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LXM23A and BCH

Servo drive system

Product manual

V2.02, 11.2014



0198441113932, V2.02, 11.2014

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All pertinent state, regional, and local safety regulations must be observed when installing and using this product. For reasons of safety and to help ensure compliance with documented system data, only the manufacturer should perform repairs to components.

When devices are used for applications with technical safety requirements, the relevant instructions must be followed.

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Safety Information

Read these instructions carefully, and look at the equipment to become familiar with the device before trying to install, operate, or maintain it. The following special messages may appear throughout this documentation or on the equipment to warn of potential hazards or to call attention to information that clarifies or simplifies a procedure.



The addition of this symbol to a Danger safety label indicates that an electrical hazard exists, which will result in personal injury if the instructions are not followed.



This is the safety alert symbol. It is used to alert you to potential personal injury hazards. Obey all safety messages that follow this symbol to avoid possible injury or death.

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.

NOTICE

NOTICE indicates a potentially hazardous situation, which, if not avoided, **can result** in equipment damage.

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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.

Intended use

This product consists of a drive and a three-phase servo motor; it is intended for industrial use in this combination 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.

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.

Basic information

The use and application of the information contained herein require expertise in the design and programming of automated control systems.

Only you, the user, machine builder or integrator, can be aware of all the conditions and factors present during installation and setup, operation, repair and maintenance of the machine or process.

You must also consider any applicable standards and/or regulations with respect to grounding of all equipment. Verify compliance with any safety information, different electrical requirements, and normative

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standards that apply to your machine or process in the use of this equipment.

Many components of the equipment, including the printed circuit board, operate with mains voltage, or present transformed high currents, and/or high voltages.

The motor itself generates voltage when the motor shaft is rotated.

⚠ ⚠ DANGER

HAZARD DUE TO ELECTRIC SHOCK, EXPLOSION OR ARC FLASH

- Only qualified personnel may install, adjust, repair and maintain this equipment.
- Do not touch any connectors, contacts, terminals, unshielded components or printed circuit boards while the equipment is under power.
- Use only electrically insulated tools.
- Block the motor shaft to prevent rotation prior to performing any type of work on the drive system.
- Insulate both ends of unused conductors of the motor cable to help prevent AC voltage from coupling to 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.
  - Do not assume that the DC bus is voltage-free when the DC bus LED is off.
- Refit/replace and secure all covers, accessories, hardware, cables, and wires and verify that a proper ground connection exists before applying power to the unit.

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

This equipment has been designed to operate outside of any hazardous location. Only install this equipment in zones known to be free of a hazardous atmosphere.

⚠ DANGER

POTENTIAL FOR EXPLOSION

Install and use this equipment in non-hazardous locations only.

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

If the power stage is disabled unintentionally, for example as a result of power outage, errors or functions, the motor is no longer decelerated in a controlled way. Overload, errors or incorrect use may cause

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the holding brake to no longer operate properly and may result in premature wear.

⚠ WARNING

UNINTENDED EQUIPMENT OPERATION

- Verify that movements without braking effect cannot cause injuries or equipment damage.
- Verify the function of the holding brake at regular intervals.
- Do not use the holding brake as a service brake.
- Do not use the holding brake for safety-related purposes.

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

Drive systems may perform unanticipated movements because of incorrect wiring, incorrect settings, incorrect data or other errors.

⚠ WARNING

UNINTENDED EQUIPMENT OPERATION

- 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, serious injury, or equipment damage.

⚠ 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 all 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, serious injury, or equipment damage.

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 and Operation of Adjustable-Speed Drive Systems”.

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DC bus voltage measurement

The DC bus voltage can exceed 400 Vdc. The DC bus LED is not an indicator of the absence of DC bus voltage.

⚠ ⚠ DANGER

ELECTRIC SHOCK, EXPLOSION OR ARC FLASH

- Disconnect the voltage supply to all connections.
- Wait 10 minutes to allow the DC bus capacitors to discharge.
- Use a properly rated voltage-sensing device for measuring (>400 Vdc).
- Measure the DC bus voltage between the DC bus terminals (PA/+ and PC/-) to verify that the voltage is less than 42 Vdc.
- Contact your local Schneider Electric representative if the DC bus capacitors do not discharge to less than 42 Vdc within a period of 10 minutes.
- Do not operate the product if the DC bus capacitors do not discharge properly.
- Do not attempt to repair the product if the DC bus capacitors do not discharge properly.
- Do not assume that the DC bus is voltage-free when the DC bus LED is off.

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

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", etc.

Among others, these standards include:

- IEC 61800 series: "Adjustable speed electrical power drive systems"
- IEC 61158 series: "Digital data communications for measurement and control – Fieldbus for use in industrial control systems"
- IEC 61784 series: "Industrial communication networks – Profiles"
- IEC 61508 series: "Functional safety of electrical/electronic/programmable electronic safety-related systems"

In addition, the term "zone of operation" is used in conjunction with the description of specific hazards, and is defined as it is for a "hazard zone" or "danger zone" in the EC Machinery Directive (2006/42/EC) and in ISO 12100-1.

Also see the glossary at the end of this manual.

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About the book

This manual is valid for LXM23A and BCH standard products.

Source manuals

The latest versions of the manuals can be downloaded from the Internet at:

http://www.schneider-electric.com

Source CAD data

For easier engineering, CAD data (drawings or EPLAN macros) are available for download from the Internet at:

http://www.schneider-electric.com

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 step
- ▶ 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

Technical data are specified in SI units. Converted units are shown in parentheses behind the SI unit; they may be rounded.

Example:
Minimum conductor cross section: 1.5 mm^2 (AWG 14)

Glossary

Explanations of special technical terms and abbreviations.

Index

List of keywords with references to the corresponding page numbers.

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1 Introduction

1.1 Device overview

The LXM23 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.

This product manual describes the LXM23A servo drive and the BCH servo motor.



Overview of some of the features of the servo drive:

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

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1.2 Components and interfaces

Carefully read and observe all safety instructions and the chapter "Before you begin - safety information".

DC bus LED
The LED lights when mains voltage or internal charge are present. The DC bus LED is not an indicator of the absence of DC bus voltage.
Information: page *13*

Controller supply (L1, L2)
Connect to mains circuit.
Information: page *77*

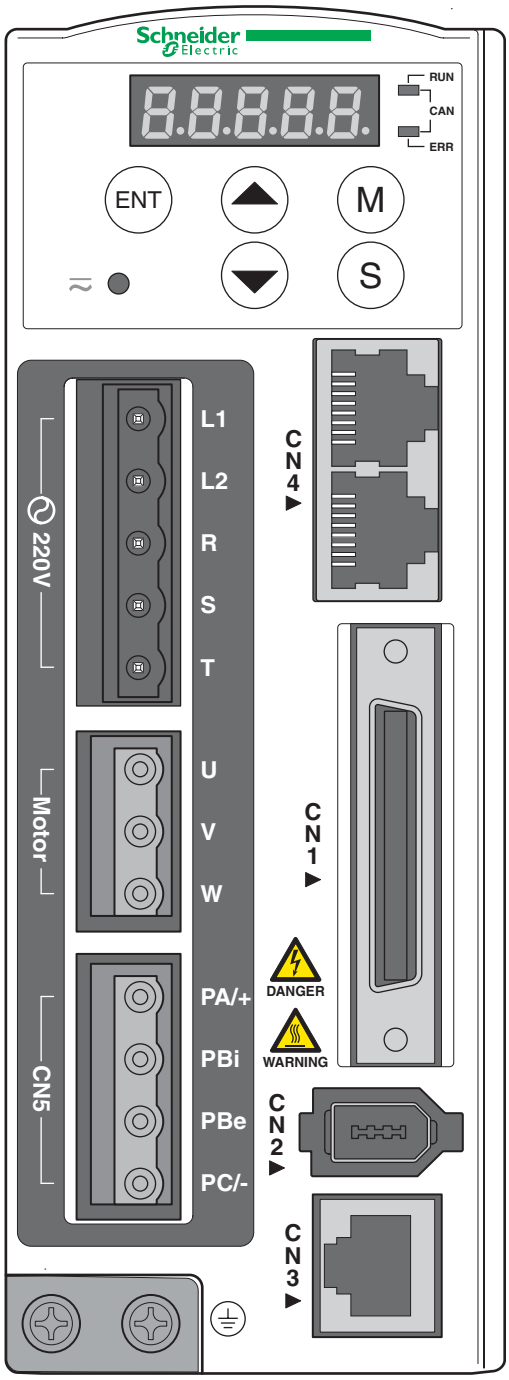
Power stage supply (R,S,T)
Connect to mains circuit.
Information: page *77*

Servo motor terminals (U,V, W)
Connect output (U, V, W) to the motor.
Information: page *77*

Braking resistor terminal (CN5)
Information: page *77*

- Internal braking resistor PA/+ and PBi bridged (PBe not connected)
- External braking resistor PA/+ and PBe (PBi not connected)

Ground terminal
For grounding the drive and the connected components.
Information: page *77*



HMI display
Information: page *123*
Alarm codes: page *231*

HMI keypad
M: HMI mode
S: Shift (several functions)
UP: Navigate, increase values
DOWN: Navigate, decrease values
ENT: Confirm, store data
Information: page *123*

Fieldbus (CN4)
CANopen and CANmotion
Information: page *77*

I/O Interface (CN1)
For connecting master controller (PLC) or I/O signals.
Information: page *77*

Encoder Interface (CN2)
For connecting motor encoder.
Information: page *77*

Commissioning interface (CN3)
For connecting PC via converter VW3M8131
Information: page *77*

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1.3 Nameplate

Drive The nameplate contains the following data:

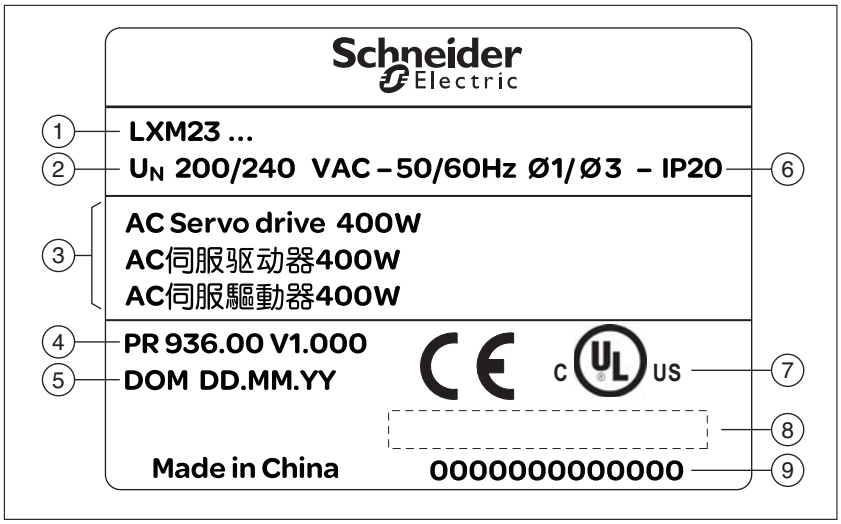


Figure 1: Nameplate

(1) Type code
(2) Nominal voltage
(3) Motor type
(4) Firmware version
(5) Date of manufacture DOM, see page *431*
(6) Degree of protection
(7) CE marking and UL marking
(8) Barcode
(9) Serial number

Motor The nameplate contains the following data:

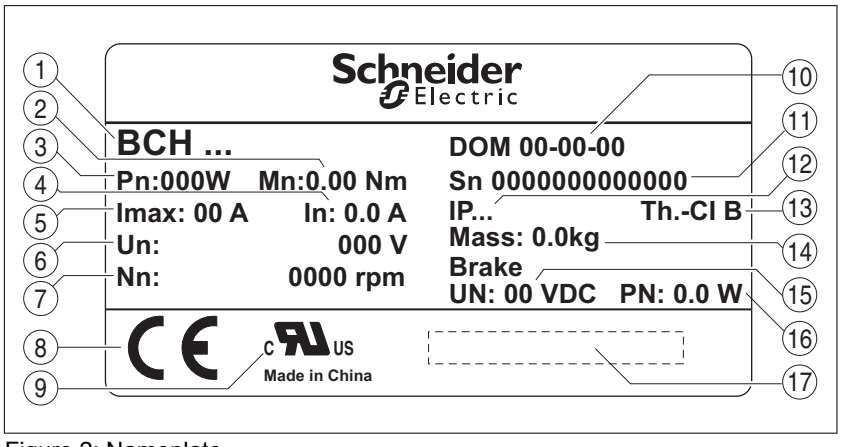


Figure 2: Nameplate

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(1) Motor type, see type code
(2) Nominal torque
(3) Nominal power
(4) Nominal current
(5) Maximum peak current
(6) Nominal voltage
(7) Nominal speed of rotation
(8) CE marking
(9) UL marking
(10) Date of manufacture DOM, see page *431*
(11) Serial number
(12) Degree of protection
(13) Temperature class
(14) Mass
(15) Nominal voltage of the holding brake (optional)
(16) Nominal power of the holding brake (optional)
(17) Barcode

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1.4 Type code

Drive

LXM	23	A	U07	M3X	(••••)

Product designation
LXM = Lexium

Product type
23 = AC servo drive for one axis

Interfaces
D = I/O
A = Fieldbus CANopen

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 kW
U45 = 4.5 kW
U55 = 5.5 kW
U75 = 7.5 kW

Power stage supply [V_{ac}]
M3X = 3~, 200/240 V_{ac}

Further options

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Motor

BCH	040	1	O	0	2	A	1	C

Product family
BCH = Synchronous motor - medium moment of inertia

Size (housing)
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
1 = 1 stack
2 = 2 stacks
3 = 3 stacks
4 = 4 stacks
5 = 5 stacks

Winding
M = Optimized in terms of torque (1000 min^{-1}/1500 min^{-1})
N = Optimized in terms of torque and speed of rotation (2000 min^{-1})
O = Optimized in terms of speed of rotation (3000 min^{-1})

Shaft and degree of protection
0 = Smooth shaft; degree of protection: IP40
1 = Parallel key; IP40
2 = Smooth shaft; degree of protection: shaft and housing IP65
3 = Parallel key; degree of protection: shaft and housing IP 65

Encoder system
2 = High-resolution encoder (20 bit)

Holding brake
A = Without holding brake
F = With holding brake

Connection version
1 = Flying leads (for BCH040, BCH060, BCH080); military connector (for BCH100, BCH130, BCH180)

Mechanical interface - mounting
C = Asian standard

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1.5 Servo Drive and Servo Motor Combinations

BCH servo motor output power	BCH servo motor inertia (without brake)	Rated torque	Peak stall torque	Maximum speed	Rated speed	Combinations		
						Servo drive	Servo motor	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
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

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2 Technical Data

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

2.1 Ambient conditions

Ambient conditions of motor see chapter *"2.4 Motor data"*.

2.1.1 Ambient conditions of drive

Climatic environmental conditions transportation and storage

The environment during transportation and storage must be dry and free from dust.

Temperature	°C (°F)	-20 ... 65 (-4 ... 149)

The following relative humidity is permissible during transportation and storage:

Relative humidity (non-condensing)	%	0 ... 90

Climatic environmental conditions operation

The maximum permissible ambient temperature during operation depends on the mounting distances between the devices and on the required power. Observe the pertinent instructions in the chapter *"4 Installation"*.

Ambient temperature (no icing, non-condensing)	°C (°F)	0 ... 45 (32 ... 113)
Ambient temperature (no icing, non-condensing) if all of the following conditions are met: • Installed in a well ventilated location • No obstructed airflow for the cooling fan	°C (°F)	45 ... 55 (113 ... 131)

The following relative humidity is permissible during operation:

Relative humidity (non-condensing)	%	5 ... 95
Atmospheric pressure	kPa (psi)	86 ... 106 (12.47 ... 15.37)

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Altitude above mean sea level without derating	m (ft)	<1000 (<3281)
Altitude above mean sea level if all of the following conditions are met: • 45 °C (113 °F) maximum ambient temperature • Reduction of the continuous power by 1 % per 100 m (328 ft) above 1000 m (3281 ft)	m (ft)	1000 ... 2000 (3281 ... 6562)

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 of protection

LXM23•	**U01, U02, U04, U07, U10, U15**	**U20, U30, U45, U55, U75**
Pollution degree	2	
Degree of protection	IP20	IP10

Vibration

Vibration resistance mass <20 kg (<44.1 lb)	Tested as per IEC 60068-2-6 3 mm [2 ... 9 Hz] 10 m/s^2 [9 ... 200 Hz]
Vibration resistance mass 20 ... 100 kg (44.1 ... 220.5 lb)	Tested as per IEC 60068-2-6 1.5 mm [2 ... 13 Hz] 6 m/s^2 [13 ... 200 Hz]

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2.2 Dimensions

2.2.1 Dimensions of drive

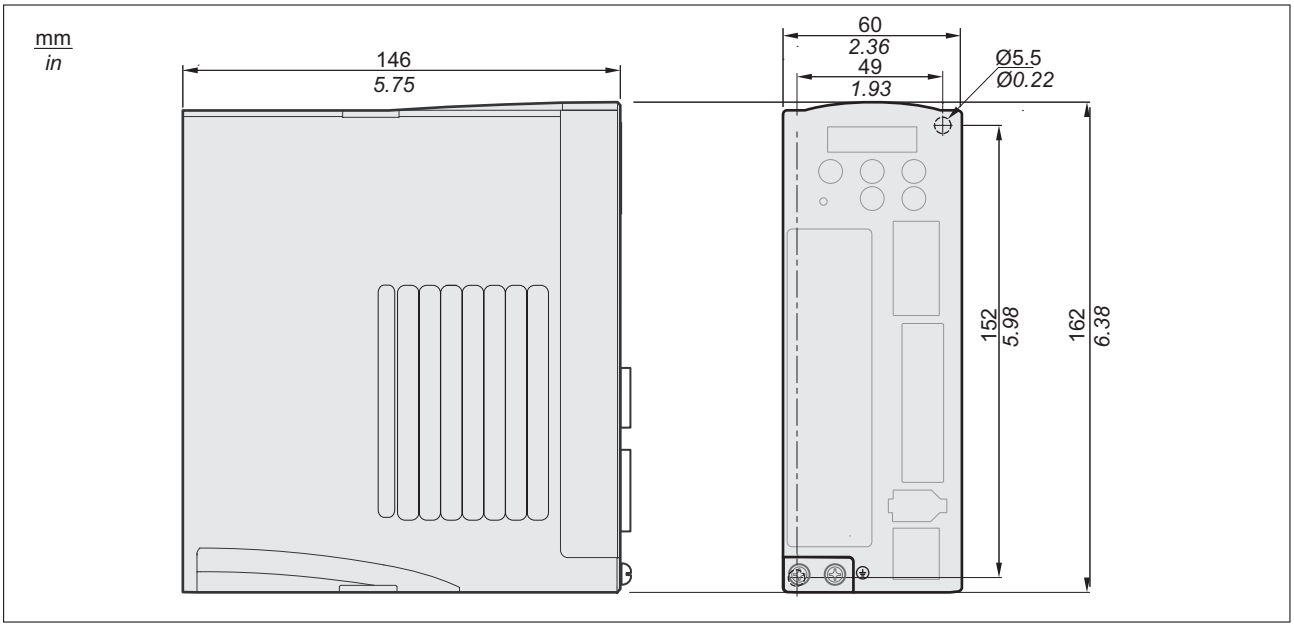


Figure 3: Dimensions LXM23•U01M3X, LXM23•U02M3X, LXM23•U04M3X

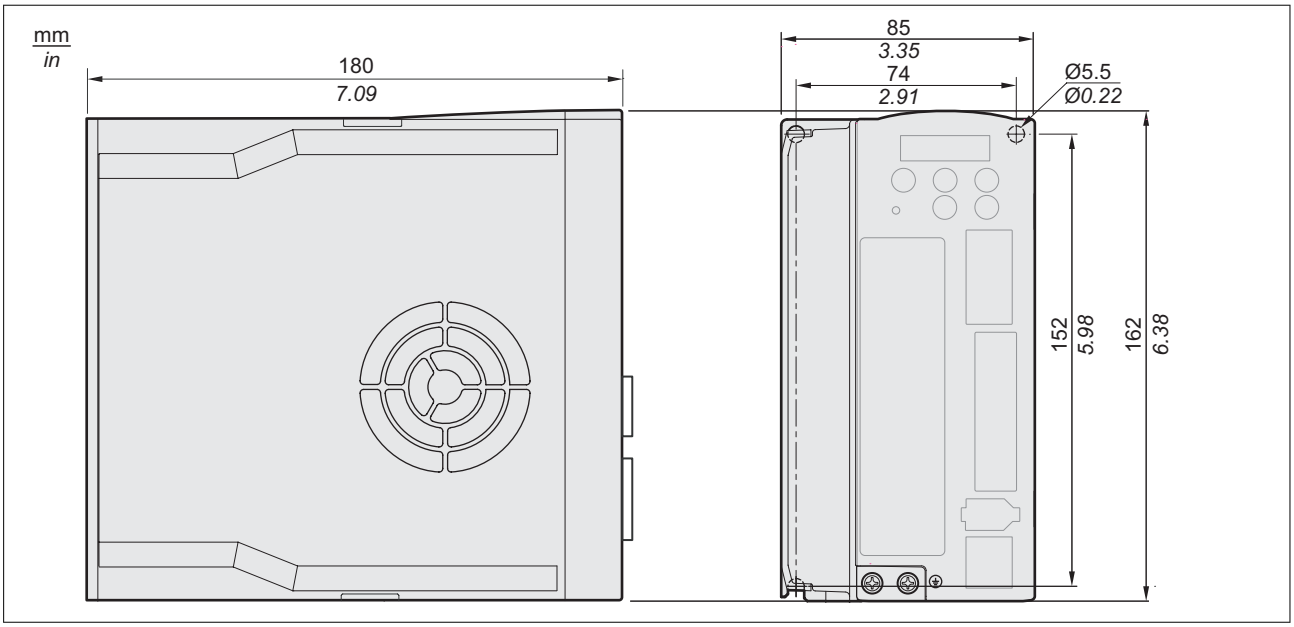


Figure 4: Dimensions LXM23•U07M3X, LXM23•U10M3X, LXM23•U15M3X

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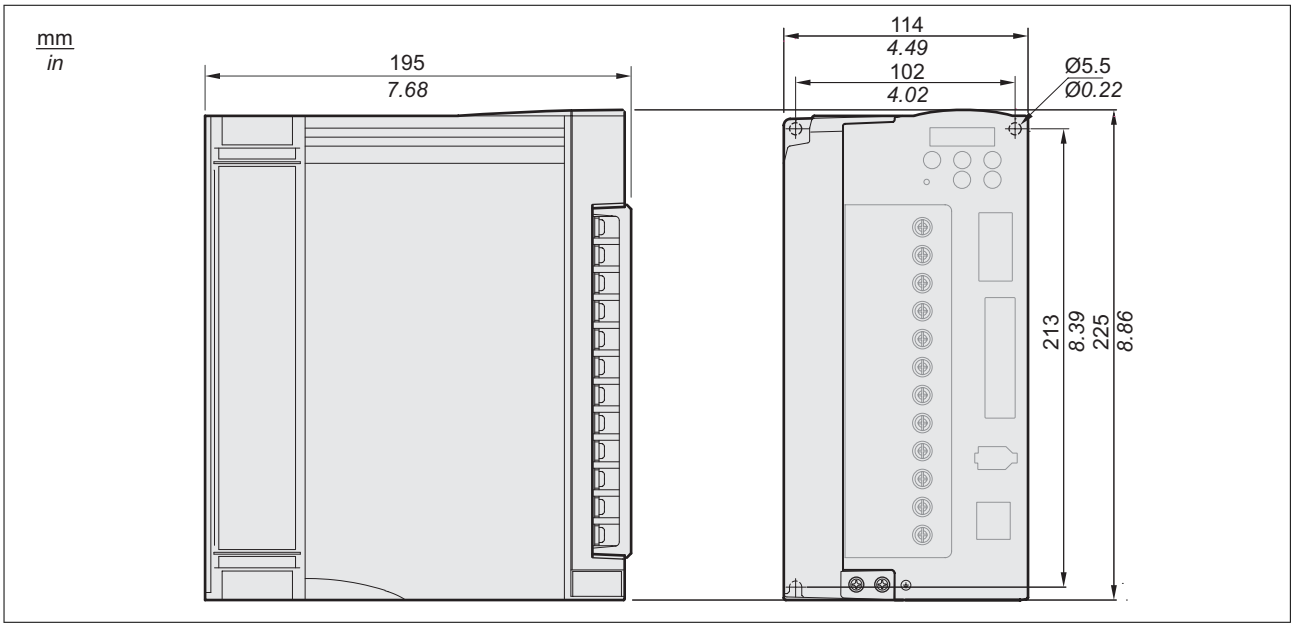


Figure 5: Dimensions LXM23•U20M3X, LXM23•U30M3X

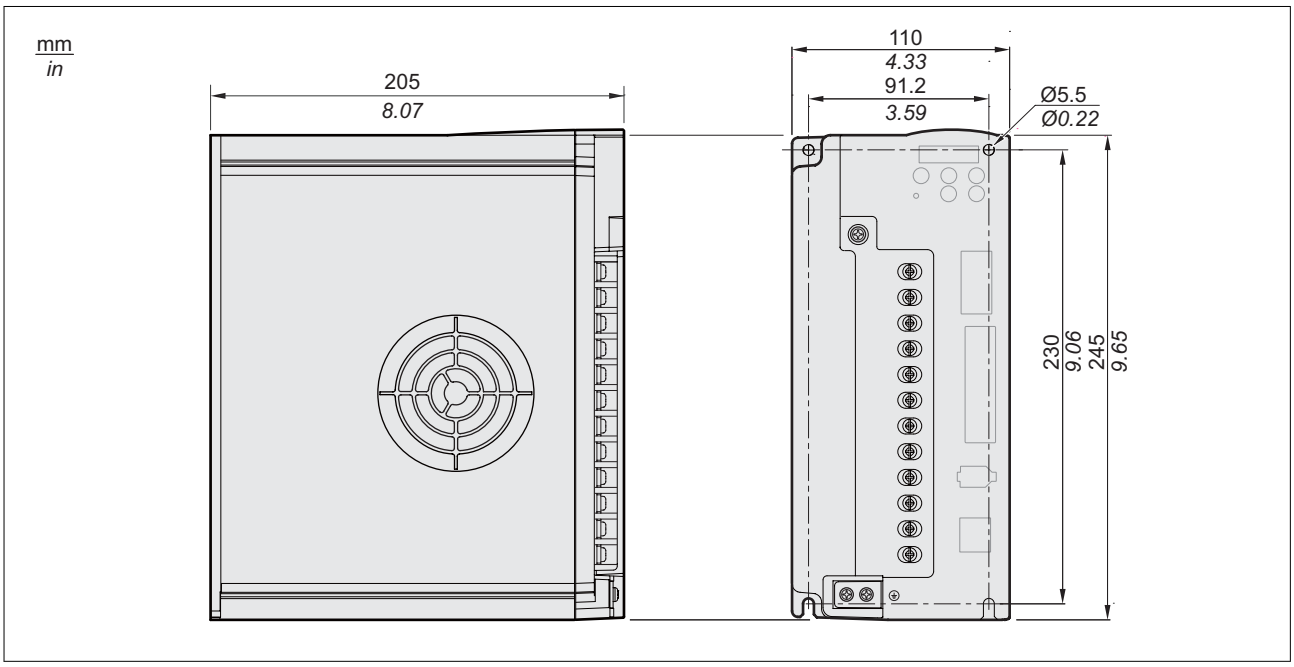


Figure 6: Dimensions LXM23•U45M3X

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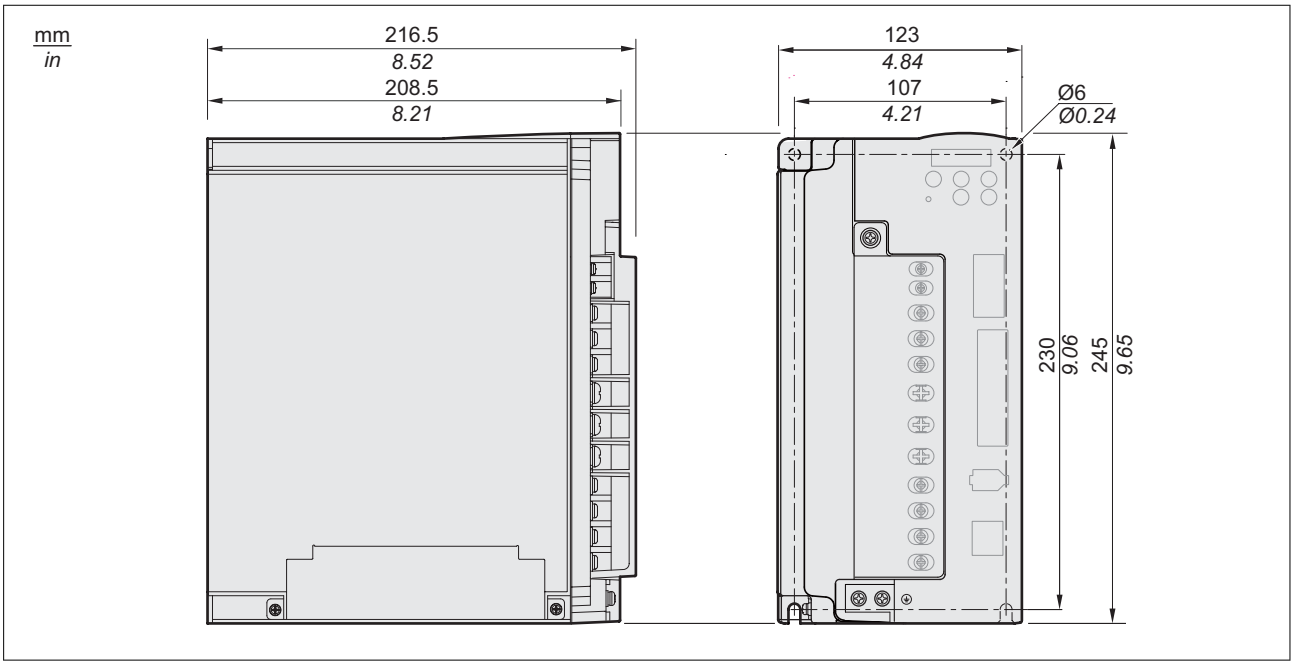


Figure 7: Dimensions LXM23•U55M3X

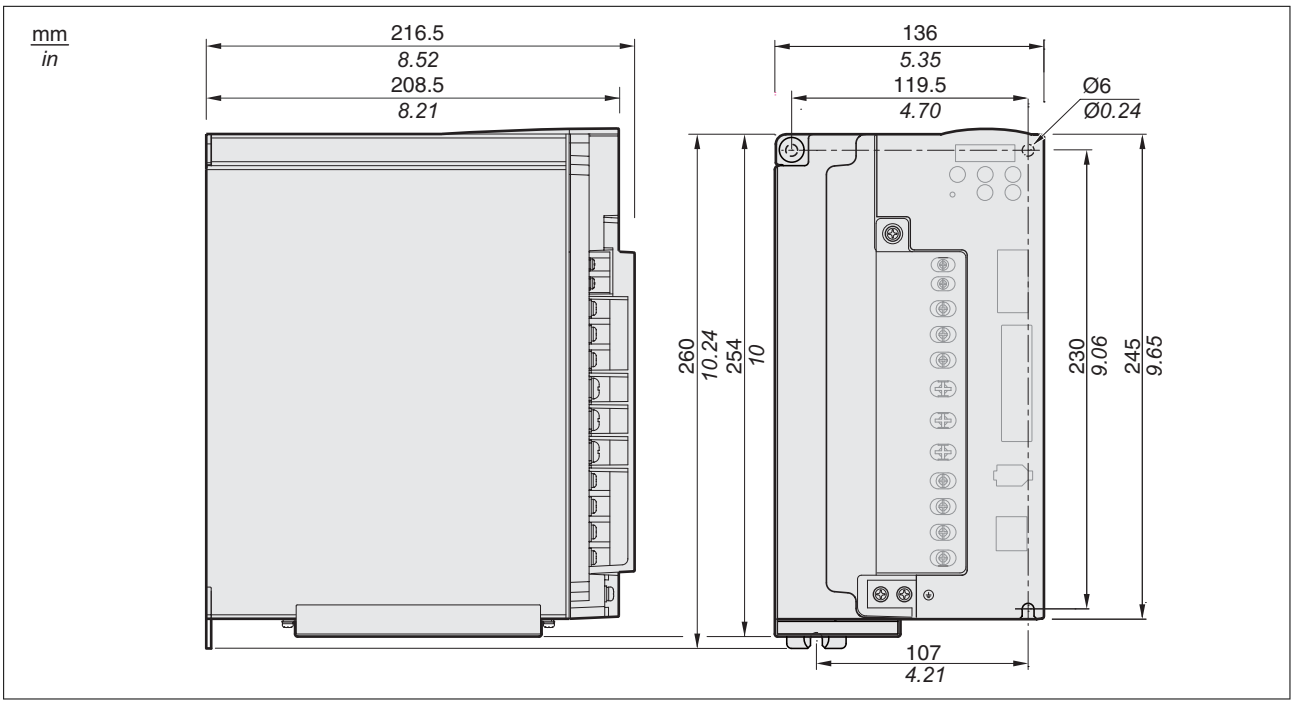


Figure 8: Dimensions LXM23•U75M3X

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2.2.2 Dimensions of motor

Dimensions BCH040

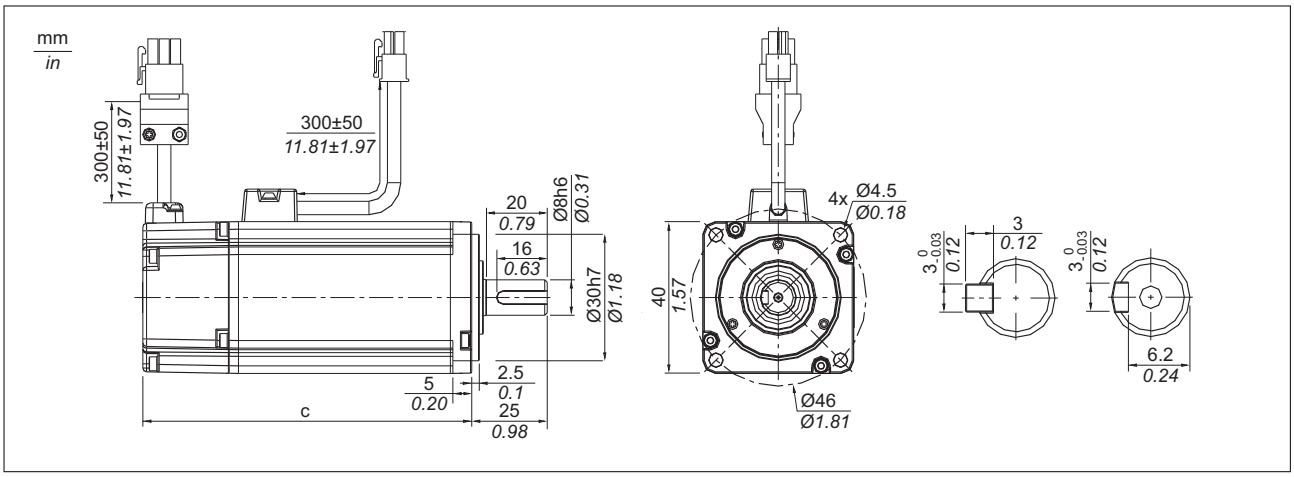


Figure 9: Dimensions BCH040

		c (without holding brake)	c (with holding brake)
BCH040	mm (in)	100.6 (3.96)	136.6 (5.38)

Dimensions BCH060

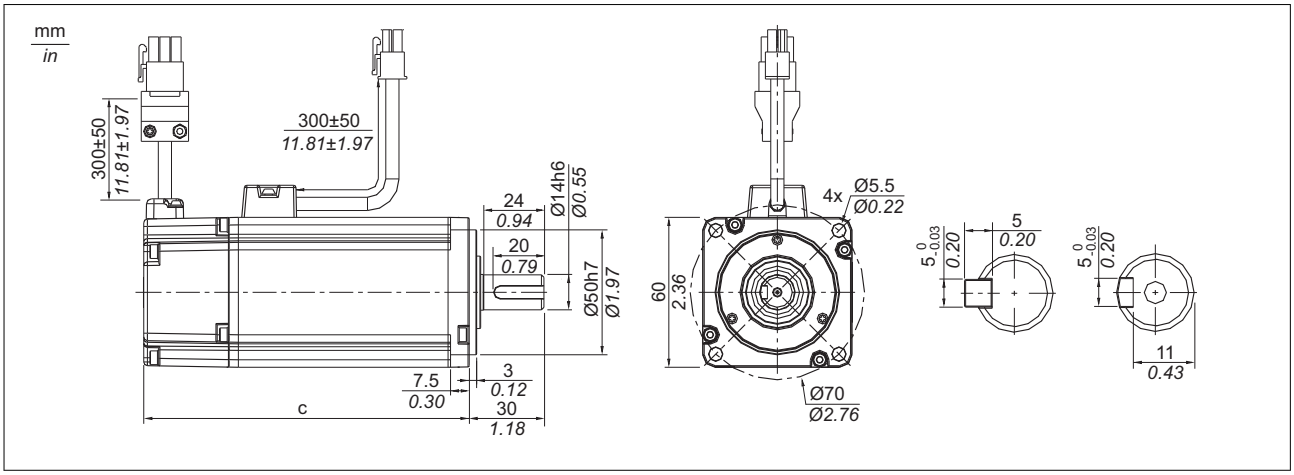


Figure 10: Dimensions BCH060

		c (without holding brake)	c (with holding brake)
BCH0601	mm (in)	105.5 (4.15)	141.6 (5.57)
BCH0602	mm (in)	130.7 (5.15)	166.8 (6.57)

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Dimensions BCH080

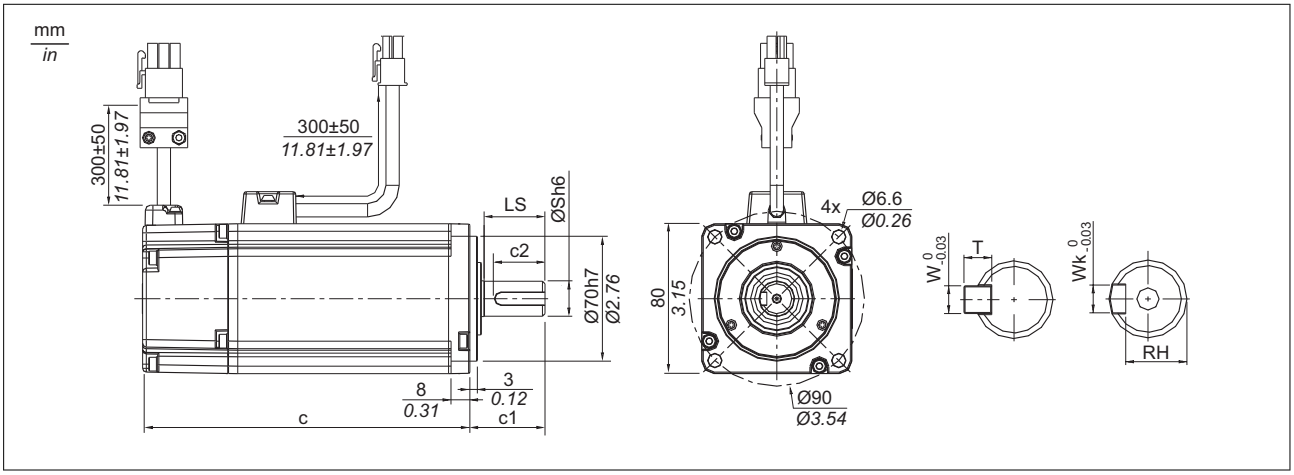


Figure 11: Dimensions BCH080

		c (without holding brake)	c (with holding brake)	S	c1	c2	LS	RH	Wk	W	T
BCH0801	mm (in)	105.5 (4.15)	141.6 (5.57)	14 (0.55)	30 (1.18)	20 (0.79)	24.5 (0.96)	11 (0.43)	5 (0.2)	5 (0.2)	5 (0.2)
BCH0802	mm (in)	130.7 (5.15)	166.8 (6.57)	19 (0.75)	35 (1.38)	25 (0.98)	29.5 (1.16)	15.5 (0.61)	6 (0.24)	6 (0.24)	6 (0.24)

Dimensions BCH100

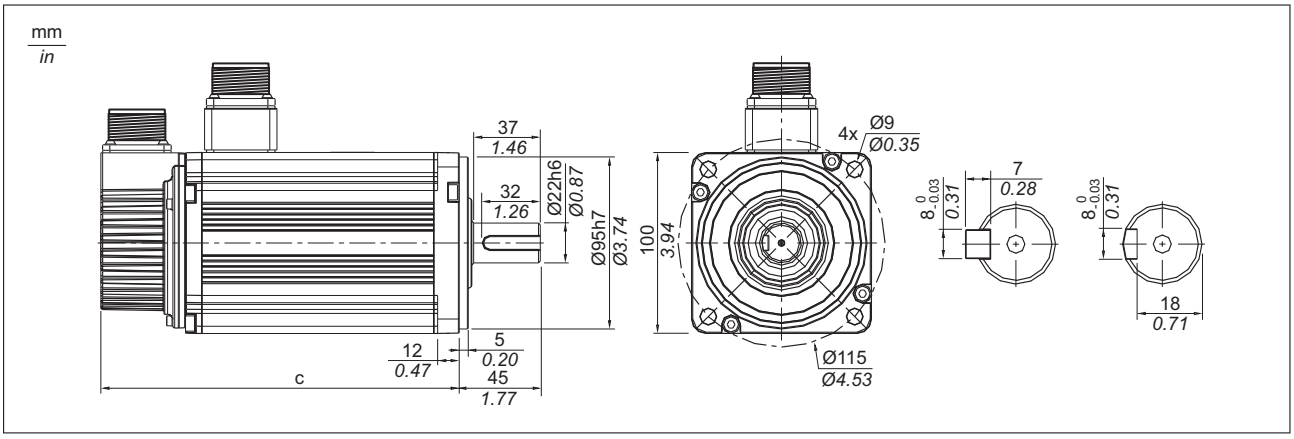


Figure 12: Dimensions BCH100

		c (without holding brake)	c (with holding brake)
BCH1001	mm (in)	153.5 (6.04)	192.5 (7.58)
BCH1002	mm (in)	199 (7.83)	226 (8.9)

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Dimensions BCH130

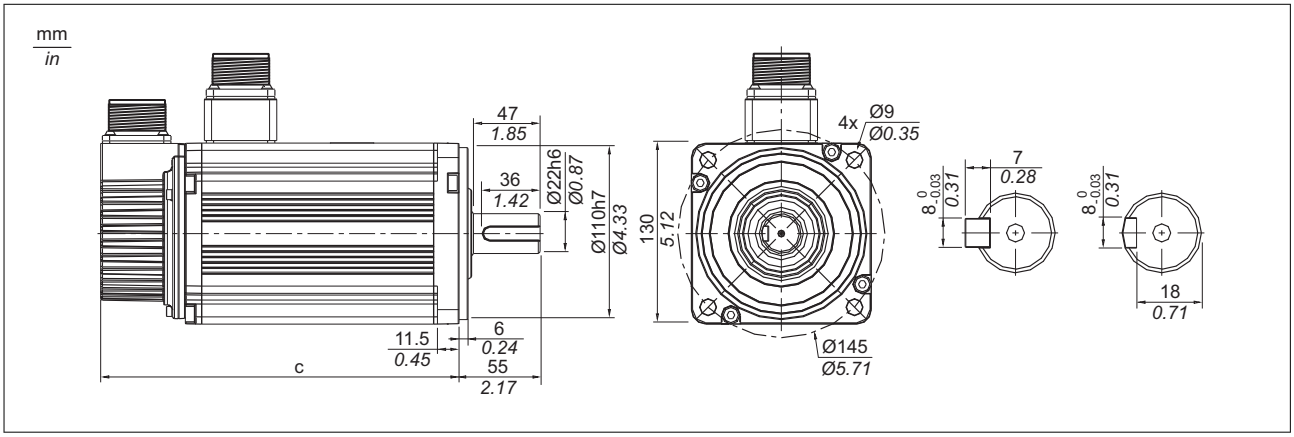


Figure 13: Dimensions BCH130

		c (without holding brake)	c (with holding brake)
BCH1301	mm (in)	147.5 (5.81)	183.5 (7.22)
BCH1302	mm (in)	147.5 (5.81)	183.5 (7.22)
BCH1303M	mm (in)	163.5 (6.44)	198 (7.8)
BCH1303N	mm (in)	167.5 (6.59)	202 (7.95)
BCH1304	mm (in)	187.5 (7.38)	216 (8.5)

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Dimensions BCH180

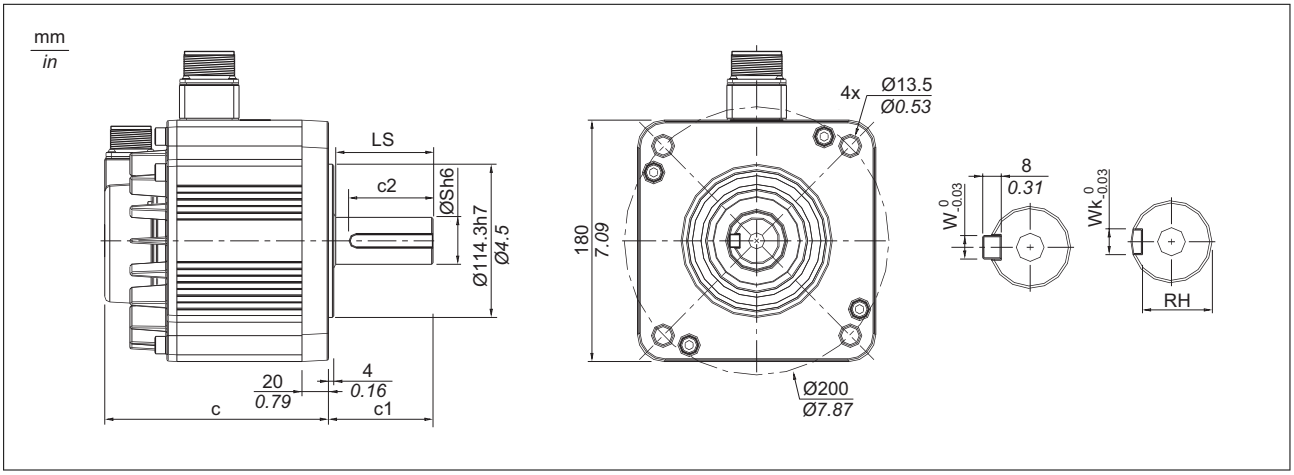


Figure 14: Dimensions BCH180

		c (without holding brake)	c (with holding brake)	S	c1	c2	LS	RH	Wk	W
BCH1801	mm (in)	169 (6.65)	203.1 (8)	35 (1.38)	79 (3.11)	63 (2.48)	73 (2.87)	30 (1.18)	10 (0.39)	10 (0.39)
BCH1802N	mm (in)	202.1 (7.96)	235.3 (9.26)	35 (1.38)	79 (3.11)	63 (2.48)	73 (2.87)	30 (1.18)	10 (0.39)	10 (0.39)
BCH1802M	mm (in)	202.1 (7.96)	235.3 (9.26)	35 (1.38)	79 (3.11)	63 (2.48)	73 (2.87)	30 (1.18)	10 (0.39)	10 (0.39)

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2.3 Electrical data of drive

2.3.1 Specification of drive

LXM23•			U01	U02	U04	U07	U10	U15	U20	U30	U45	U55	U75
Power supply	Phase / Voltage		Three-phase or single-phase: 220 Vac						Three-phase: 220 Vac				
	Permissible Voltage Range		Three-phase: 170 ... 255 Vac Single-phase: 200 ... 255 Vac						Three-phase: 170 ... 255 Vac				
	Continuous output current		0.9 A_{rms}	1.55 A_{rms}	2.6 A_{rms}	5.1 A_{rms}	7.3 A_{rms}	8.3 A_{rms}	13.4 A_{rms}	19.4 A_{rms}	32.5 A_{rms}	40 A_{rms}	47.5 A_{rms}
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			Internal								External		
Position Control Mode	Max. Input Pulse Frequency		Input PULSE: Max. 500 Kpps (Line driver), Max. 200 Kpps (Open collector) Input HPULSE: Max. 4 Mpps (Line receiver)										
	Pulse Type		Pulse + Direction, A phase + B phase, CCW pulse + CW pulse										
	Command Source		External pulse train (Pt mode) / Internal procedures (Pr mode)										
	Smoothing		Low-pass and P-curve filter										
	Electronic Gear		Electronic gear N/M multiple N: 1 ... 32767, M: 1:32767 (1/50<N/M<25600)										
	Torque Limit Operation		Set by parameters										
	Feed Forward Compensation		Set by parameters										
Speed Control Mode	Analog Input Command	Voltage Range	±10 Vdc										
		Input Resistance	10 kΩ										
		Time Constant	2.2 µs										
	Speed Control Range [1]		1:5000									1:3000	
	Command Source		External analog signal / Internal parameters										
	Smoothing		Low-pass and S-curve filter										
	Torque Limit Operation		Set by parameters or via analog input										
	Frequency Response Characteristic		Maximum 1 kHz										
	Speed Accuracy [2] (at rated speed of rotation)		0.01 % or less at 0 ... 100 % load fluctuation										
			0.01 % or less at ±10% power fluctuation										
			0.01 % or less at 0 ... 50 °C (32 ... 122 °F)ambient temperature fluctuation xxx										

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LXM23•			U01	U02	U04	U07	U10	U15	U20	U30	U45	U55	U75
Torque Control Mode	Analog Input Command	Voltage Range	±10 Vdc										
		Input Resistance	10 kΩ										
		Time Constant	2.2 µs										
	Command Source		External analog signal / Internal parameters										
	Smoothing		Low-pass filter										
	Speed Limit Operation		Set by parameters or via analog input										
	Analog Monitor Output		Monitor signal can set by parameters (Output voltage range: ±8V)										
Digital Inputs/ Outputs		Inputs	Servo On, Reset, Gain switching, Pulse clear, Zero speed CLAMP, Command input reverse control, 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, Operational 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.										
		Outputs	Encoder signal output (A, B, Z Line Driver and Z Open Collector)										
			Servo ready, Servo On, At Zero speed, At Speed reached, At Positioning completed, At Torques limit, Alarm signal, Holding brake control, Homing completed, Output overload warning, Warning signal, Position command overflow, Forward / Reverse software limit, Internal position command completed, Capture operation completed output, Motion control completed output.										
Monitoring functions			Overcurrent, Overvoltage, Undervoltage, Motor overheated, Regeneration error, Overload, Overspeed, Abnormal pulse control command, Excessive deviation, Encoder error, Adjustment error, Operational stop activated, Reverse/ Forward limit switch error, Serial communication error, Input power phase loss, Serial communication timeout, short circuit protection of U, V, W,										
Communication Interface			RS-232 (for PC) / RS-485 / CANopen										
Environment	Installation Site		Indoor location (free from direct sunlight), no corrosive liquid and gas (far away from oil mist, flammable gas, dust)										
	Power System		TN System [3]										
	Approvals		IEC/EN 61800-5-1, UL 508C, C-tick										

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 grounded,the exposed conductive parts of the installation being connected to that points by protective ground conductor; see IEC 60364-1 for additional information.

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

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2.3.2 DC bus data

DC bus data for single-phase drives

LXM23• (single-phase)		U01	U02	U04	U07	U10	U15
Nominal voltage single-phase	Vac	220	220	220	220	220	220
Nominal voltage DC bus	Vdc	311	311	311	311	311	311
Undervoltage limit	Vdc	P4-24 * √2	P4-24 * √2	P4-24 * √2	P4-24 * √2	P4-24 * √2	P4-24 * √2
Voltage limit: activation of error reaction in drive (quickstop)	Vdc	410	410	410	410	410	410
Overvoltage limit	Vdc	410	410	410	410	410	410

DC bus data for three-phase drives

LXM23• (three-phase)		U20	U30	U45	U55	U75
Nominal voltage three-phase	Vac	220	220	220	220	220
Nominal voltage DC bus	Vdc	311	311	311	311	311
Undervoltage limit	Vdc	P4-24 * √2	P4-24 * √2	P4-24 * √2	P4-24 * √2	P4-24 * √2
Voltage limit:activation of error reaction in drive (quickstop)	Vdc	410	410	410	410	410
Overvoltage limit	Vdc	410	410	410	410	410

2.3.3 Additional EMC input filters

Limit values

This product meets the EMC requirements according to the standard IEC 61800-3 if the measures described in this manual are implemented during installation.

If the selected composition (product itself, mains filter, other accessories and measures) does not meet the requirements of category C1, the following information applies as it appears in IEC 61800-3:

⚠ WARNING

RADIO INTERFERENCE

In a domestic environment this product may cause radio interference in which case supplementary mitigation measures may be required.

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

Applications

When combined with LXM23•U• •M3X servo drives, additional EMC filters 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.

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Characteristics of EMC filter

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			See ambient conditions for the drive.
Altitude above mean sea level without derating		m (ft)	<1000 (<3281)
Altitude above mean sea level if all of the following conditions are met: • Max. temperature 40 °C (104 °F) • Mounting distance between servo drives >50 mm (1,97 in) • Protective cover removed		m (ft)	1000 ... 2000 (3281 ... 6562)
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 %

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Additional EMC input filters

The specified limit values are complied with if the installation is EMC-compliant and if the cables and the external mains filters offered as accessories are used.

EN 55011	Class A Gr2
IEC/EN 61800-3	Category C3 in environment 2

Additional EMC input filters		
For servo drive	Ordernumber	Weight
		kg (lb)
Single-phase supply voltage		
LXM23•U07M3X LXM23•U10M3X LXM23•U15M3X	VW3A31403	0.775 (1.71)
LXM23•U01M3X LXM23•U02M3X LXM23•U04M3X	VW3A31401	0.600 (1.32)
Three-phase supply voltage		
LXM23•U07M3X LXM23•U10M3X LXM23•U15M3X LXM23•U20M3X LXM23•U30M3X	VW3A31404	0.900 (1.98)
LXM23•U45M3X LXM23•U55M3X	VW3A31406	1.350 (2.98)
LXM23•U75M3X	VW3A31407	3.150 (6.94)

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2.3.4 Upstream circuit breaker, fuse

The following tables provide information on the minimum and maximum circuit breaker and fuse ratings for installations as per IEC and UL. Select fuses with the lowest possible fuse ratings suitable for your application within the ranges specified in the tables below. The conductors must have a sufficiently large cross section so that the fuses can trip if required.

Single-phase: 220 Vac

The following table shows circuit breaker and fuses to be placed upstream for single-phase 220 Vac.

		Input current	**Circuit breaker minimum** [1]	**Circuit breaker maximum**)	**Fuse minimum** [2]	**Fuse maximum**)
LXM23•U01M3X	A	0.69	6	6.3	5	5
LXM23•U02M3X	A	1.92	6	6.3	5	5
LXM23•U04M3X	A	4.50	6	10	6	20
LXM23•U07M3X	A	6.78	10	10	10	20
LXM23•U10M3X	A	8.87	13	15	12	25
LXM23•U15M3X	A	10.30	16	25	20	40

1) IEC Circuit: Breaker Characteristic C
2) UL Fuse: Class CC or Class T

Three-phase: 170 Vac

The following table shows circuit breaker and fuses to be placed upstream for three-phase 170 Vac.

		Input current	**Circuit breaker minimum** [1]	**Circuit breaker maximum**)	**Fuse minimum** [2]	**Fuse maximum**)
LXM23•U01M3X	A	0.39	6	6.3	5	5
LXM23•U02M3X	A	1.11	6	6.3	5	5
LXM23•U04M3X	A	1.86	6	10	6	20
LXM23•U07M3X	A	3.66	8	10	8	20
LXM23•U10M3X	A	4.68	10	15	10	25
LXM23•U15M3X	A	5.90	13	25	12	40
LXM23•U20M3X	A	8.70	16	30	15	60
LXM23•U30M3X	A	9.80	20	30	20	80
LXM23•U45M3X	A	17.5	30	60	30	160
LXM23•U55M3X	A	19.7	40	60	40	160
LXM23•U75M3X	A	26.3	50	75	50	200

1) IEC Circuit: Breaker Characteristic C
2) UL Fuse: Class CC or Class T

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2.4 Motor data

2.4.1 Specification of motor

Approved drives For permitted combination of motor and drive see chapter *"1.5 Servo Drive and Servo Motor Combinations"*.

Ultra low/low Inertia Series

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BCH...	0401O	0601O	0602O	0801O	0802O	1001O	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
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
Winding resistance [Ohm]	9.3	2.79	1.55	0.93	0.42	0.20	0.13
Winding inductance [mH]	24	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 without brake [kg (lb)]	0.5 (1.1)	1.2 (2.6)	1.6 (3.5)	2.1 (4.6)	3.0 (6.6)	4.3 (9.5)	6.2 (13.7)
Weight with brake [kg (lb)]	0.8 (1.8)	1.5 (3.3)	2.0 (4.4)	2.9 (6.4)	3.8 (8.4)	4.7 (10.5)	7.2 (15.9)
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
Rotor moment of inertia [kg.cm^2] (with brake)	0.04	0.192	0.30	0.73	1.18	3.33	4.953
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	8.0	8.0
Brake power consumption (at 20°C) [W]	7.3	6.5	6.5	8.3	8.2	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 ... 40 °C (32 ... 104 °F)						
Storage temperature	-10 ... 80 °C (-14 ... 176 °F)						
Operating humidity	20 ... 90 % RH (non-condensing)						
Storage humidity	20 ... 90 % RH (non-condensing)						
Vibration capacity	2.5 m/s^2						
IP Rating	IP65 (when IP65 connectors are used, and when an oil seal is fitted to the rotating shaft (an oil seal model is used))						
Approvals							

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Medium / High Inertia Series

BCH...	1301N	1302N	1303N	1304N	1801N	1802N	1803N
Rated output power [kW]	0.5	1.0	1.5	2.0	2.0	3.0	
Rated torque [Nm]	2.39	4.77	7.16	9.55	9.55	14.32	
Maximum torque [Nm]	7.16	14.3	21.48	28.65	28.65	42.97	
Rated speed [RPM]	2000						
Maximum speed [RPM]	3000						
Rated current (A)	2.9	5.6	8.3	11.01	11.22	16.1	
Maximum current (A)	8.7	16.8	24.9	33.03	33.66	48.3	
Rotor moment of inertia ($kg.cm^2$) (without brake)	8.17	8.41	11.18	14.59	34.68	54.95	
Mechanical time constant (ms)	1.91	1.51	1.10	0.96	1.62	1.06	
Torque constant-KT (Nm/A)	0.83	0.85	0.87	0.87	0.85	0.89	
Voltage constant-KE [mV/RPM]	30.9	31.9	31.8	31.8	31.4	32	
Winding resistance (Ohm)	0.57	0.47	0.26	0.174	0.119	0.052	
Winding inductance (mH)	7.39	5.99	4.01	2.76	2.84	1.38	
Electrical time constant (ms)	12.96	12.88	15.31	15.86	23.87	26.39	
Insulation class	Class A (UL), Class B (CE)						
Insulation resistance	>100MΩ, DC 500V						
Insulation strength	1500V_{ac}, 60 seconds						
Weight without brake [kg (lb)]	6.8 (15.0)	7.0 (15.4)	7.5 (16.5)	7.8 (17.2)	13.5 (29.8)	18.5 (40.8)	
Weight with brake [kg (lb)]	8.2 (18.1)	8.4 (18.5)	8.9 (19.6)	9.2 (20.3)	17.5 (38.6)	22.5 (49.6)	
Max. radial shaft load [N]	490	490	490	490	1176	1470	
Max. thrust shaft load [N]	98	98	98	98	490	490	
Rotor moment of inertia [$kg.cm^2$] (with brake)	8.94	9.14	11.90	15.88	37.86	57.06	
Mechanical time constant [ms] (with brake)	2.07	1.64	1.19	1.05	1.77	1.10	
Brake holding torque [Nm] (min)	10	10	10	10	25	25	
Brake power consumption (at 20°C) [W]	19	19	19	19	20.4	20.4	
Brake release time [ms] (Max)	10	10	10	10	10	10	
Brake pull-in time [ms] (Max)	70	70	70	70	70	70	
Vibration grade [µm]	15						
Operating temperature	0 ... 40 °C (32 ... 104 °F)						
Storage temperature	-10 ... 80 °C (-14 ... 176 °F)						
Operating humidity	20 ... 90 % RH (non-condensing)						
Storage humidity	20 ... 90 % RH (non-condensing)						
Vibration capacity	2.5m/s^2						
IP Rating	IP65 (when IP65 connectors are used, and when an oil seal is fitted to the rotating shaft (an oil seal model is used))						
Approvals							

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Medium / High Inertia Series

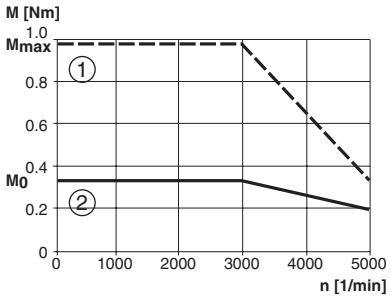
BCH...	**1301M**	**1302M**	**1303M**	**1802M**	**1803M**	**1804M**	**1805M**
Rated output power [kW]	0.3	0.6	0.9	3.0	4.5	5.5	7.5
Rated torque [Nm]	2.86	5.73	8.59	19.10	28.65	35.01	47.74
Maximum torque [Nm]	8.59	17.19	21.48	57.29	71.62	87.53	119.36
Rated speed [RPM]	1000			1500			
Maximum speed [RPM]	2000			3000			
Rated current (A)	2.5	4.8	7.5	19.4	32.5	40.0	47.5
Maximum current (A)	7.5	14.4	22.5	58.2	81.3	100.0	118.8
Rotor moment of inertia ($kg.cm^2$) (without brake)	8.17	8.41	11.18	54.95	77.75	99.78	142.7
Mechanical time constant (ms)	1.84	1.40	1.06	1.28	0.92	0.96	0.63
Torque constant KT (Nm/A)	1.15	1.19	1.15	0.98	0.88	0.88	1.01
Voltage constant KE [mV/RPM]	42.5	43.8	41.6	35.0	32.0	31.0	35.5
Winding resistance (Ohm)	1.06	0.82	0.43	0.077	0.032	0.025	0.015
Winding inductance (mH)	14.29	11.12	6.97	1.27	0.89	0.60	0.40
Electrical time constant (ms)	13.55	13.50	16.06	16.5	27.8	24.0	26.7
Insulation class	Class A (UL), Class B (CE)						
Insulation resistance	>100MΩ, DC 500V						
Insulation strength	$1500V_{ac}$, 60 seconds						
Weight without brake [kg (lb)]	6.8 (15.0)	7.0 (15.4)	7.5 (16.5)	18.5 (40.8)	23.5 (51.8)	30.5 (67.2)	37.0 (81.6)
Weight with brake [kg (lb)]	8.2 (18.1)	8.4 (18.5)	8.9 (19.6)	22.5 (49.6)	29.0 (63.9)	36.0 (79.4)	53.0 (116.9)
Max. radial shaft load [N]	490	490	490	1470	1470	1764	1764
Max. thrust shaft load [N]	98	98	98	490	490	588	588
Rotor moment of inertia [$kg.cm^2$] (with brake)	8.94	9.14	11.9	57.06	80.65	102.70	145.55
Mechanical time constant [ms] (with brake)	2.0	1.51	1.13	1.33	0.96	0.99	0.64
Brake holding torque [Nm] (min)	10	10	10	25.0	25.0	25.0	25.0
Brake power consumption (at 20°C) [W]	19	19	19	20.4	20.4	20.4	20.4
Brake release time [ms] (Max)	10	10	10	10	10	10	10
Brake pull-in time [ms] (Max)	70	70	70	70	70	70	70
Vibration grade [µm]	15						
Operating temperature	0 ... 40 °C (32 ... 104 °F)						
Storage temperature	-10 ... 80 °C (-14 ... 176 °F)						
Operating humidity	20 ... 90 % RH (non-condensing)						
Storage humidity	20 ... 90 % RH (non-condensing)						
Vibration capacity	$2.5m/s^2$						
IP Rating	IP65 (when IP65 connectors are used, and when an oil seal is fitted to the rotating shaft (an oil seal model is used))						
Approvals							

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

Characteristic curves BCH040

BCH0401O + LXM23•U01M3X

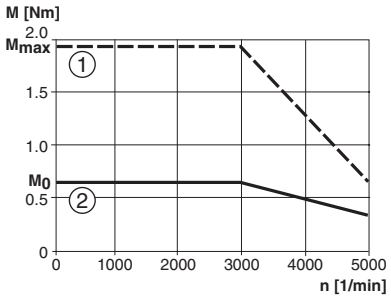


Measurement of the characteristic curves with 220 V single-phase.

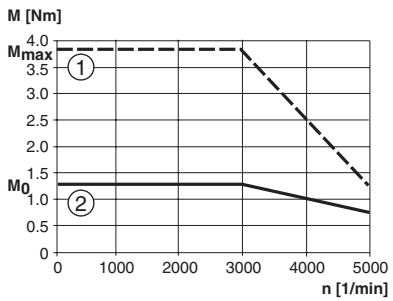
(1) Peak current
(2) Continuous torque

Characteristic curves BCH060

BCH0601O + LXM23•U02M3X



BCH0602O + LXM23•U04M3X

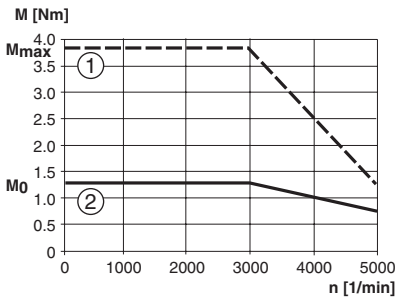


Measurement of the characteristic curves with 220 V single-phase.

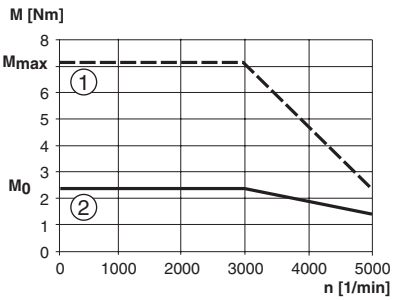
(1) Peak current
(2) Continuous torque

Characteristic curves BCH080

BCH0801O + LXM23•U04M3X



BCH0802O + LXM23•U07M3X



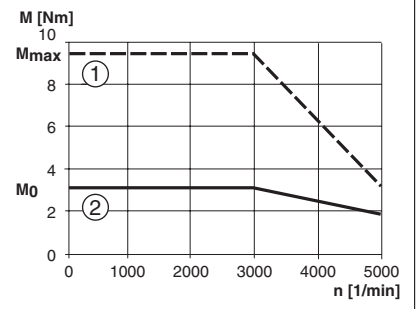
Measurement of the characteristic curves with 220 V single-phase.

(1) Peak current
(2) Continuous torque

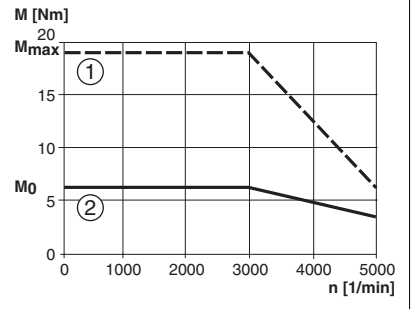
0198441113932, V2.02, 11.2014

Characteristic curves BCH100

BCH1001O + LXM23•U10M3X



BCH1002O + LXM23•U20M3X



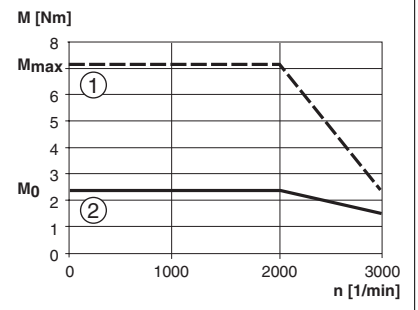
BCH1001O: Measurement of the characteristic curves with 220 V single-phase.

BCH1002O: Measurement of the characteristic curves with 220 V three-phase.

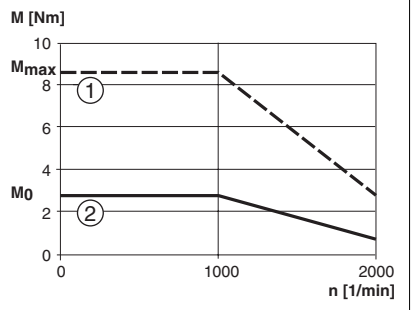
(1) Peak current
(2) Continuous torque

Characteristic curves BCH1301

BCH1301N + LXM23•U04M3X



BCH1301M + LXM23•U04M3X

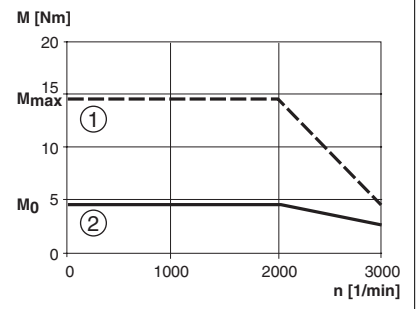


Measurement of the characteristic curves with 220 V single-phase.

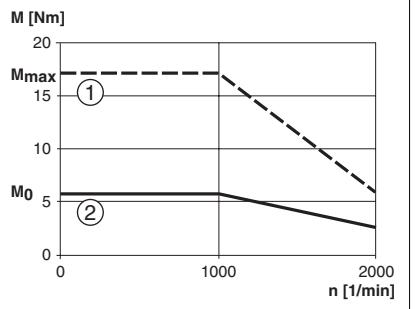
(1) Peak current
(2) Continuous torque

Characteristic curves BCH1302

BCH1302N + LXM23•U10M3X



BCH1302M + LXM23•U07M3X



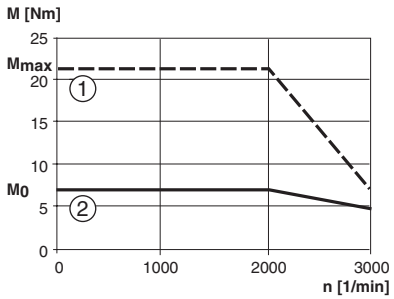
Measurement of the characteristic curves with 220 V single-phase.

(1) Peak current
(2) Continuous torque

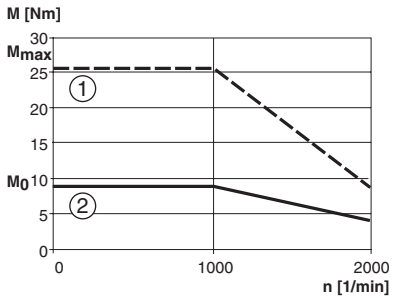
0198441113932, V2.02, 11.2014

Characteristic curves BCH1303

BCH1303N + LXM23•U15M3X



BCH1303M + LXM23•U10M3X

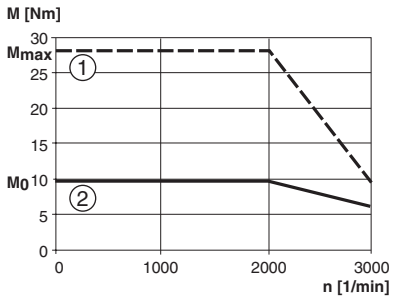


Measurement of the characteristic curves with 220 V single-phase.

(1) Peak current
(2) Continuous torque

Characteristic curves BCH1304

BCH1304N + LXM23•U20M3X

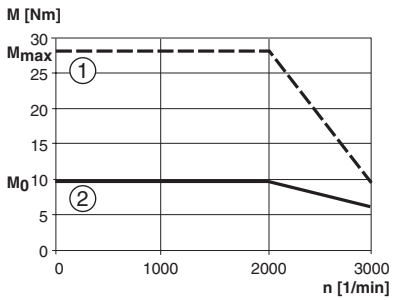


Measurement of the characteristic curves with 220 V three-phase.

(1) Peak current
(2) Continuous torque

Characteristic curves BCH1801

BCH1801N + LXM23•U20M3X



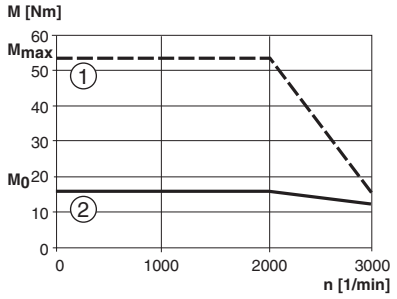
Measurement of the characteristic curves with 220 V three-phase.

(1) Peak current
(2) Continuous torque

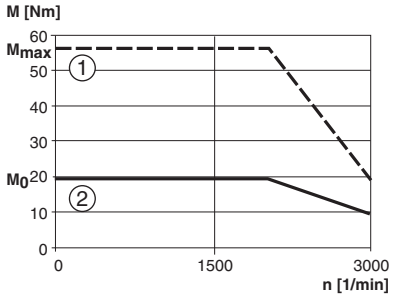
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Characteristic curves BCH1802

BCH1802N + LXM23•U30M3X



BCH1802M + LXM23•U30M3X

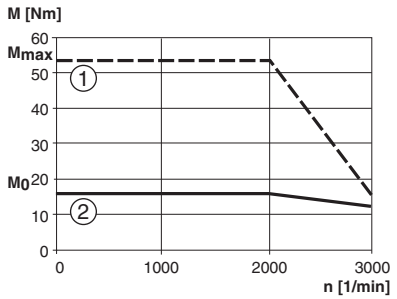


Measurement of the characteristic curves with 220 V three-phase.

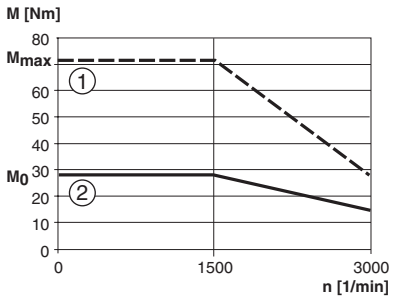
(1) Peak current
(2) Continuous torque

Characteristic curves BCH1803

BCH1803N + LXM23•U45M3X



BCH1803M + LXM23•U45M3X

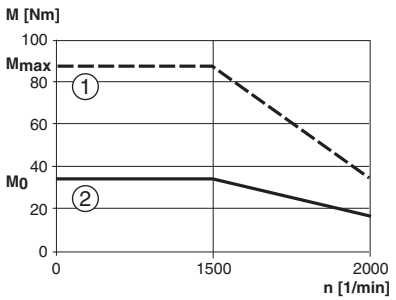


Measurement of the characteristic curves with 220 V three-phase.

(1) Peak current
(2) Continuous torque

Characteristic curves BCH1804

BCH1804M + LXM23•U55M3X



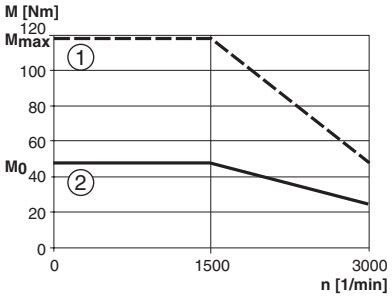
Measurement of the characteristic curves with 220 V three-phase.

(1) Peak current
(2) Continuous torque

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Characteristic curves BCH1805

BCH1805M + LXM23•U75M3X



Measurement of the characteristic curves with 220 V three-phase.

(1) Peak current

(2) Continuous torque

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2.4.3 Overload Characteristics

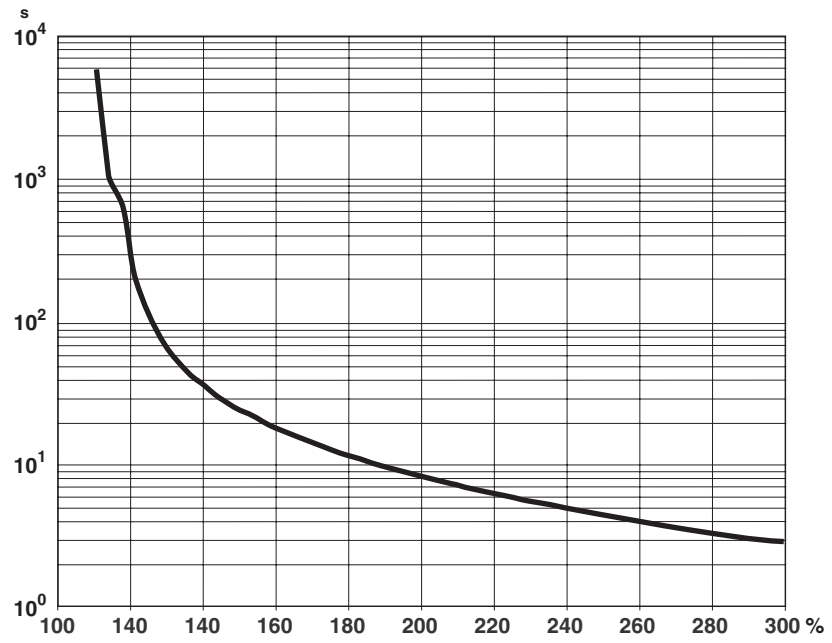
Motor overload monitoring is a function that monitors for excessively high current in the motor phases.

Motor overload monitoring

1. Motor was operated for several seconds with a torque exceeding 100% torque.
2. Motor had driven high inertia machine and had accelerated and decelerated at high frequency.
3. Motor 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.

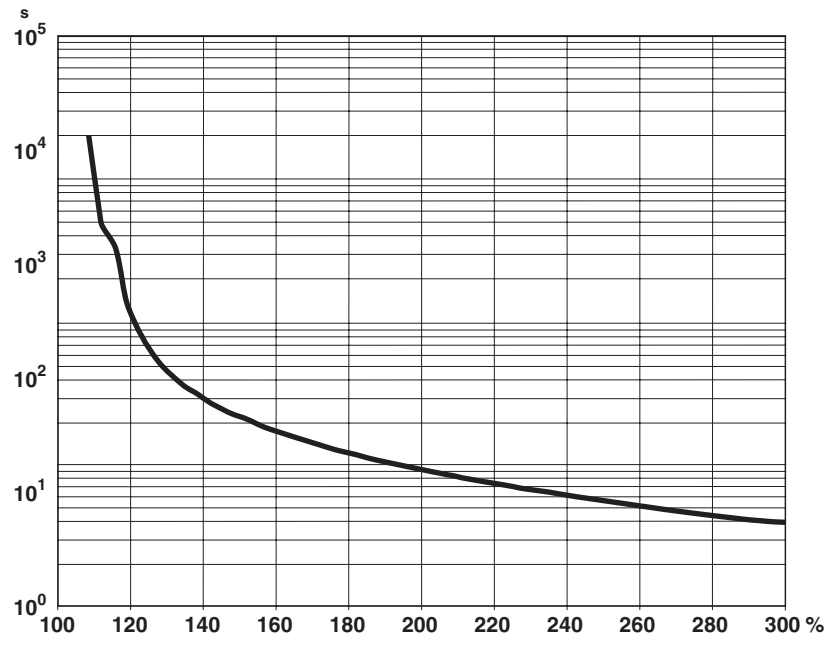
0198441113932, V2.02, 11.2014

Chart of load and operating time



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

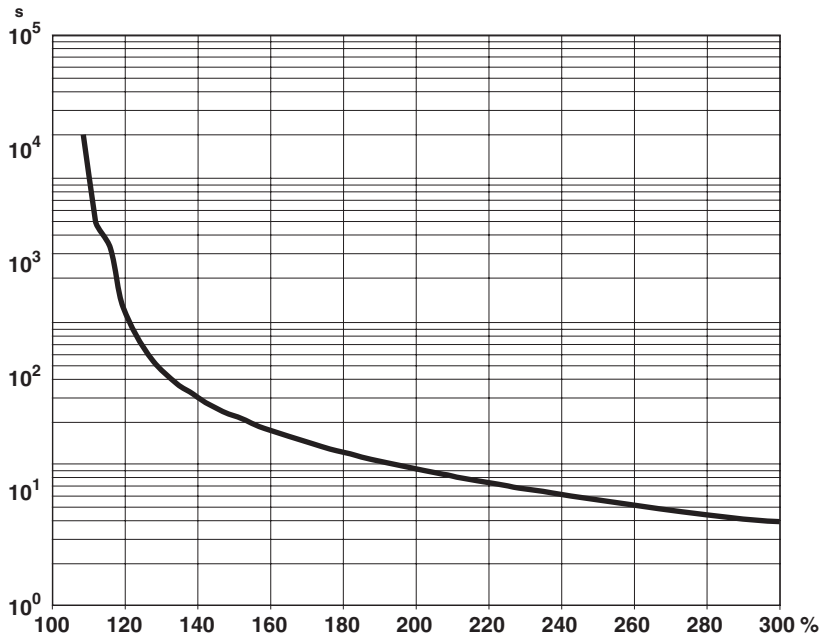
Table 1: Ultra low/low Inertia Series (BCH0401O, BCH0601O, BCH0602O, BCH0801O, BCH0802O, BCH1001O, BCH1002O)



Load	Operating Time
120 %	527.6 s
140 %	70.4 s
160 %	35.2 s
180 %	22.4 s
200 %	16 s
220 %	12.2 s
240 %	9.6 s
260 %	7.8 s
280 %	6.6 s
300 %	5.6 s

Table 2: Medium and Medium-High Inertia Series (BCH1301N, BCH1302N, BCH1303N, BCH1304N, BCH1801N, BCH1802N, BCH1802M)

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Load	Operating Time
120 %	527.6 s
140 %	70.4 s
160 %	35.2 s
180 %	22.4 s
200 %	16 s
220 %	12.2 s
240 %	9.6 s
260 %	7.8 s
280 %	6.6 s
300 %	5.6 s

Table 3: High Inertia Series (BCH1301M, BCH1302M, BCH1303M)

2.5 Conditions for UL 508C

If the product is used to comply with UL 508C, the following conditions must also be met:

Wiring Use at least 60/75 °C copper conductors.

2.6 Certifications

Product certifications:

Assigned file number	Related products	Certified by
E153659	LXM23A servo drives, LXM23D servo drives,	UL
E208613	BCH servo motors	UL

0198441113932, V2.02, 11.2014

2.7 Declaration of conformity

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

EC DECLARATION OF CONFORMITY
YEAR 2011

☐ according to EC Directive on Machinery 2006/42/EC
☒ according to EC Directive EMC 2004/108/EC
☒ according to EC Directive Low Voltage 2006/95/EC

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

Designation:	AC Servo drive
Type:	LXM23xx
Applied harmonized standards, especially:	EN 61800-5-1:2007 EN 61800-3:2004
Applied national standards and technical specifications, especially:	UL 508C Product documentation
Company stamp:	Schneider Electric Motion Deutschland GmbH Postfach 11 80 • D-77901 Lahr Breslauer Str. 7 • D-77933 Lahr
Date/Signature:	4 April 2011 ppa.
Name/Department:	Björn Hagemann/Development

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

EC DECLARATION OF CONFORMITY YEAR 2011

☐ according to EC Directive on Machinery 2006/42/EC
☐ according to EC Directive EMC 2004/108/EC
☒ according to EC Directive Low Voltage 2006/95/EC

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

Designation:	AC Servo motor
Type:	BCHxx
Applied harmonized standards, especially:	EN 61800-5-1:2007 EN 60034-1:2010 EN 60034-5:2001 EN 60034-5/A1:2007
Applied national standards and technical specifications, especially:	UL 1004 Product documentation
Company stamp:	Schneider Electric Motion Deutschland GmbH Postfach 11 80 · D-77901 Lahr Breslauer Str. 7 · D-77933 Lahr
Date/Signature:	4 April 2011 ppa.
Name/Department:	Björn Hagemann/Development

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3 Engineering

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

Subject	Page
"3.1 Electromagnetic compatibility (EMC)"	*55*
"3.2 Residual current device"	*57*
"3.3 Operation in an IT mains"	*57*
"3.4 Common DC bus"	*57*
"3.5 Rating the braking resistor"	*58*
"3.6 Monitoring functions"	*65*
"3.7 Configurable inputs and outputs"	*66*

3.1 Electromagnetic compatibility (EMC)

Signal interference can cause unexpected responses of the device and of other equipment in the vicinity of the device.

⚠ WARNING

SIGNAL AND DEVICE INTERFERENCE

- Install the wiring in accordance with the EMC requirements described.
- Verify compliance with the EMC requirements described.
- Verify compliance with all EMC regulations and requirements applicable in the country in which the product is to be operated and with all EMC regulations and requirements applicable at the installation site.

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 IEC 61800-3 if the measures described in this manual are implemented during installation.

If the selected composition (product itself, mains filter, other accessories and measures) does not meet the requirements of category C1, the following information applies as it appears in IEC 61800-3:

⚠ WARNING

RADIO INTERFERENCE

In a domestic environment this product may cause radio interference in which case supplementary mitigation measures may be required.

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

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

Control cabinet design

EMC measures	Objective
Use mounting plates with good electrical conductivity, connect large surface areas of metal parts, remove paint from contact areas.	Good conductivity due to large surface contact.
Ground the control cabinet, the control cabinet door and the mounting plate with ground straps or ground wires. The conductor cross section must be at least 10 mm^2 (AWG 6).	Reduces emissions.
Install switching devices such as power contactors, relays or solenoid valves with interference suppression units or arc suppressors (for example, diodes, varistors, RC circuits).	Reduces mutual interference
Do not install power components and control components adjacent to one another.	Reduces mutual interference

Additional measures for EMC improvement

Depending on the application, the following measures can improve the EMC-dependent values:

EMC measures	Objective
Use mains reactors	Reduces mains harmonics, prolongs product service life.
Use external mains filters	Improves the EMC limit values.
Additional EMC measures, for example mounting in a closed control cabinet with 15 dB shielding attenuation of radiated interference	Improves the EMC limit values.

Equipotential bonding conductors

Potential differences can result in excessive currents on the cable shields. Use equipotential bonding conductors to reduce currents on the cable shields.

The equipotential bonding conductor must be rated for the maximum current. Practical experience has shown that the following conductor cross sections can be used:

- 16 mm^2 (AWG 4) for equipotential bonding conductors up to a length of 200 m (656 ft)
- 20 mm^2 (AWG 4) for equipotential bonding conductors with a length of more than 200 m (656 ft)

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3.2 Residual current device

⚠ WARNING

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, serious injury, or equipment damage.

Conditions for use of residual current device

If a residual current device (RCD / GFCI) or a residual current monitor (RCM) is used for protection against direct or indirect contact, the following conditions must be met:

- A residual current device "type A", series s.i. (super-immunized, Schneider Electric) can be used for single-phase drives.
- In all other cases, you must use a residual current device "type B", with sensitivity to all currents and with approval for frequency inverters.

Additional conditions:

- The product has an increased leakage current when it is switched on. Use residual current devices with a response delay so that the residual current device does not trip inadvertently due to the peak current that occurs when the product is switched on.
- High-frequency currents must be filtered.
- When using residual current devices, consider the leakage currents of connected consumers.

3.3 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 an IT mains into a TT/TN mains. The device may be connected to this mains.

3.4 Common DC bus

Parallel connection of the DC bus of multiple drives (daisy-chaining) is not permitted. Operation with parallel connection via the DC bus may permanently damage the drives either immediately or over time.

⚠ CAUTION

PERMANENT DAMAGE TO THE DEVICE DUE TO PARALLEL CONNECTION OF THE DC BUS

Do not interconnect the DC bus of multiple drives.

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

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3.5 Rating the braking resistor

An insufficiently rated braking resistor can cause overvoltage on the DC bus. Overvoltage on the DC bus causes the power stage to be disabled. The motor is no longer actively decelerated.

⚠ WARNING

UNINTENDED EQUIPMENT OPERATION

- Verify that the braking resistor has a sufficient rating by performing a test run under maximum load conditions.
- Verify that the parameter settings for the braking resistor are correct.

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.

The temperature of the braking resistor may exceed 250 °C (482 °F) during operation.

⚠ WARNING

HOT SURFACES

- Ensure that it is not possible to make any contact with a hot braking resistor.
- Do not allow flammable or heat-sensitive parts in the immediate vicinity of the braking resistor.
- Verify that the heat dissipation is sufficient by performing a test run under maximum load conditions.

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

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Internal braking resistor

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

Internal braking resistor specifications				
Servo Drive (kW)	Resistance [Ω] (parameter P1-52)	Nominal power [W] (parameter P1-53)	Regenerative Power processed by internal braking resistor [W]	Min. Permissible Resistance [Ω]
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

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External braking Resistor

An external braking resistor is required for applications in which the motor must be decelerated quickly and the internal braking resistor cannot absorb the excess braking energy.

Note the following when using an external braking resistor:

1. Set the resistance (parameter P1-52) and capacity (parameter P1-53) correctly.

2. If you install an external braking resistor, its resistance must be the same as the resistance of the internal braking resistor. If combining multiple small-capacity braking resistors in parallel to increase the resistor capacity, the resistance of the braking resistor must comply with the specifications listed in the above table.

3. When the amount of regenerative power (average value) that can be processed is used at or below the rated load ratio, the resistor temperature will increase to 120 °C (248 °F) or higher (if the regeneration condition occurs continuously). Use forced air cooling to reduce the temperature of the external braking resistors. Use external braking resistors with thermal switches.

The device is shipped with the internal braking resistor activated by means of a factory-installed jumper over PA/+ and PBi. The internal braking resistor and an external braking resistor must not be used simultaneously. Before connecting an external braking resistor, you must remove the jumper over PA/+ and PBi to deactivate the internal braking resistor.

⚠ CAUTION

DESTRUCTION OF DEVICE

Remove the jumper between PA/+ and PBi before connecting an external braking resistor.

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

If you use an external braking resistor, connect it to PA/+ and PBe. The circuit between PA/+ and PBi must be open. The resistance of the external braking resistor must comply with the specification of the internal braking resistor (listet in the table above). The dissipative power of IGBT (Insulated Gate Bipolar Transistor) is ignored so you can calculate the capacity of the braking resistor. The following sections describe the Regenerative Power Calculation Method and the Simple Calculation Method for calculating the regenerative power capacity of external braking resistors.

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Sizing the braking resistor

(1) Without Load

When there is no external load torque, if the servo motor repeats operation, the regenerative power generated by braking will be transmitted into the capacitance of the DC bus. After the capacitance voltage exceeds a specific value, the braking resistor can dissipate the remaining regenerative power.

Use the table and procedure described below to calculate the regenerative power.

Servo Drive (kW)		Servo Motor	Rotor Inertia J (kg.cm2)	Regenerative power from empty load 3000 RPM to stop Eo (joule)	Max. regenerative power of capacitance Ec (joule)
Low Inertia	0.1	BCH0401O	0.037	0.18	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
High Inertia	3.5	BCH1803N			
	4.5	BCH1803M	77.75	384.47	25
	5.5	BCH1804M	99.78	493.4	27
	7.5	BCH1805M	142.7	705.66	93

Eo = J x wr2/182 (joule) , Wr : RPM

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If the load inertia is N x motor inertia, the regenerative power will be (N +1) x E0 when the servo motor brakes from 3000 RPM to 0. Then, the braking resistor can dissipate (N+1) x E0 - Ec (joule). If the time of repeat operation cycle is T seconds, then the regenerative power is 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 braking resistor to the maximum	Change the value of P1-53 to maximum
2	Set the operation cycle T	User input
3	Set motor speed Wr	User input or read via P0-02 Drive State Display
4	Set load/motor inertia ratio N	User input or read via P0-02 Drive State Display
5	Calculate the maximum regenerative power Eo	Eo = Jxwr2/182
6	Set the regenerative power Ec that can be absorbed	See table above
7	Calculate the required regenerative power capacity	2 x (N+1) x Eo-Ec) / T

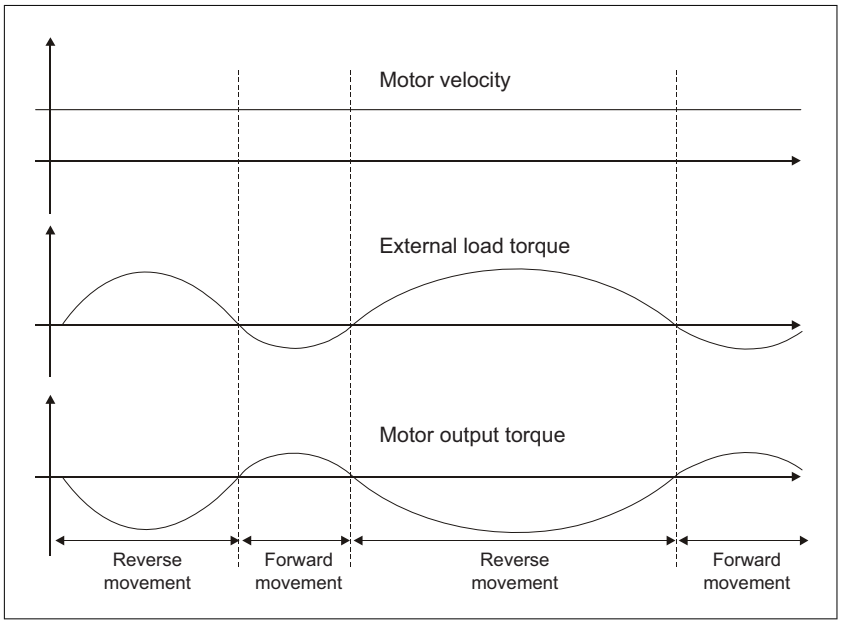
For example: If a 400 W servo drive is used, the time of repeat operation cycle is T = 0.4 sec, the maximum motor speed is 3000 RPM, the load inertia is 7 x motor inertia, then the necessary power of the braking resistor is 2 x ((7+1) x 1.68 - 8) / 0.4 = 27.2 W. If the calculation result is smaller than the regenerative power, you should use the 60 W internal braking resistor. Usually the internal braking resistor of the drive can meet the requirements of general application if the external load inertia is not excessive.

If the capacity of the braking resistor is insufficient, the accumulated power will be larger and the temperature will also increase. The alarm AL005 may occur if the temperature is too high. The following figure shows the actual operation of the braking resistor.

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(2) With Load

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



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

Example:

If the external load torque is a +70 % of the rated torque and the speed of rotation reaches 3000 RPM, for a 400 W servo drive (rated torque 1.27 Nm), you must connect an external braking resistor whose power is 2 x (0.7 x 1.27) x (3000 x 2 x p / 60) = 560 W, 40 Ω.

Simple Calculation Method

You can select the adequate braking resistors according to the permissible frequency required by actual operation and the permissible frequency when the servo motor runs without load. The permissible frequency when the servo motor runs without load is the maximum frequency that can be operated during continuous operation when the servo motor accelerates from 0 RPM to rated speed and decelerates from rated speed to 0 RPM. The permissible frequencies when the servo motor runs without load are shown in the following table.

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Permissible frequency when the servo motor runs without load (times/min) and uses the internal braking resistor											
Motor power	600W	750W	900W	1.0kW	1.5kW	2.0kW	2.0kW	3.0kW	4.5kW	5.5kW	7.5kW
Servo motor	06	07	09	10	15	20	20	30	45	55	75
BCH....O	-	312	-	137	-	83 (F100)	83 (F100)	-	-	-	-
BCH....N	-	-	-	42	32	24 (F130)	10 (F180)	11	-	-	
BCH....M	42	-	31	-	-	-	-	11	8	-	-

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

$$\text{Allowable frequency} = \frac{\text{Allowable frequency when servo motor runs without load}}{m+1} \times \left[\frac{\text{Rated speed}}{\text{Operating speed}}\right]^2 \frac{\text{times}}{\text{min}}$$

m = load/motor inertia ratio

You can select the adequate external braking resistors according to the permissible frequency by referring to the table below:

Permissible frequency when the servo motor runs without load (times/min) and uses an external braking resistor						
Motor power	BCH....O					
Recommended braking resistor specifications	200 W	400 W (F60)	400 W (F80)	750 W	1.0 kW	2.0 kW
	02	04	04	07	10	20
400 W, 80 Ω	13710	8761	3569	-	-	-
400 W, 40 Ω	-	-	-	2147	-	-
500 W, 40 Ω	-	-	-	-	1145	-
1 kW, 16 Ω	-	-	-	-	-	1363

Permissible frequency when the servo motor runs without load (times/min) and uses an external braking resistor						
Motor power	BCH....N					
Recommended braking resistor specifications	0.5 kW	1 kW	1.5 kW	2.0 kW	2.0 kW	3.0 kW
	04	10	15	20	20	30
400 W, 80 Ω	291	-	-	-	-	-
400 W, 40 Ω	-	289	217	-	-	-
1 kW, 16 Ω	-	-	-	416	175	-
1.5 kW, 16 Ω	-	-	-	-	-	166

Permissible frequency when the servo motor runs without load (times/min) and uses an external braking resistor				
Motor power	BCH....M			
Recommended braking resistor specifications	400 W	750 W	1.0 kW	3.0 kW (F180)
	03	07	10	30
400 W, 80 Ω	297	-	-	-
400 W, 40 Ω	-	289	-	-
1 kW, 40 Ω	-	-	543	-
1.5 kW, 16 Ω	-	-	-	166

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If 2 or more braking resistors are connected to one drive, note the following criteria:

- The braking resistors must be connected in parallel or in series so the required resistance is reached. Only connect resistors with identical resistance in parallel in order to evenly distribute the load to all braking resistors.
- The total resistance of all external braking resistors connected to one drive must not fall below a lower limit.
- The continuous power of the network of connected braking resistors must be calculated. The result must be greater than or equal to the actually required continuous power.

NOTE: Regarding the selection of braking resistor, see the table of braking resistor specifications in chapter *"11 Accessories and spare parts"*.

3.6 Monitoring functions

The monitoring functions of the product can be used to monitor movements and to monitor device-internal signals. These monitoring functions are not safety functions.

The following monitoring functions are available:

Monitoring function	Task
Data connection	Monitors data connection for interruption
Limit switch signals	Monitors for permissible movement range
Position deviation	Monitors for difference between actual 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 power stage supply and the DC bus
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 *"7.2.1 Monitor Variables"*.

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3.7 Configurable inputs and outputs

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

⚠ WARNING

LOSS OF CONTROL

- Ensure that limit switches are installed if your application, based on your risk assessment, requires limit switches.
- Verify correct connection of the limit switches.
- Verify that the limit switches are mounted in a position far enough away from the mechanical stop to allow for an adequate stopping distance.
- Verify correct parameterization and function of the limit switches.

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 *"4.5.6 Input / Output Interface Connector CN1"* for additional information.

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4 Installation

An engineering phase is mandatory prior to mechanical and electrical installation. See chapter *"3 Engineering"* for basic information.

This product has a leakage current greater than 3.5 mA. If the protective ground connection is interrupted, a hazardous touch current may flow if the housing is touched.

⚠ ⚠ DANGER

ELECTRIC SHOCK CAUSED BY INSUFFICIENT GROUNDING

- Use a protective ground conductor at with least 10 mm^2 (AWG 6) or two protective ground conductors with the cross section of the conductors supplying the power terminals.
- Verify compliance with all local and national electrical code requirements as well as all other applicable regulations with respect to grounding of all equipment.

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

⚠ ⚠ DANGER

ELECTRIC SHOCK CAUSED BY INSUFFICIENT GROUNDING

- Verify compliance with all local and national electrical code requirements as well as all other applicable regulations with respect to grounding of the entire drive system.
- Ground the drive system before applying voltage.
- Do not use conduits as protective ground conductors; use a protective ground conductor inside the conduit.
- The cross section of the protective ground conductor must comply with the applicable standards.
- Do not consider cable shields to be protective ground conductors.

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

⚠ ⚠ DANGER

ELECTRIC SHOCK OR UNINTENDED EQUIPMENT OPERATION

- Keep foreign objects from getting into the product.
- Verify the correct seating of seals and cable entries in order to avoid deposits and humidity.

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

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The metal surfaces of the product may exceed 100 °C (212 °F) during operation.

⚠ WARNING

HOT SURFACES

- Avoid unprotected contact with hot surfaces.
- Do not allow flammable or heat-sensitive parts in the immediate vicinity of hot surfaces.
- Verify that the heat dissipation is sufficient by performing a test run under maximum load conditions.

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

⚠ CAUTION

PERMANENT DAMAGE TO THE DRIVE DUE TO INCORRECT MAINS VOLTAGE CONNECTION

- Verify that you use the correct mains voltage; install a transformer, if necessary.
- Do not connect mains voltage to the output terminals (U, V, W).

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

4.1 Before mounting

Inspecting the product

- ▸ Verify the product version by means of the type code on the nameplate. See chapter *"1.3 Nameplate"* and chapter *"1.4 Type code"*.
- ▸ Prior to mounting, inspect the product for visible damage.

Damaged products may cause electric shock or unintended equipment operation.

⚠ ⚠ DANGER

ELECTRIC SHOCK OR UNINTENDED EQUIPMENT OPERATION

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

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

Contact your local Schneider Electric sales office if you detect any damage whatsoever.

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4.2 Scope of supply

Package contents:

Part I : Drive

- Servo drive LXM23A
- 5 pin terminal block for L1, L2, R, S, T (available for 100 ... 1500 W versions)
- 3 pin terminal block "Motor" for U, V, W (available for 100 ... 1500 W versions)
- 4 pin terminal block "CN5" for PA/+, PBi, PBe,PC/- (available for 100 ... 1500 W versions)
- One operating lever (for wire to terminal block insertion; available for 100 ... 1500 W versions)
- One jumper bar (installed at CN5, pins PA/+ and PBi)
- Adhesive labels with safety instructions in various languages

Part II : Motor

- Servo motor BCH

Part III : Accessory

- Ordered accessory

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4.3 Mechanical installation of drive

Attaching a label with safety instructions

- ▸ Select the label suitable for the target country.
  Observe the safety regulations in the target country.
- ▸ Attach the label to the front of the device so that it is clearly visible.

Control cabinet

The control cabinet must have a sufficient size so that all devices and components can be permanently installed and wired in compliance with the EMC requirements.

The ventilation of the control cabinet must be sufficient to comply with the specified ambient conditions for the devices and components operated in the control cabinet.

Mounting distances, ventilation

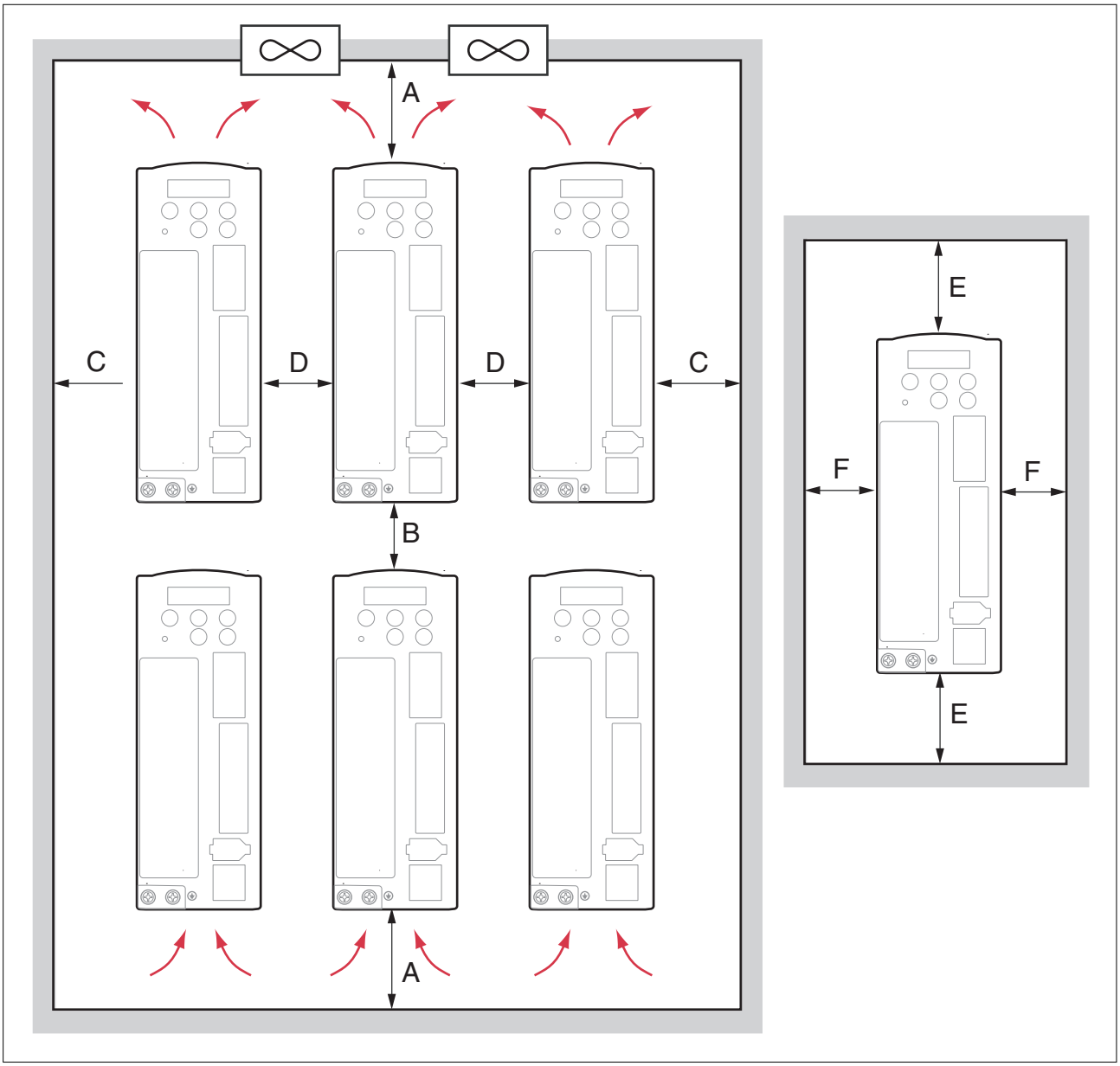
When selecting the position of the device in the control cabinet, note the following:

- Mount the device in a vertical position (±10°). This is required for cooling the device.
- Adhere to the minimum installation distances for required cooling. Avoid heat accumulations.
- Do not mount the device close to heat sources.
- Do not mount the device on flammable materials.
- The heated airflow from other devices and components must not heat up the air used for cooling the device.

The connection cables of the devices are routed to the top and to the bottom. The minimum distances must be adhered to for air circulation and cable installation.

- Do not mount the servo drive or motor in a location where it will be subjected to high levels of electromagnetic radiation.
- When mounting the servo drive, tighten the screws to properly secure the drive in place.

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Distance	
A ≥100 mm (≥4 in)	Free space above/below devices
B ≥80 mm (≥3.2 in)	Free space between devices
C ≥40 mm (≥1.6 in)	Free space between devices and cabinet
D ≥10 mm (≥0.4 in)	Free space between devices
E ≥50 mm (≥2 in)	Free space above/below the device
F ≥20 mm (≥0.8 in)	Free space between device and cabinet

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Mounting the device

See chapter *"2.2 Dimensions"*, page *27* for the dimensions of the mounting holes.

NOTE: Painted surfaces have an insulating effect. Before mounting the device to a painted mounting plate, remove all paint across a large area of the mounting points until the metal is completely bare.

- Note the ambient conditions in chapter *"2 Technical Data"*, page *25*.
- Mount the device in a vertical position (±10°).

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4.4 Mechanical installation of motor

Motors are very heavy relative to their size. The great mass of the motor can cause injuries and damage.

⚠ WARNING

GREAT MASS OR FALLING PARTS

- Use a a suitable crane or other suitable lifting gear for mounting the motor if this is required by the mass of the motor.
- Use the necessary personal protective equipment (for example, safety shoes, safety glasses and protective gloves).
- Mount the motor in such a way (tightening torque, securing screws) that it cannot come loose, even in the case of fast acceleration or continuous vibration.

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

Motors can generate strong local electrical and magnetic fields. This can cause interference in sensitive devices.

⚠ WARNING

STRONG ELECTROMAGNETIC FIELDS

- Keep persons with electronic medical implants, such as pacemakers, away from the motor.
- Do not place any sensitive devices close to the motor.

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

If the permissible ambient conditions are not respected, external substances from the environment may penetrate the product and cause unintended movement or equipment damage.

⚠ WARNING

UNINTENDED MOVEMENT

- Verify that the ambient conditions are respected.
- Do not allow seals to run dry.
- Keep liquids from getting to the shaft bushing (for example, in mounting position IM V3).
- Do not expose the shaft sealing rings and cable entries of the motor to the direct spray of a pressure washer.

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

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If the maximum permissible forces at the motor shaft are exceeded, this will result in premature wear of the bearing, shaft breakage or damage to the encoder.

⚠ WARNING

UNINTENDED EQUIPMENT OPERATION DUE TO MECHANICAL DAMAGE TO THE MOTOR

- Do not exceed the maximum permissible axial and radial forces at the motor shaft.
- Protect the motor shaft from impact.
- Do not exceed the maximum permissible axial force when pressing components onto the motor shaft.

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

⚠ CAUTION

DAMAGE CAUSED BY IMPROPER APPLICATION OF FORCES

- Do not use the motor as a step to climb into or onto the machine.
- Do not use the motor as a load-bearing part.
- Verify that the motor cannot be improperly used at the machine, for example, by means of design measures.

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

NOTICE

DAMAGE TO THE MOTOR CAUSED BY FORCES ACTING ON THE REAR SIDE OF THE MOTOR

- Do not place the motor on the rear side.
- Protect the rear side of the motor from impact.
- Do not lift motors via the rear side.
- Only lift motors equipped with eyebolts via the eyebolts.

Failure to follow these instructions can result in equipment damage.

Mounting surface for flange

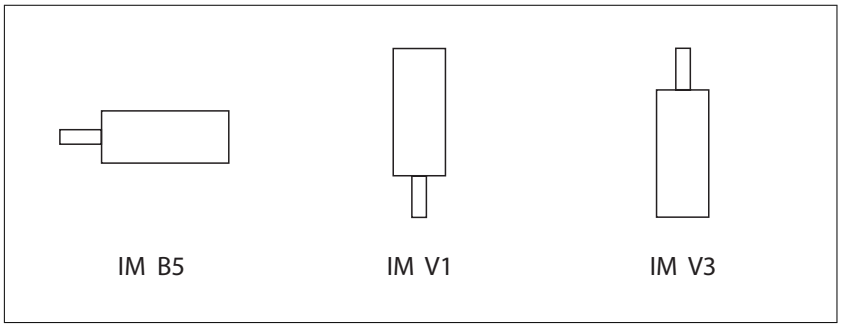
The mounting surface must be stable, clean and low-vibration.

▸ Verify that the system side meets all requirements in terms of dimensions and tolerances.

Mounting position

The following mounting positions are defined and approved as per IEC 60034-7:

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Mounting When the motor is mounted to the mounting surface, it must be accurately aligned axially and radially and make even contact with the mounting surface. All mounting screws must be tightened with the specified tightening torque. No uneven mechanical load must be applied when the mounting screws are tightened. See chapter *"2 Technical Data"* for data, dimensions and degrees of protection (IP).

Mounting output components Output components such as pulleys or couplings must be mounted with suitable equipment and tools. Motor and output component must be accurately aligned both axially and radially. Improper alignment of the motor or the output element causes runout and premature wear.

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4.5 Electrical installation of drive

4.5.1 Overview

Carefully read and observe all safety instructions and the chapter "Before you begin - safety information".

DC bus LED
The LED lights when mains voltage or internal charge are present. The DC bus LED is not an indicator of the absence of DC bus voltage.
Information: page *13*

Controller supply (L1, L2)
Connect to mains circuit.
Information: page *77*

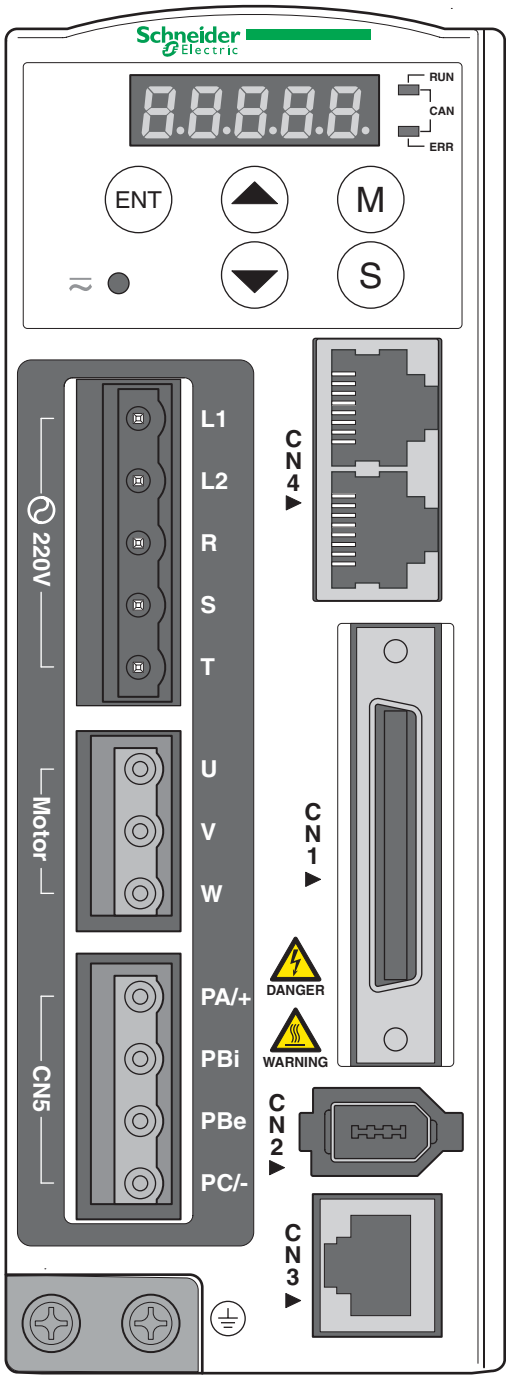
Power stage supply (R,S,T)
Connect to mains circuit.
Information: page *77*

Servo motor terminals (U,V, W)
Connect output (U, V, W) to the motor.
Information: page *77*

Braking resistor terminal (CN5)
Information: page *77*

- Internal braking resistor PA/+ and PBi bridged (PBe not connected)
- External braking resistor PA/+ and PBe (PBi not connected)

Ground terminal
For grounding the drive and the connected components.
Information: page *77*



HMI display
Information: page *123*
Alarm codes: page *231*

HMI keypad
M: HMI mode
S: Shift (several functions)
UP: Navigate, increase values
DOWN: Navigate, decrease values
ENT: Confirm, store data
Information: page *123*

Fieldbus (CN4)
CANopen and CANmotion
Information: page *77*

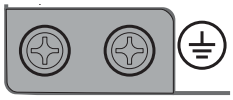
I/O Interface (CN1)
For connecting master controller (PLC) or I/O signals.
Information: page *77*

Encoder Interface (CN2)
For connecting motor encoder.
Information: page *77*

Commissioning interface (CN3)
For connecting PC via converter VW3M8131
Information: page *77*

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4.5.2 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 drive version.</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 drive version.</td></tr>
<tr><td rowspan="5">U, V, W</td><td rowspan="5">Servo motor output</td><td colspan="3">Used to connect servo motor</td></tr>
<tr><td>Terminal Symbol</td><td>Wire Color</td><td>Description</td></tr>
<tr><td>U</td><td>Red</td><td rowspan="3">Connecting to three-phase motor cable.</td></tr>
<tr><td>V</td><td>White</td></tr>
<tr><td>W</td><td>Black</td></tr>
<tr><td rowspan="2">PA/+, PBi, PBe, PC/-</td><td rowspan="2">Braking resistor terminal</td><td>Internal braking resistor</td><td colspan="2">The circuit is closed between PA/+ and PBi. The circuit is open between PA/+ and PBe.</td></tr>
<tr><td>External braking resistor</td><td colspan="2">Connect braking resistor to PA/+ and PBe. The circuit between PA/+ and PBi must be open.</td></tr>
<tr><td>PE (ground)
</td><td>Ground terminal</td><td colspan="3">Used to connect the grounding wire of power supply and servo motor (green/yellow).</td></tr>
<tr><td>CN1</td><td>I/O interface</td><td colspan="3">Used to connect external masters/controllers and I/O signals. See chapter "4.5.6 Input / Output Interface Connector CN1" for details.</td></tr>
<tr><td rowspan="7">CN2</td><td rowspan="7">Encoder interface</td><td colspan="3">Used to connect the motor encoder. See chapter "4.5.7 Encoder Connector CN2" for details.</td></tr>
<tr><td>Terminal Symbol</td><td>Wire Color</td><td>Pin No.</td></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 and Red/White</td><td>1</td></tr>
<tr><td>GND</td><td>Black and Black/ White</td><td>2, 4</td></tr>
<tr><td>CN3</td><td>Serial commissioning interface</td><td colspan="3">Used for RS485 or RS232 communication connection.
See chapter "4.5.8 Serial Communication Connector CN3" for details.</td></tr>
<tr><td>CN4</td><td>Fieldbus communication interface</td><td colspan="3">Used to connect field bus interface CANopen and CANmotion.
See chapter "4.5.9 CANopen and CANmotion Communication Interface CN4" for details.</td></tr>
</table>

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Wiring Notes

1. The entire installation procedure must be performed without voltage present.

2. Verify that the power supply as well as the entire wiring power terminals (R, S, T, L1, L2, U, V, W) is correct.

3. Use shielded twisted-pair cables for wiring to reduce voltage coupling and electrical noise and interference.

4. The cables connected to R, S, T and U, V, W terminals must be placed in conduits separate from the encoder or other signal cables. Separate them by at least 30 cm (11.8 inches).

5. If the encoder cable (CN2) is too short, use a shielded twisted-pair cable with grounding conductor. The maximum cable length is 20 m (65.62 ft.). For lengths greater than 20 m (65.62 ft.), double the cross section to reduce signal attenuation.

6. For the motor cable, use 600 V PTFE wire. The maximum cable length is 30 m (98.4 ft.). For lengths greater than 30 m (98.4 ft.), select cross sections in accordance with the voltage drop.

7. The shield of shielded twisted-pair cables must be connected to the ground terminal of the drive.

8. Insert only one wire into one terminal on the terminal block. See chapter *"4.5.4 Cable specifications for servo drive"* for connectors and cable specifications.

9. Do not bend or strain the connection cables between the servo drive and the motor.

Tightening torque for terminal screws

Dimension	Tightening torque [Nm] ([lb.in])
M3	1.4 (12.4)
M4	1.6 (14.2)
M6	3.0 (26.6)

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Conductor cross sections according to method of installation

The following sections describe the conductor cross sections for two standard methods of installation:

- Method of installation B2:

  Cables in conduits or cable trunking systems
- Method of installation E:

  Cables on open cable trays

Cross section in mm² (AWG) [1]	**Current carrying capacity with method of installation E in A** [2]	**Current-carrying capacity with method of installation B2 in A** [2]
0.75 (18)	10.4	8.5
1 (16)	12.4	10.1
1.5 (14)	16.1	13.1
2.5 (12)	22	17.4
4 (10)	30	23
6 (8)	37	30
10 (6)	52	40
16 (4)	70	54
25 (2)	88	70

1) See chapter *"11 Accessories and spare parts"* for available cables.
2) Values as per IEC 60204-1 for continuous operation, copper conductors and ambient air temperature 40°C (104 °F); see IEC 60204-1 for additional information.

Note the derating factors for grouping of cables and correction factors for other ambient conditions (IEC 60204-1).

The conductors must have a sufficiently large cross section so that the upstream fuse can trip.

In the case of longer cables, it may be necessary to use a greater conductor cross section to reduce the energy losses.

For cross section see also chapter
"4.5.4 Cable specifications for servo drive", power cable U, V, W.

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4.5.3 Wiring Methods

For servo drives from 200 W to 1.5 kW, the input power can be either single-phase or three-phase. For servo drives from 2 kW to 7.5 kW, the input power must be three-phase.

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

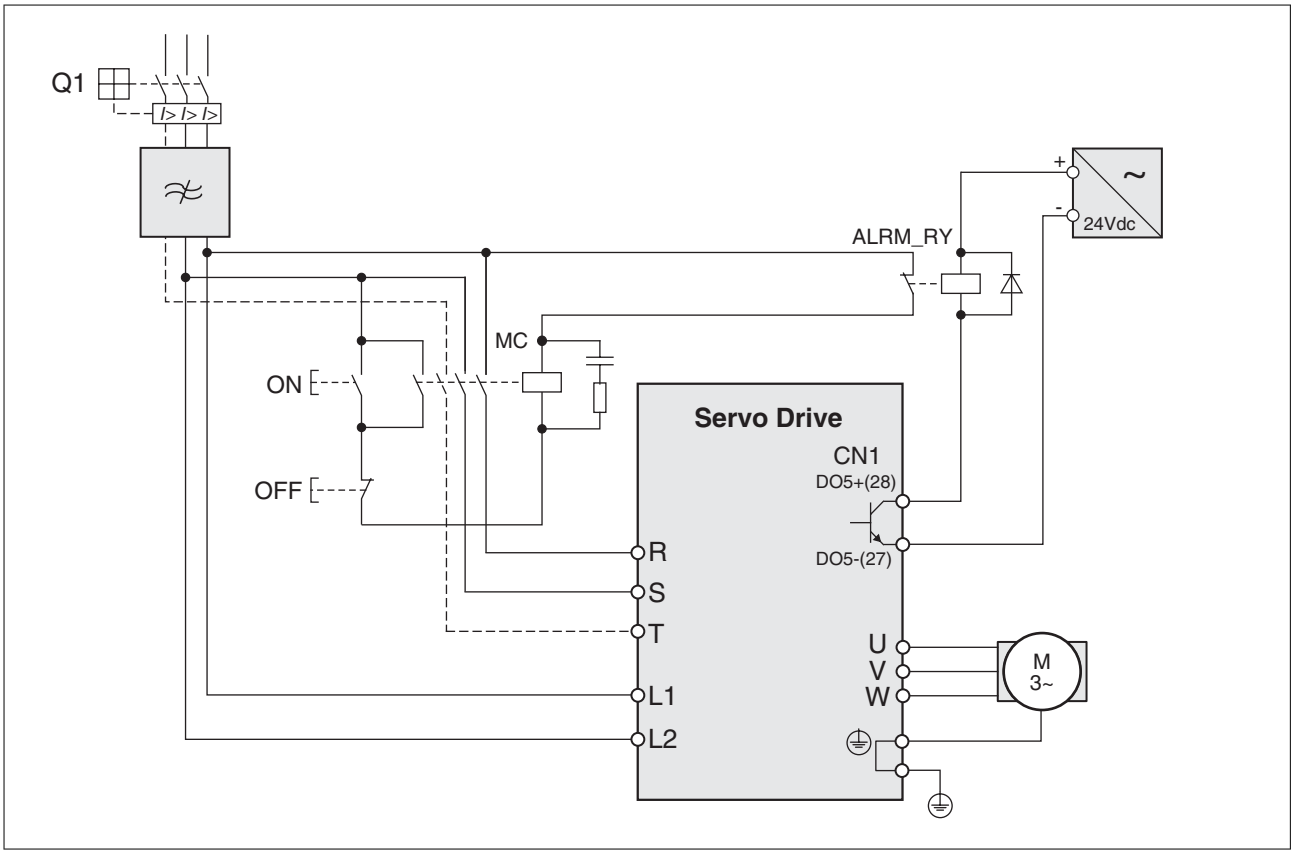


Figure 15: Single-phase and three-phase power supply connection

- Check whether additional circuit breakers are required if you use different wire cross sections.

See chapter *"6.4.4 Holding Brake"* for information on using a motor with a holding brake.

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4.5.4 Cable specifications for servo drive

Power cables

Servo Drive and Servo Motor		Power Cable - Cross Section mm² (AWG)	
		U, V, W	PA/+, PBe
LXM23•U01M3X	BCH0401O	0.82 (AWG18)	2.1 (AWG14)
LXM23•U02M3X	BCH0601O	0.82 (AWG18)	2.1 (AWG14)
LXM23•U04M3X	BCH0602O	0.82 (AWG18)	2.1 (AWG14)
	BCH0801O	0.82 (AWG18)	2.1 (AWG14)
	BCH1301N	0.82 (AWG18)	2.1 (AWG14)
	BCH1301M	0.82 (AWG18)	2.1 (AWG14)
LXM23•U07M3X	BCH0802O	0.82 (AWG18)	2.1 (AWG14)
	BCH1302M	0.82 (AWG18)	2.1 (AWG14)
LXM23•U10M3X	BCH1001O	1.3 (AWG16)	2.1 (AWG14)
	BCH1302N	1.3 (AWG16)	2.1 (AWG14)
	BCH1303M	1.3 (AWG16)	2.1 (AWG14)
LXM23•U15M3X	BCH1303N	1.3 (AWG16)	2.1 (AWG14)
LXM23•U20M3X	BCH1002O	2.1 (AWG14)	2.1 (AWG14)
	BCH1304N	2.1 (AWG14)	2.1 (AWG14)
	BCH1801N	3.3 (AWG12)	2.1 (AWG14)
LXM23•U30M3X	BCH1802N	3.3 (AWG12)	3.3 (AWG12)
	BCH1802M	3.3 (AWG12)	3.3 (AWG12)
LXM23•U45M3X	BCH1803M	8.4 (AWG8)	3.3 (AWG12)
LXM23•U55M3X	BCH1804M	13.3 (AWG6)	3.3 (AWG12)
LXM23•U75M3X	BCH1805M	13.3 (AWG6)	3.3 (AWG12)

Encoder Cables

Servo Drive	Encoder Cable			
	Cross Section mm² (AWG)	Core Number	UL Rating	Cable Length
LXM23•	0.13 (AWG26)	10 core (4 pair)	UL2464	3m (9.84ft.)

NOTE:

1) Use shielded twisted-pair cables for wiring to reduce voltage coupling and electrical noise and interference.

2) The shield of shielded twisted-pair cables must be connected to the ground terminal of the servo drive.

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4.5.5 Structure of the drive system

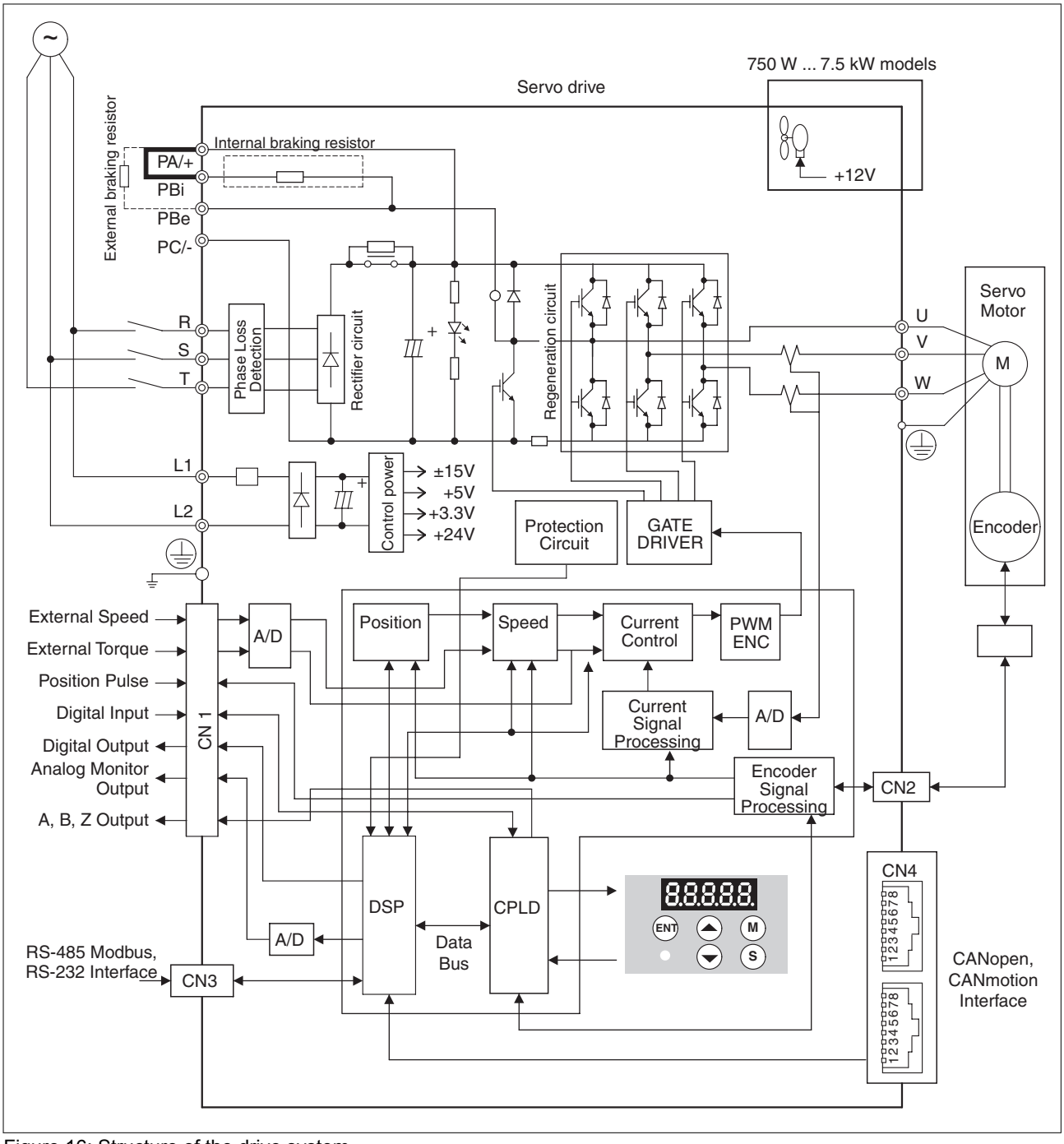


Figure 16: Structure of the drive system

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4.5.6 Input / Output Interface Connector CN1

The CN1 Interface Connector provides access to three signal groups:

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

2. 8 programmable Digital Inputs (DI), can be set via parameters P2-10 ... P2-17.

3. 5 programmable Digital Outputs (DO), can be set via parameters P2-18 ... P2-22.

A detailed explanation of each group is available in chapter *"4.5.6.2 Signals Explanation of Connector CN1"*.

4.5.6.1 CN1 Terminal Identification

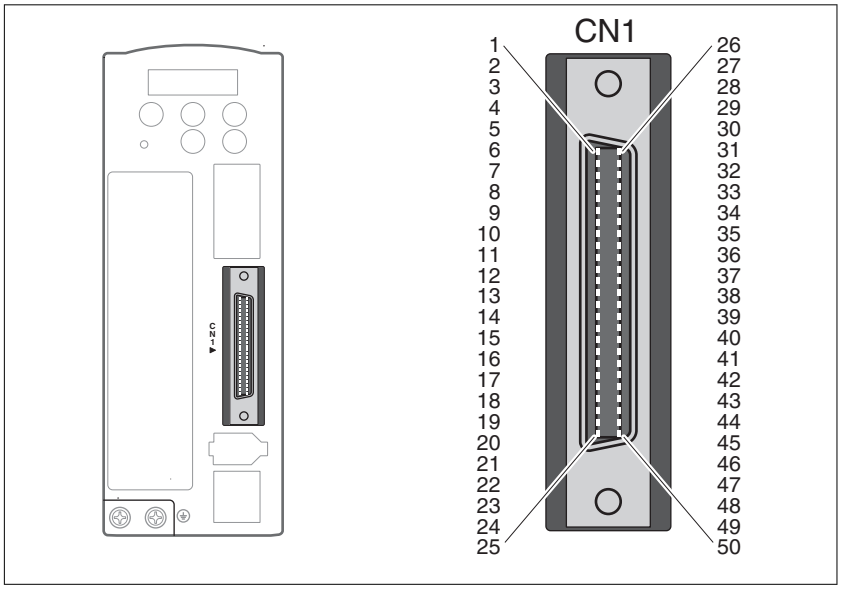


Figure 17: The Layout of CN1 Drive Connector

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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	Reserved
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_S (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

Connections which are labeled with "NC" or whose function is described as "Reserved" are reserved for future functions. Using reserved connections may lead to unintended equipment operation or equipment damage.

⚠ WARNING

UNINTENDED EQUIPMENT OPERATION

Do not use connections which are labeled as "NC" or whose function is described as "Reserved".

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

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4.5.6.2 Signals Explanation of Connector CN1

The following tables detail the three groups of signals of the CN1 interface.

- General Signals
- Digital Output (DO) signals
- Digital Input (DI) signals

The General Signals are set by the factory and cannot be changed, reprogrammed or adjusted. Both the Digital Input and Digital Output signals can be programmed by the user.

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Signal		Pin No.	Details	Wiring Diagram
Analog Signal Input	V_REF	42	1. Motor speed command: -10 V ... +10 V, corresponds to -3000 ... +3000 RPM speed command (factory default setting). 2. Motor speed command: -10 V ... +10 V, corresponds to -3 ... +3 rotations position command (factory default setting).	C1
	T_REF	18	Motor torque command: -10 V to +10 V, 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 accepts two different types of pulse inputs: Line-driver input (maximum input frequency is 500 Kpps) and Open-collector input (maximum input frequency is 200 Kpps). 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	If 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 accepts two different types of high-speed pulse inputs: +5 V input and Line-driver input. The maximum input frequency is 4 MHz. Three different pulse commands can be selected via parameter P1-00. They are A phase + B phase (Quadrature), CW pulse + CCW pulse, and Pulse + Direction.	C4-2
Position Pulse Output	OA /OA	21 22	Encoder signal output A, B, Z (Line-driver output). The motor encoder signals are available via 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 +24 V source voltage provided by the drive. The maximum permissible current is 500 mA.	-
	COM+ COM-	11 45, 47, 49	COM+ is the common voltage rail of the Digital Input (DI) and Digital Output (DO) signals. If VDD is used, VDD must be connected to COM+. If VDD is not used, an externally applied power (+12 V to +24 V) is to be added. The positive end of this applied power is to be connected to COM+ and the negative end of this applied power is to be connected to COM-.	
	VCC	20	VCC is a +12 V power rail provided by the drive. It is used for providing simple analog commands (analog speed or analog torque command). The maximum permissible current is 100 mA.	
Power	GND	12, 13, 19, 44	The polarity of VCC is with respect to Ground (GND).	

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Signal		Pin No.	Details	Wiring Diagram
Other	NC	14	No Connection.	

Table 4: General Signals

The Digital Input (DI) and Digital Output (DO) have factory default settings which correspond to the various servo drive control modes. However, both the DIs and DOs can be programmed independently to meet user requirements.

The DIs and DOs and their corresponding pin numbers are factory-set and cannot be changed. However, the assigned signals and control modes can be changed. For example, the factory default setting of DO5 (pins 28/27) can be assigned to DO1 (pins 7/6) and vice versa.

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DO Signal	Assigned Control Mode	Pin No. (Default)		Details	Wiring Diagram
		+	-		
SRDY	All	7	6	SRDY is activated when the servo drive is ready to run. Alarm conditions, if present, have been cleared.	C5/C6/C7/C8
SON	Not assigned	-	-	SON is activated when control power is applied to the servo drive. The drive may or may not be ready to run as an alarm condition may exist. Servo ON (SON) is "ON" with control power applied to the servo drive, there may be an alarm condition or not. The servo is not ready to run. Servo ready (SRDY) is "ON" where the servo is ready to run, no alarm exists.	
ZSPD	All	5	4	ZSPD is activated when the drive detects that the motor is equal to or below the Zero Speed Range setting as set in parameter P1-38. For example, at factory default, ZSPD will be activated when the drive detects that the motor rotates at a speed of 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 that the motor has reached the Target Rotation Speed setting as set 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 to 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 range of the target position. For example, at factory default, TPOS will be activated once the motor is in a -99 pulses range of the target position, then deactivated after it reaches a +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 an alarm condition. In the case of reverse limit error, forward limit error, operational stop, serial communication error and undervoltage, a warning (WARN) is triggered before the alarm occurs.	
BRKR	All	1	26	BRKR is activated for 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	-	-	Warning signal output. WARN is activated when the drive has detected reverse limit error, forward limit error, operational stop, serial communication error and undervoltage alarm conditions.	

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DO Signal	Assigned Control Mode	Pin No. (Default)		Details	Wiring Diagram
		+	-		
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 the reverse software limit is reached.	
SPL (SCCWL)	Pr	-	-	Forward software limit. SPL is activated when the servo drive has detected that the 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 a capture operation has been completed.	
MC_OK	Pr	-	-	Motion control completed output. MC_OK is activated when CMD_OK and TPOS are both ON. MC_OK is only activated if the servo drive has detected that the position command has been given and the positioning has been completed. If only CMD_OK or TPOS is ON, MC_OK will not be activated.	
SP_OK	S, Sz	-	-	SP_OK is activated when the speed error is equal to and below the setting value of P1-47.	
SDO_0	All	-	-	Output the status of bit 0 of P4-06.	C5/C6/C7/C8
SDO_1	All	-	-	Output the status of bit 1 of P4-06.	
SDO_2	All	-	-	Output the status of bit 2 of P4-06.	
SDO_3	All	-	-	Output the status of bit 3 of P4-06.	
SDO_4	All	-	-	Output the status of bit 4 of P4-06.	
SDO_5	All	-	-	Output the status of bit 5 of P4-06.	
SDO_6	All	-	-	Output the status of bit 6 of P4-06.	
SDO_7	All	-	-	Output the status of bit 7 of P4-06.	
SDO_8	All	-	-	Output the status of bit 8 of P4-06.	
SDO_9	All	-	-	Output the status of bit 9 of P4-06.	
SDO_A	All	-	-	Output the status of bit 10 of P4-06.	
SDO_B	All	-	-	Output the status of bit 11 of P4-06.	
SDO_C	All	-	-	Output the status of bit 12 of P4-06.	
SDO_D	All	-	-	Output the status of bit 13 of P4-06.	
SDO_E	All	-	-	Output the status of bit 14 of P4-06.	
SDO_F	All	-	-	Output the status of bit 15 of P4-06.	

Table 5: DO Signals

NOTE:

1) PINS 3 and 2 can either be TSPD or HOME, depending on the control mode selected.

2) The DO signals that do not have pin numbers are not default DO signals. If you want to use these non-default DO signals, you must

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change the settings of parameters P2-18 ... P2-22. The state of the output function may be turned ON or OFF as it depends on the settings of parameters P2-18 ... P2-22. See chapter *"4.5.6.3 User-defined DI and DO signals"* for details.

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DI Signal	Assigned Control Mode	Pin No. (Default)	Details(*2)	Wiring Diagram
SON	All	9	Servo On. Switch servo to "Servo Ready".	C9/C10/C11/C12
ARST	All	33	A number of alarms can be cleared by activating ARST. See chapter *"9.6 Clearing alarms"* for alarms that can be cleared with the ARST command. If the alarm persists or if the alarm message suggests that a closer inspection of the drive system may be advisable, check into the details of the alarm.	
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 less than the setting value of P1-38, it is used to lock the motor in the current 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 corresponds to the settings of POS0 ... POS2. 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 8 stored positions are programmed via a combination of the POS0 ... POS2 commands. See chapter *"6.3.1.2 Command source for Position Control (Pr) mode"*.	
POS1		8		
POS2		-		
SPD0	S, Sz, Pt-S, Pr-S, S-T	34	Select the source of speed command: See chapter *"6.3.2.1 Command Source of Speed Control Mode"*.	
SPD1		8		
TCM0	Pt, T, Tz, Pt-T, Pr-T, S-T	34	Select the source of torque command: See chapter *"6.3.3.1 Command Source of Torque Control Mode"*.	
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	
Pt-Pr	Pt, Pr	-	Internal position (Pr) and external pulse (Pt) mode switching. OFF: Pt, ON: Pr	C9/C10/C11/C12
OPST	All	30	It should be contact "b" and normally ON or an alarm (AL013) will display.	
NL(CWL)	Pt, Pr, S, T, Sz, Tz	32	Reverse inhibit limit. It should be contact "b" and normally ON or an alarm (AL014) will display.	
PL(CCWL)	Pt, Pr, S, T, Sz, Tz	31	Forward inhibit limit. It should be contact "b" and normally ON or an alarm (AL015) will display.	
ORGP	Pr	-	When ORGP is activated, the drive will command the motor to start to search the reference "Home" sensor.	

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DI Signal	Assigned Control Mode	Pin No. (Default)	Details(*2)	Wiring Diagram
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).	
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.	
STOP	Pr	-	Motor stop.	

Table 6: DI Signals

NOTE:

The DI signals that do not have pin numbers are not default DI signals. If you want to use these non-default DI signals, you must 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 depend on the settings of parameters P2-10 ... P2-17. See chapter *"4.5.6.3 User-defined DI and DO signals"* for details.

A suggested setting for the DI and DO signals in the different control modes are listed in the following tables.

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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)												
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		
Pt-Pr	0x2A	Internal position (Pr) and external pulse (Pt) mode switching (OFF: Pt, ON: Pr)												
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)												

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Signal	DI Code	Function	Pt	Pr	S	T	Sz	Tz	Pt S	Pt T	Pr S	Pr T	S T	CANopen
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												
STOP	0x46	Motor stop												

Table 7: Suggested DI signals and control modes

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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	DO 1	DO 1	DO 1	DO 1	DO 1	DO 1	DO 1	DO 1	DO 1	DO 1	DO 1	DO1
SON	0x02	Servo On												
ZSPD	0x03	At Zero speed	DO 2	DO 2	DO 2	DO 2	DO 2	DO 2	DO 2	DO 2	DO 2	DO 2	DO 2	
TSPD	0x04	At Speed reached			DO 3	DO 3	DO 3	DO 3	DO 3	DO 3	DO 3	DO 3	DO 3	
TPOS	0x05	At Positioning completed	DO 4	DO 4					DO 4	DO 4	DO 4	DO 4		
TQL	0x06	At torques limit												
ALRM	0x07	Servo alarm activated	DO 5	DO 5	DO 5	DO 5	DO 5	DO 5	DO 5	DO 5	DO 5	DO 5	DO 5	DO5
BRKR	0x08	Holding brake control			DO 4	DO 4	DO 4	DO 4						
HOME	0x09	Homing completed	DO 3	DO 3										
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 bit 0 of P4-06.												
SDO_1	0x31	Output the status of bit 1 of P4-06.												
SDO_2	0x32	Output the status of bit 2 of P4-06.												
SDO_3	0x33	Output the status of bit 3 of P4-06.												
SDO_4	0x34	Output the status of bit 4 of P4-06.												
SDO_5	0x35	Output the status of bit 5 of P4-06.												
SDO_6	0x36	Output the status of bit 6 of P4-06.												
SDO_7	0x37	Output the status of bit 7 of P4-06.												
SDO_8	0x38	Output the status of bit 8 of P4-06.												

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Signal	DO Code	Function	Pt	Pr	S	T	Sz	Tz	Pt S	Pt T	Pr S	Pr T	S T	CANopen
SDO_9	0x39	Output the status of bit 9 of P4-06.												
SDO_A	0x3A	Output the status of bit 10 of P4-06.												
SDO_B	0x3B	Output the status of bit 11 of P4-06.												
SDO_C	0x3C	Output the status of bit 12 of P4-06.												
SDO_D	0x3D	Output the status of bit 13 of P4-06.												
SDO_E	0x3E	Output the status of bit 14 of P4-06.												
SDO_F	0x3F	Output the status of bit 15 of P4-06.												

Table 8: Suggested DO signals and control modes

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4.5.6.3 User-defined DI and DO signals

If the default DI and DO signals do not meet your requirements, you can use user-defined DI and DO signals. The user-defined DI and DO signals are set via parameters P2-10 ... P2-17 and P2-18 ... P2-22.

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
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	

Table 9: User-defined DI and DO signals

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4.5.6.4 Wiring Diagrams of I/O Signals (CN1)

⚠ WARNING

UNINTENDED OPERATION

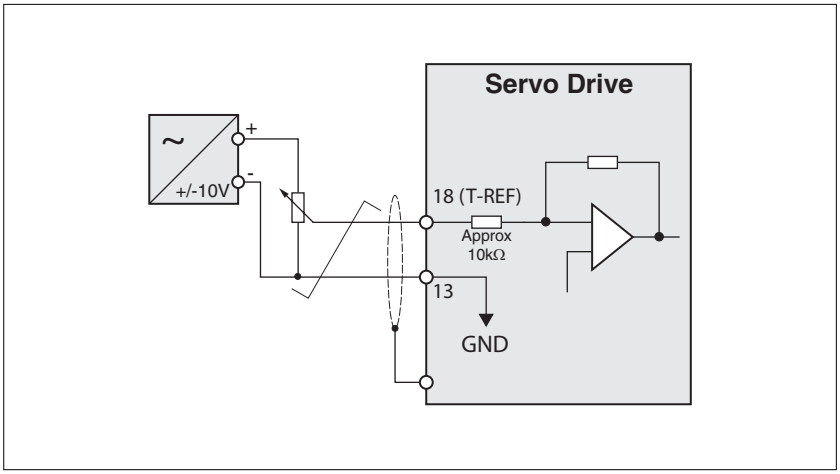
Wire and configure the system in such a way that unintended movements cannot occur in the case of wire breaks or ground faults of a signal wire.

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

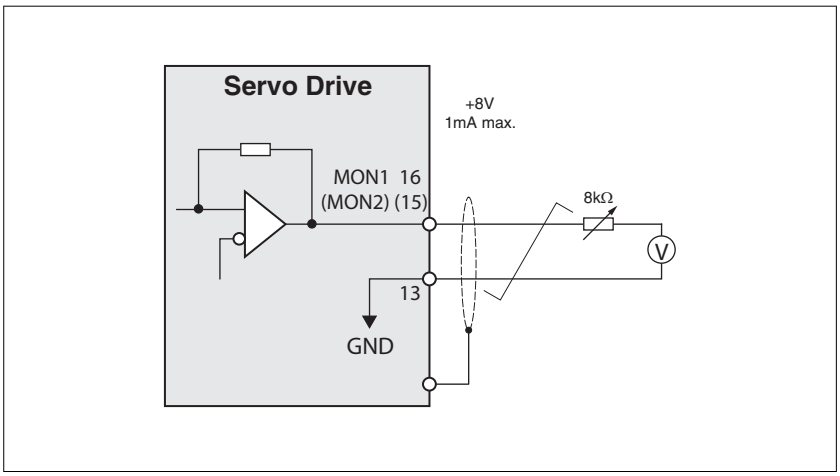
Analog signals

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

C1: Speed/torque analog signal input



C2: Analog monitor output (MON1, MON2)



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Pulse inputs (open-collector)

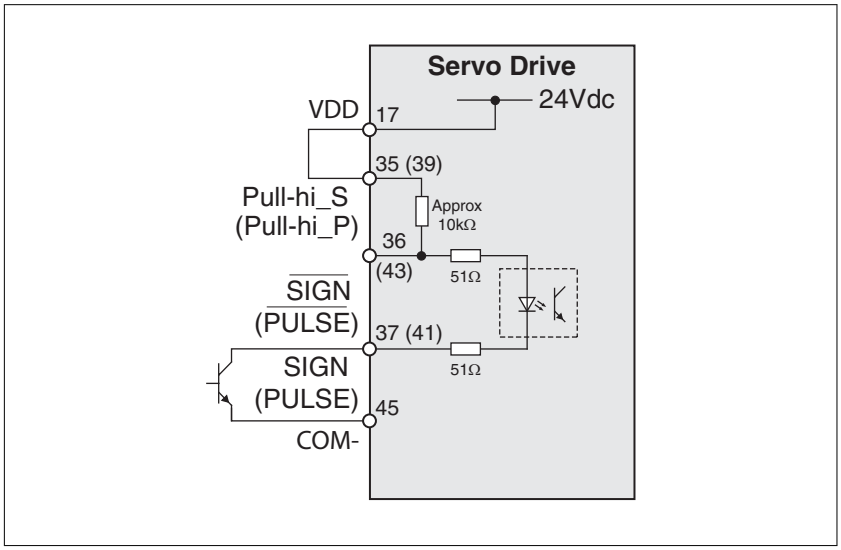
NOTICE

EQUIPMENT DAMAGE DUE TO EXTERNAL POWER SUPPLY

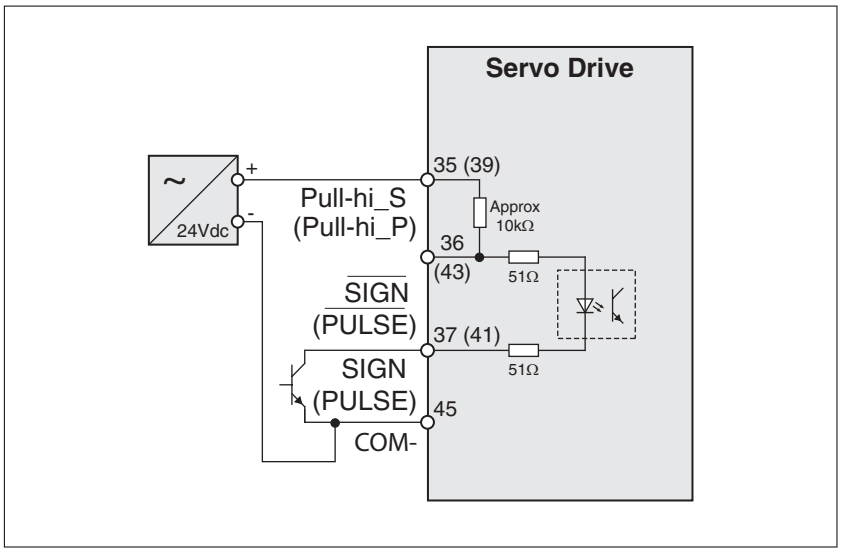
Do not connect VDD to an external power supply.

Failure to follow these instructions can result in equipment damage.

C3-1: Pulse input (open-collector), for the use of internal power supply.



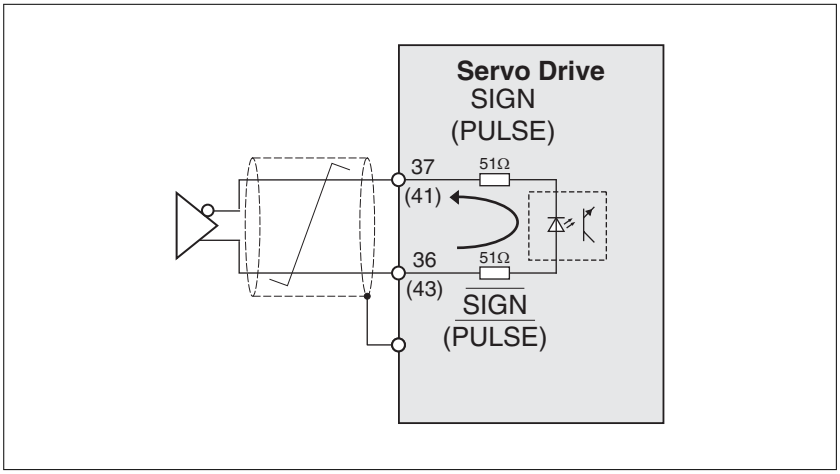
C3-2: Pulse input (open-collector), for the use of external power supply.



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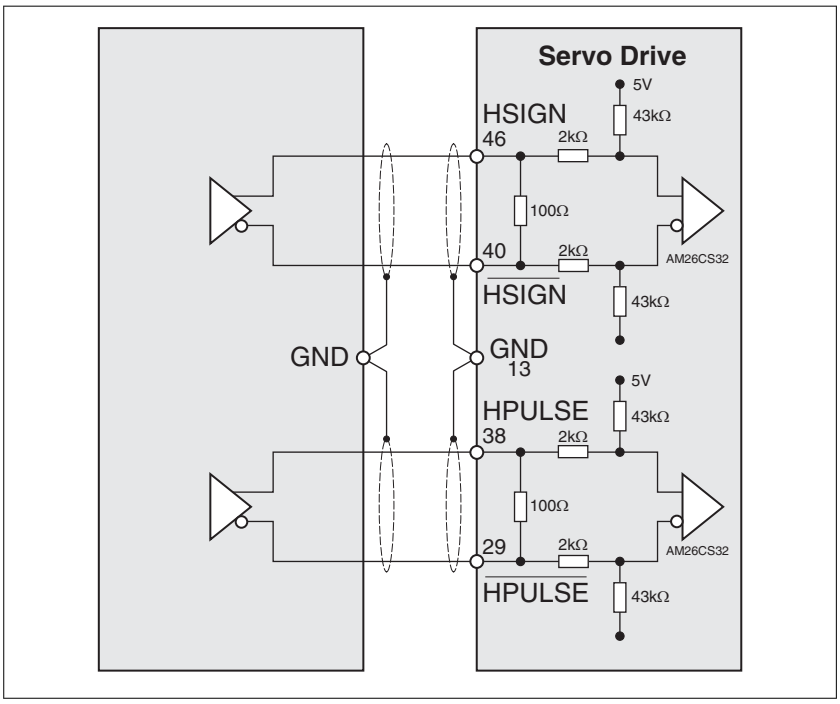
Pulse inputs (line driver)

C4-1: Pulse input (line driver). It requires a 5 V power supply. Do not use a 24 V power supply.



Verify the dicrection of the current at the input. The optocoupler is unidirectional.

C4-2: High-speed pulse input (line driver). It requires a 5 V power supply. Do not use a 24 V power supply.

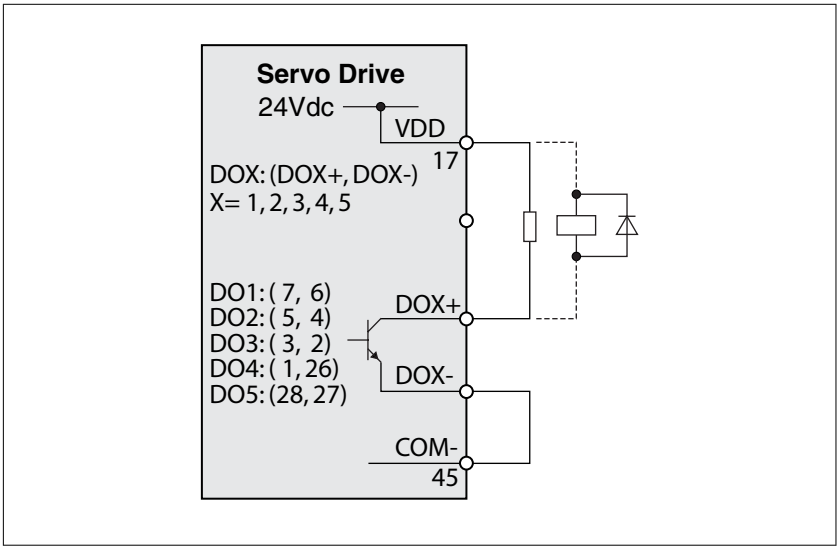


NOTE: Connect the cable shield to the ground terminal of the master and to the ground terminal of the servo drive.

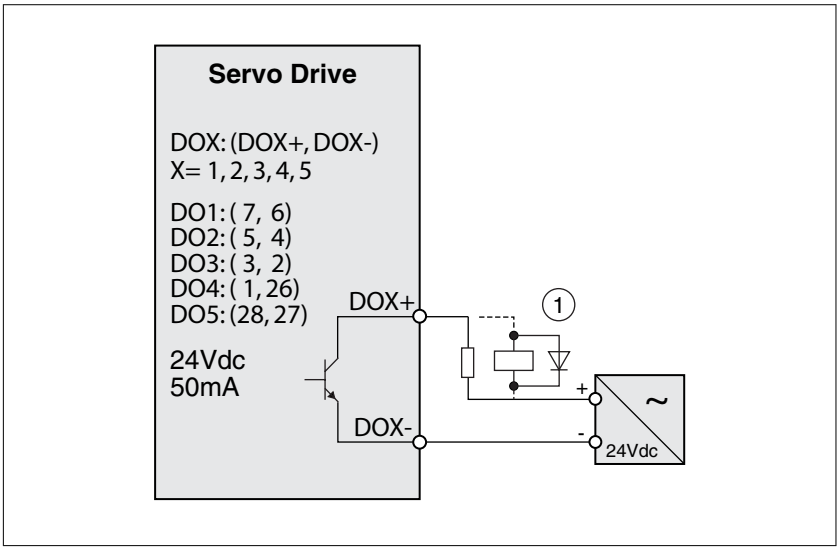
0198441113932, V2.02, 11.2014

Wiring of DO signal (sink mode)

C5: Wiring of DO signal (sink mode), for the use of internal power supply (resistive load and inductive load).



C6: Wiring of DO signal (sink mode), for the use of external power supply (resistive load and inductive load).



Inductive loads using DC voltages may may damage the signal outputs. A protection circuit is required to protect the signal outputs against inductive loads.

⚠ CAUTION

DAMAGE TO THE SIGNAL OUTPUTS DUE TO INDUCTIVE LOADS

Use appropriate protective circuits to avoid damage caused by inductive loads.

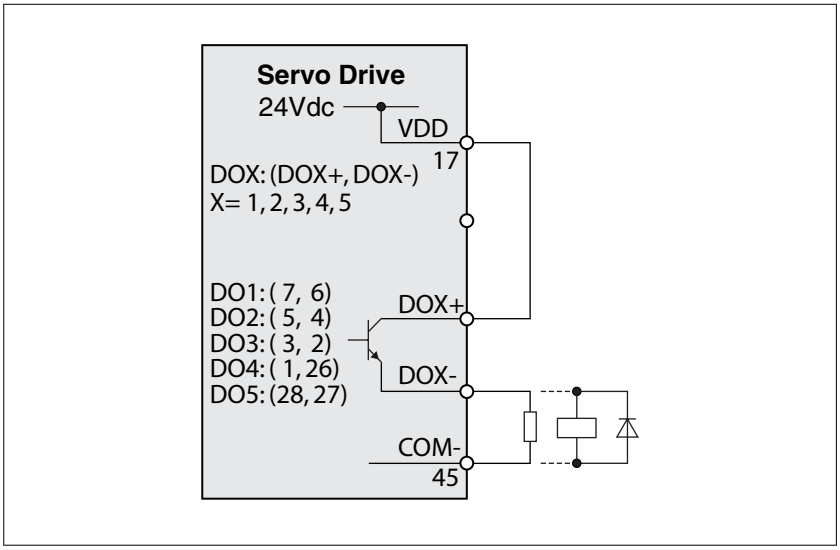
Failure to follow these instructions can result in injury or equipment damage.

A diode can be used to protect the signal outputs against inductive loads. Use a diode with the following ratings:
Reverse withstand voltage: Voltage of signal output * 10
Forward current: Higher than the load current

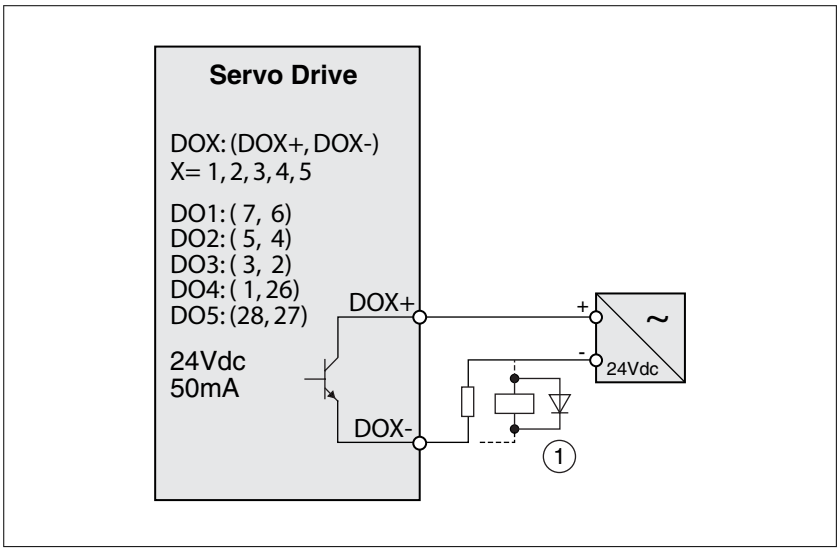
0198441113932, V2.02, 11.2014

Wiring of DO signal (source mode)

C7: Wiring of DO signal (source mode), for the use of internal power supply (resistive load and inductive load).



C8: Wiring of DO signal (source mode), for the use of external power supply (resistive load and inductive load).



Inductive loads using DC voltages may may damage the signal outputs. A protection circuit is required to protect the signal outputs against inductive loads.

⚠ CAUTION

DAMAGE TO THE SIGNAL OUTPUTS DUE TO INDUCTIVE LOADS

Use appropriate protective circuits to avoid damage caused by inductive loads.

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

A diode can be used to protect the signal outputs against inductive loads. Use a diode with the following ratings:
Reverse withstand voltage: Voltage of signal output * 10
Forward current: Higher than the load current

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Wiring of DI signal (sink mode)

NOTICE

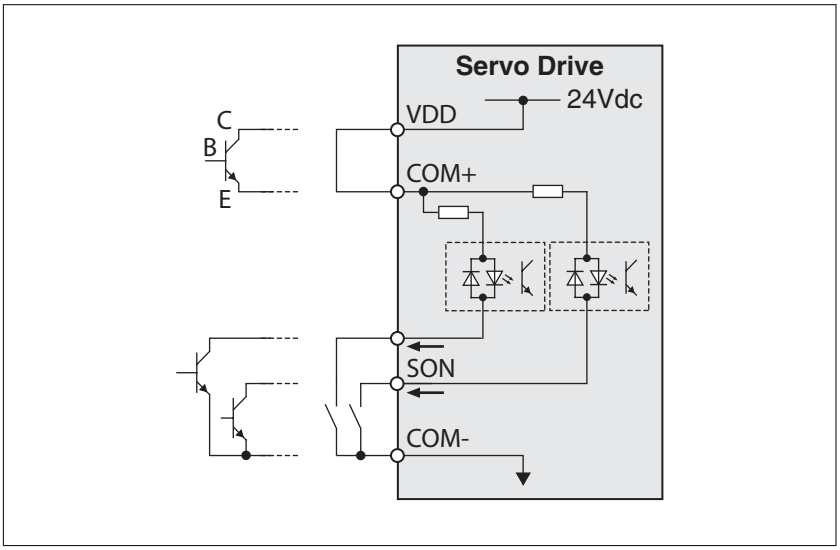
EQUIPMENT DAMAGE DUE TO EXTERNAL POWER SUPPLY

Do not connect VDD to an external power supply.

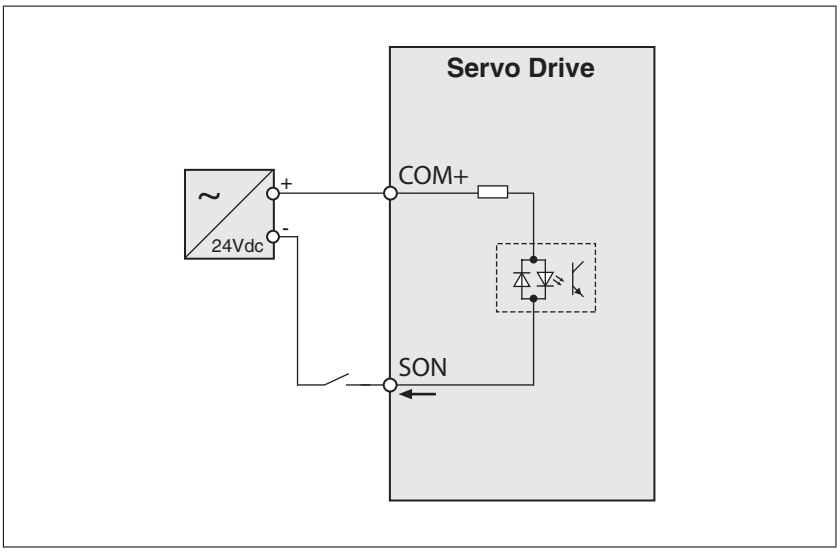
Failure to follow these instructions can result in equipment damage.

Use a relay or open-collector output (NPN transistor) to input signal.

C9: Wiring of DI signal (sink mode), for the use of internal power supply



C10: Wiring of DI signal (sink mode), for the use of external power supply



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Wiring of DI signal (source mode)

NOTICE

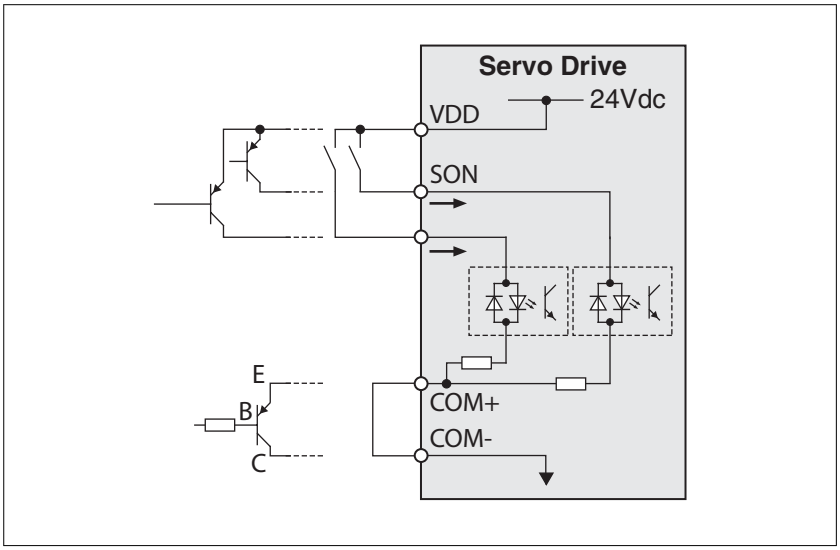
EQUIPMENT DAMAGE DUE TO EXTERNAL POWER SUPPLY

Do not connect VDD to an external power supply.

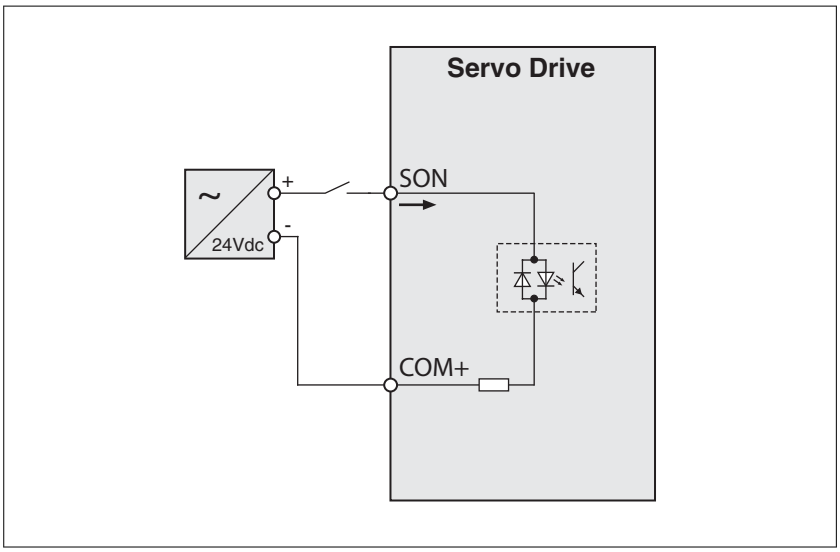
Failure to follow these instructions can result in equipment damage.

Use a relay or open-collector output (PNP transistor) to input signal.

C11: Wiring of DI signal (source mode), for the use of internal power supply



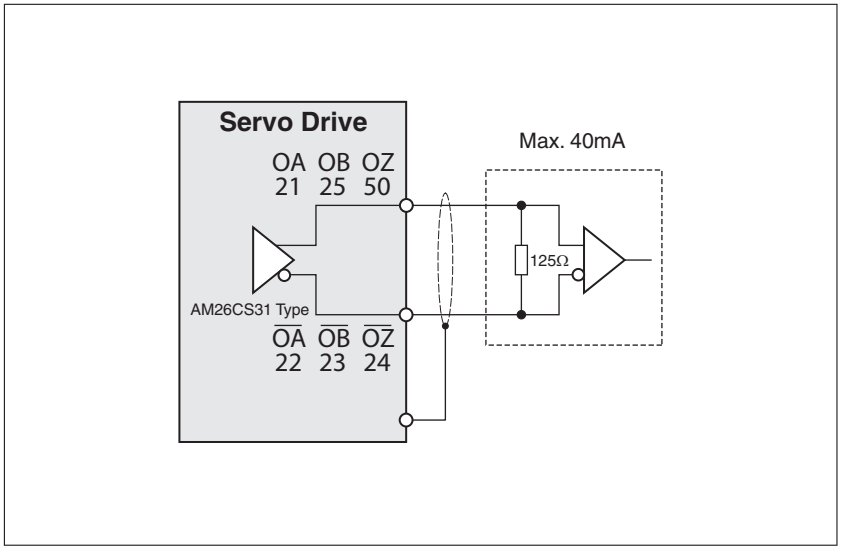
C12: Wiring of DI signal (source mode), for the use of external power supply



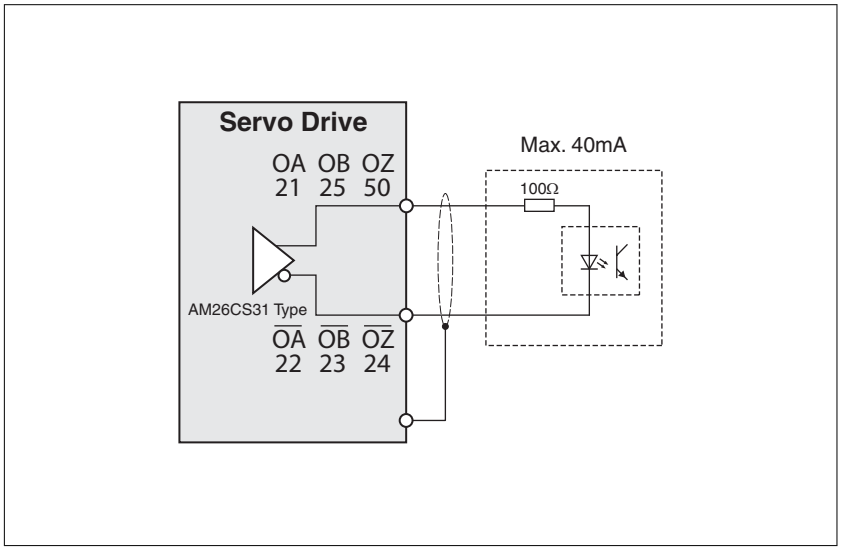
0198441113932, V2.02, 11.2014

Encoder output signal

C13: Encoder output signal (line driver)



C14: Encoder output signal (high-speed opto-coupler)



0198441113932, V2.02, 11.2014

4.5.7 Encoder Connector CN2

Feedback to the amplifier of the UVW signals for commutation is supplied 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 1280000 ppr for increased control accuracy.

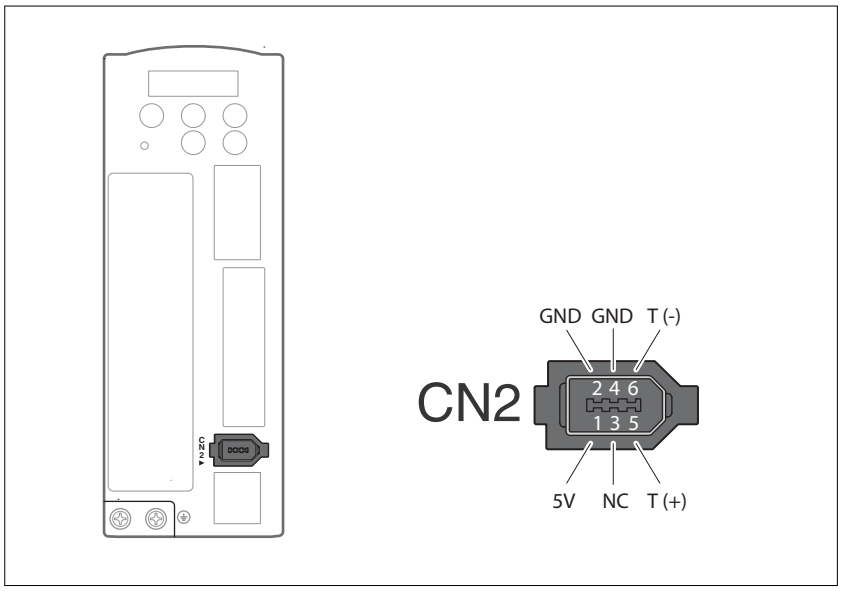


Figure 18: CN2 drive connector

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	+5 V power supply	S	7	Red & Red/White
2, 4	GND	Ground	R	8	Black & Black/ White
-	-	Shielding	L	9	-

0198441113932, V2.02, 11.2014

4.5.8 Serial Communication Connector CN3

CN3 terminal layout and identification

The servo drive can be connected to a PC or controller via the serial communication connector CN3.

The communication connector CN3 of the servo drive provides two serial communication interfaces: RS-232 and RS-485.

RS-232 is used for commissioning the drive with the commissioning software "LEXIUM 23 CT". The maximum cable length for an RS-232 connection is 15 m (50 ft).

The RS-485 connection can be used as host interface, for example to connect a personal computer for diagnostics.

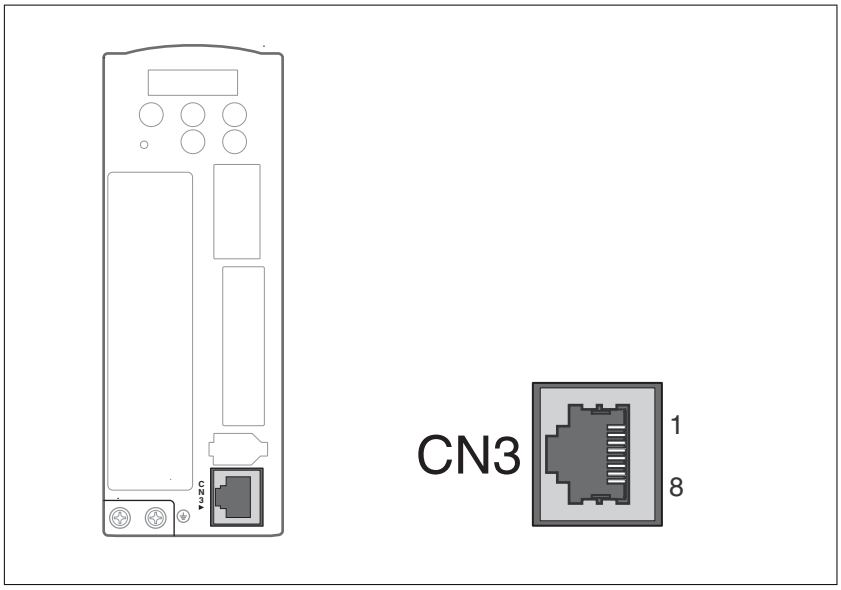


Figure 19: CN3 drive connector

CN3 terminal signal identification

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

Connection between PC and connector CN3

To connect a personal computer to the drive, the USB to RJ45 (RS232) interface connector "VW3M8131" and RJ45 cable "490NTW00002" can be used.

0198441113932, V2.02, 11.2014

4.5.9 CANopen and CANmotion Communication Interface CN4

Function

The LXM23A device can be connected to CANopen and CANmotion via 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 the drive is determined via parameter P3-05 during commissioning. The baud rate is determined via parameter P3-01 and must be the same for all drives in the fieldbus. For further information on the fieldbus, see the LXM23A CANopen fieldbus manual.

Connector CN4 provides two communication ports: one is for transmission (CAN-out) and the other is for receiving (CAN-In), convenient for connecting more than one servo drive in series. A termination resistor must be connected to the last connected servo drive.

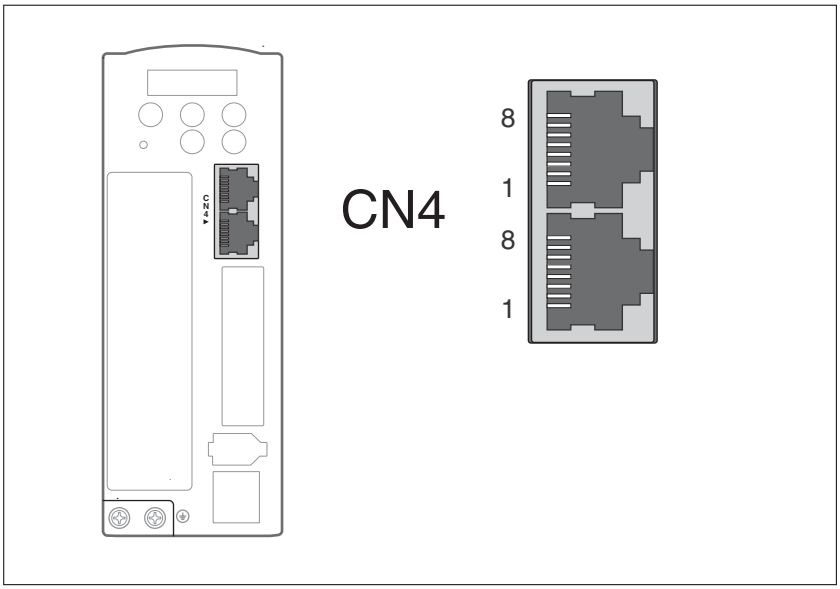


Figure 20: CN4 connector

CN4 Interface Signal Identification

Pin No.	Signal Name	Description
1	CAN_H	CAN_H bus line (dominant high)
2	CAN_L	CAN_H bus line (dominant low)
3	CAN_GND	Ground / 0V/V-
4	-	Reserved
5	-	Reserved
6	-	Reserved
7	CAN_GND	Ground / 0V/V-
8	-	Reserved

Connecting CANopen

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- 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.
- Use pre-assembled cables (see chapter *"11 Accessories and spare parts"*) to reduce the risk of wiring errors.

Cable specifications

Shield:	Required, both ends grounded
Twisted Pair:	Required
PELV:	Required
Cable composition for cables with RJ45 connectors 1):	8 * 0.14 mm² (AWG 24)
Cable composition with D-SUB connectors:	2 * 0.25 mm², 2 * 0.20 mm² (2 * AWG 22, 2 * AWG 24) Cross section 0.20 mm² (AWG 24) for CAN level, cross section 0.25 mm² (AWG 22) for reference potential.

1) Cables with RJ45 connectors may only be used inside of control cabinets.

Equipotential bonding conductors

Potential differences can result in excessive currents on the cable shields. Use equipotential bonding conductors to reduce currents on the cable shields.

The equipotential bonding conductor must be rated for the maximum current. Practical experience has shown that the following conductor cross sections can be used:

- 16 mm² (AWG 4) for equipotential bonding conductors up to a length of 200 m (656 ft)
- 20 mm² (AWG 4) for equipotential bonding conductors with a length of more than 200 m (656 ft)

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Connectors D-SUB and RJ45

Usually, a cable with D-Sub connectors is used for CAN fieldbus 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, see the figure below. 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 *"11 Accessories and spare parts"*.

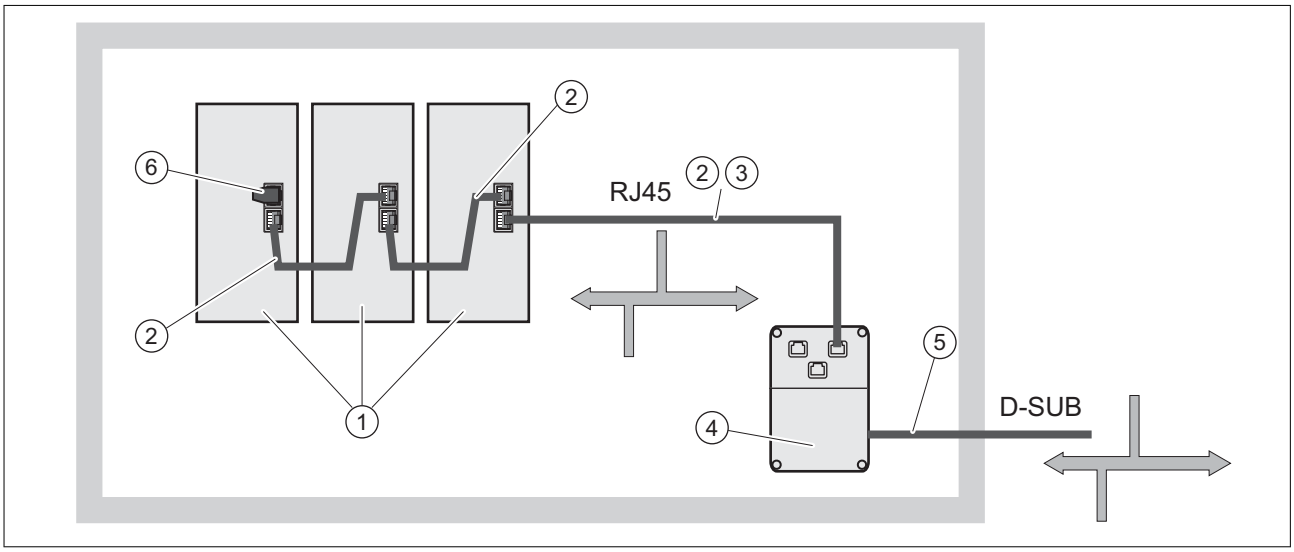


Figure 21: Connection of RJ45 CAN in the control cabinet to the field

(1) Devices with RJ45 CAN connection in the control cabinet

(2) CANopen cables with RJ45 connectors

(3) Connection cables between device and tap, for example TCSCCN4F3M3T for tap TSXCANTDM4

(4) Tap in the control cabinet, for example TSXCANTDM4 as D-SUB four-port tap or VW3CANTAP2 as RJ45 tap

(5) Fieldbus cable (trunk line) to the bus devices outside of the control cabinet, connected to the tap by means of screw terminals.
Cross section 0.20 mm^2 (AWG 24) for CAN level, cross section 0.25 mm^2 (AWG 22) for reference potential.

(6) Terminating resistor 120 Ω RJ45 (TCSCAR013M120)

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Maximum bus length CAN

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

Baud rate	Maximum bus length
50 kbit/s	1000 m
125 kbit/s	500 m
250 kbit/s	250 m
500 kbit/s	100 m
1000 kbit/s	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.

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 0.3 m.

Terminating resistors

Both ends of a CAN bus line must be terminated. A 120 Ω terminating resistor between `CAN_L` and `CAN_H` is used for this purpose.

Connectors with integrated terminating resistors are available as accessories, see chapter *"11 Accessories and spare parts"*.

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4.6 Electrical installation motor

4.6.1 Connections and pin assignments

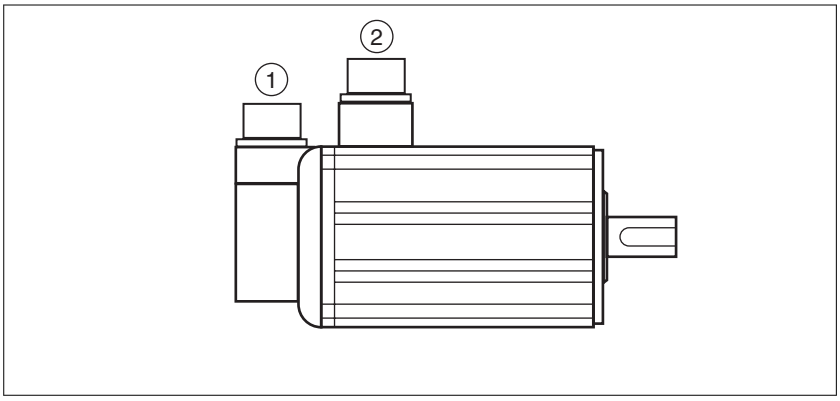


Figure 22: Connection overview

(1) Encoder connection
(2) Motor connection

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Pin assignment motor connection

Pin assignments of motor phases and holding brake

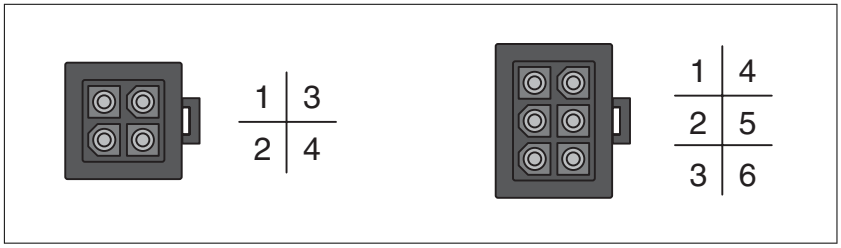


Figure 23: Motor connection plastic connector (type A and type B)

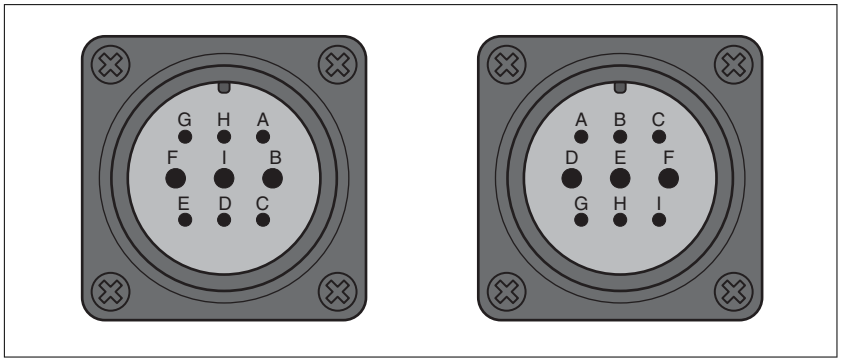


Figure 24: Motor connection military connector (type C and type D)

Pin Type A	Pin Type B	Pin Type C	Pin Type D	Signal	Meaning	Color (IEC 757)
1	1	F	D	U	Motor phase U	RD
2	2	I	E	V	Motor phase V	WH
3	4	B	F	W	Motor phase W	BK
4	5	E	G	PE	Protective ground conductor	GN
-	3	G	A	BRAKE1	Reserved	BU
-	6	H	B	BRAKE2	Reserved	BN

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Pin assignment encoder connection

Pin assignment of the 20 bits encoder.

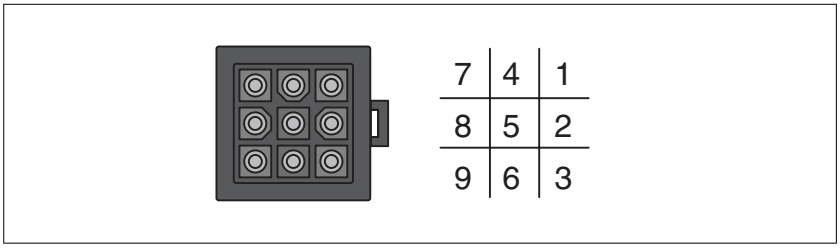


Figure 25: Encoder connection plastic connector

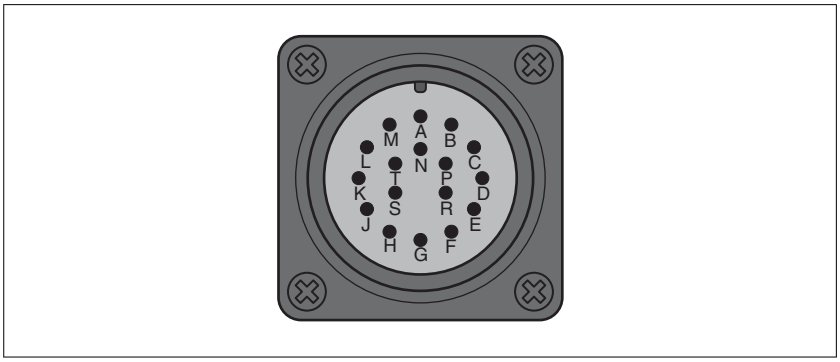


Figure 26: Encoder connection military connector

Pin Plastic connector	Pin Military connector	Signal	Meaning	Color (IEC 757)
1	A	T+	Data	BU
2	B	-	Reserved	-
3	C	-	Reserved	-
4	D	T-	Data	BU / BK
5	F	-	Reserved	-
6	G	-	Reserved	-
7	S	DC+5V	Supply voltage	RD /WH
8	R	GND	Reference potential	BK / WH
9	L	Shield	Shield	-

Mating connector

See chapter *"11 Accessories and spare parts"* for suitable mating connectors.

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4.6.2 Connection of motor and encoder

High voltages may be present at the motor connection. The motor itself generates voltage when the motor shaft is rotated. AC voltage can couple voltage to unused conductors in the motor cable.

⚠ ⚠ DANGER

ELECTRIC SHOCK

- Disconnect all power prior to performing any type of work on the drive system.
- Block the motor shaft to prevent rotation prior to performing any type of work on the drive system.
- Insulate both ends of unused conductors of the motor cable.
- Supplement the motor cable grounding conductor with an additional protective ground conductor to the motor housing.
- Verify compliance with all local and national electrical code requirements as well as all other applicable regulations with respect to grounding of all equipment.

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

The motor is designed for operation via a drive. Connecting the motor directly to three-phase AC voltage will damage the motor and can cause fires.

⚠ DANGER

FIRE HAZARD DUE TO INCORRECT CONNECTION

Only connect the motor to an approved drive.

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

Protective ground conductor connection

- ▸ Ground the motor via the flange if grounding via the protective ground conductor of the motor cable is not sufficient.

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Connecting the cables

Incorrect installation of the cable may destroy the insulation. Broken conductors in the cable or improperly connected connectors may be melted by arcs.

⚠ ⚠ DANGER

ELECTRIC SHOCK, ARC FLASH AND FIRE CAUSED BY INCORRECT INSTALLATION OF THE CABLE

- Disconnect all power before plugging in or unplugging the connectors.
- Verify correct pin assignment of the connectors according to the specifications in this chapter before connecting the cables.
- Verify that the connectors are properly plugged in and locked before applying power.
- Avoid impermissible movements of the cable.
- Avoid forces or movements of the cable at the cable entries.

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

- ▸ Connect the motor cable and the encoder cable to the drive according to the wiring diagram of the drive.
- ▸ If your motor is equipped with a holding brake, follow the instructions in chapter *"4.6.3 Holding brake connection"*.

4.6.3 Holding brake connection

The holding brake in the motor has the task of holding the current motor position when the power stage is disabled, even if external forces act (for example, in the case of a vertical axis). The holding brake is not a safety function and not a service brake.

A motor with a holding brake requires a suitable holding brake controller which releases the brake when the power stage is enabled and locks the motor shaft when the power stage is disabled.

As a result of damage to the insulation of the motor cable, mains voltage may get to the wires for the holding brake.

⚠ ⚠ DANGER

ELECTRICAL SHOCK CAUSED BY DAMAGE TO THE MOTOR CABLE

Use a separate, galvanically isolated power supply for the holding brake.

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

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Releasing the holding brake may cause an unintended movement in the system, for example, if vertical axes are used.

⚠ WARNING

UNINTENDED MOVEMENT

- Take appropriate measures to avoid damage caused by falling or lowering loads.
- Verify that there are no persons or obstacles in the zone of operation when performing a test of the holding brake.

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

Cable specifications

See chapter *"4.5.4 Cable specifications for servo drive"*, page *81* for the cable specifications.

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4.7 Verifying installation

Verify proper installation:

- ▶ Verify the mechanical installation of the entire drive system:
- Does the installation meet the specified distance requirements?
- Did you tighten all fastening screws with the specified tightening torque?
- ▶ Verify the electrical connections and the cabling:
- Did you connect all protective ground conductors?
- Do all fuses have the correct rating; are the fuses of the specified type?
- Did you connect all wires of the cables or insulate them?
- Did you properly connect and install all cables and connectors?
- Are the mechanical locks of the connectors correct and effective?
- Did you properly connect the signal wires?
- Are the required shield connections EMC-compliant?
- Did you take all measures for EMC compliance?
- ▶ Check the installation of the motor:
- Drive elements: verify that any output components already installed are balanced and accurately aligned.
- Parallel key on the shaft end of the motor: if you have a motor with a parallel key groove and parallel key, the parallel key must not be inserted during commissioning without output component or it must be appropriately secured.
- Function of the holding brake: Verify that the holding brake really holds the maximum load. Verify that the holding brake is released when the brake voltage is applied. Verify that the holding brake is released before a movement is started.
- ▶ Verify that all covers and seals of the control cabinet are properly installed to meet the required degree of protection.

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5 Commissioning

This chapter describes how to commission the product.

An overview of the parameters can be found in the chapter *"10 Parameters"*. The use and the function of some parameters are explained in more detail in this chapter.

Unsuitable settings or unsuitable data may trigger unintended movements, trigger signals, damage parts and disable monitoring functions. Some settings do not become active until after a restart.

⚠ WARNING

UNINTENDED EQUIPMENT OPERATION

- Do not operate the drive system with unknown settings or data.
- Never modify a parameter unless you fully understand the parameter and all effects of the modification.
- After modifications to settings, restart the drive and verify the saved data or settings.
- When commissioning the product, 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 zone of operation.

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

If the power stage is disabled unintentionally, for example as a result of power outage, errors or functions, the motor is no longer decelerated in a controlled way.

⚠ WARNING

UNINTENDED EQUIPMENT OPERATION

Verify that movements without braking effect cannot cause injuries or equipment damage.

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

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The metal surfaces of the product may exceed 100 °C (212 °F) during operation.

⚠ WARNING

HOT SURFACES

- Avoid unprotected contact with hot surfaces.
- Do not allow flammable or heat-sensitive parts in the immediate vicinity of hot surfaces.
- Verify that the heat dissipation is sufficient by performing a test run under maximum load conditions.

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

Rotating parts may cause injuries and may catch clothing or hair. Loose parts or parts that are out of balance may be ejected.

⚠ WARNING

MOVING UNGUARDED EQUIPMENT

Verify that rotating parts cannot cause injuries or equipment damage.

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

Motor with holding brake

Applying the holding brake while the motor is running will cause excessive wear and loss of the braking force.

⚠ WARNING

LOSS OF BRAKING FORCE DUE TO WEAR OR HIGH TEMPERATURE

- Do not use the holding brake as a service brake.
- Do not exceed the maximum number of brake applications and the kinetic energy during braking of moving loads.

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

Releasing the holding brake may cause an unintended movement in the system, for example, if vertical axes are used.

⚠ WARNING

UNINTENDED MOVEMENT

- Take appropriate measures to avoid damage caused by falling or lowering loads.
- Verify that there are no persons or obstacles in the zone of operation when performing a test of the holding brake.

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

5.1 Commissioning steps

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

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To be done

To be done ...	Page
"4.7 Verifying installation"	*118*
"5.3 Commissioning procedure"	*130*

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5.2 Commissioning tools

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

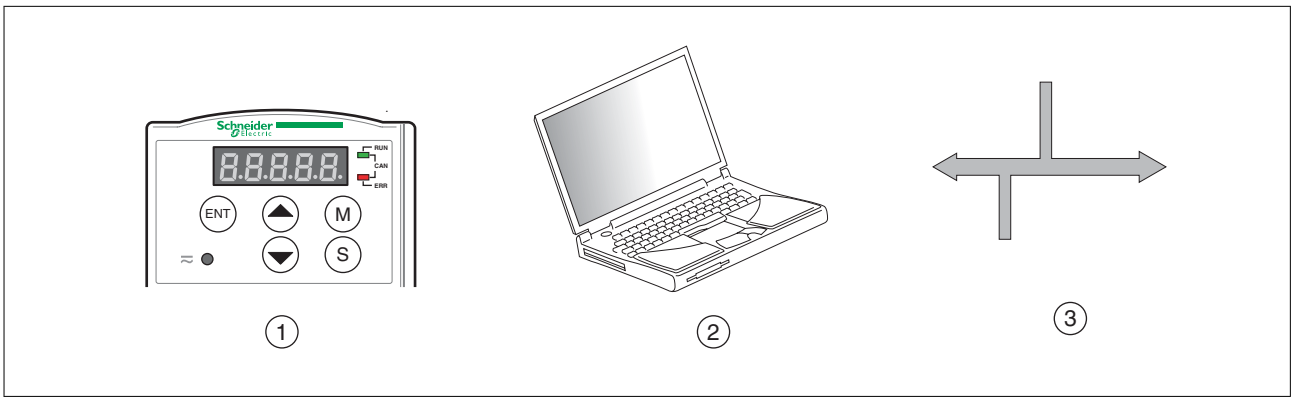


Figure 27: Commissioning tools

(1) Integrated HMI
(2) PC with commissioning software "Lexium 23 PLUS CT"
(3) Fieldbus

Access to the parameters is possible via the HMI 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.

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5.2.1 Integrated HMI

5.2.1.1 Description of the integrated HMI

The integrated HMI consists of a display and buttons. The following figure shows the features of the integrated HMI and provides an overview of their functions.

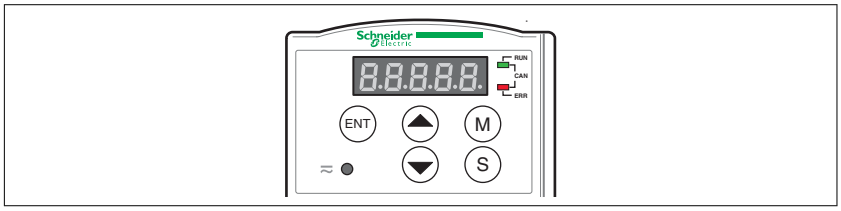


Figure 28: HMI

Name	Function
HMI display	The HMI display (5-digit 7-segment display) shows the monitor codes, parameter settings and operation values of the drive.
DC bus LED	The DC bus LED lights to indicate that power is applied to the circuit.
M button	The **M** button allows you to enter or exit different parameter groups and switch between HMI mode Monitor and HMI mode Edit Parameter.
S button	Pressing the **S** button scrolls through parameter groups. After a parameter is selected and its value displayed, pressing the **S** button moves the cursor to the left. The currently selected digit blinks. The parameter settings (blinking digit) can then be changed with the **UP** button or **DOWN** button.
UP button and **DOWN** button	Pressing the **UP** button or **DOWN** button scrolls through and changes monitor codes, parameter groups and various parameter settings.
ENT button	Pressing the **ENT** button displays and saves parameter groups and the various parameter settings. In HMI mode Monitor, pressing the **ENT** button switches between decimal or hexadecimal display. In HMI mode Edit Parameter, pressing the **ENT** button allows you to change the parameter settings. During diagnostic operation, pressing the **ENT** button executes the function in the last step. Changes to parameter settings do not become effective until you press the **ENT** button.

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5.2.1.2 Display Flowchart

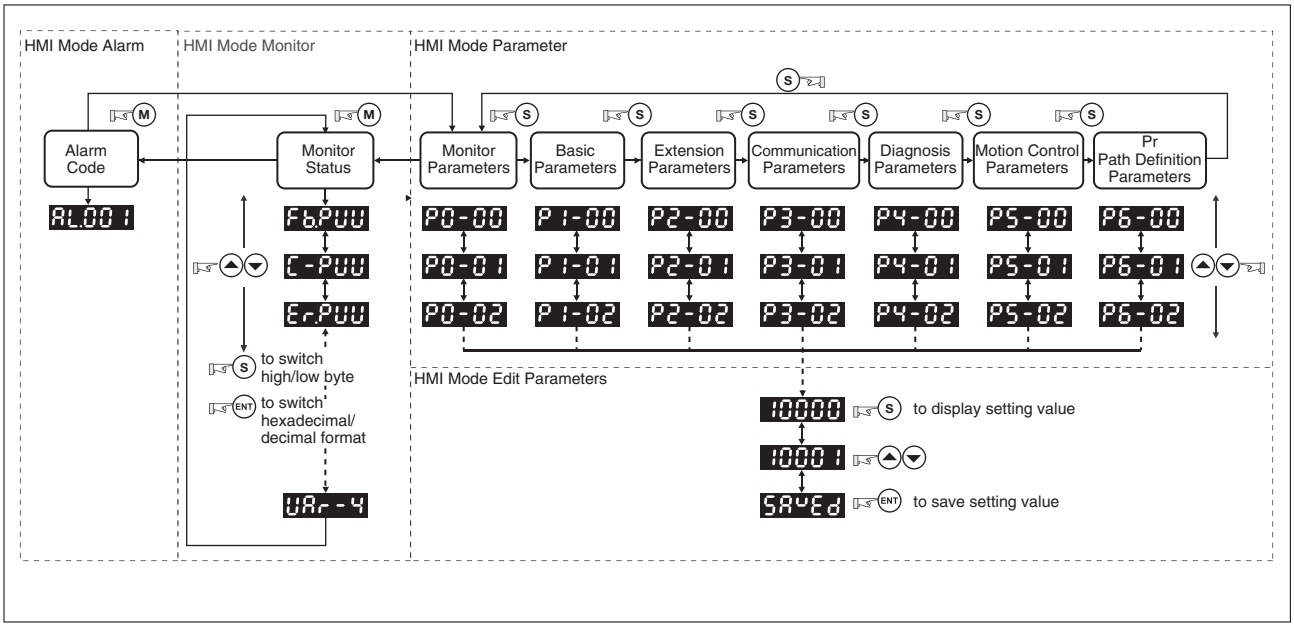


Figure 29: Using the HMI

1. When power is applied to the drive, the HMI display will show the monitor function codes for approximately one second and then enter into the HMI mode Monitor.

2. If you are in HMI mode Monitor, press the **M** button to enter into HMI mode Edit Parameter. In HMI mode Edit Parameter, press the **M** button to return to HMI mode Monitor.

3. If an alarm is detected, the system immediately switches to HMI mode Alarm, regardless of the currently active HMI mode. Pressing the **M** button in HMI mode Alarm switches to another mode, but the alarm remains active. The system automatically returns to HMI mode Alarm if no button is pressed for a period of more than 20 seconds.

4. In HMI mode Monitor, pressing the **UP** button or **DOWN** button switches the parameter code of the parameter to be monitored. The monitor display symbol will display for approximately one second.

5. In HMI mode Monitor mode, pressing the **M** button activates the HMI mode Edit Parameter. In HMI mode Edit Parameter, pressing the **S** button switches theparameter group and pressing the **UP** button or **DOWN** button changes parameter group code.

6. In HMI mode Edit Parameter, the system will enter into the setting mode immediately after the **ENT** button is pressed. The HMI display shows the corresponding setting value of this parameter. You can use the **UP** button or **DOWN** button to change the parameter value or press the **M** button to exit.

7. Use the **S** button to move the cursor to the digit to be changed and change the value with by pressing the **UP** button or **DOWN** button.

8. After the setting value change is completed, press the **ENT** button to save the parameter settings or execute the command.

9. When the parameter setting is completed, HMI display will show the end code "SAVED" and automatically return to HMI mode Edit Parameter.

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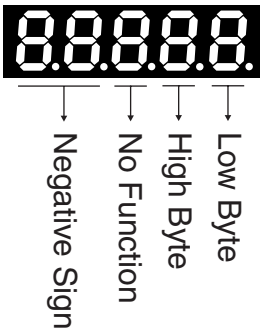
5.2.1.3 Status Display

Save setting display

After the **ENT** button is pressed, the HMI display will show the following display messages for approx. one second, depending on the status.

Display Message	Description
SAvEd	The setting value is saved correctly. (Saved)
r-oLy	This parameter is read only. Write-protected. (Read-Only)
LocKd	Invalid password or no password has been entered. (Locked)
out-r	The setting value is incorrect or invalid. (Out of Range)
Sruon	The servo system is running and this setting value cannot be changed at the moment. (Servo On)
Po-On	This parameter is valid after restarting the drive. (Power On)

Decimal point display

Display Message	Description
	High/Low byte display. When the data is 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 two leftmost digits represent negative sign, irrespective of whether it is a 16-bit or 32-bit data. If the data is displayed in hexadecimal format, it is always a positive value and no negative sign is displayed.

Alarm message display

Display Message	Description
AL.nnn	When an alarm occurs, the HMI display will display "ALnnn". "AL" indicates the alarm and "nnn" indicates the alarm code. For the list of alarm codes, see parameter P0-01 in chapter *"10 Parameters"* or see chapter *"9 Diagnostics and troubleshooting"*.

Sign setting display

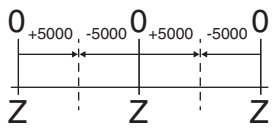
Display Message	Description
02468	Positive value display. When you are in HMI mode Edit Parameter, the **UP** button or **DOWN** button increase or decrease the displayed value. The **S** button is used to select a digit (the selected digit blinks).
2.4680	Negative value display. Hold down the **S** button for two seconds and then the positive(+) or negative(-) sign can be switched. When the setting value exceeds the setting range, the positive(+) and negative(-) sign cannot be switched. The negative value display is for a decimal negative value only. There is no negative value display for a hexadecimal negative value.

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Monitor setting display

When power is applied to the drive, the HMI display will show the monitor function codes for approximately one second and then enter into the HMI mode Monitor. In HMI mode Monitor mode, you can change the monitor status by pressing the **UP** button or **DOWN** button. It is also possible to change parameter P0-02 directly to specify the monitor status. When 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 power is applied, the monitor function will be the input pulse number of the pulse command. This means that the C-PLS monitor codes will be shown first and then the pulse number.

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P0-02 Setting	Display Message	Description	Unit
0	FbPuu	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	ErPuu	Position error counts between control command pulse and feedback pulse	[user unit]
3	FbPLS	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	ErPLS	Position error counts	[pulse]
6	CP-Fr	Input frequency of pulse command	[Kpps]
7	SPEEd	Speed of rotation of motor rotation	[RPM]
8	CSPd1	Speed input command	[Volt]
9	CSPd2	Speed input command	[RPM]
10	C-t91	Torque input command	[Volt]
11	C-t92	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 (note that if the display is 130, it indicates that the actual inertia is 13.0)	[0.1 times]
16	1 GbtE	IGBT temperature	[oC]
17	rSnFr	Resonance frequency (the low byte is the first resonance point and the high byte is the second resonance point)	[Hz]
18	d1 FF2 	Absolute pulse number relative to encoder (use Z phase as home). The value of Z phase home point is 0, and it can be a value from -5000 to +5000 pulses.	-
19	nnAP1	Mapping parameter 1: Display the content of parameter P0-25 (mapping target is specified by parameter P0-35)	-
20	nnAP2	Mapping parameter 2: Display the content of parameter P0-26 (mapping target is specified by parameter P0-36)	-
21	nnAP3	Mapping parameter 3: Display the content of parameter P0-27 (mapping target is specified by parameter P0-37)	-
22	nnAP4	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)	-

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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 shows 01234.
1234	(Hex.)		Hexadecimal display. When the actual value is 0x1234, the display shows 1234.
1234.5	(Dec. High Byte)	32-bit Data	Decimal display. When the actual value is 1234567890, the high byte is shown as 1234.5 and the low byte is shown as 67890.
67890.	(Dec. Low Byte)		
h1234	(Hex. High Byte)		Hexadecimal display. When the actual value is 0x12345678, the high byte is shown as h1234 and the low byte is shown as L5678.
L5678	(Hex. Low Byte)		
1.2.345.		Negative value display. When the actual value is -12345, the display shows 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 used in HMI mode Monitor and HMI mode Edit Parameter.

3) The monitor variables are 32-bit data. You can switch to high byte or low byte and display format (Dec. or Hex.). For each parameter, only one kind of display format is available and cannot be changed.

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5.2.2 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 mantenance
- 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 chapter *"4.5.8 Serial Communication Connector CN3"* 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 the F1 key.



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5.3 Commissioning procedure

Unsuitable settings or unsuitable data may trigger unintended movements, trigger signals, damage parts and disable monitoring functions. Some settings do not become active until after a restart.

⚠ WARNING

UNINTENDED EQUIPMENT OPERATION

- Do not operate the drive system with unknown settings or data.
- Never modify a parameter unless you fully understand the parameter and all effects of the modification.
- After modifications to settings, restart the drive and verify the saved data or settings.
- When commissioning the product, 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 zone of operation.

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

The product can be accessed via different types of access channels. Simultaneous access via multiple access channels may cause unintended equipment operation.

⚠ WARNING

UNINTENDED EQUIPMENT OPERATION

- Verify that simultaneous access via multiple access channels cannot cause unintended triggering or blocking of commands.
- Verify that the required access channels are available.

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.

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5.3.1 Commissioning without load (trial run)

This chapter describes tests for servo drive and motor without load. Complete the run without load first before performing the run with load.

When the product is operated for the first time, there is a risk of unanticipated movements caused by, for example, incorrect wiring or unsuitable parameter settings.

⚠ WARNING

UNINTENDED MOVEMENT

- Run initial tests without coupled loads.
- Verify that a functioning emergency stop push-button is within reach of all persons involved in running tests.
- Anticipate movements in unintended directions or oscillation of the motor.
- Only operate the system if there are no persons or obstructions in the zone of operation.

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

The motor may move, tip and fall as a result of incorrect or insufficient mounting.

⚠ WARNING

FALLING PARTS

Mount the motor properly secured.

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

Checking wiring

- ▸ Verify that the wiring of the drive and motor is correct.
  See chapter *"4.5 Electrical installation of drive"* for details.
  See chapter *"4.6 Electrical installation motor"* for details.

Controller supply voltage

- ▸ Measure mains voltage for L1 and L2. For limits see page *34*.
- ▸ Switch on controller supply (L1, L2).
- ◃ The HMI display will illuminate.



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Parameter setting

Unsuitable settings or unsuitable data may trigger unintended movements, trigger signals, damage parts and disable monitoring functions. Some settings do not become active until after a restart.

⚠ WARNING

UNINTENDED EQUIPMENT OPERATION

- Do not operate the drive system with unknown settings or data.
- Never modify a parameter unless you fully understand the parameter and all effects of the modification.
- After modifications to settings, restart the drive and verify the saved data or settings.
- When commissioning the product, 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 zone of operation.

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

- ▸ Configure parameters correctly. Different machines may require different parameter values.

Power stage supply voltage

- ▸ Measure mains voltage for R, S and T. For limits see page *34*.
- ▸ Switch on mains voltage to R, S and T.
- ◃ The DC bus LED gets lit.

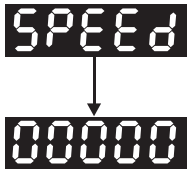
When the power is on (L1, L2 and R, S, T), the display should look as shown in the following figure:



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 you do not want to use the default settings of DI6 ... DI8, you can change their settings by using parameters P2-15 to P2-17 as required.

When the setting value of parameters P2-15 to P2-17 is 0, the function of this DI signal is disabled. For more information on parameters P2-15 to P2-17, see chapter *"10 Parameters"*.

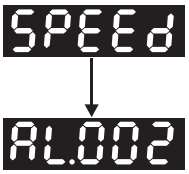
If the parameter P0-02 is set as motor speed (06), the display should look as shown in the following figure:



If nothing is displayed on the display, check if the voltage of the control circuit terminal (L1, L2) is too low.

1) If the display shows:

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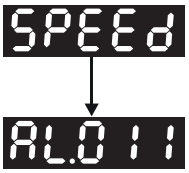


Overvoltage: The main circuit voltage has exceeded the maximum permissible value or the input power is incorrect.

Corrective Actions:

- Use voltmeter to check whether the main circuit input voltage is within the rated input voltage range.
- Use voltmeter to check whether the input voltage is within the specified limit.

2) The display shows:

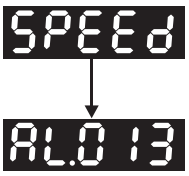


Encoder error: Verify that the wiring is correct. Check if the encoder wiring (CN2) of the motor is loose or incorrect.

Corrective Actions:

- Verify that the wiring complies with the product manual.
- Check the encoder connector and cable.
- Check whether wire is loose.
- Check if the encoder is damaged.

3) If the display shows:



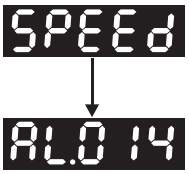
Operational stop activated: Check whether any of the digital input signals DI1 to DI8 are set to "Operational Stop" (OPST).

Corrective Actions:

- If "Operational Stop (OPST)" is not needed as an input signal, it is sufficient to confirm that none of the digital inputs DI1 to DI8 are set to "Operational Stop (OPST)", i.e. the setting value of parameters P2-10 to P2-17 is not 21.
- If "Operational Stop (OPST)" is required as an input signal, you must confirm which of the digital inputs DI1 to DI8 is set to "Operational Stop (OPST)" and check if the digital input signal is ON (it should be activated).

4) If the display shows:

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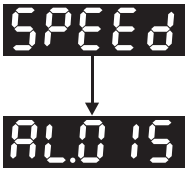


Reverse limit switch error: Check if any of the digital input signals DI1 to DI8 are set to "Reverse inhibit limit (NL)" and check if the signal is ON or not.

Corrective Actions:

- If "Reverse inhibit limit (NL)" is not needed as an input signal, it is sufficient to confirm that none of the digital inputs DI1 to DI8 are set to "Reverse inhibit limit (NL)", the setting value of parameters P2-10 to P2-17 is not 22.
- If "Reverse inhibit limit (NL)" is required as an input signal, you must confirm which of the digital inputs DI1 to DI8 is set to "Reverse inhibit limit (NL)" and check if the digital input signal is ON (it should be activated).

5) If the display shows:



Forward limit switch error: Check if any of digital input signals DI1 to DI8 are set to "Forward inhibit limit (PL)" and check if the signal is ON or not.

Corrective Actions:

- If "Forward inhibit limit (PL)" is not required as an input signal, it is sufficient to confirm that none of the digital inputs DI1 to DI8 are set to "Forward inhibit limit (PL)", i.e. the setting value of parameters P2-10 to P2-17 is not 23.
- If "Forward inhibit limit (PL)" is required as an input signal, you must confirm which of digital inputs DI1 to DI8 is set to "Forward inhibit limit (PL)" and check if the digital input signal is ON (it should be activated).

If "Digital Input 1 (DI1)" is set to Servo On (SON), if DI1 is set to ON (Servo On (SON) function is enabled) and the following alarm message shows on the display:

6) If the display shows:



Overcurrent

Corrective Actions:

- Check the wiring connections between the drive and the motor.
- Check if the circuit of the wiring is closed.
- Remove the short-circuit and keep conductors from being exposed.

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7) If the display shows:



Undervoltage

Corrective Actions:

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

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5.3.1.1 JOG Trial Run without Load

It is very convenient to use JOG trial run without load to test the drive and motor as it can save the wiring. The external wiring is not necessary and you only need to use the Integrated HMI of the drive. Set the JOG velocity to a low value. Follow the steps below to perform JOG trial run without load.

- Turn the drive ON via the commissioning software. The setting value of parameter P2-30 must be 1 (Servo On).
- Set parameter P4-05 to JOG speed (unit: RPM). Set the required JOG velocity and then press the **ENT** button. The drive automatically Step JOG mode.
- You can press the **UP** button or **DOWN** button to change JOG speed and press the **S** button to adjust the digit number of the displayed value.
- Pressing the **ENT** button can determine the speed of JOG operation.
- Press the **UP** button and the motor will run in P(CCW) direction. After releasing the **UP** button, the motor will stop.
- Press the **DOWN** button and the servo motor will run in N(CW) direction. After releasing the **DOWN** button, the motor will stop.

  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.
- Press the **M** button to exit JOG control mode.

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

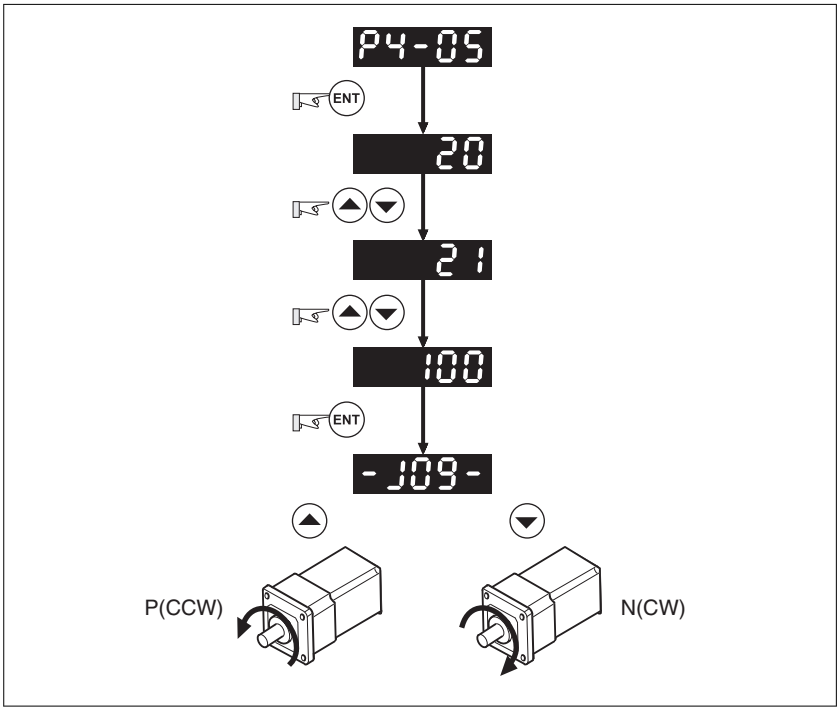


Figure 30: Jog operation

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If the motor does not rotate, verify that the wiring of the U, V, W terminals and the encoder is correct.

If the servo motor does not rotate properly, verify that the phase of U, V, W cables is connected correctly.

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5.3.1.2 Speed Trial Run without Load

Step 1:

Set the value of parameter P1-01 to 02 and it is speed (S) control mode. After selecting speed (S) control mode, restart the drive because 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 below:

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 DI8 is the function of operational stop. If you do not set the setting value of parameters P2-15 to P2-17 and P2-36 to P2-41 to 0 (Disabled), the alarms (AL013, AL014 and AL015) will occur (see chapter *"9 Diagnostics and troubleshooting"* for information on alarm messages). Therefore, if you do not need to use these three digit inputs, set the setting value of parameters P2-15 to P2-17 and P2-36 to P2-41 to 0 (Disabled) in advance.

The digital inputs of the drive are user-defined and the DI signals can be set as required.

Refer to the definitions of DI signals before changing the settings. If any alarm code displays after the setting is completed, you can restart the drive or set DI5 to be activated to clear the alarm.

The speed command is selected by SPD0, SPD1. See 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.

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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:

P1-09 is set to +30000	Input value command	Rotation direction
P1-10 is set to +1000	+	N(CW)
P1-11 is set to -30000	-	P(CCW)

Step 3:

1. You can use DI1 to enable the drive (Servo On).

2. If DI3 (SPD0) and DI4 (SPD1) are OFF both, it indicates S1 command is selected. In this case, 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 3000 RPM 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 -3000 RPM at this time.

6. Repeat the action of (3), (4), (5) freely.

7. When you want to stop the speed trial run, use DI1 to disable the drive (Servo Off).

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5.3.1.3 Position Trial Run without Load

Step 1:

Set the value of parameter P1-01 to 01 and it is position (Pr) control mode. After selecting position (Pr) control mode, restart the drive for the setting to become effective.

Step 2:

In position control mode, the necessary DI setting is listed below:

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 DI8 is the function of operational stop. If you do not set the setting value of parameters P2-15 to P2-17 and P2-36 to P2-41 to 0 (Disabled), the alarms (AL013, AL014 and AL015) will occur (see chapter *"9 Diagnostics and troubleshooting"* for information on alarm messages. Therefore, if you do not need to use these three digital inputs, set the setting value of parameters P2-15 to P2-17 and P2-36 to P2-41 to 0 (Disabled) in advance.

The digital inputs of the drive are user-defined and the DI signals can be set as required.

Refer to the definitions of DI signals before changing the settings. If any alarm code displays after the setting is completed, you can restart the drive or set DI5 to be activated to clear the alarm.

Because POS2 is not the default DI, you need to change the value of parameters P2-14 to 113.

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

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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)

You can set the value of these 8 groups of commands (P6-00 ... P6-17) freely. The command can be absolute position command as well.

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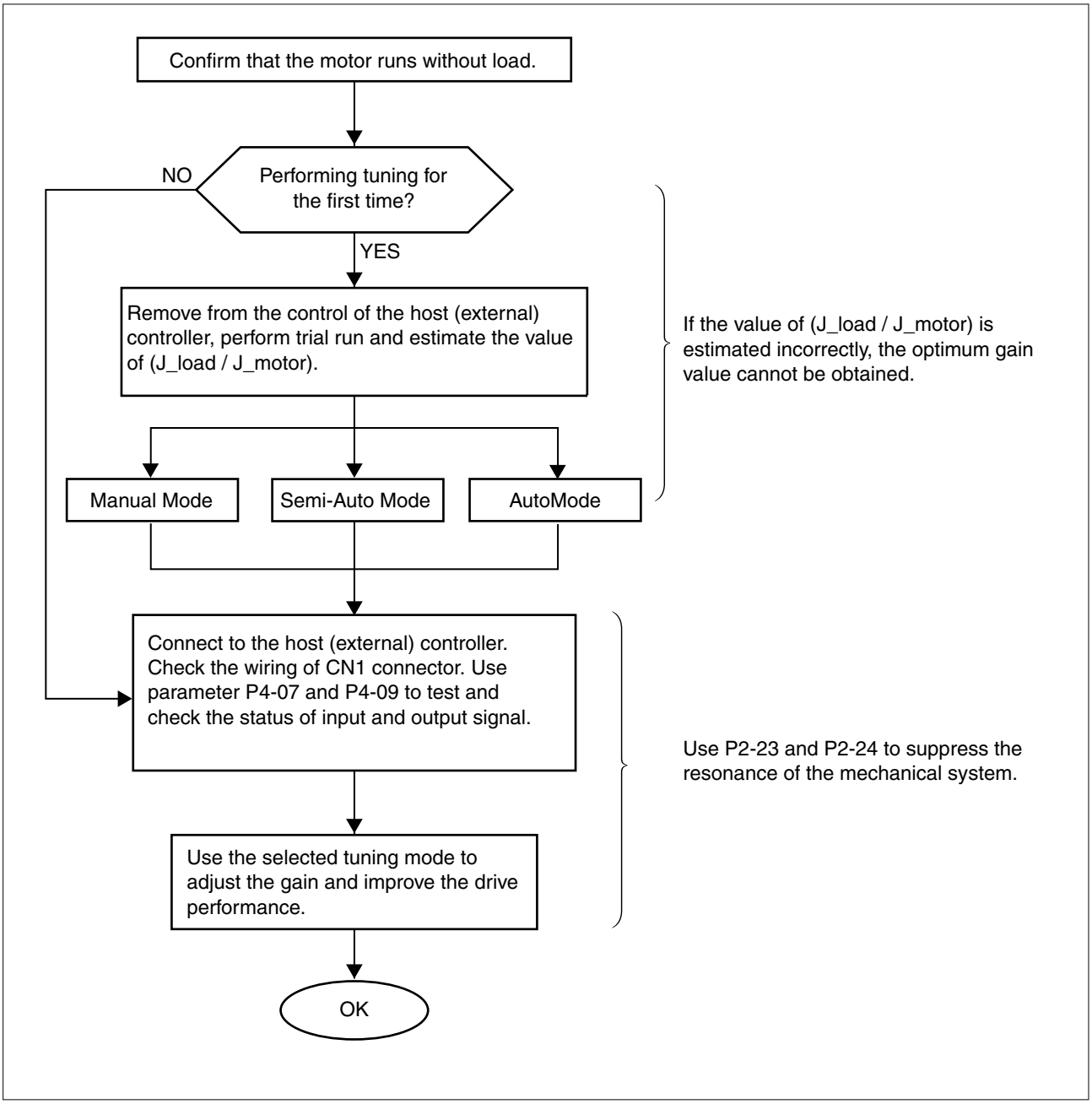
5.3.2 Tuning with load

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

Step		HMI display
1	After wiring is completed, when power in connected to the drive, the display will appear as shown to the right.	RLE 14
2	Press the **M** button to enter into HMI mode Edit Parameter.	P0-00
3	Press the **S** button twice to select parameter group.	P2-00
4	Press the **UP** button to view each parameter and select parameter P2-17.	P2-17
5	Press the **ENT** button to display the parameter value as shown on the right side.	21
6	Press the **S** button twice to change the parameter values. Use the **UP** button to cycle through the available settings and then press the **ENT** button to determine the parameter settings.	121
7	Press the **UP** button to view each parameter and select parameter P2-30.	P2-30
8	Press the **ENT** button to display the parameter value as shown to the right.	0
9	Select parameter value 1. Use the **UP** button to cycle through the available settings.	1
10	At this time, the drive is ON and display will appear as shown to the right.	0
11	Press the **DOWN** button 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) (default setting is 5.0).	5.0
13	Press the **M** button to select HMI mode Edit Parameter.	P2-30
14	Press the **S** button twice to select parameter group.	P4-00
15	Press the **UP** button to select user parameter P4-05.	P4-05
16	Press the **ENT** button and JOG speed 20 RPM will be displayed. Press the **UP** button or **DOWN** button to increase or decrease JOG speed. Pressing the **S** button once time adds one digit number.	20 200
17	Select required JOG speed, press the **ENT** button and the display will appear as shown to the right.	-JOG-
18	Pressing the **UP** button is forward rotation and pressing the **DOWN** button is reverse rotation.	
19	Execute JOG operation in low speed first. After the machine is running smoothly, 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. Press the **M** button twice continuously to see the ratio of Load Inertia to Servo Motor Inertia (J_load /J_motor). Then, execute JOG operation again, press the **M** button once and press the **ENT** button twice to view the data on the display. Check if the value of J_load /J_motor is adjusted to a fixed value and displayed after acceleration and deceleration repeatedly.	

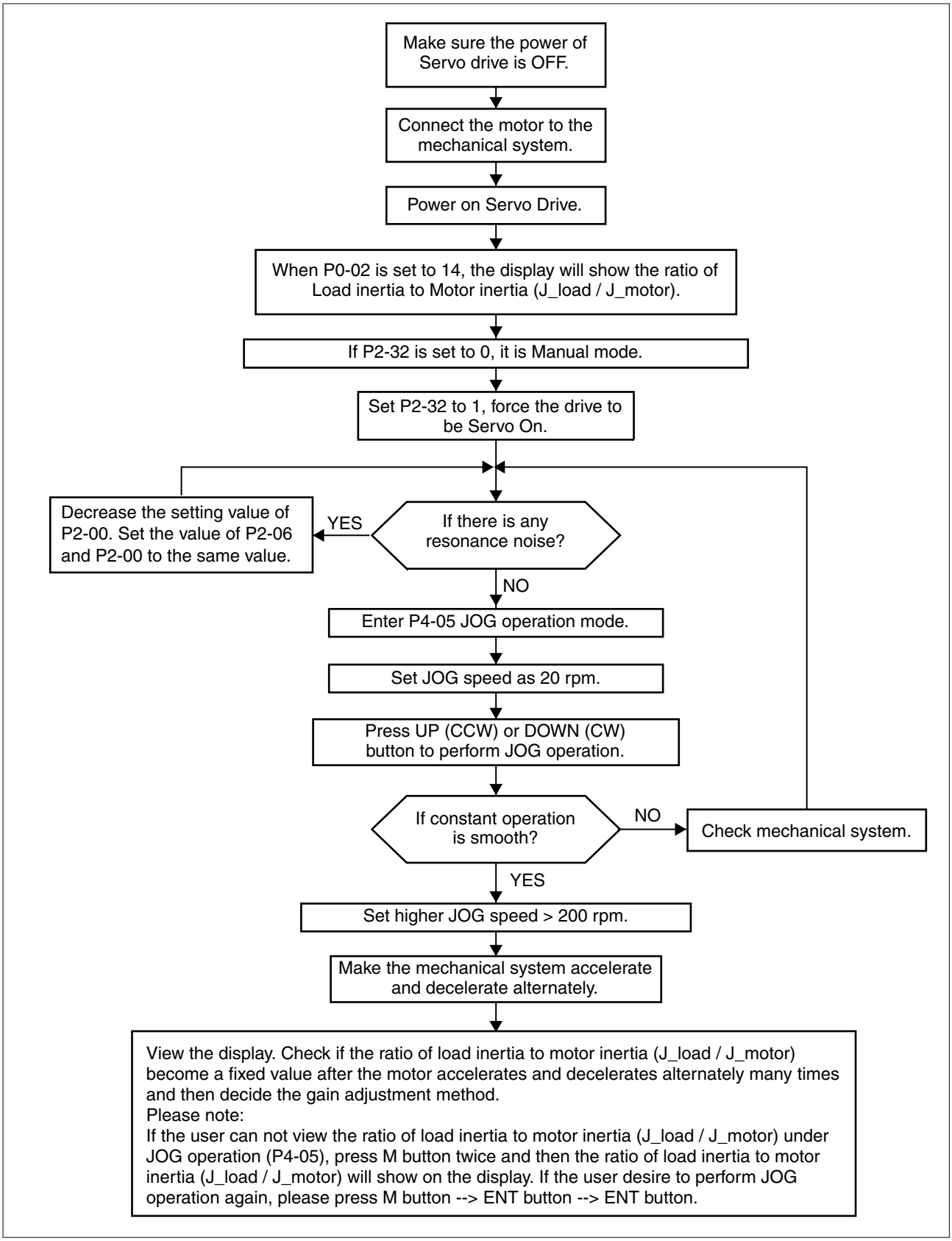
0198441113932, V2.02, 11.2014

5.3.2.1 Tuning Flowchart



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5.3.2.2 Load Inertia Estimation Flowchart



5.3.2.3 Auto Mode Tuning Flowchart

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

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The 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

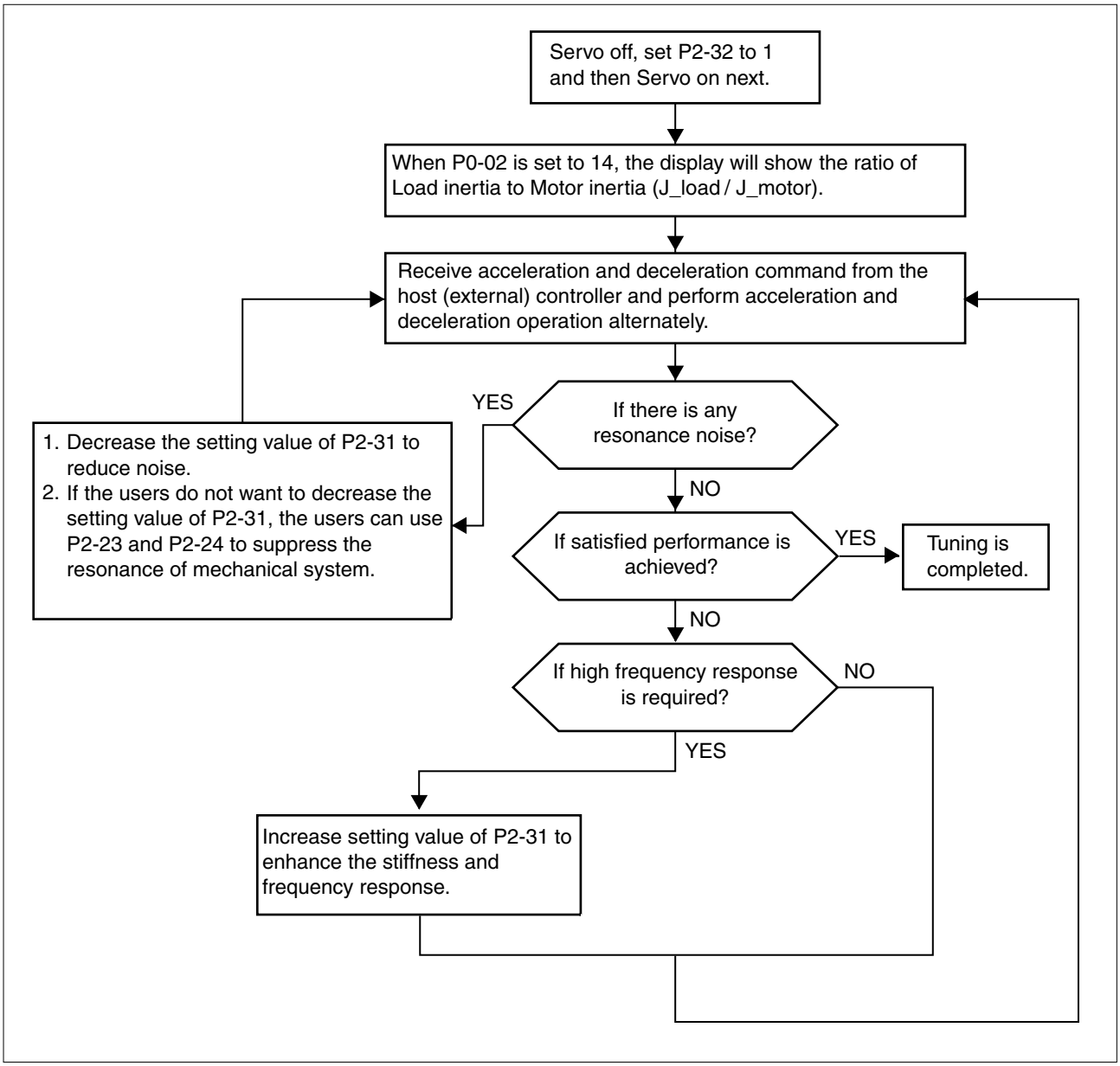
251 ... 850Hz : High stiffness and high frequency response

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.

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5.3.2.4 Semi-Auto Mode Tuning Flowchart

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

The 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 drive will perform continuous adjustment for estimating the load inertia (P1-37) again. The 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

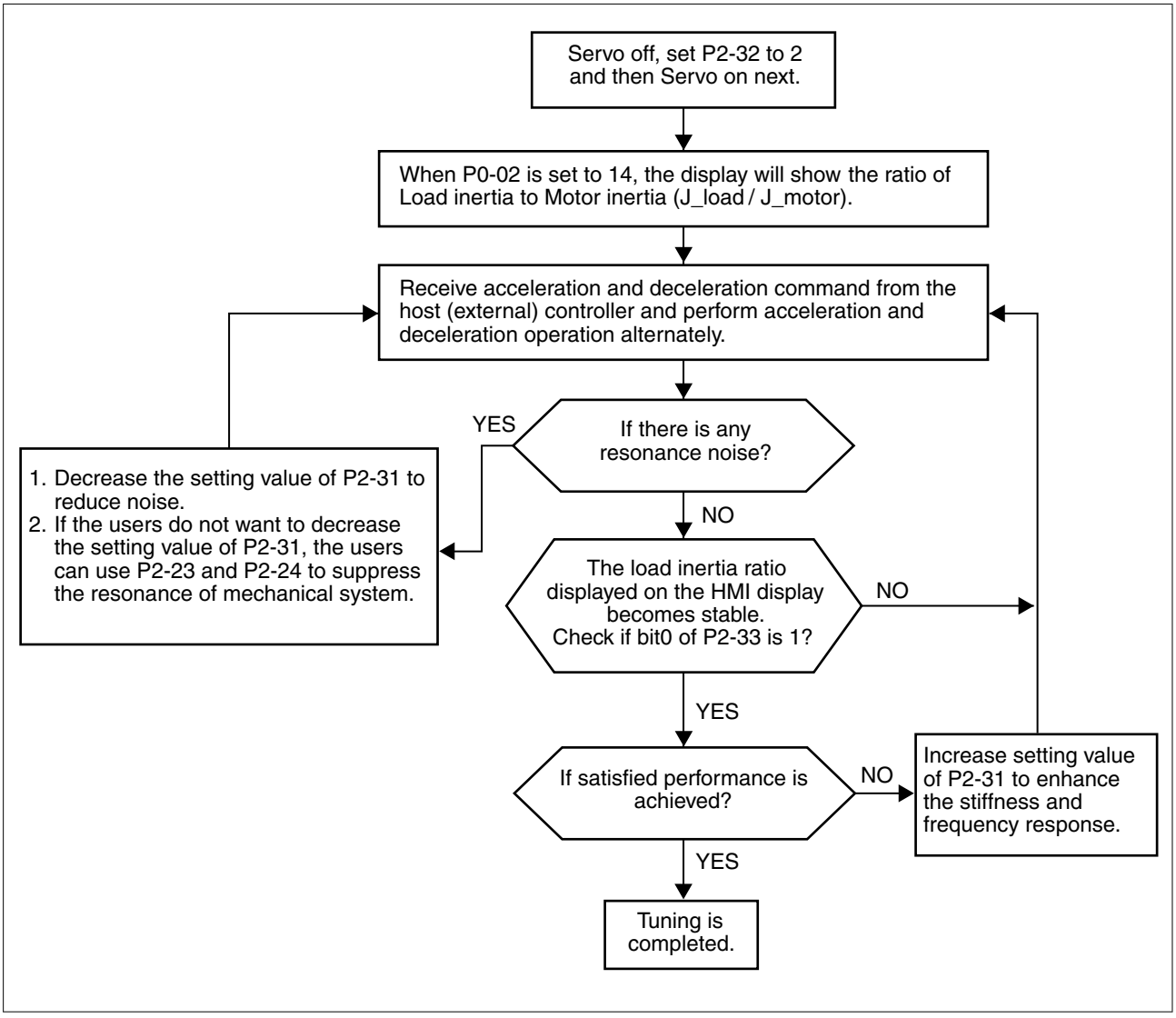
0198441113932, V2.02, 11.2014

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.

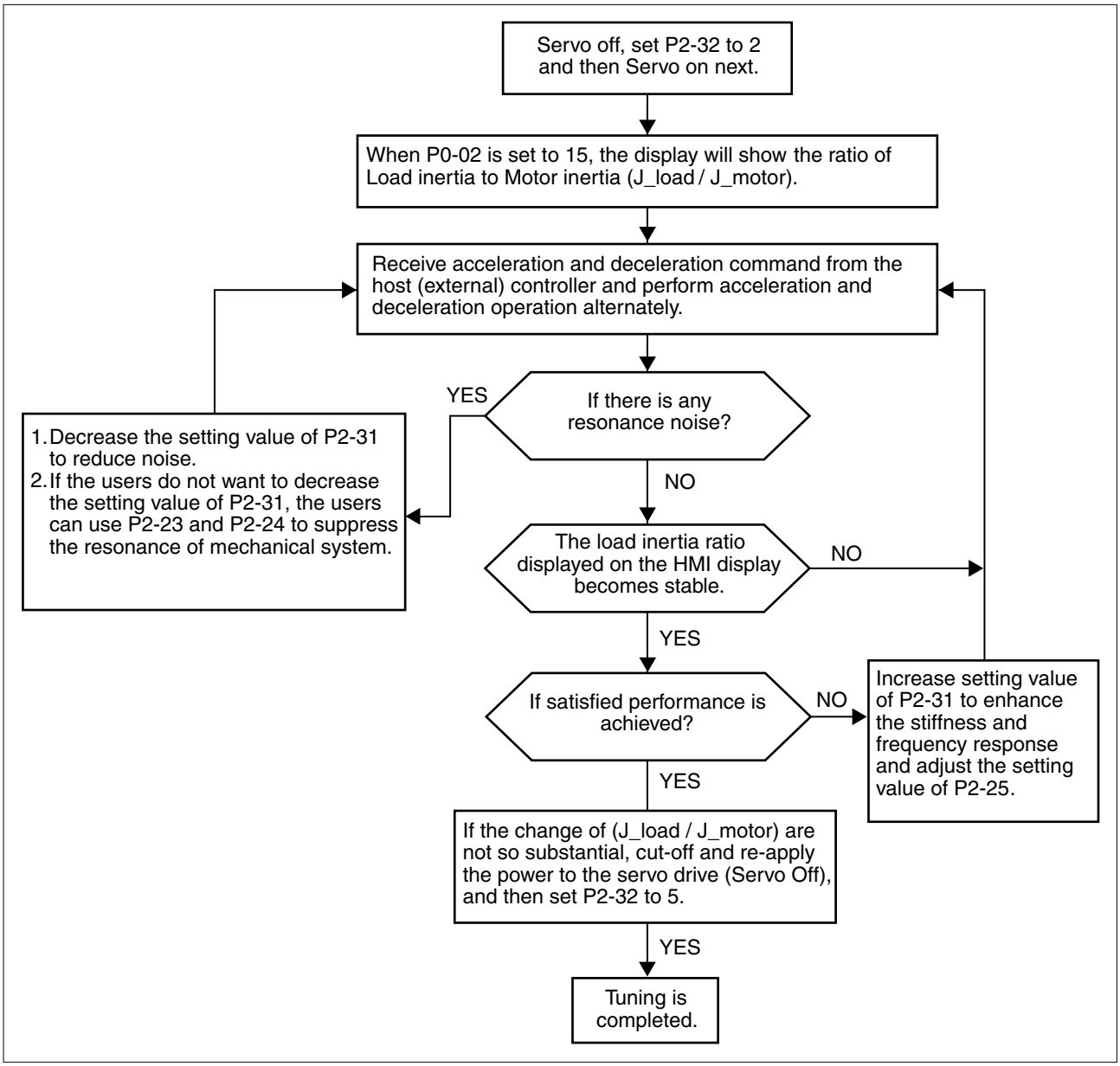
2) If reset bit0 of P2-33 to 0, it will start estimating the system inertia again.

5.3.2.5 Limit of Load Inertia Estimation

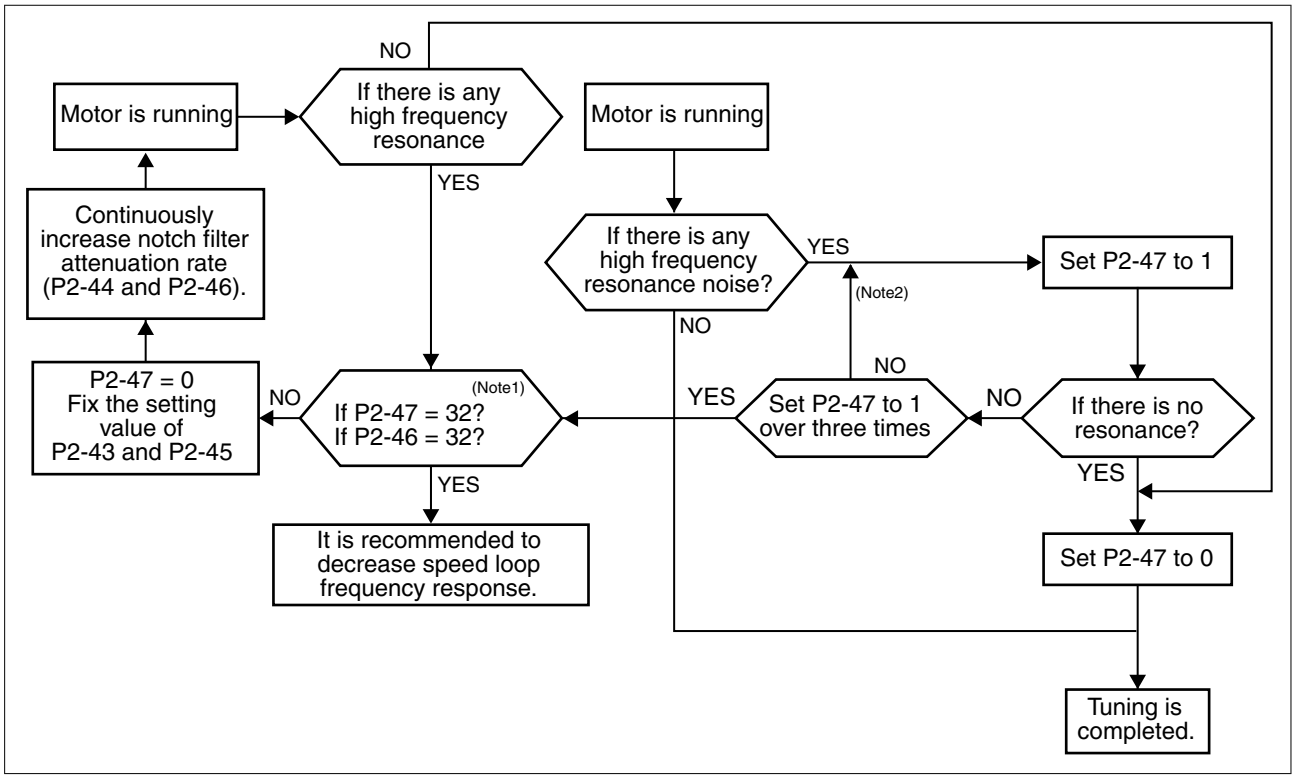
The acceleration / deceleration time for reaching 2000 RPM must be below 1 second. The rotation speed must be above 200 RPM. The load inertia must be 100 multiple or less of motor inertia. The change

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of external force and the inertia ratio cannot 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.



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NOTE:

1) Parameters P2-44 and P2-46 are used to set notch filter attenuation rate. If the resonance cannot be suppressed when the setting values of P2-44 and P2-46 are set to 32bB (the maximum value), decrease the speed loop frequency response. After setting P2-47, you 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 you 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.

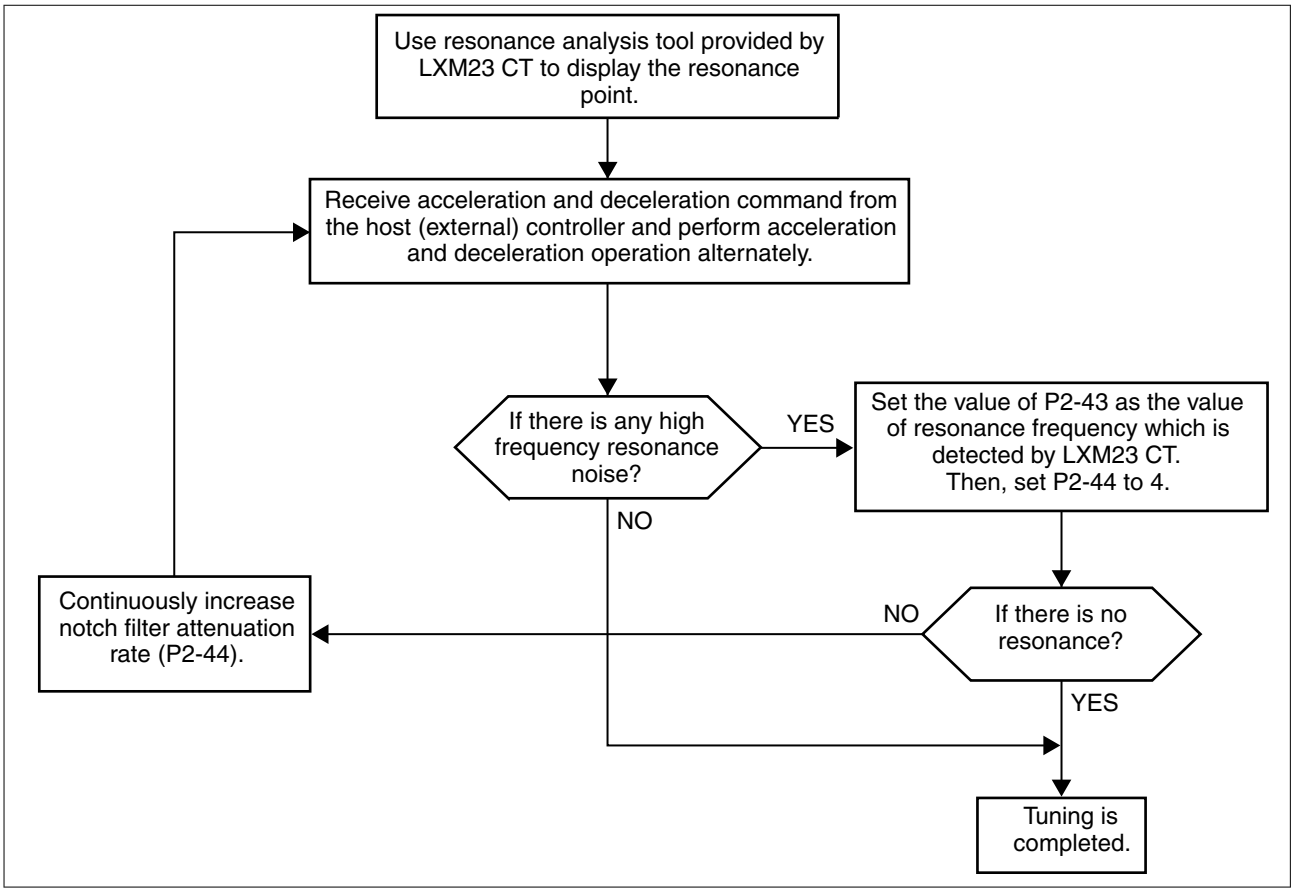
2) If the resonance conditions are not improved when P2-47 is set to 1 for more than three times, adjust the notch filters (resonance suppression parameters) manually to remove the resonance.

5.3.2.6 Mechanical Resonance Suppression Method

In order to suppress the high frequency resonance of the mechanical system, the drive provides two notch filters (resonance suppression parameters) for resonance suppression. These notch filters can be set to suppress the resonance automatically. If you do not want to suppress the resonance automatically, these two notch filter can also be set to remove the resonance manually.

See the following flowchart for manual adjustment.

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5.3.2.7 Relationship between Tuning Modes and Parameters

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

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

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

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5.3.2.8 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 result in the resonance of machinery system. Therefore, for the applications of high frequency response, the machinery system with control stiffness is required to remove the resonance. Especially when adjusting the frequency response of an unfamiliar system, you can gradually increase the gain setting value to improve frequency response until the resonance occurs, and then decrease the gain setting value. The related parameters and gain adjusting methods are described below.

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 excessively high, the machinery system may generate vibration or noise, or even overshoot during positioning.

The position loop frequency response is calculated as follows:

$$\frac{KPP}{2\pi}$$

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 excessively 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:

$$fv = \left(\frac{KPP}{2\pi}\right) \times \left[\frac{(1+P1\text{-}37/10)}{(1+JL/JM)}\right] Hz$$

JM: Motor Inertia
JL: Load Inertia

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:

$$fv = \frac{KPP}{2\pi} Hz$$

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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 excessively high, it may result in the vibration of machinery system.

The recommended setting value is as follows:

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

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

If the value of (J_load / J_motor) is high, the frequency response of speed loop may decrease. In this case, you 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 result in the vibration of machinery system. Use this parameter to suppress or remove 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 excessively high, this may lead to instability of the speed loop and overshoot of the system.

The recommended setting value is as follows:

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

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 excessively high, it may lead to the overshoot of machinery system. If the value of electronic gear ratio (P1-44/P1-45) is greater than 10, the machine system may also generate vibration or noise.

5.3.3 Forcing the digital outputs

Forcing of signals means that the digital inputs and outputs are set manually. Forcing input and output values can have serious consequences on the operation of a machine or process.

⚠ WARNING

UNINTENDED EQUIPMENT OPERATION CAUSED BY FORCING

- Only use the function if there are no persons or obstructions in the zone of operation.
- Only use the forcing function if you are fully familiar with the effects of the signals.
- Only use the forcing function for test purposes; do not use the forcing function for regular operation.

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

For testing, the digital outputs can be forced to be activated (ON) or deactivated (OFF) by using parameters P2-08 and P4-06. First, set parameter P2-08 to 406 to enable forcing. Then use parameter P4-06 to force the digital outputs to be activated. See *" Forcing outputs"* for details. If P4-06 is set to 2, the digital output DO2 is activated. If P4-06 is set to 5, the digital outputs DO1 and DO3 are both activated. The

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value of parameter P4-06 is not retained when power is shut off. When the drive is switched on again, the normal state of all digital outputs is restored. If you set parameter P2-08 to 400, this switches forcing of the outputs to normal Digital Output (DO) control mode.

The DO function and status are determined via aparameters P2-18 to P2-22. This function is enabled only when the drive is in the state Servo Off (the drive is disabled).

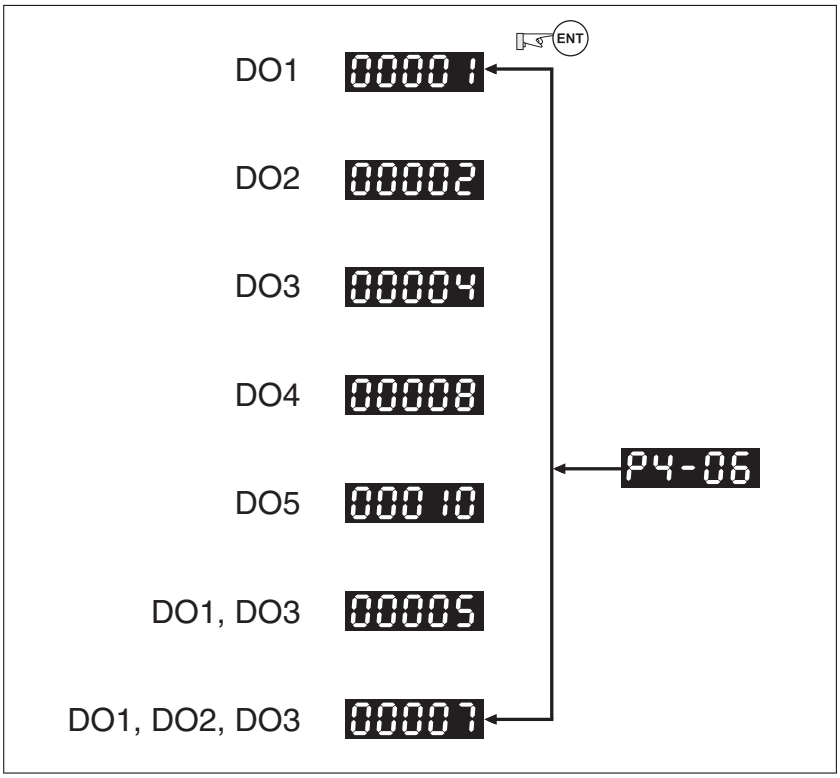


Figure 31: Forcing outputs

NOTE: Since P4-06 is displayed in hexadecimal notation, 0 (zero) of the fifth digit is not shown on the display.

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6 Operation

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

Unsuitable settings or unsuitable data may trigger unintended movements, trigger signals, damage parts and disable monitoring functions. Some settings do not become active until after a restart.

⚠ WARNING

UNINTENDED EQUIPMENT OPERATION

- Do not operate the drive system with unknown settings or data.
- Never modify a parameter unless you fully understand the parameter and all effects of the modification.
- After modifications to settings, restart the drive and verify the saved data or settings.
- When commissioning the product, 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 zone of operation.

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

6.1 Access channels

The product can be accessed via different types of access channels. Simultaneous access via multiple access channels may cause unintended equipment operation.

⚠ WARNING

UNINTENDED EQUIPMENT OPERATION

- Verify that simultaneous access via multiple access channels cannot cause unintended triggering or blocking of commands.
- Verify that the required access channels 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

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6.2 General Function Operation

6.2.1 Displaying alarm codes

After entering HMI mode Parameter P4-00 to P4-04 (alarm code), press the **ENT** button to display the alarm history for the parameter.

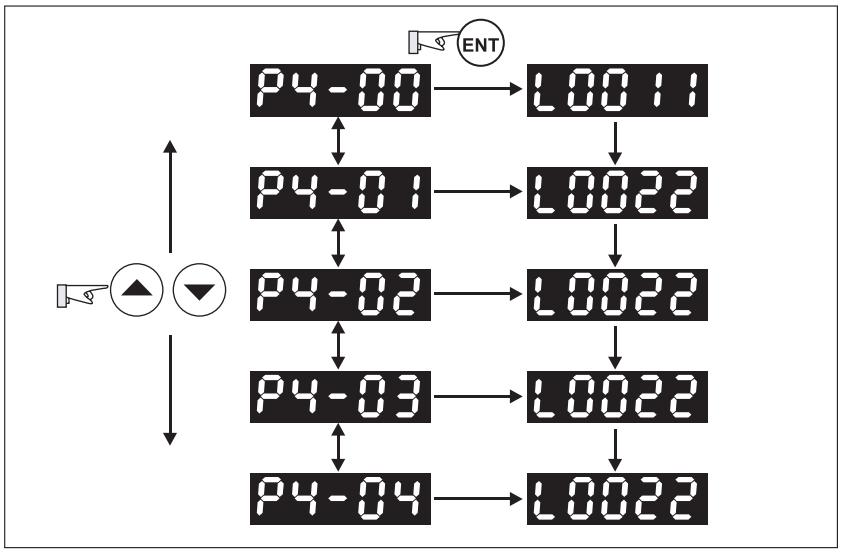


Figure 32: Alarm code history

P4-00	Most recent alarm code
...	...
P4-04	Oldest alarm code

6.2.2 Jog operation

Perform the following steps to operate the drive in Jog mode:

- Enable the drive (for example P2-30 = 1).
- Enter HMI mode Parameter P4-05.
- Press the **ENT** button to display the velocity in RPM for Jog. The default value is 20 RPM.
- Press the **UP** button or **DOWN** button to increase or decrease the required Jog velocity. You can also press the **S** button to move the cursor to the required digit (digit will blink). Then change the value of this digit with the **UP** button or **DOWN** button. In the example display in *" Jog operationJog operation"*, the velocity is set to 100 RPM.
- After you have set the required velocity, press the **ENT** button. The display shows "JOG".
- Press the **UP** button or **DOWN** button to jog the motor in the required direction N(CW) and P(CCW) (see *" Jog operationJog operation"*). The motor only rotates while the button is pressed.
- To change the Jog velocity, press the **M** button. The display shows "P4-05". Press the **ENT** button. The display shows the currently selected velocity. Change the velocity as described above.

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NOTE:

Jog operation is only available when the drive is in the state Servo On (when the drive is enabled).

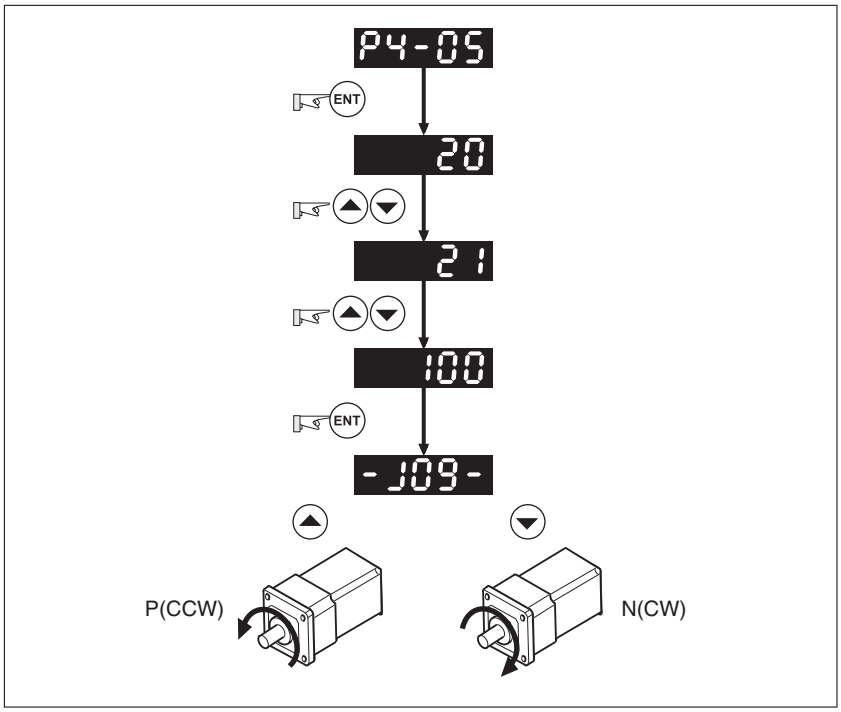


Figure 33: Jog operation

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6.3 Control modes

LXM23 can be programmed to provide single control modes and dual control modes. The following table summarizes these control modes.

Mode name		Mode	Code	Description
Single Mode	External Position Control	Pt	00	Position control of the motor is achieved via an external pulse command.
	Internal Position Control	Pr	01	Position control of the motor is achieved via internal position commands stored in the drive. Execution of the 8 positions is performed via digital input (DI) signals.
	Speed Control	S	02	Speed control of the motor can be achieved via parameters set in the drive or via an external analog -10 ... +10 V_{dc} command. Control of the internal speed parameters is performed via the digital inputs (DI). A maximum of three speeds can be stored internally.
	Internal Speed Control	Sz	04	Speed control of the motor is only achieved via parameters set in the drive. Control of the internal speed parameters is performed via the digital inputs (DI). A maximum of three speeds can be stored internally.
	Torque Control	T	03	Torque control of the motor can be achieved via parameters set in the drive or via an external analog -10 ... +10 V_{dc} command. Control of the internal torque parameters is performed via the digital inputs (DI). A maximum of three torque levels can be stored internally.
	Internal Torque Control	Tz	05	Torque control of the motor is achieved via parameters set in the drive. Control of the internal torque parameters is performed 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).
CANopen Mode		CANopen	0B	The drive is controlled by an external master via CANopen.

Changing the control mode:

(1) Set the drive to the state Servo Off. Turn the SON signal of digitial input to off to complete this action.

(2) Use parameter P1-01. See chapter *"10 Parameters"*.

(3) After having completed the setting, shut off the power and restart the drive.

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

6.3.1 Position Control mode

Position Control mode (Pt or Pr mode) is usually used for applications requiring precision positioning, such as industrial positioning machines, indexing tables, etc. The drive supports two types of com-

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mand sources in Position Control mode. One command source is an external pulse train (Pt: external Position Control via pulse train). The internal parameters P6-00 to P6-17 serve as the second command source (Pr: internal Position Control via position register).

The external pulse train controls the rotation angle of the motor. The maximum input frequency for the external pulse command is 4 Mpps.

The drive also provides 8 internal parameters for internal position control. There are two methods of setting these parameters. The first method is to assign different position commands to these eight parameters before operation and then use POS0 to POS2 of DI signals of CN1 to perform position control. The second method is to use serial communication to change the setting values of these eight internal parameters.

To make the motor and load run smoothly, the drive also provides full Position Spine Line (P-curve) profiles for position control mode. For closed-loop positioning, the speed control loop is the principal part and the additional factors are position loop gain and feed forward compensation. Two tuning modes are available (manual/auto) for gain adjustment. This section focuses on gain adjustment and feed forward compensation.

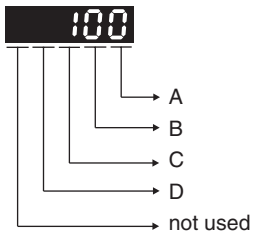
6.3.1.1 Command source for Position Conrol (Pt) mode

The command source for Pt Position Control mode is an external pulse train input. There are three types of pulse input. Each pulse type is with logic type (positive (+), negative (-)). The settings can be made via parameter P1-00.

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

Default: 0x0002
Applicable control mode: Pt
Unit:
Range: 0x0000 ... 0x1142
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

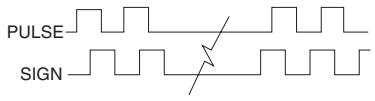
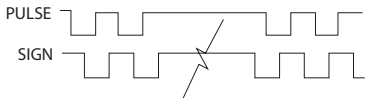
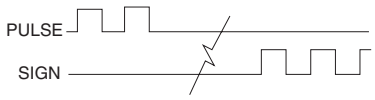
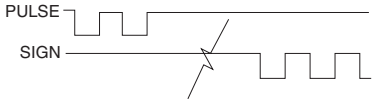
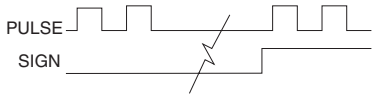
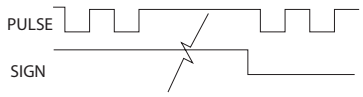
B: Input pulse filter

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This setting is used to suppress or reduce the chatter caused by the noise, etc. However, if the instant input pulse filter frequency is excessivley 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.

The position pulse can be supplied via the 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. See chapter *"4.5.6.4 Wiring Diagrams of I/O Signals (CN1)"* for wiring details.

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6.3.1.2 Command source for Position Control (Pr) mode

The command sources for Position Control (Pr) mode are the eight parameters P6-00, P6-01 to P6-16, P6-17. Via external I/O signals (CN1, POS0 to POS2 and CTRG), one of these parameters can be selected as the source of the position command.

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 to POS2:

0 indicates that the contact is OFF (normally open)

1 indicates that the contact is ON (normally closed)

CTRG↑: the instant when the contact changes from 0 (open) to 1 (closed). Position control allows you to run simple positioning sequences where positioning can be absolute or incremental. For example, position command P1 is 10 revolutions and P2 is 20 revolutions. Assume that position command P1 is executed first and position command P2 after that. *" Absolute and incremental positioning"* shows the difference between absolute and incremental positioning.

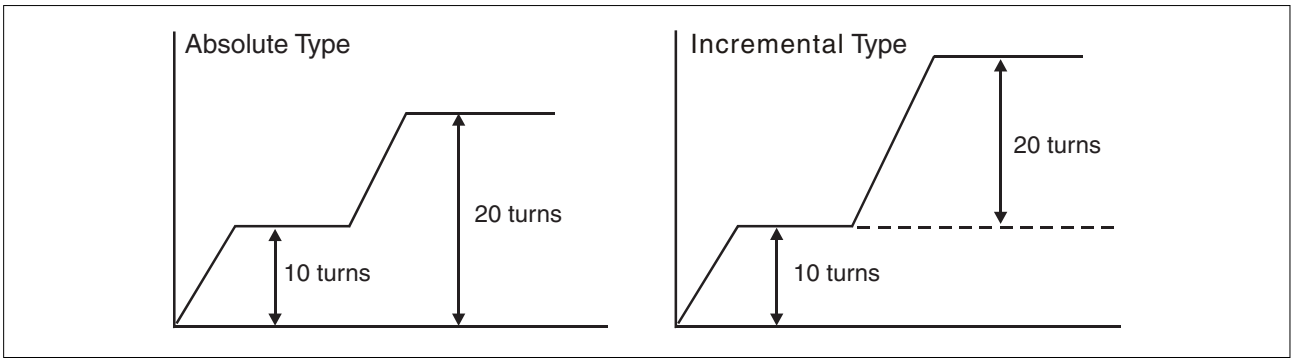
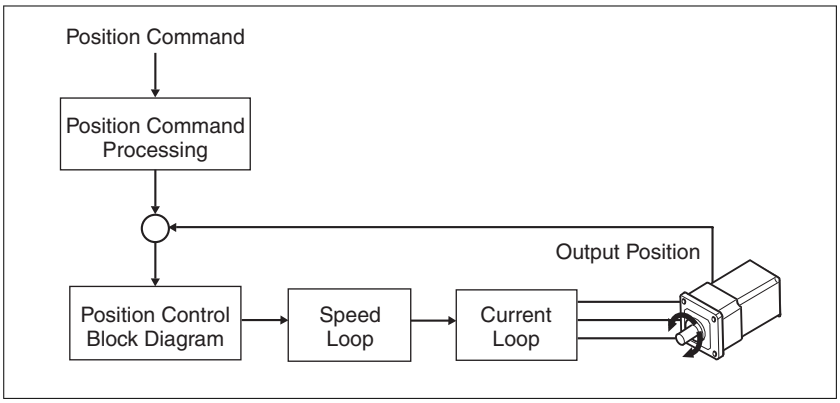


Figure 34: Absolute and incremental positioning

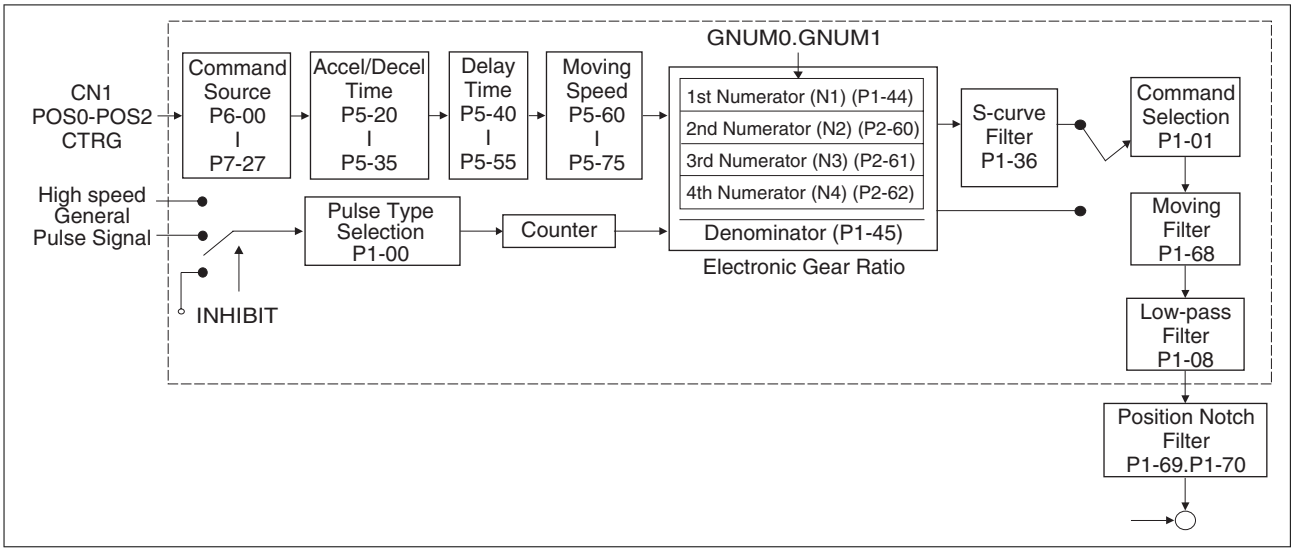
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6.3.1.3 Structure of Position Control mode

The figure below shows the basic structure of the Position Control mode.



The figure below shows how the pulse signal should is modified via position command processing.

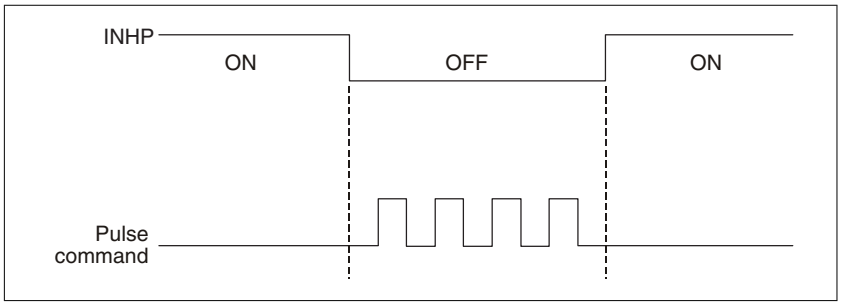


The different Position Control modes (Pr and Pt) are selected via parameters. An electronic gear ratio can be set in both modes. In addition, S-curve and low-pass filter are provided for smoothing. See chapter *"6.3.1.4 S-curve filter for Position Control"*, *"6.3.1.5 Electronic gear ratio"* and *"6.3.1.6 Low-pass filter"* for details on S-curve, electronic gear and low-pass filter.

Pulse Inhibit Input function (INHIBIT)

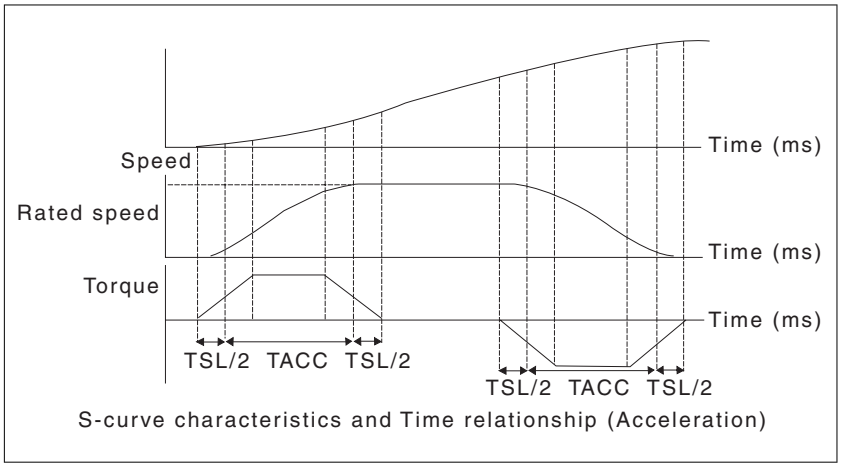
This function is activated via digital inputs. See parameters P2-10 to P2-17. When the drive is in Position Control mode and if INHP is activated, the external pulse command is not valid and the motor stop. Only DI8 supports this function.

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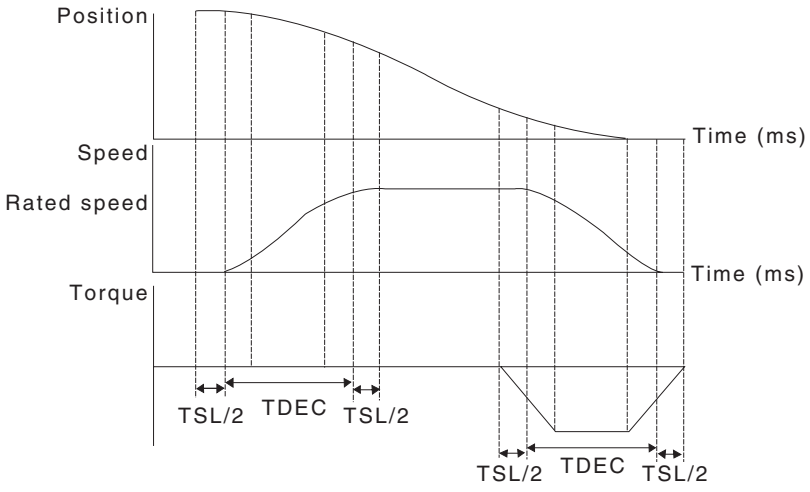
6.3.1.4 S-curve filter for Position Control

The S-curve filter can be used to smooth the position command and allows for smoother response of the motor to sudden sudden position commands. Since the speed and acceleration curves are continuous and the time for the motor to accelerate is short, using the S-curve filter can improve the performance when motor acceleratess or decelerates and can also can make motor to run more smoothly (from a mechanical perspective). When the load changes, the motor may not start and stop due to the friction and inertia change. You can can increase the acceleration/deceleration S-curve constant (TSL), the acceleration time constant (TACC) and the deceleration time constant (TDEC) to improve performance. Because the speed and anglurar acceleration are continuous when the position command is changed to pulse signal input, so it is not needed to use S-curve filter.



S-curve characteristics and Time relationship (Acceleration)

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S-curve characteristics and Time ralationship (Deceleration)

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

Default: 200
Applicable control mode: S
Unit: ms
Range: 1 ... 65500
Data size: 16-bit
Display format: Decimal

Settings:

This parameter is used to specify the acceleration time to accelerate from 0 to the 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. This means that the parameters P1-34 and P1-35 are not disabled even if P1-36 is disabled.

If the source of the speed command is an analog signal, the maximum setting value of P1-36 is set to 0 and the acceleration and deceleration functions are disabled.

If the source of the speed command is an analog signal, the maximum setting value of P1-34 is automatically limited to 20000.

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

Default: 200
Applicable control mode: S
Unit: ms
Range: 1 ... 65500
Data size: 16-bit
Display format: Decimal

Settings:

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This parameter is used to specify the deceleration time to decelerate from the rated motor speed to 0. 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. This means that the parameters P1-34 and P1-35 are not disabled even if P1-36 is disabled.

If the source of the speed command is an analog signal, the maximum setting value of P1-36 is set to 0 and the acceleration and deceleration functions are disabled.

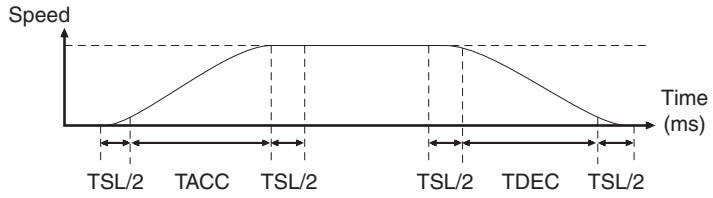
If the source of the speed command is an analog signal, the maximum setting value of P1-35 is automatically limited to 20000.

P1-36 TSL	Acceleration / Deceleration S-curve	Address: 0148h, 0149h

Default: 0
Applicable control mode: Pr, S
Unit: ms
Range: 0 ... 65500
Data size: 16-bit
Display format: Decimal

Settings:

This parameter is used to make the motor run more smoothly during acceleration and deceleration.



TACC: P1-34, acceleration time

TDEC: P1-35, deceleration time

TSL: P1-36, acceleration/deceleration

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. This means that the parameters P1-34 and P1-35 are not disabled even if P1-36 is disabled.

If the source of the speed command is an analog signal, the maximum setting value of P1-36 is set to 0 and the acceleration and deceleration functions are disabled.

If the source of the speed command is an analog signal, the maximum setting value of P1-36 is automatically limited to 10000.

If the motor is controlled via internal parameters, the command curve should be defined by the user.

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6.3.1.5 Electronic gear ratio

Parameters:

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

Default: 128
Applicable control mode: Pt, Pr
Unit:
Range: 1 ... 536870911
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 via P1-45. P2-60 ... P2-62 are used to set the additional numerators.

In Position Contol Pt mode, the value of P1-44 can only be changed only when the drive is enabled (Servo On).

In Position Contol Pr mode, the value of P1-44 can only be changed when the drive is disabled (Servo Off).

P1-45 ▲ GR2	Electronic Gear Ratio (Denominator) (M)	Address: $015A_h$, $015B_h$

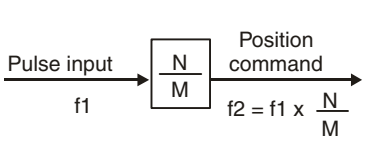
Default: 10
Applicable control mode: Pt, Pr
Unit:
Range: 1 ... 2147483647
Data size: 32-bit
Display format: Decimal

Settings:

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

Incorrect gear ratio settings may cause unintended movements and jerks and change the speed of rotation. Observe the following rules when setting parameters P1-44 and P1-45.

Setting the electronic gear ratio (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

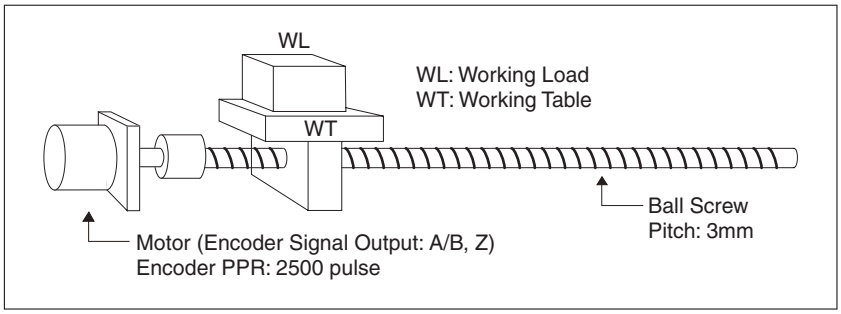
In Position Control modes Pt and Pr, the value of P1-45 cannot be changed when the drive is enabled (Servo On).

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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, you 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 10000 ppr, 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 1μm/pulse, the machinery will become easier to be used.



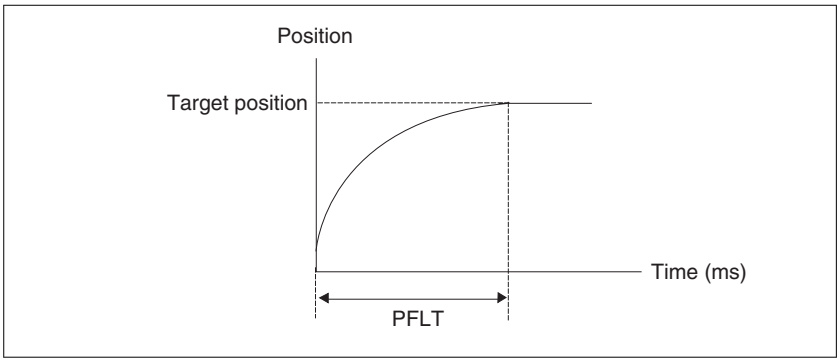
	Electronic Gear Ratio	**Corresponding travel distance per pulse**
When the electronic gear ratio is not used	$= \frac{1}{1}$	$= \frac{3 \times 1000}{4 \times 2500} = \frac{3000}{10000}$ μm
When the electronic gear ratio is used	$= \frac{10000}{3000}$	= 1 μm

6.3.1.6 Low-pass filter

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

Default: 0
Applicable control mode: Pt, Pr
Unit: 10 ms
Range: 0 ... 1000
Data size: 16-bit
Display format: Decimal

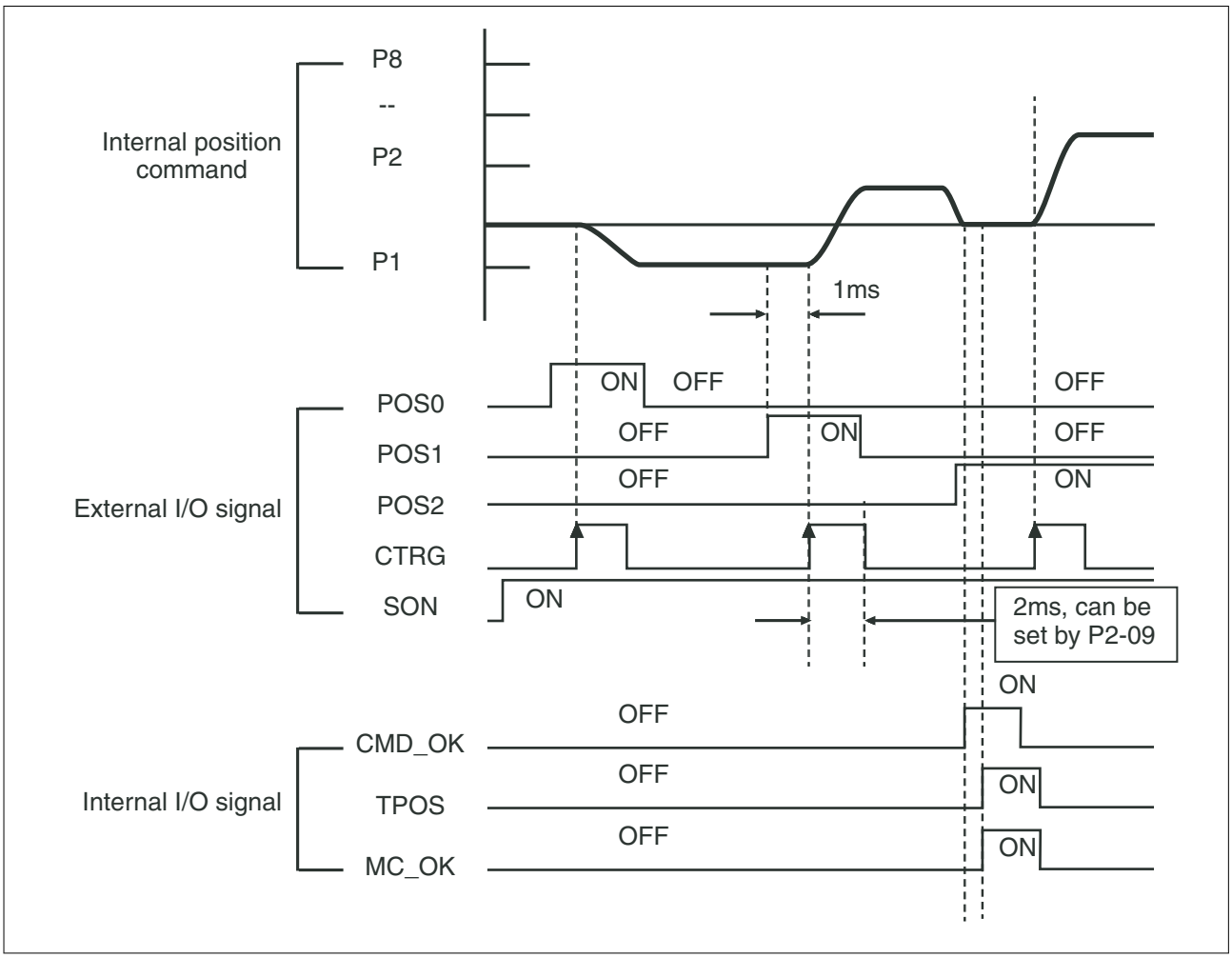
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6.3.1.7 Timing of Position Control (Pr) mode

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

See *"6.3.1.2 Command source for Position Control (Pr) mode"* for the relationship between DI signals and parameters. The following figure shows the timing in Postion Control Pr mode:



CMD_OK: CMD_OK is activated when the drive has detected that the 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.

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

6.3.1.8 Position loop gain adjustment

Before uisng position control (setting position control block diagram), complete the speed control setting by using Manual mode (parameter P-32) since the position loop contains the 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 the speed and position control block diagram automatically.

1) Proportional position loop gain: Increasing this gain can enhance the position loop responsiveness.

2) Position feed forward gain: Increasing this gain can reduce the position tracking error during operation.

The position loop responsiveness cannot exceed the speed loop responsiveness. The speed loop responsiveness should be at least four times faster than the position loop responsiveness. This also means that the value of the proportional speed loop gain KVP should be at least four times faster than proportional position loop gain KPP.

Equation:

$$fp \le \frac{fv}{4}$$

fv: Speed loop responsiveness (Hz)
fp: Position loop responsiveness (Hz)

KPP = 2 x p x fp

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

Then, KPP = 2 x p x 20= 125 rad/s.

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

Default: 35
Applicable control mode: Pt, Pr
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 too high, it may generate vibration or noise.

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

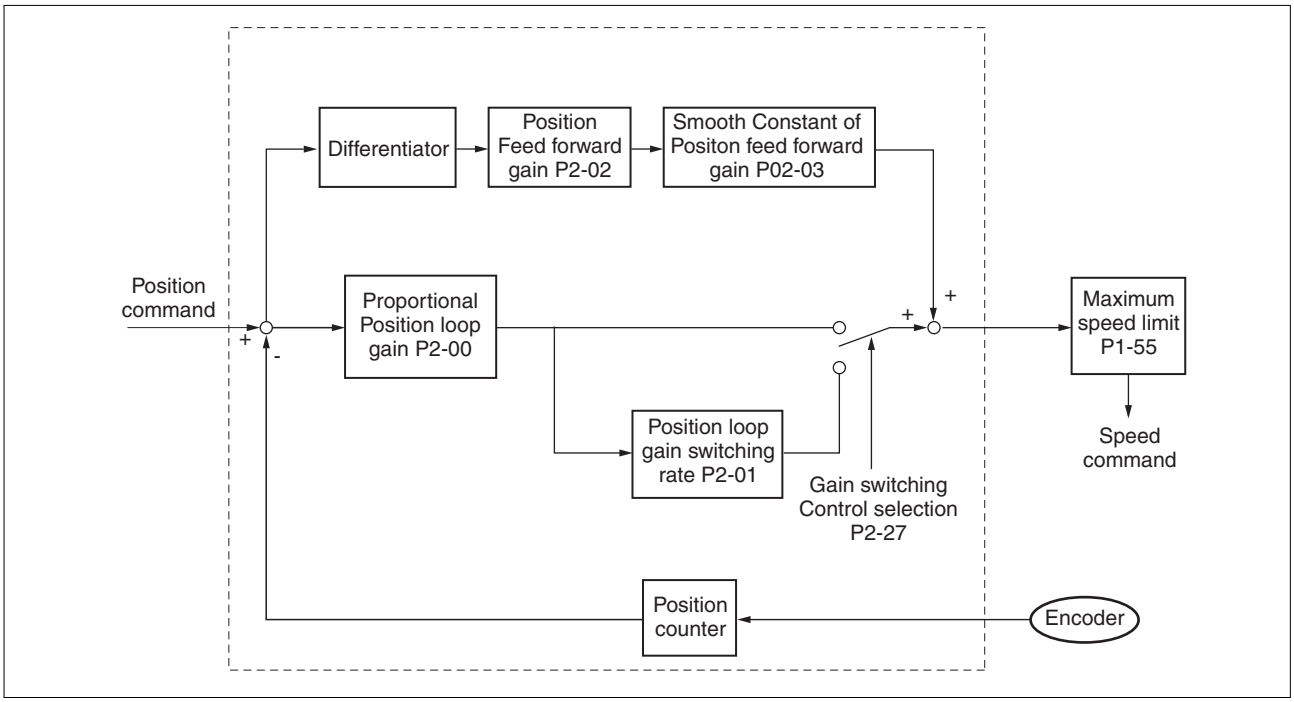
Default: 50
Applicable control mode: Pt, Pr

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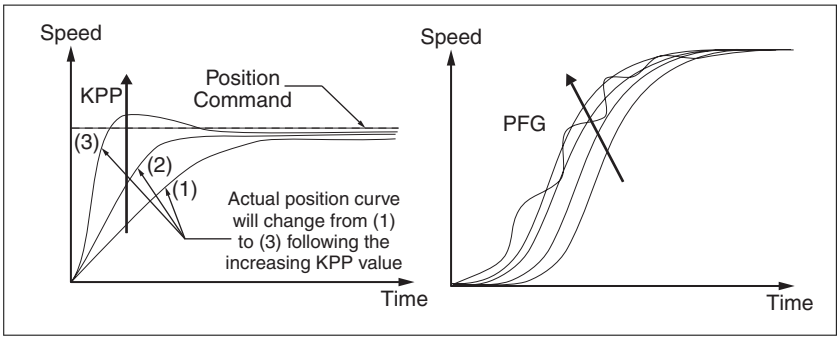
Unit: %
Range: 0 ... 100
Data size: 16-bit
Display format: Decimal

Settings:

This parameter is used to set the feed forward gain when position control commands are executed. When position smoothing is used, increasing the gain can improve position track deviation. When position smoothing is not used, decreasing the gain can improve the resonance condition of the mechanical system.



When the value of the proportional position loop gain KPP is too great, the position loop responsiveness will be increased and it will result in a small phase margin. If this happens, the rotor of the motor will oscillate. In this case, decrease the value of KPP until the rotor of the motor stops oscillating. If an external torque command is interrupted, an excessively low KPP value will keep the motor from overcoming the external force and the requirement of reasonable position track error demand cannot be met. Adjust feed forward gain PFG (P2-02) to efficiently reduce the dynamic position track error.



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6.3.1.9 Low-frequency vibration suppression

If low-frequency vibration suppression is active, extreme responses may occur.

⚠ WARNING

UNINTENDED MOVEMENTS IF VIBRATION SUPPRESSION IS USED

- Verify that a functioning button for emergency stop is within reach.
- Only start the system if there are no persons or obstructions in the zone of operation.
- Anticipate movements in the incorrect direction or oscillation of the motor.
- Verify the stability of the settings.

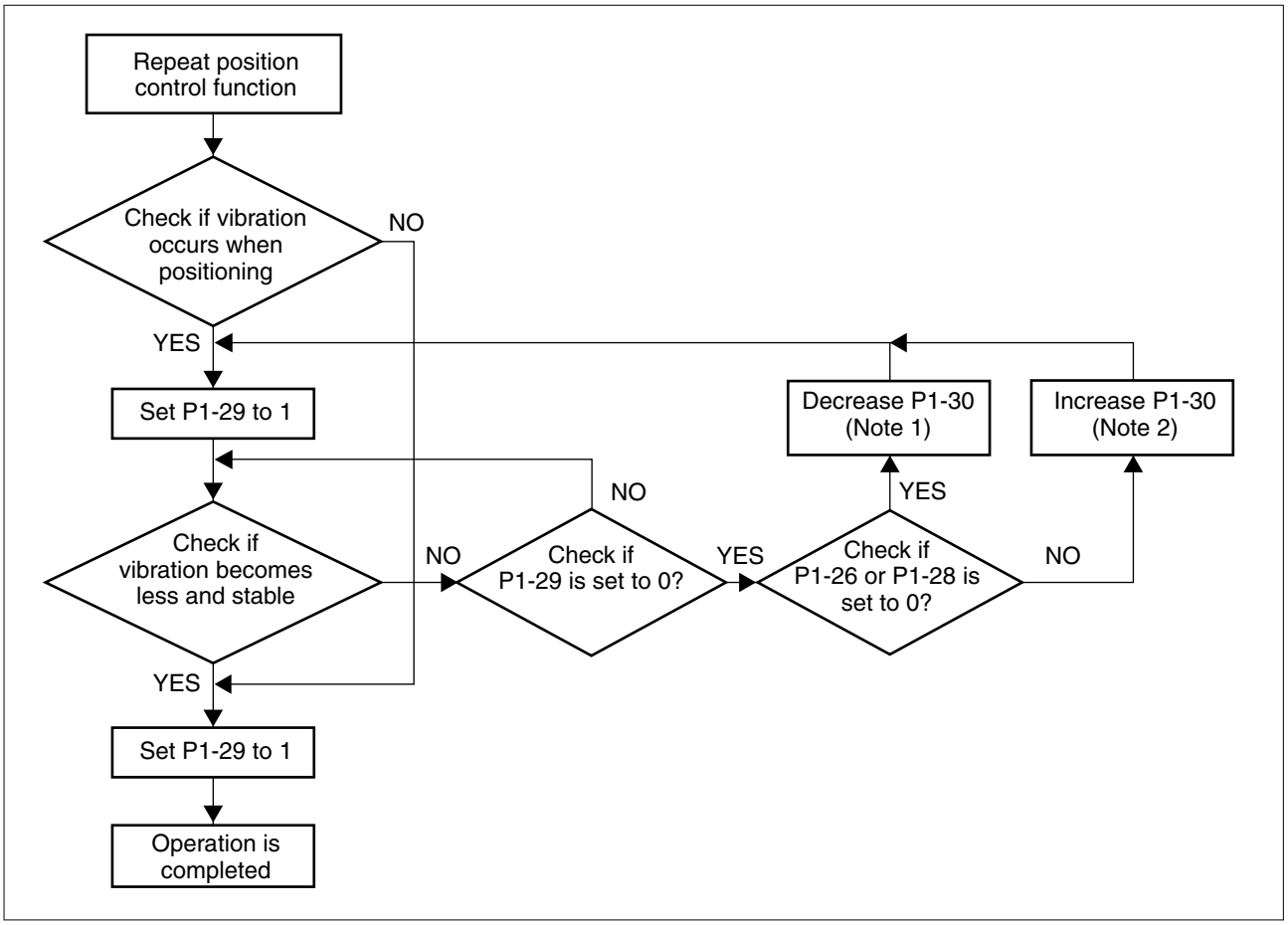
Failure to follow these instructions can result in death, serious injury, or equipment damage.

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

Auto Mode

If you know the point where the low-frequency occurs, you 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, check whether 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. Decrease the setting value of P1-30 (Low-frequency Vibration Detection Level) and set P1-29 to 1 to find the low-frequency again. Check the setting value of P1-30 since if the setting value of P1-30 is too low, it is easy to regard the interference as the low-frequency and results in incorrect measurement.

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NOTE:

1) When P1-26 and P1-28 are both set to 0, it indicates that the system could not find the frequency. Check the setting value of P1-30 because when the setting value of P1-30 is too high, the frequency may get difficult to be found.

2) When P1-26 and P1-28 are both set to a non-zero value, if the vibration condition cannot be improved, check the setting value of P1-30 because the low setting value of P1-30 may result in incorrect measurement. The system may regard the interference as a low-frequency.

3) When the vibration still exists and cannot be suppressed after using auto low-frequency vibration suppression function, if you know the vibration frequency, set P1-25 and P1-27 manually to improve the vibration condition.

P1-29 AVSM	Auto Vibration Suppression Mode Selection	Address: $013A_h$, $013B_h$

Default: 0
Applicable control mode: Pt, Pr
Unit:
Range: 0 ... 1
Data size: 16-bit
Display format: Decimal

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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: $013C_h$, $013D_h$

Default: 500
Applicable control mode: Pt, Pr
Unit:
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 incorrect measurement. If the setting value of P1-30 is too high, although the probability of incorrect 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 cannot be detected (out of range), it indicates that the setting value of P1-30 is too high and you should decrease the setting value of P1-30. You can also use the Scope function provided in the 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 excessively 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.

P1-25 VSF1	Vibration Suppression Frequency 1	Address: 0132_h, 0133_h

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Default: 1000
Applicable control mode: Pt, Pr
Unit: Hz
Range: 10 ... 1000
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	Vibration Suppression Gain 1	Address: 0134_h, 0135_h

Default: 0
Applicable control mode: Pt, Pr
Unit:
Range: 0 ... 9
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 excessively high, it may affect the normal operation of the motor. It is recommended to set P1-26 to 1.

P1-27 VSF2	Vibration Suppression Frequency 2	Address: 0136_h, 0137_h

Default: 1000
Applicable control mode: Pt, Pr
Unit: Hz
Range: 10 ... 1000
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	Vibration Suppression Gain 2	Address: 0138_h, 0139_h

Default: 0
Applicable control mode: Pt, Pr
Unit:
Range: 0 ... 9
Data size: 16-bit
Display format: Decimal

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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 excessively high, it may affect the normal operation of the motor. It is recommended to set P1-28 to 1.

NOTE:

1) The low-frequency vibration suppression function can only be enabled only in position control mode (Pt, Pr or Pr-Pt mode).

2) When the resonance suppression function is used, the resonance condition can be improved immediately after the correct resonance frequency is found. However, when the low-frequency vibration suppression function is used, the vibration of the mechanical system will not be removed 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.

3) After the low-frequency vibration suppression function is enabled, it will affect the original response performance. When the value of the low-frequency is lower, the effect upon the response performance is greater. In this case, you can adjust the setting value of P1-26 to increase the position response. But 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.

4) In order to keep the vibration frequency from not being found easily when the commanding time is too fast in Auto mode, you can set a longer command delay time. The command can be given after the vibration frequency is found.

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6.3.2 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. The drive supports two kinds of command sources in speed control mode. One is external analog signal and the other is internal parameter. The external analog signal is from external voltage input and it can control the speed of the motor. The internal paramters can be used in two ways. One usage is to 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, the drive also provides complete S-curve profile for speed control mode. For the closed-loop speed control, the drive provides gain adjustment function and an integrated PI or PDFF controller. Besides, two modes of tuning technology (Manual/Auto) are also provided (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, the auto and auxiliary function will be disabled.
- Auto Mode: Continuous adjustment of loop gains according to measured inertia, with ten levels of system bandwidth. The parameter set by user is default value.

6.3.2.1 Command Source of Speed Control Mode

Speed command Sources:

1) External analog signal: External analog voltage input, -10V ... +10V

2) Internal parameter: P1-09 ... P1-11

Speed Command	CN1 DI signal		Command Source			Content	Range
	SPD1	SPD0					
S1	0	0	Mode	S	External analog signal	Voltage between V-REF-GND	-10 V ... +10V
				Sz	N/A	Speed command is 0	0
S2	0	1	Internal parameter			P1-09	-60000 ... +60000 RPM
S3	1	0				P1-10	
S4	1	1				P1-11	

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- 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 you do not use analog voltage as speed command, you can choose Sz mode and circumvent 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 (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).

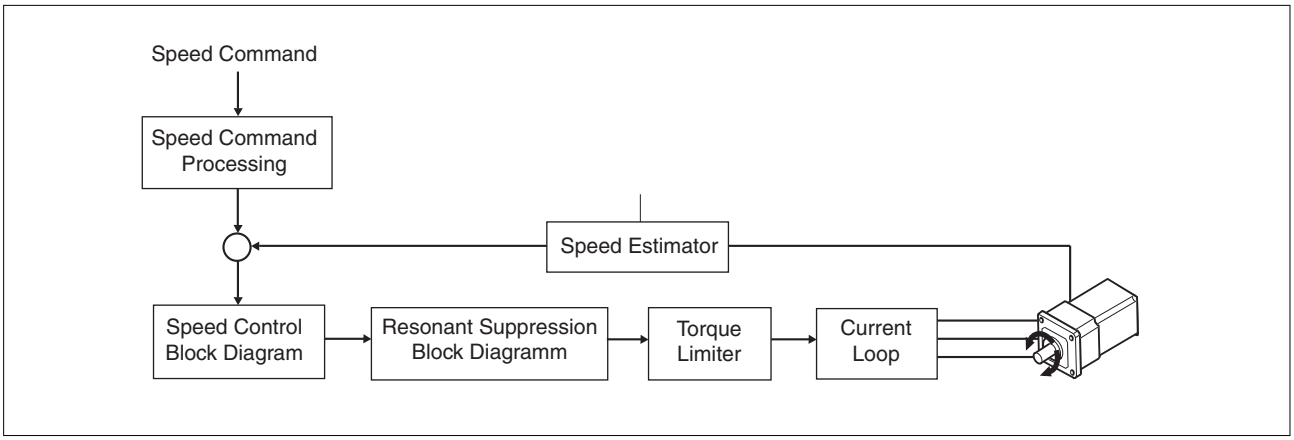
6.3.2.2 Structure of Speed Control Mode

Speed command Sources:

1) External analog signal: External analog voltage input, -10V to +10V

2) Internal parameter: P1-09 to P1-11

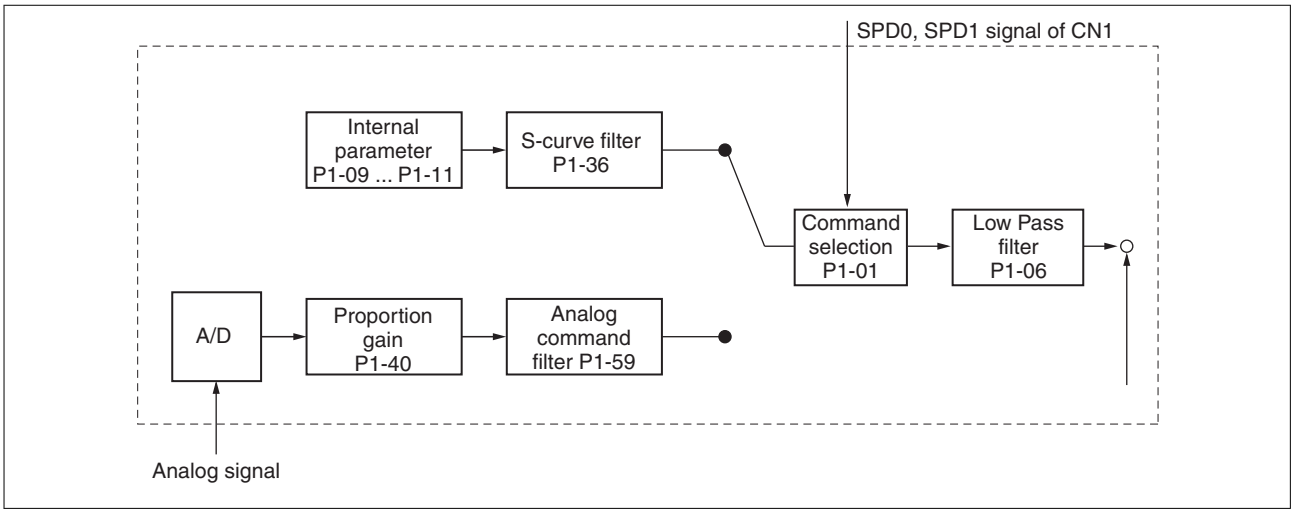
Basic Structure:



In the figure above, the speed command processing is used to select the command source of speed control according to chapter *"6.3.2.1 Command Source of Speed Control Mode"*, 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 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 in the figure below:

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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 smoothed, you can use S-curve and low-pass filter.

6.3.2.3 Smoothing Strategy of Speed Control Mode

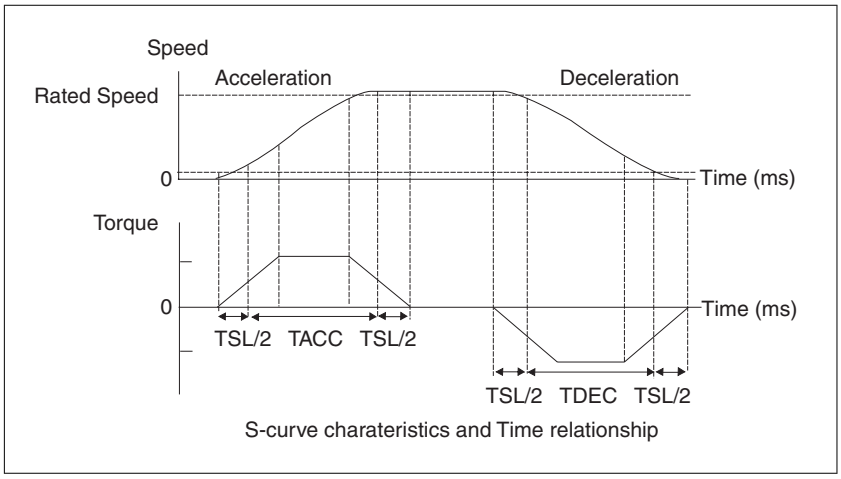
S-curve Filter

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 motor run more smoothly in response to a sudden speed command change.

Since the speed and acceleration curve are both continuous, in order to keep mechanical resonance and noise from occurring due to a sudden speed command (differentiation of acceleration), using the S-curve filter can improve the performance when the motor accelerates or decelerates and can also 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 you can use these three parameters to improve the motor performance during acceleration, deceleration and operation.

The drive also supports 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.

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S-curve charateristics and Time relationship

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

Default: 200
Applicable control mode: S
Unit: ms
Range: 1 ... 65500
Data size: 16-bit
Display format: Decimal

Settings:

This parameter is used to specify the acceleration time to accelerate from 0 to the 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. This means that the parameters P1-34 and P1-35 are not disabled even if P1-36 is disabled.

If the source of the speed command is an analog signal, the maximum setting value of P1-36 is set to 0 and the acceleration and deceleration functions are disabled.

If the source of the speed command is an analog signal, the maximum setting value of P1-34 is automatically limited to 20000.

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

Default: 200
Applicable control mode: S
Unit: ms
Range: 1 ... 65500
Data size: 16-bit
Display format: Decimal

Settings:

This parameter is used to specify the deceleration time to decelerate from the rated motor speed to 0. 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. This means that

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the parameters P1-34 and P1-35 are not disabled even if P1-36 is disabled.

If the source of the speed command is an analog signal, the maximum setting value of P1-36 is set to 0 and the acceleration and deceleration functions are disabled.

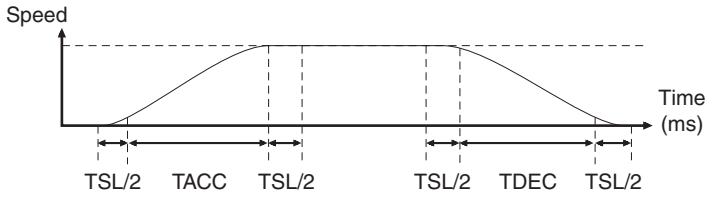
If the source of the speed command is an analog signal, the maximum setting value of P1-35 is automatically limited to 20000.

P1-36 TSL	Acceleration / Deceleration S-curve	Address: 0148h, 0149h

Default: 0
Applicable control mode: Pr, S
Unit: ms
Range: 0 ... 65500
Data size: 16-bit
Display format: Decimal

Settings:

This parameter is used to make the motor run more smoothly during acceleration and deceleration.



TACC: P1-34, acceleration time

TDEC: P1-35, deceleration time

TSL: P1-36, acceleration/deceleration

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. This means that the parameters P1-34 and P1-35 are not disabled even if P1-36 is disabled.

If the source of the speed command is an analog signal, the maximum setting value of P1-36 is set to 0 and the acceleration and deceleration functions are disabled.

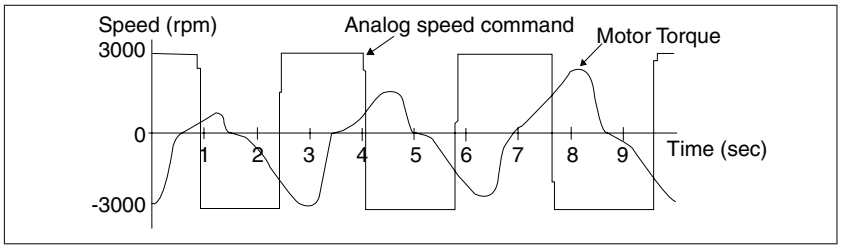
If the source of the speed command is an analog signal, the maximum setting value of P1-36 is automatically limited to 10000.

If the motor is controlled via internal parameters, the command curve should be defined by the user.

Analog Speed Command S-curve Filter

The drive also provides Analog Speed Command S-curve Filter for the smoothing in response to a sudden analog input signal.

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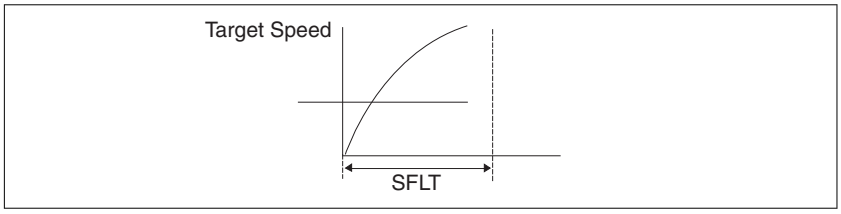
The analog speed command S-curve filter is for the smoothing of analog input signal and its function is the same as the S-curve filter. The speed and acceleration curve of analog speed command S-curve filter are both continuous. The above figure shows the curve of analog speed command S-curve filter and you can see the ramp of speed command is different during acceleration and deceleration. Also, you 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 remove high frequency response and electrical interference from an analog speed command and it is also with smoothing function.

P1-06 SFLT	Acceleration / Deceleration Smoothing Constant of Analog Speed Command (Low-pass Filter)	Address: 010Ch, 010Dh

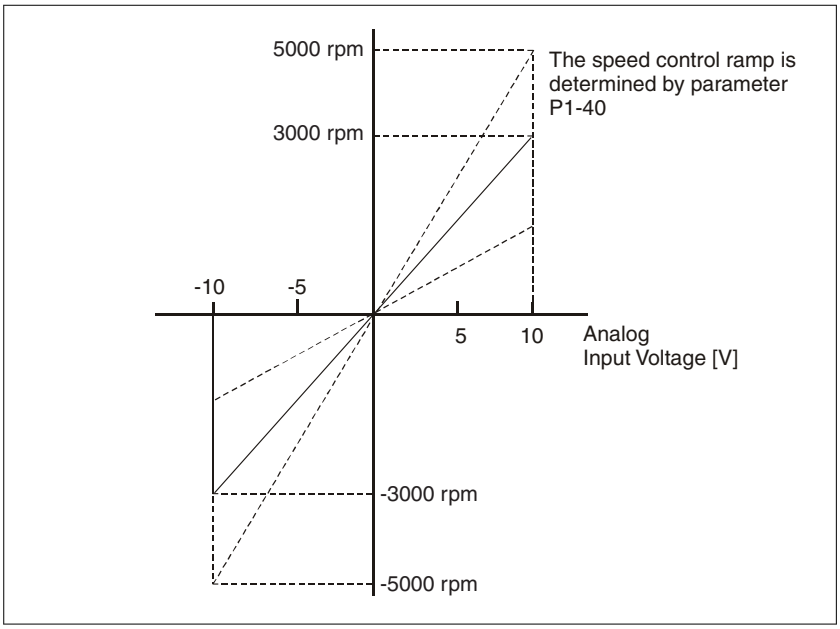
Default: 0
Applicable control mode: S
Unit: ms
Range: 0 ... 1000
Data size: 16-bit
Display format: Decimal



6.3.2.4 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.

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P1-40 VCM	Max. Analog Speed Command / Limit	Address: 0150_h, 0151_h

Default: 10001
Applicable control mode: S, T
Unit: RPM
Range: 0 ... 10001
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).

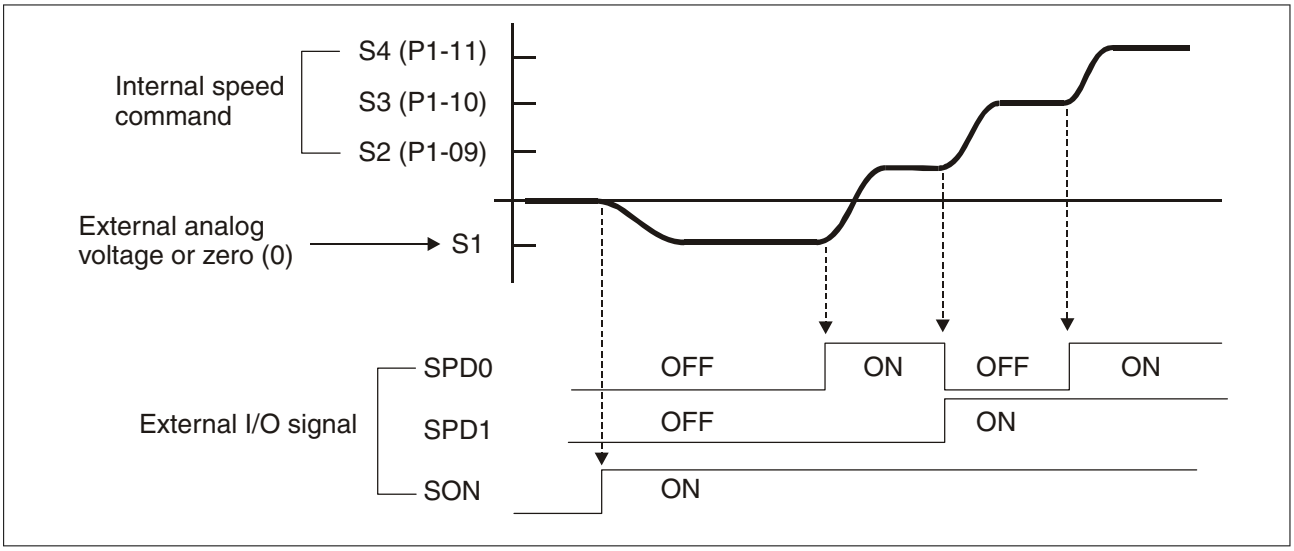
In Torque mode, this parameter is used to set the maximum analog speed limit based on the maximum input voltage (10V).

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

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6.3.2.5 Timing Chart of Speed Control Mode



NOTE:

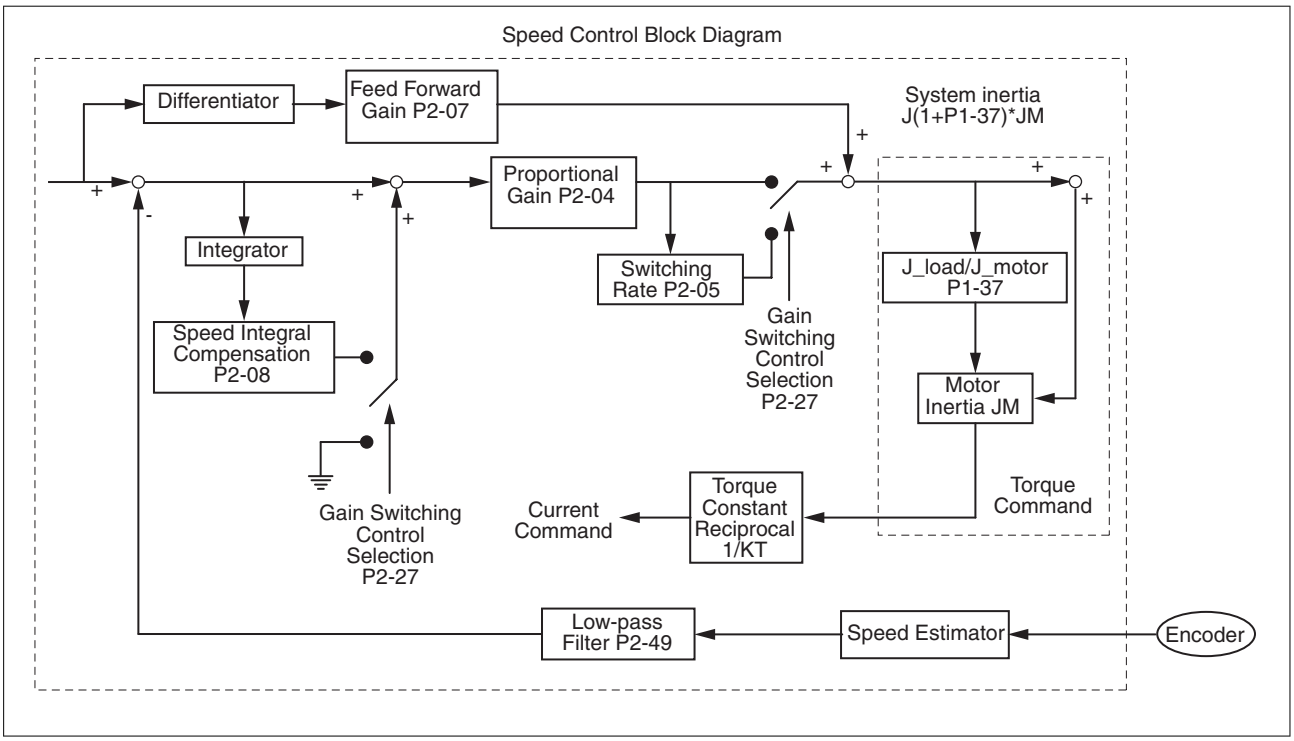
1) OFF indicates normally open and ON indicates normally closed.

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 (see P1-01).

3) After Servo ON, you can select command according to the state of SPD0 ... 1.

6.3.2.6 Speed Loop Gain Adjustment

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



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There are two turning modes of gain adjustment: Manual and Auto modes. The gain of the drive can be adjusted by using any one of two tuning modes.

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

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

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

Default: 0x0000
Applicable control mode: Pt, Pr, S, T
Unit:
Range: 0x0000 ... 0x0002
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.

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 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.

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1. When switching mode #1 or #2 to #0, the 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 drive will continuously perform the adjustment for a period of time.

3. When the value of the system inertia becomes excessively high, the display of P2-33 will show 0 and the drive will start to adjust the load inertia value continuously.

Manual Mode

When Tuning Mode Settings of P2-32 is set to 0, you 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 motor Inertia (1-37). Description:

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

P2-04 KVP	Proportional Speed Loop Gain	Address: 0208_h, 0209_h

Default: 500
Applicable control mode: Pt, Pr, S, T
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 excessively high, it may generate vibration or noise.

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P2-06 KVI	Speed Integral Compensation	Address: 020C$_h$, 020D$_h$

Default: 100
Applicable control mode: Pt, Pr, S, T
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 excessively high, it may generate vibration or noise.

P2-07 KVF	Speed Feed Forward Gain	Address: 020E$_h$, 020F$_h$

Default: 0
Applicable control mode: Pt, Pr, S, T
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.

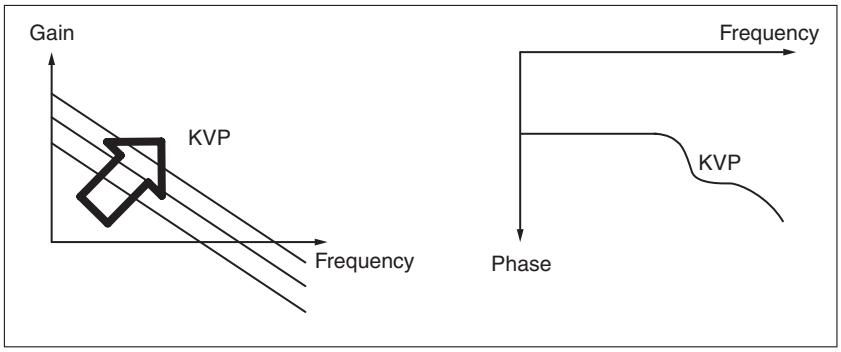
When not using speed smooth command, decrease gain can improve the resonance condition of mechanical system.

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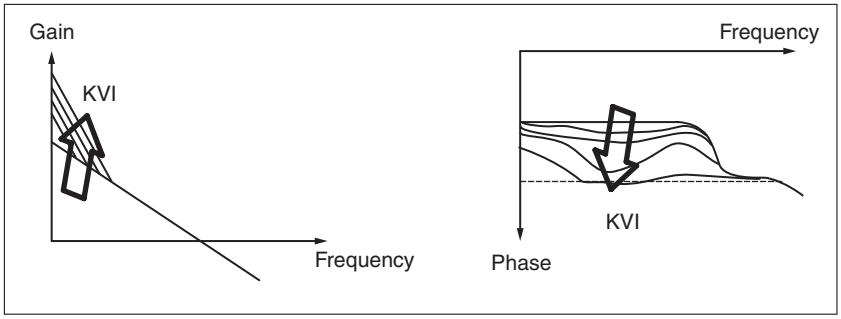
In theory, stepping response can be used to explain proportional gain (KVP), integral gain (KVI) and feed forward gain (KVF). Now we use frequency area and time area respectively to explain the logic.

Frequency Domain

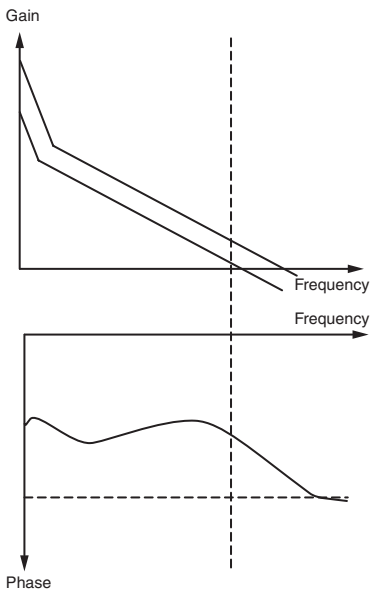
Step 1: Set the value of KVI=0, the value of KVF=0 and adjust the value of KVP.



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

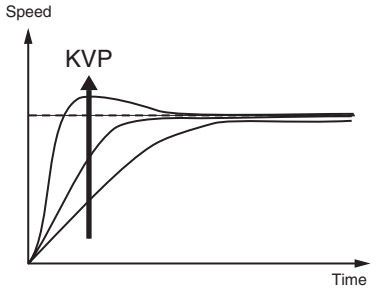


Step 3: Select the value of KVI, if the value of phase margin is too small, re-adjust the value of KVP again to obtain the value, 45deg of phase margin.

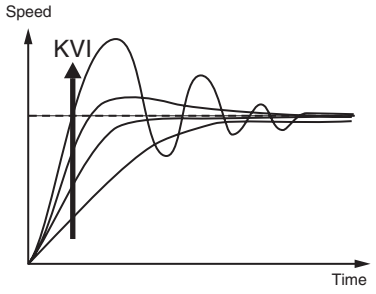


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Time Domain

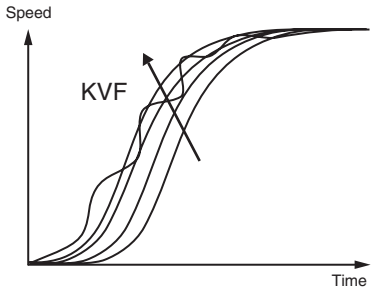


When the value of KVP is greater, the value of the responsiveness is also greater and the raising time is shorter. However, when the value of phase margin is too low, it is not helpful to steady error. But it is helpful to dynamic tracking error.



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 you should have this kind of analysis technology. However, when using time domain method, you only need to prepare an oscilloscope. Therefore, users usually use time domain method with the analog DI/DO terminal provided by the drive to adjust what is referred to 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. You 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 motor. To change the stiffness and responsiveness, use parameter P2-31.

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6.3.2.7 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 by using low-pass filter (parameter P2-25) and notch filter (parameters P2-43 ... P2-46) without changing control parameter.

P2-43 NCF1	Notch Filter 1 (Resonance Suppression)	Address: 0256_h, 0257_h

Default: 1000
Applicable control mode: Pt, Pr, S, T
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: 0258_h, 0259_h

Default: 0
Applicable control mode: Pt, Pr, S, T
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: $025A_h$, $025B_h$

Default: 1000
Applicable control mode: Pt, Pr, S, T
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.

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P2-46 DPH2	Notch Filter Attenuation Rate 2 (Resonance Suppression)	Address: 025C$_h$, 025D$_h$

Default: 0
Applicable control mode: Pt, Pr, S, T
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.

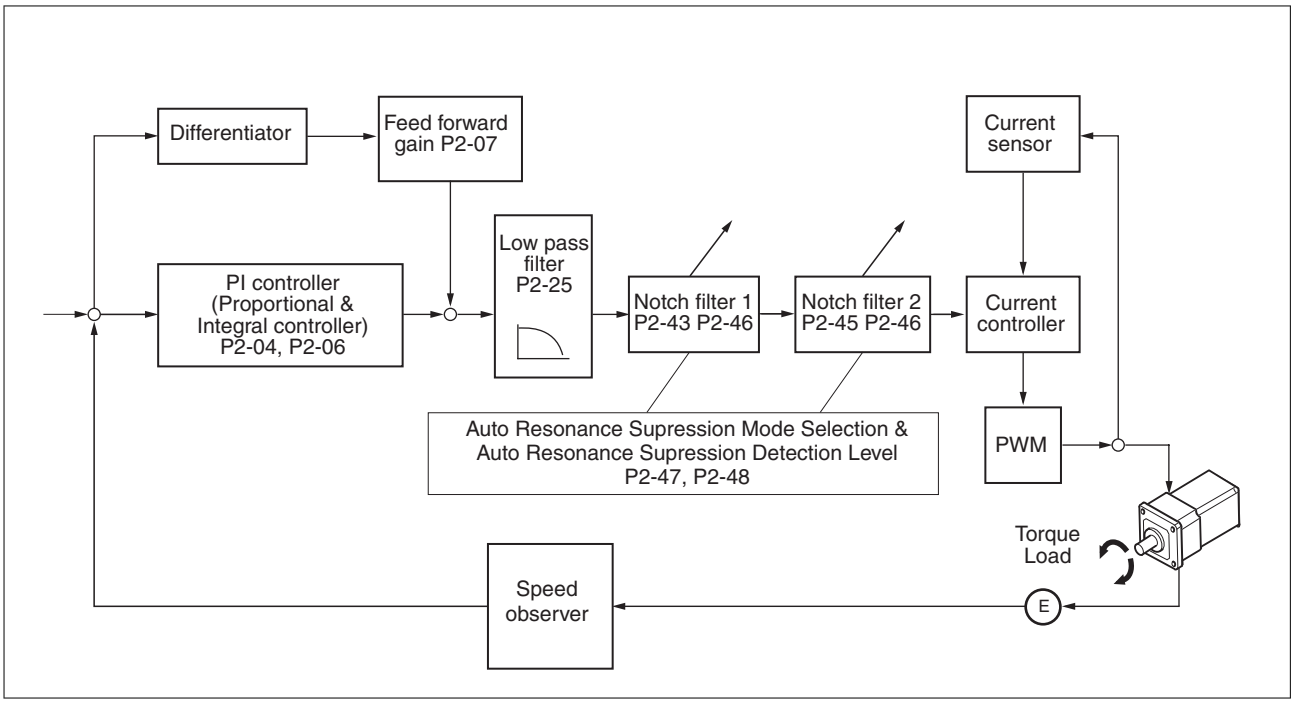
P2-25 NLP	Low-Pass Filter Time Constant (Resonance Suppression)	Address: 0232$_h$, 0233$_h$

Default: 0.2
Applicable control mode: Pt, Pr, S, T
Unit: 0.1 ms
Range: 0.0 ... 100.1
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 the drive. The first group of notch filters is P2-43 and P2-44, and the second group of notch filters is P2-45 and P2-46. When there is resonance, set P2-47

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to 1 or 2 (Auto mode), and then the 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.

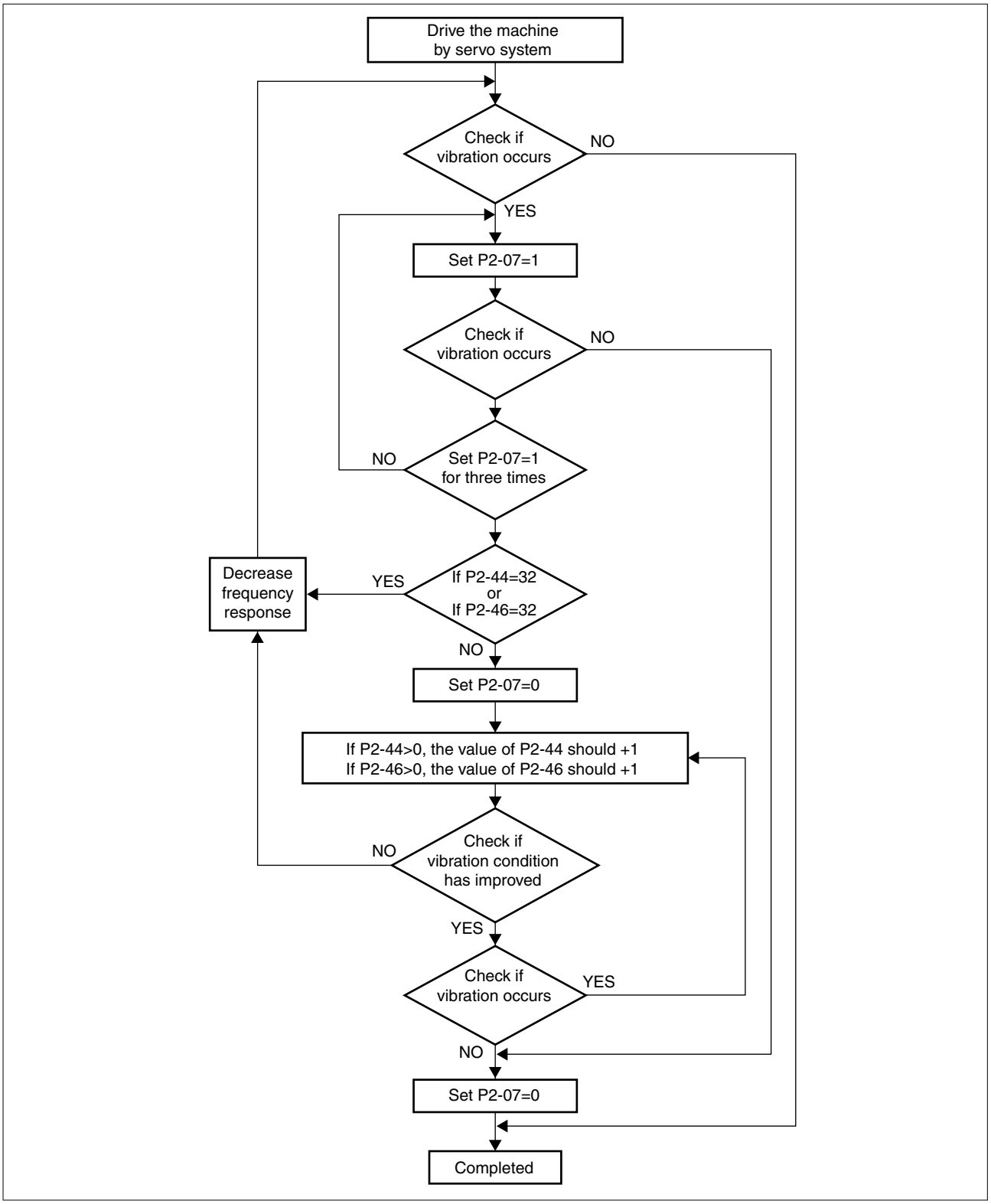
When P2-47 is set to 1, the resonance suppression will be enabled automatically. After the mechanical system becomes stable (approximate 20 minutes), the setting value of P2-47 will return to 0 (disable auto resonance suppression function). When P2-47 is set to 2, the system will find the resonance point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

When P2-47 is set to 1 or 2, if the resonance conditions cannot be removed, you should 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, decrease the speed frequency response and estimate the resonance point again. If the resonance conditions cannot be removed when the setting values of P2-44 and P2-46 are both less than 32, set P2-47 to 0 first, and increase the setting value of P2-44 and P2-46 manually. If the resonance still exists after the setting value of P2-44 and P2-46 has been increased, 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, watch 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 the 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. In this case, if you increase the value of notch filter attenuation rate which does not exist, the performance of the current mechanical system may decrease.

Settings of P2-47		
Current Value	**Required 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.

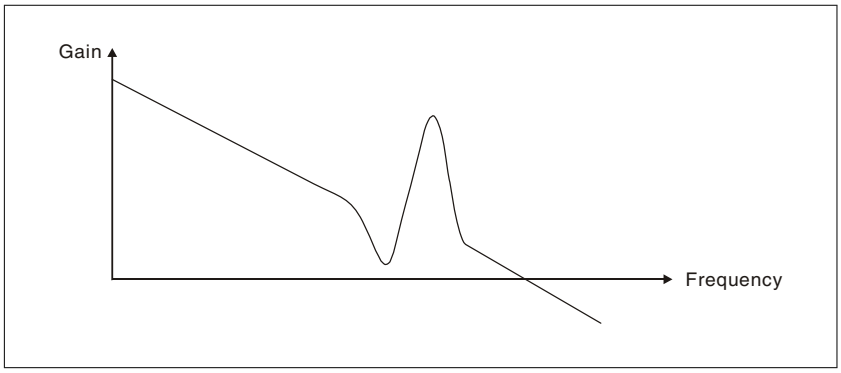
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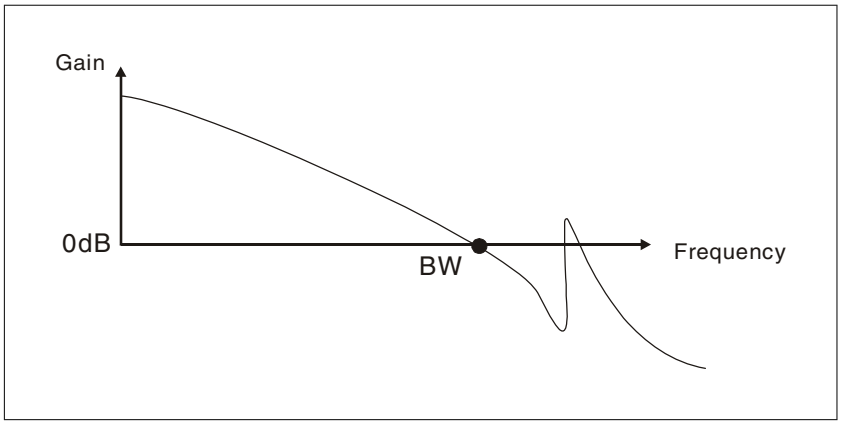
Low-pass filter

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

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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.



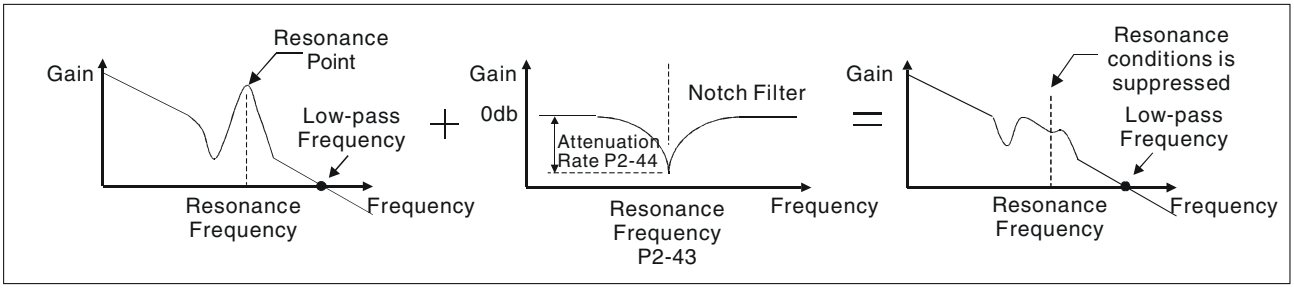
Notch Filter

Usually, if you know the resonance frequency, you can remove 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, you should use the low-pass filter (parameter P2-25) to improve resonant condition.

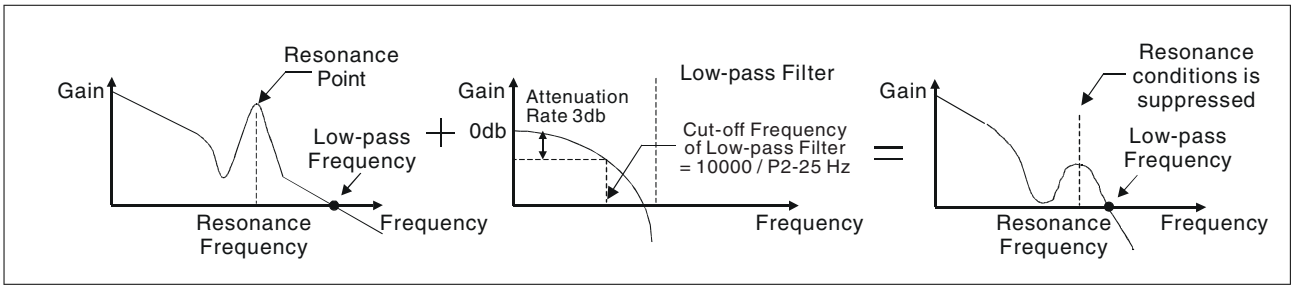
See the following figures and explanation to learn how to use notch filter and low-pass filter to improve resonant condition.

Use Notch Filter to suppress resonance



Use Low-pass Filter to suppress resonance

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

Therefore, if you know the resonance frequency, you can remove the resonance conditions directly by using notch filter (parameter P2-43, P2-44). Usually, if the resonant frequency can be recognized, you can directly use the notch filter (parameter P2-43, P2-44) to remove the resonance. However, if the resonant frequency will drift or drifts out of the notch filter range, you should not use the notch filter, but the low-pass filter to improve resonant conditions.

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6.3.3 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. Lexium 23A 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 the motor. The internal parameters are from P1-12 to P1-14 which are used to be the torque command in torque control mode.

6.3.3.1 Command Source of Torque Control Mode

Torque command Sources:

1) External analog signal: External analog voltage input, -10V ... +10V

2) Internal parameter: P1-12 ... P1-14

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

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

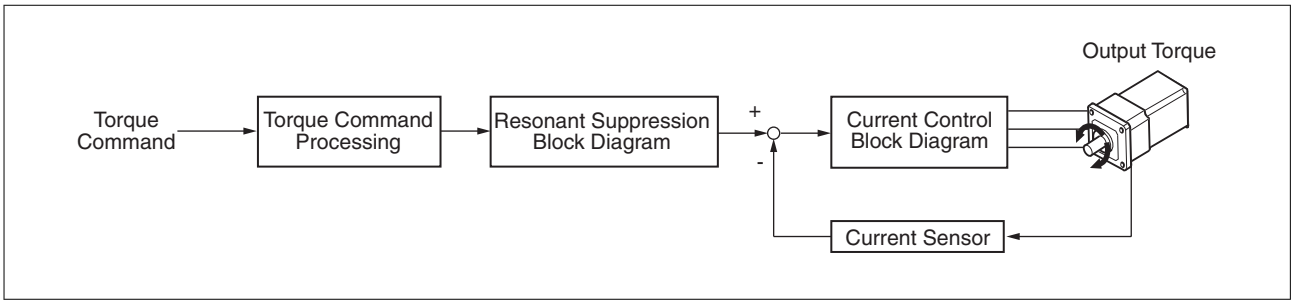
- State of TCM0 ... 1: 0: indicates OFF (Normally Open); 1: indicates ON (Normally Closed)
- When TCM0 and TCM1 are both 0 (OFF), if the control mode of operation is Tz, then the command is 0. Therefore, if you do not use analog voltage as torque command, you can choose Tz mode to operation torque control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

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

6.3.3.2 Structure of Torque Control Mode

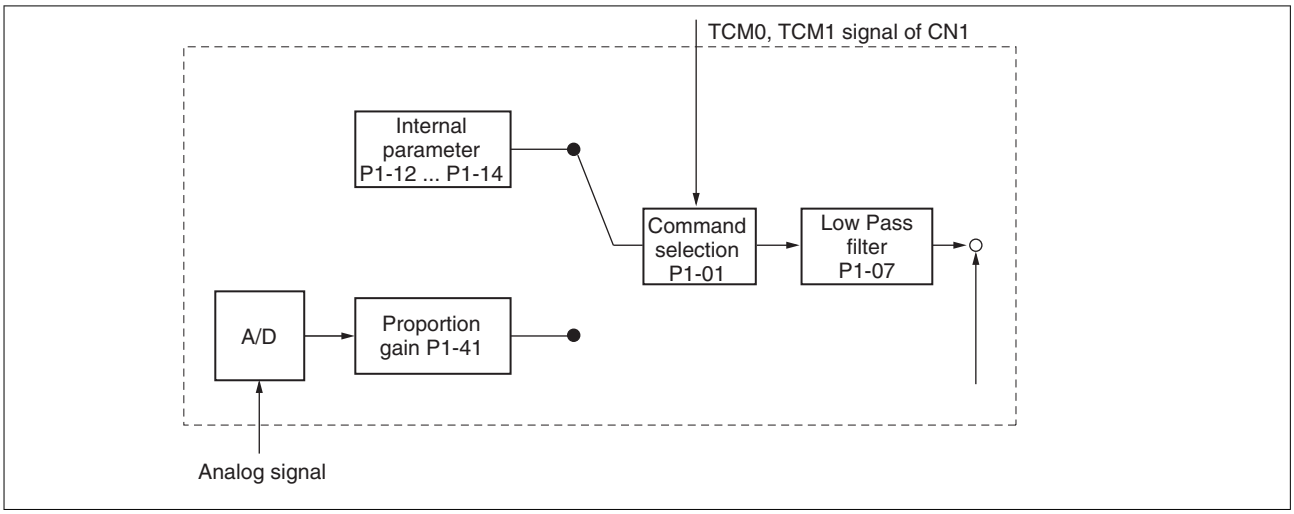
Basic Structure:

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The toque command processing is used to select the command source of torque control according to chapter *"6.3.3.1 Command Source of Torque Control Mode"*, 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 drive and calculate the current input provided to the 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 in 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 smoothed, you can use proportional gain (scalar) and low-pass filter to adjust torque.

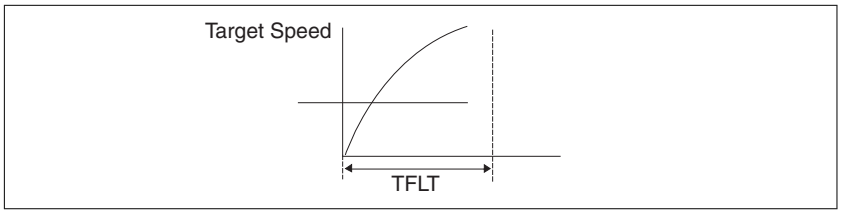
6.3.3.3 Smoothing Strategy of Torque Control Mode

P1-07 TFLT	Smoothing Constant of Analog Torque Command (Low-pass Filter)	Address: $010E_h$, $010F_h$

Default: 0
Applicable control mode: T
Unit: ms
Range: 0 ... 1000
Data size: 16-bit
Display format: Decimal

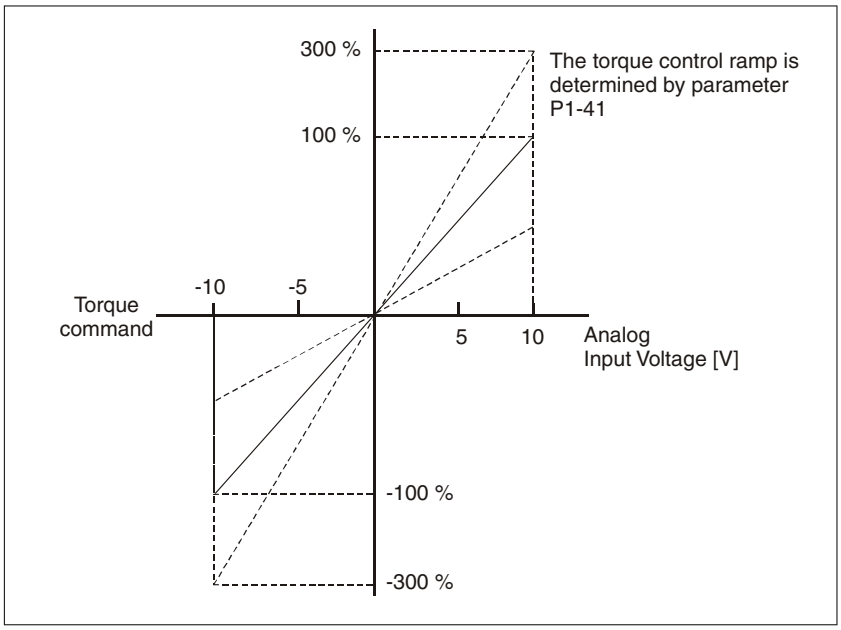
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NOTE: If the setting value of parameter P1-07 is set to 0, it indicates the function of this parameter is disabled and the command is just By-Pass.



6.3.3.4 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.



P1-41 ▲ TCM	Max. Analog Torque Command / Limit	Address: 0152h, 0153h

Default: 100
Applicable control mode: Pt, Pr, S, T
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 (10 V).

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).

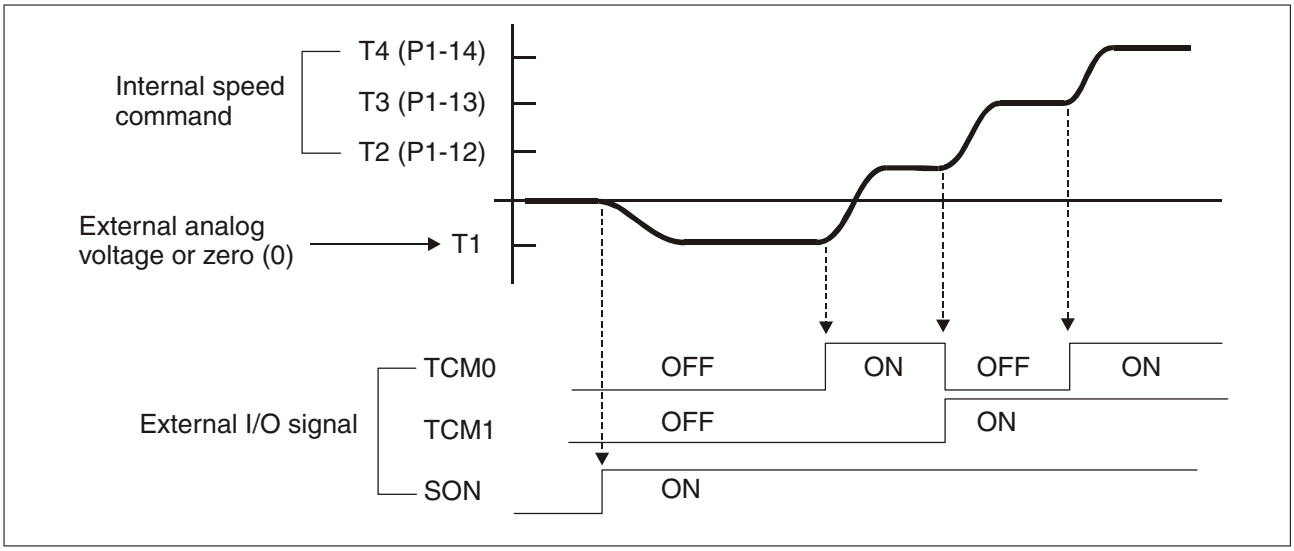
For example, in torque mode, if P1-41 is set to 100 and the input voltage is 10V, it indicates that the torque command is 100% rated torque.

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If P1-41 is set to 100, but the input voltage is changed to 5 V, then the torque command is changed to 50% rated torque.

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

6.3.3.5 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 (see P1-01).

3) After Servo ON, you can select command according to the state of TCM0 ... 1.

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6.3.4 Control Modes Selection

In addition to single control mode operation, the drive also provides dual control mode operation.

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

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).

Sz and Tz mode selection is not provided. In order not to use too many DI inputs, you 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, you can use Pt mode to input pulse to reduce the use of DI inputs (POS0 ... 5).

6.3.4.1 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 in the figure below:

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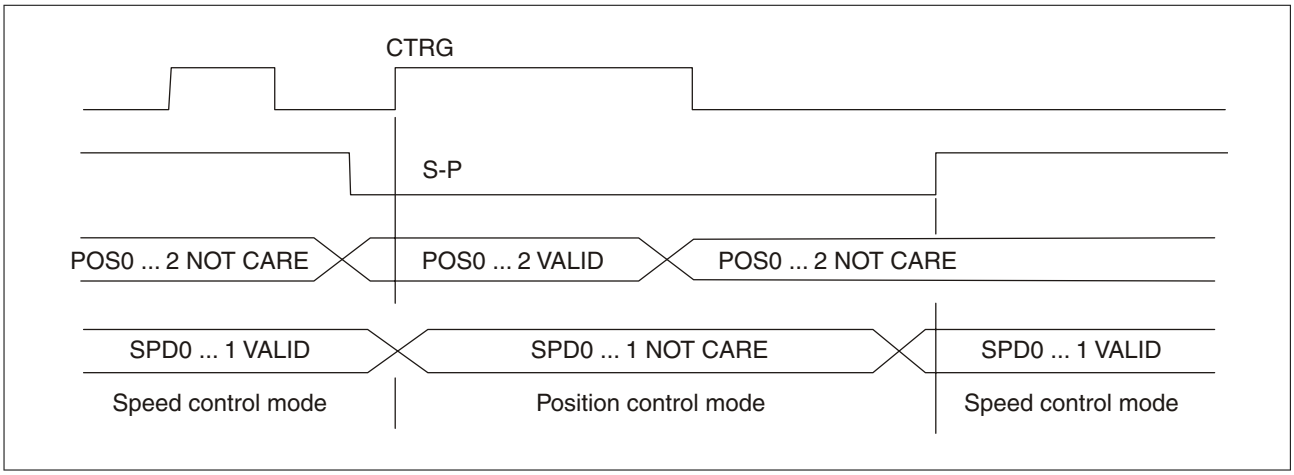


Figure 1. : Speed / Position Control Mode Selection

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, see the introduction to single mode.

6.3.4.2 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 in the figure below:

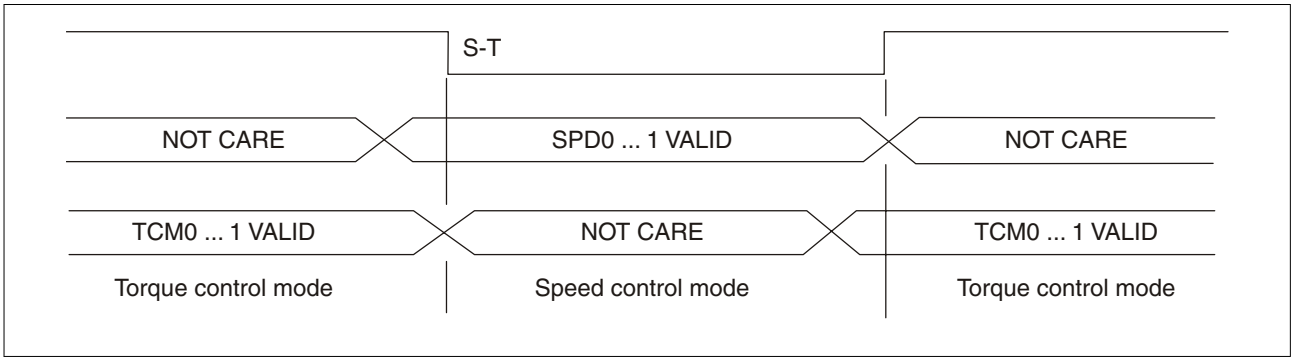


Figure 2. : Speed / Torque Control Mode Selection

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

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immediately rotate following the command. After S-T is ON again, it will immediately return to torque mode.

6.3.4.3 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 in the figure below:

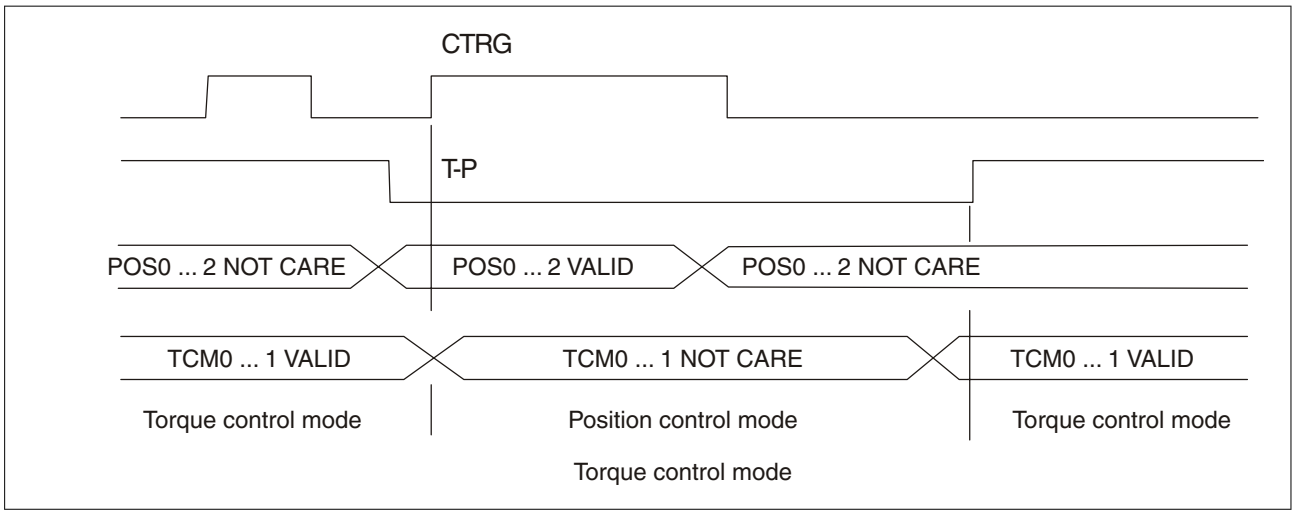


Figure 3. :Torque / Position Control Mode Selection

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, see the introduction to single mode.

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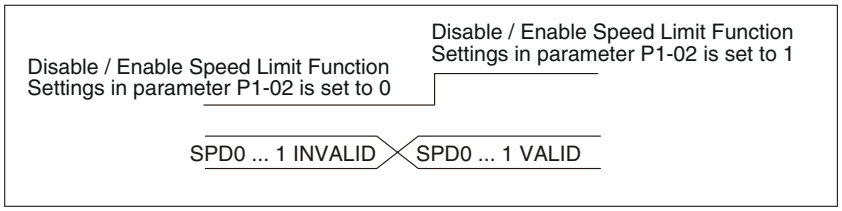
6.4 Other functions

6.4.1 Speed Limit

The maximum motor speed can be limited by using parameter P1-55 in position, speed or torque control modes.

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 on speed command source, see chapter
"6.3.2.1 Command Source of Speed Control Mode".

The speed limit only can be used in torque mode (T mode) to limit the 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 in the figure below:



Command Source Selection of Speed Limit

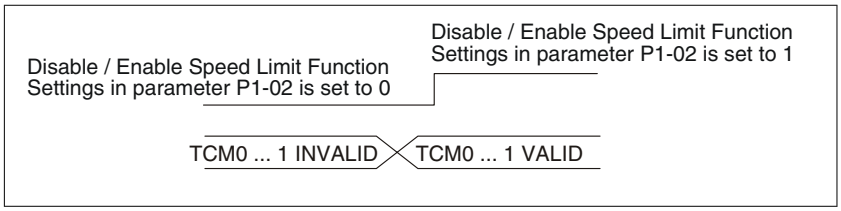
6.4.2 Torque Limit

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 on torque command source, see chapter
"6.3.3.1 Command Source of Torque Control Mode".

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 the 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 in the figure below:

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Command Source Selection of Torque Limit

6.4.3 Analog Monitor

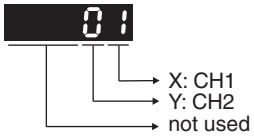
Users can use analog monitor to observe the required analog voltage signals. The drive provides two analog channels, they are PIN No. 15 and 16 of CN1 connector. The parameters rleating to the analog monitor are explained below.

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

Default: 0x0000
Applicable control mode: Pt, Pr, S, T
Unit:
Range: 0x0000 ... 0x0077
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

NOTE: For the setting of analog output voltage proportion, see P1-04 and P1-05.

Example:

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

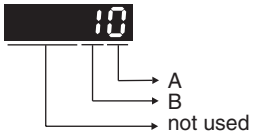
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Motor speed = (Max. motor speed x V1 / 8) x P1-04 / 100, when the output voltage value of CH1 is V1.

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

Default: 0x0000
Applicable control mode: Pt, Pr, S, T
Unit:
Range: 0x0000 ... 0x0013
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 (MON1) (100% for full scale)	Address: 0108_h, 0109_h

Default: 100
Applicable control mode: Pt, Pr, S, T
Unit: %
Range: 0 ... 100
Data size: 16-bit
Display format: Decimal

P1-05 MON2	Analog Monitor Output Proportion 2 (MON2) (100% for full scale)	Address: $010A_h$, $010B_h$

Default: 100
Applicable control mode: Pt, Pr, S, T
Unit: %
Range: 0 ... 100

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Data size: 16-bit
Display format: Decimal

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

Default: 0
Applicable control mode: Pt, Pr, S, T
Unit: mV
Range: -800 ... 800
Data size: 16-bit
Display format: Decimal

Settings:

If P2-08 is set to 10, you cannot reset this parameter.

P4-21 DOF2	Analog Monitor Output Drift Adjustment (CH2)	Address: $042A_h$, $042B_h$

Default: 0
Applicable control mode: Pt, Pr, S, T
Unit: mV
Range: -800 ... 800
Data size: 16-bit
Display format: Decimal

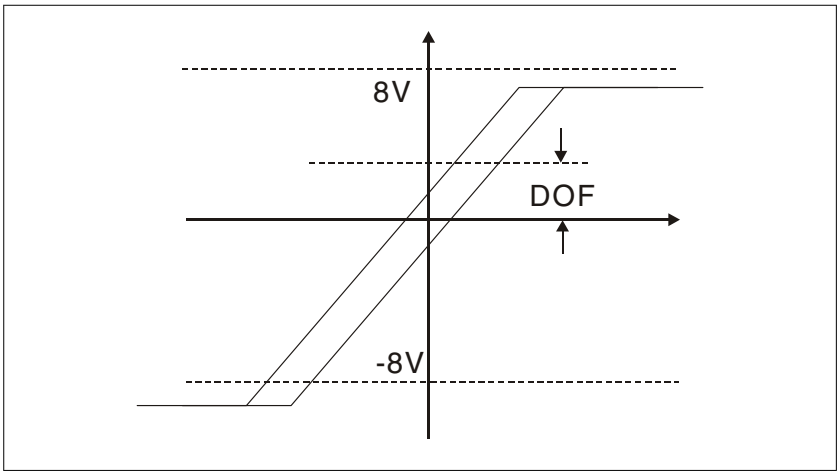
Settings:

If P2-08 is set to 10, you cannot reset this parameter.

For example, when you want to observe the analog voltage signal of channel 1, if the monitor output setting range is 8 V per 325Kpps, then you must change the setting value of parameter P1-04 (Analog Monitor Output Proportion 1) to 50 (=325 Kpps/maximum input frequency). Other related parameters setting include parameter P0-03 (A=3) and P1-03 (A=0 ... 3, output polarity setting). In general, when the output voltage value of Ch1 is V1, the pulse command frequency is equal to: Maximum input frequency x V1 / 8) x 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. You 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 ±8 V. If the output voltage exceed its limit, it is still limited within the range of ±8 V. The revolution provided by the drive is 10 bit, approximated to 13 mv/LSB.

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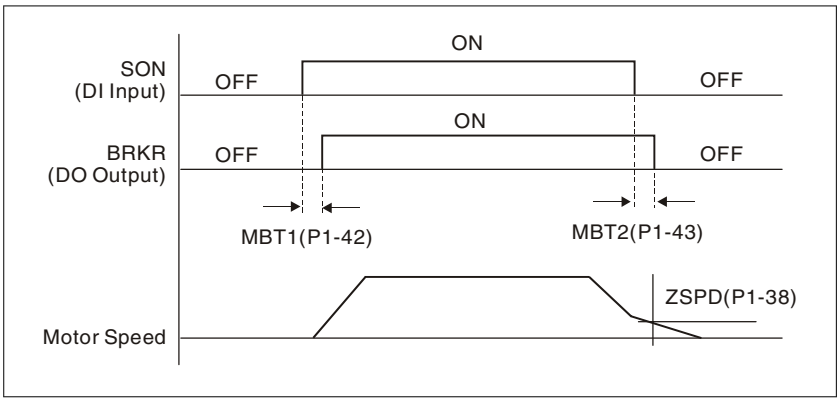
6.4.4 Holding Brake

When the drive is operating, if the digital output BRKR is set to Off, it indicates the holding brake is disabled and motor is at a standstill and locked. If the digital output BRKR is set to ON, it indicates the holding brake is enabled and motor can run freely.

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

If you want to control the holding brake via an external controller, not by the drive, you must execute the function of holding brake during the period of time when the motor is braking. The braking strength of motor and holding brake must be in the same direction when the motor is braking. Then, the drive will operate normally. However, the drive may generate higher currents during acceleration or at constant speed and it may be the cause of overload (servo alarm).

Timing chart for using motor with holding brake:



BRKR output timing explanation:

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1. When Servo Off (when DI SON is not activated), the BRKR output goes Off (holding 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 (holding 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.

Holding Brake Wiring Diagram:

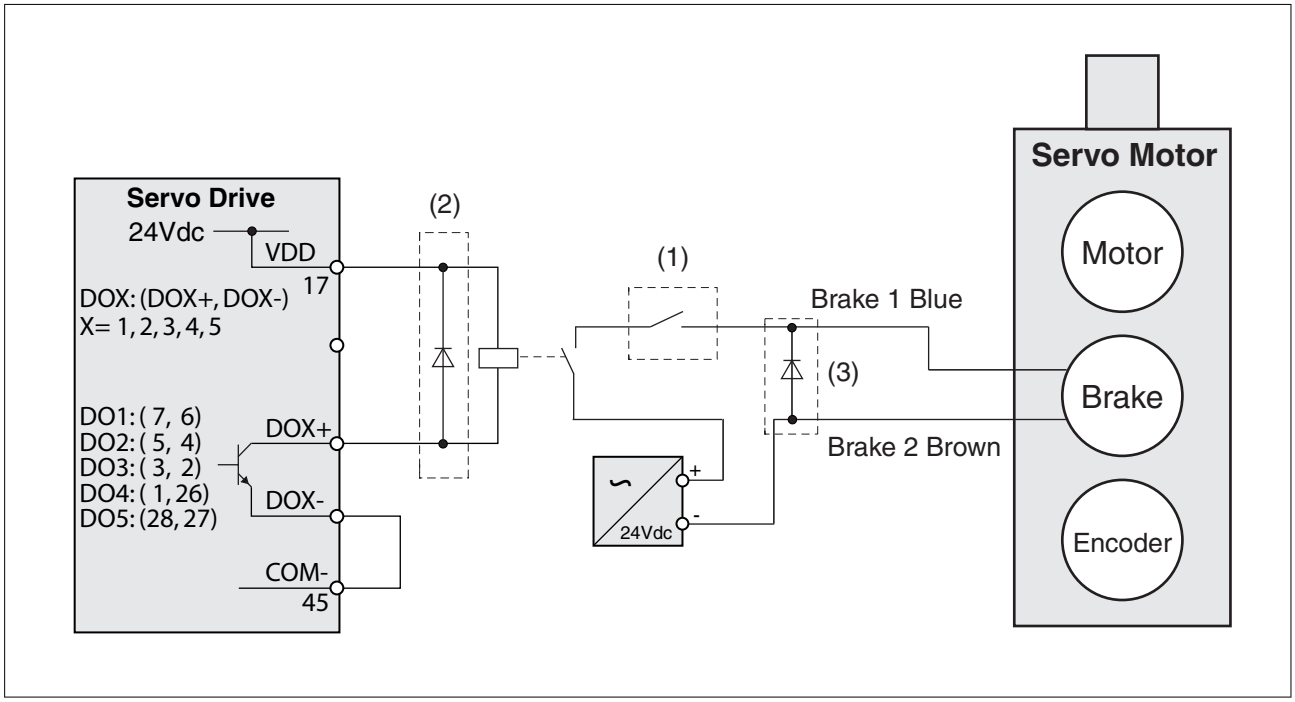


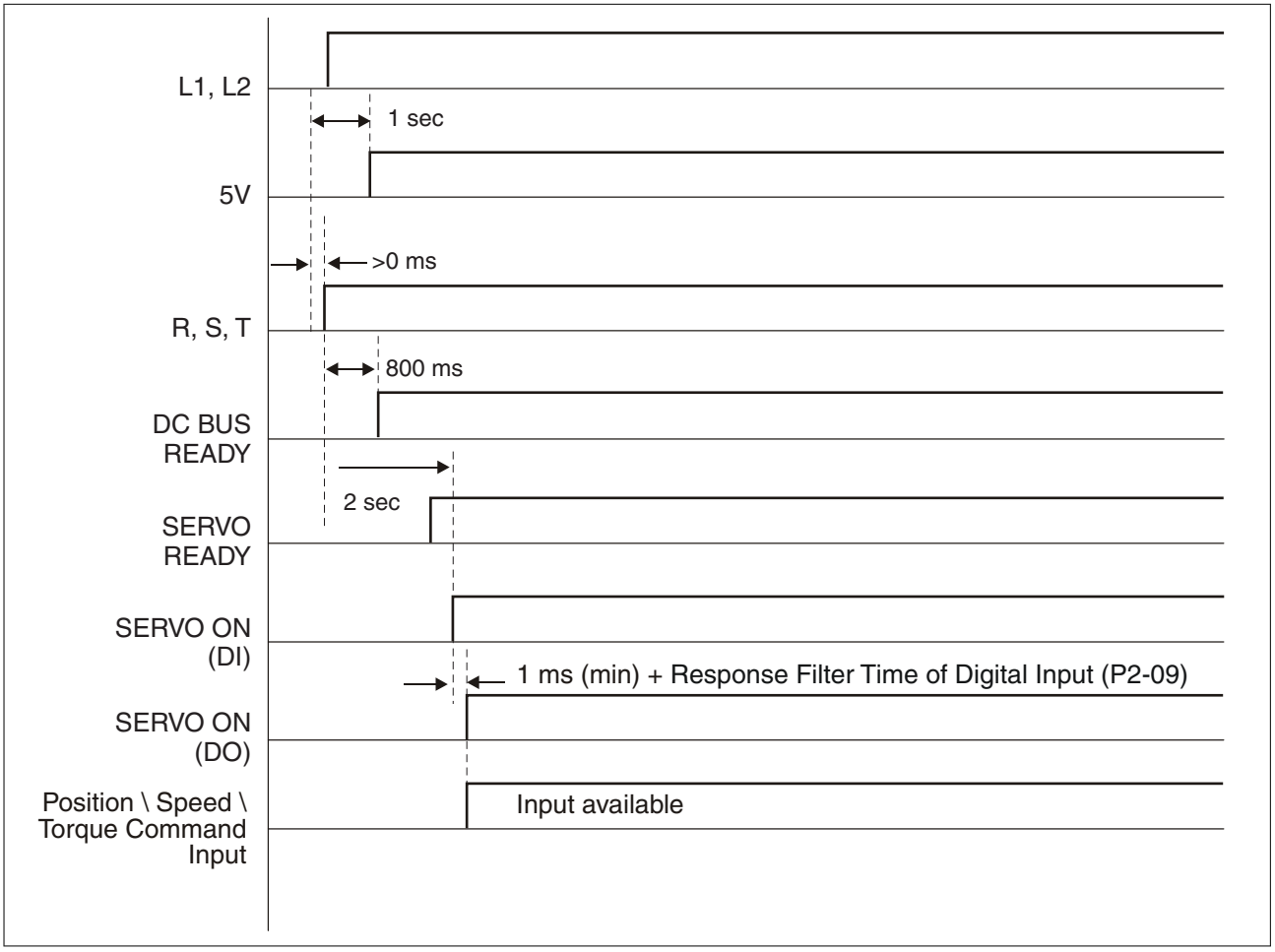
Figure 35: Example (Sink mode) of wiring of relais for holding brake

NOTE:

- See chapter *"4 Installation"* for additional wiring information.
- The BRKR signal is used to control the brake. The VDD power supply of the drive (24 V_{dc}) can be used to supply the relay coil. When the BRKR signal is ON, the holding brake of the motor is released.
- An EMERGENCY STOP should apply the brake (1).
- Verrify the polarity of the diodes (2, 3)
- The voltage supply for brake is 24 V_{dc}. Use a separate, galvanically isolated voltage supply for the holding brake. Do not connect the circuit to VDD.
- The coil of the holding brake has no polarity.

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Timing charts of control circuit power and main circuit power:



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7 Motion Control Function

7.1 Available Motion Control Functions

The drive provides the following motion control functions:
1) Pr mode for single-axis motion control
2) Capture functions

7.2 Servo Drive Information

The information on the servo drive includes:
1. Servo parameters
2. Monitor variables

	Parameters	**Monitor variables**
Usage	Operation mode, 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	HMI display: displays PX-XX. Press the **ENT** button to display the setting value of parameters. See chapter *"5.2.1 Integrated HMI"* for information on how to use the HMI.	Set P0-02 directly to enter into HMI mode Monitor and specify the monitor status. The monitor status depends on the setting value of P0-02. Press the **M** button on the HMI keypad to directly enter activate HMI mode Monitor. See chapter *"5.2.1 Integrated HMI"* for information on using the HMI.
Access method	Read and write (depends on the settings of parameters)	Read
Data length	16-bit or 32-bit (depends on the settings of parameters)	32-bit integer
Communication	Support MODBUS/CANopen Read & Write, each parameter occupies two MODBUS addresses.	Monitoring is accomplished via CN3 (commissioning tool) Do not support MODBUS/ CANopen Read & Write directly unless you 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 HMI mode Monitor, press the **UP** button or **DOWN** button to change the monitor variable (codes 0 to 26). NOTE: Not all monitor variables can be displayed (total of 150 monitor variables.

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7.2.1 Monitor Variables

The table below provides an overview of the monitor variables:

Item	Explanation
Variable code	Each monitor variable has a 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 drive.
Type	There are two types of monitor variables, basic variables and extension variables: 1. Basic variable: Activate HMI mode Monitor by pressing the **M** button on the HMI keypad. In HMI mode Monitor, press the **UP** button or **DOWN** button to select the available monitor variables (P0-02=0 ... 26). Extension variable: Other variables are called extension variables (P0-02=27 ... 127).
Monitor method	There are two methods for monitoring the monitor variables: via the HMI display and via mapping parameters: 1. HMI display: Monitor the monitor variables directly via the HMI display. 2. Mapping parameters: The settings of monitor variables depend on the setting value of the parameters. You can know the settings of monitor variables through the corresponding parameters.
Display	1. Press the **M** button to switch to HMI mode Monitor and then press the **UP** button or **DOWN** button to select the required monitor variables. 2. Set P0-02 directly and then display the settings of the required monitor variables. Press the **S** button to switch between high/low byte display. Press the **ENT** button to switch between decimal/hexadecimal display.
Mapping function	1. The parameters P0-09 to P0-13 support the mapping function. See Chapter *"10 Parameters"* 2. Using mapping parameters and read & write monitor variables through communication. 3. The setting values of P0-09 to P0-13 (Status Monitor 1 to 5) are the content of basic variables (17h,18h,19h,1Ah). When you want to monitor P0-09, P0-17 must first be setto read the status value (see P0-02). When reading the drive status through Modbus communication, the system will read the monitor status specified by P0-17. When the drive status is read via the HMI display, if P0-02 is set to 23, VAR-1 will be shown for about two seconds and then the value of P0-09 will be shown on the HMI display.

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Attributes of monitor variables:

Attribute	Explanation
B	Basic variable. These are the monitor variables which you can scrolled through with the **UP** button or **DOWN** button.
Dn	Decimal place display. D1 indicates one decimal place, D2 indicates two decimal places.
Dec	Decimal display only. The **ENT** button on the HMI keypad cannot be used to switch to hexadecimal display.
Hex	Hexadecimal display only. The **ENT** button on the HMI keypad cannot be used to switch to decimal display.

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Explanation of monitor variables:

Code	Monitor variable /attribute	Explanation
000 (00h)	Feedback position (PUU) B	Motor feedback - actual position. Unit is user unit, PUU.
001 (01h)	Position command (PUU) B	Position command - current position. Unit is user unit, PUU. Pt mode: the pulse command received by the servo drive. Pr mode: the absolute position command. It is equal to the pulse number sent by the (external) master.
002 (02h)	Position error (PUU) B	Position error counts between position command pulse and feedback pulse. Unit is user unit, PUU.
003 (03h)	Feedback position (pulse) B	Motor feedback - actual position. Unit is encoder unit, pulse.
004 (04h)	Position command (pulse) B	Position command - actual position. Unit is encoder unit, pulse. This is also the position command after the electronic gear ratio has been set.
005 (05h)	Position error (pulse) B	Position error counts between position command pulse and feedback pulse. Unit is encoder unit, pulse.
006 (06h)	Input frequency of pulse command B	Input frequency of pulse command received by the servo drive. Unit is Kpps. Applicable to Pt and Pr mode.
007 (07h)	Feedback speed B D1 Dec	Actual speed of rotation of motor. Unit is 0.1 RPM. The low-pass filter function is used so the value is more stable.
008 (08h)	Speed input command (Analog) B D2 Dec	Analog speed input command. Unit is 0.01 V.
009 (09h)	Speed command (Integrated) B	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) B D2 Dec	Analog torque input command. Unit is 0.01 V.
011 (0Bh)	Torque command (Integrated) B	Integrated torque input command. Unit is percent (%). The command source may be from analog command / internal parameter / position loop.
012 (0Ch)	Average load B	Average load output by the servo drive. Unit is percent (%).
013 (0Dh)	Peak load B	Peak load output by the servo drive. Unit is percent (%).
014 (0Eh)	DC Bus voltage B	Main circuit voltage after rectification. Unit is volt.

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Code	Monitor variable /attribute	Explanation
015 (0Fh	Ratio of load inertia to motor inertia B D1 Dec	Ratio of load inertia to motor inertia. Unit is 0.1 times.
016 (10h)	IGBT temperature B	IGBT temperature. Unit is °C.
017 (11h)	Resonance frequency B Dec	Resonance frequency of the mechanical system. There are two groups of resonance frequency: F1 and F2. When the drive status is read via the HMI, press the **S** button to switch between F1 and F2. F2: No decimal point F1: Display one decimal point When the drive status is read via 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) B 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 a value from -5000 to +5000 pulses. When the value is higher, the deviation pulse number is higher too.
019 (13h)	Mapping parameter #1 B	Display the content of parameter P0-25 (mapping target is specified by parameter P0-35)
020 (14h)	Mapping parameter #2 B	Display the content of parameter P0-26 (mapping target is specified by parameter P0-36).
021 (15h)	Mapping parameter #3 B	Display the content of parameter P0-27 (mapping target is specified by parameter P0-37).
022 (16h)	Mapping parameter #4 B	Display the content of parameter P0-28 (mapping target is specified by parameter P0-38).
023 (17h)	Status monitor #1 B	Display the content of parameter P0-09 (the monitor status is specified by parameter P0-17).
024 (18h)	Status monitor #2 B	Display the content of parameter P0-10 (the monitor status is specified by parameter P0-18).
025 (19h)	Status monitor #3 B	Display the content of parameter P0-11 (the monitor status is specified by parameter P0-19).
026 (1Ah)	Status monitor #4 B	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 (via software). P3-06 can determine how digital inputs accept commands.

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Code	Monitor variable /attribute	Explanation
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 is displayed via P0-46. See P0-46 for details.
043 (2Bh)	Capture data	The most recent data captured with the 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) D1 Dec	Integrated speed input command. Unit is 0.1 RPM. The command source may be from analog command / internal parameter / position loop.
051 (33h)	Feedback speed (Instant) D1 Dec	Actual motor speed. Unit is 0.1 RPM.
052 (34h)	Feedback speed (Filter) D1 Dec	Actual motor speed. Unit is 0.1 RPM. (The low-pass filter function is used.)
053 (35h)	Torque command (Integrated) D1 Dec	Integrated torque command. Unit is 0.1 percent (%). The command source may be from analog command / internal parameter / speed loop.
054 (36h)	Feedback Torque D1 Dec	Actual motor torque. Unit is 0.1 percent (%).
055 (37h)	Feedback current D2 Dec	Actual motor current. Unit is 0.01A.
056 (38h)	DC bus voltage D1 Dec	Main circuit voltage after rectification. Unit is 0.1 V.
064 (40h)	End register of Pr command	In Pr mode, this is the end of the position command (Cmd_E).
065 (41h)	Output register of Pr command.	In Pr mode, this is the accumulated outputs of position command.
067 (43h)	Target speed of Pr command	This is the 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 S-curve 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 S-curve 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 S-curve filter). Unit is PPS (pulse per second).

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Code	Monitor variable /attribute	Explanation
096 (60h)	Firmware version of servo drive Dec	Includes 2 versions: DSP and CPLD When the firmware version is read via the HMI, press the **S** button to switch between the versions DSP and CPLD. DSP: No decimal place CPLD: One decimal place When the firmware version is read via 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)	Drive alarm code	Displays the "Drive alarm code".
123 (7Bh)	HMI monitor value	When the monitor value is read via the HMI, this is used to read the monitor value to be displayed on the HMI display.

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7.3 Motion Axis

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

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 (external) master input from CN1. The pulse type can be set via P1-00.	R/W	Substantial axis
3. Capture Axis1 (DI7) (P5-37)	It is the motion axis which is used to enable the Capture function. The command source can 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 set via Pr path.	R	Suppositional axis
5. Internal time axis	Internal timer. The value will increase by 1 every 1 ms.	R	Suppositional axis

NOTE:

1. Substantial axis: Position value is obtained from the actual terminal signal counts.

2. Output axis: Axis output by the substantial axis. The value will not be 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: Axis generated by the servo firmware, e.g. Pr command axis. It is unable to command in real time so it cannot be the command axis for the Capture function.

7.4 Introduction to Pr mode

Pr mode can be composed of a single position command or multiple position commands, and triggered by the DI signal CTRG. DI signals POS0 to POS2 are used to specify the required trigger position.

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7.5 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 an (external) master to the internal position command unit of the drive, i.e. the electronic gear ratio of the drive.

1) Position command unit of servo drive (pulse): encoder unit, 1280000 pulses per revolution (pulse/rev).

2) User unit (PUU): unit of (external) master. 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

7.6 Registers of Pr mode

1) Position registers of Pr mode: They are indicated 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 (during movement or at standstill):
Err_PUU = Cmd_O - Fb_PUU.

Effect of position commands:

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Command Type	When position command is given =>	=> When position command is executing=>	=> When position command is completed
Absolute position command	Cmd_E = command data (absolute) Cmd_O retain unchanged DO signal: CMD_OK is OFF	Cmd_E retain unchanged Cmd_O continuously output ...	Cmd_E retain unchanged Cmd_O = Cmd_E DO signal: CMD_OK is ON
Incremental position command	Cmd_E+= command data (incremental) Cmd_O retain unchanged DO signal: CMD_OK is OFF	Cmd_E retain unchanged Cmd_O continuously output ...	Cmd_E retain unchanged Cmd_O = Cmd_E DO signal: CMD_OK is ON
Stop command, DI signal, STP	Cmd_E retain unchanged Cmd_O continuously output DO: CMD_OK output retain unchanged	Cmd_E retain unchanged Cmd_O stop in accordance with deceleration curve	Cmd_E retain unchanged Cmd_O = position at stop DO signal: CMD_OK is ON
Homing command	Cmd_E retain unchanged Cmd_O retain unchanged DO signal: CMD_OK is OFF DO signal: HOME is OFF	Cmd_E continuously output Cmd_O continuously output	Cmd_E = Z pulse (absolute position) Cmd_O = position at stop DO signal: CMD_OK is ON DO signal: HOME is ON
Speed command	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		
Enter Pr at the first time (Servo Off -> Servo On or other mode for entering Pr mode)		Cmd_O = Cmd_E = current motor feedback position	
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.			

7.7 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.

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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 you 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.

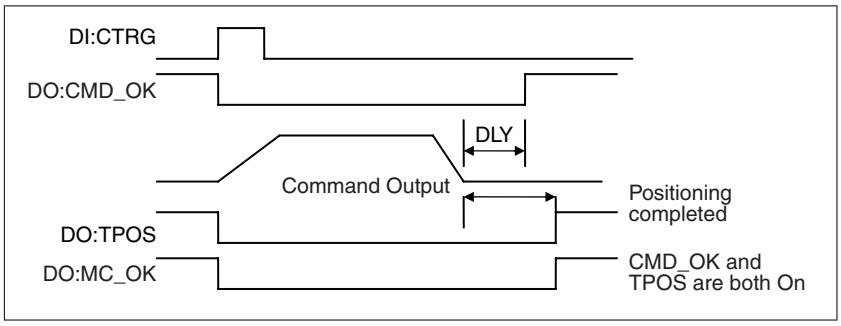
In Pr mode, after homing operation, it can execute the specified path and command the motor to return to the position of Z pulse automatically.

When homing function is executed, the software limit function is disabled.

7.8 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



Trigger method of Pr command:
There are 8 position settings in Pr mode. Path 0 is homing mode and the others (Path 1 to 8) can be user-defined. For the trigger method of Pr command, see the table below.

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	Command Source	Explanation
Stand-ard method	DI signals: CTRG + POS0 to 2	Use DI signals POS0 to 5 to specify the required 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.
Soft-ware setting	P5-07	Set P5-07 to the required trigger path number and it will trigger the dedicated position command immediately. P5-07 can be set via the HMI / communication (RS-485 and CANopen). Suitable application: PC or PLC commands the servo drive by using the communication.

7.9 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 (ms)

NOTE: The acceleration time is used for DO signals, STP/EMS/ NL(CWL)/PL(CCWL) when you 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 (ms)

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

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	32 BIT
P5-00	Reserved
P5-01	Reserved (for internal testing, do not use)
P5-02	Reserved (for internal testing, do not use)
P5-03	Deceleration Time of monitoring 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:

OPT				
Bit 7	Bit 6	Bit 5	Bit 4	Explanation
CMD		-	INS	
0	0	0	-	Absolute position command: Cmd_E = DATA (Note 1)
1	0			Incremental position command: Cmd_E = Cmd_E + DATA (Note 2)

* 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

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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

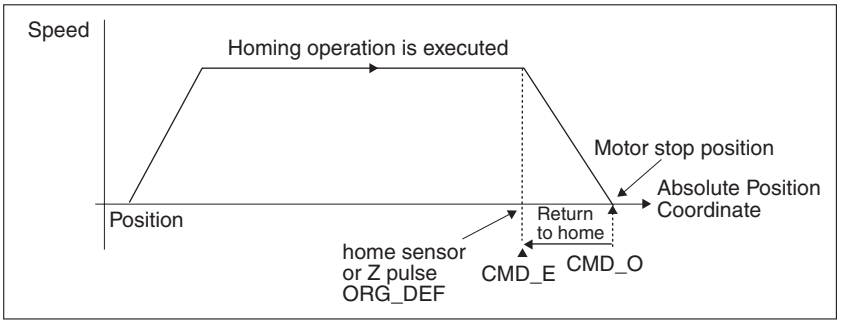
BOOT: Boot mode. Disable or enable homing function when power is applied to the servo drive (power on).
0: Disable homing function
1: Enable homing function (when power is applied to the servo drive, first time Servo On)

ORG_DEF: Homing definition value which is determined by the parameter P6-01. The homing definition value does not necessarily have to be 0.

The drive 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.

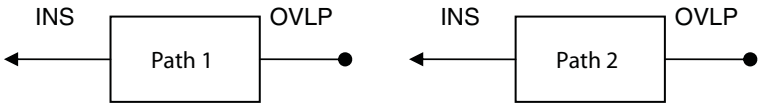
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For example, if you want the motor to move a distance S (relative to home sensor or Z pulse), and defined the position coordinate as P, set Pr path as a non-zero value and set ORG_DEF=P - S.

(P is the absolute position command and S is the incremental position command)

7.9.1 Path Order

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

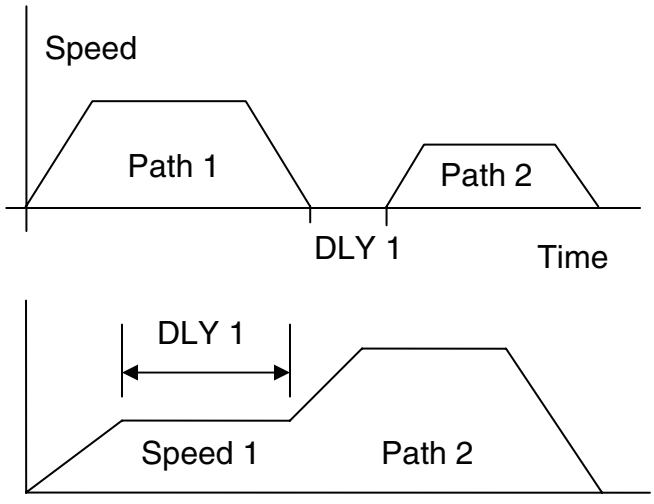


2) The priority of INS is higher than OVLP.

PATH 1	PATH 2	Path Order	Out-put	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	INS=1	Interrupt	N/A	PATH1 and PATH2 can be speed or position command
OVLP= 1				

7.9.2 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)

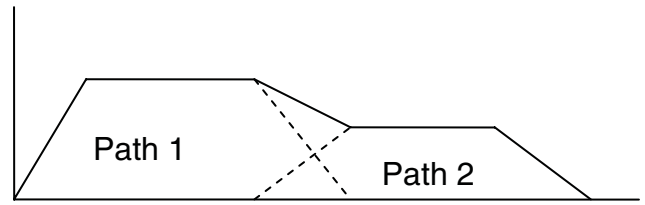
Path 1: Speed command, DLY is set

Path 2: Position command

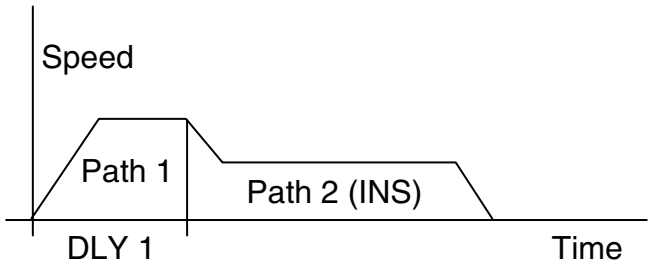
(DLY: Delay time is calculated from the time when the position command is completed)

2) Path Overlap

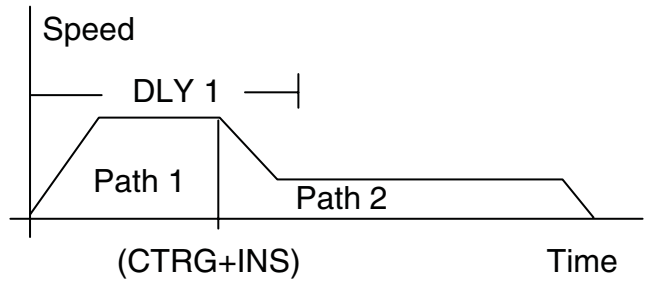
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	Path 1: OVLP is set, DLY cannot be set. Path 2: INS is not set

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.

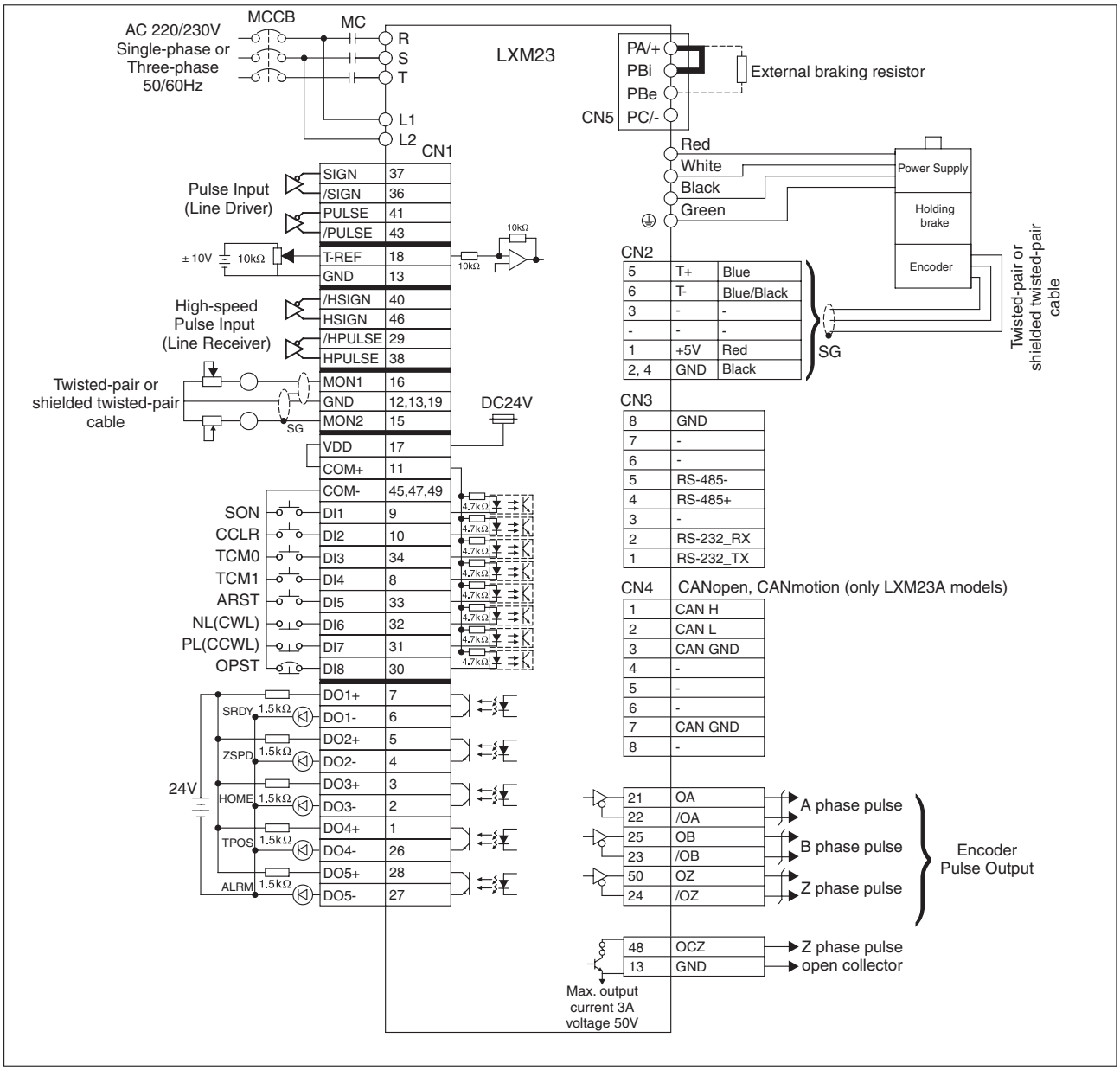
4) External interrupt

	Path 1: AUTO or SINGLE, irrespective of whether or not DLY is set. Path 2: INS is set (DLY is effective for external interrupt) This path setting can be used to change position profile freely.

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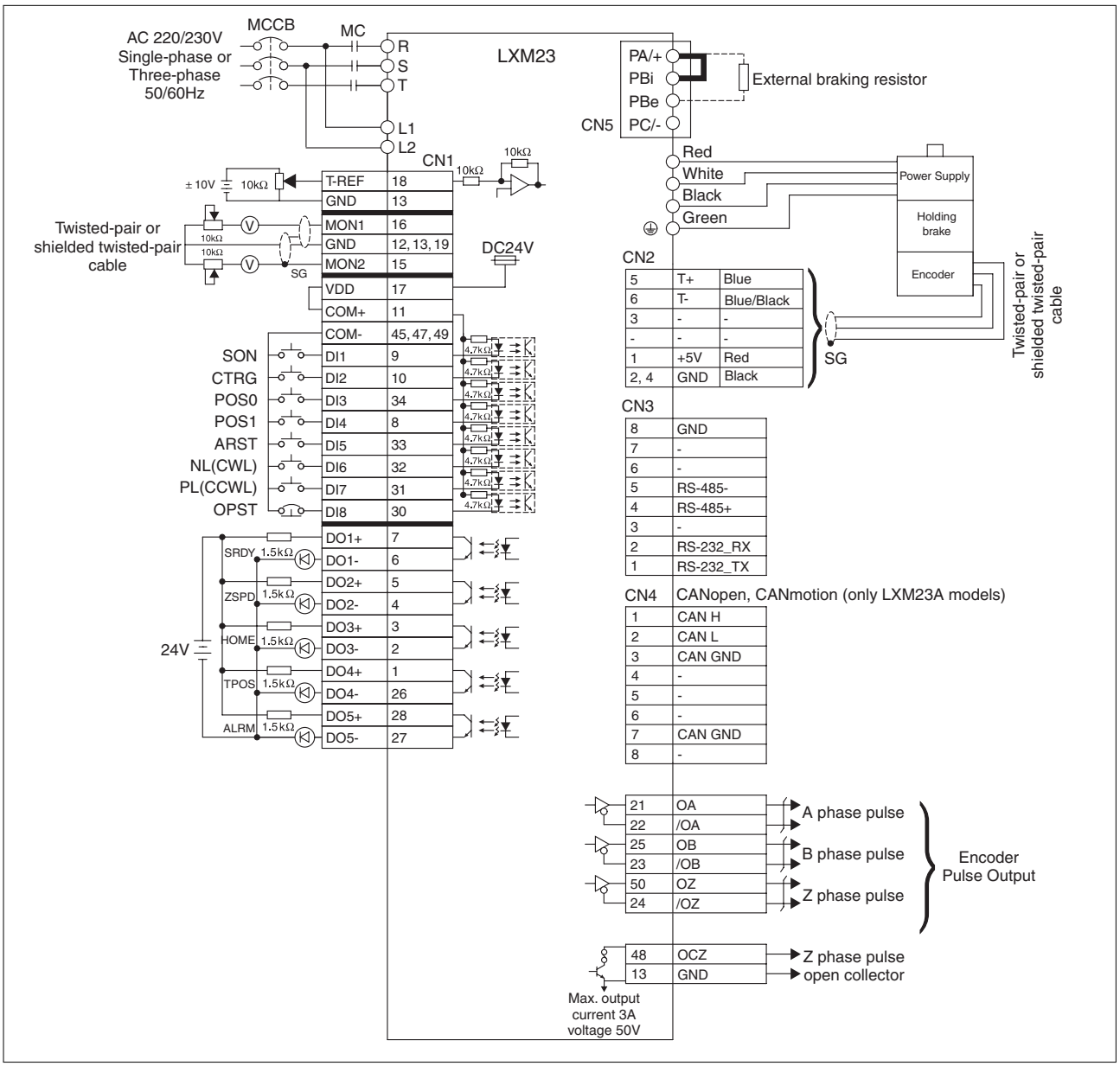
8 Examples

8.1 Position control mode wiring diagram (pulse control)



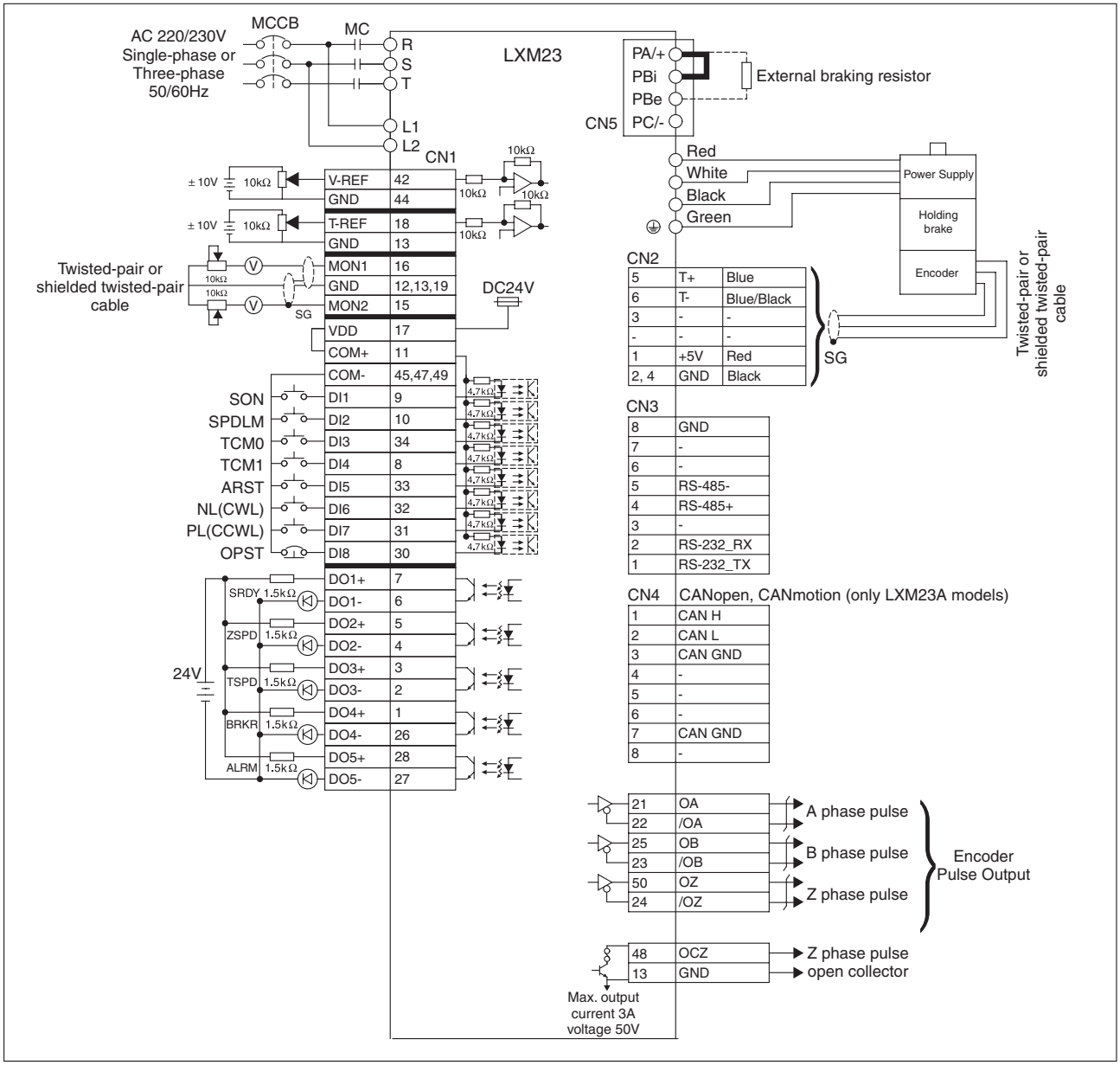
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8.2 Position control mode wiring diagram (build-in motion sequence)



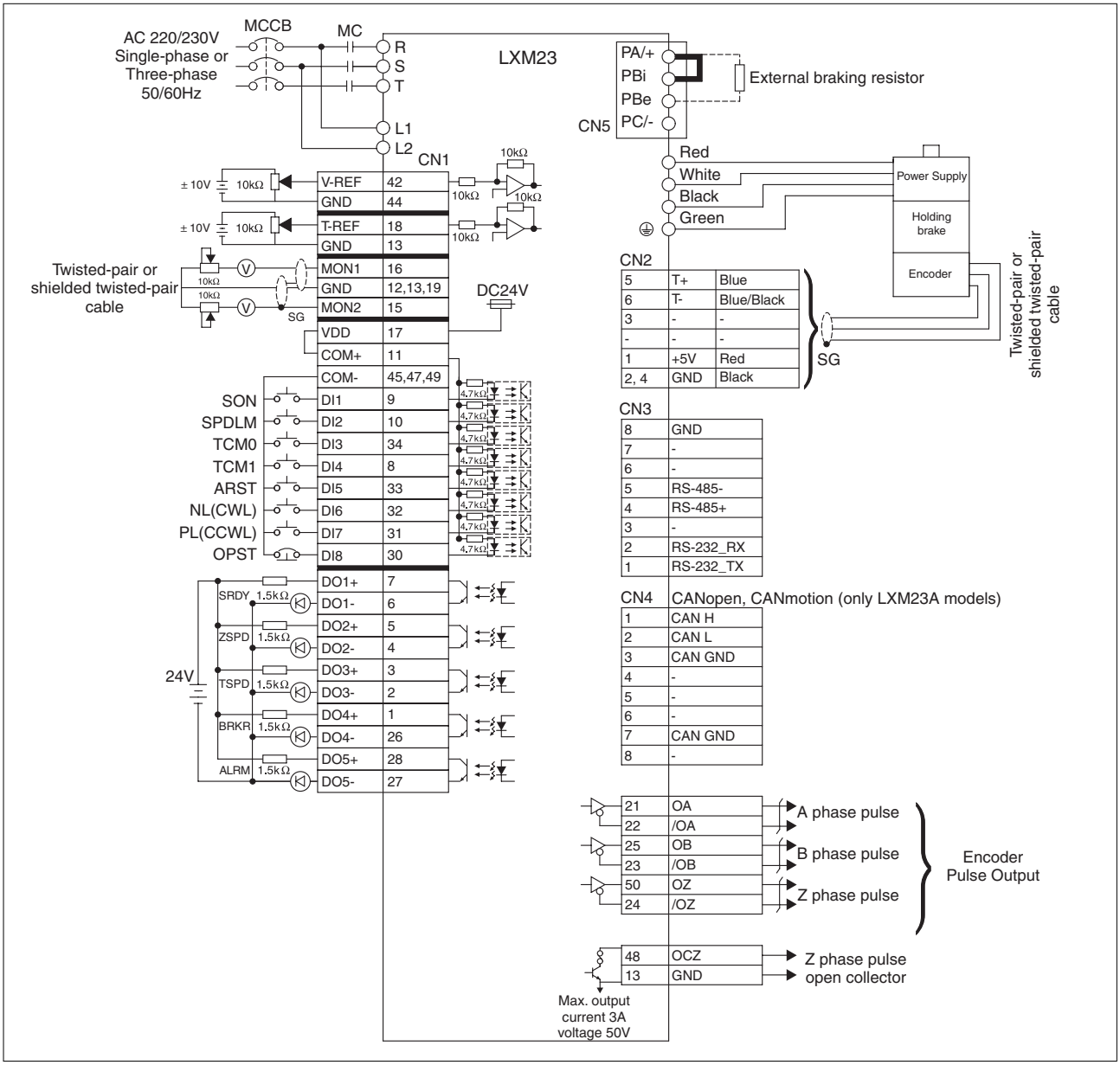
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8.3 Speed control mode wiring diagram



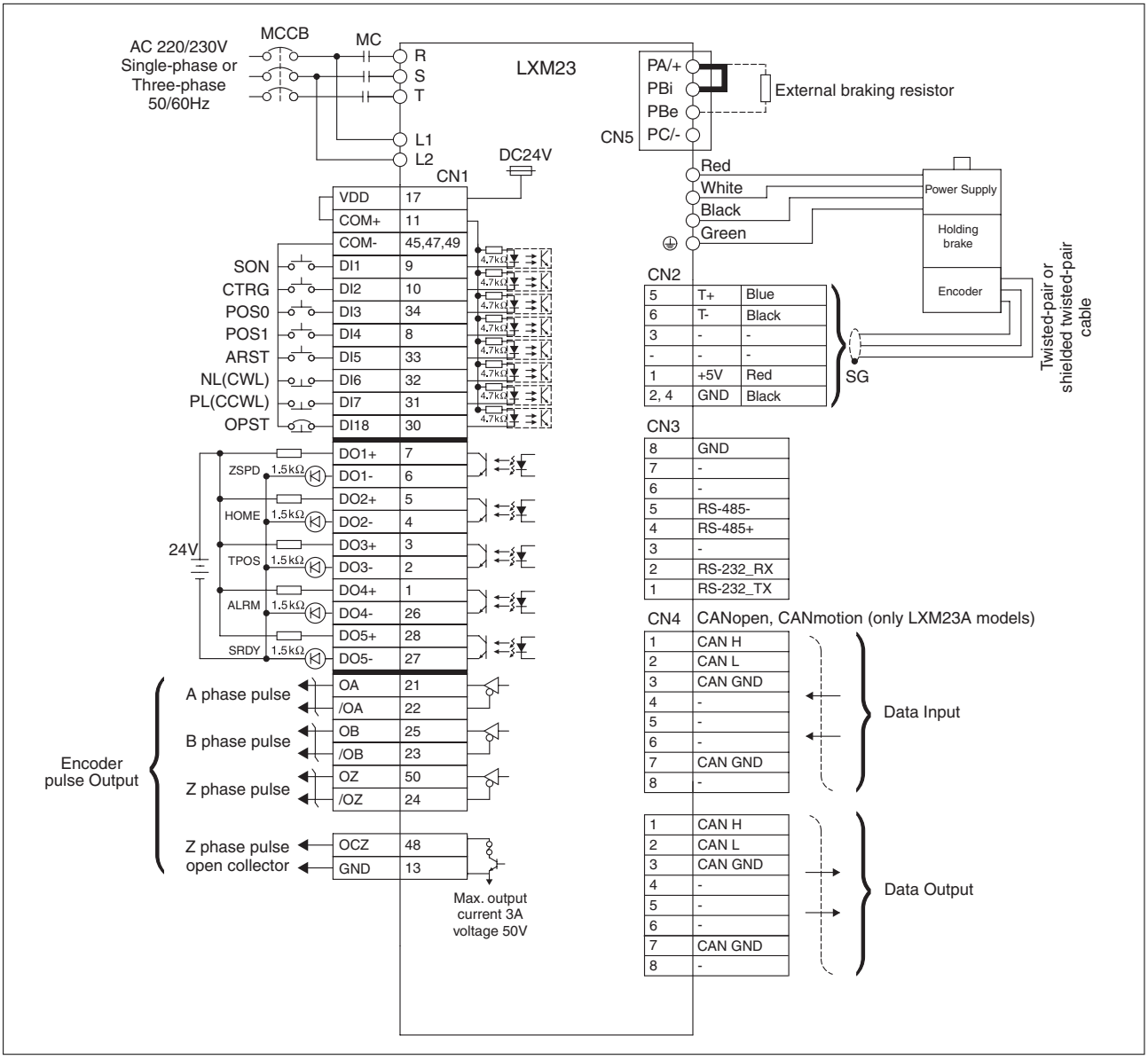
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8.4 Torque control mode wiring diagram



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8.5 CANopen control mode wiring diagram



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9 Diagnostics and troubleshooting

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

9.1 Status request/status indication

Information on the product status is provided by:

- Integrated HMI
- Commissioning software

  See the information provided with the commissioning software for details on how to display the device status.
- The alarm memory also contains a history of the last 5 alarms.

  The alarm memory can be found in the Diagnostics Parameter (P4-00 ... P4-04).The five most recent alarms are stored.

  See the information provided with the commissioning software for details on how to read the alarm memory using the commissioning software.

9.2 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 ... DI8, the corresponding status is shown on the display of the drive. When the bit is set to "1", it means that the corresponding digital input signal is ON.

Example:

Suppose that the drive display shows “3FE1".

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

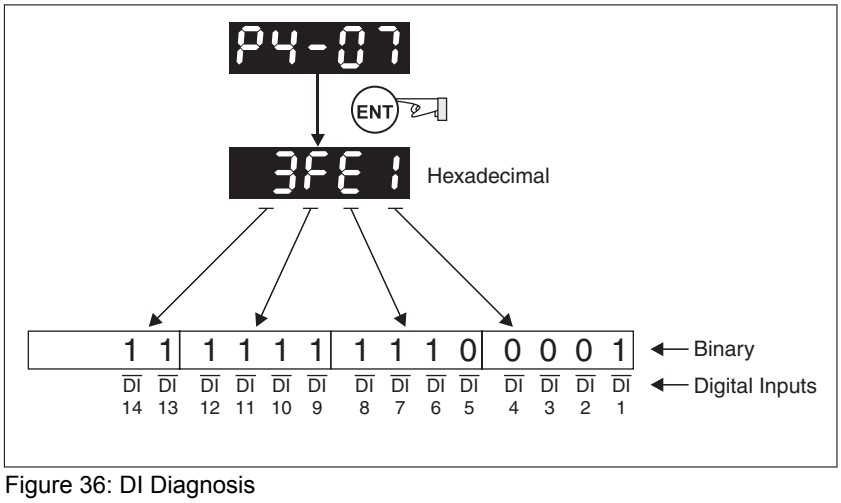


Figure 36: DI Diagnosis

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9.3 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 ... DO5, the corresponding status is shown on the display of the drive. When the Bit is set to "1", it means that the corresponding digital output signal is ON

Example:

Suppose that the drive display shows "1F".

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

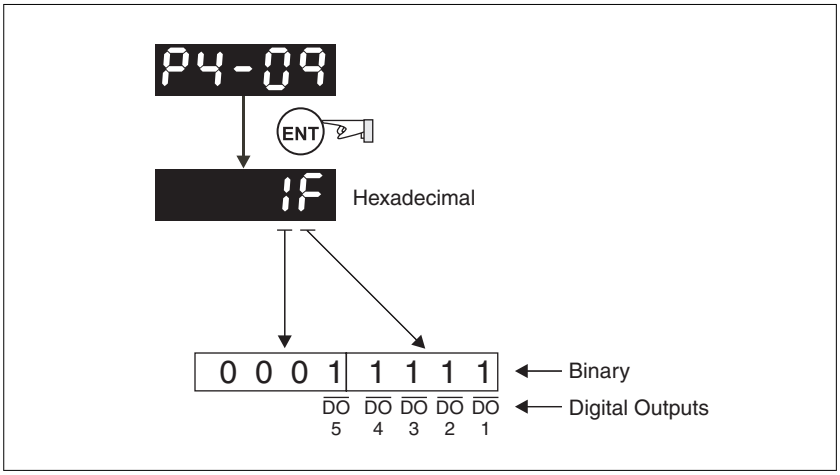


Figure 37: DO Diagnosiss

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9.4 Alarm Messages Table

Drive alarm messages

Alarm Messages		
Display	**Alarm Name**	**Alarm Description**
AL001	Overcurrent	Main circuit current is higher than 1.5 multiples of motor's instantaneous maximum current value.
AL002	Overvoltage	Main circuit voltage has exceeded the maximum permissible value.
AL003	Undervoltage	Main circuit voltage is below the minimum specified value.
AL004	Motor error	The motor does not match the drive. They are not correctly matched for size (power rating).
AL005	Braking resistor error	Braking resistor control operation error detected.
AL006	Overload	Servo motor and drive are overloaded.
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 the permissible setting value.
AL009	Excessive deviation	Position control deviation value exceeds the limit of the permissible setting value.
AL011	Encoder error	Pulse signal error detected.
AL012	Adjustment error	Adjusted value exceeds the limit of the permissible setting value when electrical adjustment is performed.
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 too high.
AL017	Memory error	EEPROM write-in and read-out error detected.
AL018	Encoder output error	The encoder output exceeds the rated output frequency.
AL020	Serial communication timeout	RS-485 communication timeout.
AL022	Input power phase missing	One phase of the input power is missing.
AL023	Pre-overload	Indicates that the servo motor and drive is going to overload. This alarm will display before ALM06. When the servo motor reaches the setting value of P1-56, the motor will send a message to the drive. After the drive has received the message, the DO signal OLW will be activated and this alarm message will be displayed.
AL024	Encoder initial magnetic field error	The magnetic field of the encoder U, V, W signal is incorrect.

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Alarm Messages		
Display	**Alarm Name**	**Alarm Description**
AL025	Encoder internal error	The internal memory of the encoder is inoperative. An internal counter error has been 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 is inoperative.
AL030	Motor monitoring error	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 ground are incorrect.
AL099	DSP firmware upgrade	EEPROM is not reset after the firmware version is upgraded. This alarm can be cleared after setting P2-08 to 30 first, and then setting P2-08 to 28 next and restarting the servo drive.

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CANopen communication alarm messages

Alarm Messages		
Display	**Alarm Name**	**Alarm 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 EEPROM.	An error occurs when loading the default settings from EEPROM at start-up. The CANopen objects return to their default settings automatically.
AL129	Error occurs when writing CANopen PDO object into EEPROM.	An error occurs when writing the current settings into EEPROM.
AL130	EEPROM invalid address range	The amount of the data saved in EEPROM 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 EEPROM cannot be used.
AL131	EEPROM checksum error	The data saved in EEPROM has been damaged and the CANopen objects return to their default settings automatically.
AL132	Password error	The parameter is password protected when using CANopen communication to access the parameter. 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.

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Alarm Messages		
Display	**Alarm Name**	**Alarm Description**
AL185	CANbus error	CANbus off or Error Rx/Tx Counter exceeds 128.
AL201	CANopen data initial error	An error occurs when loading data from EEPROM.
AL235	Command overflow	This alarm 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.
AL277	Password error	The parameter is password protected when using CANopen communication to access the parameter. 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 error	No synchronous communication with the external master.
AL3E2	CANopen SYNC signal error	The CANopen SYNC signal is received too early.
AL3E3	CANopen SYNC timeout	The CANopen SYNC signal is not received within the specified time.
AL3E4	CANopen IP command error	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 further details, see parameter P1-48.

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Alarm Messages		
Display	**Alarm Name**	**Alarm Description**
AL401	CAN bus error	NMT reset or NMT stop command is received when the servo drive is enabled.

NOTE:

For additional information on the CANopen objects, see the CANopen fieldbus manual.

9.5 Potential Cause and Corrective Actions

Drive alarm 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.	Remove the short circuit and keep conductors from being exposed.
Motor wiring error	Check if the wiring steps are correct when connecting motor to drive.	Follow the wiring steps in the product manual to reconnect wiring.
IGBT error	Heat sink overheated	Contact Schneider Electric support.
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. Verify 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 the maximum permissible value.	Use voltmeter to check whether the input voltage is in the rated input voltage range.	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 use series transformer.
The hardware of the servo drive is damaged.	Use voltmeter to verify that the main circuit input voltage is in the specified limit,	If the error persists even if the main circuit input voltage is in the specified limit, contact Schneider Electric support.

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AL003	: Undervoltage	
Potential Cause	Checking Method	Corrective Actions
The main circuit voltage is below the 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.	Check 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	: Braking resistor error	
Potential Cause	Checking Method	Corrective Actions
Braking resistor is not connected or the value of the braking resistor is too low.	Check the wiring connection of braking resistor.	Reconnect braking resistor or calculate the value of the braking resistor.
Braking resistor switch transistor error	Check if braking resistor switch transistor is short-circuited.	Contact Schneider Electric support.
Parameter setting error	Confirm the parameter settings of P1-52 and P1-53, and specifications of braking resistor.	Correctly reset parameter settings and the specifications of braking resistor again.

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AL006	: Overload	
Potential Cause	Checking Method	Corrective Actions
The drive has exceeded the rated load during continuous operation.	Check if the drive is overloaded. You can set parameter P0-02 (Drive Alarm Code) to 11 and monitor if the value of the average torque [%] keeps exceeding 100%.	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 incorrect.	Check the wiring of U, V, W and encoder.	Verify that the wiring is correct.
The encoder of the motor is damaged.	Contact Schneider Electric support.	

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.	Verify that the input command frequency is stable (not fluctuate too much) and activate filter function.
Over-speed parameter setting is incorrect	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.

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AL011	: Encoder error (Position detector error)	
Potential Cause	Checking Method	Corrective Actions
The wiring of the encoder is incorrect.	1. Check if the wiring is correct. 2. Check if wiring has been performed in accordance with the product manual.	Verify that the wiring is correct.
Encoder is loose	Check the encoder connector (CN2).	Install the motor again.
The wiring of encoder is incorrect.	Check if the connections are tight.	Re-wire.
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.	Reset the power supply.	If the error persists after resetting the power supply, contact Schneider Electric support.

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.

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AL016	: IGBT temperature error	
Potential Cause	Checking Method	Corrective Actions
The drive has exceeded the 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.	Verify that the wiring is correct.

AL017	: Memory error	
Potential Cause	Checking Method	Corrective Actions
Parameter data error when writing into EEPROM.	Check the parameter settings. Procedure: 1. Press the **S** button on the HMI keypad and check the parameter shown on the HMI display. 2. If E320A is displayed (in hexadecimal format), it indicates it is parameter P2-10. Check the parameter settings of P2-10. 3. If E3610 is displayed (in hexadecimal format), it indicates it is parameter P6-16. Check the parameter settings of P6-16.	1. If this alarm occurs when power is applied to the drive, the setting value of one parameter has exceeded the specified range. Correct the setting value of the parameter to clear the alarm and restart the servo drive. 2. If this alarm occurs during normal operation, the error occurs when data is written to EEPROM. Turn ARST (DI signal) ON to clear the alarm or restart the servo drive.
The setting value of hidden parameter is in error.	Press the **S** button on the HMI keypad and check if E100X is displayed on the HMI display.	If this alarm 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 EEPROM is damaged.	Press the **S** button on the HMI keypad and check if E0001 is displayed on the HMI display.	If this alarm occurs when power is applied to the drive, it indicates that the data in EEPROM is damaged or there is no data in EEPROM. Contact Schneider Electric support.

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AL018	: Encoder output error	
Potential Cause	Checking Method	Corrective Actions
Encoder inoperative or encoder wiring error.	Check if the recent alarm messages (P4-00 ... P4-05) on the display in accordance with the alarm 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 the permissible setting value.	Check if the following conditions occur: Condition 1: Motor speed is above the value set by P1-76. Condition 2: $\frac{\text{Motor Speed}}{60} \times \text{P1-46} \times 4 > 19.8 \times 10^6$	Correctly set P1-76 and P1-46. 1. Verify that the motor speed is below the value set by P1-76. 2. $\frac{\text{Motor Speed}}{60} \times \text{P1-46} \times 4 < 19.8 \times 10^6$

AL020	: Serial communication timeout	
Potential Cause	Checking Method	Corrective Actions
Setting value in timeout parameter is not correct.	Check communication timeout 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, verify that the communication cable is not damaged and verify that the wiring is correct.

AL022	: Input power phase missing	
Potential Cause	Checking Method	Corrective Actions
Control power supply error.	Check the power cable and connections of R, S, T. Check whether the power cable is loose or an input power phase missing.	If the alarm persists even when the three-phase power is connected correctly, contact Schneider Electric support.

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. See the corrective actions for AL006. 2. Increase the setting value of P1-56 or set P1-56 to 100 and above.

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AL024	: Encoder initial magnetic field error	
Potential Cause	Checking Method	Corrective Actions
The magnetic field of the encoder U, V, W signal is incorrect.	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. 3. Check if the shielded cables are used when performing encoder wiring.	If the error persists after the checks have been performed, contact Schneider Electric support.

AL025	: Encoder internal error	
Potential Cause	Checking Method	Corrective Actions
The internal memory of the encoder is inoperative. 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. 3. Check if the shielded cables are used when performing encoder wiring.	1. Connect the grounding (green color) of U, V, W terminal to the heatsink of the servo drive. 2. Verify that the encoder signal cables are placed in separate conduits from the cables connected to R, S, T and U, V, W terminals. 3. Use shielded cables for encoder wiring. 4. If the error persists after the above actions have been performed, contact Schneider Electric support.

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. 3. Check if the shielded cables are used when performing encoder wiring.	1. Connect the grounding (green color) of U, V, W terminal to the heatsink of the servo drive. 2. Verify that the encoder signal cables are placed in separate conduits from the cables connected to R, S, T and U, V, W terminals. 3. Use shielded cables for encoder wiring. 4. If the error persists after the above actions have been performed, contact Schneider Electric support.

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AL027	: Encoder reset error	
Potential Cause	Checking Method	Corrective Actions
An encoder reset error has been detected. Communi-cation errorbetween encoder and drive.	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. 3. Check if the shielded cables are used when per-forming encoder wiring.	1. Connect the grounding (green color) of U, V, W terminal to the heatsink of the servo drive. 2. Verify that the encoder signal cables are placed in separate conduits from the cables connected to R, S, T and U, V, W terminals. 3. Use shielded cables for encoder wiring. 4. If the error persists after the above actions have been performed, contact Schneider Electric support.

AL030	: Motor monitoring 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 ena-bled. 2. Check if the setting val-ues of P1-57 and P1-58 are both too small.	1. Set P1-57 to 0. 2. Correctly set P1-57 and P1-58. Excessively low settings may results in errors.. Excessively high settings may cause the motor monitoring function to become inoperative.

AL031	: U,V,W wiring error	
Potential Cause	Checking Method	Corrective Actions
Incorrect wiring con-nections of U, V, W (for servo motor output) and ground.	Check if wiring connec-tions of U, V, W are not correct.	Follow the wiring steps in the product manual to reconnect the wiring and ground the servo drive and motor properly.

AL099	: DSP firmware upgrade	
Potential Cause	Checking Method	Corrective Actions
EEPROM is not reset after the firm-ware version is upgraded.	Check if EEPROM is reset after the firmware version is upgraded.	Set P2-08 to 30 first, and then 28 next, and restart the servo drive.

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CANopen communication alarm 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 Master sends "Reset node" command to the slave or reset the alarm 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 Master sends "Reset node" command to the slave or reset the alarm 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 Master sends "Reset node" command to the slave or reset the alarm 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 Master sends "Reset node" command to the slave or reset the alarm 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 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 Master sends "Reset node" command to the slave or reset the alarm by sending the control word (0x6040) through CAN communication (the value of CANopen object 0x6040 should be reset)

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AL124	: 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 Master sends "Reset node" command to the slave or reset the alarm by sending the control word (0x6040) through CAN communication (the value of CANopen object 0x6040 should be reset)

AL125	: 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 Master sends "Reset node" command to the slave or reset the alarm 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	
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 master sends "Reset node" command to the slave or reset the alarm by sending the control word (0x6040) through CAN communication (the value of CANopen object 0x6040 should be reset)

AL127	: 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 master sends "Reset node" command to the slave or reset the alarm by sending the control word (0x6040) through CAN communication (the value of CANopen object 0x6040 should be reset)

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AL128	: Error occurs when reading CANopen PDO object from EEPROM	
Potential Cause	Checking Method	Corrective Actions
An error occurs when loading the default settings from EEPROM at start-up. The CANopen objects return to their default settings automatically.	Check if it causes an error when the specified object reads EEPROM when accessing PDO object.	NMT master sends "Reset node" command to the slave or reset the alarm 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 EEPROM	
Potential Cause	Checking Method	Corrective Actions
An error occurs when writing the current settings into EEPROM.	Check if it causes an error when the specified object writes EEPROM when accessing PDO object.	NMT master sends "Reset node" command to the slave or reset the alarm by sending the control word (0x6040) through CAN communication (the value of CANopen object 0x6040 should be reset)

AL130	: EEPROM invalid address range	
Potential Cause	Checking Method	Corrective Actions
The amount of the data saved in EEPROM 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 EEPROM cannot be used.	Check if the specified object lets the address range of EEPROM exceed the specification when accessing PDO object.	NMT master sends "Reset node" command to the slave or reset the alarm by sending the control word (0x6040) through CAN communication (the value of CANopen object 0x6040 should be reset)

AL131	: EEPROM checksum error	
Potential Cause	Checking Method	Corrective Actions
The data saved in EEPROM has been damaged and the CANopen objects return to their default settings automatically.	Check if the specified object results in the checksum error of EEPROM when accessing PDO object.	NMT master sends "Reset node" command to the slave or reset the alarm by sending the control word (0x6040) through CAN communication (the value of CANopen object 0x6040 should be reset)

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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 master sends "Reset node" command to the slave or reset the alarm 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 master sends "Reset node" command to the slave. be reset)

AL185	: CANbus error	
Potential Cause	Checking Method	Corrective Actions
CANbus off or Error Rx/Tx Counter exceeds 128.	1. Check 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 master sends "Reset node" command to the slave or restart the servo drive.

AL201	: CANopen data initial error	
Potential Cause	Checking Method	Corrective Actions
An error occurs when loading data from EEPROM.	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 EEPROM is damaged. Procedure: a. If you 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 you 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 alarm. 2. Use CANopen "0x1011" object to restore default parameters.

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AL235	:command overflow	
Potential Cause	Checking Method	Corrective Actions
This alarm 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 master sends "Reset node" command to the slave or reset the alarm 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.	Verify that the correct data is used.	NMT master sends "Reset node" command to the slave or reset the alarm 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.	Verify that the correct data is used.	NMT master sends "Reset node" command to the slave or reset the alarm 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.	Verify that the correct data is used.	NMT master sends "Reset node" command to the slave or reset the alarm by sending the control word (0x6040) through CAN communication (the value of CANopen object 0x6040 should be reset)

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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.	Verify that the correct data is used.	NMT master sends "Reset node" command to the slave or reset the alarm 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).	Verify that the correct data is used.	NMT master sends "Reset node" command to the slave or reset the alarm 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.	Verify that the correct data is used.	NMT master sends "Reset node" command to the slave or reset the alarm 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.	Verify that the correct data is used.	NMT master sends "Reset node" command to the slave or reset the alarm 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.	Verify that the correct data is used.	NMT master sends "Reset node" command to the slave or reset the alarm by sending the control word (0x6040) through CAN communication (the value of CANopen object 0x6040 should be reset)

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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 alarm is activated, the actual position may not exceed the limit. Setting the proper deceleration time is able to solve this problem. See parameter P5-03.	When the servo drive does not reach the limit, i.e. the position command is less than forward software limit, this alarm message can be removed automatically

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 alarm is activated, the actual position may not exceed the limit. Setting the proper deceleration time is able to solve this problem. See parameter P5-03.	When the servo drive does not reach the limit, i.e. the position command is less than reverse software limit, this alarm message can be removed automatically

AL3E1	: CANopen SYNC error	
Potential Cause	Checking Method	Corrective Actions
CAN IP mode error. No synchronous communication with the external master.	1. Check if the communication quality is good quality state. 2. Check if the (external) master 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 master sends "Reset node" command to the slave or reset the alarm by sending the control word (0x6040) through CAN communication (the value of CANopen object 0x6040 should be reset)

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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 the (external) master. 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 (external) master is not correct.	NMT master sends "Reset node" command to the slave or reset the alarm by sending the control word (0x6040) through CAN communication (the value of CANopen object 0x6040 should be reset)

AL3E3	: CANopen SYNC timeout	
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 (external) master. 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 (external) master is not correct.	NMT master sends "Reset node" command to the slave or reset the alarm by sending the control word (0x6040) through CAN communication (the value of CANopen object 0x6040 should be reset)

AL3E4	: CANopen IP command error	
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.	NMT master sends "Reset node" command to the slave or reset the alarm by sending the control word (0x6040) through CAN communication (the value of CANopen object 0x6040 should be reset)

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AL3E5	: SYNC period error	
Potential Cause	Checking Method	Corrective Actions
Object 0x1006 Data Error. SYNC period 1006h value is invalid.	Check the data of 0x1006. The SYNC period 1006h value should not be equal to or less than 0 or this alarm will occur.	NMT master sends "Reset node" command to the slave or reset the alarm by sending the control word (0x6040) through CAN communication (the value of CANopen object 0x6040 should be reset)

AL380	: 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. See parameter P1-48 for further details.	1. Turn ARST (DI signal) ON to clear the alarm. 2. Set P0-01 to 0.

AL401	: 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 alarm by sending the control word (0x6040) through CAN communication (the value of CANopen object 0x6040 should be reset). 2. Reset the alarm by triggering FR of driveCtrl of dmControl (control data of PLCopen Profile).

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9.6 Clearing alarms

Drive alarm messages

Display	Alarm Name	Clearing Method
AL001	Overcurrent	Turn ARST (DI signal) ON to clear the alarm.
AL002	Overvoltage	Turn ARST (DI signal) ON to clear the alarm.
AL003	Undervoltage	This alarm message can be removed automatically after the voltage has returned to a permissible value.
AL004	Motor error	This alarm message can be removed by restarting the servo drive.
AL005	Braking resistor error	Turn ARST (DI signal) ON to clear the alarm.
AL006	Overload	Turn ARST (DI signal) ON to clear the alarm.
AL007	Overspeed	Turn ARST (DI signal) ON to clear the alarm.
AL008	Abnormal pulse control command	Turn ARST (DI signal) ON to clear the alarm.
AL009	Excessive deviation	Turn ARST (DI signal) ON to clear the alarm.
AL011	Encoder error	This alarm message can be removed by restarting the servo drive.
AL012	Adjustment error	This alarm 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	Turn ARST (DI signal) ON to clear the alarm.
AL014	Reverse limit switch error	1. Turn ARST (DI signal) ON to clear the alarm. 2. This alarm message can be removed when the servo drive is Off (Servo Off). 3. When the servo drive does not reach the limit, this alarm message can be removed automatically
AL015	Forward limit switch error	1. Turn ARST (DI signal) ON to clear the alarm. 2. This alarm message can be removed when the servo drive is Off (Servo Off). 3. When the servo drive does not reach the limit, this alarm message can be removed automatically
AL016	IGBT temperature error	Turn ARST (DI signal) ON to clear the alarm.
AL017	Memory error	1. If this alarm occurs when power is applied to the drive, correct the setting value of the parameter to clear the alarm and restart the servo drive. 2. If this alarm occurs during normal operation, turn ARST (DI signal) ON to clear the alarm.

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Display	Alarm Name	Clearing Method
AL018	Encoder output error	Turn ARST (DI signal) ON to clear the alarm.
AL020	Serial communication timeout	Turn ARST (DI signal) ON to clear the alarm.
AL022	Input power phase missing	Turn ARST (DI signal) ON to clear the alarm. This alarm message can be removed automatically after the problem with the missing input power phase has been solved.
AL023	Pre-overload warning	Turn ARST (DI signal) ON to clear the alarm.
AL024	Encoder initial magnetic field error	This alarm message can be removed by restarting the servo drive.
AL025	Encoder internal error	This alarm message can be removed by restarting the servo drive.
AL026	Encoder data error	This alarm message can be removed by restarting the servo drive.
AL027	Encoder reset error	This alarm message can be removed by restarting the servo drive.
AL030	Motor protection error	Turn ARST (DI signal) ON to clear the alarm.
AL031	U,V,W wiring error	This alarm message can be removed by restarting the servo drive.
AL099	DSP firmware upgrade	This alarm message can be removed after setting P2-08 to 30 first, and then 28 next and restarting the servo drive.

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CANopen communication alarm messages

Display	Alarm 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 sends "Reset node" command to the slave or reset the alarm 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 sends "Reset node" command to the slave or reset the alarm 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 sends "Reset node" command to the slave or reset the alarm 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 sends "Reset node" command to the slave or reset the alarm 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 sends "Reset node" command to the slave or reset the alarm 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 sends "Reset node" command to the slave or reset the alarm 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 sends "Reset node" command to the slave or reset the alarm 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 sends "Reset node" command to the slave or reset the alarm by sending the control word (0x6040) through CAN communication (the value of CANopen object 0x6040 should be reset).
AL127	CANopen PDO object is write-protected when Servo On.	NMT master sends "Reset node" command to the slave or reset the alarm by sending the control word (0x6040) through CAN communication (the value of CANopen object 0x6040 should be reset).

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Display	Alarm Name	Clearing Method
AL128	Error occurs when reading CANopen PDO object from EEPROM.	NMT master sends "Reset node" command to the slave or reset the alarm 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 EEPROM.	NMT master sends "Reset node" command to the slave or reset the alarm by sending the control word (0x6040) through CAN communication (the value of CANopen object 0x6040 should be reset).
AL130	EEPROM invalid address range.	NMT master sends "Reset node"command to the slave or reset the alarm by sending the control word (0x6040) through CAN communication (the value of CANopen object 0x6040 should be reset).
AL131	EEPROM checksum error.	NMT master sends ""Reset node" command to the slave or reset the alarm by sending the control word (0x6040) through CAN communication (the value of CANopen object 0x6040 should be reset).
AL132	Password error	NMT master sends "Reset node" command to the slave or reset the alarm 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 master sends "Reset node"command to the slave.
AL185	CANbus error	NMT master sends "Reset node"command to the slave or restart the servo drive.
AL201	CANopen Data Initial Error	1. Turn ARST (DI signal) ON to clear the alarm. 2. Use CANopen "0x1011± object to restore default parameters.
AL201	CANopen Data Initial Error	1. Turn ARST (DI signal) ON to clear the alarm. 2. Use CANopen "0x1011± object to restore default parameters.
AL235	Command Overflow	NMT master sends "Reset node" command to the slave or reset the alarm 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 master sends "Reset node" command to the slave or reset the alarm by sending the control word (0x6040) through CAN communication (the value of CANopen object 0x6040 should be reset).

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Display	Alarm Name	Clearing Method
AL263	Sub-index error occurs when accessing CANopen object.	NMT master sends "Reset node" command to the slave or reset the alarm 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 master sends "Reset node" command to the slave or reset the alarm 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 master sends "Reset node" command to the slave or reset the alarm 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.	NMT master sends "Reset node" command to the slave or reset the alarm 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 master sends "Reset node" command to the slave or reset the alarm 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 master sends "Reset node" command to the slave or reset the alarm by sending the control word (0x6040) through CAN communication (the value of CANopen object 0x6040 should be reset).
AL277	Password error	NMT master sends "Reset node" command to the slave or reset the alarm 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 alarm 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 alarm message can be removed automatically
AL3E1	CANopen SYNC error	NMT master sends "Reset node" command to the slave or reset the alarm by sending the control word (0x6040) through CAN communication (the value of CANopen object 0x6040 should be reset).

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Display	Alarm Name	Clearing Method
AL3E2	CANopen SYNC signal error	NMT master sends "Reset node" command to the slave or reset the alarm by sending the control word (0x6040) through CAN communication (the value of CANopen object 0x6040 should be reset).
AL3E3	CANopen SYNC timeout	NMT master sends "Reset node" command to the slave or reset the alarm by sending the control word (0x6040) through CAN communication (the value of CANopen object 0x6040 should be reset).
AL3E4	CANopen IP command error	NMT master sends :Reset node: command to the slave or reset the alarm by sending the control word (0x6040) through CAN communication (the value of CANopen object 0x6040 should be reset).
AL3E5	SYNC period error	NMT master sends "Reset node" command to the slave or reset the alarm 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 alarm. 2. Set P0-01 to 0.
AL401	CANopen state error	1. Reset the alarm by sending the control word (0x6040) through CAN communication (the value of CANopen object 0x6040 should be reset). 2. Reset the alarm by triggering FR of driveCtrl of dmControl (control data of PLCopen Profile).

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10 Parameters

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

Unsuitable settings or unsuitable data may trigger unintended movements, trigger signals, damage parts and disable monitoring functions. Some settings do not become active until after a restart.

⚠ WARNING

UNINTENDED EQUIPMENT OPERATION

- Do not operate the drive system with unknown settings or data.
- Never modify a parameter unless you fully understand the parameter and all effects of the modification.
- After modifications to settings, restart the drive and verify the saved data or settings.
- When commissioning the product, 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 zone of operation.

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

10.1 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

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Symbols 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.

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10.2 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 two-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

Symbols 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.

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10.3 Parameter Summary

10.3.1 Parameters Listed by Group

10.3.1.1 Group 0: Monitor Parameters

Parameter	Name	Function	Default	Unit	Control Mode			
					Pt	Pr	S	T
P0-00 *	VER	Firmware Version	0x1006		•	•	•	•
P0-01 ■	ALE	Drive Alarm Code	0x0000		•	•	•	•
P0-02	STS	Drive Status	1		•	•	•	•
P0-03	MON	Analog Monitor Output	0x0000		•	•	•	•
P0-04 ■		Monitor Variable 1	0x00000000		•	•	•	•
P0-05 ■		Monitor Variable 2	0x00000000		•	•	•	•
P0-06 ■		Monitor Variable 3	0x00000000		•	•	•	•
P0-07 ■		Monitor Variable 4	0x00000000		•	•	•	•
P0-08 *	TSON	Servo Operating Hour Meter	0	h	•	•	•	•
P0-09 * ■	CM1	Status Monitor 1	0		•	•	•	•
P0-10 * ■	CM2	Status Monitor 2	0		•	•	•	•
P0-11 * ■	CM3	Status Monitor 3	0		•	•	•	•
P0-12 * ■	CM4	Status Monitor 4	0		•	•	•	•
P0-13 * ■	CM5	Status Monitor 5	0		•	•	•	•
P0-14	Reserved (Do Not Use)							
P0-15	Reserved (Do Not Use)							
P0-16	Reserved (Do Not Use)							
P0-17	CM1A	Display Status Monitor 1	0		•	•	•	•
P0-18	CM2A	Display Status Monitor 2	0		•	•	•	•
P0-19	CM3A	Display Status Monitor 3	0		•	•	•	•
P0-20	CM4A	Display Status Monitor 4	0		•	•	•	•
P0-21	CM5A	Display Status Monitor 5	0		•	•	•	•
P0-22	Reserved (Do Not Use)							
P0-23	Reserved (Do Not Use)							
P0-24	Reserved (Do Not Use)							
P0-25 ■	MAP1	Paramenter Mapping 1	0x00000000		•	•	•	•
P0-26 ■	MAP2	Paramenter Mapping 2	0x00000000		•	•	•	•
P0-27 ■	MAP3	Paramenter Mapping 3	0x00000000		•	•	•	•
P0-28 ■	MAP4	Paramenter Mapping 4	0x00000000		•	•	•	•
P0-29 ■	MAP5	Paramenter Mapping 5	0x00000000		•	•	•	•
P0-30 ■	MAP6	Paramenter Mapping 6	0x00000000		•	•	•	•
P0-31 ■	MAP7	Paramenter Mapping 7	0x00000000		•	•	•	•
P0-32 ■	MAP8	Paramenter Mapping 8	0x00000000		•	•	•	•
P0-33	Reserved (Do Not Use)							
P0-34	Reserved (Do Not Use)							

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Parameter	Name	Function	Default	Unit	Control Mode			
					Pt	Pr	S	T
P0-35	MAP1A	Block Data Read / Write Register 1 (for P0-25)	0x00000000		•	•	•	•
P0-36	MAP2A	Block Data Read / Write Register 2 (for P0-26)	0x00000000		•	•	•	•
P0-37	MAP3A	Block Data Read / Write Register 3 (for P0-27)	0x00000000		•	•	•	•
P0-38	MAP4A	Block Data Read / Write Register 4 (for P0-28)	0x00000000		•	•	•	•
P0-39	MAP5A	Block Data Read / Write Register 5 (for P0-29)	0x00000000		•	•	•	•
P0-40	MAP6A	Block Data Read / Write Register 6 (for P0-30)	0x00000000		•	•	•	•
P0-41	MAP7A	Block Data Read / Write Register 7 (for P0-31)	0x00000000		•	•	•	•
P0-42	MAP8A	Block Data Read / Write Register 8 (for P0-32)	0x00000000		•	•	•	•
P0-43	Reserved (Do Not Use)							
P0-44	Reserved (Do Not Use)							
P0-45	Reserved (Do Not Use)							
P0-46 * ■	SVSTS	Servo Output Status Display	0x0000		•	•	•	•

Symbols 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.

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10.3.1.2 Group 1: Basic Parameters

Parameter	Name	Function	Default	Unit	Control Mode			
					Pt	Pr	S	T
P1-00 ▲	PTT	External Pulse Input Type	0x0002		•			
P1-01 ●	CTL	Control Mode and Output Direction	0x0000		•	•	•	•
P1-02 ▲	PSTL	Speed and Torque Limit Setting	0x0000		•	•	•	•
P1-03	AOUT	Pulse Output Polarity Setting	0x0000		•	•	•	•
P1-04	MON1	Analog Monitor Output Proportion 1 (MON1) (100% for full scale)	100	%	•	•	•	•
P1-05	MON2	Analog Monitor Output Proportion 2 (MON2) (100% for full scale)	100	%	•	•	•	•
P1-06	SFLT	Acceleration / Deceleration Smoothing Constant of Analog Speed Command (Low-pass Filter)	0	ms			•	
P1-07	TFLT	Smoothing Constant of Analog Torque Command (Low-pass Filter)	0	ms				•
P1-08	PFLT	Smoothing Constant of Position Command (Low-pass Filter)	0	10 ms	•	•		
P1-09	SP1	1st Speed Command/ Limit	1000	0.1 RPM			•	•
P1-10	SP2	2nd Speed Command/ Limit	2000	0.1 RPM			•	•
P1-11	SP3	3rd Speed Command/ Limit	3000	0.1 RPM			•	•
P1-12	TQ1	1st Torque Command/ Limit	100	%	•	•	•	•
P1-13	TQ2	2nd Torque Command/ Limit	100	%	•	•	•	•
P1-14	TQ3	3rd Torque Command/ Limit	100	%	•	•	•	•
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	Vibration Suppression Frequency 1	1000	Hz	•	•		
P1-26	VSG1	Vibration Suppression Gain 1	0		•	•		
P1-27	VSF2	Vibration Suppression Frequency 2	1000	Hz	•	•		
P1-28	VSG2	Vibration Suppression Gain 2	0		•	•		
P1-29	AVSM	Auto Vibration Suppression Mode Selection	0		•	•		
P1-30	VCL	Low-Frequency Vibration Detection Level	500		•	•		
P1-31	Reserved (Do Not Use)							
P1-32	LSTP	Motor Stop Mode Selection	0x0000		•	•	•	•
P1-33	Reserved (Do Not Use)							
P1-34	TACC	Acceleration Time	200	ms			•	
P1-35	TDEC	Deceleration Time	200	ms			•	
P1-36	TSL	Acceleration / Deceleration S-curve	0	ms		•	•	

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Parameter	Name	Function	Default	Unit	Control Mode			
					Pt	Pr	S	T
P1-37	GDR	Ratio of Load Inertia to Servo Motor Inertia	1.0		•	•	•	•
P1-38	ZSPD	Zero Speed Range Setting	10.0	0.1 RPM	•	•	•	•
P1-39	SSPD	Target Rotation Speed	3000	RPM	•	•	•	•
P1-40	VCM	Max. Analog Speed Command / Limit	10001	RPM			•	•
P1-41 ▲	TCM	Max. Analog Torque Command / Limit	100	%	•	•	•	•
P1-42	MBT1	ON Delay Time of Holding Brake	0	ms	•	•	•	•
P1-43	MBT2	OFF Delay Time of Holding Brake	0	ms	•	•	•	•
P1-44	GR1	Electronic Gear Ratio (1st Numerator) (N1)	128		•	•		
P1-45 ▲	GR2	Electronic Gear Ratio (Denominator) (M)	10		•	•		
P1-46 ▲	GR3	Encoder Output Pulse Number	2500		•	•	•	•
P1-47	SPOK	Speed Reached Output Range	10				•	
P1-48	MCOK	Motion Control Completed Output Selection	0x0000			•		
P1-49	Reserved (Do Not Use)							
P1-50	Reserved (Do Not Use)							
P1-51	Reserved (Do Not Use)							
P1-52	RES1	Resistance of External Braking Resistor	751	Ohm	•	•	•	•
P1-53	RES2	Nominal Power of External Braking Resistor	3001	W	•	•	•	•
P1-54	PER	Positioning Completed Width	12800		•	•		
P1-55	MSPD	Maximum Speed Limit	6001	RPM	•	•	•	•
P1-56	OVW	Output Overload Warning	120	%	•	•	•	•
P1-57	CRSHA	Motor Overshoot Warning Percentage	0	%	•	•	•	•
P1-58	CRSHT	Motor Overshoot Warning Time	1	ms	•	•	•	•
P1-59	MFLT	Analog Speed Linear Filter	0.0	0.1 ms			•	
P1-60	Reserved (Do Not Use)							
P1-61	Reserved (Do Not Use)							
P1-62	FRCL	Friction Compensation Percentage	0	%	•	•	•	
P1-63	FRCT	Friction Compensation Smoothing Constant	1		•	•	•	•
P1-64	Reserved (Do Not Use)							
P1-65	Reserved (Do Not Use)							
P1-66	PCM	Max. Rotation Number of Analog Position Command	30	0.1	•			
P1-67	Reserved (Do Not Use)							
P1-68	PFLT2	Position Command Moving Filter	4	ms	•	•		
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	5500	RPM	•	•	•	•

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Symbols Explanation of symbols

(*) Read-only register.

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

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10.3.1.3 Group 2: Extension Parameters

Parameter	Name	Function	Default	Unit	Control Mode			
					Pt	Pr	S	T
P2-00	KPP	Proportional Position Loop Gain	35	rad/s	•	•		
P2-01	PPR	Position Loop Gain Switching Rate	100	%	•	•		
P2-02	PFG	Position Feed Forward Gain	50	%	•	•		
P2-03	PFF	Smooth Constant of Position Feed Forward Gain	5	ms	•	•		
P2-04	KVP	Proportional Speed Loop Gain	500	rad/s	•	•	•	•
P2-05	SPR	Speed Loop Gain Switching Rate	100	%	•	•	•	•
P2-06	KVI	Speed Integral Compensation	100	rad/s	•	•	•	•
P2-07	KVF	Speed Feed Forward Gain	0	%	•	•	•	•
P2-08 ■	PCTL	Special Factory Setting	0		•	•	•	•
P2-09	DRT	Bounce Filter	2	2 ms	•	•	•	•
P2-10	DI1	Digital Input Terminal 1 (DI1)	0x0101		•	•	•	•
P2-11	DI2	Digital Input Terminal 2 (DI2)	0x0104		•	•	•	•
P2-12	DI3	Digital Input Terminal 3 (DI3)	0x0116		•	•	•	•
P2-13	DI4	Digital Input Terminal 4 (DI4)	0x0117		•	•	•	•
P2-14	DI5	Digital Input Terminal 5 (DI5)	0x0102		•	•	•	•
P2-15	DI6	Digital Input Terminal 6 (DI6)	0x0022		•	•	•	•
P2-16	DI7	Digital Input Terminal 7 (DI7)	0x0023		•	•	•	•
P2-17	DI8	Digital Input Terminal 8 (DI8)	0x0021		•	•	•	•
P2-18	DO1	Digital Output Terminal 1 (DO1)	0x0101		•	•	•	•
P2-19	DO2	Digital Output Terminal 2 (DO2)	0x0103		•	•	•	•
P2-20	DO3	Digital Output Terminal 3 (DO3)	0x0109		•	•	•	•
P2-21	DO4	Digital Output Terminal 4 (DO4)	0x0105		•	•	•	•
P2-22	DO5	Digital Output Terminal 5 (DO5)	0x0007		•	•	•	•
P2-23	Reserved (Do Not Use)							
P2-24	Reserved (Do Not Use)							
P2-25	NLP	Low-Pass Filter Time Constant (Resonance Suppression)	0.2	0.1 ms	•	•	•	•
P2-26	DST	External Anti-Interference Gain	0	0.001	•	•	•	•
P2-27	GCC	Gain Switching Control Selection	0x0000		•	•	•	•
P2-28	GUT	Gain Switching Time Constant	10	10 ms	•	•	•	•
P2-29	GPE	Gain Switching Condition (pulse/kpps/RPM)	1280000		•	•	•	•
P2-30 ■	INH	Auxiliary Functions	0		•	•	•	•
P2-31	AUT1	Speed Responsiveness Setting of Auto and Semi-Auto Mode	80	Hz	•	•	•	•
P2-32	AUT2	Tuning Mode Selection	0x0000		•	•	•	•
P2-33	AUT3	Semi-Auto Mode Inertia Adjustment Selection	0x0000		•	•	•	•
P2-34	SDEV	Overspeed Warning Condition	5000	RPM			•	
P2-35	PDEV	Excessive deviation Condition	3840000		•	•		
P2-36	Reserved (Do Not Use)							
P2-37	Reserved (Do Not Use)							
P2-38	Reserved (Do Not Use)							

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Parameter	Name	Function	Default	Unit	Control Mode			
					Pt	Pr	S	T
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)	1000	Hz	•	•	•	•
P2-44	DPH1	Notch Filter Attenuation Rate 1 (Resonance Suppression)	0	dB	•	•	•	•
P2-45	NCF2	Notch Filter 2 (Resonance Suppression)	1000	Hz	•	•	•	•
P2-46	DPH2	Notch Filter Attenuation Rate 2 (Resonance Suppression)	0	dB	•	•	•	•
P2-47	ANCF	Auto Resonance Suppression Mode Selection	1		•	•	•	•
P2-48	ANCL	Auto Resonance Suppression Sensitivity Setting	100		•	•	•	•
P2-49	SJIT	Speed Detection Filter and Jitter Suppression	0x000B	s	•	•	•	•
P2-50	DCLR	Pulse Deviation Clear Mode	0x0000		•	•		
P2-51	Reserved (Do Not Use)							
P2-52	Reserved (Do Not Use)							
P2-53	KPI	Position Integral Compensation	0	rad/s	•	•	•	•
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)	128		•			
P2-61	GR5	Electronic Gear Ratio (3rd Numerator) (N3)	128		•			
P2-62	GR6	Electronic Gear Ratio (3rd Numerator) (N4)	128		•			
P2-63	Reserved (Do Not Use)							
P2-64	Reserved (Do Not Use)							
P2-65	GBIT	Special Function 1	0x0000		•	•	•	
P2-66	GBIT2	Special Function 2	0x0000		•	•	•	•
P2-67	JSL	Inertia Estimation Detection Level	1.5		•	•	•	•
P2-68 ●	AEAL	Auto Enable / Auto Limit	0x0000		•	•	•	•

Symbols Explanation of symbols

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10.3.1.4 Group 3: Communication Parameters

Parameter	Name	Function	Default	Unit	Control Mode			
					Pt	Pr	S	T
P3-00 ●	ADR	MODBUS Communication Address Setting	127		•	•	•	•
P3-01	BRT	Transmission Speed	0x0103	baud	•	•	•	•
P3-02	PTL	Communication Protocol	0x0006		•	•	•	•
P3-03	FLT	Transmission Error Handling	0x0000		•	•	•	•
P3-04	CWD	Communication Timeout Detection	0	s	•	•	•	•
P3-05	CMM	CANopen Communication Address Setting	0x0000		•	•	•	•
P3-06 ■	SDI	Digital Input Communication Function	0x0000		•	•	•	•
P3-07	CDT	Communication Response Delay Time	0	0.5 ms	•	•	•	•
P3-08	Reserved (Do Not Use)							
P3-09 ▲	SYC	CANopen Slave and Master Synchronization Signal Setting	0x5055					
P3-10	PLCEN	PLCopen mode selection	0x0000					
P3-11 * ■	PLCTX1	driveInput	0x0000					
P3-12 * ■	PLCTX2	driveModeCtrl	0x0000					
P3-13 * ■	PLCTX3	refA16	0x0000					
P3-14 * ■	PLCTX4	refB32	0x0000					
P3-15 ■	PLCRX1	driveStat	0x0000					
P3-16 ■	PLCRX2	mfStat	0					
P3-17 ■	PLCRX3	motionStat	0					
P3-18	PEVM1	PDO1 Event Mask	0x0001					
P3-19	PEVM2	PDO2 Event Mask	0x0001					
P3-20	PEVM3	PDO3 Event Mask	0x0001					
P3-21	PEVM4	PDO4 Event Mask	0x000F					

Symbols Explanation of symbols

(*) Read-only register.

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10.3.1.5 Group 4: Diagnosis Parameters

Parameter	Name	Function	Default	Unit	Control Mode			
					Pt	Pr	S	T
P4-00 ■	ASH1	Alarm Message (N)	0x00000000		•	•	•	•
P4-01 * ■	ASH2	Alarm Message (N-1)	0x00000000		•	•	•	•
P4-02 * ■	ASH3	Alarm Message (N-2)	0x00000000		•	•	•	•
P4-03 * ■	ASH4	Alarm Message (N-3)	0x00000000		•	•	•	•
P4-04 * ■	ASH5	Alarm Message (N-4)	0x00000000		•	•	•	•
P4-05	JOG	JOG Operation Speed	20	RPM	•	•	•	•
P4-06 ■	FOT	Force Output Control	0x0000		•	•	•	•
P4-07 ■	ITST	Input Status or Force Input Control	0x0000		•	•	•	•
P4-08 * ■	PKEY	Integrated HMI Keypad Input of Servo Drive	0x0000		•	•	•	•
P4-09 * ■	MOT	Output Status Display	0x0000		•	•	•	•
P4-10 ▲ ■	CEN	Adjustment Function	0		•	•	•	•
P4-11	SOF1	Analog Speed Input Drift Adjustment 1	16352		•	•	•	•
P4-12	SOF2	Analog Speed Input Drift Adjustment 2	16352		•	•	•	•
P4-13	TOF1	Analog Torque Drift Adjustment 1	16352		•	•	•	•
P4-14	TOF2	Analog Torque Drift Adjustment 2	16352		•	•	•	•
P4-15	COF1	Current Detector Drift Adjustment (V1 phase)	16352		•	•	•	•
P4-16	COF2	Current Detector Drift Adjustment (V2 phase)	16352		•	•	•	•
P4-17	COF3	Current Detector Drift Adjustment (W1 phase)	16352		•	•	•	•
P4-18	COF4	Current Detector Drift Adjustment (W2 phase)	16352		•	•	•	•
P4-19	TIGB	IGBT NTC Calibration	2		•	•	•	•
P4-20	DOF1	Analog Monitor Output Drift Adjustment (CH1)	0	mV	•	•	•	•
P4-21	DOF2	Analog Monitor Output Drift Adjustment (CH2)	0	mV	•	•	•	•
P4-22	SAO	Analog Speed Input Offset	0	mV			•	
P4-23	TAO	Analog Torque Input Offset	0	mV				•
P4-24	LVL	Low Voltage Alarm Detection Level	160	V	•	•	•	•

Symbols Explanation of symbols

(*) Read-only register.

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10.3.1.6 Group 5: Motion Control Parameters

Parameter	Name	Function	Default	Unit	Control Mode			
					Pt	Pr	S	T
P5-00	Reserved (Do Not Use)							
P5-01	Reserved (Do Not Use)							
P5-02	Reserved (Do Not Use)							
P5-03	PDEC	Event Deceleration Time Selection	0xE0EFEEFF		•	•	•	•
P5-04	HMOV	Homing Mode	0x0000			•		
P5-05	HSPD1	1st Speed Setting of High Speed Homing	100.0	0.1 RPM	•	•	•	•
P5-06	HSPD2	2nd Speed Setting of High Speed Homing	20.0	0.1 RPM	•	•	•	•
P5-07 ■	PRCM	Trigger Position Command (Pr Mode Only)	0			•		
P5-08	SWLP	Forward Software Limit (PUU - Pulse for User Unit)	2147483647			•		
P5-09	SWLN	Reverse Software Limit (PUU - Pulse for User Unit)	-2147483648			•		
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	Data Not Retained Setting (for P6-02 ... P6-05)	0x0000		•	•	•	•
P5-16 ■	AXEN	Motor Encoder Feedback Counter (from CN2 Terminal)	0		•	•	•	•
P5-17	Reserved (Do Not Use)							
P5-18	AXPC	Pulse Command Feedback Counter (from CN1 Terminal)	0		•	•	•	•
P5-19	Reserved (Do Not Use)							
P5-20	AC0	Acceleration / Deceleration Time 0	200	ms		•		
P5-21	AC1	Acceleration / Deceleration Time 1	300	ms		•		
P5-22	AC2	Acceleration / Deceleration Time 1	500	ms		•		
P5-23	AC3	Acceleration / Deceleration Time 3	600	ms		•		
P5-24	AC4	Acceleration / Deceleration Time 4	800	ms		•		
P5-25	AC5	Acceleration / Deceleration Time 5	900	ms		•		
P5-26	AC6	Acceleration / Deceleration Time 6	1000	ms		•		
P5-27	AC7	Acceleration / Deceleration Time 7	1200	ms		•		
P5-28	AC8	Acceleration / Deceleration Time 8	1500	ms		•		
P5-29	AC9	Acceleration / Deceleration Time 9	2000	ms		•		
P5-30	AC10	Acceleration / Deceleration Time 10	2500	ms		•		
P5-31	AC11	Acceleration / Deceleration Time 11	3000	ms		•		
P5-32	AC12	Acceleration / Deceleration Time 12	5000	ms		•		
P5-33	AC13	Acceleration / Deceleration Time 13	8000	ms		•		
P5-34	AC14	Acceleration / Deceleration Time 14	50	ms		•		
P5-35	AC15	Acceleration / Deceleration Time 15	30	ms		•		
P5-36	Reserved (Do Not Use)							

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Parameter	Name	Function	Default	Unit	Control Mode			
					Pt	Pr	S	T
P5-37 * ■	CAAX	CAPTURE Position	0		•	•	•	•
P5-38 ■	CANO	CAPTURE Amount	0		•	•	•	•
P5-39 ■	CACT	CAPTURE Enable Control	0x0000		•	•	•	•
P5-40	DLY0	Delay Time 0	0	ms		•		
P5-41	DLY1	Delay Time 1	100	ms		•		
P5-42	DLY2	Delay Time 2	200	ms		•		
P5-43	DLY3	Delay Time 3	400	ms		•		
P5-44	DLY4	Delay Time 4	500	ms		•		
P5-45	DLY5	Delay Time 5	800	ms		•		
P5-46	DLY6	Delay Time 6	1000	ms		•		
P5-47	DLY7	Delay Time 7	1500	ms		•		
P5-48	DLY8	Delay Time 8	2000	ms		•		
P5-49	DLY9	Delay Time 9	2500	ms		•		
P5-50	DLY10	Delay Time 10	3000	ms		•		
P5-51	DLY11	Delay Time 11	3500	ms		•		
P5-52	DLY12	Delay Time 12	4000	ms		•		
P5-53	DLY13	Delay Time 13	4500	ms		•		
P5-54	DLY14	Delay Time 14	5000	ms		•		
P5-55	DLY15	Delay Time 15	5500	ms		•		
P5-56	Reserved (Do Not Use)							
P5-57	Reserved (Do Not Use)							
P5-58	Reserved (Do Not Use)							
P5-59	Reserved (Do Not Use)							
P5-60	POV0	Moving Speed Setting of Position 0	20.0	0.1 RPM		•		
P5-61	POV1	Moving Speed Setting of Position 1	50.0	0.1 RPM		•		
P5-62	POV2	Moving Speed Setting of Position 2	100.0	0.1 RPM		•		
P5-63	POV3	Moving Speed Setting of Position 3	200.0	0.1 RPM		•		
P5-64	POV4	Moving Speed Setting of Position 4	300.0	0.1 RPM		•		
P5-65	POV5	Moving Speed Setting of Position 5	500.0	0.1 RPM		•		
P5-66	POV6	Moving Speed Setting of Position 6	600.0	0.1 RPM		•		
P5-67	POV7	Moving Speed Setting of Position 7	800.0	0.1 RPM		•		
P5-68	POV8	Moving Speed Setting of Position 8	1000.0	0.1 RPM		•		
P5-69	POV9	Moving Speed Setting of Position 9	1300.0	0.1 RPM		•		
P5-70	POV10	Moving Speed Setting of Position 10	1500.0	0.1 RPM		•		
P5-71	POV11	Moving Speed Setting of Position 11	1800.0	0.1 RPM		•		
P5-72	POV12	Moving Speed Setting of Position 12	2000.0	0.1 RPM		•		
P5-73	POV13	Moving Speed Setting of Position 13	2300.0	0.1 RPM		•		
P5-74	POV14	Moving Speed Setting of Position 14	2500.0	0.1 RPM		•		
P5-75	POV15	Moving Speed Setting of Position 15	3000.0	0.1 RPM		•		
P5-76	CPRS	Capture 1st Position Reset Data	16000		•	•	•	•

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Symbols Explanation of symbols

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

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10.3.1.7 Group 6: Pr Path Definition Parameters

Parameter	Name	Function	Default	Unit	Control Mode			
					Pt	Pr	S	T
P6-00	ODEF	Homing Definition	0x00000000			•		
P6-01	ODAT	Homing Definition Value	0			•		
P6-02	PDEF1	PATH#1 Definition	0x00000000			•		
P6-03	PDAT1	PATH#1 Data	0			•		
P6-04	PDEF2	PATH#2 Definition	0x00000000			•		
P6-05	PDAT2	PATH#2 Data	0			•		
P6-06	PDEF3	PATH#3 Definition	0x00000000			•		
P6-07	PDAT3	PATH#3 Data	0			•		
P6-08	PDEF4	PATH#4 Definition	0x00000000			•		
P6-09	PDAT4	PATH#4 Data	0			•		
P6-10	PDEF5	PATH#5 Definition	0x00000000			•		
P6-11	PDAT5	PATH#5 Data	0			•		
P6-12	PDEF6	PATH#6 Definition	0x00000000			•		
P6-13	PDAT6	PATH#6 Data	0			•		
P6-14	PDEF7	PATH#7 Definition	0x00000000			•		
P6-15	PDAT7	PATH#7 Data	0			•		
P6-16	PDEF8	PATH#8 Definition	0x00000000			•		
P6-17	PDAT8	PATH#8 Data	0			•		

Symbols Explanation of symbols

(*) Read-only register.

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

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10.3.2 Parameters Listed by Function

10.3.2.1 Monitor and General Use

Parameter	Name	Function	Default	Unit	Control Mode			
					Pt	Pr	S	T
P0-00 *	VER	Firmware Version	0x1006		•	•	•	•
P0-01 ■	ALE	Drive Alarm Code	0x0000		•	•	•	•
P0-02	STS	Drive Status	1		•	•	•	•
P0-03	MON	Analog Monitor Output	0x0000		•	•	•	•
P0-08 *	TSON	Servo Operating Hour Meter	0	h	•	•	•	•
P0-09 * ■	CM1	Status Monitor 1	0		•	•	•	•
P0-10 * ■	CM2	Status Monitor 2	0		•	•	•	•
P0-11 * ■	CM3	Status Monitor 3	0		•	•	•	•
P0-12 * ■	CM4	Status Monitor 4	0		•	•	•	•
P0-13 * ■	CM5	Status Monitor 5	0		•	•	•	•
P0-17	CM1A	Display Status Monitor 1	0		•	•	•	•
P0-18	CM2A	Display Status Monitor 2	0		•	•	•	•
P0-19	CM3A	Display Status Monitor 3	0		•	•	•	•
P0-20	CM4A	Display Status Monitor 4	0		•	•	•	•
P0-21	CM5A	Display Status Monitor 5	0		•	•	•	•
P0-25 ■	MAP1	Paramenter Mapping 1	0x00000000		•	•	•	•
P0-26 ■	MAP2	Paramenter Mapping 2	0x00000000		•	•	•	•
P0-27 ■	MAP3	Paramenter Mapping 3	0x00000000		•	•	•	•
P0-28 ■	MAP4	Paramenter Mapping 4	0x00000000		•	•	•	•
P0-29 ■	MAP5	Paramenter Mapping 5	0x00000000		•	•	•	•
P0-30 ■	MAP6	Paramenter Mapping 6	0x00000000		•	•	•	•
P0-31 ■	MAP7	Paramenter Mapping 7	0x00000000		•	•	•	•
P0-32 ■	MAP8	Paramenter Mapping 8	0x00000000		•	•	•	•
P0-35	MAP1A	Block Data Read / Write Register 1 (for P0-25)	0x00000000		•	•	•	•
P0-36	MAP2A	Block Data Read / Write Register 2 (for P0-26)	0x00000000		•	•	•	•
P0-37	MAP3A	Block Data Read / Write Register 3 (for P0-27)	0x00000000		•	•	•	•
P0-38	MAP4A	Block Data Read / Write Register 4 (for P0-28)	0x00000000		•	•	•	•
P0-39	MAP5A	Block Data Read / Write Register 5 (for P0-29)	0x00000000		•	•	•	•
P0-40	MAP6A	Block Data Read / Write Register 6 (for P0-30)	0x00000000		•	•	•	•
P0-41	MAP7A	Block Data Read / Write Register 7 (for P0-31)	0x00000000		•	•	•	•
P0-42	MAP8A	Block Data Read / Write Register 8 (for P0-32)	0x00000000		•	•	•	•
P0-46 * ■	SVSTS	Servo Output Status Display	0x0000		•	•	•	•
P1-04	MON1	Analog Monitor Output Proportion 1 (MON1) (100% for full scale)	100	%	•	•	•	•
P1-05	MON2	Analog Monitor Output Proportion 2 (MON2) (100% for full scale)	100	%	•	•	•	•

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Symbols Explanation of symbols

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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.

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10.3.2.2 Smooth Filter and Resonance Suppression

Parameter	Name	Function	Default	Unit	Control Mode			
					Pt	Pr	S	T
P1-06	SFLT	Acceleration / Deceleration Smoothing Constant of Analog Speed Command (Low-pass Filter)	0	ms			•	
P1-07	TFLT	Smoothing Constant of Analog Torque Command (Low-pass Filter)	0	ms				•
P1-08	PFLT	Smoothing Constant of Position Command (Low-pass Filter)	0	10 ms	•	•		
P1-25	VSF1	Vibration Suppression Frequency 1	1000	Hz	•	•		
P1-26	VSG1	Vibration Suppression Gain 1	0		•	•		
P1-27	VSF2	Vibration Suppression Frequency 2	1000	Hz	•	•		
P1-28	VSG2	Vibration Suppression Gain 2	0		•	•		
P1-29	AVSM	Auto Vibration Suppression Mode Selection	0		•	•		
P1-30	VCL	Low-Frequency Vibration Detection Level	500		•	•		
P1-34	TACC	Acceleration Time	200	ms			•	
P1-35	TDEC	Deceleration Time	200	ms			•	
P1-36	TSL	Acceleration / Deceleration S-curve	0	ms		•	•	
P1-59	MFLT	Analog Speed Linear Filter	0.0	0.1 ms			•	
P1-62	FRCL	Friction Compensation Percentage	0	%	•	•	•	
P1-63	FRCT	Friction Compensation Smoothing Constant	1		•	•	•	•
P1-68	PFLT2	Position Command Moving Filter	4	ms	•	•		
P2-25	NLP	Low-Pass Filter Time Constant (Resonance Suppression)	0.2	0.1 ms	•	•	•	•
P2-33	AUT3	Semi-Auto Mode Inertia Adjustment Selection	0x0000		•	•	•	•
P2-43	NCF1	Notch Filter 1 (Resonance Suppression)	1000	Hz	•	•	•	•
P2-44	DPH1	Notch Filter Attenuation Rate 1 (Resonance Suppression)	0	dB	•	•	•	•
P2-45	NCF2	Notch Filter 2 (Resonance Suppression)	1000	Hz	•	•	•	•
P2-46	DPH2	Notch Filter Attenuation Rate 2 (Resonance Suppression)	0	dB	•	•	•	•
P2-47	ANCF	Auto Resonance Suppression Mode Selection	1		•	•	•	•
P2-48	ANCL	Auto Resonance Suppression Sensitivity Setting	100		•	•	•	•
P2-49	SJIT	Speed Detection Filter and Jitter Suppression	0x000B	s	•	•	•	•

Symbols Explanation of symbols

(*) Read-only register.

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

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10.3.2.3 Gain and Switch

Parameter	Name	Function	Default	Unit	Control Mode			
					Pt	Pr	S	T
P2-00	KPP	Proportional Position Loop Gain	35	rad/s	•	•		
P2-01	PPR	Position Loop Gain Switching Rate	100	%	•	•		
P2-02	PFG	Position Feed Forward Gain	50	%	•	•		
P2-03	PFF	Smooth Constant of Position Feed Forward Gain	5	ms	•	•		
P2-04	KVP	Proportional Speed Loop Gain	500	rad/s	•	•	•	•
P2-05	SPR	Speed Loop Gain Switching Rate	100	%	•	•	•	•
P2-06	KVI	Speed Integral Compensation	100	rad/s	•	•	•	•
P2-07	KVF	Speed Feed Forward Gain	0	%	•	•	•	•
P2-26	DST	External Anti-Interference Gain	0	0.001	•	•	•	•
P2-27	GCC	Gain Switching Control Selection	0x0000		•	•	•	•
P2-28	GUT	Gain Switching Time Constant	10	10 ms	•	•	•	•
P2-29	GPE	Gain Switching Condition (pulse/kpps/RPM)	1280000		•	•	•	•
P2-31	AUT1	Speed Responsiveness Setting of Auto and Semi-Auto Mode	80	Hz	•	•	•	•
P2-32	AUT2	Tuning Mode Selection	0x0000		•	•	•	•

Symbols Explanation of symbols

(*) 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.

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10.3.2.4 Position Control

Parameter	Name	Function	Default	Unit	Control Mode			
					Pt	Pr	S	T
P1-01 ●	CTL	Control Mode and Output Direction	0x0000		•	•	•	•
P1-02 ▲	PSTL	Speed and Torque Limit Setting	0x0000		•	•	•	•
P1-12	TQ1	1st Torque Command/ Limit	100	%	•	•	•	•
P1-13	TQ2	2nd Torque Command/ Limit	100	%	•	•	•	•
P1-14	TQ3	3rd Torque Command/ Limit	100	%	•	•	•	•
P1-46 ▲	GR3	Encoder Output Pulse Number	2500		•	•	•	•
P1-55	MSPD	Maximum Speed Limit	6001	RPM	•	•	•	•
P2-50	DCLR	Pulse Deviation Clear Mode	0x0000		•	•		

External Pulse Control Command (Pt mode)

Parameter	Name	Function	Default	Unit	Control Mode			
					Pt	Pr	S	T
P1-00 ▲	PTT	External Pulse Input Type	0x0002		•			
P1-44	GR1	Electronic Gear Ratio (1st Numerator) (N1)	128		•	•		
P1-45 ▲	GR2	Electronic Gear Ratio (Denominator) (M)	10		•	•		
P2-60	GR4	Electronic Gear Ratio (2nd Numerator) (N2)	128		•			
P2-61	GR5	Electronic Gear Ratio (3rd Numerator) (N3)	128		•			
P2-62	GR6	Electronic Gear Ratio (3rd Numerator) (N4)	128		•			

Internal Pulse Control Command (Pr mode)

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Parameter	Name	Function	Default	Unit	Control Mode			
					Pt	Pr	S	T
P2-02	PFG	Position Feed Forward Gain	50	%	•	•		
P2-03	PFF	Smooth Constant of Position Feed Forward Gain	5	ms	•	•		
P2-04	KVP	Proportional Speed Loop Gain	500	rad/s	•	•	•	•
P2-05	SPR	Speed Loop Gain Switching Rate	100	%	•	•	•	•
P2-06	KVI	Speed Integral Compensation	100	rad/s	•	•	•	•
P2-07	KVF	Speed Feed Forward Gain	0	%	•	•	•	•
P2-08 ■	PCTL	Special Factory Setting	0		•	•	•	•
P2-09	DRT	Bounce Filter	2	2 ms	•	•	•	•
P2-10	DI1	Digital Input Terminal 1 (DI1)	0x0101		•	•	•	•
P2-11	DI2	Digital Input Terminal 2 (DI2)	0x0104		•	•	•	•
P2-12	DI3	Digital Input Terminal 3 (DI3)	0x0116		•	•	•	•
P2-13	DI4	Digital Input Terminal 4 (DI4)	0x0117		•	•	•	•
P2-14	DI5	Digital Input Terminal 5 (DI5)	0x0102		•	•	•	•
P2-15	DI6	Digital Input Terminal 6 (DI6)	0x0022		•	•	•	•
P2-16	DI7	Digital Input Terminal 7 (DI7)	0x0023		•	•	•	•
P2-17	DI8	Digital Input Terminal 8 (DI8)	0x0021		•	•	•	•
P5-03	PDEC	Event Deceleration Time Selection	0xE0EFEEFF		•	•	•	•
P5-04	HMOV	Homing Mode	0x0000			•		
P5-05	HSPD1	1st Speed Setting of High Speed Homing	100.0	0.1 RPM	•	•	•	•
P5-06	HSPD2	2nd Speed Setting of High Speed Homing	20.0	0.1 RPM	•	•	•	•
P5-07 ■	PRCM	Trigger Position Command (Pr Mode Only)	0			•		
P5-08	SWLP	Forward Software Limit (PUU - Pulse for User Unit)	2147483647			•		
P5-09	SWLN	Reverse Software Limit (PUU - Pulse for User Unit)	-2147483648			•		
P5-15 ■	PMEM	Data Not Retained Setting (for P6-02 ... P6-05)	0x0000		•	•	•	•
P5-16 ■	AXEN	Motor Encoder Feedback Counter (from CN2 Terminal)	0		•	•	•	•
P5-18	AXPC	Pulse Command Feedback Counter (from CN1 Terminal)	0		•	•	•	•
P5-20	AC0	Acceleration / Deceleration Time 0	200	ms		•		
P5-21	AC1	Acceleration / Deceleration Time 1	300	ms		•		
P5-22	AC2	Acceleration / Deceleration Time 1	500	ms		•		
P5-23	AC3	Acceleration / Deceleration Time 3	600	ms		•		
P5-24	AC4	Acceleration / Deceleration Time 4	800	ms		•		
P5-25	AC5	Acceleration / Deceleration Time 5	900	ms		•		
P5-26	AC6	Acceleration / Deceleration Time 6	1000	ms		•		
P5-27	AC7	Acceleration / Deceleration Time 7	1200	ms		•		
P5-28	AC8	Acceleration / Deceleration Time 8	1500	ms		•		
P5-29	AC9	Acceleration / Deceleration Time 9	2000	ms		•		
P5-30	AC10	Acceleration / Deceleration Time 10	2500	ms		•		

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Parameter	Name	Function	Default	Unit	Control Mode			
					Pt	Pr	S	T
P5-31	AC11	Acceleration / Deceleration Time 11	3000	ms		•		
P5-32	AC12	Acceleration / Deceleration Time 12	5000	ms		•		
P5-33	AC13	Acceleration / Deceleration Time 13	8000	ms		•		
P5-34	AC14	Acceleration / Deceleration Time 14	50	ms		•		
P5-35	AC15	Acceleration / Deceleration Time 15	30	ms		•		
P5-40	DLY0	Delay Time 0	0	ms		•		
P5-41	DLY1	Delay Time 1	100	ms		•		
P5-42	DLY2	Delay Time 2	200	ms		•		
P5-43	DLY3	Delay Time 3	400	ms		•		
P5-44	DLY4	Delay Time 4	500	ms		•		
P5-45	DLY5	Delay Time 5	800	ms		•		
P5-46	DLY6	Delay Time 6	1000	ms		•		
P5-47	DLY7	Delay Time 7	1500	ms		•		
P5-48	DLY8	Delay Time 8	2000	ms		•		
P5-49	DLY9	Delay Time 9	2500	ms		•		
P5-50	DLY10	Delay Time 10	3000	ms		•		
P5-51	DLY11	Delay Time 11	3500	ms		•		
P5-52	DLY12	Delay Time 12	4000	ms		•		
P5-53	DLY13	Delay Time 13	4500	ms		•		
P5-54	DLY14	Delay Time 14	5000	ms		•		
P5-55	DLY15	Delay Time 15	5500	ms		•		

Symbols Explanation of symbols

(*) 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.

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10.3.2.5 Speed Control

Parameter	Name	Function	Default	Unit	Control Mode			
					Pt	Pr	S	T
P1-01 ●	CTL	Control Mode and Output Direction	0x0000		•	•	•	•
P1-02 ▲	PSTL	Speed and Torque Limit Setting	0x0000		•	•	•	•
P1-09	SP1	1st Speed Command/ Limit	1000	0.1 RPM			•	•
P1-10	SP2	2nd Speed Command/ Limit	2000	0.1 RPM			•	•
P1-11	SP3	3rd Speed Command/ Limit	3000	0.1 RPM			•	•
P1-12	TQ1	1st Torque Command/ Limit	100	%	•	•	•	•
P1-13	TQ2	2nd Torque Command/ Limit	100	%	•	•	•	•
P1-14	TQ3	3rd Torque Command/ Limit	100	%	•	•	•	•
P1-40	VCM	Max. Analog Speed Command / Limit	10001	RPM			•	•
P1-41 ▲	TCM	Max. Analog Torque Command / Limit	100	%	•	•	•	•
P1-46 ▲	GR3	Encoder Output Pulse Number	2500		•	•	•	•
P1-55	MSPD	Maximum Speed Limit	6001	RPM	•	•	•	•
P1-76 ▲	AMSPD	Max. Rotation Speed of Encoder Output	5500	RPM	•	•	•	•

Symbols Explanation of symbols

(*) 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.

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10.3.2.6 Torque Control

Parameter	Name	Function	Default	Unit	Control Mode			
					Pt	Pr	S	T
P1-01 ●	CTL	Control Mode and Output Direction	0x0000		•	•	•	•
P1-02 ▲	PSTL	Speed and Torque Limit Setting	0x0000		•	•	•	•
P1-09	SP1	1st Speed Command/ Limit	1000	0.1 RPM			•	•
P1-10	SP2	2nd Speed Command/ Limit	2000	0.1 RPM			•	•
P1-11	SP3	3rd Speed Command/ Limit	3000	0.1 RPM			•	•
P1-12	TQ1	1st Torque Command/ Limit	100	%	•	•	•	•
P1-13	TQ2	2nd Torque Command/ Limit	100	%	•	•	•	•
P1-14	TQ3	3rd Torque Command/ Limit	100	%	•	•	•	•
P1-40	VCM	Max. Analog Speed Command / Limit	10001	RPM			•	•
P1-41 ▲	TCM	Max. Analog Torque Command / Limit	100	%	•	•	•	•
P1-46 ▲	GR3	Encoder Output Pulse Number	2500		•	•	•	•
P1-55	MSPD	Maximum Speed Limit	6001	RPM	•	•	•	•

Symbols 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.

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10.3.2.7 Digital I/O and Relative Input Output Setting

Parameter	Name	Function	Default	Unit	Control Mode			
					Pt	Pr	S	T
P1-38	ZSPD	Zero Speed Range Setting	10.0	0.1 RPM	•	•	•	•
P1-39	SSPD	Target Rotation Speed	3000	RPM	•	•	•	•
P1-42	MBT1	ON Delay Time of Holding Brake	0	ms	•	•	•	•
P1-43	MBT2	OFF Delay Time of Holding Brake	0	ms	•	•	•	•
P1-47	SPOK	Speed Reached Output Range	10				•	
P1-54	PER	Positioning Completed Width	12800		•	•		
P1-56	OVW	Output Overload Warning	120	%	•	•	•	•
P2-09	DRT	Bounce Filter	2	2 ms	•	•	•	•
P2-10	DI1	Digital Input Terminal 1 (DI1)	0x0101		•	•	•	•
P2-11	DI2	Digital Input Terminal 2 (DI2)	0x0104		•	•	•	•
P2-12	DI3	Digital Input Terminal 3 (DI3)	0x0116		•	•	•	•
P2-13	DI4	Digital Input Terminal 4 (DI4)	0x0117		•	•	•	•
P2-14	DI5	Digital Input Terminal 5 (DI5)	0x0102		•	•	•	•
P2-15	DI6	Digital Input Terminal 6 (DI6)	0x0022		•	•	•	•
P2-16	DI7	Digital Input Terminal 7 (DI7)	0x0023		•	•	•	•
P2-17	DI8	Digital Input Terminal 8 (DI8)	0x0021		•	•	•	•
P2-18	DO1	Digital Output Terminal 1 (DO1)	0x0101		•	•	•	•
P2-19	DO2	Digital Output Terminal 2 (DO2)	0x0103		•	•	•	•
P2-20	DO3	Digital Output Terminal 3 (DO3)	0x0109		•	•	•	•
P2-21	DO4	Digital Output Terminal 4 (DO4)	0x0105		•	•	•	•
P2-22	DO5	Digital Output Terminal 5 (DO5)	0x0007		•	•	•	•

Symbols Explanation of symbols

(*) Read-only register.

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10.3.2.8 Communication

Parameter	Name	Function	Default	Unit	Control Mode			
					Pt	Pr	S	T
P3-00 ●	ADR	MODBUS Communication Address Setting	127		•	•	•	•
P3-01	BRT	Transmission Speed	0x0103	baud	•	•	•	•
P3-02	PTL	Communication Protocol	0x0006		•	•	•	•
P3-03	FLT	Transmission Error Handling	0x0000		•	•	•	•
P3-04	CWD	Communication Timeout Detection	0	s	•	•	•	•
P3-05	CMM	CANopen Communication Address Setting	0x0000		•	•	•	•
P3-06 ■	SDI	Digital Input Communication Function	0x0000		•	•	•	•
P3-07	CDT	Communication Response Delay Time	0	0.5 ms	•	•	•	•
P3-09 ▲	SYC	CANopen Slave and Master Synchronization Signal Setting	0x5055					
P3-10	PLCEN	PLCopen mode selection	0x0000					
P3-11 * ■	PLCTX1	driveInput	0x0000					
P3-12 * ■	PLCTX2	driveModeCtrl	0x0000					
P3-13 * ■	PLCTX3	refA16	0x0000					
P3-14 * ■	PLCTX4	refB32	0x0000					
P3-15 ■	PLCRX1	driveStat	0x0000					
P3-16 ■	PLCRX2	mfStat	0					
P3-17 ■	PLCRX3	motionStat	0					

Symbols Explanation of symbols

(*) Read-only register.

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10.3.2.9 Diagnosis

Parameter	Name	Function	Default	Unit	Control Mode			
					Pt	Pr	S	T
P4-00 ■	ASH1	Alarm Message (N)	0x00000000		•	•	•	•
P4-01 * ■	ASH2	Alarm Message (N-1)	0x00000000		•	•	•	•
P4-02 * ■	ASH3	Alarm Message (N-2)	0x00000000		•	•	•	•
P4-03 * ■	ASH4	Alarm Message (N-3)	0x00000000		•	•	•	•
P4-04 * ■	ASH5	Alarm Message (N-4)	0x00000000		•	•	•	•
P4-05	JOG	JOG Operation Speed	20	RPM	•	•	•	•
P4-06 ■	FOT	Force Output Control	0x0000		•	•	•	•
P4-07 ■	ITST	Input Status or Force Input Control	0x0000		•	•	•	•
P4-08 * ■	PKEY	Integrated HMI Keypad Input of Servo Drive	0x0000		•	•	•	•
P4-09 * ■	MOT	Output Status Display	0x0000		•	•	•	•
P4-10 ▲ ■	CEN	Adjustment Function	0		•	•	•	•
P4-11	SOF1	Analog Speed Input Drift Adjustment 1	16352		•	•	•	•
P4-12	SOF2	Analog Speed Input Drift Adjustment 2	16352		•	•	•	•
P4-13	TOF1	Analog Torque Drift Adjustment 1	16352		•	•	•	•
P4-14	TOF2	Analog Torque Drift Adjustment 2	16352		•	•	•	•
P4-15	COF1	Current Detector Drift Adjustment (V1 phase)	16352		•	•	•	•
P4-16	COF2	Current Detector Drift Adjustment (V2 phase)	16352		•	•	•	•
P4-17	COF3	Current Detector Drift Adjustment (W1 phase)	16352		•	•	•	•
P4-18	COF4	Current Detector Drift Adjustment (W2 phase)	16352		•	•	•	•
P4-19	TIGB	IGBT NTC Calibration	2		•	•	•	•
P4-20	DOF1	Analog Monitor Output Drift Adjustment (CH1)	0	mV	•	•	•	•
P4-21	DOF2	Analog Monitor Output Drift Adjustment (CH2)	0	mV	•	•	•	•
P4-22	SAO	Analog Speed Input Offset	0	mV			•	
P4-23	TAO	Analog Torque Input Offset	0	mV				•
P4-24	LVL	Low Voltage Alarm Detection Level	160	V	•	•	•	•

Symbols Explanation of symbols

(*) Read-only register.

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10.4 Detailed Parameter Listings

10.4.1 Group 0: Monitor Parameters

P0-00 * VER	Firmware Version	Address: 0000_h, 0001_h

Default: 0x1006
Applicable control mode: Pt, Pr, S, T
Unit:
Range: 0x1006 ... 0x1006
Data size: 16-bit
Display format: Decimal

P0-01 ■ ALE	Drive Alarm Code	Address: 0002_h, 0003_h

Default: 0x0000
Applicable control mode: Pt, Pr, S, T
Unit:
Range: 0x0000 ... 0xFFFF
Data size: 16-bit
Display format: Hexadecimal

Settings:

This parameter shows the current servo drive alarm if there is an alarm condition.

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

Servo Drive Alarm Codes:

001: Overcurrent

002: Overvoltage

003: Undervoltage (This alarm code shows when main circuit voltage is below its minimum specified value while Servo On, and it will not show while Servo Off. This alarm code can be cleared automatically after the voltage has returned to a permissible value specification.)

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

005: Braking resistor 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

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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 timeout

022: Input power phase missing

023: Pre-overload warning

024: Encoder initial magnetic field error

025: Encoder internal error

026: Encoder data error

027: Encoder reset error

030: Motor monitoring error

031: U, V, W wiring error

040: Full-closed loop excessive deviation

099: DSP firmware upgrade

CANopen Communication Error 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 EEPROM.

129: Error occurs when writing CANopen PDO object into EEPROM.

130: EEPROM invalid address range

131: EEPROM checksum error

180: Life guard error or heart beat error

185: CANbus error

Motion Control Alarm 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.

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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.

283: Forward software limit

285: Reverse software limit

289: Position counter overflow

291: Servo Off error

3E1: CANopen SYNC error

3E2: CANopen SYNC signal error

3E3: CANopen SYNC timeout

3E4: CANopen IP command error

3E5: SYNC period error

380: Position deviation alarm for digital output, MC_OK (see P1-48.)

401: NMT reset or NMT stop is received when drive is enabled.

P0-02 STS	Drive Status	Address: 0004_h, 0005_h

Default: 1
Applicable control mode: Pt, Pr, S, T
Unit:
Range: -300 ... 127
Data size: 16-bit
Display format: Decimal

Settings:

This parameter shows the servo drive status.

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

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

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

03: Motor feedback pulse number (encoder unit, 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]

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10: Torque input command [Volt]

11: Torque input command [%]

12: Average load [%]

13: Peak load [%]

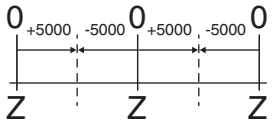
14: Main circuit voltage [Volt]

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 ... +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)

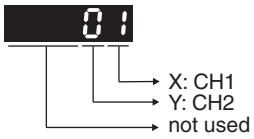
P0-03 MON	Analog Monitor Output	Address: 0006_h, 0007_h

Default: 0x0000
Applicable control mode: Pt, Pr, S, T
Unit:
Range: 0x0000 ... 0x0077
Data size: 16-bit
Display format: Hexadecimal

Settings:

This parameter determines the functions of the analog monitor outputs.

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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

NOTE: For the setting of analog output voltage proportion, see 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.

P0-04 ■	Monitor Variable 1	Address: 0008_h, 0009_h

Default: 0x00000000
Applicable control mode: Pt, Pr, S, T
Unit:
Range: 0x00000000 ... 0x20FFFFFF
Data size:
Display format: Hexadecimal

P0-05 ■	Monitor Variable 2	Address: $000A_h$, $000B_h$

Default: 0x00000000
Applicable control mode: Pt, Pr, S, T
Unit:
Range: 0x00000000 ... 0x20FFFFFF
Data size:
Display format: Hexadecimal

P0-06 ■	Monitor Variable 3	Address: $000C_h$, $000D_h$

Default: 0x00000000
Applicable control mode: Pt, Pr, S, T
Unit:
Range: 0x00000000 ... 0x20FFFFFF
Data size:
Display format: Hexadecimal

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P0-07 ■	Monitor Variable 4	Address: 000E$_h$, 000F$_h$

Default: 0x00000000
Applicable control mode: Pt, Pr, S, T
Unit:
Range: 0x00000000 ... 0x20FFFFFF
Data size:
Display format: Hexadecimal

P0-08 * TSON	Servo Operating Hour Meter	Address: 0010$_h$, 0011$_h$

Default: 0
Applicable control mode: Pt, Pr, S, T
Unit: h
Range: 0 ... 65535
Data size: 16-bit
Display format: Decimal

P0-09 * ■ CM1	Status Monitor 1	Address: 0012$_h$, 0013$_h$

Default: 0
Applicable control mode: Pt, Pr, S, T
Unit:
Range: -2147483648 ... 2147483647
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 via the integrated HMI. The drive status can be read from the communication address of this parameter via communication port.

When reading the drive status via the integrated HMI, 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.

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)

P0-10 * ■ CM2	Status Monitor 2	Address: 0014$_h$, 0015$_h$

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Default: 0
Applicable control mode: Pt, Pr, S, T
Unit:
Range: -2147483648 ... 2147483647
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 via the integrated HMI. The drive status can be read from the communication address of this parameter via communication port.

When reading the drive status via the integrated HMI, 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: 0016_h, 0017_h

Default: 0
Applicable control mode: Pt, Pr, S, T
Unit:
Range: -2147483648 ... 2147483647
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 via the integrated HMI. The drive status can be read from the communication address of this parameter via communication port.

When reading the drive status via the integrated HMI, 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: 0018_h, 0019_h

Default: 0
Applicable control mode: Pt, Pr, S, T
Unit:
Range: -2147483648 ... 2147483647
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 via the integrated HMI. The drive status can be read from the communication address of this parameter via communication port.

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When reading the drive status via the integrated HMI, 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: 001A$_h$, 001B$_h$

Default: 0
Applicable control mode: Pt, Pr, S, T
Unit:
Range: -2147483648 ... 2147483647
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 P0-13 is determined by P0-21 (desired drive status) through communication setting or via the integrated HMI. 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	Display Status Monitor 1	Address: 0022$_h$, 0023$_h$

Default: 0
Applicable control mode: Pt, Pr, S, T
Unit:
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	Display Status Monitor 2	Address: 0024$_h$, 0025$_h$

Default: 0
Applicable control mode: Pt, Pr, S, T

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Unit:
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. See P0-17 for details.

P0-19 CM3A	Display Status Monitor 3	Address: 0026_h, 0027_h

Default: 0
Applicable control mode: Pt, Pr, S, T
Unit:
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. See P0-17 for details.

P0-20 CM4A	Display Status Monitor 4	Address: 0028_h, 0029_h

Default: 0
Applicable control mode: Pt, Pr, S, T
Unit:
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. See P0-17 for details.

P0-21 CM5A	Display Status Monitor 5	Address: $002A_h$, $002B_h$

Default: 0
Applicable control mode: Pt, Pr, S, T
Unit:
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. See P0-17 for details.

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P0-22	Reserved (Do Not Use)

P0-23	Reserved (Do Not Use)

P0-24	Reserved (Do Not Use)

P0-25 ■ MAP1	Paramenter Mapping 1	Address: 0032_h, 0033_h

Default: 0x00000000
Applicable control mode: Pt, Pr, S, T
Unit:
Range: * ... *
Data size: 32-bit
Display format: Hexadecimal

Settings:

The parameters from P0-25 ... P0-32 are used to read and write the values of the parameters those communication addresses are not consecutive. You can set P0-35 ... P0-42 as the required read and write mapping parameter numbers through communication setting or the integrated HMI. 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 vice versa. See P0-35 for details.

P0-26 ■ MAP2	Paramenter Mapping 2	Address: 0034_h, 0035_h

Default: 0x00000000
Applicable control mode: Pt, Pr, S, T
Unit:
Range: * ... *
Data size: 32-bit
Display format: Hexadecimal

Settings:

See P0-25 and P0-36 for details.

P0-27 ■ MAP3	Paramenter Mapping 3	Address: 0036_h, 0037_h

Default: 0x00000000
Applicable control mode: Pt, Pr, S, T
Unit:
Range: * ... *
Data size: 32-bit
Display format: Hexadecimal

Settings:

See P0-25 and P0-37 for details.

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P0-28 ■ MAP4	Paramenter Mapping 4	Address: 0038_h, 0039_h

Default: 0x00000000
Applicable control mode: Pt, Pr, S, T
Unit:
Range: * ... *
Data size: 32-bit
Display format: Hexadecimal

Settings:

See P0-25 and P0-38 for details.

P0-29 ■ MAP5	Paramenter Mapping 5	Address: $003A_h$, $003B_h$

Default: 0x00000000
Applicable control mode: Pt, Pr, S, T
Unit:
Range: * ... *
Data size: 32-bit
Display format: Hexadecimal

Settings:

See P0-25 and P0-39 for details.

P0-30 ■ MAP6	Paramenter Mapping 6	Address: $003C_h$, $003D_h$

Default: 0x00000000
Applicable control mode: Pt, Pr, S, T
Unit:
Range: * ... *
Data size: 32-bit
Display format: Hexadecimal

Settings:

See P0-25 and P0-40 for details.

P0-31 ■ MAP7	Paramenter Mapping 7	Address: $003E_h$, $003F_h$

Default: 0x00000000
Applicable control mode: Pt, Pr, S, T
Unit:
Range: * ... *
Data size: 32-bit
Display format: Hexadecimal

Settings:

See P0-25 and P0-41 for details.

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P0-32 ■ MAP8	Paramenter Mapping 8	Address: 0040_h, 0041_h

Default: 0x00000000
Applicable control mode: Pt, Pr, S, T
Unit:
Range: * ... *
Data size: 32-bit
Display format: Hexadecimal

Settings:

See P0-25 and P0-42 for details.

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: 0046_h, 0047_h

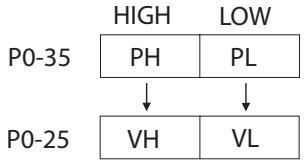
Default: 0x00000000
Applicable control mode: Pt, Pr, S, T
Unit:
Range: 0x00000000 ... 0xFFFFFFFF
Data size: 32-bit
Display format: Hexadecimal

Settings:

The parameters from P0-35 ... P0-42 are used to designate the required read and write parameter numbers for P0-25 ... P0-32, and read and write the values of the parameters whose communication addresses are not consecutive through communication setting or the integrated HMI more efficiently.

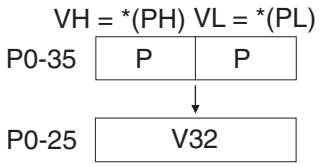
The read / write parameter could be one 32-bit parameter or two 16-bit parameters.

The operation of parameter P0-35 is described as follows:



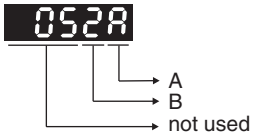
When PH ≠ PL, it indicates that P0-25 includes two 16-bit parameters.

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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 required read and write parameter number is P2-06, set P0-35 to 0206. If the required read and write parameter number is P5-42, set P0-35 to 052A, and vice versa.

If you want to read and write the value of the parameter P1-44 (32-bit parameter) via P0-25, set P0-35 to 0x012C012C through communication setting or via the integrated HMI. The the value of the parameter P1-44 will be displayed by P0-25.

If you 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, set P0-35 to 0x02040202 through communication setting or via the integrated HMI. 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: 0048_h, 0049_h

Default: 0x00000000
Applicable control mode: Pt, Pr, S, T
Unit:
Range: 0x00000000 ... 0xFFFFFFFF
Data size: 32-bit
Display format: Hexadecimal

Settings:

See P0-35 for details.

P0-37 MAP3A	Block Data Read / Write Register 3 (for P0-27)	Address: $004A_h$, $004B_h$

Default: 0x00000000
Applicable control mode: Pt, Pr, S, T

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Unit:
Range: 0x00000000 ... 0xFFFFFFFF
Data size: 32-bit
Display format: Hexadecimal

Settings:

See P0-35 for details.

P0-38 MAP4A	Block Data Read / Write Register 4 (for P0-28)	Address: 004C$_h$, 004D$_h$

Default: 0x00000000
Applicable control mode: Pt, Pr, S, T
Unit:
Range: 0x00000000 ... 0xFFFFFFFF
Data size: 32-bit
Display format: Hexadecimal

Settings:

See P0-35 for details.

P0-39 MAP5A	Block Data Read / Write Register 5 (for P0-29)	Address: 004E$_h$, 004F$_h$

Default: 0x00000000
Applicable control mode: Pt, Pr, S, T
Unit:
Range: 0x00000000 ... 0xFFFFFFFF
Data size: 32-bit
Display format: Hexadecimal

Settings:

See P0-35 for details.

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

Default: 0x00000000
Applicable control mode: Pt, Pr, S, T
Unit:
Range: 0x00000000 ... 0xFFFFFFFF
Data size: 32-bit
Display format: Hexadecimal

Settings:

See P0-35 for details.

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

Default: 0x00000000
Applicable control mode: Pt, Pr, S, T
Unit:
Range: 0x00000000 ... 0xFFFFFFFF

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Data size: 32-bit
Display format: Hexadecimal

Settings:

See P0-35 for details.

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

Default: 0x00000000
Applicable control mode: Pt, Pr, S, T
Unit:
Range: 0x00000000 ... 0xFFFFFFFF
Data size: 32-bit
Display format: Hexadecimal

Settings:

See P0-35 for details.

P0-43	Reserved (Do Not Use)

P0-44	Reserved (Do Not Use)

P0-45	Reserved (Do Not Use)

P0-46 * ■ SVSTS	Servo Output Status Display	Address: $005C_h$, $005D_h$

Default: 0x0000
Applicable control mode: Pt, Pr, S, T
Unit:
Range: 0x0000 ... 0xFFFF
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 (Alarm signal)

Bit7: BRKR (Holding brake control)

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Bit8: HOME (Homing completed)

Bit9: OLW (Output overload warning)

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

Bit11: Reserved

Bit12: Reserved

Bit13: Reserved

Bit14: Reserved

Bit15: Reserved

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

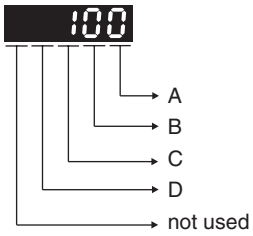
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10.4.2 Group 1: Basic Parameters

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

Default: 0x0002
Applicable control mode: Pt
Unit:
Range: 0x0000 ... 0x1142
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

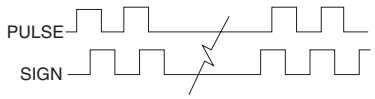
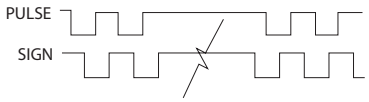
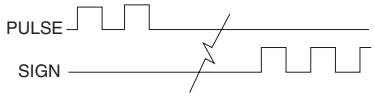
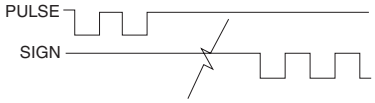
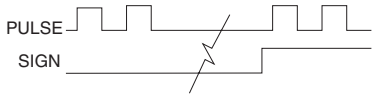
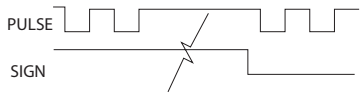
B: Input pulse filter

This setting is used to suppress or reduce the chatter caused by the noise, etc. However, if the instant input pulse filter frequency is excessivley 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

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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

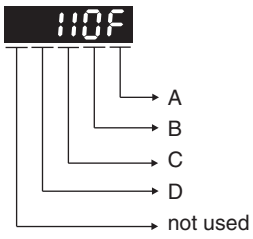
The source of pulse command can also be determined by digital input, PTCMS. When the digital input function is used, the source of pulse command is from digital input.

P1-01 • CTL	Control Mode and Output Direction	Address: 0102_h, 0103_h

Default: 0x0000
Applicable control mode: Pt, Pr, S, T
Unit:
Range: 0x0000 ... 0x110B
Data size: 16-bit
Display format: Hexadecimal

Settings:

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A/B: Control mode settings

	Pt	Pr	S	T	Sz	Tz
Single Mode						
00	x					
01		x				
02			x			
03				x		
04					x	
05						x
Dual Mode						
06	x		x			
07	x			x		
08		x	x			
09		x		x		
0A			x	x		
0B	CANopen Mode					

Pt: Position control mode. The command is from external pulse signal.

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.

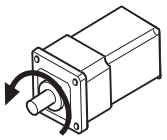
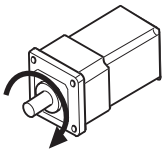
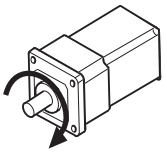
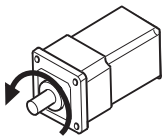
Sz: Zero speed / internal speed command

Tz: Zero torque / internal torque command

Dual Mode: Control of the mode selection is via DI signals.

C: Torque output direction settings

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Direction	0	1
Forward	 P (CCW)	 N (CW)
Reverse	 N (CW)	 P (CCW)

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.

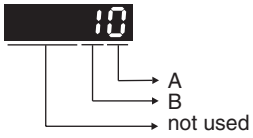
0: When switching to different mode, the setting value of digital inputs/outputs (P2-10 ... P2-22) will remain the same and will not be changed.

P1-02 ▲ PSTL	Speed and Torque Limit Setting	Address: 0104_h, 0105_h

Default: 0x0000
Applicable control mode: Pt, Pr, S, T
Unit:
Range: 0x0000 ... 0x0011
Data size: 16-bit
Display format: Hexadecimal

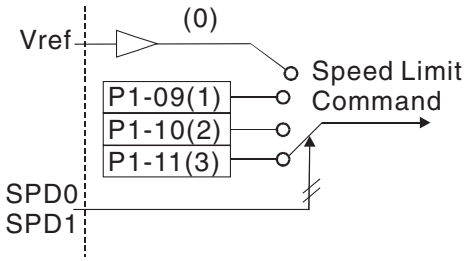
Settings:

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. You can also use DI signals, SPDLM and TRQLM to enable the speed and torque limit functions. The DI signals SPD0, SPD1, TCM0, and TCM1 are used to select the command source of the speed and torque limit.

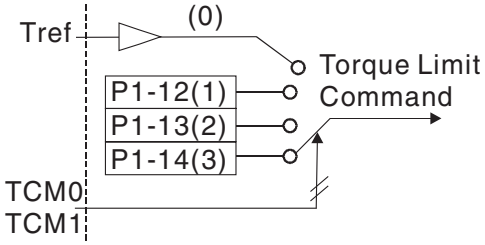


A: Disable or Enable speed limit function
0: Disable speed limit function
1: Enable speed limit function (It is available in torque mode)

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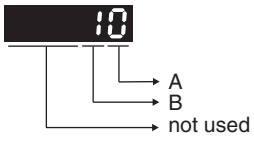
B: Disable or Enable torque limit function
0: Disable torque limit function
1: Enable torque limit function (It is available in position and speed mode)



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

Default: 0x0000
Applicable control mode: Pt, Pr, S, T
Unit:
Range: 0x0000 ... 0x0013
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

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1: Reverse output

P1-04 MON1	Analog Monitor Output Proportion 1 (MON1) (100% for full scale)	Address: 0108h, 0109h

Default: 100
Applicable control mode: Pt, Pr, S, T
Unit: %
Range: 0 ... 100
Data size: 16-bit
Display format: Decimal

P1-05 MON2	Analog Monitor Output Proportion 2 (MON2) (100% for full scale)	Address: 010Ah, 010Bh

Default: 100
Applicable control mode: Pt, Pr, S, T
Unit: %
Range: 0 ... 100
Data size: 16-bit
Display format: Decimal

P1-06 SFLT	Acceleration / Deceleration Smoothing Constant of Analog Speed Command (Low-pass Filter)	Address: 010Ch, 010Dh

Default: 0
Applicable control mode: S
Unit: ms
Range: 0 ... 1000
Data size: 16-bit
Display format: Decimal

P1-07 TFLT	Smoothing Constant of Analog Torque Command (Low-pass Filter)	Address: 010Eh, 010Fh

Default: 0
Applicable control mode: T
Unit: ms
Range: 0 ... 1000
Data size: 16-bit
Display format: Decimal

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

Default: 0
Applicable control mode: Pt, Pr
Unit: 10 ms
Range: 0 ... 1000
Data size: 16-bit
Display format: Decimal

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P1-09 SP1	1st Speed Command/ Limit	Address: 0112_h, 0113_h

Default: 1000
Applicable control mode: S, T
Unit: 0.1 RPM
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/ Limit	Address: 0114_h, 0115_h

Default: 2000
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/ Limit	Address: 0116_h, 0117_h

Default: 3000
Applicable control mode: S, T
Unit: 0.1 rpm
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

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

P1-12 TQ1	1st Torque Command/ Limit	Address: 0118_h, 0119_h

Default: 100
Applicable control mode: Pt, Pr, S, T
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/ Limit	Address: $011A_h$, $011B_h$

Default: 100
Applicable control mode: Pt, Pr, S, T
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/ Limit	Address: $011C_h$, $011D_h$

Default: 100
Applicable control mode: Pt, Pr, S, T
Unit: %

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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	Vibration Suppression Frequency 1	Address: 0132_h, 0133_h

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Default: 1000
Applicable control mode: Pt, Pr
Unit: Hz
Range: 10 ... 1000
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	Vibration Suppression Gain 1	Address: 0134h, 0135h

Default: 0
Applicable control mode: Pt, Pr
Unit:
Range: 0 ... 9
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 excessively high, it may affect the normal operation of the motor. It is recommended to set P1-26 to 1.

P1-27 VSF2	Vibration Suppression Frequency 2	Address: 0136h, 0137h

Default: 1000
Applicable control mode: Pt, Pr
Unit: Hz
Range: 10 ... 1000
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	Vibration Suppression Gain 2	Address: 0138h, 0139h

Default: 0
Applicable control mode: Pt, Pr
Unit:
Range: 0 ... 9
Data size: 16-bit
Display format: Decimal

Settings:

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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 excessively high, it may affect the normal operation of the motor. It is recommended to set P1-28 to 1.

P1-29 AVSM	Auto Vibration Suppression Mode Selection	Address: 013A$_h$, 013B$_h$

Default: 0
Applicable control mode: Pt, Pr
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: 013C$_h$, 013D$_h$

Default: 500
Applicable control mode: Pt, Pr
Unit:
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 incorrect measurement. If the setting value of P1-30 is too high, although the probability of incorrect 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)

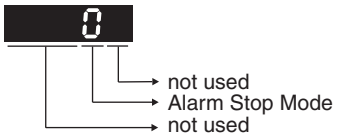
P1-32 LSTP	Motor Stop Mode Selection	Address: 0140$_h$, 0141$_h$

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Default: 0x0000
Applicable control mode: Pt, Pr, S, T
Unit:
Range: 0x0000 ... 0x0020
Data size: 16-bit
Display format: Hexadecimal

Settings:

This parameter is used to select servo motor stop mode when Servo Off or an alarm (includes OPST (Operational stop)) occurs.



Alarm 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 alarm NL(CWL) or PL(CCWL) occurs, see the settings of parameter P5-03 to determine the deceleration time. If the deceleration time is set to 1 ms, the motor will stop instantly.

P1-33	Reserved (Do Not Use)

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

Default: 200
Applicable control mode: S
Unit: ms
Range: 1 ... 65500
Data size: 16-bit
Display format: Decimal

Settings:

This parameter is used to specify the acceleration time to accelerate from 0 to the 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. This means that the parameters P1-34 and P1-35 are not disabled even if P1-36 is disabled.

If the source of the speed command is an analog signal, the maximum setting value of P1-36 is set to 0 and the acceleration and deceleration functions are disabled.

If the source of the speed command is an analog signal, the maximum setting value of P1-34 is automatically limited to 20000.

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

Default: 200
Applicable control mode: S
Unit: ms
Range: 1 ... 65500
Data size: 16-bit
Display format: Decimal

Settings:

This parameter is used to specify the deceleration time to decelerate from the rated motor speed to 0. 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. This means that the parameters P1-34 and P1-35 are not disabled even if P1-36 is disabled.

If the source of the speed command is an analog signal, the maximum setting value of P1-36 is set to 0 and the acceleration and deceleration functions are disabled.

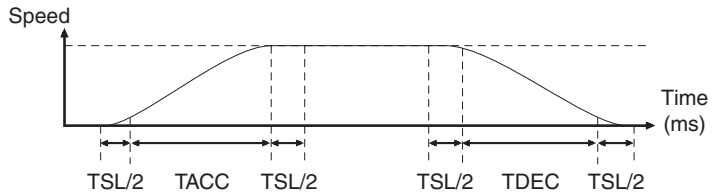
If the source of the speed command is an analog signal, the maximum setting value of P1-35 is automatically limited to 20000.

P1-36 TSL	Acceleration / Deceleration S-curve	Address: 0148h, 0149h

Default: 0
Applicable control mode: Pr, S
Unit: ms
Range: 0 ... 65500
Data size: 16-bit
Display format: Decimal

Settings:

This parameter is used to make the motor run more smoothly during acceleration and deceleration.



TACC: P1-34, acceleration time

TDEC: P1-35, deceleration time

TSL: P1-36, acceleration/deceleration

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

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are still effective. This means that the parameters P1-34 and P1-35 are not disabled even if P1-36 is disabled.

If the source of the speed command is an analog signal, the maximum setting value of P1-36 is set to 0 and the acceleration and deceleration functions are disabled.

If the source of the speed command is an analog signal, the maximum setting value of P1-36 is automatically limited to 10000.

If the motor is controlled via internal parameters, the command curve should be defined by the user.

P1-37 GDR	Ratio of Load Inertia to Servo Motor Inertia	Address: 014A$_h$, 014B$_h$

Default: 1.0
Applicable control mode: Pt, Pr, S, T
Unit:
Range: 0.0 ... 200.0
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

P1-38 ZSPD	Zero Speed Range Setting	Address: 014C$_h$, 014D$_h$

Default: 10.0
Applicable control mode: Pt, Pr, S, T
Unit: 0.1 rpm
Range: 0.0 ... 200.0
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 detects 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 Rotation Speed	Address: 014E$_h$, 014F$_h$

Default: 3000
Applicable control mode: Pt, Pr, S, T
Unit: rpm

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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 / Limit	Address: 0150_h, 0151_h

Default: 10001
Applicable control mode: S, T
Unit: RPM
Range: 0 ... 10001
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

P1-41 ▲ TCM	Max. Analog Torque Command / Limit	Address: 0152_h, 0153_h

Default: 100
Applicable control mode: Pt, Pr, S, T
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 (10 V).

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).

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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 5 V, 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 Holding Brake	Address: 0154h, 0155h

Default: 0
Applicable control mode: Pt, Pr, S, T
Unit: ms
Range: 0 ... 1000
Data size: 16-bit
Display format: Decimal

Settings:

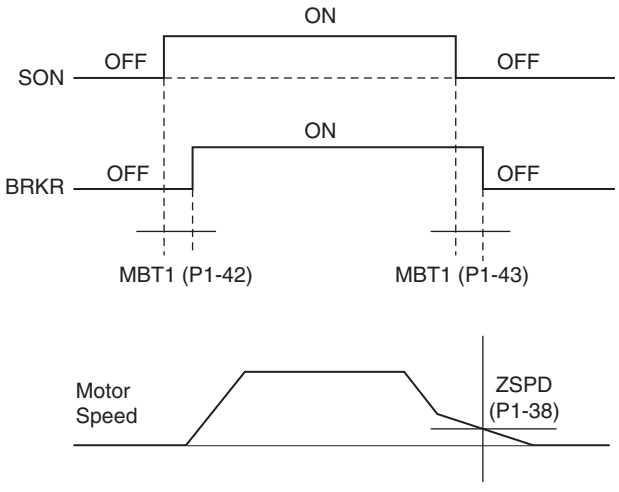
Used to set the period of time between when the servo drive is On (Servo On) and when holding brake output signal (BRKR) is activated.

P1-43 MBT2	OFF Delay Time of Holding Brake	Address: 0156h, 0157h

Default: 0
Applicable control mode: Pt, Pr, S, T
Unit: ms
Range: -1000 ... 1000
Data size: 16-bit
Display format: Decimal

Settings:

Used to set the period of time between when the servo drive is Off (Servo Off) and when holding brake output signal (BRKR) is inactivated.



NOTE:

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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 holding 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, holding brake will be engaged regardless of the current motor speed.

3. When the servo drive is disabled (Servo Off) due to an alarm (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: 0158_h, 0159_h

Default: 128
Applicable control mode: Pt, Pr
Unit:
Range: 1 ... 536870911
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 via P1-45. P2-60 ... P2-62 are used to set the additional numerators.

In Position Contol Pt mode, the value of P1-44 can only be changed only when the drive is enabled (Servo On).

In Position Contol Pr mode, the value of P1-44 can only be changed when the drive is disabled (Servo Off).

P1-45 ▲ GR2	Electronic Gear Ratio (Denominator) (M)	Address: $015A_h$, $015B_h$

Default: 10
Applicable control mode: Pt, Pr
Unit:
Range: 1 ... 2147483647
Data size: 32-bit
Display format: Decimal

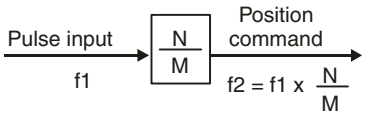
Settings:

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

Incorrect gear ratio settings may cause unintended movements and jerks and change the speed of rotation. Observe the following rules when setting parameters P1-44 and P1-45.

Setting the electronic gear ratio (also see P1-44, P2-60 ... P2-62):

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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

In Position Control modes Pt and Pr, the value of P1-45 cannot be changed when the drive is enabled (Servo On).

P1-46 ▲ GR3	Encoder Output Pulse Number	Address: 015C$_h$, 015D$_h$

Default: 2500
Applicable control mode: Pt, Pr, S, T
Unit:
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.

NOTE:

When the following conditions occur, the output frequency for pulse output may exceed the specification and cause the servo drive alarm AL018 (Encoder Output Error) to beactivated.

Condition 1: Encoder error.

Condition 2: Motor speed is above the value set by parameter P1-76.

Condition 3:

$$\frac{\text{Motor Speed}}{60} \times P1\text{-}46 \times 4 > 19.8 \times 10^6$$

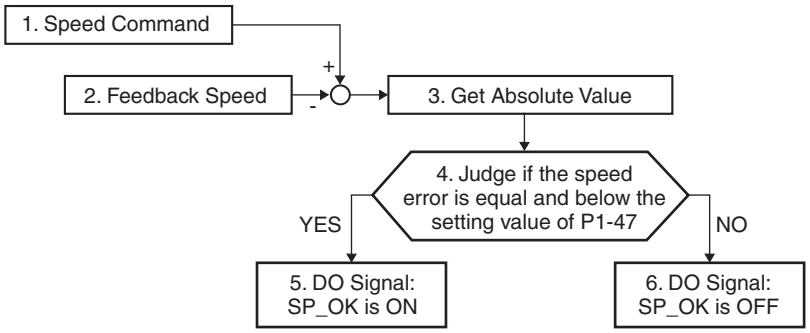
P1-47 SPOK	Speed Reached Output Range	Address: 015E$_h$, 015F$_h$

Default: 10
Applicable control mode: S
Unit:
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.

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1. Speed Command: It is the speed command input by the user (no Accel/Decel), not the front-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 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: 0160_h, 0161_h

Default: 0x0000
Applicable control mode: Pr
Unit:
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

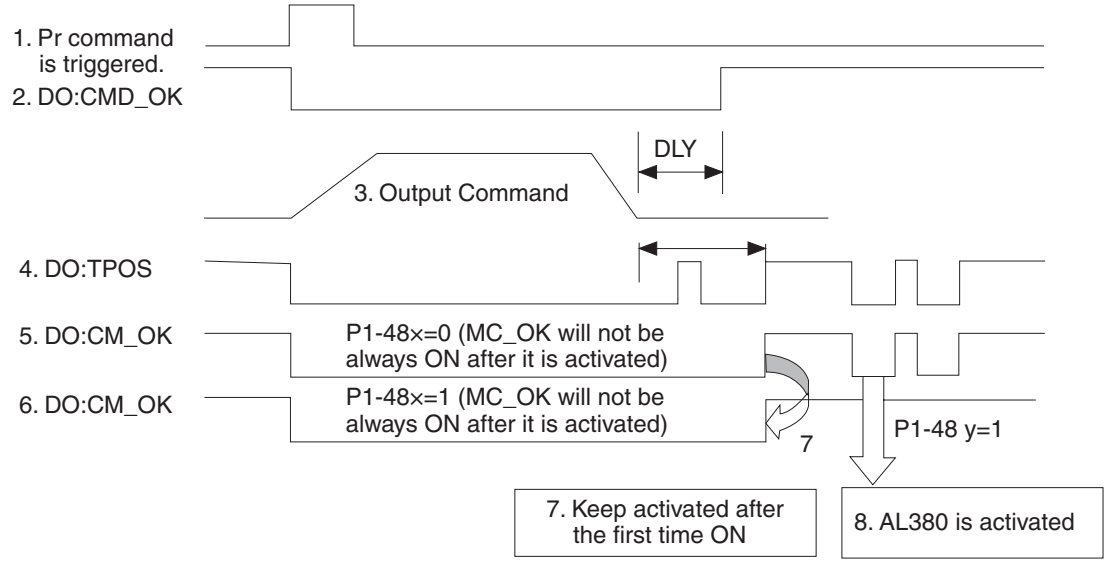
X=0: MC_OK will not be ON after it is activated.

X=1: MC_OK will be ON after it is activated.

Y=0: Position deviation alarm. AL380 will not be activated.

Y=1: Position deviation alarm. AL380 will be activated.

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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 required 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 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 an 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)

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P1-52 RES1	Resistance of External Braking Resistor	Address: 0168_h, 0169_h

Default: 751
Applicable control mode: Pt, Pr, S, T
Unit: Ohm
Range: 10 ... 751
Data size: 16-bit
Display format: Decimal

Settings:

This parameter is used to set the resistance of the braking resistor.

Model	Default
400W	40Ω
750W ... 1.5kW	40Ω
2kW ... 3kW	20Ω

P1-53 RES2	Nominal Power of External Braking Resistor	Address: $016A_h$, $016B_h$

Default: 3001
Applicable control mode: Pt, Pr, S, T
Unit: W
Range: 30 ... 3001
Data size: 16-bit
Display format: Decimal

Settings:

This parameter is used to set the capacity of the braking resistor.

Model	Default
400W	40W
750W ... 1.5kW	60W
2kW ... 3kW	100W

P1-54 PER	Positioning Completed Width	Address: $016C_h$, $016D_h$

Default: 12800
Applicable control mode: Pt, Pr
Unit:
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.

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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: 016E$_h$, 016F$_h$

Default: 6001
Applicable control mode: Pt, Pr, S, T
Unit: rpm
Range: 10 ... 6001
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	Address: 0170$_h$, 0171$_h$

Default: 120
Applicable control mode: Pt, Pr, S, T
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 alarm (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

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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, alarm signal will be ON (DO signal ALRM will be activated).

P1-57 CRSHA	Motor Overshoot Warning Percentage	Address: 0172h, 0173h

Default: 0
Applicable control mode: Pt, Pr, S, T
Unit: %
Range: 0 ... 300
Data size: 16-bit
Display format: Decimal

Settings:

This parameter is used to keep the motor from contacting 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 alarm 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 Overshoot Warning Time	Address: 0174h, 0175h

Default: 1
Applicable control mode: Pt, Pr, S, T
Unit: ms
Range: 1 ... 1000
Data size: 16-bit
Display format: Decimal

Settings:

This parameter is used to keep the motor from contacting mechanical equipment. The alarm AL030 will be activated when the setting value of P1-57 is reached after a period of time set by P1-58.

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	Address: 0176h, 0177h

Default: 0.0
Applicable control mode: S
Unit: 0.1 ms
Range: 0.0 ... 4.0
Data size: 16-bit
Display format: Decimal

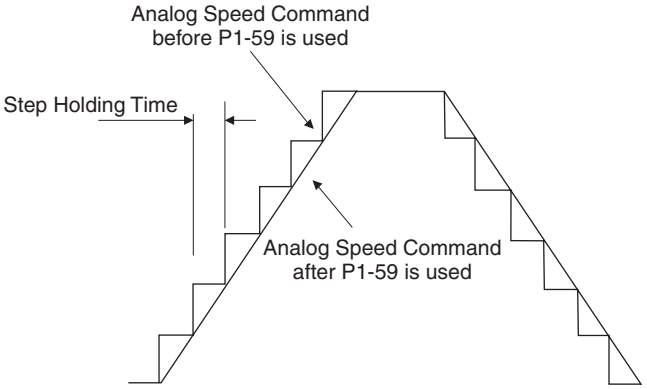
Settings:

This parameter is used to reduce the noise generated during the operation when the (external) master 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

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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: 017C$_h$, 017D$_h$

Default: 0
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 Smoothing Constant	Address: 017E$_h$, 017F$_h$

Default: 1
Applicable control mode: Pt, Pr, S, T
Unit:
Range: 1 ... 1000
Data size: 16-bit
Display format: Decimal

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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	Address: 0184_h, 0185_h

Default: 30
Applicable control mode: Pt
Unit: 0.1
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 (10 V).

For example, if P1-66 is set to 30 and the input voltage is 10 V, it indicates that the position command is +3 rotations. If P1-66 is set to 30, but the input voltage is changed to 5 V, 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: 0188_h, 0189_h

Default: 4
Applicable control mode: Pt, Pr
Unit: ms
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)

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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: 0198_h, 0199_h

Default: 5500
Applicable control mode: Pt, Pr, S, T
Unit: rpm
Range: 0 ... 6000
Data size: 16-bit
Display format: Decimal

Settings:

This parameter is used to optimize the encoder outputs (OA, OB). If you set the actually 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.

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10.4.3 Group 2: Extension Parameters

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

Default: 35
Applicable control mode: Pt, Pr
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 too high, it may generate vibration or noise.

P2-01 PPR	Position Loop Gain Switching Rate	Address: 0202_h, 0203_h

Default: 100
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. See P2-27 for gain switching control selection settings and P2-29 for gain switching condition settings.

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

Default: 50
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 position control commands are executed. When position smoothing is used, increasing the gain can improve position track deviation. When position smoothing is not used, decreasing the gain can improve the resonance condition of the mechanical system.

P2-03 PFF	Smooth Constant of Position Feed Forward Gain	Address: 0206_h, 0207_h

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Default: 5
Applicable control mode: Pt, Pr
Unit: ms
Range: 2 ... 100
Data size: 16-bit
Display format: Decimal

Settings:

When using position smooth command, increase gain can improve position track deviation. When not using position smooth command, decrease gain can improve the resonance condition of mechanical system.

P2-04 KVP	Proportional Speed Loop Gain	Address: 0208_h, 0209_h

Default: 500
Applicable control mode: Pt, Pr, S, T
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 excessively high, it may generate vibration or noise.

P2-05 SPR	Speed Loop Gain Switching Rate	Address: $020A_h$, $020B_h$

Default: 100
Applicable control mode: Pt, Pr, S, T
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. Ses P2-27 for gain switching control selection settings and P2-29 for gain switching condition settings.

P2-06 KVI	Speed Integral Compensation	Address: $020C_h$, $020D_h$

Default: 100
Applicable control mode: Pt, Pr, S, T
Unit: rad/s
Range: 0 ... 1023
Data size: 16-bit
Display format: Decimal

Settings:

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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 excessively high, it may generate vibration or noise.

P2-07 KVF	Speed Feed Forward Gain	Address: $020E_h$, $020F_h$

Default: 0
Applicable control mode: Pt, Pr, S, T
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: 0210_h, 0211_h

Default: 0
Applicable control mode: Pt, Pr, S, T
Unit:
Range: 0 ... 501
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: You can reset the parameter values to factory defaults. The parameter values will be reset after you re-power the servo drive. Before making these settings, the servo drive must be "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.

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P2-09 DRT	Bounce Filter	Address: 0212_h, 0213_h

Default: 2
Applicable control mode: Pt, Pr, S, T
Unit: 2 ms
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 1 ms = 5 ms

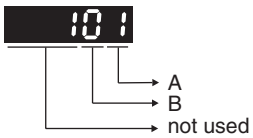
When there are too much vibrations or noise in the environment, increasing this setting value (bounce filter time) can improve the situation. However, if the time is too long, this may adversely affect the response time.

P2-10 DI1	Digital Input Terminal 1 (DI1)	Address: 0214_h, 0215_h

Default: 0x0101
Applicable control mode: Pt, Pr, S, T
Unit:
Range: 0x0000 ... 0x015F
Data size: 16-bit
Display format: Hexadecimal

Settings:

The parameters from P2-10 ... P2-17 are used to determine the functions and statuses of DI1 ... DI8.



A: DI (Digital Input) Function Settings:

For the setting value see chapter *"10.5 Input Function Definition"*.

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.

Re-start the servo drive after parameters have been changed.

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.

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P2-11 DI2	Digital Input Terminal 2 (DI2)	Address: 0216_h, 0217_h

Default: 0x0104
Applicable control mode: Pt, Pr, S, T
Unit:
Range: 0x0000 ... 0x015F
Data size: 16-bit
Display format: Hexadecimal

Settings:

See P2-10 for details.

P2-12 DI3	Digital Input Terminal 3 (DI3)	Address: 0218_h, 0219_h

Default: 0x0116
Applicable control mode: Pt, Pr, S, T
Unit:
Range: 0x0000 ... 0x015F
Data size: 16-bit
Display format: Hexadecimal

Settings:

See P2-10 for details.

P2-13 DI4	Digital Input Terminal 4 (DI4)	Address: $021A_h$, $021B_h$

Default: 0x0117
Applicable control mode: Pt, Pr, S, T
Unit:
Range: 0x0000 ... 0x015F
Data size: 16-bit
Display format: Hexadecimal

Settings:

See P2-10 for details.

P2-14 DI5	Digital Input Terminal 5 (DI5)	Address: $021C_h$, $021D_h$

Default: 0x0102
Applicable control mode: Pt, Pr, S, T
Unit:
Range: 0x0000 ... 0x015F
Data size: 16-bit
Display format: Hexadecimal

Settings:

See P2-10 for details.

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P2-15 DI6	Digital Input Terminal 6 (DI6)	Address: 021E$_h$, 021F$_h$

Default: 0x0022
Applicable control mode: Pt, Pr, S, T
Unit:
Range: 0x0000 ... 0x015F
Data size: 16-bit
Display format: Hexadecimal

Settings:

See P2-10 for details.

P2-16 DI7	Digital Input Terminal 7 (DI7)	Address: 0220$_h$, 0221$_h$

Default: 0x0023
Applicable control mode: Pt, Pr, S, T
Unit:
Range: 0x0000 ... 0x015F
Data size: 16-bit
Display format: Hexadecimal

Settings:

See P2-10 for details.

P2-17 DI8	Digital Input Terminal 8 (DI8)	Address: 0222$_h$, 0223$_h$

Default: 0x0021
Applicable control mode: Pt, Pr, S, T
Unit:
Range: 0x0000 ... 0x015F
Data size: 16-bit
Display format: Hexadecimal

Settings:

See P2-10 for details.

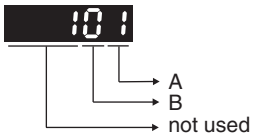
P2-18 DO1	Digital Output Terminal 1 (DO1)	Address: 0224$_h$, 0225$_h$

Default: 0x0101
Applicable control mode: Pt, Pr, S, T
Unit:
Range: 0x0000 ... 0x013F
Data size: 16-bit
Display format: Hexadecimal

Settings:

The parameters from P2-18 ... P2-22 are used to determine the functions and statuses of DO1 ... DO5.

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A: DO Function Settings:

For the setting value see chapter *"10.6 Output Function Definition"*.

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.

Re-start the servo drive after parameters have been changed.

P2-19 DO2	Digital Output Terminal 2 (DO2)	Address: 0226_h, 0227_h

Default: 0x0103
Applicable control mode: Pt, Pr, S, T
Unit:
Range: 0x0000 ... 0x013F
Data size: 16-bit
Display format: Hexadecimal

Settings:

See P2-18 for details.

P2-20 DO3	Digital Output Terminal 3 (DO3)	Address: 0228_h, 0229_h

Default: 0x0109
Applicable control mode: Pt, Pr, S, T
Unit:
Range: 0x0000 ... 0x013F
Data size: 16-bit
Display format: Hexadecimal

Settings:

See P2-18 for details.

P2-21 DO4	Digital Output Terminal 4 (DO4)	Address: $022A_h$, $022B_h$

Default: 0x0105
Applicable control mode: Pt, Pr, S, T
Unit:
Range: 0x0000 ... 0x013F
Data size: 16-bit
Display format: Hexadecimal

Settings:

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See P2-18 for details.

P2-22 DO5	Digital Output Terminal 5 (DO5)	Address: 022C$_h$, 022D$_h$

Default: 0x0007
Applicable control mode: Pt, Pr, S, T
Unit:
Range: 0x0000 ... 0x013F
Data size: 16-bit
Display format: Hexadecimal

Settings:

See P2-18 for details.

P2-23	Reserved (Do Not Use)

P2-24	Reserved (Do Not Use)

P2-25 NLP	Low-Pass Filter Time Constant (Resonance Suppression)	Address: 0232$_h$, 0233$_h$

Default: 0.2
Applicable control mode: Pt, Pr, S, T
Unit: 0.1 ms
Range: 0.0 ... 100.1
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: 0234$_h$, 0235$_h$

Default: 0
Applicable control mode: Pt, Pr, S, T
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.

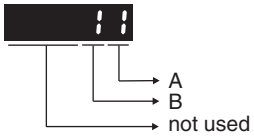
P2-27 GCC	Gain Switching Control Selection	Address: 0236$_h$, 0237$_h$

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Default: 0x0000
Applicable control mode: Pt, Pr, S, T
Unit:
Range: 0x0000 ... 0x0018
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 chapter *"10.5 Input Function Definition"*)
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 chapter *"10.5 Input Function Definition"*)
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: 0238_h, 0239_h

Default: 10
Applicable control mode: Pt, Pr, S, T
Unit: 10 ms
Range: 0 ... 1000

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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 (pulse/kpps/ rpm)	Address: 023A$_h$, 023B$_h$

Default: 1280000
Applicable control mode: Pt, Pr, S, T
Unit:
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 Functions	Address: 023C$_h$, 023D$_h$

Default: 0
Applicable control mode: Pt, Pr, S, T
Unit:
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: Frequent writing of parameters to the EEPROM reduces the service life of the EEPROM. If P2-30 is set to 5, changed parameter settings are not written to the EEPROM when the drive is switched off. Set parameter P2-30 to 5 if it is not necessary to save changed parameter settings (example: control via the communication interface).

6: Reserved

7: Reserved

8: Reserved

- 1, -5: Disable the function of setting value 1 and 5.

- 2, -3, -4,-6, -7, -8: Reserved

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P2-31 AUT1	Speed Responsiveness Setting of Auto and Semi-Auto Mode	Address: 023E$_h$, 023F$_h$

Default: 80
Applicable control mode: Pt, Pr, S, T
Unit: Hz
Range: 1 ... 1000
Data size: 16-bit
Display format: Decimal

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: 0240$_h$, 0241$_h$

Default: 0x0000
Applicable control mode: Pt, Pr, S, T
Unit:
Range: 0x0000 ... 0x0002
Data size: 16-bit
Display format: Hexadecimal

Settings:

0: Manual mode

1: Auto Mode [Continuous adjustment]

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

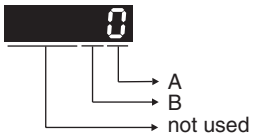
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P2-32	P1-37, Ratio of Load and Motor Rotor Inertias	P2-00, P2-02, P2-04, P2-06, P2-25, P2-26	P2-33 Semi-Auto Mode Inertia Adjustment Selection
0	Not updated automatically.	Updated manually.	Do not use.
1	Updated every 30 minutes.	Updated when P2-31 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: 0242_h, 0243_h

Default: 0x0000
Applicable control mode: Pt, Pr, S, T
Unit:
Range: 0x0000 ... 0x0001
Data size: 16-bit
Display format: Hexadecimal

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: 0244_h, 0245_h

Default: 5000
Applicable control mode: S
Unit: rpm
Range: 1 ... 5000
Data size: 16-bit
Display format: Decimal

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Settings:

This parameter is used to set the overspeed threshold that is used to determine the overspeed alarm condition. When the difference in speed between the required speed and actual motor speed is greater than the setting value of parameter P2-34, the alarm Overspeed (AL007) will be activated.

P2-35 PDEV	Excessive Deviation Condition	Address: 0246h, 0247h

Default: 3840000
Applicable control mode: Pt, Pr
Unit:
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 alarm condition. When the difference in pulse number between the required position and actual motor position is greater than the setting value of parameter P2-35, the alarm Excessive Deviation (AL009) will be activated.

P2-36	Reserved (Do Not Use)

P2-37	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
Applicable control mode: Pt, Pr, S, T
Unit: Hz

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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
Applicable control mode: Pt, Pr, S, T
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
Applicable control mode: Pt, Pr, S, T
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
Applicable control mode: Pt, Pr, S, T
Unit: dB
Range: 0 ... 32
Data size: 16-bit
Display format: Decimal

Settings:

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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: 025E$_h$, 025F$_h$

Default: 1
Applicable control mode: Pt, Pr, S, T
Unit:
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 ANCL	Auto Resonance Suppression Sensitivity Setting	Address: 0260$_h$, 0261$_h$

Default: 100
Applicable control mode: Pt, Pr, S, T
Unit:
Range: 1 ... 300
Data size: 16-bit
Display format: Decimal

Settings:

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When the setting value is smaller, the system will become more sensitive to detect and find the resonance.

P2-49 SJIT	Speed Detection Filter and Jitter Suppression	Address: 0262_h, 0263_h

Default: 0x000B
Applicable control mode: Pt, Pr, S, T
Unit: s
Range: 0x0000 ... 0x001F
Data size: 16-bit
Display format: Hexadecimal

Settings:

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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: 0264_h, 0265_h

Default: 0x0000
Applicable control mode: Pt, Pr
Unit:
Range: 0x0000 ... 0x0001
Data size: 16-bit
Display format: Hexadecimal

Settings:

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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: $026A_h$, $026B_h$

Default: 0
Applicable control mode: Pt, Pr, S, T
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 excessively 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: 0278_h, 0279_h

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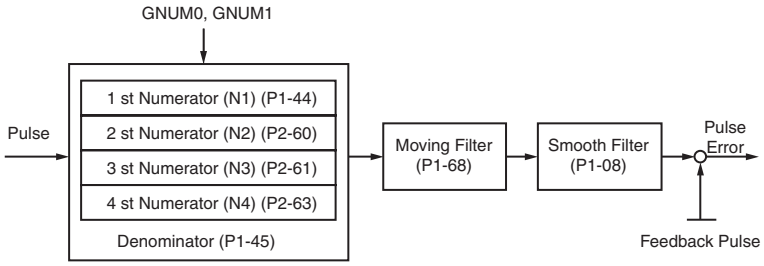
Default: 128
Applicable control mode: Pt
Unit:
Range: 1 ... 536870911
Data size: 32-bit
Display format: Decimal

Settings:

The electronic gear numerator value can be set via GNUM0, GNUM1 (see chapter *"10.5 Input Function Definition"*).

When the GNUM0, GNUM1 are not defined, the default of gear numerator value is set by P1-44.

If you want to set the gear numerator value by using GNUM0, GNUM1, set P2-60 ... P2-62 after the servo motor has been stopped so ther is no vibration of the mechanical system.



P2-61 GR5	Electronic Gear Ratio (3rd Numerator) (N3)	Address: $027A_h$, $027B_h$

Default: 128
Applicable control mode: Pt
Unit:
Range: 1 ... 536870911
Data size: 32-bit
Display format: Decimal

Settings:

See P2-60 for details.

P2-62 GR6	Electronic Gear Ratio (3rd Numerator) (N4)	Address: $027C_h$, $027D_h$

Default: 128
Applicable control mode: Pt
Unit:
Range: 1 ... 536870911
Data size: 32-bit
Display format: Decimal

Settings:

See P2-60 for details.

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P2-63	Reserved (Do Not Use)

P2-64	Reserved (Do Not Use)

P2-65 GBIT	Special Function 1	Address: 0282_h, 0283_h

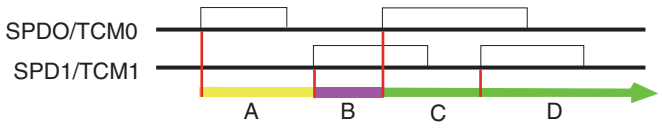
Default: 0x0000
Applicable control mode: Pt, Pr, S
Unit:
Range: 0x0000 ... 0xFFFF
Data size: N/A
Display format: Hexadecimal

Settings:

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

Bit2 ... Bit5: Reserved. Must be set to 0.

Bit6: Abnormal pulse command detection
0: enable abnormal pulse command detection
1: disable abnormal pulse command detection

Bit7: Reserved. Must be set to 0.

Bit8: U, V, W wiring error detection
1: enable U, V, W wiring error detection

Bit9: U, V, W wiring cut-off detection
1: enable U, V, W wiring cut-off detection

Bit10: DI ZCLAMP function selection

When the following conditions are met, ZCLAMP function will be activated.

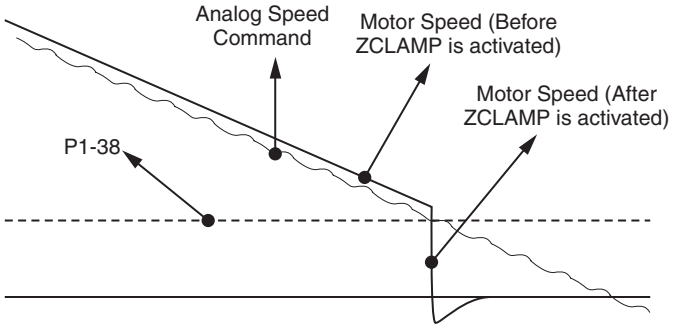
Condition1: Speed mode

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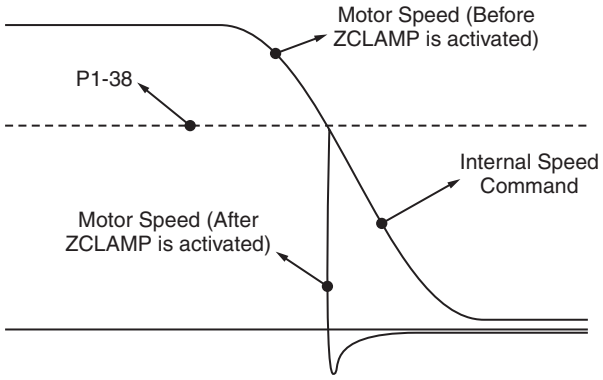
Condition2: DI ZCLAMP is activated.

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, you can use the ZCLAMP DI signal to stop the motor at the required position and disregard the acceleration and deceleration speed curve of the analog speed command. The motor will be locked at the position when ZCLAMP conditions are satisfied.

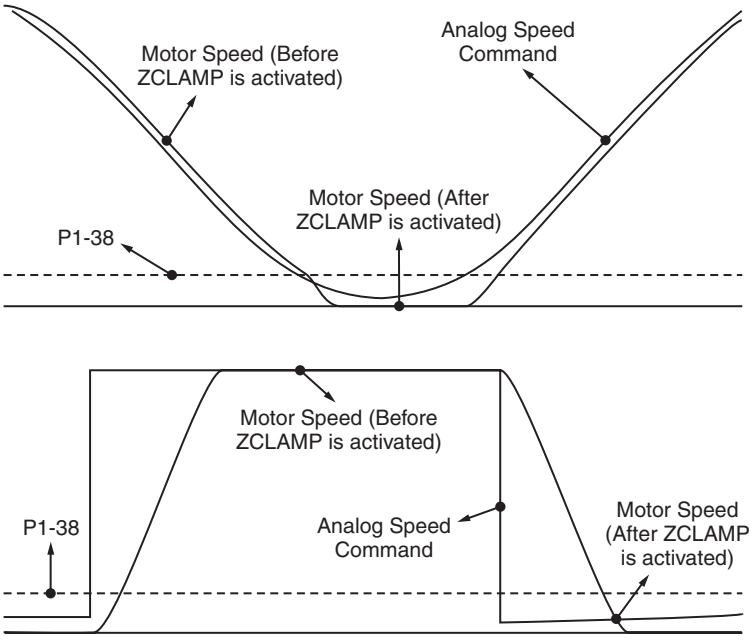


0: When the command source is an internal speed command, you can use the ZCLAMP DI signal to stop the motor at the required position and keep the the acceleration and deceleration speed curve of the internal speed command. The motor will be locked at the position when ZCLAMP conditions are satisfied.

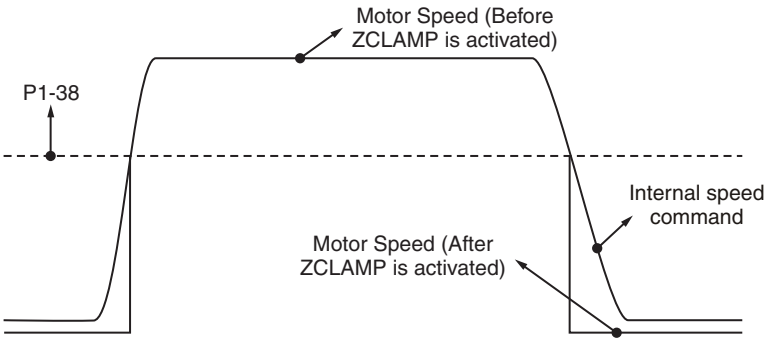


1: When the command source is an analog speed command, you can use the ZCLAMP DI signal to stop the motor at the required position and disregard the acceleration and deceleration speed curve of the internal speed command. When ZCLAMP conditions are satisfied, the speed command is decreased to 0 rpm. When ZCLAMP conditions are not satisfied, the speed command will follow the analog speed command through Accel/Decel S-curve.

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1: When the command source is an internal speed command, you can use the ZCLAMP DI signal to stop the motor at the required 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: NL(CWL)/PL(CCWL) pulse input inhibit function

0: Disable NL(CWL)/PL(CCWL) pulse input inhibit function. In Pt mode, irrespective of whether or not NL or PL exists, 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. 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.

NOTE:

If NL and PL both exist, NL and PL pulse input into the servo drive will be both inhibited.

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Bit12: Detection of missing input power phase
0: Enable detection of missing input power phase (AL022)
1: Disable detection of missing input power phase (AL022)

Bit13: Encoder output error detection function
0: Enable encoder output error (AL018) detection function
1: Disable encoder output error (AL018) detection function

Bit14 ... Bit15: Reserved. Must be set to 0.

P2-66 GBIT2	Special Function 2	Address: 0284_h, 0285_h

Default: 0x0000
Applicable control mode: Pt, Pr, S, T
Unit:
Range: 0x0000 ... 0x001F
Data size:
Display format: Hexadecimal

Settings:

Bit0 ... Bit1: Reserved. Must be set to 0.

Bit2: Undervoltage (Servo Drive alarm) clear mode selection
0: The alarm Undervoltage will not be cleared automatically.
1: The alarm Undervoltage will be cleared automatically.

Bit3 ... Bit7: Reserved. Must be set to 0.

P2-67 JSL	Inertia Estimation Detection Level	Address: 0286_h, 0287_h

Default: 1.5
Applicable control mode: Pt, Pr, S, T
Unit:
Range: 0.0 ... 200.0
Data size: 16-bit
Display format: Decimal

Settings:

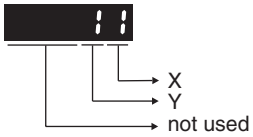
In semi-auto tuning mode, this parameter defines the threshold for a system to re-evaluate P1-37. For example, P1-37=2 and P2-67=1, the system will re-evaluate its P1-37 when a value exceeding the range of P1-37=1.5 ... 2.5 (greater than 2.5 or less than 1.5) detected. If P1-37=1 and P2-67=3, the range should be P1-37=0 ... 2.5 for a stable acknowledgment.

P2-68 ● AEAL	Auto Enable / Auto Limit	Address: 0288_h, 0289_h

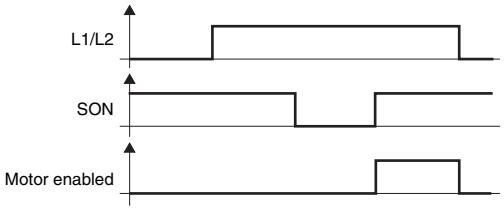
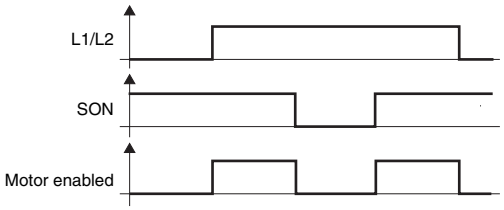
Default: 0x0000
Applicable control mode: Pt, Pr, S, T
Unit:
Range: 0x0000 ... 0x0011
Data size: 16-bit
Display format: Hexadecimal

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Settings:



X: Auto Enable function switch

X	FUNCTION
0	
1	

If X = 0, user must 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.

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10.4.4 Group 3: Communication Parameters

Modbus is intended for diagnostics and not for operation.

P3-00 ● ADR	MODBUS Communication Address Setting	Address: 0300_h, 0301_h

Default: 127
Applicable control mode: Pt, Pr, S, T
Unit:
Range: 1 ... 240
Data size: 16-bit
Display format: Decimal

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 errors .

NOTE:

1. This parameter does not provide broadcast function.

2. When the address of (external) master is set to 0xFF, it is with auto-respond function.

Then, the servo drive will receive from and respond to (external) master, irrespective of whether or not the address matches. However, the parameter P3-00 cannot be set to 0xFF.

P3-01 BRT	Transmission Speed	Address: 0302_h, 0303_h

Default: 0x0103
Applicable control mode: Pt, Pr, S, T
Unit: baud
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 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

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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: 125 kBits / second

1: 250 kBits / second

2: 500 kBits / second

3: Reserved

4: 1.0 MBits / second

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: 0304_h, 0305_h

Default: 0x0006
Applicable control mode: Pt, Pr, S, T
Unit:
Range: 0x0000 ... 0x0008
Data size: 16-bit
Display format: Hexadecimal

Settings:

This parameter is used to set the communication protocol. The alpha-numeric 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 Error Handling	Address: 0306_h, 0307_h

Default: 0x0000
Applicable control mode: Pt, Pr, S, T
Unit:
Range: 0x0000 ... 0x0011

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Data size: 16-bit
Display format: Hexadecimal

Settings:

This parameter is used to determine the operating sequence once a communication error has been detected. If '1' is selected, the drive will stop operating upon detection of the communication error. The mode of stopping is set by parameter P1-32.

0: Display error and continue operating

1: Display error and decelerate to stop operating (deceleration time is determined by parameter P5-03)

P3-04 CWD	Communication Timeout Detection	Address: 0308_h, 0309_h

Default: 0
Applicable control mode: Pt, Pr, S, T
Unit: s
Range: 0 ... 20
Data size: 16-bit
Display format: Decimal

Settings:

This parameter is used to set the maximum permissible time before detecting an error due to communication timeout. When P3-04 is set to a value greater 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 there is a communication error and show the communication error alarm message.

When P3-04 is set to 0, this parameter is disabled.

P3-05 CMM	CANopen Communication Address Setting	Address: $030A_h$, $030B_h$

Default: 0x0000
Applicable control mode: Pt, Pr, S, T
Unit:
Range: 0x0000 ... 0x007F
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 errors.

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.

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P3-06 ■ SDI	Digital Input Communication Function	Address: 030Ch, 030Dh

Default: 0x0000
Applicable control mode: Pt, Pr, S, T
Unit:
Range: 0x0000 ... 0x3FFF
Data size: 16-bit
Display format: Hexadecimal

Settings:

The setting of this parameter determines how the Digital Inputs (DI) accept commands and signals.

Bit 0 ... 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, see P2-10 ... P2-17.

This parameter P3-06 also works in conjunction with the parameter P4-07 which has several functions.

P3-07 CDT	Communication Response Delay Time	Address: 030Eh, 030Fh

Default: 0
Applicable control mode: Pt, Pr, S, T
Unit: 0.5 ms
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 master (external master via Modbus).

P3-08	Reserved (Do Not Use)

P3-09 ▲ SYC	CANopen Slave and Master Synchronization Signal Setting	Address: 0312h, 0313h

Default: 0x5055
Applicable control mode: CANopen Mode
Unit:
Range: 0x1001 ... 0x9FFF
Data size: 16-bit
Display format: Hexadecimal

Settings:

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This parameter is used to set the CANopen slave to be synchronized with the CANopen master through synchronization signal. Although this parameter allows you to perform manual adjustment, if not necessary. It is not recommended 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 mode selection	Address: 0314_h, 0315_h

Default: 0x0000
Applicable control mode: CANopen Mode
Unit:
Range: 0x0000 ... 0x0011
Data size: 16-bit
Display format: Hexadecimal

Settings:

0: PLCopen Function Disabled

1: PLCopen Function Enabled

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P3-11 * ■ PLCTX1	driveInput	Address: 0316_h, 0317_h

Default: 0x0000
Applicable control mode: CANopen Mode
Unit:
Range: 0x0000 ... 0xFFFF
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	driveModeCtrl	Address: 0318_h, 0319_h

Default: 0x0000
Applicable control mode: CANopen Mode
Unit:
Range: 0x0000 ... 0xFFFF
Data size: 16-bit
Display format: Hexadecimal

Settings:

See P3-11 for details.

P3-13 * ■ PLCTX3	refA16	Address: $031A_h$, $031B_h$

Default: 0x0000
Applicable control mode: CANopen Mode
Unit:
Range: 0x0000 ... 0xFFFF
Data size: 16-bit
Display format: Hexadecimal

Settings:

See P3-11 for details.

P3-14 * ■ PLCTX4	refB32	Address: $031C_h$, $031D_h$

Default: 0x0000
Applicable control mode: CANopen Mode

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Unit:
Range: 0x0000 ... 0xFFFF
Data size: 16-bit
Display format: Hexadecimal

Settings:

See P3-11 for details.

P3-15 ■ PLCRX1	driveStat	Address: 031E$_h$, 031F$_h$

Default: 0x0000
Applicable control mode: CANopen Mode
Unit:
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	mfStat	Address: 0320$_h$, 0321$_h$

Default: 0
Applicable control mode: CANopen Mode
Unit:
Range: -32768 ... 32767
Data size: 16-bit
Display format: Hexadecimal

Settings:

See P3-15 for details.

P3-17 ■ PLCRX3	motionStat	Address: 0322$_h$, 0323$_h$

Default: 0
Applicable control mode: CANopen Mode
Unit:
Range: -2147483648 ... 2147483647
Data size: 32-bit
Display format: Hexadecimal

Settings:

See P3-15 for details.

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P3-18 PEVM1	PDO1 Event Mask	Address: 0324_h, 0325_h

Default: 0x0001
Applicable control mode: CANopen Mode
Unit:
Range: 0x0000 ... 0x000F
Data size: 16-bit
Display format: Hexadecimal

P3-19 PEVM2	PDO2 Event Mask	Address: 0326_h, 0327_h

Default: 0x0001
Applicable control mode: CANopen Mode
Unit:
Range: 0x0000 ... 0x000F
Data size: 16-bit
Display format: Hexadecimal

P3-20 PEVM3	PDO3 Event Mask	Address: 0328_h, 0329_h

Default: 0x0001
Applicable control mode: CANopen Mode
Unit:
Range: 0x0000 ... 0x000F
Data size: 16-bit
Display format: Hexadecimal

P3-21 PEVM4	PDO4 Event Mask	Address: $032A_h$, $032B_h$

Default: 0x000F
Applicable control mode: CANopen Mode
Unit:
Range: 0x0000 ... 0x000F
Data size: 16-bit
Display format: Hexadecimal

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10.4.5 Group 4: Diagnosis Parameters

P4-00 ■ ASH1	Alarm Message (N)	Address: 0400_h, 0401_h

Default: 0x00000000
Applicable control mode: Pt, Pr, S, T
Unit:
Range: 0x00000000 ... 0xFFFFFFFF
Data size: 32-bit
Display format: Hexadecimal

Settings:

This parameter is used to set the most recent alarm message.

Display of Low Byte: LXXXX: It indicates the alarm code.

Display of High Byte: hYYYY: It indicates the corresponding CANopen error code.

P4-01 * ■ ASH2	Alarm Message (N-1)	Address: 0402_h, 0403_h

Default: 0x00000000
Applicable control mode: Pt, Pr, S, T
Unit:
Range: 0x00000000 ... 0xFFFFFFFF
Data size: 32-bit
Display format: Hexadecimal

Settings:

This parameter is used to set the second most recent alarm message.

P4-02 * ■ ASH3	Alarm Message (N-2)	Address: 0404_h, 0405_h

Default: 0x00000000
Applicable control mode: Pt, Pr, S, T
Unit:
Range: 0x00000000 ... 0xFFFFFFFF
Data size: 32-bit
Display format: Hexadecimal

Settings:

This parameter is used to set the third most recent alarm message.

P4-03 * ■ ASH4	Alarm Message (N-3)	Address: 0406_h, 0407_h

Default: 0x00000000
Applicable control mode: Pt, Pr, S, T
Unit:

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Range: 0x00000000 ... 0xFFFFFFFF
Data size: 32-bit
Display format: Hexadecimal

Settings:

This parameter is used to set the fourth most recent alarm message.

P4-04 * ■ ASH5	Alarm Message (N-4)	Address: 0408_h, 0409_h

Default: 0x00000000
Applicable control mode: Pt, Pr, S, T
Unit:
Range: 0x00000000 ... 0xFFFFFFFF
Data size: 32-bit
Display format: Hexadecimal

Settings:

This parameter is used to set the fifth most recent alarm message.

P4-05 JOG	JOG Operation Speed	Address: $040A_h$, $040B_h$

Default: 20
Applicable control mode: Pt, Pr, S, T
Unit: rpm
Range: 0 ... 5000
Data size: 16-bit
Display format: Decimal

Settings:

JOG operation command:

1. Operation Test

- Enable the drive (Servo On).
- Press the **ENT** button to display the JOG speed. The default value is 20 rpm.
- Press the **UP** button or **DOWN** button to increase or decrease the required JOG speed. This also can be done by using the **S** button to move the cursor to the required digit (the selected digit will flash) and then changing the value with the **UP** button or **DOWN** button.
- Press the **ENT** buton to activate the operating mode. The Servo Drive will display JOG.
- Press the **UP** button or **DOWN** button to jog the motor either in P(CCW) or N(CW) direction. The motor will only rotate while the **UP** button or **DOWN** button is held down.
- To change JOG speed again, press the **M** button. The servo Drive will display "P4 - 05". Press the **ENT** button and the JOG speed will be displayed again. See #(2) and #(3) to change speed.
- In JOG operation mode, if an alarm occurs, the motor will stop running. The maximum JOG speed is the rated speed of the servo motor.

2. DI Signal Control

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- Set the value of DI signal as JOGU and JOGD (see chapter *"10.5 Input Function Definition"*).
- You 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.

- Enter 1 ... 5000 for the required JOG speed
- Enter 4998 to JOG in the P(CCW) direction
- Enter 4999 to JOG in the N(CW) direction
- Enter 0 to stop the JOG operation

Note that if you use communication control, set P2-30 to 5 to keep the number of writes to the system flash memory low.

P4-06 ■ FOT	Force Output Control	Address: $040C_h$, $040D_h$

Default: 0x0000
Applicable control mode: Pt, Pr, S, T
Unit:
Range: 0x0000 ... 0x00FF
Data size: 16-bit
Display format: Hexadecimal

Settings:

The function of Digital Output (DO) is determined by the DO setting value. You 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:

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When P2-18 is set to 0x0130, it indicates that the state of DO1 is the Bit00 state of P4-06.

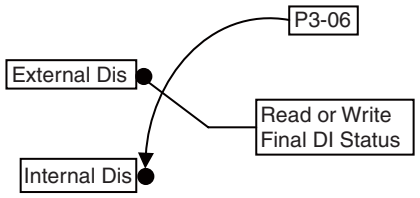
This parameter can also be used to force the state of DO signal. See P2-18 ... P2-22 for assigning the functions of digital outputs (DO signals).

P4-07 ■ ITST	Input Status or Force Input Control	Address: 040E$_h$, 040F$_h$

Default: 0x0000
Applicable control mode: Pt, Pr, S, T
Unit:
Range: 0x0000 ... 0x00FF
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 Bit 0 ... Bit 13 of P1-47) via communication (software). See P3-06 for details.



Read P4-07: Display the final status of DI input signal.

Write P4-07: Write the status of software digital inputs SDI1 ... SDI8

Irrespective of whether the servo drive is controlled via the 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, see P2-10 ... P2-17.

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P4-08 * ■ PKEY	Integrated HMI Keypad Input of Servo Drive	Address: 0410h, 0411h

Default: 0x0000
Applicable control mode: Pt, Pr, S, T
Unit:
Range: 0x0000 ... 0x00FF
Data size: 16-bit
Display format: Hexadecimal

Settings:

This parameter is used to check if the **ENT** button, **UP** button, **DOWN** button, **M** button or **S** button on the HMI keypad of the drive are being pressed or not. It is used to check if these five buttons work normally via communication during production.

P4-09 * ■ MOT	Output Status Display	Address: 0412h, 0413h

Default: 0x0000
Applicable control mode: Pt, Pr, S, T
Unit:
Range: 0x0000 ... 0x001F
Data size: 16-bit
Display format: Hexadecimal

Settings:

There is no difference when reading DO output signal via the integrated HMI of the drive or the communication. For the status of DO output signal, see P2-18 ... P2-22.

P4-10 ▲ ■ CEN	Adjustment Function	Address: 0414h, 0415h

Default: 0
Applicable control mode: Pt, Pr, S, T
Unit:
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

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NOTE:

1. This adjustment function is enabled after parameter P2-08 is set to 20.

2. When performing adjustments, 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: 0416_h, 0417_h

Default: 16352
Applicable control mode: Pt, Pr, S, T
Unit:
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 you to perform manual adjustment, it is not adviable to change the default setting value of these parameters (P4-11 ... P4-19) manually.

If P2-08 is set to 10, you cannot reset this parameter.

P4-12 SOF2	Analog Speed Input Drift Adjustment 2	Address: 0418_h, 0419_h

Default: 16352
Applicable control mode: Pt, Pr, S, T
Unit:
Range: 0 ... 32767
Data size: 16-bit
Display format: Decimal

Settings:

See P4-11 for details.

If P2-08 is set to 10, you cannot reset this parameter.

P4-13 TOF1	Analog Torque Drift Adjustment 1	Address: $041A_h$, $041B_h$

Default: 16352
Applicable control mode: Pt, Pr, S, T
Unit:
Range: 0 ... 32767
Data size: 16-bit
Display format: Decimal

Settings:

See P4-11 for details.

If P2-08 is set to 10, you cannot reset this parameter.

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P4-14 TOF2	Analog Torque Drift Adjustment 2	Address: 041C$_h$, 041D$_h$

Default: 16352
Applicable control mode: Pt, Pr, S, T
Unit:
Range: 0 ... 32767
Data size: 16-bit
Display format: Decimal

Settings:

See P4-11 for details.

If P2-08 is set to 10, you cannot reset this parameter.

P4-15 COF1	Current Detector Drift Adjustment (V1 phase)	Address: 041E$_h$, 041F$_h$

Default: 16352
Applicable control mode: Pt, Pr, S, T
Unit:
Range: 0 ... 32767
Data size: 16-bit
Display format: Decimal

Settings:

See P4-11 for details.

If P2-08 is set to 10, you cannot reset this parameter.

P4-16 COF2	Current Detector Drift Adjustment (V2 phase)	Address: 0420$_h$, 0421$_h$

Default: 16352
Applicable control mode: Pt, Pr, S, T
Unit:
Range: 0 ... 32767
Data size: 16-bit
Display format: Decimal

Settings:

See P4-11 for details.

If P2-08 is set to 10, you cannot reset this parameter.

P4-17 COF3	Current Detector Drift Adjustment (W1 phase)	Address: 0422$_h$, 0423$_h$

Default: 16352
Applicable control mode: Pt, Pr, S, T
Unit:
Range: 0 ... 32767
Data size: 16-bit
Display format: Decimal

Settings:

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See P4-11 for details.

If P2-08 is set to 10, you cannot reset this parameter.

P4-18 COF4	Current Detector Drift Adjustment (W2 phase)	Address: 0424h, 0425h

Default: 16352
Applicable control mode: Pt, Pr, S, T
Unit:
Range: 0 ... 32767
Data size: 16-bit
Display format: Decimal

Settings:

See P4-11 for details.

If P2-08 is set to 10, you cannot reset this parameter.

P4-19 TIGB	IGBT NTC Calibration	Address: 0426h, 0427h

Default: 2
Applicable control mode: Pt, Pr, S, T
Unit:
Range: 1 ... 4
Data size: 16-bit
Display format: Decimal

Settings:

See P4-11 for details.

When you perform this auto adjustment, the drive must be cooled to 25°C.

If P2-08 is set to 10, you cannot reset this parameter.

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

Default: 0
Applicable control mode: Pt, Pr, S, T
Unit: mV
Range: -800 ... 800
Data size: 16-bit
Display format: Decimal

Settings:

If P2-08 is set to 10, you cannot reset this parameter.

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

Default: 0
Applicable control mode: Pt, Pr, S, T
Unit: mV

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Range: -800 ... 800
Data size: 16-bit
Display format: Decimal

Settings:

If P2-08 is set to 10, you cannot reset this parameter.

P4-22 SAO	Analog Speed Input Offset	Address: 042C$_h$, 042D$_h$

Default: 0
Applicable control mode: S
Unit: mV
Range: -5000 ... 5000
Data size: 16-bit
Display format: Decimal

Settings:

In speed mode, you can use this parameter to add an offset value to analog speed input.

P4-23 TAO	Analog Torque Input Offset	Address: 042E$_h$, 042F$_h$

Default: 0
Applicable control mode: T
Unit: mV
Range: -5000 ... 5000
Data size: 16-bit
Display format: Decimal

Settings:

In speed mode, you can use this parameter to add an offset value to analog speed input.

P4-24 LVL	Low Voltage Alarm Detection Level	Address: 0430$_h$, 0431$_h$

Default: 160
Applicable control mode: Pt, Pr, S, T
Unit: V
Range: 140 ... 190
Data size: 16-bit
Display format: Decimal

Settings:

When DC Bus voltage is lower than the value of P4-24 x 2, the alarm Undervoltage will occur.

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10.4.6 Group 5: Motion Control Parameters

P5-00	Reserved (Do Not Use)

P5-01	Reserved (Do Not Use)

P5-02	Reserved (Do Not Use)

P5-03 PDEC	Event Deceleration Time Selection	Address: 0506_h, 0507_h

Default: 0xE0EFEEFF
Applicable control mode: Pt, Pr, S, T
Unit:
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 monitoring 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 monitoring 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 the **S** button on the HMI 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.

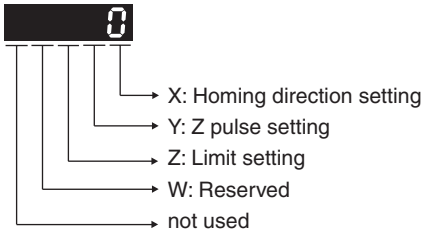
P5-04 HMOV	Homing Mode	Address: 0508_h, 0509_h

Default: 0x0000
Applicable control mode: Pr
Unit:
Range: 0x0000 ... 0x0128

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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: $050A_h$, $050B_h$

Default: 100.0
Applicable control mode: Pt, Pr, S, T

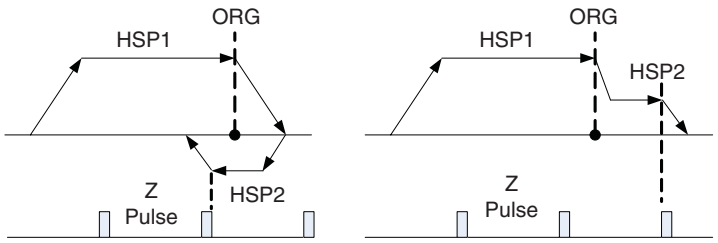
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Unit: 0.1 rpm
Range: 0.1 ... 2000.0
Data size: 16-bit
Display format: Decimal

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 High Speed Homing	Address: $050C_h$, $050D_h$

Default: 20.0
Applicable control mode: Pt, Pr, S, T
Unit: 0.1 rpm
Range: 0.1 ... 500.0
Data size: 16-bit
Display format: Decimal

Settings:

This parameter is used to set the secondary (low speed) homing speed.

See P5-05 for details.

P5-07 ■ PRCM	Trigger Position Command (Pr Mode Only)	Address: $050E_h$, $050F_h$

Default: 0
Applicable control mode: Pr
Unit:
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.

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0: Start homing function.

When entering P5-07, the default setting value 0 will display. Pressing the **ENT** button on the HMI 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 you read P5-07, 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 running, but does not reach the dedicated position (during positioning, the motor is running), if you read P5-07, 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 you read P5-07, 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 (PUU - Pulse for User Unit)	Address: 0510_h, 0511_h

Default: 2147483647
Applicable control mode: Pr
Unit:
Range: -2147483648 ... 2147483647
Data size: 32-bit
Display format: Decimal

P5-09 SWLN	Reverse Software Limit (PUU - Pulse for User Unit)	Address: 0512_h, 0513_h

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Default: -2147483648
Applicable control mode: Pr
Unit:
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	Data Not Retained Setting (for P6-02 ... P6-05)	Address: $051E_h$, $051F_h$

Default: 0x0000
Applicable control mode: Pt, Pr, S, T
Unit:
Range: 0x0000 ... 0x0011
Data size: 16-bit
Display format: Hexadecimal

Settings:

This parameter allows you 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

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P5-16 ■ AXEN	Motor Encoder Feedback Counter (from CN2 Terminal)	Address: 0520_h, 0521_h

Default: 0
Applicable control mode: Pt, Pr, S, T
Unit:
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:

You 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 AXPC	Pulse Command Feedback Counter (from CN1 Terminal)	Address: 0524_h, 0525_h

Default: 0
Applicable control mode: Pt, Pr, S, T
Unit:
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 AC0	Acceleration / Deceleration Time 0	Address: 0528_h, 0529_h

Default: 200
Applicable control mode: Pr
Unit: ms
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.

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P5-21 AC1	Acceleration / Deceleration Time 1	Address: 052A$_h$, 052B$_h$

Default: 300
Applicable control mode: Pr
Unit: ms
Range: 1 ... 65500
Data size: 16-bit
Display format: Decimal

Settings:

See P5-20 for details.

P5-22 AC2	Acceleration / Deceleration Time 1	Address: 052C$_h$, 052D$_h$

Default: 500
Applicable control mode: Pr
Unit: ms
Range: 1 ... 65500
Data size: 16-bit
Display format: Decimal

Settings:

See P5-20 for details.

P5-23 AC3	Acceleration / Deceleration Time 3	Address: 052E$_h$, 052F$_h$

Default: 600
Applicable control mode: Pr
Unit: ms
Range: 1 ... 65500
Data size: 16-bit
Display format: Decimal

Settings:

See P5-20 for details.

P5-24 AC4	Acceleration / Deceleration Time 4	Address: 0530$_h$, 0531$_h$

Default: 800
Applicable control mode: Pr
Unit: ms
Range: 1 ... 65500
Data size: 16-bit
Display format: Decimal

Settings:

See P5-20 for details.

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P5-25 AC5	Acceleration / Deceleration Time 5	Address: 0532h, 0533h

Default: 900
Applicable control mode: Pr
Unit: ms
Range: 1 ... 65500
Data size: 16-bit
Display format: Decimal

Settings:

See P5-20 for details.

P5-26 AC6	Acceleration / Deceleration Time 6	Address: 0534h, 0535h

Default: 1000
Applicable control mode: Pr
Unit: ms
Range: 1 ... 65500
Data size: 16-bit
Display format: Decimal

Settings:

See P5-20 for details.

P5-27 AC7	Acceleration / Deceleration Time 7	Address: 0536h, 0537h

Default: 1200
Applicable control mode: Pr
Unit: ms
Range: 1 ... 65500
Data size: 16-bit
Display format: Decimal

Settings:

See P5-20 for details.

P5-28 AC8	Acceleration / Deceleration Time 8	Address: 0538h, 0539h

Default: 1500
Applicable control mode: Pr
Unit: ms
Range: 1 ... 65500
Data size: 16-bit
Display format: Decimal

Settings:

See P5-20 for details.

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P5-29 AC9	Acceleration / Deceleration Time 9	Address: 053A$_h$, 053B$_h$

Default: 2000
Applicable control mode: Pr
Unit: ms
Range: 1 ... 65500
Data size: 16-bit
Display format: Decimal

Settings:

See P5-20 for details.

P5-30 AC10	Acceleration / Deceleration Time 10	Address: 053C$_h$, 053D$_h$

Default: 2500
Applicable control mode: Pr
Unit: ms
Range: 1 ... 65500
Data size: 16-bit
Display format: Decimal

Settings:

See P5-20 for details.

P5-31 AC11	Acceleration / Deceleration Time 11	Address: 053E$_h$, 053F$_h$

Default: 3000
Applicable control mode: Pr
Unit: ms
Range: 1 ... 65500
Data size: 16-bit
Display format: Decimal

Settings:

See P5-20 for details.

P5-32 AC12	Acceleration / Deceleration Time 12	Address: 0540$_h$, 0541$_h$

Default: 5000
Applicable control mode: Pr
Unit: ms
Range: 1 ... 65500
Data size: 16-bit
Display format: Decimal

Settings:

See P5-20 for details.

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P5-33 AC13	Acceleration / Deceleration Time 13	Address: 0542_h, 0543_h

Default: 8000
Applicable control mode: Pr
Unit: ms
Range: 1 ... 65500
Data size: 16-bit
Display format: Decimal

Settings:

See P5-20 for details.

P5-34 AC14	Acceleration / Deceleration Time 14	Address: 0544_h, 0545_h

Default: 50
Applicable control mode: Pr
Unit: ms
Range: 1 ... 500
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 monitoring function is activated.

P5-35 AC15	Acceleration / Deceleration Time 15	Address: 0546_h, 0547_h

Default: 30
Applicable control mode: Pr
Unit: ms
Range: 1 ... 200
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 Position	Address: $054A_h$, $054B_h$

Default: 0
Applicable control mode: Pt, Pr, S, T
Unit:
Range: -2147483648 ... 2147483647

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Data size: 32-bit
Display format: Decimal

Settings:

This Parameter stores the result Value Latched by High-Speed Latch #1 (Read-Only).

P5-38 ■ CANO	CAPTURE Amount	Address: $054C_h$, $054D_h$

Default: 0
Applicable control mode: Pt, Pr, S, T
Unit:
Range: -32768 ... 32767
Data size: 16-bit
Display format: Decimal

Settings:

The value will be increased by 1 when 1 data latched.

P5-39 ■ CACT	CAPTURE Enable Control	Address: $054E_h$, $054F_h$

Default: 0x0000
Applicable control mode: Pt, Pr, S, T
Unit:
Range: 0x0000 ... 0xF101
Data size: 16-bit
Display format: Hexadecimal

Settings:

X: Latch Function
0: Disable
1: Enable (Reset to 0 automatically when the P5-38 counter latched.)

Y: Reserved

Z: Polarity of Latch Input
0: NO
1: NC

U: Reserved

P5-40 DLY0	Delay Time 0	Address: 0550_h, 0551_h

Default: 0
Applicable control mode: Pr
Unit: ms
Range: 0 ... 32767
Data size: 16-bit
Display format: Decimal

P5-41 DLY1	Delay Time 1	Address: 0552_h, 0553_h

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Default: 100
Applicable control mode: Pr
Unit: ms
Range: 0 ... 32767
Data size: 16-bit
Display format: Decimal

P5-42 DLY2	Delay Time 2	Address: 0554_h, 0555_h

Default: 200
Applicable control mode: Pr
Unit: ms
Range: 0 ... 32767
Data size: 16-bit
Display format: Decimal

P5-43 DLY3	Delay Time 3	Address: 0556_h, 0557_h

Default: 400
Applicable control mode: Pr
Unit: ms
Range: 0 ... 32767
Data size: 16-bit
Display format: Decimal

P5-44 DLY4	Delay Time 4	Address: 0558_h, 0559_h

Default: 500
Applicable control mode: Pr
Unit: ms
Range: 0 ... 32767
Data size: 16-bit
Display format: Decimal

P5-45 DLY5	Delay Time 5	Address: $055A_h$, $055B_h$

Default: 800
Applicable control mode: Pr
Unit: ms
Range: 0 ... 32767
Data size: 16-bit
Display format: Decimal

P5-46 DLY6	Delay Time 6	Address: $055C_h$, $055D_h$

Default: 1000
Applicable control mode: Pr
Unit: ms

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Range: 0 ... 32767
Data size: 16-bit
Display format: Decimal

P5-47 DLY7	Delay Time 7	Address: 055E$_h$, 055F$_h$

Default: 1500
Applicable control mode: Pr
Unit: ms
Range: 0 ... 32767
Data size: 16-bit
Display format: Decimal

P5-48 DLY8	Delay Time 8	Address: 0560$_h$, 0561$_h$

Default: 2000
Applicable control mode: Pr
Unit: ms
Range: 0 ... 32767
Data size: 16-bit
Display format: Decimal

P5-49 DLY9	Delay Time 9	Address: 0562$_h$, 0563$_h$

Default: 2500
Applicable control mode: Pr
Unit: ms
Range: 0 ... 32767
Data size: 16-bit
Display format: Decimal

P5-50 DLY10	Delay Time 10	Address: 0564$_h$, 0565$_h$

Default: 3000
Applicable control mode: Pr
Unit: ms
Range: 0 ... 32767
Data size: 16-bit
Display format: Decimal

P5-51 DLY11	Delay Time 11	Address: 0566$_h$, 0567$_h$

Default: 3500
Applicable control mode: Pr
Unit: ms
Range: 0 ... 32767
Data size: 16-bit
Display format: Decimal

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P5-52 DLY12	Delay Time 12	Address: 0568_h, 0569_h

Default: 4000
Applicable control mode: Pr
Unit: ms
Range: 0 ... 32767
Data size: 16-bit
Display format: Decimal

P5-53 DLY13	Delay Time 13	Address: $056A_h$, $056B_h$

Default: 4500
Applicable control mode: Pr
Unit: ms
Range: 0 ... 32767
Data size: 16-bit
Display format: Decimal

P5-54 DLY14	Delay Time 14	Address: $056C_h$, $056D_h$

Default: 5000
Applicable control mode: Pr
Unit: ms
Range: 0 ... 32767
Data size: 16-bit
Display format: Decimal

P5-55 DLY15	Delay Time 15	Address: $056E_h$, $056F_h$

Default: 5500
Applicable control mode: Pr
Unit: ms
Range: 0 ... 32767
Data size: 16-bit
Display format: Decimal

P5-56	Reserved (Do Not Use)

P5-57	Reserved (Do Not Use)

P5-58	Reserved (Do Not Use)

P5-59	Reserved (Do Not Use)

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P5-60 POV0	Moving Speed Setting of Position 0	Address: 0578_h, 0579_h

Default: 20.0
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: $057A_h$, $057B_h$

Default: 50.0
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: $057C_h$, $057D_h$

Default: 100.0
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: $057E_h$, $057F_h$

Default: 200.0
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: 0580_h, 0581_h

Default: 300.0
Applicable control mode: Pr
Unit: 0.1 rpm
Range: 0.1 ... 6000.0
Data size: 16-bit
Display format: Decimal

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P5-65 POV5	Moving Speed Setting of Position 5	Address: 0582_h, 0583_h

Default: 500.0
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: 0584_h, 0585_h

Default: 600.0
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: 0586_h, 0587_h

Default: 800.0
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: 0588_h, 0589_h

Default: 1000.0
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: $058A_h$, $058B_h$

Default: 1300.0
Applicable control mode: Pr
Unit: 0.1 rpm
Range: 0.1 ... 6000.0
Data size: 16-bit
Display format: Decimal

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P5-70 POV10	Moving Speed Setting of Position 10	Address: 058C$_h$, 058D$_h$

Default: 1500.0
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: 058E$_h$, 058F$_h$

Default: 1800.0
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: 0590$_h$, 0591$_h$

Default: 2000.0
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: 0592$_h$, 0593$_h$

Default: 2300.0
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: 0594$_h$, 0595$_h$

Default: 2500.0
Applicable control mode: Pr
Unit: 0.1 rpm
Range: 0.1 ... 6000.0
Data size: 16-bit
Display format: Decimal

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P5-75 POV15	Moving Speed Setting of Position 15	Address: 0596_h, 0597_h

Default: 3000.0
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: 0598_h, 0599_h

Default: 16000
Applicable control mode: Pt, Pr, S, T
Unit:
Range: 0 ... 100000000
Data size: 32-bit
Display format: Decimal

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10.4.7 Group 6: Pr Path Definition Parameters

P6-00 ODEF	Homing Definition	Address: 0600_h, 0601_h

Default: 0x00000000
Applicable control mode: Pr
Unit:
Range: 0x00000000 ... 0xFFFFFF08
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

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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: 0602_h, 0603_h

Default: 0
Applicable control mode: Pr
Unit:
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	PATH#1 Definition	Address: 0604_h, 0605_h

Default: 0x00000000
Applicable control mode: Pr
Unit:
Range: 0x00000000 ... 0xFFFFFFF0
Data size: 32-bit
Display format: Hexadecimal

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: See chapter *"7.9 Parameter settings of Pr mode"*.

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.

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P6-03 PDAT1	PATH#1 Data	Address: 0606_h, 0607_h

Default: 0
Applicable control mode: Pr
Unit:
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	PATH#2 Definition	Address: 0608_h, 0609_h

Default: 0x00000000
Applicable control mode: Pr
Unit:
Range: 0x00000000 ... 0xFFFFFFF0
Data size: 32-bit
Display format: Hexadecimal

Settings:

See P6-02 for details.

P6-05 PDAT2	PATH#2 Data	Address: $060A_h$, $060B_h$

Default: 0
Applicable control mode: Pr
Unit:
Range: -2147483648 ... 2147483647
Data size: 32-bit
Display format: Decimal

Settings:

See P6-03 for details.

P6-06 PDEF3	PATH#3 Definition	Address: $060C_h$, $060D_h$

Default: 0x00000000
Applicable control mode: Pr
Unit:
Range: 0x00000000 ... 0xFFFFFFF0

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Data size: 32-bit
Display format: Hexadecimal

Settings:

See P6-02 for details.

P6-07 PDAT3	PATH#3 Data	Address: $060E_h$, $060F_h$

Default: 0
Applicable control mode: Pr
Unit:
Range: -2147483648 ... 2147483647
Data size: 32-bit
Display format: Decimal

Settings:

See P6-03 for details.

P6-08 PDEF4	PATH#4 Definition	Address: 0610_h, 0611_h

Default: 0x00000000
Applicable control mode: Pr
Unit:
Range: 0x00000000 ... 0xFFFFFFF0
Data size: 32-bit
Display format: Hexadecimal

Settings:

See P6-02 for details.

P6-09 PDAT4	PATH#4 Data	Address: 0612_h, 0613_h

Default: 0
Applicable control mode: Pr
Unit:
Range: -2147483648 ... 2147483647
Data size: 32-bit
Display format: Decimal

Settings:

See P6-03 for details.

P6-10 PDEF5	PATH#5 Definition	Address: 0614_h, 0615_h

Default: 0x00000000
Applicable control mode: Pr
Unit:
Range: 0x00000000 ... 0xFFFFFFF0
Data size: 32-bit
Display format: Hexadecimal

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Settings:

See P6-02 for details.

P6-11 PDAT5	PATH#5 Data	Address: 0616_h, 0617_h

Default: 0
Applicable control mode: Pr
Unit:
Range: -2147483648 ... 2147483647
Data size: 32-bit
Display format: Decimal

Settings:

See P6-03 for details.

P6-12 PDEF6	PATH#6 Definition	Address: 0618_h, 0619_h

Default: 0x00000000
Applicable control mode: Pr
Unit:
Range: 0x00000000 ... 0xFFFFFFF0
Data size: 32-bit
Display format: Hexadecimal

Settings:

See P6-02 for details.

P6-13 PDAT6	PATH#6 Data	Address: $061A_h$, $061B_h$

Default: 0
Applicable control mode: Pr
Unit:
Range: -2147483648 ... 2147483647
Data size: 32-bit
Display format: Decimal

Settings:

See P6-03 for details.

P6-14 PDEF7	PATH#7 Definition	Address: $061C_h$, $061D_h$

Default: 0x00000000
Applicable control mode: Pr
Unit:
Range: 0x00000000 ... 0xFFFFFFF0
Data size: 32-bit
Display format: Hexadecimal

Settings:

See P6-02 for details.

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P6-15 PDAT7	PATH#7 Data	Address: 061E$_h$, 061F$_h$

Default: 0
Applicable control mode: Pr
Unit:
Range: -2147483648 ... 2147483647
Data size: 32-bit
Display format: Decimal

Settings:

See P6-03 for details.

P6-16 PDEF8	PATH#8 Definition	Address: 0620$_h$, 0621$_h$

Default: 0x00000000
Applicable control mode: Pr
Unit:
Range: 0x00000000 ... 0xFFFFFFF0
Data size: 32-bit
Display format: Hexadecimal

Settings:

See P6-02 for details.

P6-17 PDAT8	PATH#8 Data	Address: 0622$_h$, 0623$_h$

Default: 0
Applicable control mode: Pr
Unit:
Range: -2147483648 ... 2147483647
Data size: 32-bit
Display format: Decimal

Settings:

See P6-03 for details.

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10.5 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

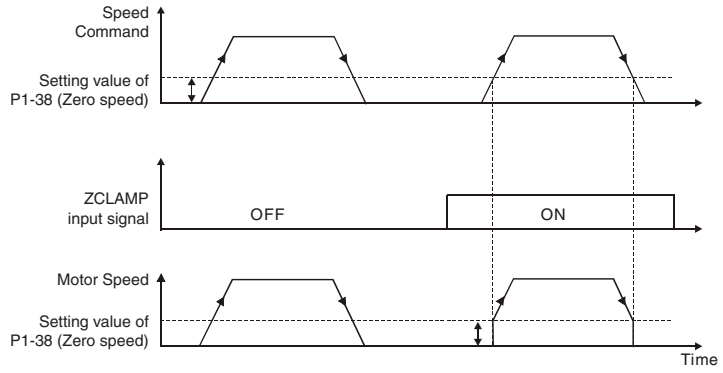
Setting value: 0x02			
DI Name	DI Function Description	Trigger Method	Control Mode
ARST	A number of alarms can be cleared by activating ARST. See table 10-3 for alarms that can be cleared with the ARST command. However, check into the alarm if it does not clear or the alarm description necessitates closer 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

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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 POS0 ... POS2 settings. Activation is triggered on the rising edge of the pulse.	Rising-edge Triggered	Pr

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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 POS0 ... POS2 commands. See chapter *"6.3.1.2 Command source for Position Control (Pr) mode"*.	Level Triggered	Pr

Setting value: 0x14 ... 0x15			
DI Name	DI Function Description	Trigger Method	Control Mode
SPD0 SPD1	Speed command selection 0 ... 1 (Command S1 ... S4) See chapter *"6.3.2.1 Command Source of Speed Control Mode"*.	Level Triggered	S

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Setting value: 0x16 ... 0x17			
DI Name	DI Function Description	Trigger Method	Control Mode
TCM0 TCM1	Torque command selection 0 ... 1 (Command T1 ... T4) See chapter *"6.3.3.1 Command Source of Torque Control Mode"*.	Level Triggered	T

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 an alarm (AL013) will display.	Level Triggered	All

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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 an alarm (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 an alarm (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

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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. Use DI8 for INHP signal for real-time operation of INHP function.	Level Triggered	Pt

Setting value: 0x46			
DI Name	DI Function Description	Trigger Method	Control Mode
STOP	Motor stop.	Rising-edge Triggered	Pr

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.

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10.6 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. Alarm and error 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 an alarm condition may exist. Servo ON (SON) is "ON" with control power applied to the servo drive, there may be an alarm condition or not. The servo is not ready to run. Servo ready (SRDY) is "ON" where the servo is ready to run, NO alarm exists.	Level Triggered	All

Setting value: 0x03			
DO Name	DO Function Description	Trigger Method	Control Mode
ZSPD	ZSPD is activated when the drive detects 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

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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 an alarm condition. (However, when Reverse limit error, Forward limit error, Operational stop, Serial communication error, and Undervoltage alarms occur, WARN is activated first.)	Level Triggered	All

Setting value: 0x08			
DO Name	DO Function Description	Trigger Method	Control Mode
BRKR	Holding brake control. BRKR is activated (actuation of holding brake). See parameters P1-42 ... P1-43)	Level Triggered	All

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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	Pre-Overload. OLW is activated when the servo drive has detected that the motor has reached the output overload time set by parameter P1-56. tOL = Permissible Time for Overload x setting value of P1-56 When overload accumulated time (continuously overload time) exceeds the value of tOL, the Pre-Overload 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 alarm (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 Pre-Overload 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, Alarm signal will be ON (DO signal ALRM will be activated).	Level Triggered	Pr

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Setting value: 0x11			
DO Name	DO Function Description	Trigger Method	Control Mode
WARN	Alarm signal. This signal is activated when the drive has detected Reverse limit error. Forward limit error, Operational stop, Serial communication error, and Under-voltage these alarm conditions.	Level Trig-gered	All

Setting value: 0x12			
DO Name	DO Function Description	Trigger Method	Control Mode
OVF	Position command overflow. OVF is acti-vated when the servo drive has detected that a position command overflows.	Level Trig-gered	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 Trig-gered	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 for-ward software limit is reached.	Level Trig-gered	All

Setting value: 0x15			
DO Name	DO Function Description	Trigger Method	Control Mode
CMD_OK	Internal position command completed out-put. CMD_OK is activated when the servo drive has detected that the internal posi-tion 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, see DO sig-nal TPOS.	Level Trig-gered	Pr

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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

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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

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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.

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11 Accessories and spare parts

11.1 Connector and cable

11.1.1 Connector

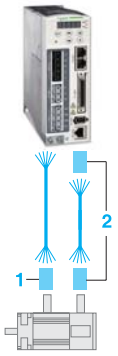
Name	Description	Order no.
Replacement connector set	Power connector set,drive side (power supply, motor, CN5)	VW3M4121
I/O connector	I/O connector of CN1 interface	VW3M4112
I/O terminal block module	Terminal block module, with 0.5 m cable	VW3M4113
Interface adapter	USB to RJ45(RS232) converter for CN3 interface	VW3M8131

11.1.2 Cable

Name	Description	Length	Order no.
		m	
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.			

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11.1.3 Connector for power cable



Description	For	Itemno.	Order no.
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

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11.1.4 Connector for encoder cable

Description	For	no.	Order no.
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

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11.1.5 Power cable



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Description	From servo motor	To servo drive	Composition	Length	Order no.
				m	
Drive side with flying lead, no brake	BCH0401O•2A1C	LXM23•U01M3X	4 x 0.82 mm²	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 mm²	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 mm²	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			
Drive side with flying lead, with brake	BCH1001O•2F1C	LXM23•U10M3X	6 x 1.3 mm²	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 mm²	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 mm²	3	VW3M5132R30
	BCH1304N•2F1C	LXM23•U20M3X		5	VW3M5132R50
Drive side with flying lead, no brake	BCH1801N•2A1C	LXM23•U20M3X	4 x 3.3 mm²	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 mm²	3	VW3M5133R30
	BCH1802N•2F1C	LXM23•U30M3X		5	VW3M5133R50
	BCH1802M•2F1C	LXM23•U30M3X			
	BCH1803N•2F1C	LXM23•U45M3X			
Servo motor side with military connector	BCH1803M•2A1C	LXM23•U45M3X	4 x 8.4 mm²	3	VW3M5124R30

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Description	From servo motor	To servo drive	Composition	Length	Order no.
				m	
Drive side with flying lead, no brake				5	VW3M5124R50
Servo motor side with military connector	BCH1803M•2F1C	LXM23•U45M3X	6 x 8.4 mm^2	3	VW3M5134R30
Drive side with flying lead, with brake				5	VW3M5134R50

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11.1.6 Encoder cable



Description	From servo motor	To servo drive	Composition	Length	Order no.
				m	
Servo motor side and drive side with plastic connector	BCH0401O•2•1C	LXM23•U01M3X	10 x 0.13 mm²	3	VW3M8121R30 (1)
	BCH0601O•2•1C	LXM23•U02M3X		5	VW3M8121R50 (1)
	BCH0602O•2•1C	LXM23•U04M3X		3	VW3M8123R30 (2)
	BCH0801O•2•1C	LXM23•U04M3X		5	VW3M8123R50 (2)
	BCH0802O•2•1C	LXM23•U07M3X			
Servo motor side with military connectorDrive side with plastic connector	BCH1001O•2•1C	LXM23•U10M3X	10 x 0.13 mm²	3	VW3M8122R30 (1)
	BCH1301M•2•1C	LXM23•U04M3X		5	VW3M8122R50 (1)
	BCH1301N•2•1C	LXM23•U04M3X		3	VW3M8124R30 (2)
	BCH1302M•2•1C	LXM23•U07M3X		5	VW3M8124R50 (2)
	BCH1302N•2•1C	LXM23•U10M3X			
	BCH1303M•2•1C	LXM23•U10M3X			
	BCH1303N•2•1C	LXM23•U15M3X			
	BCH1002O•2•1C	LXM23•U20M3X			
	BCH1304N•2•1C	LXM23•U20M3X			
	BCH1801N•2•1C	LXM23•U20M3X			
	BCH1802N•2•1C	LXM23•U30M3X			
	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			

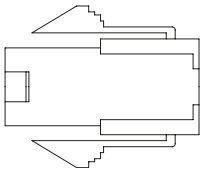
(1) without battery box

(2) with battery box, using for absolute position control

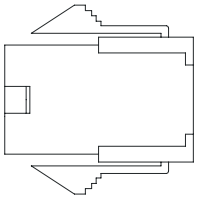
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11.2 Power Connectors

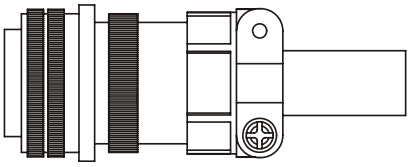
Connectors for power cables, motors without brake: VW3M5111



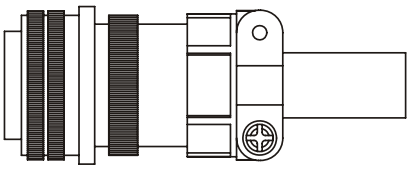
Connectors for power cables, motors with brake: VW3M5112



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

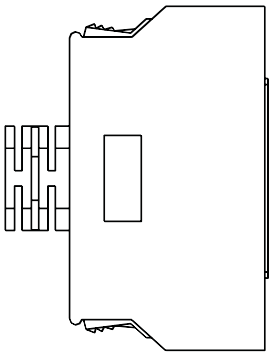
(for BCH motors 5.5kW and 7.5KW)



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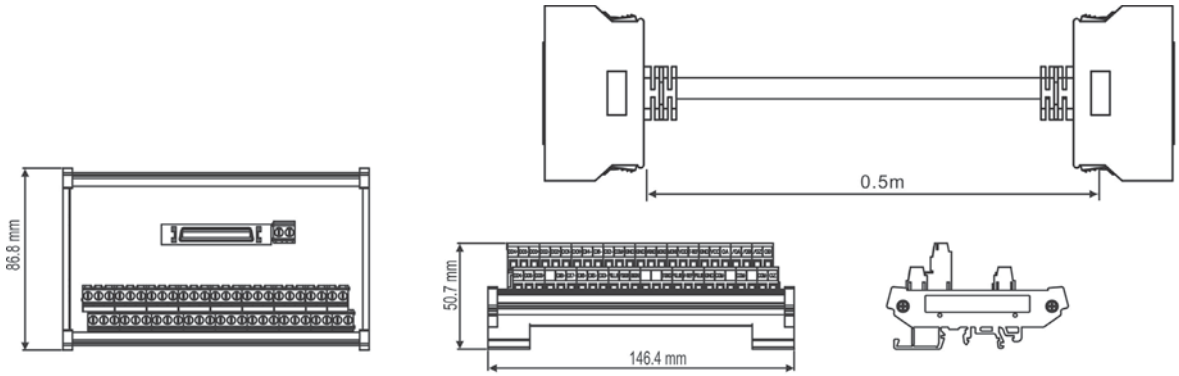
11.3 I/O Signal Connector (CN1)

Commercial reference: VW3M4112



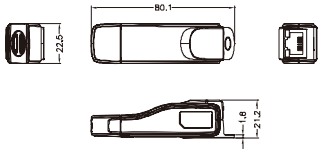
11.4 I/O Terminal Block Module

Commercial reference: VW3M4113



11.5 USB to RJ45 connector for CN3 interface

Commercial reference: VW3M8131



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11.6 Other Accessories

Description	Order no.
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
Bag of power connectors (plugs for power supply, motor, CN5)	VW3M4121
Braking Resistor 400W 40Ω (no UL)	VW3M7111
Braking Resistor 1kW 20Ω (no UL)	VW3M7112
Braking resistor IP65; 10 Ω; maximum continuous power 400 W; 0.75 m connection cable (2.1 mm^2), UL	VW3A7601R07
Braking resistor IP65; 10 Ω; maximum continuous power 400 W; 2 m connection cable (2.1 mm^2), UL	VW3A7601R20
Braking resistor IP65; 10 Ω; maximum continuous power 400 W; 3 m connection cable (2.1 mm^2), UL	VW3A7601R30
Braking resistor IP65; 27 Ω; maximum continuous power 100 W; 0.75 m connection cable (2.1 mm^2), UL	VW3A7602R07
Braking resistor IP65; 27 Ω; maximum continuous power 100 W; 2 m connection cable (2.1 mm^2), UL	VW3A7602R20
Braking resistor IP65; 27 Ω; maximum continuous power 100 W; 3 m connection cable (2.1 mm^2), UL	VW3A7602R30
Braking resistor IP65; 27 Ω; maximum continuous power 200 W; 0.75 m connection cable (2.1 mm^2), UL	VW3A7603R07
Braking resistor IP65; 27 Ω; maximum continuous power 200 W; 2 m connection cable (2.1 mm^2), UL	VW3A7603R20
Braking resistor IP65; 27 Ω; maximum continuous power 200 W; 3 m connection cable (2.1 mm^2), UL	VW3A7603R30
Braking resistor IP65; 27 Ω; maximum continuous power 400 W; 0.75 m connection cable (2.1 mm^2), UL	VW3A7604R07
Braking resistor IP65; 27 Ω; maximum continuous power 400 W; 2 m connection cable (2.1 mm^2), UL	VW3A7604R20
Braking resistor IP65; 27 Ω; maximum continuous power 400 W; 3 m connection cable (2.1 mm^2), UL	VW3A7604R30
Braking resistor IP65; 72 Ω; maximum continuous power 100 W; 0.75 m connection cable (2.1 mm^2), UL	VW3A7605R07

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Braking resistor IP65; 72 Ω; maximum continuous power 100 W; 2 m connection cable (2.1 mm^2), UL	VW3A7605R20
Braking resistor IP65; 72 Ω; maximum continuous power 100 W; 3 m connection cable (2.1 mm^2), UL	VW3A7605R30
Braking resistor IP65; 72 Ω; maximum continuous power 200 W; 0.75 m connection cable (2.1 mm^2), UL	VW3A7606R07
Braking resistor IP65; 72 Ω; maximum continuous power 200 W; 2 m connection cable (2.1 mm^2), UL	VW3A7606R20
Braking resistor IP65; 72 Ω; maximum continuous power 200 W; 3 m connection cable (2.1 mm^2), UL	VW3A7606R30
Braking resistor IP20; 15 Ω; maximum continuous power 1000 W; M6 terminals, UL	VW3A7704
Braking resistor IP20; 10 Ω; maximum continuous power 1000 W; M6 terminals, UL	VW3A7705

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11.7 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

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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 cer-tification	TSXCANCBDD1
CANopen cable, 3 m, 2 x D9-SUB (female), flame-retardant, tested as per IEC 60332-2, UL cer-tification	TSXCANCBDD3
CANopen cable, 5 m, 2 x D9-SUB (female), flame-retardant, tested as per IEC 60332-2, UL cer-tification	TSXCANCBDD5

11.8 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 com-missioning interface, 3 x RJ45 (female), with switchable terminating resistor	VW3CANTAP2
CANopen adapter cable D9-SUB to RJ45, 3 m	TCSCCN4F3M3T

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11.9 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-retard-ant, 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-retard-ant, 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-retard-ant, 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 stand-ard 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 stand-ard 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 stand-ard 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

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12 Service, maintenance and disposal



The product may only be repaired by a Schneider Electric customer service center.

The use and application of the information contained herein require expertise in the design and programming of automated control systems.

Only you, the user, machine builder or integrator, can be aware of all the conditions and factors present during installation and setup, operation, repair and maintenance of the machine or process.

You must also consider any applicable standards and/or regulations with respect to grounding of all equipment. Verify compliance with any safety information, different electrical requirements, and normative

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standards that apply to your machine or process in the use of this equipment.

Many components of the equipment, including the printed circuit board, operate with mains voltage, or present transformed high currents, and/or high voltages.

The motor itself generates voltage when the motor shaft is rotated.

⚠ ⚠ DANGER

HAZARD DUE TO ELECTRIC SHOCK, EXPLOSION OR ARC FLASH

- Only qualified personnel may install, adjust, repair and maintain this equipment.
- Do not touch any connectors, contacts, terminals, unshielded components or printed circuit boards while the equipment is under power.
- Use only electrically insulated tools.
- Block the motor shaft to prevent rotation prior to performing any type of work on the drive system.
- Insulate both ends of unused conductors of the motor cable to help prevent AC voltage from coupling to 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.
  - Do not assume that the DC bus is voltage-free when the DC bus LED is off.
- Refit/replace and secure all covers, accessories, hardware, cables, and wires and verify that a proper ground connection exists before applying power to the unit.

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

12.1 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 (with 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.

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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

12.2 Maintenance



Prior to any type of work on the drive system, consult the chapters on Installation and Commissioning for information on the precautions and processes to be observed.

Repairs cannot be made with the device installed.

12.2.1 Maintenance of drive

Include the following points in the maintenance plan of your machine.

Connections and fastening

- Check all connection cables and connectors regularly for damage. Replace damaged cables immediately.
- Tighten all mechanical and electrical threaded connections to the specified torque.

Cleaning

Clean dust and dirt off the product at regular intervals. Insufficient heat dissipation to the ambient air may excessively increase the temperature.

12.2.2 Maintenance of motor

Include the following points in the maintenance plan of your machine.

Connections and fastening

- Inspect all connection cables and connectors regularly for damage. Replace damaged cables immediately.
- Verify that all output elements are firmly seated.
- Tighten all mechanical and electrical threaded connections to the specified torque.

Lubricating the shaft sealing ring

In the case of motors with shaft sealing ring, lubricant must be applied to the space between the sealing lip of the shaft sealing ring and the shaft with a suitable non-metallic tool. If the shaft sealing rings are allowed to run dry, the service life of the shaft sealing rings will be significantly reduced.

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Cleaning

If the permissible ambient conditions are not respected, external substances from the environment may penetrate the product and cause unintended movement or equipment damage.

⚠ WARNING

UNINTENDED MOVEMENT

- Verify that the ambient conditions are respected.
- Do not allow seals to run dry.
- Keep liquids from getting to the shaft bushing (for example, in mounting position IM V3).
- Do not expose the shaft sealing rings and cable entries of the motor to the direct spray of a pressure washer.

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

Clean dust and dirt off the product at regular intervals. Insufficient heat dissipation to the ambient air may excessively increase the temperature.

Motors are not suitable for cleaning with a pressure washer. The high pressure may force water into the motor.

When using solvents or cleaning agents, verify that the cables, cable entry seals, O-rings and motor paint are not damaged.

Replacing the rolling bearing

When the rolling bearing is replaced, the motor is partially demagnetized and loses power.

NOTICE

DAMAGE TO MOTOR

Do not replace the rolling bearing.

Failure to follow these instructions can result in equipment damage.

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12.3 Replacement of drive

Unsuitable settings or unsuitable data may trigger unintended movements, trigger signals, damage parts and disable monitoring functions. Some settings do not become active until after a restart.

⚠ WARNING

UNINTENDED EQUIPMENT OPERATION

- Do not operate the drive system with unknown settings or data.
- Never modify a parameter unless you fully understand the parameter and all effects of the modification.
- After modifications to settings, restart the drive and verify the saved data or settings.
- When commissioning the product, 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 zone of operation.

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. Save the data to your PC using the commissioning software, see chapter *"5.2.2 Commissioning software"*.
- ▸ Switch off all supply voltages. Verify that no voltages are present (safety instructions).
- ▸ Label all connections and remove all connection cables (unlock connector locks).
- ▸ 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 *"4 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 *"5 Commissioning"*.

12.4 Changing the motor

Drive systems may perform unexpected movements because of incorrect connection or other errors, such as using unapproved motors. Even if motors are similar, different adjustment of the encoder system may be a source of hazards. Even if the connectors for motor connec-

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tion and encoder connection match mechanically, this does not imply that the motor is approved for use.

⚠ WARNING

UNEXPECTED MOVEMENT

Operate the device with approved motors only.

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 *"4 Installation"*.
- Commission the product as per chapter *"5 Commissioning"*.

If the connected motor is replaced by another approved motor, the new motor is automatically recognized by the drive.

12.5 Shipping, storage, disposal

Note the ambient conditions in chapter *"2.1 Ambient conditions"*.

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 are met.
Protect the product from dust and dirt.

Disposal The product consists of various materials that can be recycled. Dispose of the product in accordance with local regulations.

Visit http://www.schneider-electric.com/green-premium for information and documents on environmental protection as per ISO 14025 such as:

- EoLi (Product End-of-Life Instructions)
- PEP (Product Environmental Profile)

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Glossary

Units and conversion tables

The value in the specified unit (left column) is calculated for the desired unit (top row) with the formula (in the field).

Example: conversion of 5 meters (m) to yards (yd)
5 m / 0.9144 = 5.468 yd

Length

	in	ft	yd	m	cm	mm
in	-	/ 12	/ 36	* 0.0254	* 2.54	* 25.4
ft	* 12	-	/ 3	* 0.30479	* 30.479	* 304.79
yd	* 36	* 3	-	* 0.9144	* 91.44	* 914.4
m	/ 0.0254	/ 0.30479	/ 0.9144	-	* 100	* 1000
cm	/ 2.54	/ 30.479	/ 91.44	/ 100	-	* 10
mm	/ 25.4	/ 304.79	/ 914.4	/ 1000	/ 10	-

Mass

	lb	oz	slug	kg	g
lb	-	* 16	* 0.03108095	* 0.4535924	* 453.5924
oz	/ 16	-	* $1.942559*10^{-3}$	* 0.02834952	* 28.34952
slug	/ 0.03108095	/ $1.942559*10^{-3}$	-	* 14.5939	* 14593.9
kg	/ 0.45359237	/ 0.02834952	/ 14.5939	-	* 1000
g	/ 453.59237	/ 28.34952	/ 14593.9	/ 1000	-

Force

	lb	oz	p	N
lb	-	* 16	* 453.55358	* 4.448222
oz	/ 16	-	* 28.349524	* 0.27801
p	/ 453.55358	/ 28.349524	-	* $9.807*10^{-3}$
N	/ 4.448222	/ 0.27801	/ $9.807*10^{-3}$	-

Power

	HP	W
HP	-	* 746
W	/ 746	-

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Rotation

	min^{-1} (RPM)	**rad/s**	**deg./s**
min^{-1} (RPM)	-	* π / 30	* 6
rad/s	* 30 / π	-	* 57.295
deg./s	/ 6	/ 57.295	-

Torque

	lb·in	**lb·ft**	**oz·in**	**Nm**	**kp·m**	**kp·cm**	**dyne·cm**
lb·in	-	/ 12	* 16	* 0.112985	* 0.011521	* 1.1521	* $1.129*10^{6}$
lb·ft	* 12	-	* 192	* 1.355822	* 0.138255	* 13.8255	* $13.558*10^{6}$
oz·in	/ 16	/ 192	-	* $7.0616*10^{-3}$	* $720.07*10^{-6}$	* $72.007*10^{-3}$	* 70615.5
Nm	/ 0.112985	/ 1.355822	/ $7.0616*10^{-3}$	-	* 0.101972	* 10.1972	* $10*10^{6}$
kp·m	/ 0.011521	/ 0.138255	/ $720.07*10^{-6}$	/ 0.101972	-	* 100	* $98.066*10^{6}$
kp·cm	/ 1.1521	/ 13.8255	/ $72.007*10^{-3}$	/ 10.1972	/ 100	-	* $0.9806*10^{6}$
dyne·cm	/ $1.129*10^{6}$	/ $13.558*10^{6}$	/ 70615.5	/ $10*10^{6}$	/ $98.066*10^{6}$	/ $0.9806*10^{6}$	-

Moment of inertia

	lb·in^2	**lb·ft^2**	**kg·m^2**	**kg·cm^2**	**kp·cm·s^2**	**oz·in^2**
lb·in^2	-	/ 144	/ 3417.16	/ 0.341716	/ 335.109	* 16
lb·ft^2	* 144	-	* 0.04214	* 421.4	* 0.429711	* 2304
kg·m^2	* 3417.16	/ 0.04214	-	* $10*10^{3}$	* 10.1972	* 54674
kg·cm^2	* 0.341716	/ 421.4	/ $10*10^{3}$	-	/ 980.665	* 5.46
kp·cm·s^2	* 335.109	/ 0.429711	/ 10.1972	* 980.665	-	* 5361.74
oz·in^2	/ 16	/ 2304	/ 54674	/ 5.46	/ 5361.74	-

Temperature

	°F	**°C**	**K**
°F	-	(°F - 32) * 5/9	(°F - 32) * 5/9 + 273.15
°C	°C * 9/5 + 32	-	°C + 273.15
K	(K - 273.15) * 9/5 + 32	K - 273.15	-

Conductor cross section

AWG	1	2	3	4	5	6	7	8	9	10	11	12	13
mm^2	42.4	33.6	26.7	21.2	16.8	13.3	10.5	8.4	6.6	5.3	4.2	3.3	2.6

AWG	14	15	16	17	18	19	20	21	22	23	24	25	26
mm^2	2.1	1.7	1.3	1.0	0.82	0.65	0.52	0.41	0.33	0.26	0.20	0.16	0.13

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Terms and Abbreviations

	See chapter *" Standards and terminology"* for information on the pertinent standards on which many terms are based. Some terms and abbreviations may have specific meanings with regard to the standards.
Degree of protection	The degree of protection is a standardized specification for electrical equipment that describes the protection against the ingress of foreign objects and water (for example: IP 20).
DOM	**D**ate **o**f **m**anufacturing: The nameplate of the product shows the date of manufacture in the format DD.MM.YY or in the format DD.MM.YYYY. For example: 31.12.11 corresponds to December 31, 2011 31.12.2011 corresponds to December 31, 2011
Electronic gear	Calculation of a new output velocity for the motor movement based on the input velocity and the values of an adjustable gear ratio; calculated by the drive system.
EMC	Electromagnetic compatibility
Encoder	Sensor that converts a measured distance or angle into an electrical signal. This signal is evaluated by the drive to determine the actual position of a shaft (rotor) or a driving unit.
Error	Discrepancy between a detected (computed, measured or signaled) value or condition and the specified or theoretically correct value or condition.
Holding brake	The holding brake in the motor has the task of holding the current motor position when the power stage is disabled, even if external forces act (for example, in the case of a vertical axis). The holding brake is not a safety function and not a service brake.
IT mains	Mains in which all active components are isolated from ground or are grounded by a high impedance. IT: isolé terre (French), isolated ground. Opposite: Grounded mains, see TT/TN mains
Limit switch	Switches that signal overtravel of the permissible range of travel.
PELV	Protective Extra Low Voltage, low voltage with isolation. For more information: IEC 60364-4-41
Power stage	The power stage controls the motor. The power stage generates current for controlling the motor on the basis of the motion signals from the controller.
rms	"Root Mean Square" value of a voltage (V_{rms}) or a current (A_{rms})

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