P2-04 Proportional Speed Loop Gain

  This parameter is used to determine the frequency response of speed loop (speed loop gain). It could be used to expedite speed loop response. When the setting value of KVP is higher, the response to the speed command is quicker. However, if the setting value is over high, it may result in the resonance of machinery system. The frequency response of speed loop must be higher than the 4~6 times of the frequency response of position loop. If frequency response of position loop is higher than the frequency response of speed loop, the machinery system may generate vibration or noise, or even overshoot during positioning. The speed loop frequency response is calculated as follows:

  $$\text{Speed Loop Frequency Response } f_v = \left(\frac{\text{KVP}}{2\pi}\right) \text{X} \left[\frac{(1+\text{P1-37}/10)}{(1+\text{JL}/\text{JM})}\right] \text{Hz}$$

  JM: Motor Inertia
  JL: Load Inertia
  P1-37: 0.1 times

  When the value of P1-37 (no matter it is the measured load inertia value or the set load inertia value) is equal to the actual load inertia value, the actual speed loop frequency response will be:

$f_v = \frac{KVP}{2\pi}$ Hz.

- KVI, Parameter P2-06 Speed Integral Compensation

If the setting value of KVI is higher, the capability of decreasing the speed control deviation is better. However, if the setting value is over high, it may easily result in the vibration of machinery system. The recommended setting value is as follows:

KVI (Parameter P2-06) ≤ 1.5 x Speed Loop Frequency Response

- NLP, Parameter P2-25 Low-pass Filter Time Constant of Resonance Suppression

When the value of (J_load / J_motor) is high, the responsiveness of speed loop may decrease. At this time, the users can increase the setting value of KVP (P2-04) to keep the responsiveness of speed loop. However, when increasing the setting value of KVP (P2-04), it may easily result in the vibration of machinery system. Please use this parameter to suppress or eliminate the noise of resonance. If the setting value of NLP is higher, the capability of improving the noise of resonance is better. However, if the setting value is over high, it may easily lead to the instability of speed loop and overshoot of machinery system.

The recommended setting value is as follows:

$$\text{NLP (Parameter P2-25)} \leq \frac{10000}{6 \times \text{Speed Loop Frequency Response (Hz)}}$$

- DST, Parameter P2-26 External Anti-Interference Gain

This parameter is used to enhance the anti-interference capability and reduce the occurrence of overshoot. The default setting is 0 (Disabled). It is not recommended to use it in manual mode only when performing a few tuning on the value gotten through P2-32 AutoMode (PDFF) (setting value is 5, mode 5) automatically (The setting value of P2-26 will change to the value that measured in mode 5 (AutoMode (PDFF)) when switching mode 5 ((AutoMode (PDFF)) to mode 0 (Manual mode)).

- PFG, Parameter P2-02 Position Feed Forward Gain

This parameter is used to reduce position error and shorten the positioning settling time. However, if the setting value is over high, it may easily lead to the overshoot of machinery system. If the value of electronic gear ratio (1-44/1-45) is over than 10, the machinery system may also easily generate vibration or noise.

Chapter 6 Control Modes of Operation

6.1 Control Modes of Operation

The Delta ASDA-B2 series can be programmed to provide six single and five dual modes of operation. Their operation and description is listed in the following table.

Mode		Code	Description
Single Mode	External Position Control	P	External Position control mode for the servo motor is achieved via an external pulse command.
	Speed Control	S	(External / Internal) Speed control mode for the servo motor can be achieved via parameters set within the controller or from an external analog -10 ~ +10 V_{DC} command. Control of the internal speed mode is via the Digital Inputs (DI). (A maximum of three speeds can be stored internally).
	Internal Speed Control	Sz	Internal Speed control mode for the servo motor is only achieved via parameters set within the controller. Control of the internal speed mode is via the Digital Inputs (DI). (A maximum of three speeds can be stored internally).
	Torque Control	T	(External / Internal) Torque control mode for the servo motor can be achieved via parameters set within the controller or from an external analog -10 ~ +10 V_{DC} command. Control of the internal torque mode is via the Digital Inputs (DI). (A maximum of three torque levels can be stored internally).
	Internal Torque Control	Tz	Internal Torque control mode for the servo motor is only achieved via parameters set within the controller. Control of the internal torque mode is via the Digital Inputs (DI). (A maximum of three torque levels can be stored internally).
Dual Mode		S-P	Either S or P control mode can be selected via the Digital Inputs (DI)
		T-P	Either T or P control mode can be selected via the Digital Inputs (DI)
		S-T	Either S or T control mode can be selected via the Digital Inputs (DI)

The steps of changing mode:

(1) Switching the servo drive to Servo Off status. Turning SON signal of Digit input to be off can complete this action.

(2) Using parameter P1-01. (Refer to chapter 7).

(3) After the setting is completed, cut the power off and restart the drive again.

The following sections describe the operation of each control mode, including control structure, command source and loop gain adjustment, etc.

6.2 Position Control Mode

The position control mode is usually used for the applications requiring precision positioning, such as industry positioning machine, indexing table etc. The external pulse train with direction which can control the rotation angle of servo motor. The max. input frequency for the external pulse command is 4Mpps.

For the closed-loop positioning, speed control loop is the principal part and the auxiliary parameters are position loop gain and feed forward compensation. The users can also select two kinds of tuning mode (Manual/Auto modes) to perform gain adjustment. This Section 6.2 mainly describes the applicability of loop gain adjustment and feed forward compensation of Delta servo system.

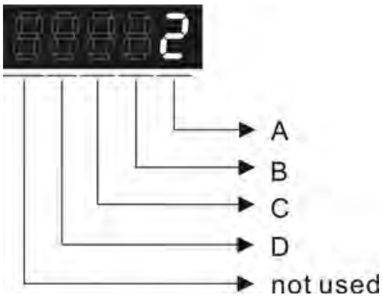
6.2.1 Command Source of Position (PT) Control Mode

The command source of P mode is external pulse train input form terminals. There are three types of pulse input and each pulse type is with·logic type (positive (+), negative (-)). They all can be set in parameter P1-00. Please refer to the following relevant parameters:

P1-00▲	**PTT**	**External Pulse Input Type**	**Address: 0100H 0101H**

Operation Interface:	Keypad/Software	Communication	Related Section: Section 6.2.1
Default:	0x2		
Control Mode:	PT		
Unit:	-		
Range:	0 ~ 1142		
Data Size:	16-bit		
Display Format:	Hexadecimal		

Settings:



A: Input pulse type

0: AB phase pulse (4x) (Quadrature Input)
1: Clockwise (CW) + Counterclockwise(CCW) pulse
2: Pulse + Direction
3: Other settings:

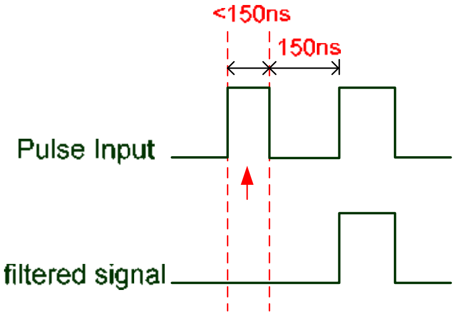
B: Input pulse filter

This setting is used to suppress or reduce the chatter caused by the noise, etc. However, if the instant input pulse filter frequency is over high, the frequency that exceeds the setting value will be regarded as noise and filtered.

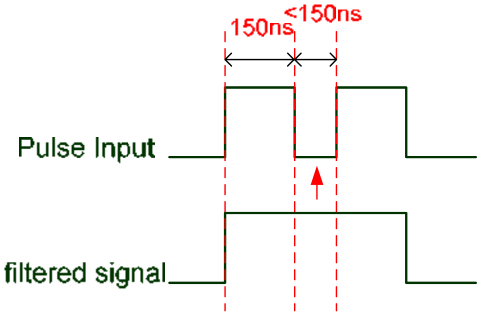
Setting Value	Low-speed Filter Frequency (Min. Filter Frequency (see note 1))	Setting Value	High-speed Filter Frequency (Min. Filter Frequency (see note 1))
0	0.83Mpps (600ns)	0	3.33Mpps (150ns)
1	208Kpps (2.4us)	1	0.83Mpps (600ns)
2	104Kpps (4.8us)	2	416Kpps (1.2us)
3	52Kpps (9.6us)	3	208Kpps (2.4us)
4	No Filter Function	4	No Filter Function

Please note:

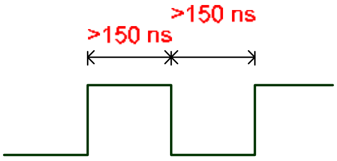
1.



When this pulse frequency is less than 150 ns, this signal will be regarded as a low-level pulse and two input pulses will be regarded as one input pulse.



When this pulse frequency is less than 150 ns, this signal will be regarded as a high-level pulse and two input pulses will be regarded as one input pulse.

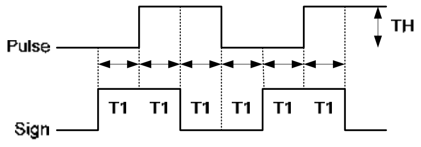
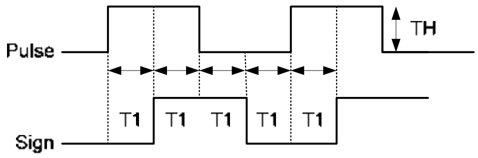
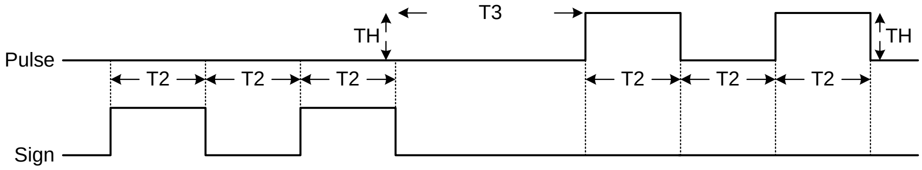
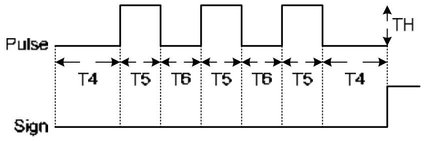
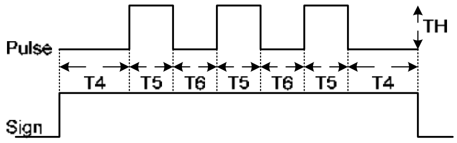
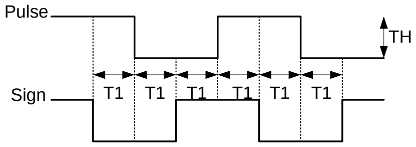
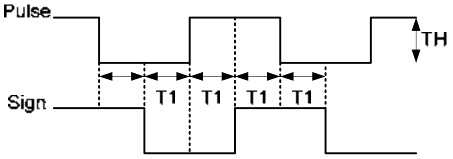
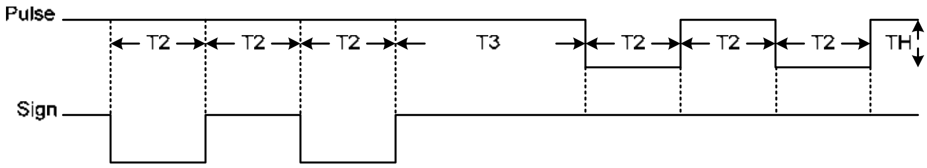
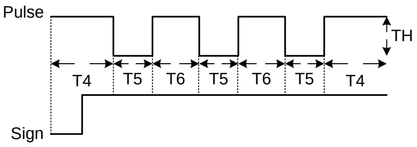
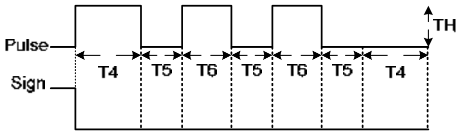


When the pulse frequencies of high-level duty and low-level duty both are greater than 150 ns, the signal will not be filtered (that is, the pulse command will pass through).

If an input pulse of 2~4MHz is used, it is recommended to change the setting value B (Input pulse filter) and set this setting value to 4. Please note that this function is available for DSP version V1.036 sub05, CPLD version V10 and later models only.

Note: If the signal is a 4Mpps high input pulse, setting the value B to 4 is able to ensure that the signal will not be filtered and will be certainly delivered.

C: Input polarity

Logic		Pulse Type	Forward	Reverse
0	Positive Logic	AB phase pulse		
		CW + CCW pulse		
		Pulse + Direction		
1	Negative Logic	AB phase pulse		
		CW + CCW pulse		
		Pulse + Direction		

Pulse specification		Max. input pulse frequency	Min. time width					
			T1	T2	T3	T4	T5	T6
High-speed pulse	Line driver	4Mpps	62.5ns	125ns	250ns	200ns	125ns	125ns
Low-speed pulse	Line driver	500Kpps	0.5μs	1μs	2μs	2μs	1μs	1μs
	Open collector	200Kpps	1.25μs	2.5μs	5μs	5μs	2.5μs	2.5μs

Pulse specification		Max. input pulse frequency	Voltage specification	Forward specification
High-speed pulse	Line driver	4Mpps	5V	< 25mA
Low-speed pulse	Line driver	500Kpps	2.8V ~ 3.7V	< 25mA
	Open collector	200Kpps	24V (Max.)	< 25mA

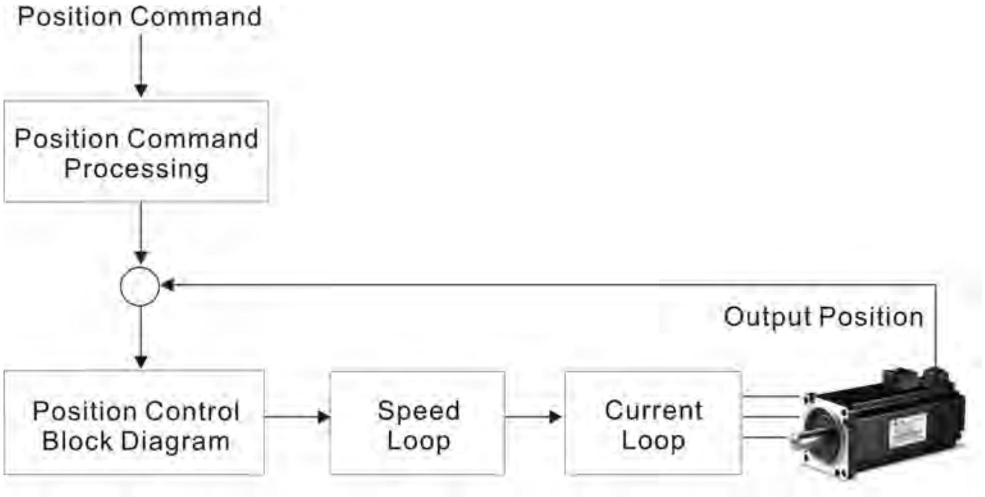
D: Source of pulse command

Setting value	Input pulse interface	Remark
0	Open collector for low-speed pulse	CN1 Terminal Identification: PULSE, SIGN
1	Line driver for high-speed pulse	CN1 Terminal Identification: PULSE_D, SIGN_D

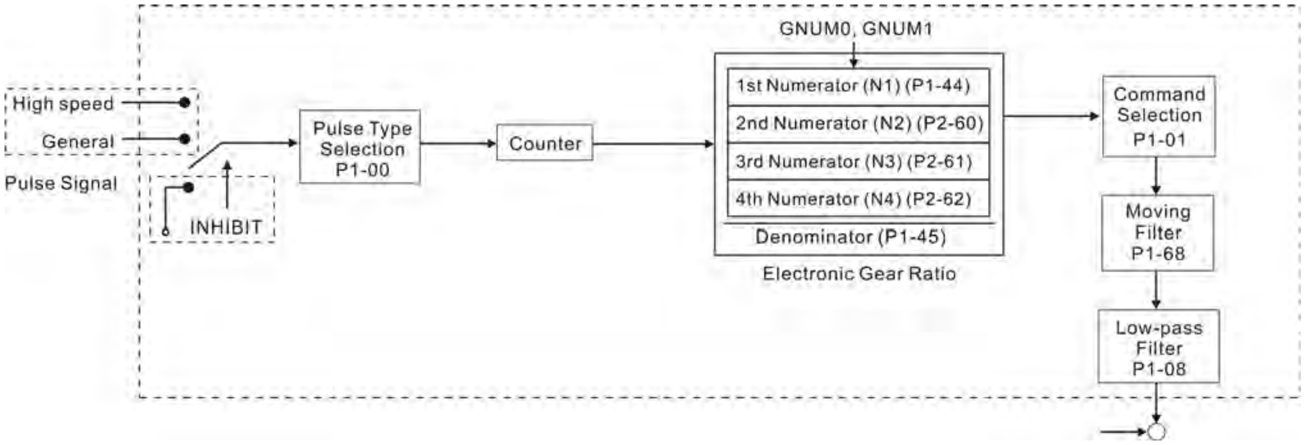
Position pulse can be input from these terminals, /PULSE (41), PULSE (43), HPULSE (38), /HPULSE (36), /SIGN (37), SIGN (39) and HSIGN (42), /HSIGN (40). It can be an open-collector circuit or line driver circuit. For the detail wiring, please refer to 3.6.1.

6.2.2 Structure of Position Control Mode

Basic Structure:



In order to pursue the goal of perfection in position control, the pulse signal should be modified through position command processing and the structure is shown as the figure below:



Using parameter P1-01 can select P mode. Electronic gear ratio can be set in P modes to set proper position revolution. ASDA-B2 series servo drive also provides low-pass filter, which are used whenever the motor and load need to be operated more smoothly. As for the information of electronic gear ratio, and low-pass filter, please refer to the following sections 6.2.3 and 6.2.4.

Pulse Inhibit Input Function (INHP)

INHP is activated via digital inputs (Please refer to parameter P2-10 ~ P2-17，P2-36 and DI INHP(07) in Table 7.1).When the drive is in position mode, if INHP is activated, the external pulse input command is not valid and the motor will stop.

6.2.3 Electronic Gear Ratio

Relevant parameters:

P1-44▲	**GR1**	**Electronic Gear Ratio (1st Numerator) (N1)**		**Address: 0158H 0159H**
	Operation Interface:	Keypad/Software	Communication	Related Section: Section 6.2.3
	Default:	16		
	Control Mode:	PT		
	Unit:	pulse		
	Range:	1 ~ $(2^{26}$-1)		
	Data Size:	32-bit		
	Display Format:	Decimal		

Settings:

This parameter is used to set the numerator of the electronic gear ratio. The denominator of the electronic gear ratio is set by P1-45. P2-60 ~ P2-62 are used to set the additional numerators.

Please note:

1. In PT mode, the setting value of P1-44 can be changed only when the servo drive is enabled (Servo On).

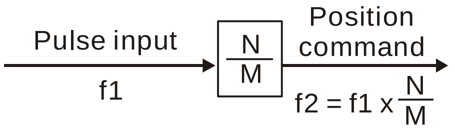
P1-45▲	**GR2**	**Electronic Gear Ratio (Denominator) (M)**		**Address: 015AH 015BH**
	Operation Interface:	Keypad/Software	Communication	Related Section: Section 6.2.3
	Default:	10		
	Control Mode:	PT		
	Unit:	pulse		
	Range:	1 ~ (2^{31}-1)		
	Data Size:	32-bit		
	Display Format:	Decimal		

Settings:

This parameter is used to set the denominator of the electronic gear ratio. The numerator of the electronic gear ratio is set by P1-44. P2-60 ~ P2-62 are used to set the additional numerators.

As the wrong setting may cause motor to run chaotically (out of control) and it may lead to personnel injury, therefore, ensure to observe the following rule when setting P1-44, P1-45.

The electronic gear ratio setting (Please also see P1-44, P2-60 ~ P2-62):



f1: Pulse input f2: Position command

N: Numerator, the setting value of P1-44 or P2-60 ~ P2-62

M: Denominator, the setting value of P1-45

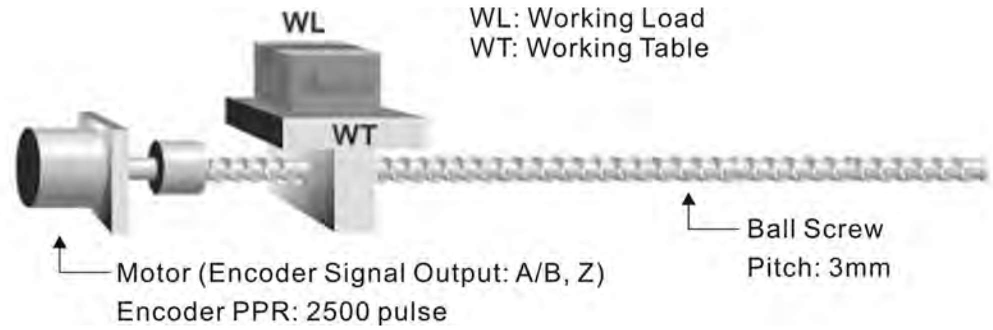
The electronic gear ratio setting range must be within: 1/50<N/M<25600.

Please note:

1. In PT mode, the setting value of P1-45 can not be changed when the servo drive is enabled (Servo On).

The electronic gear function provides easy travel distance ratio change. However, the over high electronic gear ratio will command the motor to move not smoothly. At this time, the users can use low-pass filter parameter to improve this kind of situation. For example, assume that the electronic gear ratio is equal to 1 and the encoder pulse per revolution is 10000ppr, if the electronic gear ratio is changed to 0.5, then the motor will rotate one pulse when the command from external controller is two pulses.

For example, after the proper electronic gear ratio is set, the reference travel distance is 1 μm/pulse, the machinery will become easier to be used.



	Electronic Gear Ratio	Corresponding travel distance per pulse
When the electronic gear ratio is not used	$=\frac{1}{1}$	$=\frac{3\text{x}1000}{4\text{x}2500}=\frac{3000}{10000}\ \mu\text{m}$
When the electronic gear ratio is used	$=\frac{10000}{3000}$	$=1\ \mu\text{m}$

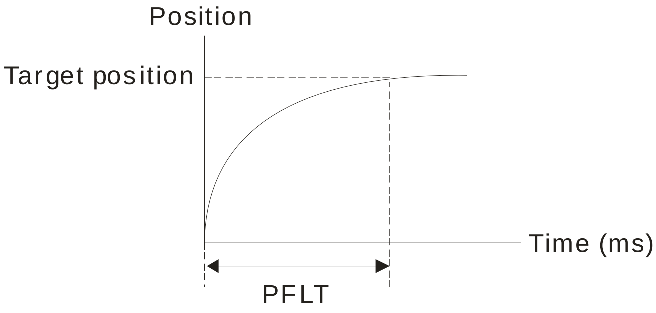
6.2.4 Low-pass Filter

Relevant parameters:

P1-08	**PFLT**	**Smooth Constant of Position Command (Low-pass Filter)**	**Address: 0110H 0111H**
Operation Interface:	Keypad/Software	Communication	Related Section: Section 6.2.4
Default:	0		
Control Mode:	PT		
Unit:	10ms		
Range:	0 ~ 1000		
Data Size:	16-bit		
Display Format:	Decimal		

Settings: 0: Disabled

For example: 11=110 msec



6.2.5 Position Loop Gain Adjustment

Before performing position control (setting position control block diagram), the users should complete the speed control setting by using Manual mode (parameter P-32) since the position loop contains speed loop. Then, adjust the Proportional Position Loop Gain, KPP (parameter P2-00) and Position Feed Forward Gain, PFG (parameter P2-02). Or use Auto mode to adjust the gain of speed and position control block diagram automatically.

1) Proportional Position Loop Gain: To increase this gain can enhance the position loop responsiveness.
2) Position Feed Forward Gain: To increase this gain can reduce the position track error during operation.

The position loop responsiveness cannot exceed the speed loop responsiveness, and it is recommended that the speed loop responsiveness should be at least four times faster than the position loop responsiveness. This also means that the setting value of Proportional Speed Loop Gain, KVP should be at least four times faster than Proportional Position Loop Gain, KPP.

The equation is shown as follows:

$fp \le \frac{fv}{4}$, fv : Speed Loop Responsiveness (Hz), fp : Position Loop Responsiveness (Hz)

$KPP = 2 \times \pi \times fp$.

For example, the desired position loop responsiveness is equal to 20 Hz.

Then, $KPP = 2 \times \pi \times 20 = 125$ rad/s.

Relevant parameters:

P2-00	**KPP**	**Proportional Position Loop Gain**		**Address: 0200H 0201H**
	Operation Interface:	Keypad/Software	Communication	Related Section: Section 6.2.5
	Default:	35		
	Control Mode:	PT		
	Unit:	rad/s		
	Range:	0 ~ 2047		
	Data Size:	16-bit		
	Display Format:	Decimal		

Settings:

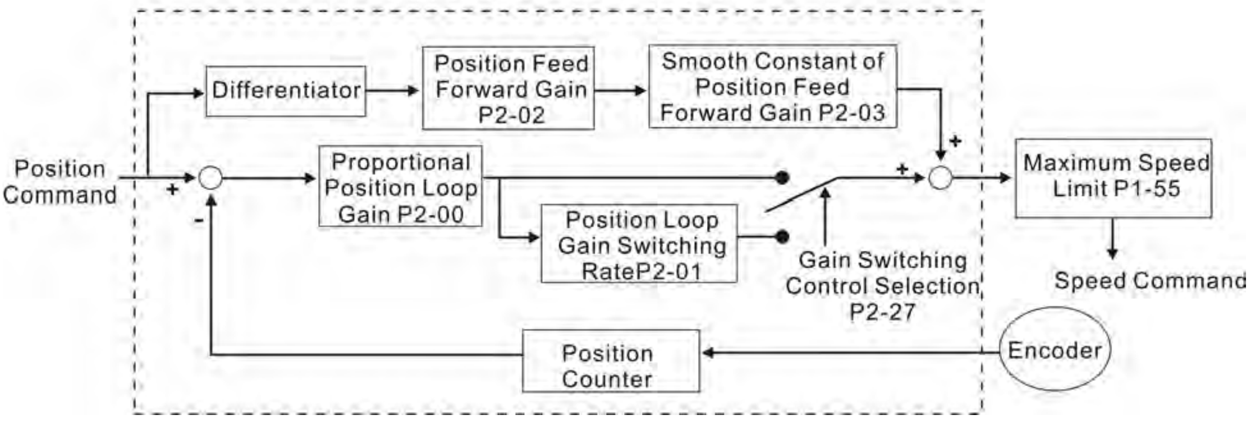
This parameter is used to set the position loop gain. It can increase stiffness, expedite position loop response and reduce position error. However, if the setting value is over high, it may generate vibration or noise.

P2-02	**PFG**	**Position Feed Forward Gain**	**Address: 0204H 0205H**
Operation Interface:	Keypad/Software	Communication	Related Section: Section 6.2.5
Default:	50		
Control Mode:	PT		
Unit:	%		
Range:	0 ~ 100		
Data Size:	16-bit		
Display Format:	Decimal		

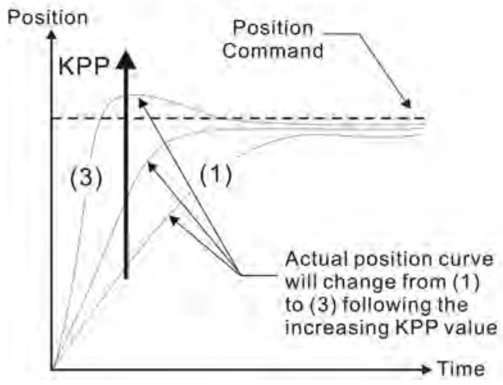
Settings:

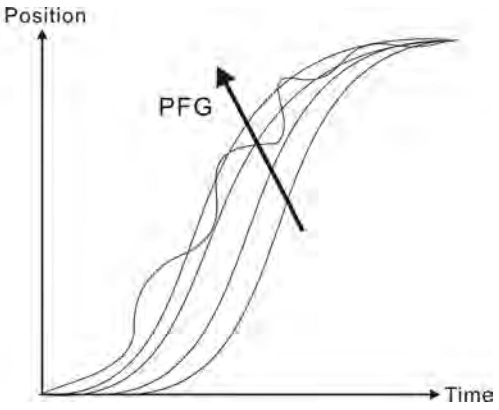
This parameter is used to set the feed forward gain when executing position control command. When using position smooth command, increase gain can improve position track deviation. When not using position smooth command, decrease gain can improve the resonance condition of mechanical system.

Position Control Block Diagram


Position Command
+
-
Differentiator
Position Feed Forward Gain P2-02
Smooth Constant of Position Feed Forward Gain P2-03
+
+
Proportional Position Loop Gain P2-00
Position Loop Gain Switching RateP2-01
Gain Switching Control Selection P2-27
Maximum Speed Limit P1-55
Speed Command
Encoder
Position Counter

When the value of Proportional Position Loop Gain, KPP is too great, the position loop responsiveness will be increased and it will result in small phase margin. If this happens, the rotor of motor will oscillate. At this time, the users have to decrease the value of KPP until the rotor of motor stop oscillating. When there is an external torque command interrupted, over low KPP value will let the motor cannot overcome the external strength and fail to meet the requirement of reasonable position track error demand. Adjust feed forward gain, PFG (P2-02) to efficiently reduce the dynamic position track error.





6.3 Speed Control Mode

The speed control mode (S or Sz) is usually used on the applications of precision speed control, such as CNC machine, etc. ASDA-B2 series servo drive supports two kinds of command sources in speed control mode. One is external analog signal and the other is internal parameter. The external analog signal is from external voltage input and it can control the speed of servo motor. There are two usage of internal parameter, one is set different speed command in three speed control parameters before operation and then using SPD0 and SPD1 of CN1 DI signal perform switching. The other usage is using serial communication to change the setting value of parameter.

Beside, in order to make the speed command switch more smoothly, ASDA-B2 series servo drive also provides complete S-curve profile for speed control mode. For the closed-loop speed control, ASDA-B2 series servo drive provides gain adjustment function and an integrated PI or PDFF controller. Besides, two modes of tuning technology (Manual/Auto) are also provided for the users to select (parameter P2-32).

There are two turning modes for gain adjustment: Manual and Auto modes.

- **Manual Mode:** User-defined loop gain adjustment. When using this mode, all auto and auxiliary function will be disabled.
- **Auto Mode:** Continuous adjustment of loop gains according to measured inertia, with ten levels of system bandwidth. The parameter set by user is default value.

6.3.1 Command Source of Speed Control Mode

Speed command Sources:

1) External analog signal: External analog voltage input, -10V to +10V
2) Internal parameter: P1-09 to P1-11

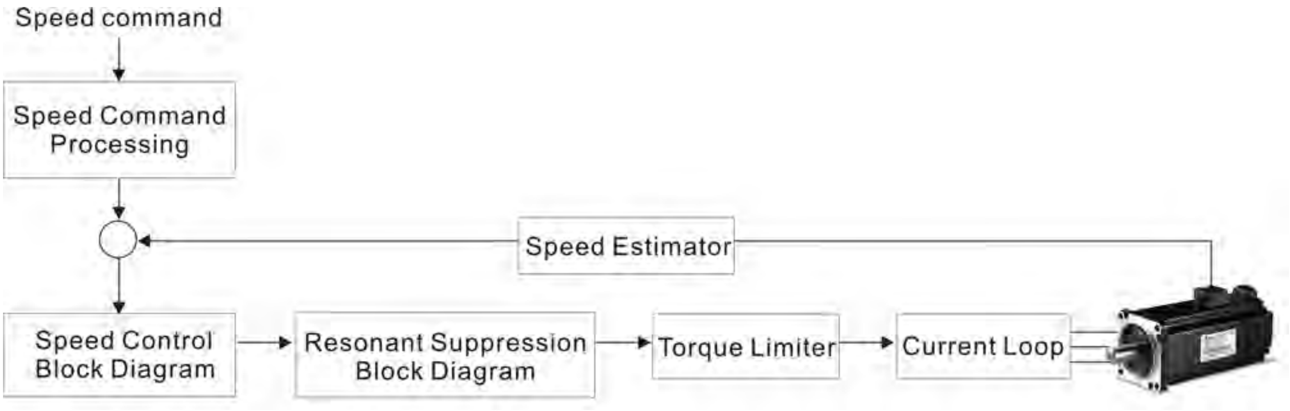
Speed Command	CN1 DI Signal		Command Source			Content	Range
	SPD 1	SPD 0					
S1	0	0	Mode	S	External analog signal	Voltage between V-REF-GND	+/-10 V
				Sz	N/A	Speed command is 0	0
S2	0	1	Internal parameter			P1-09	-50000 ~ 50000
S3	1	0				P1-10	-50000 ~ 50000
S4	1	1				P1-11	-50000 ~ 50000

- State of SPD0~1: 0: indicates OFF (Normally Open); 1: indicates ON (Normally Closed)
- When SPD0 and SPD1 are both = 0 (OFF), if the control mode of operation is Sz, then the speed command is 0. Therefore, if the users do not use analog voltage as speed command, the users can choose Sz mode and avoid the zero point drift problem of analog voltage signal. If the speed control mode is S mode, then the command is the analog voltage between V-REF and GND. The setting range of the input voltage is from -10V to +10V and the corresponding motor speed is adjustable (Please see parameter P1-40).
- When at least one of SPD0 and SPD1 is not 0 (OFF), the speed command is internal parameter (P1-09 to P1-11). The command is valid (enabled) after either SPD0 or SPD1 is changed.
- The range of internal parameters is within -50000 ~ +50000 r/min. Setting value = Range x Unit (0.1 r/min). For example, if P1-09 is set to +30000, the setting value = +30000 x 0.1 r/min = +3000 r/min.

The speed command that is described in this section not only can be taken as speed command in speed control mode (S or Sz mode) but also can be the speed limit input command in torque control mode (T or Tz mode).

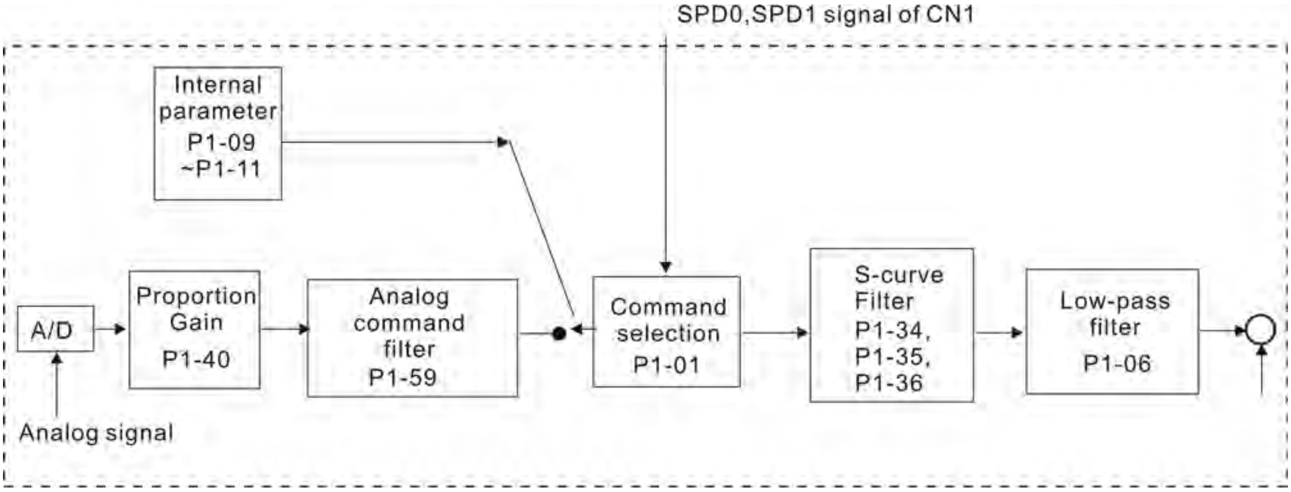
6.3.2 Structure of Speed Control Mode

Basic Structure:



In the figure above, the speed command processing is used to select the command source of speed control according to chapter 6.3.1, including proportional gain (P1-40) and S-curve filter smoothing strategy of speed control. The speed control block diagram is used to manage the gain parameters of the servo drive and calculate the current input provided to motor instantaneously. The resonance suppression block diagram is used to suppress the resonance of mechanical system.

The function and structure of speed command processing is shown as the figure below:

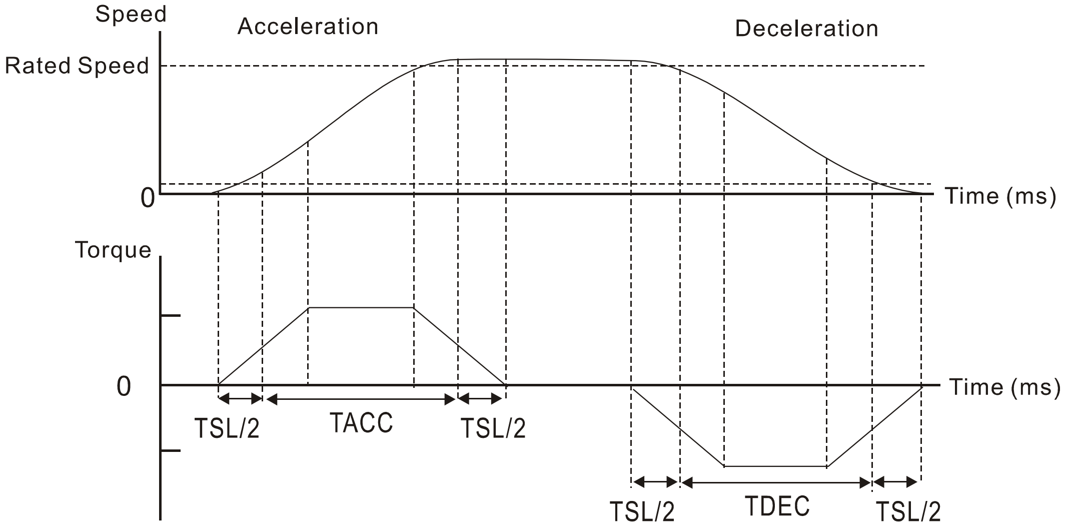


The command source is selected according to the state of SPD0, SPD1 and parameter P1-01 (S or Sz). Whenever the command signal needs to be more smoothly, we recommend the users to use S-curve and low-pass filter.

6.3.3 Smoothing Strategy of Speed Control Mode

S-curve Filter

The S-curve filter is a speed smoothing command which provides 3 steps accel / decel S-curve to smooth the speed command change of the motor during acceleration and deceleration. Using S-curve filter can let the servo motor run more smoothly in response to a sudden speed command change. Since the speed and acceleration curve are both continuous, in order to avoid the mechanical resonance and noise may occur due to a sudden speed command (differentiation of acceleration), using S-curve filter not only can improve the performance when servo motor accelerate or decelerate but also can make the motor run more smoothly. S-curve filter parameters include P1-34 Acceleration Time (TACC), P1-35 Deceleration Time (TDEC) and Accel /Decel S-curve (TSL), and the users can use these three parameters to improve the motor performance during acceleration, deceleration and operation. ASDA-B2 series servo drives also support the time calculation of completing speed command. T (ms) is the operation (running) time. S (r/min) is absolute speed command, i.e. the absolute value (the result) after starting speed subtracts the final speed.



S-curve characteristics and Time relationship

Relevant parameters:

P1-34	TACC	Acceleration Time		Address: 0144H 0145H
	Operation Interface:	Keypad/Software	Communication	Related Section: Section 6.3.3
	Default:	200		
	Control Mode:	S		
	Unit:	ms		
	Range:	1 ~ 20000		
	Data Size:	16-bit		

Display Format:	Decimal

Settings:

This parameter is used to determine the acceleration time to accelerate from 0 to its rated motor speed. The functions of parameters P1-34, P1-35 and P1-36 are each individual.

Please note:

1. When the source of speed command is analog command, the maximum setting value of P1-36 is set to 0, the acceleration and deceleration function will be disabled.

P1-35	**TDEC**	**Deceleration Time**		**Address: 0146H 0147H**
	Operation Interface:	Keypad/Software	Communication	Related Section: Section 6.3.3
	Default:	200		
	Control Mode:	S		
	Unit:	ms		
	Range:	1 ~ 20000		
	Data Size:	16-bit		
	Display Format:	Decimal		

Settings:

This parameter is used to determine the acceleration time to accelerate from 0 to its rated motor speed. The functions of parameters P1-34, P1-35 and P1-36 are each individual.

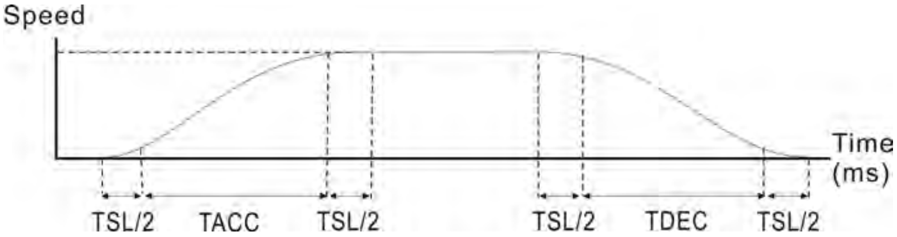
Please note:

1. When the source of speed command is analog command, the maximum setting value of P1-36 is set to 0, the acceleration and deceleration function will be disabled.

P1-36	**TSL**	**Accel /Decel S-curve**		**Address: 0148H 0149H**
	Operation Interface:	Keypad/Software	Communication	Related Section: Section 6.3.3
	Default:	0		
	Control Mode:	S		
	Unit:	ms		
	Range:	0 ~ 10000 (0: Disabled)		
	Data Size:	16-bit		
	Display Format:	Decimal		

Settings:

This parameter is used to make the motor run more smoothly when startup and windup. Using this parameter can improve the motor running stability.



TACC: P1-34, Acceleration time

TDEC: P1-35, Deceleration time

TSL: P1-36, Accel /Decel S-curve

Total acceleration time = TACC + TSL

Total deceleration time = TDEC + TSL

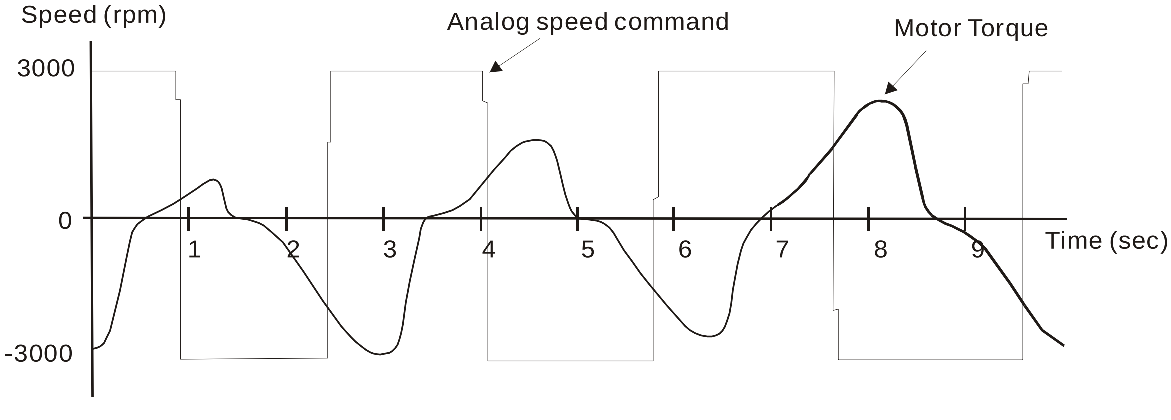
The functions of parameters P1-34, P1-35 and P1-36 are each individual. When P1-36 is set to 0 (Disabled), the settings of P1-34, P1-35 are still effective. It indicates that the parameters P1-34 and P1-35 will not become disabled even when P1-36 is disabled.

Please note:

1. When the source of speed command is analog command, the maximum setting value of P1-36 is set to 0, the acceleration and deceleration function will be disabled.

Analog Speed Command S-curve Filter

ASDA-B2 series servo drives also provide Analog Speed Command S-curve Filter for the smoothing in response to a sudden analog input signal.



The analog speed command S-curve filter is for the smoothing of analog input signal and its function is the same as the S-curve filter. The speed and acceleration curve of analog speed command S-curve filter are both continuous. The above figure shows the curve of analog speed command S-curve filter and the users can see the ramp of speed command is different during acceleration and deceleration. Also, the users can see the difference of input command tracking and can adjust time setting by using parameter P1-34, P1-35, P1-36 to improve the actual motor performance according to actual condition.

Analog Speed Command Low-pass Filter

Analog Speed Command Low-pass Filter is used to eliminate high frequency response and electrical interference from an analog speed command and it is also with smoothing function.

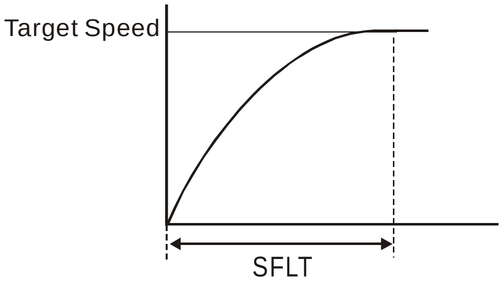
Relevant parameters:

P1-06	**SFLT**	**Accel / Decel Smooth Constant of Analog Speed Command (Low-pass Filter)**	**Address: 010CH 010DH**
Operation Interface:	Keypad/Software	Communication	Related Section: Section 6.3.3
Default:	0		
Control Mode:	S		
Unit:	ms		
Range:	0 ~ 1000 (0: Disabled)		
Data Size:	16-bit		
Display Format:	Decimal		

Settings: 0: Disabled

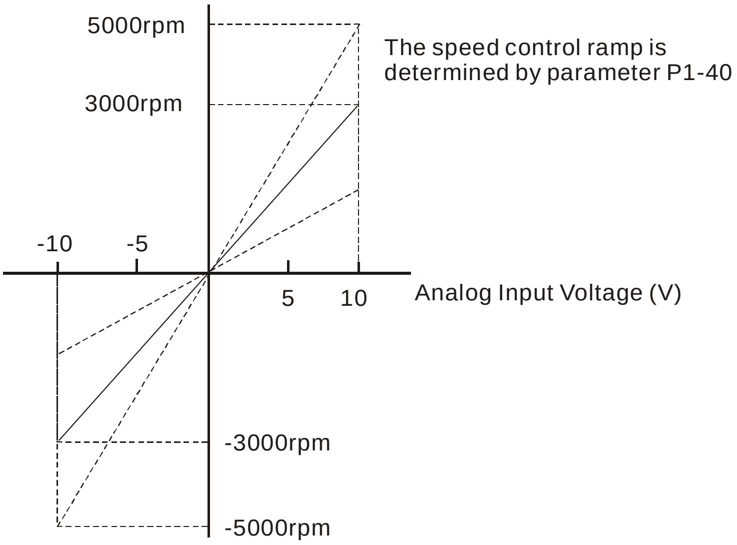
NOTE

1) If the setting value of parameter P1-06 is set to 0, it indicates the function of this parameter is disabled and the command is just By-Pass.



6.3.4 Analog Speed Input Scaling

The analog voltage between **V_REF and GND** determines the motor speed command. Using with parameter P1-40 (Max. Analog Speed Command) can adjust the speed control ramp and its range.



Relevant parameters:

P1-40▲	**VCM**	**Max. Analog Speed Command or Limit**		**Address: 0150H 0151H**
	Operation Interface:	Keypad/Software	Communication	Related Section: Section 6.3.4
	Default:	rated speed		
	Control Mode:	S, T		
	Unit:	r/min		
	Range:	0 ~ 10000		
	Data Size:	16-bit		
	Display Format:	Decimal		

Settings:

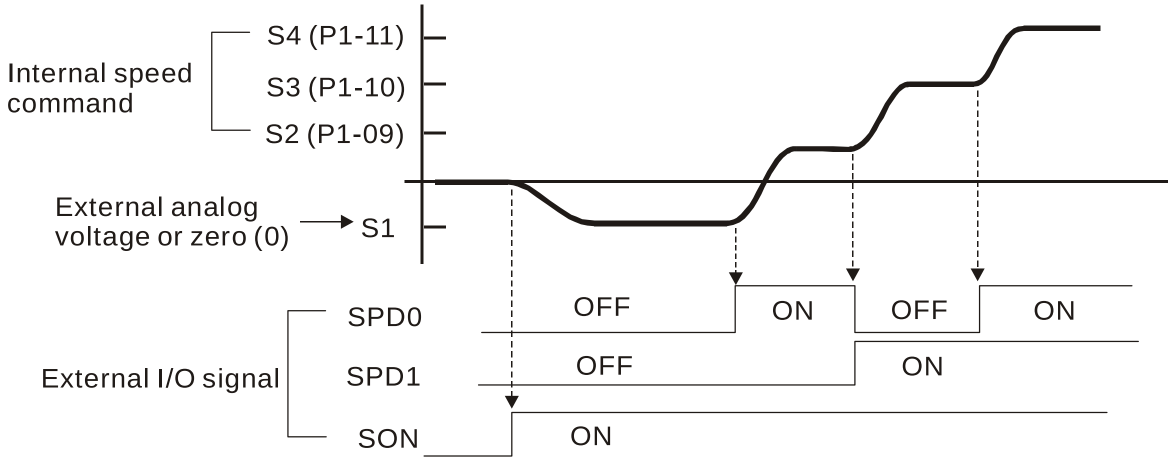
In **Speed mode**, this parameter is used to set the maximum analog speed command based on the maximum input voltage (10V).

In **Torque mode**, this parameter is used to set the maximum analog speed limit based on the maximum input voltage (10V).

For example, in speed mode, if P1-40 is set to 3000 and the input voltage is 10V, it indicates that the speed command is 3000 r/min. If P1-40 is set to 3000, but the input voltage is changed to 5V, then the speed command is changed to 1500 r/min.

Speed Command / Limit = Input Voltage Value x Setting value of P1-40 / 10

6.3.5 Timing Chart of Speed Control Mode

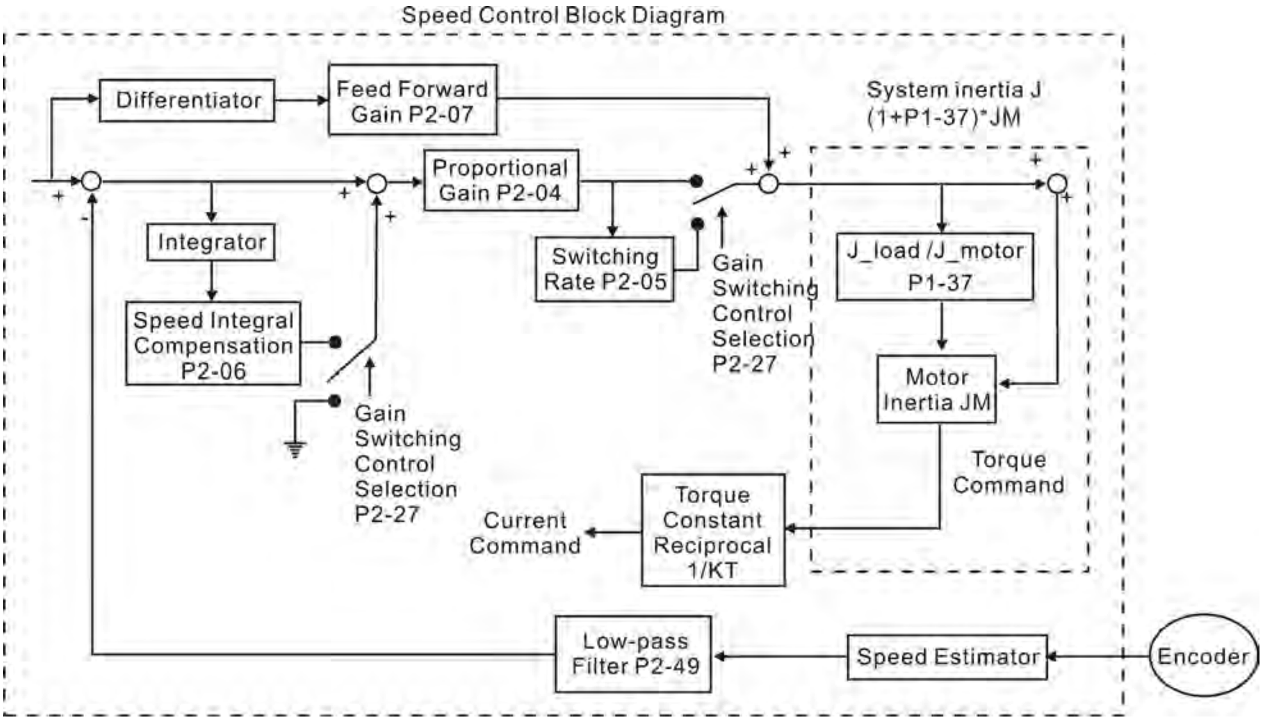


NOTE

1) OFF indicates normally open and ON indicates normally closed.
2) When speed control mode is Sz, the speed command S1=0; when speed control mode is S, the speed command S1 is external analog voltage input (Please refer to P1-01).
3) After Servo ON, the users can select command according to the state of SPD0~1.

6.3.6 Speed Loop Gain Adjustment

The function and structure of **speed control mode** is shown as the figure below:



There are two turning modes of gain adjustment: Manual and Auto modes. The gain of ASDA-B2 series servo drives can be adjusted by using any one of three tuning modes.

- **Manual Mode:** User-defined loop gain adjustment. When using this mode, all auto and auxiliary function will be disabled.
- **Auto Mode:** Continuous adjustment of loop gains according to measured inertia, with ten levels of system bandwidth. The parameter set by user is default value.

The mode of gain adjustment can be selected by parameter P2-32:

P2-32▲	**AUT2**	**Tuning Mode Selection**		**Address: 0240H** **0241H**
	Operation Interface:	Keypad/Software	Communication	Related Section: Section 5.6, Section 6.3.6
	Default:	0		
	Control Mode:	ALL		
	Unit:	N/A		
	Range:	0 ~ 2		
	Data Size:	16-bit		
	Display Format:	Hexadecimal		

Settings:

0: Manual mode

1: Auto Mode [Continuous adjustment]

2: Semi-Auto Mode [Non-continuous adjustment]

Explanation of manual mode:

1. When P2-32 is set to mode#0, the setting value of P2-00, P2-02, P2-04, P2-06, P2-07, P2-25 and P2-26 can be user-defined. When switching mode #1 or #2 to #0, the setting value of P2-00, P2-02, P2-04, P2-06, P2-07, P2-25 and P2-26 will change to the value that measured in #1 auto-tuning mode or #2 semi-auto tuning mode.

Explanation of auto-tuning mode:

The servo drive will continuously estimate the system inertia, save the measured load inertia value automatically and memorized in P1-37 every 30 minutes by referring to the frequency response settings of P2-31.

1. When switching mode #1 or #2 to #0, the servo drive will continuously estimate the system inertia, save the measured load inertia value automatically and memorized in P1-37. Then, set the corresponding parameters according to this measured load inertia value.
2. When switching mode#0 or #1 to #2, enter the appropriate load inertia value in P1-37.
3. When switching mode#1 to #0, the setting value of P2-00, P2-04 and P2-06 will change to the value that measured in #1 auto-tuning mode.

Explanation of semi-auto tuning mode:

1. When switching mode #2 to #0, the setting value of P2-00, P2-04, P2-06, P2-25 and P2-26 will change to the value that measured in #1 auto-tuning mode.
2. After the system inertia becomes stable (The displau of P2-33 will show 1), it will stop estimating the system inertia, save the measured load inertia value automatically, and memorized in P1-37. However, when P2-32 is set to mode#1 or #2, the servo drive will continuously perform the adjustment for a period of time.
3. When the value of the system inertia becomes over high, the display of P2-33 will show 0 and the servo drive will start to adjust the load inertia value continuously.

Manual Mode

When Tuning Mode Settings of P2-32 is set to 0, the users can define the proportional speed loop gain (P2-04), speed integral gain (P2-06) feed forward gain (P2-07) and ratio of load inertia to servo motor Inertia (1-37). Please refer to the following description:

- Proportional gain: Adjust this gain can increase the position loop responsiveness.
- Integral gain: Adjust this gain can enhance the low-frequency stiffness of speed loop and eliminate the steady error. Also, reduce the value of phase margin. Over high integral gain will result in the unstable servo system.
- Feed forward gain: Adjust this gain can decrease the phase delay error

Relevant parameters:

P2-04	**KVP**	**Proportional Speed Loop Gain**		**Address: 0208H 0209H**
	Operation Interface:	Keypad/Software	Communication	Related Section: Section 6.3.6
	Default:	500		
	Control Mode:	ALL		
	Unit:	rad/s		
	Range:	0 ~ 8191		
	Data Size:	16-bit		
	Display Format:	Decimal		

Settings:

This parameter is used to set the speed loop gain. When the value of proportional speed loop gain is increased, it can expedite speed loop response. However, if the setting value is over high, it may generate vibration or noise.

P2-06	**KVI**	**Speed Integral Compensation**		**Address: 020CH 020DH**
	Operation Interface:	Keypad/Software	Communication	Related Section: Section 6.3.6
	Default:	100		
	Control Mode:	ALL		
	Unit:	rad/s		
	Range:	0 ~ 1023		
	Data Size:	16-bit		
	Display Format:	Decimal		

Settings:

This parameter is used to set the integral time of speed loop. When the value of speed integral compensation is increased, it can improve the speed response ability and decrease the speed control deviation. However, if the setting value is over high, it may generate vibration or noise.

P2-07	**KVF**	**Speed Feed Forward Gain**		**Address: 020EH 020FH**
	Operation Interface:	Keypad/Software	Communication	Related Section: Section 6.3.6
	Default:	0		
	Control Mode:	ALL		
	Unit:	%		
	Range:	0 ~ 100		
	Data Size:	16-bit		
	Display Format:	Decimal		

Settings:

This parameter is used to set the feed forward gain when executing speed control command.

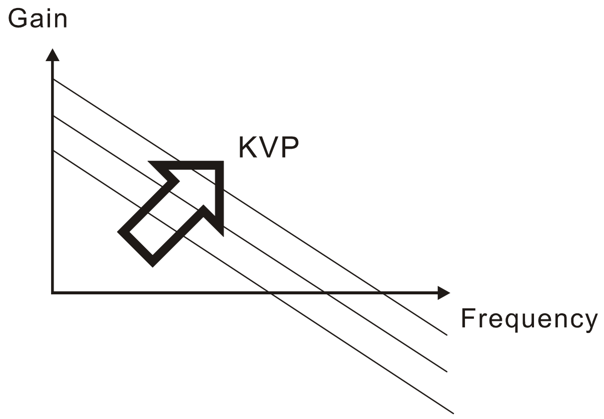
When using speed smooth command, increase gain can improve speed track deviation.

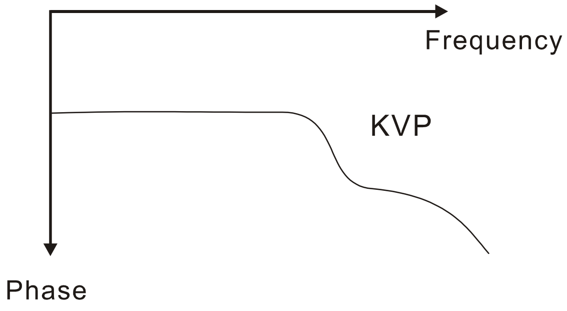
When not using speed smooth command, decrease gain can improve the resonance condition of mechanical system.

In theory, stepping response can be used to explain proportional gain (KVP), integral gain (KVI) and feed forward gain (KVF). Now we use frequency area and time area respectively to explain the logic.

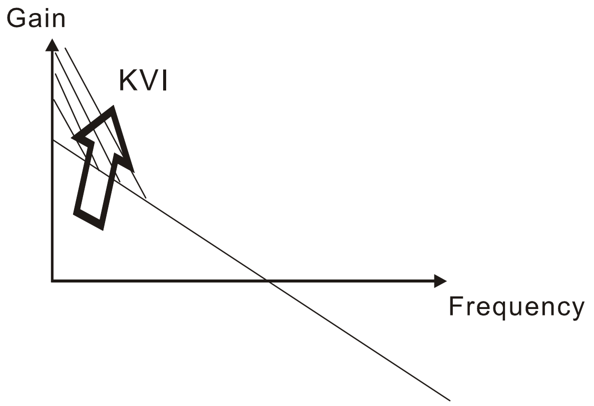
Frequency Domain

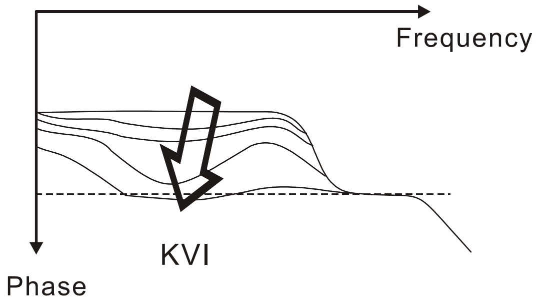
STEP 1: Set the value of KVI=0, the value of KVF=0 and adjust the value of KVP.



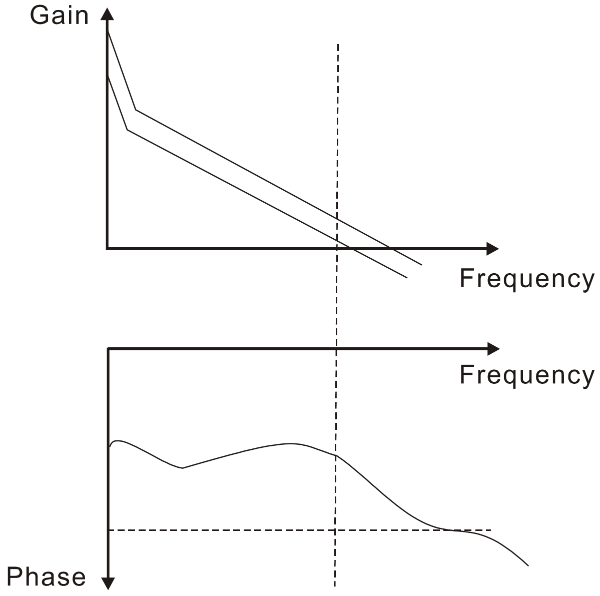


STEP 2：Fix the value of KVP and adjust the value of KVI.

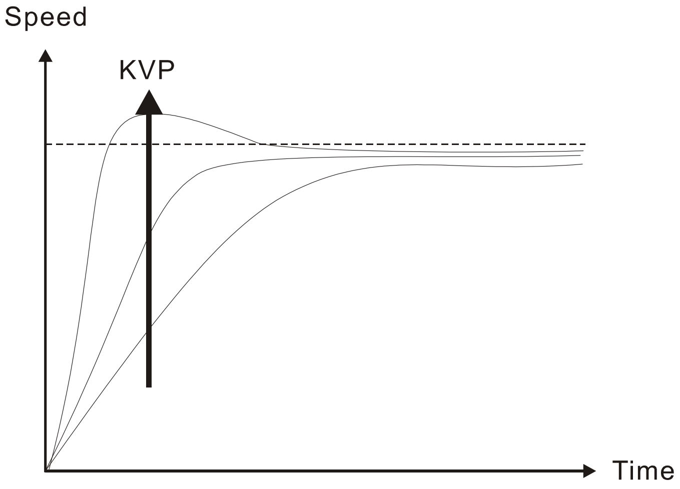




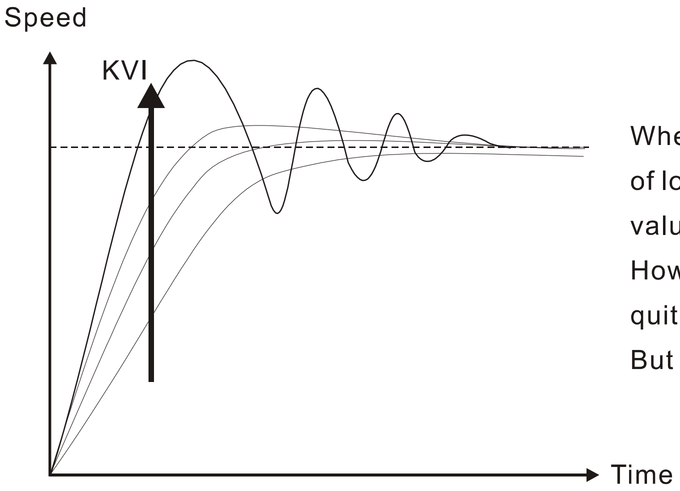
STEP 3：Select the value of KVI, if the value of phase margin is too small, re-adjust the value of KVP again to obtain the value, 45deg of phase margin.



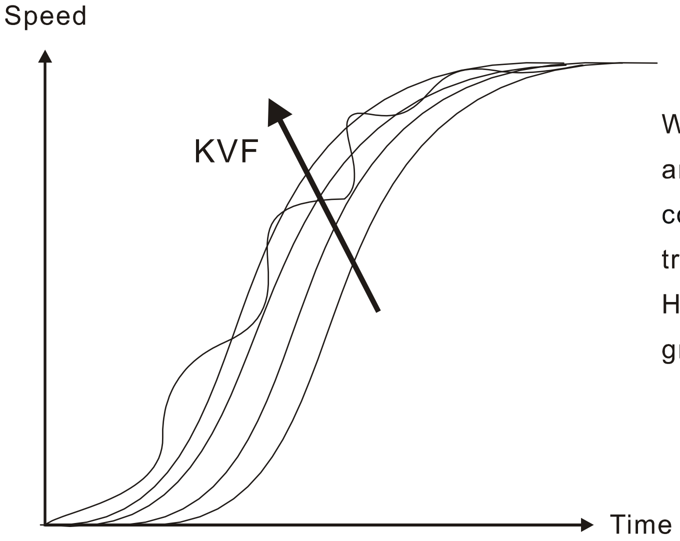
Time Domain



When the value of KVP is greater, the value of the responsiveness is also greater and the raising time is shorter. However, when the value of phase margin is over low, it is not helpful to steady error. But it is helpful to dynamic tracking error.



When the value of KVI is greater, the value of low-frequency gain is also greater and the value of steady error is nearly zero (0). However, the value of phase margin will reduce quite substantially. It is helpful to steady error. But it is not helpful to dynamic tracking error.

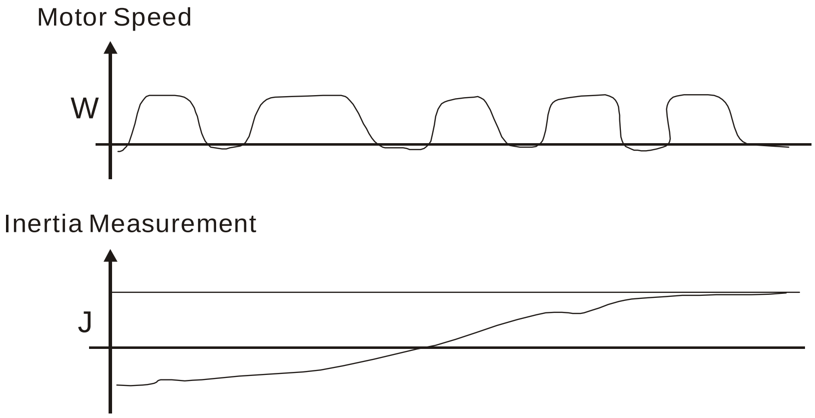


When the value of KVF is nearly to 1 and the forward compensation is more complete, then the value of dynamic tracking error will become very small. However, when the value of KVF is too great, it may cause vibration.

In general, the equipment, such as spectrum analyzer is needed and used to analyze when using frequency domain method and the users also should have this kind of analysis technology. However, when using time domain method, the users only need to prepare an oscilloscope. Therefore, the general users usually use time domain method with the analog DI/DO terminal provided by the servo drive to adjust what is called as PI (Proportional and Integral) type controller. As for the performance of torque shaft load, input command tracking and torque shaft load have the same responsiveness when using frequency domain method and time domain method. The users can reduce the responsiveness of input command tracking by using input command low-pass filter.

Auto Mode (Continuous adjustment))

This Auto Mode provides continuous adjustment of loop gains according to measured inertia automatically. It is suitable when the load inertia is fixed or the load inertia change is small and is not suitable for wide range of load inertia change. The period of adjustment time is different depending on the acceleration and deceleration of servo motor. To change the stiffness and responsiveness, please use parameter P2-31.



6.3.7 Resonance Suppression

The resonance of mechanical system may occur due to excessive system stiffness or frequency response. However, this kind of resonance condition can be improved, suppressed, even can be eliminated by using low-pass filter (parameter P2-25) and notch filter (parameter P2-23, P2-24) without changing control parameter.

Relevant parameters:

P2-23	**NCF1**	**Notch Filter 1 (Resonance Suppression)**	**Address: 022EH 022FH**

Operation Interface:	Keypad/Software	Communication	Related Section: Section 6.2.5
Default:	1000		
Control Mode:	ALL		
Unit:	Hz		
Range:	50 ~ 2000		
Data Size:	16-bit		
Display Format:	Decimal		

Settings:

This parameter is used to set first resonance frequency of mechanical system. It can be used to suppress the resonance of mechanical system and reduce the vibration of mechanical system.

If P2-24 is set to 0, this parameter is disabled.

The parameters P2-23 and P2-24 are the first group of notch filter parameters and the parameters P2-43 and P2-44 are the second group of notch filter parameters.

P2-24	**DPH1**	**Notch Filter Attenuation Rate 1 (Resonance Suppression)**	**Address: 0230H 0231H**

Operation Interface:	Keypad/Software	Communication	Related Section: Section 6.3.7
Default:	0		
Control Mode:	ALL		
Unit:	dB		
Range:	0 ~ 32 (0: Disabled)		
Data Size:	16-bit		
Display Format:	Decimal		

Settings:

This parameter is used to set magnitude of the resonance suppression that is set by parameter P2-23. If P2-24 is set to 0, the parameters P2-23 and P2-24 are both disabled.

The parameters P2-23 and P2-24 are the first group of notch filter parameters and the parameters P2-43 and P2-44 are the second group of notch filter parameters.

P2-43	**NCF2**	**Notch Filter 2 (Resonance Suppression)**	**Address: 0256H 0257H**
Operation Interface:	Keypad/Software	Communication	Related Section: Section 6.3.7
Default:	1000		
Control Mode:	ALL		
Unit:	Hz		
Range:	50 ~ 2000		
Data Size:	16-bit		
Display Format:	Decimal		

Settings:

This parameter is used to set second resonance frequency of mechanical system. It can be used to suppress the resonance of mechanical system and reduce the vibration of mechanical system.

If P2-43 is set to 0, this parameter is disabled.

The parameters P2-23 and P2-24 are the first group of notch filter parameters and the parameters P2-43 and P2-44 are the second group of notch filter parameters.

P2-44	**DPH2**	**Notch Filter Attenuation Rate 2 (Resonance Suppression)**	**Address: 0258H 0259H**
Operation Interface:	Keypad/Software	Communication	Related Section: Section 6.3.7
Default:	0		
Control Mode:	ALL		
Unit:	dB		
Range:	0 ~ 32		
Data Size:	16-bit		
Display Format:	Decimal		

Settings:

This parameter is used to set magnitude of the resonance suppression that is set by parameter P2-43. If P2-44 is set to 0, the parameters P2-43 and P2-44 are both disabled.

P2-45	**NCF3**	**Notch Filter 3 (Resonance Suppression)**	**Address: 025AH 025BH**
Operation Interface:	Keypad/Software	Communication	Related Section: Section 6.3.7
Default:	1000		
Control Mode:	ALL		
Unit:	Hz		
Range:	50 ~ 2000		
Data Size:	16-bit		
Display Format:	Decimal		

Settings:

This parameter is used to set third resonance frequency of mechanical system. It can be used to suppress the resonance of mechanical system and reduce the vibration of mechanical system.

If P2-45 is set to 0, this parameter is disabled.

P2-46	**DPH3**	**Notch Filter Attenuation Rate 3 (Resonance Suppression)**	**Address: 025CH 025DH**
Operation Interface:	Keypad/Software	Communication	Related Section: Section 6.3.7
Default:	0		
Control Mode:	ALL		
Unit:	dB		
Range:	0 ~ 32		
Data Size:	16-bit		
Display Format:	Decimal		

Settings:

This parameter is used to set magnitude of the resonance suppression that is set by parameter P2-45. If P2-46 is set to 0, the parameters P2-45 and P2-46 are both disabled.

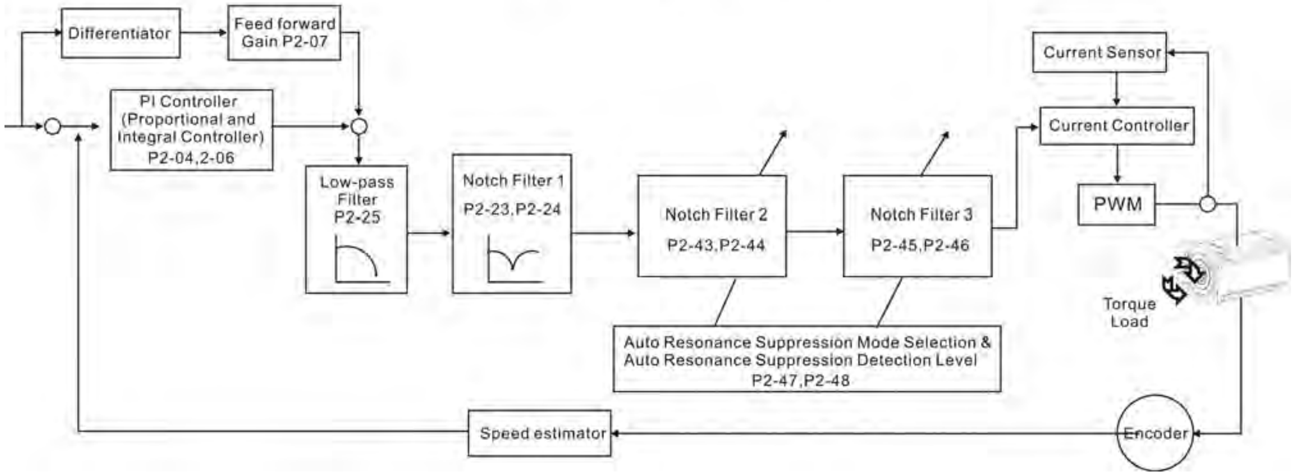
P2-25	**NLP**	**Low-pass Filter Time Constant (Resonance Suppression)**	**Address: 0232H 0233H**
Operation Interface:	Keypad/Software	Communication	Related Section: Section 6.3.7
Default:	0.2 (1kW and below models) or 0.5 (other models)	2 (1kW and below models) or 5 (other models)	
Control Mode:	ALL		

Unit:	1ms	0.1ms
Range:	0.0 ~ 100.0	0 ~ 1000
Data Size:	16-bit	
Display Format:	One-digit	Decimal
Input Value Example:	1.5 = 1.5 ms	15 = 1.5 ms

Settings:

This parameter is used to set low-pass filter time constant of resonance suppression. If P2-25 is set to 0, this parameter is disabled.

Speed Control Block Diagram


Differentiator
Feed forward Gain P2-07
PI Controller (Proportional and Integral Controller) P2-04,2-06
Low-pass Filter P2-25
Notch Filter 1 P2-23,P2-24
Notch Filter 2 P2-43,P2-44
Notch Filter 3 P2-45,P2-46
Current Sensor
Current Controller
PWM
Torque Load
Auto Resonance Suppression Mode Selection & Auto Resonance Suppression Detection Level P2-47,P2-48
Speed estimator
Encoder

There are two groups of notch filters provided by ASDA-A2 series. The first group of notch filter is P2-43 and P2-44, and the second group of notch filter is P2-45 and P2-46. When there is resonance, please set P2-47 to 1 or 2 (Auto mode), and then the servo drive will find resonance frequency and suppress the resonance automatically. After suppressing the resonance point, the system will memorize the notch filter frequency into P2-43 and P-45, and memorize the notch filter attenuation rate into P2-44 and P2-46.

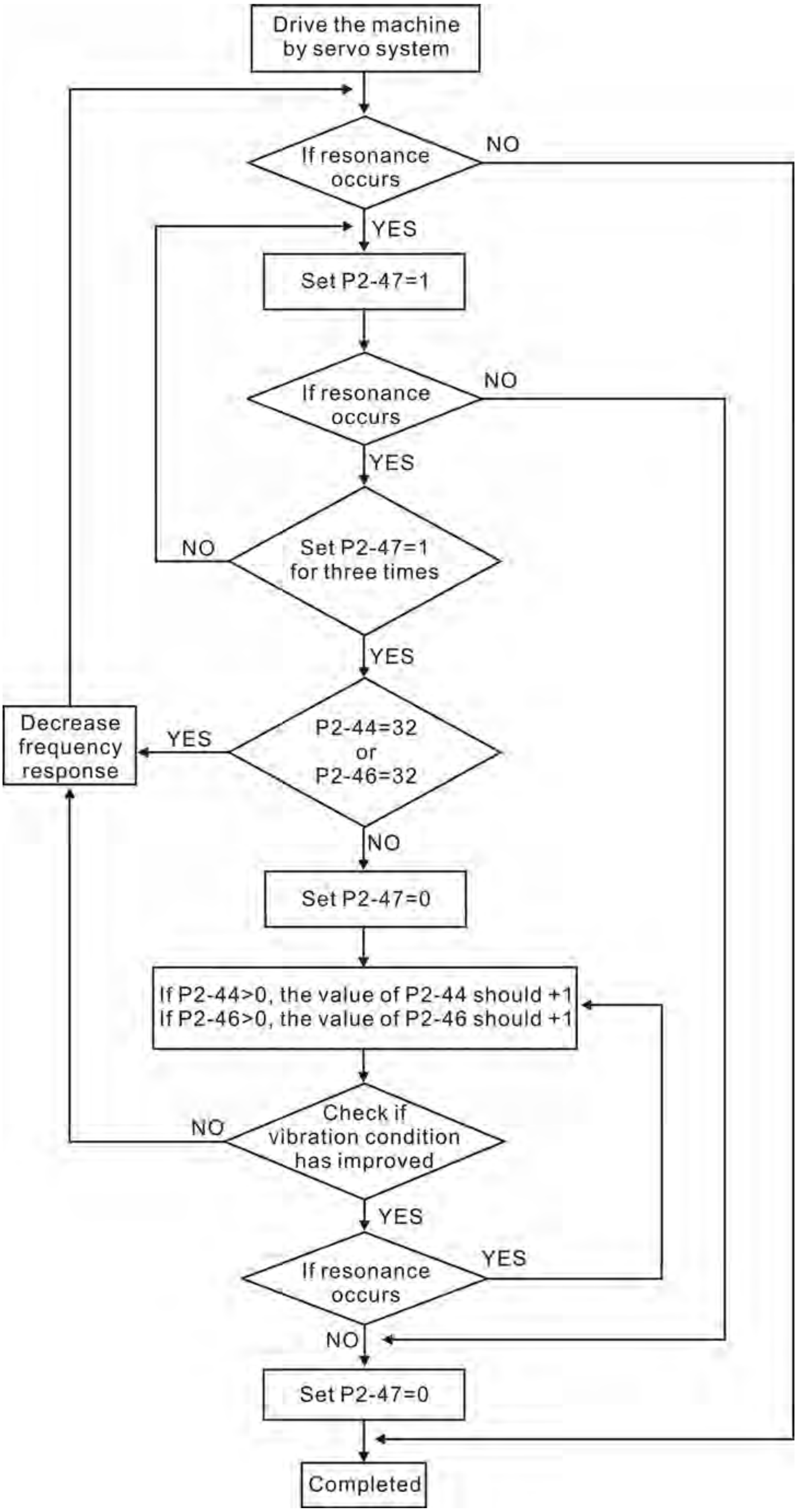
When P2-47 is set to 1, the resonance suppression will be enabled automatically. After the mechanical system becomes stable (approximate 20 minutes), the setting value of P2-47 will return to 0 (Disable auto resonance suppression function). When P2-47 is set to 2, the system will find the resonance point continuously even after the mechanical system becomes stable.

When P2-47 is set to 1 or 2, if the resonance conditions can not be eliminated, we recommend the users to check the settings of P2-44 and P2-46. If either of the setting value of P2-44 and P2-46 is set to 32, please decrease the speed frequency response and estimate the resonance point again. If the resonance conditions can not be eliminated when the setting values of P2-44 and P2-46 are both less than 32, please set P2-47 to 0 first, and increase the setting value of P2-44 and P2-46 manually. If the resonance exists still after increasing the setting value of P2-44 and P2-46, please decrease the value of speed frequency response again and then use the resonance suppression function again.

When increasing the setting value of P2-44 and P2-46 manually, ensure to pay close attention on the setting value of P2-44 and P2-46. If the value of P2-44 and P2-46 is greater than 0, it indicates that the corresponding resonance frequency of P2-43 and P2-45 is found through auto resonance suppression function. If the value of P2-44 and P2-46 is equal to 0, it indicates that the value of P2-43 and P2-45 will be the default value 1000 and this is not the frequency found by auto resonance suppression function. At this time, if the users increase the value of notch filter attenuation rate which does not exist, the performance of the current mechanical system may deteriorate.

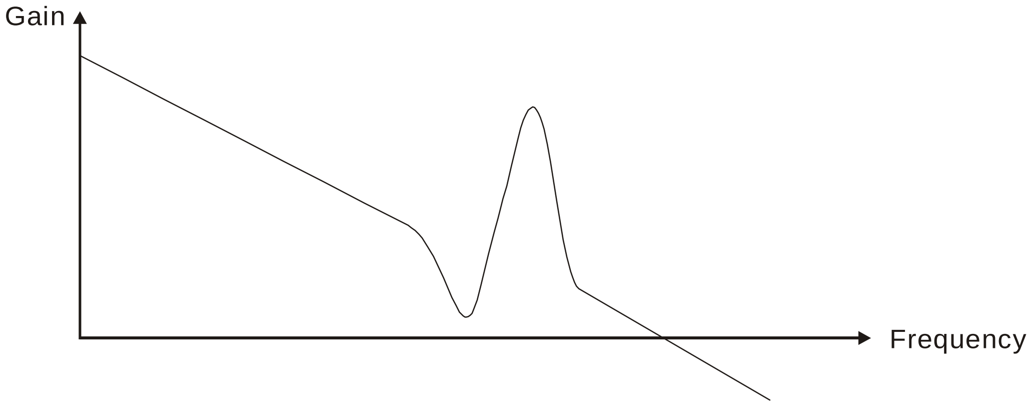
Settings of P2-47		
Current Value	Desired Value	Function
0	1	Clear the setting value of P2-43 ~ P2-46 and enable auto resonance suppression function.
0	2	Clear the setting value of P2-43 ~ P2-46 and enable auto resonance suppression function.
1	0	Save the setting value of P2-43 ~ P2-46 and disable auto resonance suppression function.
1	1	Clear the setting value of P2-43 ~ P2-46 and enable auto resonance suppression function.
1	2	Do not clear the setting value of P2-43 ~ P2-46 and enable auto resonance suppression function continuously.
2	0	Save the setting value of P2-43 ~ P2-46 and disable auto resonance suppression function.
2	1	Clear the setting value of P2-43 ~ P2-46 and enable auto resonance suppression function.
2	2	Do not clear the setting value of P2-43 ~ P2-46 and enable auto resonance suppression function continuously.

Flowchart of auto resonance suppression operation:

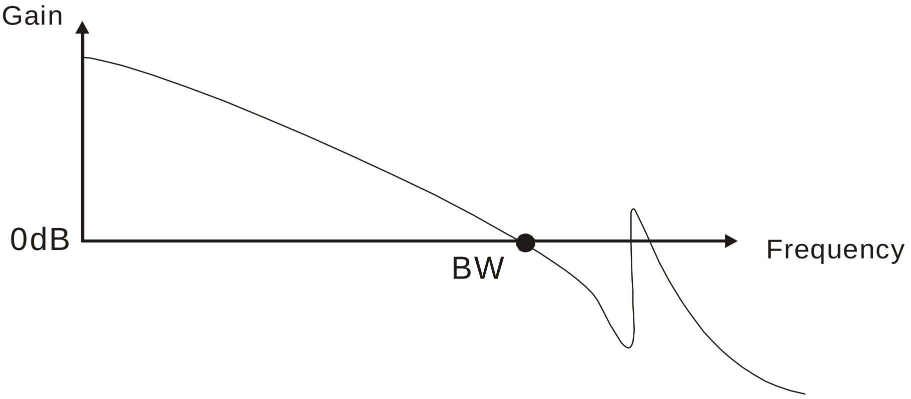

Drive the machine by servo system
If resonance occurs
NO
YES
Set P2-47=1
If resonance occurs
NO
YES
NO
Set P2-47=1 for three times
YES
Decrease frequency response
YES
P2-44=32 or P2-46=32
NO
Set P2-47=0
If P2-44>0, the value of P2-44 should +1
If P2-46>0, the value of P2-46 should +1
NO
Check if vibration condition has improved
YES
If resonance occurs
YES
NO
Set P2-47=0
Completed

Low-pass filter

Please use parameter P2-25. The figure below shows the resonant open-loop gain.



When the low-pass filter (parameter P2-25) is adjusted from 0 to high value, the value of Low-pass frequency (BW) will become smaller (see the figure below). The resonant condition is improved and the frequency response and phase margin will also decrease.

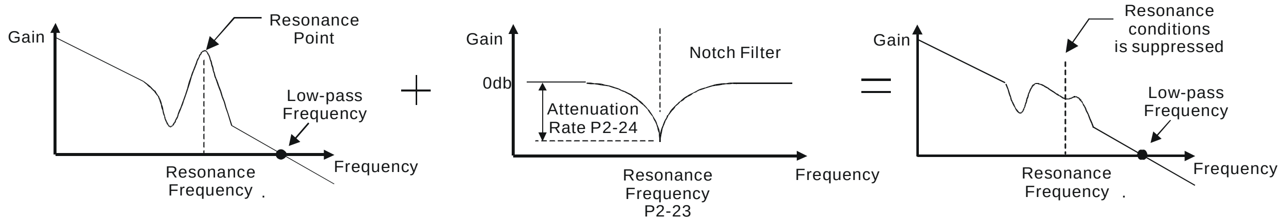


Notch Filter

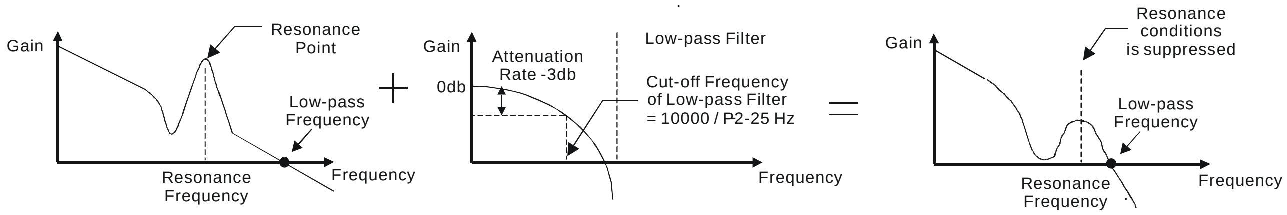
Usually, if the users know the resonance frequency, we recommend the users can eliminate the resonance conditions directly by using notch filter (parameter P2-23, P2-24). However, the range of frequency setting is from 50 to 1000Hz only and the range of resonant attenuation is 0~32 dB only. Therefore, if the resonant frequency is out of this range, we recommend the users to use low-pass filter (parameter P2-25) to improve resonant condition.

Please refer to the following figures and explanation to know how to use notch filter and low-pass filter to improve resonant condition.

Use Notch Filter to suppress resonance



Use Low-pass Filter to suppress resonance



When the low-pass filter (parameter P2-25) is adjusted from 0 to high value, the value of Low-pass frequency will become smaller (see the figure on page 6-26). The resonant condition is improved but the frequency response and phase margin will also decrease and the system may become unstable. Therefore, if the users know the resonance frequency, the users can eliminate the resonance conditions directly by using notch filter (parameter P2-23, P2-24). Usually, if the resonant frequency can be recognized, we recommend the users can directly use notch filter (parameter P2-23, P2-24) to eliminate the resonance. However, if the resonant frequency will drift or drift out of the notch filter range, we recommend the users not to use notch filter and use low-pass filter to improve resonant conditions.

6.4 Torque Control Mode

The torque control mode (T or Tz) is usually used on the applications of torque control, such as printing machine, spinning machine, twister, etc. Delta ASDA-B2 series servo drive supports two kinds of command sources in torque control mode. One is external analog signal and the other is internal parameter. The external analog signal is from external voltage input and it can control the torque of servo motor. The internal parameters are from P1-12 to P1-14 which are used to be the torque command in torque control mode.

6.4.1 Command Source of Torque Control Mode

Torque command Sources:

1) External analog signal: External analog voltage input, -10V to +10V
2) Internal parameter: P1-12 to P1-14

The command source selection is determined by the DI signal of CN1 connector.

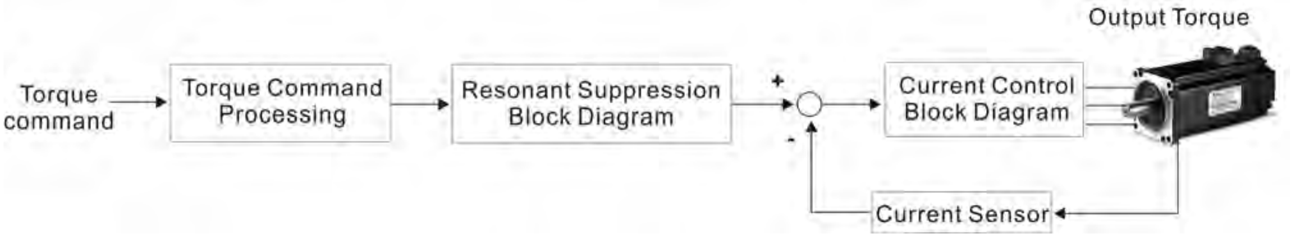
Torque Command	DI signal of CN1		Command Source			Content	Range
	TCM1	TCM0					
T1	0	0	Mode	T	External analog signal	Voltage between T-REF-GND	+/- 10 V
				Tz	None	Torque command is 0	0
T2	0	1	Internal parameter			P1-12	+/- 300 %
T3	1	0				P1-13	+/- 300 %
T4	1	1				P1-14	+/- 300 %

- State of TCM0~1: 0: indicates OFF (Normally Open); 1: indicates ON (Normally Closed)
- When TCM0 and TCM1 are both 0 (OFF), if the control mode of operation is Tz, then the command is 0. Therefore, if the users do not use analog voltage as torque command, the users can choose Tz mode to operation torque control to avoid the zero point drift problem of analog voltage. If the control mode of operation is T, then the command is the analog voltage between T-REF and GND. The setting range of the input voltage is from -10V to +10V and the corresponding torque is adjustable (see parameter P1-41).
- When at least one of TCM0 and TCM1 is not 0 (OFF), the torque command is internal parameter. The command is valid (enabled) after either TCM0 or TCM1 is changed.

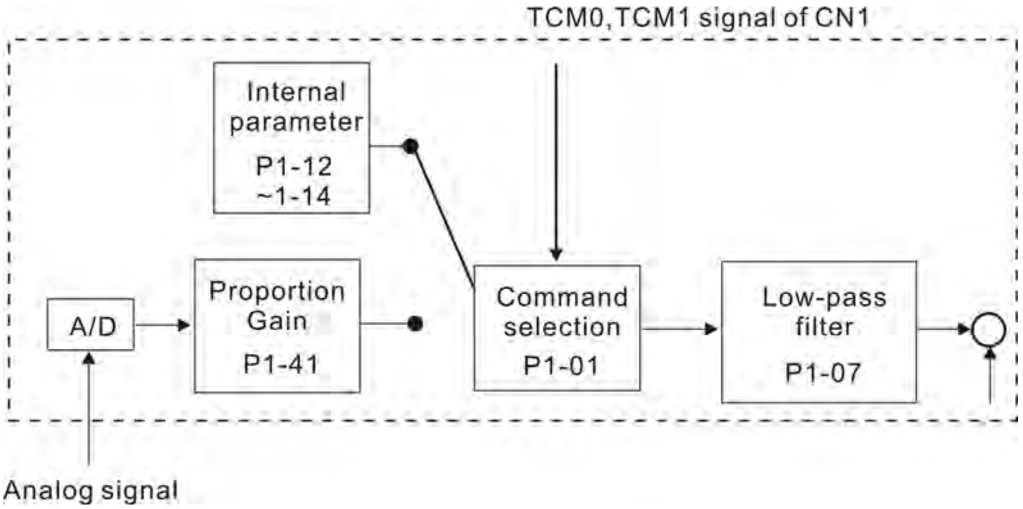
The torque command that is described in this section not only can be taken as torque command in torque control mode (T or Tz mode) but also can be the torque limit input command in position mode (P mode) and speed control mode (S or Sz mode).

6.4.2 Structure of Torque Control Mode

Basic Structure:


Output Torque
Torque command
Torque Command Processing
Resonant Suppression Block Diagram
+
-
Current Control Block Diagram
Current Sensor

The toque command processing is used to select the command source of torque control according to chapter 6.4.1, including max. analog torque command (parameter P1-41) and smoothing strategy of torque control mode. The current control block diagram is used to manage the gain parameters of the servo drive and calculate the current input provided to motor instantaneously. As the current control block diagram is too complicated, setting the parameters of current control block diagram is not allowed. The function and structure of torque command processing is shown as the figure below:



The command source is selected according to the state of TCM0, TCM1 and parameter P1-01 (T or Tz). Whenever the command signal needs to be more smoothly, we recommend the users to use proportional gain (scalar) and low-pass filter to adjust torque.

6.4.3 Smoothing Strategy of Torque Control Mode

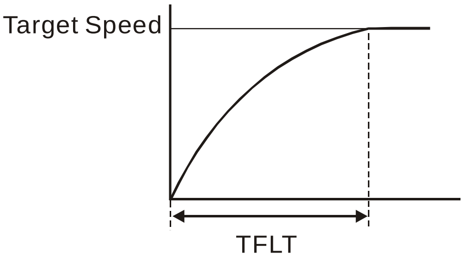
Relevant parameters:

P1-07	**TFLT**	**Smooth Constant of Analog Torque Command (Low-pass Filter)**		**Address: 010EH 010FH**
	Operation Interface:	Keypad/Software	Communication	Related Section: Section 6.4.3
	Default:	0		
	Control Mode:	T		
	Unit:	ms		
	Range:	0 ~ 1000 (0: Disabled)		
	Data Size:	16-bit		
	Display Format:	Decimal		

Settings: 0: Disabled

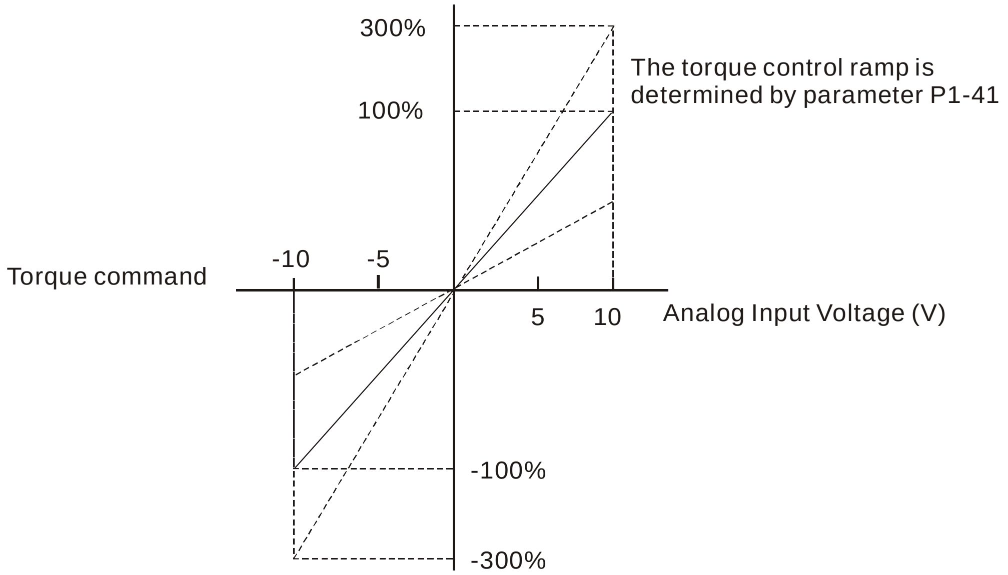
NOTE

1) If the setting value of parameter P1-07 is set to 0, it indicates the function of this parameter is disabled and the command is just By-Pass.



6.4.4 Analog Torque Input Scaling

The analog voltage between T_REF and GND controls the motor torque command. Using with parameter P1-41 can adjust the torque control ramp and its range.



Relevant parameters:

P1-41▲	**TCM**	**Max. Analog Torque Command or Limit**	**Address: 0152H 0153H**
Operation Interface:	Keypad/Software	Communication	Related Section: Section 6.4.4
Default:	100		
Control Mode:	ALL		
Unit:	%		
Range:	0 ~ 1000		
Data Size:	16-bit		
Display Format:	Decimal		

Settings:

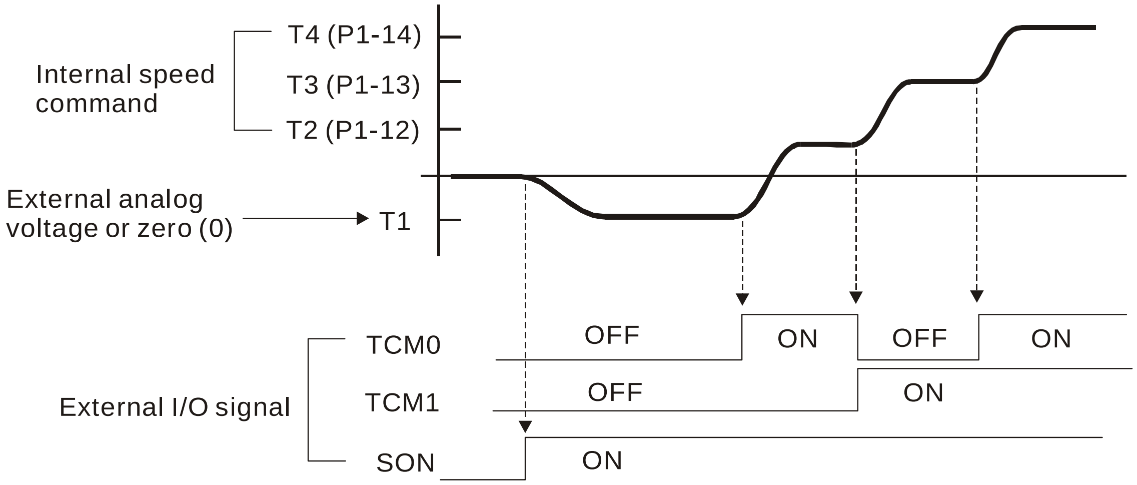
In **Torque mode**, this parameter is used to set the maximum analog torque command based on the maximum input voltage (10V).

In **PT** and **Speed mode**, this parameter is used to set the maximum analog torque limit based on the maximum input voltage (10V).

For example, in torque mode, if P1-41 is set to 100 and the input voltage is 10V, it indicates that the torque command is 100% rated torque. If P1-41 is set to 100, but the input voltage is changed to 5V, then the torque command is changed to 50% rated torque.

Torque Command / Limit = Input Voltage Value x Setting value of P1-41 / 10

6.4.5 Timing Chart of Torque Control Mode



NOTE

1) OFF indicates normally open and ON indicates normally closed.
2) When torque control mode is Tz, the torque command T1=0; when torque control mode is T, the speed command T1 is external analog voltage input (Please refer to P1-01).
3) After Servo ON, the users can select command according to the state of TCM0~1.

6.5 Control Modes Selection

Except signal control mode operation, ASDA-B2 series AC drive also provide PT-S, S-T, PT-T, these three multiple modes for the users to select.

1） Speed / Position mode selection: PT-S

2） Speed / Torque mode selection: S-T

3） Torque / Position mode selection: PT-T

Mode	Name	Code	Description
Dual Mode	PT-S	06	Either PT or S control mode can be selected via the Digital Inputs (DI)
	PT-T	07	Either PT or T control mode can be selected via the Digital Inputs (DI)
	S-T	0A	Either S or T control mode can be selected via the Digital Inputs (DI)

Sz and Tz mode selection is not provided. In order to avoid using too much DI inputs, we recommend that the users can use external analog signal as input command in speed and torque mode to reduce the use of DI inputs (SPD0~1 or TCM0~1).

Please refer to table 3.B and table 3.C in section 3.3.2 to see the default pin number of DI/DO signal.

6.5.1 Speed / Position Control Mode Selection

PT-S Mode:

The command source of PT-S mode is from external input pulse. The speed command can be the external analog voltage or internal parameters (P1-09 to P1-11). The speed and position mode switching is controlled by the S-P signal. The timing chart of speed / position control mode selection is shown as the figure below:

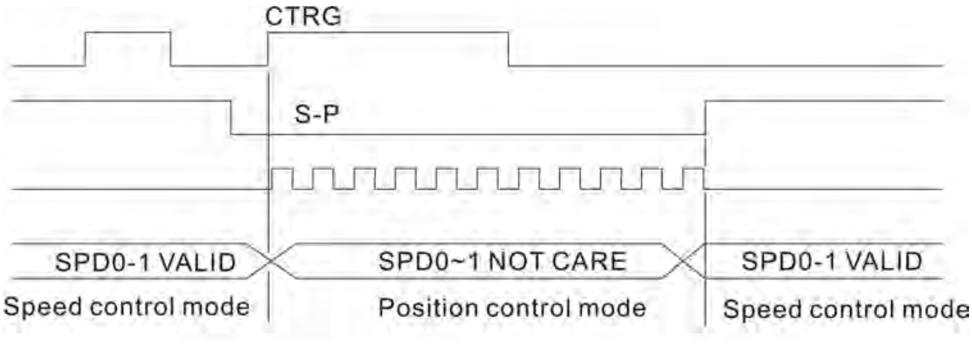


Figure 1.: Speed / Position Control Mode Selection

6.5.2 Speed / Torque Control Mode Selection

S-T Mode:

The speed command can be the external analog voltage or internal parameters (P1-09 to P1-11) and SPD0~1 is used to select speed command. The same as speed command, the torque command can be the external analog voltage or internal parameters (P1-12 to P1-14) and TCM0~1 is used to select torque command. The speed and torque mode switching is controlled by the S-T signal.

The timing chart of speed / torque control mode selection is shown as the figure below:

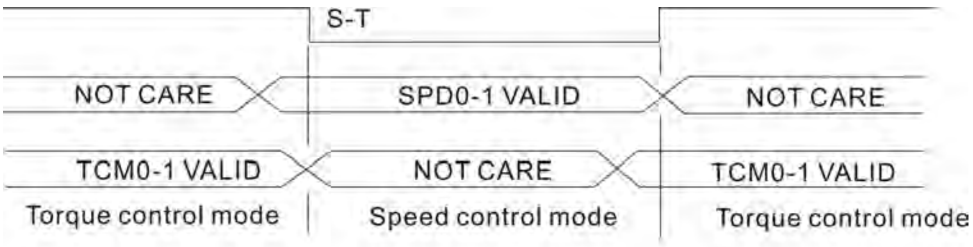


Figure 2. : Speed / Torque Control Mode Selection

In torque mode (when S-T is ON), torque command is selected by TCM0~1. When switching to the speed mode (when S-T is OFF), the speed command is selected by SPD0~1, and then the motor will immediately rotate following the command. After S-T is ON again, it will immediately return to torque mode.

6.5.3 Torque / Position Control Mode Selection

PT-T Mode:

The command source of PT-T mode is from external input pulse. The torque command can be the external input pulse or internal parameters (P1-12 to P1-14). The torque and position mode switching is controlled by T-P signal.

The timing chart of speed / position control mode selection is shown as the figure below:

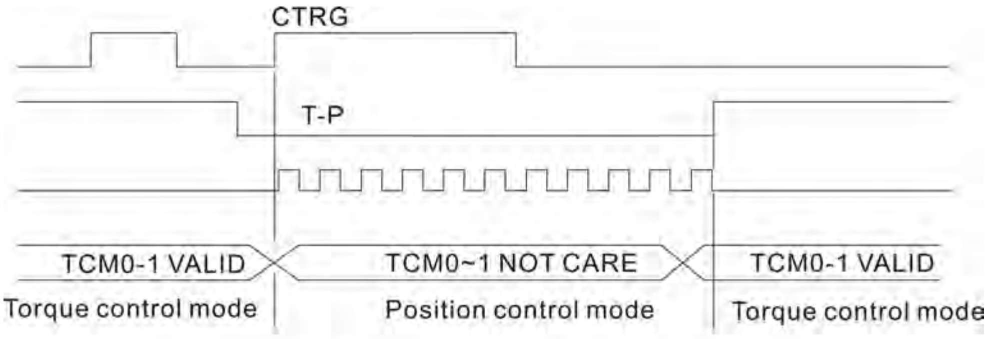


Figure 3. : Torque / Position Control Mode Selection \

6.6 Others

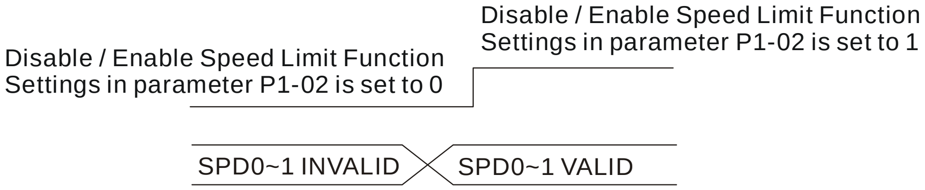
6.6.1 Speed Limit

The max. servo motor speed can be limited by using parameter P1-55 no matter in position, speed or torque control mode.

The command source of speed limit command is the same as speed command. It can be the external analog voltage but also can be internal parameters (P1-09 to P1-11). For more information of speed command source, please refer to chapter 6.3.1.

The speed limit only can be used in torque mode (T mode) to limit the servo motor speed. When the torque command is the external analog voltage, there should be surplus DI signal that can be treated as SPD0~1 and be used to select speed limit command (internal parameter). If there is not enough DI signal, the external voltage input can be used as speed limit command. When the Disable / Enable Speed Limit Function Settings in parameter P1-02 is set to 1, the speed limit function is activated.

The timing chart of speed limit is shown as the figure below:


Disable / Enable Speed Limit Function
Settings in parameter P1-02 is set to 1
Disable / Enable Speed Limit Function
Settings in parameter P1-02 is set to 0
SPD0~1 INVALID
SPD0~1 VALID

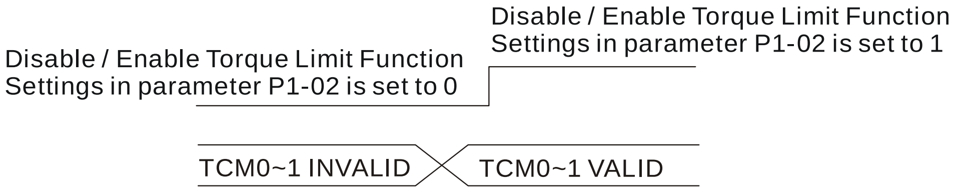
Command Source Selection of Speed Limit

6.6.2 Torque Limit

The command source of torque limit command is the same as torque command. It can be the external analog voltage but also can be internal parameters (P1-12 to P1-14). For more information of torque command source, please refer to chapter 6.4.1.

The torque limit only can be used in position mode (PT mode) and speed mode (S mode) to limit the output torque of servo motor. When the position command is the external pulse and speed command is the external analog voltage, there should be surplus DI signal that can be treated as TCM0~1 used to select torque limit command (internal parameter). If there is not enough DI signal, the external voltage input can be used as torque limit command. When the Disable / Enable Torque Limit Function Settings in parameter P1-02 is set to 1, the torque limit function is activated.

The timing chart of torque limit is shown as the figure below:


Disable / Enable Torque Limit Function
Settings in parameter P1-02 is set to 1
Disable / Enable Torque Limit Function
Settings in parameter P1-02 is set to 0
TCM0~1 INVALID
TCM0~1 VALID

Command Source Selection of Torque Limit

6.6.3 Analog Monitor

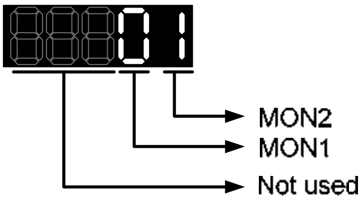
User can use analog monitor to observe the required analog voltage signals. ASDA-B2 series provide two analog channels, they are PIN No. 1 and 3 of CN5 connector. The parameters relative to analog monitor are shown below.

Relevant parameters:

P0-03	**MON**	**Analog Monitor Output**		**Address: 0006H 0007H**
	Operation Interface:	Keypad/Software	Communication	Related Section: Section 6.6.3
	Default:	00		
	Control Mode:	ALL		
	Unit:	-		
	Range:	00 ~ 77		
	Data Size:	16-bit		
	Display Format:	Hexadecimal		

Settings:

This parameter determines the functions of the analog monitor outputs.



MON1, MON2 Settings:

0: Motor speed (+/-8V / maximum motor speed)

1: Motor torque (+/-8V / maximum torque)

2: Pulse command frequency (+8Volts / 4.5Mpps)

3: Speed command (+/-8Volts / maximum speed command)

4: Torque command (+/-8Volts / maximum torque command)

5: V_BUS voltage (+/-8Volts / 450V)

6: Reserved

7: Reserved

Please note: For the setting of analog output voltage proportion, refer to the P1-04 and P1-05.

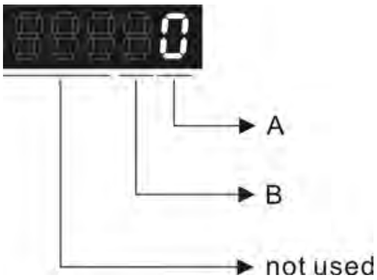
Example: P0-03 = 01 (MON1 is motor speed analog output, MON2 is motor torque analog output)

$$\text{MON1 output voltage} = 8 \times \frac{\text{Motor speed}}{\left(\text{Max. motor speed} \times \frac{\text{P1-04}}{100}\right)} \quad \text{(unit: Volts)}$$

$$\text{MON2 output voltage} = 8 \times \frac{\text{Motor toque}}{\left(\text{Max. motor torque} \times \frac{\text{P1-05}}{100}\right)} \quad \text{(unit: Volts)}$$

P1-03	**AOUT**	**Pulse Output Polarity Setting**		**Address: 0106H 0107H**
	Operation Interface:	Keypad/Software	Communication	Related Section: Section 3.3.3
	Default:	0		
	Control Mode:	ALL		
	Unit:	-		
	Range:	0 ~ 13		
	Data Size:	16-bit		
	Display Format:	Hexadecimal		

Settings:



A: Analog monitor outputs polarity
0: MON1(+), MON2(+)
1: MON1(+), MON2(-)
2: MON1(-), MON2(+)
3: MON1(-), MON2(-)

B: Position pulse outputs polarity
0: Forward output
1: Reverse output

P1-04	**MON1**	**Analog Monitor Output Proportion 1 (MON1)**		**Address: 0108H 0109H**
	Operation Interface:	Keypad/Software	Communication	Related Section: Section 6.4.4
	Default:	100		
	Control Mode:	ALL		
	Unit:	% (full scale)		
	Range:	0 ~ 100		
	Data Size:	16-bit		
	Display Format:	Decimal		

Settings:

Please note:

For the setting of analog output voltage proportion, refer to the P1-03.

Example: P0-03 = 01 (MON1 is motor speed analog output, MON2 is motor torque analog output)

$$\text{MON1 output voltage} = 8 \times \frac{\text{Motor speed}}{(\text{Max. motor speed} \times \frac{\text{P1-04}}{100})} \quad \text{(unit: Volts)}$$

$$\text{MON2 output voltage} = 8 \times \frac{\text{Motor toque}}{(\text{Max. motor torque} \times \frac{\text{P1-05}}{100})} \quad \text{(unit: Volts)}$$

P1-05	**MON2**	**Analog Monitor Output Proportion 2 (MON2)**	**Address: 010AH 010BH**
Operation Interface:	Keypad/Software	Communication	Related Section: Section 6.4.4
Default:	100		
Control Mode:	ALL		
Unit:	% (full scale)		
Range:	0 ~ 100		
Data Size:	16-bit		
Display Format:	Decimal		

Settings:

Please note:

For the setting of analog output voltage proportion, refer to the P1-03.

Example: P0-03 = 01 (MON1 is motor speed analog output, MON2 is motor torque analog output)

$$\text{MON1 output voltage} = 8 \times \frac{\text{Motor speed}}{(\text{Max. motor speed} \times \frac{\text{P1-04}}{100})} \quad \text{(unit: Volts)}$$

$$\text{MON2 output voltage} = 8 \times \frac{\text{Motor toque}}{(\text{Max. motor torque} \times \frac{\text{P1-05}}{100})} \quad \text{(unit: Volts)}$$

P4-20	**DOF1**	**Analog Monitor Output Drift Adjustment (MON1)**	**Address: 0428H 0429H**

Operation Interface:	Keypad / Software	Communication	Related Section: Section 6.4.4
Default:	Factory setting		
Control Mode:	ALL		
Unit:	mV		
Range:	-800 ~ 800		
Data Size:	16-bit		
Display Format:	Decimal		

Settings:

Please note that when P2-08 is set to 10, the users cannot reset this parameter.

P4-21	**DOF2**	**Analog Monitor Output Drift Adjustment (MON2)**	**Address: 042AH 042BH**

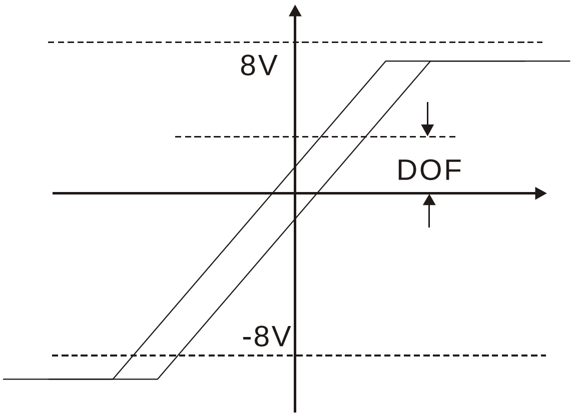
Operation Interface:	Keypad / Software	Communication	Related Section: Section 6.4.4
Default:	0		
Control Mode:	ALL		
Unit:	mV		
Range:	-800 ~ 800		
Data Size:	16-bit		
Display Format:	Decimal		

Settings:

Please note that when P2-08 is set to 10, the users cannot reset this parameter.

For example, when the users want to observe the analog voltage signal of channel 1, if the monitor output setting range is 8V per 325Kpps, then it is needed to change the setting value of parameter P1-04 (Analog Monitor Output Proportion 1) to 50 (=325Kpps/Max. input frequency). Other related parameters setting include parameter P0-03 (A=3) and P1-03 (A=0~3, output polarity setting). In general, when output voltage value of Ch1 is V1, the pulse command frequency is equal to (Max. input frequency × V1/8) × P1-04/100.

Because there is an offset value of analog monitor output voltage, the zero voltage level of analog monitor output does not match to the zero point of setting value. We recommend the users can use Analog Monitor Output Drift Adjustment, DOF1 (parameter P4-20) and DOF2 (parameter P4-21) to improve this condition. The maximum output voltage range of analog monitor output is ±8V. If the output voltage exceed its limit, it is still limited within the range of ±8V. The revolution provided by ASDA-B2 series is 10bit, approximated to 13mv/LSB.



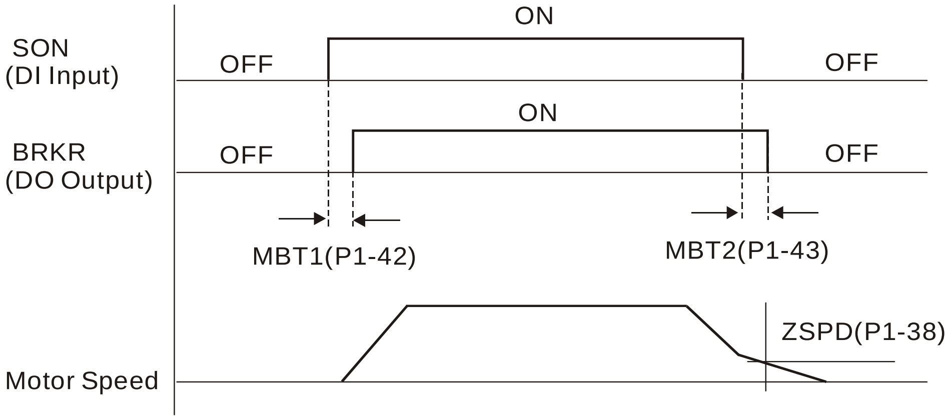
6.6.4 Electromagnetic Brake

When the servo drive is operating, if the digital output BRKR is set to Off, it indicates the electromagnetic brake is disabled and motor is stop running and locked. If the digital output BRKR is set to ON, it indicates electromagnetic brake is enabled and motor can run freely.

There are two parameters that affect the electromagnetic brake. One is parameter P1-42 (MBT1) and the other is parameter P1-43 (MBT2). The users can use these two parameters to set the On and Off delay time of electromagnetic brake. The electromagnetic brake is usually used in perpendicular axis (Z-axis) direction to reduce the large energy generated from servo motor. Using electromagnetic brake can avoid the load may slip since there is no motor holding torque when power is off. Without using electromagnetic brake may reduce the life of servo motor. To avoid malfunction, the electromagnetic brake should be activated after servo system is off (Servo Off).

If the users desire to control electromagnetic brake via external controller, not by the servo drive, the users must execute the function of electromagnetic brake during the period of time when servo motor is braking. The braking strength of motor and electromagnetic brake must be in the same direction when servo motor is braking. Then, the servo drive will operate normally. However, the servo drive may generate larger current during acceleration or at constant speed and it may the cause of overload (servo fault).

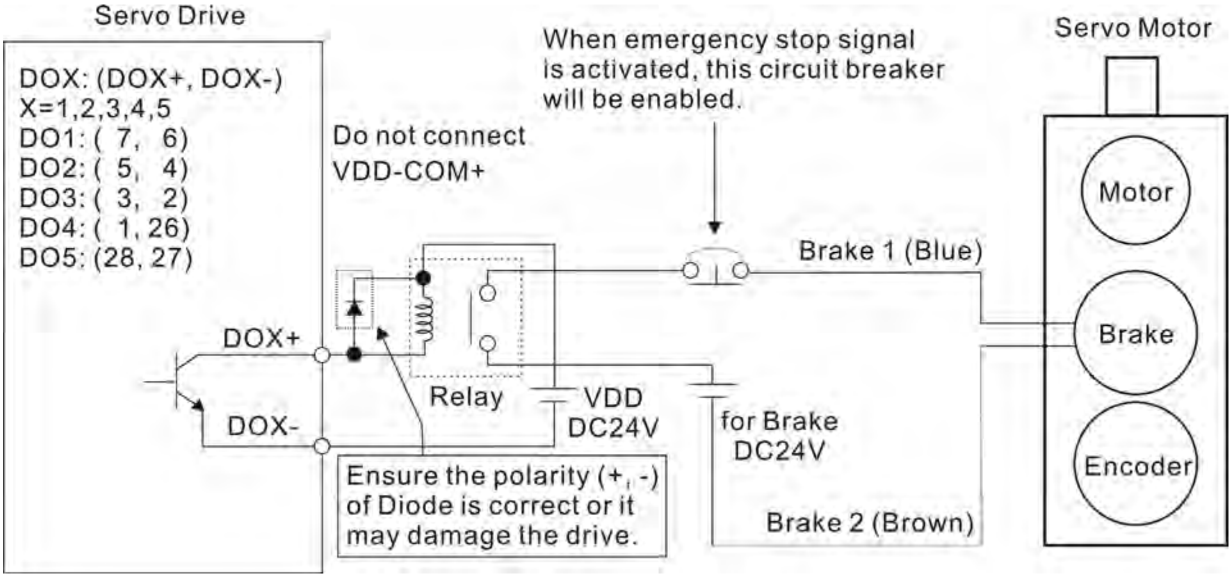
Timing chart for using servo motor with electromagnetic brake:



BRKR output timing explanation:

1. When SERVO OFF (when DI SON is not activated), the BRKR output goes Off (electromagnetic brake is locked) after the delay time set by P1-43 is reached and the motor speed is still higher than the setting value of P1-38.
2. When SERVO OFF (when DI SON is not activated), the BRKR output goes Off (electromagnetic brake is locked) if the delay time set by P1-43 is not reached and the motor speed is still lower than the setting value of P1-38.

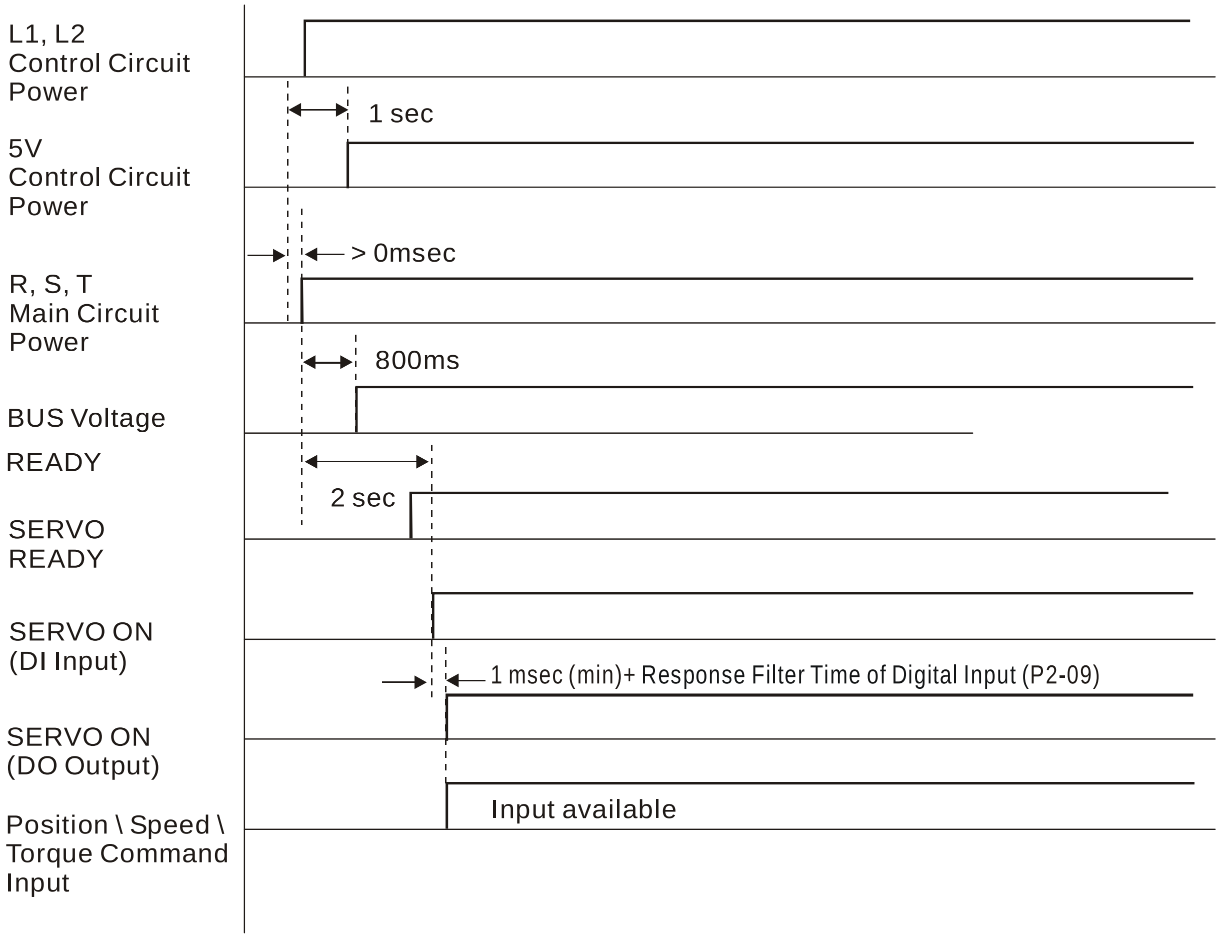
Electromagnetic Brake Wiring Diagram



NOTE

1) Please refer to Chapter 3 Connections and Wiring for more wiring information.
2) The BRKR signal is used to control the brake operation. The VDD DC24V power supply of the servo drive can be used to power the relay coil (Relay). When BRKR signal is ON, the motor brake will be activated.
3) Please note that the coil of brake has no polarity.
4) The power supply for brake is DC24V. Never use it for VDD, the +24V source voltage.

The timing charts of control circuit power and main circuit power:


L1, L2 Control Circuit Power
1 sec
5V Control Circuit Power
> 0msec
R, S, T Main Circuit Power
800ms
BUS Voltage
READY
2 sec
SERVO READY
SERVO ON (DI Input)
1 msec (min)+ Response Filter Time of Digital Input (P2-09)
SERVO ON (DO Output)
Input available
Position \ Speed \ Torque Command Input

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Chapter 7 Servo Parameters

7.1 Definition

There are following five groups for drive parameters:

Group 0: Monitor parameters	(example: P0-xx)
Group 1: Basic parameters	(example: P1-xx)
Group 2: Extension parameters	(example: P2-xx)
Group 3: Communication parameters	(example: P3-xx)
Group 4: Diagnosis parameters	(example: P4-xx)

Abbreviation of control modes:

PT: Position control mode (command from external signal)
S: Speed control mode
T: Torque control mode

Explanation of symbols (marked after parameter)

(★)	Read-only register, such as P0-00, P0-01, P4-00.
(▲)	Parameter cannot be set when Servo On (when the servo drive is enabled), such as P1-00, P1-46 and P2-33.
(●)	Parameter is effective only after the servo drive is restarted (after switching power off and on), such as P1-01 and P3-00.
(■)	Parameter setting values are not retained when power is off, such as P2-31 and P3-06.

7.2 Parameters Summary

Monitor and General Use								
Parameter	**Name**	**Function**	**Default**	**Unit**	**Control Mode**			**Related Section**
					PT	**S**	**T**	
P0-00★	VER	Firmware Version	Factory Setting	N/A	O	O	O	-
P0-01■	ALE	Drive Fault Code	N/A	N/A	O	O	O	11.1 11.2 11.3
P0-02	STS	Drive Status (Front Panel Display)	00	N/A	O	O	O	7.2
P0-03	MON	Analog Monitor Output	01	N/A	O	O	O	4.3.5
P0-08★	TSON	Servo Startup Time	0	Hour				-
P0-09★	CM1	Status Monitor 1	N/A	N/A	O	O	O	4.3.5
P0-10★	CM2	Status Monitor 2	N/A	N/A	O	O	O	4.3.5
P0-11★	CM3	Status Monitor 3	N/A	N/A	O	O	O	4.3.5
P0-12★	CM4	Status Monitor 4	N/A	N/A	O	O	O	4.3.5
P0-13★	CM5	Status Monitor 5	N/A	N/A	O	O	O	4.3.5
P0-17	CM1A	Status Monitor Selection 1	0	N/A				-
P0-18	CM2A	Status Monitor Selection 2	0	N/A				-
P0-19	CM3A	Status Monitor Selection 3	0	N/A				-
P0-20	CM4A	Status Monitor Selection 4	0	N/A				-
P0-21	CM5A	Status Monitor Selection 5	0	N/A				-
P0-46★	SVSTS	Servo Output Status Display	0	N/A	O	O	O	-
P1-04	MON1	Analog Monitor Output Proportion 1 (MON1)	100	%(full scale)	O	O	O	6.4.4
P1-05	MON2	Analog Monitor Output Proportion 2 (MON2)	100	%(full scale)	O	O	O	6.4.4

Explanation of symbols (marked after parameter)

(★)	Read-only register.
(▲)	Parameter cannot be set when Servo On (when the servo drive is enabled).
(●)	Parameter is effective only after the servo drive is restarted (after switching power off and on).
(■)	Parameter setting values are not retained when power is off.

Smooth Filter and Resonance Suppression								
Parameter	**Name**	**Function**	**Default**	**Unit**	**Control Mode**			**Related Section**
					PT	**S**	**T**	
P1-06	SFLT	Accel/Decel Smooth Constant of Analog Speed Command (Low-pass Filter)	0	ms		O		6.3.3
P1-07	TFLT	Smooth Constant of Analog Torque Command (Low-pass Filter)	0	ms			O	6.4.3
P1-08	PFLT	Smooth Constant of Position Command (Low-pass Filter)	0	10ms	O			6.2.4
P1-34	TACC	Acceleration Time	200	ms		O		6.3.3
P1-35	TDEC	Deceleration Time	200	ms		O		6.3.3
P1-36	TSL	Accel/Decel S-curve	0	ms		O		6.3.3
P1-59	MFLT	Analog Speed Linear Filter (Moving Filter)	0	0.1ms		O		-
P1-62	FRCL	Friction Compensation Percentage	0	%	O	O	O	-
P1-63	FRCT	Friction Compensation Smooth Constant	0	ms	O	O	O	-
P1-68	PFLT2	Position Command Moving Filter	0	ms	O			-
P2-23	NCF1	Notch Filter 1 (Resonance Suppression)	1000	Hz	O	O	O	6.3.7
P2-24	DPH1	Notch Filter Attenuation Rate 1 (Resonance Suppression)	0	dB	O	O	O	6.3.7
P2-43	NCF2	Notch Filter 2 (Resonance Suppression)	1000	Hz	O	O	O	6.3.7
P2-44	DPH2	Notch Filter Attenuation Rate 2 (Resonance Suppression)	0	dB	O	O	O	6.3.7
P2-45	NCF3	Notch Filter 3 (Resonance Suppression)	1000	Hz	O	O	O	6.3.7
P2-46	DPH3	Notch Filter Attenuation Rate 3 (Resonance Suppression)	0	dB	O	O	O	6.3.7
P2-47	ANCF	Auto Resonance Suppression Mode Selection	1	N/A	O	O	O	-
P2-48	ANCL	Auto Resonance Suppression Detection Level	100	N/A	O	O	O	-
P2-25	NLP	Low-pass Filter Time Constant (Resonance Suppression)	2 or 5	0.1ms	O	O	O	6.3.7
P2-49	SJIT	Speed Detection Filter and Jitter Suppression	0	sec	O	O	O	-

Explanation of symbols (marked after parameter)

(★)	Read-only register.
(▲)	Parameter cannot be set when Servo On (when the servo drive is enabled).
(●)	Parameter is effective only after the servo drive is restarted (after switching power off and on).
(■)	Parameter setting values are not retained when power is off.

Gain and Switch								
Parameter	**Name**	**Function**	**Default**	**Unit**	**Control Mode**			**Related Section**
					PT	**S**	**T**	
P2-00	KPP	Proportional Position Loop Gain	35	rad/s	O			6.2.5
P2-01	PPR	Position Loop Gain Switching Rate	100	%	O			6.2.5
P2-02	PFG	Position Feed Forward Gain	50	%	O			6.2.5
P2-03	PFF	Smooth Constant of Position Feed Forward Gain	5	ms	O			-
P2-04	KVP	Proportional Speed Loop Gain	500	rad/s	O	O	O	6.3.6
P2-05	SPR	Speed Loop Gain Switching Rate	100	%	O	O	O	-
P2-06	KVI	Speed Integral Compensation	100	rad/s	O	O	O	6.3.6
P2-07	KVF	Speed Feed Forward Gain	0	%	O	O	O	6.3.6
P2-26	DST	External Anti-interference Gain	0	0.001	O	O	O	-
P2-27	GCC	Gain Switching Control Selection	0	N/A	O	O	O	-
P2-28	GUT	Gain Switching Time Constant	10	10ms	O	O	O	-
P2-29	GPE	Gain Switching Condition	1280000	pulse Kpps r/min	O	O	O	-
P2-31	AUT1	Speed Frequency Response Level in Auto and Semi-Auto Mode	80	Hz	O	O	O	5.6 6.3.6
P2-32▲	AUT2	Tuning Mode Selection	0	N/A	O	O	O	5.6 6.3.6

Explanation of symbols (marked after parameter)

(★) Read-only register.
(▲) Parameter cannot be set when Servo On (when the servo drive is enabled).
(●) Parameter is effective only after the servo drive is restarted (after switching power off and on).
(■) Parameter setting values are not retained when power is off.

Position Control								
Parameter	**Name**	**Function**	**Default**	**Unit**	**Control Mode**			**Related Section**
					PT	**S**	**T**	
P1-01●	CTL	Control Mode and Output Direction	0	pulse r/min N-M	O	O	O	6.1
P1-02▲	PSTL	Speed and Torque Limit	0	N/A	O	O	O	6.6

Position Control								
Parameter	Name	Function	Default	Unit	Control Mode			Related Section
					PT	S	T	
P1-12 ~ P1-14	TQ1 ~ 3	1st ~ 3rd Torque Limit	100	%	O	O	O	6.4.1
P1-46▲	GR3	Encoder Output Pulse Number	2500	pulse	O	O	O	-
P1-55	MSPD	Maximum Speed Limit	rated	r/min	O	O	O	-
P2-50	DCLR	Pulse Deviation Clear Mode	0	N/A	O			-
External Pulse Control Command (PT mode)								
P1-00▲	PTT	External Pulse Input Type	0x2	N/A	O			6.2.1
P1-44▲	GR1	Electronic Gear Ratio (1st Numerator) (N1)	1	pulse	O			6.2.3
P1-45▲	GR2	Electronic Gear Ratio (Denominator) (M)	1	pulse	O			6.2.3
P2-60▲	GR4	Electronic Gear Ratio (2nd Numerator) (N2)	1	pulse	O			-
P2-61▲	GR5	Electronic Gear Ratio (3rd Numerator) (N3)	1	pulse	O			-
P2-62▲	GR6	Electronic Gear Ratio (4th Numerator) (N4)	1	pulse	O			-

Explanation of symbols (marked after parameter)

(★) Read-only register.
(▲) Parameter cannot be set when Servo On (when the servo drive is enabled).
(●) Parameter is effective only after the servo drive is restarted (after switching power off and on).
(■) Parameter setting values are not retained when power is off.

Speed Control								
Parameter	Name	Function	Default	Unit	Control Mode			Related Section
					PT	S	T	
P1-01●	CTL	Control Mode and Output Direction	0	pulse r/min N-M	O	O	O	6.1
P1-02▲	PSTL	Speed and Torque Limit	0	N/A	O	O	O	6.6
P1-46▲	GR3	Encoder Output Pulse Number	1	pulse	O	O	O	-
P1-55	MSPD	Maximum Speed Limit	rated	r/min	O	O	O	-
P1-09 ~ P1-11	SP1 ~ 3	1st ~ 3rd Speed Command	1000 ~ 3000	0.1 r/min		O	O	6.3.1
P1-12 ~ P1-14	TQ1 ~ 3	1st ~ 3rd Torque Limit	100	%	O	O	O	6.6.2

P1-40▲	VCM	Max. Analog Speed Command or Limit	rated	r/min		O	O	6.3.4
P1-41▲	TCM	Max. Analog Torque Command or Limit	100	%	O	O	O	-
P1-76	AMSPD	Max. Rotation Speed of Encoder Output	5500	r/min	O	O	O	-

Explanation of symbols (marked after parameter)

(★) Read-only register.
(▲) Parameter cannot be set when Servo On (when the servo drive is enabled).
(●) Parameter is effective only after the servo drive is restarted (after switching power off and on).
(■) Parameter setting values are not retained when power is off.

Torque Control

Parameter	Name	Function	Default	Unit	Control Mode			Related Section
					PT	S	T	
P1-01●	CTL	Control Mode and Output Direction	0	pulse r/min N-M	O	O	O	6.1
P1-02▲	PSTL	Speed and Torque Limit	0	N/A	O	O	O	6.6
P1-46▲	GR3	Encoder Output Pulse Number	1	pulse	O	O	O	-
P1-55	MSPD	Maximum Speed Limit	rated	r/min	O	O	O	-
P1-09 ~ P1-11	SP1~3	1st ~ 3rd Speed Limit	1000 ~ 3000	r/min		O	O	6.6.1
P1-12 ~ P1-14	TQ1~3	1st ~ 3rd Torque Command	100	%	O	O	O	6.4.1
P1-40▲	VCM	Max. Analog Speed Command or Limit	rated	r/min		O	O	-
P1-41▲	TCM	Max. Analog Torque Command or LImit	100	%	O	O	O	6.4.4

Explanation of symbols (marked after parameter)

(★) Read-only register.
(▲) Parameter cannot be set when Servo On (when the servo drive is enabled).
(●) Parameter is effective only after the servo drive is restarted (after switching power off and on).
(■) Parameter setting values are not retained when power is off.

Digital I/O and Relative Input Output Setting								
Parameter	**Name**	**Function**	**Default**	**Unit**	**Control Mode**			**Related Section**
					PT	**S**	**T**	
P2-09	DRT	Bounce Filter	2	2ms	O	O	O	-
P2-10	DI1	Digital Input Terminal 1 (DI1)	101	N/A	O	O	O	Table 7.A
P2-11	DI2	Digital Input Terminal 2 (DI2)	104	N/A	O	O	O	Table 7.A
P2-12	DI3	Digital Input Terminal 3 (DI3)	116	N/A	O	O	O	Table 7.A
P2-13	DI4	Digital Input Terminal 4 (DI4)	117	N/A	O	O	O	Table 7.A
P2-14	DI5	Digital Input Terminal 5 (DI5)	102	N/A	O	O	O	Table 7.A
P2-15	DI6	Digital Input Terminal 6 (DI6)	22	N/A	O	O	O	Table 7.A
P2-16	DI7	Digital Input Terminal 7 (DI7)	23	N/A	O	O	O	Table 7.A
P2-17	DI8	Digital Input Terminal 8 (DI8)	21	N/A	O	O	O	Table 7.A
P2-36	DI9	External Digital Input Terminal 9 (DI9)	0	N/A	O	O	O	Table 7.A
P2-18	DO1	Digital Output Terminal 1 (DO1)	101	N/A	O	O	O	Table 7.B
P2-19	DO2	Digital Output Terminal 2 (DO2)	103	N/A	O	O	O	Table 7.B
P2-20	DO3	Digital Output Terminal 3 (DO3)	109	N/A	O	O	O	Table 7.B
P2-21	DO4	Digital Output Terminal 4 (DO4)	105	N/A	O	O	O	Table 7.B
P2-22	DO5	Digital Output Terminal 5 (DO5)	7	N/A	O	O	O	Table 7.B
P2-37	DO6	Digital Output Terminal 6 (DO6)	7	N/A	O	O	O	Table 7.B
P1-38	ZSPD	Zero Speed Range Setting	100	0.1 r/min	O	O	O	Table 7.B
P1-39	SSPD	Target Motor Speed	3000	r/min	O	O	O	Table 7.B
P1-42	MBT1	On Delay Time of Electromagnetic Brake	0	ms	O	O	O	6.5.5
P1-43	MBT2	Off Delay Time of Electromagnetic Brake	0	ms	O	O	O	6.5.5
P1-47	SCPD	Speed Reached Output Range	10	r/min		O		Table 7.B
P1-54	PER	Positioning Completed Width	12800	pulse	O			Table 7.B
P1-56	OVW	Output Overload Warning Time	120	%	O	O	O	Table 7.B

Explanation of symbols (marked after parameter)

(★)	Read-only register.
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(●)	Parameter is effective only after the servo drive is restarted (after switching power off and on).
(■)	Parameter setting values are not retained when power is off.

Communication								
Parameter	**Name**	**Function**	**Default**	**Unit**	**Control Mode**			**Related Section**
					PT	**S**	**T**	
P3-00●	ADR	Communication Address Setting	0x7F	N/A	O	O	O	8.2
P3-01	BRT	Transmission Speed	0x0203	bps	O	O	O	8.2
P3-02	PTL	Communication Protocol	6	N/A	O	O	O	8.2
P3-03	FLT	Transmission Fault Treatment	0	N/A	O	O	O	8.2
P3-04	CWD	Communication Time Out Detection	0	sec	O	O	O	8.2
P3-05	CMM	Communication Selection	0	N/A	O	O	O	8.2
P3-06■	SDI	Digital Input Communication Function	0	N/A	O	O	O	8.2
P3-07	CDT	Communication Response Delay Time	0	1ms	O	O	O	8.2
P3-08	MNS	Monitor Mode	0000	N/A	O	O	O	8.2

Explanation of symbols (marked after parameter)

(★)	Read-only register.
(▲)	Parameter cannot be set when Servo On (when the servo drive is enabled).
(●)	Parameter is effective only after the servo drive is restarted (after switching power off and on).
(■)	Parameter setting values are not retained when power is off.

Diagnosis								
Parameter	**Name**	**Function**	**Default**	**Unit**	**Control Mode**			**Related Section**
					PT	**S**	**T**	
P4-00★	ASH1	Fault Record (N)	0	N/A	O	O	O	4.4.1
P4-01★	ASH2	Fault Record (N-1)	0	N/A	O	O	O	4.4.1
P4-02★	ASH3	Fault Record (N-2)	0	N/A	O	O	O	4.4.1
P4-03★	ASH4	Fault Record (N-3)	0	N/A	O	O	O	4.4.1
P4-04★	ASH5	Fault Record (N-4)	0	N/A	O	O	O	4.4.1
P4-05	JOG	JOG Operation	20	r/min	O	O	O	4.4.2
P4-06▲■	FOT	Force Output Contact Control	0	N/A	O	O	O	4.4.4
P4-07	ITST	Input Status	0	N/A	O	O	O	4.4.5 8.2
P4-08★	PKEY	Digital Keypad Input of Servo Drive	N/A	N/A	O	O	O	-

Diagnosis								
Parameter	**Name**	**Function**	**Default**	**Unit**	**Control Mode**			**Related Section**
					PT	**S**	**T**	
P4-09★	MOT	Output Status	N/A	N/A	O	O	O	4.4.6
P4-10▲	CEN	Adjustment Function	0	N/A	O	O	O	-
P4-11	SOF1	Analog Speed Input Drift Adjustment 1	Factory Setting	N/A	O	O	O	-
P4-12	SOF2	Analog Speed Input Drift Adjustment 2	Factory Setting	N/A	O	O	O	-
P4-14	TOF2	Analog Torque Drift Adjustment 2	Factory Setting	N/A	O	O	O	-
P4-15	COF1	Current Detector Drift Adjustment (V1 phase)	Factory Setting	N/A	O	O	O	-
P4-16	COF2	Current Detector Drift Adjustment (V2 phase)	Factory Setting	N/A	O	O	O	-
P4-17	COF3	Current Detector Drift Adjustment (W1 phase)	Factory Setting	N/A	O	O	O	-
P4-18	COF4	Current Detector Drift Adjustment (W2 phase)	Factory Setting	N/A	O	O	O	-
P4-19	TIGB	IGBT NTC Calibration	Factory Setting	N/A	O	O	O	-
P4-20	DOF1	Analog Monitor Output Drift Adjustment (MON1)	0	mV	O	O	O	6.4.4
P4-21	DOF2	Analog Monitor Output Drift Adjustment (MON2)	0	mV	O	O	O	6.4.4
P4-22	SAO	Analog Speed Input Offset	0	mV		O		-
P4-23	TAO	Analog Torque Input Offset	0	mV			O	-

Explanation of symbols (marked after parameter)

(★)	Read-only register.
(▲)	Parameter cannot be set when Servo On (when the servo drive is enabled).
(●)	Parameter is effective only after the servo drive is restarted (after switching power off and on).
(■)	Parameter setting values are not retained when power is off.

7.3 Detailed Parameter Listings

Group 0: P0-xx Monitor Parameters

P0-00★	**VER**	**Firmware Version**		**Address: 0000H 0001H**
	Operation Interface:	Keypad/Software	Communication	Related Section: N/A
	Default:	Factory setting		
	Control Mode:	ALL		
	Unit:	-		
	Range:	-		
	Data Size:	16-bit		
	Display Format:	Decimal		

Settings:

This parameter displays the firmware version of the servo drive.

P0-01■	**ALE**	**Drive Fault Code**		**Address: 0002H 0003H**
	Operation Interface:	Keypad/Software	Communication	Related Section: Section: 11.1 Section: 11.2 Section: 11.3
	Default:	-		
	Control Mode:	ALL		
	Unit:	-		
	Range:	0 ~ 0 (0: clear the fault or restart the servo drive, the same function of ARST (DI signal))		
	Data Size:	16-bit		
	Display Format:	BCD		

Settings:

This parameter shows the current servo drive fault if the servo drive is currently faulted.

The fault code is hexadecimal data but displayed in BCD format (Binary coded decimal).

Servo Drive Fault Codes:

001: Overcurrent

002: Overvoltage

003: Undervoltage (This fault code shows when main circuit voltage is below its minimum specified value while Servo On, and it will not show while Servo Off. This fault code can't be cleared automatically after the voltage has returned within its specification. Please refer to parameter P2-66.)

004: Motor error (The drive and motor are not correctly matched for size (power rating).

005: Regeneration error

006: Overload

007: Overspeed

008: Abnormal pulse control command

009: Excessive deviation

010: Reserved

011: Encoder error (The wiring of the encoder is in error and this causes the communication error between the servo drive and the encoder.)

012: Adjustment error

013: Emergency stop activated

014: Reverse limit switch error

015: Forward limit switch error

016: IGBT temperature error

017: Memory error

018: Encoder output error

019: Serial communication error

020: Serial communication time out

021: Reserved

022: Input power phase loss

023: Pre-overload warning

024: Encoder initial magnetic field error

025: Encoder internal error

026: Encoder data error

027: Motor internal error

028: Motor internal error

029: Motor internal error

030: Motor protection error

030: Motor protection error

031: U,V,W, GND wiring error

035: Motor temperature error

048: Excessive encoder output error

067: Motor temperature warning

099: DSP firmware upgrade

P0-02	**STS**	**Drive Status (Front Panel Display)**		**Address: 0004H 0005H**
	Operation Interface:	Keypad/Software	Communication	Related Section: Section 7.2
	Default:	00		
	Control Mode:	ALL		
	Unit:	-		
	Range:	0 ~ 18		
	Data Size:	16-bit		
	Display Format:	Decimal		

Settings:

This parameter shows the servo drive status.

00: Motor feedback pulse number (after electronic gear ratio is set) [user unit]

01: Input pulse number of pulse command (after electronic gear ratio is set) [user unit]

02: Position error counts between control command pulse and feedback pulse [user unit]

03: Motor feedback pulse number (encoder unit, 160000 pulse/rev) [pulse]

04: Input pulse number of pulse command (before electronic gear ratio is set) [pulse]

05: Position error counts [pulse]

06: Input frequency of pulse command [Kpps]

07: Motor rotation speed [r/min]

08: Speed input command [Volt]

09: Speed input command [r/min]

10: Torque input command [Volt]

11: Torque input command [%]

12: Average load [%]

13: Peak load [%]

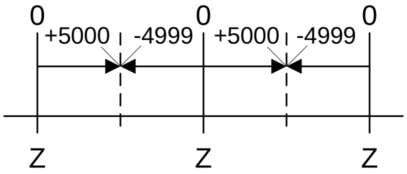
14: Main circuit voltage [Volt]

15: Ratio of load inertia to Motor inertia [0.1times]

16: IGBT temperature

17: Resonance frequency [Hz]

18: Absolute pulse number relative to encoder (use Z phase as home). The value of Z phase home point is 0, and it can be the value from -5000 to +5000 pulses.



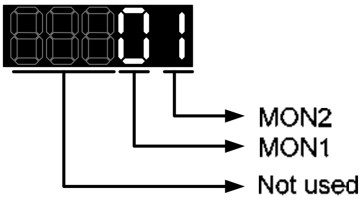
The interval of two Z phase pulse command is 10000 pulse.

112: Observe the communication quality of encoder

P0-03	**MON**	**Analog Monitor Output**		**Address: 0006H 0007H**
	Operation Interface:	Keypad/Software	Communication	Related Section: Section 6.6.3
	Default:	00		
	Control Mode:	ALL		
	Unit:	-		
	Range:	00 ~ 77		
	Data Size:	16-bit		
	Display Format:	Hexadecimal		

Settings:

This parameter determines the functions of the analog monitor outputs.



MON1, MON2 Settings:

0: Motor speed (+/-8V / maximum motor speed)

1: Motor torque (+/-8V / maximum torque)

2: Pulse command frequency (+8Volts / 4.5Mpps)

3: Speed command (+/-8Volts / maximum speed command)

4: Torque command (+/-8Volts / maximum torque command)

5: V_BUS voltage (+/-8Volts / 450V)

6: Reserved

7: Reserved

Communication error	Communication quality
Continuous communication error 7-9 times	3(servere)
Continuous communication error 5-6 times	2 (bad)
Continuous communication error 3-4 times	1(moderate)
Continuous communication error under 2 times	0 (good)

Please note: For the setting of analog output voltage proportion, refer to the P1-04 and P1-05.

Example:

P0-03 = 01 (MON1 is motor speed analog output, MON2 is motor torque analog output)

$$\text{MON1 output voltage} = 8 \times \frac{\text{Motor speed}}{\left(\text{Max. motor speed} \times \frac{\text{P1-04}}{100}\right)} \quad \text{(unit: Volts)}$$

$$\text{MON2 output voltage} = 8 \times \frac{\text{Motor toque}}{\left(\text{Max. motor torque} \times \frac{\text{P1-05}}{100}\right)} \quad \text{(unit: Volts)}$$

P0-04■	**Reserved (Do Not Use)**	**Address: 0008H 0009H**

P0-05■	**Reserved (Do Not Use)**	**Address: 000AH 000BH**

P0-06■	**Reserved (Do Not Use)**	**Address: 000CH 000DH**

P0-07■	**Reserved (Do Not Use)**	**Address: 000EH 000FH**

P0-08★	**TSON**	**Servo Startup Time**	**Address: 0010H 0011H**

Operation Interface:	Keypad/Software	Communication	Related Section: N/A
Default:	0		
Control Mode:	-		
Unit:	Hour		
Range:	High Word: 0 ~ 65535		
	Low Word: 0 ~ 65535		
Data Size:	16-bit		
Display Format:	Decimal		

Settings:

High Word: Servo enable time

Low Word: Servo power on time

P0-09★	**CM1**	**Status Monitor 1**	**Address: 0012H 0013H**

Operation Interface:	Keypad/Software	Communication	Related Section: Section 4.3.5
Default:	-		
Control Mode:	ALL		
Unit:	-		
Range:	-		
Data Size:	32-bit		
Display Format:	Decimal		

Settings:

This parameter is used to provide the value of one of the status monitoring functions found in P0-02. The value of P0-09 is determined by P0-17 (desired drive status) through communication setting or the keypad. The drive status can be read from the communication address of this parameter via communication port.

For example:

Set P0-17 to 3, then all consequent reads of P0-09 will return the motor feedback pulse number in pulse.

When reading the drive status through Modbus communication, the system should read two 16-bit data stored in the addresses of 0012H and 0013H to form a 32-bit data.

(0013H : 0012H) = (High Word : Low Word)

When reading the drive ststus through the keypad, if P0-02 is set to 23, VAR-1 will quickly show for about two seconds and then the value of P0-09 will display on the display.

P0-10★	**CM2**	**Status Monitor 2**		**Address: 0014H 0015H**
	Operation Interface:	Keypad/Software	Communication	Related Section: Section 4.3.5
	Default:	-		
	Control Mode:	ALL		
	Unit:	-		
	Range:	-		
	Data Size:	32-bit		
	Display Format:	Decimal		

Settings:

This parameter is used to provide the value of one of the status monitoring functions found in P0-02. The value of P0-10 is determined by P0-18 (desired drive status) through communication setting or the keypad. The drive status can be read from the communication address of this parameter via communication port.

When reading the drive status through the keypad, if P0-02 is set to 24, VAR-2 will quickly show for about two seconds and then the value of P0-10 will display on the display.

P0-11★	**CM3**	**Status Monitor 3**		**Address: 0016H 0017H**
	Operation Interface:	Keypad/Software	Communication	Related Section: Section 4.3.5
	Default:	-		
	Control Mode:	ALL		
	Unit:	-		
	Range:	-		
	Data Size:	32-bit		
	Display Format:	Decimal		

Settings:

This parameter is used to provide the value of one of the status monitoring functions found in P0-02. The value of P0-11 is determined by P0-19 (desired drive status) through communication setting or the keypad. The drive status can be read from the communication address of this parameter via communication port.

When reading the drive status through the keypad, if P0-02 is set to 25, VAR-3 will quickly show for about two seconds and then the value of P0-11 will display on the display.

P0-12★	**CM4**	**Status Monitor 4**		**Address: 0018H 0019H**
	Operation Interface:	Keypad/Software	Communication	Related Section: Section 4.3.5
	Default:	-		
	Control Mode:	ALL		
	Unit:	-		
	Range:	-		
	Data Size:	32-bit		
	Display Format:	Decimal		

Settings:

This parameter is used to provide the value of one of the status monitoring functions found in P0-02. The value of P0-12 is determined by P0-20 (desired drive status) through communication setting or the keypad. The drive status can be read from the communication address of this parameter via communication port.

When reading the drive status through the keypad, if P0-02 is set to 26, VAR-4 will quickly show for about two seconds and then the value of P0-12 will display on the display.

P0-13★	**CM5**	**Status Monitor 5**		**Address: 001AH 001BH**
	Operation Interface:	Keypad/Software	Communication	Related Section: Section 4.3.5
	Default:	-		
	Control Mode:	ALL		
	Unit:	-		
	Range:	-		
	Data Size:	32-bit		
	Display Format:	Decimal		

Settings:

This parameter is used to provide the value of one of the status monitoring functions found in P0-02. The value of P0-12 is determined by P0-20 (desired drive status) through communication setting or the keypad. The drive status can be read from the communication address of this parameter via communication port.

P0-14	**Reserved (Do Not Use)**	**Address: 001CH 001DH**

P0-15	**Reserved (Do Not Use)**	**Address: 001EH 001FH**

P0-16	**Reserved (Do Not Use)**	**Address: 0020H 0021H**

P0-17	**CM1A**	**Status Monitor Selection 1**	**Address: 0022H 0023H**

Operation Interface:	Keypad/Software	Communication	Related Section: N/A
Default:	0		
Control Mode:	-		
Unit:	-		
Range:	0 ~ 18		
Data Size:	16-bit		
Display Format:	Decimal		

Settings:

This parameter is used to determine the drive status found in P0-02. The selected drive status will be displayed by P0-09.

For example:

Set P0-17 to 7, then all consequent reads of P0-09 will return the motor rotation speed in r/min.

P0-18	**CM2A**	**Status Monitor Selection 2**	**Address: 0024H 0025H**

Operation Interface:	Keypad/Software	Communication	Related Section: N/A
Default:	0		
Control Mode:	-		
Unit:	-		
Range:	0 ~ 18		
Data Size:	16-bit		
Display Format:	Decimal		

Settings:

This parameter is used to determine the drive status found in P0-02.

P0-19	**CM3A**	**Status Monitor Selection 3**	**Address: 0026H 0027H**

Operation Interface:	Keypad/Software	Communication	Related Section: N/A
Default:	0		
Control Mode:	-		
Unit:	-		
Range:	0 ~ 18		
Data Size:	16-bit		
Display Format:	Decimal		

Settings:

This parameter is used to determine the drive status found in P0-02.

P0-19	**CM3A**	**Status Monitor Selection 3**	**Address: 0026H 0027H**
Operation Interface:	Keypad/Software	Communication	Related Section: N/A
Default:	0		
Control Mode:	-		
Unit:	-		
Range:	0 ~ 18		
Data Size:	16-bit		
Display Format:	Decimal		

Settings:

This parameter is used to determine the drive status found in P0-02.

P0-20	**CM4A**	**Status Monitor Selection 4**	**Address: 0028H 0029H**
Operation Interface:	Keypad/Software	Communication	Related Section: N/A
Default:	0		
Control Mode:	-		
Unit:	-		
Range:	0 ~ 18		
Data Size:	16-bit		
Display Format:	Decimal		

Settings:

This parameter is used to determine the drive status found in P0-02.

P0-21	**CM5A**	**Status Monitor Selection 5**	**Address: 002AH 002BH**
Operation Interface:	Keypad/Software	Communication	Related Section: N/A
Default:	0		
Control Mode:	-		
Unit:	-		
Range:	0 ~ 18		
Data Size:	16-bit		
Display Format:	Decimal		

Settings:

This parameter is used to determine the drive status found in P0-02.

P0-22	**Reserved (Do Not Use)**	**Address: 002CH 002DH**

P0-23	**Reserved (Do Not Use)**	**Address: 002EH 002FH**

P0-24	**Reserved (Do Not Use)**	**Address: 0030H 0031H**

P0-44★	**PCMN**	**Status Monitor Register (PC Software Setting)**	**Address: 0058H 0059H**

Operation Interface:	Keypad/Software	Communication	Related Section: Section 4.3.5
Default:	0x0		
Control Mode:	ALL		
Unit:	-		
Range:	determined by the communication address of the designated parameter		
Data Size:	32-bit		
Display Format:	Decimal		

Settings:

The function of this parameter is the same as P0-09 (Please refer to P0-09). Please note that this pamameter can be set through communication setting only.

P0-45■	**PCMNA**	**Status Monitor Register Selection (PC Software Setting)**	**Address: 005AH 005BH**

Operation Interface:	Keypad/Software	Communication	Related Section: Section 4.3.5
Default:	0x0		
Control Mode:	ALL		
Unit:	-		
Range:	0~127		
Data Size:	16-bit		
Display Format:	Decimal		

Settings:

The function of this parameter is the same as P0-17 (Please refer to P0-17). Please note that this pamameter can be set through communication setting only.

P0-46★	**SVSTS**	**Servo Output Status Display**	**Address: 005CH 005DH**

Operation Interface:	Keypad/Software	Communication	Related Section: N/A
Default:	0		
Control Mode:	ALL		
Unit:	-		
Range:	0x00 ~ 0xFF		
Data Size:	16-bit		

Display Format:	Hexadecimal

Settings:

This parameter is used to display the digital output signal of the servo drive. The servo output status display will show in hexadecimal format.

Bit0: SRDY (Servo ready)

Bit1: SON (Servo On)

Bit2: ZSPD (At Zero speed)

Bit3: TSPD (At Speed reached)

Bit4: TPOS (At Positioning completed)

Bit5: TQL (At Torque limit)

Bit6: ALRM (Servo alarm activated)

Bit7: BRKR (Electromagnetic brake control)

Bit9: OLW (Output overload warning)

Bit10: WARN (Servo warning activated. WARN is activated when the drive has detected reverse limit error; forward limit error, emergency stop, serial communication error, and undervoltage these fault conditions.)

Bit11: Reserved

Bit12: Reserved

Bit13: Reserved

Bit14: Reserved

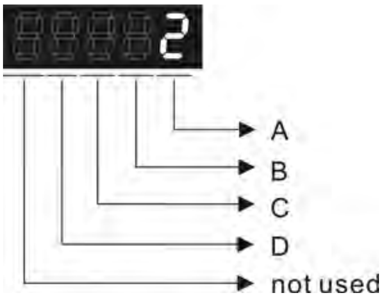
Bit15: Reserved

The servo output status display can be monitored through communication also.

Group 1: P1-xx Basic Parameters

P1-00▲	**PTT**	**External Pulse Input Type**		**Address: 0100H 0101H**
	Operation Interface:	Keypad/Software	Communication	Related Section: Section 6.2.1
	Default:	0x2		
	Control Mode:	PT		
	Unit:	-		
	Range:	0 ~ 1142		
	Data Size:	16-bit		
	Display Format:	Hexadecimal		

Settings:



A: Input pulse type

0: AB phase pulse (4x) (Quadrature Input)

1: Clockwise (CW) + Counterclockwise(CCW) pulse

2: Pulse + Direction

3: Other settings:

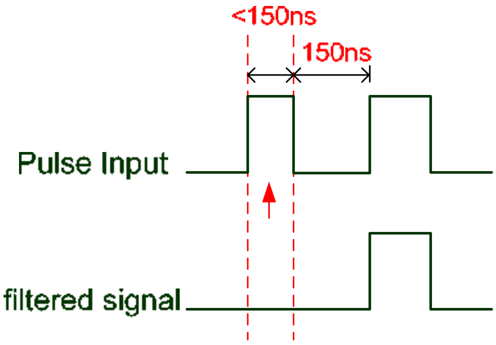
B: Input pulse filter

This setting is used to suppress or reduce the chatter caused by the noise, etc. However, if the instant input pulse filter frequency is over high, the frequency that exceeds the setting value will be regarded as noise and filtered.

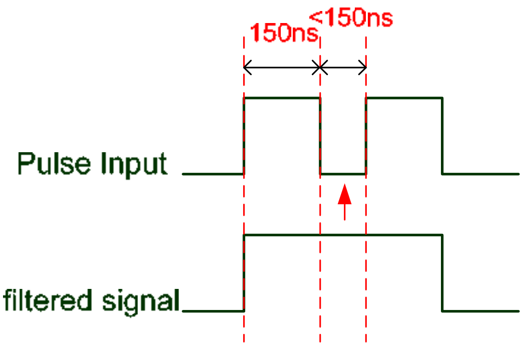
Setting Value	Low-speed Filter Frequency (Min. Filter Frequency (see note 1))	Setting Value	High-speed Filter Frequency (Min. Filter Frequency (see note 1))
0	0.83Mpps (600ns)	0	3.33Mpps (150ns)
1	208Kpps (2.4us)	1	0.83Mpps (600ns)
2	104Kpps (4.8us)	2	416Kpps (1.2us)
3	52Kpps (9.6us)	3	208Kpps (2.4us)
4	No Filter Function	4	No Filter Function

Pleae note:

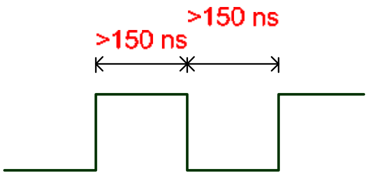
1.



When this pulse frequency is less than 150 ns, this signal will be regarded as a low-level pulse and two input pulses will be regarded as one input pulse.



When this pulse frequency is less than 150 ns, this signal will be regarded as a high-level pulse and two input pulses will be regarded as one input pulse.

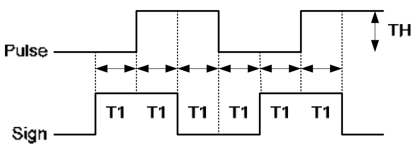
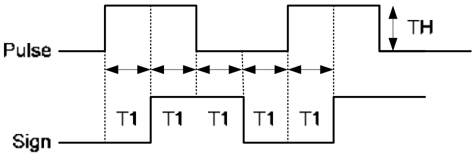
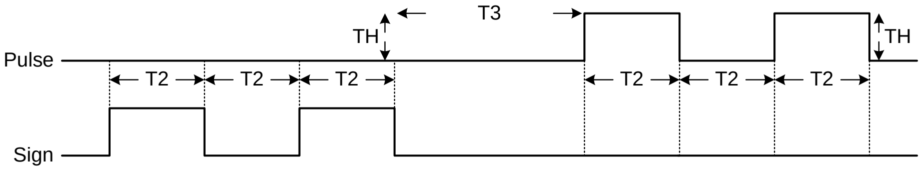
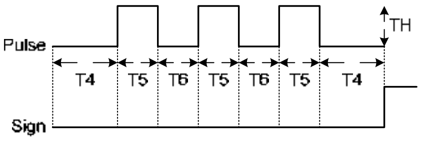
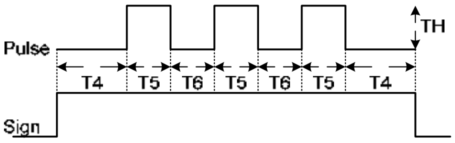
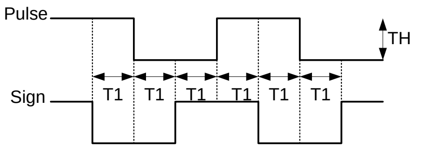
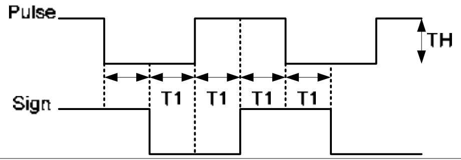
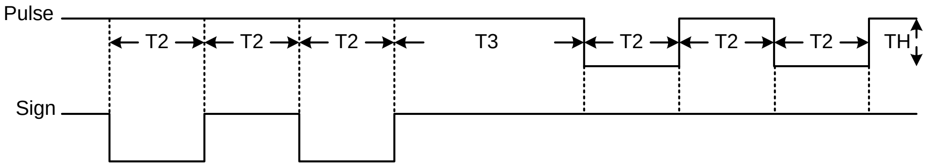
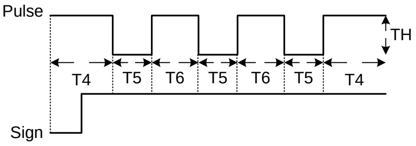
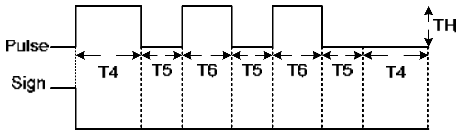


When the pulse frequencies of high-level duty and low-level duty both are greater than 150 ns, the signal will not be filtered (that is, the pulse command will pass through).

If an input pulse of 2~4MHz is used, it is recommended to change the setting value B (Input pulse filter) and set this setting value to 4. Please note that this function is available for DSP version V1.005 sub10 or above.

Note: If the signal is a 4Mpps high input pulse, setting the value B to 4 is able to ensure that the signal will not be filtered and will be certainly delivered.

C: Input polarity

Logic		Pulse Type	Forward	Reverse
0	Positive Logic	AB phase pulse		
		CW + CCW pulse		
		Pulse + Direction		
1	Negative Logic	AB phase pulse		
		CW + CCW pulse		
		Pulse + Direction		

Pulse specification		Max. input pulse frequency	Min. time width					
			T1	T2	T3	T4	T5	T6
High-speed pulse	Line driver	4Mpps	62.5ns	125ns	250ns	200ns	125ns	125ns
Low-speed pulse	Line driver	500Kpps	0.5µs	1µs	2µs	2µs	1µs	1µs
	Open collector	200Kpps	1.25µs	2.5µs	5µs	5µs	2.5µs	2.5µs

Pulse specification		Max. input pulse frequency	Voltage specification	Forward specification
High-speed pulse	Line driver	4Mpps	5V	< 25mA
Low-speed pulse	Line driver	500Kpps	2.8V ~ 3.7V	< 25mA
	Open collector	200Kpps	24V (Max.)	< 25mA

D: Source of pulse command

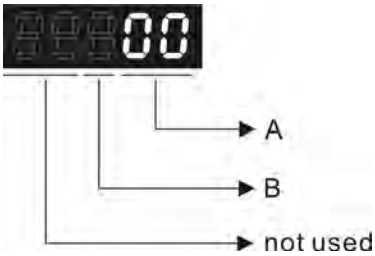
Setting value	Input pulse interface	Remark
0	Open collector for low-speed pulse	CN1 Terminal Identification: PULSE, SIGN
1	Line driver for high-speed pulse	CN1 Terminal Identification: PULSE_D, SIGN_D

P1-01●	CTL	Control Mode and Output Direction	Address: 0102H 0103H

Operation Interface:	Keypad/Software	Communication
Default:	0	
Control Mode:	ALL	
Unit:	pulse (P mode), r/min (S mode), N-m (T mode)	
Range:	00 ~ 110	
Data Size:	16-bit	
Display Format:	Hexadecimal	

Related Section:
Section 6.1,
Table 7.A

Settings:



A: Control mode settings

Mode	PT	S	T	Sz	Tz
Single Mode					
00	▲				
01	Reserved				
02		▲			
03			▲		
04				▲	
05					▲
Multiple Mode					
06	▲	▲			
07	▲		▲		
08	Reserved				
09	Reserved				
0A		▲	▲		

Single Mode:

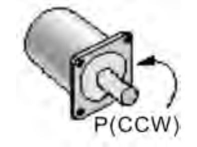
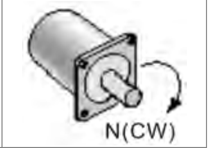
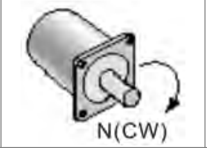
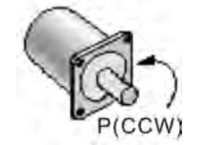
PT: Position control mode. The command is from external pulse or analog voltage (external analog voltage will be available soon). Execution of the command selection is via DI signal, PTAS.S: Speed control mode. The command is from external signal or internal signal. Execution of the command selection is via DI signals, SPD0 and SPD1.

T: Torque control mode. The command is from external signal or internal signal. Execution of the command selection is via DI signals, TCM0 and TCM1.

Sz: Zero speed / internal speed command

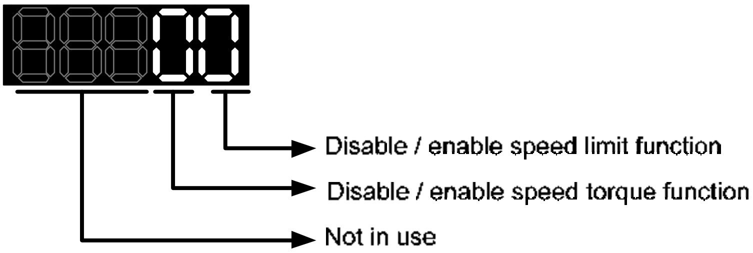
Tz: Zero torque / internal torque commandMultiple Mode: Control of the mode selection is via DI signals. For example, either PT or S control mode can be selected via DI signals, S-P (see Table 7.A).

B: Torque output direction settings

Direction	0	1
Forward		
Reverse		

P1-02▲	**PSTL**	**Speed and Torque Limit**		**Address: 0104H 0105H**
	Operation Interface:	Keypad/Software	Communication	Related Section: Section 6.6, Table 7.A
	Default:	0		
	Control Mode:	ALL		
	Unit:	-		
	Range:	00 ~ 11		
	Data Size:	16-bit		
	Display Format:	Hexadecimal		

Settings:


Disable / enable speed limit function
Disable / enable speed torque function
Not in use

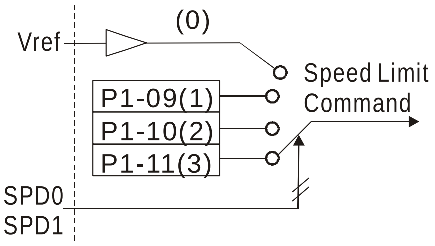
- Disable or Enable speed limit function

0: Disable speed limit function

1: Enable speed limit function (It is available in torque mode)

Others: Reserved

Speed limit setting is as the following:



Users could use speed limit function via parameter setting or DI triggering. That is to say, set P1-02 to 0x0001 or trigger DI will do. Also, users could enable or disable the limit function via DI. SPDLM, which is a more flexible way but would need to take one DI setting. Speed limit can be enabled by P1-02 or DI.

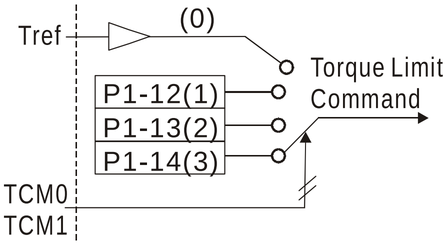
DI.SPD0 and DI.SPD1 are for selecting the limiting source.

- Disable or Enable torque limit function

0: Disable torque limit function

1: Enable torque limit function (It is available in position and speed mode)

Other: Reserved



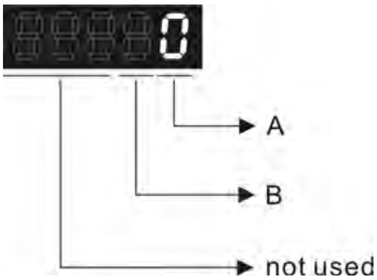
Users could use torque limit function via parameter setting or DI triggering. That is to say, set P1-02 to 0x0010 or trigger DI will do. Also, users could enable or disable the limit function via DI.TRQLM, which is a more flexible way but would need to take one DI setting. Torque limit can be enabled by P1-02 or DI.

DI.TCM0 and DI.TCM1 are for selecting the limiting source.

P1-03	**AOUT**	**Pulse Output Polarity Setting**	**Address: 0106H** **0107H**

Operation Interface:	Keypad/Software	Communication	Related Section: Section 3.3.3
Default:	0		
Control Mode:	ALL		
Unit:	-		
Range:	0 ~ 13		
Data Size:	16-bit		
Display Format:	Hexadecimal		

Settings:



A: Analog monitor outputs polarity	B: Position pulse outputs polarity
0: MON1(+), MON2(+)	0: Forward output
1: MON1(+), MON2(-)	1: Reverse output
2: MON1(-), MON2(+)	
3: MON1(-), MON2(-)	

P1-04	**MON1**	**Analog Monitor Output Proportion 1 (MON1)**		**Address: 0108H 0109H**
	Operation Interface:	Keypad/Software	Communication	Related Section: Section 6.4.4
	Default:	100		
	Control Mode:	ALL		
	Unit:	% (full scale)		
	Range:	0 ~ 100		
	Data Size:	16-bit		
	Display Format:	Decimal		

Settings:

Please note:

For the setting of analog output voltage proportion, refer to the P1-03.

Example: P0-03 = 01 (MON1 is motor speed analog output, MON2 is motor torque analog output)

$$\text{MON1 output voltage} = 8 \times \frac{\text{Motor speed}}{\left(\text{Max. motor speed} \times \frac{\text{P1-04}}{100}\right)} \quad \text{(unit: Volts)}$$

$$\text{MON2 output voltage} = 8 \times \frac{\text{Motor toque}}{\left(\text{Max. motor torque} \times \frac{\text{P1-05}}{100}\right)} \quad \text{(unit: Volts)}$$

P1-05	**MON2**	**Analog Monitor Output Proportion 2 (MON2)**		**Address: 010AH 010BH**
	Operation Interface:	Keypad/Software	Communication	Related Section: Section 6.4.4
	Default:	100		
	Control Mode:	ALL		
	Unit:	% (full scale)		
	Range:	0 ~ 100		

Data Size:	16-bit
Display Format:	Decimal

Settings:

Please note:

For the setting of analog output voltage proportion, refer to the P1-03.

Example: P0-03 = 01 (MON1 is motor speed analog output, MON2 is motor torque analog output)

$$\text{MON1 output voltage} = 8 \times \frac{\text{Motor speed}}{\left(\text{Max. motor speed} \times \frac{\text{P1-04}}{100}\right)} \quad \text{(unit: Volts)}$$

$$\text{MON2 output voltage} = 8 \times \frac{\text{Motor toque}}{\left(\text{Max. motor torque} \times \frac{\text{P1-05}}{100}\right)} \quad \text{(unit: Volts)}$$

P1-06	**SFLT**	**Accel / Decel Smooth Constant of Analog Speed Command (Low-pass Filter)**	**Address: 010CH 010DH**

Operation Interface:	Keypad/Software	Communication	Related Section: Section 6.3.3
Default:	0		
Control Mode:	S		
Unit:	ms		
Range:	0 ~ 1000 (0: Disabled)		
Data Size:	16-bit		
Display Format:	Decimal		

Settings: 0: Disabled

P1-07	**TFLT**	**Smooth Constant of Analog Torque Command (Low-pass Filter)**	**Address: 010EH 010FH**

Operation Interface:	Keypad/Software	Communication	Related Section: Section 6.4.3
Default:	0		
Control Mode:	T		
Unit:	ms		
Range:	0 ~ 1000 (0: Disabled)		
Data Size:	16-bit		
Display Format:	Decimal		

Settings: 0: Disabled

P1-08	**PFLT**	**Smooth Constant of Position Command (Low-pass Filter)**	**Address: 0110H 0111H**
Operation Interface:	Keypad/Software	Communication	Related Section: Section 6.2.4
Default:	0		
Control Mode:	PT		
Unit:	10ms		
Range:	0 ~ 1000		
Data Size:	16-bit		
Display Format:	Decimal		

Settings: 0: Disabled

For example: 11=110 msec

P1-09	**SP1**	**1st Speed Command or Limit**	**Address: 0112H 0113H**
Operation Interface:	Keypad/Software	Communication	Related Section: Section 6.3.1
Default:	1000		
Control Mode:	S, T		
Unit:	0.1r/min		
Range:	-50000 ~ +50000		
Data Size:	32-bit		
Display Format:	Decimal		

Settings:

For example: 120=12 r/min

1st Speed Command

In Speed mode, this parameter is used to set speed 1 of internal speed command.

1st Speed Limit

In Torque mode, this parameter is used to set speed limit 1 of internal speed command.

P1-10	**SP2**	**2nd Speed Command or Limit**	**Address: 0114H 0115H**
Operation Interface:	Keypad/Software	Communication	Related Section: Section 6.3.1
Default:	2000		
Control Mode:	S, T		
Unit:	0.1r/min		
Range:	-50000 ~ +50000		
Data Size:	32-bit		
Display Format:	Decimal		

Settings:

For example: 120=12 r/min

2nd Speed Command

In Speed mode, this parameter is used to set speed 2 of internal speed command.

2nd Speed Limit

In Torque mode, this parameter is used to set speed limit 2 of internal speed command.

P1-11	**SP3**	**3rd Speed Command or Limit**		**Address: 0116H 0117H**
	Operation Interface:	Keypad/Software	Communication	Related Section: Section 6.3.1
	Default:	3000		
	Control Mode:	S, T		
	Unit:	0.1r/min		
	Range:	-50000 ~ +50000		
	Data Size:	32-bit		
	Display Format:	Decimal		

Settings:

For example: 120=12 r/min

3rd Speed Command

In Speed mode, this parameter is used to set speed 3 of internal speed command.

3rd Speed Limit

In Torque mode, this parameter is used to set speed limit 3 of internal speed command.

P1-12	**TQ1**	**1st Torque Command or Limit**		**Address: 0118H 0119H**
	Operation Interface:	Keypad/Software	Communication	Related Section: Section 6.4.1
	Default:	100		
	Control Mode:	T, P&S		
	Unit:	%		
	Range:	-300 ~ +300		
	Data Size:	16-bit		
	Display Format:	Decimal		

Settings:

1st Torque Command

In Torque mode, this parameter is used to set torque 1 of internal torque command.

1st Torque Limit

In Position and Speed mode, this parameter is used to set torque limit 1 of internal torque command.

P1-13	**TQ2**	**2nd Torque Command or Limit**		**Address: 011AH 011BH**
	Operation Interface:	Keypad/Software	Communication	Related Section: Section 6.4.1
	Default:	100		
	Control Mode:	T, P&S		
	Unit:	%		
	Range:	-300 ~ +300		
	Data Size:	16-bit		
	Display Format:	Decimal		

Settings:

2nd Torque Command

In Torque mode, this parameter is used to set torque 2 of internal torque command.

2nd Torque Limit

In Position and Speed mode, this parameter is used to set torque limit 2 of internal torque command.

P1-14	**TQ3**	**3rd Torque Command or Limit**		**Address: 011CH 011DH**
	Operation Interface:	Keypad/Software	Communication	Related Section: Section 6.4.1
	Default:	100		
	Control Mode:	T, P&S		
	Unit:	%		
	Range:	-300 ~ +300		
	Data Size:	16-bit		
	Display Format:	Decimal		

Settings:

3rd Speed Command

In Torque mode, this parameter is used to set torque 3 of internal torque command.

3rd Speed Limit

In Position and Speed mode, this parameter is used to set torque limit 3 of internal torque command.

P1-15	**Reserved (Do Not Use)**	**Address: 011EH 011FH**

P1-16	**Reserved (Do Not Use)**	**Address: 0120H 0121H**

P1-17	**Reserved (Do Not Use)**	**Address: 0122H 0123H**

P1-18	**Reserved (Do Not Use)**	**Address: 0124H 0125H**

P1-19	**Reserved (Do Not Use)**	**Address: 0126H 0127H**

P1-20	**Reserved (Do Not Use)**	**Address: 0128H 0129H**

P1-21	**Reserved (Do Not Use)**	**Address: 012AH 012BH**

P1-22	**Reserved (Do Not Use)**	**Address: 012CH 012DH**

P1-23	**Reserved (Do Not Use)**	**Address: 012EH 012FH**

P1-25	**VSF1**	**Low-frequency Vibration Suppression (1)**	**Address: 0132H 0133H**

Operation Interface:	Keypad/Software	Communication	Related Section: Section 6.2.9
Default:	1000		
Control Mode:	PT		
Unit:	0.1Hz		
Range:	10 ~ 1000		
Data Size:	16bit		
Display Format:	DEC		
Example	150=15Hz		

Settings: The setting value of the first low-frequency vibration suppression. If P1-26 is set to 0, then it will disable the first low-frequency filter.

P1-26	**VSG1**	**Low-frequency Vibration Suppression Gain (1)**	**Address: 0134H 0135H**

Operation Interface:	Keypad/Software	Communication	Related Section: Section 6.2.9
Default:	0		
Control Mode:	PT		
Unit:	-		
Range:	0~9 (0: Disable the first low-frequency filter)		
Data Size:	16bit		
Display Format:	DEC		

Settings: The first low-frequency vibration suppression gain. The bigger value it is, the better the position response will be. However, if the value is set too big, the motor will not be able to smoothly operate. It is suggested to set the value to 1.

P1-27	**VSF2**	**Low-frequency Vibration Suppression (2)**	**Address: 0136H 0137H**

Operation Interface:	Keypad/Software	Communication	Related Section: Section 6.2.9
Default:	1000		

Control Mode:	PT
Unit:	0.1Hz
Range:	10 ~ 1000
Data Size:	16bit
Display Format:	DEC
Example	150=15Hz

Settings: The setting value of the second low-frequency vibration suppression. If P1-28 is set to 0, then it will disable the second low-frequency filter.

P1-28	**VSG2**	**Low-frequency Vibration Suppression Gain (2)**	**Address: 0138H 0139H**

Operation Interface:	Keypad/Software	Communication	Related Section: Section 6.2.9
Default:	0		
Control Mode:	PT		
Unit:	-		
Range:	0~9 (0: Disable the second low-frequency filter)		
Data Size:	16bit		
Display Format:	DEC		

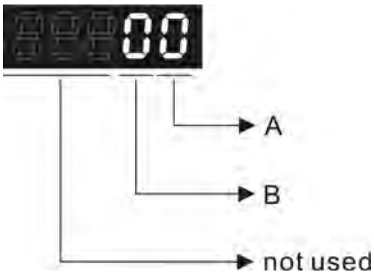
Settings: The second low-frequency vibration suppression gain. The bigger value it is, the better the position response will be. However, if the value is set too big, the motor will not be able to smoothly operate. It is suggested to set the value to 1.

P1-31	**Reserved (Do Not Use)**	**Address: 013EH 013FH**

P1-32	**LSTP**	**Motor Stop Mode Selection**	**Address: 0140H 0141H**

Operation Interface:	Keypad/Software	Communication	Related Section: N/A
Default:	0		
Control Mode:	ALL		
Unit:	-		
Range:	0 ~ 20		
Data Size:	16-bit		
Display Format:	Hexadecimal		

Settings:



A: Fault Stop Mode

When a fault occurs (except for CWL, CCWL, EMGS and serial communication error), it is used to set servo motor stop mode.

0: Stop instantly

1: Decelerate to stop

B: Dynamic Brake Option

When Servo Off or a fault (servo alarm) occurs, it is used to set servo motor stop mode.

0: Use dynamic brake

1: Allow servo motor to coast to stop

2: Use dynamic brake first, after the motor speed is below than P1-38, allow servo motor to coast to stop

When the fault NL(CWL) or PL(CCWL) occurs, please refer to the settings of parameter P1-06, P1-35, P1-36 to determine the deceleration time. If the deceleration time is set to 1ms, the motor will stop instantly.

P1-33	**Reserved (Do Not Use)**	**Address: 0142H 0143H**

P1-34	**TACC**	**Acceleration Time**	**Address: 0144H 0145H**

Operation Interface:	Keypad/Software	Communication	Related Section: Section 6.3.3
Default:	200		
Control Mode:	S		
Unit:	ms		
Range:	1 ~ 20000		
Data Size:	16-bit		
Display Format:	Decimal		

Settings:

This parameter is used to determine the acceleration time to accelerate from 0 to its rated motor speed. The functions of parameters P1-34, P1-35 and P1-36 are each individual.

Please note:

1. When the source of speed command is analog command, the maximum setting value of P1-36 is set to 0, the acceleration and deceleration function will be disabled.

P1-35	**TDEC**	**Deceleration Time**	**Address: 0146H 0147H**
Operation Interface:	Keypad/Software	Communication	Related Section: Section 6.3.3
Default:	200		
Control Mode:	S		
Unit:	ms		
Range:	1 ~ 20000		
Data Size:	16-bit		
Display Format:	Decimal		

Settings:

This parameter is used to determine the acceleration time to accelerate from 0 to its rated motor speed. The functions of parameters P1-34, P1-35 and P1-36 are each individual.

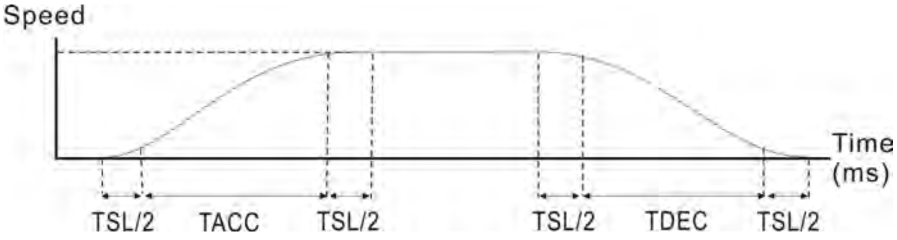
Please note:

1. When the source of speed command is analog command, the maximum setting value of P1-36 is set to 0, the acceleration and deceleration function will be disabled.

P1-36	**TSL**	**Accel /Decel S-curve**	**Address: 0148H 0149H**
Operation Interface:	Keypad/Software	Communication	Related Section: Section 6.3.3
Default:	0		
Control Mode:	S		
Unit:	ms		
Range:	0 ~ 10000 (0: Disabled)		
Data Size:	16-bit		
Display Format:	Decimal		

Settings:

This parameter is used to make the motor run more smoothly when startup and windup. Using this parameter can improve the motor running stability.



TACC: P1-34, Acceleration time

TDEC: P1-35, Deceleration time

TSL: P1-36, Accel /Decel S-curve

Total acceleration time = TACC + TSL

Total deceleration time = TDEC + TSL

The functions of parameters P1-34, P1-35 and P1-36 are each individual. When P1-36 is set to 0 (Disabled), the settings of P1-34, P1-35 are still effective. It indicates that the parameters P1-34 and P1-35 will not become disabled even when P1-36 is disabled.

Please note:

1. When the source of speed command is analog command, the maximum setting value of P1-36 is set to 0, the acceleration and deceleration function will be disabled.

P1-37	**GDR**	**Ratio of Load Inertia to Servo Motor Inertia**		**Address: 014AH 014BH**
	Operation Interface:	Keypad/Software	Communication	Related Section: N/A
	Default:	1.0	10	
	Control Mode:	ALL		
	Unit:	1 times	0.1 times	
	Range:	0.0 ~ 200.0	0 ~ 2000	
	Data Size:	16-bit		
	Display Format:	One-digit	Decimal	
	Input Value Example:	1.5 = 1.5 times	15 = 1.5 times	

Settings:

Ratio of load inertia to servo motor inertia (for Rotation Motor): (J_load /J_motor)

J_load: Total equivalent moment of inertia of external mechanical load

J_motor: Moment of inertia of servo motor

P1-38	**ZSPD**	**Zero Speed Range Setting**		**Address: 014CH 014DH**
	Operation Interface:	Keypad/Software	Communication	Related Section: Table 7.B
	Default:	10.0	100	
	Control Mode:	ALL		
	Unit:	1 r/min	0.1 r/min	
	Range:	0.0 ~ 200.0	0 ~ 2000	
	Data Size:	16-bit		
	Display Format:	One-digit	Decimal	
	Input Value Example:	1.5 = 1.5 r/min	15 = 1.5 r/min	

Settings:

This parameter is used to set output range of zero speed signal (ZSPD) and determine when zero speed signal (ZSPD) becomes activated. ZSPD is activated when the drive senses the motor is equal to or below the Zero Speed Range setting as defined in parameter P1-38.

For Example, at default ZSPD will be activated when the drive detects the motor rotating at speed at or below 100 r/min. ZSPD will remain activated until the motor speed increases above 100 r/min.

P1-39	SSPD	Target Motor Speed		Address: 014EH 014FH
	Operation Interface:	Keypad/Software	Communication	Related Section: Table 7.B
	Default:	3000		
	Control Mode:	ALL		
	Unit:	r/min		
	Range:	0 ~ 5000		
	Data Size:	16-bit		
	Display Format:	Decimal		

Settings:

When target motor speed reaches its preset value, digital output (TSPD) is enabled. When the forward and reverse speed of servo motor is equal and higher than the setting value, the motor will reach the target motor speed, and then TSPD signal will output.

TSPD is activated once the drive has detected the motor has reached the Target Motor Speed setting as defined in parameter P1-39. TSPD will remain activated until the motor speed drops below the Target Motor Speed.

P1-40▲	VCM	Max. Analog Speed Command or Limit		Address: 0150H 0151H
	Operation Interface:	Keypad/Software	Communication	Related Section: Section 6.3.4
	Default:	rated speed		
	Control Mode:	S, T		
	Unit:	r/min		
	Range:	0 ~ 10000		
	Data Size:	16-bit		
	Display Format:	Decimal		

Settings:

In **Speed mode**, this parameter is used to set the maximum analog speed command based on the maximum input voltage (10V).

In **Torque mode**, this parameter is used to set the maximum analog speed limit based on the maximum input voltage (10V).

For example, in speed mode, if P1-40 is set to 3000 and the input voltage is 10V, it indicates that the speed command is 3000 r/min. If P1-40 is set to 3000, but the input voltage is changed to 5V, then the speed command is changed to 1500 r/min.

Speed Command / Limit = Input Voltage Value x Setting value of P1-40 / 10

P1-41▲	TCM	Max. Analog Torque Command or Limit	Address: 0152H 0153H
	Operation Interface:	Keypad/Software	Communication
	Default:	100	

Operation Interface:	Keypad/Software	Communication	Related Section: Section 6.4.4
Default:	100		
Control Mode:	ALL		
Unit:	%		
Range:	0 ~ 1000		
Data Size:	16-bit		
Display Format:	Decimal		

Settings:

In **Torque mode**, this parameter is used to set the maximum analog torque command based on the maximum input voltage (10V).

In **PT** and **Speed mode**, this parameter is used to set the maximum analog torque limit based on the maximum input voltage (10V).

For example, in torque mode, if P1-41 is set to 100 and the input voltage is 10V, it indicates that the torque command is 100% rated torque. If P1-41 is set to 100, but the input voltage is changed to 5V, then the torque command is changed to 50% rated torque.

Torque Command / Limit = Input Voltage Value x Setting value of P1-41 / 10

P1-42	MBT1	On Delay Time of Electromagnetic Brake	Address: 0154H 0155H

Operation Interface:	Keypad/Software	Communication	Related Section: Section 6.5.5
Default:	0		
Control Mode:	ALL		
Unit:	ms		
Range:	0 ~ 1000		
Data Size:	16-bit		
Display Format:	Decimal		

Settings:

Used to set the period of time between when the servo drive is On (Servo On) and when electromagnetic brake output signal (BRKR) is activated.

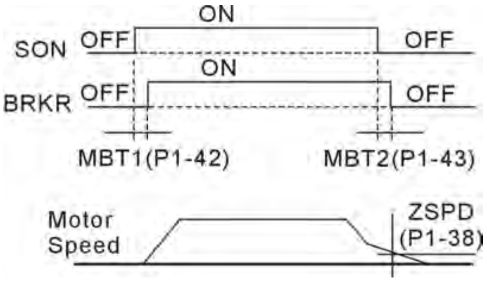
P1-43	MBT2	OFF Delay Time of Electromagnetic Brake	Address: 0156H 0157H

Operation Interface:	Keypad/Software	Communication	Related Section: Section 6.5.5
Default:	0		
Control Mode:	ALL		
Unit:	ms		
Range:	-1000 ~ +1000		
Data Size:	16-bit		

Display Format:	Decimal

Settings:

Used to set the period of time between when the servo drive is Off (Servo Off) and when electromagnetic brake output signal (BRKR) is inactivated.



Please note:

1. When servo is commanded off and the off delay time set by P1-43 has not elapsed, if the motor speed is lower than the setting value of P1-38, the electromagnetic brake will be engaged regardless of the off delay time set by P1-43.
2. When servo is commanded off and the off delay time set by P1-43 has elapsed, if the motor speed is higher than the setting value of P1-38, electromagnetic brake will be engaged regardless of the current motor speed.
3. When the servo drive is disabled (Servo Off) due to a fault (except AL022) or by EMGS (Emergency stop)) being activated, if the off delay time set by P1-43 is a negative value, it will not affect the operation of the motor. A negative value of the off delay time is equivalent to one with a zero value.

P1-44▲	**GR1**	**Electronic Gear Ratio (1st Numerator) (N1)**		**Address: 0158H 0159H**
	Operation Interface:	Keypad/Software	Communication	Related Section: Section 6.2.3
	Default:	16		
	Control Mode:	PT		
	Unit:	pulse		
	Range:	1 ~ (2^{26}-1)		
	Data Size:	32-bit		
	Display Format:	Decimal		

Settings:

This parameter is used to set the numerator of the electronic gear ratio. The denominator of the electronic gear ratio is set by P1-45. P2-60 ~ P2-62 are used to set the additional numerators.

Please note:

1. In PT mode, the setting value of P1-44 can be changed only when the servo drive is enabled (Servo On).

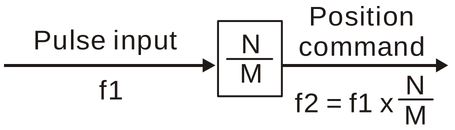
P1-45▲	GR2	Electronic Gear Ratio (Denominator) (M)		Address: 015AH 015BH
	Operation Interface:	Keypad/Software	Communication	Related Section: Section 6.2.3
	Default:	10		
	Control Mode:	PT		
	Unit:	pulse		
	Range:	1 ~ (2^{31}-1)		
	Data Size:	32-bit		
	Display Format:	Decimal		

Settings:

This parameter is used to set the denominator of the electronic gear ratio. The numerator of the electronic gear ratio is set by P1-44. P2-60 ~ P2-62 are used to set the additional numberators.

As the wrong setting may cause motor to run chaotically (out of control) and it may lead to personnel injury, therefore, ensure to observe the following rule when setting P1-44, P1-45.

The electronic gear ratio setting (Please also see P1-44, P2-60 ~ P2-62):



f1: Pulse input f2: Position command

N: Numerator, the setting value of P1-44 or P2-60 ~ P2-62

M: Denominator, the setting value of P1-45

The electronic gear ratio setting range must be within: 1/50<N/M<25600.

Please note:

1. In PT mode, the setting value of P1-45 can not be changed when the servo drive is enabled (Servo On).

P1-46▲	GR3	Encoder Output Pulse Number		Address: 015CH 015DH
	Operation Interface:	Keypad/Software	Communication	Related Section: N/A
	Default:	2500		
	Control Mode:	ALL		
	Unit:	pulse		
	Range:	4 ~ 40000		
	Data Size:	32-bit		
	Display Format:	Decimal		

Settings:

This parameter is used to set the pulse numbers of encoder outputs per motor revolution.

Please note: When the following conditions occur, the output frequency for pulse output may exceed the specification and cause that the servo drive fault AL018 (Encoder Output Error) is activated.

Condition 1: Encoder error.

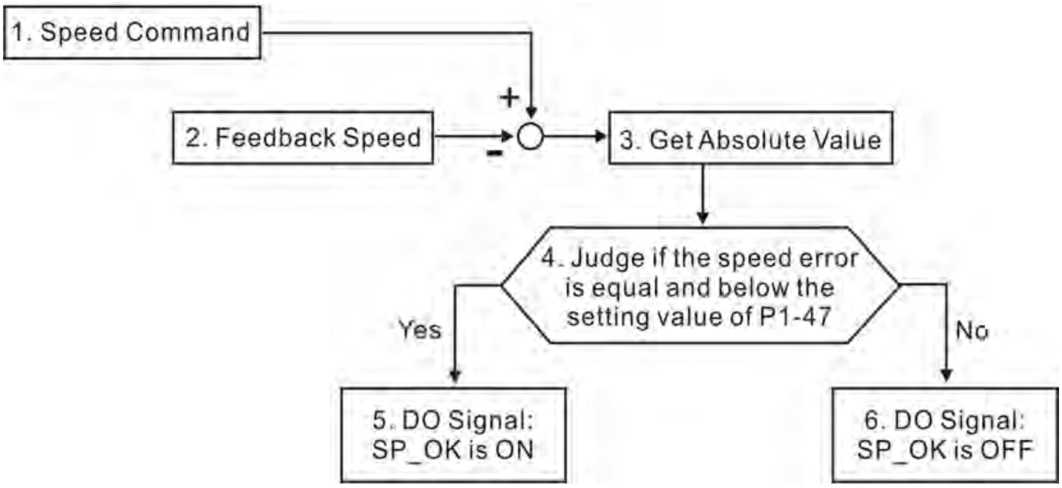
Condition 2: Motor speed is above the value set by parameter P1-76.

P1-47	**SPOK**	**Speed Reached Output Range**	**Address: 015EH 015FH**

Operation Interface:	Keypad/Software	Communication	Related Section: N/A
Default:	10		
Control Mode:	S, Sz		
Unit:	r/min		
Range:	0 ~ 300		
Data Size:	16-bit		
Display Format:	Decimal		

Settings:

This parameter is used to set the speed reached output range. The DO signal, SP_OK (0x19) will be activated when the speed error is equal and below the setting value of P1-47.


1. Speed Command
+
2. Feedback Speed
-
3. Get Absolute Value
4. Judge if the speed error is equal and below the setting value of P1-47
Yes
No
5. DO Signal: SP_OK is ON
6. DO Signal: SP_OK is OFF

1. Speed Command: It is the speed command input by the users (no Accel/Decel), not the frond-end command of speed control loop. The source of this command includes analog voltage and registers.
2. Feedback Speed: It is the actual motor speed which is filtered.
3. Get Absolute Value
4. Judge if the speed error is equal and below the setting value of P1-47: When P1-47 is set to 0, this digital output will be always off.
5. ON or OFF: When the speed error is equal and below the setting value of P1-47, SP_OK will be ON; otherwise, SP_OK will be OFF.

P1-48	**Reserved (Do Not Use)**	**Address: 0160H 0161H**

P1-49	**Reserved (Do Not Use)**	**Address: 0162H 0163H**

P1-50	Reserved (Do Not Use)	Address: 0164H 0165H

P1-51	Reserved (Do Not Use)	Address: 0166H 0167H

P1-52	RES1	Regenerative Resistor Value	Address: 0168H 0169H

Operation Interface:	Keypad/Software	Communication	Related Section: Section 6.6.3
Default:	See the table below		
Control Mode:	ALL		
Unit:	Ohm		
Range:	10 ~ 750		
Data Size:	16-bit		
Display Format:	Decimal		

Settings:

This parameter is used to set the resistance of the applicable regenerative resistor.

Model	Default
For 750W models	100Ω
For 1kW to 3kW models	40Ω

P1-53	RES2	Regenerative Resistor Capacity	Address: 016AH 016BH

Operation Interface:	Keypad/Software	Communication	Related Section: Section 6.6.3
Default:	See the table below		
Control Mode:	ALL		
Unit:	Watt		
Range:	30 ~ 3000		
Data Size:	16-bit		
Display Format:	Decimal		

Settings:

This parameter is used to set the capacity of the applicable regenerative resistor.

Model	Default
For 750W models	60W
For 1kW to 3kW models	60W

P1-54

PER	**Positioning Completed Width**		**Address: 016CH 016DH**
Operation Interface:	Keypad/Software	Communication	Related Section: Table 7.B
Default:	1600		
Control Mode:	PT		
Unit:	pulse		
Range:	0 ~ 1280000		
Data Size:	32-bit		
Display Format:	Decimal		

Settings:

In PT mode, when the error pulse numbers is less than the setting value of parameter P1-54, TPOS (At positioning completed signal) will be activated.

P1-55

MSPD	**Maximum Speed Limit**		**Address: 016EH 016FH**
Operation Interface:	Keypad/Software	Communication	Related Section: N/A
Default:	rated speed		
Control Mode:	ALL		
Unit:	r/min		
Range:	0 ~ Max. speed		
Data Size:	16-bit		
Display Format:	Decimal		

Settings:

This parameter is used to set maximum motor speed. The default setting is rated speed.

P1-56

OVW	**Output Overload Warning Time**		**Address: 0170H 0171H**
Operation Interface:	Keypad/Software	Communication	Related Section: N/A
Default:	120		
Control Mode:	ALL		
Unit:	%		
Range:	0 ~ 120		
Data Size:	16-bit		
Display Format:	Decimal		

Settings:

This parameter is used to set output overload time. If the setting value of parameter P1-56 is set to 0 ~ 100, the function of parameter P1-56 is enabled. When the motor has reached the output overload time set by parameter P1-56, the motor will send a warning to the drive. After the drive has detected the warning, the DO signal OLW will be activated. If the setting value of parameter P1-56 exceeds 100, the function of parameter P1-56 is disabled.

t_{OL} = Permissible Time for Overload x the setting value of parameter P1-56

When overload accumulated time (continuously overload time) exceeds the value of t_{OL}, the overload warning signal will output, i.e. DO signal, OLW will be ON. However, if the accumulated overload time (continuous overload time) exceeds the permissible time for overload, the overload alarm (AL006) will occur.

For example:

If the setting value of parameter P1-56 (Output Overload Warning Time) is 60%, when the permissible time for overload exceeds 8 seconds at 200% rated output, the overload fault (AL006) will be detected and shown on the LED display.

At this time, t_{OL} = 8 x 60% = 4.8 seconds

Result:

When the drive output is at 200% rated output and the drive is continuously overloaded for 4.8 seconds, the overload warning signal will be ON, i.e. DO signal OLW will be activated. If the drive is continuously overloaded for 8 seconds, the overload alarm will be detected and shown on the LED display (AL006). Then, Servo Fault signal will be ON (DO signal ALRM will be activated).

P1-57	**CRSHA**	**Motor Protection Percentage**		**Address: 0172H 0173H**
	Operation Interface:	Keypad/Software	Communication	Related Section: N/A
	Default:	0		
	Control Mode:	ALL		
	Unit:	%		
	Range:	0 ~ 300		
	Data Size:	16-bit		
	Display Format:	Decimal		

Settings:

This parameter is used to protect the motor in case the motor touchs the mechanical equipment. If P1-57 is set to 0, the function of P1-57 is disabled.

The function of P1-57 is enabled when the setting value of P1-57 is set to 1 or more. The fault AL030 will be activated when the setting value of P1-57 is reached after a period of time set by P1-58.

P1-58	**CRSHT**	**Motor Protection Time**		**Address: 0174H 0175H**
	Operation Interface:	Keypad/Software	Communication	Related Section: N/A
	Default:	1		
	Control Mode:	ALL		
	Unit:	ms		
	Range:	0 ~ 1000		
	Data Size:	16-bit		

Display Format:	Decimal

Settings:

This parameter is used to protect the motor in case the motor touchs the mechanical equipment. The fault AL030 will be activated when the setting value of P1-57 is reached after a period of time set by P1-58.

Please note that this function is applicable for non-contact applications, such as electric discharge machines only (P1-37 must be set correctly).

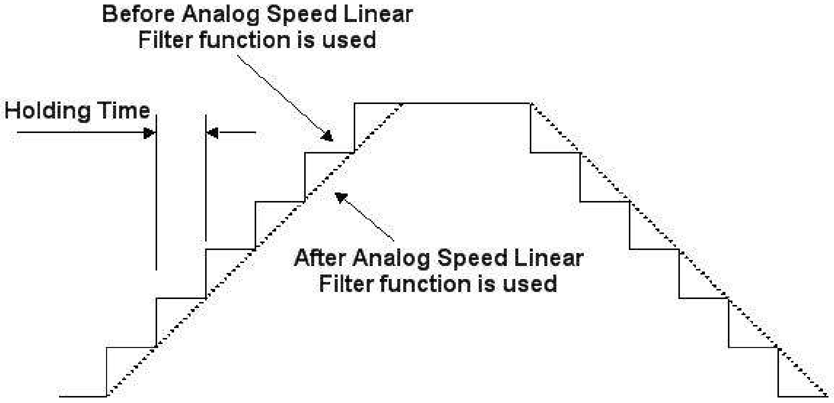
P1-59	**MFLT**	**Analog Speed Linear Filter (Moving Filter)**	**Address: 0176H 0177H**

Operation Interface:	Keypad/Software	Communication	Related Section: N/A
Default:	0.0	0	
Control Mode:	S		
Unit:	1 ms	0.1 ms	
Range:	0.0 ~ 4.0 (0: Disabled)	0 ~ 40 (0: Disabled)	
Data Size:	16-bit		
Display Format:	One-digit	Decimal	
Input Value Example:	1.5 = 1.5 ms	15 = 1.5 ms	

Settings:

This parameter is used to eliminate the noise generated during the operation when the host (external) controller sends the step analog voltage speed command. The parameter P1-06 is Low-pass Filter and parameter P1-59 is Moving Filter. The differences are that Low-pass Filter is usually used to smooth the end of the command but Moving Filter can be used to smooth the start and the end of step analog voltage speed command. Using Moving Filter can facilitate the smooth operation of the motor very effectively.

Therefore, it is recommended to use P1-06 Low-pass Filter when the speed command from the external controller is applied for position control loop. If the command is for speed control only, using Moving Filter P1-59 can achieve better (smooth) performance.


Before Analog Speed Linear Filter function is used
Holding Time
After Analog Speed Linear Filter function is used

P1-60	**Reserved (Do Not Use)**	**Address: 0178H 0179H**

P1-61	**Reserved (Do Not Use)**	**Address: 017AH 017BH**

P1-62	**FRCL**	**Friction Compensation Percentage**	**Address: 017CH 017DH**

Operation Interface:	Keypad/Software	Communication	Related Section: N/A
Default:	0		
Control Mode:	PT, S		
Unit:	%		
Range:	0 ~ 100		
Data Size:	16-bit		
Display Format:	Decimal		

Settings:

This parameter is used to set the torque percentage for friction compensation. If P1-62 is set to 0, the function of P1-62 is disabled. The function of P1-62 is enabled when the setting value of P1-62 is set to 1 or more.

P1-63	**FRCT**	**Friction Compensation Percentage**	**Address: 017EH 017FH**

Operation Interface:	Keypad/Software	Communication	Related Section: N/A
Default:	0		
Control Mode:	PT, S		
Unit:	ms		
Range:	0 ~ 1000		
Data Size:	16-bit		
Display Format:	Decimal		

Settings:

This parameter is used to set the smooth constant of friction compensation.

P1-64	**Reserved (Do Not Use)**	**Address: 0180H 0181H**

P1-65	**Reserved (Do Not Use)**	**Address: 0182H 0183H**

P1-66	**Reserved (Do Not Use)**	**Address: 0184H 0185H**

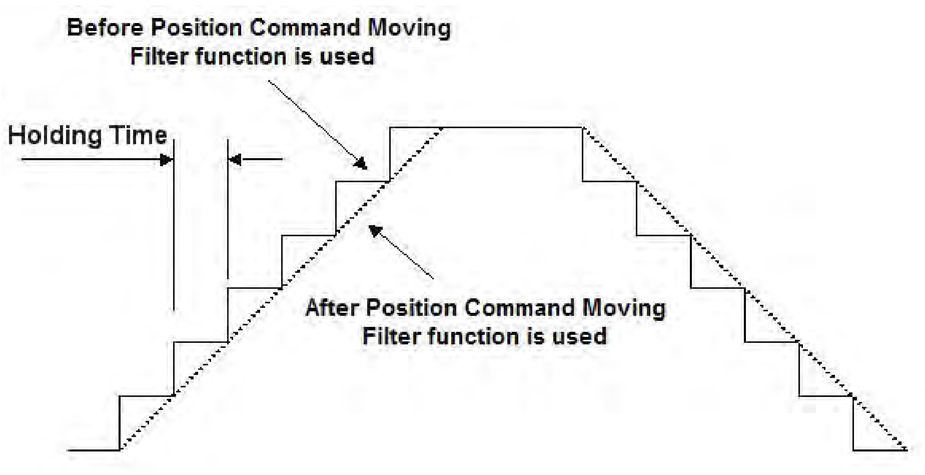
P1-67	**Reserved (Do Not Use)**	**Address: 0186H 0187H**

P1-68	**PFLT2**	**Position Command Moving Filter 1**	**Address: 0188H 0189H**

Operation Interface:	Keypad/Software	Communication	Related Section: N/A
Default:	4		
Control Mode:	PT		
Unit:	ms		
Range:	0 ~ 100 (0: Disabled)		
Data Size:	16-bit		
Display Format:	Decimal		

Settings:

Moving Filter can be used to smooth the start and the end of step position command. Using Moving Filter can facilitate the smooth operation of the motor very effectively, but it will cause command delay.


Before Position Command Moving Filter function is used
Holding Time
After Position Command Moving Filter function is used

P1-69	**Reserved (Do Not Use)**	**Address: 018AH 018BH**

P1-70	**Reserved (Do Not Use)**	**Address: 018CH 018DH**

P1-71	**Reserved (Do Not Use)**	**Address: 018EH 018FH**

P1-72	**Reserved (Do Not Use)**	**Address: 0190H 0191H**

P1-73	**Reserved (Do Not Use)**	**Address: 0192H 0193H**

P1-74	**Reserved (Do Not Use)**	**Address: 0194H 0195H**

P1-75	**Reserved (Do Not Use)**	**Address: 0196H 0197H**

P1-76	**AMSPD**	**Max. Rotation Speed of Encoder Output**	**Address: 0198H 0199H**
Operation Interface:	Keypad/Software	Communication	Related Section: P1-46
Default:	5500		
Control Mode:	ALL		
Unit:	r/min		
Range:	0 ~ 6000 (0: Disabled)		
Data Size:	16-bit		
Display Format:	Decimal		

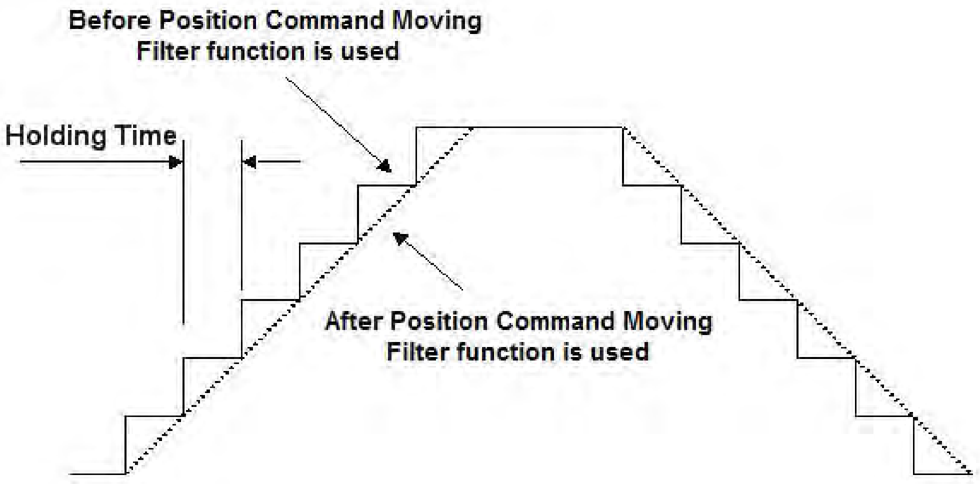
Settings:

This parameter is used to optimize the encoder outputs (OA, OB). When the users set the actual reached maximum motor speed, the servo drive will equalize the encoder outputs automatically. When P1-76 is set to 0, it indicates that equalizing function is not available.

P1-77	**PFLT3**	**Position Command Moving Filter 2**	**Address: 019AH 019BH**
Operation Interface:	Keypad/Software	Communication	Related Section: N/A
Default:	4		
Control Mode:	PT		
Unit:	ms		
Range:	0 ~ 100 (0: Disabled)		
Data Size:	16-bit		
Display Format:	Decimal		

Settings:

Moving Filter can be used to smooth the start and the end of step position command. Using Moving Filter can facilitate the smooth operation of the motor very effectively, but it will cause command delay.


Before Position Command Moving Filter function is used
Holding Time
After Position Command Moving Filter function is used

Group 2: P2-xx Extension Parameters

P2-00	**KPP**	**Proportional Position Loop Gain**		**Address: 0200H 0201H**
	Operation Interface:	Keypad/Software	Communication	Related Section: Section 6.2.5
	Default:	35		
	Control Mode:	PT		
	Unit:	rad/s		
	Range:	0 ~ 2047		
	Data Size:	16-bit		
	Display Format:	Decimal		

Settings:

This parameter is used to set the position loop gain. It can increase stiffness, expedite position loop response and reduce position error. However, if the setting value is over high, it may generate vibration or noise.

P2-01	**PPR**	**Position Loop Gain Switching Rate**		**Address: 0202H 0203H**
	Operation Interface:	Keypad/Software	Communication	Related Section: Section 6.2.5
	Default:	100		
	Control Mode:	PT		
	Unit:	%		
	Range:	10 ~ 500		
	Data Size:	16-bit		
	Display Format:	Decimal		

Settings:

This parameter is used to set the position gain switching rate when the gain switching condition is satisfied. Please refer to P2-27 for gain switching control selection settings and refer to P2-29 for gain switching condition settings.

P2-02	**PFG**	**Position Feed Forward Gain**		**Address: 0204H 0205H**
	Operation Interface:	Keypad/Software	Communication	Related Section: Section 6.2.5
	Default:	50		
	Control Mode:	PT		
	Unit:	%		
	Range:	0 ~ 100		
	Data Size:	16-bit		
	Display Format:	Decimal		

Settings:

This parameter is used to set the feed forward gain when executing position control command. When using position smooth command, increase gain can improve position track deviation. When not using position smooth command, decrease gain can improve the resonance condition of mechanical system.

P2-03

PFF	**Smooth Constant of Position Feed Forward Gain**		**Address: 0206H 0207H**
Operation Interface:	Keypad/Software	Communication	Related Section: N/A
Default:	5		
Control Mode:	PT		
Unit:	ms		
Range:	2 ~ 100		
Data Size:	16-bit		
Display Format:	Decimal		

Settings:

When using position smooth command, increase gain can improve position track deviation. When not using position smooth command, decrease gain can improve the resonance condition of mechanical system.

P2-04

KVP	**Proportional Speed Loop Gain**		**Address: 0208H 0209H**
Operation Interface:	Keypad/Software	Communication	Related Section: Section 6.3.6
Default:	500		
Control Mode:	ALL		
Unit:	rad/s		
Range:	0 ~ 8191		
Data Size:	16-bit		
Display Format:	Decimal		

Settings:

This parameter is used to set the speed loop gain. When the value of proportional speed loop gain is increased, it can expedite speed loop response. However, if the setting value is over high, it may generate vibration or noise.

P2-05

SPR	**Speed Loop Gain Switching Rate**		**Address: 020AH 020BH**
Operation Interface:	Keypad/Software	Communication	Related Section: N/A
Default:	100		
Control Mode:	ALL		
Unit:	%		
Range:	10 ~ 500		
Data Size:	16-bit		
Display Format:	Decimal		

Settings:

This parameter is used to set the speed gain switching rate when the gain switching condition is satisfied. Please refer to P2-27 for gain switching control selection settings and refer to P2-29 for gain switching condition settings.

P2-06	**KVI**	**Speed Integral Compensation**	**Address: 020CH 020DH**

Operation Interface:	Keypad/Software	Communication	Related Section: Section 6.3.6
Default:	100		
Control Mode:	ALL		
Unit:	rad/s		
Range:	0 ~ 1023		
Data Size:	16-bit		
Display Format:	Decimal		

Settings:

This parameter is used to set the integral time of speed loop. When the value of speed integral compensation is increased, it can improve the speed response ability and decrease the speed control deviation. However, if the setting value is over high, it may generate vibration or noise.

P2-07	**KVF**	**Speed Feed Forward Gain**	**Address: 020EH 020FH**

Operation Interface:	Keypad/Software	Communication	Related Section: Section 6.3.6
Default:	0		
Control Mode:	ALL		
Unit:	%		
Range:	0 ~ 100		
Data Size:	16-bit		
Display Format:	Decimal		

Settings:

This parameter is used to set the feed forward gain when executing speed control command.

When using speed smooth command, increase gain can improve speed track deviation.

When not using speed smooth command, decrease gain can improve the resonance condition of mechanical system.

P2-08■	**PCTL**	**Special Factory Setting**	**Address: 0210H 0211H**

Operation Interface:	Keypad/Software	Communication	Related Section: N/A
Default:	0		

Control Mode:	ALL
Unit:	N/A
Range:	0 ~ 65535
Data Size:	16-bit
Display Format:	Decimal

Settings:

Special parameter setting:

Parameter code	Function
10	Parameter reset (Please re-power on the servo drive after reseting)
20	Set P2-08 to 20 can change the value of P4-10
22	Set P2-08 to 22 can change the value of P4-11~P4-19
406	DO mode will be forced to be activated.
400	When force to activate the DO mode, set P2-08 to 400 can switch the mode back to normal DO mode.

Password protective setting for protecting the parameter from the end-users:

1. After enter the 5 digital numbers, please enter the same password again. And the setting shall be finished.
2. When turning on the power again, the proctective password will be activated.

Parameter setting after setting up the password:

When entering the correct password, the parameter can be set.

Clear the password: After entering the correct password, please enter “0” twice continuously.

P2-09	DRT	Bounce Filter	Address: 0212H 0213H

Operation Interface:	Keypad/Software	Communication	Related Section: N/A
Default:	2		
Control Mode:	ALL		
Unit:	2ms		
Range:	0 ~ 20		
Data Size:	16-bit		
Display Format:	Decimal		
Input Value Example:	4 = 8 ms		

Settings:

For example, if P2-09 is set to 4, the bounce filter time is 4 x 2ms = 8ms.

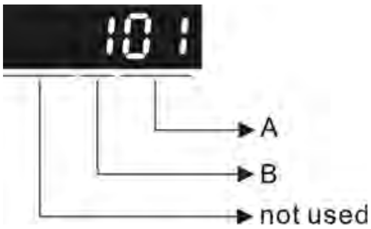
When there are too much vibration or noises around environment, increasing this setting value (bounce filter time) can improve reliability. However, if the time is too long, it may affect the response time.

P2-10	DI1	Digital Input Terminal 1 (DI1)	Address: 0214H 0215H

Operation Interface:	Keypad/Software	Communication	Related Section: Table 7.A
Default:	101		
Control Mode:	ALL		
Unit:	N/A		
Range:	0 ~ 015Fh		
Data Size:	16-bit		
Display Format:	Hexadecimal		

Settings:

The parameters from P2-10 to P2-17 and P2-36 are used to determine the functions and statuses of DI1 ~ DI8.



A: DI (Digital Input) Function Settings:

For the setting value of P2- 10 ~ P2-17 and P2-36, please refer to Table 7.A.

B: DI (Digital Input) Enabled Status Settings:

0: Normally closed (contact b)

1: Normally open (contact a)

For example, when P2-10 is set to 101, it indicates that the function of DI1 is SON (Servo On, setting value is 0x01) and it requires a normally open contact to be connected to it.

Please re-start the servo drive after parameters have been changed.

Please note:

The parameter P3-06 is used to set how the Digital Inputs (DI) accept commands and signals through the external terminals or via the communication which is determined by parameter P4-07.

P2-11	DI2	Digital Input Terminal 2 (DI2)	Address: 0216H 0217H

Operation Interface:	Keypad/Software	Communication	Related Section: Table 7.A
Default:	104		
Control Mode:	ALL		
Unit:	N/A		

Range:	0 ~ 015Fh
Data Size:	16-bit
Display Format:	Hexadecimal

Settings: Refer to P2-10 for explanation.

P2-12	**DI3**	**Digital Input Terminal 3 (DI3)**		**Address: 0218H 0219H**
	Operation Interface:	Keypad/Software	Communication	Related Section: Table 7.A
	Default:	116		
	Control Mode:	ALL		
	Unit:	N/A		
	Range:	0 ~ 015Fh		
	Data Size:	16-bit		
	Display Format:	Hexadecimal		

Settings: Refer to P2-10 for explanation.

P2-13	**DI4**	**Digital Input Terminal 4 (DI4)**		**Address: 021AH 021BH**
	Operation Interface:	Keypad/Software	Communication	Related Section: Table 7.A
	Default:	117		
	Control Mode:	ALL		
	Unit:	N/A		
	Range:	0 ~ 015Fh		
	Data Size:	16-bit		
	Display Format:	Hexadecimal		

Settings: Refer to P2-10 for explanation.

P2-14	**DI5**	**Digital Input Terminal 5 (DI5)**		**Address: 021CH 021DH**
	Operation Interface:	Keypad/Software	Communication	Related Section: Table 7.A
	Default:	102		
	Control Mode:	ALL		
	Unit:	N/A		
	Range:	0 ~ 015Fh		
	Data Size:	16-bit		
	Display Format:	Hexadecimal		

Settings: Refer to P2-10 for explanation.

P2-15	**DI6**	**Digital Input Terminal 6 (DI6)**	**Address: 021EH 021FH**
Operation Interface:	Keypad/Software	Communication	Related Section: Table 7.A
Default:	22		
Control Mode:	ALL		
Unit:	N/A		
Range:	0 ~ 015Fh		
Data Size:	16-bit		
Display Format:	Hexadecimal		

Settings: Refer to P2-10 for explanation.

P2-16	**DI7**	**Digital Input Terminal 7 (DI7)**	**Address: 0220H 0221H**
Operation Interface:	Keypad/Software	Communication	Related Section: Table 7.A
Default:	23		
Control Mode:	ALL		
Unit:	N/A		
Range:	0 ~ 015Fh		
Data Size:	16-bit		
Display Format:	Hexadecimal		

Settings: Refer to P2-10 for explanation.

P2-17	**DI8**	**Digital Input Terminal 8 (DI8)**	**Address: 0222H 0223H**
Operation Interface:	Keypad/Software	Communication	Related Section: Table 7.A
Default:	21		
Control Mode:	ALL		
Unit:	N/A		
Range:	0 ~ 015Fh		
Data Size:	16-bit		
Display Format:	Hexadecimal		

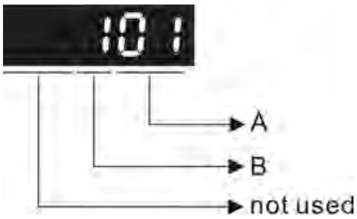
Settings: Refer to P2-10 for explanation.

P2-18	**DO1**	**Digital Output Terminal 1 (DO1)**	**Address: 0224H 0225H**
Operation Interface:	Keypad/Software	Communication	Related Section: Table 7.B
Default:	101		
Control Mode:	ALL		
Unit:	N/A		

Range:	0 ~ 013Fh
Data Size:	16-bit
Display Format:	Hexadecimal

Settings:

The parameters from P2-18 to P2-22 and P2-37 are used to determine the functions and statuses of DO1 ~ DO5.



A: DO Function Settings:

For the setting value of P2- 18 ~ P2-22 and P2-37, please refer to Table 7.B.

B: DO Enabled Status Settings:

0: Normally closed (contact b)

1: Normally open (contact a)

For example, when P2-18 is set to 101, it indicates that the function of DO1 is SRDY (Servo ready, setting value is 0x01) and it requires a normally open contact to be connected to it.

Please re-start the servo drive after parameters have been changed.

P2-19	**DO2**	**Digital Output Terminal 2 (DO2)**		**Address: 0226H 0227H**
	Operation Interface:	Keypad/Software	Communication	Related Section: Table 7.B
	Default:	103		
	Control Mode:	ALL		
	Unit:	N/A		
	Range:	0 ~ 013Fh		
	Data Size:	16-bit		
	Display Format:	Hexadecimal		

Settings: Refer to P2-18 for explanation.

P2-20	**DO3**	**Digital Output Terminal 3 (DO3)**		**Address: 0228H 0229H**
	Operation Interface:	Keypad/Software	Communication	Related Section: Table 7.B
	Default:	109		
	Control Mode:	ALL		
	Unit:	N/A		
	Range:	0 ~ 013Fh		
	Data Size:	16-bit		
	Display Format:	Hexadecimal		

Settings: Refer to P2-18 for explanation.

P2-21	**DO4**	**Digital Output Terminal 4 (DO4)**	**Address: 022AH 022BH**
Operation Interface:	Keypad/Software	Communication	Related Section: Table 7.B
Default:	105		
Control Mode:	ALL		
Unit:	N/A		
Range:	0 ~ 013Fh		
Data Size:	16-bit		
Display Format:	Hexadecimal		

Settings: Refer to P2-18 for explanation.

P2-22	**DO5**	**Digital Output Terminal 5 (DO5)**	**Address: 022CH 022DH**
Operation Interface:	Keypad/Software	Communication	Related Section: Table 7.B
Default:	7		
Control Mode:	ALL		
Unit:	N/A		
Range:	0 ~ 013Fh		
Data Size:	16-bit		
Display Format:	Hexadecimal		

Settings: Refer to P2-18 for explanation.

P2-23	**NCF1**	**Notch Filter 1 (Resonance Suppression)**	**Address: 022EH 022FH**
Operation Interface:	Keypad/Software	Communication	Related Section: Section 6.2.5
Default:	1000		
Control Mode:	ALL		
Unit:	Hz		
Range:	50 ~ 2000		
Data Size:	16-bit		
Display Format:	Decimal		

Settings:

This parameter is used to set first resonance frequency of mechanical system. It can be used to suppress the resonance of mechanical system and reduce the vibration of mechanical system.

If P2-24 is set to 0, this parameter is disabled.

The parameters P2-23 and P2-24 are the first group of notch filter parameters and the parameters P2-43 and P2-44 are the second group of notch filter parameters.

P2-24

DPH1	Notch Filter Attenuation Rate 1 (Resonance Suppression)		Address: 0230H 0231H
Operation Interface:	Keypad/Software	Communication	Related Section: Section 6.3.7
Default:	0		
Control Mode:	ALL		
Unit:	dB		
Range:	0 ~ 32 (0: Disabled)		
Data Size:	16-bit		
Display Format:	Decimal		

Settings:

This parameter is used to set magnitude of the resonance suppression that is set by parameter P2-23. If P2-24 is set to 0, the parameters P2-23 and P2-24 are both disabled.

The parameters P2-23 and P2-24 are the first group of notch filter parameters and the parameters P2-43 and P2-44 are the second group of notch filter parameters.

P2-25

NLP	Low-pass Filter Time Constant (Resonance Suppression)		Address: 0232H 0233H
Operation Interface:	Keypad/Software	Communication	Related Section: Section 6.3.7
Default:	0.2 (1kW and below models) or 0.5 (other models)	2 (1kW and below models) or 5 (other models)	
Control Mode:	ALL		
Unit:	1ms	0.1ms	
Range:	0.0 ~ 100.0	0 ~ 1000	
Data Size:	16-bit		
Display Format:	One-digit	Decimal	
Input Value Example:	1.5 = 1.5 ms	15 = 1.5 ms	

Settings:

This parameter is used to set low-pass filter time constant of resonance suppression.

If P2-25 is set to 0, this parameter is disabled.

P2-26

DST	External Anti-Interference Gain		Address: 0234H 0235H
Operation Interface:	Keypad/Software	Communication	Related Section: N/A
Default:	0		
Control Mode:	ALL		
Unit:	0.001		
Range:	0 ~ 1023 (0: Disabled)		
Data Size:	16-bit		

Display Format:	Decimal

Settings:

If P2-26 is set to 0, this parameter is disabled.

This parameter is used to increase the damping factor of speed loop. It is recommended to set the setting value of P2-26 to be equal to the setting value of P2-06.

Please note:

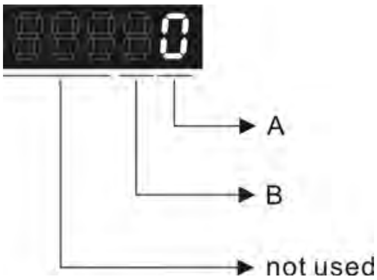
1. In speed mode, increasing the parameter value of P2-26 can reduce speed overshoot.
2. In position mode, decreasing the parameter value of P2-26 can reduce position overshoot.

P2-27	**GCC**	**Gain Switching Control Selection**	**Address: 0236H 0237H**

Operation Interface:	Keypad/Software	Communication	Related Section: N/A
Default:	0		
Control Mode:	ALL		
Unit:	N/A		
Range:	0 ~ 4		
Data Size:	16-bit		
Display Format:	Hexadecimal		

Settings:

Gain Switching Condition Settings:



A: Gain Switching Condition Settings:

0: Disabled

1: Gain switching DI (Digital Input) signal (GAINUP) is On. (see Table 8.A)

2: In position mode, position deviation is higher than the setting value of P2-29.

3: Position command frequency is higher than the setting value of P2-29.

4: Servo motor speed is higher than the setting value of P2-29.

5: Gain switching DI (Digital Input) signal (GAINUP) is Off. (see Table 8.A)

6: In position mode, position deviation is lower than the setting value of P2-29.

7: Position command frequency is lower than the setting value of P2-29.

8: Servo motor speed is lower than the setting value of P2-29.

B: Gain Switching Control Settings:

0: Gain multiple switching

1: P → PI switching

Setting	P mode	S mode	Status
0	P2-00 x 100% P2-04 x 100%	P2-04 x 100%	Before switching
	P2-00 x P2-01 P2-04 x P2-05	P2-04 x P2-05	After switching
1	P2-06 x 0% P2-26 x 0%		Before switching
	P2-06 x 100% P2-26 x 100%		After switching

P2-28	**GUT**	**Gain Switching Time Constant**	**Address: 0238H 0239H**
	Operation Interface:	Keypad/Software	Communication	Related Section: N/A
	Default:	10		
	Control Mode:	ALL		
	Unit:	10ms		
	Range:	0 ~ 1000 (0: Disabled)		
	Data Size:	16-bit		
	Display Format:	Decimal		
	Input Value Example:	15 = 150 ms		

Settings:

This parameter is used to set the time constant when switching the smooth gain.

P2-29	**GPE**	**Gain Switching Condition**	**Address: 023AH 023BH**
	Operation Interface:	Keypad/Software	Communication	Related Section: N/A
	Default:	160000		
	Control Mode:	ALL		
	Unit:	pulse, Kpps, r/min		
	Range:	0 ~ 3840000		
	Data Size:	32-bit		
	Display Format:	Decimal		

Settings:

This parameter is used to set the value of gain switching condition (pulse error, Kpps, r/min) selected in P2-27. The setting value will be different depending on the different gain switching condition.

P2-30■	**INH**	**Auxiliary Function**	**Address: 023CH 023DH**

Operation Interface:	Keypad/Software	Communication	Related Section: N/A
Default:	0		
Control Mode:	ALL		
Unit:	N/A		
Range:	-8 ~ +8		
Data Size:	16-bit		
Display Format:	Decimal		

Settings:

0: Disabled all functions described below.

1: Force the servo drive to be Servo On (upon software)

2~4: Reserved

5: After setting P2-30 to 5, the setting values of all parameters will lost (not remain in the EEPROM) at power-down. When the parameters data are no more needed, using this mode can allows users not to save parameters data into the EEPROM without damaging the EEPROM. P2-30 should be set to 5 when using communication control function.

Please note:

1. Please set P2-30 to 0 during normal operation.
2. The setting value of P2-30 will return to 0 automatically after re-power the servo drive.

P2-31	**AUT1**	**Speed Frequency Response Level in Auto and Semi-Auto Mode**	**Address: 023EH 023FH**

Operation Interface:	Keypad/Software	Communication	Related Section: Section 5.6, Section 6.3.6
Default:	80		
Control Mode:	ALL		
Unit:	Hz		
Range:	1 ~ 1000		
Data Size:	16-bit		
Display Format:	Hexadecimal		

Settings:

This parameter allows the users to set the speed frequency response level of auto-tuning and semi-auto tuning mode. The speed frequency response settings are as follows:

1 ~ 50Hz : Low stiffness and low frequency response

51 ~ 250Hz : Medium stiffness and medium frequency response

251 ~ 550Hz : High stiffness and high frequency response

Please note:

1. The servo drive will set the position frequency response according to the setting value of P2-31.
2. This parameter is activated by P2-32. Please refer to Section 5.6 for the tuning procedure and the related settings.

P2-32▲	**AUT2**	**Tuning Mode Selection**		**Address: 0240H 0241H**
	Operation Interface:	Keypad/Software	Communication	Related Section: Section 5.6, Section 6.3.6
	Default:	0		
	Control Mode:	ALL		
	Unit:	N/A		
	Range:	0 ~ 2		
	Data Size:	16-bit		
	Display Format:	Hexadecimal		

Settings:

0: Manual mode

1: Auto Mode [Continuous adjustment]

2: Semi-Auto Mode [Non-continuous adjustment]

Explanation of manual mode:

1. When P2-32 is set to mode#0, the setting value of P2-00, P2-02, P2-04, P2-06, P2-07, P2-25 and P2-26 can be user-defined. When switching mode #1 or #2 to #0, the setting value of P2-00, P2-02, P2-04, P2-06, P2-07, P2-25 and P2-26 will change to the value that measured in #1 auto-tuning mode or #2 semi-auto tuning mode.

Explanation of auto-tuning mode:

The servo drive will continuously estimate the system inertia, save the measured load inertia value automatically and memorized in P1-37 every 30 minutes by referring to the frequency response settings of P2-31.

1. When switching mode #1 or #2 to #0, the servo drive will continuously estimate the system inertia, save the measured load inertia value automatically and memorized in P1-37. Then, set the corresponding parameters according to this measured load inertia value.
2. When switching mode#0 or #1 to #2, enter the appropriate load inertia value in P1-37.
3. When switching mode#1 to #0, the setting value of P2-00, P2-04 and P2-06 will change to the value that measured in #1 auto-tuning mode.

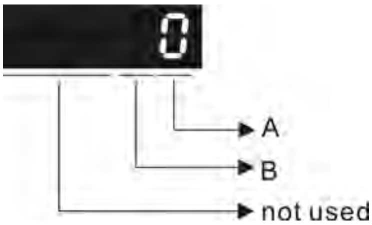
Explanation of semi-auto tuning mode:

1. When switching mode #2 to #0, the setting value of P2-00, P2-04, P2-06, P2-25 and P2-26 will change to the value that measured in #1 auto-tuning mode.
2. After the system inertia becomes stable (The displau of P2-33 will show 1), it will stop estimating the system inertia, save the measured load inertia value automatically, and memorized in P1-37. However, when P2-32 is set to mode#1 or #2, the servo drive will continuously perform the adjustment for a period of time.
3. When the value of the system inertia becomes over high, the display of P2-33 will

show 0 and the servo drive will start to adjust the load inertia value continuously.

P2-33▲	**AUT3**	**Semi-Auto Mode Inertia Adjustment Selection**		**Address: 0242H 0243H**
	Operation Interface:	Keypad/Software	Communication	Related Section: N/A
	Default:	0		
	Control Mode:	ALL		
	Unit:	N/A		
	Range:	0 ~ 1		
	Data Size:	16-bit		
	Display Format:	Decimal		

Settings:



When the setting value of A is set to 0 or display is 0, it indicates that the load inertia estimation of semi-auto tuning mode has been executed but not been completed yet.

When the setting value of A is set to 1, it indicates that the load inertia estimation of semi-auto tuning mode has been completed. The measured load inertia is memorized in P1-37. If P2-33 is reset to 0, the servo drive will perform continuous adjustment for estimating the load inertia (P1-37) again.

B: Reserved.

P2-34	**SDEV**	**Overspeed Warning Condition**		**Address: 0244H 0245H**
	Operation Interface:	Keypad/Software	Communication	Related Section: N/A
	Default:	5000		
	Control Mode:	S		
	Unit:	r/min		
	Range:	1 ~ 6000		
	Data Size:	16-bit		
	Display Format:	Decimal		

Display Format: Decimal

Settings:

This parameter is used to set the over speed threshold that is used to determine the over speed fault condition. When the difference in speed between the desired speed and actual motor speed is over than the setting value of parameter P2-34, the servo fault, Overspeed (AL007) will be activated.

P2-35	**PDEV**	**Excessive Error Warning Condition**		**Address: 0246H 0247H**
	Operation Interface:	Keypad/Software	Communication	Related Section: N/A
	Default:	480000		
	Control Mode:	PT		
	Unit:	pulse		
	Range:	1 ~ 16000000		
	Data Size:	32-bit		
	Display Format:	Decimal		

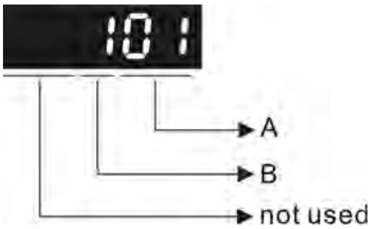
Settings:

This parameter is used to set the position deviation excessive error threshold that is used to determine the escessive deviation fault condition. When the difference in pulse number between the desired position and actual motor position is over than the setting value of parameter P2-35, the servo fault, Excessive Deviation (AL009) will be activated.

P2-36	**DI9**	**External Digital Input Terminal 9 (DI9)**		**Address: 0248H 0249H**
	Operation Interface:	Keypad/Software	Communication	Related Section: Table 7.A
	Default:	0		
	Control Mode:	ALL		
	Unit:	N/A		
	Range:	0 ~ 015Fh		
	Data Size:	16-bit		
	Display Format:	Hexadecimal		

Settings:

The parameters from P2-36 to P2-41 are used to determine the functions and statuses of external DI9 ~ DI14.



A: DI (Digital Input) Function Settings:

For the setting value of P2- 36 ~ P2-41, please refer to Table 7.A.

B: External DI (Digital Input) Enabled Status Settings:

0: Normally closed (contact b)

1: Normally open (contact a)

P2-37	**DO6**	**Digital Output Terminal 6 (DO6)**		**Address: 024AH 024BH**
	Operation Interface:	Keypad/Software	Communication	Related Section: Table 7.B
	Default:	7		
	Control Mode:	ALL		
	Unit:	N/A		
	Range:	0 ~ 013Fh		
	Data Size:	16-bit		
	Display Format:	Hexadecimal		

Settings: Refer to P2-18 for explanation.

P2-38	**Reserved (Do Not Use)**	**Address: 024CH 024DH**

P2-39	**Reserved (Do Not Use)**	**Address: 024EH 024FH**

P2-40	**Reserved (Do Not Use)**	**Address: 0250H 0251H**
P2-41	**Reserved (Do Not Use)**	**Address: 0252H 0253H**

P2-42	**Reserved (Do Not Use)**	**Address: 0254H 0255H**

P2-43	**NCF2**	**Notch Filter 2 (Resonance Suppression)**		**Address: 0256H 0257H**
	Operation Interface:	Keypad/Software	Communication	Related Section: Section 6.3.7
	Default:	1000		
	Control Mode:	ALL		
	Unit:	Hz		
	Range:	50 ~ 2000		
	Data Size:	16-bit		
	Display Format:	Decimal		

Settings:

This parameter is used to set second resonance frequency of mechanical system. It can be used to suppress the resonance of mechanical system and reduce the vibration of mechanical system.

If P2-43 is set to 0, this parameter is disabled.

The parameters P2-23 and P2-24 are the first group of notch filter parameters and the parameters P2-43 and P2-44 are the second group of notch filter parameters.

P2-44	**DPH2**	**Notch Filter Attenuation Rate 2 (Resonance Suppression)**	**Address: 0258H 0259H**

Operation Interface:	Keypad/Software	Communication	Related Section: Section 6.3.7
Default:	0		
Control Mode:	ALL		
Unit:	dB		
Range:	0 ~ 32		
Data Size:	16-bit		
Display Format:	Decimal		

Settings:

This parameter is used to set magnitude of the resonance suppression that is set by parameter P2-43. If P2-44 is set to 0, the parameters P2-43 and P2-44 are both disabled.

P2-45	**NCF3**	**Notch Filter 3 (Resonance Suppression)**	**Address: 025AH 025BH**

Operation Interface:	Keypad/Software	Communication	Related Section: Section 6.3.7
Default:	1000		
Control Mode:	ALL		
Unit:	Hz		
Range:	50 ~ 2000		
Data Size:	16-bit		
Display Format:	Decimal		

Settings:

This parameter is used to set third resonance frequency of mechanical system. It can be used to suppress the resonance of mechanical system and reduce the vibration of mechanical system.

If P2-45 is set to 0, this parameter is disabled.

P2-46	**DPH3**	**Notch Filter Attenuation Rate 3 (Resonance Suppression)**	**Address: 025CH 025DH**

Operation Interface:	Keypad/Software	Communication	Related Section: Section 6.3.7
Default:	0		
Control Mode:	ALL		
Unit:	dB		
Range:	0 ~ 32		
Data Size:	16-bit		
Display Format:	Decimal		

Settings:

This parameter is used to set magnitude of the resonance suppression that is set by parameter P2-45. If P2-46 is set to 0, the parameters P2-45 and P2-46 are both disabled.

P2-47	**ANCF**	**Auto Resonance Suppression Mode Selection**	**Address: 025EH 025FH**
	Operation Interface:	Keypad/Software	Communication	Related Section: N/A
	Default:	1		
	Control Mode:	ALL		
	Unit:	N/A		
	Range:	0 ~ 2		
	Data Size:	16-bit		
	Display Format:	Decimal		

Settings:

0: Disable Auto Resonance Suppression Mode.

The setting value of P2-23~P2-24 and P2-43~P2-46 will be fixed and will not be changed.

1: Auto Resonance Suppression Mode 1 [Non-continuous adjustment]

After the resonance is suppressed, the setting value of P2-23, P2-24, P2-43, P2-44, P2-45 and P2-46 will be fixed and will not be changed.

2: Auto Resonance Suppression Mode 2 [Continuous adjustment]

The servo drive will perform the resonance suppression continuously (will not stop). The setting value of P2-23, P2-24, P2-43, P2-44, P2-45 and P2-46 will not be fixed.

When P2-47 is set to 1, the resonance suppression will be enabled automatically. After the mechanical system becomes stable, the setting value of P2-47 will return to 0. When the mechanical system is stable, the resonance suppression point will be memorized. When the mechanical system is not stable, if the servo drive is restarted or P2-47 is set to 1, the servo drive will estimate the resonance suppression point again.

When P2-47 is set to 2, the servo drive will perform the resonance suppression continuously. When the mechanical system becomes stable, the resonance suppression point will be memorized. When the mechanical system is not stable, if the servo drive is restarted, the servo drive will estimate the resonance suppression point again.

When switching the mode#1 or #2 to #0, the setting values of P2-43, P2-44, P2-45 and P2-46 will be saved automatically.

P2-48	**ANCL**	**Auto Resonance Suppression Detection Level**	**Address: 0260H 0261H**

Operation Interface:	Keypad/Software	Communication	Related Section: N/A
Default:	100		
Control Mode:	ALL		
Unit:	N/A		
Range:	1 ~ 300%		
Data Size:	16-bit		
Display Format:	Decimal		

Settings:

When the setting value is smaller, the system will become more sensitive to detect and find the resonance.

When the value of ↑

The setting value of P2-48 ↑, the sensitivity of detecting resonance ↓.

The setting value of P2-48 ↓, the sensitivity of detecting resonance ↑.

P2-49	**SJIT**	**Speed Detection Filter and Jitter Suppression**	**Address: 0262H 0263H**

Operation Interface:	Keypad/Software	Communication	Related Section: Section 6.2.5
Default:	0		
Control Mode:	ALL		
Unit:	sec		
Range:	0 ~ 1F		
Data Size:	16-bit		
Display Format:	Decimal		

Settings:

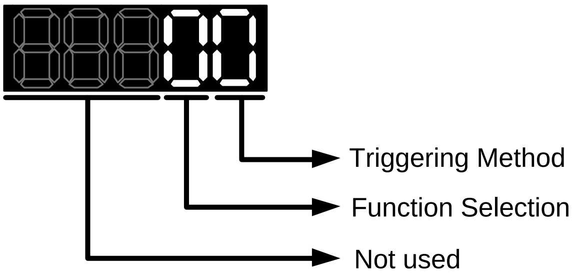
Setting Value of P2-49	Cutoff Frequency of Speed Loop Feedback (Hz)
00	2500
01	2250
02	2100
03	2000
04	1800
05	1600
06	1500
07	1400
08	1300
09	1200
0A	1100
0B	1000
0C	950

Setting Value of P2-49	Cutoff Frequency of Speed Loop Feedback (Hz)
0D	900
0E	850
0F	800
10	750
11	700
12	650
13	600
14	550
15	500
16	450
17	400
18	350
19	300
1A	250
1B	200
1C	175
1D	150
1E	125
1F	100

P2-50	**DCLR**	**Pulse Deviation Clear Mode**	**Address: 0264H 0265H**

Operation Interface:	Keypad/Software	Communication	Related Section: N/A
Default:	00		
Control Mode:	PT		
Unit:	N/A		
Range:	0 ~ 11		
Data Size:	16-bit		
Display Format:	Hexadecimal		

Settings:



For digital input function (DI function), please refer to Table 7.A.

This pulse deviation clear function is enabled when a digital input is set to pulse clear function (CCLR mode, DI (Digital Input) setting value is 0x04). When this input is triggered, the position accumulated pulse number will be clear to 0. (available in PT mode only)

Triggering Method Settings:

0: CCLR is triggered by rising-edge

1: CCLR is triggered bu level

Function Selection Settings:

0: Clear position accumulated pulse number

When this input is triggered, the position accumulated pulse number will be clear to 0.

1: Clear feedback PUU

When this input is triggered, the feedback PUU will be clear to 0.

P2-51	**Reserved (Do Not Use)**	**Address: 0266H 0267H**

P2-52	**Reserved (Do Not Use)**	**Address: 0268H 0269H**

P2-53	**KPI**	**Position Integral Compensation**	**Address: 026AH 026BH**

Operation Interface:	Keypad/Software	Communication	Related Section: Section 6.3.6
Default:	0		
Control Mode:	ALL		
Unit:	rad/s		
Range:	0 ~ 1023		
Data Size:	16-bit		
Display Format:	Decimal		

Settings:

This parameter is used to set the integral time of position loop. When the value of position integral compensation is increased, it can decrease the position control deviation. However, if the setting value is over high, it may generate position overshoot or noise.

P2-54	**Reserved (Do Not Use)**	**Address: 026CH 026DH**

P2-55	**Reserved (Do Not Use)**	**Address: 026EH 026FH**

P2-56	**Reserved (Do Not Use)**	**Address: 0270H 0271H**

P2-57	**Reserved (Do Not Use)**	**Address: 0272H 0273H**

P2-58	**Reserved (Do Not Use)**	**Address: 0274H 0275H**

P2-59	**Reserved (Do Not Use)**	**Address: 0276H 0277H**

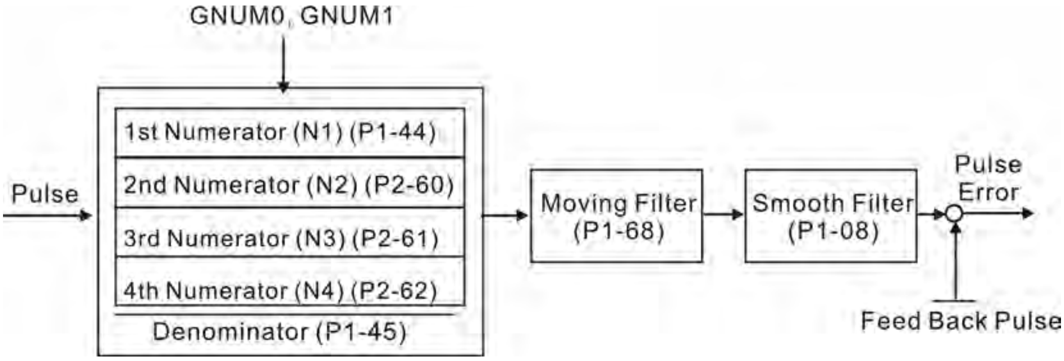
P2-60	**GR4**	**Electronic Gear Ratio (2nd Numerator) (N2)**		**Address: 0278H 0279H**
	Operation Interface:	Keypad/Software	Communication	Related Section: N/A
	Default:	16		
	Control Mode:	PT		
	Unit:	pulse		
	Range:	1 ~ (2^{26}-1)		
	Data Size:	32-bit		
	Display Format:	Decimal		

Settings:

The electronic gear numerator value can be set via GNUM0, GNUM1 (refer to Table 7.A).

When the GNUM0, GNUM1 are not defined, the default of gear numerator value is set by P1-44.

When the users wish to set the gear numerator value by using GNUM0, GNUM1, please set P2-60 ~ P2-62 after the servo motor has been stopped to prevent the mechanical system vibration.


GNUM0, GNUM1
Pulse
1st Numerator (N1) (P1-44)
2nd Numerator (N2) (P2-60)
3rd Numerator (N3) (P2-61)
4th Numerator (N4) (P2-62)
Denominator (P1-45)
Moving Filter (P1-68)
Smooth Filter (P1-08)
Pulse Error
Feed Back Pulse

P2-61	**GR5**	**Electronic Gear Ratio (3rd Numerator) (N3)**		**Address: 027AH 027BH**
	Operation Interface:	Keypad/Software	Communication	Related Section: N/A
	Default:	16		
	Control Mode:	PT		
	Unit:	pulse		
	Range:	1 ~ (2^{26}-1)		
	Data Size:	32-bit		
	Display Format:	Decimal		

Settings:

Refer to P2-60 for explanation.

P2-62	**GR6**	**Electronic Gear Ratio (4th Numerator) (N4)**	**Address: 027CH 027DH**

Operation Interface:	Keypad/Software	Communication	Related Section: N/A
Default:	16		
Control Mode:	PT		
Unit:	pulse		
Range:	1 ~ (2^{26}-1)		
Data Size:	32-bit		
Display Format:	Decimal		

Settings:

Refer to P2-60 for explanation.

P2-63	**Reserved (Do Not Use)**	**Address: 027EH 027FH**

P2-64	**Reserved (Do Not Use)**	**Address: 0280H 0281H**

P2-65	**GBIT**	**Special Function 1**	**Address: 0282H 0283H**

Operation Interface:	Keypad/Software	Communication	Related Section: N/A
Default:	0		
Control Mode:	PT, S		
Unit:	N/A		
Range:	0 ~ 0xFFFF		
Data Size:	N/A		
Display Format:	N/A		

Settings:

Bit15	Bit14	Bit13	Bit12	Bit11	Bit10	Bit9	Bit8	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0

Bit5	Bit4	Bit3	Bit2

Bit2 ~ Bit5: Reserved. Must be set to 0.

Bit6

Bit6: Abnormal pulse command detection

0: enable abnormal pulse command detection

1: disable abnormal pulse command detection

Bit8

Bit8: U, V, W wiring error detection

1: enable U, V, W wiring error detection

Bit9

Bit9: U, V, W wiring cut-off detection

1: enable U, V, W wiring cut-off detection

Bit10

Bit10: DI ZCLAMP function selection

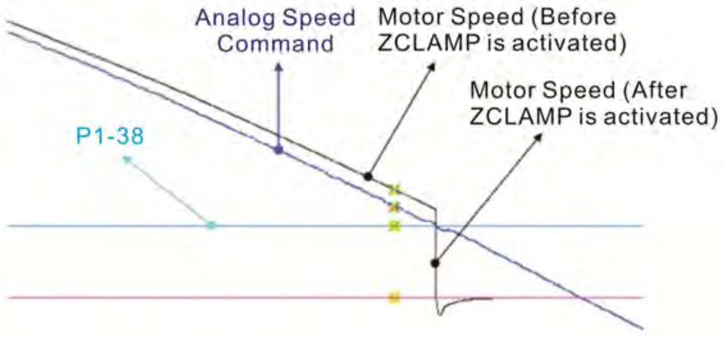
When the following conditions are all met, ZCLAMP function will be activated.

Condition1: Speed mode

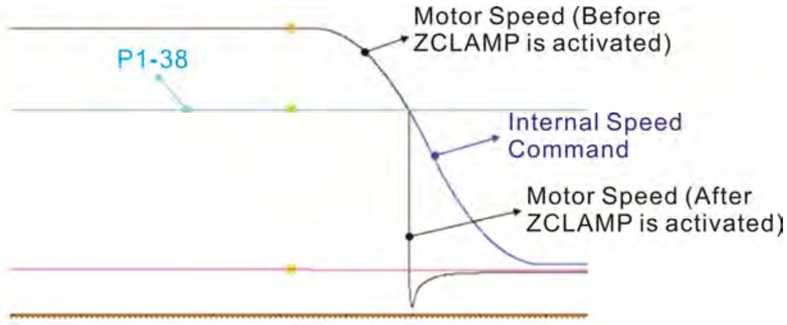
Condition2: DI ZCLAMP is activated.

Condition3: External analog speed command or internal registers speed command is less than parameter P1-38.

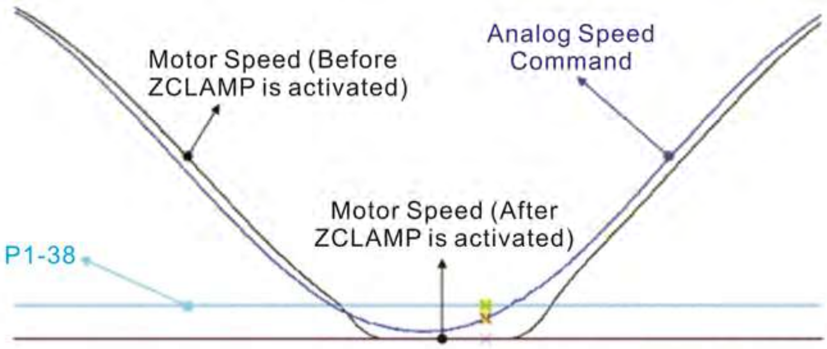
0: When the command source is an analog speed command, the users can use ZCLAMP DI signal to stop the motor at the desire position and do not care the acceleration and deceleration speed curve of the analog speed command. The motor will be locked at the position when ZCLAMP conditions are satisfied.

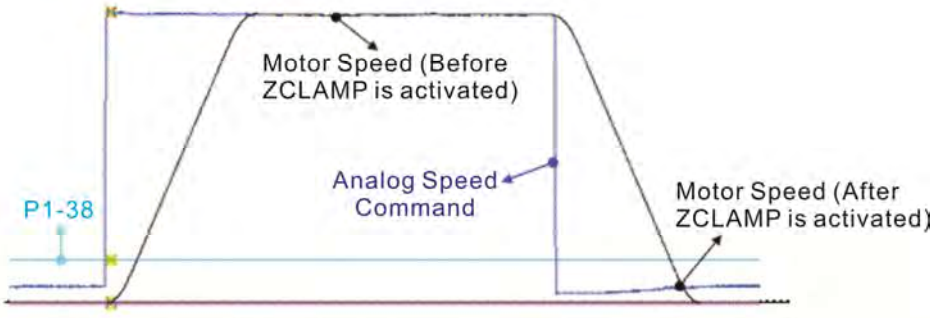


0: When the command source is an internal speed command, the users can use ZCLAMP DI signal to stop the motor at the desire position and keep the the acceleration and deceleration speed curve of the internal speed command. The motor will be locked at the position when ZCLAMP conditions are satisfied.

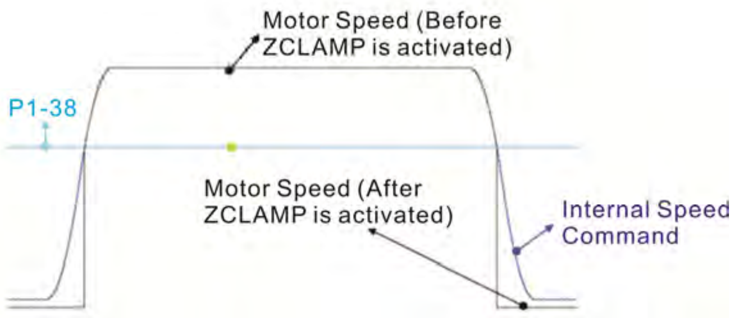


1: When the command source is an analog speed command, the users can use ZCLAMP DI signal to stop the motor at the desire position and do not care the acceleration and deceleration speed curve of the internal speed command. When ZCLAMP conditions are satisfied, the speed command is decreased to 0 r/min. When ZCLAMP conditions are not satisfied, the speed command will follow the analog speed command through Accel/Decel S-curve.





1: When the command source is an internal speed command, the users can use ZCLAMP DI signal to stop the motor at the desire position and keep the acceleration and deceleration speed curve of the analog speed command. When ZCLAMP conditions are satisfied, the speed command is forced to 0 r/min directly.



B11

Bit11: NL(CWL)/PL(CCWL) pulse input inhibit function

0: Disable NL(CWL)/PL(CCWL) pulse input inhibit function. In PT mode, no matter NL or PL exists or not, external position pulse command will be input into the servo drive.

1: Enable NL(CWL)/PL(CCWL) pulse input inhibit function. In PT mode, if NL exists, the external NL pulse input into the servo drive will be inhibited and PL pulse input will be accepted. On the one hand, in PT mode, if PL exists, the external PL pulse input into the servo drive will be inhibited and PL pulse input will be accepted.

Please note:

If NL and PL both exist, NL and PL pulse input into the servo drive will be both inhibited.

Bit12

Bit12: Input power phase loss detection function

0: Enable Input power phase loss (AL022) detection function

1: Disable Input power phase loss (AL022) detection function

Bit13

Bit13: Encoder output error detection function

0: Enable encoder output error (AL018) detection function

1: Disable encoder output error (AL018) detection function

Bit15	Bit14

Bit14 ~ Bit15: Reserved. Must be set to 0.

P2-66	GBIT2	Special Function 2		Address: 0284H 0285H
	Operation Interface:	Keypad/Software	Communication	Related Section: N/A
	Default:	0		
	Control Mode:	PT, S		
	Unit:	N/A		
	Range:	0 ~ 0xFFFF		
	Data Size:	16-bit		
	Display Format:	Hexadecimal		

Settings:

Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0

Bit0

Bit0: Speed limit accel / decel function

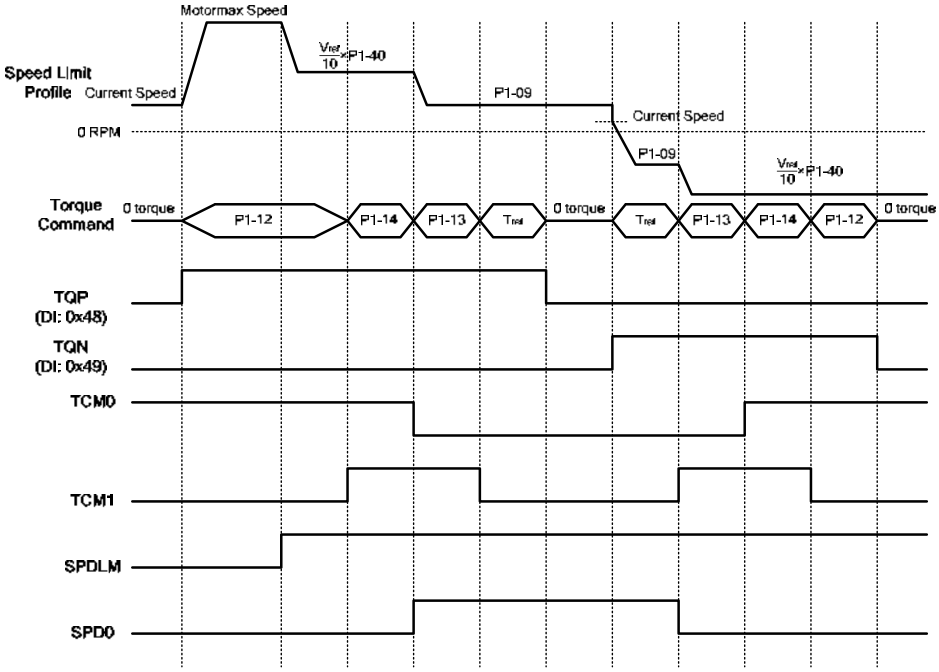
The torque command source is determined by TCM0 and TCM1. When the digital input, TQP or TQN is used, the torque command is activated by TQP or TQN. When TQP is ON, the torque will be output directly as the same as the command souce. For example, when TQP is ON, if the torque command source is an input voltage of 5V and P1-41 is set to 100, it indicates that the torque command is 50% rated torque until the speed is limited. However, whenTQN is ON, if the torque command source is an input voltage of 5V and P1-41 is set to 100, it indicates that the torque command is -50% rated torque until the speed is limited.

Speed limit function can be enabled always by P1-02. When P1-02 is set to 0x10, the speed limit function can be enabled all the time and the users do not need to use DI, SPDLM to switch the speed limit function.

The speed limit command is determined by SPD0 and SPD1. The acceleration and deceleration time is determined by P1-34, P1-35 and P1-36.

TQP (DI Code: 0x48)	TQN (DI Code: 0x49)	Torque Output
ON	ON	Zero torque output
ON	OFF	Output the torque of the command source directly (do not reverse the command, and output the torque directly)
OFF	ON	Reverse the torque of the command source (reverse the command first, and then output the torque)
OFF	OFF	Zero torque output

The timing charts of speed limit profile (with accel / decel function)and torque command (TQP/TQN):



Bit1

Bit1: Reserved. Must be set to 0.

Bit2

Bit2: Undervoltage (Servo Drive Fault, AL003) clear mode selection

0: The fault, Undervoltage will not be cleared automatically.

1: The fault, Undervoltage will be cleared automatically.

Bit6	Bit5	Bit4	Bit3

Bit3 ~ Bit6: Reserved. Must be set to 0.

Bit7

Bit7: Motor temperature warning (Servo Drive Fault, AL067) display mode selection

0: The fault, Undervoltage will be displayed.

1: The fault, Undervoltage will not be displayed.

Bit9

Bit9:

0: Alarm output (DO function 0x11)

1: Error output (DO function 0x07)

P2-67	JSL	Stable Inertia Estimating Time		Address: 0286H 0287H
	Operation Interface:	Keypad/Software	Communication	Related Section: N/A
	Default:	1.5	15	
	Control Mode:	ALL		
	Unit:	1 times	0.1 times	
	Range:	0 ~ 200.0	0 ~ 2000	
	Data Size:	16-bit		
	Display Format:	One-digit	Decimal	
	Input Value Example:	1.5 = 1.5 times	15 = 1.5 times	

Settings:

In semi-auto tuning mode, after the servo drive continuously perform the adjustment for a period of time which is determined by P2-67, the system will consider that the system inertia has become stable and finish the operation of system inertia estimation.

Group 3: P3-xx Communication Parameters

P3-00●	**ADR**	**Communication Address Setting**		**Address: 0300H 0301H**
	Operation Interface:	Keypad / Software	Communication	Related Section: Section 8.2
	Default:	0x7F		
	Control Mode:	ALL		
	Unit:	N/A		
	Range:	0x01 ~ 0x7F		
	Data Size:	16-bit		
	Display Format:	Hexadecimal		

Settings:

This parameter is used to set the communication slave address in hexadecimal format.

Display	0	0	Y	X
Range	-	-	0 ~ 7	0 ~ F

X: Axis number which indicates the value must be within the range from 0 through F.

Y: Group number which indicates the value must be within the range from 0 to through 7

When using RS-232/485 communication, this parameter is used set the communication address in hexadecimal format. If the AC servo drive is controlled by RS-232/485 communication, each drive (or device) must be uniquely identified. One servo drive only can set one address. If the address is duplicated, there will be a communication fault. This address is an absolute address which represents the servo drive on a RS-232/485 network.

Please note:

1. When the address of host (external) controller is set to 0xFF, it is with auto-respond function. Then, the servo drive will receive from and respond to host (external) controller both no matter the address is matching or not. However, the parameter P3-00 cannot be set to 0xFF.

P3-01	**BRT**	**Transmission Speed**		**Address: 0302H 0303H**
	Operation Interface:	Keypad / Software	Communication	Related Section: Section 8.2
	Default:	0x0033		
	Control Mode:	ALL		
	Unit:	bps		
	Range:	0x0000 ~ 0x0055		
	Data Size:	16-bit		
	Display Format:	Hexadecimal		

Settings:

This parameter is used to set the baud rate and data transmission speed of the communications.

	0	Z	Y	X
COM Port	-	-	RS-485	RS-232
Range	0	0	0 ~ 5	0 ~ 5

Settings:

0: Baud rate 4800 (data transmission speed: bits / second)

1: Baud rate 9600 (data transmission speed: bits / second)

2: Baud rate 19200 (data transmission speed: bits / second)

3: Baud rate 38400 (data transmission speed: bits / second)

4: Baud rate 57600 (data transmission speed: bits / second)

5: Baud rate 115200 (data transmission speed: bits / second)

P3-02	**PTL**	**Communication Protocol**		**Address: 0304H 0305H**
	Operation Interface:	Keypad / Software	Communication	Related Section: Section 8.2
	Default:	0x0066		
	Control Mode:	ALL		
	Unit:	N/A		
	Range:	0x0000 ~ 0x0088		
	Data Size:	16-bit		
	Display Format:	Hexadecimal		

Settings:

This parameter is used to set the communication protocol. The alphanumeric characters represent the following: 7 or 8 is the number of data bits; N, E or O refers to the parity bit, Non, Even or Odd; the 1 or 2 is the numbers of stop bits.

	0	Z	Y	X
COM Port	-	-	RS-485	RS-232
Range	0	0	0 ~ 8	0 ~ 8

0: Modbus ASCII mode, <7,N,2>

1: Modbus ASCII mode, <7,E,1>

2: Modbus ASCII mode, <7,O,1>

3: Modbus ASCII mode, <8,N,2>

4: Modbus ASCII mode, <8,E,1>

5: Modbus ASCII mode, <8,O,1>

6: Modbus RTU mode, <8,N,2>

7: Modbus RTU mode, <8,E,1>

8: Modbus RTU mode, <8,O,1>

P3-03	**FLT**	**Transmission Fault Treatment**		**Address: 0306H 0307H**
	Operation Interface:	Keypad / Software	Communication	Related Section: Section 8.2
	Default:	0		
	Control Mode:	ALL		
	Unit:	N/A		
	Range:	0 ~ 1		
	Data Size:	16-bit		
	Display Format:	Hexadecimal		

Settings:

0: Display fault and continue operating

1: Display fault and decelerate to stop operating

This parameter is used to determine the operating sequence once a communication fault has been detected. If '1' is selected, the drive will stop operating upon detection the communication fault. The mode of stopping is set by parameter P1-32.

P3-04	**CWD**	**Communication Time Out Detection**		**Address: 0308H 0309H**
	Operation Interface:	Keypad / Software	Communication	Related Section: Section 8.2
	Default:	0		
	Control Mode:	ALL		
	Unit:	sec		
	Range:	0 ~ 20		
	Data Size:	16-bit		
	Display Format:	Decimal		

Settings:

This parameter is used to set the maximum permissible time before detecting a fault due to communication time out. When P3-04 is set to a value over than 0, it indicates this parameter is enabled. However, if not communicating with the servo in this period of time, the servo drive will assume the communication has failed and show the communication error fault message.

When P3-04 is set to 0, this parameter is disabled.

P3-05	**CMM**	**Communication Selection**		**Address: 030AH 030BH**
	Operation Interface:	Keypad / Software	Communication	Related Section: Section 8.2
	Default:	0		
	Control Mode:	ALL		
	Unit:	N/A		
	Range:	0x00 ~ 0x01		
	Data Size:	16-bit		

Display Format:	Hexadecimal

Settings:

RS-232 Communication interface selection

0: RS-232 via Modbus communication

1: RS-232 upon ASDA-Soft software

P3-06■	**SDI**	**Digital Input Communication Function**		**Address: 030CH 030DH**
	Operation Interface:	Keypad / Software	Communication	Related Section: Section 8.2
	Default:	0		
	Control Mode:	ALL		
	Unit:	N/A		
	Range:	0x0000 ~ 0x1FFF		
	Data Size:	16-bit		
	Display Format:	Hexadecimal		

Settings:

The setting of this parameter determines how the Digital Inputs (DI) accept commands and signals.

Bit0 ~ Bit 8 corresponds with DI1 ~ DI9. The least significant bit (Bit0) shows DI1 status and the most significant bit (Bit7) shows DI8 status.

Bit settings:

0: Digital input is controlled by external command (via CN1)

1: Digital input is controlled by parameter P4-07

For the settings of DI1 ~ DI9, please refer to P2-10 ~ P2-17 and P2-36.

This parameter P3-06 also works in conjunction with the parameter P4-07 which has several functions. Please see section 8.2 for details.

P3-07	**CDT**	**Communication Response Delay Time**		**Address: 030EH 030FH**
	Operation Interface:	Keypad / Software	Communication	Related Section: Section 8.2
	Default:	0		
	Control Mode:	ALL		
	Unit:	1ms		
	Range:	0 ~ 1000		
	Data Size:	16-bit		
	Display Format:	Decimal		

Settings:

This parameter is used to delay the communication time that servo drive responds to host controller (external controller).

P3-08■	**MNS**	**Monitor Mode**		**Address: 0310H 0311H**
	Operation Interface:	Keypad / Software	Communication	Related Section: Section 8.2
	Default:	0000		
	Control Mode:	ALL		
	Unit:	N/A		
	Range:	refer to the description of Settings		
	Data Size:	16-bit		
	Display Format:	Hexadecimal		

Settings:

This parameter is used to monitor the data of the servo drive via communication. The monitor data can be displayed on PC upon the data scope function provided by ASDA-Soft software.

Word	-	-	Low	High
Function	-	-		Monitor mode
Range	0	0	0	0 ~ 3

H: Monitor mode, the value must be within the range from 0 through 3.

0: Disabled, i.e. disable monitor function.

1: Reserved.

2: High-speed monitor mode. The sampling time is 2000 times per second and 4 channels can be monitored.

3: High-speed monitor mode. The sampling time is 4000 times per second and 2 channels can be monitored.

P3-09	**Reserved (Do Not Use)**	**Address: 0312H 0313H**

P3-10	**Reserved (Do Not Use)**	**Address: 0314H 0315H**

P3-11	**Reserved (Do Not Use)**	**Address: 0316H 0317H**

Group 4: P4-xx Diagnosis Parameters

P4-00★	ASH1	Fault Record (N)	Address: 0400H 0401H

Operation Interface:	Keypad / Software	Communication	Related Section: Section 4.4.1
Default:	0		
Control Mode:	ALL		
Unit:	N/A		
Range:	N/A		
Data Size:	32-bit		
Display Format:	Hexadecimal		

Settings:

This parameter is used to set the most recent fault record.

Display of Low Word: LXXXX: It indicates the fault code, i.e. alarm code

Display of High Word: hYYYY: Reserved.

P4-01★	ASH2	Fault Record (N-1)	Address: 0402H 0403H

Operation Interface:	Keypad / Software	Communication	Related Section: Section 4.4.1
Default:	0		
Control Mode:	ALL		
Unit:	N/A		
Range:	N/A		
Data Size:	32-bit		
Display Format:	Hexadecimal		

Settings:

This parameter is used to set the second most recent fault record.

Display of Low Word: LXXXX: It indicates the fault code, i.e. alarm code.

Display of High Word: hYYYY: It indicates the CANopen error code.

P4-02★	ASH3	Fault Record (N-2)	Address: 0404H 0405H

Operation Interface:	Keypad / Software	Communication	Related Section: Section 4.4.1
Default:	0		
Control Mode:	ALL		
Unit:	N/A		
Range:	N/A		
Data Size:	32-bit		
Display Format:	Hexadecimal		

Settings:

This parameter is used to set the third most recent fault record.

Display of Low Word: LXXXX: It indicates the fault code, i.e. alarm code.

Display of High Word: hYYYY: It indicates the CANopen error code.

P4-03★	**ASH4**	**Fault Record (N-3)**		**Address: 0406H 0407H**
	Operation Interface:	Keypad / Software	Communication	Related Section: Section 4.4.1
	Default:	0		
	Control Mode:	ALL		
	Unit:	N/A		
	Range:	N/A		
	Data Size:	32-bit		
	Display Format:	Hexadecimal		

Settings:

This parameter is used to set the fourth most recent fault record.

Display of Low Word: LXXXX: It indicates the fault code, i.e. alarm code.

Display of High Word: hYYYY: It indicates the CANopen error code.

P4-04★	**ASH5**	**Fault Record (N-4)**		**Address: 0408H 0409H**
	Operation Interface:	Keypad / Software	Communication	Related Section: Section 4.4.1
	Default:	0		
	Control Mode:	ALL		
	Unit:	N/A		
	Range:	N/A		
	Data Size:	32-bit		
	Display Format:	Hexadecimal		

Settings:

This parameter is used to set the fifth most recent fault record.

Display of Low Word: LXXXX: It indicates the fault code, i.e. alarm code.

Display of High Word: hYYYY: It indicates the CANopen error code.

P4-05	**JOG**	**JOG Operation**		**Address: 040AH 040BH**
	Operation Interface:	Keypad / Software	Communication	Related Section: Section 4.4.2
	Default:	20		
	Control Mode:	ALL		
	Unit:	r/min		
	Range:	0 ~ 5000		
	Data Size:	16-bit		
	Display Format:	Decimal		

Settings:

JOG operation command:

1. Operation Test
    (1) Press the SET key to display the JOG speed. (The default value is 20 r/min).
    (2) Press the UP or DOWN arrow keys to increase or decrease the desired JOG speed. (This also can be undertaken by using the SHIFT key to move the cursor to the desired unit column (the effected number will flash) then changed using the UP and DOWN arrow keys).
    (3) Press the SET when the desired JOG speed is displayed. The Servo Drive will display "JOG".
    (4) Press the UP or DOWN arrow keys to jog the motor either P(CCW) or N(CW) direction. The motor will only rotation while the arrow key is activated.
    (5) To change JOG speed again, press the MODE key. The servo Drive will display "P4 - 05". Press the SET key and the JOG speed will displayed again. Refer back to #(2) and #(3) to change speed.
    (6) In JOG operation mode, if any fault occurs, the motor will stop running. The maximum JOG speed is the rated speed of the servo motor.
2. DI Signal Control

    Set the value of DI signal as JOGU and JOGD (refer to Table 7.A).

    Users can perform JOG run forward and run reverse control.
3. Communication Control

    To perform a JOG Operation via communication command, use communication addresses 040AH and 040BH.
    (1) Enter 1 ~ 5000 for the desired JOG speed
    (2) Enter 4998 to JOG in the P(CCW) direction
    (3) Enter 4999 to JOG in the N(CW) direction
    (4) Enter 0 to stop the JOG operation

    Please note that when using communication control, please set P2-30 to 5 to avoid that there are excessive writes to the system flash memory.

P4-06 **▲ ■**	**FOT**	**Digital Output Register (Readable and Writable)**	**Address: 040CH** **040DH**

Operation Interface:	Keypad / Software	Communication	Related Section: Section 4.4.3
Default:	0		
Control Mode:	ALL		
Unit:	-		
Range:	0 ~ 0x3F		
Data Size:	16-bit		
Display Format:	Hexadecimal		

Settings: Contact control of the force output

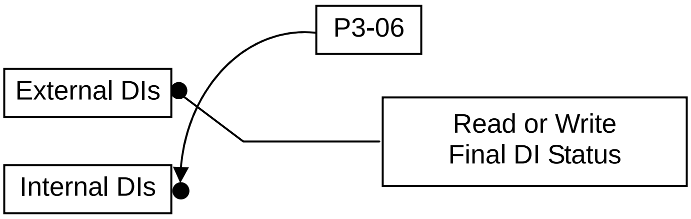
0: Non-force output (When the communication sets to 0, it can cancel the force output function.)

P4-07■

ITST	**Input Status**		**Address: 040CH 040DH**
Operation Interface:	Software (cannot read and write throught the panel)	Communication	Related Section: Section 4.4.4 Section 8.2
Default:	0		
Control Mode:	ALL		
Unit:	N/A		
Range:	0 ~ 01FF		
Data Size:	16-bit		
Display Format:	Hexadecimal		

Settings:

The control of digital inputs can be determined by the external terminals (DI1 ~ DI9) or by the internal software digital inputs SDI1 ~ SDI9 (corresponds to Bit0 ~ Bit8 of P1-47) via communication (upon software). Please refer to P3-06 and section 8.2 for the setting method.



Read P4-07: Display the final status of DI input signal.

Write P4-07: Write the status of software digital inputs SDI1 ~ SDI9

(No matter the servo drive is controller through digital keypad or communication control, the function of this parameter is the same.)

For example:

External Control: Display the final status of DI input signal

When the read value of P4-07 is 0x0011, it indicates that DI1 and DI5 are ON.

Communication Control (Internal DIs): Read the status of input signal (upon software).

For example:

When the write value of P4-07 is 0x0011, it indicates that software digital inputs SDI1 and SDI5 are ON.

Bit0 ~ Bit8 corresponds with DI1 ~ DI9.

For the settings of DI1 ~ DI9, please refer to P2-10 ~ P2-17 and P2-36.

P4-08★

PKEY	**Digital Keypad Input of Servo Drive**		**Address: 0410H 0411H**
Operation Interface:	Keypad / Software	Communication	Related Section: N/A
Default:	N/A		
Control Mode:	ALL		

Unit:	N/A
Range:	Read only
Data Size:	16-bit
Display Format:	Hexadecimal

Settings:

This parameter is used to check if MODE, UP, DOWN, SHIFT, and SET keys on the drive keypad being pressed or not. It is used to examine if these five keys work normally via communication during production.

P4-09★	**MOT**	**Output Status (Read-only)**		**Address: 0412H 0413H**
	Operation Interface:	Keypad / Software	Communication	Related Section: Section 4.4.5
	Default:	N/A		
	Control Mode:	ALL		
	Unit:	N/A		
	Range:	0 ~ 0x3F		
	Data Size:	16-bit		
	Display Format:	Hexadecimal		

Settings:

There is no difference when reading DO output signal via the drive keypad or the communication.

P4-10■	**CEN**	**Adjustment Function**		**Address: 0414H 0415H**
	Operation Interface:	Keypad / Software	Communication	Related Section: N/A
	Default:	0		
	Control Mode:	ALL		
	Unit:	N/A		
	Range:	0 ~ 6		
	Data Size:	16-bit		
	Display Format:	Decimal		

Settings:

0: Reserved

1: Execute analog speed input drift adjustment

2: Execute analog torque input drift adjustment

3: Execute current detector (V phase) drift adjustment

4: Execute current detector (W phase) drift adjustment

5: Execute drift adjustment of the above 1~4

6: Execute IGBT NTC calibration

Please note:

1. This adjustment function is enabled after parameter P2-08 is set to 20.
2. When executing any adjustment, the external wiring connected to analog speed or torque must be removed and the servo system should be off (Servo off).

P4-11	SOF1	Analog Speed Input Drift Adjustment 1		Address: 0416H 0417H
	Operation Interface:	Keypad / Software	Communication	Related Section: N/A
	Default:	Factory setting		
	Control Mode:	ALL		
	Unit:	N/A		
	Range:	0 ~ 32767		
	Data Size:	16-bit		
	Display Format:	Decimal		

Settings:

The adjustment functions from P4-11 through P4-19 are enabled after parameter P2-08 is set to 22. Although these parameters allow the users to execute manual adjustment, we still do not recommend the users to change the default setting value of these parameters (P4-11 ~ P4-19) manually.

Please note that when P2-08 is set to 10, the users cannot reset this parameter.

P4-12	SOF2	Analog Speed Input Drift Adjustment 2		Address: 0418H 0419H
	Operation Interface:	Keypad / Software	Communication	Related Section: N/A
	Default:	Factory setting		
	Control Mode:	ALL		
	Unit:	N/A		
	Range:	0 ~ 32767		
	Data Size:	16-bit		
	Display Format:	Decimal		

Settings:

Refer to P4-11 for explanation.

Please note that when P2-08 is set to 10, the users cannot reset this parameter.

P4-13	TOF1	Analog Torque Drift Adjustment 1		Address: 041AH 041BH
	Operation Interface:	Keypad / Software	Communication	Related Section: N/A
	Default:	Factory setting		
	Control Mode:	ALL		
	Unit:	N/A		
	Range:	0 ~ 32767		
	Data Size:	16-bit		

Display Format:	Decimal	

Settings:

Refer to P4-11 for explanation.

Please note that when P2-08 is set to 10, the users cannot reset this parameter.

P4-14	**TOF2**	**Analog Torque Drift Adjustment 2**		**Address: 041CH 041DH**
	Operation Interface:	Keypad / Software	Communication	Related Section: N/A
	Default:	Factory setting		
	Control Mode:	ALL		
	Unit:	N/A		
	Range:	0 ~ 32767		
	Data Size:	16-bit		
	Display Format:	Decimal		

Settings:

Refer to P4-11 for explanation.

Please note that when P2-08 is set to 10, the users cannot reset this parameter.

P4-15	**COF1**	**Current Detector Drift Adjustment (V1 phase)**		**Address: 041EH 041FH**
	Operation Interface:	Keypad / Software	Communication	Related Section: N/A
	Default:	Factory setting		
	Control Mode:	ALL		
	Unit:	N/A		
	Range:	0 ~ 32767		
	Data Size:	16-bit		
	Display Format:	Decimal		

Settings:

Refer to P4-11 for explanation.

Please note that when P2-08 is set to 10, the users cannot reset this parameter.

P4-16	**COF2**	**Current Detector Drift Adjustment (V2 phase)**		**Address: 0420H 0421H**
	Operation Interface:	Keypad / Software	Communication	Related Section: N/A
	Default:	Factory setting		
	Control Mode:	ALL		
	Unit:	N/A		
	Range:	0 ~ 32767		
	Data Size:	16-bit		

Display Format:	Decimal

Settings:

Refer to P4-11 for explanation.

Please note that when P2-08 is set to 10, the users cannot reset this parameter.

P4-17	**COF3**	**Current Detector Drift Adjustment (W1 phase)**	**Address: 0422H 0423H**

Operation Interface:	Keypad / Software	Communication	Related Section: N/A
Default:	Factory setting		
Control Mode:	ALL		
Unit:	N/A		
Range:	0 ~ 32767		
Data Size:	16-bit		
Display Format:	Decimal		

Settings:

Refer to P4-11 for explanation.

Please note that when P2-08 is set to 10, the users cannot reset this parameter.

P4-18	**COF4**	**Current Detector Drift Adjustment (W2 phase)**	**Address: 0424H 0425H**

Operation Interface:	Keypad / Software	Communication	Related Section: N/A
Default:	Factory setting		
Control Mode:	ALL		
Unit:	N/A		
Range:	0 ~ 32767		
Data Size:	16-bit		
Display Format:	Decimal		

Settings:

Refer to P4-11 for explanation.

Please note that when P2-08 is set to 10, the users cannot reset this parameter.

P4-19	**TIGB**	**IGBT NTC Calibration**	**Address: 0426H 0427H**

Operation Interface:	Keypad / Software	Communication	Related Section: N/A
Default:	Factory setting		
Control Mode:	ALL		
Unit:	N/A		
Range:	1 ~ 3		
Data Size:	16-bit		

Display Format:	Decimal

Settings:

Refer to P4-11 for explanation.

When executing this auto adjustment, please ensure to cool the servo drive to 25°C.

P4-20	**DOF1**	**Analog Monitor Output Drift Adjustment (MON1)**	**Address: 0428H 0429H**
Operation Interface:	Keypad / Software	Communication	Related Section: Section 6.4.4
Default:	Factory setting		
Control Mode:	ALL		
Unit:	mV		
Range:	-800 ~ 800		
Data Size:	16-bit		
Display Format:	Decimal		

Settings:

Please note that when P2-08 is set to 10, the users cannot reset this parameter.

P4-21	**DOF2**	**Analog Monitor Output Drift Adjustment (MON2)**	**Address: 042AH 042BH**
Operation Interface:	Keypad / Software	Communication	Related Section: Section 6.4.4
Default:	0		
Control Mode:	ALL		
Unit:	mV		
Range:	-800 ~ 800		
Data Size:	16-bit		
Display Format:	Decimal		

Settings:

Please note that when P2-08 is set to 10, the users cannot reset this parameter.

P4-22	**SAO**	**Analog Speed Input Offset**	**Address: 042CH 042DH**
Operation Interface:	Keypad / Software	Communication	Related Section: N/A
Default:	0		
Control Mode:	S		
Unit:	mV		
Range:	-5000 ~ 5000		
Data Size:	16-bit		
Display Format:	Decimal		

Settings:

In speed mode, the users can use this parameter to add an offset value to analog speed input.

P4-23	**TAO**	**Analog Torque Input Offset**	**Address: 042EH** **042FH**
Operation Interface:	Keypad / Software	Communication	Related Section: N/A
Default:	0		
Control Mode:	T		
Unit:	mV		
Range:	-5000 ~ 5000		
Data Size:	16-bit		
Display Format:	Decimal		

Settings:

In speed mode, the users can use this parameter to add an offset value to analog speed input.

P4-24	**LVL**	**Undervoltage Error Level**	**Address: 0430H** **0431H**
Operation Interface:	Keypad / Software	Communication	Related Section: N/A
Default:	160		
Control Mode:	ALL		
Unit:	V (rms)		
Range:	140 ~ 190		
Data Size:	16-bit		
Display Format:	Decimal		

Settings:

When DC Bus voltage is lower than the value of P4-24 x $\sqrt{2}$, the fault, Undervoltage will occur.

Table 7.1 Input Function Definition (DI)

Setting value: 0x01

DI Name	DI Function Description	Trigger Method	Control Mode
SON	Servo On. When this DI is activated, it indicates the servo drive is enabled.	Level Triggered	All

Setting value: 0x02

DI Name	DI Function Description	Trigger Method	Control Mode
ARST	A number of Faults (Alarms) can be cleared by activating ARST. Please see table 10-3 for applicable faults that can be cleared with the ARST command. However, please investigate Fault or Alarm if it does not clear or the fault description warrants closer inspection of the drive system.	Rising-edge Triggered	All

Setting value: 0x03

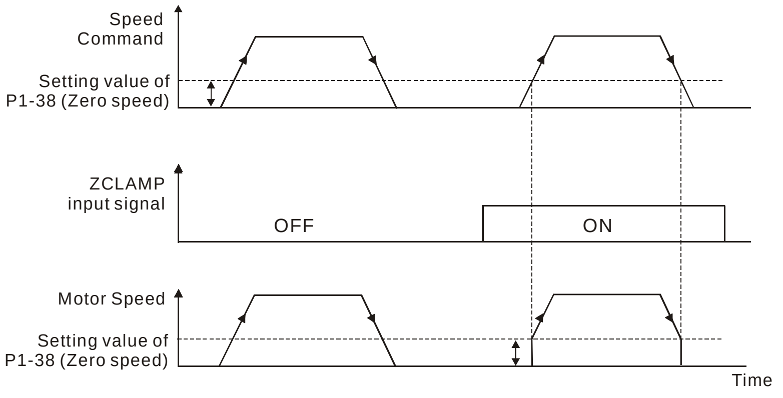
DI Name	DI Function Description	Trigger Method	Control Mode
GAINUP	Gain switching in speed and position mode. When GAINUP is activated (P2-27 is set to 1), the gain is switched to the gain multiplied by gain switching rate.	Level Triggered	PT S

Setting value: 0x04

DI Name	DI Function Description	Trigger Method	Control Mode
CCLR	When CCLR is activated, the setting parameter P2-50 Pulse Clear Mode is executed. 0: After CCLR is activated (ON), the position accumulated pulse number will be cleared continuously.	Rising-edge Triggered, Level Triggered	PT

Setting value: 0x05

DI Name	DI Function Description	Trigger Method	Control Mode
ZCLAMP	When this signal is On and the motor speed value is lower than the setting value of P1-38, it is used to lock the motor in the instant position while ZCLAMP is On.	Level Triggered	S

	 Speed Command Setting value of P1-38 (Zero speed) ZCLAMP input signal OFF ON Motor Speed Setting value of P1-38 (Zero speed) Time		

Setting value: 0x06

DI Name	DI Function Description	Trigger Method	Control Mode
CMDINV	Command input reverse control. When the drive is in the Position, Speed and Torque mode, and CMDINV is activated, the motor is in reverse rotation.	Level Triggered	S, T

Setting value: 0x07

DI Name	DI Function Description	Trigger Method	Control Mode
Reserved			

Setting value: 0x09

DI Name	DI Function Description	Trigger Method	Control Mode
TRQLM	Torque limit enabled. When the drive is in speed and position mode, and TRQLM is activated, it indicates the torque limit command is valid. The torque limit command source is internal parameter or analog voltage.	Level Triggered	PT, S

Setting value: 0x10

DI Name	DI Function Description	Trigger Method	Control Mode
SPDLM	Speed limit enabled. When the drive is in torque mode and SPDLM is activated, it indicates the speed limit command is valid. The speed limit command source is internal parameter or analog voltage.	Level Triggered	T

<table>
<tr><th colspan="4">Setting value: 0x14 ~ 0x15</th></tr>
<tr><th>DI Name</th><th>DI Function Description</th><th>Trigger Method</th><th>Control Mode</th></tr>
<tr><td>SPD0
SPD1</td><td>Speed command selection 0 ~ 1 (Command S1 ~ S4)
<table>
<tr><th rowspan="2">Command No.</th><th colspan="2">DI signal of CN1</th><th rowspan="2" colspan="3">Command Source</th><th rowspan="2">Content</th><th rowspan="2">Range</th></tr>
<tr><th>SPD1</th><th>SPD0</th></tr>
<tr><td rowspan="2">S1</td><td rowspan="2">OFF</td><td rowspan="2">OFF</td><td rowspan="2">Mode</td><td>S</td><td>External analog command</td><td>Voltage between V-REF and GND</td><td>+/-10 V</td></tr>
<tr><td>Sz</td><td>None</td><td>Speed command is 0</td><td>0</td></tr>
<tr><td>S2</td><td>OFF</td><td>ON</td><td rowspan="3" colspan="3">Internal parameter</td><td>P1-09</td><td rowspan="3">-60000 ~ +60000 r/min</td></tr>
<tr><td>S3</td><td>ON</td><td>OFF</td><td>P1-10</td></tr>
<tr><td>S4</td><td>ON</td><td>ON</td><td>P1-11</td></tr>
</table></td><td>Level Triggered</td><td>S</td></tr>
</table>

<table>
<tr><th colspan="4">Setting value: 0x16 ~ 0x17</th></tr>
<tr><th>DI Name</th><th>DI Function Description</th><th>Trigger Method</th><th>Control Mode</th></tr>
<tr><td>TCM0
TCM1</td><td>Torque command selection 0 ~ 1 (Command T1 ~ T4)
<table>
<tr><th rowspan="2">Command No.</th><th colspan="2">DI signal of CN1</th><th rowspan="2" colspan="3">Command Source</th><th rowspan="2">Content</th><th rowspan="2">Range</th></tr>
<tr><th>TCM1</th><th>TCM0</th></tr>
<tr><td rowspan="2">T1</td><td rowspan="2">OFF</td><td rowspan="2">OFF</td><td rowspan="2">Mode</td><td>T</td><td>Analog command</td><td>Voltage between V-REF and GND</td><td>+/-10 V</td></tr>
<tr><td>Tz</td><td>None</td><td>Torque command is 0</td><td>0</td></tr>
<tr><td>T2</td><td>OFF</td><td>ON</td><td rowspan="3" colspan="3">Internal parameter</td><td>P1-12</td><td rowspan="3">-300 ~ +300 %</td></tr>
<tr><td>T3</td><td>ON</td><td>OFF</td><td>P1-13</td></tr>
<tr><td>T4</td><td>ON</td><td>ON</td><td>P1-14</td></tr>
</table></td><td>Level Triggered</td><td>T</td></tr>
</table>

<table>
<tr><th colspan="4">Setting value: 0x18</th></tr>
<tr><th>DI Name</th><th>DI Function Description</th><th>Trigger Method</th><th>Control Mode</th></tr>
<tr><td>S-P</td><td>Speed / Position mode switching.
OFF: Speed mode, ON: Position mode</td><td>Level Triggered</td><td>P, S</td></tr>
</table>

Setting value: 0x19

DI Name	DI Function Description	Trigger Method	Control Mode
S-T	Speed / Torque mode switching. OFF: Speed mode, ON: Torque mode	Level Triggered	S, T

Setting value: 0x20

DI Name	DI Function Description	Trigger Method	Control Mode
T-P	Torque / Position mode switching. OFF: Torque mode, ON: Position mode	Level Triggered	P, T

Setting value: 0x21

DI Name	DI Function Description	Trigger Method	Control Mode
EMGS	Emergency stop. It should be contact “b” and normally ON or a fault (AL013) will display.	Level Triggered	All

Setting value: 0x22

DI Name	DI Function Description	Trigger Method	Control Mode
NL(CWL)	Reverse inhibit limit. It should be contact “b” and normally ON or a fault (AL014) will display.	Level Triggered	All

Setting value: 0x23

DI Name	DI Function Description	Trigger Method	Control Mode
PL(CCWL)	Forward inhibit limit. It should be contact “b” and normally ON or a fault (AL015) will display.	Level Triggered	All

Setting value: 0x25

DI Name	DI Function Description	Trigger Method	Control Mode
TLLM	Torque limit - Reverse operation (Torque limit function is valid only when P1-02 is enabled)	Level Triggered	PT, S

Setting value: 0x26

DI Name	DI Function Description	Trigger Method	Control Mode
TRLM	Torque limit - Forward operation (Torque limit function is valid only when P1-02 is enabled)	Level Triggered	PT, S

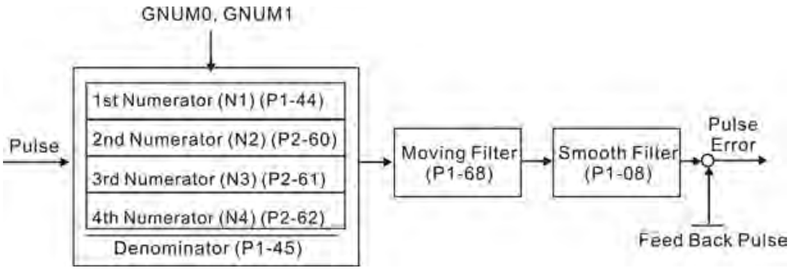
Setting value: 0x37

DI Name	DI Function Description	Trigger Method	Control Mode
JOGU	Forward JOG input. When JOGU is activated, the motor will JOG in forward direction. [see P4-05]	Level Triggered	All

Setting value: 0x38

DI Name	DI Function Description	Trigger Method	Control Mode
JOGD	Reverse JOG input. When JOGD is activated, the motor will JOG in reverse direction. [see P4-05]	Level Triggered	All

Setting value: 0x43, 0x44

DI Name	DI Function Description	Trigger Method	Control Mode
GNUM0 GNUM1	Electronic gear ratio (Numerator) selection 0 ~ 1 [see P2-60 ~ P2-62]  GNUM0, GNUM1 Pulse 1st Numerator (N1) (P1-44) 2nd Numerator (N2) (P2-60) 3rd Numerator (N3) (P2-61) 4th Numerator (N4) (P2-62) Denominator (P1-45) Moving Filter (P1-68) Smooth Filter (P1-08) Pulse Error Feed Back Pulse	Level Triggered	PT

Setting value: 0x45

DI Name	DI Function Description	Trigger Method	Control Mode
INHP	Pulse inhibit input. When the drive is in position mode, if INHP is activated, the external pulse input command is not valid.	Level Triggered	PT

Setting value: 0x48

DI Name	DI Function Description	Trigger Method	Control Mode
TQP	Torque command source. Please refer to the settings of P2-66 Bit0.	Level Triggered	T

Setting value: 0x49

DI Name	DI Function Description	Trigger Method	Control Mode
TQN	Torque command source. Please refer to the settings of P2-66 Bit0.	Level Triggered	T

NOTE

1) 11 ~ 17: Single control mode, 18 ~ 20: Dual control mode

2) When P2-10 to P2-17 and P2-36 is set to 0, it indicates input function is disabled.

Table 7.2 Output Function Definition (DO)

Setting value: 0x01

DO Name	DO Function Description	Trigger Method	Control Mode
SRDY	Servo ready. SRDY is activated when the servo drive is ready to run. All fault and alarm conditions, if present, have been cleared.	Level Triggered	All

Setting value: 0x02

DO Name	DO Function Description	Trigger Method	Control Mode
SON	SON is activated when control power is applied the servo drive. The drive may or may not be ready to run as a fault / alarm condition may exist. Servo ON (SON) is "ON" with control power applied to the servo drive, there may be a fault condition or not. The servo is not ready to run. Servo ready (SRDY) is "ON" where the servo is ready to run, NO fault / alarm exists.	Level Triggered	All

Setting value: 0x03

DO Name	DO Function Description	Trigger Method	Control Mode
ZSPD	ZSPD is activated when the drive senses the motor is equal to or below the Zero Speed Range setting as defined in parameter P1-38. For Example, at factory default ZSPD will be activated when the drive detects the motor rotating at speed at or below 10 r/min, ZSPD will remain activated until the motor speed increases above 10 r/min.	Level Triggered	All

Setting value: 0x04

DO Name	DO Function Description	Trigger Method	Control Mode
TSPD	TSPD is activated once the drive has detected the motor has reached the Target Rotation Speed setting as defined in parameter P1-39. TSPD will remain activated until the motor speed drops below the Target Rotation Speed.	Level Triggered	All

Setting value: 0x05

DO Name	DO Function Description	Trigger Method	Control Mode
TPOS	When the drive is in PT mode, TPOS will be activated when the position error is equal and below the setting value of P1-54.	Level Triggered	PT

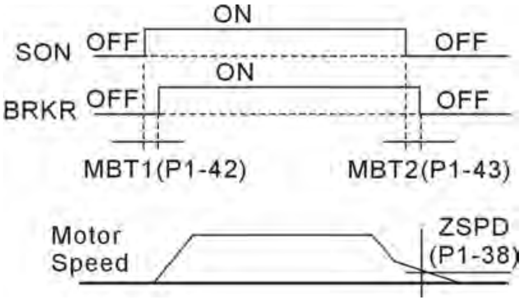
Setting value: 0x06

DO Name	DO Function Description	Trigger Method	Control Mode
TQL	TQL is activated when the drive has detected that the motor has reached the torques limits set by either the parameters P1-12 ~ P1-14 of via an external analog voltage.	Level Triggered	All, except T, Tz

Setting value: 0x07

DO Name	DO Function Description	Trigger Method	Control Mode
ALRM	ALRM is activated when the drive has detected a fault condition. (However, when Reverse limit error, Forward limit error, Emergency stop, Serial communication error, and Undervoltage these fault occur, WARN is activated first.)	Level Triggered	All

Setting value: 0x08

DO Name	DO Function Description	Trigger Method	Control Mode
BRKR	Electromagnetic brake control. BRKR is activated (Actuation of motor brake). (Please refer to parameters P1-42 ~ P1-43)  ON SON OFF OFF ON BRKR OFF OFF MBT1(P1-42) MBT2(P1-43) Motor Speed ZSPD (P1-38)	Level Triggered	All

Setting value: 0x10

DO Name	DO Function Description	Trigger Method	Control Mode
OLW	Output overload warning. OLW is activated when the servo drive has detected that the motor has reached the output overload time set by parameter P1-56. t_{OL} = Permissible Time for Overload x setting value of P1-56 When overload accumulated time (continuously overload time) exceeds the value of **tOL**, the overload warning signal will output, i.e. DO signal, OLW will be ON. However, if the accumulated overload time (continuous overload time) exceeds the permissible time for overload, the overload alarm (AL006) will occur. For example: If the setting value of parameter P1-56 (Output Overload Warning Time) is 60%, when the permissible time for overload exceeds 8 seconds at 200% rated output, the overload fault (AL006) will be detected and shown on the LED display. At this time, t_{OL} = 8 x 60% = 4.8 seconds Result: When the drive output is at 200% rated output and the drive is continuously overloaded for 4.8 seconds, the overload warning signal will be ON (DO code is 0x10, i.e. DO signal OLW will be activated). If the drive is continuously overloaded for 8 seconds, the overload alarm will be detected and shown on the LED display (AL006). Then, Servo Fault signal will be ON (DO signal ALRM will be activated).	Level Triggered	All

Setting value: 0x11

DO Name	DO Function Description	Trigger Method	Control Mode
WARN	Servo warning activated. WARN is activated when the drive has detected Reverse limit error. Forward limit error, Emergency stop, Serial communication error, and Undervoltage these fault conditions.	Level Triggered	All

Setting value: 0x13

DO Name	DO Function Description	Trigger Method	Control Mode
SNL (SCWL)	Reverse software limit. SNL is activated when the servo drive has detected that reverse software limit is reached.	Level Triggered	All

Setting value: 0x14

DO Name	DO Function Description	Trigger Method	Control Mode
SPL (SCCWL)	Forward software limit. SPL is activated when the servo drive has detected that forward software limit is reached.	Level Triggered	All

Setting value: 0x19

DO Name	DO Function Description	Trigger Method	Control Mode
SP_OK	Speed reached output. SP_OK will be activated when the speed error is equal and below the setting value of P1-47.	Level Triggered	S, Sz

NOTE

1) When P2-18 to P2-22 and P2-37 is set to 0, it indicates output function is disabled.

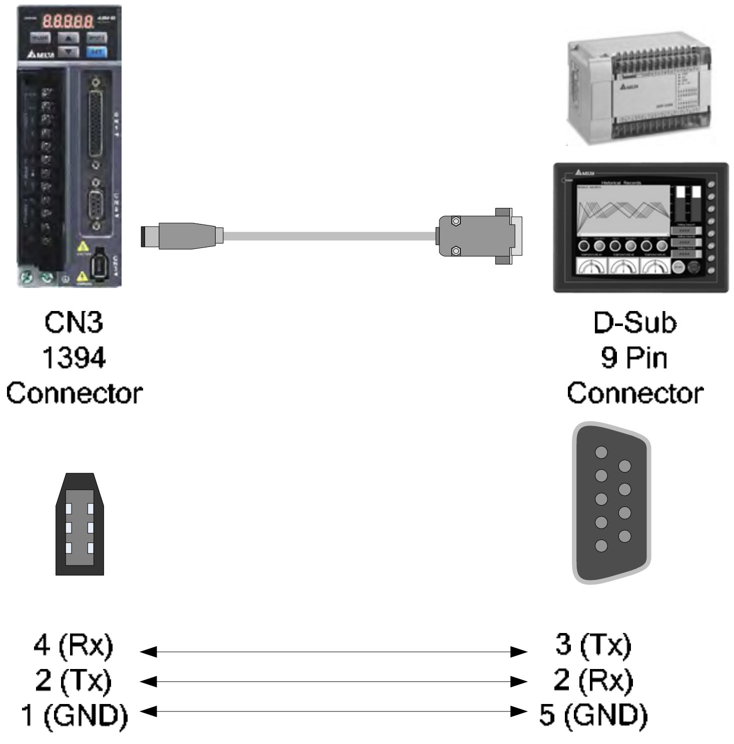
Chapter 8 MODBUS Communications

8.1 Communication Hardware Interface

The ASDA-B2 series servo drive has three modes of communication: RS-232 and RS-485. All aspects of control, operation and monitoring as well as programming of the controller can be achieved via communication. The two communication modes can be used at a time. Please refer to the following sections for connections and limitations.

RS-232

- **Connection**



NOTE

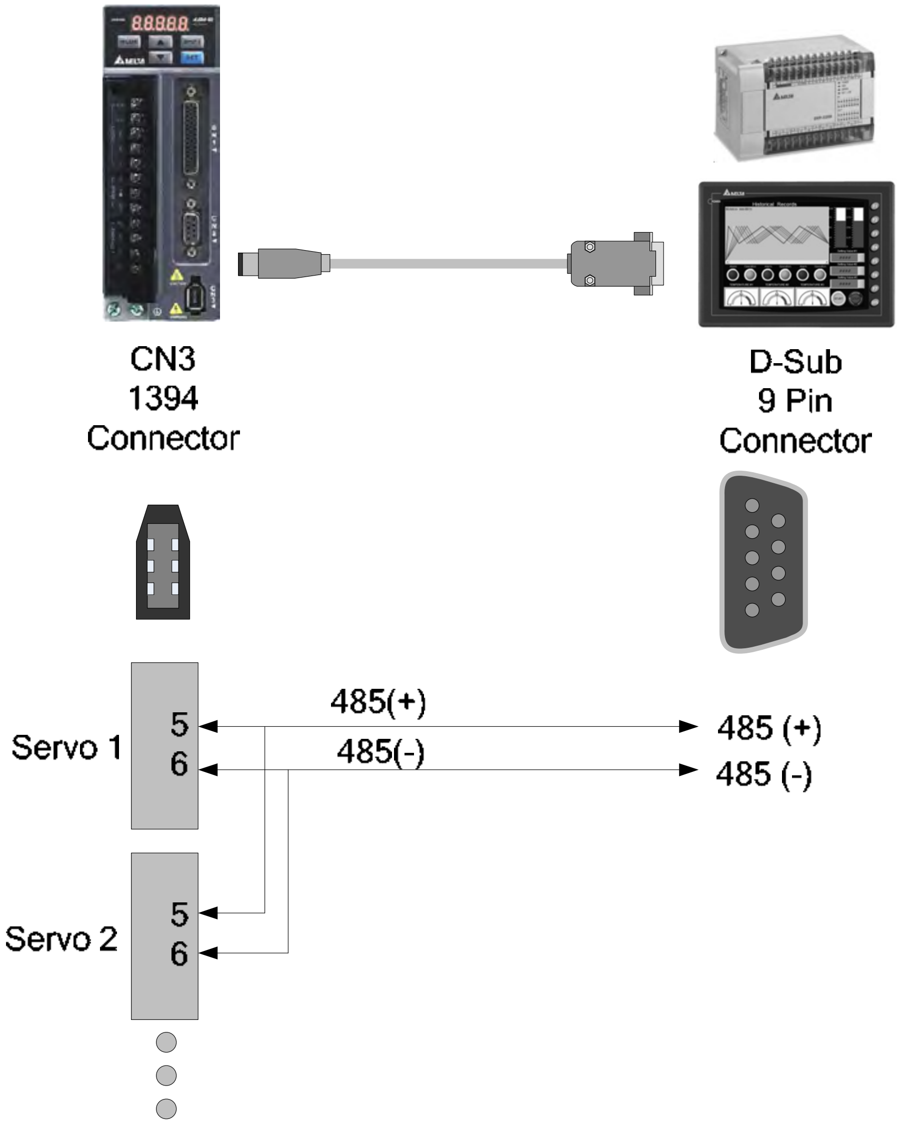
1) Recommended maximum cable length is 15m (50ft.). Please note, RFI / EME noise should be kept to a minimum, communication cable should kept apart from high voltage wires. If a

transmission speed of 38400 bps or greater is required, the maximum length of the communication cable is 3m (9.84ft.) which will ensure the correct and desired baud rate.

2) The number shown in the pervious figure indicates the terminal number of each connector.

RS-485

■ Connection



NOTE

1) The maximum cable length is 100m (39.37inches) when the servo drive is installed in a location where there are only a few interferences. Please note, RFI / EME noise should be kept to a minimum, communication cable should kept apart from high voltage wires. If a transmission speed of 38400bps or greater is required, the maximum length of the communication cable is 15m (50ft.) which will ensure the correct and desired baud rate.

2) The number shown in the pervious figure indicates the terminal number of each connector.

3) The power supply should provide a +12V and higher DC voltage.

4) Please use a REPEATER if more than 32 synchronous axes are required.

5) For the terminal identification of CN3, please refer to Section 3.5.

8.2 Communication Parameter Settings

The following describes the communication addresses for the communication parameters.

Parameters P3-00, P3-01, P3-02 and P3-05 are required to be set for any communication between the servo drives and motors. The other optional parameters such as P3-03, P3-04, P3-06, P3-07 and P3-08 are used depending on different customer demands and applications.

For optional communication parameters, please refer to the Chapter 7.

P3-00●	**ADR**	**Communication Address Setting**		**Address: 0300H 0301H**
	Operation Interface:	Keypad / Software	Communication	Related Section: Section 8.2
	Default:	0x7F		
	Control Mode:	ALL		
	Unit:	N/A		
	Range:	0x01 ~ 0x7F		
	Data Size:	16-bit		
	Display Format:	Hexadecimal		

Settings: This parameter is used to set the communication slave address in hexadecimal format.

Display	0	0	Y	X
Range	-	-	0 ~ 7	0 ~ F

X: Axis number which indicates the value must be within the range from 0 through F.

Y: Group number which indicates the value must be within the range from 0 to through 7

When using RS-232/485 communication, this parameter is used set the communication address in hexadecimal format. If the AC servo drive is controlled by RS-232/485 communication, each drive (or device) must be uniquely identified. One servo drive only can set one address. If the address is duplicated, there will be a communication fault. This address is an absolute address which represents the servo drive on a RS-232/485 network.

Please note:

1. When the address of host (external) controller is set to 0xFF, it is with auto-respond function. Then, the servo drive will receive from and respond to host (external) controller both no matter the address is matching or not. However, the parameter P3-00 cannot be set to 0xFF.

P3-01	**BRT**	**Transmission Speed**	**Address: 0302H 0303H**

Operation Interface:	Keypad / Software	Communication	Related Section: Section 8.2
Default:	0x0033		
Control Mode:	ALL		
Unit:	bps		
Range:	0x0000 ~ 0x0055		
Data Size:	16-bit		
Display Format:	Hexadecimal		

Settings: This parameter is used to set the baud rate and data transmission speed of the communications.

	0	Z	Y	X
COM Port	-	-	RS-485	RS-232
Range	0	0	0 ~ 5	0 ~ 5

Settings:

0: Baud rate 4800 (data transmission speed: bits / second)
1: Baud rate 9600 (data transmission speed: bits / second)
2: Baud rate 19200 (data transmission speed: bits / second)
3: Baud rate 38400 (data transmission speed: bits / second)
4: Baud rate 57600 (data transmission speed: bits / second)
5: Baud rate 115200 (data transmission speed: bits / second)

P3-02	**PTL**	**Communication Protocol**	**Address: 0304H 0305H**

Operation Interface:	Keypad / Software	Communication	Related Section: Section 8.2
Default:	0x0066		
Control Mode:	ALL		
Unit:	N/A		
Range:	0x0000 ~ 0x0088		
Data Size:	16-bit		
Display Format:	Hexadecimal		

Settings: This parameter is used to set the communication protocol. The alphanumeric characters represent the following: 7 or 8 is the number of data bits; N, E or O refers to the parity bit, Non, Even or Odd; the 1 or 2 is the numbers of stop bits.

	0	Z	Y	X
COM Port	-	-	RS-485	RS-232
Range	0	0	0 ~ 8	0 ~ 8

0: Modbus ASCII mode, <7,N,2>

1: Modbus ASCII mode, <7,E,1>

2: Modbus ASCII mode, <7,O,1>

3: Modbus ASCII mode, <8,N,2>

4: Modbus ASCII mode, <8,E,1>

5: Modbus ASCII mode, <8,O,1>

6: Modbus RTU mode, <8,N,2>

7: Modbus RTU mode, <8,E,1>

8: Modbus RTU mode, <8,O,1>

P3-05	**CMM**	**Communication Selection**	**Address: 030AH** **030BH**
	Operation Interface:	Keypad / Software	Communication	Related Section: Section 8.2
	Default:	1		
	Control Mode:	ALL		
	Unit:	N/A		
	Range:	0x00 ~ 0x01		
	Data Size:	16-bit		
	Display Format:	Hexadecimal		

Settings: RS-232 Communication interface selection

0: RS-232 via Modbus communication

1: RS-232 upon ASDA-Soft software

8.3 MODBUS Communication Protocol

When using RS-232/485 serial communication interface, each ASDA-B2 series AC servo drive has a pre-assigned communication address specified by parameter “P3-00”. The computer then controls each AC servo drive according to its communication address. ASDA-B2 series AC servo drive can be set up to communicate on a MODBUS networks using on of the following modes: ASCII (American Standard Code for Information Interchange) or RTU (Remote Terminal Unit). Users can select the desired mode along with the serial port communication protocol in parameter “P3-02”.

■ Code Description:

ASCII Mode:

Each 8-bit data is the combination of two ASCII characters. For example, a 1-byte data: 64 Hex, shown as ‘64’ in ASCII, consists of ‘6’ (36Hex) and ‘4’ (34Hex).

The following table shows the available hexadecimal characters and their corresponding ASCII codes.

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

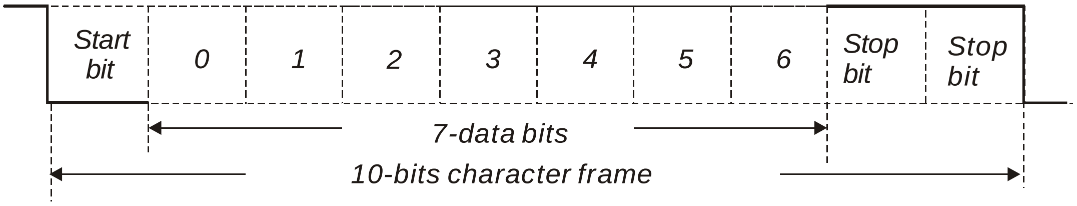
RTU Mode:

Each 8-bit data is the combination of two 4-bit hexadecimal characters. For example, a 1-byte data: 64 Hex.

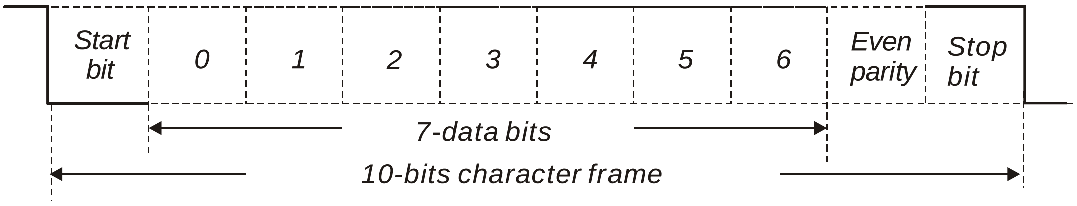
■ Data Format:

10-bit character frame (For 7-bit character)

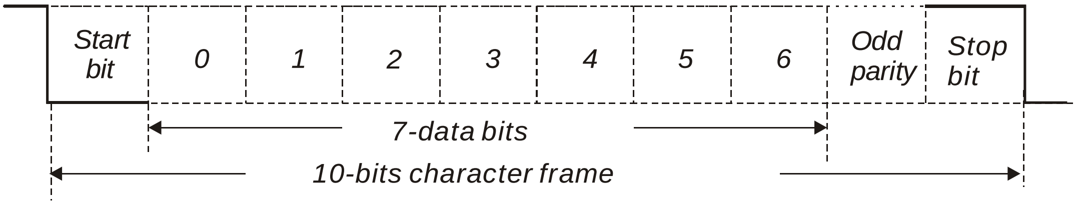
7N2



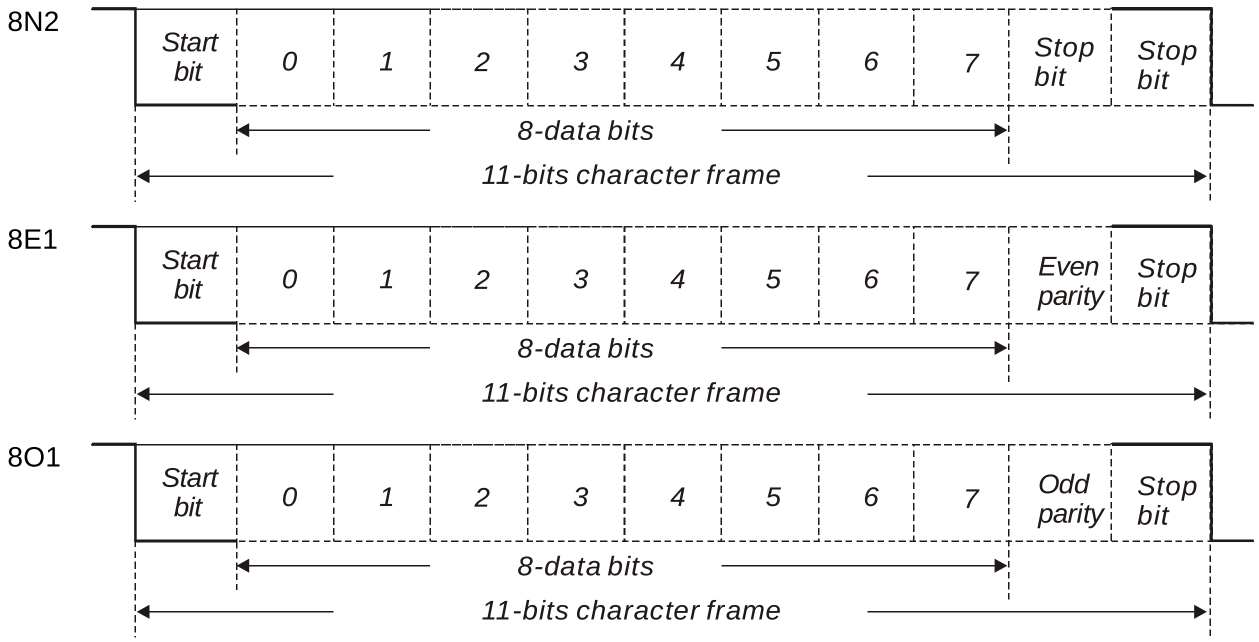
7E1



7O1



11-bit character frame (For 8-bit character)



■ Communication Protocol:

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)	Contents of data: n word = n x 2-byte consists of n x 4 ASCII codes, n≤10
…….	
DATA(0)	
LRC	LRC check sum: 1-byte consists of 2 ASCII codes
End 1	End code 1: (0DH)(CR)
End 0	End code 0: (0AH)(LF)

ASCII Mode: ’:’ character

ADR (Communication Address) consists of 2 ASCII codes and it ends in CR (Carriage Return) and LF (Line Feed)

CR (Carriage Return) is represented by ASCII number 13, and LF (Line Feed) is represented by ASCII number 10.

There are communication address, function code, contents of data, LRC (Longitudinal Redundancy Check) between start and end characters.

RTU Mode:

Start	A silent interval of more than 10ms
Slave address	Communication address: 1-byte
Function	Function code: 1-byte
DATA(n-1)	Contents of data: n word = n x 2-byte, n≤10
…….	
DATA(0)	
CRC	CRC check sum: 1-byte
End 1	A silent interval of more than 10ms

RTU Mode: A silent interval of more than 10ms

RTU (Remote Terminal Unit) starts from a silent signal and ends at another silent signal.

There are communication address, function code, contents of data, CRC (Cyclical Redundancy Check) between start and end characters.

DATA (Data Characters)

The format of data characters depends on the function code. The available command codes and examples for AC servo drive are described as follows:

Example 1

Function code: 03H, read N words (multiple words). The maximum value of N is 10.

For example, reading continuous 2 words from starting address 0200H of AC servo drive with address 01H.

ASCII Mode:

Command message:

Start	‘:’
Slave address	‘0’
	‘1’
Function	‘0’
	‘3’
Starting data address	‘0’
	‘2’
	‘0’
	‘0’
Number of data	‘0’
	‘0’
	‘0’
	‘2’
LRC Check	‘F’
	‘8’
End 1	(0DH)(CR)
End 0	(0AH)(LF)

Response message:

Start	‘:’
Slave address	‘0’
	‘1’
Function	‘0’
	‘3’
Number of data (In Byte)	‘0’
	‘4’
Contents of starting data address 0200H	‘0’
	‘0’
	‘B’
	‘1’
Contents of second data address 0201H	‘1’
	‘F’
	‘4’
	‘0’
LRC Check	‘E’
	‘8’
End 1	(0DH)(CR)
End 0	(0AH)(LF)

RTU Mode:

Command message:

Slave address	01H
Function	03H
Starting data address	02H (Upper bytes)
	00H (Lower bytes)
Number of data (In Word)	00H
	02H
CRC Check Low	C5H (Lower bytes)
CRC Check High	B3H (Upper bytes)

Response message:

Slave address	01H
Function	03H
Number of data (In Byte)	04H
Contents of starting data address 0200H	00H (Upper bytes)
	B1H (Lower bytes)
Contents of second data address 0201H	1FH (Upper bytes)
	40H (Lower bytes)
CRC Check Low	A3H (Lower bytes)
CRC Check High	D4H (Upper bytes)

Please note that a silent interval of more than 10ms is required before and after data transmission in RTU mode.

Example 2

Function code: 06H, write 1 word

For example, writing 100 (0064H) to starting data address 0200H of ASDA-B2 series with address 01H.

ASCII Mode:

Command message:

Start	‘:’
Slave address	‘0’
	‘1’
Function	‘0’
	‘6’
Starting data address	‘0’
	‘2’
	‘0’
	‘0’
Content of data	‘0’
	‘0’
	‘6’
	‘4’
LRC Check	‘9’
	‘3’
End 1	(0DH)(CR)
End 0	(0AH)(LF)

Response message:

Start	‘:’
Slave address	‘0’
	‘1’
Function	‘0’
	‘6’
Starting data address	‘0’
	‘2’
	‘0’
	‘0’
Content of data	‘0’
	‘0’
	‘6’
	‘4’
LRC Check	‘9’
	‘3’
End 1	(0DH)(CR)
End 0	(0AH)(LF)

RTU Mode:

Command message:

Slave Address	01H
Function	06H
Starting data address	02H (Upper bytes)
	00H (Lower bytes)
Content of data	00H (Upper bytes)
	64H (Lower bytes)
CRC Check Low	89H (Lower bytes)
CRC Check High	99H (Upper bytes)

Response message:

Slave Address	01H
Function	06H
Starting data address	02H (Upper bytes)
	00H (Lower bytes)
Content of data	00H (Upper bytes)
	64H (Lower bytes)
CRC Check Low	89H (Lower bytes)
CRC Check High	99H (Upper bytes)

Please note that a silent interval of more than 10ms is required before and after data transmission in RTU mode.

Example 3

Function code: 10H, write N words (multiple words). The maximum value of N is 10.

For example, writing continuous 2 words, 0BB8H and 0000H from starting address 0112H and address 0113H.

ASCII Mode:

Command message:

Start	‘:’
Slave Address	‘0’
	‘1’
Function	‘1’
	‘0’
Starting data address	‘0’
	‘1’
	‘1’
	‘2’
Number of data (In Word)	‘0’
	‘0’
	‘0’
	‘2’
Number of data (In Byte)	‘0’
	‘4’
Content of 1st data	‘0’
	‘B’
	‘B’
	‘8’
Content of 2nd data	‘0’
	‘0’
	‘0’
	‘0’

Response message:

Start	‘:’
Slave Address	‘0’
	‘1’
Function	‘1’
	‘0’
Starting data address	‘0’
	‘1’
	‘1’
	‘2’
Content of data	‘0’
	‘0’
	‘0’
	‘2’
LRC Check	‘D’
	‘A’
End 1	(0DH)(CR)
End 0	(0AH)(LF)

LRC Check	‘1’
	‘3’
End 1	(0DH)(CR)
End 0	(0AH)(LF)

RTU Mode:

Command message:

Slave Address	01H
Function	10H
Starting data address	01H (Upper bytes)
	12H (Lower bytes)
Number of data (In Word)	00H (Upper bytes)
	02H (Lower bytes)
Number of data (In Byte)	04H
Content of 1st data	0BH (Upper bytes)
	B8H (Lower bytes)
Content of 2nd data	00H (Upper bytes)
	00H (Lower bytes)
CRC Check Low	FCH (Lower bytes)
CRC Check High	EBH (Upper bytes)

Response message:

Slave Address	01H
Function	10H
Starting data address	01H (Upper bytes)
	12H (Lower bytes)
Content of data (In Word)	00H (Upper bytes)
	02H (Lower bytes)
CRC Check Low	E0H (Lower bytes)
CRC Check High	31H (Upper bytes)

Please note that a silent interval of more than 10ms is required before and after data transmission in RTU mode.

LRC (ASCII Mode):

LRC (Longitudinal Redundancy Check) is calculated by summing up, module 256, the values of the bytes from ADR to last data character then calculating the hexadecimal representation of the 2’s-complement negation of the sum.

Example

STX	‘:’
ADR	‘7’
	‘F’
CMD	‘0’
	‘3’
Starting data address	‘0’
	‘5’
	‘C’
	‘4’
Number of data	‘0’
	‘0’
	‘0’
	‘1’
LRC Check	‘B’
	‘4’

End 1	(0DH)(CR)
End 0	(0AH)(LF)

7FH + 03H + 05H + C4H + 00H + 01H = 14CH, the 2’s complement negation of 4CH is B4H.

Hence, we can know that LRC CHK is ’B’,’4’.

CRC (RTU Mode):

CRC (Cyclical Redundancy Check) is calculated by the following steps:

Step 1: Load a 16-bit register (called CRC register) with FFFFH.

Step 2: Exclusive OR the first 8-bit byte of the command message with the low order byte of the 16-bit CRC register, putting the result in the CRC register.

Step 3: Extract and examine the LSB. If the LSB of CRC register is 0, shift the CRC register one bit to the right. If the LSB of CRC register is 1, shift the CRC register one bit to the right, then Exclusive OR the CRC register with the polynomial value A001H.

Step 4: Repeat step 3 until eight shifts have been performed. When this is done, a complete 8-bit byte will have been processed, then perform step 5.

Step 5: Repeat step 2 to step 4 for the next 8-bit byte of the command message.

Continue doing this until all bytes have been processed. The final contents of the CRC register are the CRC value.

NOTE

1) When transmitting the CRC value in the message, the upper and lower bytes of the CRC value must be swapped, i.e. the lower order byte will be transmitted first.

2) For example, reading 2 words from address 0101H of the AC servo drive with address 01H. The final content of the CRC register from ADR to last data character is 3794H, then the command message is shown as follows. What should be noticed is that 94H have to be transmitted before 37H.

Command Message	
ADR	01H
CMD	03H
Starting data address	01H (Upper byte)
	01H (Lower bytes)
Number of data (In Word)	00H (Upper bytes)
	02H (Lower bytes)
CRC Check Low	94H (Lower bytes)
CRC Check High	37H (Upper bytes)

End1, End0 (Communication End)

ASCII Mode:

In ASCII mode, (0DH) stands for character ’\r’ (carriage return) and (0AH) stands for character ’\n’ (new line), they indicate communication end.

RTU Mode:

In RTU mode, a silent interval of more than 10ms indicates communication end.

CRC Program Example

The following is an example of CRC generation using C language. The function takes two arguments:

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;
}
```

PC communication program example:

```
#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’,’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);
outportb(PORT+BRDH,0x00);
outportb(PORT+LCR,0x06);         /* set prorocol
                                      <7,E,1> = 1AH,          <7,O,1> = 0AH
                                      <8,N,2> = 07H           <8,E,1> = 1BH
                                      <8,O,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  */
    }
}
}
```

8.4 Communication Parameter Write-in and Read-out

There are following five groups for parameters:

Group 0: Monitor parameter (example: P0-xx)
Group 1: Basic parameter (example: P1-xx)
Group 2: Extension parameter (example: P2-xx)
Group 3: Communication parameter (example: P3-xx)
Group 4: Diagnosis parameter (example: P4-xx)

For a complete listing and description of all parameters, refer to Chapter 7.

Communication write-in parameters for ASDA-B2 series are including:

Group 0: All parameters except P0-00 ~ P0-01, P0-08 ~ P0-13 and P0-46
Group 1: P1-00 ~ P1-76
Group 2: P2-00 ~ P2-67
Group 3: P3-00 ~ P3-11
Group 4: All parameters except P4-00 ~ P4-04 and P4-08 ~ P4-09

NOTE

1) P3-01 After the new transmission speed is set, the next data will be written in new transmission speed.

2) P3-02 After the new communication protocol is set, the next data will be written in new communication protocol.

3) P4-05 JOG control of servo motor. For the description, refer to Chapter 7.

4) P4-06 Force output contact control. This parameter is for the users to test if DO (Digit output) is normal. User can set 1, 2, 4, 8, 16, 32 to test DO1, DO2, DO3, DO4, DO5, DO6 respectively. After the test has been completed, please set this parameter to 0 to inform the drive that the test has been completed.

5) P4-10 Adjustment function selection. If the user desires to change the settings of this parameter, the user has to set the value of the parameter P2-08 to 20 (hexadecimal: 14H) first and then restart. After restarting, the settings of parameter P4-10 can become modified.

6) P4-11 ~ P4-21 These parameters are for offset adjustment. Do not change the factory default setting if not necessary. If the user desires to change the settings of these parameters, the user has to set the value of the parameter P2-08 to 22 (hexadecimal: 16H) first and then restart. After restarting, the settings of parameters P4-11 to P4-21 can become modified.

Communication read-out parameters for ASDA-B2 series are including:

Group 0: P0-00 ~ P0-46

Group 1: P1-00 ~ P1-76

Group 2: P2-00 ~ P2-67

Group 3: P3-00 ~ P3-11

Group 4: P4-00 ~ P4-24

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Chapter 9 Troubleshooting

If a fault is detected on the servo drive or motor a corresponding fault code will be shown on the drive's LED display. Fault codes can also be transmitted via communication, see P0-01 and P4-00 ~ P4-04 for display on controller or HMI.

9.1 Fault Messages Table

Servo Drive Fault Messages

Fault Messages		
Display	**Fault Name**	**Fault Description**
AL001	Overcurrent	Main circuit current is higher than 1.5 multiple of motor's instantaneous maximum current value.
AL002	Overvoltage	Main circuit voltage has exceeded its maximum allowable value.
AL003	Undervoltage	Main circuit voltage is below its minimum specified value.
AL004	Motor error	The motor does not match the drive. They are not correctly matched for size (power rating).
AL005	Regeneration error	Regeneration control operation is in error.
AL006	Overload	Servo motor and drive is overload.
AL007	Overspeed	Motor's control speed exceeds the limit of normal speed.
AL008	Abnormal pulse control command	Input frequency of pulse command exceeds the limit of its allowable setting value.
AL009	Excessive deviation	Position control deviation value exceeds the limit of its allowable setting value.
AL010	Reserved	Reserve
AL011	Encoder error	Pulse signal is in error.
AL012	Adjustment error	Adjusted value exceeds the limit of its allowable setting value when perform electrical adjustment.
AL013	Emergency stop activated	Emergency stop switch is activated.
AL014	Reverse limit switch error	Reverse limit switch is activated.
AL015	Forward limit switch error	Forward limit switch is activated.
AL016	IGBT temperature error	The temperature of IGBT is over high.
AL017	Memory error	EE-PROM write-in and read-out is in error.

Fault Messages		
Display	**Fault Name**	**Fault Description**
AL018	Encoder output error	The encoder output exceeds the rated output frequency.
AL019	Serial communication error	RS232/485 communication is in error.
AL020	Serial communication time out	RS232/485 communication time out.
AL021	Reserved	Reserve
AL022	Input power phase loss	One phase of the input power is loss.
AL023	Pre-overload warning	To warn that the servo motor and drive is going to overload. This alarm will display before ALM06. When the servo motor reach the setting value of P1-56, the motor will send a warning to the drive. After the drive has detected the warning, the DO signal OLW will be activated and this fault message will display.
AL024	Encoder initial magnetic field error	The magnetic field of the encoder U, V, W signal is in error.
AL025	Encoder internal error	The internal memory of the encoder is in error. An internal counter error is detected.
AL026	Encoder data error	An encoder data error is detected for three times.
AL027	Motor internal error	The setting value of the encoder is in error.
AL028	Motor internal error	The encoder U, V, W signals are in error.
AL029	Motor internal error	The internal address of the encoder is in error.
AL030	Motor protection error	In order to protect the motor, this alarm will be activated when the setting value of P1-57 is reached after a period of time set by P1-58.
AL031	U,V,W, GND wiring error	The wiring connections of U, V, W (for servo motor output) and GND (for grounding) are in error.
AL035	Motor temperature error	Motor is working under temperature over 105°C (221°F).
AL048	Excessive encoder output error	The encoder output errors or output pulses exceed hardware tolerance.
AL067	Motor temperature warning	The temperature of motor is over 85°C (185°F).
AL099	DSP firmware upgrade	EE-PROM is not reset after the firmware version is upgraded. This fault can be cleared after setting P2-08 to 30 first, and then setting P2-08 to 28 next and restarting the ervo drive.

NOTE

1) If there is any unknown fault code that is not listed on the above table, please inform the distributor or contact with Delta for assistance.

9.2 Potential Cause and Corrective Actions

Servo Drive Fault Messages

AL001 : Overcurrent

Potential Cause	Checking Method	Corrective Actions
Short-circuit at drive output (U, V, W)	1. Check the wiring connections between drive and motor. 2. Check if the wire is short-circuited.	Repair the short-circuited and avoid metal conductor being exposed.
Motor wiring error	Check if the wiring steps are all correct when connecting motor to drive.	Follow the wiring steps in the user manual to reconnect wiring.
IGBT error	Heat sink overheated	Please contact your distributor for assistance or contact with Delta.
Control parameter setting error	Check if the setting value exceeds the factory default setting.	Set the setting back to factory default setting and then reset and adjust the parameter setting again.
Control command setting error	Check if the control input command is unstable (too much fluctuation).	1. Ensure that input command frequency is stable (too much fluctuation). 2. Activate filter function.

AL002 : Overvoltage

Potential Cause	Checking Method	Corrective Actions
The main circuit voltage has exceeded its maximum allowable value.	Use voltmeter to check whether the input voltage falls within the rated input voltage.	Use correct power supply or stabilizing power.
Input power error (Incorrect power input)	Use voltmeter to check whether the input voltage is within the specified limit.	Use correct power supply or stabilizing power.

AL003 : Undervoltage

Potential Cause	Checking Method	Corrective Actions
The main circuit voltage is below its minimum specified value.	Check whether the wiring of main circuit input voltage is normal.	Reconfirm voltage wiring.
No input voltage at main circuit.	Use voltmeter to check whether input voltage at main circuit is normal.	Reconfirm power switch.
Input power error (Incorrect power input)	Use voltmeter to check whether the input voltage is within the specified limit.	Use correct power supply or serial stabilizing power.

AL004 : Motor error

Potential Cause	Checking Method	Corrective Actions
Encoder is damage.	Check Encoder for the damage.	Repair or replace the motor.
Encoder is loose.	Examine the Encoder connector.	Install the motor again.
The type of the servo motor is incorrect.	Check if the servo drive and servo motor are not correctly matched for size (power rating).	Replace the motor.

AL005 : Regeneration error

Potential Cause	Checking Method	Corrective Actions
Regenerative resistor is not connected.	Check the wiring connection of regenerative resistor.	Reconnect regenerative resistor.
Regenerative switch transistor fault	Check if regenerative switch transistor is short-circuited.	Please contact your distributor for assistance or contact with Delta.
Parameter setting is in error	Confirm the parameter setting and specifications of regenerative resistor.	Correctly reset parameter again.

AL006 : Overload

Potential Cause	Checking Method	Corrective Actions
The drive has exceeded its rated load during continuous operation.	Check if the drive is overloaded.	Increase motor capacity or reduce load.
Control system parameter setting is incorrect.	Check if there is mechanical vibration	Adjust gain value of control circuit.
	Accel/Decel time setting is too fast.	Decrease Accel/Decel time setting.
The wiring of drive and encoder is in error.	Check the wiring of U, V, W and encoder.	Ensure all wiring is correct.

AL007 : Overspeed

Potential Cause	Checking Method	Corrective Actions
Speed input command is not stable (too much fluctuation).	Use signal detector to detect if input signal is abnormal.	Ensure that input command frequency is stable (not fluctuate too much) and activate filter function (P1-06, P1-07 and P1-08).
Over-speed parameter setting is defective.	Check if over-speed parameter setting value is too low.	Correctly set over-speed parameter setting (P2-34).

AL008 : Abnormal pulse control command

Potential Cause	Checking Method	Corrective Actions
Pulse command frequency is higher than rated input frequency.	Use pulse frequency detector to measure input frequency.	Correctly set the input pulse frequency.

AL009 : Excessive deviation

Potential Cause	Checking Method	Corrective Actions
Maximum deviation parameter setting is too small.	Check the maximum deviation parameter setting and observe the position error value when the motor is running.	Increases the parameter setting value of P2-35.
Gain value is too small.	Check for proper gain value.	Correctly adjust gain value.
Torque limit is too low.	Check torque limit value.	Correctly adjust torque limit value.
There is an overload.	Check for overload condition.	Reduce external applied load or re-estimate the motor capacity.

AL010: Reserved

AL011 : Encoder error (Position detector fault)

Potential Cause	Checking Method	Corrective Actions
The wiring of encoder is in error.	1. Check if all wiring is correct. 2. Check if the users conduct the wiring by the wiring information in the user manual.	Ensure all wiring is correct.
Encoder is loose	Examine the encoder connector.	Install the motor again.
The wiring of encoder is defective.	Check if all connections are tight.	Conduct the wiring again.
Encoder is damage	Check the encoder for the damage.	Repair or replace the motor.

AL012 : Adjustment error

Potential Cause	Checking Method	Corrective Actions
The setting value of drift adjustment has exceeded its maximum allowable value.	1. Remove CN1 wiring. 2. Execute the drift adjustment again. (Set P2-08 to 20 first, and then set P4-10 to 5.)	If the error does not clear after executing the drift adjustment again, please contact your distributor for assistance or contact with Delta.

AL013 : Emergency stop activated

Potential Cause	Checking Method	Corrective Actions
Emergency stop switch is activated.	Check if emergency stop switch is On or Off.	Activate emergency stop switch.

AL014 : Reverse (CWL) limit switch error

Potential Cause	Checking Method	Corrective Actions
Reverse limit switch is activated.	Check if reverse limit switch is On or Off.	Activate reverse limit switch.
Servo system is not stable.	Check the value of control parameter setting and load inertia.	Modify parameter setting and re-estimate motor capacity.

AL015 : Forward (CCWL) limit switch error

Potential Cause	Checking Method	Corrective Actions
Forward limit switch is activated.	Check if forward limit switch is On or Off.	Activate forward limit switch.
Servo system is not stable.	Check the value of control parameter setting and load inertia.	Modify parameter setting and re-estimate motor capacity.

AL016 : IGBT temperature error

Potential Cause	Checking Method	Corrective Actions
The drive has exceeded its rated load during continuous operation.	Check if there is overload or the motor current is too high.	Increase motor capacity or reduce load.
Short-circuit at drive output.	Check the drive input wiring.	Ensure all wiring is correct.

AL017: Memory error

Potential Cause	Checking Method	Corrective Actions
Parameter data error when writing into EE-PROM.	Examine the parameter settings. Please do the following steps: 1. Press SHIFT key on the drive keypad, and examine the parameter shown on LED display. 2. If E320A is displayed (in hexadecimal format), it indicates it is parameter P2-10. Please examine the parameter settings of P2-10. 3. If E3610 is displayed (in hexadecimal format), it indicates it is parameter P6-16. Please examine the parameter settings of P6-16.	1. If this fault occurs when power is applied to the drive, it indicates that the setting value of one parameter has exceeded the specified range. Correct the setting value of the parameter to clear the fault and restart the servo drive. 2. If this fault occurs during normal operation, it indicates that the error occurs when writing data into EE-PROM. Turn ARST (DI signal) ON to clear the fault or restart the servo drive.
The setting value of hidden parameter is in error.	Press SHIFT key on the drive keypad and examine if E100X is displayed on LED display.	If this fault occurs when resetting the parameter settings, it indicates that the servo drive type is not set correctly. Correctly set the servo drive type again.

Potential Cause	Checking Method	Corrective Actions
Data in EE-PROM is damaged.	Press SHIFT key on the drive keypad and examine if E0001 is displayed on LED display.	If this fault occurs when power is applied to the drive, it indicates that the data in EE-RPM is damaged or there is no data in EE-PROM. Please contact your distributor for assistance or contact with Delta.

AL018 : Encoder output error

Potential Cause	Checking Method	Corrective Actions
Encoder itself or the wiring of encoder is in error.	Check if the recent fault records (P4-00 ~ P4-05) display on the drive keypad in accordance with the fault codes AL011, AL024, AL025 and AL026.	Perform the corrective actions as described in AL011, AL024, AL025 and AL026.
The output frequency for pulse output may exceed the limit of its allowable setting value.	Check if the following conditions occur: Condition 1: Motor speed is above the value set by P1-76. Condition 2: $\frac{\text{Motor Speed}}{60} \times P1-46 \times 4 > 19.8 \times 10^6$	Correctly set P1-76 and P1-46. 1. Ensure that the motor speed is below the value set by P1-76. 2. $\frac{\text{Motor Speed}}{60} \times P1-46 \times 4 < 19.8 \times 10^6$

AL019 : Serial communication error

Potential Cause	Checking Method	Corrective Actions
Communication parameter setting is defective.	Check the communication parameter setting.	Correctly set parameter setting.
Communication address is incorrect.	Check the communication address.	Correctly set communication address.
Communication value is incorrect.	Check the communication value.	Correctly set communication value.

AL020 : Serial communication time out

Potential Cause	Checking Method	Corrective Actions
Setting value in time out parameter is not correct.	Check communication time out parameter setting.	Correctly set P3-07.
Not receiving communication command for a long time.	Check whether communication cable is loose or broken.	Tighten the communication cable, make sure the communication cable is not damaged and ensure all wiring is correct.

AL021 : Reserved

AL022 : Input power phase loss

Potential Cause	Checking Method	Corrective Actions
Control power supply is in error.	Check the power cable and connections of R, S, and T. Check whether the power cable is loose or the possible loss of phase on input power.	If the fault does not clear even when the three-phase power is connected correctly, please contact your distributor for assistance or contact with Delta.

AL023 : Pre-overload warning

Potential Cause	Checking Method	Corrective Actions
The drive is going to overload.	1. Check the load condition of the servo motor and drive. 2. Check the setting value of P1-56. Check whether the setting value of P1-56 is too small.	1. Please refer to the correction actions of ALE06. 2. Increase the setting value of P1-56 or set P1-56 to 100 and above.

AL024: Encoder initial magnetic field error

Potential Cause	Checking Method	Corrective Actions
The magnetic field of the encoder U, V, W signal is in error.	1. Check if the servo motor is properly grounded. 2. Check if the encoder signal cables are placed in separate conduits from the cables connected to R, S, T and U, V, W terminals to prevent the interference. 3. Check if the shielded cables are used when performing encoder wiring.	If the error does not clear after each checking is done, please contact your distributor for assistance or contact with Delta.

AL025: Encoder internal error

Potential Cause	Checking Method	Corrective Actions
The internal memory of the encoder is in error. An encoder counter error occurs.	1. Check if the servo motor is properly grounded. 2. Check if the encoder signal cables are placed in separate conduits from the cables connected to R, S, T and U, V, W terminals to prevent the interference. 3. Check if the shielded cables are used when performing encoder wiring.	1. Please connect the grounding (green color) of U, V, W terminal to the heat sink of the servo drive. 2. Ensure that the encoder signal cables are placed in separate conduits from the cables connected to R, S, T and U, V, W terminals to prevent the interference. 3. Please use shielded cables for Encoder wiring. 4. If the error does not clear after all the above actions are done, please contact your distributor for assistance or contact with Delta.

AL026: Encoder data error

Potential Cause	Checking Method	Corrective Actions
An encoder data error occurs for three times.	1. Check if the servo motor is properly grounded. 2. Check if the encoder signal cables are placed in separate conduits from the cables connected to R, S, T and U, V, W terminals to prevent the interference. 3. Check if the shielded cables are used when performing encoder wiring.	1. Please connect the grounding (green color) of U, V, W terminal to the heat sink of the servo drive. 2. Ensure that the encoder signal cables are placed in separate conduits from the cables connected to R, S, T and U, V, W terminals to prevent the interference. 3. Please use shielded cables for Encoder wiring. 4. If the error does not clear after all the above actions are done, please contact your distributor for assistance or contact with Delta.

AL027 : Motor internal error

Potential Cause	Checking Method	Corrective Actions
The setting value of the encoder is in error.	1. Check if the servo motor is properly grounded. 2. Check if the encoder signal cables are placed in separate conduits from the cables connected to R, S, T and U, V, W terminals to prevent the interference. 3. Check if the shielded cables are used when performing encoder wiring.	1. Please connect the grounding (green color) of U, V, W terminal to the heat sink of the servo drive. 2. Ensure that the encoder signal cables are placed in separate conduits from the cables connected to R, S, T and U, V, W terminals to prevent the interference. 3. Please use shielded cables for Encoder wiring. 4. If the error does not clear after all the above actions are done, please contact your distributor for assistance or contact with Delta.

AL028 : Motor internal error

Potential Cause	Checking Method	Corrective Actions
The encoder U, V, W signals are in error.	1. Check if the servo motor is properly grounded. 2. Check if the encoder signal cables are placed in separate conduits from the cables connected to R, S, T and U, V, W terminals to prevent the interference. 3. Check if the shielded cables are used	1. Please connect the grounding (green color) of U, V, W terminal to the heat sink of the servo drive. 2. Ensure that the encoder signal cables are placed in separate conduits from the cables connected to R, S, T and U, V, W terminals to

	when performing encoder wiring.	prevent the interference. 3. Please use shielded cables for Encoder wiring. 4. If the error does not clear after all the above actions are done, please contact your distributor for assistance or contact with Delta.

AL029 : Motor internal error

Potential Cause	Checking Method	Corrective Actions
The internal address of the encoder is in error.	1. Check if the servo motor is properly grounded. 2. Check if the encoder signal cables are placed in separate conduits from the cables connected to R, S, T and U, V, W terminals to prevent the interference. 3. Check if the shielded cables are used when performing encoder wiring.	1. Please connect the grounding (green color) of U, V, W terminal to the heat sink of the servo drive. 2. Ensure that the encoder signal cables are placed in separate conduits from the cables connected to R, S, T and U, V, W terminals to prevent the interference. 3. Please use shielded cables for Encoder wiring. 4. If the error does not clear after all the above actions are done, please contact your distributor for assistance or contact with Delta.

AL030 : Motor protection error

Potential Cause	Checking Method	Corrective Actions
The setting value of parameter P1-57 is reached after a period of time set by parameter P1-58.	1. Check if P1-57 is enabled. 2. Check if the setting values of P1-57 and P1-58 are both too small.	1. Set P1-57 to 0. 2. Correctly set P1-57 and P1-58. Please note that the over-low setting may results in malfunction, but over-high setting may let the motor protection function not operate.

AL031: U, V, W, GND wiring error

Potential Cause	Checking Method	Corrective Actions
The wiring connections of U, V, W (for servo motor output) and GND (for grounding) are in error.	Check if wiring connections of U, V, and W are not correct.	Follow the wiring steps in the user manual to reconnect the wiring and ground the servo drive and motor properly.
The ground connection is loose or not conducting properly.	Check if the ground connection is loose and ensure the ground is conducting properly.	

AL035 : Motor temperature error

Potential Cause	Checking Method	Corrective Actions
Motor is working under temperature over 105°C (221°F).	Check if the environment temperature is too high.	Try to reduce environment temperature.

AL048 : Excessive encoder output error

Potential Cause	Checking Method	Corrective Actions
Encoder error causes abnormal encoder output.	Exam error records (P4-00~P4-05) to check if encoder errors occurred. (AL011, AL024, AL025, AL026)	Please refer to AL011, AL024, AL025, AL026 and take corrective actions.
Output pulses exceed hardware tolerance.	Check if conditions below occur, P1-76 < Motor rotation speed, or, $\frac{\text{Motor rotation speed}}{60} \times P1-46 \times 4 > 19.8 \times 1$	Correctly set P1-76 and P1-46: P1-76 > Motor rotation speed, and, $\frac{\text{Motor rotation speed}}{60} \times P1-46 \times 4 > 19.8 \times 10^6$

AL067: Motor temperature warning

Potential Cause	Checking Method	Corrective Actions
Motor is working under temperature over 85°C (185°F).	Check if the environment temperature is too high.	Try to reduce environment temperature.

AL099: DSP firmware upgrade

Potential Cause	Checking Method	Corrective Actions
EE-PROM is not reset after the firmware version is upgraded.	Check if EE-PROM is reset after the firmware version is upgraded.	Set P2-08 to 30 first, and then 28 next, and restart the servo drive.

9.3 Clearing Faults

Display	Fault Name	Clearing Method
AL001	Overcurrent	Turn ARST (DI signal) ON to clear the fault or restart the servo drive.
AL002	Overvoltage	Turn ARST (DI signal) ON to clear the fault or restart the servo drive.
AL003	Undervoltage	This fault message can be removed automatically after the voltage has returned within its specification.
AL004	Motor error	This fault message can be removed by restarting the servo drive.
AL005	Regeneration error	Turn ARST (DI signal) ON to clear the fault or restart the servo drive.
AL006	Overload	Turn ARST (DI signal) ON to clear the fault or restart the servo drive.
AL007	Overspeed	Turn ARST (DI signal) ON to clear the fault or restart the servo drive.
AL008	Abnormal pulse control command	Turn ARST (DI signal) ON to clear the fault or restart the servo drive.
AL009	Excessive deviation	Turn ARST (DI signal) ON to clear the fault or restart the servo drive.
AL010	Reserved	This fault message cannot be cleared.
AL011	Encoder error	This fault message can be removed by restarting the servo drive.
AL012	Adjustment error	This fault message can be removed after the wiring of CN1 connector (I/O signal connector) is removed and auto adjustment function is executed.
AL013	Emergency stop activated	This fault message can be removed automatically by turning off EMGS (DI signal).
AL014	Reverse limit switch error	Turn ARST (DI signal) ON to clear the fault. This fault message can be removed when the servo drive is Off (Servo Off)
AL015	Forward limit switch error	Turn ARST (DI signal) ON to clear the fault. This fault message can be removed when the servo drive is Off (Servo Off)
AL016	IGBT temperature error	Turn ARST (DI signal) ON to clear the fault or restart the servo drive.
AL017	Memory error	Turn ARST (DI signal) ON to clear the fault or restart the servo drive.
AL018	Encoder output error	Turn ARST (DI signal) ON to clear the fault.

Display	Fault Name	Clearing Method
AL019	Serial communication error	Turn ARST (DI signal) ON to clear the fault. This fault message can also be removed automatically after the communication is normal.
AL020	Serial communication time out	Turn ARST (DI signal) ON to clear the fault or restart the servo drive.
AL021	Reserved	This fault message cannot be cleared.
AL022	Input power phase loss	Turn ARST (DI signal) ON to clear the fault. This fault message can be removed automatically after input power phase lost problem is solved.
AL023	Pre-overload warning	Turn ARST (DI signal) ON to clear the fault or restart the servo drive.
AL024	Encoder initial magnetic field error	This fault message can be removed by restarting the servo drive.
AL025	Encoder internal error	This fault message can be removed by restarting the servo drive.
AL026	Encoder data error	This fault message can be removed by restarting the servo drive.
AL027	Motor internal error	This fault message can be removed by restarting the servo drive.
AL028	Motor internal error	This fault message can be removed by restarting the servo drive.
AL029	Motor internal error	This fault message can be removed by restarting the servo drive.
AL030	Motor protection error	Turn ARST (DI signal) ON to clear the fault.
AL031	U,V,W, GND wiring error	This fault message can be removed by restarting the servo drive.
AL035	Motor temperature error	This fault message can be removed by restarting the servo drive.
AL048	Excessive encoder output error	Turn ARST (DI signal) ON to clear the fault.
AL067	Motor temperature warning	This fault message can be removed after temperature drops to normal degree.
AL099	DSP firmware upgrade	This fault message can be removed after setting P2-08 to 30 first, and then 28 next and restarting the servo drive.

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Chapter 10 Specifications

10.1 Specifications of Servo Drives (ASDA-B2 Series)

Model: ASDA-B2 Series			100W	200W	400W	750W	1kW	1.5kW	2kW	3kW
			01	02	04	07	10	15	20	30
Power Supply	Phase / Voltage		Three-phase: 170 ~ 255VAC, 50／60Hz ±5% Single-phase: 200 ~ 255VAC, 50／60Hz ±5%						Three-phase: 170 ~ 255VAC, 50／60Hz ±5%	
	Continuous Output Current		0.9 Arms	1.55 Arms	2.6 Arms	5.1 Arms	7.3 Arms	8.3 Arms	13.4 Arms	19.4 Arms
Cooling System			Natural Air Circulation				Fan Cooling			
Encoder Resolution / Feedback Resolution			17-bit (160000 p/rev)							
Control of Main Circuit			SVPWM Control							
Tuning Modes			Auto / Manual							
Dynamic Brake			-			Built-in				
Position Control Mode	Max. Input Pulse Frequency		Line driver: Max. 500Kpps (low speed)/ Max.4Mpps(high speed) Open collector: Max. 200Kpps							
	Pulse Type		Pulse + Direction, A phase + B phase, CCW pulse + CW pulse							
	Command Source		External pulse train							
	Smoothing Strategy		Low-pass filter							
	Electronic Gear		Electronic gear N/M multiple N: 1 ~ (2^{26}-1)/M:1 ~ (2^{31}-1) 1/50 < N/M < 25600							
	Torque Limit Operation		Set by parameters							
	Feed Forward Compensation		Set by parameters							
Speed Control Mode	Analog Input Command	Voltage Range	0 ~ ±10 V_{DC}							
		Input Resistance	10KΩ							
		Time Constant	2.2 us							
	Speed Control Range*1		1:5000							
	Command Source		External analog signal / Internal parameters							
	Smoothing Strategy		Low-pass and S-curve filter							
	Torque Limit Operation		Set by parameters or via Analog input							
	Responsiveness Characteristic		Maximum 550Hz							
	Speed Fluctuation Rate*2 (at rated speed)		0.01% or less at load fluctuation 0 to 100%							
			0.01% or less at power fluctuation ±10%							
			0.01% or less at ambient temperature fluctuation 0°C to 50°C							

Model: ASD-B2 Series			100W	200W	400W	750W	1kW	1.5kW	2kW	3kW
			01	02	04	07	10	15	20	30
Torque Control Mode	Analog Input Command	Voltage Range	0 ~ ±10 V_{DC}							
		Input Resistance	10KΩ							
		Time Constant	2.2 us							
	Command Source		External analog signal / Internal parameters							
	Smoothing Strategy		Low-pass filter							
	Speed Limit Operation		Parameter Setting or via Analog input							
Analog Monitor Output			Monitor signal can set by parameters (Output voltage range: ±8V)							
Digital Inputs/Outputs		Inputs	Servo On, Reset, Gain switching, Pulse clear, Zero speed CLAMP, Command input reverse control, Speed/Torque limit enabled, Speed command selection, Position / Speed mode switching, Speed / Torque mode switching, Torque / Position mode switching, Emergency stop, Forward / Reverse inhibit limit, Forward / Reverse operation torque limit, Forward / Reverse JOG input, Electronic gear ratio (Numerator) selection and Pulse inhibit input							
		Outputs	Encoder signal output (A, B, Z Line Driver / Z Open collector)							
			Servo ready, Servo On, At Zero speed, At Speed reached, At Positioning completed, At Torques limit, Servo alarm (Servo fault) activated, Electromagnetic brake control, Output overload warning, Servo warning activated							
Protective Functions			Overcurrent, Overvoltage, Undervoltage, Motor overheated, Overload, Overspeed, Excessive deviation, Regeneration error, Abnormal pulse control command, Encoder error, Adjustment error, Emergency stop activated, Reverse/ Forward limit switch error, IGBT temperature error, Serial communication error, Input power phase loss, Serial communication time out, terminals with short circuit protection (U, V ,W , CN1, CN2, CN3 terminals)							
Communication Interface			RS-232／RS-485							
Environment	Installation Site		Indoor location (free from direct sunlight), no corrosive liquid and gas (far away from oil mist, flammable gas, dust)							
	Altitude		Altitude 1000m or lower above sea level							
	Atmospheric pressure		86kPa to 106kPa							
	Operating Temperature		0°C to 55°C (32°F to 131°F) (If operating temperature is above specified range, forced cooling will be required)							
	Storage Temperature		-20℃ ~ 65℃							
	Humidity		0 to 90% (non-condensing)							
	Vibration		9.80665m/s^2 (1G) less than 20Hz, 5.88m/ s^2 (0.6G) 20 to 50Hz							
	IP Rating		IP20							
	Power System		TN System [*4]							
	Standards/Requirement		IEC/EN 61800-5-1, UL 508C							

Footnote:

*1 Rated rotation speed: When full load, speed ratio is defined as the minimum speed (the motor will not pause).

*2 When command is rated rotation speed, the speed fluctuation rate is defined as:

(Empty load rotation speed – Full load rotation speed) / Rated rotation speed

*3 TN system: A power distribution system having one point directly earthed, the exposed conductive parts of the installation being connected to that points by protective earth conductor.

*4 Please refer to “Chart of load and operating time” in section 10.4 “Overload Characteristics”.

10.2 Specifications of Servo Motors (ECMA Series)

Low Inertia Servo Motors

Model: ECMA Series	C△04	C△06		C△08		C△09		C△10	
	01	02	04	04	07	07	10	10	20
Rated output power (kW)	0.1	0.2	0.4	0.4	0.75	0.75	1.0	1.0	2.0
Rated torque (N-m) [*1]	0.32	0.64	1.27	1.27	2.39	2.38	3.18	3.18	6.37
Maximum torque (N-m)	0.96	1.92	3.82	3.82	7.16	7.14	8.78	9.54	19.11
Rated speed (r/min)	3000								
Maximum speed (r/min)	5000					3000		5000	
Rated current (A)	0.90	1.55	2.60	2.60	5.10	3.66	4.25	7.30	12.05
Maximum current (A)	2.70	4.65	7.80	7.74	15.3	11	12.37	21.9	36.15
Power rating (kW/s) (without brake)	27.7	22.4	57.6	22.1	48.4	29.6	38.6	38.1	90.6
Rotor moment of inertia ($\times 10^{-4}$kg.m^2) (without brake)	0.037	0.177	0.277	0.68	1.13	1.93	2.62	2.65	4.45
Mechanical time constant (ms) (without brake)	0.75	0.80	0.53	0.73	0.62	1.72	1.20	0.74	0.61
Torque constant-KT (N-m/A)	0.36	0.41	0.49	0.49	0.47	0.65	0.75	0.43	0.53
Voltage constant-KE (mV/(r/min))	13.6	16.0	17.4	18.5	17.2	27.5	24.2	16.8	19.2
Armature resistance (Ohm)	9.30	2.79	1.55	0.93	0.42	1.34	0.897	0.20	0.13
Armature inductance (mH)	24.0	12.07	6.71	7.39	3.53	7.55	5.7	1.81	1.50
Electrical time constant (ms)	2.58	4.30	4.30	7.96	8.36	5.66	6.35	9.30	11.4
Insulation class	Class A (UL), Class B (CE)								
Insulation resistance	>100MΩ, DC 500V								
Insulation strength	1500V AC, 60 seconds								
Weight (kg) (without brake)	0.5	1.2	1.6	2.1	3.0	2.9	3.8	4.3	6.2
Weight (kg) (with brake)	0.8	1.5	2.0	2.9	3.8	3.69	5.5	4.7	7.2
Max. radial shaft load (N)	78.4	196	196	245	245	245	245	490	490
Max. thrust shaft load (N)	39.2	68	68	98	98	98	98	98	98
Power rating (kW/s) (with brake)	25.6	21.3	53.8	22.1	48.4	29.3	37.9	30.4	82.0
Rotor moment of inertia ($\times 10^{-4}$kg.m^2) (with brake)	0.04	0.192	0.30	0.73	1.18	1.95	2.67	3.33	4.95
Mechanical time constant (ms) (with brake)	0.81	0.85	0.57	0.78	0.65	1.74	1.22	0.93	0.66
Brake holding torque [Nt-m (min)] [*2]	0.3	1.3	1.3	2.5	2.5	2.5	2.5	8.0	8.0
Brake power consumption (at 20°C) [W]	7.2	6.5	6.5	8.2	8.2	8.2	8.2	18.5	18.5

Model: ECMA Series	**C△04**	**C△06**		**C△08**		**C△09**		**C△10**	
	01	**02**	**04**	**04**	**07**	**07**	**10**	**10**	**20**
Brake release time [ms (Max)]	5	10	10	10	10	10	10	10	10
Brake pull-in time [ms (Max)]	25	70	70	70	70	70	70	70	70
Vibration grade (um)	15								
Operating temperature	0 ~ 40 ^{o}C								
Storage temperature	-10 ~ 80 ^{o}C								
Operating humidity	20% to 90% RH (non-condensing)								
Storage humidity	20% to 90% RH (non-condensing)								
Vibration capacity	2.5G								
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	CE c UL US LISTED								

Footnote:

*1 Rate torque values are continuous permissible values at 0~40^{o}C ambient temperature when attaching with the sizes of heatsinks listed below:

ECMA-__04 / 06 / 08 : 250mm x 250mm x 6mm

ECMA-__10 : 300mm x 300mm x 12mm

ECMA-__13 : 400mm x 400mm x 20mm

ECMA-__18 : 550mm x 550mm x 30mm

Material type : Aluminum – F40, F60, F80, F100, F130, F180

*2 The holding brake is used to hold the motor shaft, not for braking the rotation. Never use it for decelerating or stopping the machine.

*3 For the specifications of the motors with rotary magnetic encoders, please refer to the specifications of the corresponding standard models.

*4 (△) in the mode of servo motor indicates the type of encoder. △ = 1: increment, 20-bit; △= 2: increment, 17-bit.

NOTE

1) Please refer to Section 1.2 for details about the model explanation.

Medium / High Inertia Servo Motors

Model: ECMA Series	E△13				E△18		F△18	G△13		
	05	10	15	20	20	30	30	03	06	09
Rated output power (kW)	0.5	1.0	1.5	2.0	2.0	3.0	3.0	0.3	0.6	0.9
Rated torque (N-m) [*1]	2.39	4.77	7.16	9.55	9.55	14.32	19.10	2.86	5.73	8.59
Maximum torque (N-m)	7.16	14.32	21.48	28.65	28.65	42.97	57.29	8.59	17.19	21.48
Rated speed (r/min)	2000						1500	1000		
Maximum speed (r/min)	3000							2000		
Rated current (A)	2.9	5.6	8.3	11.01	11.22	16.1	19.4	2.5	4.8	7.5
Maximum current (A)	8.7	16.8	24.81	33.0	33.66	48.3	58.2	7.44	14.49	22.5
Power rating (kW/s) (without brake)	7.0	27.1	45.9	62.5	26.3	37.3	66.4	10.0	39.0	66.0
Rotor moment of inertia (× 10^{-4}kg.m^{2})	8.17	8.41	11.18	14.59	34.68	54.95	54.95	8.17	8.41	11.18
Mechanical time constant (ms)	1.91	1.51	1.11	0.96	1.62	1.06	1.28	1.84	1.40	1.07
Torque constant-KT (N-m/A)	0.83	0.85	0.87	0.87	0.85	0.89	0.98	1.15	1.19	1.15
Voltage constant-KE (mV/(r/min))	30.9	31.9	31.8	31.8	31.4	32.0	35.0	42.5	43.8	41.6
Armature resistance (Ohm)	0.57	0.47	0.26	0.174	0.119	0.052	0.077	1.06	0.82	0.43
Armature inductance (mH)	7.39	5.99	4.01	2.76	2.84	1.38	1.27	14.29	11.12	6.97
Electrical time constant (ms)	12.96	12.88	15.31	15.86	23.87	26.39	16.51	13.55	13.55	16.06
Insulation class	Class A (UL), Class B (CE)									
Insulation resistance	>100MΩ, DC 500V									
Insulation strength	AC 1500V，60 sec									
Weight (kg) (without brake)	6.8	7.0	7.5	7.8	13.5	18.5	18.5	6.8	7.0	7.5
Weight (kg) (with brake)	8.2	8.4	8.9	9.2	17.5	22.5	22.5	8.2	8.4	8.9
Max. radial shaft load (N)	490	490	490	490	1176	1470	1470	490	490	490
Max. thrust shaft load (N)	98	98	98	98	490	490	490	98	98	98
Power rating (kW/s) (with brake)	6.4	24.9	43.1	59.7	24.1	35.9	63.9	9.2	35.9	62.1
Rotor moment of inertia (× 10^{-4}kg.m^{2}) (with brake)	8.94	9.14	11.90	15.88	37.86	57.06	57.06	8.94	9.14	11.9
Mechanical time constant (ms) (with brake)	2.07	1.64	1.19	1.05	1.77	1.10	1.33	2.0	1.51	1.13
Brake holding torque [Nt-m (min)] [*2]	10.0	10.0	10.0	10.0	25.0	25.0	25.0	10.0	10.0	10.0
Brake power consumption (at 20^{o}C) [W]	19.0	19.0	19.0	19.0	20.4	20.4	20.4	19.0	19.0	19.0

Model: ECMA Series	**E△13**				**E△18**		**F△18**	**G△13**		
	05	**10**	**15**	**20**	**20**	**30**	**30**	**03**	**06**	**09**
Brake release time [ms (Max)]	10	10	10	10	10	10	10	10	10	10
Brake pull-in time [ms (Max)]	70	70	70	70	70	70	70	70	70	70
Vibration grade (um)	15									
Operating temperature	0 ~ 40 °C									
Storage temperature	-10 ~ 80 °C									
Operating humidity	20% to 90% RH (non-condensing)									
Storage humidity	20% to 90% RH (non-condensing)									
Vibration capacity	2.5G									
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	CE c UL US LISTED									

Footnote:

*1 Rate torque values are continuous permissible values at 0~40°C ambient temperature when attaching with the sizes of heatsinks listed below:

ECMA-__04 / 06 / 08 : 250mm x 250mm x 6mm

ECMA-__10 : 300mm x 300mm x 12mm

ECMA-__13 : 400mm x 400mm x 20mm

ECMA-__18 : 550mm x 550mm x 30mm

Material type : Aluminum – F40, F60, F80, F100, F130, F180

*2 The holding brake is used to hold the motor shaft, not for braking the rotation. Never use it for decelerating or stopping the machine.

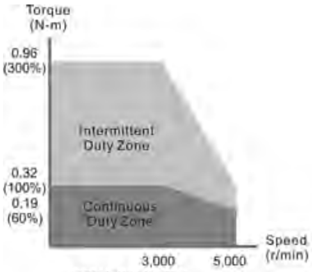
*3 For the specifications of the motors with rotary magnetic encoders, please refer to the specifications of the corresponding standard models.

*4 (△) in the mode of servo motor indicates the type of encoder. △ = 1: increment, 20-bit; △= 2: increment, 17-bit.

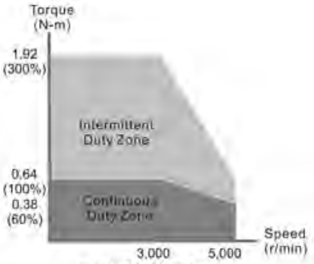
NOTE

1) Please refer to Section 1.2 for details about the model explanation.

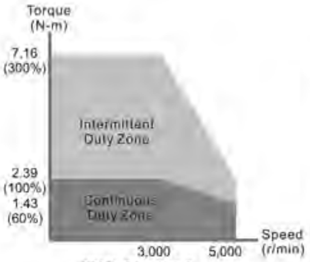
10.3 Servo Motor Speed-Torque Curves



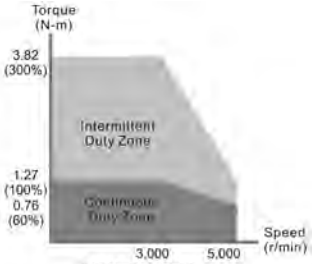
ECMA-C20401□S



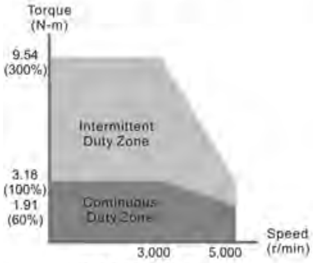
ECMA-C20602□S



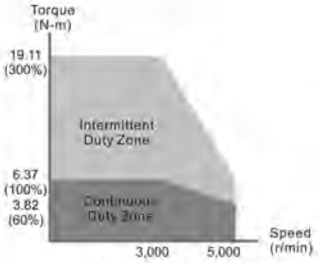
ECMA-C20807□S



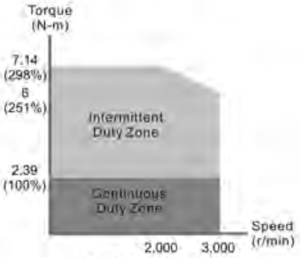
ECMA-C20604□S
ECMA-C20804□7
ECMA-CM0604PS



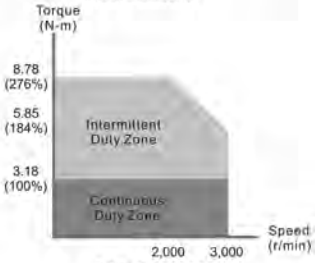
ECMA-C21010□S



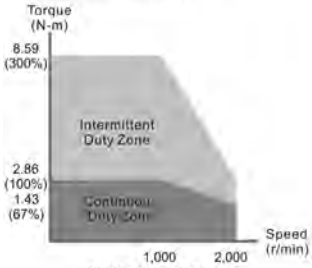
ECMA-C21020□S



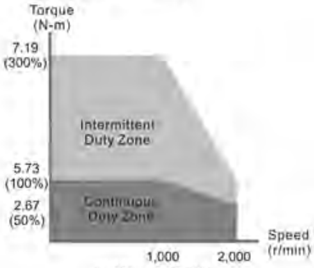
ECMA-C20910□S



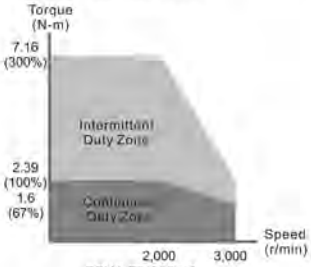
ECMA-C20907□S



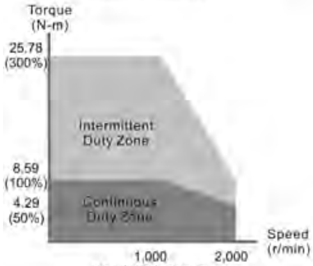
ECMA-G21303□S



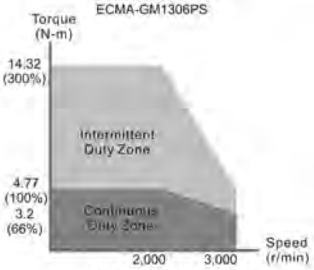
ECMA-G21306□S
ECMA-GM1306PS



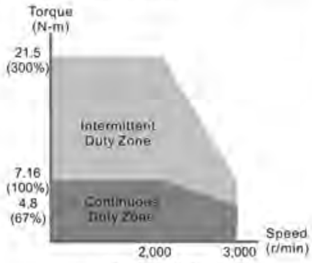
ECMA-E21305□S



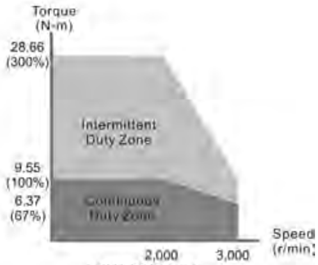
ECMA-G21309□S
ECMA-GM1309PS



ECMA-E21310□S



ECMA-E21315□S



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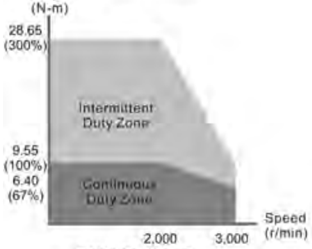
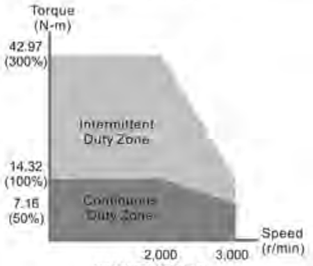
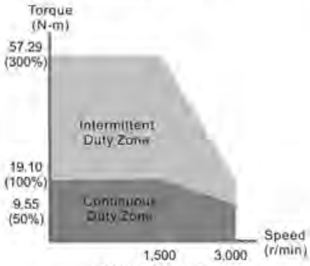


ECMA-E21820□S



ECMA-E21830□S



ECMA-F21830□S

10.4 Overload Characteristics

■ Overload Protection Function

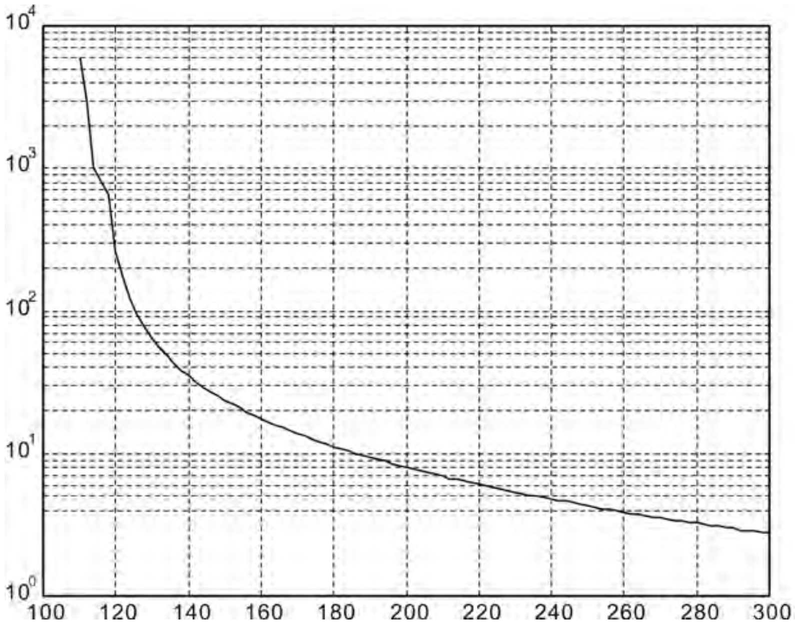
Overload protection is a built-in protective function to prevent a motor from overheating.

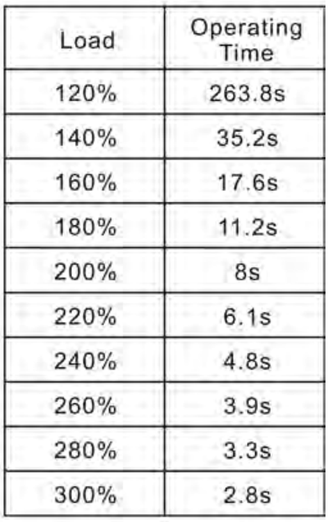
■ Occasion of Overload

1. Motor was operated for several seconds under a torque exceeding 100% torque.
2. Motor had driven high inertia machine and had accelerated and decelerated at high frequency.
3. Motor UVW cable or encoder cable was not connected correctly.
4. Servo gain was not set properly and caused motor hunting.
5. Motor holding brake was not released.

■ Chart of load and operating time

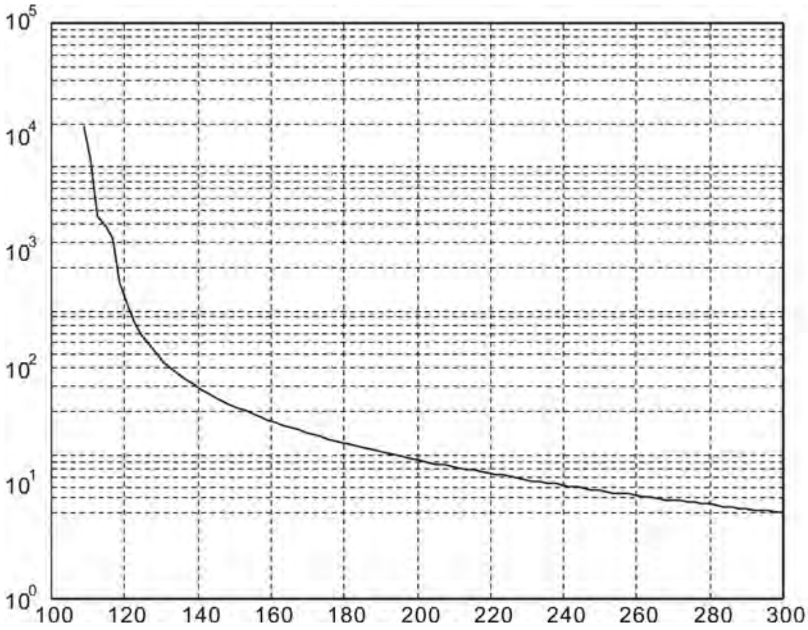
Low Inertia Series (ECMA C/CM Series)





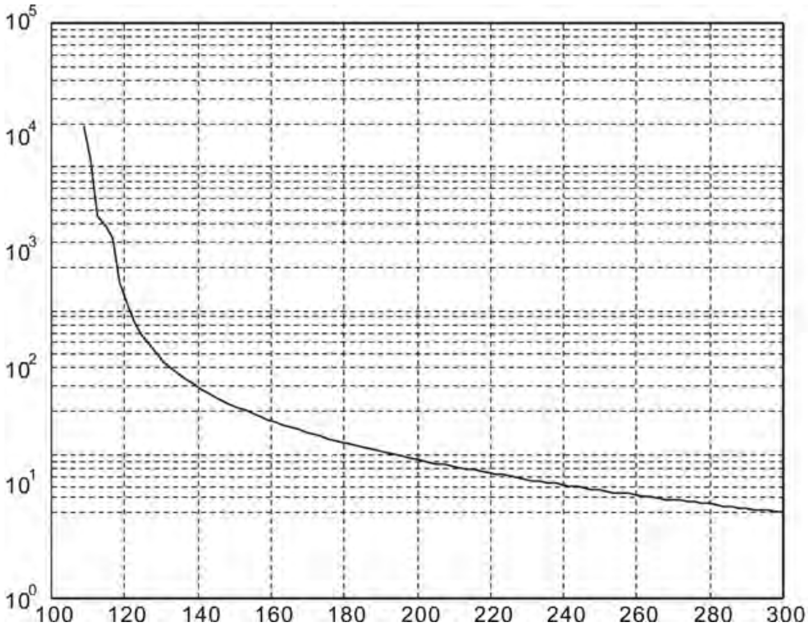
Load	Operating Time
120%	263.8s
140%	35.2s
160%	17.6s
180%	11.2s
200%	8s
220%	6.1s
240%	4.8s
260%	3.9s
280%	3.3s
300%	2.8s

Medium and Medium-High Inertia Series (ECMA E, F Series)



Load	Operating Time
120%	527.6s
140%	70.4s
160%	35.2s
180%	22.4s
200%	16s
220%	12.2s
240%	9.6s
260%	7.8s
280%	6.6s
300%	5.6s

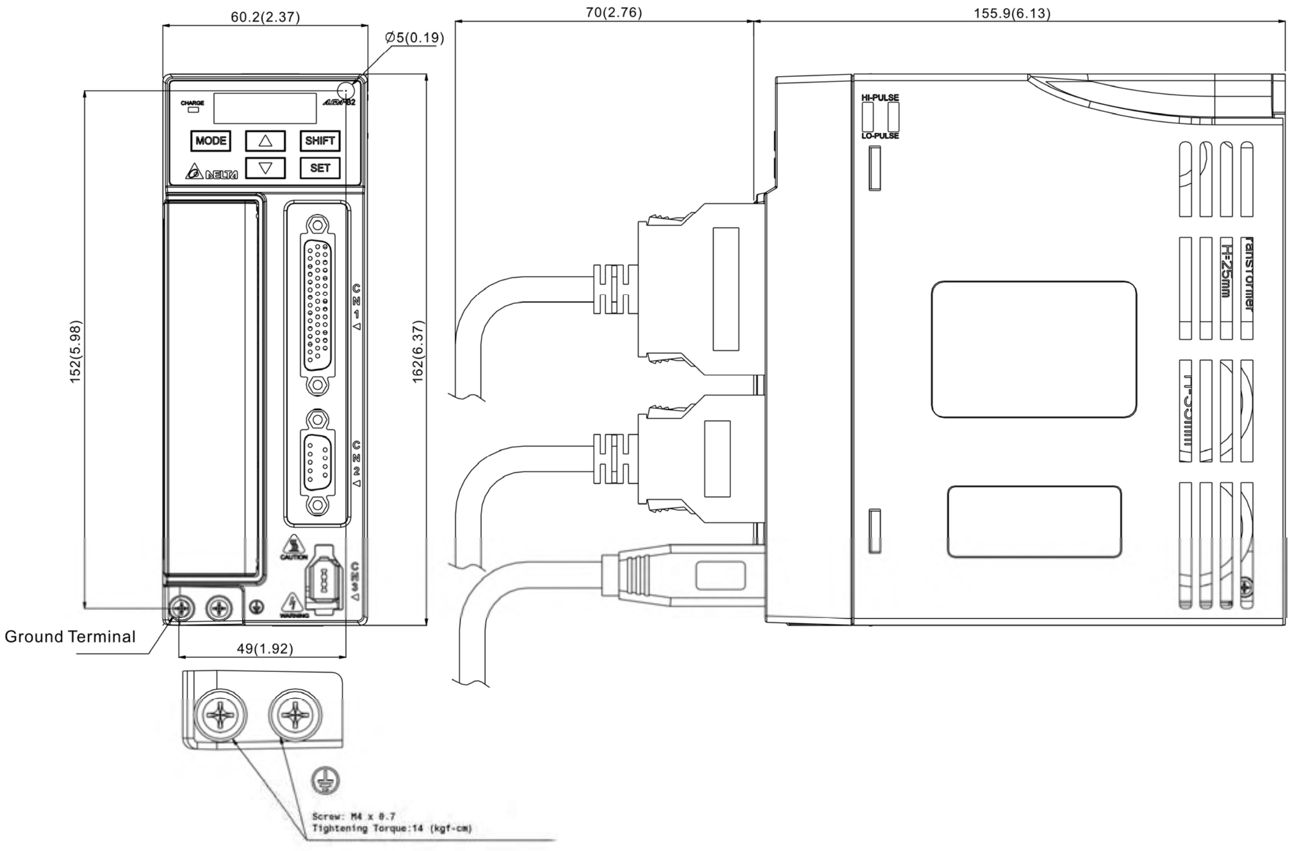
High Inertia Series (ECMA G/GM Series)



Load	Operating Time
120%	527.6s
140%	70.4s
160%	35.2s
180%	22.4s
200%	16s
220%	12.2s
240%	9.6s
260%	7.8s
280%	6.6s
300%	5.6s

10.5 Dimensions of Servo Drives

Order P/N: ASD-B2-0121; ASD-B2-0221; ASD-B2-0421 (100W ~ 400W)



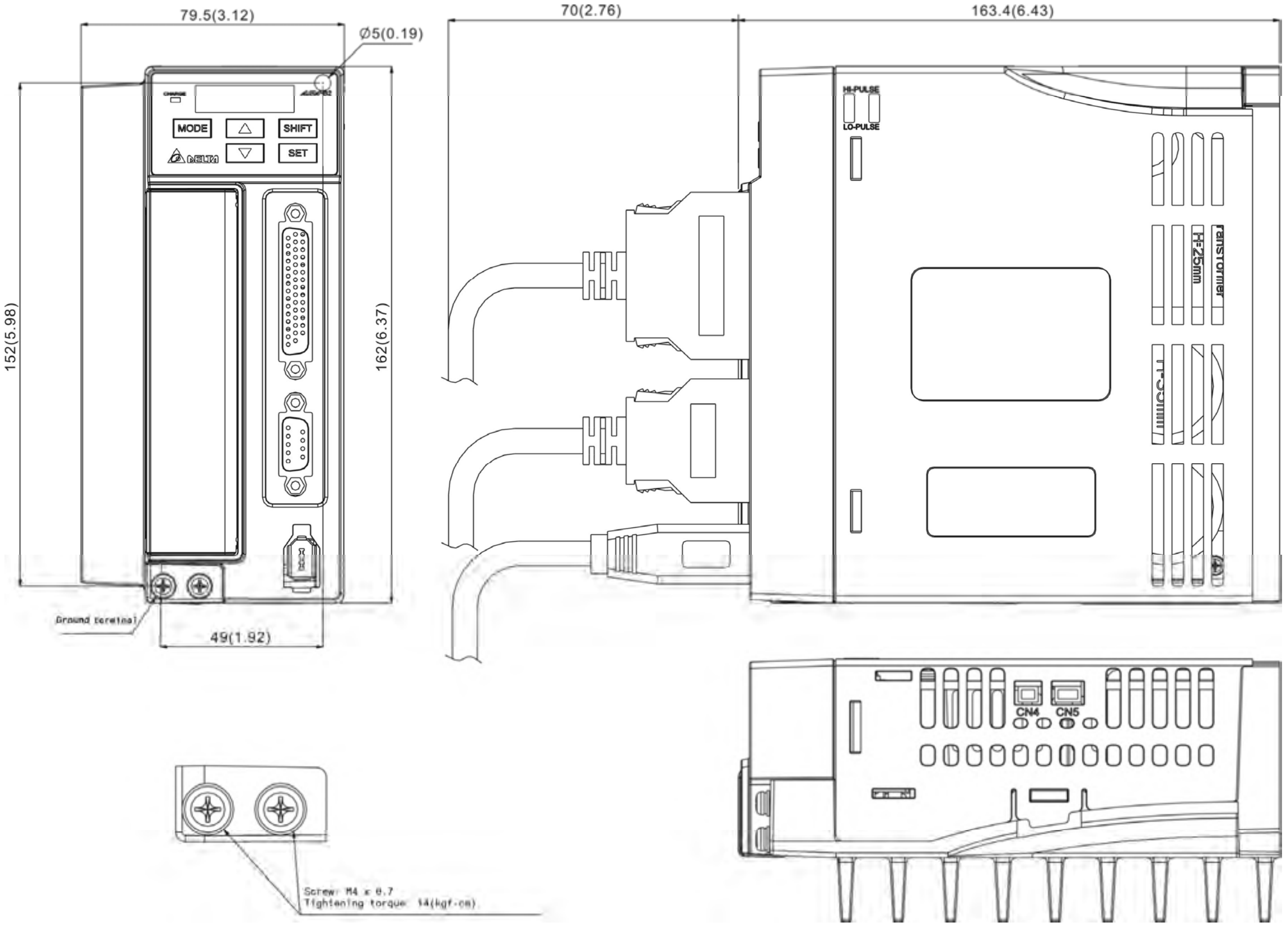
WEIGHT
1.07 (2.36)

NOTE

1) Dimensions are in millimeters (inches); Weights are in kilograms (kg) and (pounds (lbs)).

2) Dimensions and weights of the servo drive may be revised without prior notice.

Order P/N: ASD-B2-0721 (750W)

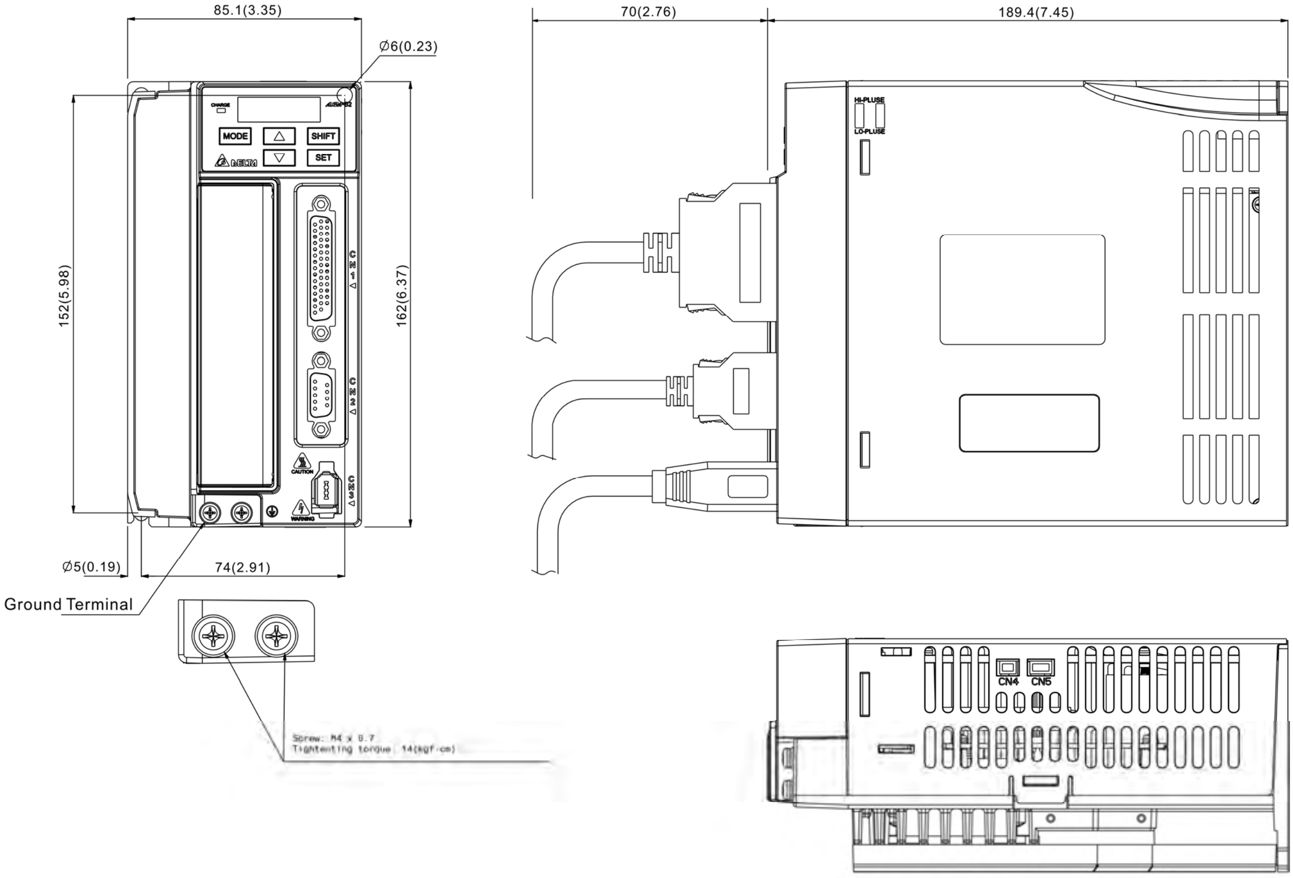


WEIGHT
1.54 (3.40)

NOTE

1) Dimensions are in millimeters (inches); Weights are in kilograms (kg) and (pounds (lbs)).
2) Dimensions and weights of the servo drive may be revised without prior notice.

Order P/N: ASD-B2-1021;ASD-B2-1521 (1kW ~ 1.5kW)



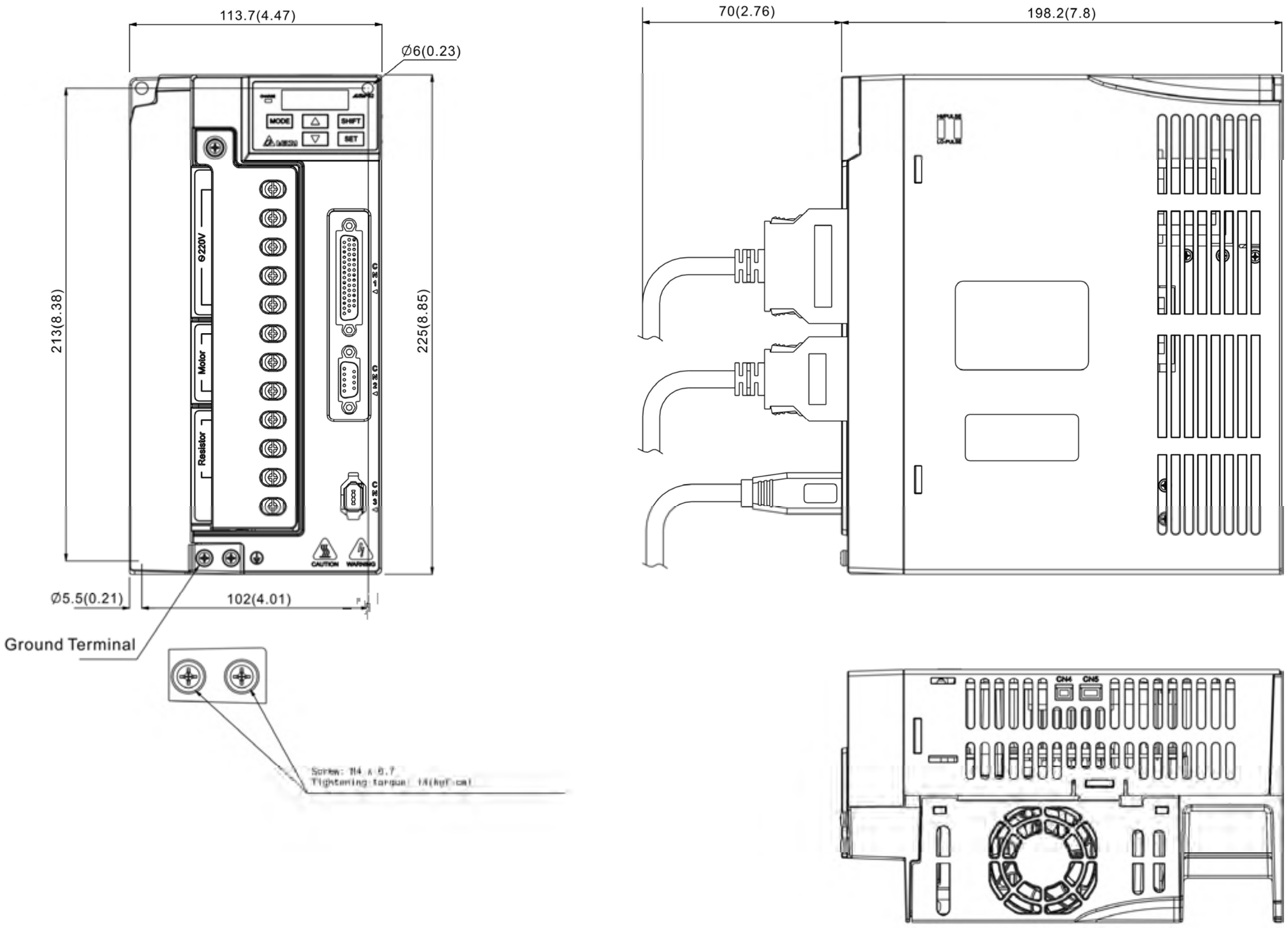
WEIGHT
1.72 (3.79)

NOTE

1) Dimensions are in millimeters (inches); Weights are in kilograms (kg) and (pounds (lbs)).

2) Dimensions and weights of the servo drive may be revised without prior notice.

Order P/N: ASD-B2-2023;ASD-B2-3023 (2kW ~ 3kW)



WEIGHT
2.67 (5.88)

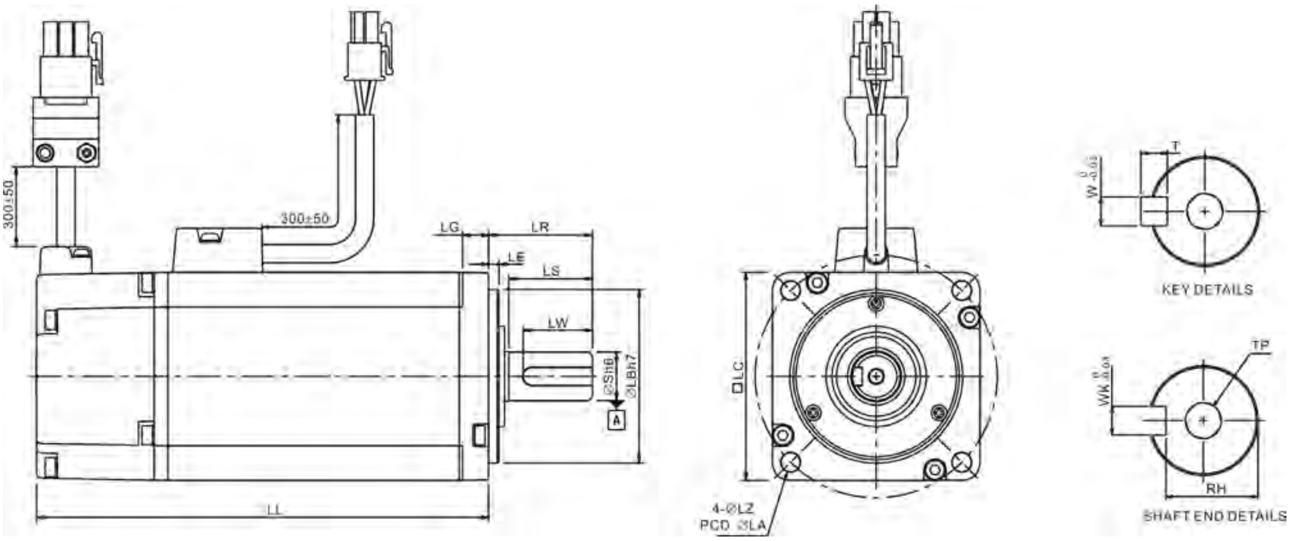
NOTE

1) Dimensions are in millimeters (inches); Weights are in kilograms (kg) and (pounds (lbs)).

2) Dimensions and weights of the servo drive may be revised without prior notice.

10.6 Dimensions of Servo Motors

Motor Frame Size: 86mm and below Models



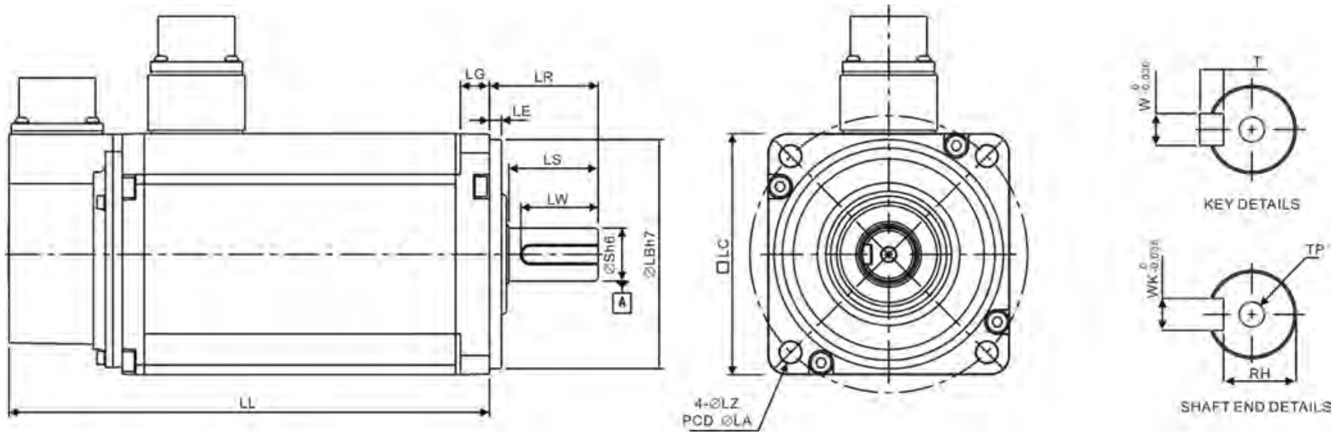
Model	C△0401□S	C△0602□S	C△0604□S	C△0804□S	C△0807□S	C△0907□S	C△0910□S
LC	40	60	60	80	80	86	86
LZ	4.5	5.5	5.5	6.6	6.6	6.6	6.6
LA	46	70	70	90	90	100	100
S	$\mathbf{8}(^{+0}_{-0.009})$	$\mathbf{14}(^{+0}_{-0.011})$	$\mathbf{14}(^{+0}_{-0.011})$	$\mathbf{14}(^{+0}_{-0.011})$	$\mathbf{19}(^{+0}_{-0.013})$	$\mathbf{16}(^{+0}_{-0.011})$	$\mathbf{16}(^{+0}_{-0.011})$
LB	$\mathbf{30}(^{+0}_{-0.021})$	$\mathbf{50}(^{+0}_{-0.025})$	$\mathbf{50}(^{+0}_{-0.025})$	$\mathbf{70}(^{+0}_{-0.030})$	$\mathbf{70}(^{+0}_{-0.030})$	$\mathbf{80}(^{+0}_{-0.030})$	$\mathbf{80}(^{+0}_{-0.030})$
LL (without brake)	100.6	105.5	130.7	112.3	138.3	130.2	153.2
LL (with brake)	136.6	141.6	166.8	152.8	178	161.3	184.3
LS (without oil seal)	20	27	27	27	32	30	30
LS (with oil seal)	20	24	24	24.5	29.5	30	30
LR	25	30	30	30	35	35	35
LE	2.5	3	3	3	3	3	3
LG	5	7.5	7.5	8	8	8	8
LW	16	20	20	20	25	20	20
RH	6.2	11	11	11	15.5	13	13
WK	3	5	5	5	6	5	5
W	3	5	5	5	6	5	5
T	3	5	5	5	6	5	5
TP	M3 Depth 8	M4 Depth 15	M4 Depth 15	M4 Depth 15	M6 Depth 20	M5 Depth 15	M5 Depth 15

NOTE

1) Dimensions are in millimeters.
2) Dimensions and weights of the servo motor may be revised without prior notice.
3) The boxes (□) in the model names are for optional configurations. (Please refer to section 1.2 for model explanation.)
4) (△) in the mode of servo motor indicates the type of encoder. △ = 1: increment, 20-bit; △= 2: increment, 17-bit.

5) Except ECMA-CM0604PS LL: 116.2mm, for the specifications of the motors with rotary magnetic encoders, please refer to the specifications of the corresponding standard models.

Motor Frame Size: 100mm ~ 130mm Models



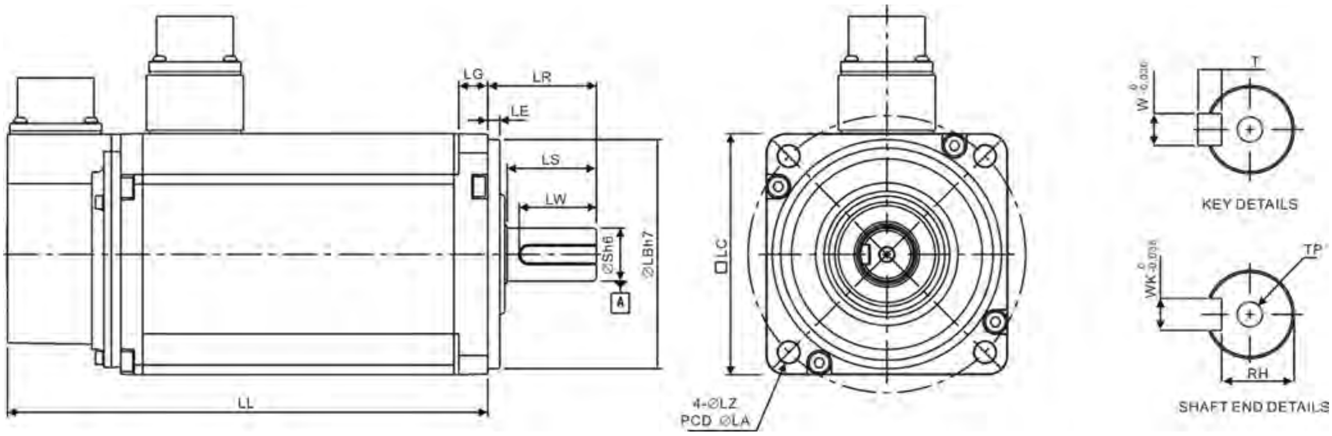
Model	G△1303□S	E△1305□S	G△1306□S	G△1309□S	C△1010□S
LC	130	130	130	130	100
LZ	9	9	9	9	9
LA	145	145	145	145	115
S	$\mathbf{22\left(^{+0}_{-0.013}\right)}$	$\mathbf{22\left(^{+0}_{-0.013}\right)}$	$\mathbf{22\left(^{+0}_{-0.013}\right)}$	$\mathbf{22\left(^{+0}_{-0.013}\right)}$	$\mathbf{22\left(^{+0}_{-0.013}\right)}$
LB	$\mathbf{110\left(^{+0}_{-0.035}\right)}$	$\mathbf{110\left(^{+0}_{-0.035}\right)}$	$\mathbf{110\left(^{+0}_{-0.035}\right)}$	$\mathbf{110\left(^{+0}_{-0.035}\right)}$	$\mathbf{95\left(^{+0}_{-0.035}\right)}$
LL (without brake)	147.5	147.5	147.5	163.5	153.3
LL (with brake)	183.5	183.5	183.5	198	192.5
LS	47	47	47	47	37
LR	55	55	55	55	45
LE	6	6	6	6	5
LG	11.5	11.5	11.5	11.5	12
LW	36	36	36	36	32
RH	18	18	18	18	18
WK	8	8	8	8	8
W	8	8	8	8	8
T	7	7	7	7	7
TP	M6 Depth 20	M6 Depth 20	M6 Depth 20	M6 Depth 20	M6 Depth 20

NOTE

1) Dimensions are in millimeters.
2) Dimensions and weights of the servo motor may be revised without prior notice.
3) The boxes (☐) in the model names are for optional configurations. (Please refer to section 1.2 for model explanation.)
4) (△) in the mode of servo motor indicates the type of encoder. △ = 1: increment, 20-bit; △= 2: increment, 17-bit.

5) For the specifications of the motors with rotary magnetic encoders, please refer to the specifications of the corresponding standard models.

Motor Frame Size: 100mm ~ 130mm Models

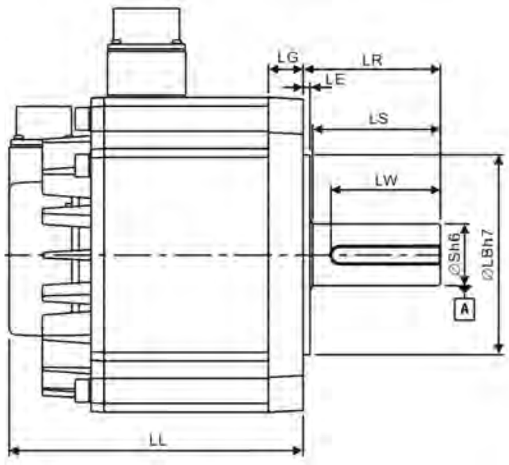


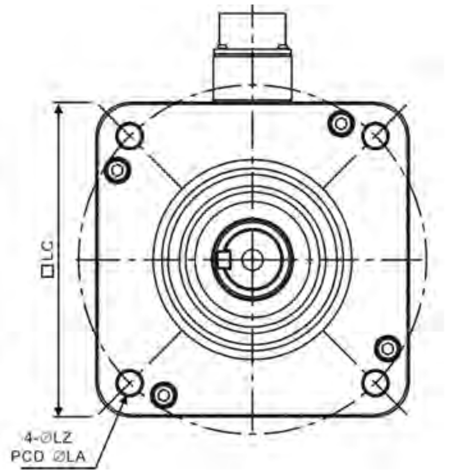
Model	E△1310□S	E△1315□S	C△1020□S	E△1320□S
LC	130	130	100	130
LZ	9	9	9	9
LA	145	145	115	145
S	**$22(^{+0}_{-0.013})$**	**$22(^{+0}_{-0.013})$**	**$22(^{+0}_{-0.013})$**	**$22(^{+0}_{-0.013})$**
LB	**$110\ (^{+0}_{-0.035})$**	**$110\ (^{+0}_{-0.035})$**	**$95(^{+0}_{-0.035})$**	**$110\ (^{+0}_{-0.035})$**
LL (without brake)	147.5	167.5	199	187.5
LL (with brake)	183.5	202	226	216
LS	47	47	37	47
LR	55	55	45	55
LE	6	6	5	6
LG	11.5	11.5	12	11.5
LW	36	36	32	36
RH	18	18	18	18
WK	8	8	8	8
W	8	8	8	8
T	7	7	7	7
TP	M6 Depth 20	M6 Depth 20	M6 Depth 20	M6 Depth 20

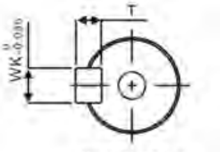
NOTE

1) Dimensions are in millimeters.
2) Dimensions and weights of the servo motor may be revised without prior notice.
3) The boxes (☐) in the model names are for optional configurations. (Please refer to section 1.2 for model explanation.)
4) (△) in the mode of servo motor indicates the type of encoder. △ = 1: increment, 20-bit; △= 2: increment, 17-bit.

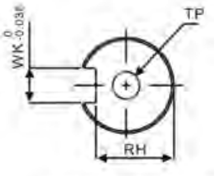
Motor Frame Size: 180mm Models







KEY DETAILS



SHAFT END DETAILS

Model	E△1820□S	E△1830□S	F△1830□S
LC	180	180	180
LZ	13.5	13.5	13.5
LA	200	200	200
S	$35(^{+0}_{-0.016})$	$35(^{+0}_{-0.016})$	$35(^{+0}_{-0.016})$
LB	$114.3(^{+0}_{-0.035})$	$114.3(^{+0}_{-0.035})$	$114.3(^{+0}_{-0.035})$
LL (without 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

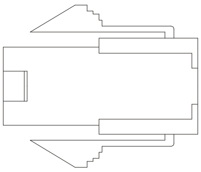
NOTE

1) Dimensions are in millimeters.
2) Dimensions and weights of the servo motor may be revised without prior notice.
3) The boxes (☐) in the model names are for optional configurations. (Please refer to section 1.2 for model explanation.)
4) (△) in the mode of servo motor indicates the type of encoder. △ = 1: increment, 20-bit; △= 2: increment, 17-bit.

Appendix A Accessories

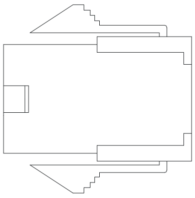
■ Power Connectors

Delta Part Number: ASDBCAPW0000



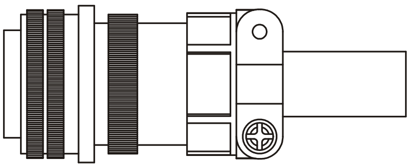
Title	Part No.	Manufacturer
Housing	C4201H00-2*2PA	JOWLE
Terminal	C4201TOP-2	JOWLE

Delta Part Number:ASDBCAPW0100



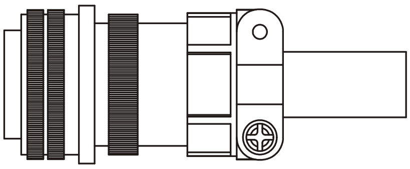
Title	Part No.	Manufacturer
Housing	C4201H00-2*3PA	JOWLE
Terminal	C4201TOP-2	JOWLE

Delta Part Number: ASD-CAPW1000



3106A-20-18S

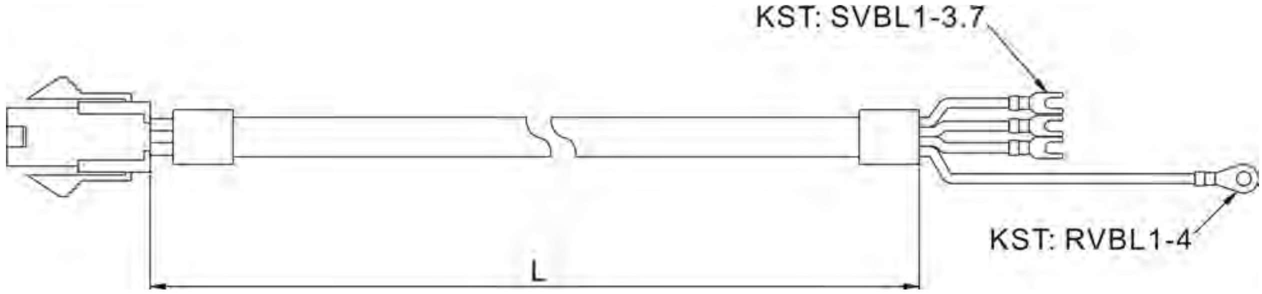
Delta Part Number: ASD-CAPW2000



3106A-24-11S

■ Power Cables

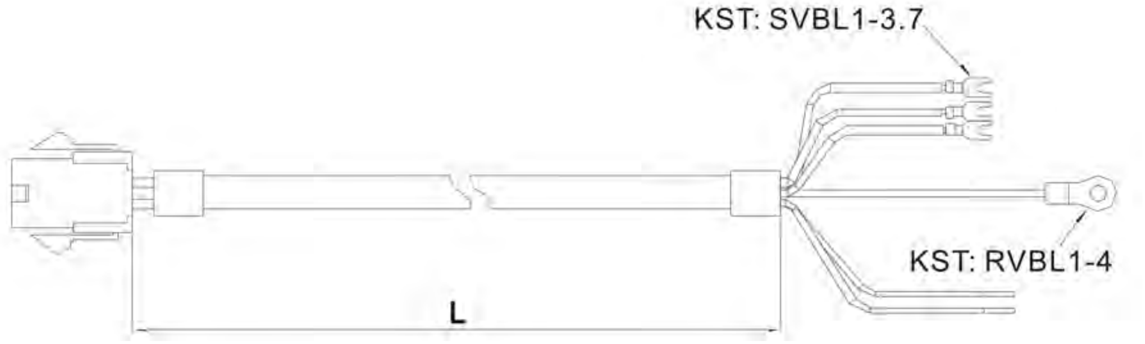
Delta Part Number: ASDBCAPW0203／0205



Title	Part No.	Manufacturer
Housing	C4201H00-2*2PA	JOWLE
Terminal	C4201TOP-2	JOWLE

Title	Part No.	L	
		mm	inch
1	ASDBCAPW0203	3000 ± 50	118 ± 2
2	ASDBCAPW0205	5000 ± 50	197 ± 2

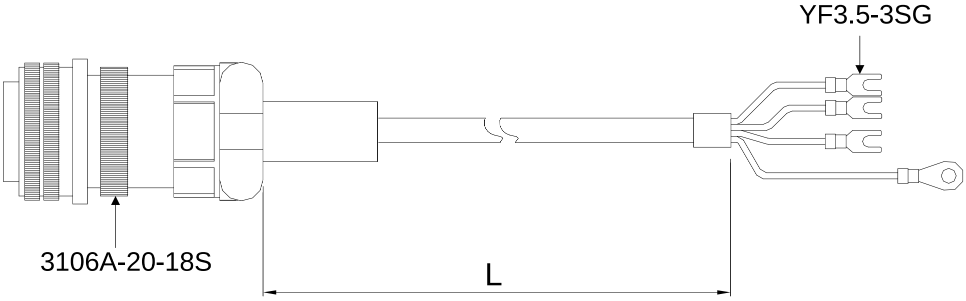
Delta Part Number: ASDBCAPW0303／0305



Title	Part No.	Manufacturer
Housing	C4201H00-2*3PA	JOWLE
Terminal	C4201TOP-2	JOWLE

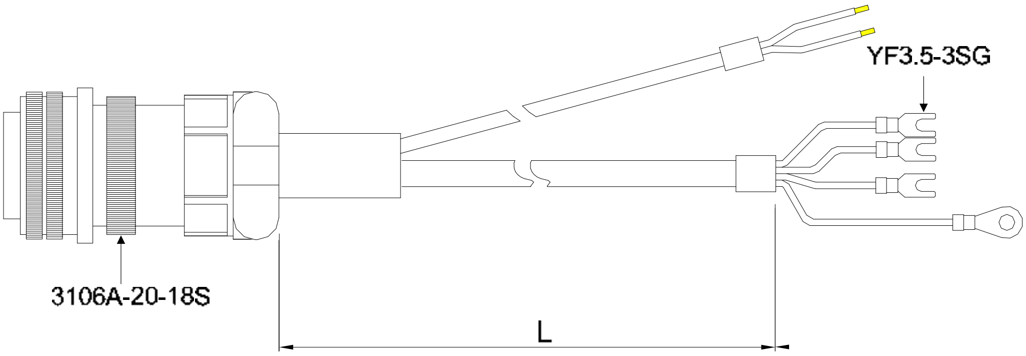
Title	Part No.	L	
		mm	inch
1	ASDBCAPW0303	3000 ± 50	118 ± 2
2	ASDBCAPW0305	5000 ± 50	197 ± 2

Delta Part Number: ASDBCAPW1203／1205



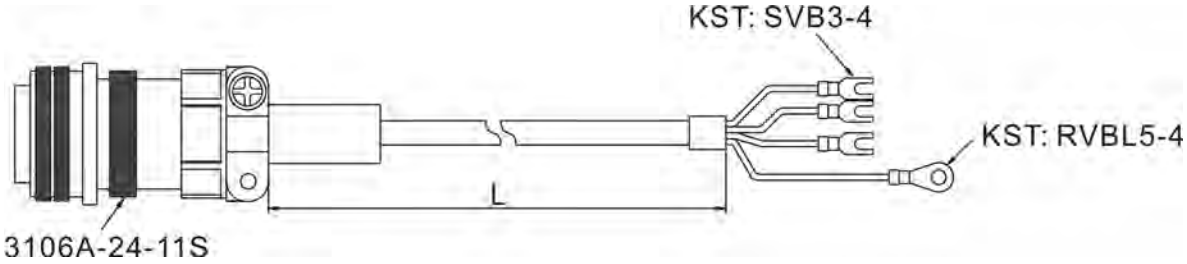
Title	Part No.	Straight	L	
			mm	inch
1	ASDBCAPW1203	3106A-20-18S	3000 ± 50	118 ± 2
2	ASDBCAPW1205	3106A-20-18S	5000 ± 50	197 ± 2

Delta Part Number: ASDBCAPW1303／1305



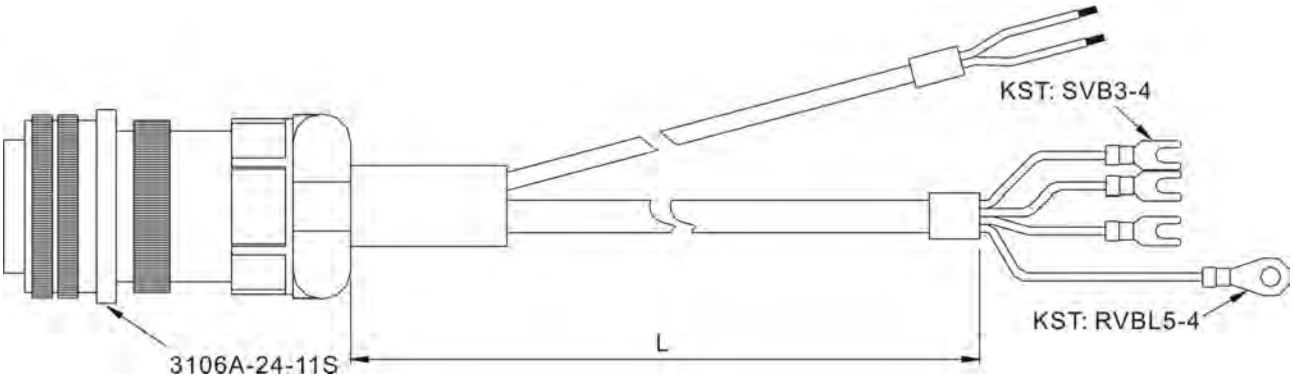
Title	Part No.	Straight	L	
			mm	inch
1	ASDBCAPW1303	3106A-20-18S	3000 ± 50	118 ± 2
2	ASDBCAPW1305	3106A-20-18S	5000 ± 50	197 ± 2

Delta Part Number: ASD-CAPW2203／2205



Title	Part No.	Straight	L	
			mm	inch
1	ASD-CAPW2203	3106A-24-11S	3000 ± 50	118 ± 2
2	ASD-CAPW2205	3106A-24-11S	5000 ± 50	197 ± 2

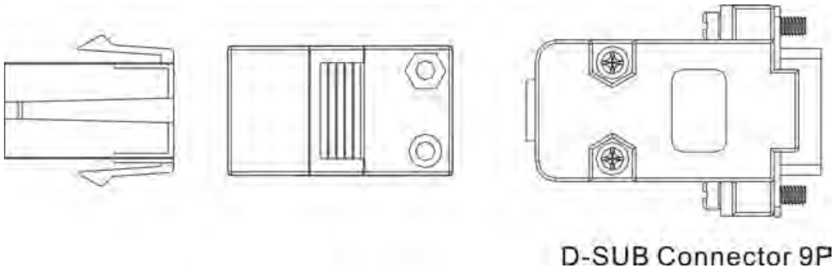
Delta Part Number: ASD-CAPW2303／2305



Title	Part No.	Straight	L	
			mm	inch
1	ASD-CAPW2303	3106A-24-11S	3000 ± 50	118 ± 2
2	ASD-CAPW2305	3106A-24-11S	5000 ± 50	197 ± 2

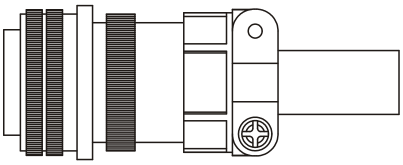
■ Encoder Connectors

Delta Part Number: ASDBCAEN0000

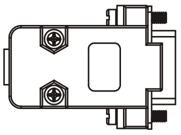


Title	Part No.	Manufacturer
Housing	AMP (1-172161-9)	AMP
Terminal	AMP (170359-3)	AMP
CLAMP	DELTA (34703237XX)	DELTA

Delta Part Number: ASDBCAEN1000



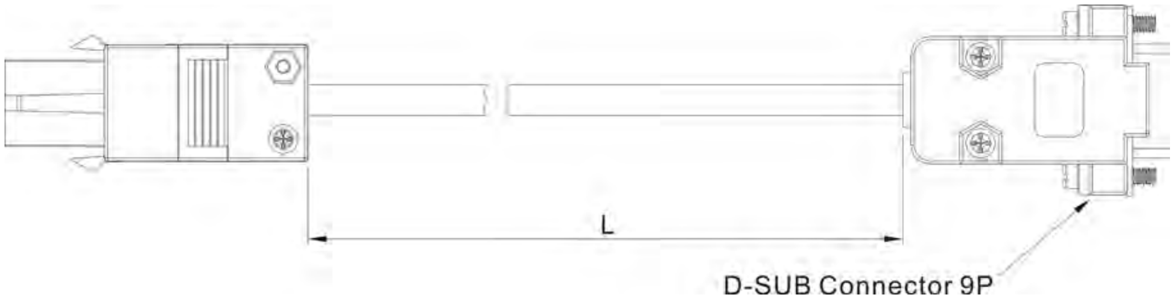
3106A-20-29S



D-SUB Connector 9P

■ Encoder Cables

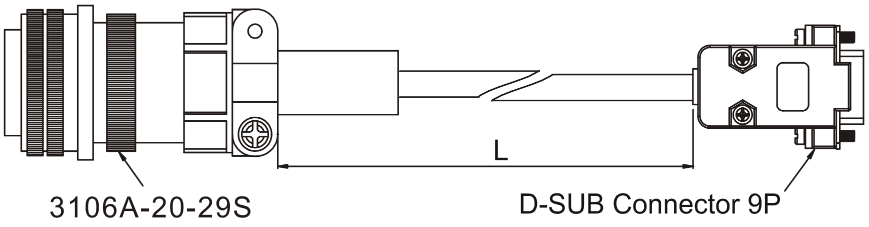
Delta Part Number: ASDBCAEN0003／0005



Title	Part No.	Manufacturer
Housing	AMP (1-172161-9)	AMP
Terminal	AMP (170359-3)	AMP
CLAMP	DELTA (34703237XX)	DELTA

Title	Part No.	L	
		mm	inch
1	ASDBCAEN0003	3000 ± 50	118 ±2
2	ASDBCAEN0005	5000 ± 50	197 ± 2

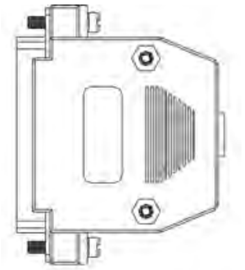
Delta Part Number: ASDBCAEN1003／1005



Title	Part No.	Straight	L	
			mm	inch
1	ASDBCAEN1003	3106A-20-29S	3000 ± 50	118 ± 2
2	ASDBCAEN1005	3106A-20-29S	5000 ± 50	197 ± 2

■ I/O Signal Connector (CN1)

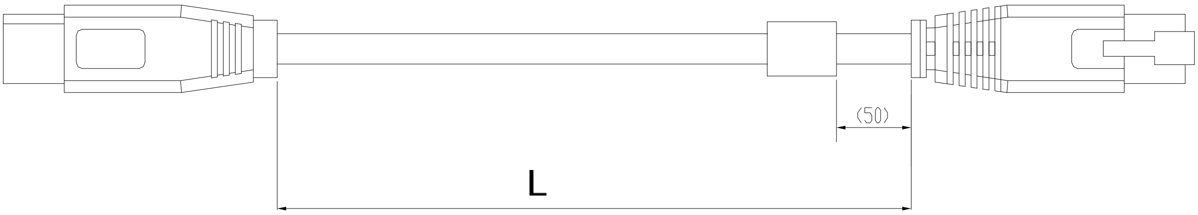
Delta Part Number: ASDBCNDS0044

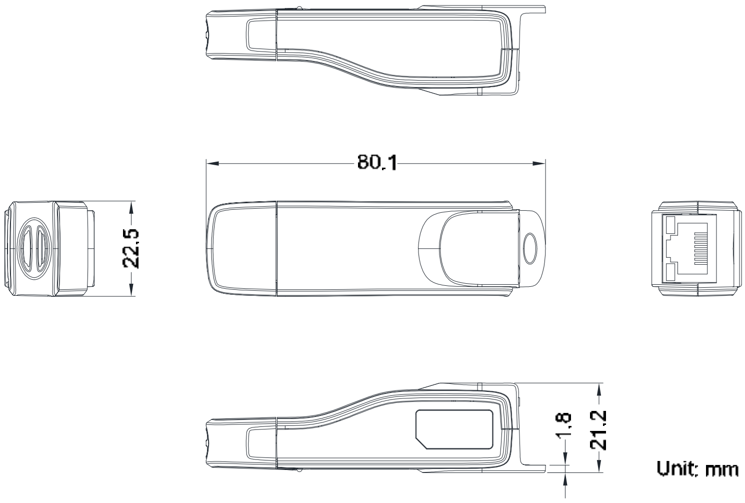


D-SUB 44 PIN PLUG

■ Communication Cable between Servo Drive and Computer (for PC)

Delta Part Number: ASD-CNUS0A08

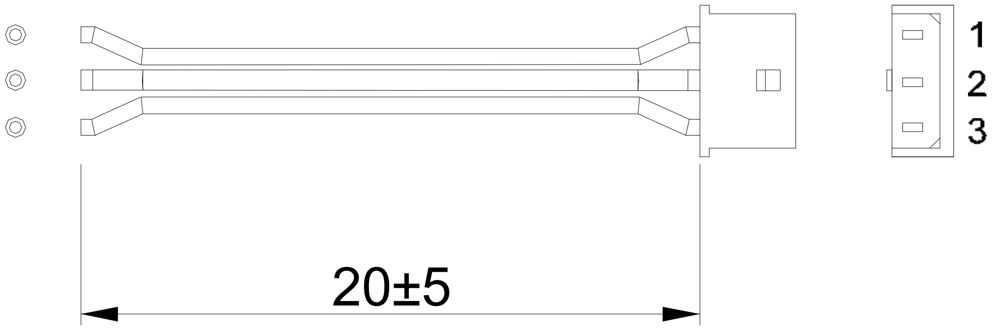




Title	Part No. : ASD-CNUS0A08	
cable	L	3000 ± 100 mm
		118 ±4 inch
connector	RJ connector	RJ-45
	USB connector	A-type (USB V2.0)

■ Voltage Output Cable (Analog Signal)

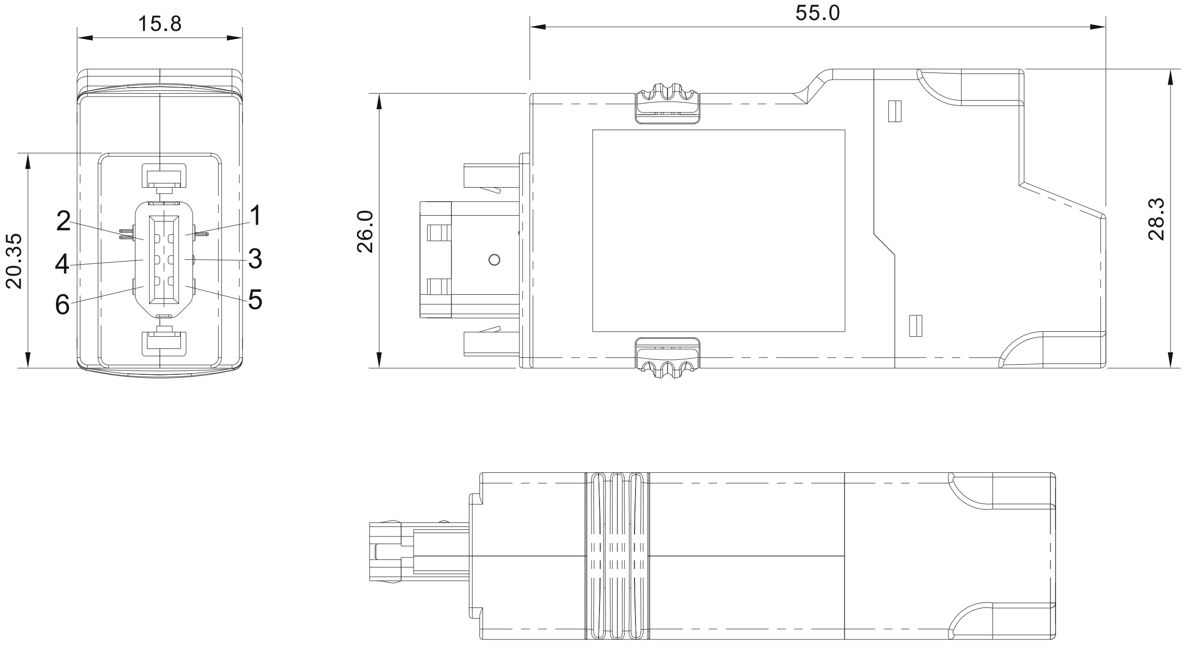
Delta Serial Number: 3864471800



Title	Part No.	Manufacturer
Housing	A2004H00-3P	JWT
Terminal	A2004TOP-2	JWT

■ RS-485 Connector

Delta Part Number: ASD-CNIE0B06



■ Servo Drive, Servo Motor and Accessories Combinations

100W Servo Drive and 100W Low Inertia Servo Motor

Servo Drive	ASD-B2-0121-B
Low inertia Servo Motor	ECMA-C△0401□S
Motor Power Cable (Without Brake)	ASDBCAPW020X
Power Connector (Without Brake)	ASDBCAPW0000
Motor Power Cable (With Brake)	ASDBCAPW030X
Power Connector (With Brake)	ASDBCAPW0100
Encoder Cable	ASDBCAEN000X
Encoder Connector	ASDBCAEN0000

(X=3 means 3m; X=5 means 5m)

200W Servo Drive and 200W Low Inertia Servo Motor

Servo Drive	ASD-B2-0122-B
Low inertia Servo Motor	ECMA-C△0602□S
Motor Power Cable (Without Brake)	ASDBCAPW020X
Power Connector (Without Brake)	ASDBCAPW0000
Motor Power Cable (With Brake)	ASDBCAPW030X
Power Connector (With Brake)	ASDBCAPW0100
Encoder Cable	ASDBCAEN000X
Encoder Connector	ASDBCAEN0000

(X=3 means 3m; X=5 means 5m)

400W Servo Drive and 400W Low Inertia Servo Motor

Servo Drive	ASD-B2-0421-B
Low inertia Servo Motor	ECMA-C△0604□S ECMA-C△0804□7 ECMA-CM0604PS
Motor Power Cable (Without Brake)	ASDBCAPW020X
Power Connector (Without Brake)	ASDBCAPW0000
Motor Power Cable (With Brake)	ASDBCAPW030X

Power Connector (With Brake)	ASDBCAPW0100
Encoder Cable	ASDBCAEN000X
Encoder Connector	ASDBCAEN0000

(X=3 means 3m; X=5 means 5m)

400W Servo Drive and 500W Medium Inertia Servo Motor

Servo Drive	ASD-B2-0421-B
Medium inertia Servo Motor	ECMA-E△1305□S
Motor Power Cable (Without Brake)	ASDBCAPW120X
Motor Power Cable (With Brake)	ASDBCAPW130X
Power Connector	ASD-CAPW1000
Increment Encoder Cable	ASDBCAEN100X
Encoder Connector	ASDBCAEN1000

(X=3 means 3m; X=5 means 5m)

400W Servo Drive and 300W High Inertia Servo Motor

Servo Drive	ASD-B2-0421-B
High inertia Servo Motor	ECMA-G△1303□S
Motor Power Cable (Without Brake)	ASDBCAPW120X
Motor Power Cable (With Brake)	ASDBCAPW130X
Power Connector	ASD-CAPW1000
Encoder Cable	ASDBCAEN100X
Encoder Connector	ASDBCAEN1000

(X=3 means 3m; X=5 means 5m)

750W Servo Drive and 750W Low Inertia Servo Motor

Servo Drive	ASD-B2-0721-B
Low inertia Servo Motor	ECMA-C△0807□S ECMA-C△0907□S
Motor Power Cable (Without Brake)	ASDBCAPW020X
Power Connector (Without Brake)	ASDBCAPW0000
Motor Power Cable (With Brake)	ASDBCAPW030X
Power Connector (With Brake)	ASDBCAPW0100

Encoder Cable	ASDBCAEN000X
Encoder Connector	ASDBCAEN0000

(X=3 means 3m; X=5 means 5m)

750W Servo Drive and 600W High Inertia Servo Motor

Servo Drive	ASD-B2-0721-B
High inertia Servo Motor	ECMA-G△1306□S ECMA-GM1306PS
Motor Power Cable (Without Brake)	ASDBCAPW120X
Motor Power Cable (With Brake)	ASDBCAPW130X
Power Connector	ASD-CAPW1000
Encoder Cable	ASDBCAEN100X
Encoder Connector	ASDBCAEN1000

(X=3 means 3m; X=5 means 5m)

1kW Servo Drive and 1kW Low Inertia Servo Motor

Servo Drive	ASD-B2-1021-B
Low inertia Servo Motor	ECMA-C△1010□S
Motor Power Cable (Without Brake)	ASDBCAPW120X
Motor Power Cable (With Brake)	ASDBCAPW130X
Power Connector	ASD-CAPW1000
Encoder Cable	ASDBCAEN100X
Encoder Connector	ASDBCAEN1000

(X=3 means 3m; X=5 means 5m)

1kW Servo Drive and 1kW Low Inertia Servo Motor

Servo Drive	ASD-B2-1021-B
Low inertia Servo Motor	ECMA-C△0910□S
Motor Power Cable (Without Brake)	ASDBCAPW020X
Power Connector (Without Brake)	ASDBCAPW0000
Motor Power Cable (With Brake)	ASDBCAPW030X
Power Connector (With Brake)	ASDBCAPW0100
Encoder Cable	ASDBCAEN000X
Encoder Connector	ASDBCAEN0000

(X=3 means 3m; X=5 means 5m)

1kW Servo Drive and 1kW Medium Inertia Servo Motor

Servo Drive	ASD-B2-1021-B
Medium inertia Servo Motor	ECMA-C△1310□S
Motor Power Cable (Without Brake)	ASDBCAPW120X
Motor Power Cable (With Brake)	ASDBCAPW130X
Power Connector	ASD-CAPW1000
Encoder Cable	ASDBCAEN100X
Encoder Connector	ASDBCAEN1000

(X=3 means 3m; X=5 means 5m)

1kW Servo Drive and 900W High Inertia Servo Motor

Servo Drive	ASD-B2-1021-B
High Inertia Servo Motor	ECMA-G△1309□S ECMA-GM1309PS
Motor Power Cable (Without Brake)	ASDBCAPW120X
Motor Power Cable (With Brake)	ASDBCAPW130X
Power Connector	ASD-CAPW1000
Encoder Cable	ASDBCAEN100X
Encoder Connector	ASDBCAEN1000

(X=3 means 3m; X=5 means 5m)

1.5kW Servo Drive and 1.5kW Medium Inertia Servo Motor

Servo Drive	ASD-B2-1521-B
Medium Inertia Servo Motor	ECMA-E△1315□S
Motor Power Cable (Without Brake)	ASDBCAPW120X
Motor Power Cable (With Brake)	ASDBCAPW130X
Power Connector	ASD-CAPW1000
Encoder Cable	ASDBCAEN100X
Encoder Connector	ASDBCAEN1000

(X=3 means 3m; X=5 means 5m)

2kW Servo Drive and 2kW Low Inertia Servo Motor

Servo Drive	ASD-B2-2023-B
Low Inertia Servo Motor	ECMA-C△1020□S
Motor Power Cable (Without Brake)	ASDBCAPW120X
Motor Power Cable (With Brake)	ASDBCAPW130X
Power Connector	ASD-CAPW1000
Encoder Cable	ASDBCAEN100X
Encoder Connector	ASDBCAEN1000

(X=3 means 3m; X=5 means 5m)

2kW Servo Drive and 2kW Medium Inertia Servo Motor

Servo Drive	ASD-B2-2023-B
Medium Inertia Servo Motor	ECMA-E△1320□S
Motor Power Cable (Without Brake)	ASDBCAPW120X
Motor Power Cable (With Brake)	ASDBCAPW130X
Power Connector	ASD-CAPW1000
Encoder Cable	ASDBCAEN100X
Encoder Connector	ASDBCAEN1000

(X=3 means 3m; X=5 means 5m)

2kW Servo Drive and 2kW Medium Inertia Servo Motor

Servo Drive	ASD-B2-2023-B
Medium Inertia Servo Motor	ECMA-E△1820□S
Motor Power Cable (Without Brake)	ASD-CAPW220X
Motor Power Cable (With Brake)	ASD-CAPW230X
Power Connector	ASD-CAPW2000
Encoder Cable	ASDBCAEN100X
Encoder Connector	ASDBCAEN1000

(X=3 means 3m; X=5 means 5m)

3kW Servo Drive and 3kW Medium Inertia Servo Motor

Servo Drive	ASD-B2-3023-B
Medium Inertia Servo Motor	ECMA-E△1830□S
Motor Power Cable (Without Brake)	ASD-CAPW220X
Motor Power Cable (With Brake)	ASD-CAPW230X
Power Connector	ASD-CAPW2000
Encoder Cable	ASDBCAEN100X
Encoder Connector	ASDBCAEN1000

(X=3 means 3m; X=5 means 5m)

3kW Servo Drive and 3kW Medium/High Inertia Servo Motor

Servo Drive	ASD-B2-3023-B
Medium/High Inertia Servo Motor	ECMA-F△1830□S
Motor Power Cable (Without Brake)	ASD-CAPW220X
Motor Power Cable (With Brake)	ASD-CAPW230X
Power Connector	ASD-CAPW2000
Encoder Cable	ASDBCAEN100X
Encoder Connector	ASDBCAEN1000

(X=3 means 3m; X=5 means 5m)

Other Accessories (for ASDA-B2 series all models)	
Description	Delta Part Number
Communication Cable between Servo Drive and Computer (for PC)	ASD-CARS0003
Regenerative Resistor 400W 100Ω	BR400W040
Regenerative Resistor 1kW 1000Ω	BR1K0W020

NOTE

1) (□) at the ends of the servo drive model names are for optional configurations (Full closed-loop, CANopen and extension DI port). For the actual model name, please refer to the ordering information of the actual purchased product.
2) (△) in the model of servo motor indicates the encoder mode. △ =1: increment, 20-bit; △ =2: increment, 17-bit.
3) (□) in the servo motor model names are for optional configurations (keyway, brake and oil seal).

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Appendix B Maintenance and Inspection

Delta AC servo drives are based on solid state electronics technology. Preventive maintenance is required to operate this AC servo drives in its optimal condition, and to ensure a long life. It is recommended to perform a periodic maintenance and inspection of the AC servo drive by a qualified technician. Before any maintenance and inspection, always turn off the AC input power to the unit.

WARNING

- ***Be sure to disconnect AC power and ensure that the internal capacitors have fully discharged before performing the maintenance and inspection!***

Basic Inspection

After power is in connected to the AC servo drive, the charge LED will be lit which indicates that the AC servo drive is ready.

Item	Content
General Inspection	● Periodically inspect the screws of the servo drive, motor shaft, terminal block and the connection to mechanical system. Tighten screws as necessary as they may loosen due to vibration and varying temperatures. ● Ensure that oil, water, metallic particles or any foreign objects do not fall inside the servo drive, motor, control panel or ventilation slots and holes. As these will cause damage. ● Ensure the correct installation and the control panel. It should be free from airborne dust, harmful gases or liquids. ● Ensure that all wiring instructions and recommendations are followed; otherwise damage to the drive and or motor may result.
Inspection before operation (Control power is not applied)	● Inspect the servo drive and servo motor to insure they were not damaged. ● To avoid an electric shock, be sure to connect the ground terminal of servo drive to the ground terminal of control panel. ● Before making any connection, wait 10 minutes for capacitors to discharge after the power is disconnected, alternatively, use an appropriate discharge device to discharge. ● Ensure that all wiring terminals are correctly insulated. ● Ensure that all wiring is correct or damage and or malfunction may result. ● Visually check to ensure that there are not any unused screws, metal strips, or any conductive or inflammable materials inside the drive.

Item	Content
	● Never put inflammable objects on servo drive or close to the external regenerative resistor. ● Make sure control switch is OFF. ● If the electromagnetic brake is being used, ensure that it is correctly wired.
Inspection before operation (Control power is not applied)	● If required, use an appropriate electrical filter to eliminate noise to the servo drive. ● Ensure that the external applied voltage to the drive is correct and matched to the controller.
Inspection during operation (Control power is applied)）	● Ensure that the cables are not damaged, stressed excessively or loaded heavily. When the motor is running, pay close attention on the connection of the cables and notice that if they are damaged, frayed or over extended. ● Check for abnormal vibrations and sounds during operation. If the servo motor is vibrating or there are unusual noises while the motor is running, please contact the dealer or manufacturer for assistance. ● Ensure that all user-defined parameters are set correctly. Since the characteristics of various machinery are different, in order to avoid accident or cause damage, do not adjust the parameter abnormally and ensure the parameter setting is not an excessive value. ● Ensure to reset some parameters when the servo drive is off (Please refer to Chapter 7). Otherwise, it may result in malfunction. ● If there is no contact sound or there be any unusual noises when the relay of the servo drive is operating, please contact your distributor for assistance or contact with Delta. ● Check for abnormal conditions of the power indicators and LED display. If there is any abnormal condition of the power indicators and LED display, please contact your distributor for assistance or contact with Delta.

Maintenance

- Use and store the product in a proper and normal environment.
- Periodically clean the surface and panel of servo drive and motor.
- Make sure the conductors or insulators are corroded and/or damaged.
- Do not disassemble or damage any mechanical part when performing maintenance.
- Clean off any dust and dirt with a vacuum cleaner. Place special emphasis on cleaning the ventilation ports and PCBs. Always keep these areas clean, as accumulation of dust and dirt can cause unforeseen failures.

Life of Replacement Components

- **Smooth capacitor**

  The characteristics of smooth capacitor would be deteriorated by ripple current affection. The life of smooth capacitor varies according to ambient temperature and operating conditions. The common guaranteed life of smooth capacitor is ten years when it is properly used in normal air-conditioned environment.

- **Relay**

  The contacts will wear and result in malfunction due to switching current. The life of relay varies according to power supply capacity. Therefore, the common guaranteed life of relay is cumulative 100,000 times of power on and power off.

- **Cooling fan**

  The cooling fan life is limited and should be changed periodically. The cooling fan will reach the end of its life in 2~3 years when it is in continuous operation. However, it also must be replaced if the cooling fan is vibrating or there are unusual noises.

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