Lexium 23A
AC servo drive

Product manual

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www.schneider-electric.cn

Schneider Electric

Important information

This manual is part of the product.
Carefully read this manual and observe all instructions.
Keep this manual for future reference.
Hand this manual and all other pertinent product documentation over to all users of the product.
Carefully read and observe all safety instructions and the chapter "2. Before you begin - safety information".

Some products are not available in all countries.
For information on the availability of products, please consult the catalog.
Subject to technical modifications without notice.
All details provided are technical data which do not constitute warranted qualities.
Most of the product designations are registered trademarks of their respective owners, even if this is not explicitly indicated.

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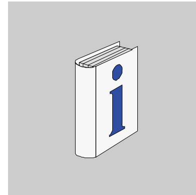
About this manual



This manual is valid for LXM23A servo drives and corresponding BCH motors. It describes the technical data, installation, commissioning and the operating modes and functions. Chapter 1 "Introduction" lists the type code for these products.

Work steps

If work steps must be performed consecutively, this sequence of steps is represented as follows:

■ Special prerequisites for the following work steps
▶ Step 1
◁ Specific response to this work Lexium 23Astep
▶ Step 2

If a response to a work step is indicated, this allows you to verify that the work step has been performed correctly.
Unless otherwise stated, the individual steps must be performed in the specified sequence.

Making work easier

Information on making work easier is highlighted by this symbol:
Sections highlighted this way provide supplementary information on making work easier.

SI units

SI units are the original values. Converted units are shown in brackets behind the original value; they may be rounded.
Example:
Minimum conductor cross section: 1.5 mm^2 (AWG 14)

Introduction

1

At a Glance

What's in this Chapter?

This chapter contains the following topics:

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 Section1.5 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 Schneider Electric sales representative.
A complete and workable AC servo system should include the following parts:

Part I : Schneider Electric standard supplied parts
(1) Servo drive Lexium 23A
(2) Servo motor Lexium BCH
(3) 5 PIN Terminal Block for L1, L2, R, S, T (available for 100W ~ 1.5kW models)
(4) 3 PIN Terminal Block "motor" for U,V,W (available for 100W ~ 1.5kW models)
(5) 4 PIN Terminal Block "CN5" for PA/+, PBi, PBe,PC/- (available for 100W ~ 1.5kW models)
(6) One operating lever (for wire to terminal block insertion) available for 100W ~1.5kW models)
(7) One jumper bar (installed at CN5, pins PA/+ and PBi)
(8) Instruction Sheets (Traditional Chinese, Simplified Chinese and English version)

Part II : Optional parts (Refer to chapter 12)
(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: 50 PIN connector, IO interface (3M type)
(4) CN2: 6 PIN connector (IEEE1394 type), motor encoder interface
(5) CN3: RJ45 connector, serial communication interface for drive set-up
(6) CN4: two RJ45 connectors, CANopen and CANmotion interface

1.2 Device overview

The Lexium 23 Plus product family consists of two servo drive models that cover different application areas. Together with Lexium BCH servo motors as well as a comprehensive range of options and accessories, the drives are ideally suited to implement compact, high-performance drive solutions for a wide range of power requirements.

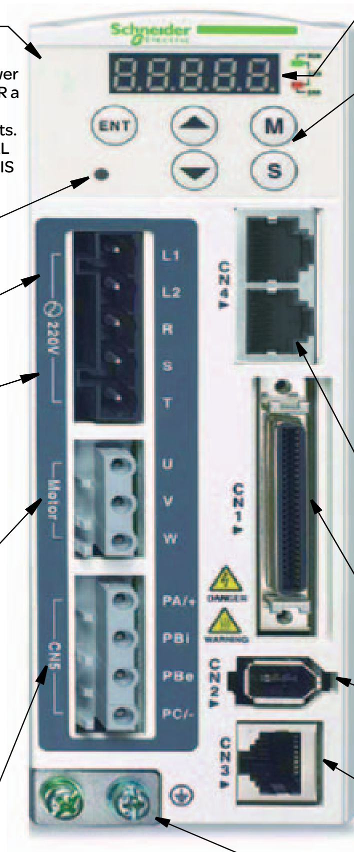
Lexium servo drive LXM23A

This product manual describes the LXM23A servo drive.

Overview of some of the features of the LXM23A servo drive:

- CANopen and CANmotion field bus interface to access all parameters and to control all operation modes of the servo drive
- The product is commissioned via the integrated HMI or a PC with commissioning software.
- Operating modes Jog, Position control mode,Speed Control,Torque control,Switching mode.

1.3 Components and interfaces



Heatsink
Used to secure servo drive and for heat dissipation

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 in chapter 2).

Control Circuit Terminal (L1, L2)
Used to connect 200~230Vac, 50/60Hz 1-phase/3-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 therminal 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 PA/+ and PBe to the regenerative resistor and ensure that the circuit between PA/+ and PBi is open.
2) When using theinternal regenerative resistor, ensure that the circuit between PA/+ and PBi is closed and the circuit between PA/+ and PBe is open.

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:

- M : Press this key to select/ change mode
- S : Shift Key has several functions: moving the cursor and indexing through the parameter groups. Press this key to shift cursor to the left
- ▲ : Press this key to increase values on the display
- ▼ : Press this key to decrease values on the display
- ENT : Press this key to store data

Field bus communication interface CANopen and CANmotion

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

Encoder Interface
Used to connect Encoder of Servo Motor

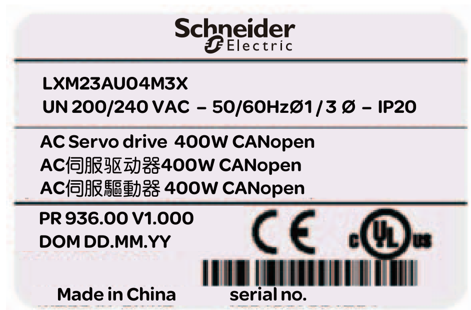
Serial Communication Interface
For RS-485/232 serial communication for drive set-up. Used to connect personal computer or other controllers

Ground Terminal

1.4 Nameplate information

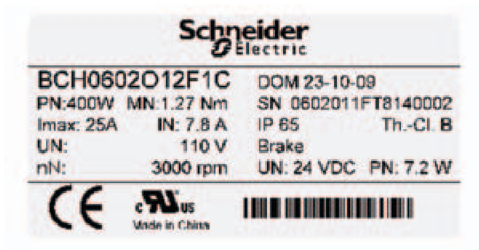
Lexium 23 Series Servo Drive

- Nameplate Explanation



BCH Series Servo Motor

- Nameplate Explanation



1.5 Type code

Lexium 23 Plus drive commercial reference

L	X	M	2	3	A	U	0	1	M	3	X

LXM = Lexium Servo Drive

23 = Product series

Interface
A = CANopen
D = I/O

Continuous Power
U01 = 0.1 KW
U02 = 0.2 KW
U04 = 0.4 KW
U07 = 0.75 KW
U10 = 1 KW
U15 = 1.5 KW
U20 = 2 KW
U30 = 3.0 kW
U45 = 4.5 kW
U55 = 5.5 kW
U75 = 7.5 kW

Mains voltage
M3X = 200/240VAC 3-phases (or single phase depending on caliber), no EMC filter

BCH motor commercial reference

B	C	H	0	4	0	1	O	0	2	A	1	C

BCH = BCH servo motor series

Flange size
040 = 40 mm Flange
060 = 60 mm Flange
080 = 80 mm Flange
100 = 100 mm Flange
130 = 130 mm Flange
180 = 180 mm Flange

Length (Number of stacks)
1 = one stack
2 = two stacks
3 = three stacks
4 = four stacks
5 = five stacks

Speed type
M = Low Speed (1000/1500 rpm)
N = Medium Speed (2000 rpm)
O = High Speed (3000 rpm)

Shaft
0 = w/o key (smooth) :No Oil Seal (IP40 for shaft end)
1 = with key : No Oil Seal (IP40 for shaft end)
2 = w/o key (smooth) : With Oil seal (IP65 for shaft end)
3 = with key: Oil Seal (IP65 for shaft end)

Encoder
2 = High resolution incremental encoder 20 Bits

Brake
A = w/o brake
F = with brake

Connection System
1 = flying leeds (for BCH 040, 060, 080), military connector (for BCH 100, 130, 180)

Mount
C = mechanical mount: Asian standard

1.6 Servo Drive and Servo Motor Combinations

Lexium 23 Plus servo drive / BCH servo motor combination

BCH servo motor output power	BCH servo motor inertia (without brake)	Rated torque	Peak stall torque	Maximum speed	Rated speed	Combination		
						Servo drive Reference	Servo motor Reference	Motor inertia type
kW	kgcm^2	Nm	Nm	rpm	rpm			
Single phase: 200...255 V ∿ 50/60 Hz or three phase : 170...255 V ∿ 50/60 Hz								
0.1	0.037	0.32	0.96	5000	3000	**LXM23●U01M3X**	**BCH0401O●2●1C**	ultra low
0.2	0.177	0.64	1.92	5000	3000	**LXM23●U02M3X**	**BCH0601O●2●1C**	ultra low
0.3	8.17	2.86	8.59	2000	1000	**LXM23●U04M3X**	**BCH1301M●2●1C**	medium
0.4	0.277	1.27	3.82	5000	3000	**LXM23●U04M3X**	**BCH0602O●2●1C**	ultra low
0.4	0.68	1.27	3.82	5000	3000	**LXM23●U04M3X**	**BCH0801O●2●1C**	low
0.5	8.17	2.39	7.16	3000	2000	**LXM23●U04M3X**	**BCH1301N●2●1C**	medium
0.6	8.41	5.73	17.19	2000	1000	**LXM23●U07M3X**	**BCH1302M●2●1C**	medium
0.75	1.13	2.39	7.16	5000	3000	**LXM23●U07M3X**	**BCH0802O●2●1C**	low
0.9	11.18	8.59	25.78	2000	1000	**LXM23●U10M3X**	**BCH1303M●2●1C**	medium
1	2.65	3.18	9.54	5000	3000	**LXM23●U10M3X**	**BCH1001O●2●1C**	low
1	11.18	4.77	14.32	3000	2000	**LXM23●U10M3X**	**BCH1302N●2●1C**	medium
1.5	11.18	7.16	21.48	3000	2000	**LXM23●U15M3X**	**BCH1303N●2●1C**	medium
Three phase : 170...255 V ∿ 50/60 Hz								
2	4.45	6.37	19.11	5000	3000	**LXM23●U20M3X**	**BCH1002O●2●1C**	low
2	14.59	9.55	26.65	3000	2000	**LXM23●U20M3X**	**BCH1304N●2●1C**	medium
2	34.68	9.55	26.65	3000	2000	**LXM23●U20M3X**	**BCH1801N●2●1C**	high
3	54.95	14.32	42.96	3000	2000	**LXM23●U30M3X**	**BCH1802N●2●1C**	high
3	54.95	19.10	57.29	3000	1500	**LXM23●U30M3X**	**BCH1802M●2●1C**	high
3.5	54.8	16.71	50.31	3000	2000	**LXM23●U45M3X**	BCH1803N●2●1C	high
4.5	77.75	28.65	71.62	3000	1500	**LXM23●U45M3X**	BCH1803M●2●1C	high
5.5	99.78	35.01	87.53	3000	1500	**LXM23●U55M3X**	BCH1804M●2●1C	high
7.5	142.7	47.74	119.36	3000	1500	**LXM23●U75M3X**	BCH1805M●2●1C	high

Before you begin - safety information

2

At a Glance

What's in this Chapter?

This chapter contains the following topics:

2.1 Qualification of personnel

Only appropriately trained persons who are familiar with and understand the contents of this manual and all other pertinent product documentation are authorized to work on and with this product. In addition, these persons must have received safety training to recognize and avoid hazards involved. These persons must have sufficient technical training, knowledge and experience and be able to foresee and detect potential hazards that may be caused by using the product, by changing the settings and by the mechanical, electrical and electronic equipment of the entire system in which the product is used.

All persons working on and with the product must be fully familiar with all applicable standards, directives, and accident prevention regulations when performing such work.

2.2 Intended use

This product is a drive for 3-phase servo motors and intended for industrial use according to this manual.
The product may only be used in compliance with all applicable safety regulations and directives, the specified requirements and the technical data.
Prior to using the product, you must perform a risk assessment in view of the planned application. Based on the results, the appropriate safety measures must be implemented.
Since the product is used as a component in an entire system, you must ensure the safety of persons by means of the design of this entire system (for example, machine design).
Operate the product only with the specified cables and accessories. Use only genuine accessories and spare parts.
The product must NEVER be operated in explosive atmospheres (hazardous locations, Ex areas).
Any use other than the use explicitly permitted is prohibited and can result in hazards.
Electrical equipment should be installed, operated, serviced, and maintained only by qualified personnel.

2.3 Hazard categories

Safety instructions to the user are highlighted by safety alert symbols in the manual. In addition, labels with symbols and/or instructions are attached to the product that alert you to potential hazards.
Depending on the seriousness of the hazard, the safety instructions are divided into 4 hazard categories.

⚠ DANGER
DANGER indicates an imminently hazardous situation, which, if not avoided, will result in death or serious injury.

⚠ WARNING
WARNING indicates a potentially hazardous situation, which, if not avoided, can result in death, serious injury, or equipment damage.

⚠ CAUTION
CAUTION indicates a potentially hazardous situation, which, if not avoided, can result in injury or equipment damage.

CAUTION
CAUTION used without the safety alert symbol, is used to address practices not related to personal injury (e.g. can result in equipment damage).

2.4 Basic information

⚠ DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION OR ARC FLASH

- Only appropriately trained persons who are familiar with and understand the contents of this manual and all other pertinent product documentation and who have received safety training to recognize and avoid hazards involved are authorized to work on and with this drive system. Installation, adjustment, repair and maintenance must be performed by qualified personnel.
- The system integrator is responsible for compliance with all local and national electrical code requirements as well as all other applicable regulations with respect to grounding of all equipment.
- Many components of the product, including the printed circuit board, operate with mains voltage. Do not touch. Only use electrically insulated tools.
- Do not touch unshielded components or terminals with voltage present.
- The motor generates voltage when the shaft is rotated. Prior to performing any type of work on the drive system, block the motor shaft to prevent rotation.
- AC voltage can couple voltage to unused conductors in the motor cable. Insulate both ends of unused conductors in the motor cable.
- Do not short across the DC bus terminals or the DC bus capacitors.
- Before performing work on the drive system:
  - Disconnect all power, including external control power that may be present.
  - Place a "DO NOT TURN ON" label on all power switches.
  - Lock all power switches in the open position.
  - Wait 10 minutes to allow the DC bus capacitors to discharge. Measure the voltage on the DC bus as per chapter "DC bus voltage measurement" and verify the voltage is < 42 Vdc. The DC bus LED is not an indicator of the absence of DC bus voltage.
- Install and close all covers before applying voltage.

Failure to follow these instructions will result in death or serious injury.

⚠ WARNING

UNEXPECTED MOVEMENT

Drives may perform unexpected movements because of incorrect wiring, incorrect settings, incorrect data or other errors.
Interference (EMC) may cause unpredictable responses in the system.

- Carefully install the wiring in accordance with the EMC requirements.
- Do NOT operate the product with unknown settings or data.
- Perform a comprehensive commissioning test.

Failure to follow these instructions can result in death or serious injury.

⚠ WARNING

LOSS OF CONTROL

- The designer of any control scheme must consider the potential failure modes of control paths and, for certain critical functions, provide a means to achieve a safe state during and after a path failure. Examples of critical control functions are EMERGENCY STOP, overtravel stop, power outage and restart.
- Separate or redundant control paths must be provided for critical functions.
- System control paths may include communication links. Consideration must be given to the implication of unanticipated transmission delays or failures of the link.
- Observe the accident prevention regulations and local safety guidelines. [1)]
- Each implementation of the product must be individually and thoroughly tested for proper operation before being placed into service.

Failure to follow these instructions can result in death or serious injury.

1) For USA: Additional information, refer to NEMA ICS 1.1 (latest edition), Safety Guidelines for the Application, Installation, and Maintenance of Solid State Control and to NEMA ICS 7.1 (latest edition), Safety Standards for Construction and Guide for Selection, Installation for Construction and Operation of Adjustable-Speed Drive Systems.

2.5 DC bus voltage measurement

Disconnect all power prior to starting work on the product.

⚠ DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION OR ARC FLASH

- Only appropriately trained persons who are familiar with and understand the safety instructions in the chapter "Before you begin - safety information" may perform the measurement.

Failure to follow these instructions will result in death or serious injury.

The DC bus voltage can exceed 800 Vdc. Use a properly rated voltagesensing device for measuring. Procedure:

▶ Disconnect all power.
▶ Wait 10 minutes to allow the DC bus capacitors to discharge.
▶ Measure the DC bus voltage between the DC bus terminals to verify that the voltage is < 42 Vdc.
▶ If the DC bus capacitors do not discharge properly, contact your local Schneider Electric representative. Do not repair or operate the product.

The Charge LED (DC-bus) is not an indicator of the absence of DC bus voltage.

2.6 Standards and terminology

Technical terms, terminology and the corresponding descriptions in this manual are intended to use the terms or definitions of the pertinent standards.
In the area of drive systems, this includes, but is not limited to, terms such as "safety function", "safe state", "fault", "fault reset", "failure", "error", "error message", "warning", "warning message", etc.
Among others, these standards include:

- IEC 61800 series: "Adjustable speed electrical power drive systems"
- IEC 61800-7 series: "Adjustable speed electrical power drive systems - Part 7-1: Generic interface and use of profiles for power drive systems - Interface definition"

Also see the glossary at the end of this manual.

Technical Data

3

At a Glance

Presentation

This chapter contains information on the ambient conditions and on the mechanical and electrical properties of the product family and the accessories.

What's in this Chapter?

This chapter contains the following topics:

3.1 Ambient conditions

Ambient conditions transportation and storage

The environment during transport and storage must be dry and free from dust. The maximum vibration and shock load must be within the specified limits.

Temperature	[°C]	-25 ...65

The following relative humidity is permissible during transportation and storage:

Relative humidity (non-condensing)	[%]	5 to 95

Ambient conditions for operation

The maximum permissible ambient temperature during operation depends on the mounting distances between the devices and the required power. Observe the pertinent instructions in the chapter Installation.

Ambient temperature (no icing, non-condensing)	[°C]	0 ...55 (if operating temperature is above specified range, forced cooling will be required)

The following relative humidity is permissible during operation:

Relative humidity (non-condensing)	[%]	5 to 95% RH (without condensation)

The following relative humidity is permissible during operation:

Atmospheric pressure	[kPA]	86~106

The installation altitude is defined as height above sea level.

Installation altitude above mean sea level without derating	[m]	<1000
Installation altitude above mean sea level when all of the following conditions are met: • 45°C max. ambient temperature • Reduction of the continuous power by 1% per 100m above 1000m	[m]	1000 ... 2000

Installation site and connection

For operation, the device must be mounted in a closed control cabinet. The device may only be operated with a permanently installed connection.

Pollution degree and degree ofprotection

Pollution degree		2
Degree of protection		IP 20

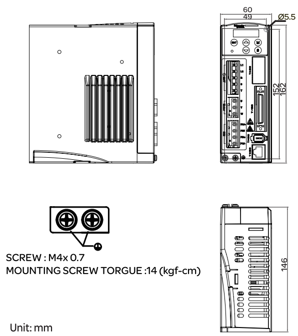
Vibration

Vibration resistance		3 mm 5m/s^2 [2..9 Hz] / 1g [9..200 Hz] < 20kg 1,5 mm 10m/s^2 [2..13 Hz] / 0,6g [13..200 Hz] 20kg ⩽ Weight ⩽ 100kg

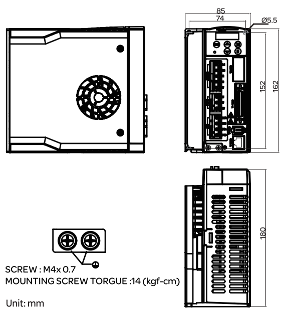
3.2 Dimensions

3.2.1 Dimensions of Servo Drive

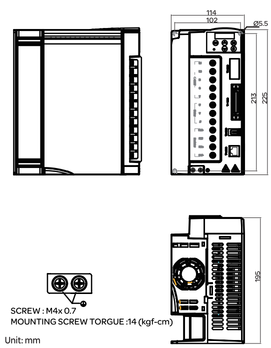
LXM23AU01M3X, LXM23AU02M3X, LXM23AU04M3X



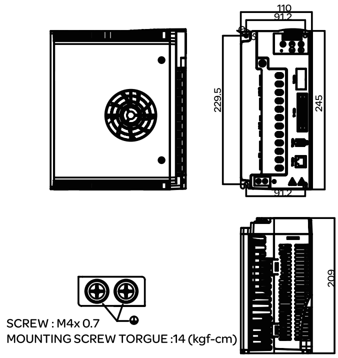
LXM23AU07M3X, LXM23AU10M3X, LXM23AU15M3X



LXM23AU20M3X,LXM23AU30M3X

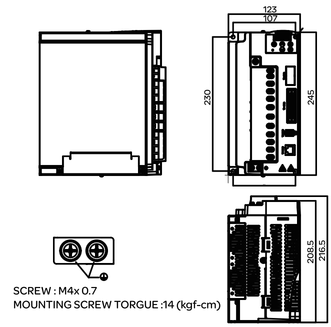


LXM23AU45M3X



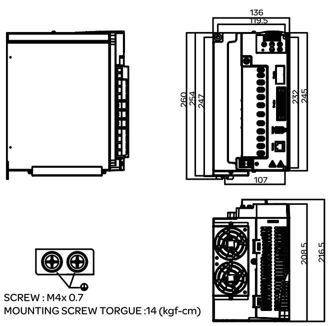
Unit: mm

LXM23AU55M3X



Unit: mm

LXM23AU75M3X

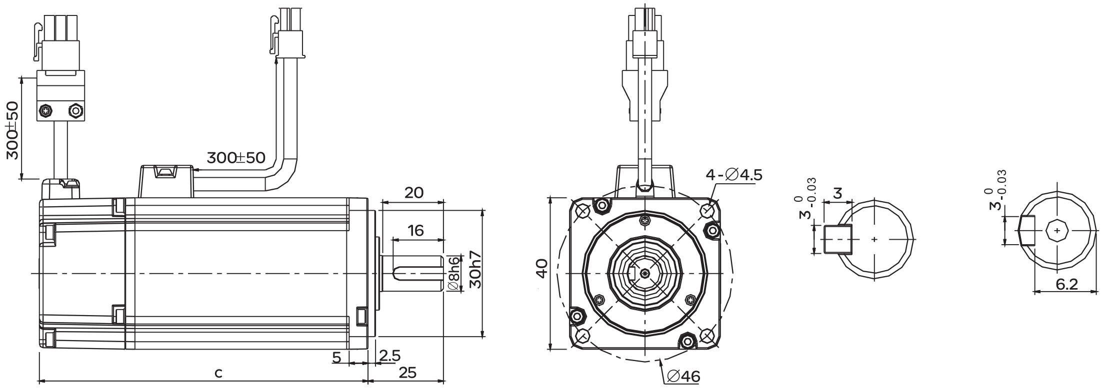


Unit: mm

3.2.2 Dimensions of Servo Motors

BCH040 (Servo motor/brake and Motor Power Connector 1 and Encoder Connector 2)

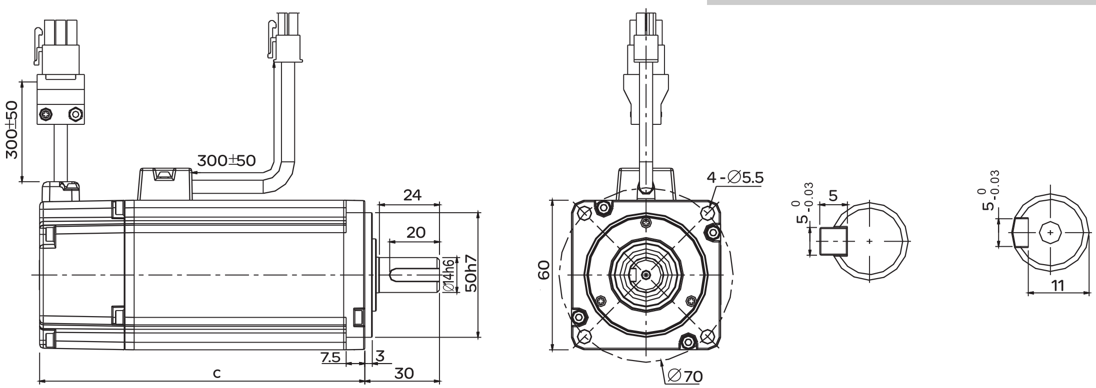
Key shaft (optional)



	c (without brake)	c (with brake)	weight (in kg) (without brake)	weight (in kg) (with brake)
BCH0401	100.6	-136.6	0.5	0.8

BCH060 (Servo motor/brake and Motor Power Connector 1 and Encoder Connector 2)

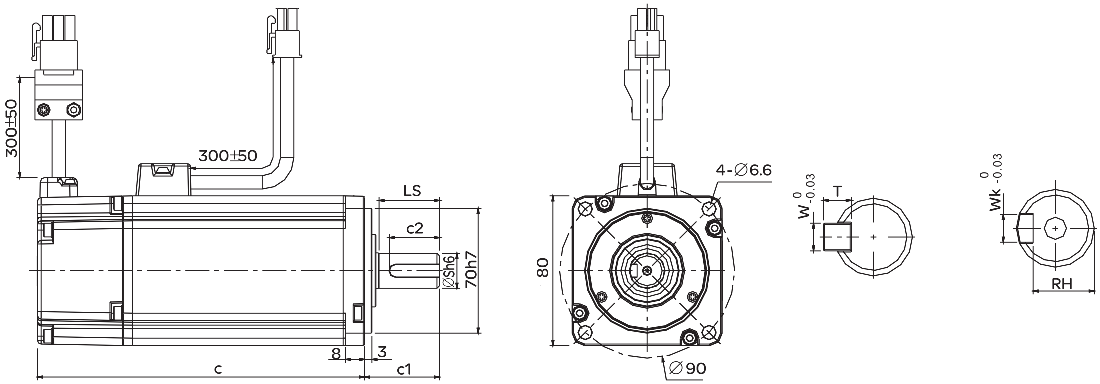
Key shaft (optional)



	c (without brake)	c (with brake)	weight (in kg) (without brake)	weight (in kg) (with brake)
BCH0601	105.5	141.6	1.2	1.5
BCH0602	130.7	166.8	1.6	2.0

BCH080 (Servo motor/brake and Motor Power Connector 1 and Encoder Connector 2)

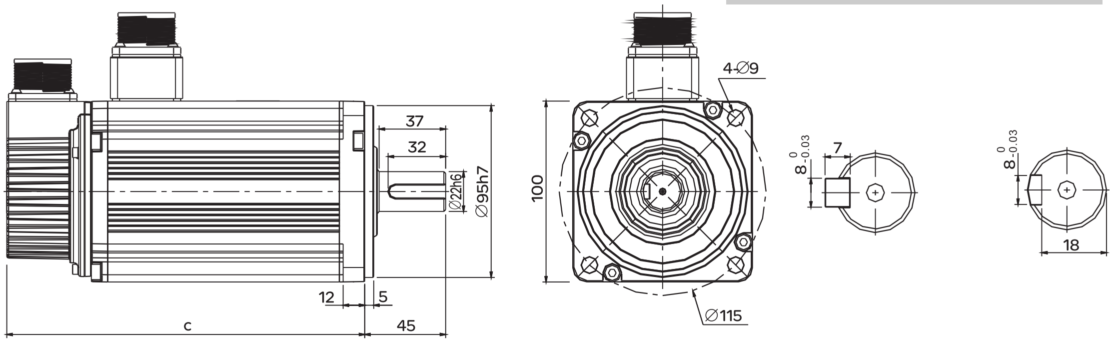
Key shaft (optional)



	c (without brake)	c (with brake)	S	c1	c2	LS	RH	Wk	W	T	weight (in kg) (without brake)	weight (in kg) (with brake)
BCH0801	112.3	152.8	14	30	20	24.5	11	5	5	5	2.1	2.9
BCH0802	138.3	178.0	19	35	25	29.5	15.5	6	6	6	3.0	3.8

BCH100 (Servo motor/brake and Motor Power Connector 1 and Encoder Connector 2)

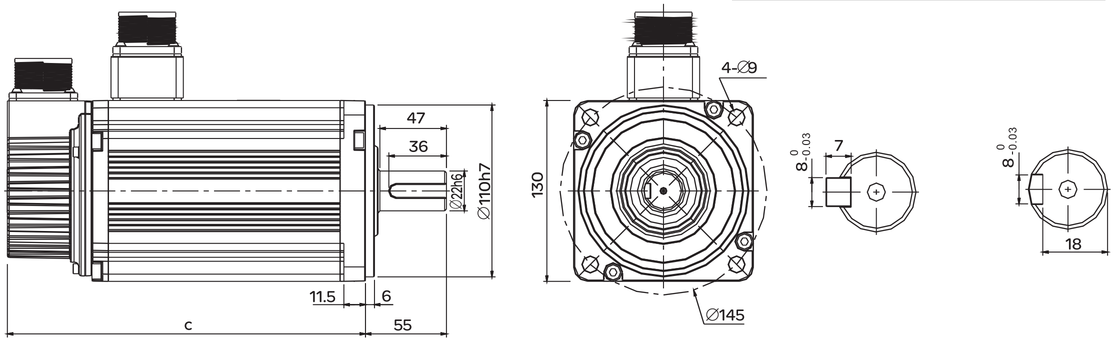
Key shaft (optional)



	c (without brake)	c (with brake)	weight (in kg) (without brake)	weight (in kg) (with brake)
BCH1001	153.5	192.5	4.3	4.7
BCH1002	199.0	226.0	6.2	7.2

BCH130 (Servo motor/brake and Motor Power Connector 1 and Encoder Connector 2)

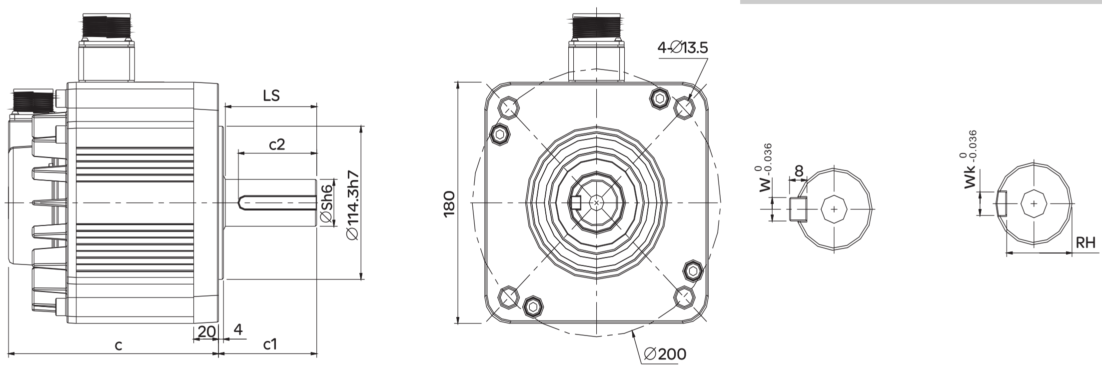
Key shaft (optional)



	c (without brake)	c (with brake)	weight (in kg) (without brake)	weight (in kg) (with brake)
BCH1301	147.5	183.5	6.8	8.2
BCH1302	147.5	183.5	7	8.4
BCH1303M	163.5	198.0	7.5	8.9
BCH1303N	167.5	202.0	7.5	8.9
BCH1304	187.5	216.0	7.8	9.2

BCH180 (Servo motor/brake and Motor Power Connector 1 and Encoder Connector 2)

Key shaft (optional)



	c (without brake)	c (with brake)	S	c1	c2	LS	RH	Wk	W	weight (in kg) (without brake)	weight (in kg) (with brake)
BCH1801	169.0	203.1	35	79	63	73	30	10	10	13.5	17.5
BCH1802N	202.1	235.3	35	79	63	73	30	10	10	18.5	22.5
BCH1802M	202.1	235.3	35	79	63	73	30	10	10	18.5	22.5

3.3 Electrical Data

The products are intended for industrial use and may only be operated with a permanently installed connection.

3.3.1 Specifications of Servo Drives (Lexium23 Plus Series)

Lexium23 Plus Series		100W	200W	400W	750W	1kW	1.5kW	2kW	3kW	4.5kW	5.5kW	7.5kW
		01	**02**	**04**	**07**	**10**	**15**	**20**	**30**	**45**	**55**	**75**
Power supply	Phase / Voltage	Three-phase or Single-phase: 220 VAC							Three-phase 220VAC,			
Power supply	Permissible Voltage Range	170 ~ 255VAC Three-phase , 200 ~ 255VAC single phase							170~255VAC Three phase			
Power supply	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	32.5 Arms	40 Arms	47.5 Arms
Cooling System		Natural Air Circulation			Fan Cooling							
Encoder Resolution / Feedback Resolution		20-bit (1 280 000 p/rev)										
Control of Main Circuit		SVPWM (Space Vector Pulse Width Modulation) Control										
Tuning Modes		Auto / Manual										
Dynamic Brake		Built-in								External		
Position Control Mode	Max. Input Pulse Frequency	Max. 500Kpps (Line driver), Max. 200Kpps (Open collector) Max. 4Mpps (Line receiver)										
Position Control Mode	Pulse Type	Pulse + Direction, A phase + B phase, CCW pulse + CW pulse										
Position Control Mode	Command Source	External pulse train (Pt mode) / Internal procedures (Pr mode)										
Position Control Mode	Smoothing Strategy	Low-pass and P-curve filter										
Position Control Mode	Electronic Gear	Electronic gear N/M multiple N: 1~32767, M: 1:32767 (1/50<N/M<25600)										
Position Control Mode	Torque Limit Operation	Set by parameters										
Position Control Mode	Feed Forward Compensation	Set by parameters										
Speed Control Mode	Analog Input Command: Voltage Range	0 ~ ± 10 VDC										
Speed Control Mode	Analog Input Command: Input Resistance	10KΩ										
Speed Control Mode	Analog Input Command: Time Constant	2.2 µs										
Speed Control Mode	Speed Control Range *1	1:5000									1:3000	
Speed Control Mode	Command Source	External analog signal / Internal parameters										
Speed Control Mode	Smoothing Strategy	Low-pass and S-curve filter										
Speed Control Mode	Torque Limit Operation	Set by parameters or via analog input										
Speed Control Mode	Frequency Response Characteristic	Maximum 1kHz										
Speed Control Mode	Speed Accuracy *2 (at rated rotation speed)	0.01% or less at 0 to 100% load fluctuation										
Speed Control Mode	Speed Accuracy *2 (at rated rotation speed)	0.01% or less at ± 10% power fluctuation										
Speed Control Mode	Speed Accuracy *2 (at rated rotation speed)	0.01% or less at 0 oC to 50 oC ambient temperature fluctuation										

<table>
<tr><th colspan="3" rowspan="2">Lexium23 Plus</th><th>100W</th><th>200W</th><th>400W</th><th>750W</th><th>1kW</th><th>1.5kW</th><th>2kW</th><th>3kW</th><th>4.5kW</th><th>5.5kW</th><th>7.5kW</th></tr>
<tr><th>01</th><th>02</th><th>04</th><th>07</th><th>10</th><th>15</th><th>20</th><th>30</th><th>45</th><th>55</th><th>75</th></tr>
<tr><td rowspan="7">Torque Control Mode</td><td rowspan="3">Analog Input Command</td><td>Voltage Range</td><td colspan="11">0 ~ ± 10 VDC</td></tr>
<tr><td>Input Resistance</td><td colspan="11">10KΩ</td></tr>
<tr><td>Time Constant</td><td colspan="11">2.2 μs</td></tr>
<tr><td colspan="2">Command Source</td><td colspan="11">External analog signal / Internal parameters</td></tr>
<tr><td colspan="2">Smoothing Strategy</td><td colspan="11">Low-pass filter</td></tr>
<tr><td colspan="2">Speed Limit Operation</td><td colspan="11">Set by parameters or via analog input</td></tr>
<tr><td colspan="2">Analog Monitor Output</td><td colspan="11">Monitor signal can set by parameters (Output voltage range: ± 8V)</td></tr>
<tr><td colspan="2" rowspan="3">Digital Inputs/Outputs</td><td>Inputs</td><td colspan="11">Servo On, Reset, Gain switching, Pulse clear, Zero speed CLAMP, Command input reverse control, Command triggered, Speed/Torque limit enabled, Position command selection, Motor stop, Speed Position Selection, Position / Speed mode switching, Speed / Torque mode switching, Torque / Position mode switching, Pt / Pr command switching, Emergency stop, Forward / Reverse inhibit limit, Reference "Home" sensor, Forward / Reverse operation torque limit, Move to "Home", Forward / Reverse JOG input, Event trigger Pr command, Electronic gear ratio (Numerator) selection and Pulse inhibit input.</td></tr>
<tr><td rowspan="2">Outputs</td><td colspan="11">Encoder signal output (A, B, Z Line Driver and Z Open Collector)</td></tr>
<tr><td colspan="11">Servo ready, Servo On, At Zero speed, At Speed reached, At Positioning completed, At Torques limit, Servo alarm (Servo fault) activated, Electromagnetic brake control, Homing completed, Output overload warning, Servo warning activated, Position command overflow, Forward / Reverse software limit, Internal position command completed, Capture operation completed output., Motion control completed output.</td></tr>
<tr><td colspan="3">Protective Functions</td><td colspan="11">Overcurrent, Overvoltage, Undervoltage, Motor overheated, Regeneration error, Overload, Overspeed, Abnormal pulse control command, Excessive deviation, Encoder error, Adjustment error, Emergency stop activated, Reverse/ Forward limit switch error, Serial communication error, Input power phase loss, Serial communication time out, short circuit protection of U, V, W,</td></tr>
<tr><td colspan="3">Communication Interface</td><td colspan="11">RS-232(for PC) / RS-485 / CANopen /</td></tr>
<tr><td rowspan="3">Environment</td><td colspan="2">Installation Site</td><td colspan="11">Indoor location (free from direct sunlight), no corrosive liquid and gas (far away from oil mist, flammable gas, dust)</td></tr>
<tr><td colspan="2">Power System</td><td colspan="11">TN System*3</td></tr>
<tr><td colspan="2">Approvals</td><td colspan="11">IEC/EN 61800-5-1, UL 508C, C-tick</td></tr>
</table>

Footnote:

*1 During full load, the speed ratio is defined as min. speed (no go and stop)/rated speed.

*2 When command is rated speed, speed fluctuation rate is defined as (empty load speed -full load speed)/rated speed.

*3 TN system: A power distribution 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 3.3.4 "Overload Characteristics".

3.3.2 Specifications of Servo Motors

Ultra low/low Inertia Series

BCH Series	BCH 0401O	BCH 0601O	BCH 0602O	BCH 0801O	BCH 0802O	BCH 1001O	BCH 1002O
Rated output power (kW)	0.1	0.2	0.4	0.4	0.75	1.0	2.0
Rated torque (Nm)	0.32	0.64	1.27	1.27	2.39	3.18	6.37
Maximum torque (Nm)	0.96	1.92	3.82	3.82	7.16	9.54	19.11
Rated speed (rpm)	3000						
Maximum speed (rpm)	5000						
Rated current (A)	0.9	1.55	2.6	2.6	5.1	7.3	12.05
Maximum current (A)	2.7	4.65	7.8	7.8	15.3	21.9	36.15
Power rating (kW/s)	27.7	22.4	57.6	24.0	50.4	38.1	90.6
Rotor moment of inertia (kg.cm^2) (without brake)	0.037	0.177	0.277	0.68	1.13	2.65	4.45
Mechanical time constant (ms)	0.75	0.80	0.53	0.74	0.63	0.74	0.61
Torque constant-KT (Nm/A)	0.36	0.41	0.49	0.49	0.47	0.43	0.53
Voltage constant-KE (mV/(rpm))	13.6	16	17.4	18.5	17.2	16.8	19.2
Armature resistance (Ohm)	9.3	2.79	1.55	0.93	0.42	0.20	0.13
Armature inductance (mH)	21	12.07	6.71	7.39	3.53	1.81	1.50
Electrical time constant (ms)	2.58	4.3	4.3	7.96	8.37	9.3	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	4.3	6.2
Weight (kg) (with brake)	0.8	1.5	2.0	2.9	3.8	4.7	7.2
Max. radial shaft load (N)	78.4	196	196	245	245	490	490
Max. thrust shaft load (N)	39.2	68	68	98	98	98	98
Power rating (kW/s) (with brake)	25.6	21.3	53.8	22.1	48.4	30.4	82
Rotor moment of inertia (kg.cm^2) (with brake)	0.04	0.192	0.30	0.73	1.18	3.33	4.953

BCH Series	BCH 04010	BCH 06010	BCH 06020	BCH 08010	BCH 08020	BCH 10010	BCH 10020
Mechanical time constant (ms) (with brake)	0.81	0.85	0.57	0.78	0.65	0.93	0.66
Brake holding torque [Nm (min)]	0.3	1.3	1.3	2.5	2.5	12	12
Brake power consumption (at 20°C) [W]	7.2	7.2	7.2	8.5	8.5	19.4	19.4
Brake release time [ms (Max)]	5	10	10	10	10	10	10
Brake pull-in time [ms (Max)]	25	70	70	70	70	70	70
Vibration grade (µm)	15						
Operating temperature	0 °C to 40°C (32 °F to 104°F)						
Storage temperature	-10 C to 80C (-14 °F to 176°F)						
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						

Medium / High Inertia Series

Medium / High Inertia Series	BCH 1301N	BCH 1302N	BCH 1303N	BCH 1304N	BCH 1801N	BCH 1802N	BCH 1802M	BCH 1301M	BCH 1302M	BCH 1303M
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 (Nm)	2.39	4.77	7.16	9.55	9.55	14.32	19.10	2.86	5.73	8.59
Maximum torque (Nm)	7.16	14.3	21.48	28.65	28.65	42.97	57.29	8.59	17.19	21.4 8
Rated speed (rpm)	2000						1500	1000		
Maximum speed (rpm)	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	24.9	33.03	33.66	48.3	58.2	7.5	14.4	22.5
Power rating (kW/s)	7.0	27.1	45.9	62.5	26.3	37.3	66.4	10.0	39.0	66.0
Rotor moment of inertia (kg.cm^2) (without brake)	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	1.10	0.96	1.62	1.06	1.28	1.84	1.40	1.06
Torque constant-KT (Nm/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/(rpm))	30.9	31.9	31.8	31.8	31.4	32	35	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	13.50	16.06
Insulation class	Class A (UL), Class B (CE)									
Insulation resistance	>100MΩ, DC 500V									
Insulation strength	1500V AC, 60 seconds									
Weight (kg) (without brake)	6.8	7	7.5	7.8	13.5	18.5	18.5	6.8	7	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 (kg.cm^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 [Nm (min)]	16.5	16.5	16.5	16.5	25	25	25	16.5	16.5	16.5

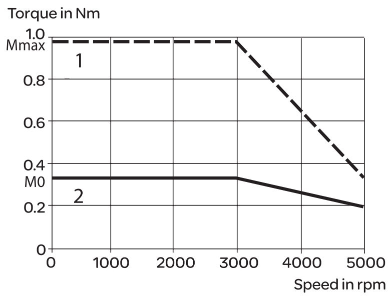
Medium / High Inertia Series	BCH 1301N	BCH 1302N	BCH 1303N	BCH 1304N	BCH 1801N	BCH 1802N	BCH 1802M	BCH 1301M	BCH 1302M	BCH 1303M
Brake power consumption (at 20°C) [W]	21.0	21.0	21.0	21.0	31.1	31.1	31.1	21.0	21.0	21.0
Brake release time [ms (Max)]	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Brake pull-in time [ms (Max)]	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0
Vibration grade (µm)	15									
Operating temperature	0 °C to 40°C (32 °F to 104°F)									
Storage temperature	-10 °C to 80°C (-14 °F to 176°F)									
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 cULus									

3.3.3 Servo Motor Speed-Torque Curves (T-N Curves)

BCH0401O servo motor

Control by LXM23●U01M3X servo drive

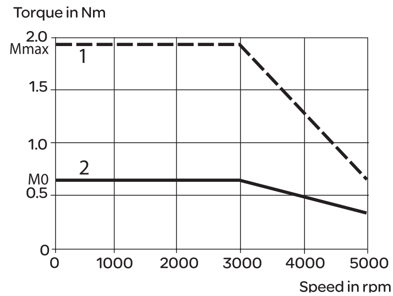
Single phase 220 V



BCH0601O servo motor

Control by LXM23●UO2M3X servo drive

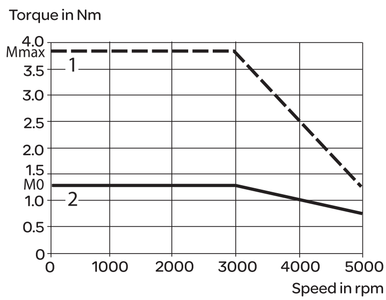
Single phase 220 V



BCH0602O servo motor

Control by LXM23●U04M3X servo drive

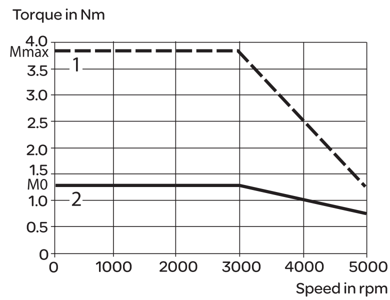
Single phase 220 V



BCH0801O servo motor

Control by LXM23●U04M3X servo drive

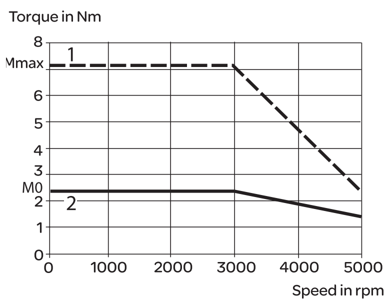
Single phase 220 V



BCH0802O servo motor

Control by LXM23●U07M3X servo drive

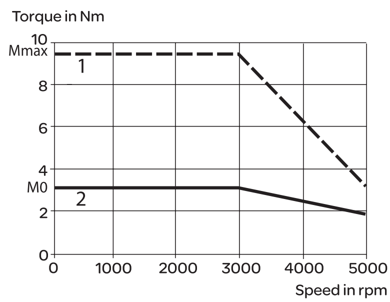
Single phase 220 V



BCH1001O servo motor

Control by LXM23●U10M3X servo drive

Single phase 220 V

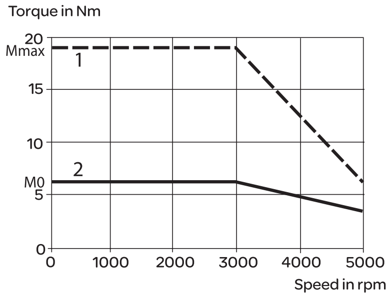


1 Peak torque
2 Continuous torque

BCH1002O servo motor

Control by LXM23●U20M3X servo drive

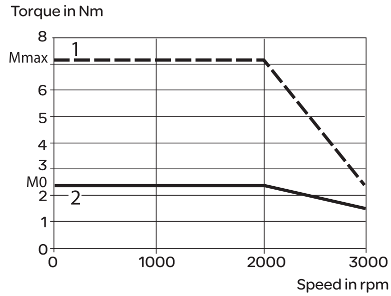
Three phase 220 V



BCH1301N servo motor

Control by LXM23●U04M3X servo drive

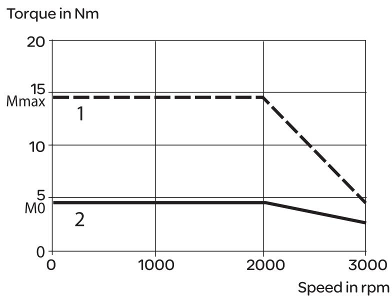
Single phase 220 V



BCH1302N servo motor

Control by LXM23●U10M3X servo drive

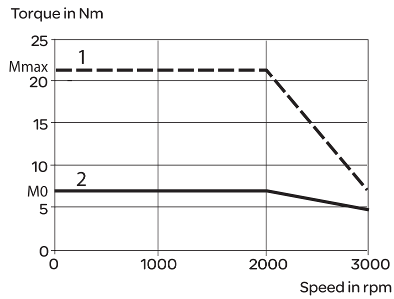
Single phase 220 V



BCH1303N servo motor

Control by LXM23●U15M3X servo drive

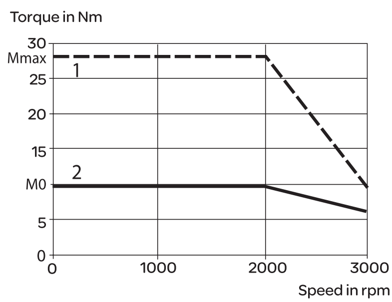
Single phase 220 V



BCH1304N servo motor

Control by LXM23●U20M3X servo drive

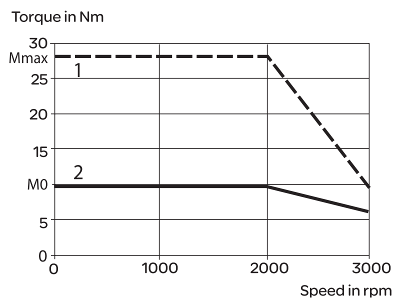
Three phase 220 V



BCH1801N servo motor

Control by LXM23●U20M3X servo drive

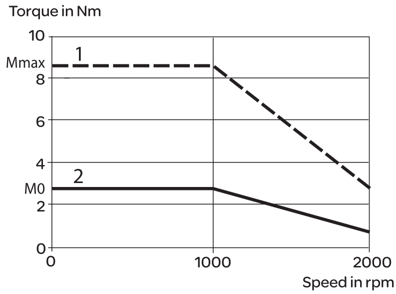
Three phase 220 V



1 Peak torque
2 Continuous torque

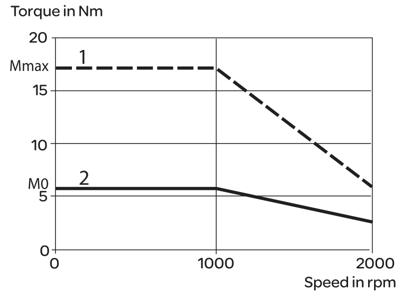
BCH1301M servo motor

Control by LXM23●U04M3X servo drive
Single phase 220 V



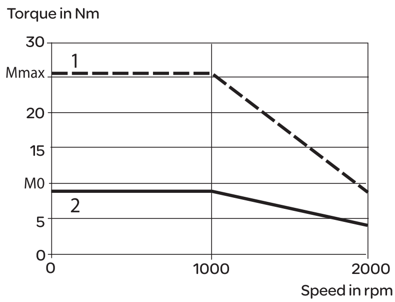
BCH1302M servo motor

Control by LXM23●U07M3X servo drive
Single phase 220 V



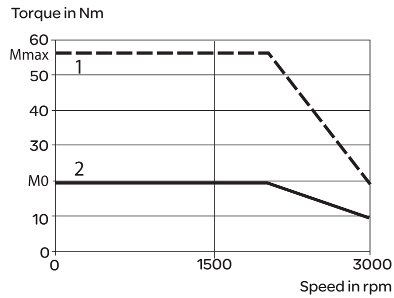
BCH1303M servo motor

Control by LXM23●U10M3X servo drive
Single phase 220 V



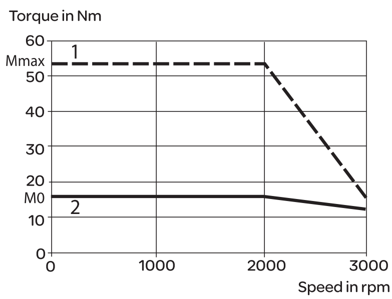
BCH1802M servo motor

Control by LXM23●U30M3X servo drive
Three phase 220 V



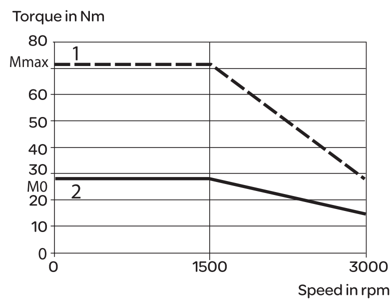
BCH1802N servo motor

Control by LXM23●U30M3X servo drive
Three phase 220 V



BCH1803M servo motor

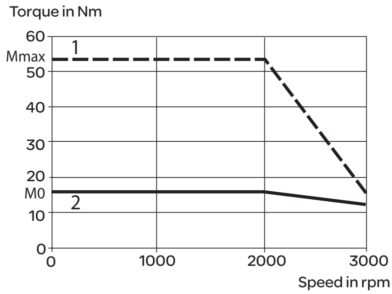
Control by LXM23●U45M3X servo drive
Three phase 220 V



1 Peak torque
2 Continuous torque

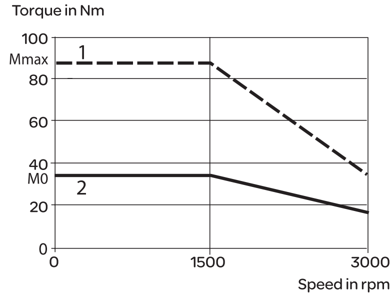
BCH1803N servo motor

Control by LXM23●U45M3X servo drive
Three phase 220 V



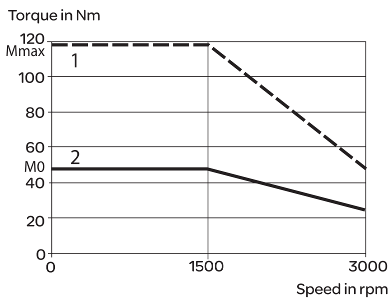
BCH1804M servo motor

Control by LXM23●U55M3X servo drive
Three phase 220 V



BCH1805M servo motor

Control by LXM23●U75M3X servo drive
Three phase 220 V



1 Peak torque
2 Continuous torque

3.3.4 Overload Characteristics

Overload Protection Function

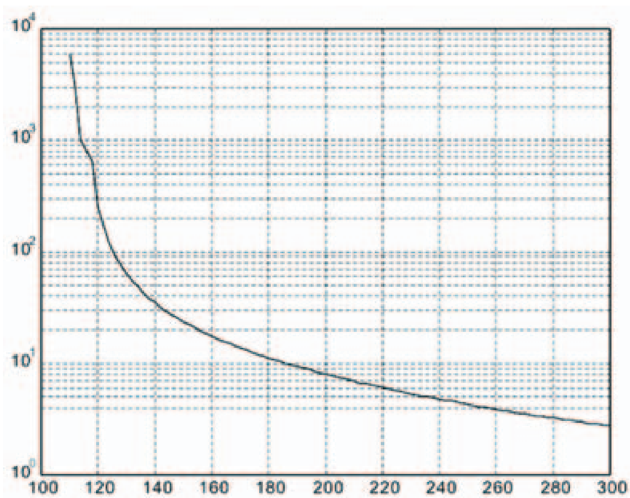
Overload protection is a built-in protective function to prevent a motor from overheating.

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.

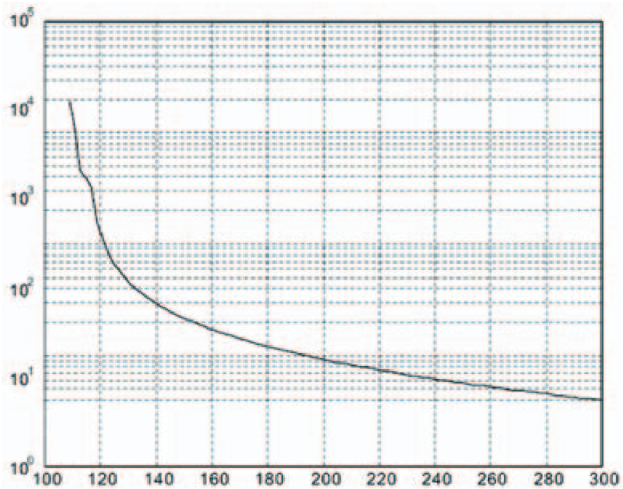
Chart of load and operating time

Ultra low/low Inertia Series (BCH0401O, BCH0601O, BCH0602O, BCH0801O, BCH0802O, BCH1001O, BCH1002O)



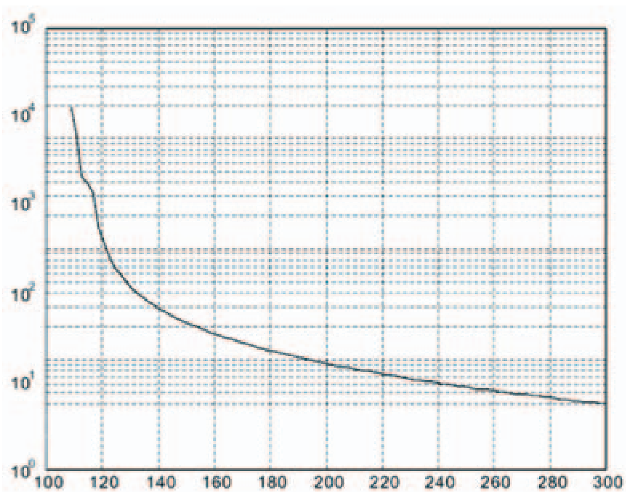
Load	Operating Time
120%	263.8s
140%	35.2s
160%	17.6s
180%	11.2s
200%	8s
220%	6.1s
240%	4.8s
260%	3.9s
280%	3.3s
300%	2.8s

Medium and Medium-High Inertia Series (BCH1301N, BCH1302N, BCH1303N, BCH1304N, BCH1801N,BCH1802N, BCH1802M)



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 (BCH1301M, BCH1302M, BCH1303M)



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

3.3.5 DC Bus data

DC bus data for single-phase drives

LXM23A,LXM23D(1phase)	100W	200W	400W	759W	1KW	1.5KW
Nominal voltage 1 phase[VAC]	220	220	220	220	220	220
Nominal voltage DC bus[VDC]	311	311	311	311	311	311
Undervoltage limit[VDC]	$P4\text{-}24*\sqrt{2}$	$P4\text{-}24*\sqrt{2}$	$P4\text{-}24*\sqrt{2}$	$P4\text{-}24*\sqrt{2}$	$P4\text{-}24*\sqrt{2}$	$P4\text{-}24*\sqrt{2}$
Voltage limit:activation of error Reaction in drive (quickstop)	410	410	410	410	410	410
Overvoltage limit[VDC]	410	410	410	410	410	410
Maximum continuous power via DC BUS[kw]	0.1	0.2	0.4	0.75	1	1.5
Maximum continuous current Via DC bus	3	3	3	6	6	6

DC bus data for three-phase drives

LXM23A,LXM23D(3phase)	2kW	3kW	4.5W	5.5W	7.5KW
Nominal voltage 3 phase[VAC]	220	220	220	220	220
Nominal voltage DC bus[VDC]	311	311	311	311	311
Undervoltage limit[VDC]	$P4\text{-}24*\sqrt{2}$	$P4\text{-}24*\sqrt{2}$	$P4\text{-}24*\sqrt{2}$	$P4\text{-}24*\sqrt{2}$	$P4\text{-}24*\sqrt{2}$
Voltage limit:activation of error Reaction in drive (quickstop)	410	410	410	410	410
Overvoltage limit[VDC]	410	410	410	410	410
Maximum continuous power via DC BUS[kw]	2	3	4.5	5.5	7.5
Maximum continuous current Via DC bus	16	16	16	20	20

3.3.6 Additional EMC input filters

Applications

When combined with LXM 23●U●●M3X servo drives, additional EMC fi lters can be used to meet more stringent requirements and are designed to reduce conducted emissions on the line supply below the limits of standard IEC 61800-3, edition 2, categories C2 and C3.

Use according to the type of line supply

These additional fi lters can only be used on TN (neutral connection) and TT (neutral to earth) type supplies.

The fi lters must not be used on IT (impedance or isolated neutral) type supplies.

Standard IEC/EN 61800-3, appendix D2.1, states that on IT (isolated or impedance earthed neutral) type supplies, fi lters can adversely affect the operation of the insulation monitors. In addition, the effectiveness of additional fi lters on this type of line supply depends on the type of impedance between neutral and earth, and therefore cannot be predicted.

Note: If a machine is to be installed on an IT supply, one solution is to insert an isolation transformer in order to re-create a TT system on the secondary side.

Characteristics of servo drive/EMC filter mounting

Conforming to standards			EN 133200
Degree of protection			IP 41 on the upper part with protective cover in place IP 20 after removal of the protective cover
Relative humidity			According to IEC 60721-3-3, class 3K3, 5% to 85%, without condensation or dripping water
Ambient air temperature around the device	Operation	°C	0 °C ~ 55 °C (If operating temperature is above 45 °C, forced cooling will be required)
	Storage	°C	-20 °C to 65 °C (-4°F to 149°F)
Altitude		m	1000 m without derating Up to 2000 m under the following conditions: ● Max. temperature 40°C ● Mounting distance between servo drives > 50 mm ● Protective cover removed
Vibration resistance	Conforming to IEC 60068-2-6		10 Hz to 57 Hz: amplitude 0.075 mm 57 Hz to 150 Hz: 1 g
Shock resistance	Conforming to IEC 60068-2-27		15 gn for 11 ms
Maximum nominal voltage	Single-phase 50/60 Hz	V	120 + 10 % 240 + 10 %
	Three-phase 50/60 Hz	V	240 + 10 %
Application, category: EN 61800-3: 2001-02 ; IEC 61800-3, Ed. 2			**Description**
Category C2 in environment 1			Restricted distribution, for domestic use, sale conditioned by the competence of the user and the distributor on the subject of EMC compatibility
Category C3 in environment 2			Use in industrial premises

References

Additional EMC input fi lters				
For servo drive	**Maximum servo motor cable length conforming to**		**Reference**	**Weight**
	EN 55011 class A Gr1	**EN 55011 class A Gr2**		
	IEC/EN 61800-3 category C2 in environment 1	**IEC/EN 61800-3 category C3 in environment 2**		
	m	**m**		**kg**
Single-phase supply voltage				
LXM23●U07M3X **LXM23●U10M3X** **LXM23●U15M3X**	20	40	**VW3 A31403**	0.775
LXM23●U01M3X **LXM23●U02M3X** **LXM23●U04M3X**	20	40	**VW3 A31401**	0.600
Three-phase supply voltage				
LXM23●U07M3X **LXM23●U10M3X** **LXM23●U15M3X** **LXM23●U20M3X** **LXM23●U30M3X**	20	40	**VW3 A31404**	0.900
LXM23●U45M3X **LXM23●U55M3X**	20	40	**VW3 A31406**	1.350
LXM23●U75M3X	20	40	**VW3 A31407**	3.150

3.3.7 Protection by circuit breaker

Application

The combinations listed below can be used to create a complete motor starter unitcomprising a circuit breaker, a contactor and a Lexium 23 Plus servo drive.
The circuit breaker provides protection against accidental short-circuits, disconnection and, if necessary, isolation.The contactor starts up and manages any safety features, as well as isolating the servo motor on stopping.
The servo drive controls the servo motor, provides protection against short-circuits between the servo drive and the servo motor and protects the motor cable against overloads. The overload protection is provided by the motor thermal protection of the servo drive.

Motor starters for Lexium 23 Plus servo drives		
	Reference	**Rating**
	kW	**A**
Single phase 220...255VAC/three phase:170...255VAC		
LXM23●U01M3X	0.1	6.3
LXM23●U02M3X	0.2	6.3
LXM23●U04M3X	0.4	10
LXM23●U07M3X	0.7	10
LXM23●U10M3X	1	14
LXM23●U15M3X	1.5	25
LXM23●U20M3X	2	30
LXM23●U30M3X	3	30
LXM23●U45M3X	4.5	60
LXM23●U55M3X	5.5	60
LXM23●U75M3X	7.5	75

(1)Composition of contactors:
● LC1 K06: 3 poles + 1 "N/O" auxiliary contact
● LC1 D09: 3 poles + 1 "N/O" auxiliary contact + 1 "N/C" auxiliary contact
(2)Usual control circuit voltages, see table below:

AC control circuit							
	Volts～	**24**	**48**	**110**	**220**	**230**	**240**
LC1-K	**50/60 Hz**	**B7**	**E7**	**F7**	**M7**	**P7**	**U7**
	Volts～	**24**	**48**	**110**	**220/230**	**230**	**230/240**
LC1-D	50 Hz	**B5**	**E5**	**F5**	**M5**	**P5**	**U5**
	60 Hz	**B6**	**E6**	**F6**	**M6**	**-**	**U6**
	50/60 Hz	**B7**	**E7**	**F7**	**M7**	**P7**	**U7**

Note:
For other voltages between 24 V and 660 V, or for a DC control circuit, please consult your Regional Sales Office.

3.3.8 Protection using fuses

Protection using class fuses(UL standsrd)		
Servo drive reference	**Nominal power**	**Fuse to be placed upstream**
	kW	**A**
Single phase:200...255/three phase:170...255VAC		
LXM23●U01M3X	0.1	5
LXM23●U02M3X	0.2	5
LXM23●U04M3X	0.4	20
LXM23●U07M3X	0.7	20
LXM23●U10M3X	1	25
LXM23●U15M3X	1.5	40
LXM23●U20M3X	2	60
LXM23●U30M3X	3	80
LXM23●U45M3X	4.5	160
LXM23●U55M3X	5.5	160
LXM23●U75M3X	7.5	200

3.4 Certifications

Product certifications:

Assigned file number	Related products	Certified by
E198280	LXM23A servo drives, LXM23D servo drives, LXM23C servo drives, LXM23M servo drives	UL
E198273	BCH servo motors	UL

3.5 Declaration of conformity

The following declaration of conformity is applicable if the product is used under the specified conditions and with the cables listed in the Ac-cessories chapter.

Schneider Electric

SCHNEIDER ELECTRIC MOTION DEUTSCHLAND GmbH
Breslauer Str. 7 D-77933 Lahr

EC DECLARATION OF CONFORMITY
YEAR 2010

☐ according to EC Directive on Machinery 98/37/EC
☒ according to EC Directive EMC 2004/108/EC
☒ according to EC Directive Low Voltage 2006/95/EC

We declare that the products listed below meet the requirements of the mentioned EC Directives with respect to design, construction and version distributed by us. This declaration becomes invalid with any modification on the products not authorized by us.

Designation:	AC Servo Drive
Type:	LXM23xx
Applied harmonized standards, especially:	EN61800-5-1:2007 EN61800-3:2004
Applied national standards and technical specifications, especially:	UL 508C

Company stamp: Schneider Electric Motion Deutschland GmbH
Postfach 11 80 · D-77901 Lahr
Breslauer Str. 7 · D-77933 Lahr

Date/ Signature: January 29, 2010 ppa.

Name/ Department: Dr. Björn Hagemann / VP Offer Implementation

SCHNEIDER ELECTRIC MOTION DEUTSCHLAND GmbH
Breslauer Str. 7 D-77933 Lahr

EC DECLARATION OF CONFORMITY
YEAR 2010

☐ according to EC Directive on Machinery 98/37/EC
☐ according to EC Directive EMC 2004/108/EC
☒ according to EC Directive Low Voltage 2006/95/EC

We declare that the products listed below meet the requirements of the mentioned EC Directives with respect to design, construction and version distributed by us. This declaration becomes invalid with any modification on the products not authorized by us.

Designation:	AC Servo Motor
Type:	BCHxx
Applied harmonized standards, especially:	EN61800-5-1:2007 EN60034-1:2004-06 EN60034-5:2001-02; EN60034-5/A1:2007-01
Applied national standards and technical specifications, especially:	UL 1004

Company stamp: Schneider Electric Motion Deutschland GmbH
Postfach 11 80 • D-77901 Lahr
Breslauer Str. 7 • D-77933 Lahr

Date/ Signature: January 29, 2010 ppa.

Name/ Department: Dr. Björn Hagemann / VP Offer Implementation

Engineering

4

At a Glance

Presentation

This chapter contains information on the application of the product that is vital in the design phase.

What's in thisChapter?

This chapter contains the following topics:

4.1 Electromagnetic compatibility, EMC

⚠ WARNNG

SIGNAL AND DEVICE INTERFERENCE

Signal interference can cause unexpected responses of device.

- Install the wiring in accordance with the EMC requirements.
- Verify compliance with the EMC requirements.

Failure to follow these instructions can result in death, serious injury or equipment damage.

Limit values

This product meets the EMC requirements according to the standard IEC61800-3, if the measures described in this manual are implemented during installation.

If the selected composition is not designed for category C1, note the following:

⚠ WARNNG

HIGH-FREQUENCY INTERFERENCE

In a residential environment this product may cause high-frequency interference that may require interference suppression.

Failure to follow these instructions can result in death or serious injury.

An EMC-compliant design is required to meet the specified limit values. Note the following requirements:

Control cabinet design

EMC measures	Objective
Use galvanised or chrome-plated mounting plates, make large contact surface connections for metal parts, remove paint from contact surfaces	Good conductivity due to two-dimensional contacts
Ground the control cabinet, door and mounting plate with ground straps or ground wires with a cross section greater than 10mm^2 (AWG6).	Reduces emissions.
Fit switching devices such as contactors, relays or solenoid valves with interference suppression assemblies or arc suppressors (for example, diodes, varistors, RC circuits).	Reduces mutual interference
Install power and control components separately.	Reduces mutual interference

Additional measures for EMC improvement

An EMC-compliant design is required to meet the specified limit values. Depending on the application, better results can be achieved with the following measures:

EMC measures	Objective
Upstream mains reactors	Reduces mains harmonics, prolongs product service life.
Upstream external mains filters	Improves the EMC limit values.
Particularly EMC-compliant design, e.g. in a closed control cabinet with 15dB damping of radiated interference	Improves the EMC limit values.

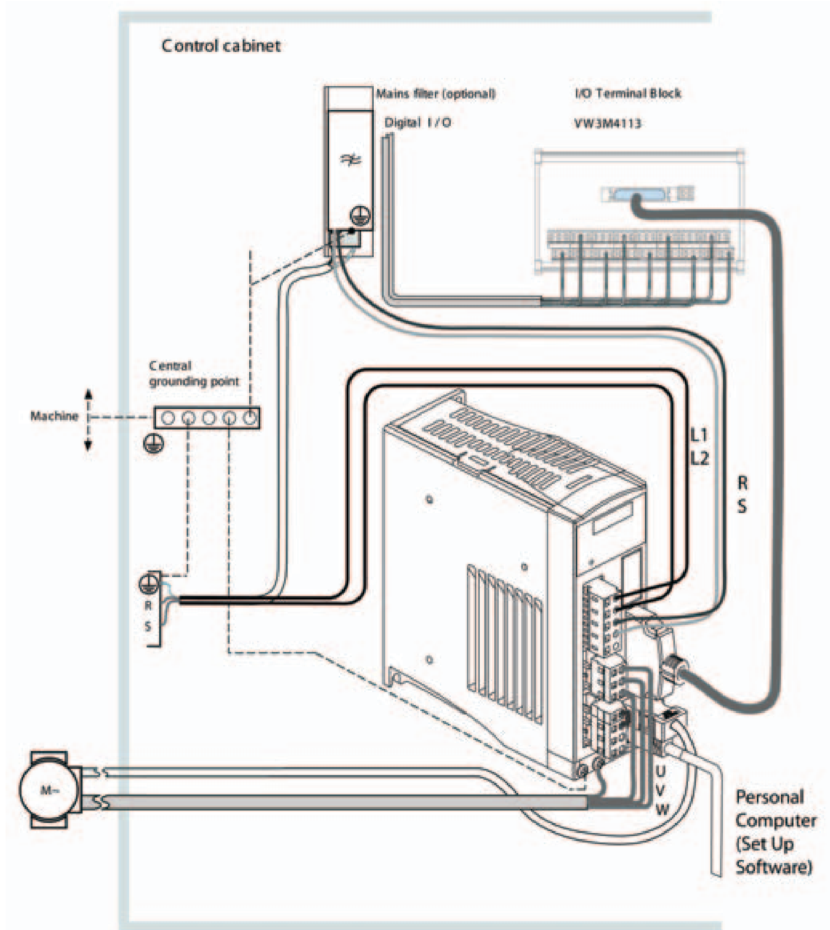


Figure 4.1 EMC measures

4.2 Residual current device

⚠ WARNNG

THIS PRODUCT MAY CAUSE DIRECT CURRENT IN THE PROTECTIVE GROUND CONDUCTOR

If a residual current device (RCD) is used, conditions must be observed.

Failure to follow these instructions can result in death or serious injury.

Conditions for use of residualcurrent device

Where the installation regulations require upstream protection against direct or indirect contact by means of a residual current device (RCD) or a residual current monitor (RCM), a residual current device of "type A" can be used for a singlephase drive with connection between N and L. In other cases, a "type B" RCD must be used.

Note the following:

- Filtering of high-frequency currents.
- Delayed triggering to avoid triggering as a result of capacitance which may be present when the unit is switched on. 30 mA residual current devices rarely have a delay. Use residual current devices which are not sensitive to unintentional triggering, for example residual current devices with increased immunity.

Use residual current devices that meet the following conditions:

- For single-phase devices, type A: Residual current devices of series s.i (superimmunized, Schneider Electric).
- For three-phase devices, type B: sensitive to all current types with approval for frequency inverters

When using residual current devices, consider the leakage currents of connected consumers.

4.3 Operation in an IT mains

The device is intended for operation in a TT/TN mains. The device is not suitable for operation in an IT mains.

A transformer grounded at the output turns a TT/TN mains into an IT mains. The device may be connected to this mains.

4.4 Rating the braking resistor

WARNNG

MOTOR WITHOUT BRAKING EFFECT

An insufficient braking resistor causes overvoltage on the DC bus and switches off the power stage. The motor is no longer actively decelerated.

- Verify that the braking resistor has a sufficient rating.
- Check the parameter settings for the braking resistor.
- Check the I^2t value under the most critical condition by performing a test run. The device switches off at an I^2t value of 100%.
- When performing the calculation and the test run, take into account the fact that the DC bus capacitors can absorb less braking energy at higher mains voltages.

Failure to follow these instructions can result in death, serious injury or equipment damage.

WARNNG

HOT SURFACES

The braking resistor may heat up to over 250° C (480° F) during operation.

- Avoid contact with the hot braking resistor.
- Do not allow flammable or heat-sensitive parts in the immediate vicinity of the braking resistor.
- Provide for good heat dissipation.
- Check the temperature of the braking resistor under the most critical condition by performing a test run.

Failure to follow these instructions can result in death, serious injury or equipment damage.

Braking resistors are required for dynamic applications. During deceleration, the kinetic energy is transformed into electrical energy in the motor. The electrical energy increases the DC bus voltage. The braking resistor is activated when the defined threshold value is exceeded. The braking resistor transforms electrical energy into heat. If highly dynamic deceleration is required, the braking resistor must be well adapted to the system.

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. Lexium23 Plus series servo drives provide 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	100	60	30	60
0.2	100	60	30	60
0.4	100	60	30	60
0.75	40	60	30	30
1	40	60	30	30
1.5	40	60	30	30
2	40	60	30	15
3	40	60	30	15
4.5	20	100	50	10
5.5	-	-	-	8
7.5	-	-	-	6

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 PA/+ and PBe, and make sure the circuit between PA/+ and PBi 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.

Sizing the braking resistor

(1) 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 (kg.cm^2)	Regenerative power from empty load 3000rpm to stop Eo (joule)	Max. regenerative power of capacitance E c (joule)
Low Inertia	0.1	BCH0401O	0.037	0.15	3
	0.2	BCH0601O	0.177	0.87	4
	0.4	BCH0602O	0.277	1.37	8
		BCH0801O	0.68	3.36	
	0.75	BCH0802O	1.13	5.59	14
	1.0	BCH1001O	2.65	13.1	18
	2.0	BCH1002O	4.45	22.0	21
Medium Inertia	0.4	BCH1301N	8.17	40.40	8
	1.0	BCH1302N	8.41	41.59	18
	1.5	BCH1303N	11.18	55.28	18
	2.0	BCH1304N	14.59	72.15	21
		BCH1801N	34.68	171.50	
	3.0	BCH1802N	54.95	217.73	28
High Inertia	0.4	BCH1301M	8.17	40.40	8
	0.75	BCH1302M	8.41	41.59	14
	1.0	BCH1303M	11.18	55.29	18
	3.0	BCH1802M	54.95	217.73	28

$Eo = J \times wr^2/182$ (joule) , Wr : rpm

If the load inertia is N x motor inertia, the regenerative power will be (N+1) x E0 when servo motor brakes from 3000 rpm 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:

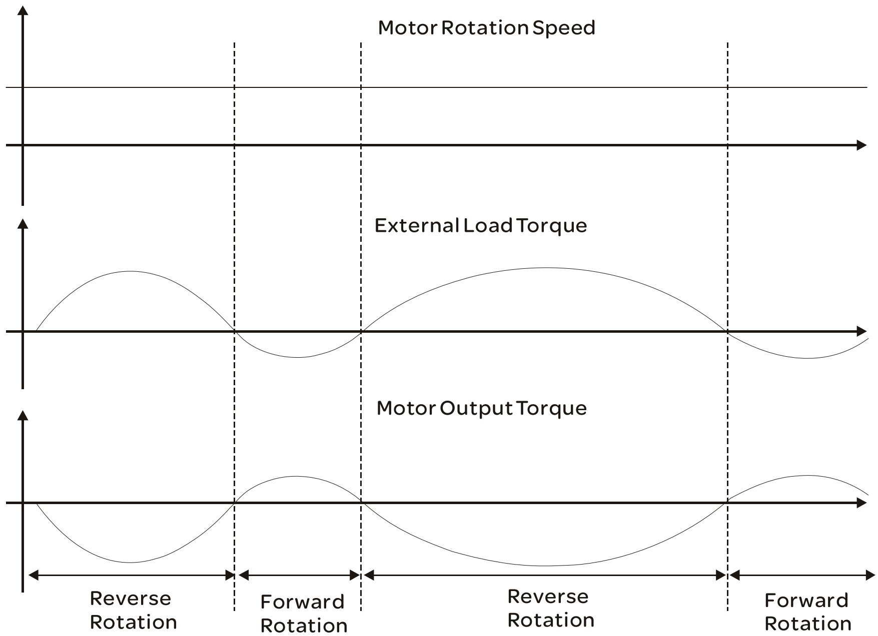
Step	Procedure	Equation and Setting Method
1	Set the capacity of regenerative resistor to the maximum	Change the value of P1-53 to maximum
2	Set the operation cycle T	Input by the users
3	Set motor speed Wr	Input by the users or read via P0-02 Drive State Display
4	Set load/motor inertia ratio N	Input by the users or read via P0-02 Drive State Display
5	Calculate the max. regenerative power Eo	Eo = Jxwr^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 3000 rpm, the load inertia = 7 x motor inertia, then the necessary the power of regenerative resistor = 2 x ((7+1) x 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 Lexium23 Plus series servo drives 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, AL005 may occur if the temperature is over high. The following figure shows the actual operation of regenerative resistor.

(2) 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 3000 rpm, if using 400W servo drive (rated torque: 1.27 Nm), 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.

● **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 0 rpm to rated speed and decelerate from rated speed down to 0 rpm. The allowable frequencies when the servo motor run without load are summarized in the following table.

Allowable frequency when the servo motor run without load (times/min) and uses built-in regenerative resistor								
Motor Capacity	600W	750W	900W	1.0KW	1.5KW	2.0KW	2.0KW	3.0KW
Servo Motor	06	07	09	10	15	20	20	30
BCH....O	-	312	-	137	-	83 (F100)		-
BCH....N	-	-	-	42	32	24 (F130)	10 (F180)	11
BCH....M	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 external regenerative resistors according to the allowable frequency by referring to the table below:

Allowable frequency when the servo motor run without load(times/min) and uses external regenerative resistor						
Motor Capacity / Recommended Regenerative Resistor Specifications	BCH....O					
	200W	400W (F60)	400W (F80)	750W	1.0KW	2.0KW
	02	04	04	07	10	20
400W 80Ω	13710	8761	3569	-	-	-
400W 40Ω	-	-	-	2147	-	-
500W 40Ω	-	-	-	-	1145	-
1KW 16Ω	-	-	-	-	-	1363

Allowable frequency when the servo motor run without load(times/min) and uses external regenerative resistor						
Motor Capacity / Recommended Regenerative Resistor Specifications	BCH....N					
	0.5KW	1KW	1.5Kw	2.0KW	2.0KW	3.0KW
	04	10	15	20	20	30
400W 80Ω	291	-	-	-	-	-
400W 40Ω	-	289	217	-	-	-
1KW 16Ω	-	-	-	416	175	-
1.5KW 16Ω	-	-	-	-	-	166

Allowable frequency when the servo motor run without load(times/min) and uses external regenerative resistor				
Motor Capacity / Recommended Regenerative Resistor Specifications	BCH....M			
	400KW	750KW	1.0KW	3.0KW (F180)
	03	07	10	30
400W 80Ω	297	-	-	-
400W 40Ω	-	289	-	-
1KW 40Ω	-	-	543	-
1.5KW 16Ω	-	-	-	166

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

NOTE: Regarding the selection of regenerative resistor, please refer to the table of regenerative resistor specifications described in section 4.5.

4.5 Logic type

⚠ WARNNG

UNINTENDED OPERATION

If source is used, a ground fault of a signal is detected as an On state.

- Use great care in wiring to exclude the possibility of ground faults.

Failure to follow these instructions can result in death, serious injury or equipment damage.

The digital inputs and outputs of this product can be wired for sink or source. for further information please refer to section 5.2.8.4 Wiring Diagrams of I/O Signals (CN1).

Signal inputs are protected against reverse polarity, outputs are shortcircuit protected. The inputs and outputs are galvanically isolated.

4.6 Monitoring functions

The monitoring functions in the product can help to guard the system and reduce the risks involved in a system misoperation. These monitoring functions may not be used to protect persons.

The following monitoring functions are available:

Monitoring	**Task**
Data link	Error response if the link becomes inoperative
Limit switch signals	Monitors for permissible range of travel
Following error	Monitors for difference between actual motor position and reference position
Motor overload	Monitors for excessively high current in the motor phases
Overvoltage and undervoltage	Monitors for overvoltage and undervoltage of the supply voltage
Overtemperature	Monitors the device for overtemperature
I^2t limitation	Power limitation in the case of overloads for the motor, the output current, the output power and the braking resistor.

For a description of the monitoring functions, see chapter 8.2.1 "Monitor Variables".

4.7 Configurable inputs and outputs

⚠ WARNNG

LOSS OF CONTROL

The use of limit switches can provide some protection against hazards (for example, collision with mechanical stop caused by incorrect reference values).

- If possible, use the limit switches.
- Verify correct connection of the limit switches.
- Verify the correct installation of the limit switches. The limit switches must be mounted in a position far enough away from the mechanical stop to allow for an adequate stopping distance.
- Before you can use the limit switches, you must enable them.

Failure to follow these instructions can result in death, serious injury or equipment damage.

This product has digital inputs and outputs that can be configured. The inputs and outputs have a defined standard assignment depending on the operating mode. This assignment can be adapted to the requirements of the customer's installation. See chapter 5.2.8 "Configuration of the digital signal inputs and signal outputs" for additional information.

Installation

5

At a Glance

Presentation

An engineering phase is mandatory prior to mechanical and electrical installation. See chapter4 "Engineering", for basic information.

What's in this Chapter?

This chapter contains the following topics:

⚠ WARNNG

LOSS OF CONTROL

- The designer of any control scheme must consider the potential failure modes of control paths and, for certain critical functions, provide a means to achieve a safe state during and after a path failure. Examples of critical control functions are EMERGENCY STOP, overtravel stop, power outage and restart.
- Separate or redundant control paths must be provided for critical functions.
- System control paths may include communication links. Consideration must be given to the implication of unanticipated transmission delays or failures of the link.
- Observe the accident prevention regulations and local safety guidelines. [1)]
- Each implementation of the product must be individually and thoroughly tested for proper operation before being placed into service.

Failure to follow these instructions can result in death or serious injury.

1) For USA: Additional information, refer to NEMA ICS 1.1 (latest edition), Safety Guidelines for the Application, Installation, and Maintenance of Solid State Control and to NEMA ICS 7.1 (latest edition), Safety Standards for Construction and Guide for Selection, Installation for Construction and Operation of Adjustable-Speed Drive Systems.

5.1 Mechanical installation

DANGER

ELECTRIC SHOCK CAUSED BY FOREIGN OBJECTS OR DAMAGE

Conductive foreign objects in the product or serious damage may cause parasitic voltage.

- Do not use damaged products.
- Keep foreign objects such as chips, screws or wire clippings from getting into the product.
- Do not use products that contain foreign objects.

Failure to follow these instructions will result in death or serious injury.

WARNNG

HOT SURFACES

The heat sink at the product may heat up to over 100° C (212° F) during operation.

- Avoid contact with the hot heat sink.
- Do not allow flammable or heat-sensitive parts in the immediate vicinity.
- Consider the measures for heat dissipation described.

Failure to follow these instructions can result in death or serious injury.

5.1.1 Installation Notes

Please pay close attention on 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.

5.1.2 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.
- Correctly packaged and placed on a solid surface.

5.1.3 Installation Conditions

Operating Temperature

Lexium23 Plus Series Servo Drive : 0•C to 55•C (32•F to 131•F)
BCH Series Servo Motor : 0•C to 40•C (32•F to 104•F)
The ambient temperature of servo drive for long-term reliability should be under 45•C (113•F).
If the ambient temperature of servo drive is greater than 45•C (113•F), please install the drive in a wellventilated 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!

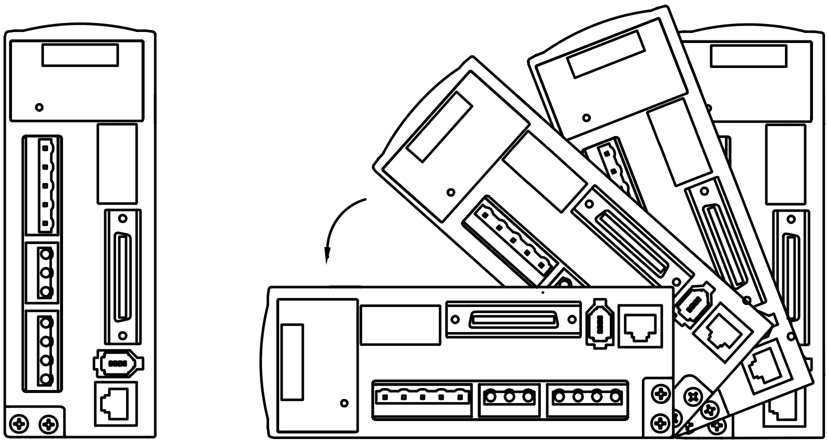
- Do not mount the servo drive or motor adjacent to heat-radiating elements or in direct sunlight.
- Do not mount the servo drive or motor in a location subjected to corrosive gases, liquids, or airborne dust or metallic particles.
- Do not mount the servo drive or motor in a location where temperatures 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.

5.1.4 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 Lexium23 Plus series servo drive 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 Lexium23 Plus series 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.

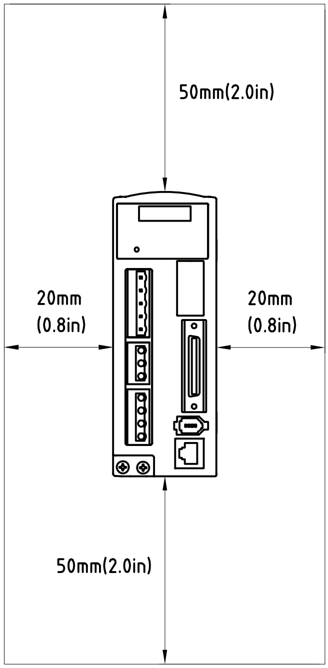
Motor Mounting

The BCH 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 3.3.1 and 3.3.2 "Specifications".

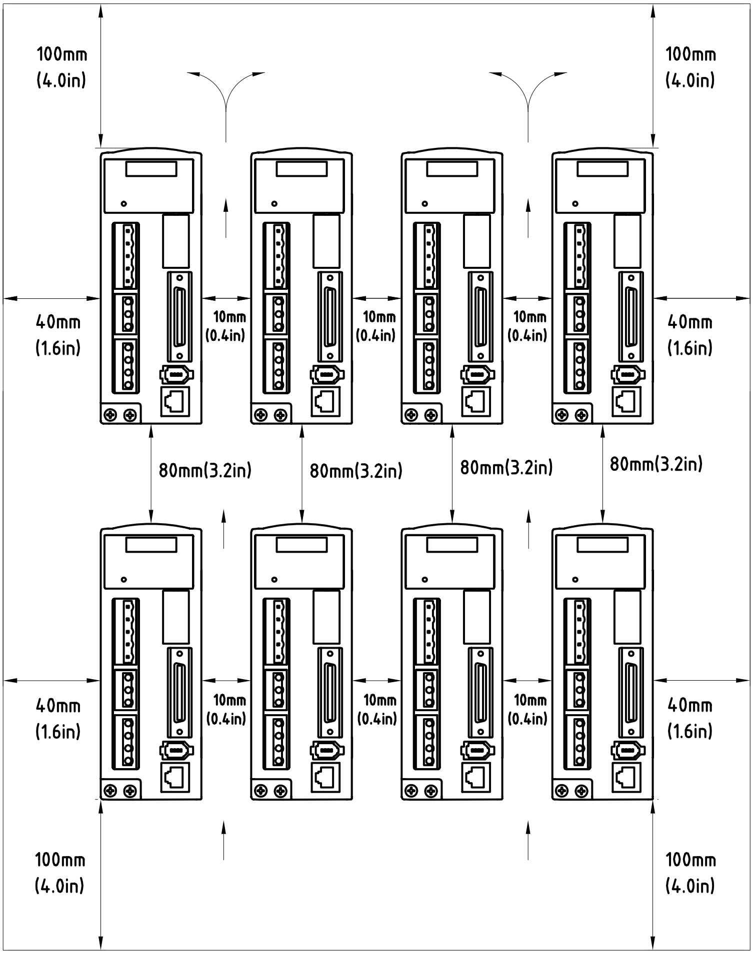
Minimum Clearances
Install a fan to increase ventilation to avoid ambient temperatures that exceed the specification. When installing two or more drives adjacent to each other please follow the clearances as shown in the following diagram.

- Minimum Clearances



NOTE:
1) The scale of the clearances does not match the dimensions as shown in the drawing above. In the event of any discrepancy between the clearances and the dimensions, the dimensions shall prevail.

● Side by Side Installation



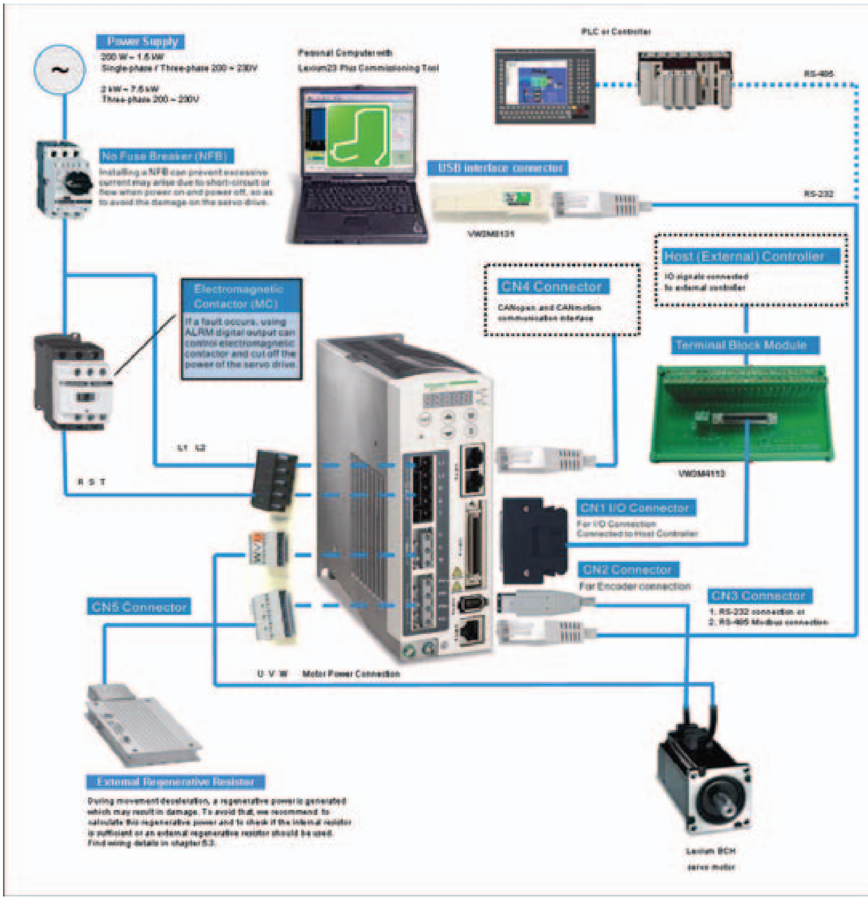
NOTE:

1) The scale of the clearances does not match the dimensions as shown in the drawing above. In the event of any discrepancy between the clearances and the dimensions, the dimensions shall prevail.

5.2 Electrical installation

5.2.1 Connecting to Peripheral Devices

Figure 5.1 Configuration



5.2.2 Servo Drive Connectors and Terminals

<table>
<tr><th>Terminal Identification</th><th>Terminal Description</th><th colspan="3">Notes</th></tr>
<tr><td>L1, L2</td><td>Control circuit terminal</td><td colspan="3">Used to connect single-phase AC control circuit power depending on connecting servo drive model.</td></tr>
<tr><td>R, S, T</td><td>Main circuit terminal</td><td colspan="3">Used to connect three-phase AC main circuit power depending on connecting servo drive model.</td></tr>
<tr><td rowspan="6">U, V, W
FG (⏚)</td><td rowspan="6">Servo motor output</td><td colspan="3">Used to connect servo motor</td></tr>
<tr><th>Terminal Symbol</th><th>Wire Color</th><th>Description</th></tr>
<tr><td>U</td><td>Red</td><td rowspan="3">Connecting to threephase 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">PA/+, PBi, PBe, PC/-</td><td rowspan="3">Regenerative resistor terminal or braking unit</td><td>Internal resistor</td><td colspan="2">Ensure the circuit is closed between PA/+ and PBi, and the circuit is open between PA/+ and PBe.</td></tr>
<tr><td>External resistor</td><td colspan="2">Connect regenerative resistor to PA/+ and PBe, and ensure an open circuit between PA/+ and PBi.</td></tr>
<tr><td>External braking unit</td><td colspan="2">Connect braking unit to PA/+ and PC/-, and ensure an open circuit between PA/+ and PBi, and PA/+ and PBe.
(N terminal is built in L1, L2, PC/-, and R, S, T.)
PA/+: Connecting to (+) terminal of V_BUS voltage.
PC/-: Connecting to (-) terminal of V_BUS voltage.</td></tr>
<tr><td>⏚ two places</td><td>Ground terminal</td><td colspan="3">Used to connect grounding wire of power supply and servo motor.</td></tr>
<tr><td>CN1</td><td>I/O connector (Optional Part)</td><td colspan="3">Used to connect external controllers. Please refer to chapter 5.2.8 for details.</td></tr>
<tr><td rowspan="7">CN2</td><td rowspan="7">Encoder connector (Optional Part)</td><td colspan="3">Used to connect encoder of servo motor. Please refer to chapter 5.2.9 for details.</td></tr>
<tr><th>Terminal Symbol</th><th>Wire Color</th><th>Pin No.</th></tr>
<tr><td>T+</td><td>Blue</td><td>5</td></tr>
<tr><td>T-</td><td>Blue/Black</td><td>6</td></tr>
<tr><td>n.c.</td><td>-</td><td>3</td></tr>
<tr><td>+5V</td><td>Red & Red/White</td><td>1</td></tr>
<tr><td>GND</td><td>Black & Black/White</td><td>2,4</td></tr>
<tr><td>CN3</td><td>Communication connector (Optional Part)</td><td colspan="3">Used for RS-485 or RS-232 communication connection.
Please refer to chapter 9 "Communication" for details.</td></tr>
<tr><td>CN4</td><td>Communication connector</td><td colspan="3">Used to connect field bus interface CANopen and CANmotion.
Please refer to chapter 5.2.11 for details.</td></tr>
</table>

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, L1, L2, 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, L1, L2, 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 chapter 2 "Before you begin - safety information").
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 (CN2) 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.
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.

5.2.3 Wiring Methods

For servo drives from 200W 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 5.2 & 5.3:
Power ON : contact "a" (normally open)
Power OFF /ALRM_RY : contact "b" (normally closed)
MC : coil of electromagnetic contactor, self-holding power, contact of main circuit power

Figure 5.2 Single-Phase Power Supply Connection (for 1.5kW and below models)

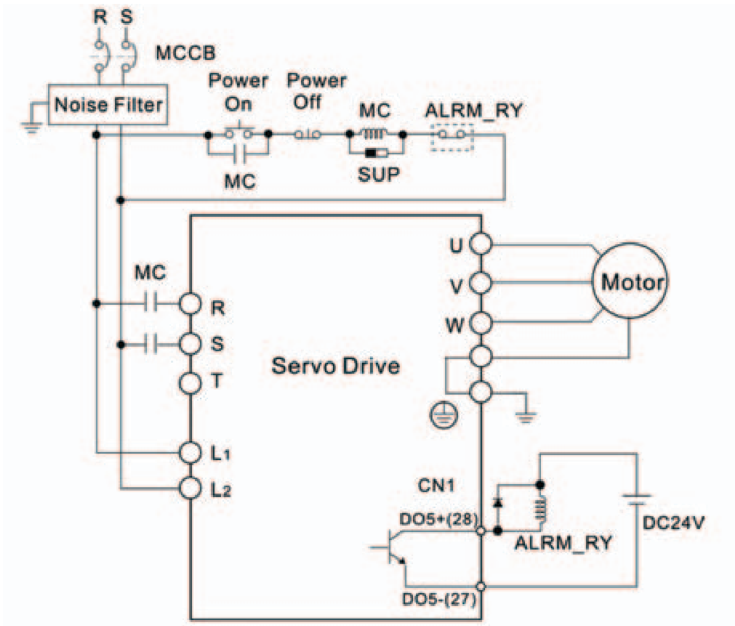
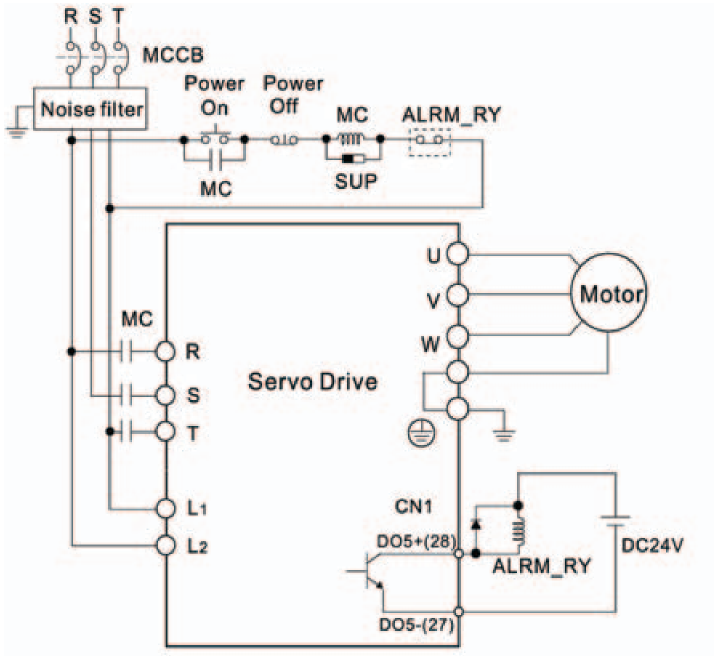
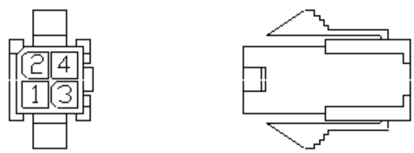
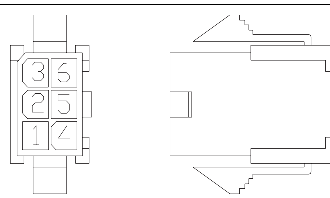
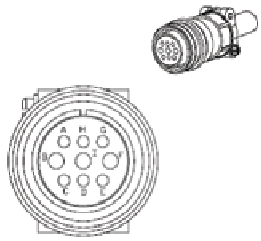
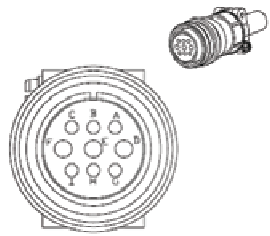


Figure 5.3 Three-Phase Power Supply Connection (for 2kW and above models)



5.2.4 Motor Power Cable Connector Specifications

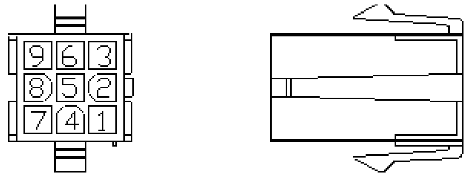
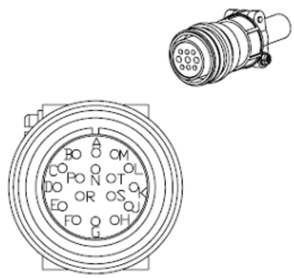
Motor Model Name	U, V, W / Electromagnetic Brake Connector	Terminal Identification
BCH0401O (100W) BCH0601O (200W) BCH0602O (400W) BCH0801O (400W) BCH0802O (750W)	 VW3M5111	A
BCH0401O (100W) BCH0601O (200W) BCH0602O (400W) BCH0801O (400W) BCH0801O (750W)	 VW3M5112	B

Motor Model Name	U, V, W / Electromagnetic Brake Connector	Terminal Identification
BCH1301M (300W) BCH1301N (500W) BCH1302M (600W) BCH1303M (900W) BCH1001O (1000W) BCH1302N (1000W) BCH1303N (1500W) BCH1002O (2000W) BCH1304N (2000W)	 VW3M5121	C
BCH1801N (2000W) BCH1802N (3500W) BCH1802M (3000W)	 VW3M5131	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

NOTE:
1) The coil of brake has no polarity. The names of terminal identification are BRAKE1 (Yellow) and BRAKE2 (Blue).
2) The power supply for brake is DC24V. Never use it for VDD, the +24V source voltage.

5.2.5 Encoder Connector Specifications

Motor Model Name	Encoder Connector	Terminal Identification
BCH0401O (100W) BCH0601O (200W) BCH0602O (400W) BCH0801O (400W) BCH0802O (750W)	 VW3M8121	A
BCH1301M (300W) BCH1301N (500W) BCH1302M (600W) BCH1303M (900W) BCH1001O (1000W) BCH1302N (1000W) BCH1303N (1500W) BCH1002O (2000W) BCH1304N (2000W) BCH1801N (2000W) BCH1802N (3500W) BCH1802M (3000W)	 VW3M8122	B

Terminal Identification	T+	T-	Reserved	Reserved	Reserved	Reserved	DC+5V	GND	BRAID SHELD
A	1 (Blue)	4 (Blue/ Black)	-	-	-	-	7 (Red & Red/ White)	8 (Black & Black/ White)	9
B	A	B	C	D	F	G	S	R	L

5.2.6 Cable Specifications for Servo Drive

Power Cable

Servo Drive and Servo Motor		Power Cable - Wire Gauge mm^2(AWG)			
		L1, L2	R, S, T	U, V, W	PA/+, PBe
LXM23AU01M3X	BCH0401O	1.3 (AWG16)	2.1 (AWG14)	0.82 (AWG18)	2.1 (AWG14)
LXM23AU02M3X	BCH0601O	1.3 (AWG16)	2.1 (AWG14)	0.82 (AWG18)	2.1 (AWG14)
LXM23AU04M3X	BCH0602O	1.3 (AWG16)	2.1 (AWG14)	0.82 (AWG18)	2.1 (AWG14)
	BCH0801O	1.3 (AWG16)	2.1 (AWG14)	0.82 (AWG18)	2.1 (AWG14)
	BCH1301N	1.3 (AWG16)	2.1 (AWG14)	0.82 (AWG18)	2.1 (AWG14)
	BCH1301M	1.3 (AWG16)	2.1 (AWG14)	0.82 (AWG18)	2.1 (AWG14)
LXM23AU07M3X	BCH0802O	1.3 (AWG16)	2.1 (AWG14)	0.82 (AWG18)	2.1 (AWG14)
	BCH1302M	1.3 (AWG16)	2.1 (AWG14)	0.82 (AWG18)	2.1 (AWG14)
LXM23AU10M3X	BCH1001O	1.3 (AWG16)	2.1 (AWG14)	1.3 (AWG16)	2.1 (AWG14)
	BCH1302N	1.3 (AWG16)	2.1 (AWG14)	1.3 (AWG16)	2.1 (AWG14)
	BCH1303M	1.3 (AWG16)	2.1 (AWG14)	1.3 (AWG16)	2.1 (AWG14)
LXM23AU15M3X	BCH1303N	1.3 (AWG16)	2.1 (AWG14)	1.3 (AWG16)	2.1 (AWG14)
LXM23AU20M3X	BCH1002O	1.3 (AWG16)	2.1 (AWG14)	2.1 (AWG14)	2.1 (AWG14)
	BCH1304N	1.3 (AWG16)	2.1 (AWG14)	2.1 (AWG14)	2.1 (AWG14)
	BCH1801N	1.3 (AWG16)	2.1 (AWG14)	3.3 (AWG12)	2.1 (AWG14)
LXM23AU30M3X	BCH1802N	1.3 (AWG16)	3.3 (AWG12)	3.3 (AWG12)	3.3 (AWG12)
	BCH1802M	1.3 (AWG16)	3.3 (AWG12)	3.3 (AWG12)	3.3 (AWG12)
LXM23AU45M3X	BCH1803M	1.3 (AWG16)	3.3 (AWG12)	8.4 (AWG8)	3.3 (AWG12)
LXM23AU55M3X	BCH1804M	1.3 (AWG16)	3.3 (AWG12)	13.3 (AWG6)	3.3 (AWG12)
LXM23AU75M3X	BCH1805M	1.3 (AWG16)	5.3 (AWG10)	13.3 (AWG6)	3.3 (AWG12)

Encoder Cable

Servo Drive	Encoder Cable - Wire Gauge mm^2 (AWG)			
	Wire Size	Core Number	UL Rating	Wire Length
LXM23AU01M3X	0.13 (AWG26)	10 core (4 pair)	UL2464	3m (9.84ft.)
LXM23AU02M3X	0.13 (AWG26)	10 core (4 pair)	UL2464	3m (9.84ft.)
LXM23AU04M3X	0.13 (AWG26)	10 core (4 pair)	UL2464	3m (9.84ft.)
LXM23AU07M3X	0.13 (AWG26)	10 core (4 pair)	UL2464	3m (9.84ft.)
LXM23AU10M3X	0.13 (AWG26)	10 core (4 pair)	UL2464	3m (9.84ft.)
LXM23AU15M3X	0.13 (AWG26)	10 core (4 pair)	UL2464	3m (9.84ft.)
LXM23AU20M3X	0.13 (AWG26)	10 core (4 pair)	UL2464	3m (9.84ft.)
LXM23AU30M3X	0.13 (AWG26)	10 core (4 pair)	UL2464	3m (9.84ft.)
LXM23AU45M3X	0.13 (AWG26)	10 core (4 pair)	UL2464	3m (9.84ft.)
LXM23AU55M3X	0.13 (AWG26)	10 core (4 pair)	UL2464	3m (9.84ft.)
LXM23AU75M3X	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 of the servo drive.
3) In order to prevent fire hazard and accidents, please form the wiring by following the cable specifications outlined above.

5.2.7 Basic Wiring

Figure 5.4 Basic Wiring Schematic of 400W and below models

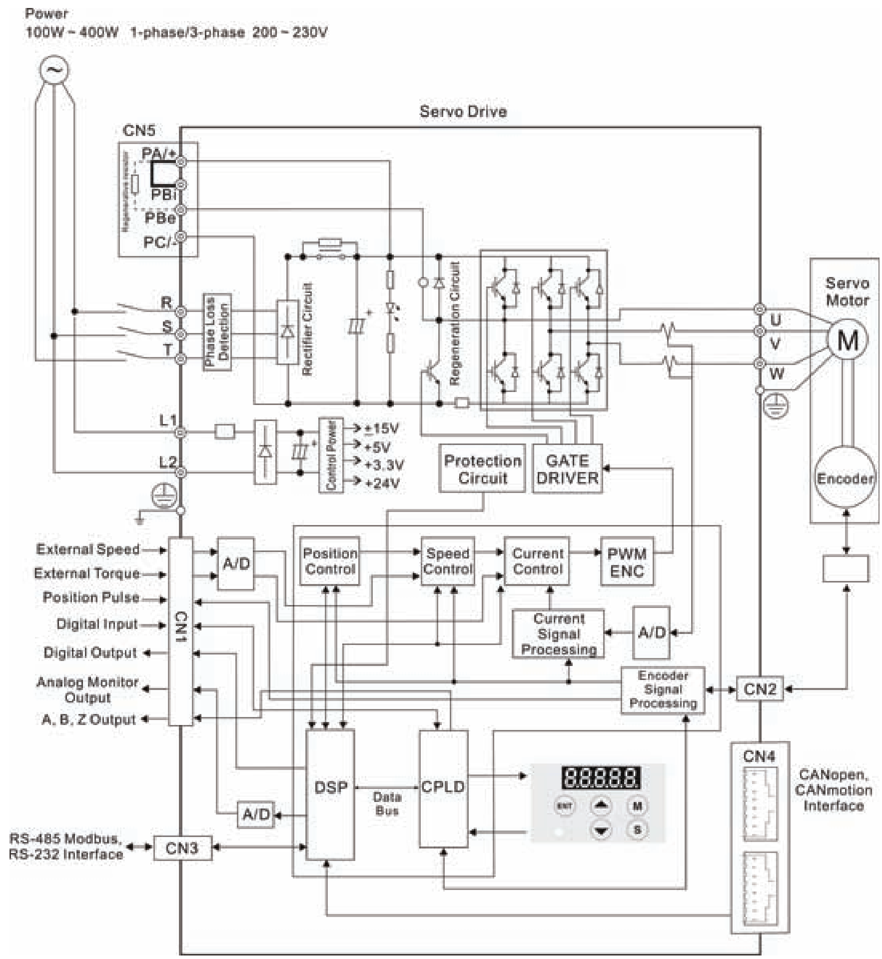
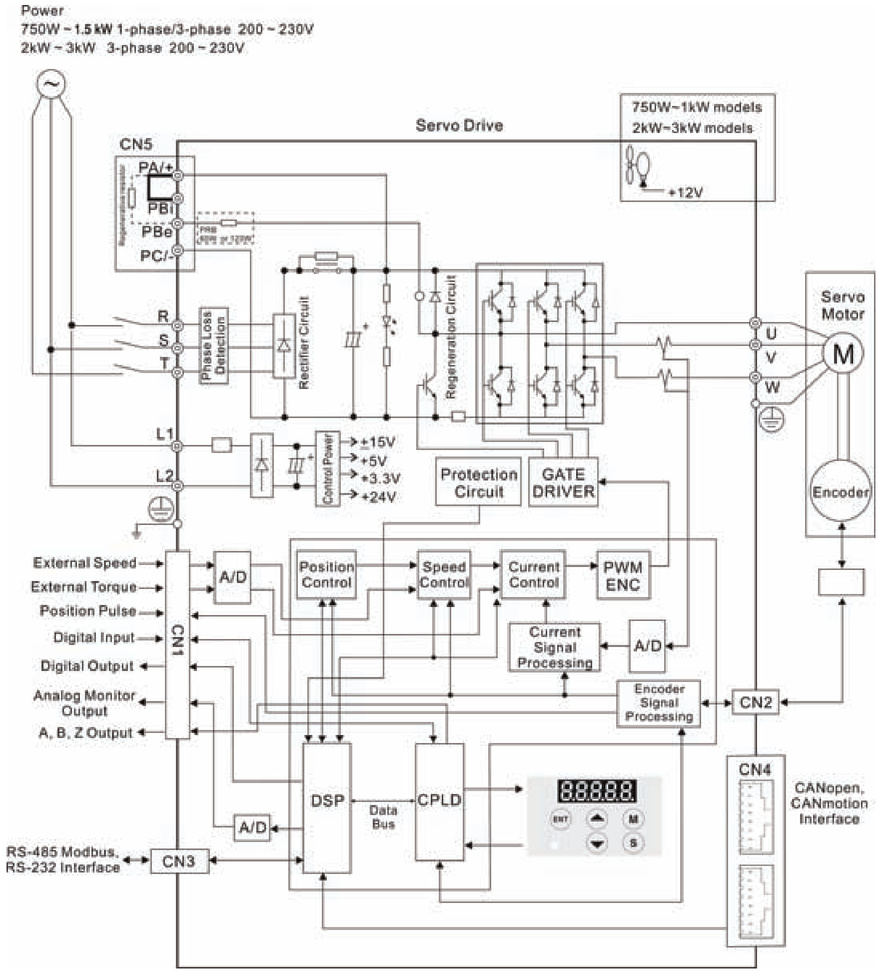


Figure 5.5 Basic Wiring Schematic of 750W and above models



5.2.8 Input / Output Interface Connector -CN1

The CN1 Interface Connector provides access to three signal groups:

i General interface for the analog speed and torque control, encoder reference signal from the motor, pulse / direction inputs, and reference voltages.

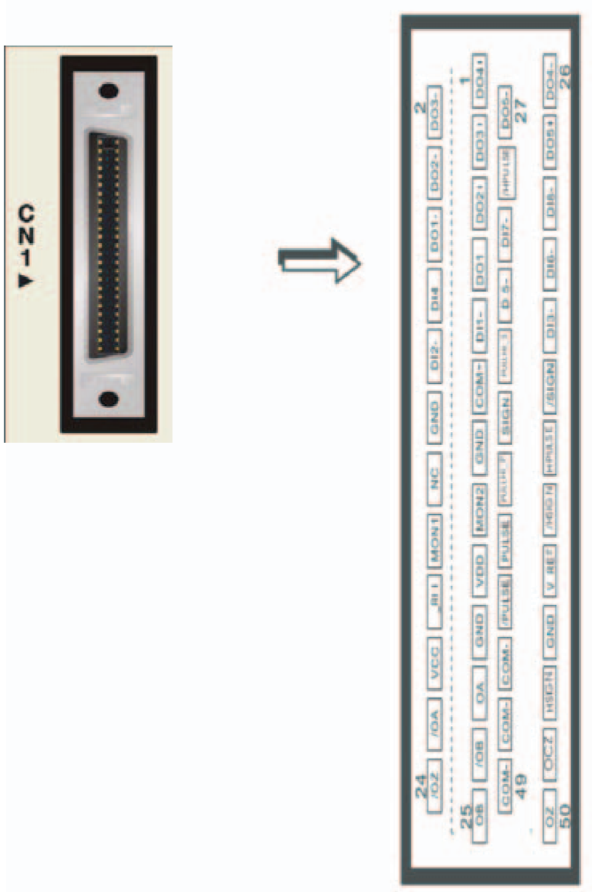
ii 8 programmable Digital Inputs (DI), can be set via parameters P2-10 ~ P2-17

iii 5 programmable Digital Outputs (DO), can be set via parameters P2-18 ~ P2-22

A detailed explanation of each group is available in Section 3.3.2, Tables 3.A, 3.B & 3.C.

5.2.8.1 CN1 Terminal Identification

Figure 5.6 The Layout of CN1 Drive Connector



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**	GND	Analog input signal ground
13	GND	Analog input signal ground	**14**	NC	No Connection
15	MON2	Analog monitor output 2	**16**	MON1	Analog monitor output 1
17	VDD	+24V power output (for external I/O)	**18**	T_REF	Analog torque Input
19	GND	Analog input signal ground	**20**	VCC	+12V power output (for analog command)
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	/HPULSE	High-speed Pulse input (-)	**30**	DI8-	Digital input
31	DI7-	Digital input	**32**	DI6-	Digital input
33	DI5-	Digital input	**34**	DI3-	Digital input
35	PULL HI (SIGN)	Pulse applied power (SIGN)	**36**	/SIGN	Position sign (-)
37	SIGN	Position sign (+)	**38**	HPULSE	High-speed Pulse input (+)
39	PULL HI_P (PULSE)	Pulse applied Power (PULSE)	**40**	/HSIGN	High-speed position sign (-)
41	PULSE	Pulse input (+)	**42**	V_REF	Analog speed input (+)
43	/PULSE	Pulse input (-)	**44**	GND	Analog input signal ground
45	COM-	VDD(24V) power ground	**46**	HSIGN	High-speed position sign (+)
47	COM-	VDD(24V) power ground	**48**	OCZ	Encoder Z pulse Open-collector output
49	COM-	VDD(24V) power ground	**50**	OZ	Encoder Z pulse Line-driver output

Note:

1) The terminal marked "NC" must be left unconnected (No Connection). The NC terminal is used within the servo drive. Any outside connection to the NC terminal will result in damage to the drive and void the warranty!

5.2.8.2 Signals Explanation of Connector CN1

The Tables 5.A, 5.B, & 5.C detail the three groups of signals of the CN1 interface. Table 3.A details the general signals. Table 5.B details the Digital Output (DO) signals and Table 5.C details the Digital Input (DI) signals. The General Signals are set by the factory and can not be changed, reprogrammed or adjusted. Both the Digital Input and Digital Output signals can be programmed by the users.

Table 5.A General Signals

Signal		Pin No.	Details	Wiring Diagram (Refer to 5.2.8.4)
Analog Signal Input	V_REF	42	1. Motor speed command: -10V to +10V, corresponds to -3000 ~ +3000 rpm 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
Analog Monitor Output	MON1 MON2	16 15	Monitor operation status: Motor characteristics such as speed and current can be represented by analog voltages. The drive provides two channels which can be configured with the parameter P0-03 to output the desired characteristics. Please reference the parameter P0-03 for monitoring commands and P1-04 / P1-05 for scaling factors. Output voltage is reference to the power ground.	C2
Position Pulse Input	/PULSE PULSE /SIGN SIGN	43 41 36 37	The drive can accept two different types of pulse inputs: Line-driver input (max. input frequency is 500Kpps) and Open-collector input (max. input frequency is 200Kpps). 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.	C3/C4
	PULL HI_P PULL HI_S	39 35	When an Open-collector type of pulse is used, this terminal must be connected to a pull-up power supply.	C3/C4
Highspeed Position Pulse Input	HSIGN /HSIGN HPULSE /HPULSE	46 40 38 29	The drive can accept two different types of highspeed 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

Signal		Pin No.	Details	Wiring Diagram (Refer to 5.2.8.4)
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	50 24		
	OCZ	48	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 45 47 49	COM+ is the common voltage rail of the Digital Input (DI) and Digital Output (DO) signals. When using VDD, VDD should be connected to COM+. If not using VDD, the users should add an external applied power (+12V to +24V). The positive end of this applied power should be connected to COM+ and the negative end of this applied power should be connected to COM-.	
	VCC	20	VCC is a +12V power rail provided by the drive. It is used for providing simple analog command (analog speed or analog torque command). Maximum permissible current 100mA.	
Power	GND	12, 13, 19, 44	The polarity of VCC is with respect to Ground (GND).	
Other	NC	14	See previous note for NC terminal description of CN1 connector on page 3-13.	

The Digital Input (DI) and Digital Output (DO) have factory default settings which correspond to the various servo drive control modes. (See section 6.1). However, both the DI's and DO's can be programmed independently to meet the requirements of the users.

Detailed in Tables 5.B and 5.C are the DO and DI functions with their corresponding signal name and wiring schematic. The factory default settings of the DI and DO signals are detailed in Table 5.G and 5.H.

All of the DI's and DO's and their corresponding pin numbers are factory set and non-changeable, however, all of the assigned signals and control modes are user changeable. For Example, the factory default setting of DO5 (pins 28/27) can be assigned to DO1 (pins 7/6) and vise versa.

The following Tables 5.B and 5.C detail the functions, applicable operational modes, signal name and relevant wiring schematic of the default DI and DO signals.

Table 5.B DO Signals

DO Signal	Assigned Control Mode	Pin No. (Default)		Details	Wiring Diagram (Refer to 5.2.8.4)
		+	-		
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	-	-	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.	
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. For Example, at factory default ZSPD will be activated when the drive detects the motor rotating at speed at or below 10 rpm, ZSPD will remain activated until the motor speed increases above 10 rpm.	
TSPD	ALL (except Pt, Pr)	-	-	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.	
TPOS	Pt, Pr, Pt-S,Pt-T, Pr-S, Pr-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. 2. When the drive is in Pr mode, TPOS will be activated when the drive detects that the position of the motor is in a -P1-54 to +P1-54 band of the target position. For Example, at factory default TPOS will activate once the motor is in -99 pulses range of the target position, then deactivate after it reaches +99 pulses range of the desired position.	
TQL	Not assigned	-	-	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.	
ALRM	ALL	28	27	ALRM is activated when the drive has detected a fault condition. (However, when Reverse limit error, Forward limit error, operational stop, Serial communication error, and Undervoltage these fault occur, WARN is activated first.)	

DO Signal	Assigned Control Mode	Pin No. (Default) +	Pin No. (Default) -	Details(*1)	Wiring Diagram (Refer to 5.2.8.4)
BRKR	ALL	1	26	BRKR is activated actuation of motor brake.	C5/C6/C7/C8
HOME	ALL	3	2	HOME is activated when the servo drive has detected that the "HOME" sensor (ORGP, digital input 0x24) has been detected.	
OLW	ALL	-	-	OLW is activated when the servo drive has detected that the motor has reached the output overload level set by the parameter P1-56.	
WARN	ALL	-	-	Servo warning output. WARN is activated when the drive has detected Reverse limit error, Forward limit error, operational stop, Serial communication error, and Undervoltage these fault conditions.	
OVF	ALL	-	-	Position command overflow. OVF is activated when the servo drive has detected that a position command overflows.	
SNL (SCWL)	Pr	-	-	Reverse software limit. SNL is activated when the servo drive has detected that reverse software limit is reached.	
SPL (SCCWL)	Pr	-	-	Forward software limit. SPL is activated when the servo drive has detected that forward software limit is reached.	
CMD_OK	Pr	-	-	Internal position command completed output. CMDOK is activated when the servo drive has detected that the internal position command has been completed.	
CAP_OK	Pr	-	-	Capture operation completed output. CAP_OK is activated when the servo drive has detected that capture operation has been completed.	
MC_OK	Pr	-	-	Motion control completed output. MC_OK is activated when CMD_OK and TPOS are both ON. It indicates MC_OK is activated only when the servo drive has detected that the position command has been given and the positioning has been completed also. If only CMD_OK or TPOS is ON, MC_OK will not be activated.	
SP_OK	S, Sz	-	-	SP_OK will be activated when the speed error is equal and below the setting value of P1-47.	

DO Signal	Assigned Control Mode	Pin No. (Default)		Details(*1)	Wiring Diagram (Refer to 5.2.8.4)
		+	-		
SDO_0	ALL	-	-	Output the status of bit00 of P4-06.	C5/C6/C7/C8
SDO_1	ALL	-	-	Output the status of bit00 of P4-06.	
SDO_2	ALL	-	-	Output the status of bit00 of P4-06.	
SDO_3	ALL	-	-	Output the status of bit00 of P4-06.	
SDO_4	ALL	-	-	Output the status of bit00 of P4-06.	
SDO_5	ALL	-	-	Output the status of bit00 of P4-06.	
SDO_6	ALL	-	-	Output the status of bit00 of P4-06.	
SDO_7	ALL	-	-	Output the status of bit00 of P4-06.	
SDO_8	ALL	-	-	Output the status of bit00 of P4-06.	
SDO_9	ALL	-	-	Output the status of bit00 of P4-06.	
SDO_A	ALL	-	-	Output the status of bit00 of P4-06.	
SDO_B	ALL	-	-	Output the status of bit00 of P4-06.	
SDO_C	ALL	-	-	Output the status of bit00 of P4-06.	
SDO_D	ALL	-	-	Output the status of bit00 of P4-06.	
SDO_E	ALL	-	-	Output the status of bit00 of P4-06.	
SDO_F	ALL	-	-	Output the status of bit00 of P4-06.	

NOTE:

1) PINS 3 & 2 can either be TSPD or HOME dependent upon control mode 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 5.2.8.3 for details.

Table 5.C DI Signals

DI Signal	Assigned Control Mode	Pin No. (Default)	Details(*2)	Wiring Diagram (Refer to 5.2.8.4)
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. 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.	
GAINUP	ALL	-	Gain switching	
CCLR	Pt, Pr	10	When CCLR is activated, the setting 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.	
CTRG	Pr, Pr-S, Pr-T, S, Sz		When the drive is in Pr mode and CTRG is activated, the drive will command the motor to move the stored position which correspond the POS 0 ~ POS 5 settings. Activation is triggered on the rising edge of the pulse.	
TRQLM	S, Sz	10	ON indicates the torque limit command is valid.	
SPDLM	T, Tz	10	ON indicates the speed limit command is valid.	
POS0	Pr, Pr-S, Pr-T	34	When the Pr Control Mode is selected, the 64 stored positions are programmed via a combination of the POS 0 ~ POS 5 commands. See table 5.D.	
POS1		8		
POS2		-		
STOP	-	-	Motor stop.	
SPD0	S, Sz, Pt-S, Pr-S, S-T	34	Select the source of speed command: See table 5.E.	
SPD1		8		
TCM0	Pt, T, Tz, Pt-T, Pr-T, S-T	34	Select the source of torque command: See table 5.F.	
TCM1		8		
S-P	Pt-S, Pr-S	31	Speed / Position mode switching OFF: Speed, ON: Position	
S-T	S-T	31	Speed / Torque mode switching OFF: Speed, ON: Torque	
T-P	Pt-T, Pr-T	31	Torque / Position mode switching OFF: Torque, ON: Position "the next closer BSH motor variant from stock":	

DI Signal	Assigned Control Mode	Pin No. (Default)	Details(*2)	Wiring Diagram (Refer to 5.2.8.4)
Pt-Pr	Pt, Pr	-	Internal position (Pr) and external pulse (Pt) mode switching. OFF: Pt, ON: Pr	C9/C10/C11/C12
PTAS	Pt	-	External command source selection: pulse and analog voltage switching. OFF: The command source is external pulse. ON: The command source is external analog voltage.	
PTCMS	Pt	-	External command source selection: high-speed / low-speed pulse switching OFF: The command source is low-speed pulse (PULSE, /PULSE, SIGN, /SIGN). ON: The command source is high-speed pulse (HPULSE, /HPULSE, HSIGN, /HSIGN). When high-speed pulse is selected, the users can add an external manual pulse generator and use this DI signal to switch the command source.	
EMGS	ALL	30	It should be contact "b" and normally ON or a fault (AL013) will display.	
NL(CWL)	Pt, Pr, S, T, Sz, Tz	32	Reverse inhibit limit. It should be contact "b" and normally ON or a fault (AL014) will display.	
PL(CCWL)	Pt, Pr, S, T, Sz, Tz	31	Forward inhibit limit. It should be contact "b" and normally ON or a fault (AL015) will display.	
ORGP	Pr	-	When ORGP is activated, the drive will command the motor to start to search the reference "Home" sensor.	
TLLM	Not assigned	-	Reverse operation torque limit (Torque limit function is valid only when P1-02 is enabled)	
TRLM	Not assigned	-	Forward operation torque limit (Torque limit function is valid only when P1-02 is enabled)	
SHOM	Pr	-	When SHOM is activated, the drive will command the motor to move to "Home".	
JOGU	All modes except CAN	-	Forward JOG input. When JOGU is activated, the motor will JOG in forward direction. [see P4-05]	
JOGD	All modes except CAN	-	Reverse JOG input. When JOGD is activated, the motor will JOG in reverse direction. [see P4-05]	

DI Signal	Assigned Control Mode	Pin No. (Default)	Details(*2)	Wiring Diagram (Refer to 5.2.8.4)
GNUM0	Pt, Pr, Pt-S, Pr-S	-	Electronic gear ratio (Numerator) selection 0. [See P2-60~P2-62]	C9/C10/C11/ C12
GNUM1	Pt, Pr, Pt-S, Pr-S	-	Electronic gear ratio (Numerator) selection 1. [See P2-60~P2-62]	
INHP	Pt, Pt-S	-	Pulse inhibit input. When the drive is in position mode, if INHP is activated, the external pulse input command is not valid.	

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 5.2.8.3 for details.

Table 5.D Command source of Position (Pr) control mode

Position Command	POS2	POS1	POS0	CTRG	Parameters
P1	0	0	0	↑	P6-02
					P6-03
P2	0	0	1	↑	P6-04
					P6-05
P3	0	1	0	↑	P6-06
					P6-07
P4	0	1	1	↑	P6-08
					P6-09
P5	1	0	0	↑	P6-10
					P6-11
P6	1	0	1	↑	P6-12
					P6-13
P7	1	1	0	↑	P6-14
					P6-15
P8	1	1	1	↑	P6-16
					P6-17

Table 5.E Source of Speed Command

SPD1	**SPD0**	**Parameter**
OFF	OFF	S mode: analog input Sz mode: 0
OFF	ON	P1-09
ON	OFF	P1-10
ON	ON	P1-11

Table 5.F Source of Torque Command

TCM1	**TCM0**	**Parameter**
OFF	OFF	T mode: analog input Tz mode: 0
OFF	ON	P1-12
ON	OFF	P1-13
ON	ON	P1-14

The default DI and DO signals in different control mode are listed in the following table 5.G and table 5.H. Although the content of the table 5.G and table 5.H do not provide more information than the table 5.B and table 5.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 5.G and table 5.H.

Table 5.G Default DI signals and Control modes

Signal	DI Code	Function	Pt	Pr	S	T	Sz	Tz	Pt S	Pt T	Pr S	Pr T	S T	CANopen
SON	0x01	Servo On	DI1	DI1	DI1	DI1	DI1	DI1	DI1	DI1	DI1	DI1	DI1	
ARST	0x02	Alarm Reset	DI5	DI5	DI5	DI5	DI5	DI5						
GAINUP	0x03	Gain switching												
CCLR	0x04	Pulse clear	DI2						DI2	DI2				
ZCLAMP	0x05	Low speed CLAMP												
CMDINV	0x06	Command input reverse control												
Reserved	0x07	Reserved												
CTRG	0x08	Command triggered		DI2							DI2	DI2		
TRQLM	0x09	Torque limit enabled			DI2		DI2							
SPDLM	0x10	Speed limit enabled				DI2		DI2						
POS0	0x11	Position command selection 0 (1~8)		DI3							DI3	DI3		
POS1	0x12	Position command selection 1 (1~8)		DI4							DI4	DI4		
POS2	0x13	Position command selection 2 (1~8)												
STOP	0x46	Motor stop												
SPD0	0x14	Speed command selection 0 (1~4)			DI3		DI3		DI3		DI5		DI3	
SPD1	0x15	Speed command selection 1 (1~4)			DI4		DI4		DI4		DI6		DI4	
TCM0	0x16	Torque command selection 0 (1~4)	DI3			DI3		DI3		DI3		DI5	DI5	
TCM1	0x17	Torque command selection 0 (1~4)	DI4			DI4		DI4		DI4		DI6	DI6	
S-P	0x18	Position / Speed mode switching (OFF: Speed, ON: Position)							DI7		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		DI7		

Signal	DI Code	Function	Pt	Pr	S	T	Sz	Tz	Pt S	Pt T	Pr S	Pr T	S T	CANopen
Pt-Pr	0x2A	Internal position (Pr) and external pulse (Pt) mode switching (OFF: Pt, ON: Pr)												
PTAS	0x2B	External command source selection: pulse and analog voltage switching (in Pt mode only)												
PTCMS	0x2C	External command source selection: highspeed / low-speed pulse switching (in Pt mode only)												
OPST	0x21	Operational stop	DI8	DI8	DI8	DI8	DI8	DI8	DI8	DI8	DI8	DI8	DI8	DI8
CWL(NL)	0x22	Reverse inhibit limit	DI6	DI6	DI6	DI6	DI6	DI6						DI6
CCWL(PL)	0x23	Forward inhibit limit	DI7	DI7	DI7	DI7	DI7	DI7						DI7
ORGP	0x24	Reference "Home" sensor												DI5
TLLM	0x25	Reverse operation torque limit (torque limit function is valid only when P1-02 is enabled)												
TRLM	0x26	Forward operation torque limit (torque limit function is valid only when P1-02 is enabled)												
SHOM	0x27	Move to "Home"												
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 5.2.8.1

Table 5.H Default DO signals and Control modes

Signal	DO Code	Function	Pt	Pr	S	T	Sz	Tz	Pt S	Pt T	Pr S	Pr T	S T	CANopen
SRDY	0x01	Servo ready	DO1	DO1	DO1	DO1	DO1	DO1	DO1	DO1	DO1	DO1	DO1	DO1
SON	0x02	Servo On												
ZSPD	0x03	At Zero speed	DO2	DO2	DO2	DO2	DO2	DO2	DO2	DO2	DO2	DO2	DO2	
TSPD	0x04	At Speed reached			DO3	DO3	DO3	DO3	DO3	DO3	DO3	DO3	DO3	
TPOS	0x05	At Positioning completed	DO4	DO4					DO4	DO4	DO4	DO4		
TQL	0x06	At Torques limit												
ALRM	0x07	Servo alarm (Servo fault) activated	DO5	DO5	DO5	DO5	DO5	DO5	DO5	DO5	DO5	DO5	DO5	DO5
BRKR	0x08	Electromagnetic brake control			DO4	DO4	DO4	DO4						
HOME	0x09	Homing completed	DO3	DO3										
OLW	0x10	Output overload warning												
WARN	0x11	Servo warning activated												
OVF	0x12	Position command overflow												
SCWL (SNL)	0x13	Reverse software limit												
SCCWL (SPL)	0x14	Forward software limit												
Cmd_OK	0x15	Internal position command completed output												
CAP_OK	0x16	Capture operation completed output												
MC_OK	0x17	Motion control completed output												
SP_OK	0x19	Speed reached output												
SDO_0	0x30	Output the status of bit00 of P4-06.												
SDO_1	0x31	Output the status of bit01 of P4-06.												
SDO_2	0x32	Output the status of bit02 of P4-06.												
SDO_3	0x33	Output the status of bit03 of P4-06.												
SDO_4	0x34	Output the status of bit04 of P4-06.												

Signal	DO Code	Function	Pt	Pr	S	T	Sz	Tz	Pt S	Pt T	Pr S	Pr T	S T	CANopen
SDO_5	0x35	Output the status of bit05 of P4-06.												
SDO_6	0x36	Output the status of bit06 of P4-06.												
SDO_7	0x37	Output the status of bit07 of P4-06.												
SDO_8	0x38	Output the status of bit08 of P4-06.												
SDO_9	0x39	Output the status of bit09 of P4-06.												
SDO_A	0x3A	Output the status of bit10 of P4-06.												
SDO_B	0x3B	Output the status of bit11 of P4-06.												
SDO_C	0x3C	Output the status of bit12 of P4-06.												
SDO_D	0x3D	Output the status of bit13 of P4-06.												
SDO_E	0x3E	Output the status of bit14 of P4-06.												
SDO_F	0x3F	Output the status of bit15 of P4-06.												

Note:
1) For Pin numbers of DO1~DO5 signals, please refer to section 5.2.8.1.

5.2.8.3 User-defined DI and DO signals

If the default DI and DO signals could not be able to fulfill users' requirements, there are still userdefined 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 and P2-18 to P2-22.
Please refer to the following Table 5.I for the settings.

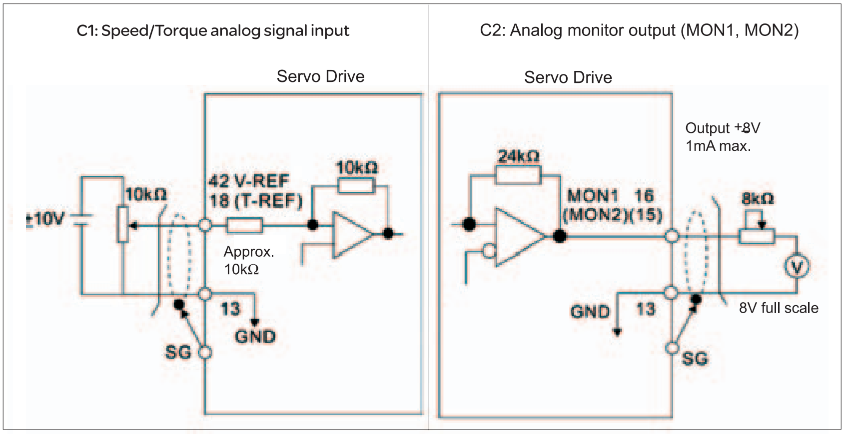
Table 5.I User-defined DI and DO signals

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

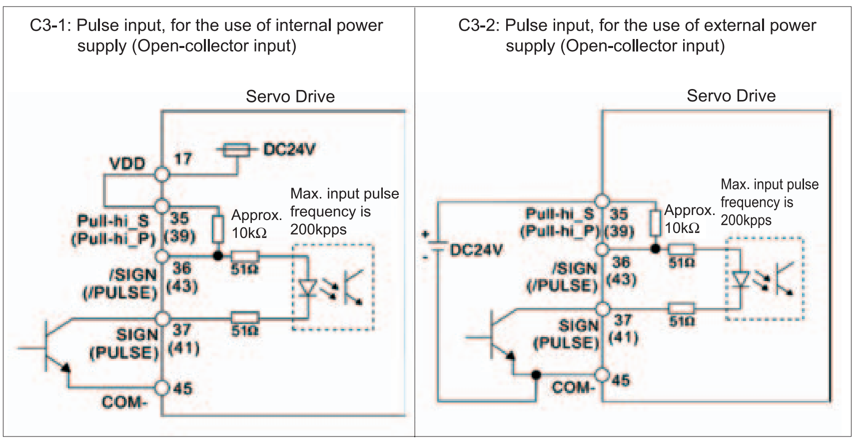
Signal Name		Pin No.	Parameter
Standard DO	DO1+	Pin 7 of CN1	P2-18
	DO1-	Pin 6 of CN1	
	DO2+	Pin 5 of CN1	P2-19
	DO2-	Pin 4 of CN1	
	DO3+	Pin 3 of CN1	P2-20
	DO3-	Pin 2 of CN1	
	DO4+	Pin 1 of CN1	P2-21
	DO4-	Pin 26 of CN1	
	DO5+	Pin 28 of CN1	P2-22
	DO5-	Pin 27 of CN1	

5.2.8.4 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. The value of input impedance is 10kΩ.

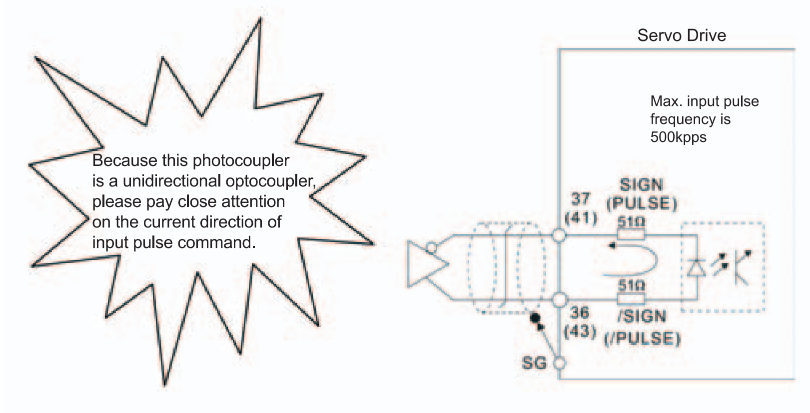


There are two kinds of pulse inputs, Line driver input and Open-collector input. Max. input pulse frequency of Line-driver input is 500kpps and max. input pulse frequency of Open-collector input is 200kpps.

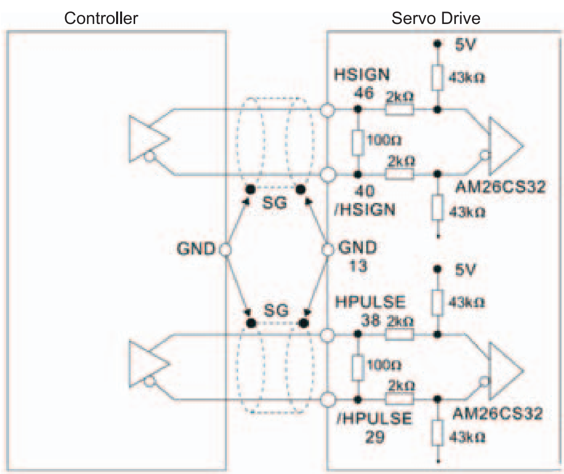


Caution: Do not use dual power supply. Failure to observe this caution may result in damage to the servo drive and servo motor.

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



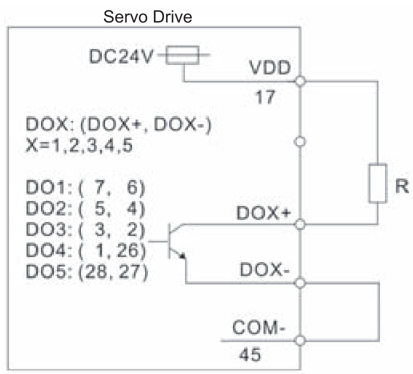
C4-2: High-speed pulse input (Line driver). It requires 5V power supply only. Never apply a 24V power supply.



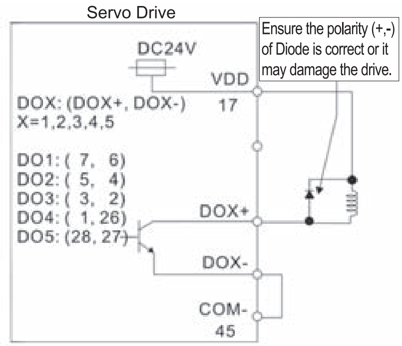
Caution: Ensure that the ground terminal of the controller and the servo drive should be connected to each other.

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

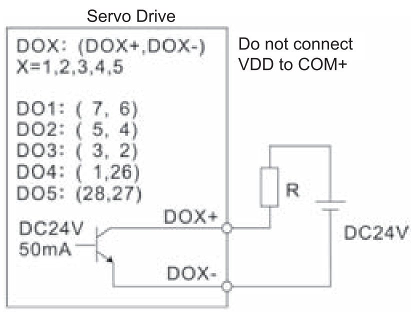
C5: Wiring of DO signal, for the use of internal power supply, general load



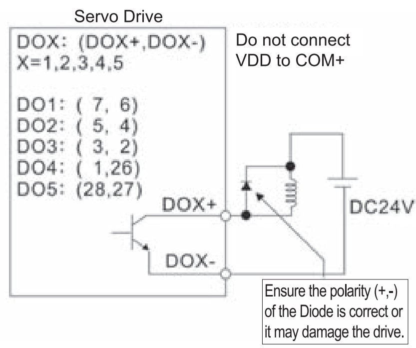
C6: Wiring of DO signal, for the use of internal power supply, inductive load



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

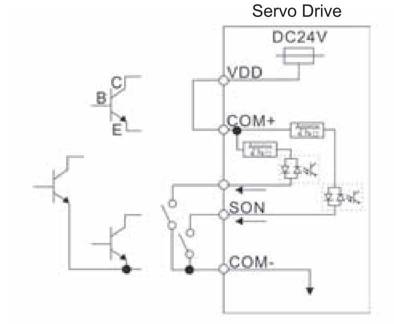


C8: Wiring of DO signal, for the use of external power supply, inductive load

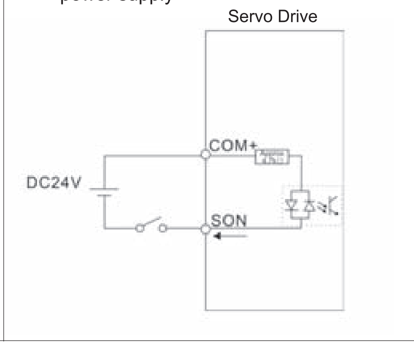


Use a relay or open-collector transistor to input signal.
NPN transistor with multiple emitter fingers (SINK Mode)

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

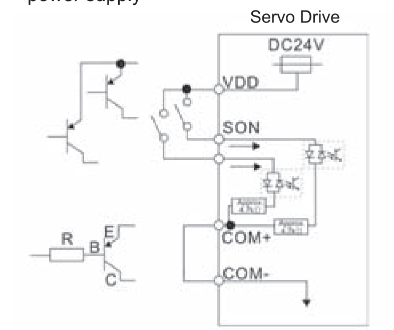


C10: Wiring of DI signal, for the use of external power supply

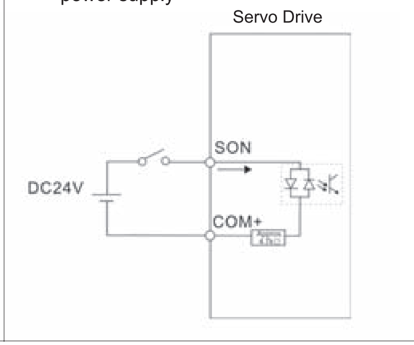


PNP transistor with multiple emitter fingers (SOURCE Mode)

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

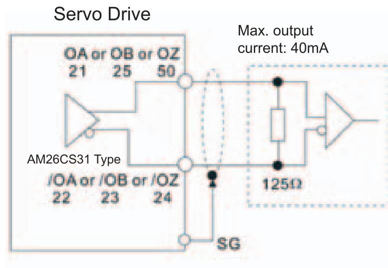


C12: Wiring of DI signal, for the use of external power supply

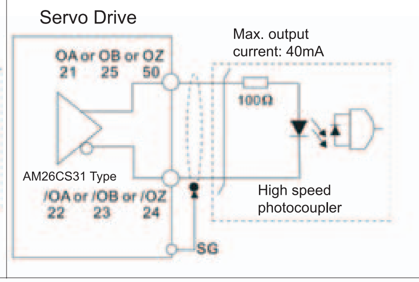


Caution: Do not use dual power supply. Failure to observe this caution may result in damage to the servo drive and servo motor.

C13: Encoder output signal (Line driver)



C14: Encoder output signal (Photocoupler)



5.2.9 Encoder Connector CN2

Feedback to the amplifier of the UVW signals for commutation is via the ABZ encoder signal wires. Following rotor position sensing the amplifier automatically switches to encoding for commutation control.
The 20-bit encoder is automatically multiplied to 1280000ppr for increased control accuracy.

Figure 5.7 The layout of CN2 Drive Connector

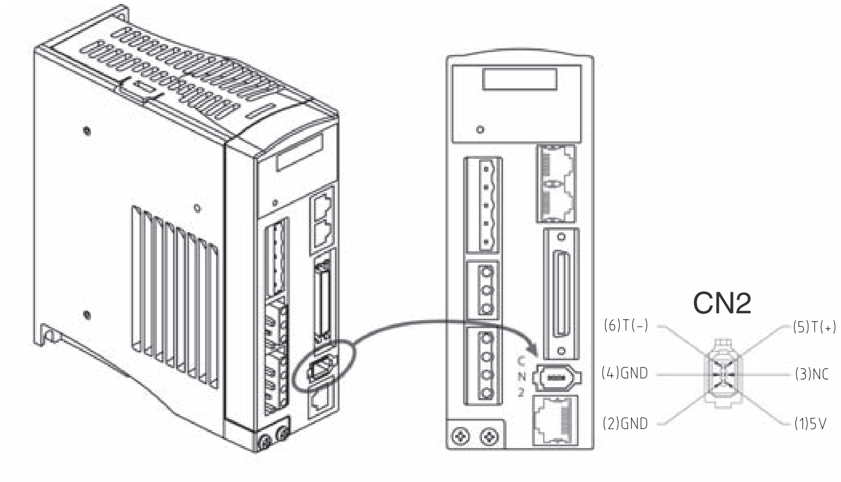
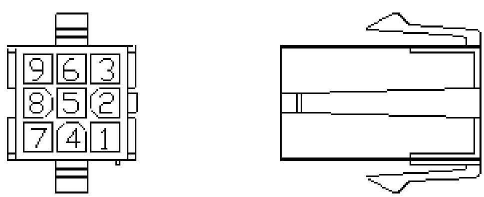
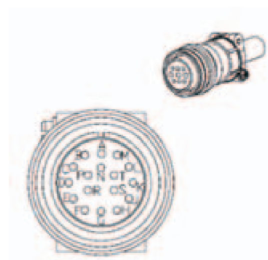


Figure 5.8 The layout of CN2 Motor Connector





Quick Connector

Military Connector

CN2 Terminal Signal Identification

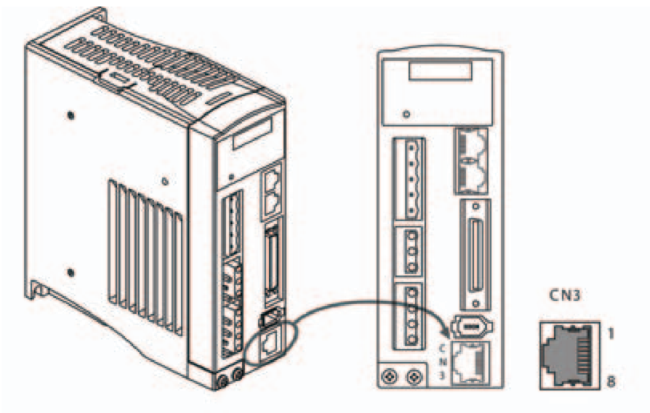
Drive Connector			Motor Connector		
PIN No.	Terminal Identification	Description	Military Connector	Quick Connector	Color
5	T+	Serial communication signal input / output (+)	A	1	Blue
6	T-	Serial communication signal input / output (-)	B	4	Blue/Black
1	+5V	+5V power supply	S	7	Red & Red/ White
2, 4	GND	Ground	R	8	Black & Black/ White
-	-	Shielding	L	9	-

5.2.10 Serial Communication Connector CN3

CN3 Terminal Layout and Identification

The servo drive can be connected to a PC or controller via this serial communication connector CN3.
The communication connector CN3 of Schneider Electric servo drive can provides two serial communication interfaces: RS-232 and RS-485 connection. RS-232 is used for the drive commissioning with the software tool "Lexium23 Plus CT". The maximum cable length for an RS-232 connection is 15 meters (50 feet). RS-485 connection can be used as host interface, for example to connect a machine controller or personal computer with one or multiple LXM23 Plus servo drives to be connected simultaneously.

Figure 5.9 The layout of CN3 Drive Connector



CN3 Terminal Signal Identification

Pin No.	Signal Name	Terminal Identification	Description
1	RS-232 data transmission	RS-232_TX	For data transmission of the servo drive. Connected to the RS-232 interface of PC.
2	RS-232 data receiving	RS-232_RX	For data receiving of the servo drive. Connected to the RS-232 interface of PC.
3, 6, 7	-	-	Reserved
4	RS-485 data transmission	RS-485(+)	For data transmission of the servo drive (differential line driver + end)
5	RS-485 data transmission	RS-485(-)	For data transmission of the servo drive (differential line driver - end)
8	Grounding	GND	Ground

NOTE:
1) For the connection of RS-485, please refer to chapter 9 "Communication".

Connection between PC and Connector CN3

To connect a personal computer with the CN3 interface of LXM23 Plus servo drives, the USB to RJ45 (RS232) interface connector "VW3M8131" and RJ45 cable "490NTW00002" can be used.

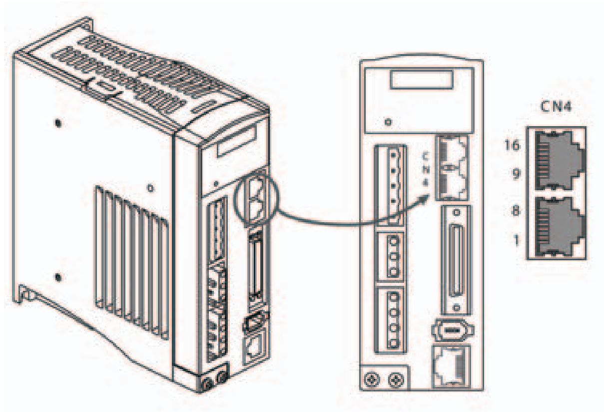
5.2.11 CANopen and CANmotion Communication Interface CN4

Function
The LXM23A device is suitable for connection to CANopen and CANmotion through interface connector CN4.

A CAN bus connects multiple devices via a bus cable. Each network device can transmit and receive messages. Data between network devices is transmitted serially.
Each network device must be configured before it can be operated on the network. The device is assigned a unique node address (node ID) between 1 (0x01) and 127 (0x7F). The node address of a LXM23A device is determined by parameter P3-05 during commissioning. The baud rate must be the same for all devices in the field bus. For further information on the field bus, see the LXM23A CANopen field bus manual.

There are two communication ports of connector CN4, one is for transmission (CAN-out) and the other is for receiving (CAN-In), convenient for connecting to more than one servo drives in serial. Ensure to connect a termination resistor to the last connected servo drive.

Figure 5.10 The layout of CN4 Connector



CN4 Interface Signal Identification

Pin No.	Signal Name	Description
1.9	CAN_H	CAN_H bus line (dominant high)
2.10	CAN_L	CAN_H bus line (dominant low)
3.11	CAN_GND	Ground / OV/V-
4.12	-	Reserved
5.13	-	Reserved
6.14	-	Reserved
7.15	CAN_GND	Ground / OV/V-
8.16	-	Reserved

Connecting CANopen

- Connect the CANopen cable to CN4 (pins 1, 2 and 3) with an RJ45 connector. Note the information on using cables with RJ45 connectors.
- Verify that the connector locks snap in properly at the housing.

Cable specifications

Shield:	Required, both ends grounded
Twisted Pair:	Required
PELV:	Required
Cable composition:	2*0.25 mm^2, 2* 0.20 mm^2, (2*AWG 22,2* AWG 24)
Max. cable length:	See Table 6.3 Maximum length depends on the number of devices, baud rate, connectors and signal propagation delay. The higher the baud rate, the shorter the bus cable needs to be.
Special features:	The cable composition relates to cables with D-SUB connectors. In the case of cables with RJ45 connectors, the conductor cross section is reduced; therefore, the maximum bus length is only half as long as in the case of cables with D-SUB connectors. Cables with RJ45 connectors may only be used inside of control cabinets.Multiple-port taps for trunk lines are available as accessories.

- se equipotential bonding conductors.
- se pre-assembled cables (see chapter 12 Accessories and spare parts) to reduce the risk of wiring errors.

Connectors D-SUB and RJ45

Usually, a cable with D-Sub connectors is used for CAN field bus connection in the field. Inside control cabinets, connections with RJ45 cables have the benefit of easier and faster wiring. In the case of CAN cables with RJ45 connectors, the maximum permissible bus length is reduced by 50%.

Multiple-port taps can be used to connect an RJ45 system inside the control cabinet to a D-SUB system in the field. The trunk line is connected to the multiple-port tap by means of screw terminals; the devices are connected by means of pre-assembled cables. See chapter 12 CANopen cable with connectors, CANopen connectors, distributors, terminating resistors", multiple-port taps.

Maximum bus length CAN

The maximum bus length depends on the selected baud rate. Table x.x shows the maximum recommended overall length of the CAN bus in the case of cables with D-SUB connectors.

Baud rate [kblt/s]	Maxlmum bus length [m]
50	1000
125	500
250	250
500	100
1000	20[1)]

1) According to the CANopen specification,the maximum bus length is 4 m. However, in practice, 20 m have been possible in most cases. External interference may reduce this length.

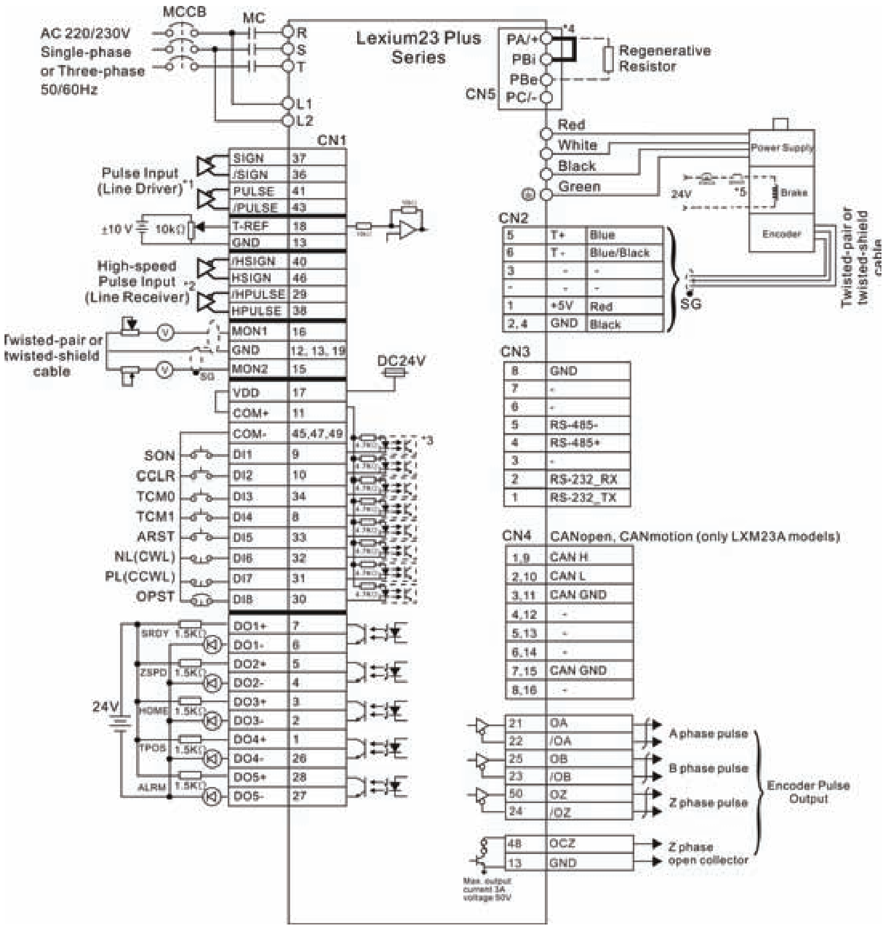
Table x.x Maximum bus length for CAN with D-SUB connection

NOTE: If you use cables with RJ45 connectors, the maximum bus length is reduced by 50%.

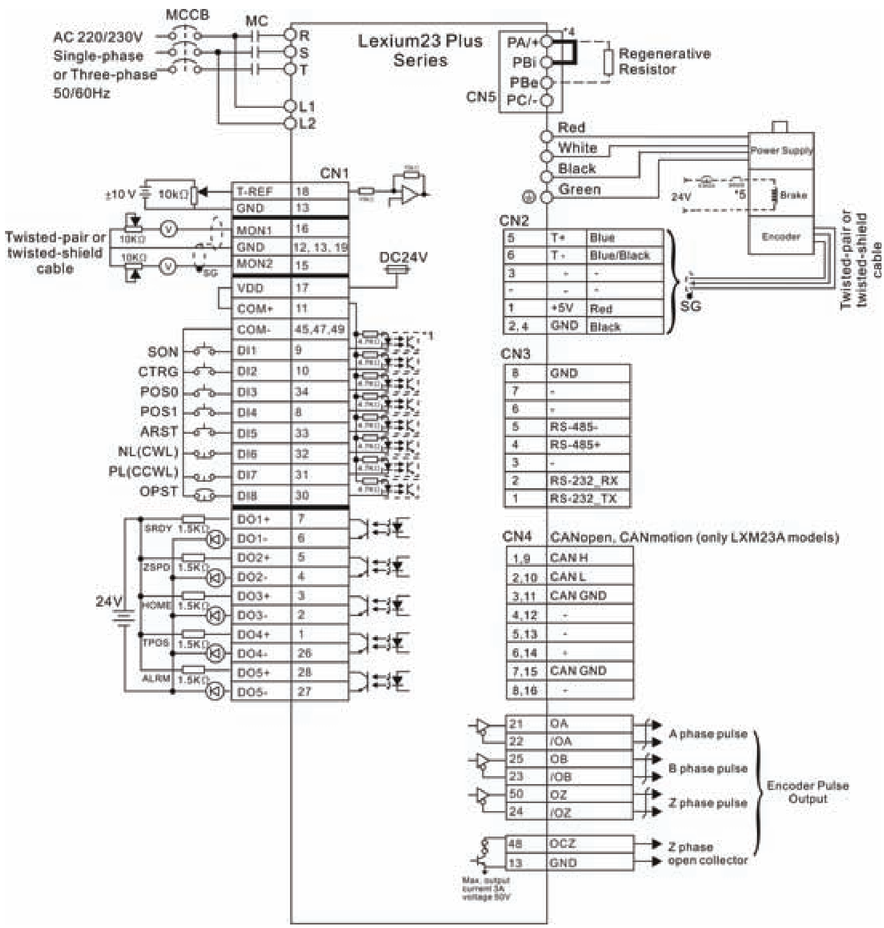
At a baud rate of 1 Mbit/s, the drop lines are limited to 0.3m. Terminating resistors Both ends of a CAN bus line must be terminated. A 120 ohm terminating resistor between CAN_L and CAN_H is used for this purpose. Connectors with integrated terminating resistors are available as accessories, see chapter 12 "CANopen connectors, distributors, terminating resistors".

5.3 Standard Connection Example

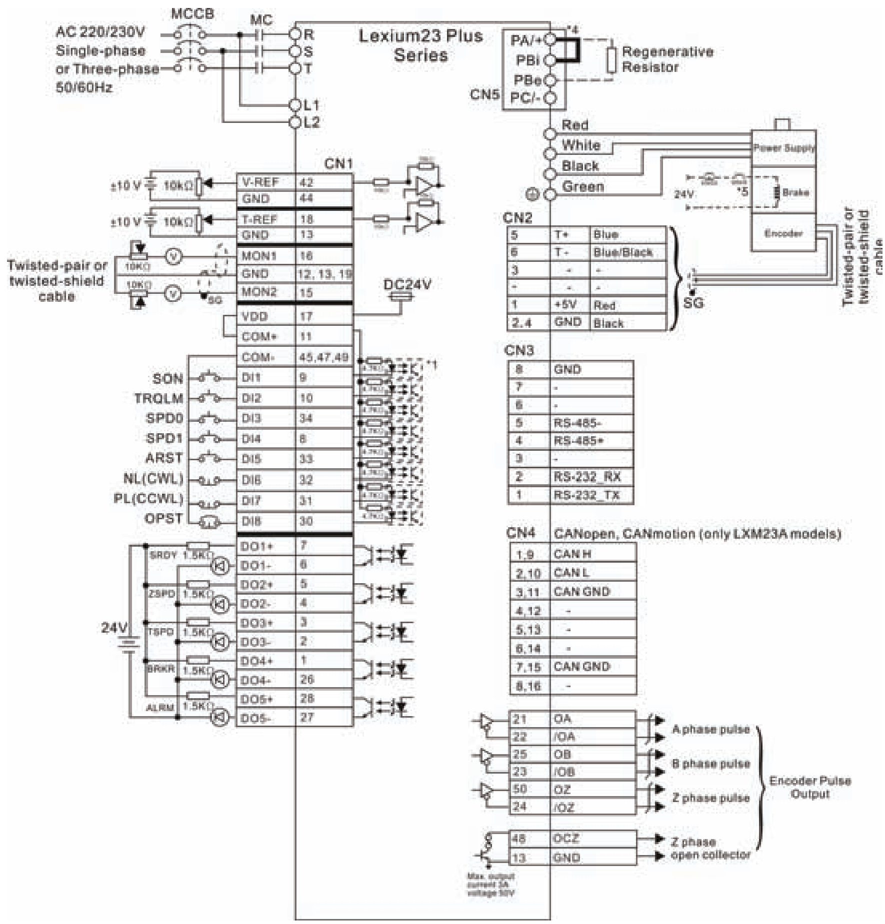
5.3.1 Position control mode wiring diagram (pulse control)



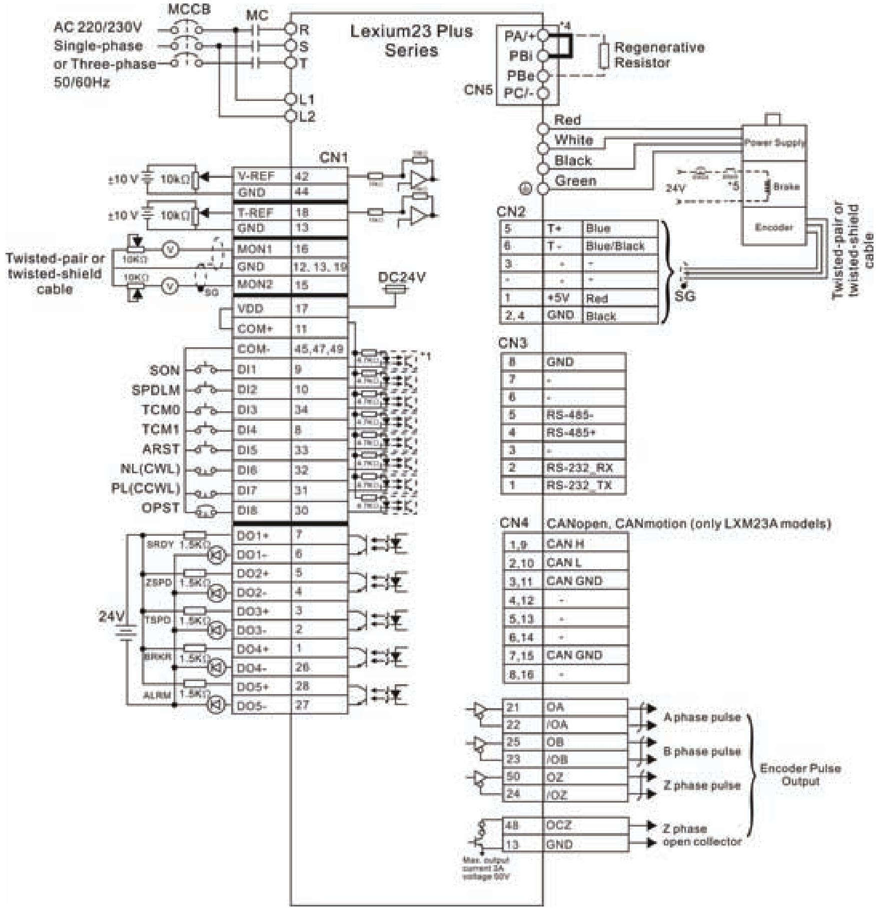
5.3.2 Position control mode wiring diagram (build-in motion sequence)



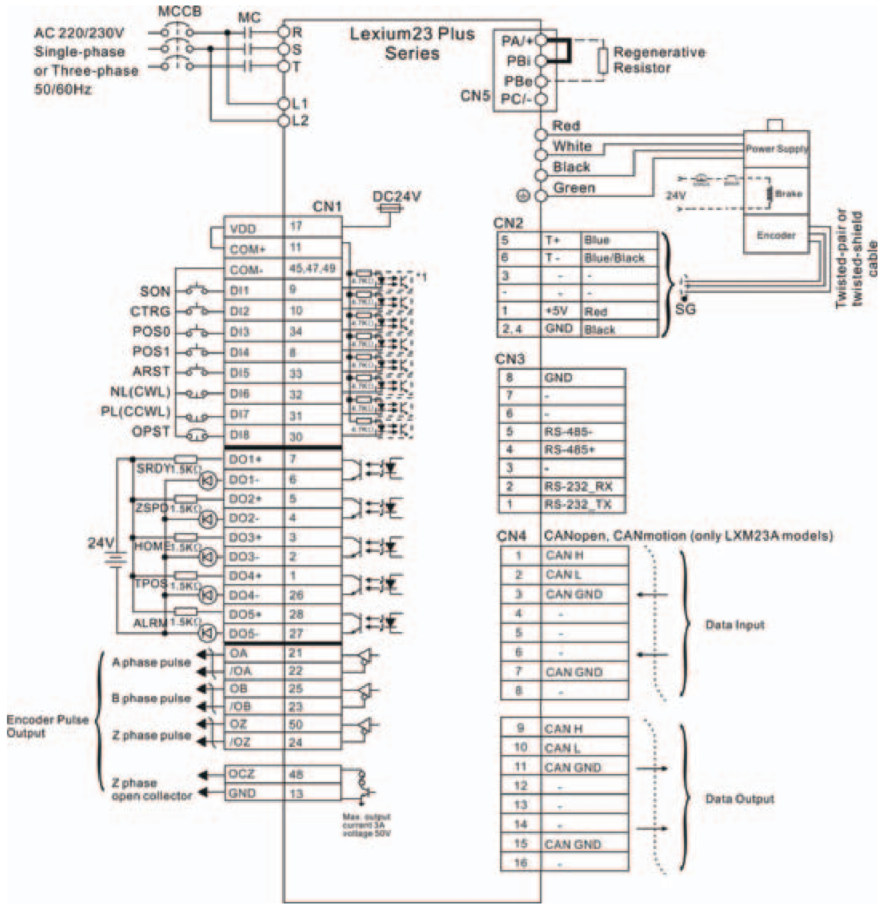
5.3.3 Speed control mode wiring diagram



5.3.4 Torque control mode wiring diagram



5.3.5 CANopen control mode wiring diagram



Commissioning

6

At a Glance

Presentation

This chapter describes the basic operation of the Integrated HMI and the features it offers.

What's in this Chapter?

This chapter contains the following topics:

6.1 Basic information

An overview of the parameters can be found in the chapter "Parameters". The use and the function of some parameters are explained in more detail in this chapter.

⚠ DANGER

ELECTRIC SHOCK CAUSED BY INCORRECT USE

The DC bus voltage is still present.

- Turn off the mains voltage using an appropriate switch to achieve a voltage-free condition.

Failure to follow these instructions will result in death or serious injury.

⚠ DANGER

UNINTENDED CONSEQUENCES OF EQUIPMENT OPERATION

When the system is started, the drives are usually out of the opera-tor's view and cannot be visually monitored.

- Only start the system if there are no persons in the hazardous area.

Failure to follow these instructions will result in death or serious injury.

⚠ WARNING

UNINTENDED BEHAVIOR

The behavior of the drive system is governed by numerous stored data or settings. Unsuitable settings or data may trigger unexpected movements or responses to signals and disable monitoring functions.

- Do NOT operate the drive system with unknown settings or data.
- Verify that the stored data and settings are correct.
- When commissioning, carefully run tests for all operating states and potential error situations.
- Verify the functions after replacing the product and also after making changes to the settings or data.
- Only start the system if there are no persons or obstructions in the hazardous area.

Failure to follow these instructions can result in death, serious injury or equipment damage.

⚠ WARNING

UNINTENDED BEHAVIOR

The behavior of the drive system is governed by numerous stored data or settings. Unsuitable settings or data may trigger unexpected movements or responses to signals and disable monitoring functions.

- Do NOT operate the drive system with unknown settings or data.
- Verify that the stored data and settings are correct.
- When commissioning, carefully run tests for all operating states and potential error situations.
- Verify the functions after replacing the product and also after making changes to the settings or data.
- Only start the system if there are no persons or obstructions in the hazardous area.

Failure to follow these instructions can result in death, serious injury or equipment damage.

⚠ WARNING

MOTOR WITHOUT BRAKING EFFECT

If power outage and faults cause the power stage to be switched off, the motor is no longer stopped by the brake and may increase its speed even more until it reaches a mechanical stop.

- Verify the mechanical situation.
- If necessary, use a cushioned mechanical stop or a suitable hold-ing brake.

Failure to follow these instructions can result in death, serious injury or equipment damage.

WARNING

UNEXPECTED MOVEMENT

When the drive is operated for the first time, there is a risk of unex-pected movements caused by possible wiring errors or unsuitable pa-rameters.

- Perform the first test run without coupled loads.
- Verify that a functioning button for EMERGENCY STOP is within reach.
- Anticipate movements in the incorrect direction or oscillation of the drive.
- Only start the system if there are no persons or obstructions in the hazardous area.

Failure to follow these instructions can result in death, serious injury or equipment damage.

WARNING

HOT SURFACES

The heat sink at the product may heat up to over 100° C (212° F) during operation.

- Avoid contact with the hot heat sink.
- Do not allow flammable or heat-sensitive parts in the immediate vicinity.
- Consider the measures for heat dissipation described.

Failure to follow these instructions can result in death or serious injury.

6.2 Overview

6.2.1 Commissioning steps

You must also recommission an already configured device if you want to use it under changed operating conditions.

To be done

To be done ...	**Info**
Checking the installation	Page120
Switching on the device for the first time	Page131
Setting basic parameters and limit values	Page133
Setting, scaling and checking analog signals	Page137
Setting and testing digital signals	Page139
Checking the holding brake	Page144
Checking the direction of movement of the motor	Page145
Setting the braking resistor parameters	Page150
Autotuning the device	Page152
Manually optimizing the controller settings - Velocity controller - Position controller	Page157 Page158 Page164

6.2.2 Commissioning tools

Overview

The following tools can be used for commissioning, parameterization and diagnostics:

Figure 6.1 Commissioning tools

(1) Integrated HMI
(2) PC with commissioning software

Access to all parameters is possible with the digital keypad or the commissioning software.

Device settings can be duplicated. Stored device settings can be transferred to a device of the same type. Duplicating the device settings can be used if multiple devices are to have the same settings, for example, when devices are replaced.

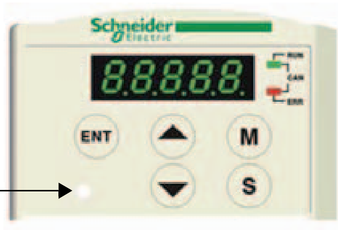
6.3 Integrated HMI Digital Keypad

6.3.1 Description of the Integrated HMI

The Integrated HMI includes the display panel and function keys. The Figure 6.2 shows all of the features of the Integrated HMI and an overview of their functions.

Figure 6.2 Keypad Features

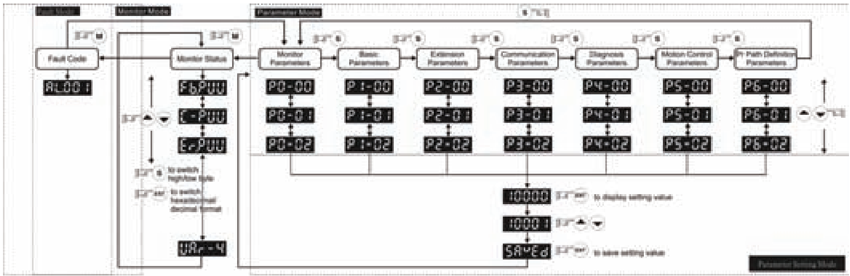
Charge LED



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.
M Key	M Key. Pressing M key can enter or exit different parameter groups, and switch between Monitor mode and Parameter mode.
S Key	S Key. Pressing S key can scrolls through parameter groups. After a parameter is selected and its value displayed, pressing S key can move the cursor to the left and then change parameter settings (blinking digits) by using arrow keys.
▲ and ▼ Key	▲ and ▼ key. Pressing the ▲ and ▼ key can scroll through and change monitor codes, parameter groups and various parameter settings.
ENT Key	ENT key. Pressing the ENT key can display and save the parameter groups, the various parameter settings. In monitor mode, pressing ENT key can switch decimal or hexadecimal display. In parameter mode, pressing ENT key can enter into parameter setting mode. During diagnosis operation, pressing ENT key can execute the function in the last step. (The parameter settings changes are not effective until the ENT key is pressed.)

6.3.2 Display Flowchart

Figure 6.3 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 M key can enter into parameter mode. In parameter mode, pressing M 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 M 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 ▲ or ▼ arrow key can switch monitor parameter code. At this time, monitor display symbol will display for approximately one second.
5. In monitor mode, pressing M key can enter into parameter mode. In parameter mode, pressing S key can switch parameter group and pressing ▲ or ▼ arrow key can change parameter group code.
6. In parameter mode, the system will enter into the setting mode immediately after the ENT key is pressed. The LCD display will display the corresponding setting value of this parameter simultaneously. Then, users can use ▲ or ▼ arrow key to change parameter value or press M 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 S key and change the parameter settings (blinking digits) by pressing the ▲ or ▼ arrow key.
8. After the setting value change is completed, press ENT 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.

6.3.3 Status Display

6.3.3.1 Save Setting Display

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

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

6.3.3.2 Decimal Point Display

Display Message	Description
	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.

6.3.3.3 Fault Message Display

Display Message	Description
AL.nnn	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 in Chapter 11 (Servo Parameters) or refer to Chapter 10 (Troubleshooting).

6.3.3.4 Polarity Setting Display

Display Message	Description
02468	Positive value display. When entering into parameter setting mode, pressing ▲ or ▼ arrow key can increase or decrease the display value. S key is used to change the selected digit (The selected digit will blink).
2.4.680	Negative value display. Continuously press S 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.)

6.3.3.5 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 ▲ or ▼ arrow key or change parameter P0-02 directly to specify the monitor status. When the power is applied, the monitor status depends 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, the C-PLS monitor codes will first display 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, 1280000 pulse/rev)	[pulse]
4	C-PLS	Input pulse number of pulse command (before electronic gear ratio is set)	[pulse]
5	Er.PLS	Position error counts	[pulse]
6	CP-Fr	Input frequency of pulse command	[Kpps]
7	SPEEd	Motor rotation speed	[rpm]
8	CSPd1	Speed input command	[Volt]
9	CSPd2	Speed input command	[rpm]
10	C-tq1	Torque input command	[Volt]
11	C-tq2	Torque input command	[%]
12	AuG-L	Average load	[%]
13	PE-L	Peak load	[%]
14	U 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)	[0.1 times]
16	IGbt.t	IGBT temperature	[°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 	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.	-

P0-02 Setting	Display Message	Description	Unit
19	MAP1	Mapping Parameter 1: Display the content of parameter P0-25 (mapping target is specified by parameter P0-35)	-
20	MAP2	Mapping Parameter 2: Display the content of parameter P0-26 (mapping target is specified by parameter P0-36)	-
21	MAP3	Mapping Parameter 3: Display the content of parameter P0-27 (mapping target is specified by parameter P0-37)	-
22	MAP4	Mapping Parameter 4: Display the content of parameter P0-28 (mapping target is specified by parameter P0-38)	-
23	UAr-1	Status Monitor 1: Display the content of parameter P0-09 (the monitor status is specified by parameter P0-17)	-
24	UAr-2	Status Monitor 2: Display the content of parameter P0-10 (the monitor status is specified by parameter P0-18)	-
25	UAr-3	Status Monitor 3: Display the content of parameter P0-11 (the monitor status is specified by parameter P0-19)	-
26	UAr-4	Status Monitor 4: Display the content of parameter P0-12 (the monitor status is specified by parameter P0-20)	-

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 67890.	(Dec. High Byte) (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 L5678	(Hex. High Byte) (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.
1.2.3.4.5.			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.

6.4 Commissioning software

The commissioning software has a graphic user interface and is used for commissioning, diagnostics and testing settings.

- Tuning of the controller parameters via a graphical user interface
- Comprehensive set of diagnostics tools for optimization and manntenance
- Long-term recording for evaluation of the performance
- Testing the input and output signals
- Tracking signals on the screen
- Archiving of device settings and recordings with export function for further processing in other applications

See page 256 for details on connecting a PC to the device.

Online help

The commissioning software offers help functions, which can be accessed via "?-Help Topics" or by pressing theF1key.

6.5 Commissioning procedure

⚠ WARNING

LOSS OF CONTROL DUE TO UNSUITABLE PARAMETER VALUES

Unsuitable parameter values may disable monitoring functions and trigger unexpected movements or responses of signals.

- Prepare a list with the parameters required for the functions used.
- Check the parameters before operation.
- Only start the system if there are no persons or obstructions in the hazardous area.

Failure to follow these instructions can result in death, serious injury or equipment damage.

6.5.1 Switching on the device for the first time

Duplicating device settings

The commissioning software allows you duplicate device settings.

Automatic reading of the motor data

When the servo drive is switched on and if a BCH motor is connected, the device automatically reads the motor data from the motor encoder. The data record is checked by the servo drive. With this data, the BCH motor type is identified by the LXM23 Plus servo drive.

The record contains motor specific information. The record cannot be changed by the user.

Preparation

If the device is not to be commissioned exclusively via the Integrated HMI, a PC with the commissioning software must be connected.

Switching on the device

■ The power stage supply voltage is switched off.

▶ Switch on the controller supply voltage.

◁ The device goes through an initialization routine, all LEDs are tested, all segments of the 7-segment display and the LEDs light up.

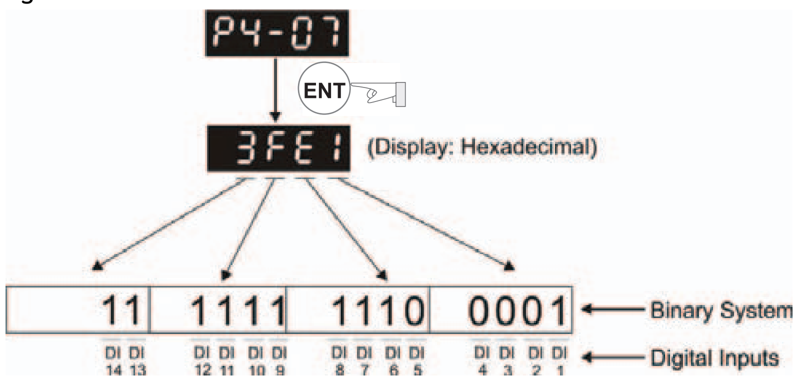
After the initialization, the device is ready for operation. The device is in the Pt operating mode. See chapter 8.3 "Operating modes", page 160 for changing operating modes.

6.5.2 DI Diagnosis Operation

Following the setting method in Figure 6.4 can perform DI diagnosis operation (parameter P4-07, Input Status). According to the ON and OFF status of the digital inputs DI1 to DI8, 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 6.4)

For example:
Suppose that the servo drive LED display is "3FE1".
"E" is hexadecimal, which is equal to "1110" in binary system, and it means that the digital inputs DI6 ~ DI8 are ON.

Figure 6.4

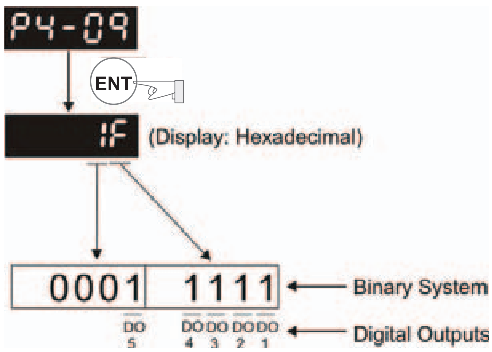


6.5.3 DO Diagnosis Operation

Following the setting method in Figure 6.5 can perform DO diagnosis operation (parameter P4-09, Output Status Display). According to the ON and OFF status of the digital outputs DO1 to DO5, 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 6.5)

For example:
Suppose that the servo drive LED display is "1F".
"F" is hexadecimal, which is equal to "1111" in binary system, and it means that the digital outputs DO1 ~ DO4 are ON.

Figure 6.5



6.5.4 Trial Run and Tuning Procedure

This part, 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.

6.5.4.1 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:

1. Inspection before operation (Control power is not applied)

- Inspect the servo drive and servo motor to insure they were not damaged.
- 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.
- Make sure control switch is OFF.
- Never put inflammable objects on servo drive or close to the external regenerative resistor.
- 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.

2. 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 different machinery equipment are not the same, 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 11). 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 Schneider Electric.
- 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 Schneider Electric.

6.5.4.2 Applying Power to the Drive

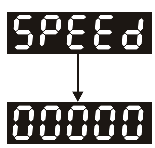
The users please observe the following steps when applying power supply to the servo drive.

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 5.2.
   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 5.2.

⚠ 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.

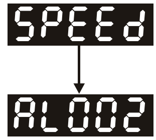
2. Main circuit wiring
   Connect power to the AC servo. For three-phase input power connection and single-phase input power connection, please refer to Section 5.2.3.
3. Turn the Power On
   The Power includes control circuit power (L1, L2) and main circuit power (R, S, T). When the power is on, the 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 Operational Stop (OPST) 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 11 "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 ((L1, L2) is over low.

1) When display shows:



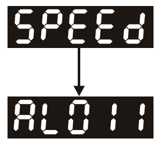
Overvoltage:

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 main circuit 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:



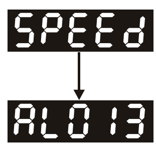
Encoder error:

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:



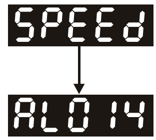
Operational stop activated:

Please check if any of digital inputs DI1 ~ DI8 signal is set to "Operational Stop" (OPST).

Corrective Actions:

- If it does not need to use "Operational Stop (OPST)" as input signal, the users only need to confirm that if all of the digital inputs DI1 ~ DI8 are not set to "Operational Stop (OPST)". (The setting value of parameter P2-10 to P2-17 is not set to 21.)
- If it is necessary to use "Operational Stop (OPST)" as input signal, the users only need to confirm that which of digital inputs DI1 ~ DI8 is set to "Operational Stop (OPST)" and check if the digital input signal is ON (It should be activated).

4) When display shows:



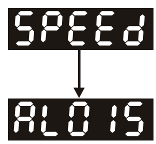
Reverse limit switch error:

Please check if any of digital inputs DI1 ~ DI8 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 ~ DI8 are not set to "Reverse inhibit limit (NL)". (The setting value of parameter P2-10 to P2-17 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 ~ DI8 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 ~ DI8 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 ~ DI8 are not set to "Forward inhibit limit (PL)". (The setting value of parameter P2-10 to P2-17 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 ~ DI8 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:

<u>Corrective Actions:</u>
- 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:

<u>Corrective Actions:</u>
- 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 limit.

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 Schneider Electric for assistance.

6.5.4.3 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 Integrated HMI 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: rpm). After the desired JOG speed is set, and then press ENT key, the drive will enter into JOG operation mode automatically.

STEP 3: The users can press ▲ and ▼ key to change JOG speed and press S key to adjust the digit number of the displayed value.

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

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

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

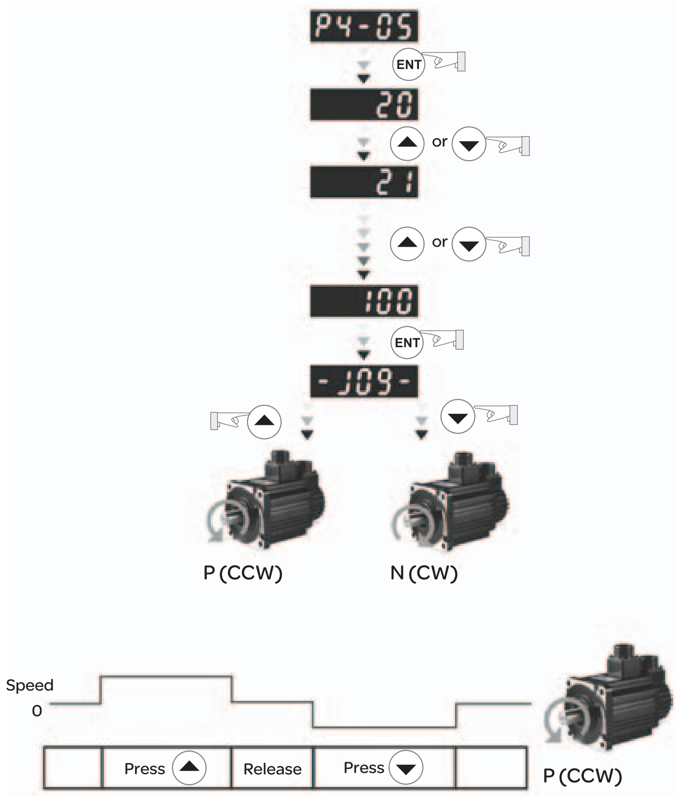
N (CW) and P(CCW) Definition:

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.

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

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



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.

6.5.4.4 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	-

By default, DI6 is the function of reverse inhibit limit, DI7 is the function of forward inhibit limit and DI6 is the function of operational stop (DI8), if the users do not set the setting value of parameters P2-15 to P2-17 and P2-36 to P2-41 to 0 (Disabled), the faults (AL013, 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 P2-41 to 0 (Disabled) in advance.
All the digital inputs of Lexium23 Plus servo drives 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 11.A in Chapter 11). 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 6.5.4.2.

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	-60000 ~ 60000
S3	1	0		P1-10	-60000 ~ 60000
S4	1	1		P1-11	-60000 ~ 60000

0: indicates OFF (Normally Open); 1: indicates ON (Normally Closed)
The range of internal parameter is from -60000 to 60000.
Setting value of speed command = Setting range x unit (0.1 rpm).
For example:
If P1-09 is set to +30000, the setting value of speed command = +30000 x 0.1 rpm = +3000 rpm.

The settings of speed command:

	Input value command	Rotation direction
P1-09 is set to +30000		
P1-10 is set to +1000	+	N(CW)
P1-11 is set to -30000	-	P(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 +30000) is selected, and the motor speed is 3000rpm at this time.
4. If only DI4 is ON (SPD1), it indicates S3 command (P1-10 is set to +1000) is selected, and the motor speed is 100 rpm at this time.
5. If DI3 (SPD0) and DI4 (SPD1) are ON both, it indicates S4 command (P1-11 is set to -30000) is selected, and the motor speed is -3000rpm 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).

6.5.4.5 Position Trial Run without Load

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

STEP 1:
Set the value of parameter P1-01 to 01 and it is position (Pr) control mode. After selecting the operation mode as position (Pr) control mode, please restart the drive and the setting would be valid.

STEP 2:
In position control mode, the necessary DI setting is 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=108	CTRG	Command trigged	DI2-=10
DI3	P2-12=111	POS0	Position command selection	DI3-=34
DI4	P2-13=112	POS1	Position 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	-

By default, DI6 is the function of reverse inhibit limit, DI7 is the function of forward inhibit limit and DI6 is the function of operational stop (DI8), if the users do not set the setting value of parameters P2-15 to P2-17 and P2-36 to P2-41 to 0 (Disabled), the faults (AL013, 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 P2-41 to 0 (Disabled) in advance.
All the digital inputs of Schneider Electric Lexium23 Plus servo drives 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 11.A in Chapter 11). 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 6.5.4.2.
For the information of wiring diagram, please refer to Section 5.3.2 (Wiring of position (Pr) control mode).
Because POS2 is not the default DI, the users need to change the value of parameter P2-14 to 113.

Please refer to the following table for 8 groups of position commands and position command selection from POS0 to POS2.

Position Command	POS2	POS1	POS0	CTRG	Parameters
P1	0	0	0	↑	P6-02
					P6-03
P2	0	0	1	↑	P6-04
					P6-05
P3	0	1	0	↑	P6-06
					P6-07
P4	0	1	1	↑	P6-08
					P6-09
P5	1	0	0	↑	P6-10
					P6-11
P6	1	0	1	↑	P6-12
					P6-13
P7	1	1	0	↑	P6-14
					P6-15
P8	1	1	1	↑	P6-16
					P6-17

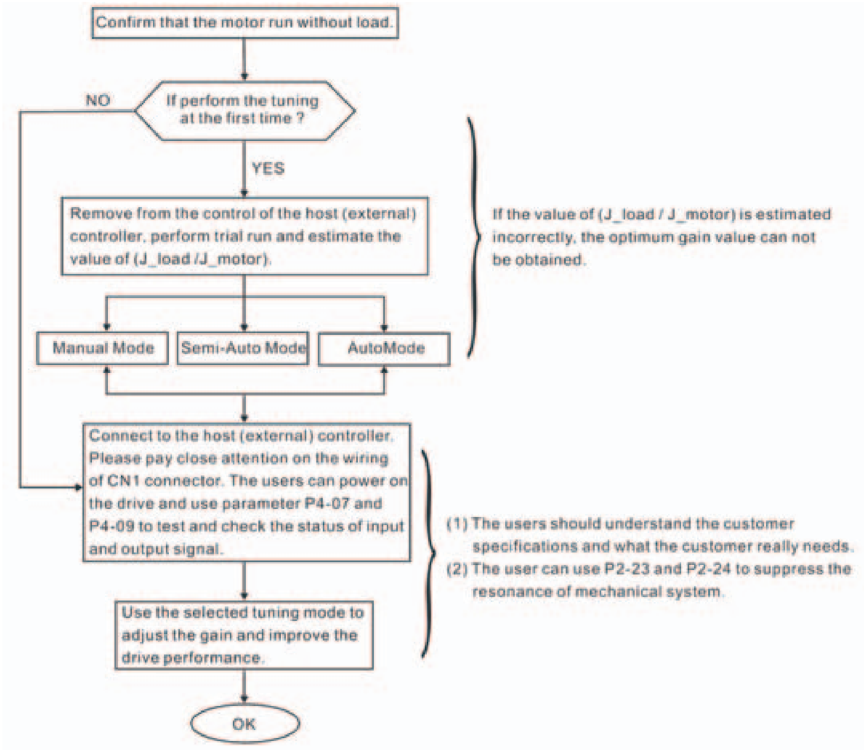
0: indicates OFF (Normally Open); 1: indicates ON (Normally Closed)
The users can set the value of these 8 groups of commands (P6-00 ~p6-17) freely. The command can be absolute position command as well.

6.5.4.6 Tuning Procedure

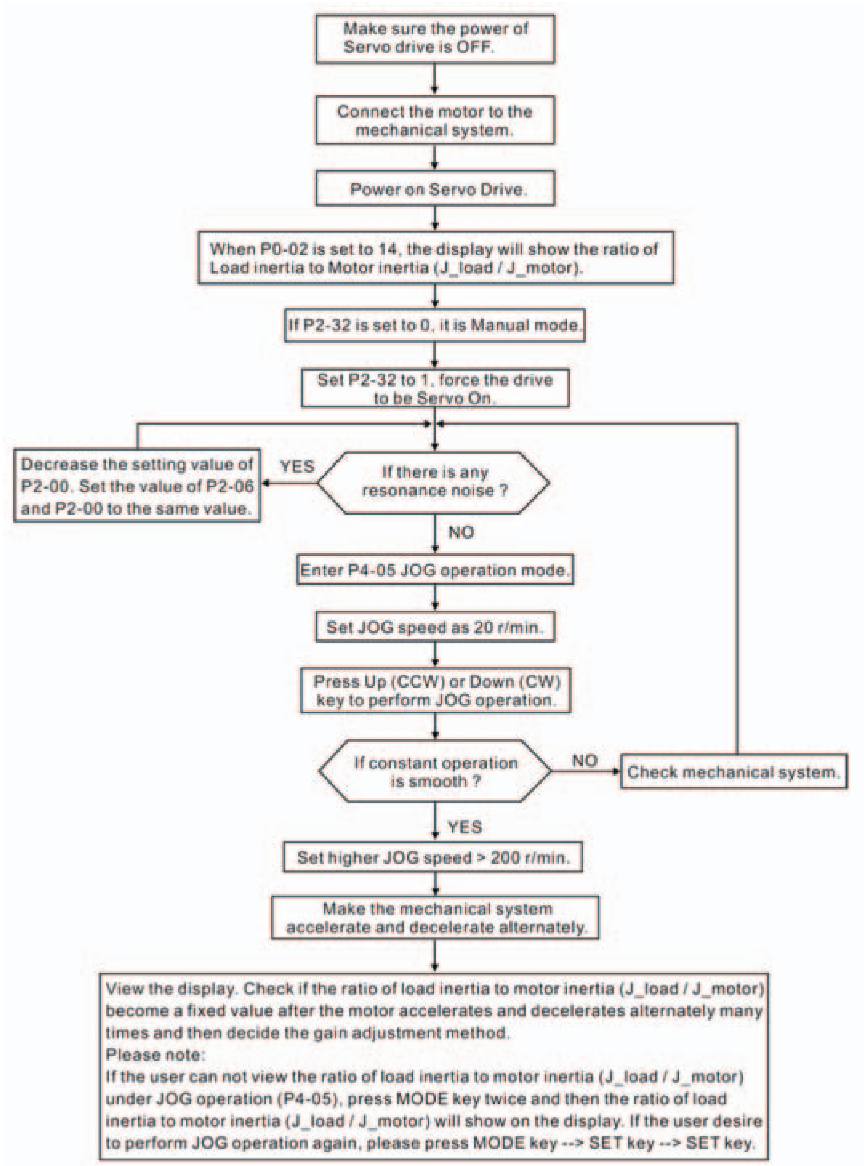
Table 5.A Estimate the ratio of Load Inertia to Servo Motor Inertia (J_load /J_motor): JOG Mode

1. After wiring is completed, when power in connected to the AC servo drive, the right side display will show on the LCD display.	ALE 14
2. Press M key to enter into parameter mode.	P0-00
3. Press S key twice to select parameter group.	P2-00
4. Press ▲ key to view each parameter and select parameter P2-17.	P2-17
5. Press ENT key to display the parameter value as shown on the right side.	21
6. Press S key twice to change the parameter values. Use ▲ key to cycle through the available settings and then press ENT key to determine the parameter settings.	121
7. Press ▲ key to view each parameter and select parameter P2-30.	P2-30
8. Press ENT key to display the parameter value as shown on the right side.	0
9. Select parameter value 1. Use ▲ 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 ▼ 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.)	5.0
13. Press M key to select parameter mode.	P2-30
14. Press S key twice to select parameter group.	P4-00
15. Press ▲ key to select user parameter P4-05.	P4-05
16. Press ENT key and JOG speed 20 rpm will be displayed. Press ▲ and ▼ key to increase and decrease JOG speed. To press S key one time can add one digit number.	20 200
17. Select desired JOG speed, press ENT key and it will show the right side display.	-JOG-
18. Pressing ▲ key is forward rotation and pressing ▼ 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.	
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 M 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 M key once and press ENT 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.	

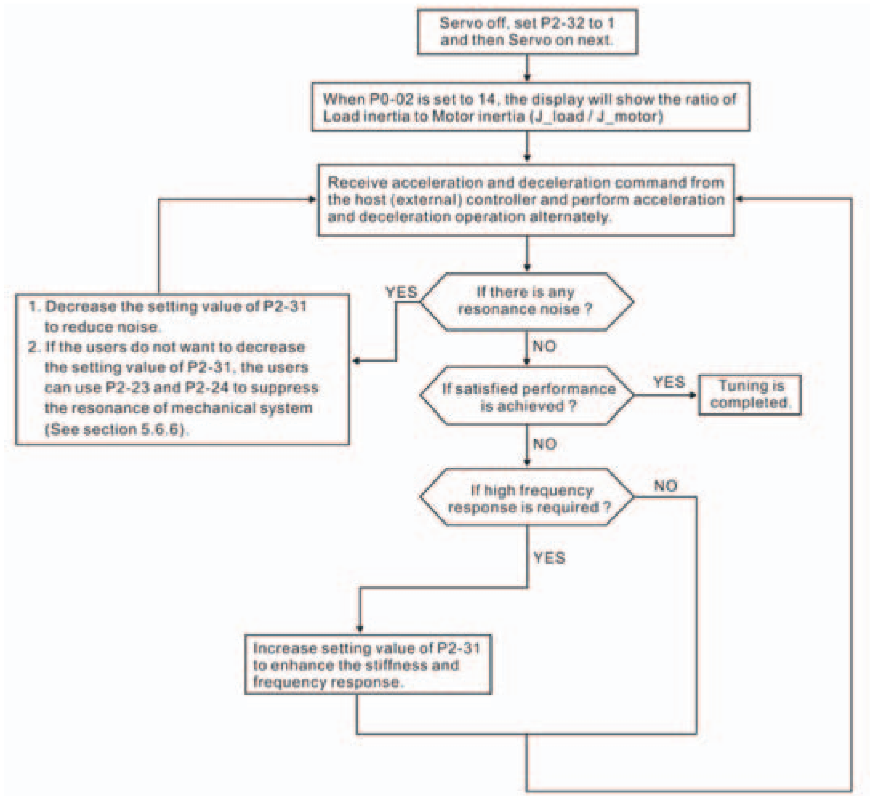
(1) Tuning Flowchart



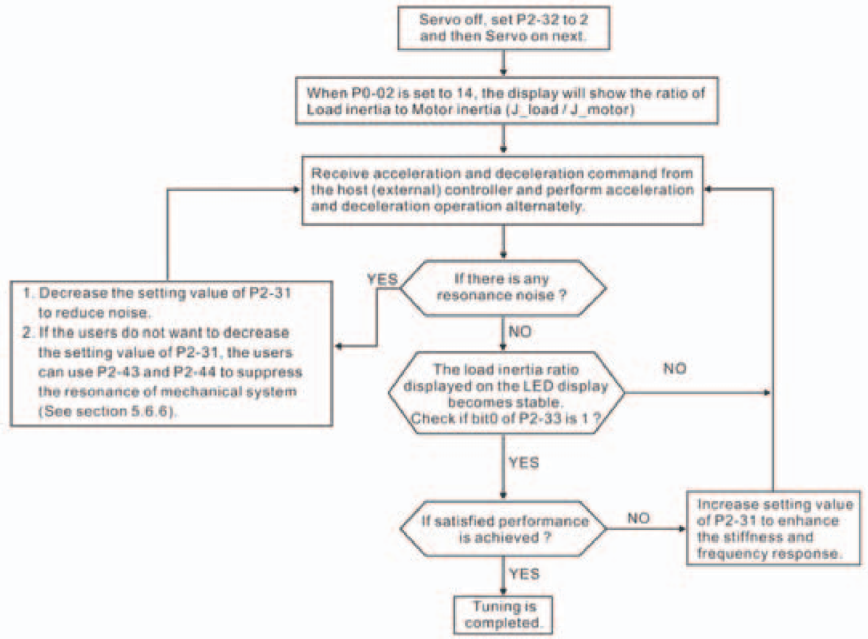
(2) Load Inertia Estimation Flowchart



(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 ~ 850Hz : High stiffness and high frequency response
851 ~ 1000Hz : Extremely high stiffness and extremely 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.



(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 ~ 850Hz : High stiffness and high frequency response
851 ~ 1000Hz : Extremely high stiffness and extremely 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.

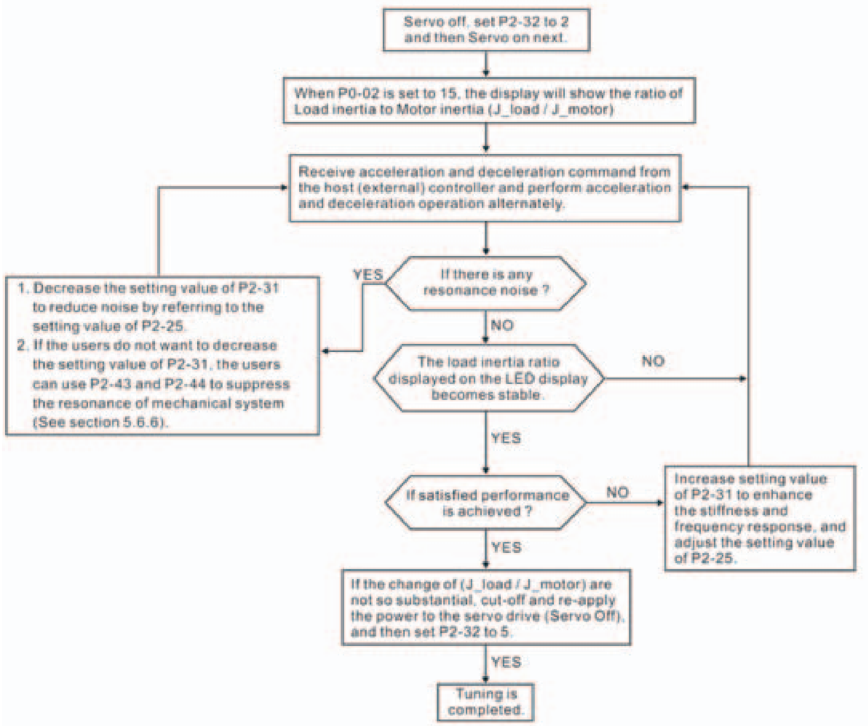


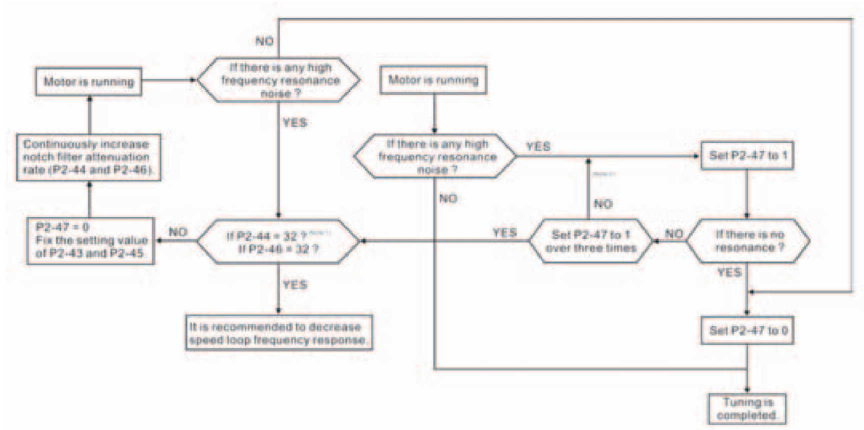
NOTE:

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) Limit of Load Inertia Estimation

The accel. / decel. time for reaching 2000 rpm must be below 1 second. The rotation speed must be above 200 rpm. 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.





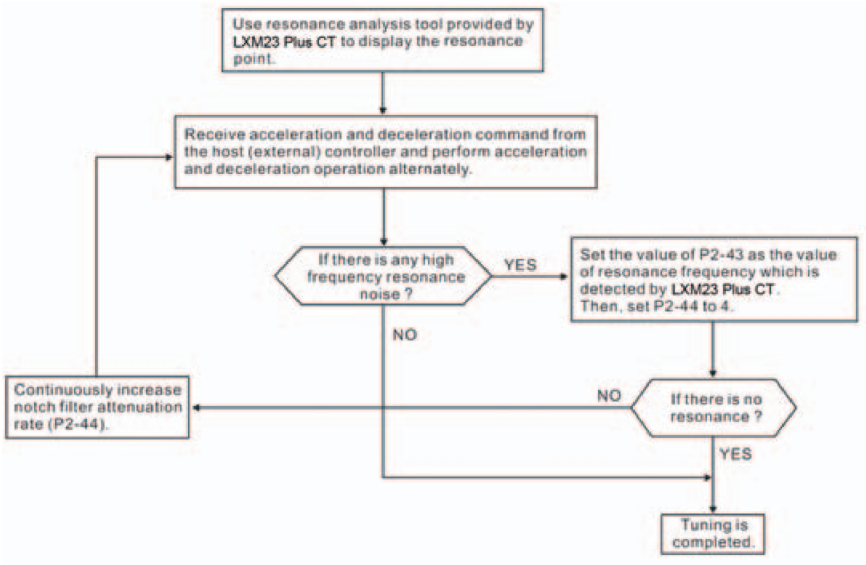
NOTE:

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.

(6) Mechanical Resonance Suppression Method

In order to suppress the high frequency resonance of the mechanical system, Lexium23 Plus servo drive provides two notch filters (resonance suppression parameters) for resonance suppression. This 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.



(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]	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)	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.

(8) Gain Adjustment in Manual Mode

The position and speed frequency response 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 frequency response may easily result in the resonance of machinery system. Therefore, for the applications of high frequency response, the machinery system with control stiffness is needed to avoid the resonance. Especially when adjusting the frequency response of unfamiliar machinery system, the users can gradually increase the gain setting value to improve frequency response 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 frequency response 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 frequency response is calculated as follows:

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

- 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:

  Speed Loop Frequency Response $f_V = \left(\frac{KVP}{2\pi}\right) \times \left[\frac{(1+P1\text{-}37/10)}{(1+JL/JM)}\right]$ 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) $\leqslant$ 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 frequency response of speed loop may decrease. At this time, the users can increase the setting value of KVP (P2-04) to keep the frequency response 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:

$$\text{NLP (Parameter P2-25)} \leqslant \frac{1000}{6 \times \text{Speed Loop Frequency Response (Hz)}}$$

- 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 Auto 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 (P1-44/P1-45) is over than 10, the machinery system may also easily generate vibration or noise.

Operation

7

At a Glance

What's in this Chapter?

This chapter contains the following topics:

The chapter "Operation" describes the basic operating states, operating modes and functions of the device.

⚠ WARNNG
UNINTENDED BEHAVIOR The behavior of the drive system is governed by numerous stored data or settings. Unsuitable settings or data may trigger unexpected movements or responses to signals and disable monitoring functions. ● Do NOT operate the drive system with unknown settings or data. ● Verify that the stored data and settings are correct. ● When commissioning, carefully run tests for all operating states and potential error situations. ● Verify the functions after replacing the product and also after making changes to the settings or data. ● Only start the system if there are no persons or obstructions in the hazardous area. **Failure to follow these instructions can result in death, serious injury or equipment damage.**

7.1 Access channels

⚠ WARNNG
UNEXPECTED BEHAVIOR CAUSED BY UNSUITABLE ACCESS CONTROL By means of unsuitable use of access channels, for example, commands could be unintendedly released or locked. ● Verify that incorrect accesses are locked. ● Verify that required accesses are available. **Failure to follow these instructions can result in death, serious injury or equipment damage.**

The product can be addressed via different access channels. Access channels are:

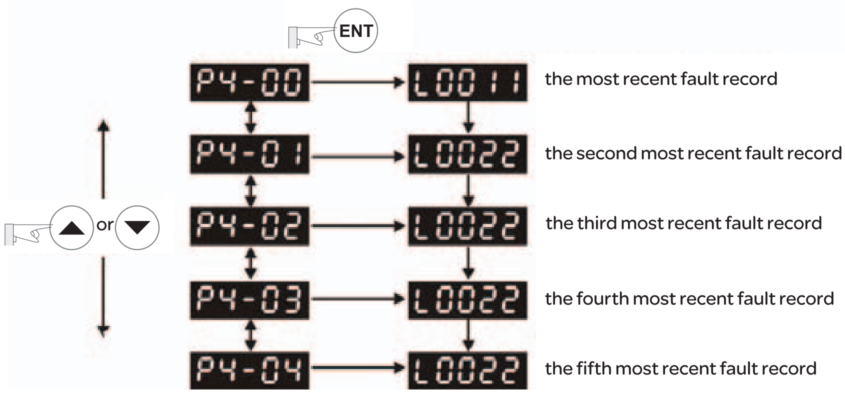
- Integrated HMI
- Commissioning software
- Digital input signals

7.2 General Function Operation

7.2.1 Fault Code Display Operation

After entering the parameter mode P4-00 to P4-04 (Fault Record), press ENT key to display the corresponding fault code history for the parameter. Please refer to the Figure 7.1

Figure 7.1



7.2.2 JOG Operation

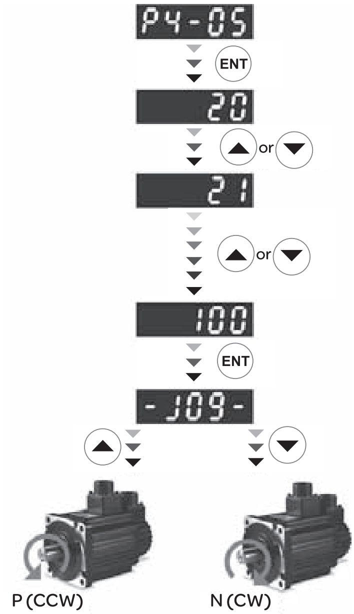
After entering parameter mode P4-05, the users can follow the following steps to perform JOG operation. (Please also refer to Figure 7.2).

Step1. Press the ENT key to display the JOG rpm speed. (The default value is 20 rpm).
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 7.2 is adjusted as 100 rpm).
Step3. Press the ENT 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 N(CW) and P(CCW) direction. 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 ENT key and the JOG rpm 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).

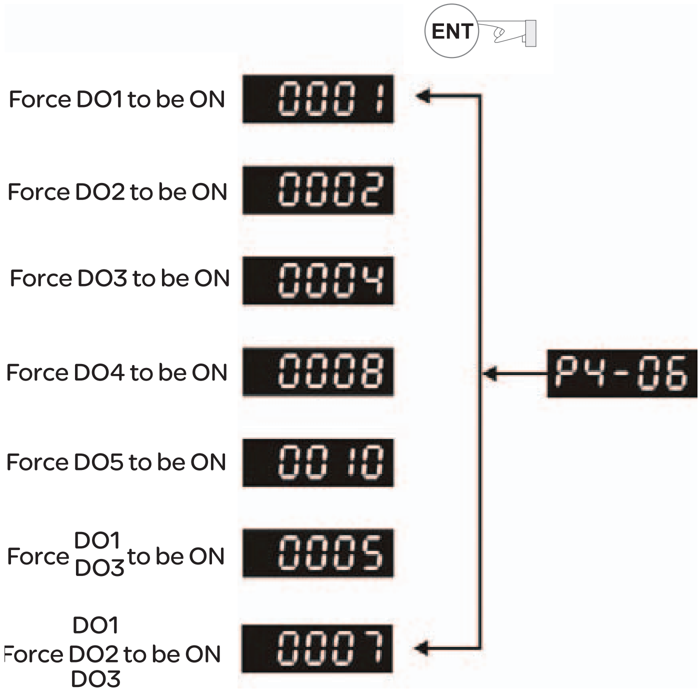
Figure 7.2



7.2.3 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 7.3 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 5, the digital outputs, DO1 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 7.3



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

7.3. Control Modes of Operation

7.3.1 Control Modes of Operation

The Lexium23 Plus series can be programmed to provide six single, eight dual modes and two multiple modes of operation. Their operation and description is listed in the following table.

Mode		Mode	Code	Description
Single Mode	External Position Control	Pt	00	Position control for the servo motor is achieved via an external pulse command.
	Internal Position Control	Pr	01	Position control for the servo motor is achieved via by internal position commands stored within the servo controller. Execution of the 8 positions is via Digital Input (DI) signals.
	Speed Control	S	02	Speed control for the servo motor can be achieved via parameters set within the controller or from an external analog -10 ~ +10 Vdc command. Control of the internal speed parameters is via the Digital Inputs (DI). (A maximum of three speeds can be stored internally).
	Internal Speed Control	Sz	04	Speed control for the servo motor is only achieved via parameters set within the controller. Control of the internal speed parameters is via the Digital Inputs (DI). (A maximum of three speeds can be stored internally).
	Torque Control	T	03	Torque control for the servo motor can be achieved via parameters set within the controller or from an external analog -10 ~ +10 Vdc command. Control of the internal torque parameters is via the Digital Inputs (DI). (A maximum of three torque levels can be stored internally).
	Internal Torque Control	Tz	05	Torque control for the servo motor is only achieved via parameters set within the controller. Control of the internal torque parameters is via the Digital Inputs (DI). (A maximum of three torque levels can be stored internally).
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).
		Pr-S	08	Either Pr or S control mode can be selected via the Digital Inputs (DI).
		Pr-T	09	Either Pr 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).

Mode	Mode	Code	Description
	canopen	0B	CAN communication control is achieved via the commands from the host (external) controller.
	Reserved	0C	Reserved
Multiple Mode	Pt-Pr	0D	Either Pt or Pr control mode can be selected via the Digital Inputs (DI).
	Pt-Pr-S	0E	Either Pt or Pr or S control mode can be selected via the Digital Inputs (DI).
	Pt-Pr-T	0F	Either Pt or Pr 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 completethis action.

(2) Using parameter P1-01. (Refer to chapter 11).

(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.

7.3.2 Position Control Mode

The position control mode (Pt or Pr mode) is usually used for the applications requiring precision positioning, such as industry positioning machine, indexing table etc. Lexium23 Plus series servo drives support two kinds of command sources in position control mode. One is an external pulse train (Pt: Position Terminals, External Position Control) and the other is internal parameter (Pr: Position Register, i.e. internal parameters P6-00 to P6-17, Internal Position Control). 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 4MKpps.

In order to provide a convenient position control function, Lexium23 Plus servo drive provides 8 internal preset parameters for position control. There are two setting methods of internal parameters, one is to set different position command into these 8 internal parameters before operation and then use POS0~POS2 of DI signals of CN1 to perform positioning control. The other setting method is to use serial communication to change the setting value of these eight internal parameters.

To make the servo motor and load operate more smoothly, Lexium23 Plus servo drive also provide complete Position Spine Line (P-curve) profile for position control mode. 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 7.3.2 mainly describes the applicability of loop gain adjustment and feed forward compensation of Lexium23 Plus servo system.

7.3.2.1 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:

Relevant Parameter:

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

Default: 0x2

Applicable Control Mode: Pt

Unit: N/A

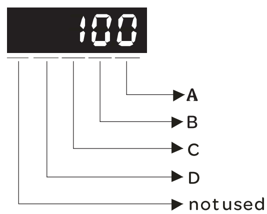
Range: 0 ~ 1132

Data Size: 16-bit

Display Format: Hexadecimal

Settings:

Related Section: Section 7.3.2.1



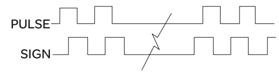
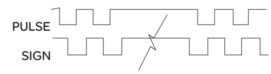
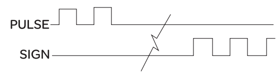
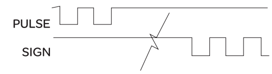
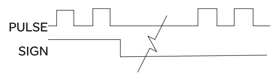
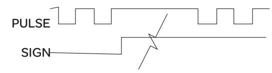
A: Input pulse type
- 0: AB phase pulse (4x) (Quadrature Input)
- 1: Clockwise (CW) + Counterclockwise(CCW) pulse
- 2: Pulse + Direction

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.

B	Low Filter	Setting Value	High Filter
0	1.66Mpps	0	6.66Mpps
1	416Kpps	1	1.66Mpps
2	208Kpps	2	833Kpps
3	104Kpps	3	416Kpps

C: Input polarity

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

Input pulse interface	Max. input pulse frequency
Line driver/Line receiver	500Kpps/4Mpps
Open collector	200Kpps

D: Source of pulse command

Setting value	Input pulse interface	Remark
0	Low-speed pulse	CN1 Terminal Identification: PULSE, SIGN
1	High-speed puls	CN1 Terminal Identification: HPULSE, HSIGN

Note: The source of pulse command can also be determined by digital input, PTCMS. When the digital input function is used, the source of pulse command is from digital input.

Position pulse can be input from these terminals, PULSE (43), /PULSE (41), HPULSE (38), /HPULSE (29), SIGN (36), /SIGN (37) and HSIGN (46), /HSIGN (40). It can be an open-collector circuit or line driver circuit. For the detail wiring, please refer to 5.3.1.

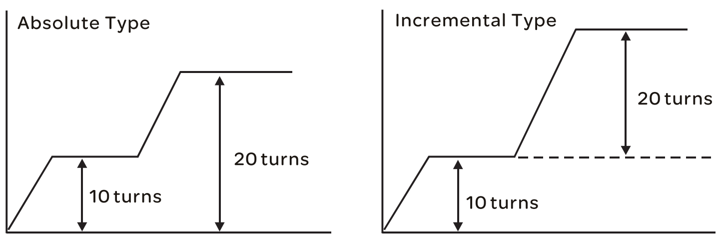
7.3.2.2 Command Source of Position (Pr) Control Mode

The command sources of Pr mode are (P6-00, P6-01) ~ (P6-16, P6-17) these 8 built-in parameters. Using with external I/O signals (CN1, POS 0 to POS 5 and CTRG) can select one of the 8 built-in parameters to be position command. Please refer to the table below:

Position Command	POS2	POS1	POS0	CTRG	Parameters
P1	0	0	0	↑	P6-02
					P6-03
P2	0	0	1	↑	P6-04
					P6-05
P3	0	1	0	↑	P6-06
					P6-07
P4	0	1	1	↑	P6-08
					P6-09
P5	1	0	0	↑	P6-10
					P6-11
P6	1	0	1	↑	P6-12
					P6-13
P7	1	1	0	↑	P6-14
					P6-15
P8	1	1	1	↑	P6-16
					P6-17

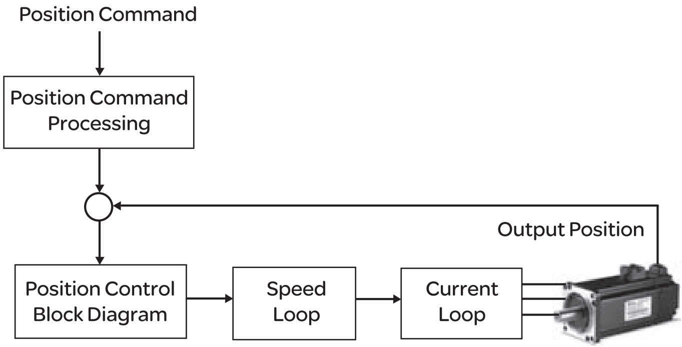
State of POS0~5: 0 indicates the contact is OFF (Normally Open)
1 indicates the contact is ON (Normally Closed)

CTRG↑: the instant time when the contact changes from 0 (open) to 1 (closed).
The application of absolute and incremental position control is various and multiple. This kind of position control is equal to a simple sequence control. Users can easily complete the cycle running by using the above table. For example, the position command, P1 is 10 turns and P2 is 20 turns. Give the position command P1 first and then give the position command P2. The difference between absolute and incremental position control is shown as the figure below:



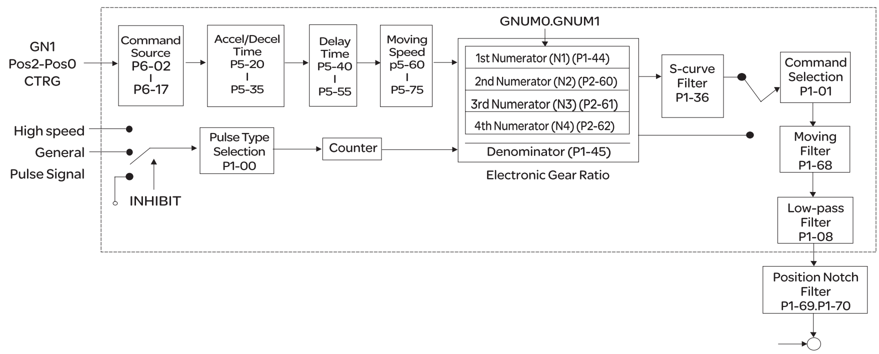
7.3.2.3 Structure of Position Control Mode

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:

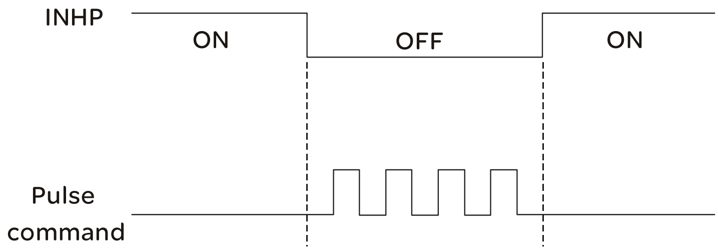
Lexium23 Plus Series:



Using parameter can select Pr mode and Pt mode. Electronic gear ratio can be set in both two modes to set proper position revolution. Lexium23 Plus series servo drives also provide S-curve and 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, S-curve and low-pass filter, please refer to the following sections 7.3.2.4, 7.3.2.5 and 7.3.2.6.

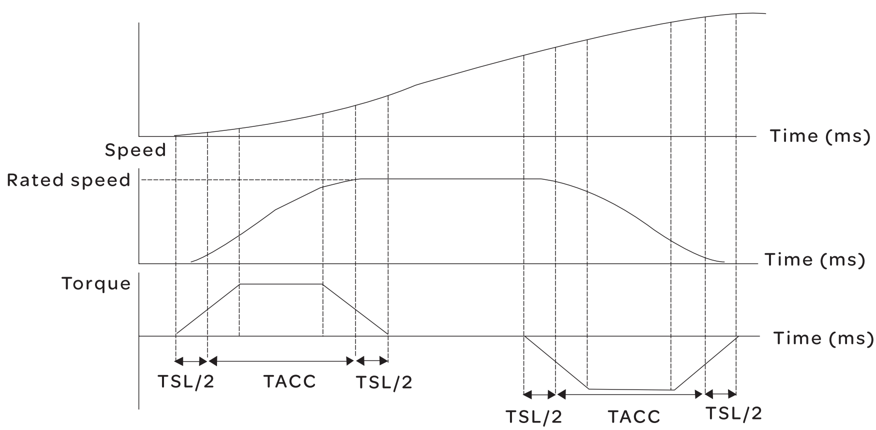
Pulse Inhibit Input Function (INHIBIT)

This function is activated via digital inputs (Please refer to parameter P2-10 ~ P2-17 and DI INHP in Table 11.A).When the drive is in position mode, if INHP is activated, the external pulse input command is not valid and the motor will stop (Please note that only DI8 supports this function).

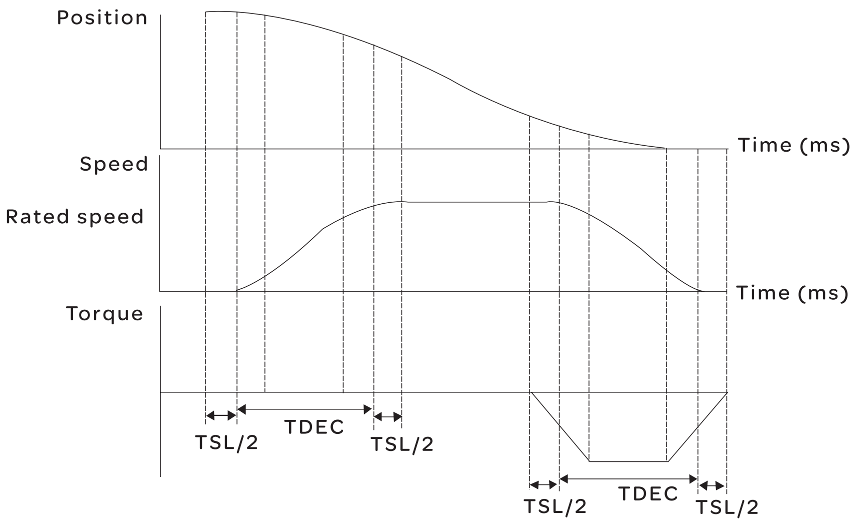


7.3.2.4 S-curve Filter for Position Control

The S-curve filter is for the position smoothing of motion command. Using S-curve filter can run the servo motor more smoothly in response to a sudden position command. Since the speed and acceleration curve are both continuous and the time for the servo motor to accelerate is short, using Scurve filter not only can improve the performance when servo motor accelerate or decelerate but also can make motor to operate more smoothly (from mechanical view). When the load is change, the motor usually run not smoothly when starts to run and stop due to the friction and inertia change. At this moment, users can increase Accel/Decel S-curve constant (TSL), Accel time constant (TACC) and Decel time constant (TDEC) to improve the performance. Because the speed and angle acceleration are continuous when position command is changed to pulse signal input, so it is not needed to use Scurve filter.



S-curve characteristics and Time relationship (Acceleration)



S-curve characteristics and Time ralationship (Deceleration)

Relevant Parameters:

P1-34	TACC	Acceleration Time	Address: 0144H, 0145H

Default: 200 | Related Section:

Applicable Control Mode: S | Section 7.3.3.3

Unit: msec
Range: 1 ~ 65500
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. 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.
2) When the source of speed command is analog command, the maximum setting value of P1-34 is limited to 20000 automatically.

P1-35	TDEC	Deceleration Time	Address: 0146H, 0147H

Default: 200 — Related Section: Section 7.3.3.3

Applicable Control Mode: S

Unit: msec

Range: 1 ~ 65500

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. 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.

2 When the source of speed command is analog command, the maximum setting value of P1-35 is limited to 20000 automatically.

P1-36	TSL	Accel /Decel S-curve	Communication Addr.: 0124H

Default: 0 — Related Section: Section 7.3.3.3

Unit: msec

Applicable Control Mode: S, Pr

Unit: msec

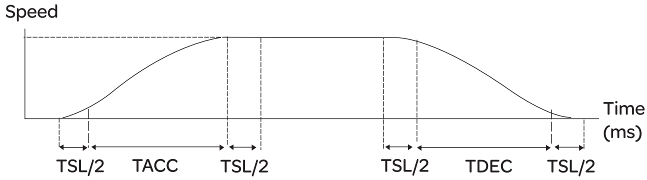
Range: 0 ~ 65500 (0: Disabled)

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.

2 When the source of speed command is analog command, the maximum setting value of P1-36 is limited to 10000 automatically.

7.3.2.5 Electronic Gear Ratio

Relevant parameters:

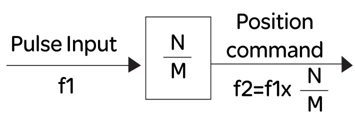
P1-44▲	GR1	Electronic Gear Ratio (1st Numerator) (N1)	Address: 0158H, 0159H

Default: 128
Applicable Control Mode: Pt, Pr
Related Section: Section 7.3.2.5
Unit: pulse
Range: 1 ~ (2^{29}-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 numberators. Please note:

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

P1-45▲	GR2	Electronic Gear Ratio (Denominator) (M)	Address: 015AH, 015BH

Default: 10
Applicable Control Mode: Pt, Pr
Related Section: Section 7.3.3.6
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):



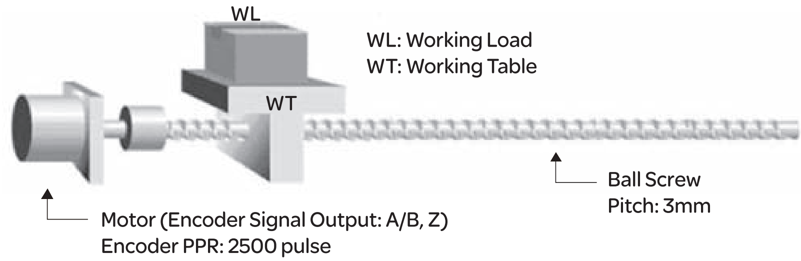
f1: Pulse input f2: Position command
N: Numerator 1, 2, 3, 4, the setting value of P1-44 or P2-60~P2-63
M: Denominator, the setting value of P1-45

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

Please note:

1 In Pt and Pr 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 1μ m/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	$=\frac{1}{1}$	$=\frac{3\times1000}{4\times2500}=\frac{3000}{10000}=\mu m$
When the electronic gear ratio is not used	$=\frac{10000}{3000}$	$=1\ \mu m$

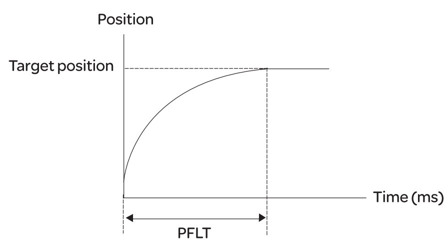
7.3.2.6 Low-pass Filter

Relevant parameters:

P1-08	PFLT	Smooth Constant of Position Command (Low-pass Filter)	Address: 0110H, 0111H

Default: 0
Applicable Control Mode: Pt/Pr
Unit: 10msec
Range: 0 ~ 1000 (0: Disabled)
Data Size: 16-bit
Display Format: Decimal

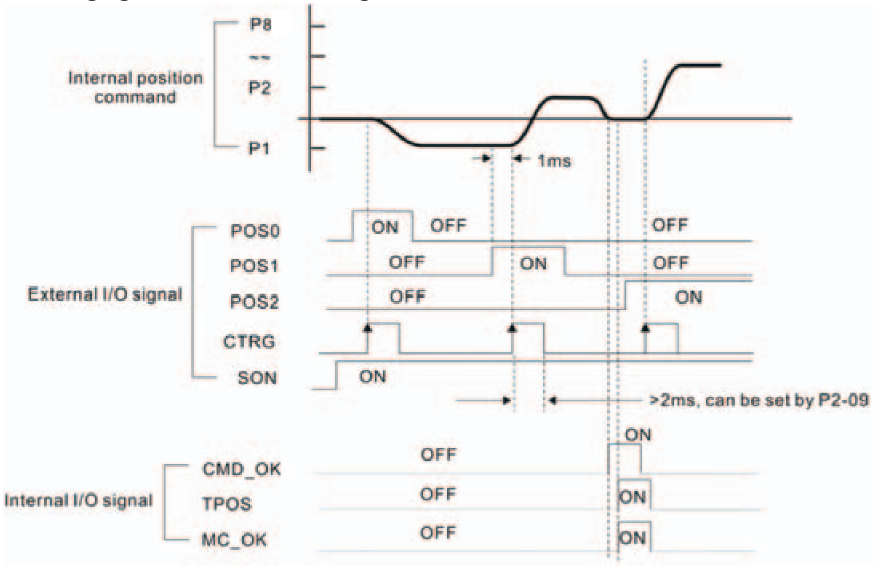
Related Section:
Section 7.3.2.6



7.3.2.7 Timing Chart of Position (Pr) Control Mode

In Pr mode, position command source is DI signal from CN1, i.e. selected by POS0~POS2 and CTRG.

Please refer to 7.3.2.2 to see the relationship between DI signals and parameters. The following figure is shown the timing chart of Pr mode:



CMD_OK:CMD_OK is activated when the servo drive has detected that Pr command has been completed

TPOS:TPOS will be activated when the drive detects that the position of the motor is in a -P1-54 to +P1-54 band of the target position.

MC OK:MC OK is activated when CMD OK and TPOS are both ON.

7.3.2.8 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:

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

KPP = 2 x π x fp.

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

Then, KPP = 2 x π x 20= 125 rad/s.

Relevant parameters:

P2-00	KPP	Proportional Position Loop Gain	Address: 0200H, 0201H

Default: 35 — Related Section:

Applicable Control Mode: Pt, Pr — Section 7.3.2.8

Unit: rad/s

Range: 0 ~ 2047

Data Size: 16-bit

Display Format: Decimal

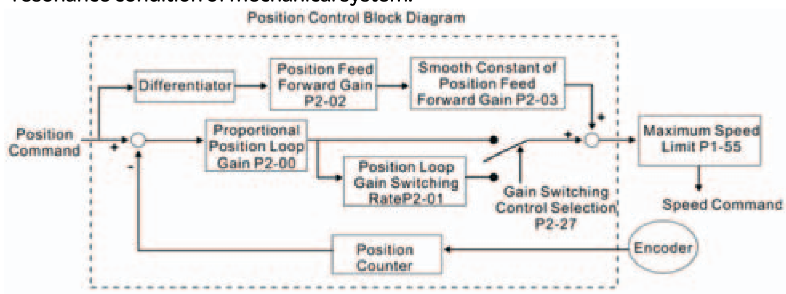
Settings:

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.

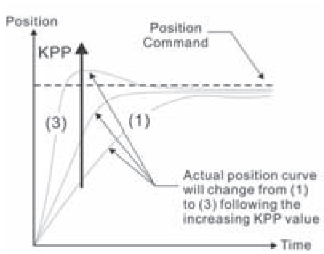
P2-02	PFG	Position Feed Forward Gain	Address: 0204H, 0205H

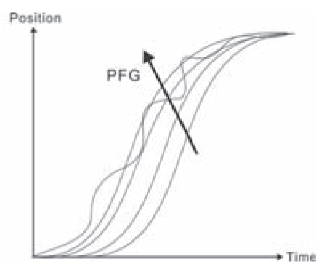
Default: 50 | Related Section:
Applicable Control Mode: Pt, Pr | Section 7.3.2.8

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.



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.



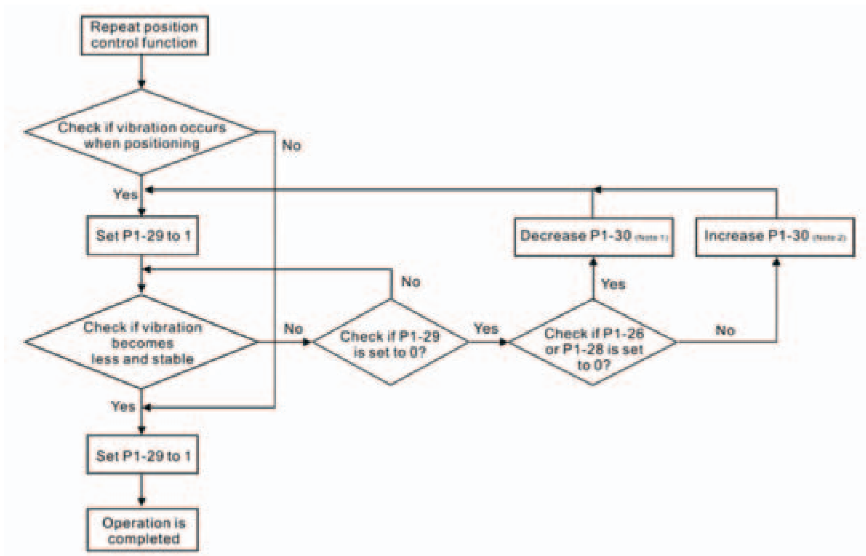


7.3.2.9 Low-frequency Vibration Suppression

If the stiffness of the mechanical system is not sufficient, after the positioning command has completed, continuous vibration of the mechanical system may occur still even when the motor has almost stopped. At this time, using low-frequency vibration suppression function can suppress the low-frequency vibration of mechanical system. The range of frequency setting is from 1.0 to 100.0Hz. Besides, two modes (Manual/Auto) of low-frequency vibration suppression function are available for the users to select.

• Auto Mode

If the users know the point where the low-frequency occurs, we recommend the users can use this mode to find the low-frequency of the mechanical vibration automatically. When P1-29 is set to 1, the system will disable the filter function and find the vibration frequency of low-frequency automatically. After the detected frequency becomes fixed and stable, the system will set P1-29 to 0, save the first measured low-frequency value automatically into P1-25 and set P1-26 to 1; then save the second measured low-frequency value automatically into P1-27 and set P1-28 to 1. If any low-frequency vibration occurs after P1-29 is set to 0 automatically, please examine if the function of P1-26 or P1-28 is enabled or not. When the setting value of P1-26 or P1-28 is 0, it indicates that there is no frequency is detected. Please decrease the setting value of P1-30 (Low-frequency Vibration Detection Level) and set P1-29 to 1 to find the low-frequency again. Please pay close attention on the setting value of P1-30 as if the setting value of P1-30 is too low, it is easy to regard the interference as the low-frequency and results in erroneous measurement.



Please note:

1) When P1-26 and P1-28 are both set to 0, it indicates that the system could not find the frequency. Please check the setting value of P1-30 because when the setting value of P1-30 is too high, it may causes that the frequency becomes difficult to be found.
2) When P1-26 and P1-28 are both set to a non-zero value, if the vibration condition can not be improved, please check the setting value of P1-30 as the low setting value of P1-30 may result in erroneous measurement. The system may regard the interference as a low-frequency.
3) When the vibration still exists and can not be suppressed after using auto low-frequency vibration suppression function, if the users know the vibration frequency, please set P1-25 and P1-27 manually to improve the vibration condition.

Relevant parameters:

P1 - 29	AVSM	Auto Low-frequency Vibration Suppression Mode Selection	Address: 013AH, 013BH

Default: 0 | Related Section:

Applicable Control Mode: Pt/Pr | Section 7.3.2.9

Unit: -

Range: 0 ~ 1

Data Size: 16-bit

Display Format: Decimal

Settings:

0: Normal mode (Disable Auto Low-frequency Vibration Suppression Mode).

1: Auto mode (Enable Auto Low-frequency Vibration Suppression Mode).

Explanation:

If P1-29 is set to 0, the setting of low-frequency vibration suppression is fixed and will not change automatically.

If P1-29 is set to 1, when there is no low-frequency vibration or the low-frequency vibration becomes less and stable, the system will set P1-29 to 0, save the measured low-frequency value automatically and memorize it in P1-25.

P1 - 30	VCL	Low-frequency Vibration Detection Level	Address: 013CH, 013DH

Default: 500 | Related Section:

Applicable Control Mode: Pt/Pr | Section 7.3.2.9

Unit: pulse

Range: 1 ~ 8000

Data Size: 16-bit

Display Format: Decimal

Settings:

When P1-29 is set to 1, the system will find this detection level automatically. If the setting value of P1-30 is too low, the detection of frequency will become sensitive and result in erroneous measurement. If the setting value of P1-30 is too high, although the probability of erroneous measurement will decrease, the frequency will become difficult to be found especially when the vibration of mechanical system is less.

The setting value of P1-30 indicates the range of vibration frequency. When the vibration can not be detected (out of range), it indicates that the setting value of P1-30 is too high and we recommend the users can decrease the setting value of P1-30. The users can also use the Scope function provided in Lexium23 Plus configuration software to observe the vibration during positioning operation so as to set P1-30 appropriately.

● **Manual Mode**

There area two groups of low-frequency vibration suppression parameters. The first group is P1-25 and P1-26 and the second group is P1-27 and P1-28. Using these two groups of parameters can improve the vibration condition of two different low frequencies. P1-25 and P1-26 are used to set the occurred vibration frequency and P1-26 and P1-28 are used to set the frequency response after filter function is used. When the setting values of P1-26 and P1-28 are higher, the performance of frequency response will be better. However, if the setting value is over high, it may affect the motor operation. The default setting of P1-26 and P1-28 are both 0, and it indicates that the low-frequency vibration suppression function is disabled.

Relevant parameters:

P1 - 25	VSF1	Low-frequency Vibration Suppression (1)	Address: 0132H, 0133H

Default: 100.0 | Related Section:
Applicable Control Mode: Pt/Pr | Section 7.3.2.9

Unit: Hz

Range: 1.0 ~ 100.0

Data Size: 16-bit

Display Format: Decimal

Settings:

This parameter is used to set the first group of the low-frequency of mechanical system. It can be used to suppress the low-frequency vibration of mechanical system. If P1-26 is set to 0, this parameter is disabled.

P1 - 26	VSG1	Low-frequency Vibration Suppression Gain (1)	Address: 0134H, 0135H

Default: 0 | Related Section:
Applicable Control Mode: Pt/Pr | Section 7.3.2.9

Unit: -

Range: 0 ~ 9 (0: Disable the function of P1-25)

Data Size: 16-bit

Display Format: Decimal

Settings:

This parameter is used to set the vibration suppression gain for P1-25. When the setting value is higher, the position response is quicker. However, if the setting value is over high, it may addect the normal operation of servo motor. It is recommended to set P1-26 as 1.

P1 - 27	VSF2	Low-frequency Vibration Suppression (2)	Address: 0136H, 0137H

Default: 100.0 | Related Section:
Applicable Control Mode: Pt/Pr | Section 7.3.2.9
Unit: Hz
Range: 1.0 ~ 100.0
Data Size: 16-bit
Display Format: Decimal
Settings:
This parameter is used to set the second group of the low-frequency of mechanical system. It can be used to suppress the low-frequency vibration of mechanical system. If P1-28 is set to 0, this parameter is disabled.

P1 - 28	VSG2	Low-frequency Vibration Suppression Gain (2)	Address: 0138H, 0139H

Default: 0 | Related Section:
Applicable Control Mode: Pt/Pr | Section 7.3.2.9
Unit: -
Range: 0 ~ 9 (0: Disable the function of P1-27)
Data Size: 16-bit
Display Format: Decimal
Settings:
This parameter is used to set the vibration suppression gain for P1-27. When the setting value is higher, the position response is quicker. However, if the setting value is over high, it may addect the normal operation of servo motor. It is recommended to set P1-28 as 1.

Please note:
1) After the low-frequency vibration is suppressed, the changes of the response may become excessive. Therefore, please ensure that the machine is able to stop any time and ensure the safety of personnel working with the machine when execute low-frequency vibration suppression function.
2) The low-frequency vibration suppression function can be enabled only in position control mode (Pt, Pr or Pr-Pt mode).
3) When the users use resonance suppression function, the resonance condition can be improved immediately after the correct resonance frequency is found. However, when the users use low-frequency vibration suppression function, the vibration of the mechanical system will not be eliminated immediately. The vibration condition is improved gradually after the correct frequency is found. This is because the low-frequency vibration suppression function is not effective for the vibration caused by external force and the vibration occurred before using suppression function.
4) After the low-frequency vibration suppression function is enabled, it will certainly affect the original response performance. When the value of the low-frequency is lower, the effect upon the response performance is greater. At this time, the users can adjust the setting value of P1-26 to increase the position response. But, please do not set P1-26 to a higher value. If the setting value of P1-26 is too high, it will affect the motor operation.
5) n order to avoid that the vibration frequency may not easily to be found when the commanding time is too fast in Auto mode, we recommend the users can set a longer command delay time. The command can be given after the vibration frequency is found.

7.3.3 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. Lexium23 Plus series servo drives support 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, Lexium23 Plus series servo drives also provide complete S-curve profile for speed control mode. For the closed-loop speed control, Lexium23 Plus series servo drives provide 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.

7.3.3.1 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

<table>
<tr><th rowspan="2">Speed Command</th><th colspan="2">CN1 DI signal</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">0</td><td rowspan="2">0</td><td rowspan="2">Mode</td><td>S</td><td>External analog signal</td><td>Voltage between V-REF-GND</td><td>-10 V ~ +10V</td></tr>
<tr><td>Sz</td><td>N/A</td><td>Speed command is 0</td><td>0</td></tr>
<tr><td>S2</td><td>0</td><td>1</td><td rowspan="3" colspan="3">Internal parameter</td><td>P1-09</td><td rowspan="3">-60000 ~ +60000 rpm</td></tr>
<tr><td>S3</td><td>1</td><td>0</td><td>P1-10</td></tr>
<tr><td>S4</td><td>1</td><td>1</td><td>P1-11</td></tr>
</table>

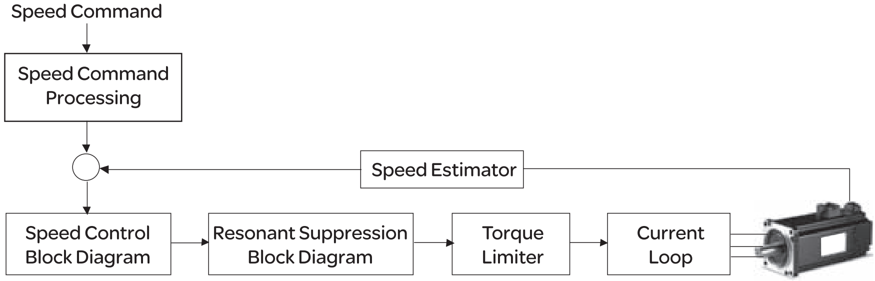
- State of SPD0~1: 0: indicates OFF (Normally Open); 1: indicates ON (Normally Closed)
- When SPD0 and SPD1 are both = 0 (OFF), if the control mode of operation is Sz, then the speed command is 0. Therefore, if the users do not use analog voltage as speed command, the users can choose Sz mode and avoid 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 -60000 ~ +60000 rpm. Setting value = Range x Unit (0.1 rpm). For example, if P1-09 is set to +30000, the setting value = +30000 x 0.1 rpm = +3000 rpm.

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).

7.3.3.2 Structure of Speed Control Mode

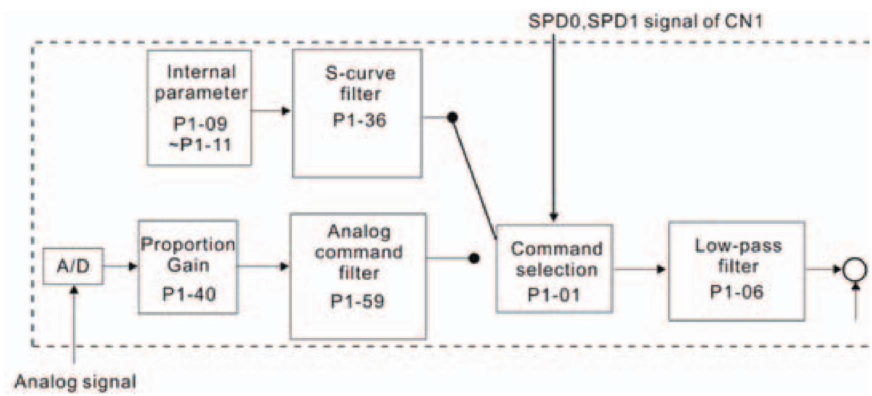
Speed command Sources:
1) External analog signal: External analog voltage input, -10V to +10V
2) Internal parameter: P1-09 to P1-11

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.

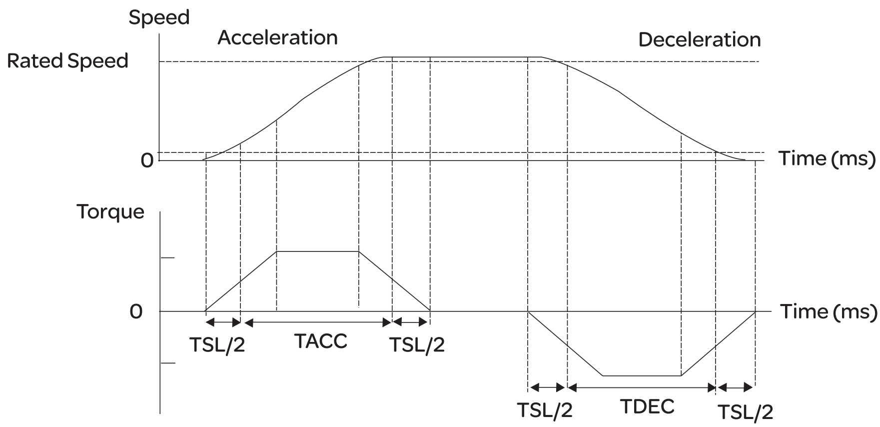
7.3.3.3 Smoothing Strategy of Speed Control Mode

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.

Lexium23 Plus series servo drives also support the time calculation of completing speed command. T (ms) is the operation (running) time. S (rpm) is absolute speed command, i.e. the absolute value (the result) after starting speed subtracts the final speed.



S-curve charateristics and Time relationship

Relevant parameters:

P1 - 34	TACC	Acceleration Time	Address: 0144H, 0145H

Default: 200 | Related Section:
Applicable Control Mode: S | Section 7.3.3.3,

Unit: msec
Range: 1 ~ 65500
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. 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.
2. When the source of speed command is analog command, the maximum setting value of P1-34 is limited to 20000 automatically.

P1 - 35	TDEC	Deceleration Time	Address: 0146H, 0147H

Default: 200 | Related Section:
Applicable Control Mode: S | Section 7.3.3.3,

Unit: msec
Range: 1 ~ 65500
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. 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.
2. When the source of speed command is analog command, the maximum setting value of P1-35 is limited to 20000 automatically.

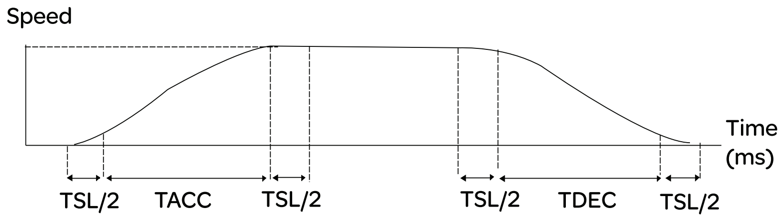
P1 - 36	TSL	Accel /Decel S-curve	Address: 0148H, 0149H

Default: 0 | Related Section:
Unit: msec | Section 7.3.3.3,

Applicable Control Mode: S, Pr

Unit: msec

Range: 0 ~ 65500 (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.



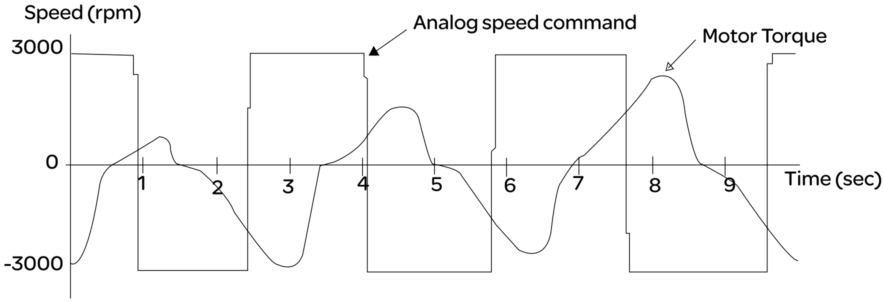
TACC: P1-34, Acceleration time
TDEC: P1-35, Deceleration time
TSL: P1-36, Accel /Decel S-curve
Total acceleration time = TACC + TSL
Total deceleration time = TDEC + TSL

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.
2 When the source of speed command is analog command, the maximum setting value of P1-36 is limited to 10000 automatically.
3 If the control of the servo motor is achieved via internal parameters, the command curve should be defined by the users.

Analog Speed Command S-curve Filter

Lexium23 Plus 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

Default: 0 | Related Section:

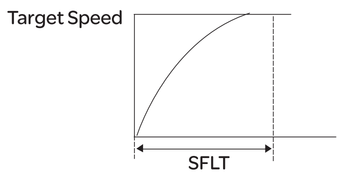
Applicable Control Mode: S | Section 7.3.3.3

Unit: msec

Range: 0 ~ 1000 (0: Disabled)

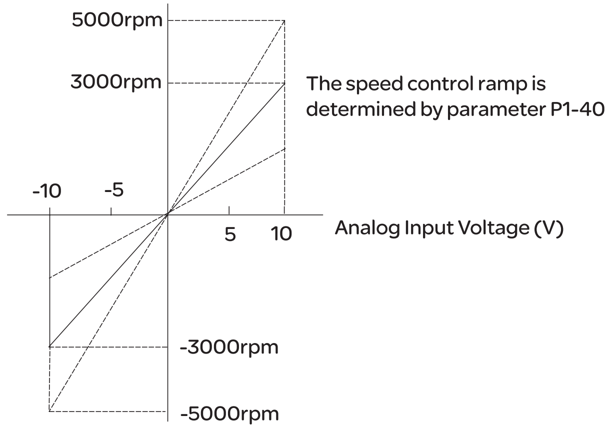
Data Size: 16-bit

Display Format: Decimal



7.3.3.4 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:

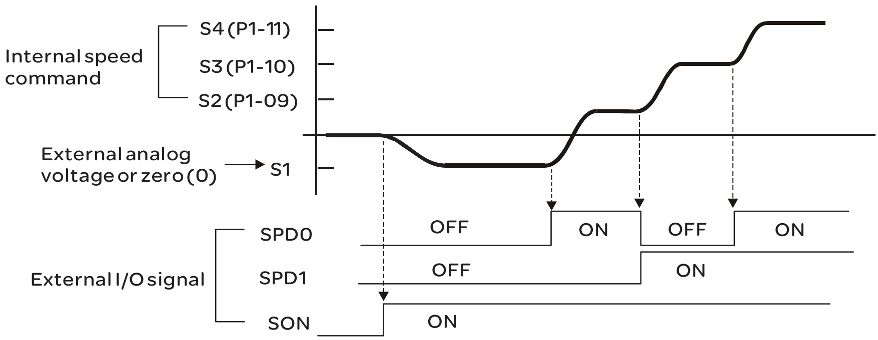
P1-40▲	VCM	Max. Analog Speed Command or Limit	Address: 0150H, 0151H

Default: rated speed | Related Section:

Applicable Control Mode: S, T | Section 7.3.3.4

Unit: rpm
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 rpm. If P1-40 is set to 3000, but the input voltage is changed to 5V, then the speed command is changed to 1500 rpm.
Speed Command / Limit = Input Voltage Value x Setting value of P1-40 / 10

7.3.3.5 Timing Chart of Speed Control Mode

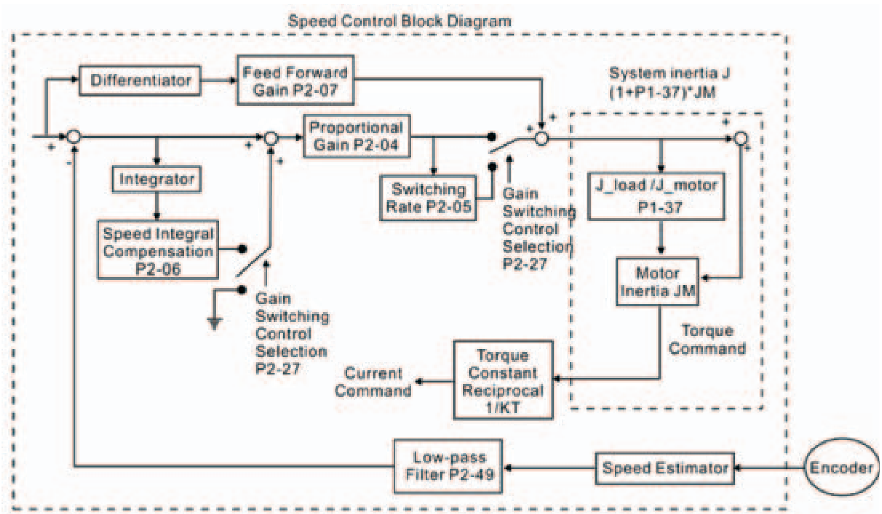


Note:

1) OFF indicates normally open and ON indicates normally closed.
3) 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.

7.3.3.6 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 Lexium23 Plus series servo drives can be adjusted by using any one of two 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:

Relevant Parameter:

P2-32▲	AUT2	Tuning Mode Selection	Address: 0240H, 0241H

Default: 0

Applicable Control Mode: ALL

Related Section:
Section 5.6, Section 7.3.3.6

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

Default: 500 — Related Section: Section 7.3.3.6
Applicable 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

Default: 100 — Related Section: Section 7.3.3.6
Applicable 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.

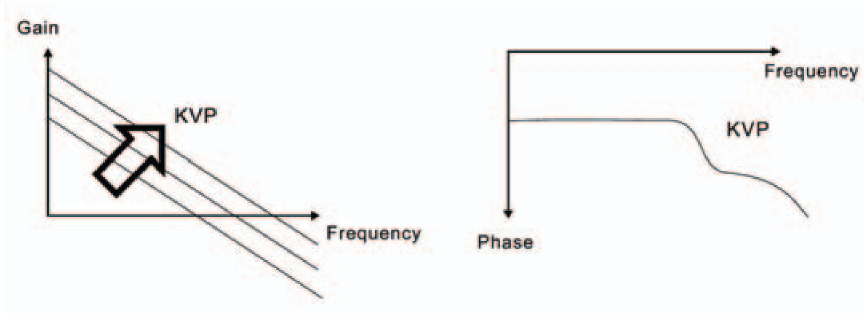
P2-07	KVF	Speed Feed Forward Gain	Address: 020EH, 020FH

Default: 0 — Related Section: Section 7.3.3.6
Applicable 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.

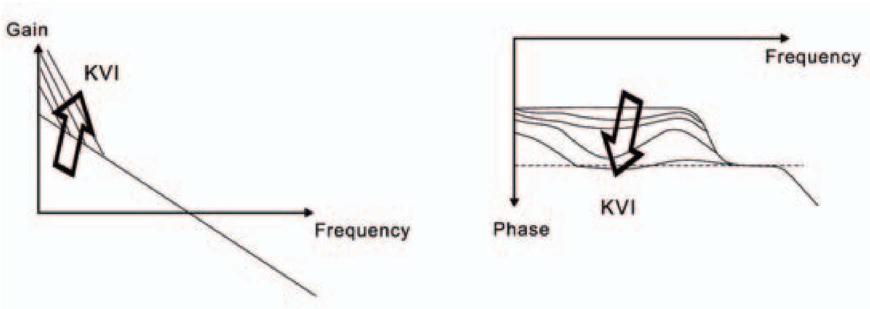
In theory, stepping response can be used to explain proportional gain (KVP), integral gain (KVI) and feed forward gain (KVF). Now we use frequency area and time area respectively to explain the logic.

Frequency Domain

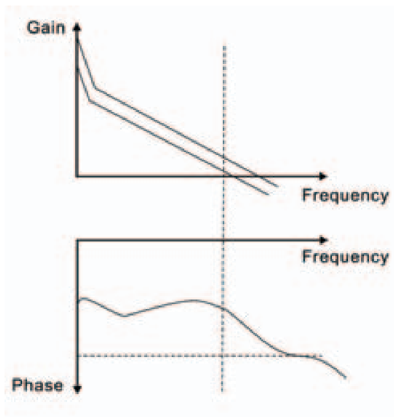
STEP 1: Set the value of KVI=0, the value of KVF=0 and adjust the value of KVP.



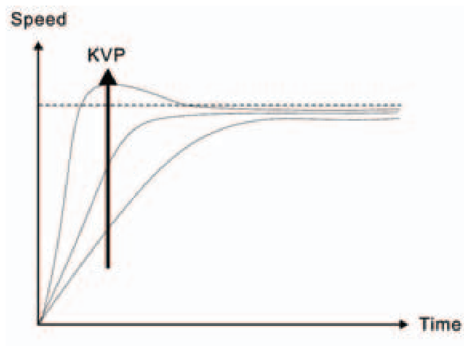
STEP 2: Fix the value of KVP and adjust the value of KVI.



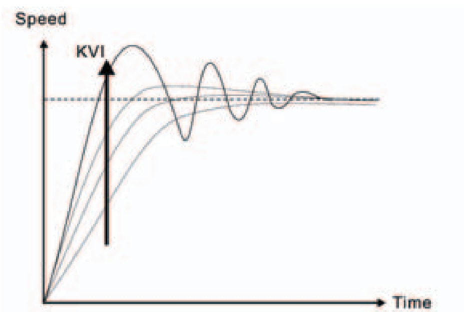
STEP 3: Select the value of KVI, if the value of phase margin is too small, re-adjust the value of KVP again to obtain the value, 45deg of phase margin.



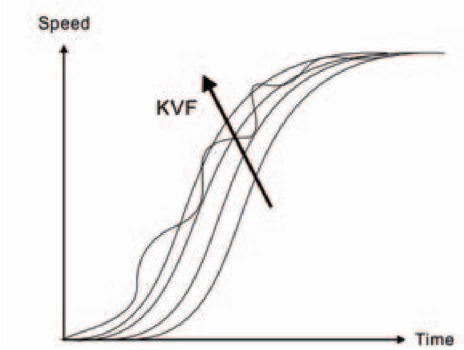
Time Domain



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.



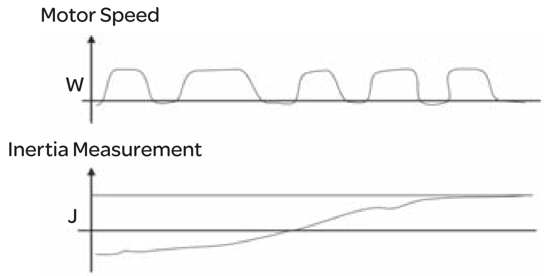
When the value of KVI is greater, the value of low-frequency gain is also greater and the value of steady error is nearly zero (0).
However, the value of phase margin will reduce quite substantially. It is helpful to steady error. But it is not helpful to dynamic tracking error.



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.



7.3.3.7 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 (parameters P2-43 ~ P2-46) without changing control parameter.

Relevant parameters:

P2 - 43	NCF1	Notch Filter1 (Resonance Suppression)	Address: 0256H, 0257H

Default: 1000

Applicable Control Mode: ALL

Unit: Hz

Range: 50 ~ 2000

Data Size: 16-bit

Display Format: Decimal

Related Section: Section 7.3.3.7

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.

P2-44	DPH1	Notch Filter Attenuation Rate 1 (Resonance Suppression)	Address: 0258H, 0259H

Default: 0
Applicable Control Mode: ALL
Unit: dB
Range: 0 ~ 32
Data Size: 16-bit
Display Format: Decimal

Related Section:
Section 7.3.3.7

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	NCF2	Notch Filter 2 (Resonance Suppression)	Address: 025AH, 025BH

Default: 1000
Applicable Control Mode: ALL
Unit: Hz
Range: 50 ~ 2000
Data Size: 16-bit
Display Format: Decimal

Related Section:
Section 7.3.3.7

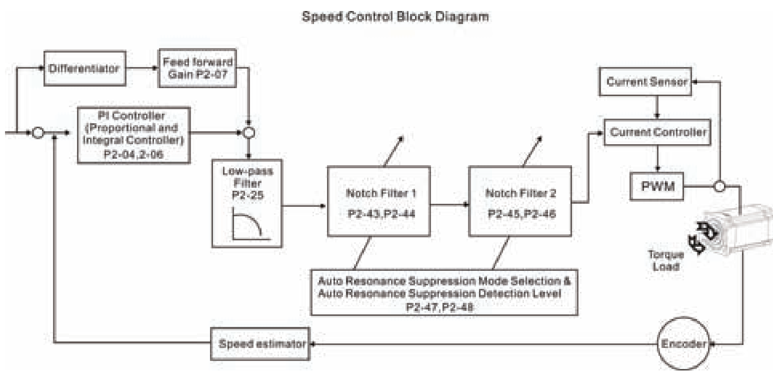
Settings:
This parameter is used to set third resonance frequency of mechanical system. It can be used to suppress the resonance of mechanical system and reduce the vibration of mechanical system.
If P2-45 is set to 0, this parameter is disabled.

P2 - 46	DPH2	Notch Filter Attenuation Rate 2 (Resonance Suppression)	Address: 025CH, 025DH

Default: 0 | Related Section:
Applicable Control Mode: ALL | Section 7.3.3.7
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.

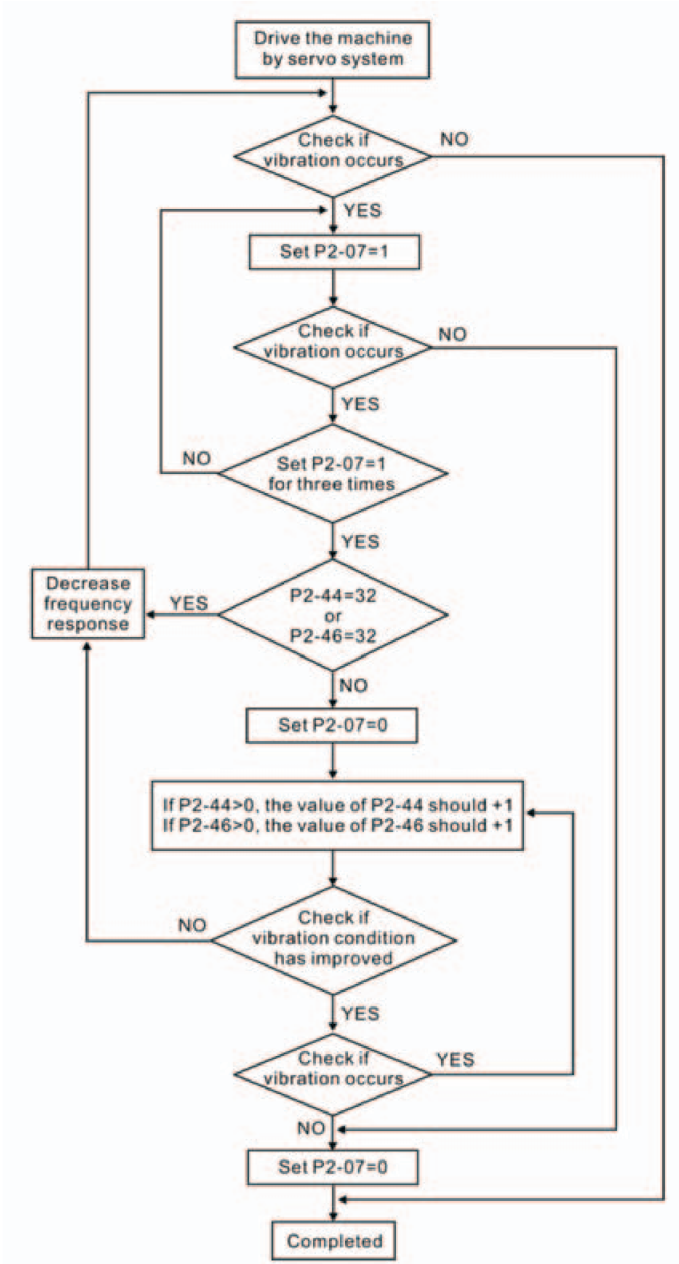
P2 - 25	NLP	Low-pass Filter Time Constant (Resonance Suppression)	Address: 0232H, 0233H

Default: 2 (1kW and below models) or
5 (other models) | Related Section:
Applicable Control Mode: ALL | Section 7.3.3.7
Unit: 0.1 msec
Range: 0 ~ 1000
Data Size: 16-bit
Display Format: Decimal
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.



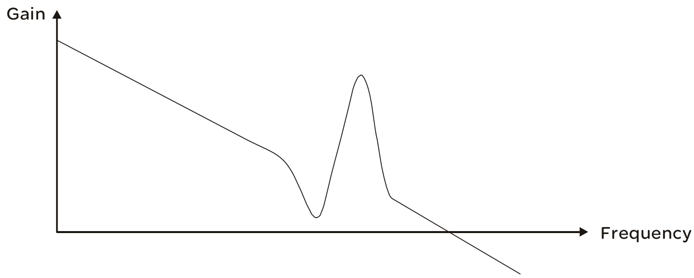
There are two groups of notch filters provided by Lexium23 Plus series. The first group of notch filter is P2-43 and P2-44, and the second group of notch filter is P2-45 and P2-46. When there is resonance, please set P2-47 to 1 or 2 (Auto mode), and then the servo drive will find resonance frequency 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.

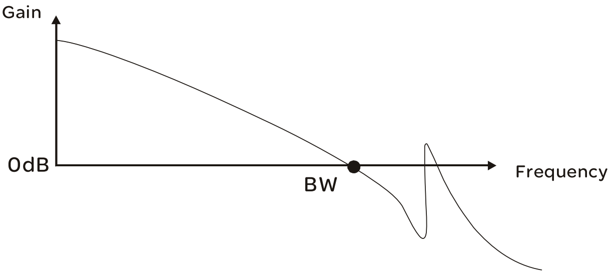

Drive the machine by servo system
Check if vibration occurs
NO
YES
Set P2-07=1
Check if vibration occurs
NO
YES
NO
Set P2-07=1 for three times
YES
Decrease frequency response
YES
P2-44=32 or P2-46=32
NO
Set P2-07=0
If P2-44>0, the value of P2-44 should +1
If P2-46>0, the value of P2-46 should +1
NO
Check if vibration condition has improved
YES
Check if vibration occurs
YES
NO
Set P2-07=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.



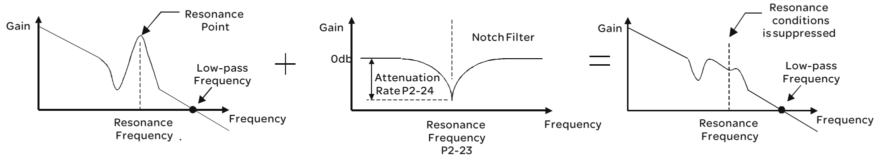
Notch Filter

Usually, if the users know the resonance frequency, we recommend the users can eliminate the resonance conditions directly by using notch filter (parameter P2-43, P2-44). However, the range of frequency setting is from 50 to 1000Hz only and the range of resonant attenuation is 0~32 dB only.

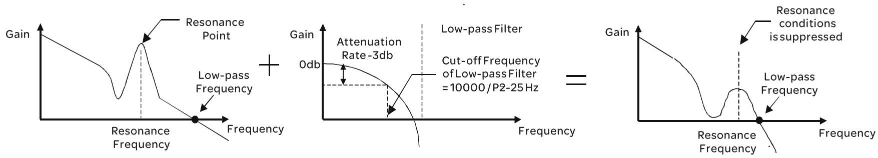
Therefore, if the resonant frequency is out of this range, we recommend the users to use low-pass filter (parameter P2-25) to improve resonant condition.

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 chapter 7.3.2.6). 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 P2-43, P2-44). Usually, if the resonant frequency can be recognized, we recommend the users can directly use notch filter (parameter P2-43, P2-44) 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.

7.3.4 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. Lexium23A series servo drives support 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.

7.3.4.1 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.

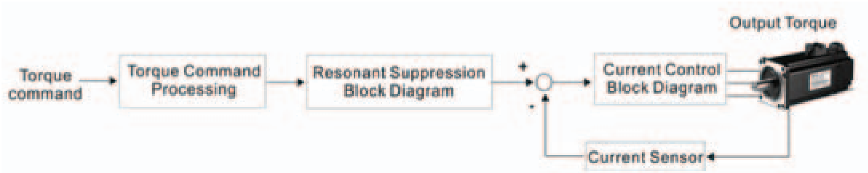
<table>
<tr><th rowspan="2">Torque Command</th><th colspan="2">DI signal of CN1</th><th colspan="3" rowspan="2">Command Source</th><th rowspan="2">Content</th><th rowspan="2">Range</th></tr>
<tr><th>TCM1</th><th>TCM0</th></tr>
<tr><td rowspan="2">T1</td><td rowspan="2">0</td><td rowspan="2">0</td><td rowspan="2">Mode</td><td>T</td><td>External analog signal</td><td>Voltage between T-REF-GND</td><td>-10V ~ +10V</td></tr>
<tr><td>Tz</td><td>None</td><td>Torque command is 0</td><td>0</td></tr>
<tr><td>T2</td><td>0</td><td>1</td><td colspan="3" rowspan="3">Internal parameter</td><td>P1-12</td><td rowspan="3">-300% ~ 300%</td></tr>
<tr><td>T3</td><td>1</td><td>0</td><td>P1-13</td></tr>
<tr><td>T4</td><td>1</td><td>1</td><td>P1-14</td></tr>
</table>

- 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).

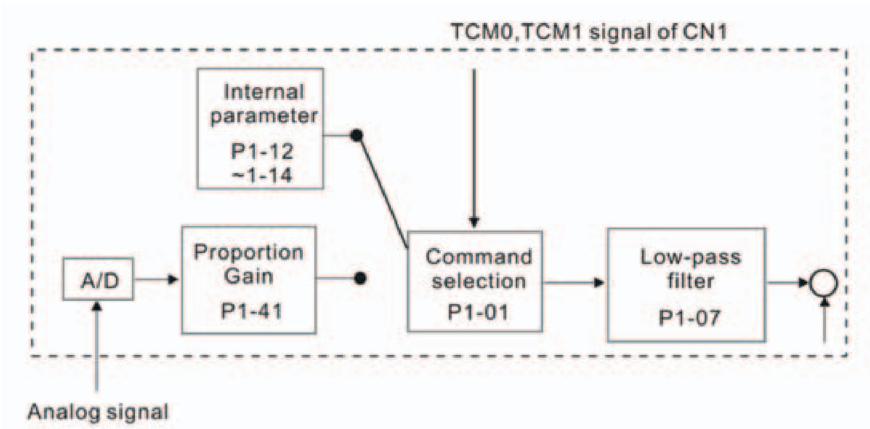
7.3.4.2 Structure of Torque Control Mode

Basic Structure:



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.

7.3.4.3 Smoothing Strategy of Torque Control Mode

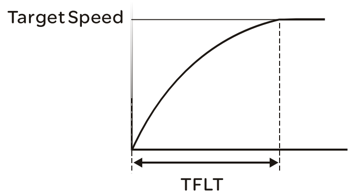
Relevant parameters:

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

Default: 0
Applicable Control Mode: T
Unit: msec
Range: 0 ~ 1000 (0: Disabled)
Data Size: 16-bit
Display Format: Decimal

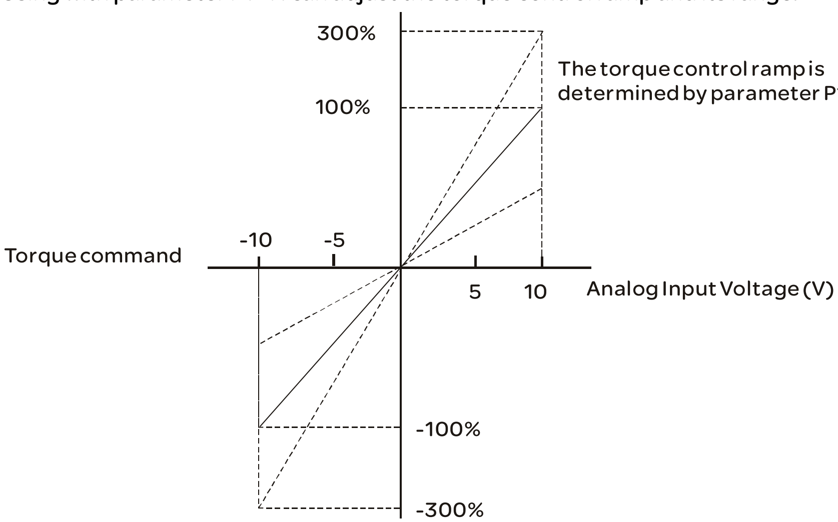
Related Section:
Section 7.3.4.3

Note: 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.



7.3.4.4 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

Default: 100

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

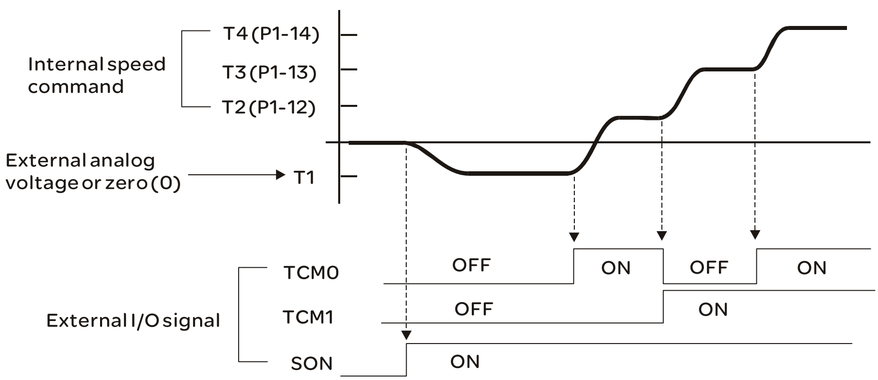
For example, in torque mode, if P1-41 is set to 100 and the input voltage is 10V, it indicates that the torque command is 100% rated torque. If P1-41 is set to 100, but the input voltage is changed to 5V, then the torque command is changed to 50% rated torque.

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

Related Section:

Section 7.3.4.4

7.3.4.5 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.

7.3.5 Control Modes Selection

Except signal control mode operation, Lexium 23 Plus series servo drives also provide many dual and multiple modes for the users to select.
1) Speed / Position mode selection: Pt-S, Pr-S, Pt-Pr
2) Speed / Torque mode selection: S-T
3) Torque / Position mode selection: Pt-T, Pr-T
4) Position / Speed multiple mode selection: Pt-Pr-S
5) Position / Torque multiple mode selection: Pt-Pr-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)
	Pr-S	**08**	Either Pr or S control mode can be selected via the Digital Inputs (DI)
	Pr-T	**09**	Either Pr 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)
	Pt-Pr	**0D**	Either Pt or Pr control mode can be selected via the Digital Inputs (DI).
Multiple Mode	**Pt-Pr-S**	**0E**	Either Pt or Pr or S control mode can be selected via the Digital Inputs (DI).
	Pt-Pr-T	**0F**	Either Pt or Pr 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). In position mode, we recommend that the users can use Pt mode to input pulse to reduce the use of DI inputs (POS0~5).
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.

7.3.5.1 Speed / Position Control Mode Selection

Pt-S Mode / Pr-S Mode:
The command source of Pt-S mode is from external input pulse. The command source of Pr-S mode is from internal parameters (P6-00 to P6-17). 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 selection will be more complicated when the position of Pr-S mode and speed command are both selected through DI signal.
The timing chart of speed / position control mode selection is shown as the figure below:

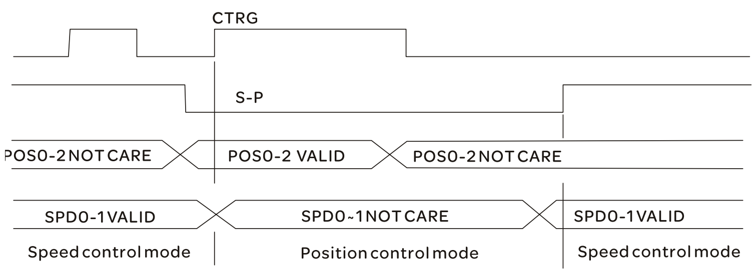


Figure 1. : Speed / Position Control Mode Selection

In speed mode (when S-P is ON), speed command is selected by SPD0~1 and CTRG is disabled at this time. When switching to the position mode (when S-P is OFF), the position command is not determined (it needs to wait that CTRG is on the rising edge), so the motor stop running. Once CTRG is on the rising edge, position command will be selected according to POS0~5 and the motor will immediately move to the determined position. After S-P is ON, it will immediately return to speed mode. For the relationship between DI signal and selected command in each mode, please refer to the introduction of single mode.

7.3.5.2 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:

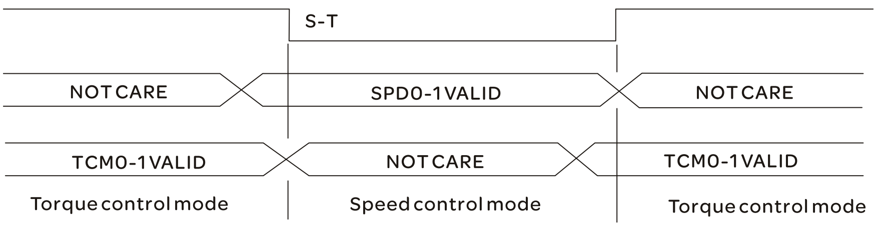


Figure 2. : Speed / Torque Control Mode Selection

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.

7.3.5.3 Torque / Position Control Mode Selectionn

Pt-T Mode / Pr-T Mode:

The command source of Pt-T mode is from external input pulse. The command source of Pr-T mode is from internal parameters (P6-00 to P6-17). 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 selection will be more complicated when the position of Pr-T mode and torque command are both selected through DI signal.

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

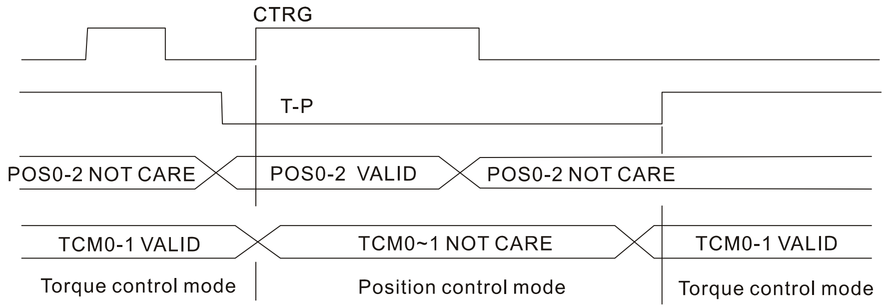


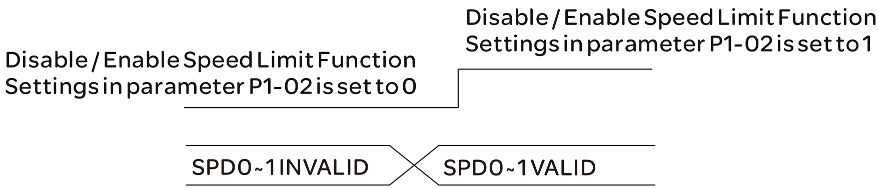
Figure 3. :Torque / Position Control Mode Selection

In torque mode (when T-P is ON), torque command is selected by TCM0~1 and CTRG is disabled at this time. When switching to the position mode (when T-P is OFF), the position command is not determined (it needs to wait that CTRG is on the rising edge), so the motor stop running. Once CTRG is on the rising edge, position command will be selected according to POS0~5 and the motor will immediately move to the determined position. After T-P is ON, it will immediately return to torque mode. For the relationship between DI signal and selected command in each mode, please refer to the introduction of single mode.

7.4 Other functions

7.4.1 Speed Limit

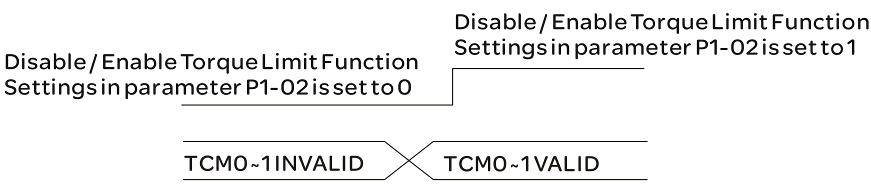
The max. servo motor speed can be limited by using parameter P1-55 no matter in position, speed or torque control mode.
The command source of speed limit command is the same as speed command. It can be the external analog voltage but also can be internal parameters (P1-09 to P1-11). For more information of speed command source, please refer to chapter 7.3.3.1.
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:



Command Source Selection of Speed Limit

7.4.2 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 7.3.4.1.
The torque limit only can be used in position mode (Pt and Pr 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:



Command Source Selection of Torque Limit

7.4.3 Analog Monitor

Users can use analog monitor to observe the required analog voltage signals. Lexium23 Plus series servo drives provide two analog channels, they are PIN No. 15 and 16 of CN1 connector. The parameters relative to analog monitor are shown below.

Relevant parameters:

P0 - 03	MON	Analog Monitor Output	Address: 0006H, 0007H

Default: 01

Applicable Control Mode: ALL

Unit: N/A

Range: 00 ~ 77

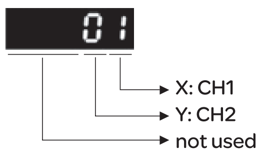
Data Size: 16-bit

Display Format: Hexadecimal

Settings:

This parameter determines the functions of the analog monitor outputs.

Related Section:
Section 6.3.3.5



XY: (X: CH1; Y: CH2)

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.

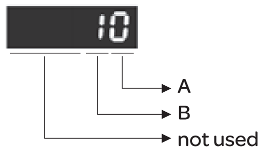
Example:

P0-03 = 01(CH1 is speed analog output)

Motor speed = (Max. motor speed x V1/8) x P1-04/100, when the output voltage value of CH1 is V1.

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

Default: 0 | Related Section:
Applicable Control Mode: ALL | Section 5.2.8.3
Unit: N/A
Range: 0 ~ 13
Data Size: 16-bit
Display Format: Hexadecimal
Settings:



This parameter is used to determine the polarity of analog monitor outputs and position pulse outputs. The analog monitor outputs can be configured with different polarity individually, but the position pulse outputs have to be each with the same polarity.

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 (CH1)	Address: 0108H, 0109H

Default: 100 | Related Section:
Applicable Control Mode: ALL | Section 7.3.4.4
Unit: % (full scale)
Range: 0 ~ 100
Data Size: 16-bit
Display Format: Decimal

P1 - 05	MON2	Analog Monitor Output Proportion 2 (CH2)	Address: 010AH, 010BH

Default: 100 | Related Section:
Applicable Control Mode: ALL | Section 7.3.4.4
Unit: % (full scale)
Range: 0 ~ 100
Data Size: 16-bit
Display Format: Decimal

P4 - 20	DOF1	Analog Monitor Output Drift Adjustment (CH1)	Address: 0428H, 0429H

Default: Factory setting
Applicable 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.

Related Section:
Section 7.3.4.4

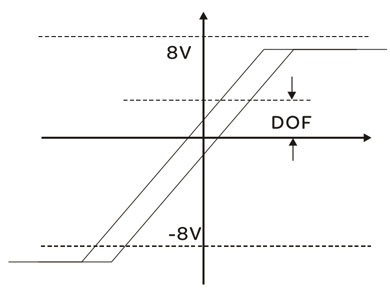
P4 - 21	DOF2	Analog Monitor Output Drift Adjustment (CH2)	Address: 042AH, 042BH

Default: Factory setting
Applicable 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.

Related Section: N/A
Section 7.3.4.4

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 Lexium23 Plus series servo drives is 10bit, approximated to 13mv/LSB.



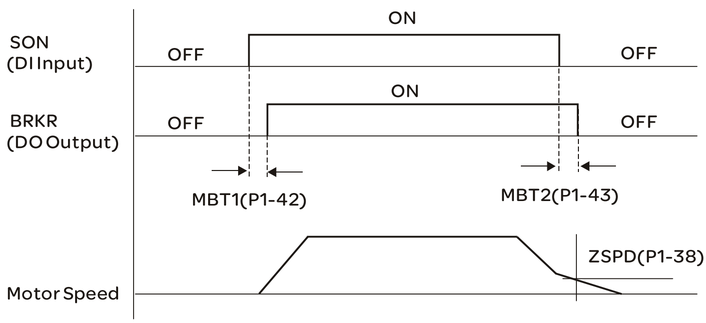
7.4.4 Electromagnetic Brake

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).

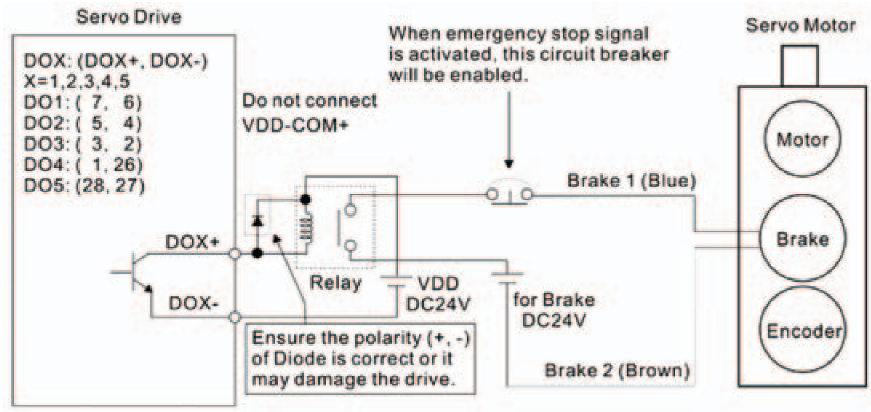
Timing chart for using servo motor with electromagnetic brake:



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.

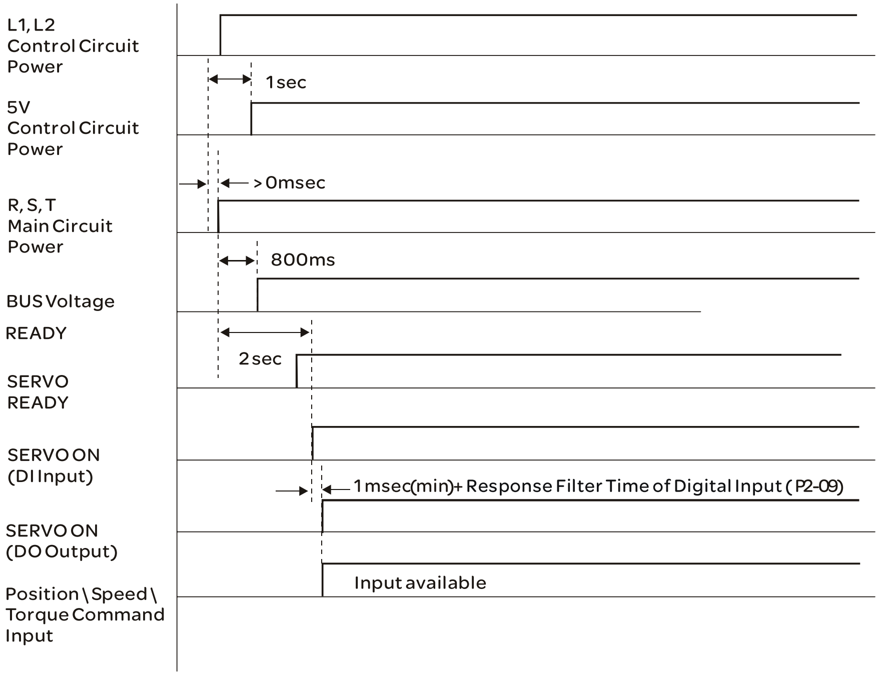
Electromagnetic Brake Wiring Diagram



Note:

1) Please refer to Chapter 5 installation 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:



Motion Control Function

8

At a Glance

What's in this Chapter?

This chapter contains the following topics:

8.1 Available Motion Control Functions

Lexium23 Plus servo drives provides the following motion control functions:
1) Pr mode for single-axis motion control
2) CAPTURE / COMPARE functions

8.2 Servo Drive Information

The information of the servo drive includes: 1. Servo Parameters; 2. Monitor Variables.

	Servo Parameters	Monitor Variables
Usage	Operation mode, important data and conditions of the servo drive, such as position/speed/torque control modes, position/speed loop gain, etc.	Real-time status of the servo drive or motor, such as motor position, motor speed and current settings, etc.
Display Method	LED Display: display PX-XX on the display. Press the ENT key to display the setting value of parameters. For the operation of the digital keypad, please refer to Chapter 6.3.	Set P0-02 directly to enter into monitor mode and specify the monitor status. The monitor status depends on the setting value of P0-02. Press MODE key on the keypad is to enter into monitor mode directly. For the operation of the digital keypad, please refer to Chapter 6.3.
Access Method	Able to read and write (depends on the settings of parameters)	Read only
Data Length	16-bit or 32-bit (depends on the settings of parameters)	32-bit integer
Communication	Support MODBUS/CANopen Read & Write, each parameter occupy two MODBUS addresses.	● Monitoring is accomplished through CN3 (upon commissioning tool) ● Do not support MODBUS/CANopen Read & Write directly unless the users use mapping function to monitor the specified monitor variable via the corresponding system parameters.
Mapping Parameters	P0-25 ~ P0-32, total 8 parameters (Determined by P0-35 ~ P0-42)	P0-09 ~ P0-13, total 5 parameters (Determined by P0-17 ~ P0-21)
Remark	-	In monitor mode, the users can press UP or DOWN arrow key to change the monitor variables in common use (code 0 ~ 26). Please note that not all monitor variables can be displayed (total 150 kinds of monitor variables).

8.2.1 Monitor Variables

Please refer to the following table for the explanation of monitor variables:

Item	Explanation
Variable Code	Each monitor variable has one corresponding code. The parameter P0-02 is used to set this code and monitor the monitor variable.
Format	Each monitor variable is saved in 32-bit (long integer) in the servo drive.
Type	There are two types of monitor variables, basic variable and extension variable: 1. Basic variable: Enter into monitor mode by pressing MODE key on the digital keypad. In monitor mode, press ▲/▼ arrow keys to find the available monitor variables (P0-02=0~26). Extension variable: Other variables are called extension variables except basic variables (P0-02=27~127).
Monitor Method	There are two kinds of methods for monitoring the monitor variables, one is through LED display of the digital keypad and the other is via mapping parameters: 1. LED display of digital keypad: Monitor the monitor variables through the LED display of the digital keypad directly. 2. Mapping parameters: The settings of monitor variables will be reflected on the setting value of the parameters. The users can know the settings of monitor variables through the corresponding parameters.
Display	1. Press M key to switch to monitor mode and then press ▲/▼ arrow keys to select the desired monitor variables. 2. Set P0-02 directly and then display the settings of the desired monitor variables. Press S key to switch high/low byte display; Press ENT key to switch decimal/hexadecimal display.
Mapping Function	1. The parameters which support mapping function includes: P0-09 ~ P0-13. (Please refer to section 11.4 "Detailed Parameter Listings" of Chapter 11. 2. Using mapping parameters and read & write monitor variables through communication. 3. The setting values of P0-09 ~ P0-13 (Status Monitor 1 ~ 5) are the content of basic variables (17h,18h,19h,1Ah). When the users want to monitor P0-09, P0-17 must be set first to read the status value (see P0-02). When reading the drive status through Modbus communication, the system will read the monitor status which specified by P0-17. When reading the drive status 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.

Attribute of monitor variables:

Attribute	Explanation
8	Basic variable. The monitor variables which can be scrolled through by pressing ▲/▼ keys.
0n	Decimal place display. 0 1 indicates one decimal place, 0 2 indicates two decimal place.
0ec	Decimal display only. When pressing ENT key on the keypad, the system can not switch to hexadecimal display.
Hex	Hexadecimal display only. When pressing ENT key on the keypad, the system can not switch to decimal display.

Explanation of monitor variables:

Code	Monitor Variable / Attribute	Explanation
000 (00h)	Feedback position (PUU) 8	Motor feedback - current position. Unit is user unit, PUU.
001 (01h)	Position command (PUU) 8	Position command current position. Unit is user unit, PUU. Pt mode: it indicates the pulse command received by the servo drive. Pr mode: it indicates the absolute position command. It is equal to the pulse number sent by the host (external) controller.
002 (02h)	Position error (PUU) 8	Position error counts between position command pulse and feedback pulse. Unit is user unit, PUU.
003 (03h)	Feedback position (pulse) 8	Motor feedback - current position. Unit is encoder unit, pulse.
004 (04h)	Position command (pulse) 8	Position command - current position. Unit is encoder unit, pulse. It is also the position command after electronic gear ratio is set.
005 (05h)	Position error (pulse) 8	Position error counts between position command pulse and feedback pulse. Unit is encoder unit, pulse.
006 (06h)	Input frequency of pulse command 8	Input frequency of pulse command received by the servo drive. Unit is Kpps. Applicable for Pt and Pr mode.
007 (07h)	Feedback speed 8 0 1 Dec	Actual motor speed. Unit is 0.1 rpm. The low-pass filter function is used so the value is more stable.
008 (08h)	Speed input command (Analog) 8 0 2 Dec	Analog speed input command. Unit is 0.01Volt.
009 (09h)	Speed command (Integrated) 8	Integrated speed input command. Unit is 1 rpm. The command source may be from analog command / internal parameter / position loop.
010 (0Ah)	Torque command (Analog) 8 0 2 Dec	Analog torque input command. Unit is 0.01Volt.
011 (0Bh)	Torque command (Integrated) 8	Integrated torque input command. Unit is Percent (%). The command source may be from analog command / internal parameter / position loop.
012 (0Ch)	Average load 8	Average load output by the servo drive. Unit is Percent (%).
013 (0Dh)	Peak load 8	Peak load output by the servo drive. Unit is Percent (%)。
014 (0Eh)	DC Bus voltage 8	Main circuit voltage after rectification. Unit is Volt.
015 (0Fh	Ratio of load inertia to motor inertia 8 0 1 Dec	Ratio of load inertia to motor inertia. Unit is 0.1times.
016 (10h)	IGBT temperature 8	IGBT temperature. Unit is ° C.

Code	Monitor Variable / Attribute	Explanation
017 (11h)	Resonance frequency 8 Dec	Resonance frequency of the mechanical system. There are two groups of resonance frequency: F1 and F2 When reading the drive status through the keypad, pressing S key can switch the display of F1 and F2. F2: no decimal point; F1: display one decimal point When reading the drive status through the communication, Low 16-bit (Low Byte) will display frequency F2 High 16-bit (High Byte) will display frequency F1
018 (12h)	Absolute pulse number relative to encoder (use Z phase as home) 8 Dec	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. When the value is higher, the deviation pulse number is higher too.
019 (13h)	Mapping parameter #1 8	Display the content of parameter P0-25 (mapping target is specified by parameter P0-35)
020 (14h)	Mapping parameter #2 8	Display the content of parameter P0-26 (mapping target is specified by parameter P0-36).
021 (15h)	Mapping parameter #3 8	Display the content of parameter P0-27 (mapping target is specified by parameter P0-37).
022 (16h)	Mapping parameter #4 8	Display the content of parameter P0-28 (mapping target is specified by parameter P0-38).
023 (17h)	Status monitor #1 8	Display the content of parameter P0-09 (the monitor status is specified by parameter P0-17).
024 (18h)	Status monitor #2 8	Display the content of parameter P0-10 (the monitor status is specified by parameter P0-18).
025 (19h)	Status monitor #3 8	Display the content of parameter P0-11 (the monitor status is specified by parameter P0-19).
026 (1Ah)	Status monitor #4 8	Display the content of parameter P0-12 (the monitor status is specified by parameter P0-20).
039 (27h)	DI status (Integrated) Hex	Integrated DI status. Each bit corresponds to one channel of digital input. The command source may be from DI signal or communication control (upon software). P3-06 can determine how digital inputs accept commands.
040 (28h)	DO status (Hardware) Hex	Actual DO output status. Each bit corresponds to one channel of digital output.
041 (29h)	Drive Status	The drive status will display via P0-46. Please refer to P0-46 for explanation.
043 (2Bh)	Capture data	The latest captured data by using Capture function. Note: Using Capture function is able to capture many positions.
049 (31h)	Pulse command CNT	Pulse counts input by pulse command (CN1).
050 (32h)	Speed command (Integrated) 0 1 Dec	Integrated speed input command. Unit is 0.1 rpm. The command source may be from analog command / internal parameter / position loop.

Code	Monitor Variable / Attribute	Explanation
051 (33h)	Feedback speed (Instant) 01 Dec	Actual motor speed. Unit is 0.1rpm.
052 (34h)	Feedback speed (Filter) 01 Dec	Actual motor speed. Unit is 0.1 rpm. (The low-pass filter function is used.)
053 (35h)	Torque command (Integrated) 01 Dec	Integrated torque command. Unit is 0.1Percent (%). The command source may be from analog command / internal parameter / speed loop.
054 (36h)	Feedback Torque 01 Dec	Actual motor torque. Unit is 0.1Percent(%).
055 (37h)	Feedback current 02 Dec	Actual motor current. Unit is 0.01ampere (Amp).
056 (38h)	DC Bus voltage 01 Dec	Main circuit voltage after rectification. Unit is 0.1Volt.
064 (40h)	End register of Pr command.	In Pr mode, it is the end of the position command (Cmd_E).
065 (41h)	Output register of Pr command.	In Pr mode, it is the accumulated outputs of position command.
067 (43h)	Target speed of Pr command.	It is target speed of Pr path command. Unit is PPS (Pulse Per Second).
068 (44h)	S-curve filter (Input)	Input data of S-curve filter which is used to create the effect of Scurve filter. In Pr mode, it is effective for internal speed command.
069 (45h)	S-curve filter (Output)	Output data of S-curve filter which is used to create the effect of Scurve filter. In Pr mode, it is effective for internal speed command.
076 (4Ch)	Speed command of Pr mode	In Pr mode, it is the terraced speed curve drawn up according to target speed / accel & decel time / position move (before using Scurve filter). Unit is PPS (Pulse Per Second).
096 (60h)	Firmware version of servo drive Dec	Includes 2 versions: DSP and CPLD When reading the firmware version through the keypad, pressing S key can switch the version display of DSP and CPLD. DSP: no decimal place; CPLD: it will display one decimal place. When reading the firmware version through the communication (using mapping parameters): Low 16-bit (Low word) will display DSP firmware version. High 16-bit (High word) will display CPLD firmware version.
111 (6Fh)	Servo fault code	Display servo fault code. But it only displays the servo drive fault code. The fault code for motion control will not be displayed.
123 (7Bh)	Keypad monitor value	When reading the monitor value through the keypad, it is used to read the monitor value displayed on the keypad.

8.3 Motion Axis

Motion axis is a counter within the servo drive which is used to count the data of absolute position (32-bit integer). The available motion axes are introduced in the following table.

Axis Name	Description	Read (R) / Write (W)	Attribute
1. Motor encoder axis (P5-16)	It indicates the motor absolute feedback position and the user unit is PUU.	R	Substantial axis
2. Pulse command axis (P5-18)	It is the pulse counts of the host (external) controller input from CN1. The pulse type can be defined by P1-00.	R/W	Substantial axis
3. Capture Axis1 (P5-37) and Capture Axis2 (P5-57)	It is the motion axis which is used to enable Capture function. The command source could be from motor encoder axis and pulse command axis. Position offset exists between output axis and substantial axis. After the first point is captured, the axis position can be defined again.	R/W	Output axis
4. Pr command axis	Command position defined by Pr path.	R	Suppositional axis
5. Internal time axis	Internal timer. The value will increase 1 every 1msec.	R	Suppositional axis
Please note: 1. Substantial axis: Position value is obtained from the actual terminal signal counts. 2. Output axis: It is the axis output by the substantial axis. The value will be not the same as the source of substantial axis, but the increasing value will be the same as the increasing value of substantial axis. 3. Suppositional axis: It is the axis generated by the servo firmware, e.g. Pr command axis. It is unable to command in real time so it could not be the command axis for Capture function.			

8.4 Pr Mode Introduction

Pr mode could be composed of one position command or multiple position commands, and triggered by DI signal, CTRG. DI signals, POS0 ~ POS2 are used to specify the desired trigger position.

8.5 Position Command Unit of Pr Mode

The position command unit of Pr mode is presented by PUU(Pulse of User Unit). It also indicates the ratio of position command unit of host (external) controller to internal position command unit of servo drive, i.e. electronic gear ratio of servo drive.

1) Position command unit of servo drive (pulse): encoder unit, 1280000pulses per revolution (pulse/rev).
2) User unit (PUU): unit of host (external) controller. If the pulse number per revolution is P pulses (PUU/rev), then the electronic gear ratio should be set to: GEAR_NUM(P1-44) / GEAR_DEN(P1-45) = 1280000 / P

8.6 Registers of Pr Mode

1) Position registers of Pr mode: They are indicates as user unit, PUU.
2) Command register (Monitor variable 064): End register of Pr command, Cmd_E. It indicates the end of the position command.
3) Position output register (Monitor variable 001): Cmd_O. It indicates the current output absolute position command.
4) Feedback register (Monitor variable 000): Fb_PUU. It indicates the current motor feedback position.
5) Error register (variable 002): Err_PUU. It indicates the position error counts between position command pulse and feedback pulse.
6) In Pr mode, at any time (no matter during operation or at stop): Err_PUU = Cmd_O - Fb_PUU.

The effect from position commands:

<table>
<tr><th>Command Type</th><th>When position command is given =></th><th>=> When position command is executing=></th><th>=> When position command is completed</th></tr>
<tr><td>Absolute position command</td><td>Cmd_E = command data (absolute)
Cmd_O retain unchanged
DO signal: CMD_OK is OFF</td><td>Cmd_E retain unchanged
Cmd_O continuously output
...</td><td>Cmd_E retain unchanged
Cmd_O = Cmd_E
DO signal: CMD_OK is ON</td></tr>
<tr><td>Incremental position command</td><td>Cmd_E+= command data (incremental)
Cmd_O retain unchanged
DO signal: CMD_OK is OFF</td><td>Cmd_E retain unchanged
Cmd_O continuously output
...</td><td>Cmd_E retain unchanged
Cmd_O = Cmd_E
DO signal: CMD_OK is ON</td></tr>
<tr><td>Stop command DI signal, STP</td><td>Cmd_E retain unchanged
Cmd_O continuously output
DO: CMD_OK output retain unchanged</td><td>Cmd_E retain unchanged
Cmd_O stop in accordance
with deceleration curve</td><td>Cmd_E retain unchanged
Cmd_O = position at stop
DO signal: CMD_OK is ON</td></tr>
<tr><td>Homing command</td><td>Cmd_E retain unchanged
Cmd_O retain unchanged
DO signal: CMD_OK is OFF
DO signal: HOME is OFF</td><td>Cmd_E continuously output
Cmd_O continuously output
...
...</td><td>Cmd_E = Z pulse (absolute position)
Cmd_O = position at stop
DO signal: CMD_OK is ON
DO signal: HOME is ON</td></tr>
<tr><td>Speed command</td><td colspan="3">Cmd_E continuously output
Cmd_O continuously output. After speed command is completed, it indicates that the speed reaches the setting value and the motor will not stop.
DO signal: CMD_OK is OFF</td></tr>
<tr><td colspan="2">Enter Pr at the first time (Servo Off -> Servo On
or other mode for entering Pr mode)</td><td colspan="2">Cmd_O = Cmd_E = current motor feedback position</td></tr>
<tr><td colspan="4">Note: The incremental position command performs accumulation according to the end of the position command (Cmd_E). It is irrelevant to current motor position and command timing as well.</td></tr>
</table>

8.7 Homing Function of Pr Mode

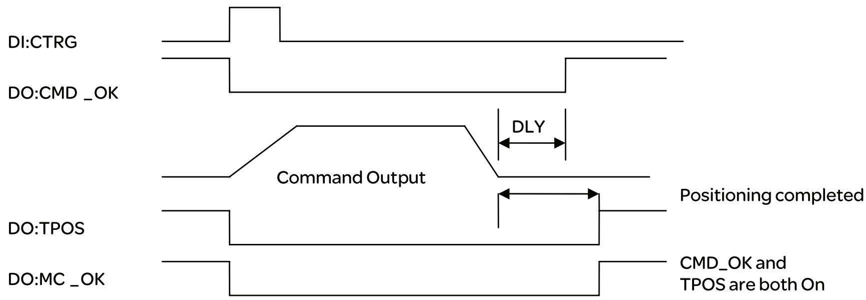
The homing function determines the homing characteristics of servo motors. The purpose of homing function is used to connect the position of Z pulse of motor encoder to the internal coordinate of the servo drive. The coordinate value corresponds to Z pulse can be specified.
After homing operation is completed, the stop position will not locate at the position of Z pulse. This is
because the motor must accelerate to stop when Z pulse is found. Generally, the motor stop position will be a little ahead of the position of Z pulse. At this time, Z pulse is set correctly so it will not affect the position precision.
For example, if the coordinate corresponds to Z pulse is set to 100, after homing operation is completed, Cmd=300. It indicates that the acceleration distance is equal to 300-100=200(PUU). Since Cmd_E=100 (absolute position of Z pulse), if the users want to command the motor to return to the position of Z pulse, just set absolute position command to 100 or incremental position command to 0.
In Pr mode of Lexium23 Plus servo drives series, after homing operation, it can execute the specified path and command the motor to return to the position of Z pulse automatically.
When homing function is executed, the software limit function is disabled.

8.8 DI and DO signals of Pr Mode

DI signals:
CTRG, SHOM, STP, POS0 ~ POS2, ORG, PL(CCWL), NL(CWL)

DO signals:
CMD_OK, MC_OK, TPOS, ALRM, CAP_OK

Timing chart:



Trigger method of Pr command:

There are 8 position settings in Pr mode. Path 0 is homing mode and the others (Path 1 ~ 8) can be userdefined. For the trigger method of Pr command, please refer to the table below:

	Command Source	Explanation
Standard Method	DI signals: CTRG + POS0 ~ 2	Use DI signals, POS0 ~ 5 to specify the desired trigger path number, and then use the rising-edge of DI signal, CTRG to trigger Pr command. Suitable application: PC or PLC commands the servo drive by using DI signals
Special Method	DI signals: STP,SHM	DI signal: Set STP from OFF ➜ ON, and the command will stop. DI signal: Set SHOM from OFF ➜ ON, and the servo drive will start to perform homing operation.
Software Setting	P5-07	Set P5-07 to the desired trigger path number and it will trigger the dedicated position command immediately. P5-07 can be set through the keypad / communication (RS-485 and CANopen). Suitable application: PC or PLC commands the servo drive by using the communication.

8.9 Parameter Settings of Pr Mode

1) Target speed: P5-60 ~ P5-75 (Moving Speed Setting of Position 0 ~ 15), total 16 groups

Bit	15 ~ 0
W0	TARGET_SPEED：0.1 ~ 6000.0(rpm)

2) Accel / Decel time: P5-20 ~ P5-35 (Accel / Decel Time 0 ~ 15), total 16 parameters

Bit	15 ~ 0
W0	T_ACC / T_DEC：1 ~ 65500(msec)

Note: The acceleration time is used for DO signals, STP/EMS/NL(CWL)/PL(CCWL) when the users want to stop the motor. The function of P5-07 will refer to this setting when perform stop positioning as well.

3) Delay time: P5-40 ~ P5-55 (Delay Time 0 ~ 15), total 16 groups.

Bit	15 ~ 0
W0	IDLE：0 ~ 32767(msec)

4) Path parameters: P5-00 ~ P5-09, P6-00 ~ P6-01, total 12 DWORD.

	32 BIT
P5-00	Reserved
P5-01	Reserved (for internal testing, do not use it)
P5-02	Reserved (for internal testing, do not use it)
P5-03	Deceleration Time of Protectin Function
P5-04	Homing Mode
P5-05	1st Speed Setting of High Speed Homing
P5-06	2nd Speed Setting of Low Speed Homing
P5-07	Trigger Position Command (Pr mode only)
P5-08	Forward Software Limit
P5-09	Reverse Software Limit
P6-00	Homing Definition
P6-01	Homing Definition Value (Z pulse position)

5) Path Definition: P6-02 ~ P6-17 (64 BIT), total 8 groups (2N).
Each path occupies two parameters.

BIT	31 ~ 28	27 ~ 24	23 ~ 20	19 ~ 16	15 ~ 12	11 ~ 8	7 ~ 4	3 ~ 0
DW0	-	-	DLY	SPD	DEC	ACC	OPT	0
DW1	DATA (32 bit): Target Position. Unit: Pulse of User Unit							

OPT:

<table>
<tr><th colspan="5">OPT</th></tr>
<tr><th>Bit 7</th><th>Bit 6</th><th>Bit 5</th><th>Bit 4</th><th rowspan="2">Explanation</th></tr>
<tr><th colspan="2">CMD</th><th>-</th><th>INS</th></tr>
<tr><td>0</td><td>0</td><td rowspan="2">0</td><td rowspan="2">-</td><td>Absolute position command: Cmd_E = DATA (Note 1)</td></tr>
<tr><td>1</td><td>0</td><td>Incremental position command: Cmd_E = Cmd_E + DATA (Note 2)</td></tr>
</table>

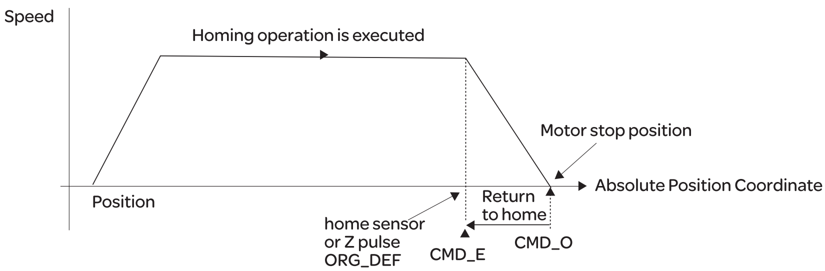
* It can accept DI signals, STP (Motor Stop), SNL(SCWL, Reverse Software Limit), SPL(SCCWL, Forward Software Limit).
INS: Interrupt the previous path.
CMD: The calculation method for Cmd_E (End of position command) is described in the notes below:
Note 1: The end of position command is an absolute position command which is equal to DATA directly.
Note 2: The end of the position command is an incremental position command which is equal to the end of the position command (Cmd_E, monitor variable 40h) plus a designated DATA.
ACC: Acceleration time
DEC1 / DEC2: 1st deceleration time / 2nd deceleration time.
DLY: Delay time

6) Homing Definition: P6-00 ~ P6-01, (64 bits), total 1 group.

Bit	31 ~ 28	27 ~ 24	23 ~ 20	19 ~ 16	15 ~ 12	11 ~ 8	7 ~ 4	3 ~ 0
DW0	BOOT	-	DLY	DEC2	DEC1	ACC	PATH	BOOT
DW1	ORG_DEF (32 bit)							

PATH: 0 ~8. Path style (4 bits)
0: Stop mode. Motor stops after homing is completed.
1~8: Auto mode. Motor goes the dedicated path 1 ~ 8 after homing is completed.
ACC: Acceleration time
DEC1 / DEC2: 1st deceleration time / 2nd deceleration time..
DLY: Delay time
BOOT: Boot mode. Disable or enable homing function when the servo drive is applied to power (power on).
0: Disable homing function
1: Enable homing function (when the servo drive is applied to power, first time Servo On)
ORG_DEF: Homing definition value which is determined by the parameter P6-01. The homing definition value does not necessarily have to be 0.

A. Lexium23 Plus servo drives does not provide the functions that find Z pulse and regard Z pulse as "Home".
Therefore, it needs to decide if the motor return to Z pulse position when homing operation is completed.
After home sensor or Z pulse is found, the motor must accelerate to stop. Generally, the motor stop position will be a little ahead of the position of Z pulse.

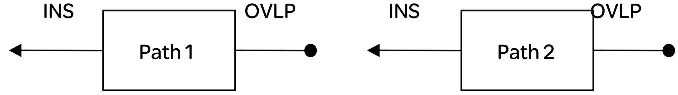


Do not return to Z pulse: Set PATH=O
Return to Z pulse: Set PATH= a non-zero value and set absolute position command=ORG_DEF.
CMD_O： Command Output Position
CMD_E： Command End Position

B. Position offset values are not defined when performing homing operation. After homing operation, the position offset values can be set as a dedicated Pr path.
For example, if the users want the motor to move a distance S (relative to home senor or Z pulse), and defined the position coordinate as P, set Pr path as a non-zero value and set ORG_DEF=P - S.
(P is the absolute position command and S is the incremental position command)

8.9.1 Path Order

1) Each path can set to interrupt the previous path (INS) or overlap the next path (OVLP).

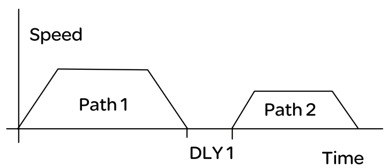


2) The priority of INS is higher than OVLP.

PATH 1	PATH 2	Path Order	Output	Note
OVLP=0	INS=0	In order	DLY 1	PATH1 and PATH2 can be speed or position command
OVLP=1	INS=0	Overlap	NO DLY	When PATH 2 is a speed command, OVLP function is disabled,
OVLP=0 OVLP=1	INS=1	Interrupt	N/A	PATH1 and PATH2 can be speed or position command

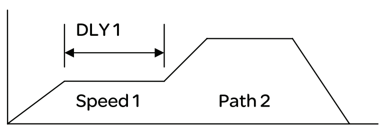
8.9.2 Pr Path

1) Path In Order



Path 1: AUTO, DLY is set
Path 2: INS is not set

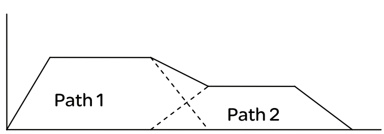
(DLY: Delay time is calculated from the time when the position command is completed)



Path 1: Speed command, DLY is set
Path 2: Position command

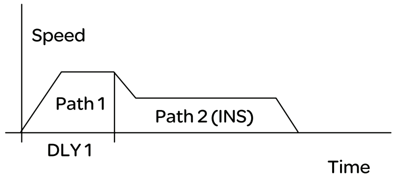
(DLY: Delay time is calculated from the time when the position command is completed)

2) Path Overlap



Path 1: OVLP is set, DLY can not be set.
Path 2: INS is not set

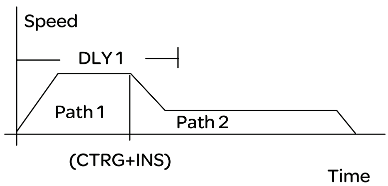
3) Internal Interrupt



Path 1: AUTO, DLY is set
Path 2: INS is set

(DLY is effective for internal interrupt)
This path setting can be used to create complicated position profile.

4) External Interrupt



Path 1: AUTO or SINGLE, no matter DLY is set or not.
Path 2: INS is set

(DLY is effective for external interrupt)
This path setting can be used to change position profile freely.

Communication

9

At a Glance

What's in this Chapter?

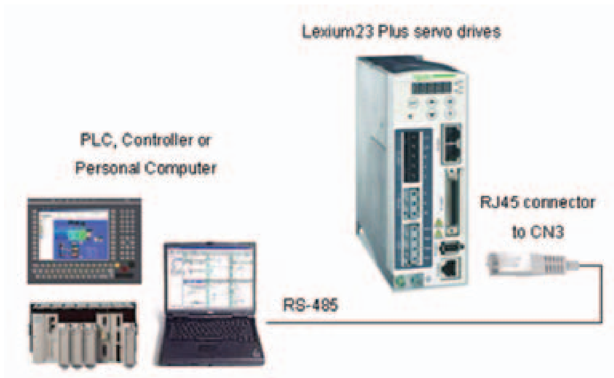
This chapter contains the following topics:

9.1 RS-485 Communication Hardware Interface

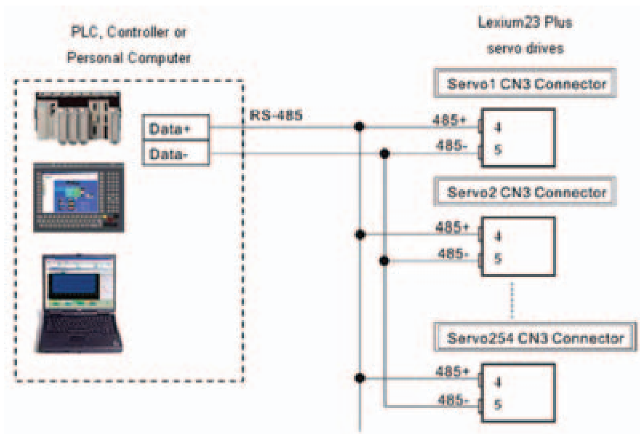
The Lexium23 Plus series servo drives support RS-485 serial communication to connect a host system such as a PLC or machine controller. All aspects of control, operation and monitoring as well as programming of the controller can be achieved via communication.

RS-485

- Configuration



- Cable 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 38400 bps 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. Maximum 254 servo drives can be connected.
5) For the terminal identification of CN3, please refer to Section 5.2.10.

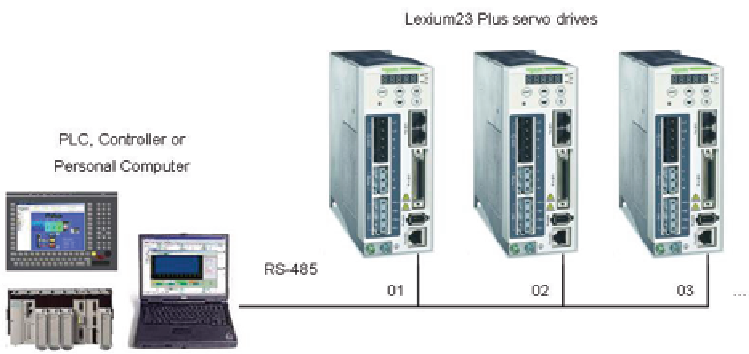
9.2 Communication Parameter Settings

The following describes the communication addresses for the communication parameters.
For communication parameters, please refer to the Chapter 9.

0300H 0301H Communication Address Setting	Default: 0x7F Range: 0x01 ~ 0x7F Settings (Hexadecimal):

Display	0	0	Y	X
Range	-	-	0 ~ 7	0 ~ F

When using RS-485 communication, this parameter is used set the communication address in hexadecimal format. If the AC servo drive is controlled by RS-485 communication, each drive (or device) must be uniquely identified. One servo drive only can set one address. If the address is duplicate, there will be a communication fault. This address is an absolute address which represents the servo drive on a RS-485 network. 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.



<table>
<tr>
<td>0302H
0303H
Transmission
Speed</td>
<td>Default: 0x0203
Range: 0x0000 ~ 0x0405
Settings (Hexadecimal):
<table>
<tr><td>Display</td><td>0</td><td>Z</td><td>Y</td><td>X</td></tr>
<tr><td>COM Port</td><td>-</td><td>CAN</td><td>-</td><td>RS-485</td></tr>
<tr><td>Range</td><td>0</td><td>0 ~ 4</td><td>0</td><td>0 ~ 5</td></tr>
</table>
X: Baud rate setting
0: Baud rate 4800
1: Baud rate 9600
2: Baud rate 19200
3: Baud rate 38400
4: Baud rate 57600
5: Baud rate 115200
Y: Reserved. Must be set to 0.
Z: CANopen Data transmission speed setting.
0: 125K bits / second
1: 250K bits / second
2: 500K bits / second
3: 750K bits / second
4: 1.0M bits / second
Please note:
1. When setting this parameter via CANopen communication, only the setting of Z (data transmission speed setting) can be configured.</td>
</tr>
</table>

This parameter is used to set the desired transmission speed between the computer and AC servo drive.
Users can set this parameter and control transmission speed to reach the maximum baud rate of 115200 bps.

<table>
<tr>
<td>0304H
0305H
Communication
Protocol</td>
<td>Default: 6
Range: 0~8
Settings:
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></td>
</tr>
</table>

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.

0306H 0307H Transmission Fault Treatment	Default: 0 Range: 0~1 Settings: 0: Display fault and continue operating 1: Display fault and decelerate to stop operating (deceleration time is determined by parameter P5-03)

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.

0308H 0309H Communication Time Out Detection	Watch Dog Timer (It is not recommended to change the factory default setting if not necessary) Default: 0 Range: 0~20 The factory default setting is set to 0 and it indicates this function is disabled.

When this parameter is set to any value over 0, it indicates that the timer is enabled. The value set in this parameter is the communication time and the communication time out detection should be completed within the time. Otherwise, a communication error will occur.

For example, if the value set in this parameter is 5, it indicates that the communication time out detection will be activated once in five seconds or a communication error will occur.

030CH 030DH Digital Input Communication Function	Digital Input Control: Default: 0 Range: 0x0000 ~ 0x3FFF Bit0 ~ Bit 7 corresponds with DI1 ~ DI8. 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 ~ DI8, please refer to P2-10 ~ P2-17.

The setting of this parameter determines how the Digital Inputs (DI) accept commands and signals.
Input commands or signals through the DI can be either from an external source, through the CN1 interface connector, or via communication (upon software). If this parameter is set to "0", all commands are external and via CN1; if this parameter is set to "FFFF"(hexadecimal), all the DI signals are via communication (upon software).
For example, if P3-06 is set to 55 ("binary" display is 01010101), it indicates that Digital Inputs 1, 3, 5, & 7 are controlled by external commands and Digital Inputs 2, 4, 6, & 8 are controlled by communication (upon software).
Please see Chapter 4.4.5 DI Signal Display Diagnosis Operation for display layout of the Digital Signal selection.
The Digital Input Control parameter, P3-06 also works in conjunction with the Digital Input Status parameter P4-07 which has several functions.
The contents of P4-07 is "read only" via the drive keypad and will display the state on or off of the eight Digital Inputs which have been set in accordance to P3-06. For E xample; if P3-06 has been set to "FFFF" (All digital inputs are via communication (upon software)) and the P4-07 display is 11 ("binary" display is 00010001), it indicates that the state of Digital Inputs 1 & 5 are on and the state of Digital Inputs 2, 3, 4, 6, 7 & 8 are off.

030EH 030FH Communication Response Delay Time	Default: 0 Range: 0~1000

This parameter is used to delay the communication time that servo drive responds to host controller (external controller).
When this parameter is set to 0, it indicates that the communication time that servo drive responds to host controller (external controller) will no be delayed.

9.3 MODBUS Communication Protocol

When using RS-485 serial communication interface, each Lexium23 Plus servo drive has a preassigned communication address specified by parameter "P3-00". The computer then controls each AC servo drive according to its communication address. Lexium23 Plus servo drives 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:

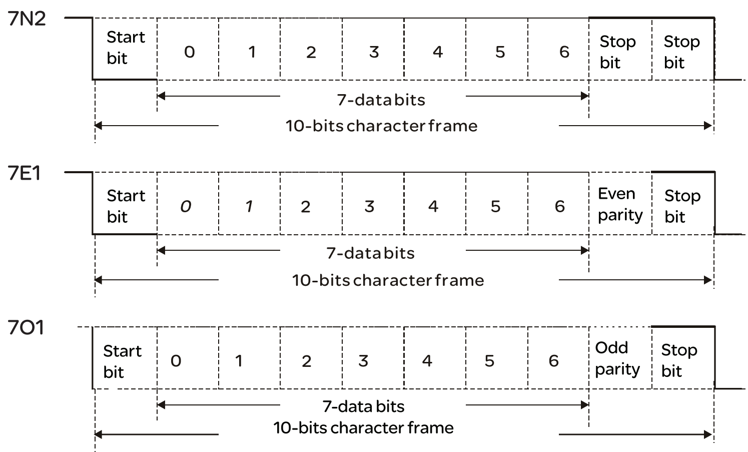
ASCII Mode:
Each 8-bit data is the combination of two ASCII characters. For example, a 1-byte data: 64 Hex, shown as '64' in ASCII, consists of '6' (36Hex) and '4' (34Hex).
The following table shows the available hexadecimal characters and their corresponding ASCII codes.

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

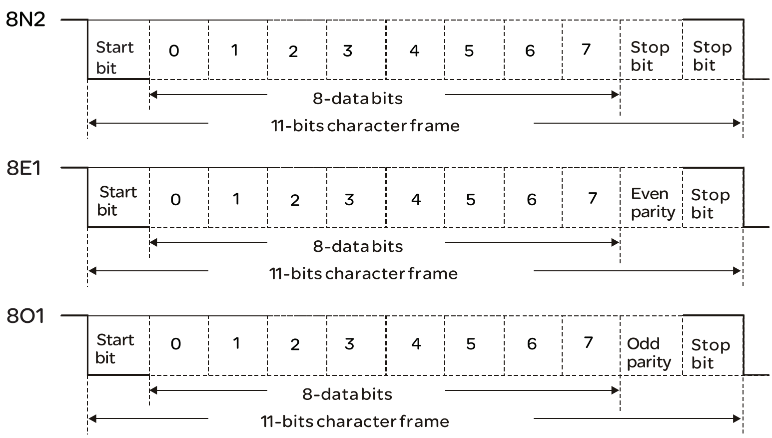
RTU Mode:
Each 8-bit data is the combination of two 4-bit hexadecimal characters. For example, a 1-byte data: 64 Hex.

Data Format:

10-bit character frame (For 7-bit character)



11-bit character frame (For 8-bit character)



Communication Protocol:

ASCII Mode:

STX	Start character ': ' (3AH)
ADR	Communication address: 1-byte consists of 2 ASCII codes
CMD	Command 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 ⩽ 12
……	
DATA (0)	
LRC	Command code: 1-byte consists of 2 ASCII codes
End 1	End code 1: (0DH)(CR)
End 0	End code 0: (0AH)(LF)

RTU Mode:

STX	A silent interval of more than 10ms
ADR	Communication address: 1-byte
CMD	Command code: 1-byte
DATA(n-1)	Contents of data: n word = n x 2-byte, n ⩽ 12
……	
DATA(0)	
CRC	Command code: 1-byte
End 1	A silent interval of more than 10ms

STX (Communication Start)
ASCII Mode: ':' character
RTU Mode: A silent interval of more than 10ms

ADR (Communication Address)
The valid communication addresses are in the range of 1 to 254.
For example, communication to AC servo drive with address 16 decimal:
ASCII Mode: ADR='1', '0'=> '1'=31H, '0'=30H
RTU Mode: ADR = 10H

CMD (Command Codes) and DATA (Data Characters)
The format of data characters depends on the command code. The available command codes and examples for AC servo drive are described as follows:
Command code: 03H, read N 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:

STX	‘:’
ADR	‘0’
	‘1’
CMD	‘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:

STX	‘:’
ADR	‘0’
	‘1’
CMD	‘0’
	‘3’
Number of data (Count by 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:

ADR	01H	
CMD	03H	
Starting data address	02H (Upper bytes)	
	00H (Lower bytes)	
Number of data (Count by word)	00H	
	02H	
CRC Check Low	C5H (Lower bytes)	
CRC Check High	B3H (Upper bytes)	

Response message:

ADR	01H
CMD	03H
Number of data (Count by 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)

Command code: 06H, write 1 word
For example, writing 100 (0064H) to starting data address 0200H of Lexium23 Plus servo drives with address 01H.

ASCII Mode:

Command message:

STX	‘:’
ADR	‘0’
	‘1’
CMD	‘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:

STX	‘:’
ADR	‘0’
	‘1’
CMD	‘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:

ADR	01H
CMD	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:

ADR	01H
CMD	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)

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.

For example, reading 1 word from address 0201H of the Lexium23 Plus servo drive with address 01H.

STX	‘:’
ADR	‘0’
	‘1’
CMD	‘0’
	‘3’
Starting data address	‘0’
	‘2’
	‘0’
	‘1’
Number of data	‘0’
	‘0’
	‘0’
	‘1’
LRC Check	‘F’
	‘8’
End 1	(0DH) (CR)
End 0	(0AH) (LF)

01H+03H+02H+01H+00H+01H = 08H, the 2's complement negation of 08H is F8H. Hence, we can know that LRC CHK is 'F', '8'.

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.

ARD	01H
CMD	03H
Starting data address	01H (Upper byte)
	01H (Lower bytes)
Number of data (Count by 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.

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 LXM23 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 */
    }
}
}
```

9.4 Communication Parameter Write-in and Read-out

There are following 7 groups for 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)
Group 5: Motion control parameters	(example: P5-xx)
Group 6: Pr path definition parameters	(example: P6-xx)

For a complete listing and description of all parameters, refer to Chapter 11.

Communication write-in parameters for Lexium23 Plus servo drives 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
Group 5: All parameters except P5-10, P5-16 and P5-76
Group 6: P6-00 ~ P6-17

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 11.
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 to test DO1, DO2, DO3, DO4, DO5, 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 user desires to change the settings of this parameter, 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 Lexium23 Plus servo drives 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 ~ P4-23
Group 5: P5-00 ~ P5-76
Group 6: P6-00 ~ P6-17

Diagnostic and troubleshooting

10

At a Glance

Presentation

This chapter describes the various types of diagnostics and provides troubleshooting assistance.

What's in this Chapter?

This chapter contains the following topics:

10.1 Status request/status indication

Information on the product status are provided by:

- Integrated HMI
  See chapter Fault Message Display
- Commissioning software
  For details on how to display the device state see the information provided in the commissioning software "Lexium23 Plus CT".
- The error memory also contains a history of the last 5 errors.
  The error memory can be found in the Diagnosis Parameter section (P4-00 to P4-04).The five most recent errors are stored.
  See the information provided with the commissioning software for details on how to read the error memory using the commissioning software.

10.2 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.
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	Operational stop activated	Operational 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.
AL018	Encoder output error	The encoder output exceeds the rated output frequency.
AL020	Serial communication time out	RS-485 communication time out.
AL022	Input power phase loss	One phase of the input power is loss.

Fault Messages		
Display	Fault Name	Fault Description
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	Encoder reset error	An encoder reset error is detected. The communication between the encoder and the servo drive are 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 wiring error	The wiring connections of U, V, W (for servo motor output) and GND (for grounding) are in error.
AL040	Full closed-loop excessive deviation	The position control deviation value of full closed-loop exceeds the specified limit.
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 servo drive.

CANopen Communication Fault Messages

Fault Messages		
Display	Fault Name	Fault Description
AL111	CANopen SDO receive buffer overrun	SDO Rx buffer overrun is detected (receive two or more SDO packets in 1ms).
AL112	CANopen PDO receive buffer overrun	PDO Rx buffer overrun is detected (receive two or more PDO (same COBID) packets in 1ms).
AL121	Index error occurs when accessing CANopen PDO object.	The specified Index in the message does not exist.
AL122	Sub-index error occurs when accessing CANopen PDO object.	The specified Sub-index in the message does not exist.
AL123	Data type (size) error occurs when accessing CANopen PDO object.	The data length in the message does not match the specified object.
AL124	Data range error occurs when accessing CANopen PDO object.	The data in the message has exceeded the data range of the specified object.
AL125	CANopen PDO object is read-only and write-protected.	The specified object in the message is read-only and write-protected (cannot be changed).
AL126	CANopen PDO object does not support PDO.	The specified object in the message does not support PDO.
AL127	CANopen PDO object is write-protected when Servo On.	The specified object in the message is write-protected (cannot be changed) when Servo On.
AL128	Error occurs when reading CANopen PDO object from EE-PROM.	An error occurs when loading the default settings from EE-PROM at start-up. All CANopen objects return to their default settings automatically.
AL129	Error occurs when writing CANopen PDO object into EE-PROM.	An error occurs when writing the current settings into EE-PROM.
AL130	EE-PROM invalid address range	The amount of the data saved in EE-PROM has exceeded the space determined by the firmware. Maybe the firmware version has been upgraded, and it causes that the data of old firmware version saved in EE-PROM cannot be used.

Fault Messages		
Display	Fault Name	Fault Description
AL131	EE-PROM checksum error	The data saved in EE-PROM has been damaged and all CANopen objects return to their default settings automatically.
AL132	Password error	The parameter is password protected when using CANopen communication to access the parameter. The users must enter the valid password to unlock the parameter.
AL180	Life guard error or heartbeat error	Receive node guarding or heartbeat message or heartbeat error has timed out.
AL185	CANbus error	CANbus off or Error Rx/Tx Counter exceeds 128.
AL201	CANopen data initial error	An error occurs when loading data from EE-PROM.
AL235	Command overflow	This fault occurs when position command counter register overflowed and at this time an absolute position command is executed.
AL261	Index error occurs when accessing CANopen object.	The specified Index in the message does not exist.
AL263	Sub-index error occurs when accessing CANopen object.	The specified Sub-index in the message does not exist.
AL265	Data type (size) error occurs when accessing CANopen object.	The data length in the message does not match the specified object.
AL267	Data range error occurs when accessing CANopen object.	The data in the message has exceeded the data range of the specified object.
AL269	CANopen object is read-only and write-protected.	The specified object in the message is read-only and write-protected (cannot be changed).
AL26b	CANopen object does not support PDO.	The specified object in the message does not support PDO.
AL26d	CANopen object is write-protected when Servo On.	The specified object in the message is write-protected (cannot be changed) when Servo On.

Fault Messages		
Display	Fault Name	Fault Description
AL277	Password error	The parameter is password protected when using CANopen communication to access the parameter. The users must enter the valid password to unlock the parameter.
AL283	Forward software limit	Position command is equal to or more than forward software limit.
AL285	Reverse software limit	Position command is equal to or less than forward software limit.
AL3E1	CANopen SYNC failed	The synchronous communication with the external controller has failed.
AL3E2	CANopen SYNC signal error	The CANopen SYNC signal is received too early.
AL3E3	CANopen SYNC time out	The CANopen SYNC signal is not received within the specified time.
AL3E4	CANopen IP command failed	Internal command of CANopen IP mode cannot be sent and received.
AL3E5	SYNC period error	Object 0x1006 data error. SYNC period 1006h value is invalid.
AL380	Position deviation alarm for digital output, MC_OK	After MC_OK is activated, when the digital output, TPOS is Off, the digital output, MC_OK becomes Off. For more detailed explanation, please refer to parameter P1-48 in Chapter 8.
AL401	CAN bus error	NMT reset or NMT stop command is received when the servo drive is enabled.

NOTE:

1) If there is any unknown fault code that is not listed on the above table, please inform the distributor or contact with Schneider Electric for assistance.
2) For more information about the CANopen objects, please refer to CANopen Instruction Manual.

10.3 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 Schneider Electric.
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. (For voltage specification, please refer to section 3.3.1 in Chapter 3.)	Use correct power supply or stabilizing power or using series transformer.
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 or using series transformer.
The hardware of the servo drive is damaged.	Use voltmeter to ensure that the main circuit input voltage falls within the specified limit,	If the error does not clear even if the main circuit input voltage falls within the specified limit, please contact your distributor for assistance or contact with Schneider Electric.

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 stabilizing power or using series transformer.

AL004 : Motor error

Potential Cause	Checking Method	Corrective Actions
Encoder is damaged.	Check the encoder for the damage.	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 or the value of the regenerative resistor is too low.	Check the wiring connection of regenerative resistor.	Reconnect regenerative resistor or calculate the value of the regenerative resistor.
Regenerative switch transistor fault	Check if regenerative switch transistor is shortcircuited.	Please contact your distributor for assistance or contact with Schneider Electric.
Parameter setting is in error	Confirm the parameter settings of P1-52 and P1-53, and specifications of regenerative resistor.	Correctly reset parameter settings and the specifications of regenerative resistor 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. The users can set parameter P0-02 (Drive Fault Code) to 11 and monitor if the value of the average torque [%] exceeds 100% always.	Increase motor capacity or reduce load.
Control system parameter setting is incorrect.	1. Check if there is mechanical vibration 2. Accel/Decel time setting is too fast.	1. Adjust gain value of control circuit. 2. 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.
The encoder of the motor is damaged.	Please contact your distributor for assistance or contact with Schneider Electric.	

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.
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 reestimate the motor capacity.

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 (CN2).	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 motor for the damage.	Replace the motor.

AL012 : Adjustment error

Potential Cause	Checking Method	Corrective Actions
The analog input contact does not go back to zero.	Measure if the voltage of the analog input contact is the same as the voltage of the ground.	Correctly ground the analog input contact.
The detection device is damaged.	damaged. Reset the power supply.	If the error does not clear after resetting the power supply, please contact your distributor for assistance or contact with Schneider Electric.

AL013 : Operational stop activated

Potential Cause	Checking Method	Corrective Actions
Operational stop switch is activated.	Check if operational stop switch is On or Off.	Activate operational 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 reestimate 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 reestimate 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.
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 E E-PROM. Please contact your distributor for assistance or contact with Schneider Electric.

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: $\frac{\text{Motor Speed}}{60} \text{ P1-46} \times 4 > 19.8 \times 10^6$	Correctly set P1-76 and P1-46. 1. Ensure that the motor speed is below the value set by P1-76. 2. $\frac{\text{Motor Speed}}{60} \text{ P1-46} \times 4 < 19.8 \times 10^6$

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.

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, 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 Schneider Electric.

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 to small.	1. Please refer to the correction actions of AL006. 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 Schneider Electric.

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 heatsink 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 Schneider Electric.

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 heatsink 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 Schneider Electric.

AL027 : Encoder reset error

Potential Cause	Checking Method	Corrective Actions
An encoder reset error is detected. The communication between the encoder and the servo drive 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 when performing encoder wiring.	1. Please connect the grounding (green color) of U, V, W terminal to the heatsink 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 Schneider Electric.

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 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, W are not correct.	Follow the wiring steps in the user manual to reconnect the wiring and ground the servo drive and motor properly.

AL040 : Full closed-loop excessive deviation

Potential Cause	Checking Method	Corrective Actions
The position control deviation value of fullclosed loop exceeds the specified limit. Maximum deviation parameter setting is too small.	1. Check if the setting value of P1-73 is too small. 2. Check if all connections are tight and wellconnected to the mechanical equipment.	1. Increases the parameter setting value of P1-73. 2. Ensure all connections are tight and well-connected to the mechanical

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.

CANopen Communication Fault Messages

AL111 : CANopen SDO receive buffer overrun

Potential Cause	Checking Method	Corrective Actions
SDO Rx buffer overrun is detected (receive two or more SDO packets in 1ms).	Check if the servo drive (Master) receives two or more SDO packets in 1ms.	NMT Maser send "Reset node" command to its slave or reset the fault by sending the control word (0x6040) through CAN communication (the value of CANopen object 0x6040 should be reset)

AL112 : CANopen PDO receive buffer overrun

Potential Cause	Checking Method	Corrective Actions
PDO Rx buffer overrun is detected (receive two or more PDO packets in 1ms).	Check if the servo drive (Master) receives two or more PDO (same COB-ID) packets in 1ms.	NMT Maser send "Reset node" command to its slave or reset the fault by sending the control word (0x6040) through CAN communication (the value of CANopen object 0x6040 should be reset)

AL121 : Index error occurs when accessing PDO object

Potential Cause	Checking Method	Corrective Actions
The specified Index in the message does not exist.	Check if the Entry index value in PDO mapping is changed when accessing PDO object.	NMT Maser send "Reset node" command to its slave or reset the fault by sending the control word (0x6040) through CAN communication (the value of CANopen object 0x6040 should be reset)

AL122 : Sub-index error occurs when accessing PDO object

Potential Cause	Checking Method	Corrective Actions
The specified Sub-index in the message does not exist.	Check if the Entry Sub-index value in PDO mapping is changed when accessing PDO object.	NMT Maser send "Reset node" command to its slave or reset the fault by sending the control word (0x6040) through CAN communication (the value of CANopen object 0x6040 should be reset)

AL 123 : Data type (size) error occurs when accessing PDO object

Potential Cause	Checking Method	Corrective Actions
The data length in the message does not match the specified object.	Check if the Entry data length in PDO mapping is changed when accessing PDO object.	NMT Maser send "Reset node" command to its slave or reset the fault by sending the control word (0x6040) through CAN communication (the value of CANopen object 0x6040 should be reset)

AL 124 : Data range error occurs when accessing PDO object

Potential Cause	Checking Method	Corrective Actions
The data in the message has exceeded the data range of the specified object.	Check if the write-in data range in PDO mapping is not correct when accessing PDO object.	NMT Maser send "Reset node" command to its slave or reset the fault by sending the control word (0x6040) through CAN communication (the value of CANopen object 0x6040 should be reset)

AL 125 : Object is read-only and write-protected

Potential Cause	Checking Method	Corrective Actions
The specified object in the message is read-only and write-protected (cannot be changed).	Check if the specified object is set to read-only write-protected (cannot be changed) when accessing PDO object.	NMT Maser send "Reset node" command to its slave or reset the fault by sending the control word (0x6040) through CAN communication (the value of CANopen object 0x6040 should be reset)

AL 126 : CANopen PDO object does not support PDO

Potential Cause	Checking Method	Corrective Actions
The specified object in the message cannot support PDO.	Check if the specified object cannot support PDO when accessing PDO object.	NMT Maser send "Reset node" command to its slave or reset the fault by sending the control word (0x6040) through CAN communication (the value of CANopen object 0x6040 should be reset)

AL 127 : CANopen PDO object is write-protected when Servo On

Potential Cause	Checking Method	Corrective Actions
The specified object in the message is write-protected (cannot be changed) when Servo On.	Check if the specified object in the message is write-protected (cannot be changed) while the servo drive is enabled (Servo On) when accessing PDO object.	NMT Maser send "Reset node" command to its slave or reset the fault by sending the control word (0x6040) through CAN communication (the value of CANopen object 0x6040 should be reset)

AL 128 : Error occurs when reading CANopen PDO object from EE-PROM

Potential Cause	Checking Method	Corrective Actions
An error occurs when loading the default settings from EE-PROM at start-up. All CANopen objects return to their default settings automatically.	Check if it causes an error when the specified object reads EE-PROM when accessing PDO object.	NMT Maser send "Reset node" command to its slave or reset the fault by sending the control word (0x6040) through CAN communication (the value of CANopen object 0x6040 should be reset)

AL 129 : Error occurs when writing CANopen PDO object into EE-PROM

Potential Cause	Checking Method	Corrective Actions
An error occurs when writing the current settings into EE-PROM.	Check if it causes an error when the specified object writes EE-PROM when accessing PDO object.	NMT Maser send "Reset node" command to its slave or reset the fault by sending the control word (0x6040) through CAN communication (the value of CANopen object 0x6040 should be reset)

AL 130 : EE-PROM invalid address range

Potential Cause	Checking Method	Corrective Actions
The amount of the data saved in EE-PROM has exceeded the space determined by the firmware. Maybe the firmware version has been upgraded, and it causes that the data of old firmware version saved in EE-PROM cannot be used.	Check if the specified object lets the address range of EE-PROM exceed the specification when accessing PDO object.	NMT Maser send "Reset node" command to its slave or reset the fault by sending the control word (0x6040) through CAN communication (the value of CANopen object 0x6040 should be reset)

AL131 : EE-PROM checksum error

Potential Cause	Checking Method	Corrective Actions
The data saved in EE-PROM has been damaged and all CANopen objects return to their default settings automatically.	Check if the specified object results in the checksum error of EE-PROM when accessing PDO object.	NMT Maser send "Reset node" command to its slave or reset the fault by sending the control word (0x6040) through CAN communication (the value of CANopen object 0x6040 should be reset)

AL132 : Password error

Potential Cause	Checking Method	Corrective Actions
The parameter is password protected when using CANopen communication to access the parameter.	Check if the password for the specified object is invalid when accessing PDO object.	NMT Maser send "Reset node" command to its slave or reset the fault by sending the control word (0x6040) through CAN communication (the value of CANopen object 0x6040 should be reset)

AL180 : Life guard error or heartbeat error

Potential Cause	Checking Method	Corrective Actions
Receive node guarding or heartbeat message has timed out.	Check the settings of node guarding or heartbeat function.	NMT Maser send "Reset node" command to its slave. be reset)

AL185 : CANbus error

Potential Cause	Checking Method	Corrective Actions
CANbus off or Error Rx/Tx Counter exceeds 128.	1. Examine CANbus communication cable. 2. Check if the communication quality is good quality state. (It is recommended to use shielded cables and use common grounding.)	NMT Maser send "Reset node" command to its slave or restart the servo drive.

AL201 : CANopen data initial error

Potential Cause	Checking Method	Corrective Actions
An error occurs when loading data from EE-PROM.	1. Restart the servo drive to check if the error can be cleared. 2. If the error cannot be cleared after restarting the servo drive, it indicates that the data in EE-PROM is damaged and the users must do the following actions: a. If the users want to write default setting values, set P2-08 to 30 first and then 28 next, or use CANopen "0x1011" object to restore parameters from non-volatile memory. b. If the users want to write current setting values, use CANopen "0x1010" object to save parameters in non-volatile memory.	1. Turn ARST (DI signal) ON to clear the fault. 2. Use CANopen "0x1011" object to restore default parameters.

AL235 :command overflow

Potential Cause	Checking Method	Corrective Actions
This fault occurs when position command counter register overflowed and at this time an absolute position command is executed.	1. Check if the position command is executing continuously toward single direction and make the feedback position command counter overflow. 2. Check if the above situation causes that the correct position cannot be gauged. 3. Check if an absolute position command is executed after the position command counter register overflowed.	NMT Maser send "Reset node" command to its slave or reset the fault by sending the control word (0x6040) through CAN communication (the value of CANopen object 0x6040 should be reset)

AL261 : Index error occurs when accessing CANopen object

Potential Cause	Checking Method	Corrective Actions
The specified Index in the message does not exist.	If this fault occurs, please contact your distributor for assistance or contact with Schneider Electric.	NMT Maser send "Reset node"command to its slave or reset the fault by sending the control word (0x6040) through CAN communication (the value of CANopen object 0x6040 should be reset)

AL263 : Sub-index error occurs when accessing CANopen object

Potential Cause	Checking Method	Corrective Actions
The specified Sub-index in the message does not exist.	If this fault occurs, please contact your distributor for assistance or contact with Schneider Electric.	NMT Maser send "Reset node" command to its slave or reset the fault by sending the control word (0x6040) through CAN communication (the value of CANopen object 0x6040 should be reset)

AL265 : Data type (size) error occurs when accessing CANopen object

Potential Cause	Checking Method	Corrective Actions
The data length in the message does not match the specified object.	If this fault occurs, please contact your distributor for assistance or contact with Schneider Electric.	NMT Maser send "Reset node" command to its slave or reset the fault by sending the control word (0x6040) through CAN communication (the value of CANopen object 0x6040 should be reset)

AL267 : Data range error occurs when accessing CANopen object

Potential Cause	Checking Method	Corrective Actions
The data in the message has exceeded the data range of the specified object.	If this fault occurs, please contact your distributor for assistance or contact with Schneider Electric.	NMT Maser send "Reset node" command to its slave or reset the fault by sending the control word (0x6040) through CAN communication (the value of CANopen object 0x6040 should be reset)

AL269 : Object is read-only and write-protected

Potential Cause	Checking Method	Corrective Actions
The specified object in the message is read-only and write-protected (cannot be changed).	If this fault occurs, please contact your distributor for assistance or contact with Schneider Electric.	NMT Maser send "Reset node" command to its slave or reset the fault by sending the control word (0x6040) through CAN communication (the value of CANopen object 0x6040 should be reset)

AL26b : CANopen object does not support PDO

Potential Cause	Checking Method	Corrective Actions
The specified object in the message does not support PDO.	If this fault occurs, please contact your distributor for assistance or contact with Schneider Electric.	NMT Maser send "Reset node" command to its slave or reset the fault by sending the control word (0x6040) through CAN communication (the value of CANopen object 0x6040 should be reset)

AL26d : Object is write-protected when Servo On

Potential Cause	Checking Method	Corrective Actions
The specified object in the message is write-protected (cannot be changed) when Servo On.	If this fault occurs, please contact your distributor for assistance or contact with Schneider Electric.	NMT Maser send "Reset node" command to its slave or reset the fault by sending the control word (0x6040) through CAN communication (the value of CANopen object 0x6040 should be reset)

AL277 : Password error

Potential Cause	Checking Method	Corrective Actions
The parameter is password protected when using CANopen communication to access the parameter.	If this fault occurs, please contact your distributor for assistance or contact with Schneider Electric.	NMT Maser send "Reset node" command to its slave or reset the fault by sending the control word (0x6040) through CAN communication (the value of CANopen object 0x6040 should be reset)

AL283 : Forward software limit

Potential Cause	Checking Method	Corrective Actions
Position command is equal to or more than forward software limit.	This software limit is determined according to position command, not actual feedback position. It indicates that when this fault is activated, the actual position may not exceed the limit. Setting the proper deceleration time is able to solve this problem. Please refer to parameter P5-03.	NMT Maser send "Reset node" command to its slave or reset the fault by sending the control word (0x6040) through CAN communication (the value of CANopen object 0x6040 should be reset)

AL285 : Reverse software limit

Potential Cause	Checking Method	Corrective Actions
Position command is equal to or less than forward software limit.	This software limit is determined according to position command, not actual feedback position. It indicates that when this fault is activated, the actual position may not exceed the limit. Setting the proper deceleration time is able to solve this problem. Please refer to parameter P5-03.	NMT Maser send "Reset node" command to its slave or reset the fault by sending the control word (0x6040) through CAN communication (the value of CANopen object 0x6040 should be reset)

AL3E1 : CANopen SYNC failed

Potential Cause	Checking Method	Corrective Actions
CAN IP mode error. The synchronous communication with the external controller has failed.	1. Check if the communication quality is good quality state. 2. Check if the host (external) controller has sent SYNC signal. 3. Check if the setting value of parameter P3-09 is a proper value (It is recommended to use default setting).	NMT Maser send "Reset node" command to its slave or reset the fault by sending the control word (0x6040) through CAN communication (the value of CANopen object 0x6040 should be reset)

AL3E2 : CANopen SYNC error

Potential Cause	Checking Method	Corrective Actions
CAN IP mode error. The SYNC signal is received too early.	1. Check if the setting of 0x1006 (communication cycle period) is the same as the setting in host (external) controller. 2. Check if the setting value of parameter P3-09 is a proper value (It is recommended to use default setting). 3. Check if the procedure of host (external) controller is not correct.	NMT Maser send "Reset node" command to its slave or reset the fault by sending the control word (0x6040) through CAN communication (the value of CANopen object 0x6040 should be reset)

AL3E3 : CANopen SYNC time out

Potential Cause	Checking Method	Corrective Actions
CAN IP mode error. The SYNC signal is not received with the specified time.	1. Check if the communication quality is good quality state. 2. Check if the setting of 0x1006 (communication cycle period) is the same as the setting in host (external) controller. 3. Check if the setting value of parameter P3-09 is a proper value (It is recommended to use default setting). 4. Check if the procedure of host (external) controller is not correct.	NMT Maser send "Reset node" command to its slave or reset the fault by sending the control word (0x6040) through CAN communication (the value of CANopen object 0x6040 should be reset)

AL 3E4 : CANopen IP command failed

Potential Cause	Checking Method	Corrective Actions
CAN IP mode error. Internal command cannot be sent and received.	The calculation time of IP mode is too long. Please disable USB monitor function.	NMT Maser send "Reset node" command to its slave or reset the fault by sending the control word (0x6040) through CAN communication (the value of CANopen object 0x6040 should be reset)

AL 3E5 : SYNC period error

Potential Cause	Checking Method	Corrective Actions
Object 0x1006 Data E rror. SYNC period 1006h value is invalid.	Examine the data of 0x1006. The SYNC period 1006h value should not be equal to or less than 0 or this fault will occur.	NMT Maser send "Reset node" command to its slave or reset the fault by sending the control word (0x6040) through CAN communication (the value of CANopen object 0x6040 should be reset)

AL 380 : Position deviation alarm for digital output, MC_OK

Potential Cause	Checking Method	Corrective Actions
After MC_OK is activated, when the digital output, TPOS is Off, the digital output, MC_OK becomes Off.	Check if the motor position changes by external force after the positioning is completed. This alarm can be disabled by the setting of P1-48. Please refer to the descriptions of parameter P1-48 for more detailedexplanation.	1. Turn ARST (DI signal) ON to clear the fault. 2. Set P0-01 to 0.

AL 401 : CANopen state error

Potential Cause	Checking Method	Corrective Actions
NMT reset or NMT stop command is received when the servo drive is enabled.	Check if NMT reset or NMT stop command is sent when drive is enabled.	1.Reset the fault by sending the control word (0x6040) through CAN communication (the value of CANopen object 0x6040 should be reset). 2. Reset the fault by triggering FR of driveCtrl of dmControl (control data of PLCopen Profile).

10.4 Clearing Faults

Servo Drive Fault Messages

Display	Fault Name	Clearing Method
AL001	Overcurrent	Turn ARST (DI signal) ON to clear the fault.
AL002	Overvoltage	Turn ARST (DI signal) ON to clear the fault.
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.
AL006	Overload	Turn ARST (DI signal) ON to clear the fault.
AL007	Overspeed	Turn ARST (DI signal) ON to clear the fault.
AL008	Abnormal pulse control command	Turn ARST (DI signal) ON to clear the fault.
AL009	Excessive deviation	Turn ARST (DI signal) ON to clear the fault.
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	Operational stop activated	This fault message can be removed automatically by turning off OPST (DI signal).
AL014	Reverse limit switch error	1. Turn ARST (DI signal) ON to clear the fault. 2. This fault message can be removed when the servo drive is Off (Servo Off). 3. When the servo drive does not reach the limit, this fault message can be removed automatically
AL015	Forward limit switch error	1. Turn ARST (DI signal) ON to clear the fault. 2. This fault message can be removed when the servo drive is Off (Servo Off). 3. When the servo drive does not reach the limit, this fault message can be removed automatically

Display	Fault Name	Clearing Method
AL016	IGBT temperature error	Turn ARST (DI signal) ON to clear the fault.
AL017	Memory error	1. If this fault occurs when power is applied to the drive, correct the setting value of the parameter to clear the fault and restart the servo drive. 2. If this fault occurs during normal operation, turn ARST (DI signal) ON to clear the fault.
AL018	Encoder output error	Turn ARST (DI signal) ON to clear the fault.
AL020	Serial communication time out	Turn ARST (DI signal) ON to clear the fault.
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.
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	Encoder reset 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 wiring error	This fault message can be removed by restarting the servo drive.
AL040	Full closed-loop excessive deviation	Turn ARST (DI signal) ON to clear the fault.
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.

CANopen Communication Fault Messages

Display	Fault Name	Clearing Method
AL111	CANopen SDO receive buffer overrun	When servo drive is starting in CAN mode, verify that the CAN master is already active. NMT Master send "Reset node" command to its slave or reset the fault by sending the control word (0x6040) through CAN communication (the value of CANopen object 0x6040 should be reset).
AL112	CANopen PDO receive buffer overrun	NMT Master send "Reset node" command to its slave or reset the fault by sending the control word (0x6040) through CAN communication (the value of CANopen object 0x6040 should be reset).
AL121	Index error occurs when accessing CANopen PDO object.	NMT Master send "Reset node" command to its slave or reset the fault by sending the control word (0x6040) through CAN communication (the value of CANopen object 0x6040 should be reset).
AL122	Sub-index error occurs when accessing CANopen PDO object.	NMT Master send "Reset node" command to its slave or reset the fault by sending the control word (0x6040) through CAN communication (the value of CANopen object 0x6040 should be reset).
AL123	Data type (size) error occurs when accessing CANopen PDO object.	NMT Master send "Reset node" command to its slave or reset the fault by sending the control word (0x6040) through CAN communication (the value of CANopen object 0x6040 should be reset).
AL124	Data range error occurs when accessing CANopen PDO object.	NMT Master send "Reset node" command to its slave or reset the fault by sending the control word (0x6040) through CAN communication (the value of CANopen object 0x6040 should be reset).
AL125	CANopen PDO object is read-only and write-protected.	NMT Master send "Reset node" command to its slave or reset the fault by sending the control word (0x6040) through CAN communication (the value of CANopen object 0x6040 should be reset).
AL126	CANopen PDO object does not support PDO.	NMT Master send "Reset node" command to its slave or reset the fault by sending the control word (0x6040) through CAN communication (the value of CANopen object 0x6040 should be reset).

Display	Fault Name	Clearing Method
AL127	CANopen PDO object is write-protected when Servo On.	NMT Master send "Reset node" command to its slave or reset the fault by sending the control word (0x6040) through CAN communication (the value of CANopen object 0x6040 should be reset).
AL128	Error occurs when reading CANopen PDO object from EE-PROM.	NMT Master send "Reset node" command to its slave or reset the fault by sending the control word (0x6040) through CAN communication (the value of CANopen object 0x6040 should be reset).
AL129	Error occurs when writing CANopen PDO object into EE-PROM.	NMT Master send "Reset node" command to its slave or reset the fault by sending the control word (0x6040) through CAN communication (the value of CANopen object 0x6040 should be reset).
AL130	EE-PROM invalid address range.	NMT Master send "Reset node"command to its slave or reset the fault by sending the control word (0x6040) through CAN communication (the value of CANopen object 0x6040 should be reset).
AL131	EE-PROM checksum error.	NMT Master send ""Reset node" command to its slave or reset the fault by sending the control word (0x6040) through CAN communication (the value of CANopen object 0x6040 should be reset).
AL132	Password error	NMT Master send "Reset node" command to its slave or reset the fault by sending the control word (0x6040) through CAN communication (the value of CANopen object 0x6040 should be reset).
AL180	Life guard error or heartbeat error	NMT Maser send "Reset node"command to its slave.
AL185	CANbus error	NMT Master send "Reset node"command to its slave or restart the servo drive.
AL201	CANopen Data Initial E rror	1. Turn ARST (DI signal) ON to clear the fault. 2. Use CANopen "0x1011" object to restore default parameters.
AL201	CANopen Data Initial E rror	1. Turn ARST (DI signal) ON to clear the fault. 2. Use CANopen "0x1011" object to restore default parameters.

Display	Fault Name	Clearing Method
AL235	Command Overflow	NMT Maser send "Reset node" command to its slave or reset the fault by sending the control word (0x6040) through CAN communication (the value of CANopen object 0x6040 should be reset).
AL245	Pr Positioning Time out	NMT Maser send "Reset node" command to its slave or reset the fault by sending the control word (0x6040) through CAN communication (the value of CANopen object 0x6040 should be reset).
AL249	Invalid Pr Path Number	NMT Maser send "Reset node" command to its slave or reset the fault by sending the control word (0x6040) through CAN communication (the value of CANopen object 0x6040 should be reset).
AL261	Index error occurs when accessing CANopen object.	NMT Maser send "Reset node" command to its slave or reset the fault by sending the control word (0x6040) through CAN communication (the value of CANopen object 0x6040 should be reset).
AL263	Sub-index error occurs when accessing CANopen object.	NMT Maser send "Reset node" command to its slave or reset the fault by sending the control word (0x6040) through CAN communication (the value of CANopen object 0x6040 should be reset).
AL265	Data type (size) error occurs when accessing CANopen object.	NMT Maser send "Reset node" command to its slave or reset the fault by sending the control word (0x6040) through CAN communication (the value of CANopen object 0x6040 should be reset).
AL267	Data range error occurs when accessing CANopen object.	NMT Maser send "Reset node" command to its slave or reset the fault by sending the control word (0x6040) through CAN communication (the value of CANopen object 0x6040 should be reset).

Display	Fault Name	Clearing Method
AL269	Object is read-only and write-protected.	NMT Maser send "Reset node" command to its slave or reset the fault by sending the control word (0x6040) through CAN communication (the value of CANopen object 0x6040 should be reset).
AL26b	CANopen object does not support PDO.	NMT Maser send "Reset node" command to its slave or reset the fault by sending the control word (0x6040) through CAN communication (the value of CANopen object 0x6040 should be reset).
AL26d	CANopen object is write-protected when Servo On.	NMT Maser send "Reset node" command to its slave or reset the fault by sending the control word (0x6040) through CAN communication (the value of CANopen object 0x6040 should be reset).
AL277	Password error	NMT Maser send "Reset node" command to its slave or reset the fault by sending the control word (0x6040) through CAN communication (the value of CANopen object 0x6040 should be reset).
AL283	Forward software limit	When the servo drive does not reach the limit, i.e. the position command is less than forward software limit, this fault message can be removed automatically
AL285	Reverse software limit	When the servo drive does not reach the limit, i.e. the position command is more than reverse software limit, this fault message can be removed automatically
AL283	Forward software limit	When the servo drive does not reach the limit, i.e. the position command is less than forward software limit, this fault message can be removed automatically
AL285	Reverse software limit	When the servo drive does not reach the limit, i.e. the position command is more than reverse software limit, this fault message can be removed automatically

Display	Fault Name	Clearing Method
AL3E1	CANopen SYNC failed	NMT Maser send "Reset node" command to its slave or reset the fault by sending the control word (0x6040) through CAN communication (the value of CANopen object 0x6040 should be reset).
AL3E2	CANopen SYNC signal error	NMT Maser send "Reset node" command to its slave or reset the fault by sending the control word (0x6040) through CAN communication (the value of CANopen object 0x6040 should be reset).
AL3E3	CANopen SYNC time out	NMT Maser send "Reset node" command to its slave or reset the fault by sending the control word (0x6040) through CAN communication (the value of CANopen object 0x6040 should be reset).
AL3E4	CANopen IP command failed	NMT Maser send :Reset node: command to its slave or reset the fault by sending the control word (0x6040) through CAN communication (the value of CANopen object 0x6040 should be reset).
AL3E5	SYNC period error	NMT Maser send "Reset node" command to its slave or reset the fault by sending the control word (0x6040) through CAN communication (the value of CANopen object 0x6040 should be reset).
AL380	Position deviation alarm	1. Turn ARST (DI signal) ON to clear the fault. 2. Set P0-01 to 0.
AL401	CANopen state error	1. Reset the fault by sending the control word (0x6040) through CAN communication (the value of CANopen object 0x6040 should be reset). 2. Reset the fault by triggering FR of driveCtrl of dmControl (control data of PLCopen Profile).

Servo Parameters

11

At a Glance

Presentation

This chapter provides an overview of the parameters which can be used for operating the product.

What's in this Chapter?

This chapter contains the following topics:

⚠ WARNING

UNINTENDED BEHAVIOR CAUSED BY PARAMETERS

The behavior of the drive system is governed by numerous parame-ters. Unsuitable parameter values can trigger unintended movements or signals or deactivate monitoring functions.

- Never change a parameter unless you understand its meaning.
- Only start the system if there are no persons or obstructions in the hazardous area.
- When commissioning, carefully run tests for all operating states and potential fault situations.

Failure to follow these instructions can result in death, serious injury or equipment damage.

11.1 Representation of the parameters

The way parameters are shown provides information required for unique identification of a parameter. In addition, information is provided on possible settings, defaults and parameter properties.

Parameter name — The parameter name uniquely identifies a parameter.

Description — Short description
The short description contains information on the parameter and a cross reference to the page that describes the use of the parameter.
Selection values
In the case of parameters which offer a selection of settings, the value to be entered via commissioning software or the embedded HMI.
Further description and details:
Provides further information on the parameter.

Unit — The unit of the value.

Value range — The value range between minimum value and maximum value which can be entered.

Default value — Factory settings when the product is shipped

Explanation of symbols
(★) Read-only register.
(▲) Parameters cannot be changed while Servo On (when the servo drive enabled).
(●) Parameters are effective only after the servo drive is restarted (after switching power off and on).
(■) Parameters will be restored to their default values when power is off.

11.2 Definition

There are seven groups of drive parameters, which are composed with three parts and they are the P that stands for Parameter, a single-digit number that represents for the group number, and a tow-digits number that is the ID code for this parameter.

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)
Group 5: Motion control parameters	(example: P5-xx)
Group 6: Pr path definition parameters	(example: P6-xx)

Abbreviation of control modes:
Pt: Position control mode (pulse command from external signal)
Pr: Position control mode (position command from internal profile)
S: Speed control mode
T: Torque control mode

Explanation of symbols (marked after parameters)
(★) Read-only registers, such as P0-00, P0-01 and P4-00.
(▲) Parameters cannot be changed while Servo On (when the servo drive is enabled), such as P1-00, P1-46 and P2-33.
(●) Parameters are effective only after the servo drive is restarted (after switching power off and on), such as P1-01 and P3-00.
(■) Parameters will be restored to their default values when power is off, such as P2-30 and P3-06.

11.3 Parameter Summary

11.3.1 Parameters Listed by Group

Group 0: P0-xx

Monitor Parameters								
Parameter	Name	Function	Default	Unit	Control Mode			
					Pt	Pr	S	T
P0-00★	VER	Firmware Version	Factory setting	N/A	O	O	O	O
P0-01■	ALE	Drive Fault Code	N/A	N/A	O	O	O	O
P0-02	STS	Drive Status (Front Panel Display)	00	N/A	O	O	O	O
P0-03	MON	Analog Monitor Output	01	N/A	O	O	O	O
P0-04 ~ P0-07	Reserved (Do Not Use)							
P0-08★	TSON	Servo Startup Timer	0	Hour	O	O	O	O
P0-09★	CM1	Status Monitor 1	N/A	N/A	O	O	O	O
P0-10★	CM2	Status Monitor 2	N/A	N/A	O	O	O	O
P0-11★	CM3	Status Monitor 3	N/A	N/A	O	O	O	O
P0-12★	CM4	Status Monitor 4	N/A	N/A	O	O	O	O
P0-13★	CM5	Status Monitor 5	N/A	N/A	O	O	O	O
P0-14 ~ P0-16	Reserved (Do Not Use)							
P0-17	CM1A	Status Monitor Selection 1	0	N/A	O	O	O	O
P0-18	CM2A	Status Monitor Selection 2	0	N/A	O	O	O	O
P0-19	CM3A	Status Monitor Selection 3	0	N/A	O	O	O	O
P0-20	CM4A	Status Monitor Selection 4	0	N/A	O	O	O	O
P0-21	CM5A	Status Monitor Selection 5	0	N/A	O	O	O	O
P0-22 ~ P0-24	Reserved (Do Not Use)							
P0-25	MAP0	Mapping Parameter 1	N/A	N/A	O	O	O	O
P0-26	MAP1	Mapping Parameter 2	N/A	N/A	O	O	O	O
P0-27	MAP2	Mapping Parameter 3	N/A	N/A	O	O	O	O
P0-28	MAP3	Mapping Parameter 4	N/A	N/A	O	O	O	O
P0-29	MAP4	Mapping Parameter 5	N/A	N/A	O	O	O	O
P0-30	MAP5	Mapping Parameter 6	N/A	N/A	O	O	O	O
P0-31	MAP6	Mapping Parameter 7	N/A	N/A	O	O	O	O
P0-32	MAP7	Mapping Parameter 8	N/A	N/A	O	O	O	O
P0-33 ~ P0-34	Reserved (Do Not Use)							

Monitor Parameters								
Parameter	Name	Function	Default	Unit	Control Mode			
					Pt	Pr	S	T
P0-35	MAP1A	Block Data Read / Write Register 1 (for P0-25)	0x0	N/A	O	O	O	O
P0-36	MAP2A	Block Data Read / Write Register 2 (for P0-26)	0x0	N/A	O	O	O	O
P0-37	MAP3A	Block Data Read / Write Register 3 (for P0-27)	0x0	N/A	O	O	O	O
P0-38	MAP4A	Block Data Read / Write Register 4 (for P0-28)	0x0	N/A	O	O	O	O
P0-39	MAP5A	Block Data Read / Write Register 5 (for P0-29)	0x0	N/A	O	O	O	O
P0-40	MAP6A	Block Data Read / Write Register 6 (for P0-30)	0x0	N/A	O	O	O	O
P0-41	MAP7A	Block Data Read / Write Register 7 (for P0-31)	0x0	N/A	O	O	O	O
P0-42	MAP8A	Block Data Read / Write Register 8 (for P0-32)	0x0	N/A	O	O	O	O
P0-43	Reserved (Do Not Use)							
P0-44	PCMN	Status Monitor Register (PC Software Setting)	0x0	N/A	O	O	O	O
P0-45	PCMNA	Status Monitor Register Selection (PC Software Setting)	0x0	N/A	O	O	O	O
P0-46★	SVSTS	Servo Output Status Display	0	N/A	O	O	O	O

Explanation of symbols (marked after parameters)

(★) Read-only register.

(▲) Parameters cannot be changed while Servo On (when the servo drive enabled).

(●) Parameters are effective only after the servo drive is restarted (after switching power off and on).

(■) Parameters will be restored to their default values when power is off.

Group 1: P1-xx

Basic Parameters								
Parameter	Name	Function	Default	Unit	Control Mode			
					Pt	Pr	S	T
P1-00 ▲	PTT	External Pulse Input Type	0x2	N/A	O			
P1-01●	CTL	Control Mode and Output Direction	0	pulse rpm Nm	O	O	O	O
P1-02 ▲	PSTL	Speed and Torque Limit	0	N/A				
P1-03	AOUT	Pulse Output Polarity Setting	0	N/A	O	O	O	O
P1-04	MON1	Analog Monitor Output Proportion 1 (CH1)	100	% (full scale)	O	O	O	O
P1-05	MON2	Analog Monitor Output Proportion 2 (CH2)	100	% (full scale)	O	O	O	O
P1-06	SFLT	Accel / Decel Smooth Constant of Analog Speed Command (Low-pass Filter)	0	Msec			O	
P1-07	TFLT	Smooth Constant of Analog Torque Command (Low-pass Filter)	0	Msec				O
P1-08	PFLT	Smooth Constant of Position Command (Low-pass Filter)	0	msec	O			
P1-09~ P1-11	SP1~ 3	1st ~ 3rd Speed Command 1st ~ 3rd Speed Limit	-60000 ~ +60000	rpm			O	O
P1-12 ~ P1-14	TQ1 ~ 3	1st ~ 3rd Torque Command 1st ~ 3rd Torque Limit	-300 ~ +300	%	O		O	O
P1-15 ~ P1-24	Reserved (Do Not Use)							
P1-25	VSF1	Low-frequency Vibration Suppression (1)	100.0	Hz	O	O		
P1-26	VSG1	Low-frequency Vibration Suppression Gain (1)	0	N/A	O	O		
P1-27	VSF2	Low-frequency Vibration Suppression (2)	100.0	Hz	O	O		
P1-28	VSG2	Low-frequency Vibration Suppression Gain (2)	0	N/A	O	O		
P1-29	AVSM	Auto Low-frequency Vibration Suppression Mode Selection	0	N/A	O	O		
P1-30	VCL	Low-frequency Vibration Detection Level	500	pulse	O	O		
P1-31	Reserved (Do Not Use)							
P1-32	LSTP	Motor Stop Mode Selection	0	N/A	O	O	O	O
P1-33	Reserved (Do Not Use)							
P1-34	TACC	Acceleration Time	200	msec			O	
P1-35	TDEC	Deceleration Time	200	msec			O	

Basic Parameters								
Parameter	Name	Function	Default	Unit	Control Mode			
					Pt	Pr	S	T
P1-36	TSL	Accel /Decel S-curve	0	msec		O	O	
P1-37	GDR	Ratio of Load Inertia to Servo Motor Inertia	10	0.1 times	O	O	O	O
P1-38	ZSPD	Zero Speed Range Setting	100	0.1 rpm	O	O	O	O
P1-39	SSPD	Target Motor Speed	3000	rpm	O	O	O	O
P1-40 ▲	VCM	Max. Analog Speed Command or Limit	rated speed	rpm			O	O
P1-41 ▲	TCM	Max. Analog Torque Command or Limit	100	%	O	O	O	O
P1-42	MBT1	On Delay Time of Electromagnetic Brake	0	msec	O	O	O	O
P1-43	MBT2	OFF Delay Time of Electromagnetic Brake	-1000 ~ +1000	msec	O	O	O	O
P1-44 ▲	GR1	Electronic Gear Ratio (1st Numerator) (N1)	128	pulse	O	O		
P1-45	GR2	Electronic Gear Ratio (Denominator) (M)	10	pulse	O	O		
P1-46 ▲	GR3	Encoder Output Pulse Number	2500	pulse	O	O	O	O
P1-47	SPOK	Speed Reached Output Range	10	N/A			O	
P1-48	MCOK	Motion Control Completed Output Selection	0x0000	N/A	O			
P1-49 ~ P1-51	Reserved (Do Not Use)							
P1-52	RES1	Regenerative Resistor Value	-	Ohm	O	O	O	O
P1-53	RES2	Regenerative Resistor Capacity	-	Watt	O	O	O	O
P1-54	PER	Positioning Completed Width	12800	pulse	O	O		
P1-55	MSPD	Maximum Speed Limit	rated speed	rpm	O	O	O	O
P1-56	OVW	Output Overload Warning Time	120	%	O	O	O	O
P1-57	CRSHA	Motor Protection Percentage	0	%	O	O	O	O
P1-58	CRSHT	Motor Protection Time	1	msec	O	O	O	O
P1-59	MFLT	Analog Speed Linear Filter (Moving Filter)	0	0.1 msec			O	
P1-60 ~ P1-61		Reserved (Do Not Use)						
P1-62	FRCL	Friction Compensation Percentage	0	%	O	O	O	
P1-63	FRCT	Friction Compensation Smooth Constant	0	msec	O	O	O	
P1-64 ~ P1-65	Reserved (Do Not Use)							
P1-66	PCM	Max. Rotation Number of Analog Position Command (will be available soon)	30	0.1 rotation	O			

Basic Parameters								
Parameter	Name	Function	Default	Unit	Control Mode			
					Pt	Pr	S	T
P1-67	Reserved (Do Not Use)							
P1-68	PFLT2	Position Command Moving Filter	4	msec	O	O		
P1-69 ~ P1-75	Reserved (Do Not Use)							
P1-76	AMSPD	Max. Rotation Speed of Encoder Output	5500	rpm	O	O	O	O

Explanation of symbols (marked after parameters)

(★) Read-only register.

(▲) Parameters cannot be changed while Servo On (when the servo drive enabled).

(●) Parameters are effective only after the servo drive is restarted (after switching power off and on).

(■) Parameters will be restored to their default values when power is off.

Group 2: P2-xx

Extension Parameters								
Parameter	Name	Function	Default	Unit	Control Mode			
					Pt	Pr	S	T
P2-00	KPP	Proportional Position Loop Gain	35	rad/s	O	O		
P2-01	PPR	Position Loop Gain Switching Rate	100	%	O	O		
P2-02	PFG	Position Feed Forward Gain	50	%	O	O		
P2-03	PFF	Smooth Constant of Position Feed Forward Gain	5	msec	O	O		
P2-04	KVP	Proportional Speed Loop Gain	500	rad/s	O	O	O	O
P2-05	SPR	Speed Loop Gain Switching Rate	100	%	O	O	O	O
P2-06	KVI	Speed Integral Compensation	100	rad/s	O	O	O	O
P2-07	KVF	Speed Feed Forward Gain	0	%	O	O	O	O
P2-08 ■	PCTL	Special Factory Setting	0	N/A	O	O	O	O
P2-09	DRT	Bounce Filter	2	msec	O	O	O	O
P2-10	DI1	Digital Input Terminal 1 (DI1)	101	N/A	O	O	O	O
P2-11	DI2	Digital Input Terminal 2 (DI2)	104	N/A	O	O	O	O
P2-12	DI3	Digital Input Terminal 3 (DI3)	116	N/A	O	O	O	O
P2-13	DI4	Digital Input Terminal 4 (DI4)	117	N/A	O	O	O	O
P2-14	DI5	Digital Input Terminal 5 (DI5)	102	N/A	O	O	O	O
P2-15	DI6	Digital Input Terminal 6 (DI6)	22	N/A	O	O	O	O
P2-16	DI7	Digital Input Terminal 7 (DI7)	23	N/A	O	O	O	O
P2-17	DI8	Digital Input Terminal 8 (DI8)	21	N/A	O	O	O	O
P2-18	DO1	Digital Output Terminal 1 (DO1)	101	N/A	O	O	O	O
P2-19	DO2	Digital Output Terminal 2 (DO2)	103	N/A	O	O	O	O
P2-20	DO3	Digital Output Terminal 3 (DO3)	109	N/A	O	O	O	O
P2-21	DO4	Digital Output Terminal 4 (DO4)	105	N/A	O	O	O	O
P2-22	DO5	Digital Output Terminal 5 (DO5)	7	N/A	O	O	O	O
P2-25	NLP	Low-pass Filter Time Constant (Resonance Suppression)	2 or 5	0.1 msec	O	O	O	O
P2-26	DST	External Anti-Interference Gain	0	0.001	O	O	O	O
P2-27	GCC	Gain Switching Control Selection	0	N/A	O	O	O	O
P2-28	GUT	Gain Switching Time Constant	10	10msec	O	O	O	O
P2-29	GPE	Gain Switching Condition	1280000	pulse Kpps rpm	O	O	O	O
P2-30 ■	INH	Auxiliary Function	0	N/A	O	O	O	O
P2-31	AUT1	Speed Frequency Response Level in Auto and Semi-Auto Mode	80	Hz	O	O	O	O
P2-32 ▲	AUT2	Tuning Mode Selection	0	N/A	O	O	O	O
P2-33 ▲	INF	Semi-Auto Mode Inertia Adjustment Selection	0	N/A	O	O	O	O

Extension Parameters								
Parameter	Name	Function	Default	Unit	Control Mode			
					Pt	Pr	S	T
P2-34	SDEV	Overspeed Warning Condition	5000	rpm			O	
P2-35	PDEV	Excessive Error Warning Condition	3840000	pulse	O	O		
P2-36~ P2-42	Reserved (Do Not Use)							
P2-43	NCF1	Notch Filter 1 (Resonance Suppression)	1000	Hz	O	O	O	O
P2-44	DPH1	Notch Filter Attenuation Rate 1 (Resonance Suppression)	0	dB	O	O	O	O
P2-45	NCF2	Notch Filter 2 (Resonance Suppression)	1000	Hz	O	O	O	O
P2-46	DPH2	Notch Filter Attenuation Rate 2 (Resonance Suppression)	0	dB	O	O	O	O
P2-47	PED	Auto Resonance Suppression Mode Selection	1	N/A	O	O	O	O
P2-48	BLAS	Auto Resonance Suppression Detection Level	100	N/A	O	O	O	O
P2-49	SJIT	Speed Detection Filter and Jitter Suppression	0	sec	O	O	O	O
P2-50	DCLR	Pulse Deviation Clear Mode	0	N/A	O	O		
P2-51 ~ P2-52	Reserved (Do Not Use)							
P2-53	KPI	Position Integral Compensation	0	rad/s	O	O	O	O
P2-54 ~ P2-59	Reserved (Do Not Use)							
P2-60	GR4	Electronic Gear Ratio (2nd Numerator) (N2)	128	pulse	O			
P2-61	GR5	Electronic Gear Ratio (3rd Numerator) (N3)	128	pulse	O			
P2-62	GR6	Electronic Gear Ratio (4th Numerator) (N4)	128	pulse	O			
P2-63 ~ P2-64	Reserved (Do Not Use)							
P2-65	GBIT	Special Function 1	0	N/A	O	O	O	
P2-66	GBIT2	Special Function 2	0	N/A	O	O	O	
P2-67	JSL	Stable Inertia Estimating Time	1.5	0.1 times	O	O	O	
P2-68	AEAL 140H	Auto Enable and Auto Limit Enable	0x0000	N/A	O	O	O	O

Explanation of symbols (marked after parameters)

(★) Read-only register.

(▲) Parameters cannot be changed while Servo On (when the servo drive enabled).

(●) Parameters are effective only after the servo drive is restarted (after switching power off and on).

(■) Parameters will be restored to their default values when power is off.

Group 3: P3-xx

Communication Parameters								
Parameter	Name	Function	Default	Unit	Control Mode			
					Pt	Pr	S	T
P3-00 ●	ADR	Modbus Communication Address Setting	1	N/A	O	O	O	O
P3-01	BRT	Transmission Speed	0x0203	bps	O	O	O	O
P3-02	PTL	Communication Protocol	6	N/A	O	O	O	O
P3-03	FLT	Transmission Fault Treatment	0	N/A	O	O	O	O
P3-04	CWD	Communication Time Out Detection	0	sec	O	O	O	O
P3-05	CADR	CANopen Communicaton Address Setting	0x0000	N/A	CANopen mode			
P3-06 ■	SDI	Digital Input Communication Function	0	N/A	O	O	O	O
P3-07	CDT	Communication Response Delay Time	0	1 msec	O	O	O	O
P3-08	Reserved (Do not use)							
P3-09	SYC	CANopen Synchronization Setting	0x57A1	N/A	CANopen mode			
P3-10	PLCEN	PLCopen Function Switch	0x0000	N/A	CANopen mode			
P3-11★	PLCTX1	PLCopen TX Packet #1	0x0000	N/A	CANopen mode			
P3-12★	PLCTX2	PLCopen TX Packet #2	0x0000	N/A	CANopen mode			
P3-13★	PLCTX3	PLCopen TX Packet #3	0x0000	N/A	CANopen mode			
P3-14★	PLCTX4	PLCopen TX Packet #4	0x0000	N/A	CANopen mode			
P3-15★	PLCRX1	PLCopen RX Packet #1	0x0000	N/A	CANopen mode			
P3-16★	PLCRX2	PLCopen RX Packet #2	0x0000	N/A	CANopen mode			
P3-17★	PLCRX3	PLCopen RX Packet #3	0x0000 0000	N/A	CANopen mode			

Explanation of symbols (marked after parameters)

(★) Read-only register.

(▲) Parameters cannot be changed while Servo On (when the servo drive enabled).

(●) Parameters are effective only after the servo drive is restarted (after switching power off and on).

(■) Parameters will be restored to their default values when power is off.

Group 4: P4-xx

Diagnosis Parameters								
Parameter	Name	Function	Default	Unit	Control Mode			
					Pt	Pr	S	T
P4-00 ★	ASH1	Fault Record (N)	0	N/A	O	O	O	O
P4-01 ★	ASH2	Fault Record (N-1)	0	N/A	O	O	O	O
P4-02 ★	ASH3	Fault Record (N-2)	0	N/A	O	O	O	O
P4-03 ★	ASH4	Fault Record (N-3)	0	N/A	O	O	O	O
P4-04 ★	ASH5	Fault Record (N-4)	0	N/A	O	O	O	O
P4-05	JOG	JOG Operation	20	rpm	O	O	O	O
P4-06 ▲■	FOT	Force Output Contact Control	0	N/A	O	O	O	O
P4-07 ■	ITST	Input Status	0	N/A	O	O	O	O
P4-08 ★	PKEY	Digital Keypad Input of Servo Drive	N/A	N/A	O	O	O	O
P4-09 ★	MOT	Output Status	N/A	N/A	O	O	O	O
P4-10 ■	CEN	Adjustment Function	0	N/A	O	O	O	O
P4-11	SOF1	Analog Speed Input Drift Adjustment 1	Factory setting	N/A	O	O	O	O
P4-12	SOF2	Analog Speed Input Drift Adjustment 2	Factory setting	N/A	O	O	O	O
P4-13	TOF1	Analog Torque Drift Adjustment 1	Factory setting	N/A	O	O	O	O
P4-14	TOF2	Analog Torque Drift Adjustment 2	Factory setting	N/A	O	O	O	O
P4-15	COF1	Current Detector Drift Adjustment (V1 phase)	Factory setting	N/A	O	O	O	O
P4-16	COF2	Current Detector Drift Adjustment (V2 phase)	Factory setting	N/A	O	O	O	O
P4-17	COF3	Current Detector Drift Adjustment (W1 phase)	Factory setting	N/A	O	O	O	O
P4-18	COF4	Current Detector Drift Adjustment (W2 phase)	Factory setting	N/A	O	O	O	O
P4-19	TIGB	IGBT NTC Calibration	Factory setting	N/A	O	O	O	O
P4-20	DOF1	Analog Monitor Output Drift Adjustment (CH1)	0	mV	O	O	O	O
P4-21	DOF2	Analog Monitor Output Drift Adjustment (CH2)	0	mV	O	O	O	O
P4-22	SAO	Analog Speed Input Offset	0	mV	O	O	O	O
P4-23	TAO	Analog Torque Input Offset	0	mV	O	O	O	O
P4-24	LVL	Undervoltage Error Level	160	V(rms)	O	O	O	O

Group 5: P5-xx

Diagnosis Parameters								
Parameter	Name	Function	Default	Unit	Control Mode			
					Pt	Pr	S	T
P5-00 ~ P5-02	Reserved (Do Not Use)							
P5-03	PDEC	Deceleration Time of Protectin Function	0XE0E FEEFF	N/A	O	O	O	O
P5-04	HMOV	Homing Mode	0	N/A		O		
P5-05	HSPD1	1st Speed Setting of High Speed Homing	100.0	0.1 rpm	O	O	O	O
P5-06	HSPD2	2nd Speed Setting of Low Speed Homing	20.0	0.1 rpm	O	O	O	O
P5-07 ■	PRCM	Trigger Position Command (Pr mode only)	0	N/A		O		
P5-08	SWLP	Forward Software Limit	214748 3647	PUU		O		
P5-09	SWLN	Reverse Software Limit	-21474 83648	PUU		O		
P5-10~ P5-14	Reserved (Do Not Use)							
P5-15 ■	PMEM	PATH 1 ~ PATH 2 Data Not Retained Setting	0x0	N/A	O	O	O	O
P5-16 ■	AXEN	Axis Position: Motor Encoder	0	N/A	O	O	O	O
P5-17	Reserved (Do Not Use)							
P5-18	AXPC	Axis Position: Pulse Command	N/A	N/A^	O	O	O	O
P5-19	Reserved (Do Not Use)							
P5-20 ~ P5-33	AC0 ~ AC13	Accel / Decel Time 0 ~ 13	200 ~ 8000	msec		O		

Diagnosis Parameters								
Parameter	Name	Function	Default	Unit	Control Mode			
					Pt	Pr	S	T
P5-34	AC14	Accel / Decel Time 14	50	msec		O		
P5-35	AC15	Accel / Decel Time 15	30	msec		O		
P5-36	Reserved (Do Not Use)							
P5-37■	CAAX	CAPTURE: Axis Position CNT	0	PUU	O	O	O	O
P5-38■	CANO	CAPTURE: Capture Amount	0	N/A	O	O	O	O
P5-39■	CACT	CAPTURE: Capture Source Setting	0x0000	N/A	O	O	O	O
P5-40 ~ P5-55	DLY0 ~ DLY15	Delay Time 0 ~ 15	0 ~ 5500	msec		O		
P5-56~ P5-57	Reserved (Do Not Use)							
P5-58■	CMNO	COMPARE: Compare Amount	0	N/A	O	O	O	O
P5-59	CMCT	COMPARE: Compare Source Setting	0x0000	N/A	O	O	O	O
P5-60 ~ P5-75	POV0 ~ POV15	Moving Speed Setting of Position 0 ~ 15	20.0 ~ 3000.0	0.1 rpm		O		
P5-76★	CPRS	Capture 1st Position Reset Data	0	N/A	O	O	O	O

Explanation of symbols (marked after parameters)

(★) Read-only register.

(▲) Parameters cannot be changed while Servo On (when the servo drive enabled).

(●) Parameters are effective only after the servo drive is restarted (after switching power off and on).

(■) Parameters will be restored to their default values when power is off.

Group 6: P6-xx

Pr Path Definition Parameters								
Parameter	Name	Function	Default	Unit	Control Mode			
					Pt	Pr	S	T
P6-00	PDEC	Homing Definition	0x0000 0000	N/A		O		
P6-01	ODAT	Homing Definition Value	0	N/A		O		
P6-02, 04,… ~ P6-16	PDEF1 ~ PDEF8	Definition of Path 1 ~ 8	0x0000 0000	N/A		O		
P6-03, 05,… ~ P6-17	PDAT1 ~ PDEF8	Data of Path 1 ~ 8	0	N/A		O		

Explanation of symbols (marked after parameters)

(★) Read-only register.

(▲) Parameters cannot be changed while Servo On (when the servo drive enabled).

(●) Parameters are effective only after the servo drive is restarted (after switching power off and on).

(■) Parameters will be restored to their default values when power is off.

11.3.2 Parameters Listed by Function

Monitor and General Use									
Parameter	Name	Function	Default	Unit	Control Mode				Related Section
					Pt	Pr	S	T	
P0-00 ★	VER	Firmware Version	Factory Setting	N/A	O	O	O	O	-
P0-01 ■	ALE	Drive Fault Code	N/A	N/A	O	O	O	O	10.2 10.3 10.4
P0-02	STS	Drive Status (Front Panel Display)	00	N/A	O	O	O	O	8.2
P0-03	MON	Analog Monitor Output	01	N/A	O	O	O	O	6.3.3.5
P0-08 ★	TSON	Servo Startup Time	0	Hour					-
P0-09 ★	CM1	Status Monitor 1	N/A	N/A	O	O	O	O	6.3.3.5
P0-10 ★	CM2	Status Monitor 2	N/A	N/A	O	O	O	O	6.3.3.5
P0-11★	CM3	Status Monitor 3	N/A	N/A	O	O	O	O	6.3.3.5
P0-12 ★	CM4	Status Monitor 4	N/A	N/A	O	O	O	O	6.3.3.5
P0-13 ★	CM5	Status Monitor 5	N/A	N/A	O	O	O	O	6.3.3.5
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					
P0-25	MAP1	Mapping Parameter 1	N/A	N/A	O	O	O	O	6.3.3.5
P0-26	MAP2	Mapping Parameter 2	N/A	N/A	O	O	O	O	6.3.3.5
P0-27	MAP3	Mapping Parameter 3	N/A	N/A	O	O	O	O	6.3.3.5
P0-28	MAP4	Mapping Parameter 4	N/A	N/A	O	O	O	O	6.3.3.5
P0-29	MAP5	Mapping Parameter 5	N/A	N/A	O	O	O	O	6.3.3.5
P0-30	MAP6	Mapping Parameter 6	N/A	N/A	O	O	O	O	6.3.3.5
P0-31	MAP7	Mapping Parameter 7	N/A	N/A	O	O	O	O	6.3.3.5
P0-32	MAP8	Mapping Parameter 8	N/A	N/A	O	O	O	O	6.3.3.5
P0-35	MAP1A	Block Data Read / Write Register 1 (for P0-25)	0x0	N/A	O	O	O	O	6.3.3.5
P0-36	MAP2A	Block Data Read / Write Register 2 (for P0-26)	0x0	N/A	O	O	O	O	6.3.3.5
P0-37	MAP3A	Block Data Read / Write Register 3 (for P0-27)	0x0	N/A	O	O	O	O	6.3.3.5
P0-38	MAP4A	Block Data Read / Write Register 4 (for P0-28)	0x0	N/A	O	O	O	O	6.3.3.5

Monitor and General Use									
Parameter	Name	Function	Default	Unit	Control Mode				Related Section
					Pt	Pr	S	T	
P0-39	MAP5A	Block Data Read / Write Register 5 (for P0-29)	0x0	N/A	O	O	O	O	6.3.3.5
P0-40	MAP6A	Block Data Read / Write Register 6 (for P0-30)	0x0	N/A	O	O	O	O	6.3.3.5
P0-41	MAP7A	Block Data Read / Write Register 7 (for P0-31)	0x0	N/A	O	O	O	O	6.3.3.5
P0-42	MAP8A	Block Data Read / Write Register 8 (for P0-32)	0x0	N/A	O	O	O	O	6.3.3.5
P0-46 ★	SVSTS	Servo Output Status Display	0	N/A	O	O	O	O	-
P1-04	MON1	Analog Monitor Output Proportion 1 (CH1)	100	% (full scale)	O	O	O	O	7.3.4.4
P1-05	MON2	Analog Monitor Output Proportion 2 (CH2)	100	% (full scale)	O	O	O	O	7.3.4.4

Explanation of symbols (marked after parameters)

(★) Read-only register.

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(●) Parameters are effective only after the servo drive is restarted (after switching power off and on).

(■) Parameters will be restored to their default values when power is off.

Smooth Filter and Resonance Suppression									
Parameter	Name	Function	Default	Unit	Control Mode				Related Section
					Pt	Pr	S	T	
P1-06	SFLT	Accel / Decel Smooth Constant of Analog Speed Command (Low-pass Filter)	0	msec			O		7.3.3.3
P1-07	TFLT	Smooth Constant of Analog Torque Command (Low-pass Filter)	0	msec			O		7.3.4.3
P1-08	PFLT	Smooth Constant of Position Command (Low-pass Filter)	0	10 msec	O	O			7.3.2.6
P1-25	VSF1	Low-frequency Vibration Suppression (1)	100.0	Hz	O	O			7.3.2.9
P1-26	VSG1	Low-frequency Vibration Suppression Gain (1)	0	N/A	O	O			7.3.2.9
P1-27	VSF2	Low-frequency Vibration Suppression (2)	100.0	Hz	O	O			7.3.2.9
P1-28	VSG2	Low-frequency Vibration Suppression Gain (2)	0	N/A	O	O			7.3.2.9
P1-29	AVSM	Auto Low-frequency Vibration Suppression Mode Selection	0	N/A	O	O			7.3.2.9
P1-30	VCL	Low-frequency Vibration Detection Level	500	pulse	O	O			7.3.2.9
P1-34	TACC	Acceleration Time	200	msec		O	O		7.3.3.3
P1-35	TDEC	Deceleration Time	200	msec		O	O		7.3.3.3
P1-36	TSL	Accel /Decel S-curve	0	msec		O	O		7.3.3.3
P1-59	MFLT	Analog Speed Linear Filter (Moving Filter)	0	0.1 msec			O		-
P1-62	FRCL	Friction Compensation Percentage	0	%	O	O	O	O	-
P1-63	FRCT	Friction Compensation Smooth Constant	0	msec	O	O	O	O	-
P1-68	PFLT2	Position Command Moving Filter	0	msec	O	O			-
P1-75	FELP	Full-closed Loop Low-pass Filter Time Constant	100	msec	O	O			

Smooth Filter and Resonance Suppression									
Parameter	Name	Function	Default	Unit	Control Mode				Related Section
					Pt	Pr	S	T	
P2-43	NCF1	Notch Filter 1 (Resonance Suppression)	1000	Hz	O	O	O	O	7.3.3.7
P2-44	DPH1	Notch Filter Attenuation Rate 1 (Resonance Suppression)	0	dB	O	O	O	O	7.3.3.7
P2-45	NCF2	Notch Filter 2 (Resonance Suppression)	1000	Hz	O	O	O	O	7.3.3.7
P2-46	DPH2	Notch Filter Attenuation Rate 2 (Resonance Suppression)	0	dB	O	O	O	O	7.3.3.7
P2-47	ANCF	Auto Resonance Suppression Mode Selection	1	N/A	O	O	O	O	-
P2-48	ANCL	Auto Resonance Suppression Detection Level	100	N/A	O	O	O	O	-
P2-25	NLP	Low-pass Filter Time Constant (Resonance Suppression)	2 or 5	0.1 msec	O	O	O	O	7.3.3.7
P2-33 ▲	INF	Semi-Auto Mode Inertia Adjustment Selection	0	N/A	O	O	O	O	7.3.3.6
P2-49	SJIT	Speed Detection Filter and Jitter Suppression	0	sec	O	O	O	O	-

Explanation of symbols (marked after parameters)
(★) Read-only register.
(▲) Parameters cannot be changed while Servo On (when the servo drive enabled).
(●) Parameters are effective only after the servo drive is restarted (after switching power off and on).
(■) Parameters will be restored to their default values when power is off.

Gain and Switch									
Parameter	Name	Function	Default	Unit	Control Mode				Related Section
					Pt	Pr	S	T	
P2-00	KPP	Proportional Position Loop Gain	35	rad/s	O	O			7.3.2.8
P2-01	PPR	Position Loop Gain Switching Rate	100	%	O	O			7.3.2.8
P2-02	PFG	Position Feed Forward Gain	50	%	O	O			7.3.2.8
P2-03	PFF	Smooth Constant of Position Feed Forward Gain	5	msec	O	O			-
P2-04	KVP	Proportional Speed Loop Gain	500	rad/s	O	O	O	O	7.3.3.6
P2-05	SPR	Speed Loop Gain Switching Rate	100	%	O	O	O	O	-
P2-06	KVI	Speed Integral Compensation	100	rad/s	O	O	O	O	7.3.3.6
P2-07	KVF	Speed Feed Forward Gain	0	%	O	O	O	O	7.3.3.6
P2-26	DST	External Anti-Interference Gain	0	0.001	O	O	O	O	-
P2-27	GCC	Gain Switching Control Selection	0	N/A	O	O	O	O	-
P2-28	GUT	Gain Switching Time Constant	10	10 msec	O	O	O	O	-
P2-29	GPE	Gain Switching Condition	1280000	pulse Kpps rpm	O	O	O	O	-
P2-31■	AUT1	Speed Frequency Response Level in Auto and Semi-Auto Mode	80	Hz	O	O	O	O	6.5.4.6 7.3.3.6
P2-32▲	AUT2	Tuning Mode Selection	0	N/A	O	O	O	O	6.5.4.6 7.3.3.6

Explanation of symbols (marked after parameters)

(★) Read-only register.

(▲) Parameters cannot be changed while Servo On (when the servo drive enabled).

(●) Parameters are effective only after the servo drive is restarted (after switching power off and on).

(■) Parameters will be restored to their default values when power is off.

Position Control									
Parameter	Name	Function	Default	Unit	Control Mode				Related Section
					Pt	Pr	S	T	
P1-01●	CTL	Control Mode and Output Direction	0	pulse rpm Nm	O	O	O	O	7.3.1
P1-02▲	PSTL	Speed and Torque Limit	0	N/A	O	O	O	O	7.4
P1-12 ~ P1-14	TQ1 ~ 3	1st ~ 3rd Torque Limit	-300 ~ +300	%	O	O	O	O	7.3.4.1
P1-46▲	GR3	Encoder Output Pulse Number	2500	pulse	O	O	O	O	-
P1-55	MSPD	Maximum Speed Limit	rated speed	rpm	O	O	O	O	-
P2-50	DCLR	Pulse Deviation Clear Mode	0	N/A	O	O			-
External Pulse Control Command (Pt mode)									
P1-00▲	PTT	External Pulse Type	0x2	N/A	O				7.3.2.1
P1-44▲	GR1	Electronic Gear Ratio (1st Numerator) (N1)	128	pulse	O	O			7.3.2.5
P1-45▲	GR2	Electronic Gear Ratio (Denominator) (M)	10	pulse	O	O			7.3.2.5
P2-60▲	GR4	Electronic Gear Ratio (2nd Numerator) (N2)	128	pulse	O	O			-
P2-61▲	GR5	Electronic Gear Ratio (3rd Numerator) (N3)	128	pulse	O	O			-
P2-62▲	GR6	Electronic Gear Ratio (4th Numerator) (N4)	128	pulse	O	O			-
Internal Pulse Control Command (Pr mode)									
P6-02 ~ P6-17	PO1 ~ PO8	Definition of Path 1 ~ 8 Data of Path 1 ~ 8	0	N/A	O				8.10
P5-03	PDEC	Deceleration Time of Protectin Function	0XF00F FFFF	N/A	O	O	O	O	-
P5-04	HMOV	Homing Mode	0	N/A		O			-

Position Control									
Parameter	Name	Function	Default	Unit	Control Mode				Related Section
					Pt	Pr	S	T	
P5-05	HSPD1	1st Speed Setting of High Speed Homing	100	0.1 rpm	O	O	O	O	-
P5-06	HSPD2	2nd Speed Setting of Low Speed Homing	20	0.1 rpm	O	O	O	O	-
P5-07■	PRCM	Trigger Position Command (Pr mode only)	0	N/A		O			-
P5-20 ~ P5-35	AC0 ~ AC15	Accel / Decel Time 0 ~ 13	200 ~ 30	ms		O			8.10
P5-40 ~ P5-55	DLY0 ~ DLY15	Delay Time 0 ~ 15	0 ~ 5500	ms		O			8.10
P5-15■	PMEM	PATH 1 ~ PATH 2 Data Not Retained Setting	0x0	N/A	O	O	O	O	-
P5-16■	AXEN	Axis Position: Motor Encoder	0	N/A	O	O	O	O	8.3
P5-18	AXPC	Axis Position: Pulse Command	N/A	N/A	O	O	O	O	8.3
P5-08	SWLP	Forward Software Limit	$+2^{31}$	PUU	O				-
P5-09	SWLN	Reverse Software Limit	-2^{31}	PUU	O				-

Explanation of symbols (marked after parameters)

(★) Read-only register.

(▲) Parameters cannot be changed while Servo On (when the servo drive enabled).

(●) Parameters are effective only after the servo drive is restarted (after switching power off and on).

(■) Parameters will be restored to their default values when power is off.

Speed Control									
Parameter	Name	Function	Default	Unit	Control Mode				Related Section
					Pt	Pr	S	T	
P1-01●	CTL	Control Mode and Output Direction	0	pulse rpm Nm	O	O	O	O	7.3.1
P1-02▲	PSTL	Speed and Torque Limit	0	N/A	O	O	O	O	7.4
P1-46▲	GR3	Encoder Output Pulse Number	2500	pulse	O	O	O	O	-
P1-55	MSPD	Maximum Speed Limit	rated speed	rpm	O	O	O	O	-
P1-09 ~ P1-11	SP1 ~ 3	1st ~ 3rd Speed Command	-60000 ~ +60000	0.1 rpm			O	O	7.3.3.1
P1-12 ~ P1-14	TQ1 ~ 3	1st ~ 3rd Torque Limit	-300 ~ +300	%	O	O	O	O	7.4.2
P1-40▲	VCM	Max. Analog Speed Command or Limit	rated speed	rpm			O	O	7.3.3.4
P1-41▲	TCM	Max. Analog Torque Command or Limit	100	%	O	O	O	O	-
P1-76	AMSPD	Max. Rotation Speed of E ncoder Output	5500	rpm	O	O	O	O	-

Explanation of symbols (marked after parameters)

(★) Read-only register.

(▲) Parameters cannot be changed while Servo On (when the servo drive enabled).

(●) Parameters are effective only after the servo drive is restarted (after switching power off and on).

(■) Parameters will be restored to their default values when power is off.

Torque Control									
Parameter	Name	Function	Default	Unit	Control Mode				Related Section
					Pt	Pr	S	T	
P1-01●	CTL	Control Mode and Output Direction	0	pulse rpm Nm	O	O	O	O	7.3.1
P1-02▲	PSTL	Speed and Torque Limit	0	N/A	O	O	O	O	7.4
P1-46▲	GR3	Encoder Output Pulse Number	2500	pulse	O	O	O	O	-
P1-55	MSPD	Maximum Speed Limit	rated speed	rpm	O	O	O	O	-
P1-09 ~ P1-11	SP1~3	1st ~ 3rd Speed Limit	-60000 ~ +60000	rpm			O	O	7.4.1
P1-12 ~ P1-14	TQ1~3	1st ~ 3rd Torque Command	-300 ~ +300	%	O	O	O	O	7.3.4.1
P1-40▲	VCM	Max. Analog Speed Command or Limit	rated speed	rpm			O	O	-
P1-41▲	TCM	Max. Analog Torque Command or Limit	100	%	O	O	O	O	7.3.4.4

Explanation of symbols (marked after parameters)

(★) Read-only register.

(▲) Parameters cannot be changed while Servo On (when the servo drive enabled).

(●) Parameters are effective only after the servo drive is restarted (after switching power off and on).

(■) Parameters will be restored to their default values when power is off.

Digital I/O and Relative Input Output Setting									
Parameter	Name	Function	Default	Unit	Control Mode				Related Section
					Pt	Pr	S	T	
P2-09	DRT	Bounce Filter	2	msec	O	O	O	O	-
P2-10	DI1	Digital Input Terminal 1 (DI1)	101	N/A	O	O	O	O	Table 11.A
P2-11	DI2	Digital Input Terminal 2 (DI2)	104	N/A	O	O	O	O	Table 11.A
P2-12	DI3	Digital Input Terminal 3 (DI3)	116	N/A	O	O	O	O	Table 11.A
P2-13	DI4	Digital Input Terminal 4 (DI4)	117	N/A	O	O	O	O	Table 11.A
P2-14	DI5	Digital Input Terminal 5 (DI5)	102	N/A	O	O	O	O	Table 11.A
P2-15	DI6	Digital Input Terminal 6 (DI6)	22	N/A	O	O	O	O	Table 11.A
P2-16	DI7	Digital Input Terminal 7 (DI7)	23	N/A	O	O	O	O	Table 11.A
P2-17	DI8	Digital Input Terminal 8 (DI8)	21	N/A	O	O	O	O	Table 11.A
P2-18	DO1	Digital Output Terminal 1 (DO1)	101	N/A	O	O	O	O	Table 11.B
P2-19	DO2	Digital Output Terminal 2 (DO2)	103	N/A	O	O	O	O	Table 11.B
P2-20	DO3	Digital Output Terminal 3 (DO3)	109	N/A	O	O	O	O	Table 11.B
P2-21	DO4	Digital Output Terminal 4 (DO4)	105	N/A	O	O	O	O	Table 11.B
P2-22	DO5	Digital Output Terminal 5 (DO5)	7	N/A	O	O	O	O	Table 11.B
P1-38	ZSPD	Zero Speed Range Setting	100	0.1 rpm	O	O	O	O	Table 11.B
P1-39	SSPD	Target Motor Speed	3000	rpm	O	O	O	O	Table 11.B
P1-42	MBT1	On Delay Time of Electromagnetic Brake	0	msec	O	O	O	O	7.4.4
P1-43	MBT2	OFF Delay Time of E lectromagnetic Brake	0	msec	O	O	O	O	7.4.4
P1-47	SCPD	Speed Reached Output Range	10	N/A			O		Table 11.B
P1-54	PER	Positioning Completed Width	12800	pulse	O	O			Table 11.B
P1-56	OVW	Output Overload Warning Time	120	%	O	O	O	O	Table 11.B

Communication									
Parameter	Name	Function	Default	Unit	Control Mode				Related Section
					Pt	Pr	S	T	
P3-00●	ADR	Modbus Communication Address Setting	1	N/A	O	O	O	O	9.2
P3-01	BRT	Transmission Speed	0x0203	bps	O	O	O	O	9.2
P3-02	PTL	Communication Protocol	6	N/A	O	O	O	O	9.2
P3-03	FLT	Transmission Fault Treatment	0	N/A	O	O	O	O	9.2
P3-04	CWD	Communication Time Out Detection	0	sec	O	O	O	O	9.2
P3-05	CADR	CANopen Communication Address Setting	0x0000	N/A	CANopen mode				9.2
P3-06■	SDI	Digital Input Communication Function	0	N/A	O	O	O	O	9.2
P3-07	CDT	Communication Response Delay Time	0	1msec	O	O	O	O	9.2
P3-08	Reserved (do not use)								
P3-09	SYC	CANopen Synchronization Setting	0x57A1	N/A	CANopen mode				9.2
P3-10	PLCEN	PLCopen Function Switch	0x0000	N/A	CANopen mode				
P3-11★	PLCTX1	PLCopen TX Packet #1	0x0000	N/A	CANopen mode				
P3-12★	PLCTX2	PLCopen TX Packet #2	0x0000	N/A	CANopen mode				
P3-13★	PLCTX3	PLCopen TX Packet #3	0x0000	N/A	CANopen mode				
P3-14★	PLCTX4	PLCopen TX Packet #4	0x0000	N/A	CANopen mode				
P3-15★	PLCRX1	PLCopen RX Packet #1	0x0000	N/A	CANopen mode				
P3-16★	PLCRX2	PLCopen RX Packet #2	0x0000	N/A	CANopen mode				
P3-17★	PLCRX3	PLCopen RX Packet #3	0x0000 0000	N/A	CANopen mode				

Explanation of symbols (marked after parameters)

(★) Read-only register.

(▲) Parameters cannot be changed while Servo On (when the servo drive enabled).

(●) Parameters are effective only after the servo drive is restarted (after switching power off and on).

(■) Parameters will be restored to their default values when power is off.

Diagnosis									
Parameter	Name	Function	Default	Unit	Control Mode				Related Section
					Pt	Pr	S	T	
P4-00 ★	ASH1	Fault Record (N)	0	N/A	O	O	O	O	7.2.1
P4-01 ★	ASH2	Fault Record (N-1)	0	N/A	O	O	O	O	7.2.1
P4-02★	ASH3	Fault Record (N-2)	0	N/A	O	O	O	O	7.2.1
P4-03★	ASH4	Fault Record (N-3)	0	N/A	O	O	O	O	7.2.1
P4-04 ★	ASH5	Fault Record (N-4)	0	N/A	O	O	O	O	7.2.1
P4-05	JOG	JOG Operation	20	rpm	O	O	O	O	7.2.2
P4-06 ▲■	FOT	Force Output Contact Control	0	N/A	O	O	O	O	7.2.3
P4-07	ITST	Input Status	0	N/A	O	O	O	O	6.5.2 9.2
P4-08 ★	PKEY	Digital Keypad Input of Servo Drive	N/A	N/A	O	O	O	O	-
P4-09 ★	MOT	Output Status	N/A	N/A	O	O	O	O	6.5.3
P4-10 ▲	CEN	Adjustment Function	0	N/A	O	O	O	O	-
P4-11	SOF1	Analog Speed Input Drift Adjustment 1	Factory Setting	N/A	O	O	O	O	-
P4-12	SOF2	Analog Speed Input Drift Adjustment 2	Factory Setting	N/A	O	O	O	O	-
P4-13	TOF1	Analog Torque Drift Adjustment 1	Factory Setting	N/A	O	O	O	O	-
P4-14	TOF2	Analog Torque Drift Adjustment 2	Factory Setting	N/A	O	O	O	O	-
P4-15	COF1	Current Detector Drift Adjustment (V1 phase)	Factory Setting	N/A	O	O	O	O	-
P4-16	COF2	Current Detector Drift Adjustment (V2 phase)	Factory Setting	N/A	O	O	O	O	-
P4-17	COF3	Current Detector Drift Adjustment (W1 phase)	Factory Setting	N/A	O	O	O	O	-
P4-18	COF4	Current Detector Drift Adjustment (W2 phase)	Factory Setting	N/A	O	O	O	O	-
P4-19	TIGB	IGBT NTC Calibration	Factory Setting	N/A	O	O	O	O	-
P4-20	DOF1	Analog Monitor Output Drift Adjustment (CH1)	0	mV	O	O	O	O	7.3.4.4
P4-21	DOF2	Analog Monitor Output Drift Adjustment (CH2)	0	mV	O	O	O	O	7.3.4.4
P4-22	SAO	Analog Speed Input Offset	0	mV			O		-
P4-23	TAO	Analog Torque Input Offset	0	mV				O	-
P4-24	LVL	Undervoltage Error Level	160	V(rms)	O	O	O	O	-

Explanation of symbols (marked after parameters)

(★) Read-only register.

(▲) Parameters cannot be changed while Servo On (when the servo drive enabled).

(●) Parameters are effective only after the servo drive is restarted (after switching power off and on).

(■) Parameters will be restored to their default values when power is off.

11.4 Detailed Parameter Listings

Group 0: P0-xx Monitor Parameterss

P0-00 ★	VER	Firmware Version	Address: 0000H, 0001H

Default: Factory setting — Related Section: N/A

Applicable Control Mode: ALL

Unit: N/A

Range: N/A

Data Size: 16-bit

Display Format: Decimal

P0-01 ■	ALE	Drive Fault Code	Address: 0002H, 0003H

Default: N/A — Related Section: Chapter 10

Unit: N/A

Range:001 ~ 380

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 be cleared automatically after the voltage has returned within its specification.)
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
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: Operational stop activated
014: Reverse limit switch error
015: Forward limit switch error
016: IGBT temperature error
017: Memory error
018: Encoder output error
020: Serial communication time out
022: Input power phase loss
023: Pre-overload warning
024: Encoder initial magnetic field error

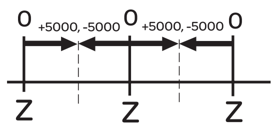
025: Encoder internal error
026: Encoder data error
027: Encoder reset error
030: Motor protection error
031: U, V, W wiring error
040: Full-closed loop excessive deviation
099: DSP firmware upgrade
CANopen Communication Fault Codes
111: CANopen SDO receive buffer overrun
112: CANopen PDO receive buffer overrun
121: Index error occurs when accessing CANopen PDO object.
122: Sub-index error occurs when accessing CANopen PDO object.
123: Data type (size) error occurs when accessing CANopen PDO object.
124: Data range error occurs when accessing CANopen PDO object.
125: CANopen PDO object is read-only and write-protected.
126: CANopen PDO object does not support PDO.
127: CANopen PDO object is write-protected when Servo On.
128: Error occurs when reading CANopen PDO object from EE-PROM.
129: Error occurs when writing CANopen PDO object into EE-PROM.
130: EE-PROM invalid address range
131: EE-PROM checksum error
132: Password error
180: Life guard error or heart beat error
185: CANbus error
Motion Control Fault Codes:
201: CANopen data initial error
235: Pr command overflow
261: Index error occurs when accessing CANopen object.
263: Sub-index error occurs when accessing CANopen object.
265: Data type (size) error occurs when accessing CANopen object.
267: Data range error occurs when accessing CANopen object.
269: CANopen object is read-only and write-protected.
26b: CANopen object does not support PDO.
26d: CANopen object is write-protected when Servo On.
277: Password error
283: Forward software limit
285: Reverse software limit
289: Position counter overflow
291: Servo Off error
3E1: CANopen SYNC failed
3E2: CANopen SYNC signal error
3E3: CANopen SYNC time out
3E4: CANopen IP command failed
3E5: SYNC period error
380: Position deviation alarm for digital output, MC_OK (Please refer to P1-48.)
401: NMT reset or NMT stop is received when drive is enabled.

P0-02	STS	Drive Status (Front Panel Display)	Address: 0004H, 0005H

Default: 00
Applicable Control Mode: ALL
Unit: N/A
Range:00 ~ 127
Data Size: 16-bit
Display Format: Decimal

Related Section: Section 6.3.3.5, Section 8.2

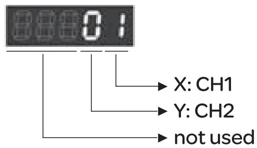
Settings:
This parameter shows the servo drive status.
00: Motor feedback pulse number (after electronic gear ratio is set) [user unit]
01: Input pulse number of pulse command (after electronic gear ratio is set) [user unit]
02: Position error counts between control command pulse and feedback pulse [user unit]
03: Motor feedback pulse number (encoder unit, 1280000 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 [rpm]
08: Speed input command [Volt]
09: Speed input command [rpm]
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.



19: Mapping Parameter 1: Display the content of parameter P0-25 (mapping target is specified by parameter P0-35)
20: Mapping Parameter 2: Display the content of parameter P0-26 (mapping target is specified by parameter P0-36)
21: Mapping Parameter 3: Display the content of parameter P0-27 (mapping target is specified by parameter P0-37)
22: Mapping Parameter 4: Display the content of parameter P0-28 (mapping target is specified by parameter P0-38)
23: Status Monitor 1: Display the content of parameter P0-09 (the monitor status is specified by parameter P0-17)
24: Status Monitor 2: Display the content of parameter P0-10 (the monitor status is specified by parameter P0-18)
25: Status Monitor 3: Display the content of parameter P0-11 (the monitor status is specified by parameter P0-19)
26: Status Monitor 4: Display the content of parameter P0-12 (the monitor status is specified by parameter P0-20)

P0-03	MON	Analog Monitor Output	Address: 0006H, 0007H

Default: 01 Related Section: Section 6.3.3.5
Unit: N/A
Range: 00 ~ 77
Data Size: 16-bit
Display Format: Hexadecimal
Settings:
This parameter determines the functions of the analog monitor outputs.



XY: (X: CH1; Y: CH2)

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(CH1 is speed analog output)
Motor speed = (Max. motor speed × V1/8) × P1-04/100, when the output voltage value of CH1 is V1.

P0-04	Reserved (Do Not Use)

P0-05	Reserved (Do Not Use)

P0-06	Reserved (Do Not Use)

P0-07	Reserved (Do Not Use)

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

Default: 0 Related Section: N/A
Applicable Control Mode: ALL
Unit: Hour
Range: 0 ~ 65535
Data Size: 16-bit
Display Format: Decimal

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

Default: N/A Related Section: Section 6.3.3.5
Applicable Control Mode: ALL
Unit: N/A
Range: N/A
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 byte : low byte)
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

Default: N/A Related Section: Section 6.3.3.5
Applicable Control Mode: ALL
Unit: N/A
Range: N/A
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

Default: N/A Related Section: Section 6.3.3.5

Applicable Control Mode: ALL

Unit: N/A

Range: N/A

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

Default: N/A Related Section: Section 6.3.3.5

Applicable Control Mode: ALL

Unit: N/A

Range: N/A

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

Default: N/A Related Section: Section 6.3.3.5

Applicable Control Mode: ALL

Unit: N/A

Range: N/A

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)

P0 - 15	Reserved (Do Not Use)

P0 - 16	Reserved (Do Not Use)

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

Default: 0 Related Section: N/A
Applicable Control Mode: ALL
Unit: N/A
Range: 0 ~ 127
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 rpm.

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

Default: 0 Related Section: N/A
Applicable Control Mode: ALL
Unit: N/A
Range: 0 ~ 127
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 P0-10. Refer to P0-17 for explanation.

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

Default: 0 Related Section: N/A
Applicable Control Mode: ALL
Unit: N/A
Range: 0 ~ 127
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 P0-11. Refer to P0-17 for explanation.

P0 - 20	CM4A	Status Monitor Selection 4	Address: 0028H, 0029H

Default: 0 — Related Section: N/A
Applicable Control Mode: ALL
Unit: N/A
Range: 0 ~ 127
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 P0-12. Refer to P0-17 for explanation.

P0 - 21	CM5A	Status Monitor Selection 5	Address: 002AH, 002BH

Default: 0 — Related Section: N/A
Applicable Control Mode: ALL
Unit: N/A
Range: 0 ~ 127
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 P0-13. Refer to P0-17 for explanation.

P0 - 22	Reserved (Do Not Use)

P0 - 23	Reserved (Do Not Use)

P0 - 24	Reserved (Do Not Use)

P0 - 25	MAP1	Mapping Parameter 1	Address: 0032H, 0033H

Default: N/A — Related Section: Section 6.3.3.5
Applicable Control Mode: ALL
Unit: N/A
Range: determined by the parameter specified by P0-35
Data Size: 32-bit
Display Format: Hexadecimal

Settings:
The parameters from P0-25 to P0-32 are used to read and write the values of the parameters those communication addresses are not consecutive. The users can set P0-35 ~ P0-42 as the desired read and write mapping parameter numbers through communication setting or the keypad. When reading or writing P0-25 ~ P0-32, the read or write values are equivalent to the values of the parameters specified by P0-35 ~ P0-42, and vise versa. Refer to P0-35 for explanation.

P0 - 26	MAP2	Mapping Parameter 2	Address: 0034H, 0035H

Default: N/A Related Section: Section 6.3.3.5

Applicable Control Mode: ALL

Unit: N/A

Range: determined by the parameter specified by P0-36

Data Size: 32-bit

Display Format: Hexadecimal

Settings:

Refer to P0-25 and P0-36 for explanation.

P0 - 27	MAP3	Mapping Parameter 3	Address: 0036H, 0037H

Default: N/A Related Section: Section 6.3.3.5

Applicable Control Mode: ALL

Unit: N/A

Range: determined by the parameter specified by P0-37

Data Size: 32-bit

Display Format: Hexadecimal

Settings:

Refer to to P0-25 and P0-37 for explanation.

P0 - 28	MAP4	Mapping Parameter 4	Address: 0038H, 0039H

Default: N/A Related Section: Section 6.3.3.5

Applicable Control Mode: ALL

Unit: N/A

Range: determined by the parameter specified by P0-38

Data Size: 32-bit

Display Format: Hexadecimal

Settings:

Refer to P0-25 and P0-38 for explanation.

P0 - 29	MAP5	Mapping Parameter 5	Address: 003AH, 003BH

Default: N/A Related Section: Section 6.3.3.5

Applicable Control Mode: ALL

Unit: N/A

Range: determined by the parameter specified by P0-39

Data Size: 32-bit

Display Format: Hexadecimal

Settings:

Refer to P0-25 and P0-39 for explanation.

P0 - 30	MAP6	Mapping Parameter 6	Address: 003CH, 003DH

Default: N/A Related Section: Section 6.3.3.5

Applicable Control Mode: ALL

Unit: N/A

Range: determined by the parameter specified by P0-40

Data Size: 32-bit

Display Format: Hexadecimal

Settings:

Refer to P0-25 and P0-40 for explanation.

P0 - 31	MAP7	Mapping Parameter 7	Address: 003EH, 003FH

Default: N/A Related Section: Section 6.3.3.5

Applicable Control Mode: ALL

Unit: N/A

Range: determined by the parameter specified by P0-41

Data Size: 32-bit

Display Format: Hexadecimal

Settings:

Refer to P0-25 and P0-41 for explanation.

P0 - 32	MAP8	Mapping Parameter 8	Address: 0040H, 0041H

Default: N/A Related Section: Section 6.3.3.5

Applicable Control Mode: ALL

Unit: N/A

Range: determined by the parameter specified by P0-42

Data Size: 32-bit

Display Format: Hexadecimal

Settings:

Refer to P0-25 and P0-42 for explanation.

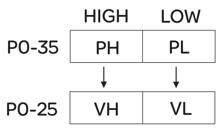
P0 - 33	Reserved (Do Not Use)

P0 - 34	Reserved (Do Not Use)

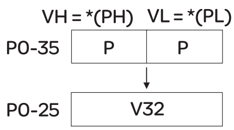
P0 - 35	MAP1A	Block Data Read / Write Register 1 (for P0-25)	Address: 0046H, 0047H

Default: 0x0 Related Section: Section 6.3.3.5

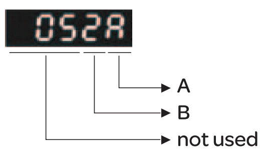
Applicable Control Mode: ALL
Unit: N/A
Range: determined by the communication address of the designated parameter
Data Size: 32-bit
Display Format: Hexadecimal
Settings:
The parameters from P0-35 to P0-42 are used to designate the desired read and write parameter numbers for P0-25 to P0-32, and read and write the values of the parameters those communication addresses are not consecutive through communication setting or the keypad more efficiently.
The read / write parameter could be one 32-bit parameter or two 16-bit parameters.
The operation of parameter P0-35 is described as follows:



When PH ≠ PL, it indicates that P0-25 includes two 16-bit parameters.



When PH = PL = P, it indicates that the content of P0-25 is one 32-bit parameter.
V32 = *(P). If P = 060Ah (parameter P6-10), the value of V32 is the value of P6-10.



A: Parameter group code in hexadecimal format
B: Parameter number in hexadecimal format
For example:
If the desired read and write parameter number is P2-06, please set P0-35 to 0206. If the desired read and write parameter number is P5-42, please set P0-35 to 052A, and vise versa.
When the users want to read and write the value of the parameter P1-44 (32-bit parameter) via P0-25, please set P0-35 to 0x012C012C through communication setting or the keypad. The the value of the parameter P1-44 will be displayed by P0-25.
When the users want to read and write the values of the parameters P2-02 (Position Feed Forward Gain, 16-bit parameter) and P2-04 (Proportional Speed Loop Gain, 16-bit parameter) via P0-25, please set P0-35 to 0x02040202 through communication setting or the keypad. The the values of the parameters P2-02 and P2-04 will be displayed by P0-25.

P0 - 36	MAP2A	Block Data Read / Write Register 2 (for P0-26)	Address: 0048H, 0049H

Default: 0x0 Related Section: Section 6.3.3.5

Applicable Control Mode: ALL

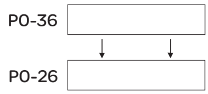
Unit: N/A

Range: determined by the communication address of the designated parameter

Data Size: 32-bit

Display Format: Hexadecimal

Settings:



Refer to P0-35 for explanation.

P0 - 37	MAP3A	Block Data Read / Write Register 3 (for P0-27)	Address: 004AH, 004BH

Default: 0x0 Related Section: Section 6.3.3.5

Applicable Control Mode: ALL

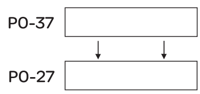
Unit: N/A

Range: determined by the communication address of the designated parameter

Data Size: 32-bit

Display Format: Hexadecimal

Settings:



Refer to P0-35 for explanation.

P0 - 38	MAP4A	Block Data Read / Write Register 4 (for P0-28)	Address: 004CH, 004DH

Default: 0x0 Related Section: Section 6.3.3.5

Applicable Control Mode: ALL

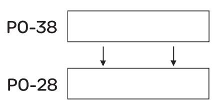
Unit: N/A

Range: determined by the communication address of the designated parameter

Data Size: 32-bit

Display Format: Hexadecimal

Settings:

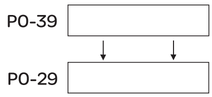


Refer to P0-35 for explanation.

P0 - 39	MAP5A	Block Data Read / Write Register 5 (for P0-29)	Address: 004EH, 004FH

Default: 0x0 Related Section: Section 6.3.3.5

Applicable Control Mode: ALL
Unit: N/A
Range: determined by the communication address of the designated parameter
Data Size: 32-bit
Display Format: Hexadecimal
Settings:

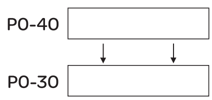


Refer to P0-35 for explanation.

P0 - 40	MAP6A	Block Data Read / Write Register 6 (for P0-30)	Address: 0050H, 0051H

Default: 0x0 Related Section: Section 6.3.3.5

Applicable Control Mode: ALL
Unit: N/A
Range: determined by the communication address of the designated parameter
Data Size: 32-bit
Display Format: Hexadecimal
Settings:

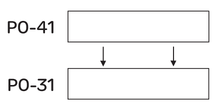


Refer to P0-35 for explanation.

P0 - 41	MAP7A	Block Data Read / Write Register 7 (for P0-31)	Address: 0052H, 0053H

Default: 0x0 Related Section: Section 6.3.3.5

Applicable Control Mode: ALL
Unit: N/A
Range: determined by the communication address of the designated parameter
Data Size: 32-bit
Display Format: Hexadecimal
Settings:



Refer to P0-35 for explanation.

P0 - 42	MAP8A	Block Data Read / Write Register 8 (for P0-32)	Address: 0054H, 0055H

Default: 0x0 Related Section: Section 6.3.3.5

Applicable Control Mode: ALL

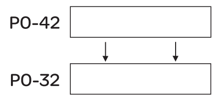
Unit: N/A

Range: determined by the communication address of the designated parameter

Data Size: 32-bit

Display Format: Hexadecimal

Settings:



Refer to P0-35 for explanation.

P0 - 43	Reserved (Do Not Use)

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

Default: 0x0 Related Section: Section 6.3.3.5

Applicable Control Mode: ALL

Unit: N/A

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

Default: 0x0 Related Section: Section 6.3.3.5

Applicable Control Mode: ALL

Unit: N/A

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

Default: 0 Related Section: -

Applicable Control Mode: ALL

Unit: N/A

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)
Bit8: HOME (Homing completed)
Bit9: OLW (Output overload warning)
Bit10: WARN (Servo warning activated. WARN is activated when the drive has detected reverse limit error; forward limit error, Operational 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

Default: 0x2 Related Section: Section 7.3.2.1

Applicable Control Mode: Pt

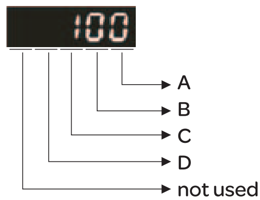
Unit: N/A

Range: 0 ~ 1132

Data Size: 16-bit

Display Format: Hexadecimal

Settings:



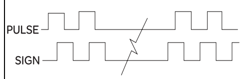
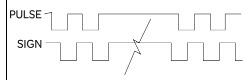
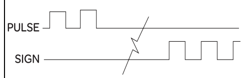
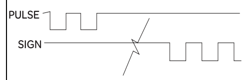
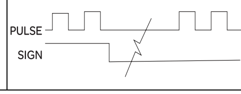
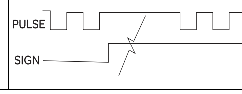
A: Input pulse type
- 0: AB phase pulse (4x) (Quadrature Input)
- 1: Clockwise (CW) + Counterclockwise (CCW) pulse
- 2: Pulse + Direction

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.

B	Low Filter	Setting Value	High Filter
0	1.66Mpps	0	6.66Mpps
1	416Kpps	1	1.66Mpps
2	208Kpps	2	833Kpps
3	104Kpps	3	416Kpps

C: Input polarity

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

Input pulse interface	Max. input pulse frequency
Line driver/Line receiver	500Kpps/4Mpps
Open collector	200Kpps

D: Source of pulse command

Setting value	Input pulse interface	Remark
0	Low-speed pulse	CN1 Terminal Identification: PULSE, SIGN
1	High-speed pulse	CN1 Terminal Identification: HPULSE, HSIGN

The source of pulse command can also be determined by digital input, PTCMS. When the digital input function is used, the source of pulse command is from digital input.

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

Default: 0

pplicable Control Mode: ALL

Related Section: Section 7.3.1, Table 11.A

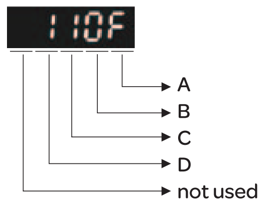
Unit: pulse (P mode), rpm (S mode), Nm (T mode)

Range: 00 ~ 110F

Data Size: 16-bit

Display Format: Hexadecimal

Settings:



A/B: Control mode settings

	Pt	Pr	S	T	Sz	Tz
00	▲					
01		▲				
02			▲			
03				▲		
04					▲	
05						▲
Multiple Mode						
OE	▲	▲	▲			
OF	▲	▲		▲		

	Pt	Pr	S	T	Sz	Tz
06	▲		▲			
07	▲			▲		
08		▲	▲			
09		▲		▲		
0A			▲	▲		
OB	CANopen Mode					
OC	Reserved					
OD	▲	▲				

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.

Pr: Position control mode. The command is from internal signal. Execution of 64 positions is via DI signals (POS0 ~ POS2). A variety of homing control is also provided.

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.

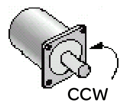
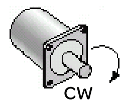
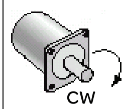
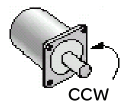
Sz: Zero speed / internal speed command

Tz: Zero torque / internal torque command

Dual Mode: Control of the mode selection is via DI signals. For example, either Pt or S control mode can be selected via DI signal, S-P (see Table 11.A).

Multiple Mode: Control of the mode selection is via DI signals. For example, either Pt or Pr or S control mode can be selected via DI signals, S-P and Pt-Pr (see Table 11.A).

C: Torque output direction settings

Direction	0	1
Forward		
Reverse		

D: Discrete I/O Setting

1: When switching to different mode, digital inputs/outputs (P2-10 ~ P2-22) can be reset to be the default value of the mode you switch to.

0: When switching to different mode, the setting value of digital inputs/outputs (P2-10 ~ P2-22) will remain the same and will not be changed.

P1-02▲	PSTL	Speed and Torque Limit	Address: 0104H, 0105H

Default: 0 | Related Section: Section 7.4, Table 11.A

Applicable Control Mode: ALL

Unit: N/A

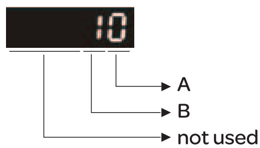
Range: 00 ~ 11

Data Size: 16-bit

Display Format: Hexadecimal

Settings:

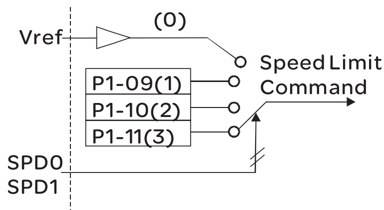
This parameter is used to determine that the speed and torque limit functions are enabled or disabled. If P1-02 is set to 11, it indicates that the speed and torque limit functions are enabled always. The users can also use DI signals, SPDLM and TRQLM to enable the speed and torque limit functions. Please note that DI signals, SPD0, SPD1, TCM0, and TCM1 are used to select the command source of the speed and torque limit.



A: Disable or Enable speed limit function

0: Disable speed limit function

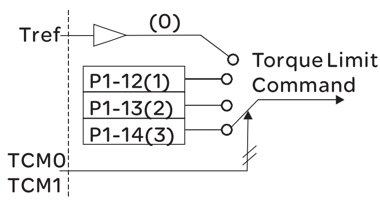
1: Enable speed limit function (It is available in torque mode)



B: Disable or Enable torque limit function

0: Disable torque limit function

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



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

Default: 0 | Related Section: Section 5.2.8.3

Applicable Control Mode: ALL

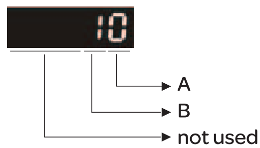
Unit: N/A

Range: 0 ~ 13

Data Size: 16-bit

Display Format: Hexadecimal

Settings:



his parameter is used to determine the polarity of analog monitor outputs and position pulse outputs. The analog monitor outputs can be configured with different polarity individually, but the position pulse outputs have to be each with the same polarity.

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 (CH1)	Address: 0108H, 0109H

Default: 100 | Related Section: Section 7.3.4.4

Applicable Control Mode: ALL

Unit: % (full scale)

Range: 0 ~ 100

Data Size: 16-bit

Display Format: Decimal

P1 - 05	MON2	Analog Monitor Output Proportion 2 (CH2)	Address: 010AH, 010BH

Default: 100 | Related Section: Section 7.3.4.4

Applicable Control Mode: ALL

Unit: % (full scale)

Range: 0 ~ 100

Data Size: 16-bit

Display Format: Decimal

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

Default: 0 Related Section: Section 7.3.3.3
Applicable Control Mode: S
Unit: msec
Range: 0 ~ 1000 (0: Disabled)
Data Size: 16-bit
Display Format: Decimal

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

Default: 0 Related Section: Section 7.3.4.3
Applicable Control Mode: T
Unit: msec
Range: 0 ~ 1000 (0: Disabled)
Data Size: 16-bit
Display Format: Decimal

P1 - 08	PFLT	Smooth Constant of Position Command (Low-pass Filter)	Address: 0110H, 0111H

Default: 0 Related Section: Section 7.3.2.6
Applicable Control Mode: Pt/Pr
Unit: msec
Range: 0 ~ 1000 (0: Disabled)
Data Size: 16-bit
Display Format: Decimal

P1 - 09	SP1	1st Speed Command or Limit	Address: 0112H, 0113H

Default: 1000 Related Section: Section 7.3.3.1
Applicable Control Mode: S, T
Unit: 0.1rpm
Range: -60000 ~ +60000
Data Size: 32-bit
Display Format: Decimal
Settings:

1 st 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

Default: 2000 Related Section: Section 7.3.3.1
Applicable Control Mode: S, T
Unit: 0.1 rpm
Range: -60000 ~ +60000
Data Size: 32-bit
Display Format: Decimal
Settings:

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

Default: 3000 Related Section: Section 7.3.3.1
Applicable Control Mode: S, T
Unit: 0.1rpm
Range: -60000 ~ +60000
Data Size: 32-bit
Display Format: Decimal
Settings:

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

Default: -300 ~ +300 Related Section: Section 7.3.4.1
Applicable 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.
Digital output signal 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.

P1 - 13	TQ2	2nd Torque Command or Limit	Address: 011AH, 011BH

Default: -300 ~ +300 Related Section: Section 7.3.4.1

Applicable 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.

Digital output signal 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.

P1 - 14	TQ3	3rd Torque Command or Limit	Address: 011CH, 011DH

Default: -300 ~ +300 Related Section: Section 7.3.4.1

Applicable Control Mode: T, P&S

Unit: %

Range: -300 ~ +300

Data Size: 16-bit

Display Format: Decimal

Settings:

3 rd Speed Command

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

3 rd Speed Limit

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

Digital output signal 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.

P1 - 15	Reserved (Do Not Use)

P1 - 16	Reserved (Do Not Use)

P1 - 17	Reserved (Do Not Use)

P1 - 18	Reserved (Do Not Use)

P1 - 19	Reserved (Do Not Use)

P1 - 20	Reserved (Do Not Use)

P1 - 21	Reserved (Do Not Use)

P1 - 22	Reserved (Do Not Use)

P1 - 23	Reserved (Do Not Use)

P1 - 24	Reserved (Do Not Use)

P1 - 25	VSF1	Low-frequency Vibration Suppression (1)	Address: 0132H, 0133H

Default: 100.0 Related Section: Section 7.3.2.9

Applicable Control Mode: Pt/Pr

Unit: Hz

Range: 1.0 ~ 100.0

Data Size: 16-bit

Display Format: Decimal

Settings:

This parameter is used to set the first group of the low-frequency of mechanical system. It can be used to suppress the low-frequency vibration of mechanical system. If P1-26 is set to 0, this parameter is disabled.

P1 - 26	VSG1	Low-frequency Vibration Suppression Gain (1)	Address: 0134H, 0135H

Default: 0 Related Section: Section 7.3.2.9

Applicable Control Mode: Pt/Pr

Unit: N/A

Range: 0 ~ 9 (0: Disable the function of P1-25)

Data Size: 16-bit

Display Format: Decimal

Settings:

This parameter is used to set the vibration suppression gain for P1-25. When the setting value is higher, the position response is quicker. However, if the setting value is over high, it may addect the normal operation of servo motor. It is recommended to set P1-26 as 1.

P1 - 27	VSF2	Low-frequency Vibration Suppression (2)	Address: 0136H, 0137H

Default: 100.0 Related Section: Section 7.3.2.9
Applicable Control Mode: Pt/Pr
Unit: Hz
Range: 1.0 ~ 100.0
Data Size: 16-bit
Display Format: Decimal

Settings:
This parameter is used to set the second group of the low-frequency of mechanical system. It can be used to suppress the low-frequency vibration of mechanical system. If P1-28 is set to 0, this parameter is disabled.

P1 - 28	VSG2	Low-frequency Vibration Suppression Gain (2)	Address: 0138H, 0139H

Default: 0 Related Section: Section 7.3.2.9
Applicable Control Mode: Pt/Pr
Unit: N/A
Range: 0 ~ 9 (0: Disable the function of P1-27)
Data Size: 16-bit
Display Format: Decimal

Settings:
This parameter is used to set the vibration suppression gain for P1-27. When the setting value is higher, the position response is quicker. However, if the setting value is over high, it may addect the normal operation of servo motor. It is recommended to set P1-28 as 1.

P1 - 29	AVSM	Auto Low-frequency Vibration Suppression Mode Selection	Address: 013AH, 013BH

Default: 0 Related Section: Section 7.3.2.9
Applicable Control Mode: Pt/Pr
Unit: N/A
Range: 0 ~ 1
Data Size: 16-bit
Display Format: Decimal

Settings:
0: Normal mode (Disable Auto Low-frequency Vibration Suppression Mode).
1: Auto mode (Enable Auto Low-frequency Vibration Suppression Mode).
Explanation:
If P1-29 is set to 0, the setting of low-frequency vibration suppression is fixed and will not change automatically.
If P1-29 is set to 1, when there is no low-frequency vibration or the low-frequency vibration becomes less and stable, the system will set P1-29 to 0, save the measured low-frequency value automatically and memorize it in P1-25.

P1 - 30	VCL	Low-frequency Vibration Detection Level	Address: 013CH, 013DH

Default: 500 Related Section: Section 7.3.2.9

Applicable Control Mode: Pt/Pr

Unit: pulse

Range: 1 ~ 8000

Data Size: 16-bit

Display Format: Decimal

Settings:

When P1-29 is set to 1, the system will search this detection level automatically. If the setting value of P1-30 is too low, the dectection of frequency will become sensitive and result in erroneous measurement. If the setting value of P1-30 is too high, although the probability of erroneous measurement will decrease, the frequency will become difficult to be found especially when the vibration of mechanical system is less.

P1 - 31	Reserved (Do Not Use)

P1 - 32	LSTP	Motor Stop Mode Selection	Address: 0140H, 0141H

Default: 0 Related Section: N/A

Applicable Control Mode: ALL

Unit: N/A

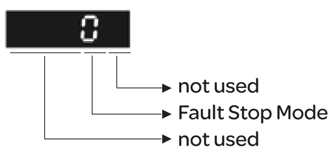
Range: 0 ~ 20

Data Size: 16-bit

Display Format: Hexadecimal

Settings:

This parameter is used to select servo motor stop mode when Servo Off or a fault (servo alarm, includes OPST (Operational stop)) occurs.



Fault 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 P5-03 to determine the deceleration time. If the deceleration time is set to 1msec, the motor will stop instantly.

P1 - 33	Reserved (Do Not Use)

P1 - 34	TACC	Acceleration Time	Address: 0144H, 0145H

Default: 200 Related Section: Section 7.3.3.3

Applicable Control Mode: S

Unit: msec

Range: 1 ~ 65500

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. 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.
2. When the source of speed command is analog command, the maximum setting value of P1-34 is limited to 20000 automatically.

P1 - 35	TDEC	Deceleration Time	Address: 0146H, 0147H

Default: 200 Related Section: Section 7.3.3.3

Applicable Control Mode: S

Unit: msec

Range: 1 ~ 65500

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. 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.

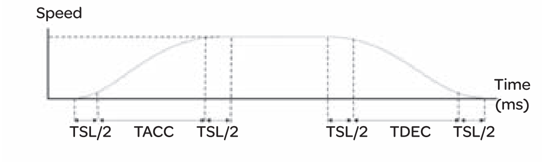
Please note:

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.
2. When the source of speed command is analog command, the maximum setting value of P1-35 is limited to 20000 automatically.

P1 - 36	TSL	Accel /Decel S-curve	Address: 0148H, 0149H

Default: 0 Related Section: Section 7.3.3.3
Applicable Control Mode: S, Pr
Unit: msec
Range: 0 ~ 65500 (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.
2. When the source of speed command is analog command, the maximum setting value of P1-36 is limited to 10000 automatically.

P1 - 37	GDR	Ratio of Load Inertia to Servo Motor Inertia	Address: 014AH, 014BH

Default: 10 Related Section: N/A
Applicable Control Mode: ALL
Unit: 0.1 times
Range: 0 ~ 2000
Data Size: 16-bit
Display Format: Decimal

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
Ratio of load weight to servo motor weight (for Linear Motor): (M_load / M_motor)(not available now but will be available soon)
M_load: Total equivalent weight of external mechanical load
M_motor: Weight of servo motor

P1 - 38	ZSPD	Zero Speed Range Setting	Address: 014CH, 014DH

Default: 100 Related Section: Table 11.A

Applicable Control Mode: ALL

Unit: 0.1 rpm

Range: 0 ~ 2000

Data Size: 16-bit

Display Format: Decimal

Settings:

This parameter is used to set output range of zero speed signal (ZSPD) and determine whrn 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 rpm. ZSPD will remain activated until the motor speed increases above 100 rpm.

P1 - 39	SSPD	Target Motor Speed	Address: 014EH, 014FH

Default: 3000 Related Section: Table11.A

Applicable Control Mode: ALL

Unit: rpm

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

Default: rated speed Related Section: Section 7.3.3.4
Applicable Control Mode: S, T
Unit: rpm
Range: 0 ~ 10000
Data Size: 16-bit
Display Format: Decimal

Settings:
In **Speed mod**e, 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 rpm. If P1-40 is set to 3000, but the input voltage is changed to 5V, then the speed command is changed to 1500 rpm.
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

Default: 100 Related Section: Section 7.3.4.4
Applicable 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 **Position (Pt, Pr)** 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

Default: 0
Applicable Control Mode: ALL
Unit: msec
Range: 0 ~ 1000
Data Size: 16-bit
Display Format: Decimal

Related Section: Section 7.4.4, Table 11.B

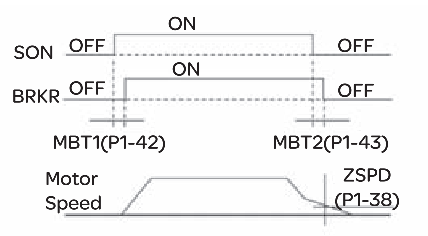
Settings:
Used to set the period of time between when the servo drive is On (Servo On) and when electromagnetic brake output signal (BRKR) is activated.

P1 - 43	MBT2	OFF Delay Time of Electromagnetic Brake	Address: 0156H, 0157H

efault: -1000 ~ +1000
Applicable Control Mode: ALL
Unit: msec
Range: -1000 ~ +1000
Data Size: 16-bit
Display Format: Decimal

Related Section: Section 7.4.4 Table 11.B

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 OPST (Operational 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

Default: 128 Related Section: Section 7.3.2.5

Applicable Control Mode: Pt, Pr

Unit: pulse

Range: 1 ~ (2^{29}-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 numberators.

Please note:

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

P1 - 45▲	GR2	Electronic Gear Ratio (Denominator) (M)	Address: 015AH, 015BH

Default: 10 Related Section: Section 7.3.2.5

Applicable Control Mode: Pt, Pr

Unit: pulse

Range: 1 ~ (2^{31}-1)

Data Size: 32-bit

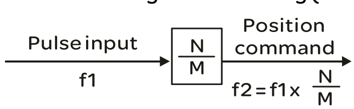
Display Format: Decimal

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 and Pr 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

Default: 2500 Related Section: N/A

Applicable Control Mode: ALL

Unit: pulse

Range: 20 ~ 320000

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.

Condition 3: $\frac{\text{Motor Speed}}{60} \times P1-46 \times 4 > 19.8 \times 10^{6}$

P1 - 47	SPOK	Speed Reached Output Range	Address: 015EH, 015FH

Default: 10 Related Section: N/A

Applicable Control Mode: S, Sz

Unit: N/A

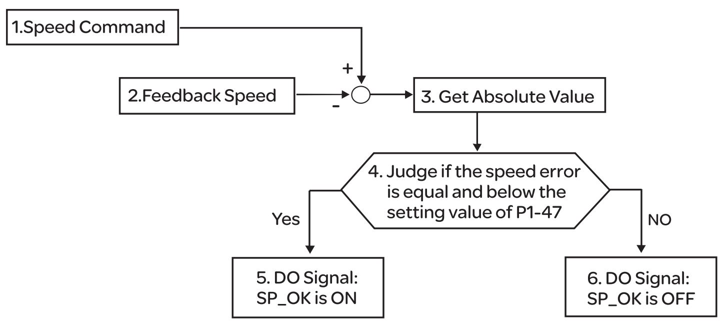
Range: 0 ~ 300

Data Size: 32-bit

Display Format: Decimal

Settings:

This parameter is used to set the speed reached output range. The DO signal, SP_OK will be activated when the speed error is equal and below the setting value of P1-47.



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	MCOK	Motion Control Completed Output Selection	Address: 0160H, 0161H

Default: 0x0000 Related Section: N/A

Applicable Control Mode: Pr

Unit: N/A

Range: 0x0000 ~ 0x0011

Data Size: 16-bit

Display Format: Hexadecimal

Settings: (for firmware version V1.002 and later models only)

This parameter is used to determine the operation after digital output signal, MC_OK (DO code is 0x17) is activated.

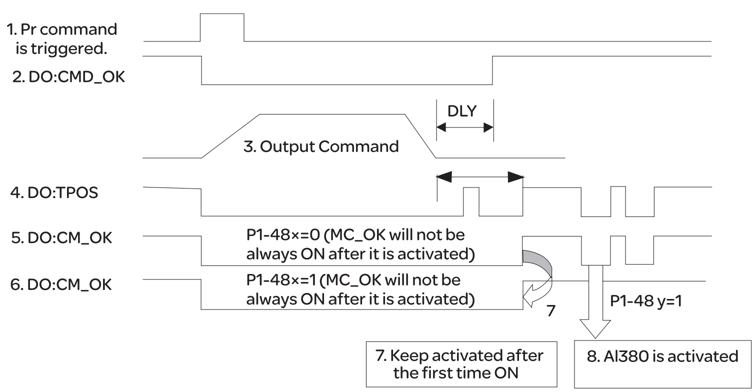
Display	0	0	Y	Y
Range	-	-	0 ~ 1	0 ~ 1

X=0: MC_OK will not be always ON after it is activated.

X=1: MC_OK will be always ON after it is activated.

Y=0: Servo fault. AL380 will not be activated.

Y=1: Servo fault. AL380 will be activated.



1. Pr command is triggerred: It indicates that the new Pr command becomes effective. When the signal 3 starts to output the command, the signals 2, 4 and 5 will be clear simetaneously.
2. CMD_OK: CMD_OK is used to detect if the internal position command, signal 3 has been completed. DLY delay time can also be set.
3. Output Command: Output the internal position command according to desired acceleration and deceleration.
4. TPOS: It is activated when the position error is equal and below the setting value of P1-54.
5. MC_OK (P1-48 X=0): It is activated when the position command has output and the positioning is completed also, i.e. CMD_OK and TPOS are both ON. However, once TPOS becomes OFF, it will become OFF as well.
6 MC_OK (P1-48 X=1): It is activated when the position command has output and the positioning is completed also, i.e. CMD_OK and TPOS are both ON. However, when TPOS becomes OFF, it will not become OFF. It will be always ON
7. The signal 5 and signal 6 cannot be selected simetaneously. This function is determined by X setting of P1-48.
8. Position deviation alarm (AL380): After signal 7 occurs, if signal 4 or 5 becomes off, it indicates a position deviation alarm is detected and AL380 can be activated to provide a alarm signal. This function is determined by Y setting of P1-48.

P1 - 49	Reserved (Do Not Use)

P1 - 50	Reserved (Do Not Use)

P1 - 51	Reserved (Do Not Use)

P1 - 52	RES1	Regenerative Resistor Value	Address: 0168H, 0169H

Default: - Related Section: Section 4.5

Applicable 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
400W	40Ω
750W ~ 1.5kW	40Ω
2kW ~ 3kW	20Ω

P1 - 53	RES2	Regenerative Resistor Capacity	Address: 016AH, 016BH

Default: -
Related Section: Section 4.5
Applicable 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
400W	40W
750W~1.5kW	60W
2kW~3kW	100W

P1 - 54	PER	Positioning Completed Width	Address: 016CH, 016DH

Default: 12800
Related Section: Table 11.A
Applicable Control Mode: Pt , Pr
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.
In Pr mode, when the difference in pulse number between the target position and the actual position 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

Default: rated speed
Related Section: N/A
Applicable Control Mode: ALL
Unit: rpm
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

Default: 120 Related Section: N/A
Applicable 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.
tOL = Permissible Time for Overload x the setting value of parameter 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, **tOL** = 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

Default: 0 Related Section: -

Applicable 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

Default: 1 Related Section: P1-57

Applicable Control Mode: ALL

Unit: msec

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

Default: 0 Related Section: N/A

Applicable Control Mode: S

Unit: 0.1msec

Range: 0 ~ 40 (0: Disabled)

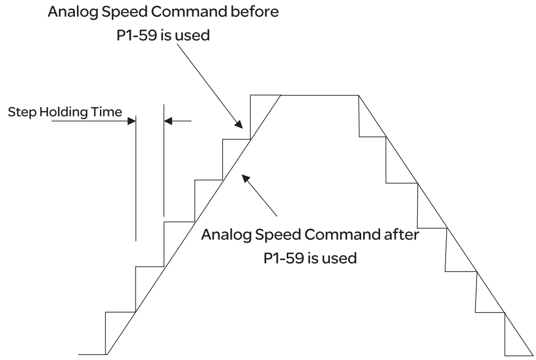
Data Size: 16-bit

Display Format: Decimal

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.



P1 - 60	Reserved (Do Not Use)

P1 - 61	Reserved (Do Not Use)

P1 - 62	FRCL	Friction Compensation Percentage	Address: 017CH, 017DH

Default: 0
Related Section: N/A
Applicable Control Mode: Pt, Pr, 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 Smooth Constant	Address: 017EH, 017FH

Default: 0 Related Section: N/A
Applicable Control Mode: ALL
Unit: msec
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)

P1 - 65	Reserved (Do Not Use)

P1 - 66	PCM	Max. Rotation Number of Analog Position Command (will be available soon)	Address: 0184H, 0185H

Default: 30 Related Section: N/A
Applicable Control Mode: Pt
Unit: 0.1 rotation
Range: 0 ~ 10000
Data Size: 16-bit
Display Format: Decimal
Settings:
This parameter is used to set the maximum rotation number of analog position command based on the maximum input voltage (10V).
For example, if P1-66 is set to 30 and the input voltage is 10V, it indicates that the position command is +3 rotations. If P1-66 is set to 30, but the input voltage is changed to 5V, then the position command is +1.5 rotations.
Position Command = Input Voltage Value x Setting value of P1-66 / 10

P1 - 67	Reserved (Do Not Use)

P1 - 68	PFLT2	Position Command Moving Filter	Address: 0188H, 0189H

Default: 4 Related Section: N/A
Applicable Control Mode: Pt, Pr
Unit: msec
Range: 0 ~ 100
Data Size: 16-bit
Display Format: Decimal

P1 - 69	Reserved (Do Not Use)

P1 - 70	Reserved (Do Not Use)

P1 - 71	Reserved (Do Not Use)

P1 - 72	Reserved (Do Not Use)

P1 - 73	Reserved (Do Not Use)

P1 - 74▲	Reserved (Do Not Use)

P1 - 75	Reserved (Do Not Use)

P1 - 76	AMSPD	Max. Rotation Speed of Encoder Output	Address: 0198H, 0199H

Default: 5500 Related Section: P1-46

Applicable Control Mode: ALL

Unit: rpm

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.

Group 2: P2-xx Extension Parameters

P2 - 00	KPP	Proportional Position Loop Gain	Address: 0200H, 0201H

Default: 35 Related Section: Section 7.3.2.8

Applicable Control Mode: Pt, Pr

Unit: rad/s

Range: 0 ~ 2047

Data Size: 16-bit

Display Format: Decimal

Settings:

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

Default: 100 Related Section: Section 7.3.2.8

Applicable Control Mode: Pt, Pr

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

Default: 50 Related Section: Section 7.3.2.8

Applicable Control Mode: Pt, Pr

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

Default: 5 Related Section: N/A

Applicable Control Mode: Pt, Pr

Unit: msec

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

Default: 500 Related Section: Section 7.3.3.6

Applicable 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

Default: 100 Related Section: N/A

Applicable 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

Default: 100 Related Section: Section 7.3.3.6
Applicable 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

Default: 0 Related Section: Section 7.3.3.6
Applicable 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

Default: 0 Related Section: N/A
Applicable Control Mode: ALL
Unit: N/A
Range: 0 ~ 65535
Data Size: 16-bit
Display Format: Decimal
Settings:
This parameter can be used to reset all parameters to their original factory settings and enable some parameters functions.

Reset parameters settings:

10: Users can reset all parameter values to factory defaults. All parameter values will be reset after re-power the servo drive. (Before perform this settings, ensure that the status of the servo drive is "Servo Off".)

Enable parameters functions:

20: If P2-08 is set to 20, then the parameter P4-10 is enabled.

22: If P2-08 is set to 22, then the parameters P4-11~P4-19 are enabled.

406: If P2-08 is set to 406, then the Digital Output (DO) signal can be forced to be activated and the drive will enter into Force Output Control operation mode.

400: If P2-08 is set to 400, it can switch the Force Output Control operation mode to normal Digital Output (DO) Control operation mode.

Users may lock the parameters and protect parameters against change by unauthorized personnel.

- Parameter Lock (Password Input):
  Enter 5-digit password (your password should be at least five characters long). Confirm your password again and then, the password input is completed. (The highest digit of your password number should be at least set to 1).
- Set parameters:
  Re-start the servo drive and the password protection function is enabled. Enter correct password, and then you can unlock the parameters and change them.
- Password Decode:
  First, enter correct password, and set P2-08 to 0(zero) twice continuously.

P2 - 09	DRT	Bounce Filter	Address: 0212H, 0213H

Default: 2 Related Section: Section 7.3.3.6

Applicable Control Mode: ALL

Unit: msec

Range: 0 ~ 20

Data Size: 16-bit

Display Format: Decimal

Settings:

For example, if P2-09 is set to 5, the bounce filter time is 5 x 1msec = 5msec.

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

Default: 101 Related Section: Table 11.A

Applicable Control Mode: ALL

Unit: N/A

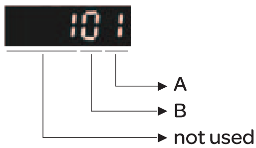
Range: 0 ~ 015Fh

Data Size: 16-bit

Display Format: Hexadecimal

Settings:

The parameters from P2-10 to P2-17 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, please refer to Table 11.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

Default: 104 Related Section: Table 11.A

Applicable 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

Default: 116 Related Section: Table 11.A
Applicable 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

Default: 117 Related Section: Table 11.A
Applicable 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

Default: 102 Related Section: Table 11.A
Applicable 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

Default: 22 Related Section: Table 11.A
Applicable 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

Default: 23 — Related Section: Table 11.A

Applicable 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

Default: 21 — Related Section: Table 11.A

Applicable 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

Default: 101 — Related Section: Table 11.B

Applicable Control Mode: ALL

Unit: N/A

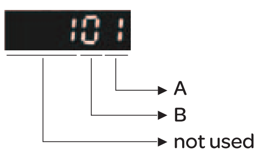
Range: 0 ~ 013Fh

Data Size: 16-bit

Display Format: Hexadecimal

Settings:

The parameters from P2-18 to P2-22 are used to determine the functions and statuses of DO1 ~ DO5.



A: DO Function Settings:

For the setting value of P2- 18 ~ P2-22, please refer to Table 11.A.

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

Default: 103 Related Section: Table 11.B
Applicable 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

Default: 109 Related Section: Table 11.B
Applicable 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

Default: 105 Related Section: Table 11.B
Applicable 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

Default: 7 Related Section: Table 11.B
Applicable 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	Reserved (Do Not Use)

P2 - 24	Reserved (Do Not Use)

P2 - 25	NLP	Low-pass Filter Time Constant (Resonance Suppression)	Address: 0232H, 0233H

Default: 2 (1kW and below models) or
5 (other models)

Related Section: Section 7.3.3.7

Applicable Control Mode: ALL

Unit: 0.1 msec

Range: 0 ~ 1000

Data Size: 16-bit

Display Format: Decimal

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

Default: 0

Related Section: N/A

Applicable Control Mode: ALL

Unit: 0.001

Range: 0 ~ 1023

Data Size: 16-bit

Display Format: Decimal

Settings:

If P2-26 is set to 0, this parameter is disabled.

P2 - 27	GCC	Gain Switching Control Selection	Address: 0236H, 0237H

Default: 0 Related Section: N/A

Applicable Control Mode: ALL

Unit: N/A

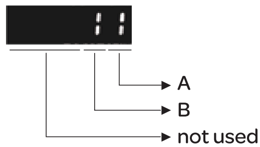
Range: 0 ~ 4

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 11.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 11.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

Default: 10 Related Section: N/A

Applicable Control Mode: ALL

Unit: 10msec

Range: 0 ~ 1000

Data Size: 16-bit

Display Format: Decimal

Settings:

This parameter is used to set the time constant when switching the smooth gain.
If P2-28 is set to 0, this parameter is disabled.

P2 - 29	GPE	Gain Switching Condition	Address: 023AH, 023BH

Default: 1280000 Related Section: N/A

Applicable Control Mode: ALL

Unit: pulse, Kpps, rpm

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, rpm) selected in P2-27. The setting value will be different depending on the different gain switching condition.

P2 - 30■	INH	Auxiliary Function	Address: 023CH, 023AH

Default: 0 Related Section: N/A

Applicable 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: Reserved
3: Reserved
4: Reserved

5: After setting P2-30 to 5, the setting values of all parameters will lost (not remain in memory) at power-down. When the parameters data are no more needed, using this mode can allows users not to save parameters data into memory without damaging the EEPROM. P2-30 should be set to 5 when using communication control function.
6: Reserved
7: Reserved
8: Reserved
- 1, -5: Disable the function of setting value 1 and 5.
- 2, -3, -4,-6, -7, -8: Reserved

P2 - 31	AUT1	Speed Frequency Response Level in Auto and Semi-Auto Mode	Address: 023EH, 023FH

Default: 80 Related Section: Section 6.5.4.6, Section 7.3.3.6
Applicable Control Mode: ALL
Unit: Hz
Range: 1 ~ 1000
Data Size: 16-bit
Display Format: Hexadecimal
Settings:
This parameter is the base for calculating P2-00, P2-02, P2-04, P2-06, P2-25, and P2-26 under auto-tuning (P2-32=1) and semi-auto tuning (P2-32=2) modes. The parameter P2-00, P2-02, P2-04, P2-06, P2-25, and P2-26 will be revised immediately whenever P2-31 is changed when these two modes applied. The stiffness of a mechanism and system response are the key factor of considering this parameter as below:
1 ~ 50Hz: Low stiffness and low frequency response
51 ~ 250Hz: Medium stiffness and medium frequency response
251 ~ 850Hz: High stiffness and high frequency response
851 ~ 1000Hz: Extremely high stiffness and extremely high frequency response

P2 - 32▲	AUT2	Tuning Mode Selection	Address: 0240H, 0241H

Default: 0 Related Section: Section 6.5.4.6, Section 7.3.3.6
Applicable 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]

P2-32	P1-37, Ratio of Load and Motor Rotor Inertias	P2-00, P2-02, P2-04, P2-06, P2-25, P2-26	P2-33 Semi-Auto Mode Inertia Adjustment Selection
0	Not updated automatically.	Updated manually.	Do not use.
1	Updated every 30 minutes.	Updated when P2-31 changed and P2-32 switched from 0 to 1.	Do not use.
2	Updated when the level set in P2-67 reached.	Updated when P2-31 changed and P2-32 switched from 0 to 2.	1: P1-37 evaluated and fixed. 0: P1-37 is under evaluating. Write 0 to P2-33 for re-evaluating P1-37.

P2 - 33▲	AUT3	Semi-Auto Mode Inertia Adjustment Selection	Address: 0242H, 0243H

Default: 0 Related Section: N/A

Applicable Control Mode: ALL

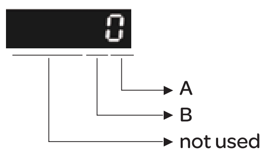
Unit: N/A

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

Default: 5000 Related Section: N/A

Applicable Control Mode: S

Unit: rpm

Range: 1 ~ 5000

Data Size: 16-bit

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

Default: 3840000 Related Section: N/A

Applicable Control Mode: Pt, Pr

Unit: pulse

Range: 1 ~ 128000000

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	Reserved (Do not use)

P2 - 38	Reserved (Do Not Use)

P2 - 39	Reserved (Do Not Use)

P2 - 40	Reserved (Do Not Use)

P2 - 41	Reserved (Do Not Use)

P2 - 42	Reserved (Do Not Use)

P2 - 43	NCF1	Notch Filter 1 (Resonance Suppression)	Address: 0256H, 0257H

Default: 1000 Related Section: Section 7.3.3.7

Applicable 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.

P2 - 44	DPH1	Notch Filter Attenuation Rate 1 (Resonance Suppression)	Address: 0258H, 0259H

Default: 0 Related Section: Section 7.3.3.7
Applicable 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	NCF2	Notch Filter 2 (Resonance Suppression)	Address: 025AH, 025BH

Default: 1000 Related Section: Section 7.3.3.7
Applicable 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	DPH2	Notch Filter Attenuation Rate 2 (Resonance Suppression)	Address: 025CH, 025DH

Default: 0 Related Section: Section 7.3.3.7
Applicable 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

Default: 1 Related Section: N/A
Applicable 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~P2-44 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 and P2-44 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 and P2-44 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 and P2-44 will be saved automatically.

P2 - 48	ANCF	Auto Resonance Suppression Detection Level	Address: 0260H, 0261H

Default: 100
Related Section: N/A
Applicable 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

Default: 0
Related Section: N/A
Applicable 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
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

Default: 0 Related Section: N/A

Applicable Control Mode: Pt, Pr

Unit: N/A

Range: 0 ~ 2

Data Size: 16-bit

Display Format: Hexadecimal

Settings:

For digital input function (DI function), please refer to Table 11.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 and Pr mode only)

0: CCLR is triggered by rising-edge

1: CCLR is triggered bu level

P2 - 51	Reserved (Do Not Use)

P2 - 52	Reserved (Do Not Use)

P2 - 53	KPI	Position Integral Compensation	Address: 026AH, 026BH

Default: 0

Related Section: Section 7.3.2.8

Applicable 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)

P2 - 55	Reserved (Do Not Use)

P2 - 56	Reserved (Do Not Use)

P2 - 57	Reserved (Do Not Use)

P2 - 58	Reserved (Do Not Use)

P2 - 59	Reserved (Do Not Use)

P2 - 60	GR4	Electronic Gear Ratio (2nd Numerator) (N2)	Address: 0278H, 0279H

Default: 128

Related Section: N/A

Applicable Control Mode: Pt

Unit: pulse

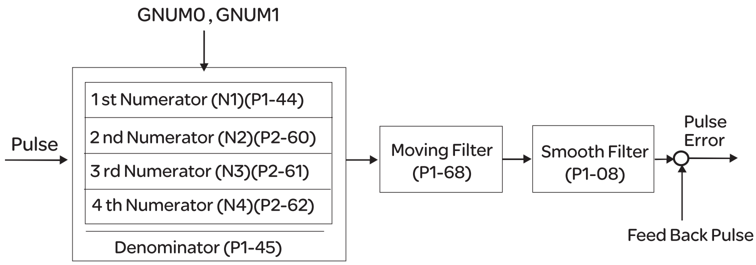
Range: 1 ~ (2^{29}-1)

Data Size: 32-bit

Display Format: Decimal

The electronic gear numerator value can be set via GNUM0, GNUM1 (refer to Table 11.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.



P2 - 61	GR5	Electronic Gear Ratio (3rd Numerator) (N3)	Address: 027AH, 027BH

Default: 128 — Related Section: N/A
Applicable Control Mode: Pt
Unit: pulse
Range: 1 ~ (2^{29}-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

Default: 128 — Related Section: N/A
Applicable Control Mode: Pt
Unit: pulse
Range: 1 ~ (2^{29}-1)
Data Size: 32-bit
Display Format: Decimal
Settings:
Refer to P2-60 for explanation.

P2 - 63	Reserved (Do Not Use)

P2 - 64	Reserved (Do Not Use)

P2 - 65	GBIT	Special Function 1	Address: 0282H, 0283H

Default: 0 Related Section: N/A
Applicable Control Mode: Pr, Pt, S
Unit: N/A
Range: 0 ~ 0xFF
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

Bit1	Bit0

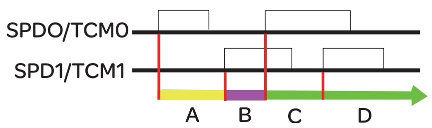
Bit0: DI SPD0/SPD1 speed command trigger mode

0: by level
1: by rising edge

Bit1: DI TCM0/TCM1 torque command trigger mode

0: by level
1: by rising edge

When the servo drive is rising-edge triggered, the internal commands work as follows:



A: Execute internal command 1
B: Execute internal command 2
C: Execute internal command 3
D: Execute internal command 3

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

Bit7

Bit7: Reserved. Must be set to 0.

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

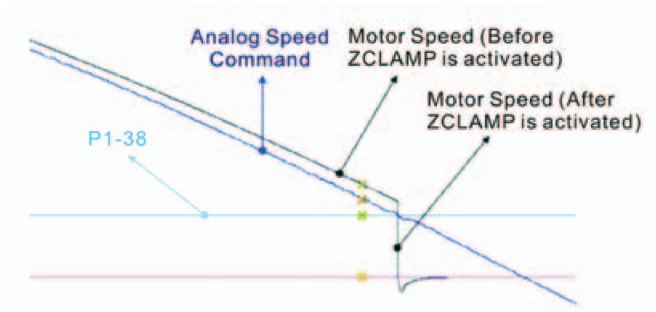
1: enable U, V, W wiring cut-off detection

Bit10

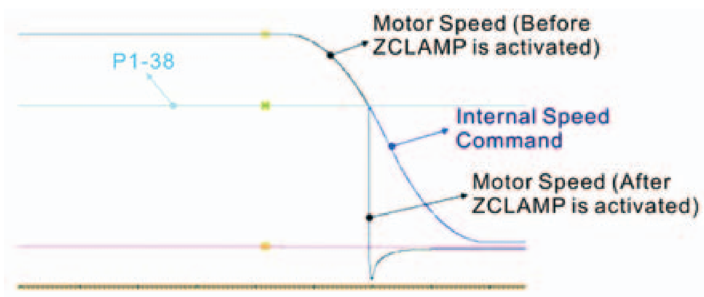
Bit10: DI ZCLAMP function selection

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.

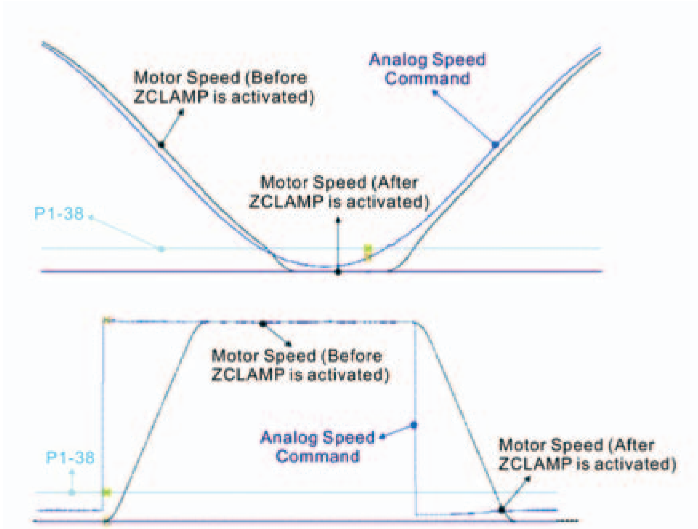
0: When the command source is an analog speed command, the users can use ZCLAMP DI signal to stop the motor at the desire position and do not care the acceleration and deceleration speed curve of the analog speed command. The motor will be locked at the position when ZCLAMP conditions are satisfied.



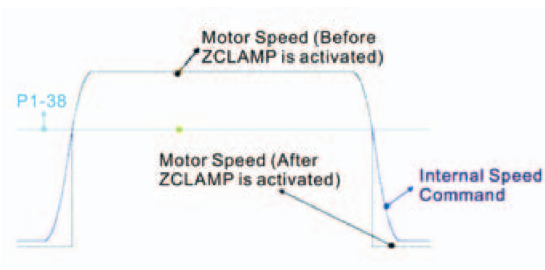
0: When the command source is an internal speed command, the users can use ZCLAMP DI signal to stop the motor at the desire position and keep the the acceleration and deceleration speed curve of the internal speed command. The motor will be locked at the position when ZCLAMP conditions are satisfied.



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 rpm. 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 rpm directly.



Bit11

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

Default: 0

Applicable Control Mode: ALL

Unit: N/A

Range: 0~20

Related Section: Section 11.3

Settings:

Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0

Bit1	Bit0

Bit0 ~ Bit1: Reserved. Must be set to 0.

Bit2

Bit2: Undervoltage (Servo Drive Fault) clear mode selection

0: The fault, Undervoltage will not be cleared automatically.

1: The fault, Undervoltage will be cleared automatically.

Bit7	Bit6	Bit5	Bit4	Bit3

Bit3 ~ Bit7: Reserved. Must be set to 0.

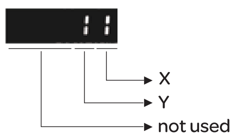
P2 - 67	JSL	Inertia Estimating Detection Level	Address: 0286H, 0287H

Default: 1.5 Related Section: N/A
Applicable Control Mode: ALL
Unit: 0.1times
Range: 0 ~ 200.0
Data Size: 16-bit
Display Format: Decimal

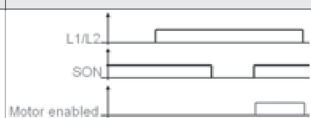
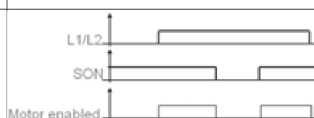
Settings:
In semi-auto tuning mode, this parameter defines the threshold for a system to re-evaluate P1-37. For example, P1-37=2 and P2-67=1, the system will re-evaluate its P1-37 when a value exceeding the range of P1-37=1.5~2.5 (greater than 2.5 or less than 1.5) detected. If P1-37=1 and P2-67=3, the range should be P1-37=0~2.5 for a stable acknowledgment.

P2 - 68 ●	AEAL	Auto Enable and Auto Limit Enable	Address: 0286H, 0287H

Default: 0x0000 Related Section: N/A
Applicable Control Mode: ALL
Unit: N/A
Range: 0x0000~0x0011
Data Size: 16-bit



Display Format: Hexadecimal
Settings:
X: Auto Enable function switch

X	Function
0	
1	

If X = 0, user must to re-trigger SON to enable motor.
If X = 1, motor will be enabled once L1/L2 and SON are both active.

Y: Auto Limit Enable function switch

Y	Function
0	AL.014/AL.015 will be latched until receives an additional ARST signal.
1	AL.014/AL.015 can be reset without ARST signal.

Group 3: P3-xx Communication Parameters

P3 - 00	ADR	Modbus Communication Address Setting	Address: 0300H, 0301H

Default: 1 Related Section: Section 9.2

Applicable Control Mode: ALL

Unit: N/A

Range: 0x01 ~ 0x7F

Data Size: 16-bit

Display Format: Hexadecimal

Settings:

This parameter is used to set the Modbus communication slave address in decimal format. This address is an absolute address which represents the servo drive on a RS-485 network.

This address is an absolute address which represents the servo drive on a RS-485 network and must be defined uniquely. Duplicate address will cause communication faults .

Please note:

1. This parameter does not provide broadcast function and doesn,t respond insecurity.
2. 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 if the address is matching or not. However, the parameter P3-00 cannot be set to 0xFF.

P3 - 01	BRT	Transmission Speed	Address: 0302H, 0303H

Default: 0x0203 Related Section: Section 9.2

Applicable Control Mode: ALL
Unit: bps
Range: 0x0000 ~ 0x0405
Data Size: 16-bit
Display Format: Hexadecimal
Settings:
This parameter is used to set the baud rate and data transmission speed of the RS-485 and CANopen communications.

Display	0	Z	Y	X
COM Port	-	CAN	-	RS-485
Range	0	0 ~ 4	0	0 ~ 5

X: Baud rate setting
- 0: Baud rate 4800
- 1: Baud rate 9600
- 2: Baud rate 19200
- 3: Baud rate 38400
- 4: Baud rate 57600
- 5: Baud rate 115200

Y: Reserved. Must be set to 0.

Z: CANopen Data transmission speed setting.
- 0: 125K bits / second
- 1: 250K bits / second
- 2: 500K bits / second
- 3: 750K bits / second
- 4: 1.0M bits / second

Please note:

1. When setting this parameter via CANopen communication, only the setting of Z (data transmission speed setting) can be configured.

P3 - 02	PTL	Communication Protocol	Address: 0304H, 0305H

Default: 6 Related Section: Section 9.2

Applicable Control Mode: ALL

Unit: N/A

Range: 0 ~ 8

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: 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

Default: 0 Related Section: Section 9.2

Applicable Control Mode: ALL

Unit: N/A

Range: 0 ~ 1

Data Size: 16-bit

Display Format: Hexadecimal

Settings:

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.

0: Display fault and continue operating

1: Display fault and decelerate to stop operating (deceleration time is determined by parameter P5-03)

P3 - 04	CWD	Communication Time Out Detection	Address: 0308H, 0309H

Default: 0 Related Section: Section 9.2

Applicable 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	CADR	CANopen Communication Address Setting	Address: 030AH, 030BH

Default: 0x0000 Related Section: Section 9.2

Applicable Control Mode: ALL

Unit: N/A

Range: 0 x00~0x7F

Data Size: 16-bit

Display Format: Hexadecimal

Settings:

This parameter is used to set the CAN communication slave address in hexadecimal format.

This address is an absolute address whlch represents the servo drive on a CAN bus network and must be defined uniquely. Duplicate address will cause communication faults.

This parameter is relevant for LXM23A servo drives only.

This parameter will be effective only after restarting drive or NMT Reset_Node indication. To change this parameter from default (0), restarting drive is necessary.

P3 - 06■	SDI	Digital Input Communication Function	Address: 030CH, 030DH

Default: 0 Related Section: Section 9.2

Applicable Control Mode: ALL

Unit: N/A

Range: 0x0000 ~ 0x3FFF

Data Size: 16-bit

Display Format: Hexadecimal

The setting of this parameter determines how the Digital Inputs (DI) accept commands and signals.

Bit0 ~ Bit 7 corresponds with DI1 ~ DI8. 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 ~ DI8, please refer to P2-10 ~ P2-17.

This parameter P3-06 also works in conjunction with the parameter P4-07 which has several functions. Please see section 9.2 for details.

P3 - 07	CDT	Communication Response Delay Time	Address: 030EH, 030FH

Default: 0 Related Section: Section 9.2

Applicable Control Mode: ALL

Unit: 1msec

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 via Modbus).

P3 - 08	Reserved (Do Not Use)

P3-09	SYC	CANopen Synchronization Setting	Address: 0312H, 0313H

Default: 0x57A1 Related Section: Section 9.2

Applicable Control Mode: CANopen

Unit: N/A

Range: refer to the description of Settings

Data Size: 16-bit

Display Format: Hexadecimal

Settings:

This parameter is used to set the CANopen slave to be synchronized with the CANopen master through synchronization signal. Although this parameter allows the users to execute manual adjustment, if not necessary, we do not recommend users to change the default setting manually.

Display	E	T	D	M
Function	SYNC error range	Target value	Dead zone range	Clock correction setting
Range	1~9	0~9	0~F	1~F

M: Clock correction setting, the value must be within the range from 1 through F, and the unit is usec.
When setting the CANopen slave to be synchronized with the CANopen master, the clock of the servo drive must be corrected. This function is used to set the maximum correction every time.

D: Dead zone range, the value must be within the range from 0 through F, and the unit is usec.
When the difference between actual value and target value of SYNC signal reach time does not exceed the dead zone range, the clock correction does not need to be changed.

T: Target value of SYNC signal reach time, the value must be within the range from 0 through 9, and the standard value of SYNC signal reach time is 500 usec.
Target reach time of synchronization signal = 400 + 10 x setting value of T.
For example:
When T is set to 5, the target reach time of synchronization signal = 400 + 10 x 5 = 450
There should be a buffer between the target value and the standard value. The target value should be less than the standard value. If the target value is above than the standard value, an error may occur.

E: SYNC error range, the value must be within the range from 1 through 9, and the unit is 10 usec.
When the difference between actual value and target value of SYNC signal reach time is below this range, it indicates that the CANopen slave synchronize with the CANopen master through synchronization signal.

P3 - 10	PLCEN	PLCopen Function Switch	Address: 0314H, 0315H

Default: 0x0000 Related Section: N/A

Applicable Control Mode: CANopen Mode

Unit: N/A

Range: 0x0000 ~ 0x0001

Data Size: 16-bit

Display Format: Hexadecimal

Settings:

0: PLCopen Function Disabled

1: PLCopen Function Enabled

P3 - 11★	PLCTX1	PLCopen TX Packet #1	Address: 0316H, 0317H

Default: 0x0000 Related Section: N/A

Applicable Control Mode: CANopen Mode

Unit: N/A

Range: Read Only

Data Size: 16-bit

Display Format: Hexadecimal

Settings:

The PLCopen TX Packet (Status Data) consists of 4 words and POTX1 ~ POTX4 represent the following fields:

Word	1	2	3	4
Function	driveStat	mfStat	motionSt	driveInput
Parameter	POTX1	POTX2	POTX3	POTX4

P3 - 12★	PLCTX2	PLCopen TX Packet #2	Address: 0318H, 0319H

Default: 0x0000 Related Section: N/A

Applicable Control Mode: CANopen Mode

Unit: N/A

Range: Read Only

Data Size: 16-bit

Display Format: Hexadecimal

Settings:

Refer to P5-11 for explanation.

P3 - 13★	PLCTX3	PLCopen TX Packet #3	Address: 031AH, 031BH
	Default: 0x0000		Related Section: N/A

Applicable Control Mode: CANopen Mode
Unit: N/A
Range: Read Only
Data Size: 16-bit
Display Format: Hexadecimal
Settings:
Refer to P5-11 for explanation.

P3 - 14★	PLCTX4	PLCopen TX Packet #4	Address: 031CH, 031DH
	Default: 0x0000		Related Section: N/A

Applicable Control Mode: CANopen Mode
Unit: N/A
Range: Read Only
Data Size: 16-bit
Display Format: Hexadecimal
Settings:
Refer to P5-11 for explanation.

P3 - 15	PLCRX1	PLCopen RX Packet #1	Address: 031EH, 031FH
	Default: 0x0000		Related Section: N/A

Applicable Control Mode: CANopen Mode
Unit: N/A
Range: 0x0000 ~ 0xFFFF
Data Size: 16-bit
Display Format: Hexadecimal
Settings:
The PLCopen RX Packet (Control Data) consists of 4 words and PORX1 ~ PORX3 represent the following fields:

Word	1	2	3	4
Function	dmCtrl	refA16	refB32	
Parameter	POTX1	POTX2	PORX3	

P3 - 16	PLCRX2	PLCopen RX Packet #2	Address: 0320H, 0321H

Default: 0x0000 — Related Section: N/A

Applicable Control Mode: CANopen Mode

Unit: N/A

Range:-32768 ~ 32767

Data Size: 16-bit

Display Format: Hexadecimal

Settings:

Refer to P5-15 for explanation.

P3 - 17	PLCRX3	PLCopen RX Packet #3	Address: 0322H, 0323H

Default: 0x00000000 — Related Section: N/A

Applicable Control Mode: CANopen Mode

Unit: N/A

Range: -2147483648 ~ +2147483647

Data Size: 32-bit

Display Format: Hexadecimal

Settings:

Refer to P5-15 for explanation.

Group 4: P4-xx Diagnosis Parameters

P4 - 00★	ASH1	Fault Record (N)	Address: 0400H, 0401H

Default: 0 Related Section: Section 7.2.1
Applicable 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 Byte: LXXXX: It indicates the fault code, i.e. alarm code
Display of High Byte: hYYYY: It indicates the corresponding CANopen error code.

P4 - 01★	ASH2	Fault Record (N-1)	Address: 0402H, 0403H

Default: 0 Related Section: Section 7.2.1
Applicable 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.

P4 - 02★	ASH3	Fault Record (N-2)	Address: 0404H, 0405H

Default: 0 Related Section: Section 7.2.1
Applicable 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.

P4 - 03★	ASH4	Fault Record (N-3)	Address: 0406H, 0407H

Default: 0 Related Section: Section 7.2.1

Applicable 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.

P4 - 04★	ASH5	Fault Record (N-4)	Address: 0408H, 0409H

Default: 0 Related Section: Section 7.2.1

Applicable 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.

P4 - 05	JOG	JOG Operation	Address: 040AH, 040BH

Default: 20 Related Section: Section 7.2.2

Applicable Control Mode: ALL

Unit: rpm

Range: 0 ~ 5000

Data Size: 16-bit

Display Format: Decimal

Settings:

JOG operation command:

1. Operation Test

(1)Press the ENT key to display the JOG speed. (The default value is 20 rpm).

(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 ENT 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 11.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	Force Output Contact Control	Address: 040CH, 040DH

Default: 0 Related Section: Section 7.2.3

Applicable Control Mode: ALL
Unit: N/A
Range: 0 ~ 0xFF
Data Size: 16-bit
Display Format: Hexadecimal
Settings:

The function of Digital Outout (DO) is determined by the DO setting value. The user can set DO setting value (0x30 ~ 0x3F) via communication and then write the values into P4-06 to complete the settings.

Bit00 corresponds with DO setting value 0x30
Bit01 corresponds with DO setting value 0x31
Bit02 corresponds with DO setting value 0x32
Bit03 corresponds with DO setting value 0x33
Bit04 corresponds with DO setting value 0x34
Bit05 corresponds with DO setting value 0x35
Bit06 corresponds with DO setting value 0x36
Bit07 corresponds with DO setting value 0x37
Bit08 corresponds with DO setting value 0x38
Bit09 corresponds with DO setting value 0x39
Bit10 corresponds with DO setting value 0x3A
Bit11 corresponds with DO setting value 0x3B
Bit12 corresponds with DO setting value 0x3C
Bit13 corresponds with DO setting value 0x3D
Bit14 corresponds with DO setting value 0x3E
Bit15 corresponds with DO setting value 0x3F

For example:

When P2-18 is set to 0x0130, it indicates that the state of DO1 is the Bit00 state of P4-06.

This parameter can also be used to force the state of DO signal. Please refer to P2-18 ~ P2-22 to assign the functions of digital outouts (DO signals) and section 7.2.3 for the Force Outputs Operation.

P4 - 07■	ITST	Input Status	Address: 040EH, 040FH

Default: 0 | Related Section: Section 6.5.2
Applicable Control Mode: ALL | Section 9.2

Unit: N/A

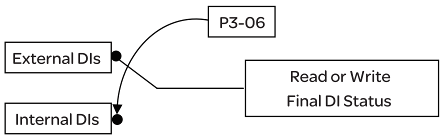
Range: 0 ~ 3FFF

Data Size: 16-bit

Display Format: Hexadecimal

Settings:

The control of digital inputs can be determined by the external terminals (DI1 ~ DI8) or by the internal software digital inputs SDI1 ~ SDI8(corresponds to Bit0 ~ Bit13 of P1-47) via communication (upon software). Please refer to P3-06 and section 9.2 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 ~ SDI8

(No matter the servo drive is controller through Integrated HMI 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 ~ Bit7 corresponds with DI1 ~ DI8.

For the settings of DI1 ~ DI8, please refer to P2-10 ~ P2-17.

P4 - 08★	PKEY	Digital Keypad Input of Servo Drive	Address: 0410H, 0411H

Default: N/A Related Section: N/A

Applicable 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 ENT 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	Address: 0412H, 0413H

Default: N/A Related Section: Section 6.5.3

Applicable Control Mode: ALL

Unit: N/A

Range: 0 ~ 0x1F

Data Size: 16-bit

Display Format: Hexadecimal

Settings:

There is no difference when reading DO output signal via the drive keypad or the communication. For the status of DO output signal, please refer to P2-18 ~ P2-22.

P4 - 10■	CEN	Adjustment Function	Address: 0414H, 0415H

Default: 0 Related Section: N/A

Applicable 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

Default: Factory setting Related Section: N/A

Applicable 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

Default: Factory setting Related Section: N/A

Applicable 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

Default: Factory setting Related Section: N/A

Applicable 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

Default: Factory setting Related Section: N/A

Applicable 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

Default: Factory setting Related Section: N/A

Applicable 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

Default: Factory setting Related Section: N/A

Applicable 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

Default: Factory setting Related Section: N/A

Applicable 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

Default: Factory setting Related Section: N/A

Applicable 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

Default: Factory setting Related Section: N/A

Applicable Control Mode: ALL
Unit: N/A
Range: 1 ~ 4
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.
Please note that when P2-08 is set to 10, the users cannot reset this parameter.

P4 - 20	DOF1	Analog Monitor Output Drift Adjustment (CH1)	Address: 0428H, 0429H

Default: 0 Related Section: Section 7.3.4.4

Applicable 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 (CH2)	Address: 042AH, 042BH

Default: 0 Related Section: Section 7.3.4.4

Applicable 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

Default: 0 Related Section: N/A

Applicable 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

Default: 0 Related Section: N/A

Applicable 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

Default: 160 Related Section: N/A

Applicable 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.

Group 5: P5-xx Motion Control Parameters

P5 - 00	Reserved (Do Not Use)

P5 - 01	Reserved (Do Not Use)

P5 - 02	Reserved (Do Not Use)

P5 - 03	PDEC	Deceleration Time of Protectin Function	Address: 0506H, 0507H

Default: 0XE0EFEEFF Related Section: N/A

Applicable Control Mode: ALL

Unit: N/A

Range: 0x00000000 ~ 0xF0FFFFFF

Data Size: 32-bit

Display Format: Hexadecimal

Settings:

Display	High Byte				Low Byte			
	D	C	B	A	W	Z	Y	X
Function	STP	Reserved	CTO	OVF	SNL	SPL	NL	PL
Range	0 ~ F	-	0 ~ F	0 ~ F	0 ~ F	0 ~ F	0 ~ F	0 ~ F

This parameter is used to set motor deceleration when protection functions, such as STOP (Motor stop), OVF (Position command overflow), SNL (Reverse software limit), SPL (Forward software limit), NL (Reverse inhibit limit) or PL (Forward inhibit limit), etc. are activated.

1.Deceleration time of protection functions include: OVF, CTO(AL020), SPL, SNL, PL, NL

2.Deceleration time of motor stop command: STP

When entering P5-03, Lower Byte display will show first. After pressing SHIFT key on the drive keypad, the high byte display will show next.

The values from 0 through F correspond with the setting values from P5-20 through P5-35.

For example, when the setting value X is set to A, it indicates that the motor PL deceleration time is determined by parameter P5-30.

P5 - 04	HMOV	Homing Mode	Address: 0508H, 0509H

Default: 0 Related Section: N/A

Applicable Control Mode: Pr

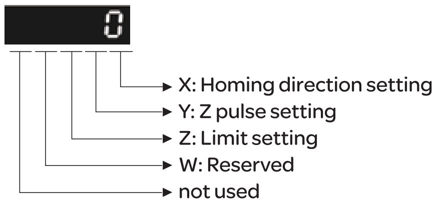
Unit: N/A

Range: 0 ~ 0x128

Data Size: 16-bit

Display Format: Hexadecimal

Settings:



This parameter is used to determine the homing characteristics of the servo motor.

Display	W	Z	Y	X
Function	Reserved	Limit setting	Z pulse setting	Homing direction setting
Range	-	0 ~ 1	0 ~ 2	0 ~ 8
Settings		-	Y=0: Stop and return to Z pulse. Y=1: Go forward to Z pulse. Y=2: Ingore Z pulse	X=0: Move forward to PL(CCWL) used as home.
		-		X=1: Move reverse to NL(CWL) used as home.
		When there is a limit: Z=0: After reaching the limit, activate the limit signal. Z=1: After reaching the limit, the motor will run in the reverse direction.		X=2: Move forward to dedicated home sensor (ORGP: OFF ➜ ON)
				X=3: Move reverse to dedicated home sensor (ORGP: OFF ➜ ON)
			-	X=4: Move forward and regard Z pulse as home sensor.
				X=5: Move reverse and regard Z pulse as home sensor.
			Y=0: Stop and return to Z pulse. Y=1: Go forward to Z pulse. Y=2: Ingore Z pulse	X=6: Move forward to dedicate home sensor (ORGP: ON ➜ OFF)
				X=7: Move reverse to dedicated home sensor (ORGP: ON ➜ OFF)
		-	-	X=8: Regard current position as home sensor

P5 - 05	HSPD1	1st Speed Setting of High Speed Homing	Address: 050AH, 050BH

Default: 100.0 Related Section: N/A

Applicable Control Mode: ALL

Unit: 0.1 rpm

Range: 1 ~ 2000.0

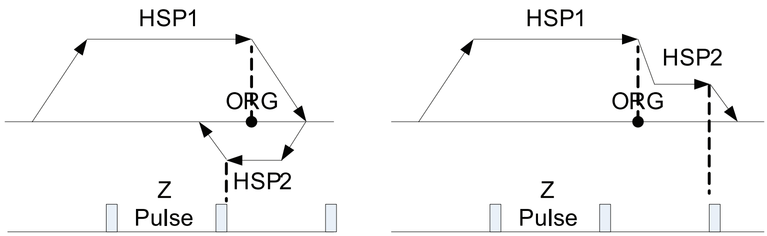
Data Size: 16-bit

Display Format: Decimal

Settings:

This parameter is used to set the initial (high speed) homing speed.

The homing operation of the servo motor involves two homing speed settings. When homeing is triggered, the servo motor will proceed at a high speed speed until a home sensor is detected. The servo motor will then move reverse at a low speed speed until off of the home sensor, and finally will stop at the next Z pulse.



P5 - 06	HSPD2	2nd Speed Setting of Low Speed Homing	Address: 050CH, 050DH

Default: 20.0 Related Section: N/A

Applicable Control Mode: ALL

Unit: 0.1 rpm

Range: 1 ~ 500.0

Data Size: 16-bit

Display Format: Decimal

Settings:

This parameter is used to set the secondary (low speed) homing speed.

Refer to P5-06 for explanation.

P5 - 07■	PRCM	Trigger Position Command (Pr mode only)	Address: 050EH, 050FH
	Default: 0		Related Section: N/A

Applicable Control Mode: Pr
Unit: N/A
Range: 0 ~ 1000
Data Size: 16-bit
Display Format: Decimal
Settings:

There are 8 stored positions can be programmed via a combination of the POS0 ~ POS2 commands. This parameter is used to trigger the dedicated position command in Pr mode and command the motor to move to the dedicated position instead of using DI (Digital Input) CTRG and POS0 ~ POS2.

0: Start homing function.

When entering P5-07, the default setting value 0 will display. Pressing ENT key on the drive keypad, the servo motor will start homing operation.

1 ~ 8: Trigger Position Command (This function is equivalent to the function of DI CTRG signal + POSn signal).

When P5-07 is set to 1 ~ 8, the dedicated position command can be triggered and the servo drive will command the motor move to the the dedicated position. For example, when P5-07 is set to 1, the position command P1 is triggered and the servo drive will command the motor to move to the position which correspond the position command P1.

9 ~ 9999: Write inhibit (Invaild setting value)

1000: Stop positioning.

When P5-07 is set to 1000, the motor stop command will be activated. This function is equivalent to the function of DI STOP signal.

The display value of P5-07:

1. When the motor does not receive the drive command (the motor is not running), if the users read P5-07 at this time, the display value of P5-07 will be the setting value of P5-07
2. When the position command is triggered and the motor start runningbut does not reach the dedicated position (during positioning, the motor is running), if the users read P5-07 at this time, the display value of P5-07 will be setting value of P5-07 plus 10000.
3. When the position command is triggered and the motor reachs the dedicated position (the positioning is completed and the motor stop running), if the users read P5-07 at this time, the display value of P5-07 will be setting value of P5-07 plus 20000.

For example, when P5-07 is set to 3, it indicates that the position command P3 will be triggered.

1. If the display value of P5-07 is 3, it indicates that the motor does not receive the drive command and the motor is not running.
2. If the display value of P5-07 is 100003, it indicates that the position command is triggered but the positioning is not completed.
3. If the display value of P5-07 is 200003, it indicates that the position command is triggered and the positioning is completed.

P5 - 08	SWLP	Forward Software Limit	Address: 0510H, 0511H

Default: 2147483647 — Related Section: N/A

Applicable Control Mode: Pr
Unit: PUU
Range: -2147483648 ~ +2147483647
Data Size: 32-bit
Display Format: Decimal

P5 - 09	SWLN	Reverse Software Limit	Address: 0512H, 0513H

Default: -2147483648 — Related Section: N/A

Applicable Control Mode: Pr
Unit: PUU
Range: -2147483648 ~ +2147483647
Data Size: 32-bit
Display Format: Decimal

P5 - 10	**Reserved (Do Not Use)**

P5 - 11	**Reserved (Do Not Use)**

P5 - 12	**Reserved (Do Not Use)**

P5 - 13	**Reserved (Do Not Use)**

P5 - 14	**Reserved (Do Not Use)**

P5 - 15■	PMEM	PATH 1 ~ PATH 2 Data Not Retained Setting	Address: 051EH, 051FH

Default: 0x0 Related Section: N/A

Applicable Control Mode: ALL

Unit: N/A

Range: 0x0 ~ 0x0011

Data Size: 16-bit

Display Format: Hexadecimal

Settings:

This parameter is designed for the users who need to change the positioning point frequently via communication.

Display	0	0	Y	X
Range	-	-	0 ~ 1	0 ~ 1

X=0: The data of PATH 1 (P6-02 ~P6-03) will be retained (memorized) when the power goes off.

X=1: The data of PATH 1 (P6-02 ~P6-03) will not be retained (memorized) when the power goes off.

Y=0: The data of PATH 2 (P6-04 ~P6-05) will be retained (memorized) when the power goes off.

Y=1: The data of PATH 2 (P6-04 ~P6-05) will not be retained (memorized) when the power goes off.

Other settings: Reserved

P5 - 16■	AXEN	Axis Position: Motor Encoder	Address: 0520H, 0521H

Default: 0 Related Section: Section 8.3

Applicable Control Mode: ALL

Unit: N/A

Range: -2147483648 ~ +2147483647

Data Size: 32-bit

Display Format: Decimal

Settings:

Read function: This parameter is used to read the actual position of the motor encoder, i.e. the monitor variable V000 + deviation value.

Write function:

The users can write any value and doing this will no change the value of monitor variable V000 and will not affect the position coordinate either.

P5 - 17	Reserved (Do not use)		

P5 - 18	AXAU	Axis Position: Pulse Command	Address: 0524H, 0525H

Default: N/A Related Section: Section 8.3

Applicable Control Mode: ALL

Unit: N/A

Range: -2147483648 ~ +2147483647

Data Size: 32-bit

Display Format: Decimal

Settings:

This parameter is used to send back the pulse counts of pulse command.

P5 - 19	Reserved (Do not use)		

P5 - 20	ACO	Accel / Decel Time 0	Address: 0528H, 0529H

Default: 200 Related Section: Section 8.10

Applicable Control Mode: Pr

Unit: msec

Range: 1 ~ 65500

Data Size: 16-bit

Display Format: Decimal

Settings:

In Pr mode, this parameter is used to set the acceleration and deceleration time, i.e. the necessary time when the motor reachs the speed of 3000 rpm from 0.

P5 - 21	AC1	Accel / Decel Time 1	Address: 052AH, 052BH

Default: 300 — Related Section: Section 8.10

Applicable Control Mode: Pr
Unit: msec
Range: 1 ~ 65500
Data Size: 16-bit
Display Format: Decimal
Settings:
Refer to P5-20 for explanation.

P5 - 22	AC2	Accel / Decel Time 2	Address: 052CH, 052DH

Default: 500 — Related Section: Section 8.10

Applicable Control Mode: Pr
Unit: msec
Range: 1 ~ 65500
Data Size: 16-bit
Display Format: Decimal
Settings:
Refer to P5-20 for explanation.

P5 - 23	AC3	Accel / Decel Time 3	Address: 052EH, 052FH

Default: 600 — Related Section: Section 8.10

Applicable Control Mode: Pr
Unit: msec
Range: 1 ~ 65500
Data Size: 16-bit
Display Format: Decimal
Settings:
Refer to P5-20 for explanation.

P5 - 24	AC4	Accel / Decel Time 4	Address: 0530H, 0531H

Default: 800 Related Section: Section 8.10
Applicable Control Mode: Pr
Unit: msec
Range: 1 ~ 65500
Data Size: 16-bit
Display Format: Decimal
Settings:
Refer to P5-20 for explanation.

P5 - 25	AC5	Accel / Decel Time 5	Address: 0532H, 0533H

Default: 900 Related Section: Section 8.10
Applicable Control Mode: Pr
Unit: msec
Range: 1 ~ 65500
Data Size: 16-bit
Display Format: Decimal
Settings:
Refer to P5-20 for explanation.

P5 - 26	AC6	Accel / Decel Time 6	Address: 0534H, 0535H

Default: 1000 Related Section: Section 8.10
Applicable Control Mode: Pr
Unit: msec
Range: 1 ~ 65500
Data Size: 16-bit
Display Format: Decimal
Settings:
Refer to P5-20 for explanation.

P5 - 27	AC7	Accel / Decel Time 7	Address: 0536H, 0537H

Default: 1200 Related Section: Section 8.10
Applicable Control Mode: Pr
Unit: msec
Range: 1 ~ 65500
Data Size: 16-bit
Display Format: Decimal
Settings:
Refer to P5-20 for explanation.

P5 - 28	AC8	Accel / Decel Time 8	Address: 0538H, 0539H

Default: 1500 Related Section: Section 8.10

Applicable Control Mode: Pr

Unit: msec

Range: 1 ~ 65500

Data Size: 16-bit

Display Format: Decimal

Settings:

Refer to P5-20 for explanation.

P5 - 29	AC9	Accel / Decel Time 9	Address: 053AH, 053BH

Default: 2000 Related Section: Section 8.10

Applicable Control Mode: Pr

Unit: msec

Range: 1 ~ 65500

Data Size: 16-bit

Display Format: Decimal

Settings:

Refer to P5-20 for explanation.

P5 - 30	AC10	Accel / Decel Time 10	Address: 053CH, 053DH

Default: 2500 Related Section: Section 8.10

Applicable Control Mode: Pr

Unit: msec

Range: 1 ~ 65500

Data Size: 16-bit

Display Format: Decimal

Settings:

Refer to P5-20 for explanation.

P5 - 31	AC11	Accel / Decel Time 11	Address: 053EH, 053FH

Default: 3000 Related Section: Section 8.10

Applicable Control Mode: Pr

Unit: msec

Range: 1 ~ 65500

Data Size: 16-bit

Display Format: Decimal

Settings:

Refer to P5-20 for explanation.

P5 - 32	AC12	Accel / Decel Time 12	Address: 0540H, 0541H

Default: 5000 Related Section: Section 8.10

Applicable Control Mode: Pr

Unit: msec

Range: 1 ~ 65500

Data Size: 16-bit

Display Format: Decimal

Settings:

Refer to P5-20 for explanation.

P5 - 33	AC13	Accel / Decel Time 13	Address: 0542H, 0543H

Default: 8000 Related Section: Section 8.10

Applicable Control Mode: Pr

Unit: msec

Range: 1 ~ 65500

Data Size: 16-bit

Display Format: Decimal

Settings:

Refer to P5-20 for explanation.

P5 - 34	AC14	Accel / Decel Time 14	Address: 0544H, 0545H

Default: 50 Related Section: Section 8.10

Applicable Control Mode: Pr

Unit: msec

Range: 1 ~ 65500

Data Size: 16-bit

Display Format: Decimal

Settings:

The default setting value of this parameter is smaller and it is for the deceleration setting when protection function is activated.

P5 - 35	AC15	Accel / Decel Time 15	Address: 0546H, 0547H

Default: 30 Related Section: Section 8.10

Applicable Control Mode: Pr

Unit: msec

Range: 1 ~ 65500

Data Size: 16-bit

Display Format: Decimal

Settings:

The default setting value of this parameter is smaller and it is for the deceleration setting when the motor stops in high speed.

P5 - 36	Reserved (Do Not use)

P5 - 37■	CAAX	CAPTURE: Axis Position CNT	Address: 054AH, 054BH

Default: 0 Related Section: Section 8.11.1

Applicable Control Mode: ALL
Unit: PUU
Range: -2147483648 ~ +2147483647
Data Size: 32-bit
Display Format: Decimal
Settings:
This parameter can be set only when capture operation is stopped (Refer to P5-39).
Please note:

1. Do not change this parameter when the capture source is the motor encoder.
2. When the capture source is the motor encoder, the value of this parameter is reset to the motor encoder feedback position (monitor variable is 00h).

P5 - 38■	CANO	CAPTURE: Capture Amount	Address: 054CH, 054DH

Default: 0 Related Section: Section 8.11.1

Applicable Control Mode: ALL
Unit: N/A
Range: 1 ~ (P5-10 ~ P5-36)
Data Size: 16-bit
Display Format: Decimal
Settings:
When the compare function is not enabled, using this parameter can set the estimated capture amount (able to read and write).
Once the capture function is enabled, everytime when one position is captured, the setting value of P5-38 will decrease 1. When the setting value of P5-38 is equal to 0, it indicates that the capture operation has finished.
Please note:
The total amount of COMPARE and CAPTURE data can not exceed the number of 800.

P5 - 39■	CACT	CAPTURE: Capture Source Setting	Address: 054EH, 054FH

Default: 0000 Related Section: Section 8.11.1

Applicable Control Mode: ALL

Unit: N/A

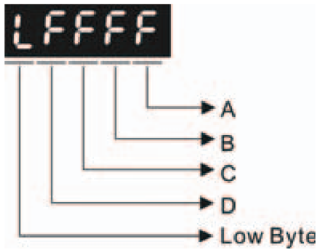
Range: 0x0000 ~ 0xF13F

Data Size: 16-bit

Display Format: Hexadecimal

Settings:

This parameter is used to determine the capture source and enable the capture function.



A: Capture function settings:

Please refer to the following table and descriptions:

Bit	3	2	1	0
Function	Execute Pr command when capture function has finished.	After first position is captured, the system will enable the compare function	After first position is captured, the position will be reset.	Start capture function
Explanation	After capture function has finished, execute Pr # 50 command.	The compare function is enabled already, and this setting will become ineffective.	When the first point is captured, the position coordinate will be reset.	Setting Bit0 to 1 will enable the capture function. When capture function has finished, the value of Bit0 will be reset to 0 automatically.

Bit0: When the value of P5-38 is higher than 0, setting Bit0 to 1 will enable the capture function and the DO signal, CAP_OK is inactivated. Once the capture function is enabled, everytime when one position is captured, the setting value of P5-38 will decrease 1. When the setting value of P5-38 is equal to 0, it indicates that the capture operation has finished. Then, DO signal, CAP_OK will be activated and the value of Bit0 will be reset to 0 automatically.

When the value of P5-38 is equal to 0, setting Bit0 to 1 will not enable the capture function, the DO signal, CAP_OK will be inactivated and then the value of Bit0 will be reset to 0 automatically. If Bit0 is set to 1 already, the new setting value cannot be 1. The users only can set Bit0 to 0 to disable the capture function.
Bit1: When Bit1 is set to 1, after first position is captured, the system will set the value of the current position as the value of the parameter P5-76.
Bit2: When Bit2 is set to 1, after first position is captured, the system will enable the compare function (Bit0 of P5-59 is set to 1 and the value of P5-58 is set to the last compare amount). If the compare function is enabled already, this setting will become ineffective.
Bit3: When Bit3 is set to 1, after capture operation is completed (all positions has been captured), the position command P50 will be triggered immediately.

B: Capture source settings
- 0: Capture function is disabled.
- 1: Reserved (Do not use).
- 2: Pulse command.
- 3: Motor encoder

C: Activate state settings
- 0: Normally open (use N.O. contact)
- 1: Normally closed (use N.C. contact)

D: Trigger time settings (unit: msec)

P5 - 40	DLY0	Delay Time 0	Address: 0550H, 0551H

Default: 0 Related Section: Section 8.10
Applicable Control Mode: Pr
Unit: msec
Range: 0 ~ 32767
Data Size: 16-bit
Display Format: Decimal

P5 - 41	DLY1	Delay Time 1	Address: 0552H, 0553H

Default: 100 Related Section: Section 8.10
Applicable Control Mode: Pr
Unit: msec
Range: 0 ~ 32767
Data Size: 16-bit
Display Format: Decimal

P5 - 42	DLY2	Delay Time 2	Address: 0554H, 0555H

Default: 200 | Related Section: Section 8.10

Applicable Control Mode: Pr
Unit: msec
Range: 0 ~ 32767
Data Size: 16-bit
Display Format: Decimal

P5 - 43	DLY3	Delay Time 3	Address: 0556H, 0557H

Default: 400 | Related Section: Section 8.10

Applicable Control Mode: Pr
Unit: msec
Range: 0 ~ 32767
Data Size: 16-bit
Display Format: Decimal

P5 - 44	DLY4	Delay Time 4	Address: 0558H, 0559H

Default: 500 | Related Section: Section 8.10

Applicable Control Mode: Pr
Unit: msec
Range: 0 ~ 32767
Data Size: 16-bit
Display Format: Decimal

P5 - 45	DLY5	Delay Time 5	Address: 055AH, 055BH

Default: 800 | Related Section: Section 8.10

Applicable Control Mode: Pr
Unit: msec
Range: 0 ~ 32767
Data Size: 16-bit
Display Format: Decimal

P5 - 46	DLY6	Delay Time 6	Address: 055CH, 055DH

Default: 1000 | Related Section: Section 8.10

Applicable Control Mode: Pr
Unit: msec
Range: 0 ~ 32767
Data Size: 16-bit
Display Format: Decimal

P5 - 47	DLY7	Delay Time 7	Address: 055EH, 055FH

Default: 1500 Related Section: Section 8.10

Applicable Control Mode: Pr

Unit: msec

Range: 0 ~ 32767

Data Size: 16-bit

Display Format: Decimal

P5 - 48	DLY8	Delay Time 8	Address: 0560H, 0561H

Default: 2000 Related Section: Section 8.10

Applicable Control Mode: Pr

Unit: msec

Range: 0 ~ 32767

Data Size: 16-bit

Display Format: Decimal

P5 - 49	DLY9	Delay Time 9	Address: 0562H, 0563H

Default: 2500 Related Section: Section 8.10

Applicable Control Mode: Pr

Unit: msec

Range: 0 ~ 32767

Data Size: 16-bit

Display Format: Decimal

P5 - 50	DLY10	Delay Time 10	Address: 0564H, 0565H

Default: 3000 Related Section: Section 8.10

Applicable Control Mode: Pr

Unit: msec

Range: 0 ~ 32767

Data Size: 16-bit

Display Format: Decimal

P5 - 51	DLY11	Delay Time 11	Address: 0566H, 0567H

Default: 3500 Related Section: Section 8.10

Applicable Control Mode: Pr

Unit: msec

Range: 0 ~ 32767

Data Size: 16-bit

Display Format: Decimal

P5 - 52	DLY12	Delay Time 12	Address: 0568H, 0569H

Default: 4000 — Related Section: Section 8.10

Applicable Control Mode: Pr

Unit: msec

Range: 0 ~ 32767

Data Size: 16-bit

Display Format: Decimal

P5 - 53	DLY13	Delay Time 13	Address: 056AH, 056BH

Default: 4500 — Related Section: Section 8.10

Applicable Control Mode: Pr

Unit: msec

Range: 0 ~ 32767

Data Size: 16-bit

Display Format: Decimal

P5 - 54	DLY14	Delay Time 14	Address: 056CH, 056DH

Default: 5000 — Related Section: Section 8.10

Applicable Control Mode: Pr

Unit: msec

Range: 0 ~ 32767

Data Size: 16-bit

Display Format: Decimal

P5 - 55	DLY15	Delay Time 15	Address: 056EH, 056FH

Default: 5500 — Related Section: Section 8.10

Applicable Control Mode: Pr

Unit: msec

Range: 0 ~ 32767

Data Size: 16-bit

Display Format: Decimal

P5 - 56	Reserved (Do Not Use)

P5 - 57	Reserved (Do Not Use)

P5 - 58■	CMNO	COMPARE: Compare Amount	Address: 0574H, 0575H

Default: 0 Related Section: Section 8.11.2

Applicable Control Mode: ALL

Unit: N/A

Range: 1 ~ (P5-10 ~ P5-56)

Data Size: 16-bit

Display Format: Decimal

Settings:

When the compare function is not enabled, using this parameter can set the estimated compare amount (able to read and write).

When the compare function is enabled, using this parameter can set the rest compare amount (read-only). When the setting value of P5-58 is equal to 0, it indicates that the compare operation has finished.

Please note:

The total amount of COMPARE and CAPTURE data can not exceed the number of 800.

P5 - 59■	CACT	COMPARE: Compare Source Setting	Address: 0576H, 0577H

Default: 0x0000 Related Section: Section 8.11.2

Applicable Control Mode: ALL

Unit: N/A

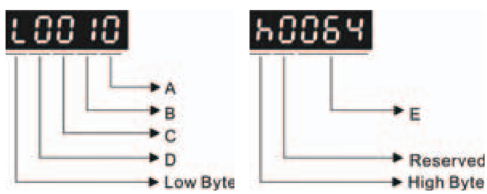
Range: 00010000h ~ 0FFF3137h

Data Size: 32-bit

Display Format: Hexadecimal

Settings:

This parameter is used to determine the compare source and enable the compare function.



A: Compare function settings:

Bit	3	2	1	0
Function	-	After the last position is compared, the system will enable the capture function	Cycle mode	Start compare function
Explanation	-	The capture function is enabled already, and this setting will become ineffective.	The compare operation will not stop.	Setting Bit0 to 1 will enable the compare function. When compare function has finished, the value of Bit0 will be reset to 0 automatically.

Bit0: When the value of P5-58 is higher than 0, setting Bit0 to 1 will enable the compare function. Once the compare function is enabled, everytime when one position is compared, the setting value of P5-58 will decrease 1. When the setting value of P5-58 is equal to 0, it indicates that the compare operation has finished and the value of Bit0 will be reset to 0 automatically.
When the value of P5-58 is equal to 0, setting Bit0 to 1 will not enable the compare function, and then the value of Bit0 will be reset to 0 automatically. If Bit0 is set to 1 already, the new setting value cannot be 1. The users only can set Bit0 to 0 to disable the compare function.
Bit1: When Bit1 is set to 1, after the last position is compared, the setting value of P5-58 will be reset and start the compare operation from the first position again. The compare operation will not stop and the value of Bit0 will be retained as 1.
Bit2: When Bit2 is set to 1, after the last position is compared, the system will enable the capture function (Bit0 of P5-39 is set to 1 and the value of P5-38 is set to the last capture amount). If the capture function is enabled already, this setting will become ineffective.
Bit3: Reserved.
B: Compare source settings
 0: Capture axis.
 1: Reserved. Do not use.
 2: Pulse command.
 3: Motor encoder
C: Activate state settings
 0: Normally open (use N.O. contact)
 1: Normally closed (use N.C. contact)
E: Length of output pulse (unit: 1 msec)

P5 - 60	POV0	Moving Speed Setting of Position 0	Address: 0578H, 0579H

Default: 20.0 Related Section: Section 8.10

Applicable Control Mode: Pr

Unit: 0.1 rpm

Range: 0.1 ~ 6000.0

Data Size: 16-bit

Display Format: Decimal

P5 - 61	POV1	Moving Speed Setting of Position 1	Address: 057AH, 057BH

Default: 50.0 Related Section: Section 8.10

Applicable Control Mode: Pr

Unit: 0.1 rpm

Range: 0.1 ~ 6000.0

Data Size: 16-bit

Display Format: Decimal

P5 - 62	POV2	Moving Speed Setting of Position 2	Address: 057CH, 057DH

Default: 100.0 Related Section: Section 8.10

Applicable Control Mode: Pr

Unit: 0.1 rpm

Range: 0.1 ~ 6000.0

Data Size: 16-bit

Display Format: Decimal

P5 - 63	POV3	Moving Speed Setting of Position 3	Address: 057EH, 057FH

Default: 200.0 Related Section: Section 8.10

Applicable Control Mode: Pr

Unit: 0.1 rpm

Range: 0.1 ~ 6000.0

Data Size: 16-bit

Display Format: Decimal

P5 - 64	POV4	Moving Speed Setting of Position 4	Address: 0580H, 0581H

Default: 300.0 Related Section: Section 8.10

Applicable Control Mode: Pr

Unit: 0.1 rpm

Range: 0.1 ~ 6000.0

Data Size: 16-bit

Display Format: Decimal

P5 - 65	POV5	Moving Speed Setting of Position 5	Address: 0582H, 0583H

Default: 500.0 Related Section: Section 8.10
Applicable Control Mode: Pr
Unit: 0.1 rpm
Range: 0.1 ~ 6000.0
Data Size: 16-bit
Display Format: Decimal

P5 - 66	POV6	Moving Speed Setting of Position 6	Address: 0584H, 0585H

Default: 600.0 Related Section: Section 8.10
Applicable Control Mode: Pr
Unit: 0.1 rpm
Range: 0.1 ~ 6000.0
Data Size: 16-bit
Display Format: Decimal

P5 - 67	POV7	Moving Speed Setting of Position 7	Address: 0586H, 0587H

Default: 800.0 Related Section: Section 8.10
Applicable Control Mode: Pr
Unit: 0.1 rpm
Range: 0.1 ~ 6000.0
Data Size: 16-bit
Display Format: Decimal

P5 - 68	POV8	Moving Speed Setting of Position 8	Address: 0588H, 0589H

Default: 1000.0 Related Section: Section 8.10
Applicable Control Mode: Pr
Unit: 0.1 rpm
Range: 0.1 ~ 6000.0
Data Size: 16-bit
Display Format: Decimal

P5 - 69	POV9	Moving Speed Setting of Position 9	Address: 058AH, 058BH

Default: 1300.0 Related Section: Section 8.10
Applicable Control Mode: Pr
Unit: 0.1 rpm
Range: 0.1 ~ 6000.0
Data Size: 16-bit
Display Format: Decimal

P5 - 70	POV10	Moving Speed Setting of Position 10	Address: 058CH, 058DH

Default: 1500.0 Related Section: Section 8.10
Applicable Control Mode: Pr
Unit: 0.1 rpm
Range: 0.1 ~ 6000.0
Data Size: 16-bit
Display Format: Decimal

P5 - 71	POV11	Moving Speed Setting of Position 11	Address: 058EH, 058FH

Default: 1800.0 Related Section: Section 8.10
Applicable Control Mode: Pr
Unit: 0.1 rpm
Range: 0.1 ~ 6000.0
Data Size: 16-bit
Display Format: Decimal

P5 - 72	POV12	Moving Speed Setting of Position 12	Address: 0590H, 0591H

Default: 2000.0 Related Section: Section 8.10
Applicable Control Mode: Pr
Unit: 0.1 rpm
Range: 0.1 ~ 6000.0
Data Size: 16-bit
Display Format: Decimal

P5 - 73	POV13	Moving Speed Setting of Position 13	Address: 0592H, 0593H

Default: 2300.0 Related Section: Section 8.10
Applicable Control Mode: Pr
Unit: 0.1 rpm
Range: 0.1 ~ 6000.0
Data Size: 16-bit
Display Format: Decimal

P5 - 74	POV14	Moving Speed Setting of Position 14	Address: 0594H, 0595H

Default: 2500.0 Related Section: Section 8.10
Applicable Control Mode: Pr
Unit: 0.1 rpm
Range: 0.1 ~ 6000.0
Data Size: 16-bit
Display Format: Decimal

P5 - 75	POV15	Moving Speed Setting of Position 15	Address: 0596H, 0597H

Default: 3000.0 Related Section: Section 8.10

Applicable Control Mode: Pr

Unit: 0.1 rpm

Range: 0.1 ~ 6000.0

Data Size: 16-bit

Display Format: Decimal

P5 - 76★	CPRS	Capture 1st Position Reset Data	Address: 0598H, 0599H

Default: 0 Related Section: Section 8.10

Applicable Control Mode: ALL

Unit: N/A

Range: -1073741824 ~ +1073741823

Data Size: 32-bit

Display Format: Decimal

Settings:

Refer to P5-39 for explanation.

Group 6: P6-xx Pr Path Definition Parameters

P6 - 00	ODEF	Homing Definition	Address: 0600H, 0601H

Default: 0x00000000 Related Section: Section 8.10

Applicable Control Mode: Pr

Unit: N/A

Range: 0x00000000~0x10FFFF08

Data Size: 32-bit

Display Format: Hexadecimal

Settings:

Homing definition:

Bit	31 ~ 28	27 ~ 24	23 ~ 20	19 ~ 16	15 ~ 12	11 ~ 8	7 ~ 4	3 ~ 0
Function	BOOT	-	DLY	DEC2	DEC1	ACC	PATH	

PATH: Path style (4 bits)

0: Stop mode. Motor stops after homing is completed.

1~8: Auto mode. Motor goes the dedicated path after homing is completed.

ACC: Acceleration time 0 ~ F, corresponds to P5-20 ~ P5-35.

DEC1 / DEC2: 1st deceleration time / 2nd deceleration time. Deceleration time 0 ~ F, corresponds to P5-20 ~ P5-35.

DLY: Delay time 0 ~ F, corresponds to P5-40 ~ P5-55.

BOOT: Boot mode. Disable or enable homing function when the servo drive is applied to power (power on).

0: Disable homing function

1: Enable homing function (when the servo drive is applied to power, first time Servo On)

Other parameters relevant to homing function:

P5-04 (Homing mode)

P5-05 (1st Speed Setting of High Speed Homing)

P5-06 (2nd Speed Setting of Low Speed Homing)

P6-01: ORG_DEF (Homing definition value). P6-01 is used to set the coordinate value of the current home position for the movement of the coordinate system. The coordinate value could be a non-zero value.

After detecting "Home" (home sensor or Z pulse), the motor will decelerate to stop the operation.

If the motor does not return to "Home", just set path number to 0.

If the motor must return to "Home", set path number to a non-zero value and set the route PABS = ORG_DEF.

When detecting "Home" (home sensor or Z pulse), if the motor has to go forward for a while (offset value S) and reach the position P, set the path number to a non-zero value and set ORG_DEF = P - S (the absolute position command of this route is P).

P6 - 01	ODAT	Homing Definition Value	Address: 0602H, 0603H

Default: 0 Related Section: Section 8.10

Applicable Control Mode: Pr
Unit: N/A
Range: -2147483648 ~ +2147483647
Data Size: 32-bit
Display Format: Decimal
Settings:
Homing definition value:

Bit	31 ~ 28	27 ~ 24	23 ~ 20	19 ~ 16	15 ~ 12	11 ~ 8	7 ~ 4	3 ~ 0
Function	ORG_DEF (32-bit)							

ORG_DEF: Homing definition value which is determined by the parameter P6-01. The homing definition value does not necessarily have to be 0.

P6 - 02	PDEF1	Definition of Path 1	Address: 0604H, 0605H

Default: 0x00000000 Related Section: Section 8.10

Applicable Control Mode: N/A
Unit: N/A
Range: 0x00000000 ~ 0xFFFFFFFF
Data Size: 32-bit
Display Format: Decimal
Settings:

Bit	31 ~ 28	27 ~ 24	23 ~ 20	19 ~ 16	15 ~ 12	11 ~ 8	7 ~ 4	3 ~ 0
P6-02	-	-	DLY	-	-	-	OPT	
P6-03	DATA (32-bit)							

OPT:

OPT			
Bit7	Bit6	Bit5	Bit4
CMD		-	INS

INS: Interrupt the previous path.
CMD: Refer to Section 7.10 in Chapter 7.
DLY: 0 ~ F. Delay time number (4 bits). The digital output of this path activates after the delay time. External INS is not effective. The delay time number settings correspond with the parameter P5-40 ~ P5-55.

DLY (4)	Index P5-40 ~ P5-55

P6 - 03	PDAT1	Data of Path 1	Address: 0606H, 0607H

Default: 0 Related Section: Section 8.10

Applicable Control Mode: Pr
Unit: N/A
Range: -2147483648 ~ +2147483647
Data Size: 32-bit
Display Format: Decimal
Settings:
Data of path 1:

Bit	31 ~ 28	27 ~ 24	23 ~ 20	19 ~ 16	15 ~ 12	11 ~ 8	7 ~ 4	3 ~ 0
Function	DATA (32-bit)							

The parameter P6-02 is used to determine the attributes of definition of Path 1 and parameter P6-03 is used to set the data (target position or jump path number) corresponding to P6-02.

P6 - 04	PDEF2	Definition of Path 2	Address: 0608H, 0609H

Default: 0x00000000 Related Section: Section 8.10

Applicable Control Mode: Pr
Unit: N/A
Range: 0x00000000 ~ 0xFFFFFFFF
Data Size: 32-bit
Display Format: Decimal
Settings:
Refer to P6-02 for explanation.

P6 - 05	PDAT2	Data of Path 2	Address: 060AH, 060BH

Default: 0 Related Section: Section 8.10

Applicable Control Mode: Pr
Unit: N/A
Range: -2147483648 ~ +2147483647
Data Size: 32-bit
Display Format: Decimal
Settings:
Refer to P6-03 for explanation.

P6 - 06	PDEF3	Definition of Path 3	Address: 060CH, 060DH

Default: 0x00000000 — Related Section: Section 8.10

Applicable Control Mode: Pr

Unit: N/A

Range: 0x00000000 ~ 0xFFFFFFFF

Data Size: 32-bit

Display Format: Decimal

Settings:

Refer to P6-02 for explanation.

P6 - 07	PDAT3	Data of Path 3	Address: 060EH, 060FH

Default: 0 — Related Section: Section 8.10

Applicable Control Mode: Pr

Unit: N/A

Range: -2147483648 ~ +2147483647

Data Size: 32-bit

Display Format: Decimal

Settings:

Refer to P6-03 for explanation.

P6 - 08	PDEF4	Definition of Path 4	Address: 0610H, 0611H

Default: 0x00000000 — Related Section: Section 8.10

Applicable Control Mode: Pr

Unit: N/A

Range: 0x00000000 ~ 0xFFFFFFFF

Data Size: 32-bit

Display Format: Decimal

Settings:

Refer to P6-02 for explanation.

P6 - 09	PDAT4	Data of Path 4	Address: 0612H, 0613H

Default: 0 — Related Section: Section 8.10

Applicable Control Mode: Pr

Unit: N/A

Range: -2147483648 ~ +2147483647

Data Size: 32-bit

Display Format: Decimal

Settings:

Refer to P6-03 for explanation.

P6 - 10	PDEF5	Definition of Path 5	Address: 0614H, 0615H

Default: 0x00000000 Related Section: Section 8.10
Applicable Control Mode: Pr
Unit: N/A
Range: 0x00000000 ~ 0xFFFFFFFF
Data Size: 32-bit
Display Format: Decimal
Settings:
Refer to P6-02 for explanation.

P6 - 11	PDAT5	Data of Path 5	Address: 0616H, 0617H

Default: 0 Related Section: Section 8.10
Applicable Control Mode: Pr
Unit: N/A
Range: -2147483648 ~ +2147483647
Data Size: 32-bit
Display Format: Decimal
Settings:
Refer to P6-03 for explanation.

P6 - 12	PDEF6	Definition of Path 6	Address: 0618H, 0619H

Default: 0x00000000 Related Section: Section 8.10
Applicable Control Mode: Pr
Unit: N/A
Range: 0x00000000 ~ 0xFFFFFFFF
Data Size: 32-bit
Display Format: Decimal
Settings:
Refer to P6-02 for explanation.

P6 - 13	PDAT6	Data of Path 6	Address: 061AH, 061BH

Default: 0 Related Section: Section 8.10
Applicable Control Mode: Pr
Unit: N/A
Range: -2147483648 ~ +2147483647
Data Size: 32-bit
Display Format: Decimal
Settings:
Refer to P6-03 for explanation.

P6 - 14	PDEF7	Definition of Path 7	Address: 061CH, 061DH

Default: 0x00000000 Related Section: Section 8.10
Applicable Control Mode: Pr
Unit: N/A
Range: 0x00000000 ~ 0xFFFFFFFF
Data Size: 32-bit
Display Format: Decimal
Settings:
Refer to P6-02 for explanation.

P6 - 15	PDAT7	Data of Path 7	Address: 061EH, 061FH

Default: 0 Related Section: Section 8.10
Applicable Control Mode: Pr
Unit: N/A
Range: -2147483648 ~ +2147483647
Data Size: 32-bit
Display Format: Decimal
Settings:
Refer to P6-03 for explanation.

P6 - 16	PDEF8	Definition of Path 8	Address: 0620H, 0621H

Default: 0x00000000 Related Section: Section 8.10
Applicable Control Mode: Pr
Unit: N/A
Range: 0x00000000 ~ 0xFFFFFFFF
Data Size: 32-bit
Display Format: Decimal
Settings:
Refer to P6-02 for explanation.

P6 - 17	PDAT8	Data of Path 8	Address: 0622H, 0623H

Default: 0 Related Section: Section 8.10
Applicable Control Mode: Pr
Unit: N/A
Range: -2147483648 ~ +2147483647
Data Size: 32-bit
Display Format: Decimal
Settings:
Refer to P6-03 for explanation.

Table 11.A Input Function Definition

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 modes except CAN

Setting value: 0x02

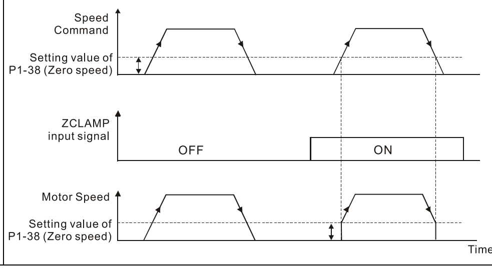
DI Name	DI Function Description	Trigger Method	Control Mode
ARST	A number of Faults (Alarms) can be cleared by activating ARST. Please see table 10-3 for applicable faults that can be cleared with the ARST command. However, please investigate Fault or Alarm if it does not clear or the fault description 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, Pr, 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

Setting value: 0x06			
DI Name	DI Function Description	Trigger Method	Control Mode
CMDINV	Command input reverse control. When the drive is in the 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: 0x08			
DI Name	DI Function Description	Trigger Method	Control Mode
CTRG	Command triggered (available in Pr mode only). When the drive is in Pr mode and CTRG is activated, the drive will command the motor to move the stored position which correspond the POS 0 ~ POS 5 settings. Activation is triggered on the rising edge of the pulse.	Rising-edge Triggered	Pr

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, Pr, 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

Setting value: 0x11, 0x12, 0x13			
DI Name	DI Function Description	Trigger Method	Control Mode
POS0 POS1 POS2	Position command selection POS0 ~ POS2 (8 positions) When the Pr Control Mode is selected, the 8 stored positions are programmed via a combination of the POS 0 ~ POS2 commands.	Level Triggered	Pr

<table>
<tr><th>DI Name</th><th>DI Function Description</th><th>Trigger Method</th><th>Control Mode</th></tr>
<tr><td>POS0
POS1
POS2</td><td>
<table>
<tr><th>Position Command</th><th>POS2</th><th>POS1</th><th>POS0</th><th>CTRG</th><th>Parameters</th></tr>
<tr><td rowspan="2">P1</td><td rowspan="2">0</td><td rowspan="2">0</td><td rowspan="2">0</td><td rowspan="2">↑</td><td>P6-02</td></tr>
<tr><td>P6-03</td></tr>
<tr><td rowspan="2">P2</td><td rowspan="2">0</td><td rowspan="2">0</td><td rowspan="2">1</td><td rowspan="2">↑</td><td>P6-04</td></tr>
<tr><td>P6-05</td></tr>
<tr><td rowspan="2">P3</td><td rowspan="2">0</td><td rowspan="2">1</td><td rowspan="2">0</td><td rowspan="2">↑</td><td>P6-06</td></tr>
<tr><td>P6-07</td></tr>
<tr><td rowspan="2">P4</td><td rowspan="2">0</td><td rowspan="2">1</td><td rowspan="2">1</td><td rowspan="2">↑</td><td>P6-08</td></tr>
<tr><td>P6-09</td></tr>
<tr><td rowspan="2">P5</td><td rowspan="2">1</td><td rowspan="2">0</td><td rowspan="2">0</td><td rowspan="2">↑</td><td>P6-10</td></tr>
<tr><td>P6-11</td></tr>
<tr><td rowspan="2">P6</td><td rowspan="2">1</td><td rowspan="2">0</td><td rowspan="2">1</td><td rowspan="2">↑</td><td>P6-12</td></tr>
<tr><td>P6-13</td></tr>
<tr><td rowspan="2">P7</td><td rowspan="2">1</td><td rowspan="2">1</td><td rowspan="2">0</td><td rowspan="2">↑</td><td>P6-14</td></tr>
<tr><td>P6-15</td></tr>
<tr><td rowspan="2">P8</td><td rowspan="2">1</td><td rowspan="2">1</td><td rowspan="2">1</td><td rowspan="2">↑</td><td>P6-16</td></tr>
<tr><td>P6-17</td></tr>
</table>
</td><td>Level Triggered</td><td>Pr</td></tr>
</table>

Setting value: 0x46

DI Name	DI Function Description	Trigger Method	Control Mode
STOP	Motor stop.	Rising-edge Triggered	Pr

Setting value: 0x14 ~ 0x15

<table>
<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 rpm</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>

Setting value: 0x16 ~ 0x17

<table>
<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 colspan="3" rowspan="2">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 colspan="3" rowspan="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>

Setting value: 0x18

DI Name	DI Function Description	Trigger Method	Control Mode
S-P	Speed / Position mode switching. OFF: Speed mode, ON: Position mode	Level Triggered	P, S

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: 0x2B

DI Name	DI Function Description	Trigger Method	Control Mode
Pt-Pr	Internal position (Pr) and external pulse (Pt) mode switching. OFF: Pt, ON: Pr	Level Triggered	Pt, Pr

Setting value: 0x21			
DI Name	DI Function Description	Trigger Method	Control Mode
OPST	Operational 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: 0x24			
DI Name	DI Function Description	Trigger Method	Control Mode
ORGP	Reference "Home" sensor. When ORGP is activated, the drive will command the motor to start to search the reference "Home" sensor. [see P5-04]	Rising-edge/ Falling-edge Triggered	Pr

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, Pr, 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, Pr, S

Setting value: 0x27

DI Name	DI Function Description	Trigger Method	Control Mode
SHOM	Move to "Home". When SHOM is activated, the drive will command the motor to move to "Home". [see P5-04]	Rising-edge Triggered	Pr

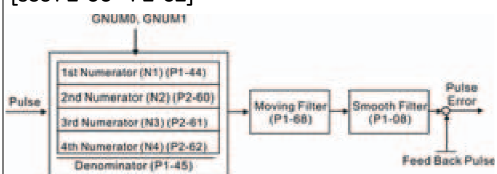
Setting value: 0x37

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 modes except CAN

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 modes except CAN

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]  	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. (Please use DI8 for INHP signal to ensure the real-time operation of INHP function.)	Level Triggered	Pt

Notes:
1)11 ~ 17: Single control mode, 18 ~ 20: Dual control mode
2)When P2-10 to P2-17 is set to 0, it indicates input function is disabled.

Table 11.B Output Function Definition

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 rpm, ZSPD will remain activated until the motor speed increases above 10 rpm.	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	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. 2.When the drive is in Pr mode, TPOS will be activated when the drive detects that the position of the motor is in a -P1-54 to +P1-54 band of the target position.	Level Triggered	Pt, Pr

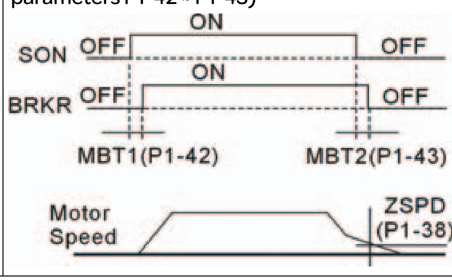
Setting value: 0x06

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) 	Level Triggered	All

Setting value: 0x09			
DO Name	DO Function Description	Trigger Method	Control Mode
HOME	Homing completed. HOME is activated when the servo drive has detected that the "HOME" sensor (ORGP, digital input 0x24) has been detected. When power to the servo drive at the first time, this DO signal is OFF. After homing operation is completed, thi DO signal will be ON and continue being ON when the motor is running. It becomes OFF until the sytem detect that a position overflow occurs. When using Pr command to trigger homing command, this DI signal will be OFF immediately. After homeing operation is completed, it becomes ON again.	Level Triggered	Pr

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	Pr

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, Operational stop, Serial communication error, and Undervoltage these fault conditions.	Level Triggered	All

Setting value: 0x12			
DO Name	**DO Function Description**	**Trigger Method**	**Control Mode**
OVF	Position command overflow. OVF is activated when the servo drive has detected that a position command overflows.	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: 0x15			
DO Name	**DO Function Description**	**Trigger Method**	**Control Mode**
CMD_OK	Internal position command completed output. CMD_OK is activated when the servo drive has detected that the internal position command has been completed. When excuting Pr command, this DI signal is OFF. After the execution of Pr command is completed, this DI signal is ON. The output is used to indicate the internal position command has been completed and it does not indicate that the motor positioning is completed. For the signal of motor positioning completed, please refer to DO signal, TPOS.	Level Triggered	Pr

Setting value: 0x16			
DO Name	DO Function Description	Trigger Method	Control Mode
CAP_OK	Capture operation completed output. CAP_OK is activated when the servo drive has detected that capture operation has been completed.	Level Triggered	Pr

Setting value: 0x17			
DO Name	DO Function Description	Trigger Method	Control Mode
MC_OK	Motion control completed output. MC_OK is activated when CMD_OK and TPOS are both ON. It indicates MC_OK is activated only when the servo drive has detected that the position command has been given and the positioning has been completed also. If only CMD_OK or TPOS is ON, MC_OK will not be activated.	Level Triggered	Pr

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

Setting value: 0x30			
DO Name	DO Function Description	Trigger Method	Control Mode
SDO_0	Output the status of bit00 of P4-06.	Level Triggered	All

Setting value: 0x31			
DO Name	DO Function Description	Trigger Method	Control Mode
SDO_1	Output the status of bit01 of P4-06.	Level Triggered	All

Setting value: 0x32			
DO Name	DO Function Description	Trigger Method	Control Mode
SDO_2	Output the status of bit02 of P4-06.	Level Triggered	All

Setting value: 0x33			
DO Name	DO Function Description	Trigger Method	Control Mode
SDO_3	Output the status of bit03 of P4-06.	Level Triggered	All

Setting value: 0x34			
DO Name	DO Function Description	Trigger Method	Control Mode
SDO_4	Output the status of bit04 of P4-06.	Level Triggered	All

Setting value: 0x35			
DO Name	DO Function Description	Trigger Method	Control Mode
SDO_5	Output the status of bit05 of P4-06.	Level Triggered	All

Setting value: 0x36			
DO Name	DO Function Description	Trigger Method	Control Mode
SDO_6	Output the status of bit06 of P4-06.	Level Triggered	All

Setting value: 0x37			
DO Name	DO Function Description	Trigger Method	Control Mode
SDO_7	Output the status of bit07 of P4-06.	Level Triggered	All

Setting value: 0x38			
DO Name	DO Function Description	Trigger Method	Control Mode
SDO_8	Output the status of bit08 of P4-06.	Level Triggered	All

Setting value: 0x39			
DO Name	DO Function Description	Trigger Method	Control Mode
SDO_9	Output the status of bit09 of P4-06.	Level Triggered	All

Setting value: 0x3A			
DO Name	DO Function Description	Trigger Method	Control Mode
SDO_A	Output the status of bit10 of P4-06.	Level Triggered	All

Setting value: 0x3B			
DO Name	DO Function Description	Trigger Method	Control Mode
SDO_B	Output the status of bit11 of P4-06.	Level Triggered	All

Setting value: 0x3C			
DO Name	DO Function Description	Trigger Method	Control Mode
SDO_C	Output the status of bit12 of P4-06.	Level Triggered	All

Setting value: 0x3D			
DO Name	DO Function Description	Trigger Method	Control Mode
SDO_D	Output the status of bit13 of P4-06.	Level Triggered	All

Setting value: 0x3E			
DO Name	DO Function Description	Trigger Method	Control Mode
SDO_E	Output the status of bit14 of P4-06.	Level Triggered	All

Setting value: 0x3F			
DO Name	DO Function Description	Trigger Method	Control Mode
SDO_F	Output the status of bit15 of P4-06.	Level Triggered	All

Notes:
1)When P2-18 to P2-22 is set to 0, it indicates output function is disabled.

Accessories and spare parts

12

At a Glance

What's in this Chapter?

This chapter contains the following topics:

Connector and cable

Connector

Name	Description	Reference
Replacement connector set	Power connector set,drive side (power supply, motor, CN5)	**VW3M4121**
I/O connector	I/O connector of CN1 interface	**VW3M4112**
I/O terminal block module	Terminal block module,with 0.5 m cable	**VW3M4113**
Interface adapter	USB to RJ45(RS232) converter for CN3 interface	**VW3M8131**

Cable

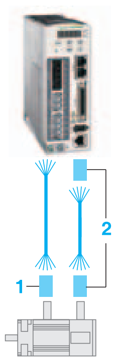
Name	Description	Length m	Reference
standard network cable	RJ45 connector on both ends	2	**490NTW00002**

This cable can be used with the converter VW3M8131 to connect it with CN3 interface.

Connection accessory

Connector for power cable

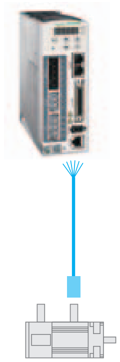
Description	For	Item no.	Reference
For motor with flying cable,no brake	BCH0401O●2A1C BCH0601O●2A1C BCH0602O●2A1C BCH0801O●2A1C BCH0802O●2A1C	1	**VW3M5111**
For motor with flying cable,with brake	BCH0601O●2F1C BCH0602O●2F1C BCH0801O●2F1C BCH0802O●2F1C	1	**VW3M5112**
Military connector	BCH1001O●2●1C BCH1301M●2●1C BCH1301N●2●1C BCH1302M●2●1C BCH1302N●2●1C BCH1303M●2●1C BCH1303N●2●1C BCH1002O●2●1C BCH1304N●2●1C	1	**VW3M5121**
Military connector	BCH1801N●2●1C BCH1802N●2●1C BCH1802M●2●1C BCH1803N●2●1C BCH1803M●2●1C	1	**VW3M5131**
Military connector	BCH1804M●2●1C BCH1805M●2●1C	1	**VW3M5141**
Brake connector	BCH1804M●2F1C BCH1805M●2F1C	1	**VW3M7151**



Connection accessory (continue)

Connector for encoder cable

Description	For	Item no.	Reference
For motor with flying cable	BCH0401O●2●1C BCH0601O●2●1C BCH0602O●2●1C BCH0801O●2●1C BCH0802O●2●1C	2	**VW3M8121**
For motor with military connector	BCH1001O●2●1C BCH1301M●2●1C BCH1301N●2●1C BCH1302M●2●1C BCH1302N●2●1C BCH1303M●2●1C BCH1303N●2●1C BCH1002O●2●1C BCH1304N●2●1C BCH1801N●2●1C BCH1802N●2●1C BCH1802M●2●1C BCH1803N●2●1C BCH1803M●2●1C BCH1804M●2●1C BCH1805M●2●1C	2	**VW3M8122**



VW3M5 111/121/131
112/122/132/133/124 R●●●

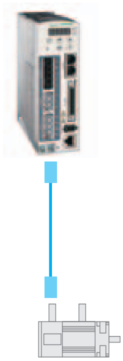
Connection accessory (continue)

Power cable

Description	From servo motor	To servo drive	Composition	Length m	Reference
Servo motor side with plastic connector Drive side with flying lead,no brake	BCH0401O●2A1C	LXM23●U01M3X	4 X0.82 mm^2	3	**VW3M5111R30**
	BCH0601O●2A1C	LXM23●U02M3X		5	**VW3M5111R50**
	BCH0602O●2A1C	LXM23●U04M3X			
	BCH0801O●2A1C	LXM23●U04M3X			
	BCH0802O●2A1C	LXM23●U07M3X			
Servo motor side with plastic connector Drive side with flying lead,with brake	BCH0401O●2F1C	LXM23●U01M3X	6 x 0.82 mm^2	3	**VW3M5112R30**
	BCH0601O●2F1C	LXM23●U02M3X		5	**VW3M5112R50**
	BCH0602O●2F1C	LXM23●U04M3X			
	BCH0801O●2F1C	LXM23●U04M3X			
	BCH0802O●2F1C	LXM23●U07M3X			
Servo motor side with military connector Drive side with flying lead,no brake	BCH1001O●2A1C	LXM23●U10M3X	4 x 1.3 mm^2	3	**VW3M5121R30**
	BCH1301M●2A1C	LXM23●U04M3X		5	**VW3M5121R50**
	BCH1301N●2A1C	LXM23●U04M3X			
	BCH1302M●2A1C	LXM23●U07M3X			
	BCH1302N●2A1C	LXM23●U10M3X			
	BCH1303M●2A1C	LXM23●U10M3X			
	BCH1303N●2A1C	LXM23●U15M3X			
Servo motor side with military connector Drive side with flying lead,with brake	BCH1001O●2F1C	LXM23●U10M3X	6 x 1.3 mm^2	3	**VW3M5131R30**
	BCH1301M●2F1C	LXM23●U04M3X		5	**VW3M5131R50**
	BCH1301N●2F1C	LXM23●U04M3X			
	BCH1302M●2F1C	LXM23●U07M3X			
	BCH1302N●2F1C	LXM23●U10M3X			
	BCH1303M●2F1C	LXM23●U10M3X			
	BCH1303N●2F1C	LXM23●U15M3X			
Servo motor side with military connector Drive side with flying lead,no brake	BCH1002O●2A1C	LXM23●U20M3X	4 x 2.1 mm^2	3	**VW3M5122R30**
	BCH1304N●2A1C	LXM23●U20M3X		5	**VW3M5122R50**
Servo motor side with military connector Drive side with flying lead,with brake	BCH1002O●2F1C	LXM23●U20M3X	6 x 2.1 mm^2	3	**VW3M5132R30**
	BCH1304N●2F1C	LXM23●U20M3X		5	**VW3M5132R50**
Servo motor side with military connector Drive side with flying lead,no brake	BCH1801N●2A1C	LXM23●U20M3X	4 x 3.3 mm^2	3	**VW3M5123R30**
	BCH1802N●2A1C	LXM23●U30M3X		5	**VW3M5123R50**
	BCH1802M●2A1C	LXM23●U30M3X			
	BCH1803N●2A1C	LXM23●U45M3X			
Servo motor side with military connector Drive side with flying lead,with brake	BCH1801N●2F1C	LXM23●U20M3X	6 x 3.3 mm^2	3	**VW3M5133R30**
	BCH1802N●2F1C	LXM23●U30M3X		5	**VW3M5133R50**
	BCH1802M●2F1C	LXM23●U30M3X			
	BCH1803N●2F1C	LXM23●U45M3X			
Servo motor side with military connector Drive side with flying lead,no brake	BCH1803M●2A1C	LXM23●U45M3X	4 x 8.4 mm^2	3	**VW3M5124R30**
				5	**VW3M5124R50**
Servo motor side with military connector Drive side with flying lead,with brake	BCH1803M●2F1C	LXM23●U45M3X	6x 8.4 mm^2	3	**VW3M5134R30**
				5	**VW3M5134R50**

Connection accessory (continue)

Encoder cable



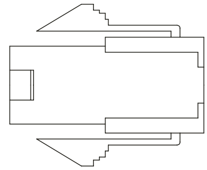
VW3M8 121/122/123/ 124 R●●●

Description	From servo motor	To servo drive	Composition	Length	Reference
				m	
Servo motor side and drive side with plastic connector	BCH0401O●2●1C	LXM23●U01M3X	10X0.13 mm^2	3	**VW3M8121R30** (1)
	BCH0601O●2●1C	LXM23●U02M3X		5	**VW3M8121R50** (1)
	BCH0602O●2●1C	LXM23●U04M3X		3	**VW3M8123R30** (2)
	BCH0801O●2●1C	LXM23●U04M3X			
	BCH0802O●2●1C	LXM23●U07M3X		5	**VW3M8123R50** (2)
Servo motor side with military connector Drive side with plastic connector	BCH1001O●2●1C	LXM23●U10M3X	10x0.13 mm^2		
	BCH1301M●2●1C	LXM23●U04M3X			
	BCH1301N●2●1C	LXM23●U04M3X			
	BCH1302M●2●1C	LXM23●U07M3X			
	BCH1302N●2●1C	LXM23●U10M3X			
	BCH1303M●2●1C	LXM23●U10M3X		3	**VW3M8122R30** (1)
	BCH1303N●2●1C	LXM23●U15M3X		5	**VW3M8122R50** (1)
	BCH1002O●2●1C	LXM23●U20M3X			
	BCH1304N●2●1C	LXM23●U20M3X			
	BCH1801N●2●1C	LXM23●U20M3X		3	**VW3M8124R30** (2)
	BCH1802N●2●1C	LXM23●U30M3X		5	**VW3M8124R50** (2)
	BCH1802M●2●1C	LXM23●U30M3X			
	BCH1803N●2●1C	LXM23●U45M3X			
	BCH1803M●2●1C	LXM23●U45M3X			
	BCH1804M●2●1C	LXM23●U55M3X			
	BCH1805M●2●1C	LXM23●U75M3X			

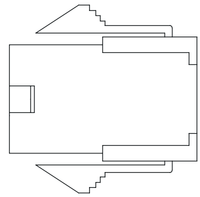
(1) without battery box
(2) with battery box, using for absolute position control

Power Connectors

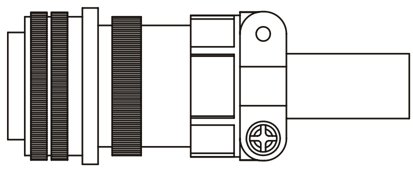
Connectors for power cables, motors without brake: VW3M5111



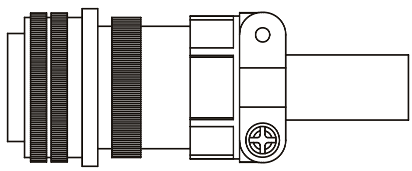
Connectors for power cables, motors with brake: VW3M5112



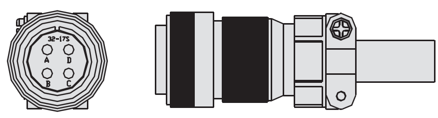
Military connector for power cables, motors without brake: VW3M5121



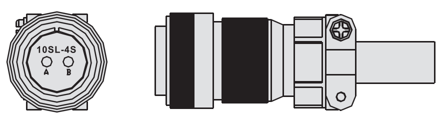
Military connector for power cables, motors with brake: VW3M5131



Military type power connector no brake: VW3M5141
(for BCH motors 5.5kW and 7.5KW)

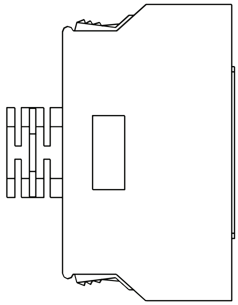


Motor brake connector :VW3M7151
(for BCH motors 5.5kW and 7.5KW)



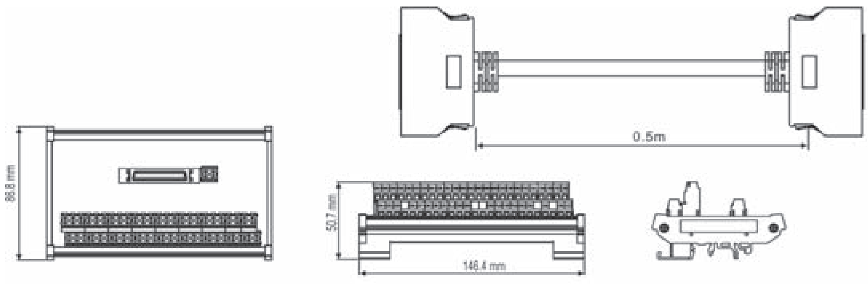
I/O Signal Connector (CN1)

Commercial reference: VW3M4112



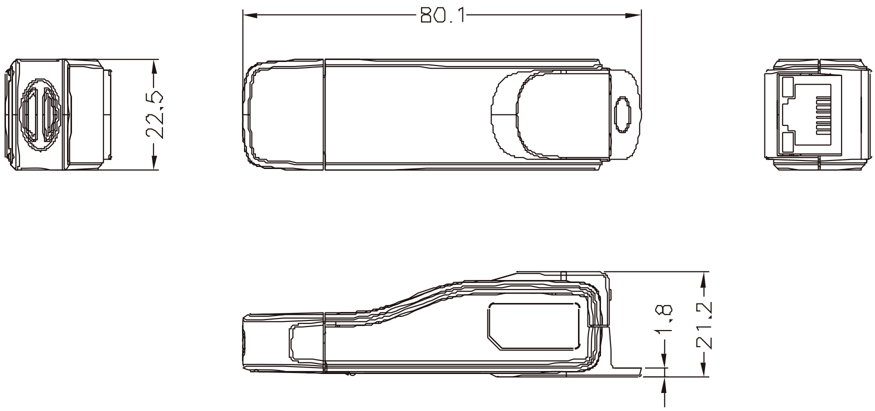
I/O Terminal Block Module

Commercial reference: VW3M4113



USB to RJ45 connector for CN3 interface

Commercial reference: VW3M8131



Other Accessories

Other Accessories (for Lexium23 Plus series, all models)	
Description	**Commercial reference**
50Pin I/O signal connector (CN1)	VW3M4112
I/O Terminal Block Module with 0.5m cable	VW3M4113
USB to RJ45 (RS-232) connector for CN3	VW3M8131
Communication Cable between Drive and Computer (RJ45 plugs)	490NTW00002
Regenerative Resistor 400W 40Ω	VW3M7111
Regenerative Resistor 1kW 20Ω	VW3M7112
Bag of power connectors (plugs for power supply, motor, CN5)	VW3M4121

CANopen cable with connectors

Description	Order no.
CANopen cable, 0.3 m, 2 x RJ45	VW3CANCARR03
CANopen cable, 1 m, 2 x RJ45	VW3CANCARR1
2 m, 2 x RJ45, shielded twisted pair cable	490NTW00002
5 m, 2 x RJ45, shielded twisted pair cable	490NTW00005
12 m, 2 x RJ45, shielded twisted pair cable	490NTW00012
2 m, 2 x RJ45, shielded twisted pair cable with UL and CSA 22.1 certification	490NTW00002U
5 m, 2 x RJ45, shielded twisted pair cable with UL and CSA 22.1 certification	490NTW00005U
12 m, 2 x RJ45, shielded twisted pair cable with UL and CSA 22.1 certification	490NTW00012U
CANopen cable, 1 m, D9-SUB (female) to RJ45	TCSCCN4F3M1T
CANopen cable, 1 m, D9-SUB (female) with integrated terminating resistor to RJ45	VW3M3805R010
CANopen cable, 3 m, D9-SUB (female) with integrated terminating resistor to RJ45	VW3M3805R030
CANopen cable, 0.3 m, 2 x D9-SUB (female), LSZH standard cable (low-smoke, zero halogen, flame-retardant, tested as per IEC 60332-1)	TSXCANCADD03
CANopen cable, 1 m, 2 x D9-SUB (female), LSZH standard cable (low-smoke, zero halogen, flame-retardant, tested as per IEC 60332-1)	TSXCANCADD1

Description	Order no.
CANopen cable, 3 m, 2 x D9-SUB (female), LSZH standard cable (low-smoke, zero halogen, flame-retardant, tested as per IEC 60332-1)	TSXCANCADD3
CANopen cable, 5 m, 2 x D9-SUB (female), LSZH standard cable (low-smoke, zero halogen, flame-retardant, tested as per IEC 60332-1)	TSXCANCADD5
CANopen cable, 0.3 m, 2 x D9-SUB (female), flame-retardant, tested as per IEC 60332-2, UL certification	TSXCANCBDD03
CANopen cable, 1 m, 2 x D9-SUB (female), flame-retardant, tested as per IEC 60332-2, UL certification	TSXCANCBDD1
CANopen cable, 3 m, 2 x D9-SUB (female), flame-retardant, tested as per IEC 60332-2, UL certification	TSXCANCBDD3
CANopen cable, 5 m, 2 x D9-SUB (female), flame-retardant, tested as per IEC 60332-2, UL certification	TSXCANCBDD5

CANopen connectors, distributors, terminating resistors

Description	Order no.
CANopen terminating resistor, 120 Ohm, integrated in RJ45 connector	TCSCAR013M120
CANopen connector with PC interface, D9-SUB (female), with switchable terminating resistor and additional D9-SUB (male) to connect a PC to the bus, PC interface straight, bus cable angled 90°	TSXCANKCDF90TP
CANopen connector, D9-SUB (female), with switchable terminating resistor, angled 90°	TSXCANKCDF90T
CANopen connector, D9-SUB (female), with switchable terminating resistor, straight	TSXCANKCDF180T
Four-port tap, for connection of 4 drop lines to trunk line, 4 x D9-SUB (male) with switchable ter-minating resistor	TSXCANTDM4
Two-port tap for connection of 2 drop lines to trunk line, with additional commissioning interface, 3 x RJ45 (female), with switchable terminating resistor	VW3CANTAP2

CANopen cables

Cables with open cable ends are suitable for connection of D-SUB con-nectors. Observe the cable cross section and the connection cross sec-tion of the required connector.

Description	Order no.
CANopen cable, 50 m, [(2 x AWG 22) + (2 x AWG 24)], LSZH standard cable (low-smoke, zero halogen, flame-retardant, tested as per IEC 60332-1), both cable ends open	TSXCANCA50
CANopen cable, 100 m, [(2 x AWG 22) + (2 x AWG 24)], LSZH standard cable (low-smoke, zero halogen, flame-retardant, tested as per IEC 60332-1), both cable ends open	TSXCANCA100
CANopen cable, 300 m, [(2 x AWG 22) + (2 x AWG 24)], LSZH standard cable (low-smoke, zero halogen, flame-retardant, tested as per IEC 60332-1), both cable ends open	TSXCANCA300
CANopen cable, 50 m, [(2 x AWG 22) + (2 x AWG 24)], flame-retardant, tested as per IEC 60332-2, UL certification, both cable ends open	TSXCANCB50
CANopen cable, 100 m, [(2 x AWG 22) + (2 x AWG 24)], flame-retardant, tested as per IEC 60332-2, UL certification, both cable ends open	TSXCANCB100
CANopen cable, 300 m, [(2 x AWG 22) + (2 x AWG 24)], flame-retardant, tested as per IEC 60332-2, UL certification, both cable ends open	TSXCANCB300
CANopen cable, 50 m, [(2 x AWG 22) + (2 x AWG 24)], flexible LSZH HD standard cable (low-smoke, zero halogen, flame-retardant, tested as per IEC 60332-1), for heavy-duty or flexible installation, oil-resistant, both cable ends open	TSXCANCD50
CANopen cable, 100 m, [(2 x AWG 22) + (2 x AWG 24)], flexible LSZH HD standard cable (low-smoke, zero halogen, flame-retardant, tested as per IEC 60332-1), for heavy-duty or flexible installation, oil-resistant, both cable ends open	TSXCANCD100
CANopen cable, 300 m, [(2 x AWG 22) + (2 x AWG 24)], flexible LSZH HD standard cable (low-smoke, zero halogen, flame-retardant, tested as per IEC 60332-1), for heavy-duty or flexible installation, oil-resistant, both cable ends open	TSXCANCD300

Service, maintenance and disposal

13

At a Glance

The product may only be repaired by a Schneider Electric customer service center. No warranty or liability is accepted for repairs made by unauthorized persons.

What's in this Chapter?

This chapter contains the following topics:

13.1 Service address

If you cannot resolve an error yourself please contact your sales office.
Have the following details available:

- Nameplate (type, identification number, serial number, DOM, ...)
- Type of error (such as LED flash code or error number)
- Previous and concomitant circumstances
- Your own assumptions concerning the cause of the error

Also include this information if you return the product for inspection or repair.

If you have any questions please contact your sales office.
Your sales office staff will be happy to give you the name of a customer service office in your area.

http://www.schneider-electric.com

13.2 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 during operation (Control power is 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 machines 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 10 of the user manual). 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 Schneider Electric. ● 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 Lexium 23 Plus.

13.3 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.

13.4 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.

13.5 Replacing devices

⚠ WARNNG

UNINTENDED BEHAVIOR

The behavior of the drive system is governed by numerous stored data or settings. Unsuitable settings or data may trigger unexpected movements or responses to signals and disable monitoring functions.

- Do NOT operate the drive system with unknown settings or data.
- Verify that the stored data and settings are correct.
- When commissioning, carefully run tests for all operating states and potential error situations.
- Verify the functions after replacing the product and also after making changes to the settings or data.
- Only start the system if there are no persons or obstructions in the hazardous area.

Failure to follow these instructions can result in death, serious injury or equipment damage.

Prepare a list with the parameters required for the functions used.

Observe the following procedure when replacing devices.

- Save all parameter settings. To do so, save the data to a PC using the commissioning software, see chapter 6.4 "Commissioning software".
- Switch off all supply voltages. Verify that no voltages are present (safety instructions).
- Label all connections and uninstall the product.
- Note the identification number and the serial number shown on the product nameplate for later identification.
- Install the new product as per chapter 5 "Installation".
- If the product to be installed has previously been used in a different system or application, you must restore the factory settings before commissioning the product.
- Commission the product as per chapter 6 "Commissioning". After the replacement, the same mechanical position of the motor does not mean that the power stage has the same position.

13.6 Changing the motor

⚠ WARNNG

UNEXPECTED MOVEMENT

Drive systems may perform unexpected movements because of incorrect connection or other errors.

- Operate the device with approved motors only. Even if motors are similar, different adjustment of the encoder system may be a source of hazards.
- Even if the connectors for power connection and encoder match mechanically, this does NOT imply that they may be used.

Failure to follow these instructions can result in death, serious injury or equipment damage.

- Switch off all supply voltages. Verify that no voltages are present (safety instructions).
- Label all connections and uninstall the product.
- Note the identification number and the serial number shown on the product nameplate for later identification.
- Install the new product as per chapter 5 "Installation".

If the connected motor is replaced by another motor, the motor is automatically recognized by the servo drive.

13.7 Shipping, storage, disposal

Note the ambient conditions on chapter 3.1.

Shipping — The product must be protected against shocks during transportation. If possible, use the original packaging for shipping.

Storage — The product may only be stored in spaces where the specified permissible ambient conditions for room temperature and humidity are met. Protect the product from dust and dirt.

Disposal — The product consists of various materials that can be recycled and must be disposed of separately. Dispose of the product in accordance with local regulations.