Easy Lexium 16

AC Servo Drive system
User Guide

Nov. 2020 for FW V01.02.12

BRU5139402

- Thanks for purchasing this Schneider Electric product.
- Before operating this product, please read the instructions carefully.
- Read the the [Safety Operating Instructions] before using the products.
- Please save this manual properly.
- This product is for industrial equipment. Don't use this product at general household.

The information provided in this documentation contains general descriptions and/or technical characteristics of the performance of the products contained terein. This documentation is not intended as a substitute for and is not to be used for determining suitability or reliability of these products for specific user applications. It is the duty of any such user or integrator to perform the appropriate and complete risk analysis, evaluation and testing of the products with respect to the relevant specific application or use thereof. Neither Schneider Electric nor any of its affiliates or subsidiaries shall be responsible or liable for misuse of the information contained herein. If you have any suggestions for improvements or amendments or have found errors in this publication, please notify us.

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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 satety requirements, the relevant instructions must be followed.

Failure to use Schneider Electric software or approved software with our hardware products may result in injury, harm, or improper operating results.

Failure to observe this information can result in injury or equipment damage.

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I. Safety Information

IMPORTANT

Declaration

Read these instructions carefully, and look at the equipment to become familiar with the device before trying to install, operate, service 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" or "Warning" 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 asfety instructions that follow this symbol to avoid possible injury or death.

DANGER

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

WARNING

WARNING indicates a hazardous situation which, if not avoided, could result in death or serious injury.

NOTICE

NOTICE is used to address practices not related to physical injury.

Note: CAUTION indicates a hazardous situation which, if not avoided, could result in minor or moderate injury.

Please note

Electrical equipment must be installed, operated, serviced and maintained only by qualified personnel. No responsibility is assumed by Schneider Electric for any consequences arising out of the use of this material.

A qualified person is one who has skills and knowledge related to the construction and operation of electrical equipment and its installation, and has received safety training to recognize and avoid the hazards involved.

Qualification of Personnel

Only appropriately trainde 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. 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 modifying the settings and by the mechanical, electrical and electronic equipment of the entire system in which the product is used.

The qualified person must be able to detect possible hazards that may arise from parameterization, modifying parameter values and generally from mechanical, electrical, or electronic equipment.

The qualified person must be familiar with the standards, provisions, and regulations for the prevention of industrial accidents, which they must observe when designing and implementing the system.

Intended use

The products described or affected by this document are servo-drive systems for three-phase servo motors along with software, accessories and options.

The products are intended for industrial use according to the instructions, directions, examples and safety information contained in the present user guide and other supporting documentation.

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 products, 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 products are used as components in an entire system, you must ensure the safety of persons by means of the design of this entire system. Operate the products only with the specified cables and accessories. Use only genuine accessories and spare parts. Any use other than the use explicitly permitted as described herein is prohibited and may result in unanticipated hazards.

⚠ WARNING

DANGERUNGARDED EQUIPMENT

- Do not use this software and related automation equipment on equipment which does not have point-of-operation protection.
- Do not reach into machinery during operation.

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

This automated equipment and relevant software are used to control a variety of industrial processes. The type or model of automation equipment suitable for each application will vary depending on factors such as the control function required, degree of protection required, production methods, unusual conditions, government regulations, etc. In some applications, more than one processor may be required, as when backup redundancy is needed.

Only you, the user, machine builder or system integrator can be aware of all the conditions and factors present during setup, operation, and maintenance of the machine and, therefore, can determine the automation equipment and the related safeties and interlocks which can be properly used. When selecting automation and control equipment and related software for a particular application, you should refer to the applicable local and national standards and regulations. The National Safety Council's Accident Prevention Manual (nationally recognized in the United States of America) also provides much useful information.

In some applications, such as packaging machinery, additional operator protection such as point-of-operation guarding must be provided. This is necessary if the operator's hands and other parts of the body are free to enter the pinch points or other hazardous areas and serious injury can occur. Software products alone cannot protect an operator from injury. For this reason the software cannot be substituted for or take the place of point-of-operation protection.

Ensure that appropriate safeties and mechanical/electrical interlocks related to point-of-operation protection have been installed and are operational before placing the equipment into service. All interlocks and safeties related to point-of-operation protection must be coordinated with the related automation equipment and software programming.

Note: Coordination of safeties and mechanical/electrical interlocks for point-of-operation protection is outside the scope of the Function Block Library, System User Guide, or other implementation referenced in this documentation.

I. Safety Information

Startup and Test

Before using electrical control and automation equipment for regular operation after installation, the system should be given a startup test by qualified personnel to verify correct operation of the equipment It is important that arrangements for such a check be made and that enough time is allowed to perform complete and satisfactory testing.

⚠ WARNING

EQUIPMENT OPERATION HAZARD

- Verify that all installation and setup procedures have been completed.
- Before operational tests are performed, remove all blocks or other temporary holding means used for shipment from all component devices.
- Remove tools, meters and debris from the equipment.

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

Follow all start-up tests recommended in the equipment documentation. Store all equipment documentation for future references.

Software testing must be done in both simulated and real environments.

Software testing must be done in both simulated and real environments.

Verify that the completed system is free from all short circuits and temporary grounds that are not installed according to local regulations (according to the National Electrical Code in the U.S.A, for instance). If high potential voltage testing is necessary, follow recommendations in equipment documentation to prevent accidental equipment damage.

Before energizing equipment:
- Remove tools, meters and debris from the equipment.
- Close the equipment enclosure door.
- Remove all temporary grounds from incoming power lines.
- Perform all startup tests recommended by the manufacturer.

Operation and Adjustment

The following precautions are from the NEMA Standards Publication ICS 7.1-1995 (English version prevails):
- Regardless of the care exercised in the design and manufacture of equipment or in the selection and ratings of components, there are hazards that can be encountered if such equipment is improperly operated.
- It is sometimes possible to misadjust the equipment and thus produce unsatisfactory or unsafe operation. Always use the manufacturer's instructions as a guide for functional adjustments. Personnel who have access to these adjustments should be familiar with the equipment manufacturer’s instructions and the machinery used with the electrical equipment.
- Only those operational adjustments actually required by the operator should be accessible to the operator. Access to other controls should be restricted to prevent unauthorized changes in operating characteristics.

Safety Precautions

General Precautions

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 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

ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

- Disconnect all power from all equipment including connected devices prior to removing any covers or doors, or installing or removing any accessories, hardware, cables, or wires.
- Place a "Do Not Turn On" or equivalent hazard label on all power switches and lock them in the non-energized position.
- Wait 15 minutes to allow the residual energy of the DC bus capacitors to discharge.
- Measure the voltage on the DC bus with a properly rated voltage sensing device and verify that the voltage is less than 42.4 Vdc.
- Do not assume that the DC bus is voltage-free when the DC bus LED is off.
- Block the motor shaft to prevent rotation prior to performing any type of work on the drive system.
- Do not create a short-circuit across the DC bus terminals or the DC bus capacitors.
- Replace and secure all covers, accessories, hardware, cables, and wires and confirm 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 EXPOLSION

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

I. Safety Information

⚠ 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.

General Precautions

⚠ WARNING

UNINTENDED MOVEMENT OR MACHINE OPERATION

- Carefully install the wiring in accordance with the EMC requirements.
- Do not operate the product with undetermined settings and data.
- Perform comprehensive commissioning tests that include verification of configuration settings and data that determine position and movement.

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 control functions, provide a means to achieve a safe state during and after a path failure. Examples of critical control functions are emergency stop and overtravel stop, power outage and restart.
- Separate or redundant control paths must be provided for critical control functions.
- System control paths may include communication links. Consideration must be given to the implications of unanticipated transmission delays or failures of the link.
- Observe all accident prevention regulations and local safety guidelines [1].
- Each implementation of this equipment 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 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 or their equivalent governing your particular location.

Machines, controllers, and related equipment are usually integrated into networks.Unauthorized persons and malware may gain access to the machine as well as to other devices on the network/fieldbus of the machine and connected networks via insufficiently secure access to software and networks.

Schneider Electric adheres to industry best practices in the development and implementation of control systems. This includes a "Defense-in-Depth" approach to secure an Industrial Control System. This approach places the controllers behind one or more firewalls to restrict access to authorized personnel and protocols only.

⚠ WARNING

UNAUTHENTICATED ACCESS AND SUBSEQUENT UNAUTHORIZED MACHINE OPERATION

- Evaluate whether your environment or your machines are connected to your critical infrastructure and, if so, take appropriate steps in terms of prevention, based on Defense-in-Depth, before connecting the automation system to any network.
- Limit the number of devices connected to a network to the minimum necessary.
- Isolate your industrial network from other networks inside your company.
- Protect any network against unintended access by using firewalls, VPN, or other, proven security measures.
- Monitor activities within your systems.
- Prevent subject devices from direct access or direct link by unauthorized parties or unauthenticated actions.
- Prepare a recovery plan including backup of your system and process information.

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

For more information on organizational measures and rules covering access to infrastructures, refer to ISO/IEC 27000 series, Common Criteria for Information Technology Security Evaluation, ISO/IEC 15408, IEC 62351, ISA/IEC 62443, NIST Cybersecurity Framework, Information Security Forum - Standard of Good Practice for Information Security.

DC bus voltage measurement

The DC bus voltage can exceed 300 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 15 minutes to allow the DC bus capacitors to discharge.
- Use a properly rated voltage-sensing device for measuring (greater than 800 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 15 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.

Connecting external braking resistor

⚠ 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.

II. Certification

Equipment	Model	Directives	Standards
Servo drive	LXM16…	Low Voltage Directive 2014/35/EU	EN 61800-5-1:2007
			EN 60034-1:2010/AC:2010
		EMC Directive 2014/30/EU	EN 61800-3:2004/A1:2012
			EN 60034-1:2010/AC:2010
Servo motor	BCH16…	Low Voltage Directive 2014/35/EU	EN 61800-5-1:2007
			EN 60034-1:2010/AC:2010
		EMC Directive 2014/30/EU	EN 61800-3:2004/A1:2012
			EN 60034-1:2010/AC:2010
Accessories	VW3…	Low Voltage Directive 2014/35/EU	EN 61800-5-1:2007
			EN 60034-1:2010/AC:2010
		EMC Directive 2014/30/EU	EN 61800-3:2004/A1:2012
			EN 60034-1:2010/AC:2010

Schneider Electric

EU DECLARATION OF CONFORMITY

We : **Schneider Electric Industries SAS**
35 rue Joseph Monier
Rueil Malmaison 92506 – France

Hereby declare under our sole responsibility that the products:

Trademark	Schneider Electric
Product, Type	LXM16…motion servo drives BCH16…servo motors VW3…options

Are in conformity with the requirements of the following directives and conformity was checked in accordance with the following standards.

Directive	**Harmonized standard**
LV Directive 2014/35/EU	EN 61800-5-1:2007 EN 60034-1:2010/AC:2010
EMC Directive 2014/30/EU	EN 61800-3:2004/A1:2012 EN 60034-1:2010/AC:2010

Subject to correct installation, maintenance and use conforming to its intended purpose, to the applicable regulations and standards, to the supplier's instructions and to accepted rules of the art.
This declaration becomes invalid in the case of any modification to the products not authorized by us.

The guides giving requirements, details and advices for installation of products used are available on:
http://www.schneider-electric.com

Issued at Carros - FRANCE: 2018.10.16

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Industrial Control & Drives
Customer Satisfaction & Quality
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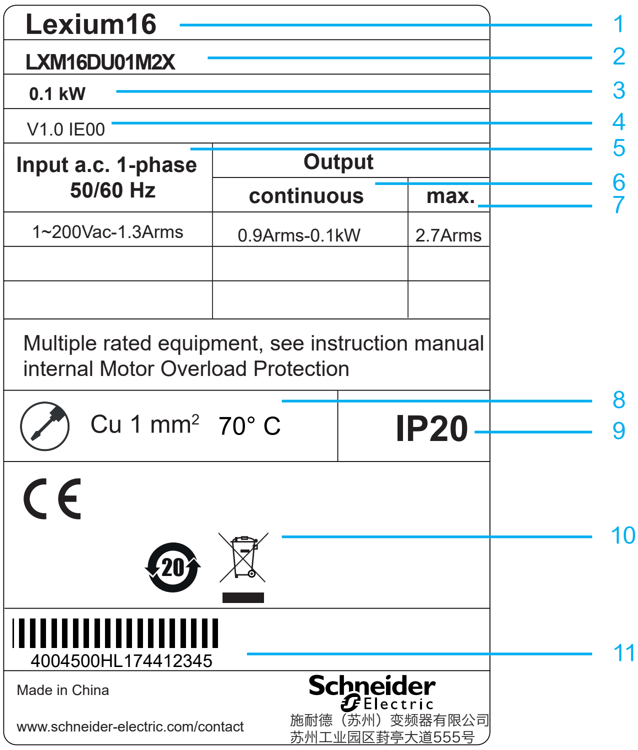
Chap01.Overview

1.1 Overview of Easy Lexium 16 Servo Drive / Servo Motor System

The servo system composed of LXM16D series servo drive and BCH16 series AC servo motor is a member of the Lexium 16 family designed to suit pulse control and offer high performance, simple interface and easy operation.
This series include a variety of 0.1 kW~1.5 kW servo drives and AC servo motors. Incorporating real-time adaptive tuning and adaptive notch filter, this series of servo drives are designed with the selection and automatic switchover of stiffness levels to address various requirements on the stability of low-stiffness machine and the high speed and accuracy of high-stiffness machine, in addition with the AC servo motor equipped with 2500-line Incremental encoder, the servo system achieves the simplicity of interface and the simple operation of machinery and positioning, thereby suiting a wide range of machines.
This manual is prepared for you to make correct and effective use of LXM16D series servo drive system with above-noted merits.

1.2 About Servo Drive

1.2.1 Nameplate of Servo Drive



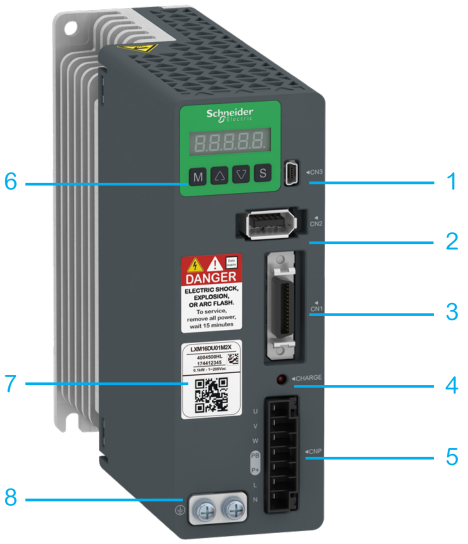
1. Range Name
2. Commercial Reference
3. Continuous power
4. Firmware & Hardware version on delivery
5. Input Voltage & Current
6. Output Current & Power
7. Maximum Output Current
8. Tool & Cable
9. Protection Degree
10. Certification
11. Serial Number

1.2.2 Servo Drive Model Code Description

Item	1	2	3	4	5
Type Code (Example)	LXM	16	D	U04	M2X

Item	Description
1	Product Designation LXM = Easy Lexium
2	Product Type 16 = AC servo drive for one axis
3	Interface D = I/O interface, PTI, PTO
4	Continuous Power U01 = 0.1 kW U02 = 0.2 kW U04 = 0.4 kW U07 = 0.75 kW U10 = 1.0 kW U15 = 1.5 kW
5	Power Stage Supply [Vac] M2X = Single phase, 200/240Vac, no built-in EMC filter

1.2.3 Designation of Parts of Servo Drive

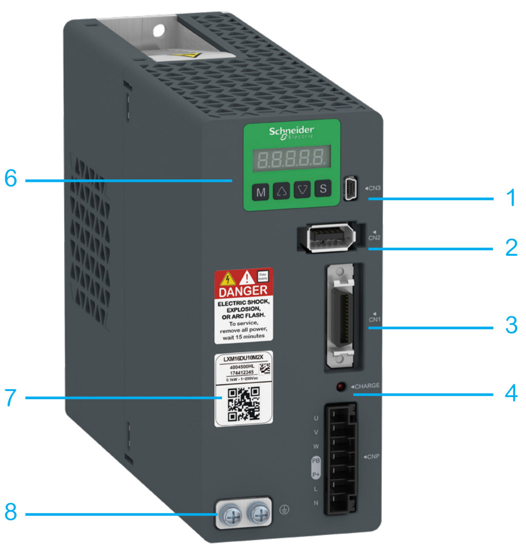


Size 1: Servo Drive - 0.1 / 0.2 / 0.4 kW

Servo Drive Front Panel:

1. Connection port CN3: MircoUSB connector
2. Connection port CN2: Encoder connector
3. Connection port CN1: Connection to host controller
4. CHARGE: Drive charge indicator LED
5. Connection port CNP: Motor, external braking resistor and power input connector
6. HMI
7. QR code, which is scanned to obtain detailed technical parameters and the guide for installation and wiring
8. Ground Terminal

Note: Size 1 servo drive is designed without ventilation fan.



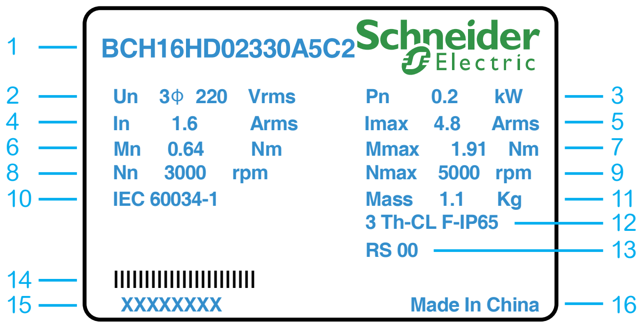
Size 2: Servo Drive - 0.75 / 1.0 / 1.5 kW

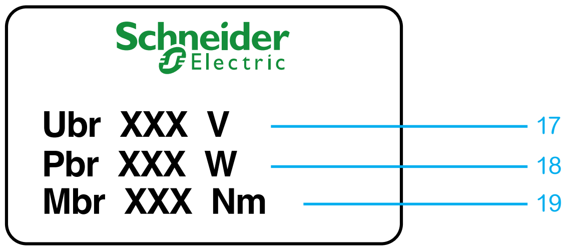
Servo Drive Front Panel:

1. Connection port CN3: MircoUSB connector
2. Connection port CN2: Encoder connector
3. Connection port CN1: Connection to host controller
4. CHARGE: Drive charge indicator LED
5. Connection port CNP: Motor, external braking resistor and power input connector
6. HMI
7. QR code, which is scanned to obtain detailed technical parameters and the guide for installation and wiring
8. Ground Terminal

1.3 About Servo Motor

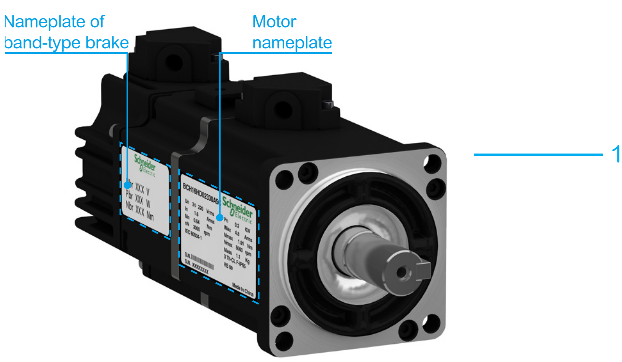
1.3.1 Nameplate of Servo Motor

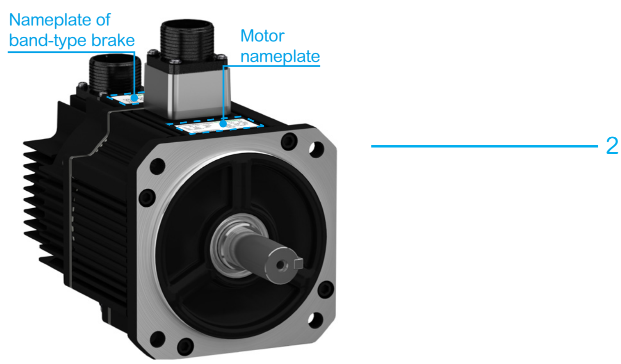




Servo motor nameplate:

1. Motor type
2. Nominal voltage
3. Nominal power
4. Nominal current
5. Maximum current
6. Nominal torque
7. Maximum torque
8. Norminal speed of rotation
9. Maximum speed of rotation
10. Applied standard
11. Mass
12. Number of motor phase, temperature class, degree of protection
13. Hardware versoin
14. Bar code
15. Serial number
16. Country of manufacture
17. Nominal voltage of holding brake
18. Nominal power of holding brake
19. Nominal torque of holding brake





Location of motor nameplate:

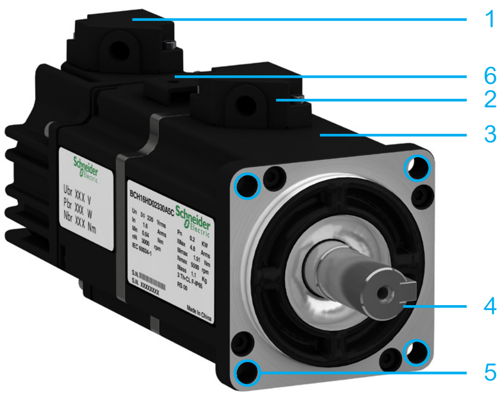
1.40/60/80 mm
2.100/130 mm

1.3.2 Servo Motor Model Code Description

Item	1	2	3	4	5	6	7	8	9	10	11
Type Code (Example)	BCH16	H	D	04	3	3	0	A	5	C	2

Item	Description
1	Product designation BCH16 = Brushless servo motor, in combination with LXM16 servo drives
2	Moment of inertia L = Low inertia M = Medium inertia H = High inertia
3	Flange size (housing) B = 40 mm Flange (Shaft 8mm) C = 60 mm Flange (Shaft 11mm) D = 60 mm Flange (Shaft 14mm) F = 80 mm Flange (Shaft 19mm) H = 100 mm Flange (Shaft 19mm) J = 100 mm Flange (Shaft 22mm) M = 130 mm Flange (Shaft 22mm)
4	Norminal power 01 = 0.1 kW 02 = 0.2 kW 04 = 0.4 kW 07 = 0.75 kW 08 = 0.85 kW 10 = 1.0 kW 15 = 1.5 kW
5	Type of winding and power supply grade 1 = Optimized in terms of torque (1000 rpm/1500 rpm); power supply 200/240 Vac 2 = Optimized in terms of torque and speed of rotation (2000 rpm); power supply 200/240 Vac 3 = Optimized in terms of speed of rotation (3000 rpm); power supply 200/240 Vac
6	Shaft and degree of protection 3 = Parallel keyed; degree of protection: shaft and housing IP65
7	Encoder system 0 = 2500 ppr incremental encoder 2 = 23bit High resolution encoder
8	Holding brake A = Without holding brake F = With holding brake
9	Connection version 5 = Free leads with plastic connectors (for BCH16*B, BCH16*C, BCH16*D, and BCH16*F) 6 = Military connectors (for BCH16*H, BCH16*J and BCH16*M)
10	Mechanical interface - Mounting C = Motor compatible with Asian style mounting style
11	Hardware version 2 = RS02

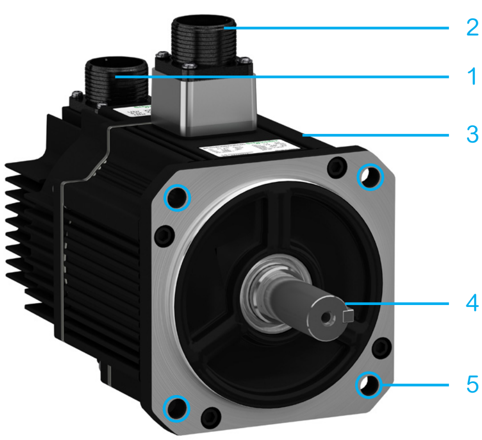
1.3.3 Designation of Parts of Servo Motor



40 / 60 / 80 mm Flange servo motor

1. Encoder connector, plastic
2. Power connector, plastic
3. Motor housing, RAL9005
4. Keyed motor shaft with oil seal
5. 4 * Mounting holes (Note 1)
6. Holding brake connector, plastic

Note 1: 40mm flange servo motor has 2 mounting holes



100 / 130 mm Flange servo motor

1. Encoder connector, military
2. Power (& holding brake) connector, military
3. Motor housing, RAL9005
4. Keyed motor shaft with oil seal
5. 4 * Mounting holes

1.4 Confirm the Mating of Servo Drive and Servo Motor

Servo Drive	Servo Motor	Nominal Power	Nominal Speed	Nominal Torque	Moment of Inertia
		kW	rpm	Nm	
LXM16DU01M2X	BCH16LB013***5C*	0.1	3000	0.32	Low
LXM16DU02M2X	BCH16HC023***5C*	0.2	3000	0.64	High
	BCH16HD023***5C*	0.2	3000	0.64	High
LXM16DU04M2X	BCH16HD043***5C*	0.4	3000	1.27	High
LXM16DU07M2X	BCH16HF073***5C*	0.75	3000	2.39	High
LXM16DU10M2X	BCH16LF103***5C*	1.0	3000	3.18	Low
	BCH16LH103***6C*	1.0	3000	3.18	Low
	BCH16LJ103***6C*	1.0	3000	3.18	Low
	BCH16HM102***6C*	1.0	2000	4.77	High
LXM16DU15M2X	BCH16HM081***6C*	0.85	1500	5.39	High
	BCH16HM152***6C*	1.5	2000	7.16	High

Chap02. Type Selection

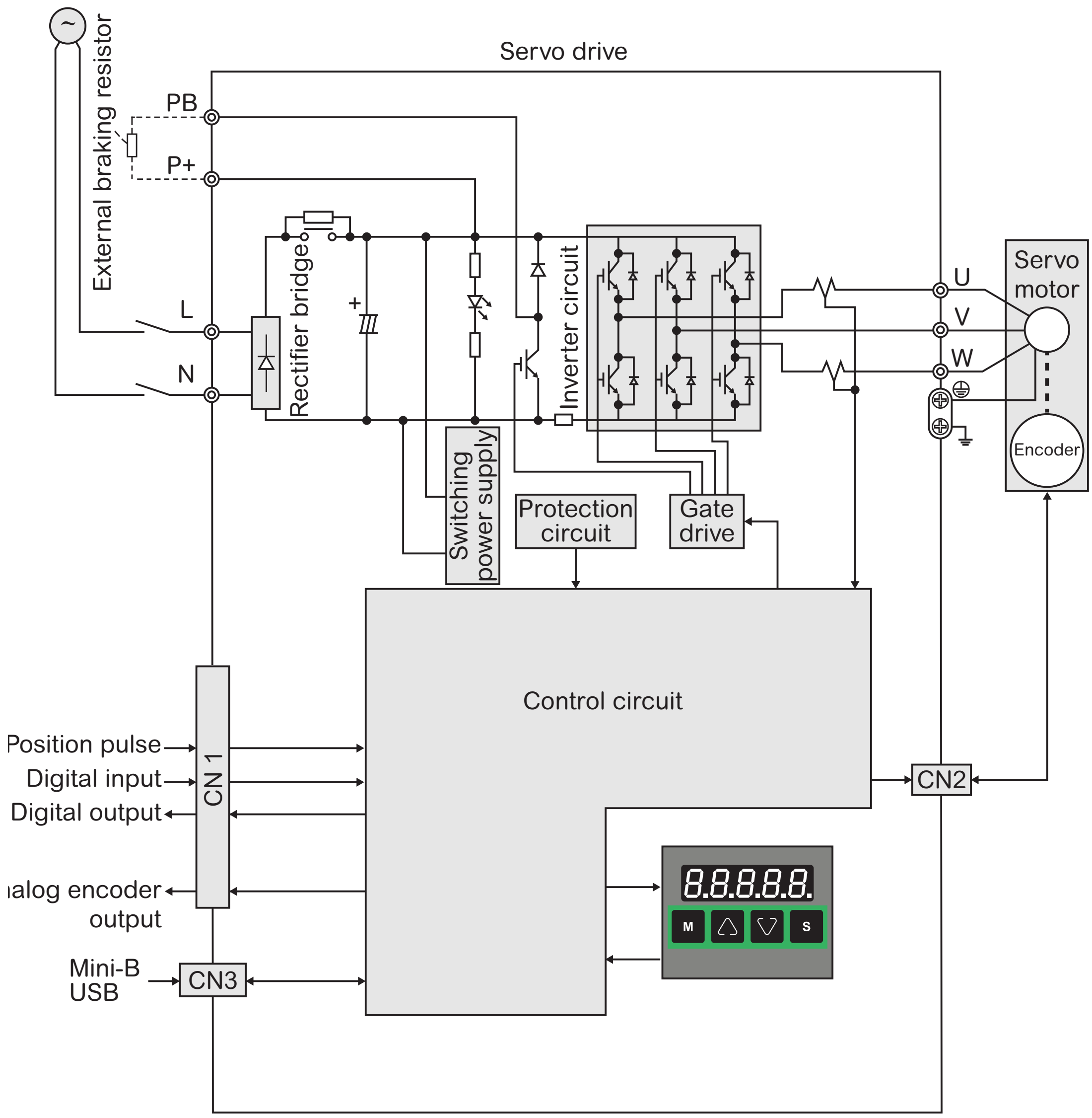
2.1 Type Selection of Servo Drive

2.1.1 Specifications of Servo Drive

Item			Specifications
Ambient	Operation	Temperature	0°C ... 40°C: Without derating 40°C ... 50°C: With derating
		Relative Humidity	5% ... 95%, no condensation
		Altitude	<= 1000M mean sea level: Without derating 1000 ... 2000M mean sea level: With derating
		Impact	3M4, 3mm [2..9Hz], Zone I
		Vibration	3M4, 1G [9..200Hz], Zone I
	Storage	Temperature	-25°C ... 70°C
		Relative Humidity	5% ... 95%, no condensation
		Vibration	2M2, 3.5mm [2..9Hz] / 1G [9..200Hz] / 1.5G [200..500Hz]
	Protection Degree		IP20
	Environmental Class		Class 2: No corrosive or inflammable gas No oil, water, or chemical splash Free from dust, dirt, salts, or iron powders
Input power	Voltage		1~ 220Vac, 200Vac -15% ... 240Vac + 10%
	Frequency		50Hz -5% ... 60Hz +5%
	Grounding Type	TT Grounding System	Allowed
		TN Grounding System	Allowed
		IT Grounding System	Not allowed
	Leakage Current		<35 mA
Heat Dissipation Method			0.1 kW ... 0.4 kW: Natural cooling 0.75 kW ... 1.5 kW: Fan cooling
Overload Capacity			300%
Feedback Interface			2500 ppr incremental encoder 8-wire
			23 bit high resolution encoder
Control Interface	Digital	Input	6 Digital inputs The input function can be set through parameters
		Output	3 Digital outputs The output function can be set through parameters
	Pulse	Input	2 Inputs: Open collector (24V) Line driver or differential high-speed pulse (3.3V)
		Output	Encoder simulation feedback output Resolution can be set through parameter
			Motor index pulse open collector output
Commissioning Interface		USB	Mini-B USB Commissioning and monitoring by PC software
		HMI	5-digit 7-segment display 4 buttons
Braking Method	Regenerative Braking		No built-in regenerative braking resistor
	Dynamic Braking		Built-in dynamic brake function, can be activated through parameter

Item			Specifications
Position Control	Pulse Train	Input Pulse Train Type	P + D
			CW + CCW
			AqB (with quadruple)
		Max. Pulse Frequency	Open collector 24V: 200Kpps
			Differential high-speed pulse (3.3V): 2Mpps
		Internal Counting	131072 pulses/revolution
		Electronic Gear Ratio	Electronic gear ratio is directly selected through parameter
			Electronic gear ratio is computed through numerator/ denominator
			Electronic gear ratio is switchable
Motion Task Control			User can program own interal motion task by script
Control Loop Setting	Auto Tuning	Easy Tuning	The servo drive moves the motor with pre-defined trajectory and optimize the control loop parameters
		Comfort Tuning	User can set trajectory parameters such as movement, direction and velocity, the servo drive then drives the motor following given criteria and yield optimized control loop parameters
		Auto Adaptive Tuning	The servo drive automatically identifies the load inertia ratio in real time and sets the control loop parameters with respect to the stiffness
		Auto Notch Filters	The servo drive automatically detects the load resonance frequency and sets 1 or 2 sets of built-in notch filters
	Manual Tuning		Cascade control loop
			Anti-vibration filters
			Manual notch filters
Control Input			1. Servo enable 2. Alarm clear 3. Parameter set switchover 4. Halt 5. Electronic gear ratio switchover 6.JOG 7. Hardware limit 8. HOME 9. Torque limit 10. Speed limit
Control Output			1. Servo alarm 2. Servo enable signal 3. Position deviation reached 4. Motor standstill 5. Error monitor 6. Warning monitor 7. Homed 8. Motor moving

2.1.2 Servo Drive Block Diagram



Item			Specifications
Position Control	Pulse Train	Input Pulse Train Type	P + D
			CW + CCW
			AqB (with quadruple)
		Max. Pulse Frequency	Open collector 24V: 200Kpps
			Differential high-speed pulse (3.3V): 2Mpps
		Internal Counting	131072 pulses/revolution
		Electronic Gear Ratio	Electronic gear ratio is directly selected through parameter
			Electronic gear ratio is computed through numerator/ denominator
			Electronic gear ratio is switchable
Motion Task Control			User can program own interal motion task by script
Control Loop Setting	Auto Tuning	Easy Tuning	The servo drive moves the motor with pre-defined trajectory and optimize the control loop parameters
		Comfort Tuning	User can set trajectory parameters such as movement, direction and velocity, the servo drive then drives the motor following given criteria and yield optimized control loop parameters
		Auto Adaptive Tuning	The servo drive automatically identifies the load inertia ratio in real time and sets the control loop parameters with respect to the stiffness
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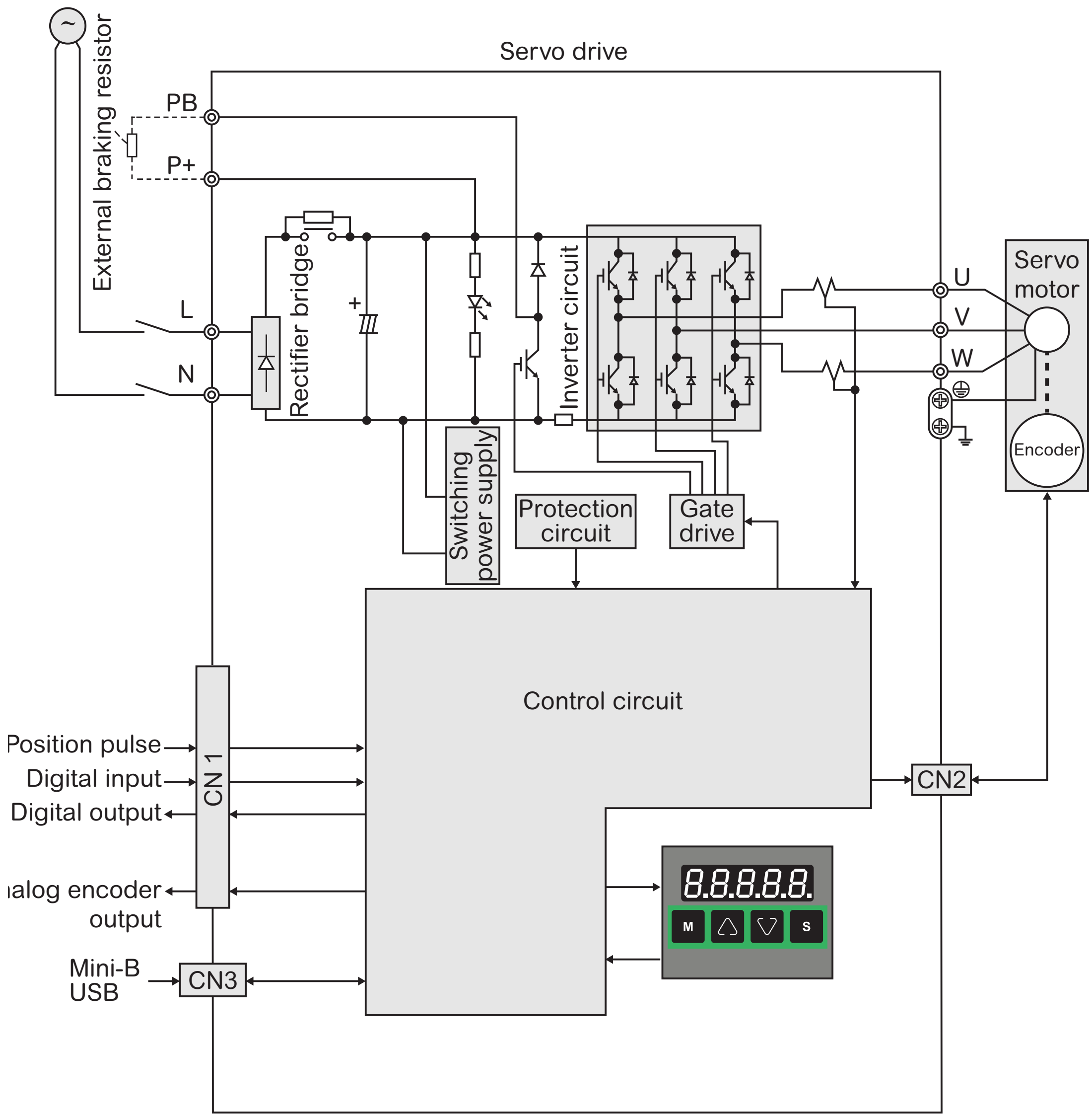
	Manual Tuning		Cascade control loop
			Anti-vibration filters
			Manual notch filters
Control Input			1. Servo enable 2. Alarm clear 3. Parameter set switchover 4. Halt 5. Electronic gear ratio switchover 6.JOG 7. Hardware limit 8. HOME 9. Torque limit 10. Speed limit
Control Output			1. Servo alarm 2. Servo enable signal 3. Position deviation reached 4. Motor standstill 5. Error monitor 6. Warning monitor 7. Homed 8. Motor moving

2.1.2 Servo Drive Block Diagram

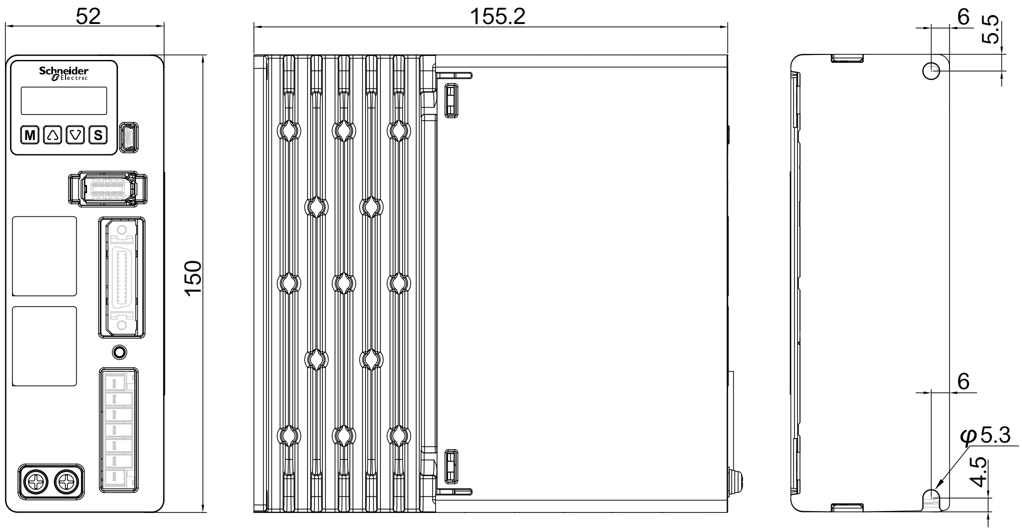


2.1.3 Ratings of Servo Drive

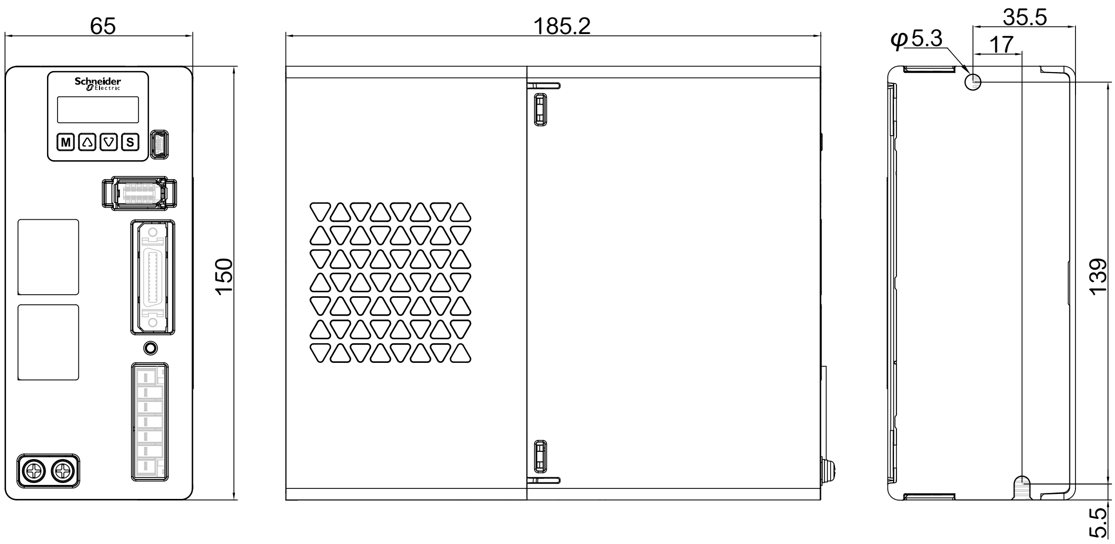
Model LXM16D*M2X	U01	U02	U04	U07	U10	U15
Nominal Input Voltage [Vac]	1~ 200 ... 240 Vac, -10% ... +15%, 50Hz -5% ... 60Hz +5%					
Continuous Iutput Current [Arms]	1.34	2.59	4.52	7.81	10.13	14.43
Nominal Output Power [kW]	0.1	0.2	0.4	0.75	1.0	1.5
Nominal Output Current [Arms]	0.9	1.55	2.6	5.1	7.3	8.3
Maximum Output Current [Arms]	2.7	4.65	7.8	15.3	21.9	24.9

2.1.4 Servo Drive Dimension

- 1~ 200Vac 0.1kW...0.4kW (U01/ U02/ U04)



- 1~ 200Vac 0.75kW...1.5kW (U07/ U10/ U15)



2.2 Type Selection of Servo Motor

2.2.1 Specifications of Servo Motor

Item			Specificaitons
Ambient	Operation	Temperature	0°C ... 40°C: Without derating 40°C ... 50°C: With derating
		Relative Humidity	5% - 80%, no condensation
		Altitude	<=1000M mean sea level: Without derating 1000 2000M mean sea level: With derating
		Shock	150m/s^2
		Vibration	0.15mm (10Hz..60Hz), 20m/s^2 (10Hz..60Hz)
	Storage	Temperature	-20°C ... -60°C
		Relative Humidity	<=75%, no condensation
Install	Orientation		IM B5 IM V1 IM V3
	Protection Grade	Shaft	IP65 (With oil seal)
		Housing	IP65
		Free Leads Connector	IP40
		Military Connector	IP65
	Connection Method		Flange connection
Excitation Method			Permanent magnet synchronous motor
Insulation Class			F(155°C)

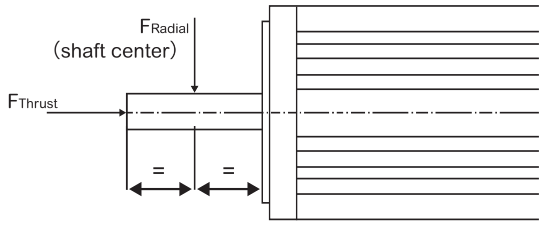
2.2.2 Ratings of Servo Motor

Model: BCH16		LB01	HC02	HD02	HD04	HF07
Voltage Level [Vac]		200 ... 240Vac				
Nominal Output Power [kW]		0.1	0.2	0.2	0.4	0.75
Nominal Torque [Nm]		0.32	0.64	0.64	1.27	2.39
Maximum Torque [Nm]		0.95	1.91	1.91	3.81	7.16
Nominal Current [Arms]		1.0	1.6	1.6	2.6	4.3
Maximum Current [Arms]		3.0	4.8	4.8	8.1	14
Nominal Speed [rpm]		3000	3000	3000	3000	3000
Maximum Speed [rpm]		5000	5000	5000	5000	5000
Torque Constant-KT [Nm/Arms]		0.32	0.46	0.46	0.47	0.56
Voltage Constant-KE [V/krpm]		23.7	28.0	28.0	32.78	37.3
Rotor Moment of Inertia [$kgcm^2$]	w/o brake	0.041	0.42	0.42	0.67	1.51
	with brake	0.047	0.48	0.48	0.73	1.64
Protection Degree		Natural cooling, IP65				
Flange [mm]		40	60	60	60	80
Holding Brake	Nominal Voltage [V]	24VDC +/-10%				
	Nominal Current [A]	0.26	0.308	0.308	0.308	0.422
	Holding Torque [Nm]	0.32	1.5	1.5	1.5	3.0
	Moment of Inertia [$kgcm^2$]	0.005	0.049	0.049	0.049	0.129
	Release Time [ms]	118	25	25	25	25
	Apply Time [ms]	15	50	50	50	50

Model: BCH16		LF10	LH10	LJ10	HM10	HM08	HM15
Voltage Level [Vac]		200 ... 240Vac					
Nominal Output Power [kW]		1.0	1.0	1.0	1.0	0.85	1.5
Nominal Torque [Nm]		3.18	3.18	3.18	4.77	5.39	7.16
Maximum Torque [Nm]		9.55	9.55	9.55	14.31	13.8	21.48
Nominal Current [Arms]		6.8	6.6	6.6	5.2	7.0	7.9
Maximum Current [Arms]		20.4	21.8	21.8	15.6	18.1	23.7
Nominal Speed [rpm]		3000	3000	3000	2000	1500	2000
Maximum Speed [rpm]		5000	5000	5000	3000	3000	3000
Torque Constant-KT [Nm/Arms]		0.51	0.48	0.48	1.0	0.78	1.0
Voltage Constant-KE [V/krpm]		31.1	31.2	31.2	60.8	51.7	60.0
Rotor Moment of Inertia [$kgcm^2$]	w/o brake	1.24	2.65	2.65	10.88	14.08	14.8
	with brake	1.37	2.75	2.75	11.58	14.78	15.5
Protection Degree		Natural cooling, IP65					
Flange [mm]		80	100	100	130	130	130
Holding Brake	Nominal Voltage [V]	24VDC +/-10%					
	Nominal Current [A]	0.422	0.612	0.612	0.816	0.816	0.816
	Holding Torque [Nm]	3.0	6.5	6.5	15.0	15.0	15.0
	Moment of Inertia [$kgcm^2$]	0.129	0.078	0.078	0.324	0.324	0.324
	Release Time [ms]	25	100	100	76	76	76
	Apply Time [ms]	50	10	10	27	27	2

2.2.3 Permissible Load on Servo Motor Output Shaft

Allowable shaft load



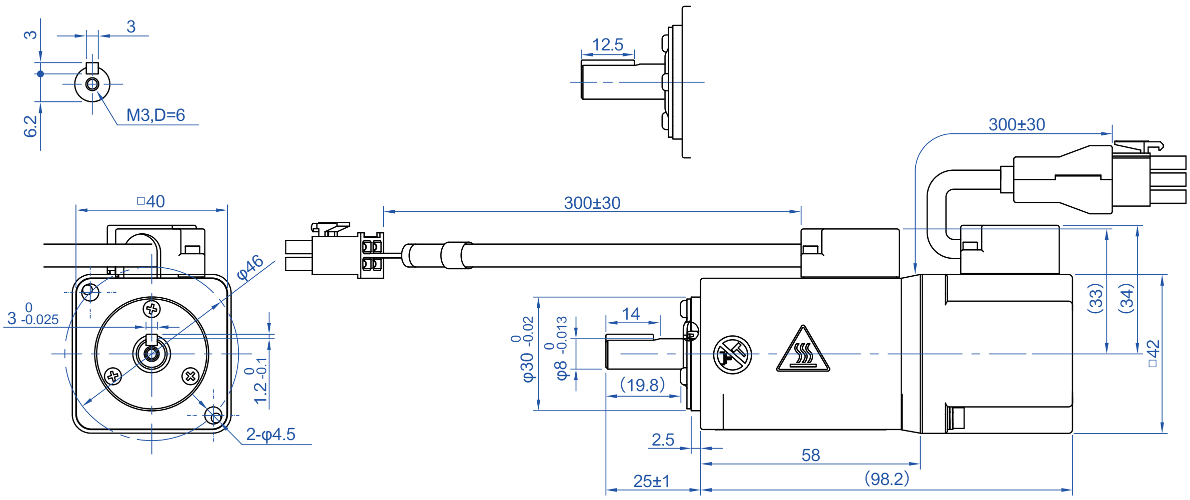
Model: BCH16	LB01	HC02	HD02	HD04	HF07
Maximum Allowable Radial Load [N]*1	73.5	197.96	197.96	220.5	221.48
Maximum Allowable Thrust Load [N]*1	12.74	61.74	61.74	61.74	61.74

Model: BCH16	LF10	LH10	LJ10	HM10	HM08	HM15
Maximum Allowable Radial Load [N]*1	221.48	343.98	343.98	578.2	498.82	709.52
Maximum Allowable Thrust Load [N]*1	61.74	122.3	122.3	211.68	176.4	176.4

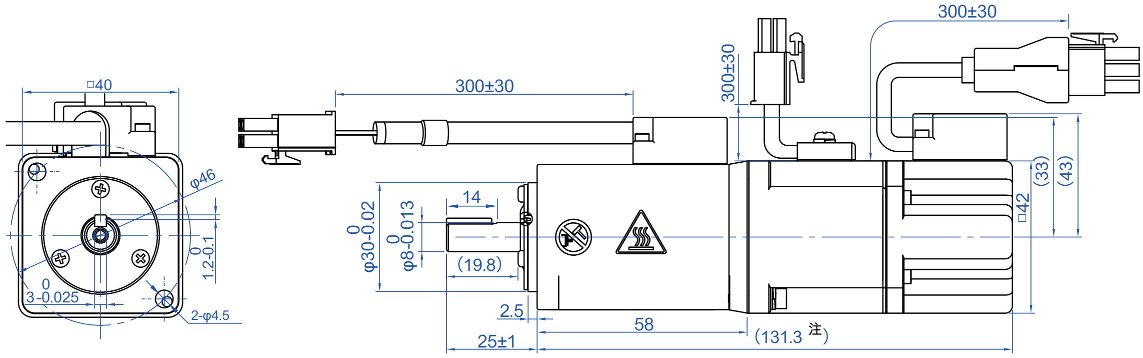
*1: Load [N]+/-10%

2.2.4 Servo Motor Dimension / T-N Curnve / Overload Characteristics

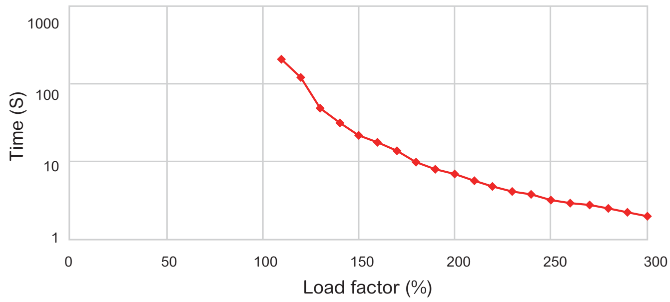
- BCH16LB0133*A5C2

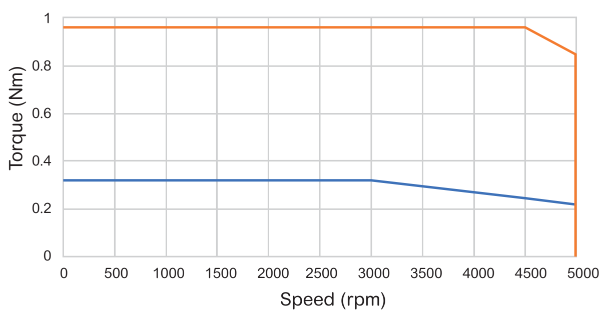


- BCH16LB0133*F5C2

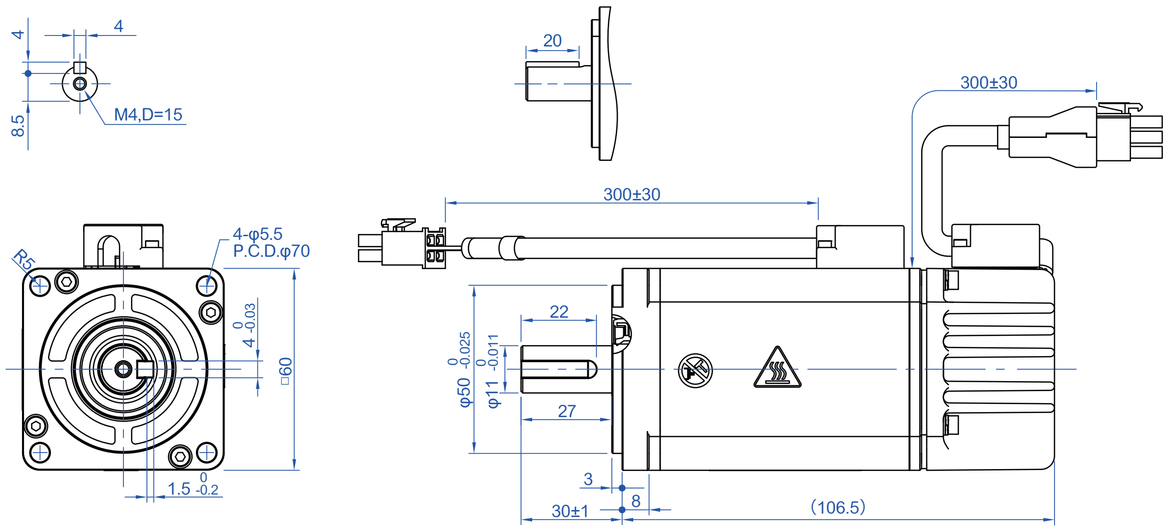


Note: BCH16LB01332F5C2 body length = 134.3

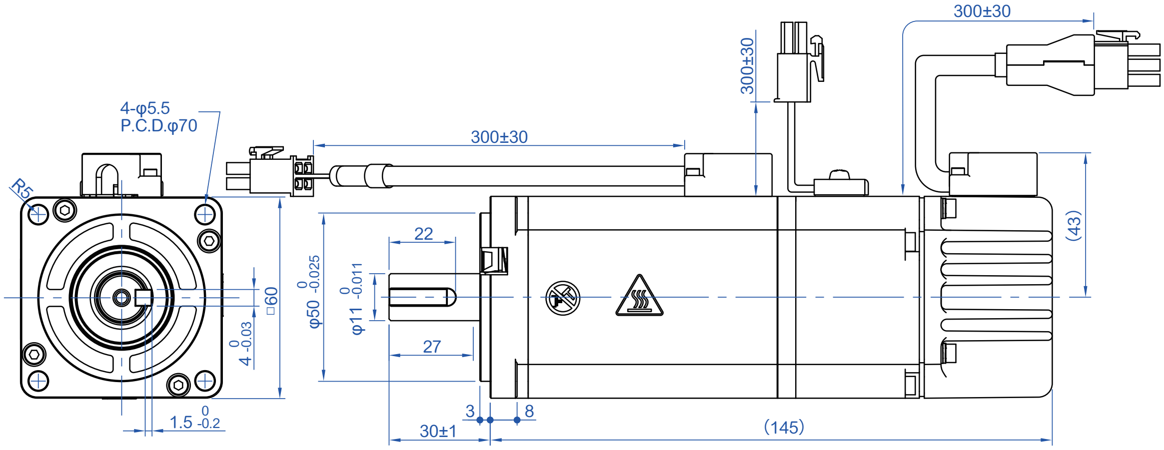


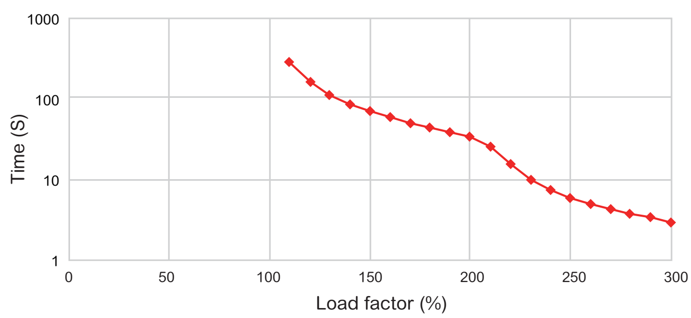


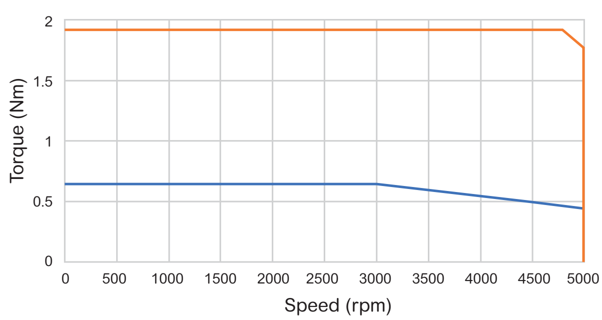
- BCH16HC0233*A5C2



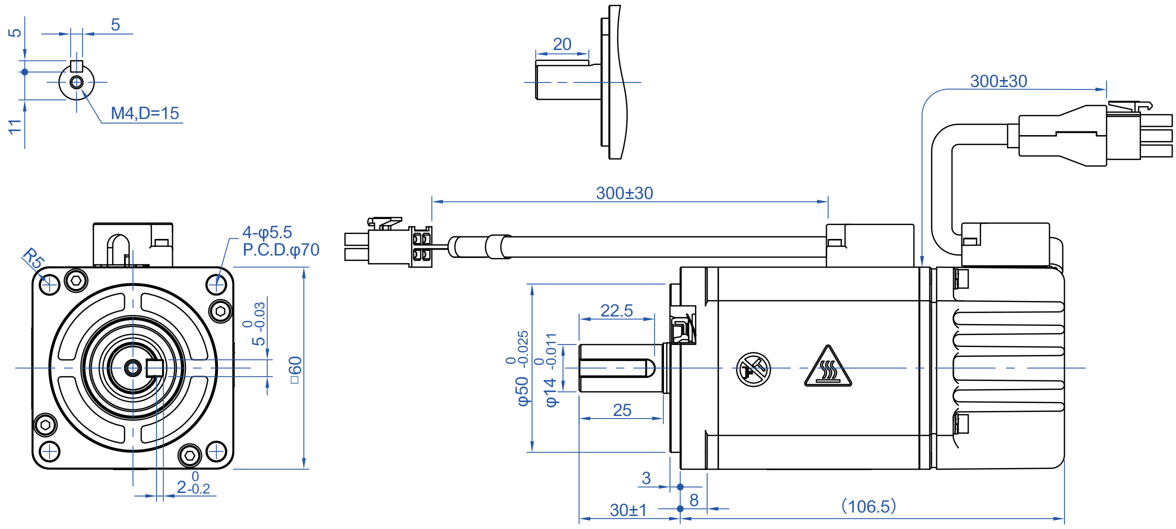
- BCH16HC0233*F5C2



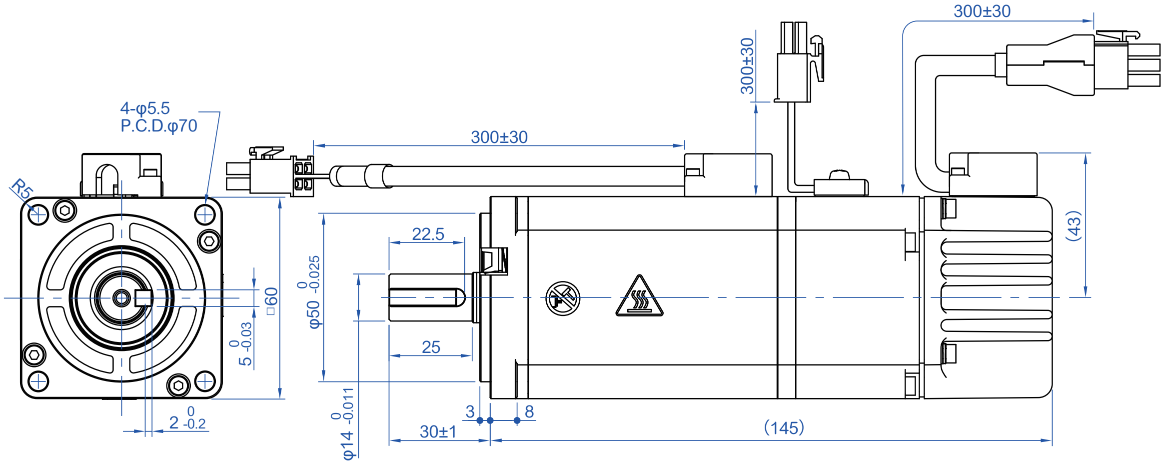


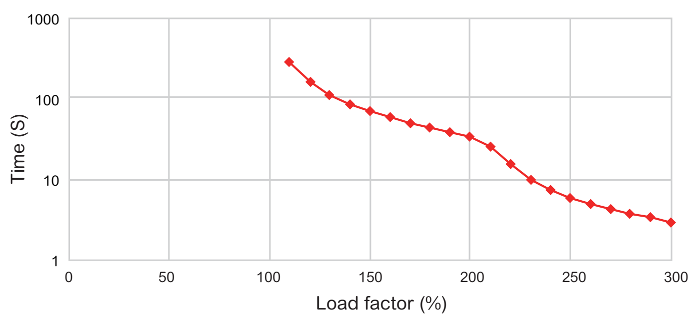


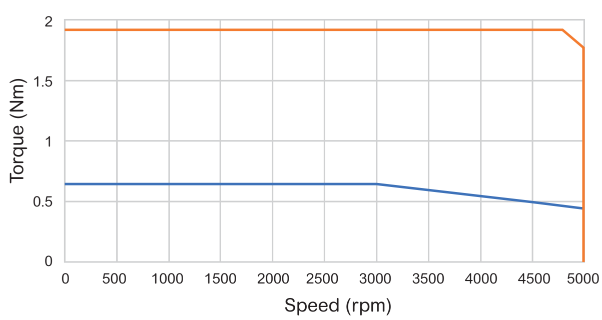
- BCH16HD0233*A5C2



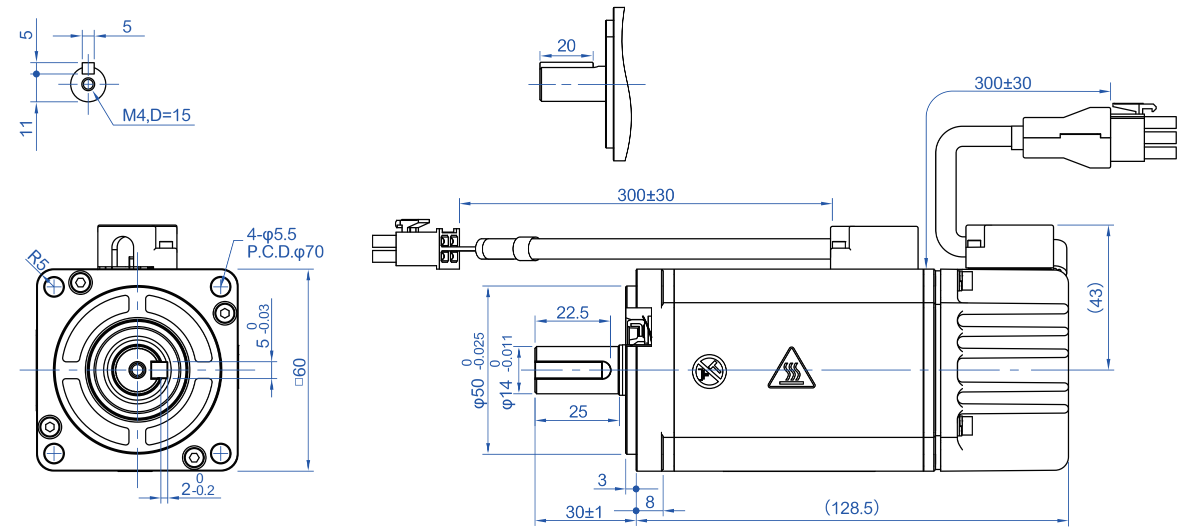
- BCH16HD0233*F5C2



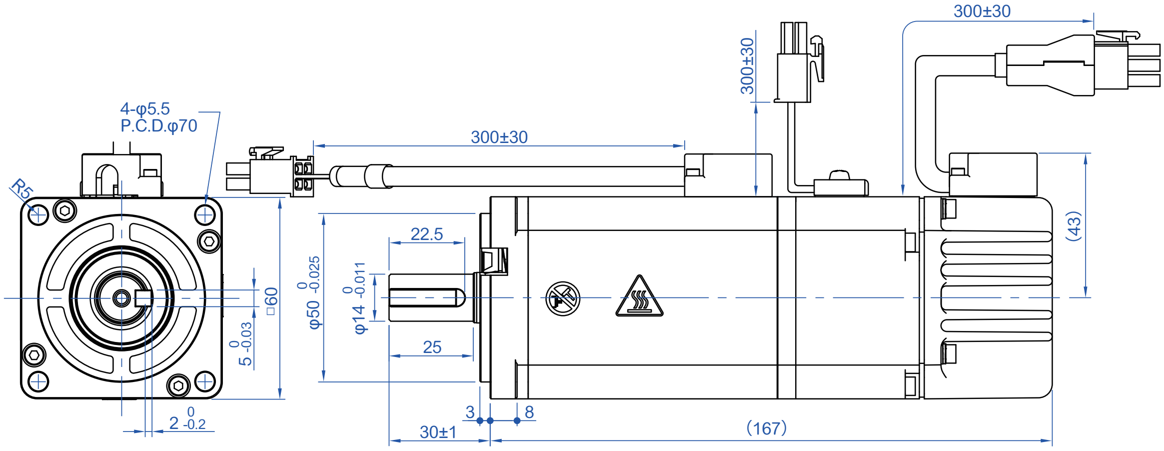


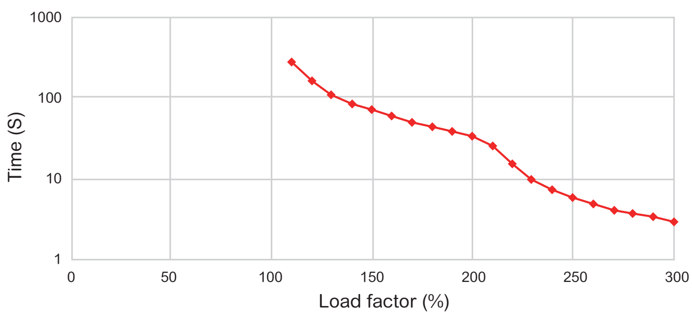


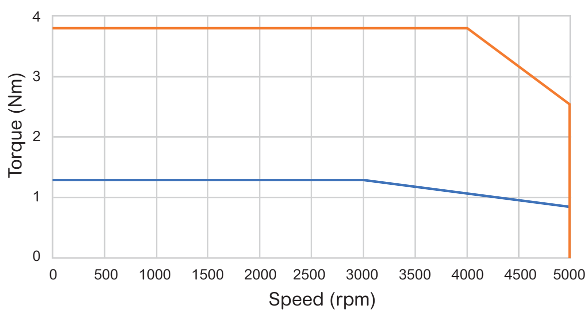
- BCH16HD0433*A5C2



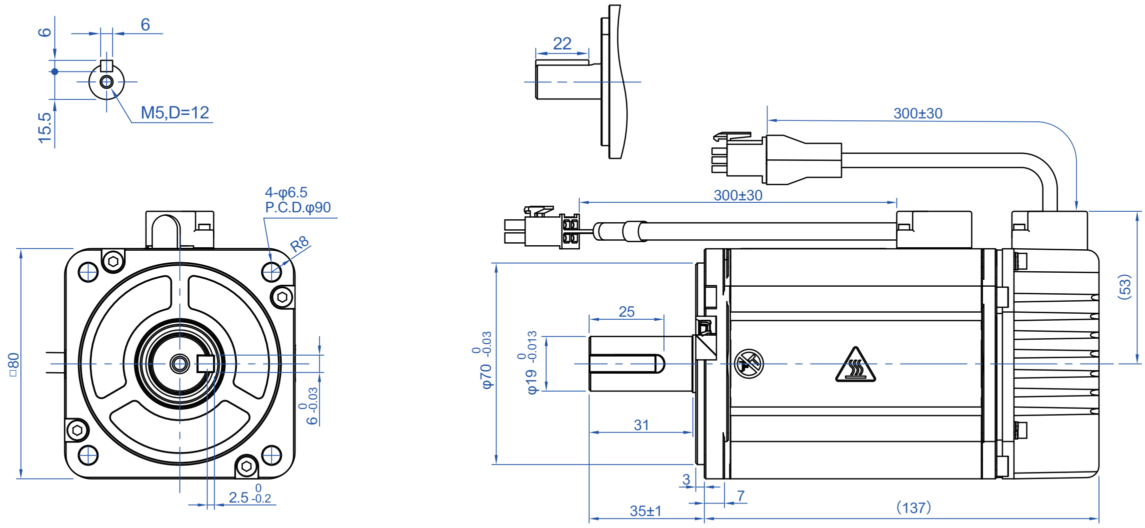
- BCH16HD0433*F5C2



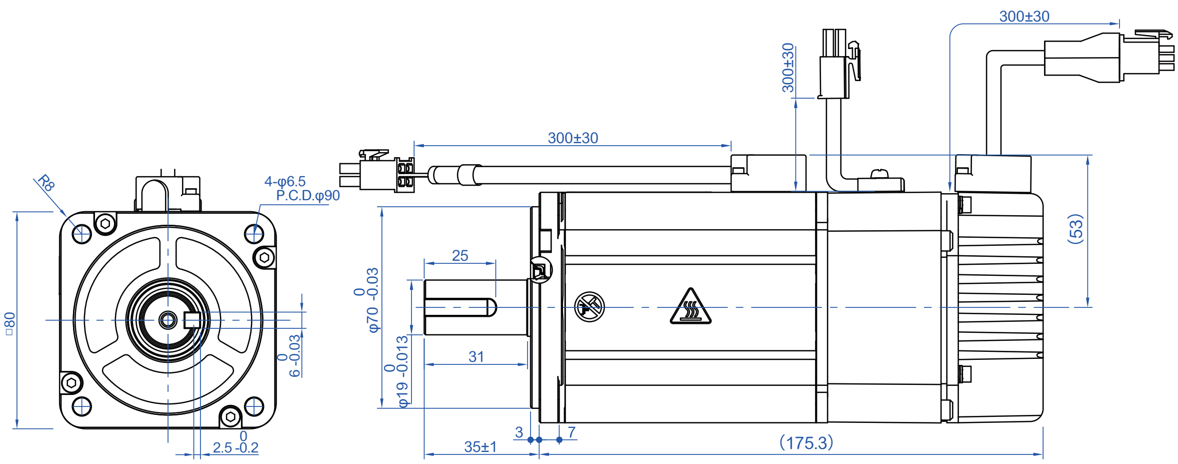


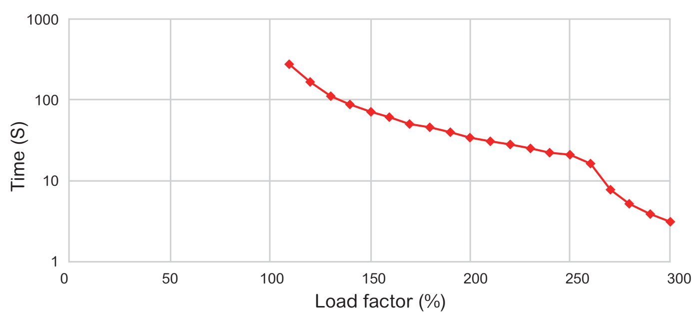


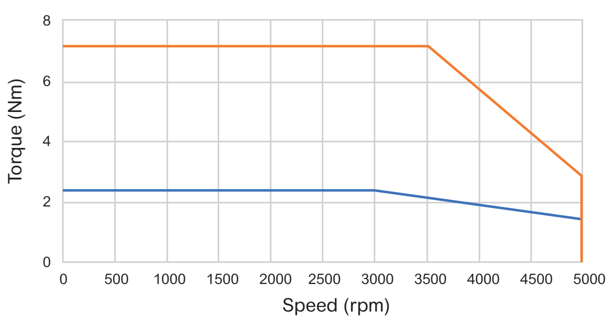
- BCH16HF0733*A5C2



- BCH16HF0733*F5C2

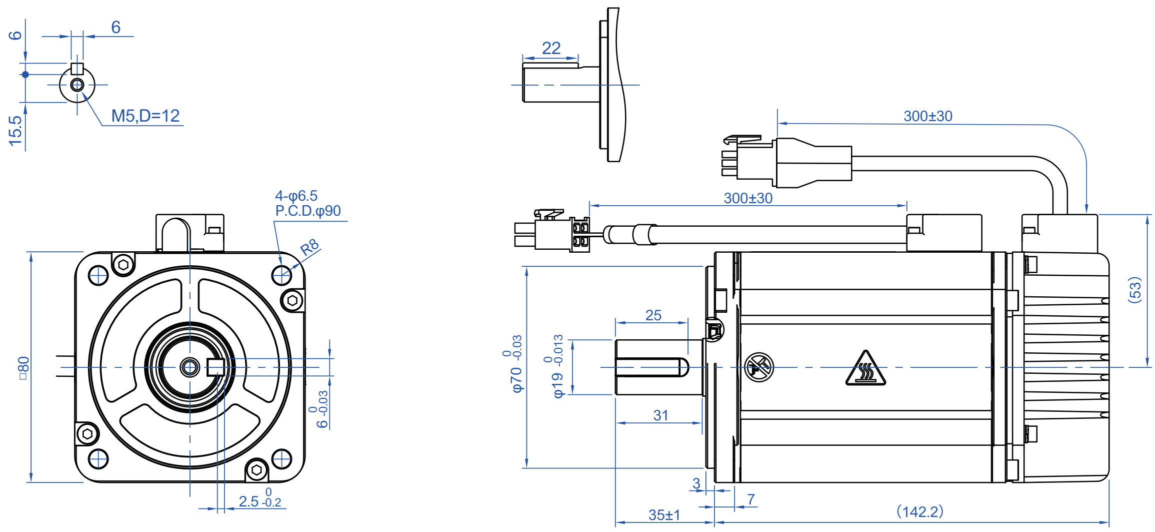




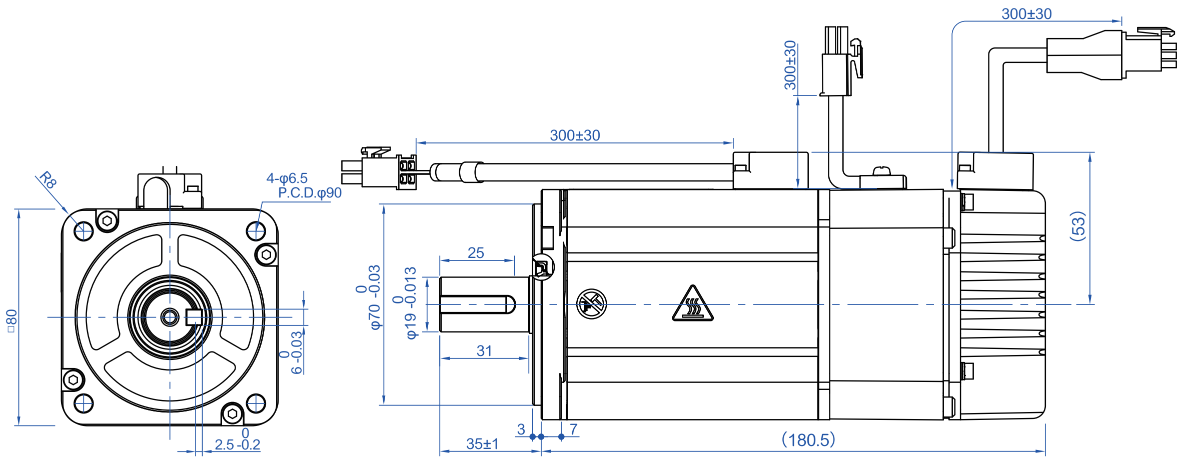


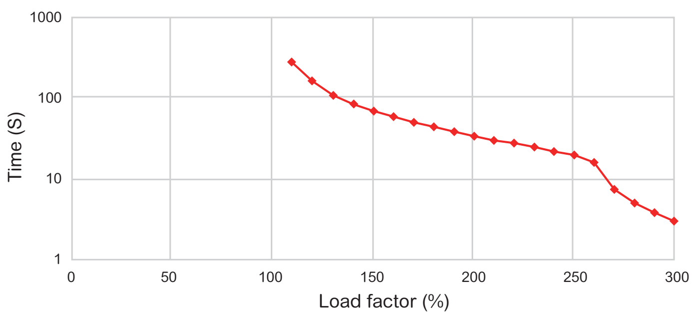
Schneider Electric

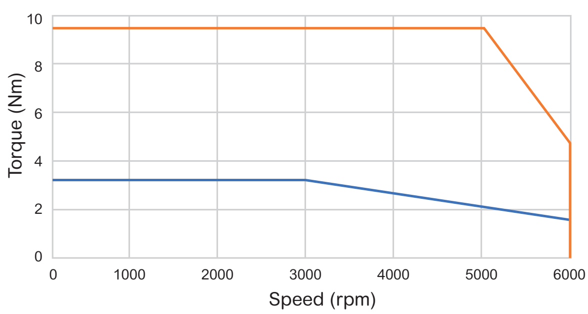
- BCH16LF1033*A5C2



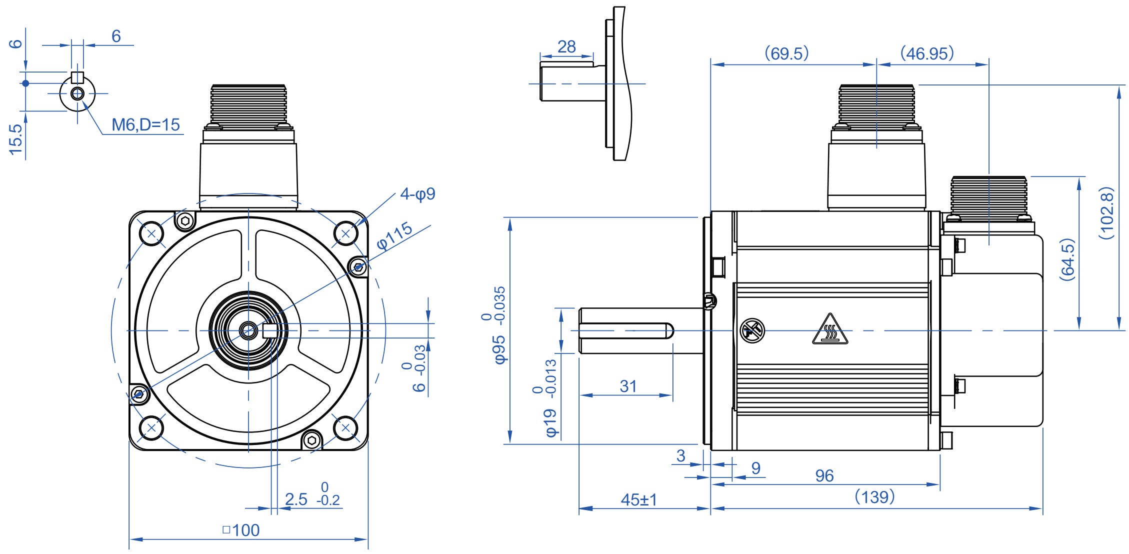
- BCH16LF1033*F5C2







- BCH16LH1033*A6C2



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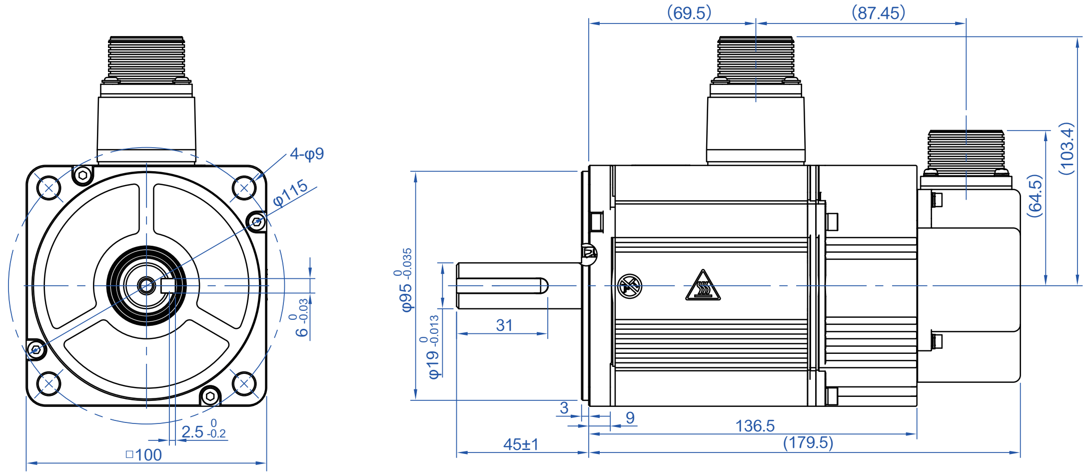
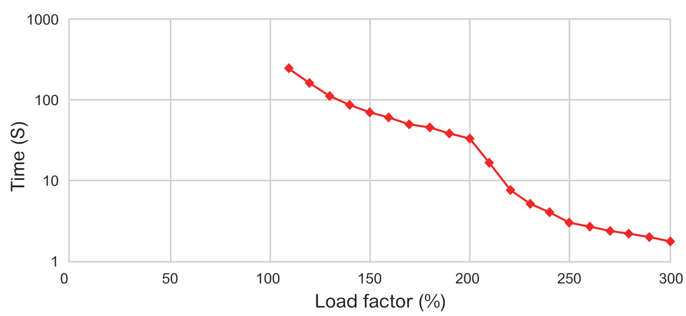
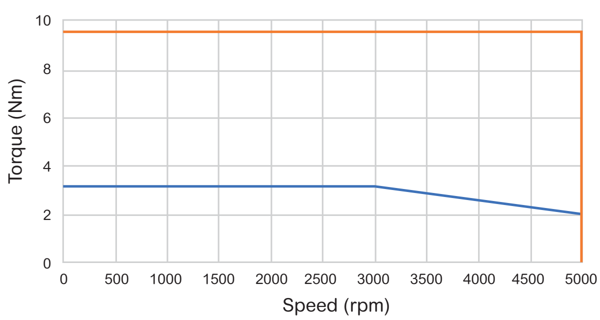
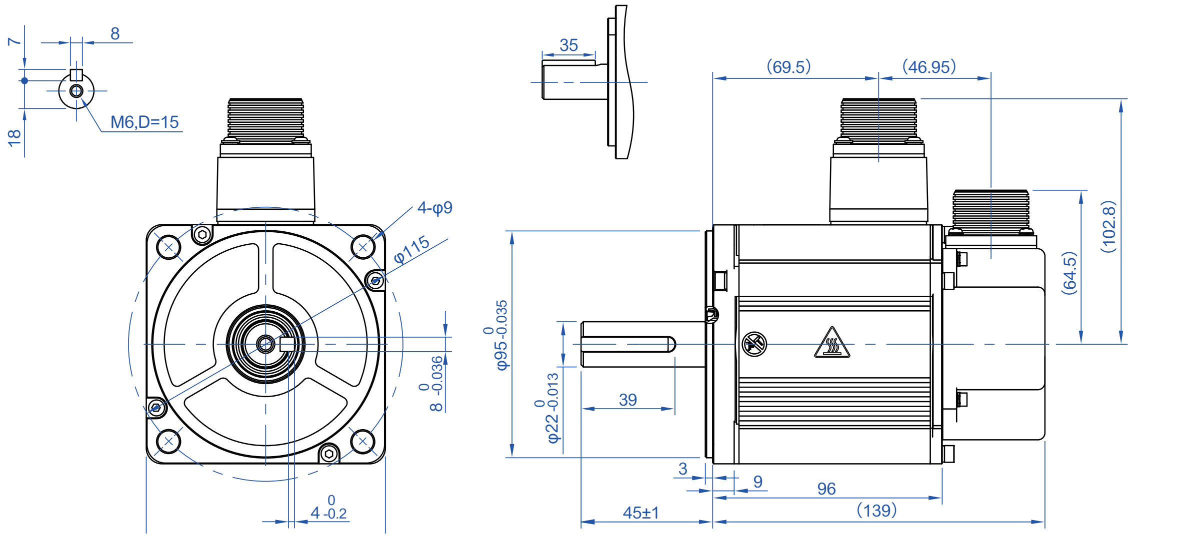






- BCH16LJ1033*A6C2



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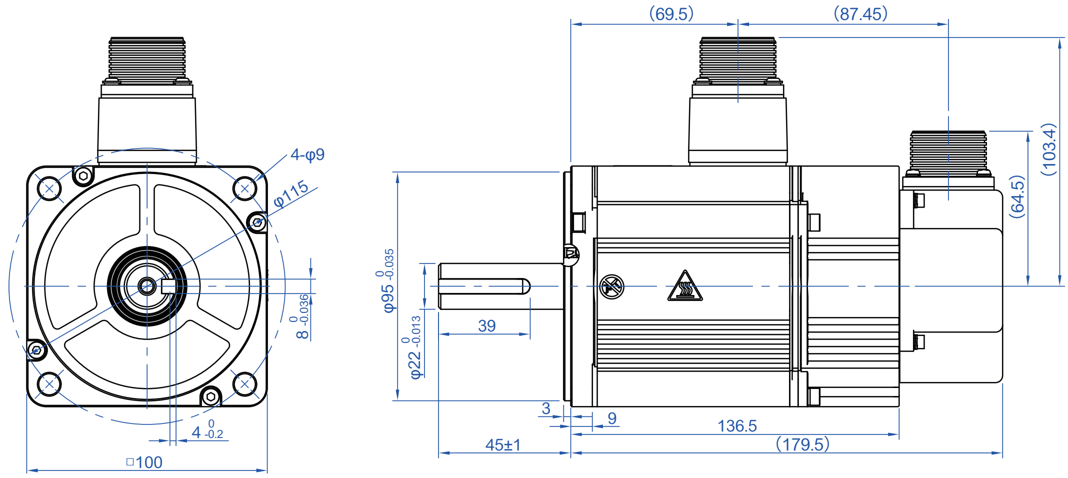
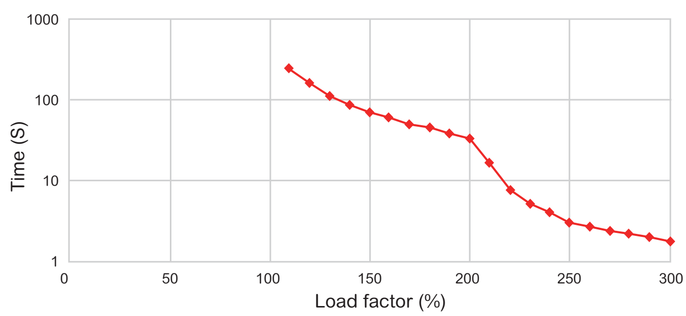
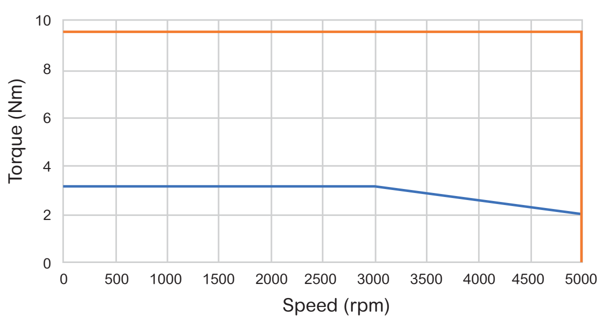
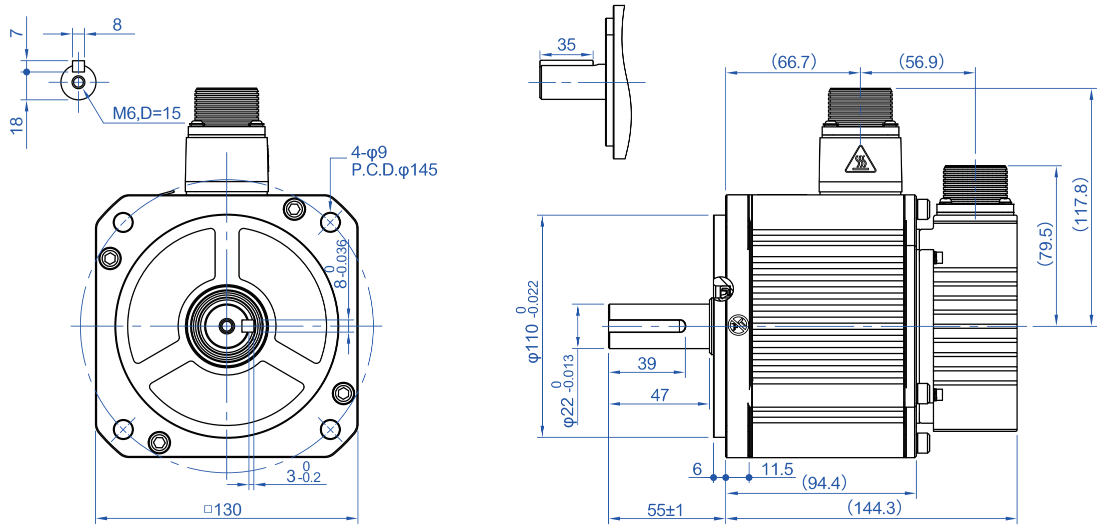


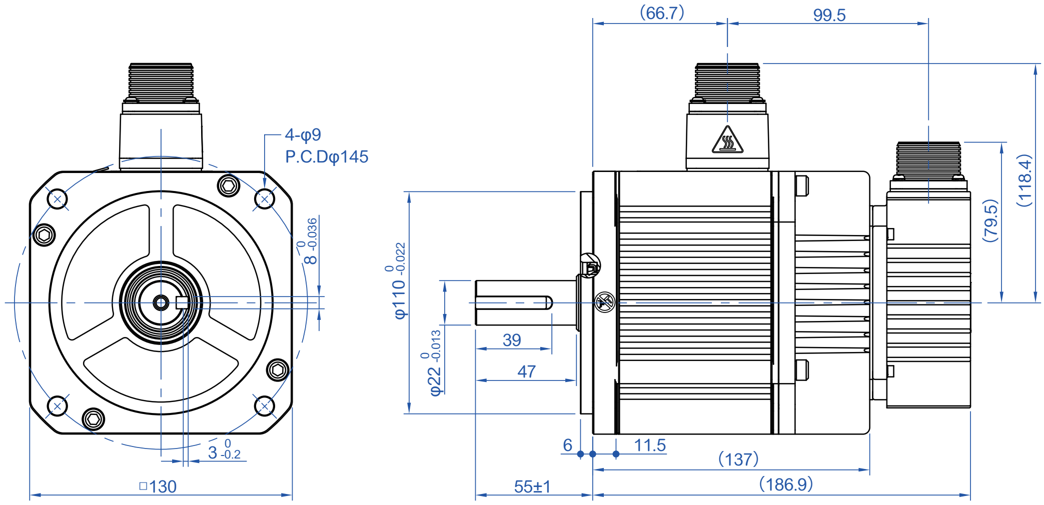


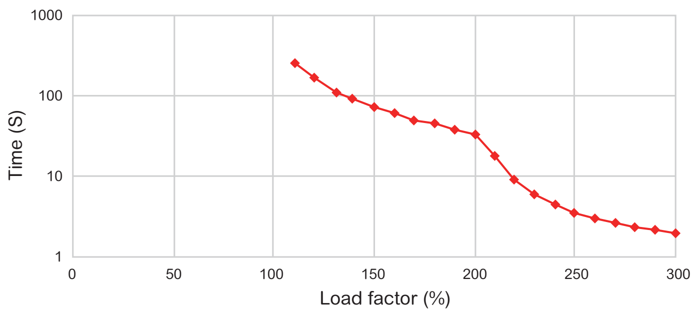


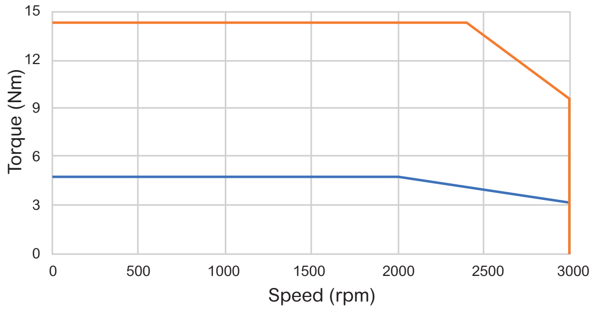
- BCH16HM1023*A6C2



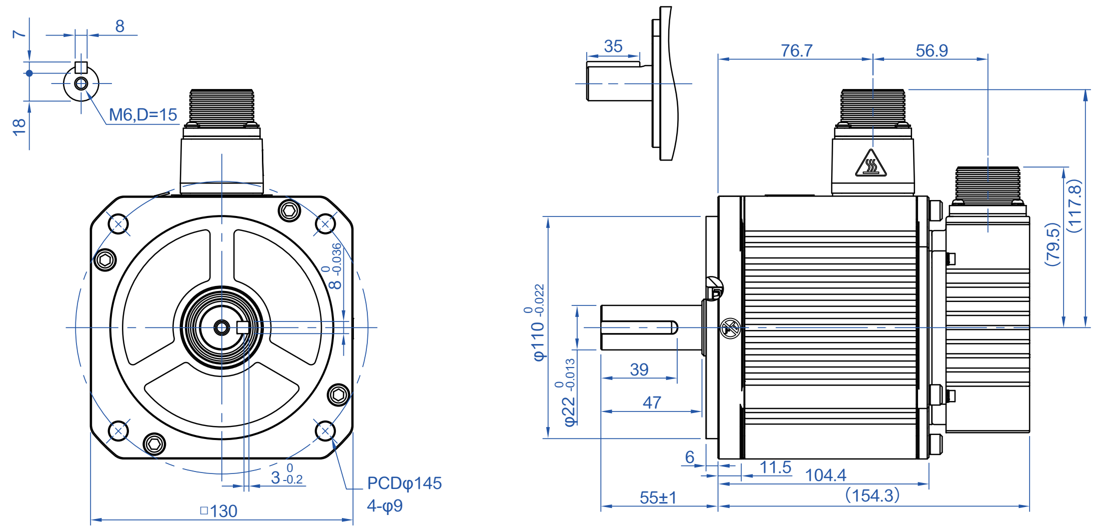
- BCH16HM1023*F6C2



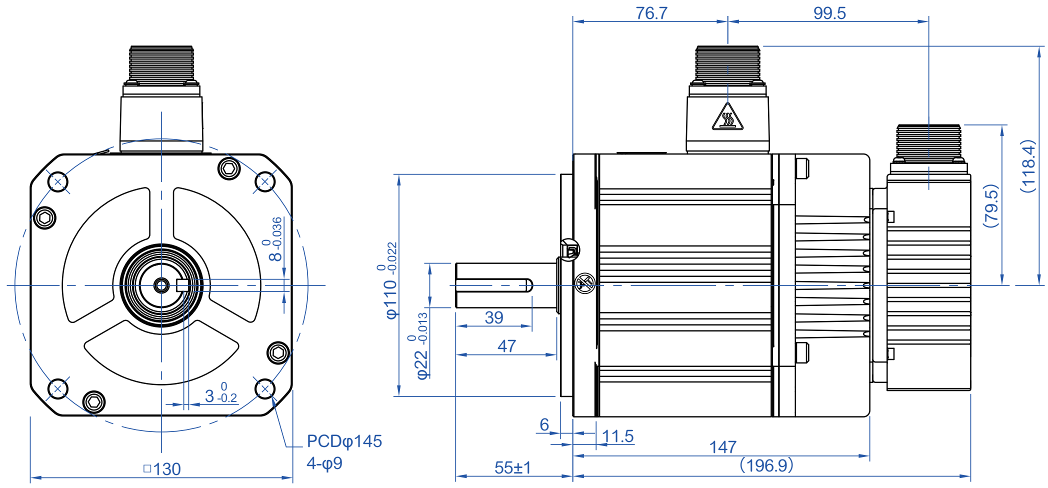


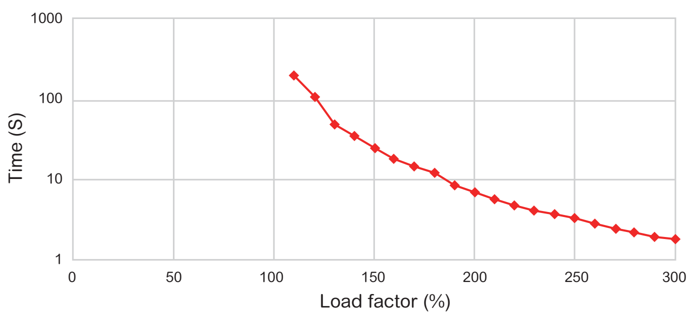


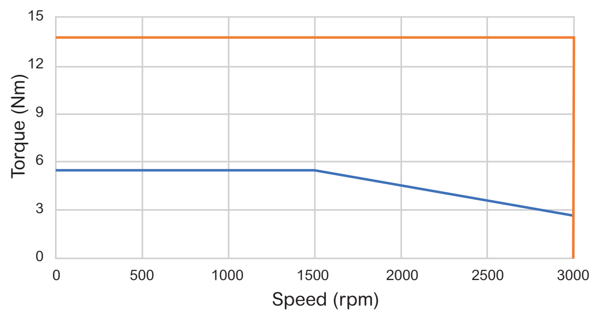
- BCH16HM0813*A6C2



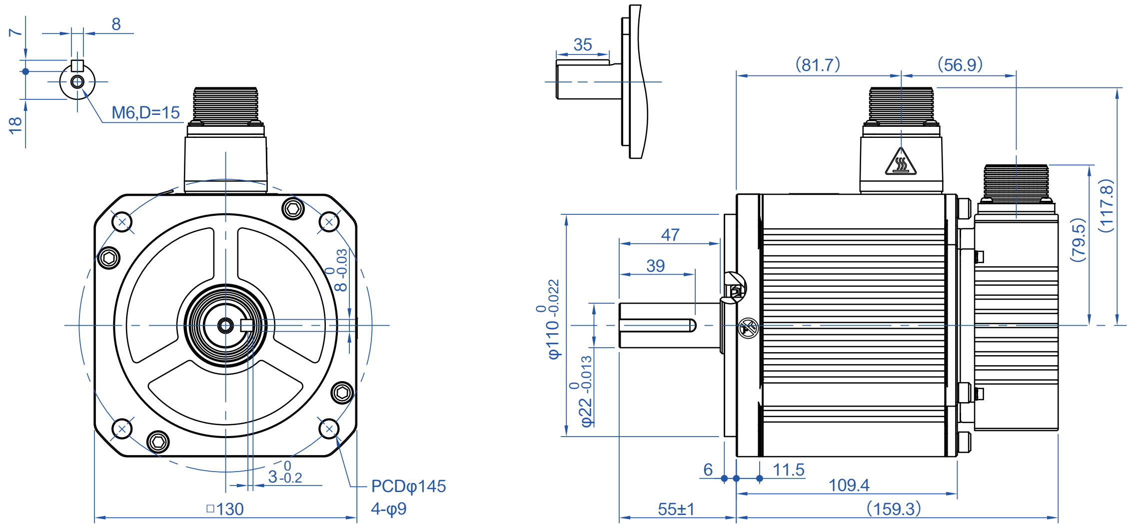
- BCH16HM0813*F6C2



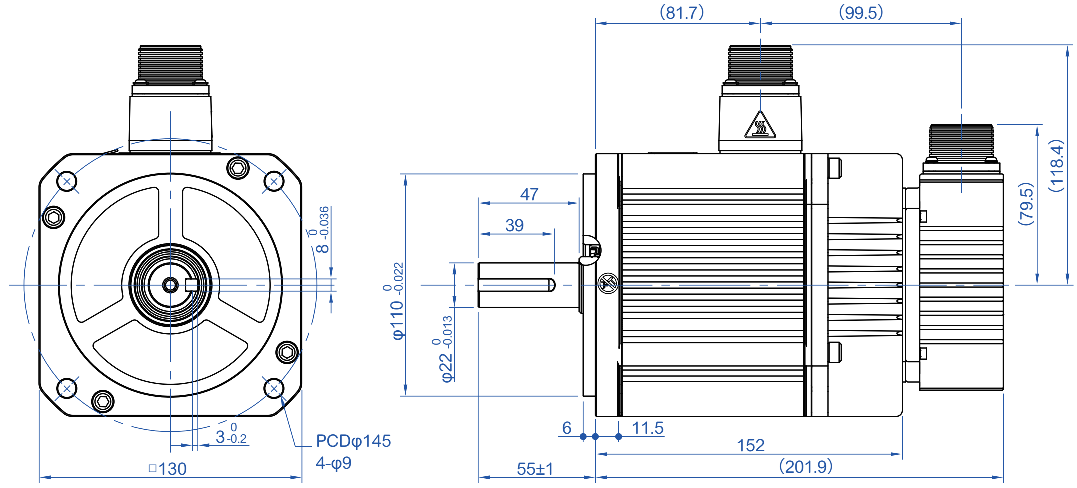


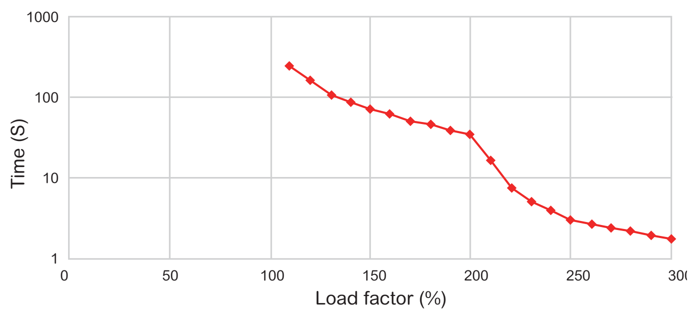


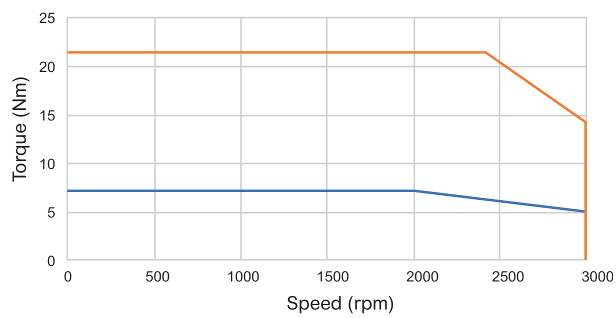
- BCH16HM1523*A6C2



- BCH16HM1523*F6C2

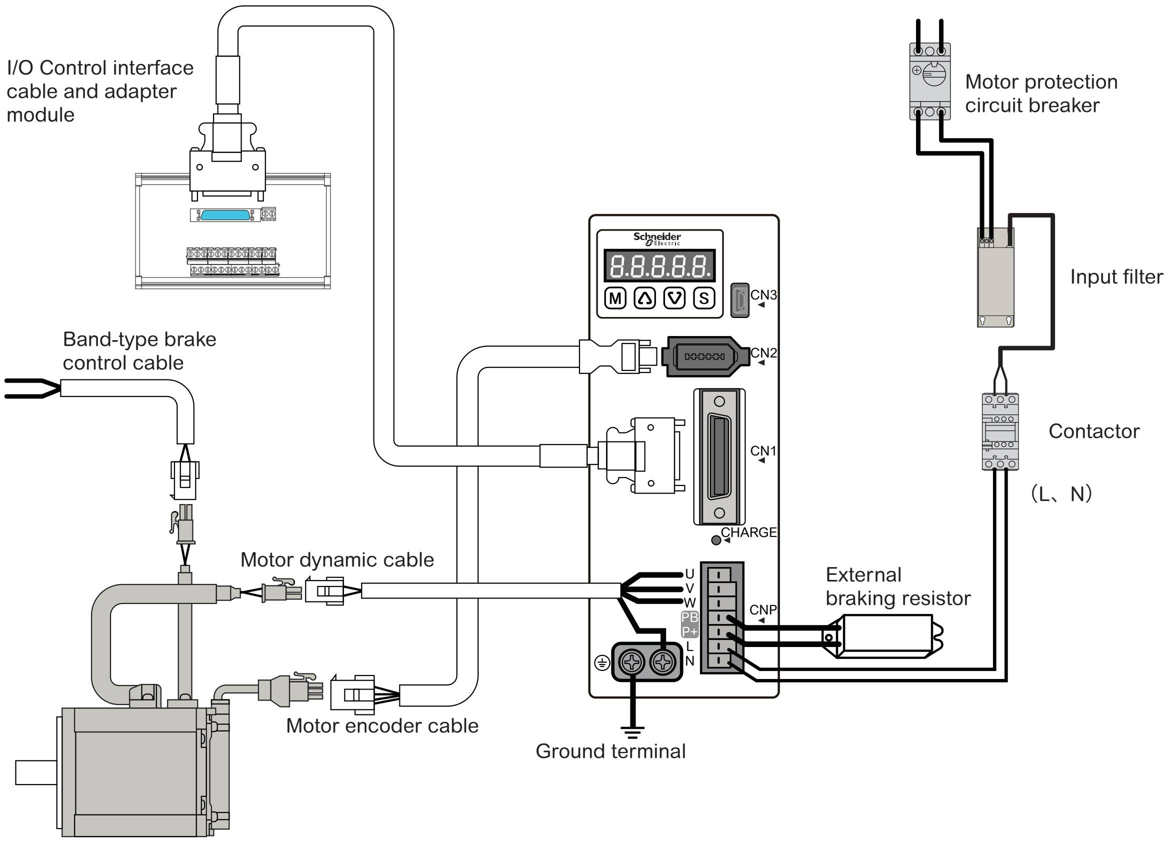






2.3 Accessories

2.3.1 Standard Composition of Servo System with Peripheral Devices

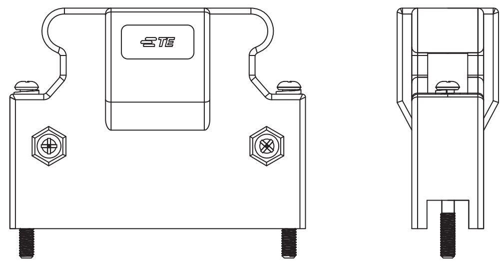


2.3.2 List of Accessories

Type	Reference	Description
Connector	VW3M4A11	Connector kit for servo drive CN1 control interface
	VW3M4A21	Connector for servo drive CNP main circuit
	VW3M4A31	Connector kit for servo drive CN2 encoder
	VW3M5A11	Plastic connector kit for motor power cable, motor end
	VW3M5A12	Plastic connector kit for motor holding brake control cable, motor end
	VW3M5A21	Military connector kit for motor power cable, motor end
	VW3M5A22	Military connector kit for motor power and holding brake control cable, motor end
	VW3M8A11	Plastic connector kit for motor encoder cable, motor end
	VW3M8A21	Military connector kit for motor encoder cable, motor end
	VW3M2A31	EMC mounting plate for motor power cable shield layer grounding
Motor Power / Holding Brake Control Cable	VW3M5A11R**	Motor power cable, plastic connector, 4G0.75mm2, optional length
	VW3M5A11R**S	Motor power cable, plastic connector, 4G0.75mm2, optional length, with shield
	VW3M5A21R**	Motor power cable, military connector, 4G2.0mm2, optional length
	VW3M5A21R**S	Motor power cable, military connector, 4G2.0mm2, optional length, with shield
	VW3M5A22R**	Motor power and holding brake control cable, military connector, 6G2.0mm2, optional length
	VW3M5A22R**S	Motor power and holding brake control cable, military connector, 6G2.0mm2, optional length, with shield
	VW3M5A12R**	Motor holding brake control cable, plastic connector, 2*0.5mm2, optional length
Motor Ecnoder Cable	VW3M8A11R**	Motor encoder cable for 2500 ppr incremental encoder, plastic connector, 2*0.5 + 3*2*0.2mm2, optional length
	VW3M8A12R**	Motor encoder cable for 23 bit high resolution encoder, plactic connector, 2*0.5 + 3*2*0.2mm2, optional length
	VW3M8A21R**	Motor encoder cable for 2500 ppr incremental encoder, military connector, 2*0.5 + 1*2*0.2mm2, optional length
	VW3M8A22R**	Motor encoder cable for 23 bit high resolution encoder, military connector, 2*0.5 + 1*2*0.2mm2, optional length
I/O Control Cable and Adapter Module	VW3M4A1*	Control cable and adapter module kit for servo drive CN1 control interface; 1.0m preassembled cable, adapter module with screw-type terminal suitable for DIN rail mounting: optional dedicated pulse train voltage level
External Braking Resistor	VW3A760*R**	External braking resistor with connecting cable with optional length; optional power and resistance
Input Filter	VW3A44**	External input filter for servo drive; optional current
Motor Protection Circuit Breaker	GV2P**	Motor protection circuit breaker; optional setting current
Contactor	LC1***	Main power contactor: optional control voltage and load

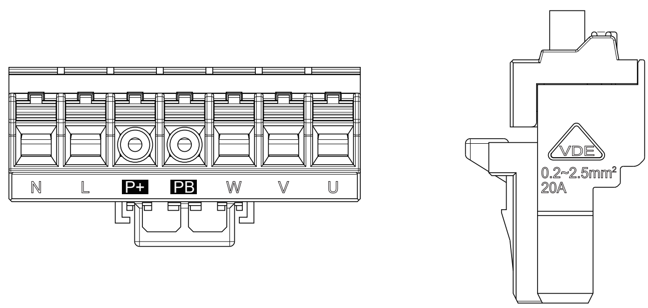
2.3.3 Connector

Description	Connector kit for servo drive CN1 control interface			
Reference	VW3M4A11		Suitable for	LXM16DU01..15M2X



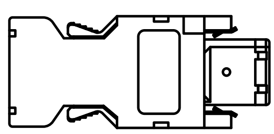
Parts				
Description	Reference	Qty.	Vendor	Remarks
Connector kit	3-2232346-1	1	TE	For CN1 (SCSI-26)

Description	Connector for servo drive CNP main circuit			
Reference	VW3M4A21		Suitable for	LXM16DU01..15M2X



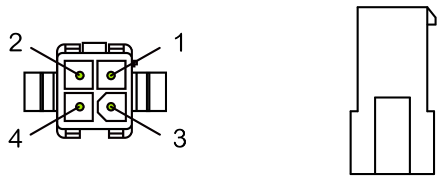
Parts				
Description	Reference	Qyt.	Vendor	Remarks
Connector kit	0150-20-S1384507	1	Dinkle	For CNP

Description	Connector kit for servo drive CN2 encoder			
Reference	VW3M4A31		Suitable for	LXM16DU01..15M2X



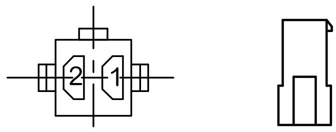
Parts				
Description	Reference	Qyt.	Vendor	Remarks
Connector kit	54599-1019	1	Molex	For CN2 (SCSI-10)

Description	Plastic connector kit for motor power cable, motor end		
Reference	VW3M5A11	Suitable for	BCH16*B/C/D/F*****



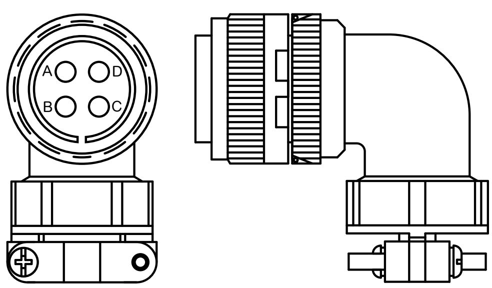
Parts				
Description	Reference	Qyt.	Vendor	Remarks
Chassis	172159-1	1	TE	
Pin	170362-1	4	TE	

Description	Plastic connector kit for motor holding brake control cable, motor end		
Reference	VW3M5A12	Suitable for	BCH16*B/C/D/F*****



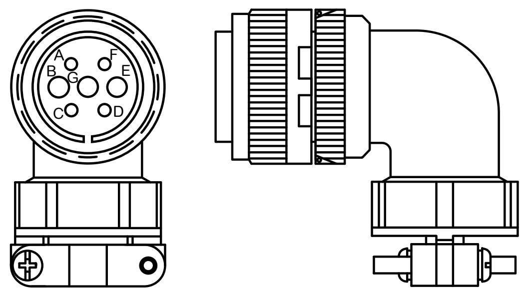
Parts				
Description	Reference	Qyt.	Vendor	Remarks
Chassis	172157-1	1	TE	
Pin	170362-1	2	TE	

Description	Military connector kit for motor power cable, motor end		
Reference	VW3M5A21	Suitable for	BCH16*H/J/M*****A***



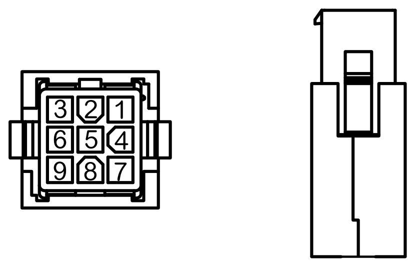
Parts				
Description	Reference	Qyt.	Vendor	Remarks
Connector kit	MS3108E20-4S	1	Amphenol	

Description	Military connector kit for motor power and holding brake control cable, motor end			
Reference	VW3M5A22		Suitable for	BCH16*H/J/M*****F***



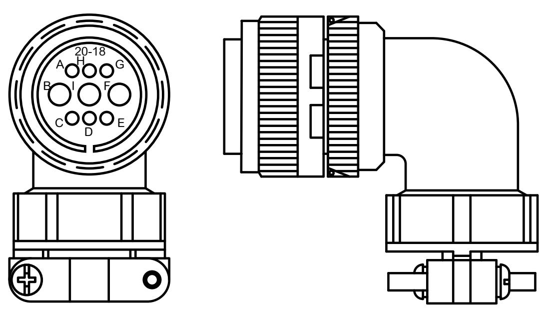
Parts				
Description	Reference	Qyt.	Vendor	Remarks
Connector kit	MS3108E20-15S	1	Amphenol	

Description	Plastic connector kit for motor encoder cable, motor end			
Reference	VW3M8A11		Suitable for	BCH16*B/C/D/F*****



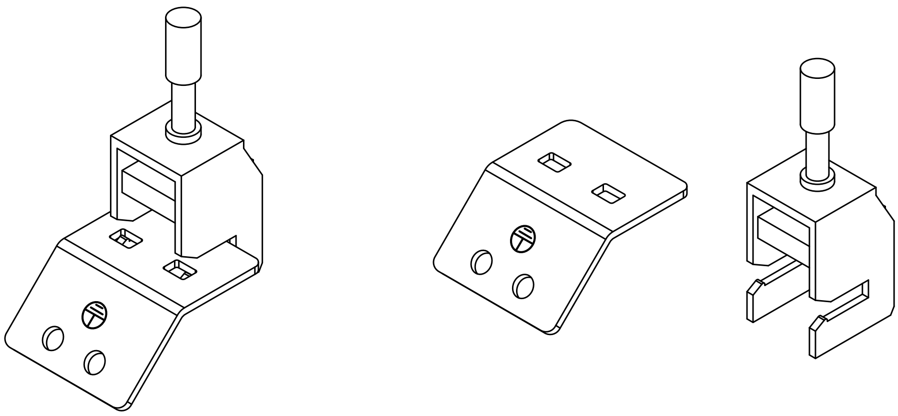
Parts				
Description	Reference	Qyt.	Vendor	Remarks
Chassis	172161-1	1	TE	
Pin	170361-1	9	TE	

Description	Military connector kit for motor encoder cable, motor end			
Reference	VW3M8A21		Suitable for	BCH16*H/J/M*****



Parts				
Description	Reference	Qyt.	Vendor	Remarks
Connector kit	MS3108E20-18S	1	Amphenol	

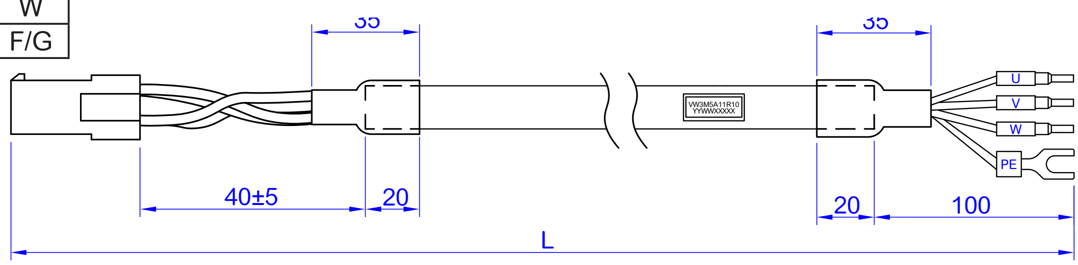
Description	EMC mounting plate for motor power cable shield layer grounding		
Reference	VW3M2A31	Suitable for	LXM16DU01 .. 15M2X



2.3.4 Motor Power / Holding Brake Control Cable

Description	Motor power cable, plastic connector		
Reference	VW3M5A11R**	Suitable for	BCH16*B/C/D/F*****

1	U
2	V
3	W
4	F/G



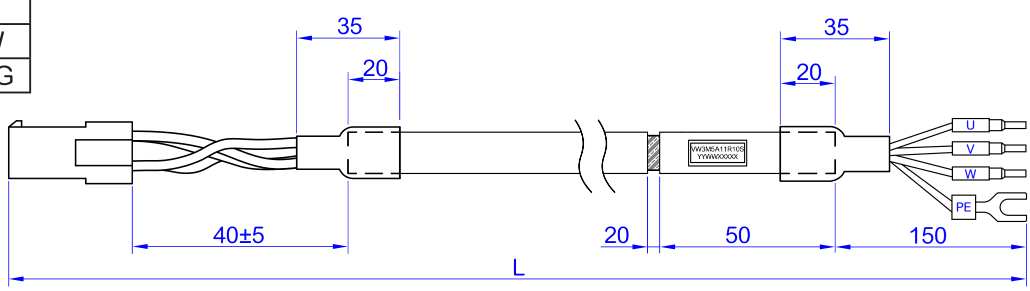
Parts

Description	Reference	Qty.	Vendor
Chassis	172159-1	1	TE
Pin	170362-1	4	TE
Cable	UL2586-SB18AWG-4C	**	SK TEC
I-type lug	AI 0.75-10	3	Phoenix Contact
Y-type lug	C-FCI 1.5/M4	1	Phoenix Contact

L (m)	Reference
1.5	VW3M5A11RA5
3	VW3M5A11R03
5	VW3M5A11R05
10	VW3M5A11R10
15	VW3M5A11R15
20	VW3M5A11R20
25	VW3M5A11R25

Description	Motor power cable, plastic connector, with shield		
Reference	VW3M5A11R**S	Suitable for	BCH16*B/C/D/F*****

1	U
2	V
3	W
4	F/G



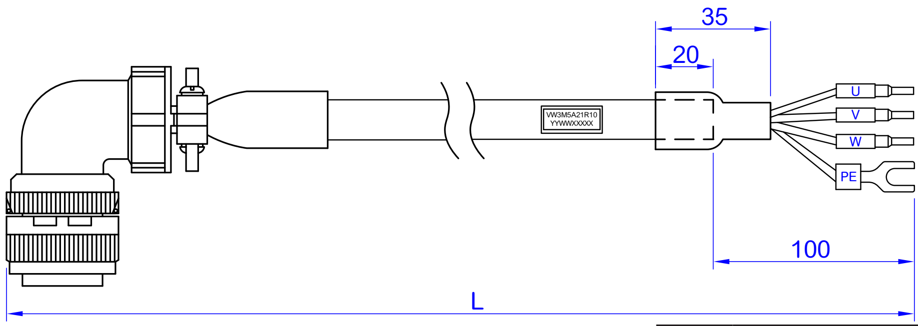
Parts

Description	Reference	Qty.	Vendor
Chassis	172159-1	1	TE
Pin	170362-1	4	TE
Cable	UL2586-SB18AWG-4C-Shield	**	SK TEC
I-type lug	AI 0.75-10	3	Phoenix Contact
Y-type lug	C-FCI 1.5/M4	1	Phoenix Contact

L(m)	Reference
1.5	VW3M5A11RA5S
3	VW3M5A11R03S
5	VW3M5A11R05S
10	VW3M5A11R10S
15	VW3M5A11R15S
20	VW3M5A11R20S
25	VW3M5A11R25S

Description	Motor power cable, military connector		
Reference	VW3M5A21R**	Suitable for	BCH16*H/J/M*****A***

A	U
B	V
C	W
D	F/G

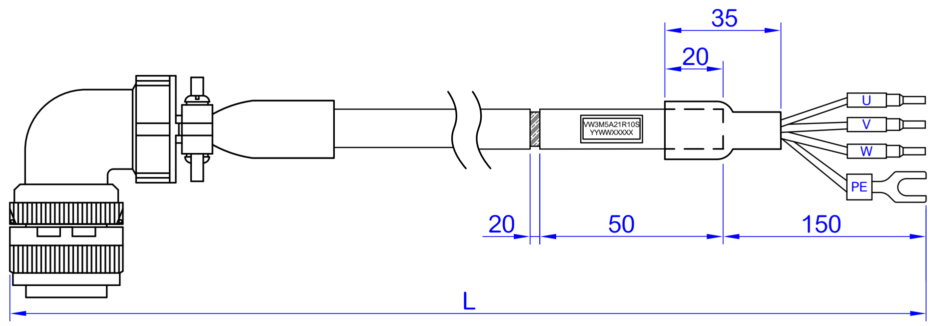


L(m)	Reference
1.5	VW3M5A21RA5
3	VW3M5A21R03
5	VW3M5A21R05
10	VW3M5A21R10
15	VW3M5A21R15
20	VW3M5A21R20
25	VW3M5A21R25

Parts			
Description	Reference	Qty.	Vendor
MIL Connector	MS3108E20-4S	1	Amphenol
Cable	UL2586-SB14AWG-4C	**	SK TEC
I-type lug	AI 2.5-12	3	Phoenix Contact
Y-type lug	C-FCI 2.5/M4	1	

Description	Motor power cable, military connector, with shield		
Reference	VW3M5A21R**S	Suitable for	BCH16*H/J/M*****A***

A	U
B	V
C	W
D	F/G

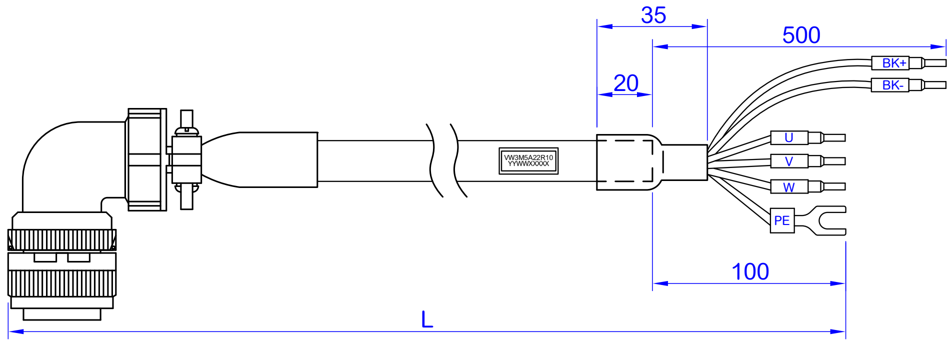


L(m)	Reference
1.5	VW3M5A21RA5S
3	VW3M5A21R03S
5	VW3M5A21R05S
10	VW3M5A21R10S
15	VW3M5A21R15S
20	VW3M5A21R20S
25	VW3M5A21R25S

Parts			
Description	Reference	Qty.	Vendor
MIL Connector	MS3108E20-4S	1	Amphenol
Cable	UL2586-SB14AWG-4C-Shield	**	SK TEC
I-type lug	AI 2.5-12	3	Phoenix Contact
Y-type lug	C-FCI 2.5/M4	1	

Description	Motor power and holding brake control cable, military connector		
Reference	VW3M5A22R**	Suitable for	BCH16*H/J/M*****F***

B	U
G	V
E	W
F	BK+
A	BK-
C	F/G
D	



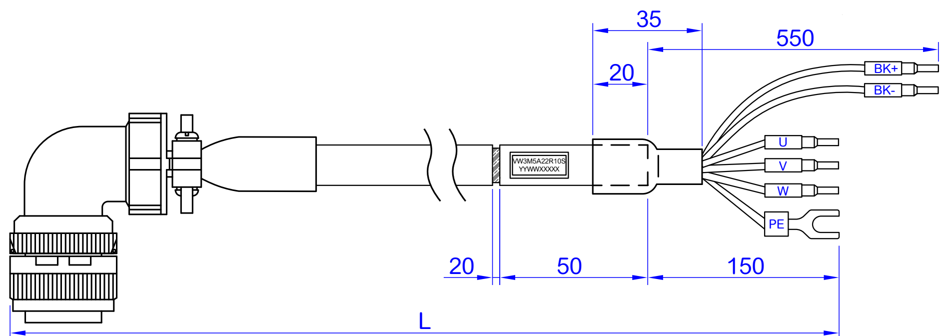
Parts

Description	Reference	Qty.	Vendor
MIL Connector	MS3108E20-15S	1	Amphenol
Cable	UL2586-SB14AWG-6C	**	SK TEC
I-type lug	AI 2.5-12	5	Phoenix Contact
Y-type lug	C-FCI 2.5/M4	1	

L(m)	Reference
1.5	VW3M5A22RA5
3	VW3M5A22R03
5	VW3M5A22R05
10	VW3M5A22R10
15	VW3M5A22R15
20	VW3M5A22R20
25	VW3M5A22R25

Description	Motor power and holding brake control cable, military connector, with shield		
Reference	VW3M5A22R**S	Suitable for	BCH16*H/J/M*****F***

B	U
G	V
E	W
F	BK+
A	BK-
C	F/G
D	



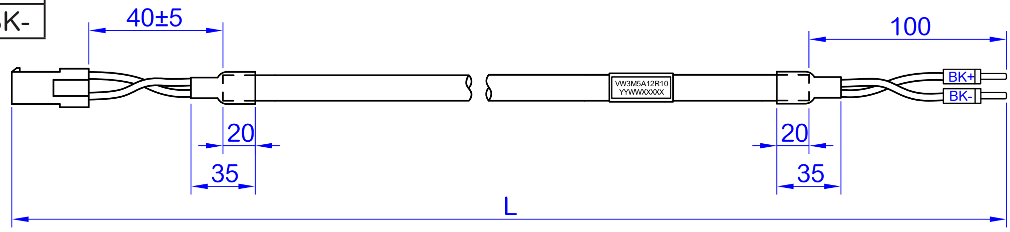
Parts

Description	Reference	Qty.	Vendor
MIL Connector	MS3108E20-15S	1	Amphenol
Cable	UL2586-SB14AWG-6C-Shield	**	SK TEC
I-type lug	AI 2.5-12	5	Phoenix Contact
Y-type lug	C-FCI 2.5/M4	1	

L(m)	Reference
1.5	VW3M5A22RA5S
3	VW3M5A22R03S
5	VW3M5A22R05S
10	VW3M5A22R10S
15	VW3M5A22R15S
20	VW3M5A22R20S
25	VW3M5A22R25S

Description	Motor holding brake control cable, plastic connector		
Reference	VW3M5A12R**	Suitable for	BCH16*B/C/D/F*****F**

1	BK+
2	BK-



Parts

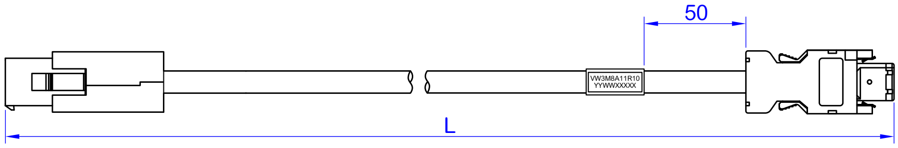
Description	Reference	Qty.	Vendor
Chassis	172157-1	1	TE
Pin	170362-1	2	TE
Cable	UL2464-SB20AWG-2C	**	SK TEC
I-type lug	AI 0.75-10	2	Phoenix Contact

L(m)	Reference
1.5	VW3M5A12RA5
3	VW3M5A12R03
5	VW3M5A12R05
10	VW3M5A12R10
15	VW3M5A12R15
20	VW3M5A12R20
25	VW3M5A12R25

2.3.5 Motor Encoder Cable

Description	Motor encoder cable for 2500 ppr incremental encoder, plastic connector		
Reference	VW3M8A11R**	Suitable for	BCH16*B/C/D/F*****

1	5V
2	0V
3	A
4	/A
5	B
6	/B
7	Z
8	/Z
9	



1	A
2	/A
3	B
4	/B
5	Z
6	Z
7	
8	
9	5V
10	0V
	Shield

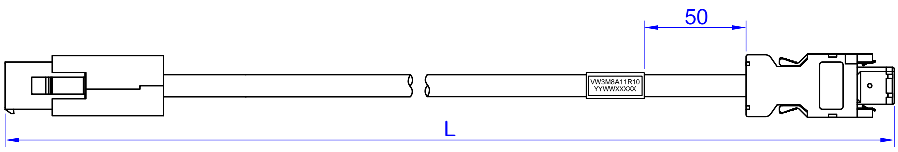
L(m)	Reference
1.5	VW3M8A11RA5
3	VW3M8A11R03
5	VW3M8A11R05
10	VW3M8A11R10
15	VW3M8A11R15
20	VW3M8A11R20
25	VW3M8A11R25

Parts

Description	Reference	Qty.	Vendor
Chassis	172161-1	1	TE
Pin	170361-1	9	TE
Cable	UL2464- SB20AWG-2C + 24AWG-3P	**	SK TEC
Connector kit	54599-1019	1	Molex

Description	Motor encoder cable for 23 bit high resolution encoder, plactic connector		
Reference	VW3M8A12R**	Suitable for	BCH16*B/C/D/F*****

1	5V
2	0V
3	
4	
5	SD+
6	SD-
7	
8	
9	



1	
2	
3	
4	
5	
6	
7	SD+
8	SD-
9	5V
10	0V
	Shield

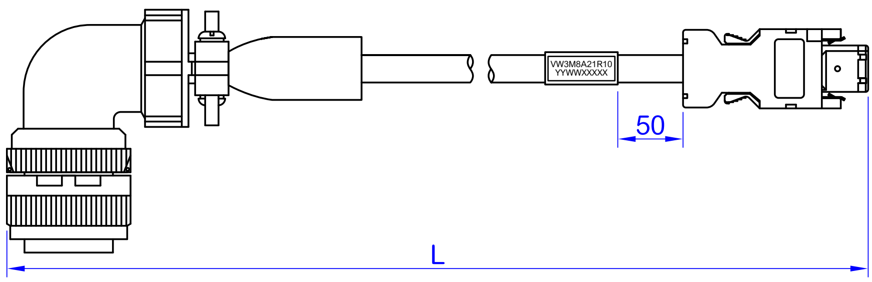
L(m)	Reference
1.5	VW3M8A12RA5
3	VW3M8A12R03
5	VW3M8A12R05
10	VW3M8A12R10
15	VW3M8A12R15
20	VW3M8A12R20
25	VW3M8A12R25

Parts

Description	Reference	Qty.	Vendor
Chassis	172161-1	1	TE
Pin	170361-1	5	TE
Cable	UL2464- SB20AWG-2C + 24AWG-1P	**	SK TEC
Connector kit	54599-1019	1	Molex

Description	Motor encoder cable for 2500 ppr incremental encoder, military connector		
Reference	VW3M8A21R**	Suitable for	BCH16*H/J/M*****

B	5V
I	0V
A	A
C	/A
H	B
D	/B
G	Z
E	/Z
F	



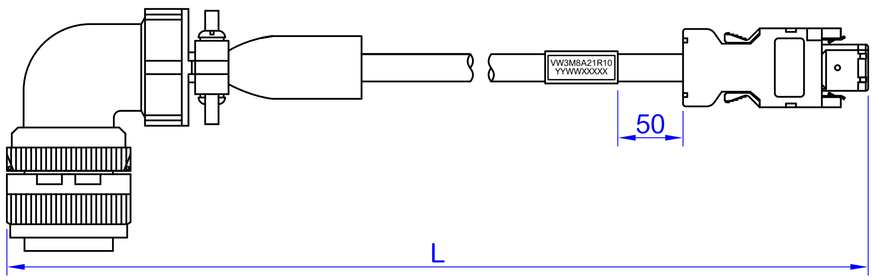
1	A
2	/A
3	B
4	/B
5	Z
6	/Z
7	
8	
9	5V
10	0V
	Shield

L(m)	Reference
1.5	VW3M8A21RA5
3	VW3M8A21R03
5	VW3M8A21R05
10	VW3M8A21R10
15	VW3M8A21R15
20	VW3M8A21R20
25	VW3M8A21R25

Parts			
Description	Reference	Qty.	Vendor
MIL Connector	MS3108E20-18S	1	Amphenol
Cable	UL2464- SB20AWG-2C + 24AWG-3P	**	SK TEC
Connector kit	54599-1019	1	Molex

Description	Motor encoder cable for 23 bit high resolution encoder, military connector		
Reference	VW3M8A22R**	Suitable for	BCH16*H/J/M*****

B	5V
I	0V
A	
C	
H	SD+
D	SD-
G	
E	
F	



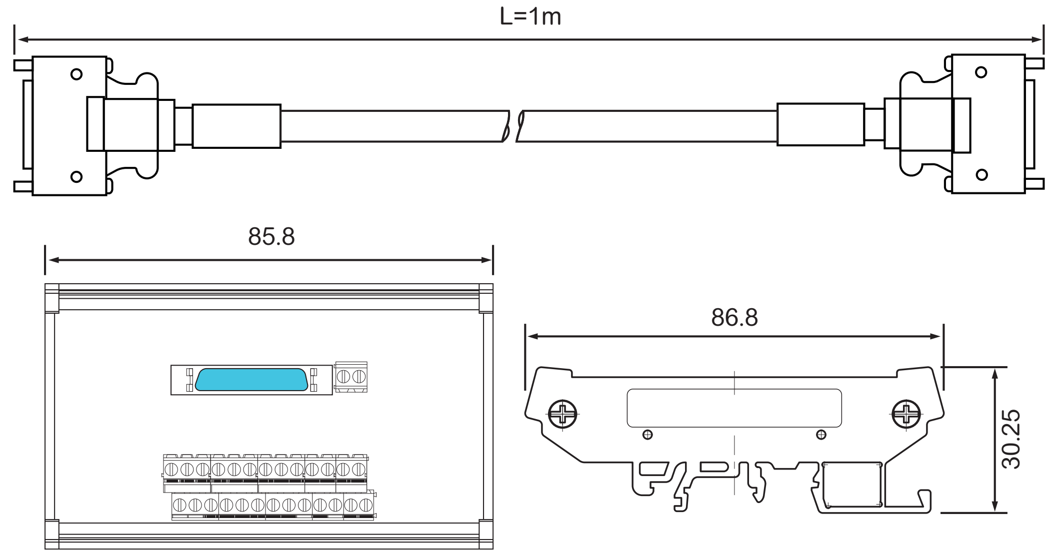
1	
2	
3	
4	
5	
6	
7	SD+
8	SD-
9	5V
10	0V
	Shield

L(m)	Reference
1.5	VW3M8A22RA5
3	VW3M8A22RA5
5	VW3M8A22RA5
10	VW3M8A22RA5
15	VW3M8A22RA5
20	VW3M8A22RA5
25	VW3M8A22RA5

Parts			
Description	Reference	Qty.	Vendor
MIL Connector	MS3108E20-18S	1	Amphenol
Cable	UL2464- SB20AWG-2C + 24AWG-1P	**	SK TEC
Connector kit	54599-1019	1	Molex

2.3.6 I/O Control Cable and Adapter Module

Description	Control cable and adapter module kit for servo drive CN1 control interface		
Reference	VW3M4A1*	Suitable for	LXM16DU01..15M2X

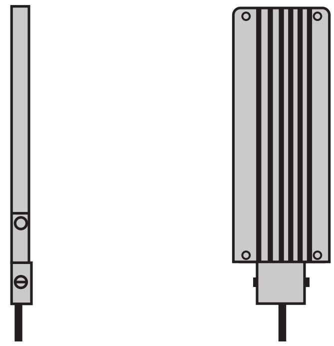


Parts

Description	Reference	Qty.	Vendor	Remarks
Control cable & Adapter module	VW3M4A12	1	Schneider Electric	For 24V OC PTI
	VW3M4A15	1		For 3.3V high speed PTI

2.3.7 External Braking Resistor

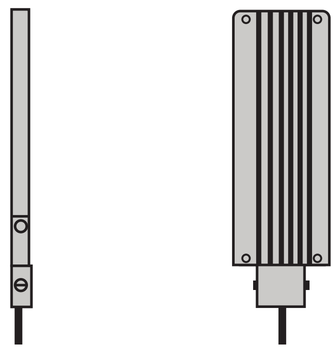
Description	External braking resistor with connecting cable		
Reference	VW3A760*R**	Suitable for	LXM16DU01..15M2X



Parts

Description	Reference	Qty.	Vendor	Remarks
External braking resistor	VW3A7605R07	1	Schneider Electric	72 Ohm, 100 W, 0.75 m cable
	VW3A7605R20	1		72 Ohm, 100 W, 2.0 m cable
	VW3A7605R30	1		72 Ohm, 100 W, 3.0 m cable
	VW3A7606R07	1		72 Ohm, 200 W, 0.75 m cable
	VW3A7606R20	1		72 Ohm, 200 W, 2.0 m cable
	VW3A7606R30	1		72 Ohm, 200 W, 3.0 m cable
	VW3A7607R07	1		72 Ohm, 400 W, 0.75 m cable
	VW3A7607R20	1		72 Ohm, 400 W, 2.0 m cable
	VW3A7607R30	1		72 Ohm, 400 W, 3.0 m cable
	VW3A7608R07	1		100 Ohm, 100 W, 0.75 m cable
	VW3A7608R20	1		100 Ohm, 100 W, 2.0 m cable
	VW3A7608R30	1		100 Ohm, 100 W, 3.0 m cable

Description	External braking resistor with connecting cable		
Reference	VW3A760*R**	Suitable for	LXM16DU07/10/15M2X

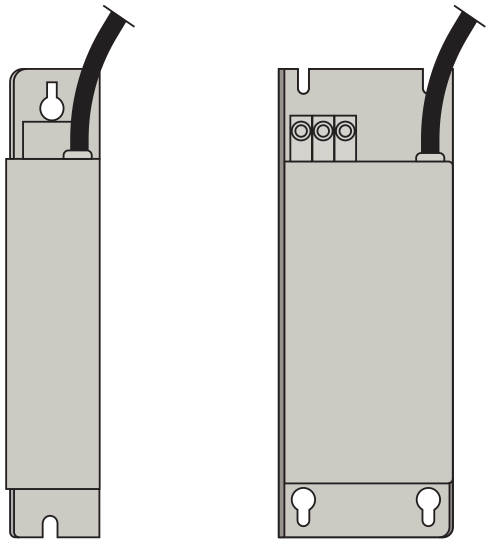


Parts

Description	Reference	Qty.	Vendor	Remarks
External braking resistor	VW3A7602R07	1	Schneider Electric	27 Ohm, 100 W, 0.75 m cable
	VW3A7602R20	1		27 Ohm, 100 W, 2.0 m cable
	VW3A7603R07	1		27 Ohm, 200 W, 0.75 m cable
	VW3A7603R20	1		27 Ohm, 200 W, 2.0 m cable
	VW3A7603R30	1		27 Ohm, 200 W, 3.0 m cable
	VW3A7604R07	1		27 Ohm, 400 W, 0.75 m cable
	VW3A7604R20	1		27 Ohm, 400 W, 2.0 m cable
	VW3A7604R30	1		27 Ohm, 400 W, 3.0 m cable

2.3.8 Input Filter

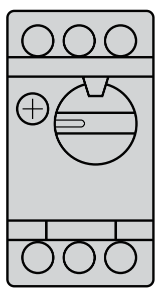
Description	Noise filter for external power supply
Reference	VW3A442*



Parts				
Description	Reference	Remarks	Vendor	Suitable for
Single phase EMI filter	VW3A4420	9 A, 115/230 Vac	Schneider Electric	LXM16DU01/02/04M2X
	VW3A4421	16 A, 115/230 Vac		LXM16DU07/10/15M2X

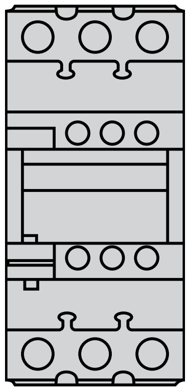
2.3.9 Motor Protection Circuit Breaker and Contactor

Description	Motor protection circuit breaker
Reference	GV2P**



Parts				
Description	Reference	Remarks	Vendor	Suitable for
Motor protection circuit breaker	GV2P14	6..10 A	Schneider Electric	LXM16DU01/02/04/07/10M2X
	GV2P16	9..14 A		LXM16DU15M2X

Description	Main power contactor, optional control voltage and load
Reference	LC1D****



Parts

Description	Reference	Remarks	Vendor	Suitable for
Contactor	LC1D09**	9 A	Schneider Electric	LXM16DU01/02/04/07M2X
	LC1D12**	12 A		LXM16DU10M2X
	LC1D18**	18 A		LXM16DU15M2X

(**)Control voltage:
- B7 - AC 24 V
- M7 - AC 220 V
- BD - DC 24 V

Chap03. Installation

3.1 Before Installation

3.1.1 Electromagnetic Compatibility (EMC)

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

⚠ WARNING

SIGNAL AND EQUIPMENT INTERFERENCE

- Only operate the drive with the specified external mains filter.
- Install the wiring in accordance with the EMC requirements described in the present document.
- Verify compliance with the EMC requirements described in the present document.
- 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.

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

⚠ WARNING

ELECTROMAGNETIC DISTURBANCES OF SIGNALS AND DEVICES

Use proper EMC shielding techniques to help prevent unintended device operation in accordance with the standard IEC 61800-3.

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

These types of devices are not intended to be used on a low-voltage public network which supplies domestic premises. Radio frequency interference is expected if used in such a network.

⚠ WARNING

RADIO INTERFERENCE

Do not use these products in domestic electrical networks.

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

As a system provider, you may have to include this information in the documentation to your customer.
Be sure to take into account the EMC requirements of control cabinet when installing the equipment therein:

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 mm2 (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.

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.
Mount in a closed control cabinet with shielded attenuation of radiated interference	Improves the EMC limit values.

3.1.2 Residual Current Device

Direct current can be introduced in the protective ground conductor of this drive. If a residual current device (RCD / GFCI) or a residual current monitor (RCM) is used for protection against direct or indirect contact, the following specific types must be used:

⚠ WARNING

DIRECT CURRENT CAN BE INTRODUCED INTO THE PROTECTIVE GROUND CONDUCTOR

- Use a Type A Residual Current Device (RCD / GFCI) or a Residual Current Monitor (RCM) for single-phase drives connected to a phase and to the neutral conductor.
- Use a Type B Residual Current Device (RCD / GFCI) or a Residual Current Monitor (RCM) that has approval for use with frequency inverters and is sensitive to all types of current for three-phase drives and for single-phase drives not connected to a phase and the neutral conductor.

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

- The drive has an increased leakage current at the moment power is applied. Use residual current devices with a response relay.
- High-frequency currents must be filtered.

3.1.3 Cables

Cables must not be twisted, stretched, crushed or bent. Use only the cables that comply with the cable specification. Consider the following in determining suitability of the cables:

- Suitable for drag chain applicaitons
- Temperature range
- Outdoor installation
- Underground installation

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

⚠ WARNING

UNINTENDED EQUIPMENT OPERATION

- Ground cable shields for all fast I/O, analog I/O, and communication signals at a single point.” (1)
- Route communications and I/O cables separately from power cables.

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

(1): Multipoint grounding is permissible if connections are made to an equipotential ground plane dimensioned to help.
Avoid cable shield damage in the event of power system short-circuit currents.

The equipotential bonding conductor must be rated for the maximum current. 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)

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

- Method of installation B2:
  Cables in conduits or cable trunking system
- Method of installation E:
  Cables on open cable trays

Cross section in mm^2 (AWG) (1)	Current carrying capacity with method of installation B2 in A (2)	Current carrying capacity with method of installation E in A (2)
0.75 (18)	8.5	10.4
1 (16)	10.1	12.4
1.5 (14)	13.1	16.1
2.5 (12)	17.4	22
4 (10)	23	30
6 (8)	30	37
10 (6)	40	52
16 (4)	54	70
25 (2)	70	88
(1) See chapter “2.3 System Accessories” 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 60240-1 for additional information.		

Please note the derating factor for grouping of cables and the 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 loss.

3.2 Drive Installation

3.2.1 On Opening the Drive Package

Please check upon opening the product package:

- Make sure that the model is what you have ordered.
- Check if the product is damaged or not during transportation.
- Check if the Safety and Environment Statement is included or not.
- Check it the Quick Start Manual is included or not.
- Check if the protective film over the servo drive top ventilation holes is damaged or not.
- Check if the connector for servo drive power supply, external braking resistor and motor output is included or not.

(Neither the I/O control connector nor encoder connector are included)

Contact your dealer for any failure.

3.2.2 Control Cabinet

With a protection degree of IP20, the servo drive must be installed in a control cabinet (enclosure) designed with adequate protection degree. The control cabinet (enclosure) 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.
Install and operate this equipment in a control cabinet rated for its intended environment and secured by a keyed or tooled locking mechanism.

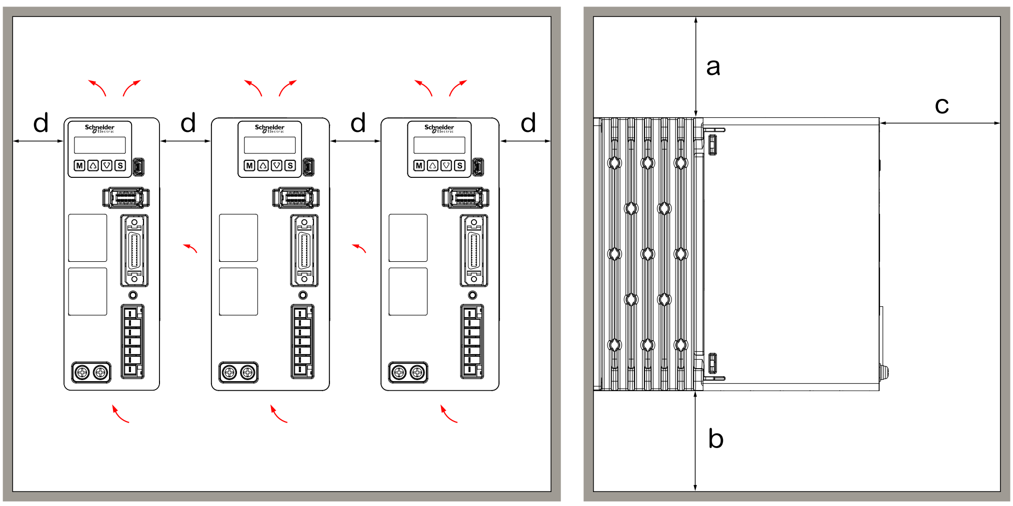
3.2.3 Installation Orientation

The servo drive must be mounted vertically (+/-10o); please use two mounting holes (the location of the mounting holes varies with respect to the servo drive model) to securely mount the servo drive to the mounting surface. Painted surfaces may create electrical resistance or isolation. Before mounting the device to a painted mounting plate, remove all paint across a large area of the mounting points.

3.2.4 Mounting Spacing and Ventilation

When selecting the position of the device in the control cabinet (enclosure), note the following. This requirement is also applicable when installing more than one servo drive in a line:

- Mount the device so that the front panel (HMI displaying surface) is facing toward the operator.
- Mount the device in a vertical position (± 100). 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 or near 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.

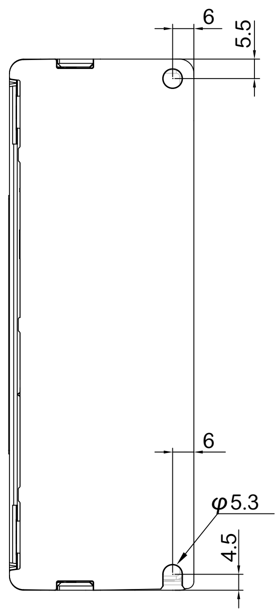


Spacing	Unit	Value
Free space a: above the device	mm	>=50 mm
Free space b: under the device	mm	>=50 mm
Free space c: in front of the device (1)	mm	>=70 mm
Free space d: between devices	mm	>=50 mm
(1) The free space is strictly for observing proper ventilation and be sufficient for your wiring requirements.		

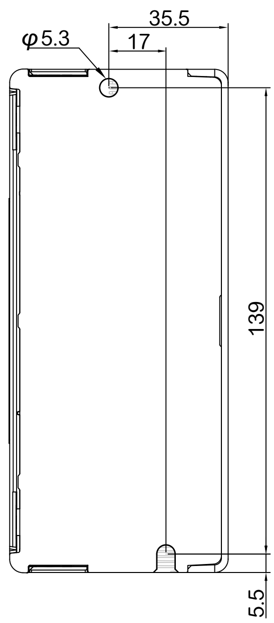
3.2.5 Mounting Footprint

Use mounting holes to securely mount the servo drive to the mounting surface. To mount the servo drive, please use a phillips screwdriver that is longer than the depth of servo drive.

- Mounting hole dimensions of Size1 0.1kW / 0.2kW / 0.4kW servo drives:



- Mounting hole dimensions of Size2 0.75kW / 1.0kW / 1.5kW servo drives:



3.3 Motor Installation

3.3.1 On Opening the Motor Package

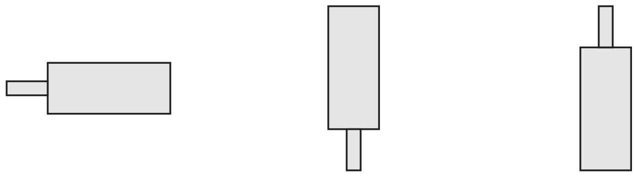
Please check upon opening the product package:

- Make sure that the model is what you have ordered.
- Check if the product is damaged or not during transportation.
- Check if the Safety and Environment Statement is included or not.
- Check if the servo motor is provided with a protective cap on its output shaft.

Contact your dealer for any failure.

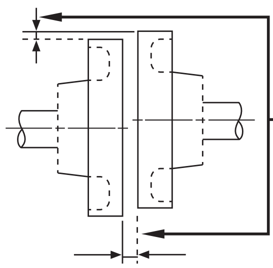
3.3.2 Installation Orientation

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



3.3.3 Connecting the Motor to Machine

Consider the extremely large mass of servo motor, essential care must be taken to avoid any injury or equipment damage during mounting.
The servo motor output shaft is coated with anticorrosive oil. Thoroughly remove the oil prior to installation.
Align the shaft of the servo motor with the shaft of the machine, and then couple the shafts. Install the servo motor so that alignment accuracy falls within the following range. Vibration will damage the bearings or encoders if the shafts are not properly aligned.



When the servo motor is mounted to the mounting surface, it must be accurately aligned axially and radially and make even contact with the mounting surface. No uneven mechanical load may be applied while the mounting screws are tightened. All mounting screws must be tightened with the specified tightening torque.
Refer to chapter 2 Type Selection of Servo Motor for flange dimensions and mounting screws model.
Do not allow direct impact to be applied to the shafts when installing the coupling as the encoder mounted on the opposite end of the shaft may be damaged.

3.3.4 Other Precautions

- Oil and water countermeasures:
  1. Keep the oil surface at servo motor mounting point under the oil seal lip
  2. To avoid excessive wear of oil seal, use the oil seal in favorably lubricated condition
  3. When using a servo motor with its shaft in upward direction (IM V3), be sure that the oil will not stay in the oil seal lip.

- Cable stress:
  When handling or mounting the servo motor, hold the servo motor rather than its cables or connectors, otherwise the connectors, power cable, holding brake control cable and encoder cable will be damaged.
  Make sure there are no bends or tension on the servo motor power cable, holding brake control cable or encoder cable to avoid stress. Securely fix the servo motor power cable, holding brake control cable and encoder cable so that they are not subject to any bends or

tension or stress, also to avoid them from been damaged because of wear or fatigue.

- Connectors:
  Note the following precautions:
  1. Visually check the connector and pins inside to make sure they are free from damage, breakage or deformation.
  2. Make sure there is no foreign matters such as dust and metal chips in the connector.
  3. Make sure of the pin arrangement.
  4. Do not apply shock to connectors. Otherwise, they may be damaged.
  5. Fix the connectors to 100mm/130mm flange servo motors with screw. Make sure the connectors are securely fixed with screws.

- Radial and thrust loads:
  Design the mechanical system so radial and thrust loads applied to the servo motor shaft end during operation fall within the allowable ranges of each motor. Refer to Chapter 2 Type Selection of Servo Motor for the allowable ranges.

Chap04. Wiring

4.1 Wiring of Servo Drive

4.1.1 Precatuions

Please pay attention to the following precautions prior to the wiring of servo drive:

DANGER

INSUFFICIENT GROUNDING

- Use a protective ground conductor with at least 10 mm² (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 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.
- Do not use cable shields as protective ground conductors.
- Keep foreign objects from getting into the product.
- Verify the correct seating of seals and cable entries in order to avoid contamination such as deposits and humidity.

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

Direct current can be introduced in the protective ground conductor of this drive. If a residual current device (RCD / GFCI) or a residual current monitor (RCM) is used for protection against direct or indirect contact, the following specific types must be used:

DANGER

DIRECT CURRENT CAN BE INTRODUCED INTO THE PROTECTIVE GROUND CONDUCTOR

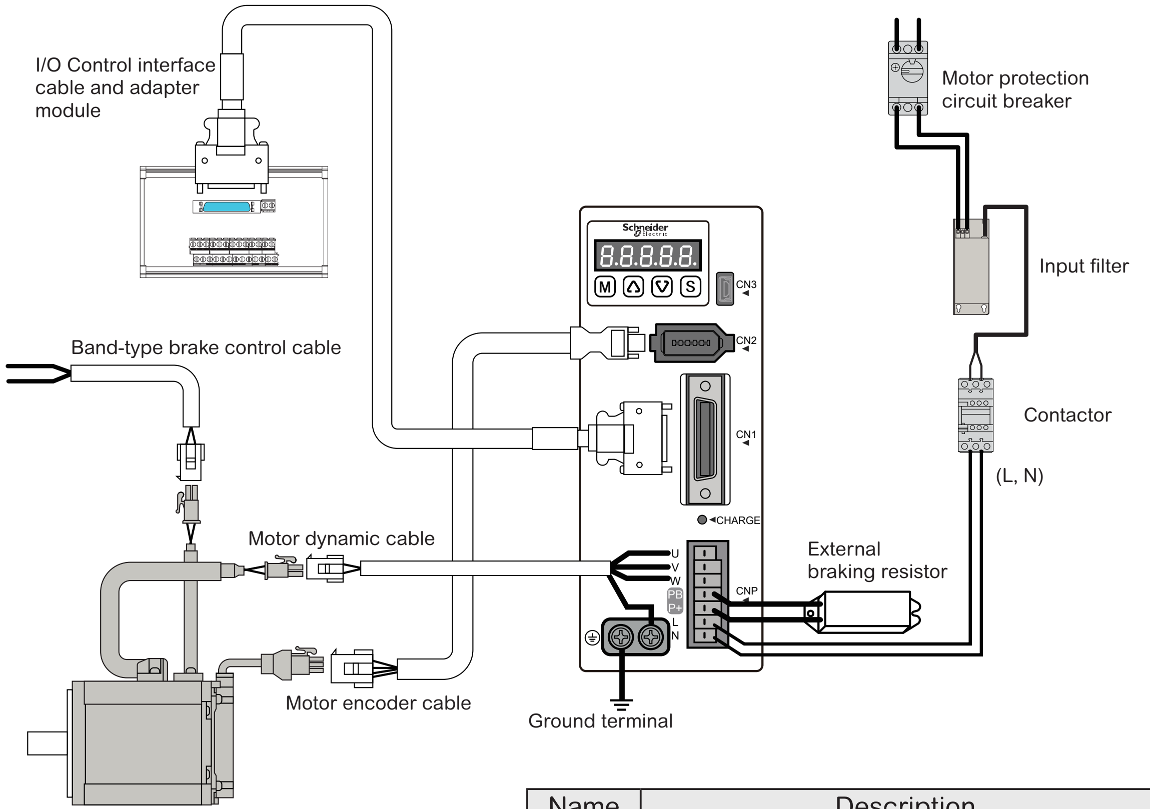
- Use a Type A Residual Current Device (RCD / GFCI) or a Residual Current Monitor (RCM) for single-phase drives connected to a phase and to the neutral conductor.
- Use a Type B Residual Current Device (RCD / GFCI) or a Residual Current Monitor (RCM) that has approval for use with frequency inverters and is sensitive to all types of current for three-phase drives and for single-phase drives not connected to a phase and the neutral conductor.

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

The entire installation procedure must be performed without voltage present.

4.1.2 Standard Composition of Servo System with Peripheral Devices

Overview of Interfaces



Name	Description
CNP	Main circuit interface of servo drive
CN1	I/O control interface of servo drive
CN2	Encoder interface of servo dirve
CN3	Commissioning interface of servo drive

4.1.3 Connecting Main Circuit (CNP)

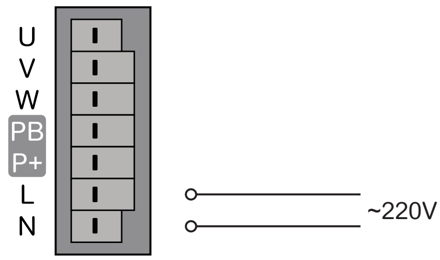
Main circuit interface (CNP) is a combined interface that includes:

- Servo drive power input (L, N)
- External braking resistor (P+, PB)
- Servo motor power output (U, V, W)

4.1.4 Connecting Power Input to Servo Drive

The equipment, drives and motors, are intended for industrial use and may only be operated with a permanently installed connection.
Prior to connecting the equipment, verify the approved mains types, refer to “2.1 Type Selection of Servo Drive” for further information.

Wiring diagram:



- All servo drives must be connected via a single-phase.
- Only TT and TN grounding system are approved rather than IT grounding system.
  The contact current of this product is greater than 3.5mA.This product has a touch 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

INSUFFICIENT GROUNDING

- Use a protective ground conductor with at least 10 mm2 (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 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.
- Do not use cable shields as protective ground conductors.
- Keep foreign objects from getting into the product.
- Verify the correct seating of seals and cable entries in order to avoid contamination such as deposits and humidity

Failure to followthese instructions will result in death or serious injury.

DANGER

INCORRECT MAINS VOLTAGE

Verify that the product is approved for the mains voltage before applying power and configuring the product.

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

Cable specifications:

Shield:	-
Twisted pair:	-
PELV:	-
Cable composition:	The conductors must have a sufficiently large cross section so that the fuse at the mains connection can trip if required.
Max. cable length:	3 m
Special characteristics:	-

Terminal specifications:
The terminals are approved for stranded conductors and solid conductors. Use type-I lugs if stranded conductors are used.

LXM16D	Unit	U01,U02,U04,U07,U10,U15
Connection cross section	mm^2	0.5 ... 2.0
Stripping (lug) length	mm	10 ... 15

4.1.5 Connecting External Braking Resistor

⚠ WARNING

HOT SURFACES

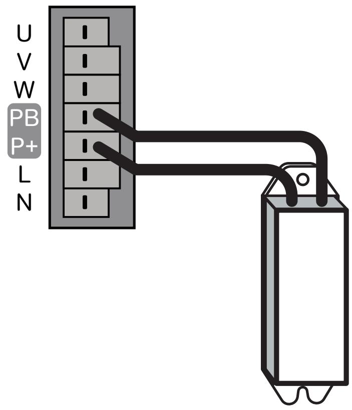
- Ensure that it Is not possible to make any contact with a hot braking resistor.
- Do not allow flammable or heat-sensitive parts In the immediate vicinity of the braking resistor.
- Verify that the heat dissipation is sufficient by performing a test run under maximum load conditions.

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

When sizing an external braking resistor, note the following:

Drive Reference	Min. resistance of external braking resistor (Ω)	Max. power of external braking resistor (W)
LXM16DU01 / 02 / 04	36	200
LXM16DU07 / 10 / 15	20	600

Wiring diagram:



An insufficiently rated braking resistor can cause overvoltage on the DC bus. Overvoltage on the DC bus causes the power stage to be disabled.

⚠ 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.

This device does not equip any internal 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. Refer to "2.3.7 External Braking Resistor" when sizing an external braking resistor.

Cable specifications:

Shield:	Required, both ends grounded
Twisted pair:	-
PELV:	-
Cable composition:	Min. conductor cross section: Same cross section as logic supply. The conductors must have a sufficiently large cross section so that the fuse at the mains connection can trip if required.
Max. cable length:	3 m
Special characteristics:	Temperature resistance

The braking resistors listed in chapter “2.3.7 External Braking Resistor” have a 3-wire, temperature-resistant cable with length of 0.75m to 3m.

Terminal specifications:
The terminals are approved for stranded conductors and solid conductors. Use type-I lugs if stranded conductors are used.

LXM16D	Unit	U01,U02,U04,U07,U10,U15
Connection cross section	mm^2	0.5 ... 2.0
Stripping (lug) length	mm	10 ... 15

Connecting the External Braking Resistor:

- Remove power from all supply voltages.Respect the safety instructions concerning electrical installation.
- Verify that no voltages are present.
- Ground the ground connection (PE) of the braking resistor.
- Connect the external braking resistor to the device.
- Connect a large surface area of the cable shield to the central grounding point of your system.

DANGER

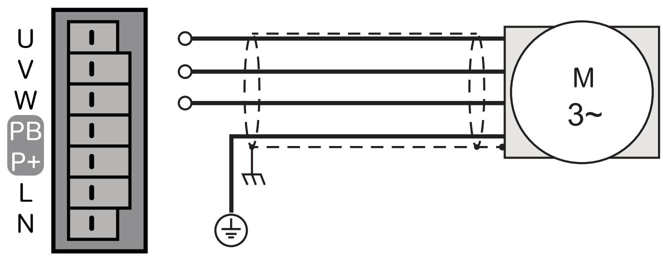
ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

- Disconnect all power from all equipment including connected devices prior to removing any covers or doors, or installing or removing any accessories, hardware, cables, or wires.
- Place a "Do Not Turn On" or equivalent hazard label on all power switches and lock them in the non- energized position.
- Wait 15 minutes to allow the residual energy of the DC bus capacitors to discharge.
- Do not assume that the DC bus is voltage-free when the DC bus LED is off.
- Block the motor shaft to prevent rotation prior to performing any type of work on the drive system.
- Do not create a short-circuit across the DC bus terminals or the DC bus capacitors.
- Replace and secure all covers, accessories, hardware, cables, and wires and confirm that a proper ground connection exists before applying power to the unit.
- Use only the specified voltage when operating this equipment and any associated products.

ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

4.1.6 Connecting Servo Motor Power Output

Wiring diagram:



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

- Verify that no voltage is present 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.

Incorrect wiring of the motor connection may cause live wires to be exposed outside of the motor connector.

DANGER

ELECTRIC SHOCK CAUSED BY INCORRECT WIRING

- Verify that the protective ground connection (PE) of the device is connected to ground.
- Do not remove the cable end (ferrule) from the protective ground terminal (PE) of the motor connector until you are prepared.
- Verify that no bare metal of the wires is exposed outside of the motor connector housing when wiring the motor connector.
- Regularly, as part of a maintenance plan, assure that the motor wires are secured in the terminals of the motor connector due to vibration or other influences.

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

Drive systems may perform unintended movements if unapproved combinations of drive and motor are used.Even if motors are similar, different adjustment of the encoder system may be a source of hazards.Even if the connectors for motor connection and encoder connection match mechanically, this does not imply that the motor is approved for use.

WARNING

UNINTENDED MOVEMENT

Only use approved combinations of drive and motor.

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

Compatibility between Servo Drive and Servo Motor is defined in the table in chapter “1.4 Confirming the Mating of Servo Drive and Servo Motor”.

Cable specifications:

Shield:	Required, both ends grounded
Twisted pair:	-
PELV:	The holding brake control wire must be PELV-compliant.
Cable composition:	3 wires for motor phases The conductors must have a sufficiently large cross section so that the fuse at the mains connection can trip if required.
Max. cable length:	Depends on the required limit values for conducted interference. Max. length: 25m
Special characteristics:	Temperature resistance

Terminal specifications:
The terminals are approved for stranded conductors and solid conductors. Use type-I lugs if stranded conductors are used.

LXM16D	Unit	U01,U02,U04,U07,U10,U15
Connection cross section	mm^2	0.5 ... 2.0
Stripping (lug) length	mm	10 ... 15

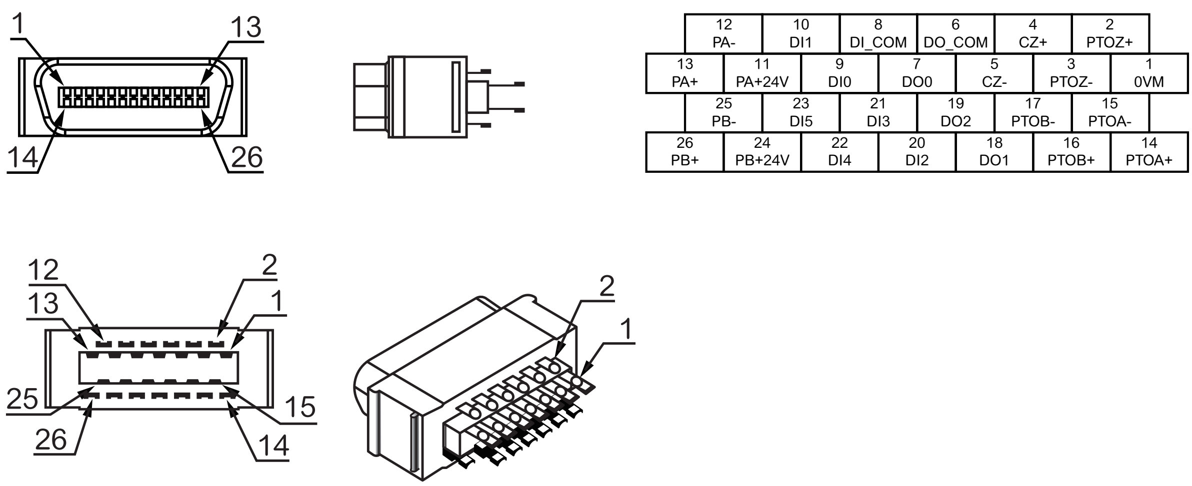
4.1.7 Connecting I/O Control Interface (CN1)

CN1 interface is a SCSI-26 connector for I/O control connection between controller and servo drive. The connector consists of:

- Pulse train input interface
- Digital input/output interface
- Encoder simulation output interface

CN1 connector pin assignment:

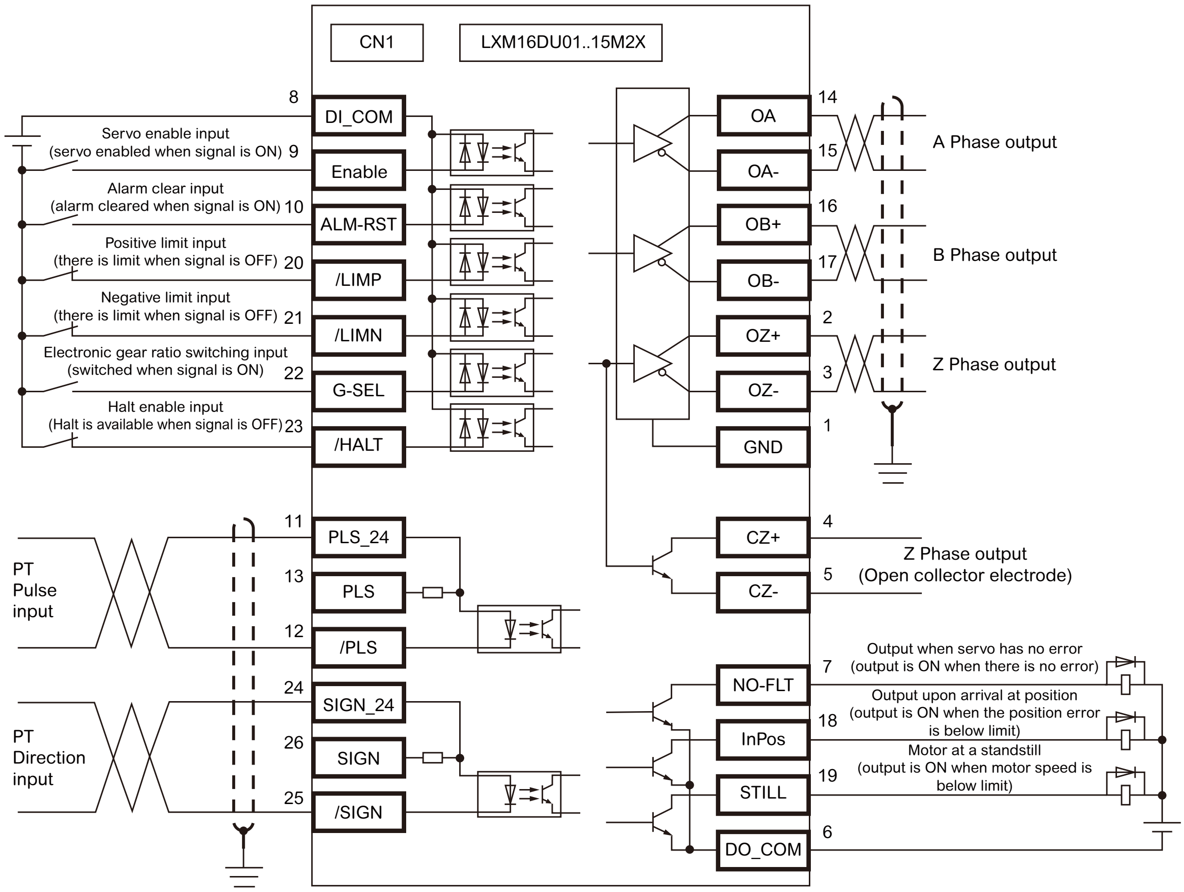
Pin	Signal	Function	Pin	Signal	Function
8	DI_COM	6 * digital input (Dual-polarity)	11	PA+24V	Pulse train input Interface A
9	DI0		13	PA+	
10	DI1		12	PA-	
20	DI2		24	PB+24V	Pulse train input Interface B
21	DI3		26	PB+	
22	DI4		25	PB-	
23	DI5		14	PTOA+	Encoder simulation output
6	DO_COM	3 * digital output (open collector)	15	PTOA-	
7	DO0		16	PTOB+	
18	DO1		17	PTOB-	
19	DO2		2	PTOZ+	
4	OCZ+	Motor index signal output (open collector)	3	PTOZ-	
5	OCZ-		1	0VM	Signal ground



Terminal specifications:
The terminals are approved for stranded conductors and solid conductors. Use type-I lugs if stranded conductors are used.

LXM16D	Unit	U01,U02,U04,U07,U10,U15
Connection cross section	mm^2	0.5 ... 2.0
Stripping (lug) length	mm	10 ... 15

Typical wiring diagram of CN1:



Notes:

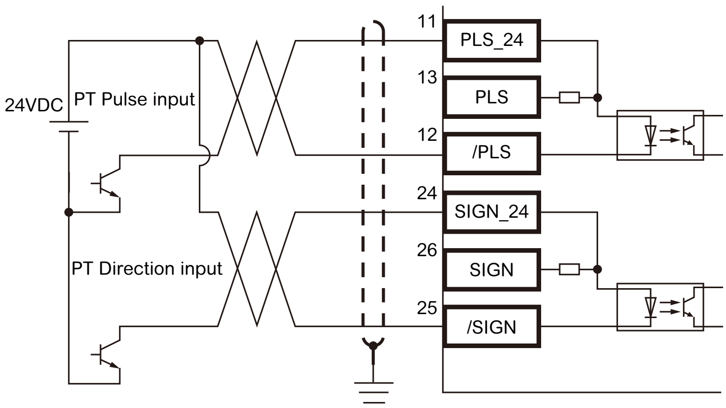
- It is a must to use a cable with shield, among which the wires for pulse train must be twist-paired.
- Connect the shield to the chassis of CN1 connector, then properly ground the connector chassis.

Input and output wiring:

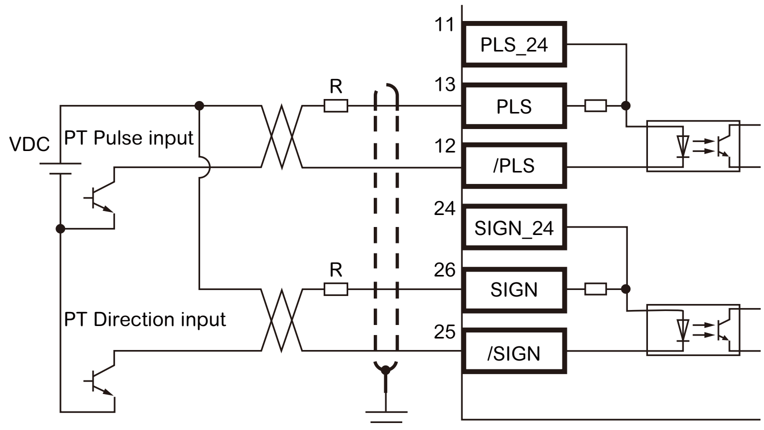
- The common terminals of the 6 input points are suitable for both positive and negative polarity.
- The 3 output points are independent open collector outputs that share the same emitter.

Wiring of Pulse Train Input (PTI)

Open Collector (24VDC)

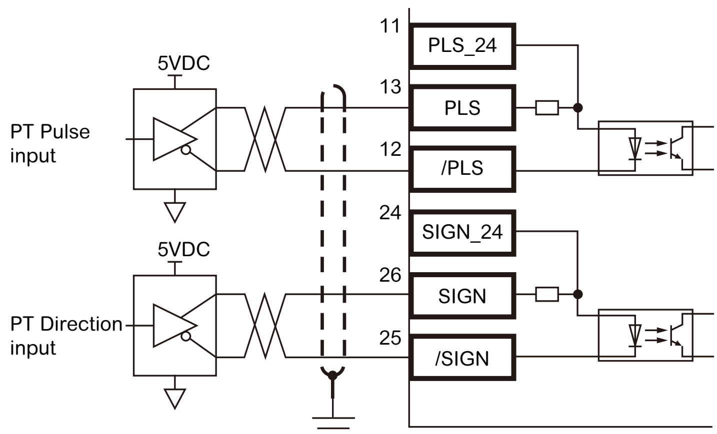


Open collector pulse train input with other voltage level (external resistors required)



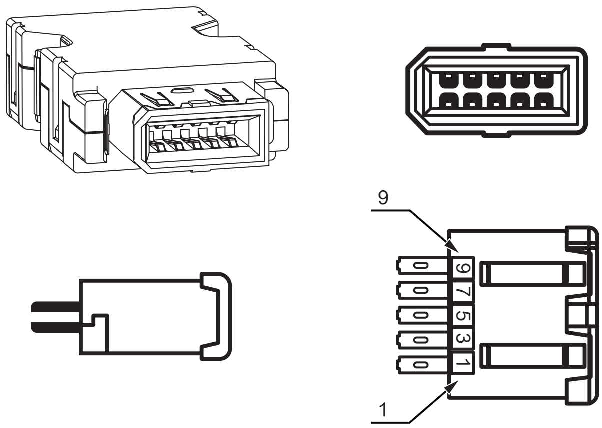
VDC	Resistor
12VDC	500 ohm / 1W
5VDC	120 ohm / 1W

Differential Signal



4.1.8 Connecting Encoder Interface (CN2)

CN2 connector is an IEEE-1394-10 connector for connection with servo motor encoder.



Pin	Description	
	2500 ppr	23 bit
1	A	
2	/A	
3	B	
4	/B	
5	Z	
6	/Z	
7		SD+
8		SD-
9	5V	5V
10	0V	0V

Cable specifications:

Shield:	Required, both ends grounded
Twisted pair:	Required
PELV:	The holding brake control wire must be PELV-compliant.
Cable composition:	2 * 0.5 + 3 * 2 * 0.2 mm^2 or 2 * 0.5 + 1 * 2 * 0.2 mm^2 The 2 conductors in 0.5 mm^2 cross section is dedicated to power supply, the other conductors in 0.2 mm^2 cross section is dedicated to signal transmission.
Max. cable length:	Depends on the required limit values for conducted interference. Max. length: 25m

4.1.9 Connecting Commissioning Interface (CN3)

CN3 is a Mini-B USB connector. CN3 interface is dedicated to the connection with PC commissioning software and cannot be used as field bus interface.

CAUTION

INOPERABLE EQUIPMENT

Cannot be used as field bus interface.

Failure to follow these instructions can result in equipment damage.

A PC with the commissioning software SoMove and LXM16D DTM Library can be connected for commissioning.

4.1.10 Connecting Grounding Screws

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

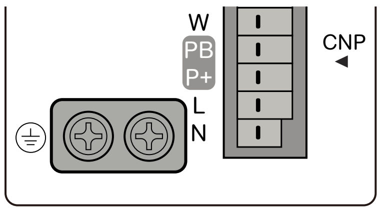
DANGER

INSUFFICIENT GROUNDING

- Use a protective ground conductor with at least 10 mm2 (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 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.
- Do not use cable shields as protective ground conductors.
- Keep foreign objects from getting into the product.
- Verify the correct seating of seals and cable entries in order to avoid contamination such as deposits and humidity.

Failure tofollowthese instructions will result in death or serious injury.

The central grounding screw of the product is located at the bottom of the front side.



Note:

- Use ring-type cable lugs or Y-type cable lugs.
- Connect the ground connection of the device to the equipotential ground plane of your system.

Tightening torque of grounding screw	Nm	1.5
Screw type	Philips head	M4×8

4.2 Wiring of Servo Motor

4.2.1 Servo Motor Connector Pin Assignment

Plastic Connector: 40 / 60 / 80 mm Flange

Motor encoder connector

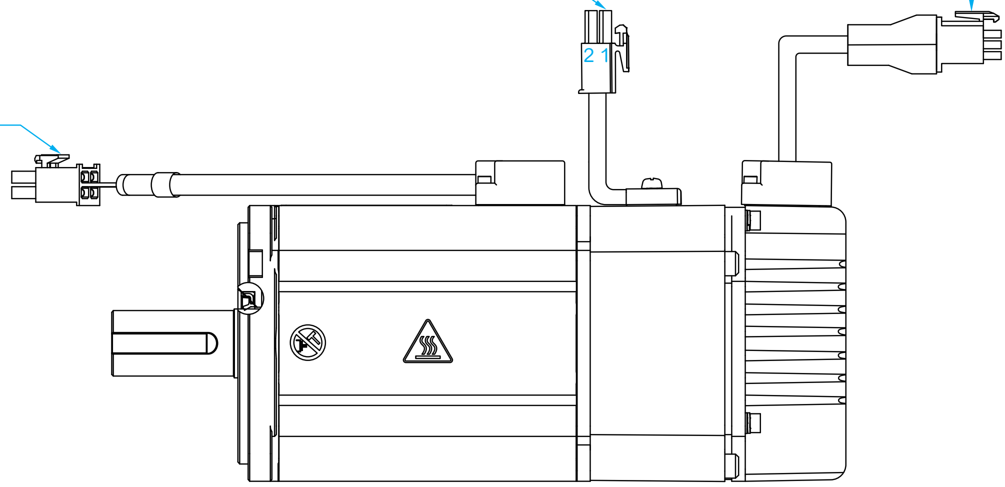
Pin	Description 2500 ppr	23 bit
1	5V	5V
2	0V	0V
3	A	
4	/A	
5	B	SD+
6	/B	SD-
7	Z	
8	/Z	
9	Shield	Shield

Motor band-type brake connector

1	BK+
2	BK-

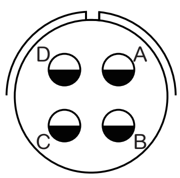
Motor dynamics connector

1	U
2	V
3	W
4	GND



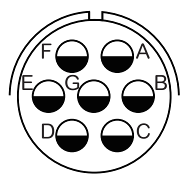
Military Connector: 100 / 130 mm Flange

Motor dynamics connector



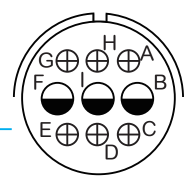
A	U
B	V
C	W
D	FG

Motor dynamics and band-type brake connectors

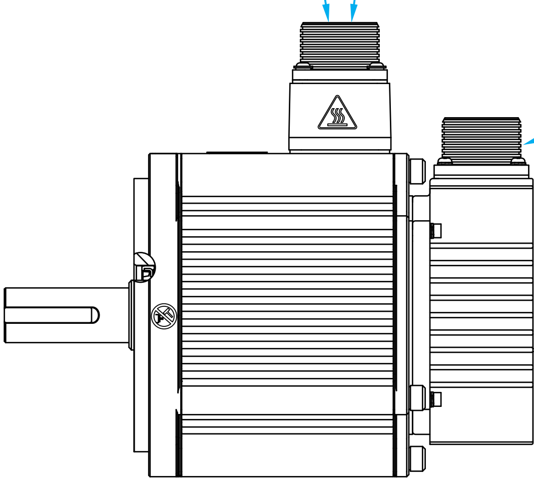


B	U
G	V
E	W
A	BK-
F	BK+
C	GND

Motor encoder connec



Pin	Description 2500 ppr	23 bit
B	5V	5V
I	0V	0V
A	A	
C	/A	
H	B	SD+
D	/B	SD-
G	Z	
E	/Z	
F	Shield	Shield



4.2.2 Connecting Servo Motor Power and Encoder

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

⚠ ⚠ DANGER

FIRE HAZARD DUE TO INCORRECT CONNECTION

Only connect the motor to a matching, approved drive.

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

Compatibility between Drive and Motor is defined in chapter “1.4 Confirming the Mating of Servo Drive and Servo Motor”.
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

- Verify that no voltage is present prior to performing any type of work.
- Block the motor shaft to prevent rotation prior to performing any type of work on the drive system 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.

Drive systems may perform unintended movements if unapproved combinations of drive and motor are used. Even if motors are similar, different adjustment of the encoder system may be a source of hazards. Even if the connectors for motor connection and encoder connection match mechanically, this does not imply that the motor is approved for use.

⚠ WARNING

UNINTENDED MOVEMENT

Only use approved combinations of drive and motor.

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

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 inserted and locked before applying power.
- 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.

4.2.3 Connecting Servo Motor Holding Brake

The holding brake in the motor has the task of holding the motor position when the power stage is disabled.
The holding brake is not a safety function and not a service brake.
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 PELV power supply for the holding brake.
- Insulate both ends of unused conductors of the motor cable.

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

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. Releasing the holding brake can cause an unintended movement, for example, lowering of the load in the case of vertical axes.

DANGER

UNINTENDED MOVEMENT

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

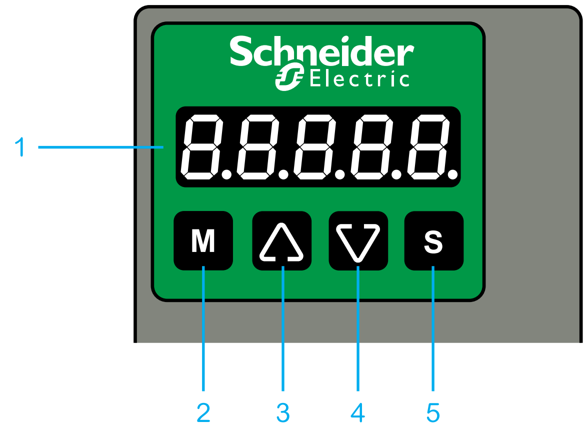
Failure to follow these instructions can result in death, serious injury, or equipment damage.

Chap05. Front Panel

5.1 Front Panel

5.1.1 Front Panel Overview

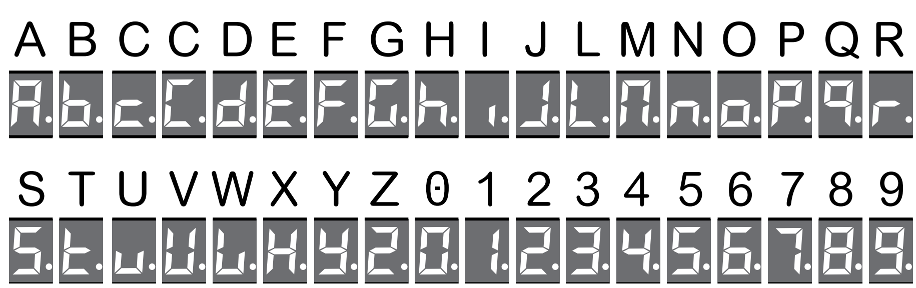
The integrated HMI allows you to edit parameters and operate the device via the integrated Human-Machine Interface (HMI). Diagnostics information (such as parameter values or error codes) can also be displayed.



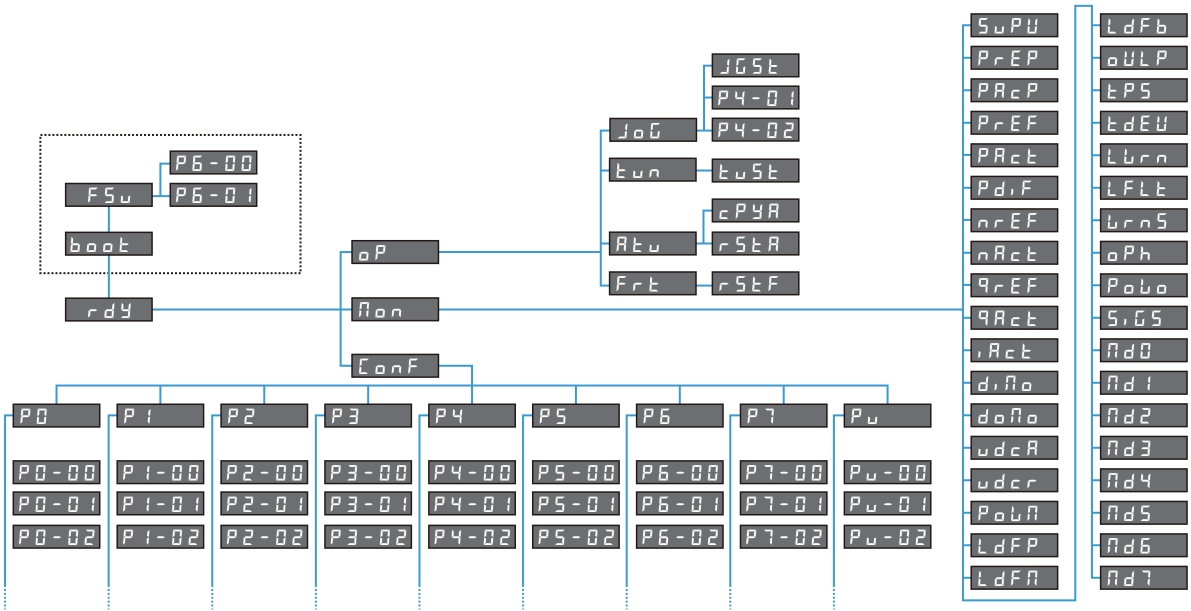
The front panel includes:

Item	Description
1	5 digital 7-segment LED display with 5 decimal points
2	M key
3	UP key
4	DOWN key
5	S key

The following table shows the assignment of the characters to the symbols displayed by the 5 digital 7-segment display.



5.1.2 Front Panel Menu Structure



5.1.3 Operation of Front Panel

Item	Description
M key	If an error is detected, the M key lets you switch between the error code / Menu
	Press the M key allows you to exit current parameter and menus. Any unsaved parameter edit will be invalid.
UP key	In Menu level, the UP key lets you navigate status information and parameters within a parameter group.
	In Editing level, the UP key lets you increase value.
DOWN key	In Menu level, the DOWN key lets you navigate status information and parameters within a parameter group.
	In Editing level, the DOWN key lets you increase value.
S key	In Menu level, the S key lets you enter and display current parameter.
	In Parameter level, the S key lets you start the editing of current parameter
	In Editing level, the S key lets you move the cursor by one position to the left.
	In Editing level, press and hold S key for more than 1.5s to save the value and stop the editing of current parameter

5.1.4 7-segment LED Display

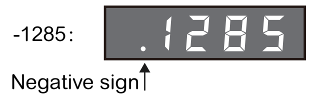
It is possible to indicate the device operating states via message displayed on the LED display:

HMI Display	Operation State	Description
init	1 Initialize	Electronics are initialized
nrdy	2 Not ready to start	The power stage is not ready to switch on
dis	3 Cannot start	Impossible to enable the power stage
rdy	4 Ready to start	The power stage is ready to switch on.
son	5 Start	Power stage is switched on
run	6 Equipment enable	Power stage is enabled / Selected operating mode is active
stop	7 Quick stop started	"Quick Stop" is being executed
flt	8 Fault response started	Error response is active
flt	9 Fault	Error response terminated / Power stage is disabled

If the user performed any operation by press the S key or save the value by press and hold the S key for more than 1.5s, a message is displayed to provide the feedback.

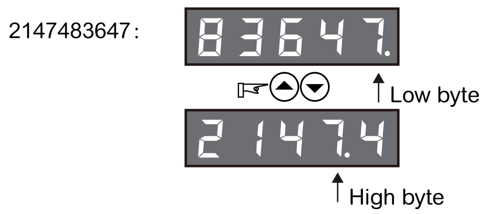
HMI Display	Description
Blink 1 time	New parameter value was saved successfully.
buSy	Access occupied by another channel (e.g. Commissioning software is active).
Rd-oL	The parameter value is a read-only value and cannot be saved (Read-Only).
outr	The new parameter value is outside the permissible value range and cannot be saved (Out of range).
Prot	MHI is locked by parameter and cannot be saved.
Sv-on	The new parameter value can only be saved when the power stage is disabled and cannot be saved (Servo On).
AdPon	Auto adaptive tuning active, cannot start easy tuning.
noPoW	Main power supply to the servo drive is off, new parameter value cannot be saved.
dEnid	The new parameter value saving was denied.

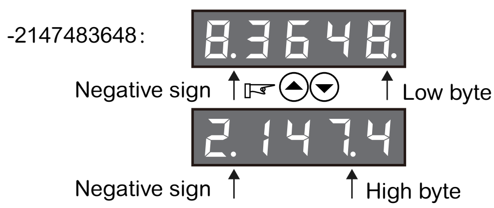
The display indicates the positive and negative nature of value by the rightmost decimal point. Decimal point indicates a negative sign when it presents, for example:



The display has 5 digits. Where the value has more than 5 digits, you may use UP and DOWN key to switch over between high and low bytes of the value. When the parameter is in Editing level, you can press the S key to move the cursor by one position to the left each time.
The display indicates the high and low bytes of the values by the two leftmost decimal points; the leftmost decimal point indicates the low byte, wherevers the second leftmost decimal point indicates the high byte.

For example:





5.1.5 Lock the Front Panel

To prevent unintended parameter value editing, the user may lock the front panel by parameter.

<table>
<tr><td rowspan="3">P5-01</td><td rowspan="3">Lock HMI</td><td>Min.</td><td>0</td><td>Unit</td><td colspan="3">Related Mode</td></tr>
<tr><td>Default</td><td>0</td><td rowspan="2">-</td><td>P</td><td>-</td><td>-</td></tr>
<tr><td>Max.</td><td>1</td><td>DYC</td><td>-</td><td>-</td></tr>
<tr><td colspan="8">Description:
Lock the front panel integrated HMI
0 / Not Locked: HMI not locked
1 / Locked: HMI locked
The following functions can no longer be started when the HMI is locked:
• Parameter change
• Jog
• Autotuning
• Fault reset

Change settings become active immediately.</td></tr>
</table>

5.2 Operation of Menu Group FSU

A FSU or "First Setup" is required when the servo drive is powered on for the first time or after the factory settings have been restored. First Setup is used to perform basic configuration of the servo drive.

5.2.1 Operation Conditions of FSU

The First Setup is required when the servo drive is powered on for the first time or after the factory settings have been restored.

5.2.2 Configuration in FSU

The servo motor reference connected to the drive needs to be configured in parameter P6-00 in FSU.
The encoder type of the servo motor connected to the drive needs to be configured in parameter P6-01 in FSU.

When the servo drive is powered on for the first time or after the factory settings have been restored, default value in parameter P6-01 is 9 - 2500 ppr incremental. User needs to configure the motor reference connected to the drive in parameter P6-00 then reboot servo drive to finish the First Setup.

If a servo motor equipped with high resolution encoder is connected to the servo drive, user needs to change the value in parmanter P6-01 to 8 - BISS then reboot the servo drive to finish the First Setup. When servo drive is powered on again, the servo drive will automatically upload motor information from electric nameplate saved in high resolution encoder. Parmater P6-00 will be read-only and display the motor reference connected to the servo drive currently.

<table>
<tr><td rowspan="3">P6-00</td><td rowspan="3">Motor type</td><td>Min.</td><td>0</td><td>Unit</td><td colspan="3">Related Mode</td></tr>
<tr><td>Default</td><td>0</td><td rowspan="2">-</td><td>P</td><td>-</td><td>-</td></tr>
<tr><td>Max.</td><td>65535</td><td>DYC</td><td>-</td><td>-</td></tr>
<tr><td colspan="8">Motor file name
Noest / Not Exist: Motor type doesn't exist
None / No Motor Selected: No motor selected
LB01A / BCH16LB013*0A5C*: 0.1 kW motor, low inertia, 40 mm flange, 8 mm shaft diameter, rated speed 3000 rpm, 2500 ppr incremental encoder, no holding brake, plastic connector, Asian style mounting interface
LB01F / BCH16LB013*0F5C*: 0.1 kW motor, low inertia, 40 mm flange, 8 mm shaft diameter, rated speed 3000 rpm, 2500 ppr incremental encoder, with holding brake, plastic connector, Asian style mounting interface
LB01A / BCH16LB013*2A5C*: 0.1 kW motor, low inertia, 40 mm flange, 8 mm shaft diameter, rated speed 3000 rpm, 23 bit high resolution encoder, no holding brake, plastic connector, Asian style mounting interface
LB01F / BCH16LB013*2F5C*: 0.1 kW motor, low inertia, 40 mm flange, 8 mm shaft diameter, rated speed 3000 rpm, 23 bit high resolution encoder, with holding brake, plastic connector, Asian style mounting interface
HC02A / BCH16HC023*0A5C*: 0.2 kW motor, high inertia, 60 mm flange, 11 mm shaft diameter, rated speed 3000 rpm, 2500 ppr incremental encoder, no holding brake, plastic connector, Asian style mounting interface
HC02F / BCH16HC023*0F5C*: 0.2 kW motor, high inertia, 60 mm flange, 11 mm shaft diameter, rated speed 3000 rpm, 2500 ppr incremental encoder, with holding brake, plastic connector, Asian style mounting interface</td></tr>
</table>

P6-00	Motor file name (continue)	Min.	0	Unit	Related Mode		
		Default	0	-	P	-	-
		Max.	65535		DYC	-	-

HC02A / BCH16HC023*2A5C*: 0.2 kW motor, high inertia, 60 mm flange, 11 mm shaft diameter, rated speed 3000 rpm, 23 bit high resolution encoder, no holding brake, plastic connector, Asian style mounting interface
HC02F / BCH16HC023*2F5C*: 0.2 kW motor, high inertia, 60 mm flange, 11 mm shaft diameter, rated speed 3000 rpm, 23 bit high resolution encoder, with holding brake, plastic connector, Asian style mounting interface
HD02A / BCH16HD023*0A5C*: 0.2 kW motor, high inertia, 60 mm flange, 14 mm shaft diameter, rated speed 3000 rpm, 2500 ppr incremental encoder, no holding brake, plastic connector, Asian style mounting interface
HD02F / BCH16HD023*0F5C*: 0.2 kW motor, high inertia, 60 mm flange, 14 mm shaft diameter, rated speed 3000 rpm, 2500 ppr incremental encoder, with holding brake, plastic connector, Asian style mounting interface
HD02A / BCH16HD023*2A5C*: 0.2 kW motor, high inertia, 60 mm flange, 14 mm shaft diameter, rated speed 3000 rpm, 23 bit high resolution encoder, no holding brake, plastic connector, Asian style mounting interface
HD02F / BCH16HD023*2F5C*: 0.2 kW motor, high inertia, 60 mm flange, 14 mm shaft diameter, rated speed 3000 rpm, 23 bit high resolution encoder, with holding brake, plastic connector, Asian style mounting interface
HD04A / BCH16HD043*0A5C*: 0.4 kW motor, high inertia, 60 mm flange, 14 mm shaft diameter, rated speed 3000 rpm, 2500 ppr incremental encoder, no holding brake, plastic connector, Asian style mounting interface
HD04F / BCH16HD043*0F5C*: 0.4 kW motor, high inertia, 60 mm flange, 14 mm shaft diameter, rated speed 3000 rpm, 2500 ppr incremental encoder, with holding brake, plastic connector, Asian style mounting interface
HD04A / BCH16HD043*2A5C*: 0.4 kW motor, high inertia, 60 mm flange, 14 mm shaft diameter, rated speed 3000 rpm, 23 bit high resolution encoder, no holding brake, plastic connector, Asian style mounting interface
HD04F / BCH16HD043*2F5C*: 0.4 kW motor, high inertia, 60 mm flange, 14 mm shaft diameter, rated speed 3000 rpm, 23 bit high resolution encoder, with holding brake, free leads, Asian style mounting interface
HF07A / BCH16HF073*0A5C*: 0.75 kW motor, high inertia, 80 mm flange, 19 mm shaft diameter, rated speed 3000 rpm, 2500 ppr incremental encoder, no holding brake, plastic connector, Asian style mounting interface
HF07F / BCH16HF073*0F5C*: 0.75 kW motor, high inertia, 80 mm flange, 19 mm shaft diameter, rated speed 3000 rpm, 2500 ppr incremental encoder, with holding brake, plastic connector, Asian style mounting interface
HF07A / BCH16HF073*2A5C*: 0.75 kW motor, high inertia, 80 mm flange, 19 mm shaft diameter, rated speed 3000 rpm, 23 bit high resolution encoder, no holding brake, plastic connector, Asian style mounting interface
HF07F / BCH16HF073*2F5C*: 0.75 kW motor, high inertia, 80 mm flange, 19 mm shaft diameter, rated speed 3000 rpm, 23 bit high resolution encoder, with holding brake, plastic connector, Asian style mounting interface
LF10A / BCH16LF103*0A5C*: 1.0 kW motor, high inertia, 80 mm flange, 19 mm shaft diameter, rated speed 3000 rpm, 2500 ppr incremental encoder, no holding brake, plastic connector, Asian style mounting interface
LF10F / BCH16LF103*0F5C*: 1.0 kW motor, high inertia, 80 mm flange, 19 mm shaft diameter, rated speed 3000 rpm, 2500 ppr incremental encoder, with holding brake, plastic connector, Asian style mounting interface
LF10A / BCH16LF103*2A5C*: 1.0 kW motor, high inertia, 80 mm flange, 19 mm shaft diameter, rated speed 3000 rpm, 23 bit high resolution encoder, no holding brake, plastic connector, Asian style mounting interface
LF10F / BCH16LF103*2F5C*: 1.0 kW motor, high inertia, 80 mm flange, 19 mm shaft diameter, rated speed 3000 rpm, 23 bit high resolution encoder, with holding brake, plastic connector, Asian style mounting interface

P6-00	Motor file name (continue)	Min.	0	Unit	Related Mode		
		Default	0	-	P	-	-
		Max.	65535		DYC	-	-

LH10A / BCH16LH103*0A6C*: 1.0 kW motor, high inertia, 100 mm flange, 19 mm shaft diameter, rated speed 3000 rpm, 2500 ppr incremental encoder, no holding brake, MIL connector, Asian style mounting interface
LH10F / BCH16LH103*0F6C*: 1.0 kW motor, high inertia, 100 mm flange, 19 mm shaft diameter, rated speed 3000 rpm, 2500 ppr incremental encoder, with holding brake, MIL connector, Asian style mounting interface
LH10A / BCH16LH103*2A6C*: 1.0 kW motor, high inertia, 100 mm flange, 19 mm shaft diameter, rated speed 3000 rpm, 23 bit high resolution encoder, no holding brake, MIL connector, Asian style mounting interface
LH10F / BCH16LH103*2F6C*: 1.0 kW motor, high inertia, 100 mm flange, 19 mm shaft diameter, rated speed 3000 rpm, 23 bit high resolution encoder, with holding brake, MIL connector, Asian style mounting interface
LJ10A / BCH16LJ103*0A6C*: 1.0 kW motor, high inertia, 100 mm flange, 22 mm shaft diameter, rated speed 3000 rpm, 2500 ppr incremental encoder, no holding brake, MIL connector, Asian style mounting interface
LJ10F / BCH16LJ103*0F6C*: 1.0 kW motor, high inertia, 100 mm flange, 22 mm shaft diameter, rated speed 3000 rpm, 2500 ppr incremental encoder, with holding brake, MIL connector, Asian style mounting interface
LJ10A / BCH16LJ103*2A6C*: 1.0 kW motor, high inertia, 100 mm flange, 22 mm shaft diameter, rated speed 3000 rpm, 23 bit high resolution encoder, no holding brake, MIL connector, Asian style mounting interface
LJ10F / BCH16LJ103*2F6C*: 1.0 kW motor, high inertia, 100 mm flange, 22 mm shaft diameter, rated speed 3000 rpm, 23 bit high resolution encoder, with holding brake, MIL connector, Asian style mounting interface
HM10A / BCH16HM102*0A6C*: 1.0 kW motor, high inertia, 130 mm flange, 22 mm shaft diameter, rated speed 2000 rpm, 2500 ppr incremental encoder, no holding brake, MIL connector, Asian style mounting interface
HM10F / BCH16HM102*0F6C*: 1.0 kW motor, high inertia, 130 mm flange, 22 mm shaft diameter, rated speed 2000 rpm, 2500 ppr incremental encoder, with holding brake, MIL connector, Asian style mounting interface
HM10A / BCH16HM102*2A6C*: 1.0 kW motor, high inertia, 130 mm flange, 22 mm shaft diameter, rated speed 2000 rpm, 23 bit high resolution encoder, no holding brake, MIL connector, Asian style mounting interface
HM10F / BCH16HM102*2F6C*: 1.0 kW motor, high inertia, 130 mm flange, 22 mm shaft diameter, rated speed 2000 rpm, 23 bit high resolution encoder, with holding brake, MIL connector, Asian style mounting interface
HM08A / BCH16HM081*0A6C*: 0.85 kW motor, high inertia, 130 mm flange, 22 mm shaft diameter, rated speed 1500 rpm, 2500 ppr incremental encoder, no holding brake, MIL connector, Asian style mounting interface
HM08F / BCH16HM081*0F6C*: 0.85 kW motor, high inertia, 130 mm flange, 22 mm shaft diameter, rated speed 1500 rpm, 2500 ppr incremental encoder, with holding brake, MIL connector, Asian style mounting interface
HM08A / BCH16HM081*2A6C*: 0.85 kW motor, high inertia, 130 mm flange, 22 mm shaft diameter, rated speed 1500 rpm, 23 bit high resolution encoder, no holding brake, MIL connector, Asian style mounting interface
HM08F / BCH16HM081*2F6C*: 0.85 kW motor, high inertia, 130 mm flange, 22 mm shaft diameter, rated speed 1500 rpm, 23 bit high resolution encoder, with holding brake, MIL connector, Asian style mounting interface
HM15A / BCH16HM152*0A6C*: 1.5 kW motor, high inertia, 130 mm flange, 22 mm shaft diameter, rated speed 2000 rpm, 2500 ppr incremental encoder, no holding brake, MIL connector, Asian style mounting interface

P6-00	Motor file name (continue)	Min.	0	Unit	Related Mode		
		Default	0	-	P	-	-
		Max.	65535		DYC	-	-

HM15F / BCH16HM152*0F6C*: 1.5 kW motor, high inertia, 130 mm flange, 22 mm shaft diameter, rated speed 2000 rpm, 2500 ppr incremental encoder, with holding brake, MIL connector, Asian style mounting interface
HM15A / BCH16HM152*2A6C*: 1.5 kW motor, high inertia, 130 mm flange, 22 mm shaft diameter, rated speed 2000 rpm, 23 bit high resolution encoder, no holding brake, MIL connector, Asian style mounting interface
HM15F / BCH16HM152*2F6C*: 1.5 kW motor, high inertia, 130 mm flange, 22 mm shaft diameter, rated speed 2000 rpm, 23 bit high resolution encoder, with holding brake, MIL connector, Asian style mounting interface

Select reference of servo motor connected to servo drive by this parameter when P6-01 = 9 / 2500 ppr.
This parameter becomes read-only when P6-01 = 8 / BISS.

Setting can only be changed if power stage is disabled.
Changed settings become active the next time the product is powered on.

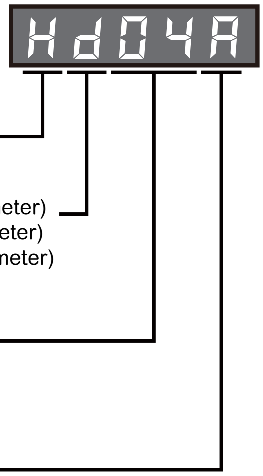
P6-01	Type of motor encoder	Min.	8	Unit	Related Mode		
		Default	9	-	P	-	-
		Max.	65535		DYC	-	-

Type of motor encoder:
8 / BISS: Communication high resolution encoder.
9 / 2500ppr: 2500 ppr incremental encoder.

Read-only parameter.

5.2.3 Code Description of Servo Motor Reference in FSU

When performing the configuration of servo motor reference in FSU, all available servo motor references supported by current servo drive will be listed out. The servo motor references is expressed by abbreviation, where the meaning of each character is shown as following:



Motor inertia: L - Low-inertia motor
H - High-inertia motor

Nominal power: B – 40 mm (8mm shaft diameter) C – 60 mm (11mm shaft diameter)
D – 60 mm (14mm shaft diameter) F – 80 mm (19mm shaft diameter)
H – 100 mm (19mm shaft diameter) J – 100 mm (22mm shaft diameter)
M – 130 mm (22mm shaft diameter)

Nominal speed: 01 - 0.1 kW 02 - 0.2 kW
04 - 0.4 kW 07 - 0.75 kW
08 - 0.85 kW 10 - 1.0 kW
15 - 1.5 kW

Motor band-type brake: A - No band-type brake
F - With band-type brake

Servo motor reference abbreviation:

Servo drive	Servo Motor	Abbreviation
LXM16DU01M2X	BCH16LB0133*A5C2	LB01A
	BCH16LB0133*F5C2	LB01F
LXM16DU02M2X	BCH16HC0233*A5C2	HC02A
	BCH16HC0233*F5C2	HC02F
	BCH16HD0233*A5C2	HD02A
	BCH16HD0233*F5C2	HD02F
LXM16DU04M2X	BCH16HD0433*A5C2	HD04A
	BCH16HD0433*A5C2	HD04F
LXM16DU07M2X	BCH16HF0733*A5C2	HF07A
	BCH16HF0733*F5C2	HF07F
LXM16DU10M2X	BCH16LF1033*A5C2	LF10A
	BCH16LF1033*F5C2	LF10F
	BCH16LH1033*A6C2	LH10A
	BCH16LH1033*F6C2	LH10F
	BCH16LJ1033*A6C2	LJ10A
	BCH16LJ1033*F6C2	LJ10F
	BCH16HM1023*A6C2	HM10A
	BCH16HM1023*F6C2	HM10F
LXM16DU15M2X	BCH16HM0813*A6C2	HM08A
	BCH16HM0813*F6C2	HM08F
	BCH16HM1523*A6C2	HM15A
	BCH16HM1523*F6C2	HM15F

5.2.4 FSU Operation

Change reference of motor connected to servo drive by configurate parameter P6-00:

Step	HMI Display	Operation	Description
0	FSu-	S	Press S key, HMI shows P6-00.
1	P6-00	S	Press S key, HMI shows current value of parameter P6-00.
2	nonE	S	Press S key to start edit, all letters on HMI start flashing.
3	nonE	UP / DOWN	Press UP or DOWN key to navigate motor references. Refer to chapter 5.2.3 for motor reference abbreviations.
4	hd04A	S >1.5S	Press and hold S key for longer than 1.5 s, current value blinks once and becomes still. Value saved.
5	hd04A	M	Press M key multi times until "boot" is shown on HMI.
6	boot	S	Press S key to warm restart servo drive.
7	WArm		HMI shows "Warm" to indicate the servo drive is performing warm restart.
8	rdY		HMI shows "rdy", motor reference configuration is successful. Servo drive is now ready for operation.

Change encoder type of servo motor connected to servo drive by configurate parameter P6-01:

Step	HMI Display	Operation	Description
0	FSu-	S	Press S key, HMI shows P6-00.
1	P6-00	▲ ▼	Press UP or DOWN key and select P6-01.
2	P6-01	S	Press S key, HMI shows current value of parameter P6-01.
3	9	S	Press S key to start edit, current value starts flashing.
4	9	▼	Press DOWN key, select value <8 - BISS>
5	8	S >1.5S	Press and hold S key for longer than 1.5 s, current value will blink once and become still. Value saved.
6	8	M	Press M key multi times until "boot" is shown on HMI.
7	boot	S	Press S key to warm restart servo drive.
8	WArM		HMI shows "Warm" to indicate the servo drive is performing warm restart.
9	rdy		HMI shows "rdy", encoder type configuration is successful. Servo drive is now ready for operation.

5.3 Operation of Menu Group oP

Press the S key in rdy state or press the M key in flt state to enter oP menu group. You may perform manual operation (JOG), easy tuning, mapping auto adaptive tuning parmaters and factory setting restore in OP menu group.

5.3.1 JOG

Users can set JOG velocity and direction then perform JOG operation in "JoG" menu group.

- Set JOG speed:

Step	HMI Display	Operation	Description
0	rdY	S	Press S key, HMI shows "oP."
1	oP	S	Press S key, HMI shows "JoG".
2	JoG	S	Press S key, HMI shows "JGSt".
3	JGSt	UP / DOWN	Press UP or DOWN key to select JOG operation or JOG parameters configuration.
4	P4-01	S	Press S key, HMI shows current value of parameter P4-01.
	P4-02		Press S key, HMI shows current value of parameter P4-02.
5	00100.	S	Press S key to start edit, the LSB digit with cursor starts flashing.
6	00100.	UP / DOWN	Press UP or DOWN key to edit the value of the digit with cursor. Press UP key once will increase value by 1, press DOWN key once will decrease value by 1.
7	00105.	S	Press S key to shift cursor from right to left. Press S key once to shift cursor by 1 digit.
8	00105.	UP / DOWN	Press UP or DOWN key to edit the value of the digit with cursor. Press UP key once increases value by 1, press DOWN key once decreases value by 1.
9	00305.	S	Press and hold S key for longer than 1.5 s, current value blinks once and becomes still. Value saved.
10	00305.	S	Press M key to exit edit.

(Continue)			
Step	HMI Display	Operation	Description
11	P4-01	M ▲ ▼ **S**	HMI shows parameter P4-01, parameter value edit finished.
	P4-02		HMI shows parameter P4-02, parameter value edit finished.

- Perform JOG operation. Servo motor will move during this operation.

Step	HMI Display	Operation	Description
0	rdy	M ▲ ▼ **S**	Press S key, HMI shows "oP".
1	oP	M ▲ ▼ **S**	Press S key, HMI shows "JoG".
2	JoG	M ▲ ▼ **S**	Press S key, HMI shows "JGSt".
3	JGSt	M **▲** **▼** S	Press S key to enable JOG operation. The servo drive power stage turns on and servo drive switches to run state.
4	JG-	M **▲** **▼** S	Press UP or DOWN key to select JOG speed and direciton.
	JG=		
	-JG		
	=JG		
5	JG-	M ▲ ▼ **S**	Press and hold S key ot JOG servo motor in positive direcion with velocity set in parameter P4-01. Servo motor will stop when S key is released.
	JG=		Press and hold S key ot JOG servo motor in positive direcion with velocity set in parameter P4-02. Servo motor will stop when S key is released.
	-JG		Press and hold S key ot JOG servo motor in negative direcion with velocity set in parameter P4-01. Servo motor will stop when S key is released.
	=JG		Press and hold S key ot JOG servo motor in negative direcion with velocity set in parameter P4-02. Servo motor will stop when S key is released.

(Continue)			
Step	HMI Display	Operation	Description
6	   		Press M key to exit JOG operation.
7			HMI shows "JoG". The servo drive power stage turns off.

- Related parameters

P4-01	Velocity for slow JOG movement	Min.	1	Unit	Related Mode		
		Default	100	usr_v	P	-	-
		Max.	2147483647		DYC	-	-

Velocity for slow JOG movement
The adjustable value is internally limited to the parameter setting in P4-03.

Changed settings become active immediately.

P4-02	Velocity for fast JOG movement	Min.	1	Unit	Related Mode		
		Default	200	usr_v	P	-	-
		Max.	2147483647		DYC	-	-

Velocity for fast JOG movement
The adjustable value is internally limited to the parameter setting in P4-03.

Changed settings become active immediately.

5.3.2 Easy Tuning

User can perform easy tuning to optimize servo motor control loop in "tun" menu group.

Step	HMI Display	Operation	Description
0	rdy	S	Press S key, HMI shows "oP".
1	oP	S	Press S key, HMI shows "JoG".
2	JoG	△ ▽	Press UP or DOWN key to select tun.
3	tun	S	Press S key, HMI shows "tuSt".
4	tuSt	S	Press S key to start easy tuning. Servo drive power stage turns on and servo drive switches to run state. Servo drive controls servo motor to run back and forth serveral rounds and tunes the control loop parameters automatically. No additional parameters need to be adjusted.
5	t 45		During process of easy tuning, HMI shows progress in formation of percentage. HMI will show "donE" to indicate that the easy tuning has finished successfully.
6	donE	S	Press S key to save the tuning result. Servo drive power stage turns off and servo drive switches to rdy state.
7	tun		HMI shows "tun", easy tuning has finished.

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5.3.3 Operation of Auto Adaptive Control Parameters

In "Atu" menu group, user can perform following operations to auto adaptive control parameters:
- Map auto adaptive control parameters to PID control parameters in <P1 - Motor Control> parameter group.
- Reset auto adaptive control parameters to default.

- Map auto adaptive control parameters to PID control parameters

Step	HMI Display	Operation	Description
0	rdY	M △ ▽ **S**	Press S key, HMI shows "oP".
1	oP	M △ ▽ **S**	Press S key, HMI shows "JoG".
2	JoG	M **△** **▽** S	Press UP or DOWN key to select "Atu".
3	Atu	M △ ▽ **S**	Press S key, HMI shows "cPYA".
4	cPYA	M △ ▽ **S**	Press S key, all letters on HMI blink once to indicate auto adaptive control parameters have been mapped to PID control parameters in <P1 - Motor Contrl> paramnter group.

- Reset auto adaptive control paramters to default

Step	HMI Display	Operation	Description
0	rdY	M △ ▽ **S**	Press S key, HMI shows "oP".
1	oP	M △ ▽ **S**	Press S key, HMI shows "JoG".
2	JoG	M **△** **▽** S	Press UP or DOWN key to select "Atu".
3	Atu	M △ ▽ **S**	Press S key, HMI shows "cPYA".
4	cPYA	M **△** **▽** S	Press UP or DOWN key to select "rStA".
5	rStA	M △ ▽ **S**	Press S key, all letters on HMI blink once to indicate adaptive control parameters have been reset to default.

5.3.4 Restore Factory Setting

User can restore servo drive to factory setting in "Frt" menu group.

Step	HMI Display	Operation	Description
0	rdy	S	Press S key, HMI shows "oP".
1	oP	S	Press S key, HMI shows "JoG".
2	JoG	UP / DOWN	Press UP or DOWN key to select "Frt".
3	Frt	S	Press S key, HMI shows "rStF".
4	rStF	S	Press S key, HMI shows "no".
5	no	S	Press S key, all letters on HMI start flashing.
6	no (flashing)	UP	Press UP key, HMI shows "YES" in flashing.
7	YES (flashing)	S >1.5S	Press and hold S key for longer than 1.5 s, all letters on HMI will blink once. HMI will then show "Fsu" to indicate the servo drive has been restore to factory setting.
8	FSu-		

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5.4 Operation of Menu Group Mon

After the servo drive power stage turned on, status information is displayed via the HMI. Users may select the type of device status information to be displayed in Menu Group Mon. Moreover, users may also select the default type of device status information to be displayed after the servo drive power stage turned on.

5.4.1 Available Device Status Information

HMI Display	Name	Description
SuPV	SuPV	Default status information to be displayed after the servo drive power stage turned on.
StAt	StAt	Servo drive current operation states (found in SuPV only)
PrEP	PrEP	Reference position in the unit of external pulse train increments
PAcP	PAcP	Actual position in the unit of external pulse train increments
PrEF	PrEF	Reference position in the unit of usr_p
PAct	PAct	Actual position in the unit of usr_p
Pdif	Pdif	Position deviation in the unit of usr_p
nrEF	nrEF	Reference speed of rotation
nAct	nAct	Actual speed of rotation
qrEF	qrEF	Reference motor current (q component, generating torque)
qAct	qAct	Actual motor current (q component, generating torque)
iAct	iAct	Total motor current
diMo	diMo	Status of digital inputs
doMo	doMo	Status of digital outputs

(Continue)		
HMI Display	Name	Description
udcA	udcA	Voltage at DC bus
udcr	udcr	Degree of utilization of DC bus voltage
PoWM	PoWM	Mean output power
LdFP	LdFP	Load of power stage
LdFM	LdFM	Load of servo motor
LdFb	LdFb	Load of braking resistor
oVLP	oVLP	Overload of power stage (%)
tPS	tPS	Temperature of power stage
tdEV	tdEV	Temperature of device
LWrn	LWrn	Detected error not causing a stop (error class 0)
LFLt	LFLt	Detected error causing a stop (error classes 1 to 4)
Wrns	Wrns	Detected error of error class 0, bit-coded (error class 0)
oPh	oPh	Operating hours counter
PoWo	PoWo	Number of power on cycles
SiGS	SiGS	Saved status of monitoring signals
Md0	Md0	MD0 value in DYC operation mode
Md1	Md1	MD1 value in DYC operation mode
Md2	Md2	MD2 value in DYC operation mode

(Continue)		
HMI Display	Name	Description
Md3	Md3	MD3 value in DYC operation mode
Md4	Md4	MD4 value in DYC operation mode
Md5	Md5	MD5 value in DYC operation mode
Md6	Md6	MD6 value in DYC operation mode
Md7	Md7	MD7 value in DYC operation mode

5.4.2 Select Type of Device Status Information

Users may select the type of device status information to be displayed in menu group "Mon"

Step	HMI Display	Operation	Description
0	rdY	M ▲ ▼ **S**	Press S key, HMI shows "oP".
1	oP	M **▲** **▼** S	Press S key, HMI shows "Mon".
2	Mon	M ▲ ▼ **S**	Press S key, HMI shows "SuPV".
3	SuPV	M **▲** **▼** S	Press UP or DOWN key to select type of device status information. Refer to "5.4.1 Available Device Information" for detailed information.
4	nAct	M ▲ ▼ **S**	Press S key, HMI shows value of selected type of device information.
5	00100		

5.4.3 Set Default Type of Device Status Information

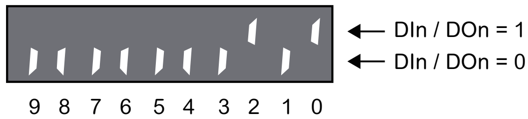
Users may select the default type of device status information to be displayed in menu group "Mon"

Step	HMI Display	Operation	Description
0	rdy	S	Press S key, HMI shows "oP".
1	oP	▲ ▼	Press S key, HMI shows "Mon".
2	Mon	S	Press S key, HMI shows "SuPV".
3	SuPV	S	Press S key, HMI shows "StAt".
4	StAt	S	Press S key to start edit, all letters on HMI start flashing.
5	StAt	▲ ▼	Press UP or DOWN key to select the default type of device status information. Refer to "5.4.1 Available Device Information" for detailed information.
6	nAct	S >1.5S	Press and hold S key for longer than 1.5 s, all letters on HMI flash once and become still. Value saved.
7	nAct	M	Press M key multi times until selected device status information is shown on HMI.
8	00100		The device status information selected in step 6 will be displayed after servo drive is enabled.

5.4.4 Monitoring of Digital Inputs and Outputs Status Information

The device has configurable inputs and outputs.

The signal states of the digital inputs and outputs can be monitored on the integrated HMI, however, they cannot be modified.



Inputs:

- Open the menu item Mon -> diMo.
  The digital inputs are displayed in a bit-coded way.

Bit	Signal
0	DI0
1	DI1
2	DI2
3	DI3
4	DI4
5	DI5

Outputs:

- Open the menu item Mon -> doMo.
  The digital outputs are displayed in a bit-coded way.

Bit	Signal
0	DO0
1	DO1
2	DO2

5.5 Operation of Menu Group Conf

5.5.1 Parameters of Numerical Types

If the parameter is one of the numerical type parameters, its value can be edited in each digit, respectively.

Example of editing parameter P1-00:

Step	HMI Display	Operation	Description
0	rdY	S	Press S key, HMI shows "oP".
1	oP	UP / DOWN	Press UP or DOWN key to select "Conf".
2	ConF	S	Press S key, HMI shows P0.
3	P0	UP / DOWN	Press Up or Down key to select P1.
4	P1	S	Press S key, HMI shows parameter P1-00.
5	P1-00	S	Press S key, HMI shows current value of parameter P1-00.
6	00212	S	Press S key to start edit, the LSB digit with cursor starts flashing.
7	00212	S	Press S key to shift cursor from right to left. Press S key once to shift cursor by 1 digit.
8	00212	UP / DOWN	Press UP or DOWN key to edit the value of the digit with cursor. Press UP key once increases value by 1, press DOWN key once decreases value by 1.
9	00312	S >1.5S	Press and hold S key for longer than 1.5 s, current value blinks once and becomes still. Value saved.
10	00312	M	Press M key to exit edit.
11	P1-00		HMI shows parameter P1-00, parameter value edit finished.

5.5.2 Parameters of Selection Type

If the parameter is one of the selection type parameters, its value consists of limited selections in the form of a list.

Example of editing parameter P0-10:

Step	HMI Display	Operation	Description
0	rdy	S	Press S key, HMI shows "oP".
1	oP	UP / DOWN	Press UP or DOWN key to select "Conf".
2	ConF	S	Press S key, HMI shows P0.
3	P0	S	Press S key, HMI shows parameter P0-00.
4	P0-00	UP / DOWN	Press UP or DOWN key to select parameter P0-10.
5	P0-01	S	Press S key, HMI shows current value of parameter P0-10.
6	10000	S	Press S key to start edit, all letters on HMI start flashing.
7	10000	UP / DOWN	Press UP or DOWN key to select value out of current parameter's value list.
8	5000	S >1.5S	Press and hold S key for longer than 1.5 s, current value blinks once and becomes still. Value saved.
9	5000	M	Press M key to exit edit.
10	P0-10		HMI shows parameter P0-10, parameter value edit finished.

5.5.3 Parameter P6-00 Motor File Name / P6-01 Type of Motor Encoder

When parameter P6-01 is configured as <9 - 2500 ppr incremental encoder>, users need to configure the servo motor reference connected to the servo drive manually in parameter P6-00. When parameter P6-01 is configured as <8 - Communication high resolution encoder>, the servo drive will try to communicate with the servo motor and upload servo motor information from electric nameplate saved in high resolution encoder. Meanwhile, parameter P6-00 will be read-only and display the motor reference connected to the servo drive currently.

- Example of editing parameter P6-00:

Step	HMI Display	Operation	Description
0	rdY	S	Press S key, HMI shows "oP".
1	oP	▲ / ▼	Press UP or DOWN key to select "Conf".
2	ConF	S	Press S key, HMI shows P0.
3	P0	▲ / ▼	Press UP or DOWN key to select P6.
4	P6	S	Press S key, HMI shows parameter P6-00.
5	P6-00	S	Press S key, HMI shows current value of parameter P6-00.
6	hd04A	S	Press S key to start edit, all letters on HMI start flashing.
7	hd04A (flashing)	▲ / ▼	Press UP or DOWN key to navigate motor references. Refer to chapter 5.2.3 for motor reference abbreviations.
8	hd04F (flashing)	S >1.5S	Press and hold S key for longer than 1.5 s, current value blinks once and becomes still. HMI will then show "Mot" to indicate the motor reference has been changed.
9	Mot	S	Press S key, HMI shows "boot".
10	boot	S	Press S key to warm restart servo drive.
11	WArM		HMI shows "Warm" to indicate the servo drive is performing warm restart.
12	rdY		HMI shows "rdy", motor reference configuration is successful. Servo drive is now ready for operation.

Set the servo motor reference with care. Improper setting of servo motor reference that is inconsistent with the physical motor will result in system performance degradation or equipment damage.

- Example of editing parameter P6-01:

Step	HMI Display	Operation	Description
0	rdy		Press S key, HMI shows "oP".
1	oP		Press UP or DOWN key to select "Conf".
2	ConF		Press S key, HMI shows P0.
3	P0		Press UP or DOWN key to select P6.
4	P6		Press S key, HMI shows parameter P6-00.
5	P6-00		Press UP or DOWN key to select parameter P6-01.
6	P6-01		Press S key, HMI shows current value of parameter P6-01.
7	9		Press S key to start edit, current value starts flashing.
8	9		Press DOWN key, select value <8 - BISS>
9	8	 >1.5S	Press and hold S key for longer than 1.5 s, current value will blink once and become still. HMI will then show "Mot" to indicate the motor reference has been changed.
10	Mot		Press S key, HMI shows "boot".
11	boot		Press S key to warm restart servo drive.
12	Warm		HMI shows "Warm" to indicate the servo drive is performing warm restart.
13	rdy		HMI shows "rdy", motor reference configuration is successful. Servo drive is now ready for operation.

P6-00	Motor type	Min.	0	Unit	Related Mode		
		Default	0	-	P	-	-
		Max.	65535		DYC	-	-

Motor file name
Noest / Not Exist: Motor type doesn't exist
None / No Motor Selected: No motor selected
LB01A / BCH16LB013*0A5C*: 0.1 kW motor, low inertia, 40 mm flange, 8 mm shaft diameter, rated speed 3000 rpm, 2500 ppr incremental encoder, no holding brake, plastic connector, Asian style mounting interface
LB01F / BCH16LB013*0F5C*: 0.1 kW motor, low inertia, 40 mm flange, 8 mm shaft diameter, rated speed 3000 rpm, 2500 ppr incremental encoder, with holding brake, plastic connector, Asian style mounting interface
LB01A / BCH16LB013*2A5C*: 0.1 kW motor, low inertia, 40 mm flange, 8 mm shaft diameter, rated speed 3000 rpm, 23 bit high resolution encoder, no holding brake, plastic connector, Asian style mounting interface
LB01F / BCH16LB013*2F5C*: 0.1 kW motor, low inertia, 40 mm flange, 8 mm shaft diameter, rated speed 3000 rpm, 23 bit high resolution encoder, with holding brake, plastic connector, Asian style mounting interface
HC02A / BCH16HC023*0A5C*: 0.2 kW motor, high inertia, 60 mm flange, 11 mm shaft diameter, rated speed 3000 rpm, 2500 ppr incremental encoder, no holding brake, plastic connector, Asian style mounting interface
HC02F / BCH16HC023*0F5C*: 0.2 kW motor, high inertia, 60 mm flange, 11 mm shaft diameter, rated speed 3000 rpm, 2500 ppr incremental encoder, with holding brake, plastic connector, Asian style mounting interface
HC02A / BCH16HC023*2A5C*: 0.2 kW motor, high inertia, 60 mm flange, 11 mm shaft diameter, rated speed 3000 rpm, 23 bit high resolution encoder, no holding brake, plastic connector, Asian style mounting interface
HC02F / BCH16HC023*2F5C*: 0.2 kW motor, high inertia, 60 mm flange, 11 mm shaft diameter, rated speed 3000 rpm, 23 bit high resolution encoder, with holding brake, plastic connector, Asian style mounting interface
HD02A / BCH16HD023*0A5C*: 0.2 kW motor, high inertia, 60 mm flange, 14 mm shaft diameter, rated speed 3000 rpm, 2500 ppr incremental encoder, no holding brake, plastic connector, Asian style mounting interface
HD02F / BCH16HD023*0F5C*: 0.2 kW motor, high inertia, 60 mm flange, 14 mm shaft diameter, rated speed 3000 rpm, 2500 ppr incremental encoder, with holding brake, plastic connector, Asian style mounting interface
HD02A / BCH16HD023*2A5C*: 0.2 kW motor, high inertia, 60 mm flange, 14 mm shaft diameter, rated speed 3000 rpm, 23 bit high resolution encoder, no holding brake, plastic connector, Asian style mounting interface
HD02F / BCH16HD023*2F5C*: 0.2 kW motor, high inertia, 60 mm flange, 14 mm shaft diameter, rated speed 3000 rpm, 23 bit high resolution encoder, with holding brake, plastic connector, Asian style mounting interface
HD04A / BCH16HD043*0A5C*: 0.4 kW motor, high inertia, 60 mm flange, 14 mm shaft diameter, rated speed 3000 rpm, 2500 ppr incremental encoder, no holding brake, plastic connector, Asian style mounting interface
HD04F / BCH16HD043*0F5C*: 0.4 kW motor, high inertia, 60 mm flange, 14 mm shaft diameter, rated speed 3000 rpm, 2500 ppr incremental encoder, with holding brake, plastic connector, Asian style mounting interface
HD04A / BCH16HD043*2A5C*: 0.4 kW motor, high inertia, 60 mm flange, 14 mm shaft diameter, rated speed 3000 rpm, 23 bit high resolution encoder, no holding brake, plastic connector, Asian style mounting interface
HD04F / BCH16HD043*2F5C*: 0.4 kW motor, high inertia, 60 mm flange, 14 mm shaft diameter, rated speed 3000 rpm, 23 bit high resolution encoder, with holding brake, free leads, Asian style mounting interface
HF07A / BCH16HF073*0A5C*: 0.75 kW motor, high inertia, 80 mm flange, 19 mm shaft diameter, rated speed 3000 rpm, 2500 ppr incremental encoder, no holding brake, plastic connector, Asian style mounting interface

P6-00	Motor file name (continue)	Min.	0	Unit	Related Mode		
		Default	0	-	P	-	-
		Max.	65535		DYC	-	-

HF07F / BCH16HF073*0F5C*: 0.75 kW motor, high inertia, 80 mm flange, 19 mm shaft diameter, rated speed 3000 rpm, 2500 ppr incremental encoder, with holding brake, plastic connector, Asian style mounting interface
HF07A / BCH16HF073*2A5C*: 0.75 kW motor, high inertia, 80 mm flange, 19 mm shaft diameter, rated speed 3000 rpm, 23 bit high resolution encoder, no holding brake, plastic connector, Asian style mounting interface
HF07F / BCH16HF073*2F5C*: 0.75 kW motor, high inertia, 80 mm flange, 19 mm shaft diameter, rated speed 3000 rpm, 23 bit high resolution encoder, with holding brake, plastic connector, Asian style mounting interface
LF10A / BCH16LF103*0A5C*: 1.0 kW motor, high inertia, 80 mm flange, 19 mm shaft diameter, rated speed 3000 rpm, 2500 ppr incremental encoder, no holding brake, plastic connector, Asian style mounting interface
LF10F / BCH16LF103*0F5C*: 1.0 kW motor, high inertia, 80 mm flange, 19 mm shaft diameter, rated speed 3000 rpm, 2500 ppr incremental encoder, with holding brake, plastic connector, Asian style mounting interface
LF10A / BCH16LF103*2A5C*: 1.0 kW motor, high inertia, 80 mm flange, 19 mm shaft diameter, rated speed 3000 rpm, 23 bit high resolution encoder, no holding brake, plastic connector, Asian style mounting interface
LF10F / BCH16LF103*2F5C*: 1.0 kW motor, high inertia, 80 mm flange, 19 mm shaft diameter, rated speed 3000 rpm, 23 bit high resolution encoder, with holding brake, plastic connector, Asian style mounting interface
LH10A / BCH16LH103*0A6C*: 1.0 kW motor, high inertia, 100 mm flange, 19 mm shaft diameter, rated speed 3000 rpm, 2500 ppr incremental encoder, no holding brake, MIL connector, Asian style mounting interface
LH10F / BCH16LH103*0F6C*: 1.0 kW motor, high inertia, 100 mm flange, 19 mm shaft diameter, rated speed 3000 rpm, 2500 ppr incremental encoder, with holding brake, MIL connector, Asian style mounting interface
LH10A / BCH16LH103*2A6C*: 1.0 kW motor, high inertia, 100 mm flange, 19 mm shaft diameter, rated speed 3000 rpm, 23 bit high resolution encoder, no holding brake, MIL connector, Asian style mounting interface
LH10F / BCH16LH103*2F6C*: 1.0 kW motor, high inertia, 100 mm flange, 19 mm shaft diameter, rated speed 3000 rpm, 23 bit high resolution encoder, with holding brake, MIL connector, Asian style mounting interface
LJ10A / BCH16LJ103*0A6C*: 1.0 kW motor, high inertia, 100 mm flange, 22 mm shaft diameter, rated speed 3000 rpm, 2500 ppr incremental encoder, no holding brake, MIL connector, Asian style mounting interface
LJ10F / BCH16LJ103*0F6C*: 1.0 kW motor, high inertia, 100 mm flange, 22 mm shaft diameter, rated speed 3000 rpm, 2500 ppr incremental encoder, with holding brake, MIL connector, Asian style mounting interface
LJ10A / BCH16LJ103*2A6C*: 1.0 kW motor, high inertia, 100 mm flange, 22 mm shaft diameter, rated speed 3000 rpm, 23 bit high resolution encoder, no holding brake, MIL connector, Asian style mounting interface
LJ10F / BCH16LJ103*2F6C*: 1.0 kW motor, high inertia, 100 mm flange, 22 mm shaft diameter, rated speed 3000 rpm, 23 bit high resolution encoder, with holding brake, MIL connector, Asian style mounting interface
HM10A / BCH16HM102*0A6C*: 1.0 kW motor, high inertia, 130 mm flange, 22 mm shaft diameter, rated speed 2000 rpm, 2500 ppr incremental encoder, no holding brake, MIL connector, Asian style mounting interface
HM10F / BCH16HM102*0F6C*: 1.0 kW motor, high inertia, 130 mm flange, 22 mm shaft diameter, rated speed 2000 rpm, 2500 ppr incremental encoder, with holding brake, MIL connector, Asian style mounting interface

P6-00	Motor file name (continue)	Min.	0	Unit	Related Mode		
		Default	0	-	P	-	-
		Max.	65535		DYC	-	-

HM10A / BCH16HM102*2A6C*: 1.0 kW motor, high inertia, 130 mm flange, 22 mm shaft diameter, rated speed 2000 rpm, 23 bit high resolution encoder, no holding brake, MIL connector, Asian style mounting interface
HM10F / BCH16HM102*2F6C*: 1.0 kW motor, high inertia, 130 mm flange, 22 mm shaft diameter, rated speed 2000 rpm, 23 bit high resolution encoder, with holding brake, MIL connector, Asian style mounting interface
HM08A / BCH16HM081*0A6C*: 0.85 kW motor, high inertia, 130 mm flange, 22 mm shaft diameter, rated speed 1500 rpm, 2500 ppr incremental encoder, no holding brake, MIL connector, Asian style mounting interface
HM08F / BCH16HM081*0F6C*: 0.85 kW motor, high inertia, 130 mm flange, 22 mm shaft diameter, rated speed 1500 rpm, 2500 ppr incremental encoder, with holding brake, MIL connector, Asian style mounting interface
HM08A / BCH16HM081*2A6C*: 0.85 kW motor, high inertia, 130 mm flange, 22 mm shaft diameter, rated speed 1500 rpm, 23 bit high resolution encoder, no holding brake, MIL connector, Asian style mounting interface
HM08F / BCH16HM081*2F6C*: 0.85 kW motor, high inertia, 130 mm flange, 22 mm shaft diameter, rated speed 1500 rpm, 23 bit high resolution encoder, with holding brake, MIL connector, Asian style mounting interface
HM15A / BCH16HM152*0A6C*: 1.5 kW motor, high inertia, 130 mm flange, 22 mm shaft diameter, rated speed 2000 rpm, 2500 ppr incremental encoder, no holding brake, MIL connector, Asian style mounting interface
HM15F / BCH16HM152*0F6C*: 1.5 kW motor, high inertia, 130 mm flange, 22 mm shaft diameter, rated speed 2000 rpm, 2500 ppr incremental encoder, with holding brake, MIL connector, Asian style mounting interface
HM15A / BCH16HM152*2A6C*: 1.5 kW motor, high inertia, 130 mm flange, 22 mm shaft diameter, rated speed 2000 rpm, 23 bit high resolution encoder, no holding brake, MIL connector, Asian style mounting interface
HM15F / BCH16HM152*2F6C*: 1.5 kW motor, high inertia, 130 mm flange, 22 mm shaft diameter, rated speed 2000 rpm, 23 bit high resolution encoder, with holding brake, MIL connector, Asian style mounting interface

Select reference of servo motor connected to servo drive by this parameter when P6-01 = 9 / 2500 ppr.
This parameter becomes read-only when P6-01 = 8 / BISS.

Setting can only be changed if power stage is disabled.
Changed settings become active the next time the product is powered on.

P6-01	Type of motor encoder	Min.	8	Unit	Related Mode		
		Default	9	-	P	-	-
		Max.	65535		DYC	-	-

Type of motor encoder:
8 / BISS: Communication high resolution encoder.
9 / 2500ppr: 2500 ppr incremental encoder.

Read-only parameter.

5.6 Warm Restart by Front Panel

User can performe warm restart by HMI when the servo drive power stage has been turned off.

Step	HMI Display	Operation	Description
0		 >2.5S	When the servo drive power stage has been turned off, press and hold both M and S key for longer than 2.5 s, HMI will show "Warm" to indicate the servo drive is ready to perform warm retart.
1			Release both M and S key, servo drive starts warm restart.
2			HMI shows "rdy". Servo drive is now ready for operation.

Chap06. Operation

6.1 Access Channel

6.1.1 Overview of Access Channel

Easy Lexium 16 servo drive incorporates the concept of access channel. LXM16D series servo drive can be accessed via different types of access channels.

Access channels are:
- Integrated HMI
- Digital inputs
- Commissioning software

Please note simultaneous access via multiple access channels or the use of exclusive access 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 use of exclusive access 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.

6.1.2 Exclusive Access Channel

Easy Lexium 16 servo drive can be accessed via exclusive access channel, only one access channel can have exclusive access to the product.

An exclusive access can be provided via different access channels:
- Via integrated HMI:
  The operating mode Jog or Autotuning can be started via the HMI
- Via commissioning software:
  The commissioning software receives exclusive access viathe switch "Exclusive access" in position "On".

When this product is powered on, no exclusive access channel exists, in which case the instruction obtained through pulse input signal will take effect. When the product is powered on, there is no exclusive access via an access channel.

The digital input functions Halt / Fault Reset / Enable / Positive Limit Switch (LIMP) / Negative Limit Switch (LIMN) / Reference Switch (REF) are always effective during exclusive access.

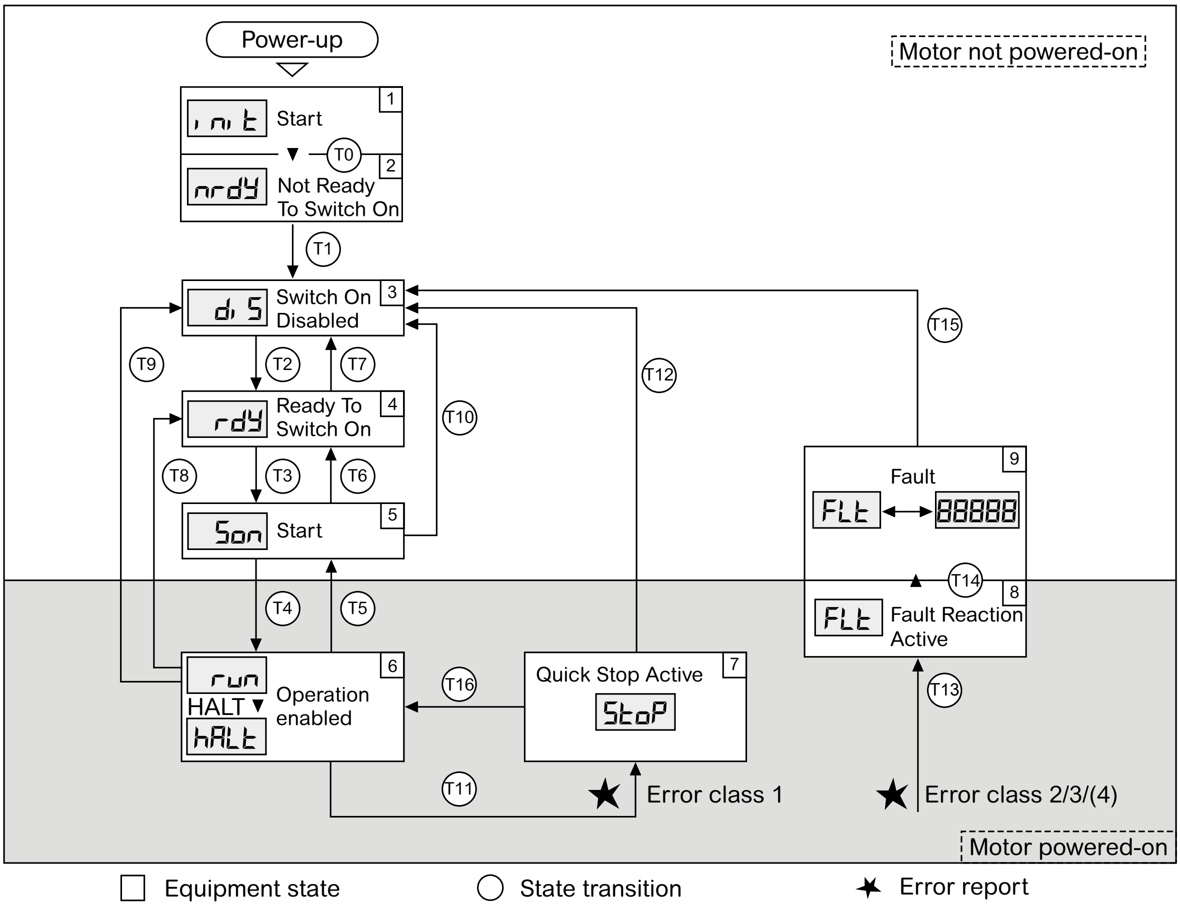
6.2 Operating States

When the Easy Lexium 16 servo drive is powered on and when an operating mode is started, the product goes through a number of operating states.

6.2.1 State Diagram

The state diagram (state machine) shows the relationships between the operating states and the state transitions.

The operating states are internally monitored and influenced by monitoring functions.



6.2.2 Operating States

HMI Display	Operation State	Description
init	1 Initialize	Electronics are initialized
nrdy	2 Not ready to start	The power stage is not ready to switch on
dis	3 Cannot start	Impossible to enable the power stage
rdy	4 Ready to start	The power stage is ready to switch on.
son	5 Start	Power stage is switched on
run	6 Equipment enable	Power stage is enabled / Selected operating mode is active
stop	7 Quick stop started	"Quick Stop" is being executed
flt	8 Fault response started	Error response is active
flt	9 Fault	Error response terminated / Power stage is disabled

6.2.3 State Transitions

State transitions are triggered by integrated HMI, an input signal or a response to a monitoring function.

State transition	Operating state	Condition / Event(1)	Response
T0	1 -> 2	Device electronics successfully initialized	
T1	2 -> 3	Parameter successfully initialized	
T2	3 -> 4	• No undervoltage • Encoder successfully checked • Motor at standstill	
T3	4 -> 5	Request for enabling the power stage	
T4	5 -> 6	Automatic transition	• Power stage is enabled. • User parameters are checked. • Holding brake is released (if available).
T5	6 -> 5	N/A	
T6	5 -> 4	N/A	
T7	4 -> 3	• Undervoltage • Actual velocity: >1000 rpm (for example by external driving force)	
T8	6 -> 4	N/A	
T9	6 -> 3	Request for disabling the power stage	• Movement is canceled with "Halt" or power stage is immediately disabled. • Holding brake is applied (if available)
T10	5 -> 3	Request for disabling the power stage	Power stage is disabled immediately
T11	6 -> 7	• Error of error class 1 • Commissioning software: Disable	Movement is canceled with "Quick Stop".

(Continue)			
State transition	Operating state	Condition / Event[1]	Response
T12	7 -> 3	Request for disabling the power stage	Power stage is disabled immediately even if "Quick Stop" is still active.
T13	x -> 8	Error of error classes 2, 3 or 4	Error response is carried out
T14	8 -> 9	• Error response terminated (error class 2) • Error of error classes 3 or 4	
T15	9 -> 3	Function: "Fault Reset"	Error is reset (cause of error must have been corrected).
T16	7 -> 6	Function: "Fault Reset"	In the event of a "Quick Stop" triggered by a detected error of class 1, a "Fault Reset" causes a direct transition to the operating state 6 Operation Enabled.
(1) In order to trigger a state transition it is sufficient if one condition is met			

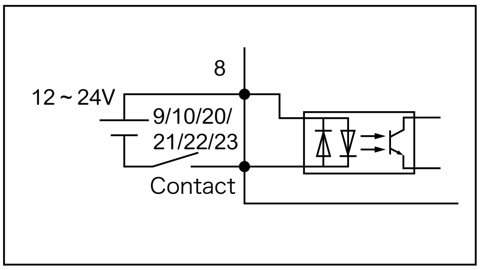
6.3 Digital Inputs and Outputs

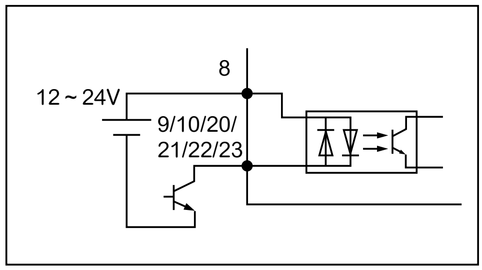
Various digital input and output functions can be assigned to the digital inputs and output of Easy Lexium 16 servo drive.

6.3.1 Connecting the Digital Inputs and Outputs

When connecting digital inputs:
- Connect to contacts of switches and relays, or open collector output transistors.
- All digital inputs equip a bi-directional photocouplers, please select proper power supply polarity connected to the digital input common terminal pin with respect to the actual loads.
- In order to secure sufficient primary current for photocouplers and to protect the primary side of the photocouplers, please make sure the upper and lower limits of voltage connected to digital inputs as between 12V-15% and 24V+15%.

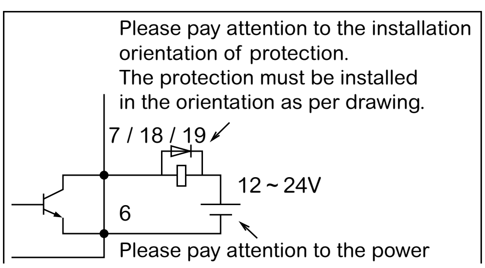
Typical examples of wiring for digital input:

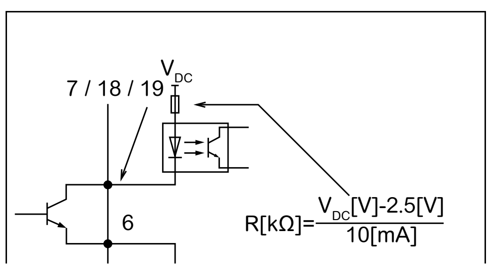




When connecting digital outputs:
- The output circuit is composed of open collector transistor outputs and connect to relays or photocouplers.
- When connecting an inductive load to the digital output, please use appropriate external protection circuit or device (e.g. fly-wheel diode) to prevent possible damage to the device.
- When connecting a photocoupler load, please use proper current limiting resistance with respect to the power supply connected. The recommended primary current value of photocoupler is 10mA, decide the resistor value using the formula of the below figure.
- All digital outputs are designed with independent collectors and common emitters, choose power supply polarity with care when connecting loads. The digital output common terminal pin shall be connected to the negative pole of power supply, connection in the opposite polarity will damage the device.
- Please pay attention to the maximum current carrying capacity of transistor at each digital output, and make sure the load current at each digital output does not exceed 100mA (at 50°C).

Typical examples of wiring for digital output:

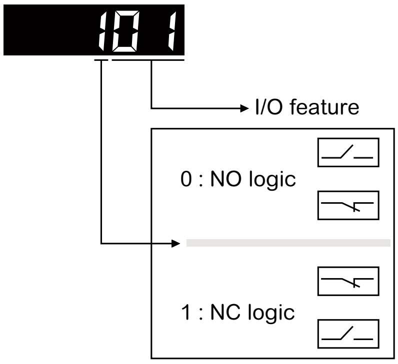




6.3.2 Parameterization of the Digital Inputs and Outputs

The digital input functions for the inputs DI0 ... DI5 are configured via the parameters P3-00 ... P3-05.
The digital output functions for the outputs DQ0 ... DQ2 are configured via the parameters P3-06 ... P3-08.
A digital input function can only be assigned to one of the digital inputs.

The parameterization of digital input/output functions is shown in the figure below:



⚠ WARNING

UNINTENDED EQUIPMENT OPERATION

- Only start the system if there are no persons or obstructions in the zone of operation.
- Verify that the wiring is appropriate for the settings.
- Carefully run tests for all operating states and potential error situations when commissioning, upgrading or otherwise modifying the operation of the drive.

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

6.3.3 Digital Input Functions

Overview of available digital input functions:

Digital Input Functions	CN1 pin	Parameter
IOfunct_DI0	9	P3-00
IOfunct_DI1	10	P3-01
IOfunct_DI2	20	P3-02
IOfunct_DI3	21	P3-03
IOfunct_DI4	22	P3-04
IOfunct_DI5	23	P3-05
DI_COM	8	-

Function	Description	Code		Related Mode	
		NO	NC	P	DYC
Freely Available	No function assigned, available as required	1	-	√	√
Fault Reset	Reset after error	2	102	√	√
Enable	Enables the power stage	3	103	√	√
Halt	Halt	4	104	√	√
Current Limitation	Limits the current to parameter value	6	106	√	√
Zero Clamp	Zero clamping	7	107	√	√
Velocity Limitation	Limits the velocity to parameter value	8	108	√	√
Jog Positive	Jog: Moves in positive direction	9	109	√	
Jog Negative	Jog: Moves in negative direction	10	110	√	
Jog Fast/Slow	Jog: Switches between slow and fast movement	11	111	√	
Gear Ratio Switch	Electronic Gear: Switches between two gear ratios	12	112	√	
Gear Offset 1	Electronic Gear: Adds first gear offset	19	119	√	
Gear Offset 2	Electronic Gear: Adds second gear offset	20	120	√	
Reference Switch (REF)	Reference switch	21	121	√	√
Positive Limit Switch(LIMP)	Positive limit switch	22	122	√	√
Negative Limit Switch(LIMN)	Negative limit switch	23	123	√	√
Switch Controller Parameter Set	Switches control loop parameter set	24	124	√	√
Velocity Controller Integral Off	Switches off velocity controller integral term	28	128	√	√
ORGP	Start homing movement	42	142	√	√

6.3.4 Digital Output Functions

Overview of available digital output functions:

Digital output functions	CN1 pin	Parameter
IOfunct_DQ0	7	P3-06
IOfunct_DQ1	18	P3-07
IOfunct_DQ2	19	P3-08
DO_COM	6	-

Function	Description	Code		Related Mode	
		NO	NC	P	DYC
Freely Available	No function assigned, available as required	1	-	√	√
No Fault	No fault found on device	2	102	√	√
Active	Device power stage is enabled	3	103	√	√
In Position Deviation Window	Position deviation is within window	5	105	√	√
In Velocity Deviation Window	Velocity deviation is within window	6	106	√	√
Velocity Below Threshold	Motor velocity below threshold	7	107	√	√
Torque Below Threshold	Motor torque below threshold	8	108	√	√
Halt Acknowledge	Halt acknowledgement	9	109	√	√
Motor Standstill	Motor at a standstill	13	113	√	√
Selected Error	One of the specified errors of error classes 1 … 4 is active	14	114	√	√
Valid Reference (ref_ ok)	Zero point is valid (ref_ok)	15	115	√	√
Selected Warning	One of the specified errors of error class 0 is active	16	116	√	√
Motor Moves Positive	Motor moves in positive direction	22	122	√	√
Motor Moves Negative	Motor moves in negative direction	23	123	√	√
Release Brake	Motor holding brake control	24	124	√	√
Torque Over Threshold	Motor torque over threshold	25	125	√	√

6.3.5 Digital Inputs and Outputs Default Functions

The Easy Lexium 16 servo drive is delivered with default digital input and output functionss. Users can also parameterize digital input and output functions as per their own requirements.

Overview of digital inputs function default settings:

Digital Input Functions	Parameter	Code	Function
IOfunct_DI0	P3-00	3	Enable
IOfunct_DI1	P3-01	2	Fault Reset
IOfunct_DI2	P3-02	122	Positive Limit Switch(LIMP)
IOfunct_DI3	P3-03	123	Negative Limit Switch(LIMN)
IOfunct_DI4	P3-04	12	Gear Ratio Switch
IOfunct_DI5	P3-05	104	Halt

Overview of digital outputs function default settings:

Digital Input Functions	Parameter	Code	Function
IOfunct_DQ0	P3-06	2	No Fault
IOfunct_DQ1	P3-07	5	In Position Deviation Window
IOfunct_DQ2	P3-08	13	Motor Standstill

6.3.6 Parameterization of Software Debonucing

Signal input debouncing comprises hardware debouncing and software debouncing.
The hardware debounce time is permanently set, the software debounce time can be set via parameters.
When a set signal function is changed and when the product is powered off and on again, software debouncing is reset to the default setting.

P3-09 ~ P3-14	Debounce time of DIx	Min.	0	Unit	Relatd Mode		
		Default	6	-	P	-	-
		Max.	6		DYC	-	-

Debounce time of DI0
0 / No: No software debouncing
1 / 0.25 ms: 0.25 ms
2 / 0.5 ms: 0.5 ms
3 / 0.75 ms: 0.75 ms
4 / 1.0 ms: 1.0 ms
5 / 1.25 ms: 1.25 ms
6 / 1.50 ms: 1.50 ms

Setting can only be changed if power stage is disabled.
Changed settings become active immediately.

6.4 Basic Functions for Operation

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

⚠ WARNING

UNINTENDED EQUIPMENT OPERATION

- Only start the system if there are no persons or obstructions in the zone of operation.
- Do not operate the drive system with undetermined parameter values or data.
- Never modify a parameter value unless you fully understand the parameter and all effects of the modification.
- Restart the drive and verify the saved operational data and/or parameter values after modifications.
- Carefully run tests for all operating states and potential error situations when commissioning, upgrading or otherwise modifying the operation of the drive.
- Verify the functions after replacing the product and also after making modifications to the parameter values and/or other operational data

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

6.4.1 Enable Power Stage

Parameterization for enable/disable servo drive power stage.

After the request for servo enabling is given with all criteria met, the power stage of equipment is switched on while the equipment operating state changes to enabled. After the request for servo disabling is given, the power stage of equipment is switched off while the equipment operating state changes to disabled.

The equipment also automatically switches off the power stage and changes the operating state to disabled when a error with error class 2, 3 and 4 is detected.
By default setting, the digital input IOfunc_DI0 with pin 9 on CN1 is set to "Enable" function.
The "Enable" function can also be assigned to other digital inputs via parameters P3-00 ... P3-05.

P3-00 ~ P3-06	Function Input of DIx	Min.	1	Unit	Relatd Mode		
		Default	-	-	P	-	-
		Max.	141		DYC	-	-

Function Input of DIx

Function	Description	Code		Related Mode	
		NO	NC	P	DYC
Enable	Enables the power stage	3	103	√	√

Setting can only be changed if power stage is disabled.
Changed settings become active the next time the product is powered on.

User can define the logic of how the equipment enable the power stage with Enable signal via parameter P3-15: to enable the power stage with the rising edge or high level of signal.

The equipment can also be set to automatically enable the power stage via parameter P3-15.

By default, the equipment enables the power stage with the rising edge of Enable signal.

<table>
<tr><td rowspan="3">P3-15</td><td rowspan="3">Enabling the power stage at PowerOn</td><td>Min.</td><td>0</td><td>Unit</td><td colspan="3">Relatd Mode</td></tr>
<tr><td>Default</td><td>0</td><td rowspan="2">-</td><td>P</td><td>-</td><td>-</td></tr>
<tr><td>Max.</td><td>2</td><td>DYC</td><td>-</td><td>-</td></tr>
<tr><td colspan="8">Enabling the power stage at PowerOn
0 / RisingEdge: A rising edge with the signal input function "Enable" enables the power stage
1 / HighLevel: An active signal input with signal input function "Enable" enables the power stage
2 / AutoOn: The power stage is automatically enabled

Changed settings become active the next time the power stage is enabled.</td></tr>
</table>

User can define action method of enabling the power stage as set in parameter P3-15 even after error by parameter P3-16.

<table>
<tr><td rowspan="3">P3-16</td><td rowspan="3">Enabling the power stage as set via P3-15 even after error</td><td>Min.</td><td>0</td><td>Unit</td><td colspan="3">Relatd Mode</td></tr>
<tr><td>Default</td><td>0</td><td rowspan="2">-</td><td>P</td><td>-</td><td>-</td></tr>
<tr><td>Max.</td><td>1</td><td>DYC</td><td>-</td><td>-</td></tr>
<tr><td colspan="8">Action method of enabling the power stage as set via P3-15 even after error
0 / Off: Setting in parameter P3-15 is only used after start-up
1 / On: Setting in parameter P3-15 is used after start- up and after detected error

Changed settings become active the next time the power stage is enabled.</td></tr>
</table>

Note:
If the equipment is set to automatically enable the power stage, the equipment will immediately enable the power stage and change the operating mode to enabled when main power supply is switched on. Unintended equipment operation may occur with position command being given. Carefully perform all essential checks and necessary safety measures before main power supply is switched on.

⚠ WARNING

UNINTENDED EQUIPMENT OPERATION

- Only start the system if there are no persons or obstructions in the zone of operation.
- Do not operate the drive system with undetermined parameter values or data.
- Never modify a parameter value unless you fully understand the parameter and all effects of the modification.
- Restart the drive and verify the saved operational data and/or parameter values after modifications.
- Carefully run tests for all operating states and potential error situations when commissioning, upgrading or otherwise modifying the operation of the drive.
- Verify the functions after replacing the product and also after making modifications to the parameter values and/or other operational data.

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

6.4.2 Selection of Motor Rotation Direction

By modify the value of parameter P0-06, it is possible to change the motor rotation direction without changing the wiring or the polarity (direction logical) of the pulse train command input. Meanwhile, although the motor rotation direction has been changed, the polarity of output signals generated by servo drive, for example encoder simulation output, will remain unchanged.

By factory default, the servo motor turns CCW in response to positive direction pulse train command input when viewed from load side shaft end.

P0-06	Inversion of direction of movement	Min.	0	Unit	Relatd Mode		
		Default	0	-	P	-	-
		Max.	1		DYC	-	-
Inversion of direction of movement 0 / Inversion Off: Inversion of direction of movement is off 1 / Inversion On: Inversion of direction of movement is on Setting can only be changed if power stage is disabled. Changed settings become active the next time the product is powered on.							

6.4.3 Limit Switches

Movements can be monitored using limit switches. A positive limit switch and a negative limit switch can be used for monitoring. When movement expired the safety stroke, the movement of servo motor will be stopped by input signal of triggered limit switch.

If the positive or negative limit switch are tripped, the movement stops. An error message is generated and the operating state switches to 7 Quick Stop Active “7 Quick Stop Active.

Note:
The limit switch only provides protection against certain hazardous circumstances (e.g. incorrect instructions-induced collisions). To avoid accidents resulting from poor contact or line break, the limit switch function is recommended to be employed in “NC” logical.

⚠ WARNING

Loss of Control

- Ensure that limit switches are installed as determined by your risk assessment.
- Verify correct connection of the limit switches.
- Verify that the limit switches are sufficiently distant from the mechanical stop to allow 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.

By factory default, the digital input IOfunc_DI2 with pin 20 on CN1 is set to "LIMP" the positive limit switch, while the digital input IOfunc_DI3 with pin 21 on CN1 is set to "LIMN" the negative limit switch.
The "LIMP" / "LIMN" function can also be assigned to other digital inputs via parameters P3-00 ... P3-05.

P3-00 ~ P3-05	Function Input of DIx	Min.	1	Unit	Relatd Mode		
		Default	122/123	-	P	-	-
		Max.	141		DYC	-	-

Function Input of DIx

Function	Description	Code		Related Mode	
		NO	NC	P	DYC
Positive Limit Switch(LIMP)	Positive limit switch	22	122	√	√
Negative Limit Switch(LIMN)	Negative limit switch	23	123	√	√

Setting can only be changed if power stage is disabled.
Changed settings become active the next time the product is powered on.

Movements can be monitored using limit switches. A positive limit switch and a negative limit switch can be used for monitoring. When movement expired the safety stroke, the movement of servo motor will be stopped by input signal of triggered limit switch.

If the positive or negative limit switch are tripped, the movement stops. An error message is generated and the operating state switches to 7 Quick Stop Active “7 Quick Stop Active.

In case a limit switch fault EA302 / EA303 is actived, user can select limit switch fault reset method via LSB of parameter P6-34:

- When LSB of P6-34 is 0, the error message EA302 / EA303 can be reset by means of a "Fault Reset" signal. The operating state switches back to 6 Operation Enabled. The movement can continue, however, only in the negative direction.
- When LSB of P6-34 is 1, the error message EA302 / EA303 can be automatically reset when receives a motion command in opposite direction of the triggered limit switch. The movement will continue in opposite direction of the triggered limit switch, too.

For example, if the positive limit switch was triggered, an error message EA302 is generated and the operating state switches to 7 Quick Stop Active.

- If LSB of P6-34 is 0, the error message EA302 can be reset by means of a "Fault Reset" signal. The operating state switches back to 6 Operation Enabled. The movement can continue, however, only in the negative direction. If the subsequent motion is still in positive direction, the error message EA302 will be generated again and the operating state switches to7 Quick Stop Active.
- If LSB of P6-34 is 1, when the drive receives a motion command in negative direction the error message EA302 will be automatically reset, the operating state switches back to 6 Operation Enabled and the movement will continue in negative direction.

P6-34	Special Function Settings	Min.	0	Unit	Relatd Mode		
		Default	0	-	P	-	-
		Max.	1		DYC	-	-

Special function settings:

Digital	Bit	Description	Function	
L XXXX[ ]	0	Auto limit switch fault reset method	0	Limit switch fault A302 / A303 will be latched until receives an additional Fault Reset signal.
			1	Limit switch fault A302 / A303 can be reset automatically when receives motion command in opposite direction of the triggered limit switch.
	1	Reserved	-	-
	2	Reserved	-	-
	3	Reserved	-	-
L XXX[ ]X	4	Reserved	-	-
	5	Reserved	-	-
	6	Reserved	-	-
	7	Reserved	-	-

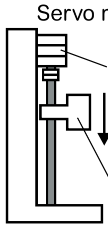
Setting can only be changed if power stage is disabled.
Changed settings become active the next time the power stage is enabled.

6.4.4 Motor Holding Brake

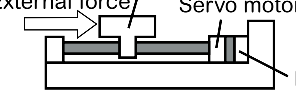
Motor holding brake is a built-in component of servo motor designed with motor holding brake. The motor holding brake is used to hold the motor's position and keep the moving part of the mechanical from been moved by external force or gravity when the servo drive power stage switched off.

Please use motor with holding brake in following applications:

- Vertical axis



- Axis under external force



When using a motor with holding brake, please note:

- Motor holding brake is not a safety-related measure.
- The motor holding brake is designed only to hold the motor position of when the power stage is disabled, it can not be used as a service brake.

⚠ WARNING

UNINTENDED AXIS MOVEMENT

- Do not use the internal holding brake as a safety-related measure.
- Only use certified external brakes as safety-related measures.

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

The motor holding brake is operated in NO logical, when motor holding brake is applied with required current, it is excited and released. When the current applied to the motor holding brake is off, it is applied.

Release and apply the motor holding brake requires a certain amount time of delay:

Motor type	Brake voltage	Release time(ms)	Apply time(ms)
BCH16*B**F*	24VDC	118	15
BCH16*C**F*		25	50
BCH16*D**F*		25	50
BCH16*F**F*		25	50
BCH16*H**F*		76	27
BCH16*J**F*		76	27
BCH16*M**F*		76	27

The "Release Brake" function can be assigned to a digital output via the parameters P3-06 ... P3-08. With "Release Brake" function been assigned to a digital output, the equipment can automatically control the release and apply of the motor holding brake, which is to say, the brake is released automatically when the power stage is enabled and is applied automatically when the power stage is disabled.

Note: Restore the factory settings can modify the assignment of the signal output functions in such a way that the motor holding brake is released unintentionally.

⚠ WARNING

UNINTENDED AXIS MOVEMENT

- Verify that the digital output to which you have assigned the digital output function Release Brake has been properly wired and configured.
- Before restore the factory setting, verify that the digital output function Release Brake for the holding brake has been assigned to any digital output to prevent unintended movement of the load caused by a release of the holding brake. or reassign the digital output function Release Brake after the factory setting restore according to the requirements of your application prior to enable the power stage.
- In all cases, take all necessary measures to prevent unintended movements of the load caused by a release of the holding brake.

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

<table>
<tr><td rowspan="3">P3-06
~
P3-08</td><td rowspan="3">Function Output of DQx</td><td>Min.</td><td>1</td><td>Unit</td><td colspan="3">Relatd Mode</td></tr>
<tr><td>Default</td><td>2</td><td rowspan="2">-</td><td>P</td><td>-</td><td>-</td></tr>
<tr><td>Max.</td><td>125</td><td>DYC</td><td>-</td><td>-</td></tr>
</table>

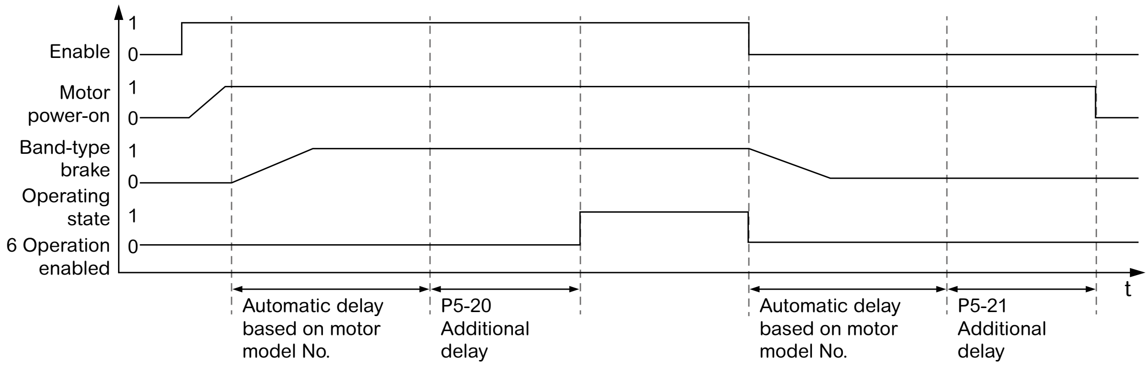
Function Output of DQx

<table>
<tr><td rowspan="2">Function</td><td rowspan="2">Description</td><td colspan="2">Code</td><td colspan="2">Related Mode</td></tr>
<tr><td>NO</td><td>NC</td><td>P</td><td>DYC</td></tr>
<tr><td>Release Brake</td><td>Motor holding brake control</td><td>24</td><td>124</td><td>√</td><td>√</td></tr>
</table>

Setting can only be changed if power stage is disabled.
Changed settings become active the next time the product is powered on.

If Easy Lexium 16 servo drive is driving to a servo motor with holding brake, a certain amount of delay time is automatically added when the power stage is enabled. Transition to the operating state "6 Operation Enabled" is only possible the holding brake is released after this time delay has elapsed. During this period the current is also applied to the motor. An additional holding brake release time delay can be set via the parameter P5-20, Transition to the operating state "6 Operation Enabled" is only possible after the entire time delay has elapsed.

In like manner, if Easy Lexium 16 servo drive is driving to a servo motor with holding brake, a certain amount of delay time is automatically added when the power stage is disabled. Current remains to be applied to the motor during this entire time delay. An additional holding brake apply time delay can be set via the parameter P5-21, the current remains to be applied to the motor during the entire time delay.



P5-20	Additional time delay for releasing the holding brake	Min.	0	Unit	Relatd Mode		
		Default	0	ms	P	-	-
		Max.	400		DYC	-	-

Additional time delay for applying the holding brake
The overall time delay for applying the holding brake is the time delay from the motor holding brake and the additional time delay in this parameter.

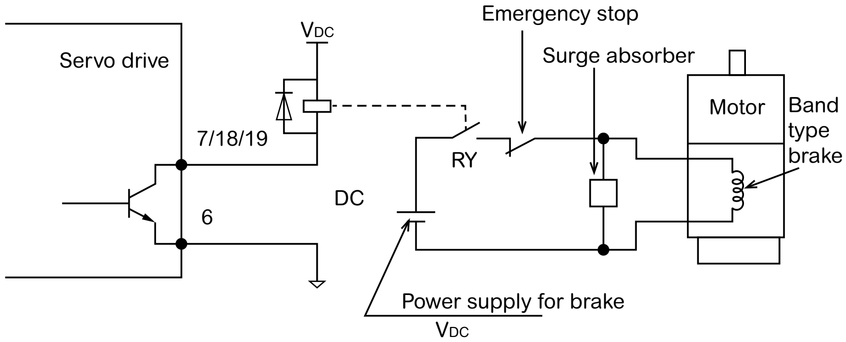
Setting can only be changed if power stage is disabled.
Changed settings become active the next time the power stage is enabled.

P5-21	Additional time delay for applying the holding brake	Min.	0	Unit	Relatd Mode		
		Default	0	ms	P	-	-
		Max.	1000		DYC	-	-

Additional time delay for releasing the holding brake
The overall time delay for releasing the holding brake is the time delay from the motor holding brake and the additional time delay in this parameter.

Setting can only be changed if power stage is disabled.
Changed settings become active the next time the power stage is enabled.

Typical wiring of motor holding brake:



Note:
- The motor holding brake has no polarity.
- Please consider a circuit which uses a relay to control motor holding brake. Do not connect the motor holding brake directly to servo drive digital output or it will result in equipment damage.
- Please design an EMERGENCY STOP SWITCH in the control circuit, by triggering the EMERGENCY STOP SWITCH the motor holding brake should be applied.
- To suppress the surge generated during release / apply of the motor holding brake, please design a surge protection device in the motor holding brake control circuit as following: Please note: by using of a fly-wheel diode, the time consumed for release the motor holding brake may be longer than with a surge protection device.
- Be sure to separate the 24VDC power supply for motor holding brake from the power supply for I/O signal (CN1) of the equipment; or it may result in malfunction of I/O signal.

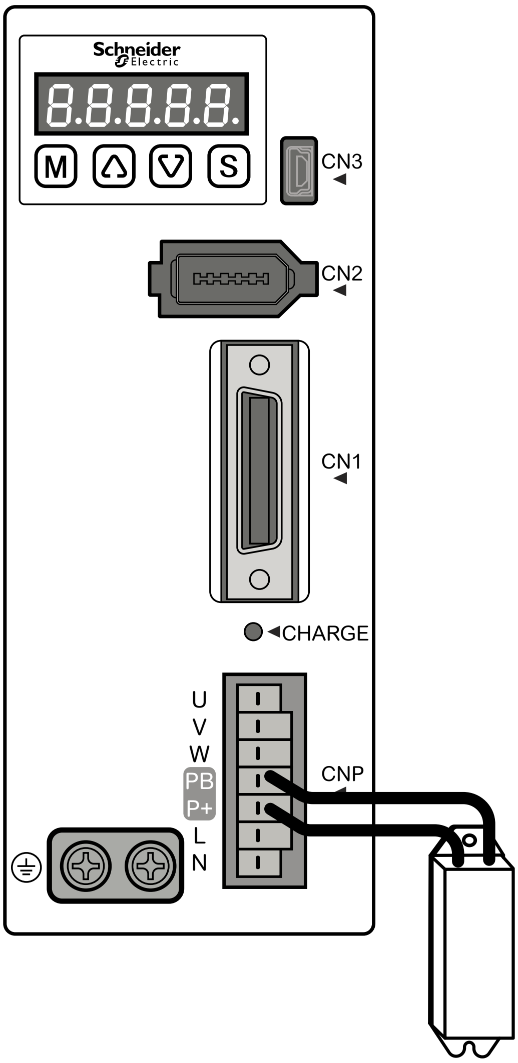
6.4.5 Braking Resistor

All the Easy Lexium 16 servo drives are designed without built-in braking resistor. If the regenerated power becomes greater than the power that can be absorbed by the servo drive, it is necessary to use an external braking resistor.

When sizing an external braking resistor, note the following:

Drive Sizing	Minimum resistance of external braking resistor (Ω)	Maximum power of external braking resistor (W)
LXM16DU01 / 02 / 04	36	200
LXM16DU07 / 10 / 15	20	600

Connecting an external braking resistor:
Connect the external braking resistor between P+ and PB of servo drive connector CNP.



After the connection of external braking resistor, please set the power, resistance and protection parameters of external braking resistor through parameters, and activate the external braking resistor.

<table>
<tr><td rowspan="3">P0-22</td><td rowspan="3">Nominal power of external braking resistor</td><td>Min.</td><td>1</td><td>Unit</td><td colspan="3">Relatd Mode</td></tr>
<tr><td>Default</td><td>10</td><td rowspan="2">W</td><td>P</td><td>-</td><td>-</td></tr>
<tr><td>Max.</td><td>32767</td><td>DYC</td><td>-</td><td>-</td></tr>
<tr><td colspan="8">Nominal power of external braking resistor

Setting can only be changed if power stage is disabled.
Changed settings become active the next time the power stage is enabled.</td></tr>
</table>

<table>
<tr><td rowspan="3">P0-23</td><td rowspan="3">Resistance value of external braking resistor</td><td>Min.</td><td>0</td><td>Unit</td><td colspan="3">Relatd Mode</td></tr>
<tr><td>Default</td><td>10000</td><td rowspan="2">0.01 Ω</td><td>P</td><td>-</td><td>-</td></tr>
<tr><td>Max.</td><td>32767</td><td>DYC</td><td>-</td><td>-</td></tr>
<tr><td colspan="8">Resistance value of external braking resistor
The minimum value depends on the type of drive

In increments of 0.01 Ω

Setting can only be changed if power stage is disabled.
Changed settings become active the next time the power stage is enabled.</td></tr>
</table>

<table>
<tr><td rowspan="3">P0-24</td><td rowspan="3">Maximum permissible switch-on time of external braking resistor</td><td>Min.</td><td>1</td><td>Unit</td><td colspan="3">Relatd Mode</td></tr>
<tr><td>Default</td><td>100</td><td rowspan="2">ms</td><td>P</td><td>-</td><td>-</td></tr>
<tr><td>Max.</td><td>30000</td><td>DYC</td><td>-</td><td>-</td></tr>
<tr><td colspan="8">Maximum permissible switch-on time of external braking resistor

Setting can only be changed if power stage is disabled.
Changed settings become active the next time the power stage is enabled.</td></tr>
</table>

<table>
<tr><td rowspan="3">P0-25</td><td rowspan="3">Selection of type of braking resistor</td><td>Min.</td><td>0</td><td>Unit</td><td colspan="3">Relatd Mode</td></tr>
<tr><td>Default</td><td>0</td><td rowspan="2">-</td><td>P</td><td>-</td><td>-</td></tr>
<tr><td>Max.</td><td>1</td><td>DYC</td><td>-</td><td>-</td></tr>
<tr><td colspan="8">Selection of type of braking resistor
0 / No External Braking Resistor: External braking resistor not activated
1 / External Braking Resistor: External braking resistor activated

Setting can only be changed if power stage is disabled.
Changed settings become active the next time the power stage is enabled.</td></tr>
</table>

6.5 Operating Mode Jog

In operation mode Jog, a movement is performed to jog the servo motor.

The purpose of Jog is to verify the wiring between servo drive and servo motor, also to check whether the servo motor could run properly.

6.5.1 Precatuions and Checklist Before Starting the Jog

To make sure the Jog can be performed properly and safely, check and confirm the following items prior to the operation:

- Servo drive:
  Check whether the wiring and settings of servo drive are correct.
  Check whether the main power supply voltage to the servo drive is normal.
- Servo motor:
  Check whether the wiring between servo motor and servo drive is correct.
  Check whether all accessories are securely fastened.

In the case a servo motor with holding brake is connected, proper voltage (DC24V) must be applied to the motor holding brake to release it prior to the operation.

⚠ WARNING
UNINTENDED MOVEMENT • Only start the system if there are no persons or obstructions in the zone of operation. • Verify that a functioning emergency stop push-button is within reach of all persons involved in the operation. **Failure to follow these instructions can result in death, serious injury, or equipment damage.**

6.5.2 Perform the Jog by Integrated HMI

Users can set JOG velocity and direction then perform JOG operation in "JoG" menu group.

- Set JOG speed:

Step	HMI Display	Operation	Description
0	rdY	S	Press S key, HMI shows "oP."
1	oP	S	Press S key, HMI shows "JoG".
2	JoG	S	Press S key, HMI shows "JGSt".
3	JGSt	UP / DOWN	Press UP or DOWN key to select JOG operation or JOG parameters configuration.
4	P4-01	S	Press S key, HMI shows current value of parameter P4-01.
	P4-02		Press S key, HMI shows current value of parameter P4-02.
5	00100.	S	Press S key to start edit, the LSB digit with cursor starts flashing.
6	00100.	UP / DOWN	Press UP or DOWN key to edit the value of the digit with cursor. Press UP key once will increase value by 1, press DOWN key once will decrease value by 1.
7	00105.	S	Press S key to shift cursor from right to left. Press S key once to shift cursor by 1 digit.
8	00105.	UP / DOWN	Press UP or DOWN key to edit the value of the digit with cursor. Press UP key once increases value by 1, press DOWN key once decreases value by 1.
9	00305.	S	Press and hold S key for longer than 1.5 s, current value blinks once and becomes still. Value saved.
10	00305.	S	Press M key to exit edit.
11	P4-01	S	HMI shows parameter P4-01, parameter value edit finished.
	P4-02		HMI shows parameter P4-02, parameter value edit finished.

- Perform JOG operation. Servo motor will move during this operation.

Step	HMI Display	Operation	Description
0	rdy	S	Press S key, HMI shows "oP".
1	oP	S	Press S key, HMI shows "JoG".
2	JoG	S	Press S key, HMI shows "JGSt".
3	JGSt	▲ ▼	Press S key to enable JOG operation. The servo drive power stage turns on and servo drive switches to run state.
4	JG-	▲ ▼	Press UP or DOWN key to select JOG speed and direciton.
	JG=		
	-JG		
	=JG		
5	JG-	S	Press and hold S key ot JOG servo motor in positive direcion with velocity set in parameter P4-01. Servo motor will stop when S key is released.
	JG=		Press and hold S key ot JOG servo motor in positive direcion with velocity set in parameter P4-02. Servo motor will stop when S key is released.
	-JG		Press and hold S key ot JOG servo motor in negative direcion with velocity set in parameter P4-01. Servo motor will stop when S key is released.
	=JG		Press and hold S key ot JOG servo motor in negative direcion with velocity set in parameter P4-02. Servo motor will stop when S key is released.
6	JG-	M	Press M key to exit JOG operation.
	JG=		
	-JG		
	=JG		

(Continue)			
Step	HMI Display	Operation	Description
7			HMI shows "JoG". The servo drive power stage turns off.

- Related parameters

P4-01	Velocity for slow JOG movement	Min.	1	Unit	Related Mode		
		Default	100	usr_v	P	-	-
		Max.	2147483647		DYC	-	-

Velocity for slow JOG movement
The adjustable value is internally limited to the parameter setting in P4-03.

Changed settings become active immediately.

P4-02	Velocity for fast JOG movement	Min.	1	Unit	Related Mode		
		Default	200	usr_v	P	-	-
		Max.	2147483647		DYC	-	-

Velocity for fast JOG movement
The adjustable value is internally limited to the parameter setting in P4-03.

Changed settings become active immediately.

6.5.3 Perform the Jog by Digital Input

Users can assign Jog velocity and direction selection functions to digital inputs then perform JOG operation by external input signals:

- The "Jog Positive" / "Jog Negative" / "Jog Fast / "Jog Slow" functions can be assigned to digital intputs via parameters P3-00...P3-05.
- The slow Jog speed is set via parameter P4-01
- The fast Jog speed is set via parameter P4-02

P3-00 ~ P3-05	Function Input of DIx	Min.	1	Unit	Relatd Mode		
		Default	-	-	P	-	-
		Max.	141		DYC	-	-

Function Input of DIx

Function	Description	Code		Related Mode	
		NO	NC	P	DYC
Jog Positive	Jog: Moves in positive direction	9	109	√	
Jog Negative	Jog: Moves in negative direction	10	110	√	
Jog Fast/Slow	Jog: Switches between slow and fast movement	11	111	√	

Setting can only be changed if power stage is disabled.
Changed settings become active the next time the product is powered on.

P4-01	Velocity for slow JOG movement	Min.	1	Unit	Relatd Mode		
		Default	100	usr_v	P	-	-
		Max.	2147483647		DYC	-	-

Velocity for slow JOG movement
The adjustable value is internally limited to the parameter setting in P4-03.

Changed settings become active immediately.

P4-02	Velocity for fast JOG movement	Min.	1	Unit	Relatd Mode		
		Default	100	usr_v	P	-	-
		Max.	2147483647		DYC	-	-

Velocity for fast JOG movement
The adjustable value is internally limited to the parameter setting in P4-03.

Changed settings become active immediately.

6.5.4 Parameterization of Motion Profile for the Jog

It is possible to change the parameterization of motion profile for the Jog.

The motion profile for the Jog consists of an acceleration, a deceleration and a maximum velocity. A linear ramp for both directions of movement is available.

The ramp slope determines the velocity changes of the motor per time unit. The ramp slope can be set for acceleration and deceleration.

Following parameters can be used to change the parameterization of motion profile for the Jog.

P4-00	Activation of the motion profile for velocity	Min.	0	Unit	Relatd Mode		
		Default	1	-	P	-	-
		Max.	1		DYC	-	-

Activation of the motion profile for velocity
0 / Profile Off: Profile off
1 / Profile On: Profile on

Setting can only be changed if power stage is disabled.
Changed settings become active immediately.

P4-03	Maximum velocity of the motion profile for velocity	Min.	1	Unit	Relatd Mode		
		Default	100	usr_v	P	-	-
		Max.	2147483647		DYC	-	-

Maximum velocity of the motion profile for velocity
If a greater reference velocity is set in one of these operating modes, it is automatically limited to value of this parameter.

Setting can only be changed if power stage is disabled.
Changed settings become active the next time the motor moves.

P4-04	Acceleration of the motion profile for velocity	Min.	1	Unit	Relatd Mode		
		Default	6000	usr_a	P	-	-
		Max.	2147483647		DYC	-	-

Acceleration of the motion profile for velocity
Writing the value 0 has no effect on the parameter.

Changed settings become active the next time the motor moves.

P4-05	Deceleration of the motion profile for velocity	Min.	1	Unit	Relatd Mode		
		Default	6000	usr_a	P	-	-
		Max.	2147483647		DYC	-	-

Deceleration of the motion profile for velocity
Writing the value 0 has no effect on the parameter.

Changed settings become active the next time the motor moves.

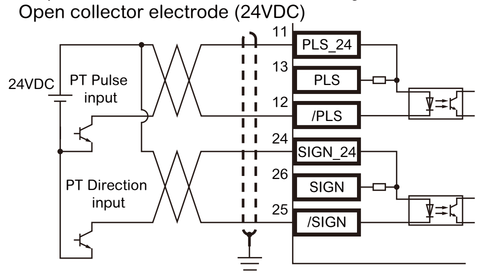
6.6 Operating Mode Electronic Gear

In the operating mode Electronic Gear, movements are carried out according to externally supplied reference value signals. The position reference value is calculated on the basis of these external reference values plus an adjustable gear ratio. The reference value signals can be A/B signals, P/D signals or CW/CCW signals.

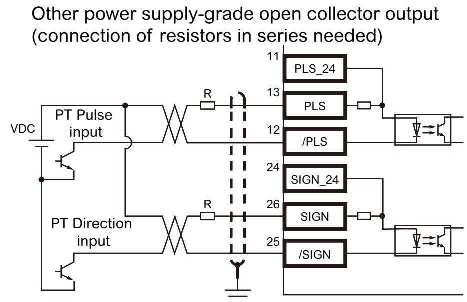
6.6.1 Wiring Example

In electronic gear mode, the pulse train input interface supports common pulse train formats given by controller. Typical wiring examples are as following:

- 24VDC open collector pulse train can be directly connected to the servo drive PTI interface:

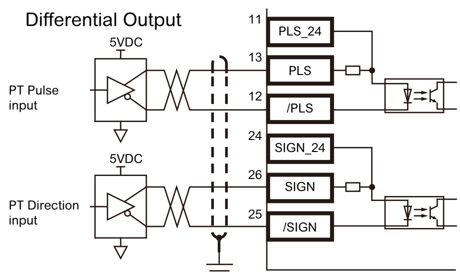


- External resistors are required when open colector pulse train on other voltage classes are connected. Recommended resistor specifications are shown in the figure:



VDC	R specifications
12VDC	500 ohm / 1W
5VDC	120 ohm / 1W

- High-speed pulse train can be directly connected to the servo drive PTI interface:



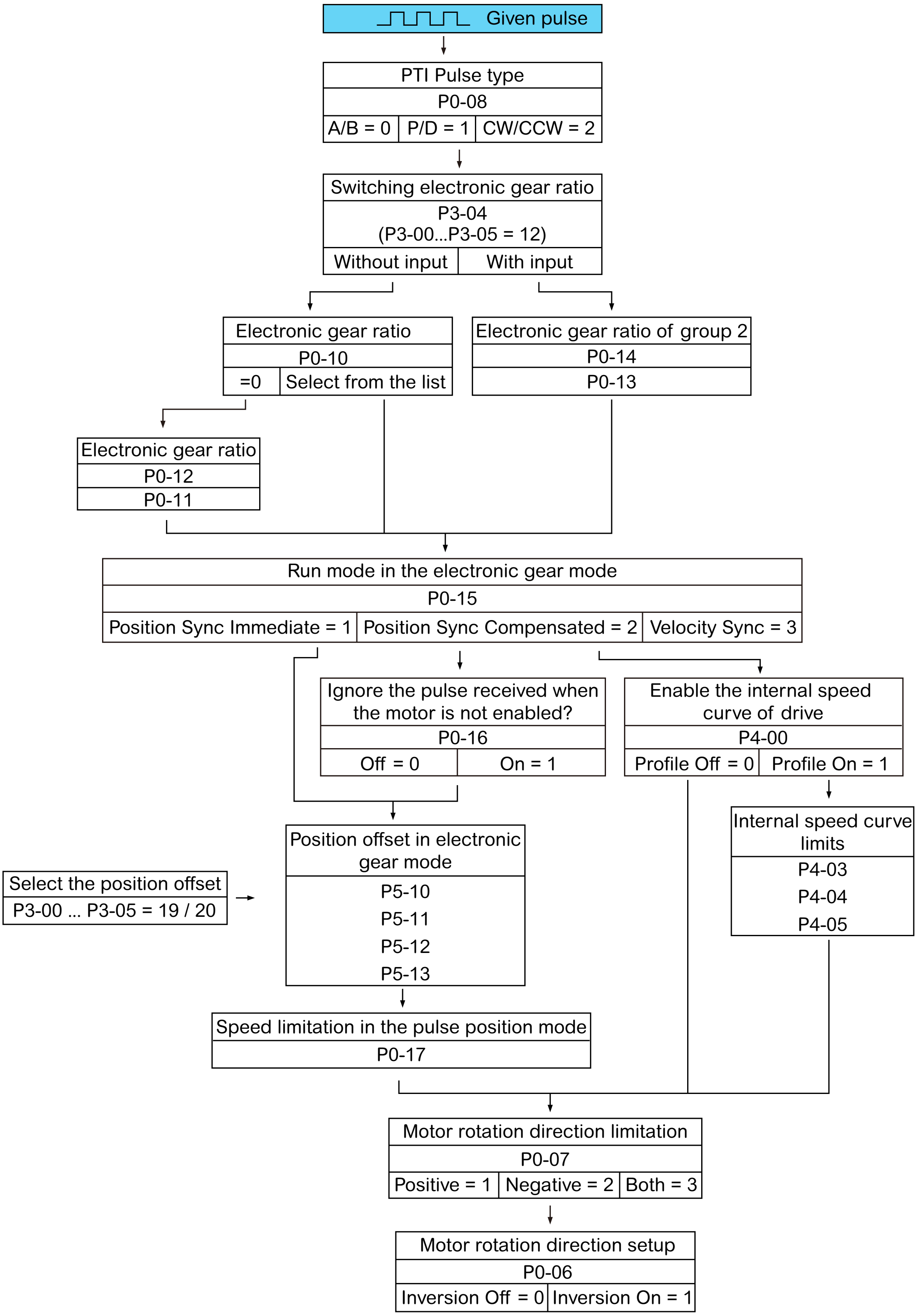
Note: Please use shielded twisted pair cable and ground both ends of the shield layer.

Electrical specifications of various pulse train commands:

Type of pulse train	Open collector 24V	Line driver	High-speed pulse
Pulse + Direction	200kHz	500kHz	2MHz
CW + CCW	200kHz	500kHz	2MHz
A / B	200kHz	500kHz	500kHz (quadrupled)

6.6.2 Basic Parameterization

The illustration below provides an overview of the parameters that can be adjusted in electronic gear mode:



6.6.3 Parameterization of Electronic Gear Ratio

The position of movement is calculated by internal position increments. The internal position scaling of Easy Lexium 16 is 131072 increments per motor revolution.

The gear ratio is the ratio of the number of motor increments and the number of externally supplied reference increments. External pulse train commands are converted into internal position increments with respect to the electronic gear ratio.

Two methods are available for parameterization of electronic gear ratio:
- Select an electronic gear ratio from the list directly via parameter P0-10
- Calculate electronic gear ratio by parameters P0-12/P0-11 or P0-14/P0-13.

Gear ratio selected from P0-10 priors to the one calculated by parmater P0-12 / P0-11 or P0-14 / P0-13. In case there is no appropriate electronic gear ratio found in the list of parameter P0-10, user may customize the electronic gear ratio by first set parameter P0-10 to 0, then calculate electronic gear ratio by parameters P0-12/P0-11 or P0-14/P0-13.

For example: Where 10,000 external pulses stand for 1 motor revolution is required, following methods are considered:
- Select 10000 in parameter P0-10
- Select 0 in parameter P0-10 first, then calculate electronic gear ratio as following:
  Electronic gear ratio = Internal position scaling / Reference pulse = 131072 / 10000
  = Electronic gear numerator / denominator
  Hence, set P0-12 = 131072 / P0-11 = 10000 or P0-14 = 131072 / P0-13 = 10000.

P0-10	Selection of gear ratio	Min.	0	Unit	Relatd Mode		
		Default	8	-	P	-	-
		Max.	11		DYC	-	-

Selection of predefined gear ratios
0 / Gear Factor: Usage of gear ratio adjusted with GERRnum / GERRdenom
1 / 200: 200
2 / 400: 400
3 / 500: 500
4 / 1000: 1000
5 / 2000: 2000
6 / 4000: 4000
7 / 5000: 5000
8 / 10000: 10000
9 / 4096: 4096
10 / 8192: 8192
11 / 16384: 16384

Changed settings become active immediately.

P0-11	1st Denominator of gear ratio	Min.	1	Unit	Relatd Mode		
		Default	10000	-	P	-	-
		Max.	2147483647		DYC	-	-

Denominator of the 1st set of electronic gear parameters
Electronic gear ratio = P0-12 (GEAR Numerator) / P0-11 (GEAR Denominator)
Number of input PTI pulses * P0-12 (GEAR Numerator) / P0-11 (GEAR Denominator) = Motor location (unit: revolution) * 131072
The new gear ratio is applied when the numerator value is supplied.

Changed settings become active immediately.

P0-12	1st Numerator of gear ratio	Min.	1	Unit	Relatd Mode		
		Default	131072	-	P	-	-
		Max.	2147483647		DYC	-	-

Numerator of the 1st set of electronic gear parameters
Refer to parameter P0-11

Changed settings become active immediately.

P0-13	2nd Denominator of gear ratio	Min.	1	Unit	Relatd Mode		
		Default	10000	-	P	-	-
		Max.	2147483647		DYC	-	-

Denominator of the 2nd set of electronic gear parameters
Electronic gear ratio = P0-14 (GEAR Numerator) / P0-13 (GEAR Denominator)
Number of input PTI pulses * P0-14 (GEAR Numerator) / P0-13 (GEAR Denominator) = Motor location (unit: revolution) * 131072
The new gear ratio is applied when the numerator value is supplied.

Changed settings become active immediately.

P0-14	2nd Numerator of gear ratio	Min.	1	Unit	Relatd Mode		
		Default	131072	-	P	-	-
		Max.	2147483647		DYC	-	-

Numerator of the 2nd set of electronic gear parameters
Refer to parameter P0-13

Changed settings become active immediately.

By digital input been assigned as "Gear Ratio Switch" function, the user may switch between two different electronic gear ratio.

By factory default setting, the digital input IOfunc_DI4 with pin 22 on CN1 is set to "Gear Ratio Switch function". The "Gear Ratio Switch" function can also be assigned to other digital inputs with parameters P3-00 ... P3-05.

P3-00 ~ P3-05	Function Input of DIx	Min.	1	Unit	Relatd Mode		
		Default	-	-	P	-	-
		Max.	141		DYC	-	-

Function Input of DIx

Function	Description	Code		Related Mode	
		NO	NC	P	DYC
Gear Ratio Switch	Electronic Gear: Switches between two gear ratios	12	112	√	

Setting can only be changed if power stage is disabled.
Changed settings become active the next time the product is powered on.

6.6.4 Selection of the Pulse Reference Method

The Easy Lexium 16D servo drive supports 3 methods the movement is to be performed, pulse reference method is selected with parameter P0-15:

- 1 / Position Synchronization Immediate:
  In the case of position synchronization without compensation movement, the movement is made synchronously
  (position synchronicity) with the supplied reference value signals.Reference value signals supplied during an interruption caused by Halt or by a detected error of error class 1 are not taken into account.
- 2 / Position Synchronization Compensated:
  In the case of position synchronization with compensation movement, the movement is made synchronously (position synchronicity) with the supplied reference value signals.Reference value signals supplied during an interruption caused by Halt or by a detected error of error class 1 are taken into account and compensated for.
- 3 / Velocity Synchronization:
  In the case of velocity synchronization, the movement is made synchronously (velocity synchronicity) with the supplied reference value signals.

<table>
<tr><td rowspan="3">P0-15</td><td rowspan="3">Processing mode for operating mode Electronic Gear</td><td>Min.</td><td>1</td><td>Unit</td><td colspan="3">Relatd Mode</td></tr>
<tr><td>Default</td><td>1</td><td rowspan="2">-</td><td>P</td><td>-</td><td>-</td></tr>
<tr><td>Max.</td><td>3</td><td>DYC</td><td>-</td><td>-</td></tr>
<tr><td colspan="8">Processing mode for operating mode Electronic Gear
1 / Position Synchronization Immediate: Position synchronization without compensation movement
2 / Position Synchronization Compensated: Position synchronization with compensation movement
3 / Velocity Synchronization: Velocity synchronization

Changed settings become active the next time the motor moves.</td></tr>
</table>

6.6.5 Position Change with Power Stage Disabled

If the method "2 - Synchronization With Compensation Movement" is selected via parameter P0-15, the parameter P0-16 determines the way changes to the motor position and to the reference value signals are handled with disabled power stage.

Position changes can be ignored or taken into account during a transition to operating state "6 Operation Enabled":

- Off: Position changes with disabled power stage are ignored.
- On: Position changes with disabled power stage are taken into account.
  Position changes between starting the operating mode and the subsequent enabling of the power stage are not taken into account.

By factory default, parameter P0-16 is set to “0 - Off”.

P0-15	Processing mode for operating mode Electronic Gear	Min.	1	Unit	Relatd Mode		
		Default	1	-	P	-	-
		Max.	3		DYC	-	-

Processing mode for operating mode Electronic Gear
1 / Position Synchronization Immediate: Position synchronization without compensation movement
2 / Position Synchronization Compensated: Position synchronization with compensation movement
3 / Velocity Synchronization: Velocity synchronization

Changed settings become active the next time the motor moves.

P0-16	Treatment of position changes with inactive power stage	Min.	0	Unit	Relatd Mode		
		Default	0	-	P	-	-
		Max.	1		DYC	-	-

Treatment of position changes with inactive power stage
0 / Off: Position changes in states with disabled power stage are ignored.
1 / On: Position changes in states with disabled power stage are taken into account.

This parameter is effective only when P0-015 is set to "2 - Position synchronization with position compensation”

Changed settings become active the next time the product is powered on.

6.6.6 Velocity Limitation in Electronic Gear Mode

A velocity limitation can be activated with parameter P0-17 for the methods "1 / Position Synchronization Immediate" and "2 / Position Synchronization Compensated".

<table>
<tr><td rowspan="3">P0-17</td><td rowspan="3">Velocity limitation for the method Position Synchronization</td><td>Min.</td><td>0</td><td>Unit</td><td colspan="3">Relatd Mode</td></tr>
<tr><td>Default</td><td>0</td><td rowspan="2">usr_v</td><td>P</td><td>-</td><td>-</td></tr>
<tr><td>Max.</td><td>2147483647</td><td>DYC</td><td>-</td><td>-</td></tr>
<tr><td colspan="8">Velocity limitation for the method Position Synchronization
0: No velocity limitation
>0: Velocity limitation in usr_v

Changed settings become active immediately.</td></tr>
</table>

6.6.7 Release of Direction

Release of direction allows you to limit movements to positive or negative direction. Release of direction is set with the parameter P0-07.

By factory default, parameter P0-07 is set to "3 - BOTH" to release movement in both direction.

<table>
<tr><td rowspan="3">P0-07</td><td rowspan="3">Enabled direction of movement for operating mode Electronic Gear</td><td>Min.</td><td>1</td><td>Unit</td><td colspan="3">Relatd Mode</td></tr>
<tr><td>Default</td><td>3</td><td rowspan="2">-</td><td>P</td><td>-</td><td>-</td></tr>
<tr><td>Max.</td><td>3</td><td>DYC</td><td>-</td><td>-</td></tr>
<tr><td colspan="8">Choose whether the motor is allowed to move in forward, reverse or both directions
1 / POSITIVE: Positive direction
2 / NEGATIVE: Negative direction
3 / BOTH: Both directions
This allows you to activate a return movement lock function.

Changed settings become active immediately.</td></tr>
</table>

6.6.8 Offset Movement

The offset movement allows you to perform a movement with a parameterizable number of increments.

Offset movements are only available for the methods "1 / Position Synchronization Immediate" and "2 / Position Synchronization Compensated".

Two parameterizable offset positions are available. The parameters P5-10 and P5-11 are used to set the offset positions. The velocity and the acceleration for the offset movement are set via the parameters P5-12 and P5-13.

The offset movement is started via a signal input. In order to start offset movements via the signal input, you must parameterize the signal input functions "Gear Offset 1" and "Gear Offset 2" with parameters P3-00 ... P3-05.

P3-00 ~ P3-05	Function Input of DIx	Min.	1	Unit	Relatd Mode		
		Default	-	-	P	-	-
		Max.	141		DYC	-	-

Function Input of DIx

Function	Description	Code		Related Mode	
		NO	NC	P	DYC
Gear Offset 1	Electronic Gear: Adds first gear offset	19	119	√	
Gear Offset 2	Electronic Gear: Adds second gear offset	20	120	√	

Setting can only be changed if power stage is disabled.
Changed settings become active the next time the product is powered on.

P5-10	Relative offset position 1 for offset movement	Min.	-2147483648	Unit	Relatd Mode		
		Default	0	Inc	P	-	-
		Max.	2147483647		-	-	-

Relative offset position 1 for offset movement

Changed settings become active immediately.

P5-11	Relative offset position 2 for offset movement	Min.	-2147483648	Unit	Relatd Mode		
		Default	0	Inc	P	-	-
		Max.	2147483647		-	-	-

Relative offset position 2 for offset movement

Changed settings become active immediately.

P5-12	Target velocity for offset movement	Min.	1	Unit	Relatd Mode		
		Default	60	usr_v	P	-	-
		Max.	2147483647		-	-	-

Target velocity for offset movement

Changed settings become active immediately.

P5-13	Acceleration and deceleration for offset movement	Min.	1	Unit	Relatd Mode		
		Default	600	usr_a	P	-	-
		Max.	2147483647		DYC	-	-

Acceleration and deceleration for offset movement

Setting can only be changed if power stage is disabled.
Changed settings become active the next time the power stage is enabled

6.6.9 Changing the Motion Profile for the Velocity

If the method "3 / Velocity Synchronization" is selected, the motion profile for the velocity can be changed.

The motion profile for the velocity consists of an acceleration, a deceleration and a maximum velocity. A linear ramp for both directions of movement is available.

The ramp slope determines the velocity changes of the motor per time unit. The ramp slope can be set for acceleration and deceleration.

Following parameters can be used to change the parameterization of motion profile for the velocity.

P0-15	Processing mode for operating mode Electronic Gear	Min.	1	Unit	Relatd Mode		
		Default	1	-	P	-	-
		Max.	3		DYC	-	-

Processing mode for operating mode Electronic Gear
1 / Position Synchronization Immediate: Position synchronization without compensation movement
2 / Position Synchronization Compensated: Position synchronization with compensation movement
3 / Velocity Synchronization: Velocity synchronization

Changed settings become active the next time the motor moves.

P4-00	Activation of the motion profile for velocity	Min.	0	Unit	Relatd Mode		
		Default	1	-	P	-	-
		Max.	1		DYC	-	-

Activation of the motion profile for velocity
0 / Profile Off: Profile off
1 / Profile On: Profile on

Setting can only be changed if power stage is disabled.
Changed settings become active immediately.

P4-03	Maximum velocity of the motion profile for velocity	Min.	1	Unit	Relatd Mode		
		Default	100	usr_v	P	-	-
		Max.	2147483647		DYC	-	-

Maximum velocity of the motion profile for velocity
If a greater reference velocity is set in one of these operating modes, it is automatically limited to value of this parameter.

Setting can only be changed if power stage is disabled.
Changed settings become active the next time the motor moves.

P4-04	Acceleration of the motion profile for velocity	Min.	1	Unit	Relatd Mode		
		Default	6000	usr_a	P	-	-
		Max.	2147483647		DYC	-	-

Acceleration of the motion profile for velocity
Writing the value 0 has no effect on the parameter.

Changed settings become active the next time the motor moves.

P4-05	Deceleration of the motion profile for velocity	Min.	1	Unit	Relatd Mode		
		Default	6000	usr_a	P	-	-
		Max.	2147483647		DYC	-	-

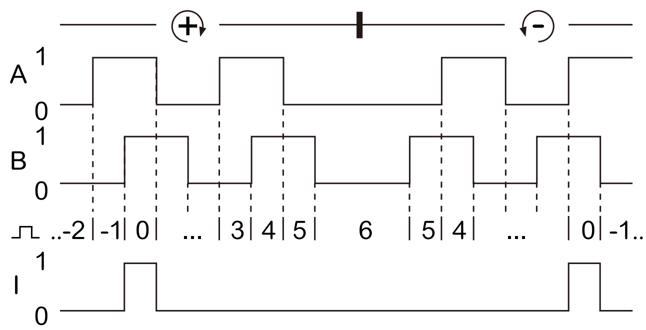
Deceleration of the motion profile for velocity
Writing the value 0 has no effect on the parameter.

Changed settings become active the next time the motor moves.

6.6.10 Encoder Simulation Output

The Easy Lexium 16 servo drives support encoder simulation output function.

The protocol of encoder simulation output is RS-422 of 3.3VDC voltage level with A/B signals. There will be one Index signal per each motor movement.



The resolution for the encoder simulation output is set with the parameter P0-18, the direction for the encoder simulation output is set with the parameter P0-19.

P0-18	Resolution of encoder simulation	Min.	0	Unit	Relatd Mode		
		Default	10000	EncInc	P	-	-
		Max.	65535		DYC	-	-

Resolution of encoder simulation
Resolution defines the number of increments per revolution (AB signal with quadruple evaluation). The index pulse is created once per revolution at an interval where signal A and signal B are high.

Setting can only be changed if power stage is disabled.
Changed settings become active the next time the product is powered on.

P0-19	Inversion of direction of encoder simulation	Min.	0	Unit	Relatd Mode		
		Default	0	-	P	-	-
		Max.	1		DYC	-	-

Set whether the analog encoder output direction is opposite to the rotation direction of motor
0 / Inversion Off: Analog encoder output direction is the same with the rotation direction of motor
1 / Inversion On: Analog encoder output direction is opposite to the rotation direction of motor

Setting can only be changed if power stage is disabled.
Changed settings become active the next time the product is powered on.

The electric characteristics of encoder simulation output is as following:

Logic level	Unit	As per RS-422(1)
Output frequency per signal	KHz	<= 500
Motor increments per second	Inc/s	<= 1.6×10^6
(1) Due to the input current of the optocoupler in the input circuit, a parallel connection of a driver output to several devices is not permitted.		

6.6.11 Pulse Clear

Pulse clear in Electronic Gear mode is used to clear the position deviation in position deviation counter to zero.

The pulse clear function in Electronic Gear mode is realized via "Halt" signal input. You must parameterize the signal input functions "Halt" with parameters P3-00 ... P3-05.

By factory default setting, the digital input IOfunc_DI5 with pin 23 on CN1 is set to "Halt". The "Halt" function can also be assigned to other digital inputs with parameters P3-00 ... P3-05.

P3-00 ~ P3-05	Function Input of DIx	Min.	1	Unit	Relatd Mode		
		Default	-	-	P	-	-
		Max.	141		DYC	-	-

Function Input of DIx

Function	Description	Code		Related Mode	
		NO	NC	P	DYC
Halt	Halt	4	104	√	√

Setting can only be changed if power stage is disabled.
Changed settings become active the next time the product is powered on.

Once the "Halt" function is activated, the servo drive will reset all position deviation in position deviation counter of the servo drive and the movement will be interrupted.

The movement can be interrupted with 2 different deceleration types. The parameter P5-14 lets you set the type of deceleration:

- Deceleration via deceleration ramp
  The deceleration ramp is set with the parameter P4-05 via the motion profile for the velocity
- Deceleration via torque ramp
  The torque ramp is set with the parameter P5-15.

P5-14	Halt option code	Min.	1	Unit	Relatd Mode		
		Default	1	-	P	-	-
		Max.	3		DYC	-	-

Halt option code
1 / Deceleration Ramp: Deceleration ramp
3 / Torque Ramp: Torque ramp
When P5-14 = 1 / Deceleration Ramp, the stop mode will be based on the deceleration curve set up through parameter P4-05
When P5-14 = 3 / Torque Ramp, the stop mode will be based on the deceleration torque set up through parameter P5-15

If a deceleration ramp is already active, the parameter cannot be written.

Changed settings become active immediately.

<table>
<tr><td rowspan="3">P4-05</td><td rowspan="3">Deceleration of the motion profile for velocity</td><td>Min.</td><td>1</td><td>Unit</td><td colspan="3">Relatd Mode</td></tr>
<tr><td>Default</td><td>6000</td><td rowspan="2">usr_a</td><td>P</td><td>-</td><td>-</td></tr>
<tr><td>Max.</td><td>2147483647</td><td>DYC</td><td>-</td><td>-</td></tr>
<tr><td colspan="8">Deceleration of the motion profile for velocity
Writing the value 0 has no effect on the parameter.

Changed settings become active the next time the motor moves.</td></tr>
</table>

<table>
<tr><td rowspan="3">P5-15</td><td rowspan="3">Current for Halt</td><td>Min.</td><td>1</td><td>Unit</td><td colspan="3">Relatd Mode</td></tr>
<tr><td>Default</td><td>1</td><td rowspan="2">0.01 Arms</td><td>P</td><td>-</td><td>-</td></tr>
<tr><td>Max.</td><td>46300</td><td>DYC</td><td>-</td><td>-</td></tr>
<tr><td colspan="8">Current for Halt
This value is only limited by the minimum/maximum value range (no limitation of this value by motor/power stage).
In the case of a Halt, the current limit is one of the following values (whichever is lowest):
- Value in this parameter
- Maximum current of the motor
- Maximum current of the drive

In increments of 0.01 Arms

Changed settings become active immediately.</td></tr>
</table>

6.7 Operating Mode Homing

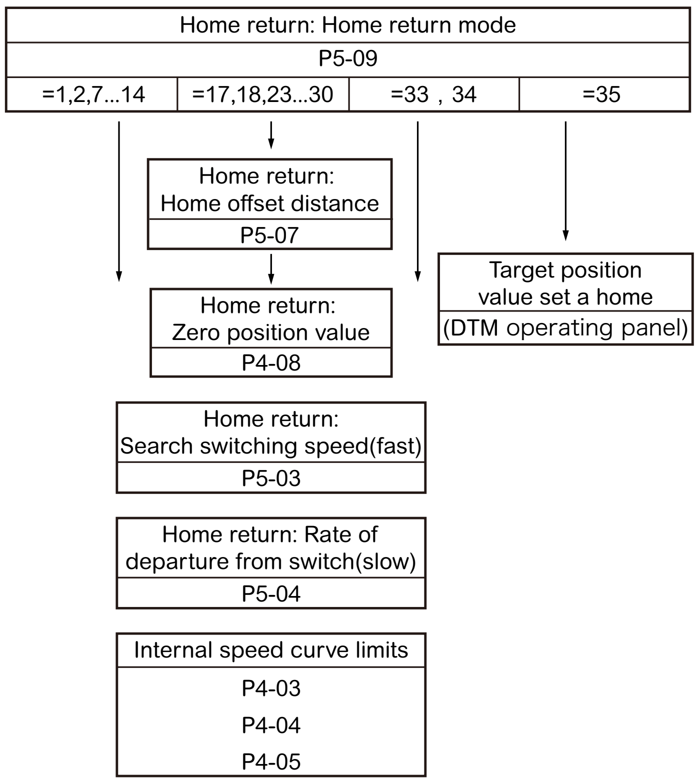
In the operating mode Homing, Easy Lexium 16 generates a reference between a mechanical position and the actual position of the motor.

A successful reference movement or position setting homes the motor and the zero point becomes valid, it could be indicated by means of a digital output. The zero point is the point of reference for absolute movements.

A reference movement must be terminated without interruption for the new zero point to be valid. If the reference movement is interrupted, it must be started again.

6.7.1 Overview

The reference movement is triggered via a digital input signal. Some reference methods requires an external switch signal as the reference signal, it could be the positive limit switch, negative limit switch or reference switch with respect to the reference method chose.



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6.7.2 Basic Parameterization

The limit switches and reference switches must be set to meet the requirements.
By factory default, the digital input IOfunc_DI2 with pin 20 on CN1 is set to "LIMP" the positive limit switch, while the digital input IOfunc_DI3 with pin 21 on CN1 is set to "LIMN" the negative limit switch.
The "LIMP" / "LIMN" function can also be assigned to other digital inputs via parameters P3-00 ... P3-05.
On the other hand, the "Ref" function can also be assigned to a digital output via the parameters P3-06 ... P3-08.

P3-00 ~ P3-05	Function Input of DIx	Min.	1	Unit	Relatd Mode		
		Default	-	-	P	-	-
		Max.	141		DYC	-	-

Function Input of DIx

Function	Description	Code		Related Mode	
		NO	NC	P	DYC
Reference Switch (REF)	Reference switch	21	121	√	√
Positive Limit Switch(LIMP)	Positive limit switch	22	122	√	√
Negative Limit Switch(LIMN)	Negative limit switch	23	123	√	√

Setting can only be changed if power stage is disabled.
Changed settings become active the next time the product is powered on.

1 Overview
2 Type Selection
3 Installation
4 Wiring
5 Front Panel
6 Operation
7 Commissioning
8 Diagnostics
9 Parameters

There are various Homing methods which can be selected via the parameter P5-09.
The Homing methods parameter is used to save the preferred method to the EEPROM (persistent).
When the preferred method has been set in this parameter, the method is performed during homing even after the device is powered off and on.

P5-09	Homing: Preferred homing method	Min.	1	Unit	Relatd Mode		
		Default	18	-	P	-	-
		Max.	35		DYC	-	-

Preferred homing method

Switch type	Step 1	Step 2	Step 3	Step 4	Value
Limit switch	Move to LIMN in negative direction at velocity P5-03	Move to switch point of the LIMN switch in positive direction at velocity P5-04	-	Move to index pulse outside of LIMN switch in positive direction at velocity P5-04	1
				Move to distance given in parameter P5-07 from switching point in positive direction at velocity P5-04	17
	Move to LIMP in positive direction at velocity P5-03	Move to switch point of the LIMP switch in negative direction at velocity P5-04	-	Move to index pulse outside of LIMP switch in negative direction at velocity P5-04	2
				Move to distance given in parameter P5-07 from switching point in negative direction at velocity P5-04	18
Reference switch	Move to REF in positive direction at velocity P5-03	Move to switch point of the REF switch in negative direction at velocity P5-04	-	Move to index pulse outside of REF switch in negative direction at velocity P5-04	7
				Move to distance given in parameter P5-07 from switching point in negative direction at velocity P5-04	23
			Move to REF in positive direction at velocity P5-04	Move to index pulse inside of REF switch in positive direction at velocity P5-04	8
				Move to distance given in parameter P5-07 from switching point in positive direction at velocity P5-04	24
		Move to switch point of the REF switch in positive direction at velocity P5-04	Move to REF in negative direction at velocity P5-04	Move to index pulse inside of REF switch in negative direction at velocity P5-04	9
				Move to distance given in parameter P5-07 from switching point in negative direction at velocity P5-04	25
			-	Move to index pulse outside of REF switch in positive direction at velocity P5-04	10
				Move to distance given in parameter P5-07 from switching point in positive direction at velocity P5-04	26

Changed settings become active the next time the motor moves.

P5-09	Homing: Preferred homing method (Continue)	Min.	1	Unit	Relatd Mode		
		Default	18	-	P	-	-
		Max.	35		DYC	-	-

Switch type	Step 1	Step 2	Step 3	Step 4	Value
Reference switch	Move to REF in negative direction at velocity P5-03	Move to switch point of the REF switch in positive direction at velocity P5-04	-	Move to index pulse outside of REF switch in positive direction at velocity P5-04	11
				Move to distance given in parameter P5-07 from switching point in positive direction at velocity P5-04	27
			Move to REF in negative direction at velocity P5-04	Move to index pulse inside of REF switch in negative direction at velocity P5-04	12
				Move to distance given in parameter P5-07 from switching point in negative direction at velocity P5-04	28
		Move to switch point of the REF switch in negative direction at velocity P5-04	Move to REF in positive direction at velocity P5-04	Move to index pulse inside of REF switch in positive direction at velocity P5-04	13
				Move to distance given in parameter P5-07 from switching point in positive direction at velocity P5-04	29
			-	Move to index pulse outside of REF switch in negative direction at velocity P5-04	14
				Move to distance given in parameter P5-07 from switching point in negative direction at velocity P5-04	30
Index pulse	Move to index pulse in negative direction at velocity P5-04	-	-	-	33
	Move to index pulse in positive direction at velocity P5-04	-	-	-	34
	Position setting	-	-	-	35

Changed settings become active the next time the motor moves.

The parameters P5-03 and P5-04 are used to set the velocities for searching the switch and for moving away from the switch.

P5-03	Homing: Target velocity for searching the switch (fast)	Min.	1	Unit	Relatd Mode		
		Default	60	usr_v	P	-	-
		Max.	2147483647		DYC	-	-

Target velocity for searching the switch (fast)
The available value is internally limited to the parameter setting in P4-03

Changed settings become active immediately.

P5-04	Homing: Target velocity for moving away from switch (slow)	Min.	1	Unit	Relatd Mode		
		Default	60	usr_v	P	-	-
		Max.	2147483647		DYC	-	-

Target velocity for moving away from switch (slow)
The available value is internally limited to the parameter setting in P4-03

Changed settings become active immediately.

A distance to the switching point of the limit switch or the reference switch must be parameterized for a reference movement without index pulse. The parameter P5-07 lets you set the distance to the switching limit switch or the reference switch.

P5-07	Homing: Distance from switching point	Min.	1	Unit	Relatd Mode		
		Default	200	usr_p	P	-	-
		Max.	2147483647		DYC	-	-

Distance from switching point
The distance from the switching point is defined as the reference point.
The parameter is only effective during a reference movement without index pulse.

Changed settings become active the next time the motor moves.

The parameter P5-08 is used to specify a desired position value, which is set at the reference point after a successful reference movement. The desired position value at the reference point defines the zero point.
If the value 0 is used, the zero point corresponds to the reference point.

P5-08	Homing: Position at reference point	Min.	-2147483648	Unit	Relatd Mode		
		Default	0	usr_p	P	-	-
		Max.	2147483647		DYC	-	-

Position at reference point
After a successful reference movement, this position is automatically set at the reference point.

Changed settings become active the next time the motor moves.

6.7.3 Parameterization of Monitoring Functions

The parameters P5-05 and P5-06 allow you to activate monitoring of the limit switches and the reference switch.

P5-05	Homing: Maximum search distance after overtravel of switch	Min.	0	Unit	Relatd Mode		
		Default	0	usr_p	P	-	-
		Max.	2147483647		DYC	-	-

Maximum search distance after overtravel of switch
0: Search distance monitoring disabled
>0: Search distance
The switch must be activated again within this search distance, otherwise the reference movement is canceled.

Changed settings become active the next time the motor moves.

P5-06	Homing: Maximum distance for search for switching point	Min.	0	Unit	Relatd Mode		
		Default	0	usr_p	P	-	-
		Max.	2147483647		DYC	-	-

Maximum distance for search for switching point
0: Monitoring of distance inactive
>0: Maximum distance
After detection of the switch, the drive starts to search for the defined switching point. If the defined switching point is not found within the distance defined here, the reference movement is canceled and an error is detected.

Changed settings become active the next time the motor moves.

6.7.4 Parameterization of Trigger of Reference Movement

Reference movement is triggered via a digital input signal.

The user could assign "ORGP" function to a digital input via parameter P3-00 ... P3-05 to trigger the reference movement.
In addition, the user could also assign "Valid REference" function to a digital output via parameter P3-06 ... P3-08 to indicate a successful reference movement.

P3-00 ~ P3-05	Function Input of DIx	Min.	1	Unit	Relatd Mode		
		Default	-	-	P	-	-
		Max.	141		DYC	-	-

Function Input of DIx

Function	Description	Code		Related Mode	
		NO	NC	P	DYC
ORGP	Start homing movement	42	142	√	√

Setting can only be changed if power stage is disabled.
Changed settings become active the next time the product is powered on.

P3-06 ~ P3-08	Function Output of DQx	Min.	1	Unit	Relatd Mode		
		Default	-	-	P	-	-
		Max.	125		DYC	-	-

Function Output of DQx

Function	Description	Code		Related Mode	
		NO	NC	P	DYC
Valid Reference (ref_ ok)	Zero point is valid (ref_ok)	15	115	√	√

Setting can only be changed if power stage is disabled.
Changed settings become active the next time the product is powered on.

6.7.5 Reference Movement to a Limit Switch

Follwoing reference movement method to a limit switch can be select via parameter P5-09:

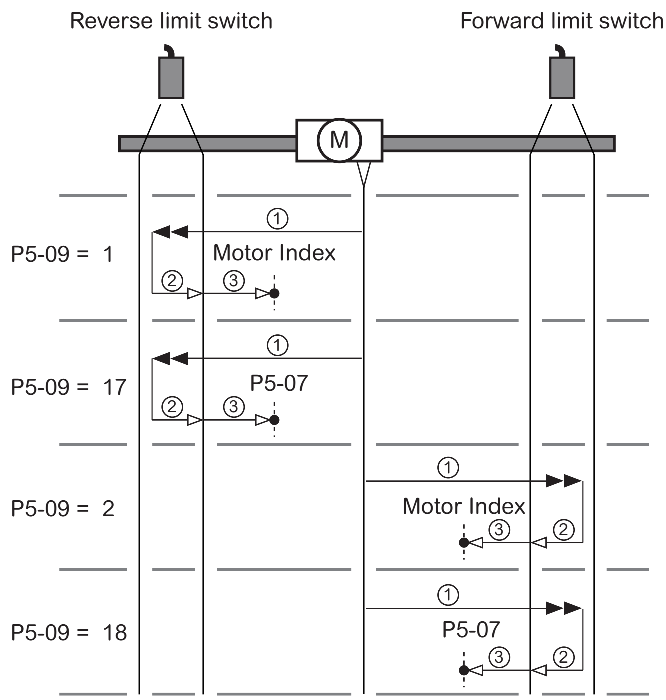
P5-09	Homing: Preferred homing method	Min.	1	Unit	Relatd Mode		
		Default	18	-	P	-	-
		Max.	35		DYC	-	-

Preferred homing method

Switch type	Step 1	Step 2	Step 3	Step 4	Value
Limit switch	Move to LIMN in negative direction at velocity P5-03	Move to switch point of the LIMN switch in positive direction at velocity P5-04	-	Move to index pulse outside of LIMN switch in positive direction at velocity P5-04	1
				Move to distance given in parameter P5-07 from switching point in positive direction at velocity P5-04	17
	Move to LIMP in positive direction at velocity P5-03	Move to switch point of the LIMP switch in negative direction at velocity P5-04	-	Move to index pulse outside of LIMP switch in negative direction at velocity P5-04	2
				Move to distance given in parameter P5-07 from switching point in negative direction at velocity P5-04	18

Changed settings become active the next time the motor moves.

The illustration below shows a reference movement to a limit switch:



Speed = P5-03

Speed = P5-04

1 Search for limit switch signal with speed P5-03
2 Search for switch signal switching pointwith speed P5-04
3 Search for motorwith speed P5-04 Index Signal or movement P5-07 The set offset distance

6.7.6 Reference Movement to a Reference Switch in Positive Direction

Follwoing reference movement method to a reference switch in positive direction can be select via parameter P5-09:

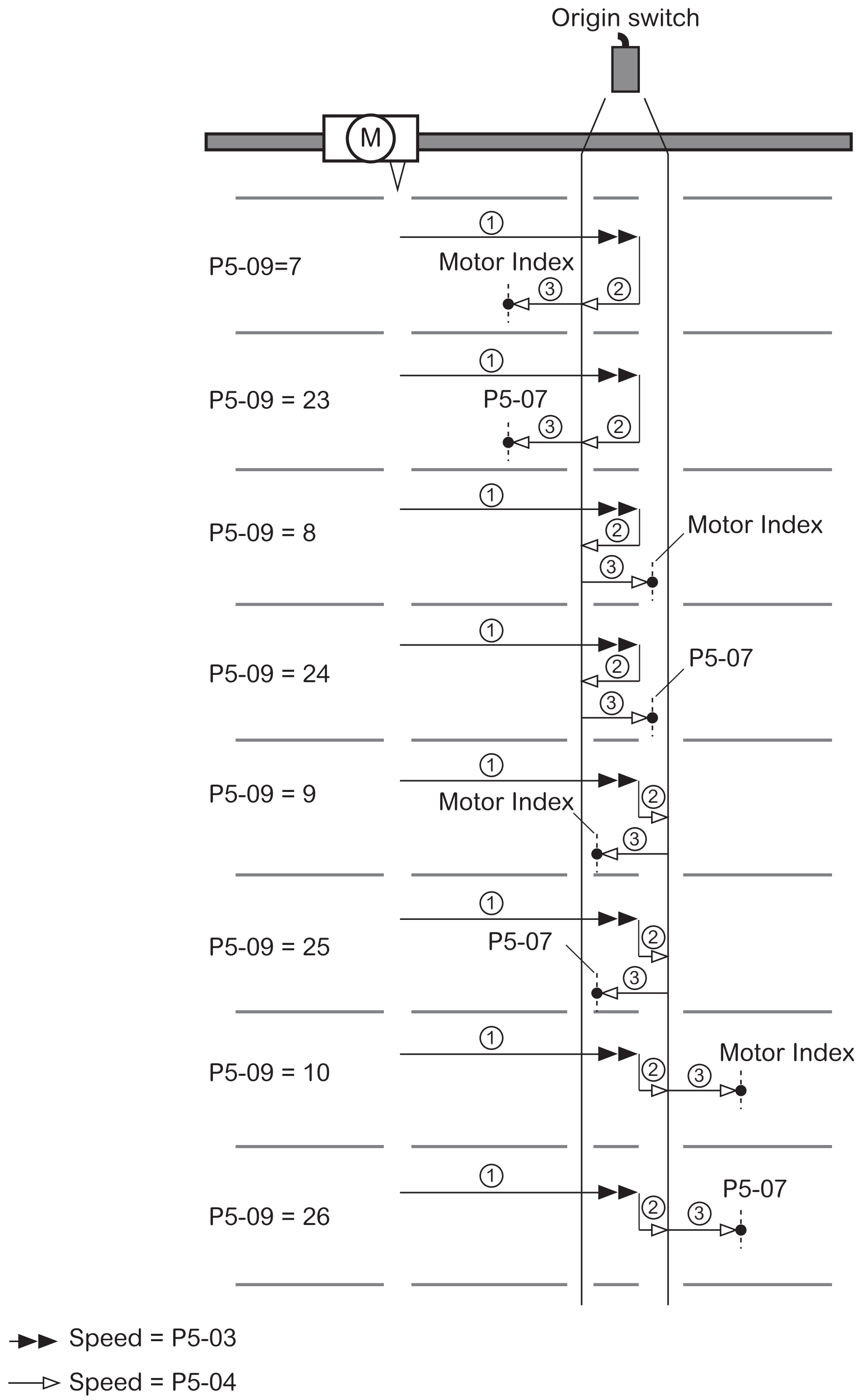
<table>
<tr><td rowspan="3">P5-09</td><td rowspan="3">Homing: Preferred homing method</td><td>Min.</td><td>1</td><td>Unit</td><td colspan="3">Relatd Mode</td></tr>
<tr><td>Default</td><td>18</td><td rowspan="2">-</td><td>P</td><td>-</td><td>-</td></tr>
<tr><td>Max.</td><td>35</td><td>DYC</td><td>-</td><td>-</td></tr>
</table>

Preferred homing method

<table>
<tr><th>Switch type</th><th>Step 1</th><th>Step 2</th><th>Step 3</th><th>Step 4</th><th>Value</th></tr>
<tr><td rowspan="8">Reference switch</td><td rowspan="8">Move to REF in positive direction at velocity P5-03</td><td rowspan="4">Move to switch point of the REF switch in negative direction at velocity P5-04</td><td rowspan="2">-</td><td>Move to index pulse outside of REF switch in negative direction at velocity P5-04</td><td>7</td></tr>
<tr><td>Move to distance given in parameter P5-07 from switching point in negative direction at velocity P5-04</td><td>23</td></tr>
<tr><td rowspan="2">Move to REF in positive direction at velocity P5-04</td><td>Move to index pulse inside of REF switch in positive direction at velocity P5-04</td><td>8</td></tr>
<tr><td>Move to distance given in parameter P5-07 from switching point in positive direction at velocity P5-04</td><td>24</td></tr>
<tr><td rowspan="4">Move to switch point of the REF switch in positive direction at velocity P5-04</td><td rowspan="2">Move to REF in negative direction at velocity P5-04</td><td>Move to index pulse inside of REF switch in negative direction at velocity P5-04</td><td>9</td></tr>
<tr><td>Move to distance given in parameter P5-07 from switching point in negative direction at velocity P5-04</td><td>25</td></tr>
<tr><td rowspan="2">-</td><td>Move to index pulse outside of REF switch in positive direction at velocity P5-04</td><td>10</td></tr>
<tr><td>Move to distance given in parameter P5-07 from switching point in positive direction at velocity P5-04</td><td>26</td></tr>
</table>

Changed settings become active the next time the motor moves.

The illustration below shows a reference movement to a reference switch in positive direciton:



1 Search for limit switch signal with speed P5-03
2 Search for switch signal switching pointwith speed P5-04
3 Search for motorwith speed P5-04 Index Signal or movement P5-07 The set offset distance

6.7.7 Reference Movement to a Reference Switch in Negative Direction

Follwoing reference movement method to a reference switch in negative direction can be select via parameter P5-09:

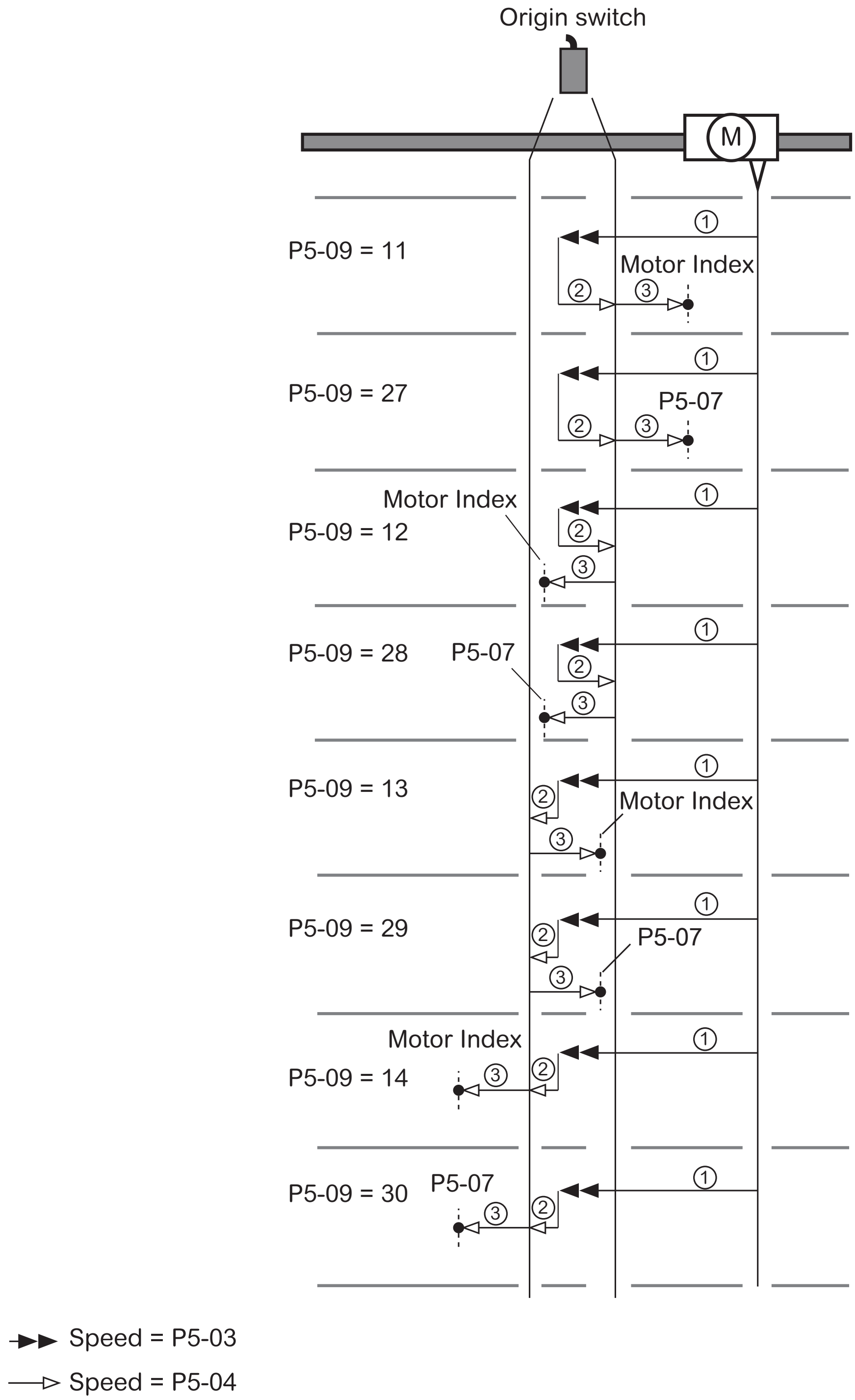
<table>
<tr><td rowspan="3">P5-09</td><td rowspan="3">Homing: Preferred homing method</td><td>Min.</td><td>1</td><td>Unit</td><td colspan="3">Relatd Mode</td></tr>
<tr><td>Default</td><td>18</td><td rowspan="2">-</td><td>P</td><td>-</td><td>-</td></tr>
<tr><td>Max.</td><td>35</td><td>DYC</td><td>-</td><td>-</td></tr>
</table>

Preferred homing method

<table>
<tr><th>Switch type</th><th>Step 1</th><th>Step 2</th><th>Step 3</th><th>Step 4</th><th>Value</th></tr>
<tr><td rowspan="8">Reference switch</td><td rowspan="8">Move to REF in negative direction at velocity P5-03</td><td rowspan="4">Move to switch point of the REF switch in positive direction at velocity P5-04</td><td rowspan="2">-</td><td>Move to index pulse outside of REF switch in positive direction at velocity P5-04</td><td>11</td></tr>
<tr><td>Move to distance given in parameter P5-07 from switching point in positive direction at velocity P5-04</td><td>27</td></tr>
<tr><td rowspan="2">Move to REF in negative direction at velocity P5-04</td><td>Move to index pulse inside of REF switch in negative direction at velocity P5-04</td><td>12</td></tr>
<tr><td>Move to distance given in parameter P5-07 from switching point in negative direction at velocity P5-04</td><td>28</td></tr>
<tr><td rowspan="4">Move to switch point of the REF switch in negative direction at velocity P5-04</td><td rowspan="2">Move to REF in positive direction at velocity P5-04</td><td>Move to index pulse inside of REF switch in positive direction at velocity P5-04</td><td>13</td></tr>
<tr><td>Move to distance given in parameter P5-07 from switching point in positive direction at velocity P5-04</td><td>29</td></tr>
<tr><td rowspan="2">-</td><td>Move to index pulse outside of REF switch in negative direction at velocity P5-04</td><td>14</td></tr>
<tr><td>Move to distance given in parameter P5-07 from switching point in negative direction at velocity P5-04</td><td>30</td></tr>
</table>

Changed settings become active the next time the motor moves.

The illustration below shows a reference movement to a reference switch in negative direciton:



1 Search for limit switch signal with speed P5-03
2 Search for switch signal switching pointwith speed P5-04
3 Search for motorwith speed P5-04 Index Signal or movement P5-07 The set offset distance

6.7.8 Reference Movement to Motor Index

Follwoing reference movement method to motor index can be select via parameter P5-09:

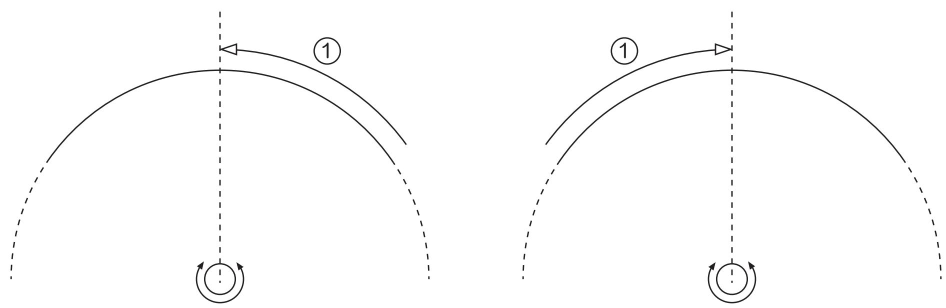
<table>
<tr><td rowspan="3">P5-09</td><td rowspan="3">Homing: Preferred homing method</td><td>Min.</td><td>1</td><td>Unit</td><td colspan="3">Relatd Mode</td></tr>
<tr><td>Default</td><td>18</td><td rowspan="2">-</td><td>P</td><td>-</td><td>-</td></tr>
<tr><td>Max.</td><td>35</td><td>DYC</td><td>-</td><td>-</td></tr>
</table>

Preferred homing method

Switch type	Step 1	Step 2	Step 3	Step 4	Value
Index pulse	Move to index pulse in negative direction at velocity P5-04	-	-	-	33
	Move to index pulse in positive direction at velocity P5-04	-	-	-	34

Changed settings become active the next time the motor moves.

The illustration below shows a reference movement to motor index:



P5-09 = 33

P5-09 = 34

1 Search for motor with speed P5-04 Index Signal

6.7.9 Position Setting

Position setting function can be select via parameter P5-09

By means of position setting, the actual position of the motor is set to zero. This also defines the zero point.

Position setting is only possible when the motor is at a standstill. Any active position deviation remains active and can still be compensated for by the position controller after position setting.

P5-09	Homing: Preferred homing method	Min.	1	Unit	Relatd Mode		
		Default	18	-	P	-	-
		Max.	35		DYC	-	-

Preferred homing method

Switch type	Step 1	Step 2	Step 3	Step 4	Value
	Position setting	-	-	-	35

Changed settings become active the next time the motor moves.

6.7.10 Software Limit Switches

Movements can be monitored using software limit switches. A positive position limit and a negative position limit can be set for monitoring.

If the positive or negative position limit switch are reached, the movement stops. An error message is generated and the operating state switches to "7 Quick Stop Active".

The error message can be reset by means of a “Fault Reset”. The operating state switches back to "6 Operation Enabled".

The movement can continue, however, only in the opposite direction of the position limit. For example, if the positive position limit was reached, further movement is only possible in negative direction. In the case of further movement in positive direction, a new error message is generated and the operating state switches back to "7 Quick Stop Active".

Software limit switch monitoring only works with a valid zero point

Following parameters shall be parameterized where software limit switches function is used:
- The software limit switches are activated via the parameter P6-11
- Use the parameter P6-12 to set the behavior for reaching a position limit.
- Standstill at the position limit in operating modes without target position requires the parameter P5-16 to be set to "6 / Deceleration ramp (Quick Stop)",
- The software limit switches position are set via the parameters P6-13 and P6-14.

<table>
<tr><td rowspan="3">P5-16</td><td rowspan="3">Quick Stop option code</td><td>Min.</td><td>-2</td><td>Unit</td><td colspan="3">Relatd Mode</td></tr>
<tr><td>Default</td><td>6</td><td rowspan="2">-</td><td>P</td><td>-</td><td>-</td></tr>
<tr><td>Max.</td><td>7</td><td>DYC</td><td>-</td><td>-</td></tr>
<tr><td colspan="8">Choose the stop mode when quick stop is activated
-2 / Torque Ramp (Fault): Use torque ramp and transit to operating state 9 Fault
-1 / Deceleration Ramp (Fault): Use deceleration ramp and transit to operating state 9 Fault
6 / Deceleration Ramp (Quick Stop): Use deceleration ramp and remain in operating state 7 Quick Stop 7 / Torque Ramp (Quick Stop): Use torque ramp and remain in operating state 7 Quick Stop
When P5-16 = -1 / Deceleration Ramp (Fault) or 6 / Deceleration Ramp (Quick Stop), the motion will be stopped based on the deceleration curve set by parameter P5-17
When P5-16 = -2 / Torque Ramp (Fault) and 7 or Torque Ramp (Quick Stop), the motion will be stopped based on the deceleration torque set by parameter P5-18

If a deceleration ramp is already active, the parameter cannot be written.

Changed settings become active immediately.</td></tr>
</table>

<table>
<tr><td rowspan="3">P6-11</td><td rowspan="3">Activation of software limit switches</td><td>Min.</td><td>0</td><td>Unit</td><td colspan="3">Related Mode</td></tr>
<tr><td>Default</td><td>0</td><td rowspan="2">-</td><td>P</td><td>-</td><td>-</td></tr>
<tr><td>Max.</td><td>3</td><td>DYC</td><td>-</td><td>-</td></tr>
<tr><td colspan="8">Activation of software limit switches
0 / None: Deactivated
1 / SWLIMP: Activation of software limit switches positive direction
2 / SWLIMN: Activation of software limit switches negative direction
3 / SWLIMP + SWLIMN: Activation of software limit switches both directions
Software limit switches can only be activated if the zero point is valid.

Changed settings become active immediately.</td></tr>
</table>

<table>
<tr><td rowspan="3">P6-12</td><td rowspan="3">Behavior when position limit is reached</td><td>Min.</td><td>0</td><td>Unit</td><td colspan="3">Related Mode</td></tr>
<tr><td>Default</td><td>0</td><td rowspan="2">-</td><td>P</td><td>-</td><td>-</td></tr>
<tr><td>Max.</td><td>1</td><td>DYC</td><td>-</td><td>-</td></tr>
<tr><td colspan="8">Behavior when position limit is reached
0 / Standstill Behind Position Limit: Quick Stop is triggered at position limit and standstill is reached behind position limit
1 / Standstill At Position Limit: Quick Stop is triggered in front of position limit and standstill is reached at position limit

Changed settings become active immediately.</td></tr>
</table>

<table>
<tr><td rowspan="3">P6-13</td><td rowspan="3">Positive position limit for software limit switch</td><td>Min.</td><td>-2147483648</td><td>Unit</td><td colspan="3">Related Mode</td></tr>
<tr><td>Default</td><td>2147483647</td><td rowspan="2">-</td><td>P</td><td>-</td><td>-</td></tr>
<tr><td>Max.</td><td>2147483647</td><td>DYC</td><td>-</td><td>-</td></tr>
<tr><td colspan="8">Positive position limit for software limit switch
If a user-defined value entered is outside of the permissible range, the limit switch limits are automatically set to the maximum permissible value.

Setting can only be changed if power stage is disabled.
Changed settings become active the next time the power stage is enabled.</td></tr>
</table>

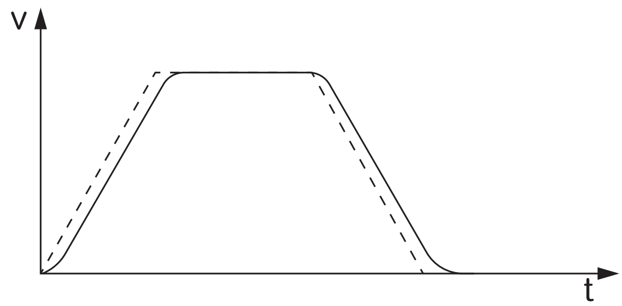
<table>
<tr><td rowspan="3">P6-14</td><td rowspan="3">Negative position limit for software limit switch</td><td>Min.</td><td>-2147483648</td><td>Unit</td><td colspan="3">Related Mode</td></tr>
<tr><td>Default</td><td>2147483647</td><td rowspan="2">-</td><td>P</td><td>-</td><td>-</td></tr>
<tr><td>Max.</td><td>2147483647</td><td>DYC</td><td>-</td><td>-</td></tr>
<tr><td colspan="8">Negative position limit for software limit switch
If a user-defined value entered is outside of the permissible range, the limit switch limits are automatically set to the maximum permissible value.

Setting can only be changed if power stage is disabled.
Changed settings become active the next time the power stage is enabled.</td></tr>
</table>

6.8 Auxiliary Functions for Operation

6.8.1 Jerk Limitation

Jerk limitation smoothes sudden acceleration changes to allow for smooth transitions with almost no jerking.



Jerk limitation is available in the following operating modes:

- Jog
- Electronic Gear (position synchronizaiton)
- Homing
- DYC

Jerk limitation is activated for the operating mode Electronic Gear (position sychronization) by means of the parameter P1-23.
Jerk limitation is set via the parameter P1-24.

P1-23	Activation of jerk limitation	Min.	0	Unit	Relatd Mode		
		Default	0	-	P	-	-
		Max.	1		DYC	-	-

Activation of jerk limitation
0 / Off: Jerk limitation deactivated
1 / PosSyncOn: Jerk limitation active

The time for jerk limitation must be set via parameter P1-24.

Setting can only be changed if power stage is disabled.
Changed settings become active the next time the power stage is enabled.

P1-24	Jerk limitation of the motion profile for velocity	Min.	0	Unit	Relatd Mode		
		Default	0	-	P	-	-
		Max.	1		DYC	-	-

Jerk limitation of the motion profile for velocity
0 / Off: Off
1 / 1: 1 ms
4 / 4: 4 ms
8 / 8: 8 ms
16 / 16: 16 ms
32 / 32: 32 ms
64 / 64: 64 ms
128 / 128: 128 ms

Changed settings become active the next time the motor moves.

6.8.2 Stop Movement with Halt

With a Halt, the ongoing movement is interrupted and it can be resumed.

In Easy Lexium 16 servo drive a Halt can be triggered via a digital signal input or a command sent from commissioning software.

By factory default, the digital input IOfunc_DI5 with pin number 23 on CN1 is assigned as "Halt" function. The "Halt" function can also be assigned to other digital inputs via parameters P3-00 ... P3-05.

P3-00 ~ P3-05	Function Input of DIx	Min.	1	Unit	Relatd Mode		
		Default	-	-	P	-	-
		Max.	141		DYC	-	-

Function Input of DIx

Function	Description	Code		Related Mode	
		NO	NC	P	DYC
Halt	Halt	4	104	√	√

Setting can only be changed if power stage is disabled.
Changed settings become active the next time the product is powered on.

The movement can be interrupted with 2 different deceleration types. The parameter P5-14 lets you select the type of deceleration:

- Deceleration via deceleration ramp, the deceleratoin ramp is set with the parameter P4-05
- Deceleration via torque ramp, the torque ramp is set with the parameter P5-15

P4-05	Deceleration of the motion profile for velocity	Min.	1	Unit	Relatd Mode		
		Default	6000	usr_a	P	-	-
		Max.	2147483647		DYC	-	-

Deceleration of the motion profile for velocity
Writing the value 0 has no effect on the parameter.

Changed settings become active the next time the motor moves.

P5-14	Halt option code	Min.	1	Unit	Relatd Mode		
		Default	1	-	P	-	-
		Max.	3		DYC	-	-

Halt option code
1 / Deceleration Ramp: Deceleration ramp
3 / Torque Ramp: Torque ramp
When P5-14 = 1 / Deceleration Ramp, the stop mode will be based on the deceleration curve set up through parameter P4-05
When P5-14 = 3 / Torque Ramp, the stop mode will be based on the deceleration torque set up through parameter P5-15

If a deceleration ramp is already active, the parameter cannot be written.

Changed settings become active immediately.

P5-15	Current for Halt	Min.	1	Unit	Relatd Mode		
		Default	1	0.01 Arms	P	-	-
		Max.	46300		DYC	-	-

Current for Halt
This value is only limited by the minimum/maximum value range (no limitation of this value by motor/power stage).
In the case of a Halt, the current limit is one of the following values (whichever is lowest):
- Value in this parameter
- Maximum current of the motor
- Maximum current of the drive

In increments of 0.01 Arms

Changed settings become active immediately.

6.8.3 Stop Movement with Quick Stop

With a Quick Stop, the ongoing movement is stopped and it cannot be resumed.

In Easy Lexium 16 servo drive a Quick Stop can be triggered by a detected error of error classes 1 or 2 or a command sent from commissioning software.

The movement can be stopped with 2 different deceleration types. The parameter P5-16 lets you select the type of deceleration:

- Deceleration via deceleration ramp,the deceleration ramp is set with the parameter P5-17
- Deceleration via torque ramp, the torque ramp is set with the parameter P5-18

In addition, you can set the operating state to switch to after the deceleration.

- Transition to operating state "9 Fault"
- Transition to operating state "7 Quick Stop Active"

P5-16	Quick Stop option code	Min.	-2	Unit	Relatd Mode		
		Default	6	-	P	-	-
		Max.	7		DYC	-	-

Choose the stop mode when quick stop is activated
-2 / Torque Ramp (Fault): Use torque ramp and transit to operating state 9 Fault
-1 / Deceleration Ramp (Fault): Use deceleration ramp and transit to operating state 9 Fault
6 / Deceleration Ramp (Quick Stop): Use deceleration ramp and remain in operating state 7 Quick Stop 7 / Torque Ramp (Quick Stop): Use torque ramp and remain in operating state 7 Quick Stop
When P5-16 = -1 / Deceleration Ramp (Fault) or 6 / Deceleration Ramp (Quick Stop), the motion will be stopped based on the deceleration curve set by parameter P5-17
When P5-16 = -2 / Torque Ramp (Fault) and 7 or Torque Ramp (Quick Stop), the motion will be stopped based on the deceleration torque set by parameter P5-18

If a deceleration ramp is already active, the parameter cannot be written.

Changed settings become active immediately.

P5-17	Deceleration ramp for Quick Stop	Min.	1	Unit	Relatd Mode		
		Default	6000	usr_a	P	-	-
		Max.	2147483647		DYC	-	-

Deceleration ramp for Quick Stop
Deceleration ramp for a software stop or an error with error class 1 or 2.

Changed settings become active the next time the motor moves.

P5-18	Current for Quick Stop	Min.	1	Unit	Relatd Mode		
		Default	1	0.01 Arms	P	-	-
		Max.	46300		DYC	-	-

Current value for Quick Stop
In the case of a Quick Stop, the current limit is one of the following values (whichever is lowest):
- Value in this parameter
- Maximum current of the motor
- Maximum current of the drive

Further current limitations caused by I2t monitoring are also taken into account during a Quick Stop

In increments of 0.01 Arms

Changed settings become active immediately.

6.8.4 Motor Stopping Modes for Servo Off and Faults

The user can choose motor stopping modes for servo off and faults of error class 2, 3 and 4, as well as the status after motor stops via parameter P5-19.

The available stopping modes and status after motor stops including dynamic brake (DB) and free coasting.

Note:
- Do not start / stop the motor by turning on / off the Servo-On signal (Enable), otherwise it may damage the dynamic brake (DB) circuit of the drive.
- Dynamic brake (DB) function is designed for emergency stop only. When dynamic brake (DB) is actived during high speed motor running, mechnical impact and acoustic noise will be expected.
- Do not apply the dynamic brake (DB) function too frequently. Keep at least 10 minutes of time interval if dynamic brake (DB) is actived during high speed motor running.
- The servo motor becomes a generator when it is driven by external force and short-circuit current will pass through the equipment and servo motor when dynamic brake function is activated. If the servo motor is continuously driven by external forces, the equipment may cause smoking or fire.

⚠ WARNING

FIRE DUE TO EXTERNAL DRIVING FORCES ACTING ON MOTOR
- Verify that no external forces can act on the motor in the case of main power supply to the servo drive is switched off.
- Verify that no external forces can act on the motor if motor stays in dynamic brake (DB) status after stops.

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

P5-19	Motor Stopping modes for Servo Off and Faults	Min.	0	Unit	Relatd Mode		
		Default	0	-	P	-	-
		Max.	22		DYC	-	-

Motor stopping modes for servo off and faults

Digital	Function	Value	Stopping mode	Status after Motor Stops
L XXXX[ ]	Stopping methods for faults of error class 2, 3 and 4	0	Free coasting	Free coasting
		1	Dynamic brake (DB)	Dynamic brake (DB)
		2	Dynamic brake (DB)	Free coasting
L XXX[ ]X	Stopping methods for servo off	0	Free coasting	Free coasting
		1	Dynamic brake (DB)	Dynamic brake (DB)
		2	Dynamic brake (DB)	Free coasting

Example:
When P5-19 = 0021:
- In case a fault of error class 2, 3 and 4 happens, the motor will start deceleration in stopping mode of dynamic brake (DB). After motor stops it will stay in dynamic brake (DB) status.
- If servo off happens when motor is running, the motor will start deceleration in stopping mode of dynamic brake (DB). After motor stops it will stay in free coasting status.

Changed settings become active immediately.

6.8.5 Limitation of the Velocity via Signal Input

The velocity can be limited to a specific value via a digital signal input. The parameter P3-18 lets you set the velocity limitation.

The user could assign "Velocity Limitation" function to a digital input via parameter P3-00 ... P3-05 to trigger the velocity limitation.

P3-00 ~ P3-05	Function Input of DIx	Min.	1	Unit	Relatd Mode		
		Default	-	-	P	-	-
		Max.	141		DYC	-	-

Function Input of DIx

Function	Description	Code		Related Mode	
		NO	NC	P	DYC
Velocity Limitation	Limits the velocity to parameter value	8	108	√	√

Setting can only be changed if power stage is disabled.
Changed settings become active the next time the product is powered on.

P3-18	Velocity limitation via input	Min.	0	Unit	Relatd Mode		
		Default	10	usr_v	P	-	-
		Max.	2147483647		DYC	-	-

Velocity limitation via input
A velocity limitation can be activated via a digital input.

Changed settings become active the next time the product is powered on.

6.8.6 Limitation of the Current via Signal Input

The current can be limited to a specific value via a digital signal input. The parameter P3-19 lets you set the current limitation.

The user could assign "Current Limitation" function to a digital input via parameter P3-00 ... P3-05 to trigger the current limitation.

P3-00 ~ P3-05	Function Input of DIx	Min.	1	Unit	Relatd Mode		
		Default	-	-	P	-	-
		Max.	141		DYC	-	-

Function Input of DIx

Function	Description	Code		Related Mode	
		NO	NC	P	DYC
Current Limitation	Limits the current to parameter value	6	106	√	√

Setting can only be changed if power stage is disabled.
Changed settings become active the next time the product is powered on.

P3-19	Current limitation via input	Min.	0	Unit	Relatd Mode		
		Default	20	0.01 Arms	P	-	-
		Max.	30000		DYC	-	-

Current limitation via input
A current limit can be activated via a digital input.

In increments of 0.01 Arms

Changed settings become active the next time the product is powered on.

6.8.7 Zero Clamp

The motor can be stopped via a digital signal input. The velocity of the motor must be below a parameterizable velocity value. The parameter P4-06 lets you set the velocity value.

The signal input function “Zero Clamp” is available in the Electronic Gear (velocity sychronization) operating mode.

In order to stop the motor via a digital signal input, you must first assign “Zero Clamp” function to a digital input via parameter P3-00 ... P3-05.

P3-00 ~ P3-05	Function Input of DIx	Min.	1	Unit	Relatd Mode		
		Default		-	P	-	-
		Max.	141		DYC	-	-

Function Input of DIx

Function	Description	Code		Related Mode	
		NO	NC	P	DYC
Zero Clamp	Zero clamping	7	107	√	√

Setting can only be changed if power stage is disabled.
Changed settings become active the next time the product is powered on.

P4-06	Velocity limit for Zero Clamp	Min.	0	Unit	Relatd Mode		
		Default	10	usr_v	P	-	-
		Max.	2147483647		DYC	-	-

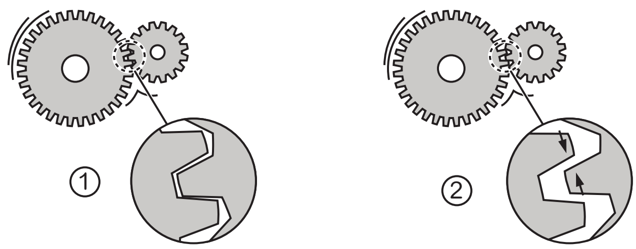
Velocity limit for Zero Clamp
The zero speed lock feature is applicable only when the given speed is lower than the low speed threshold of zero speed lock

Changed settings become active immediately.

6.8.8 Backlash Compensation

By setting backlash compensation, you can compensate for mechanical backlash.

Example of mechanical backlash:



1 Narrow reverse backlash

2 Wide reverse backlash

When backlash compensation is activated, the drive automatically compensates for the mechanical backlash during each movement.

Backlash compensation is possible in the following operating modes:
- Jog
- Electronic Gear
- Homing
- DYC

Before you can activate backlash compensation, there must be a movement in positive or negative direction. Backlash compensation is activated with the parameter P5-22.

In order to compensate the backlash, follwoing parameters must be set:
- The parameter P5-23 lets you set the amount of backlash in user-defined units.
- The parameter P5-24 lets you set the processing time in ms.

P5-22	Processing mode of backlash compensation	Min.	0	Unit	Relatd Mode		
		Default	0	-	P	-	-
		Max.	3		DYC	-	-

Processing mode of backlash compensation
0 / Off: Backlash compensation is off
1 / OnAfterPositiveMovement: Backlash compensation is on, last movement was in positive direction
2 / OnAfterNegativeMovement: Backlash compensation is on, last movement was in negative direction
3 / OnAfterBothMovement: Backlash compensation is on, last movement was in both positive and negative direction

Changed settings become active immediately.

P5-23	Position value for backlash compensation	Min.	0	Unit	Relatd Mode		
		Default	0	usr_p	P	-	-
		Max.	2147483647		DYC	-	-

Position value for backlash compensation

Setting can only be changed if power stage is disabled.
Changed settings become active the next time the power stage is enabled.

P5-24	Processing time for backlash compensation	Min.	0	Unit	Relatd Mode		
		Default	0	ms	P	-	-
		Max.	16383		DYC	-	-

Processing time for backlash compensation
0: Immediate backlash compensation
>0: Processing time for backlash compensation

Setting can only be changed if power stage is disabled.
Changed settings become active the next time the power stage is enabled.

6.9 Monitoring Funcitons for Operation

The Easy Lexium 16 servo drive offers the following monitoring functions:

- Temperature monitoring
- Load and overload monitoring
- Load-dependent position deviation (following error)
- Target position standstill window
- Position deviation window
- Velocity deviation window
- Velocity threshold value
- Current threshold value

6.9.1 Temperature Monitoring

The Easy Lexium 16 servo drive monitors the power stage temperature and the CPU temperature, the values can be displayed by means of HMI:

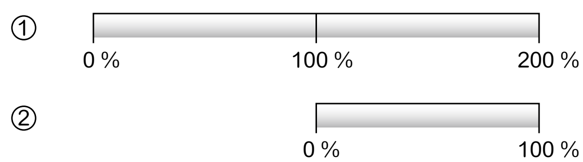
- The current temperature of CPU is displayed via parameter Mon->tdeV
- The current power stage temperature of drive is displayed via parameter Mon->tPS

If the current power stage temperature expires the warning threshold (90°C), the monitoring function will generate error with error class 0. If the current power stage temperature expires the error threshold (95°C), the monitoring functoin will generate error with error class 3 and stop the operation.

6.9.2 Load and Overload Monitoring

The load is the thermal load on the power stage, the motor and the braking resistor. The servo drive calculates the load and overload using I^2T algorithm and monitoring the load and overload of various components internally. The load and overload values can be read by means of parameters.

Overload starts at a load value of 100 %. the overload is calculated as following:



1 Load
2 Overload

Load and overload on the individual components are monitored internally, the values can be read by means of HMI:

- The current load of drive power stage is displayed via parameter Mon->LdFP
- The current load of motor is displayed via parameter Mon->LdFM
- The current load of external brake resistor is displayed via parameter Mon->LdFb
- The current overload of drive power stage is displayed via parameter Mon->oVLP

In the case of 100% overload of the power stage or the motor, I^2T protectin will be engaged. User can select the action method via parameter P6-33:

- The power stage current output will be limited internally.
- The monitoring function will generate error with error class 3 and stop the operation.

P6-33	Suppressing errors	Min.	0	Unit	Relatd Mode		
		Default	0	-	P	-	-
		Max.	0x0280		DYC	-	-

Suppressing errors:

Digital	Bits	Description	Related Errors	Function	
L XXXX[ ]	0	Reversed	-	-	-
	1	Reversed	-	-	-
	2	Reversed	-	-	-
	3	Reversed	-	-	-
L XXX[ ]X	4	Reversed	-	-	-
	5	Reversed	-	-	-
	6	Reversed	-	-	-
	7	Power stage or motor overload (I^2T)	4102 4302	0	Limit power stage current output when overload (I^2T) happens
				1	Activate error code 4102 or 4302 of error class 3 when overload (I^2T) happens
L XX[ ]XX	8	Reversed	-	-	-
	9	DC bus undervoltage	3201 3202	0	Error code 3201 or 3202 will NOT be stored in error memory of the device
				1	Error code 3201 or 3202 will be stored in error memory of the device
	10	Reversed	-	-	-
	11	Reversed	-	-	-
L X[ ]XXX	12	Reversed	-	-	-
	13	Reversed	-	-	-
	14	Reversed	-	-	-
	15	Reversed	-	-	-
L [ ]XXXX	16	Reversed	-	-	-
	17	Reversed	-	-	-
	18	Reversed	-	-	-
	19	Reversed	-	-	-
H XXXX[ ]	20	Reversed	-	-	-
	21	Reversed	-	-	-
	22	Reversed	-	-	-
	23	Reversed	-	-	-
H XXX[ ]X	24	Reversed	-	-	-
	25	Reversed	-	-	-
	26	Reversed	-	-	-
	27	Reversed	-	-	-
H XX[ ]XX	28	Reversed	-	-	-
	29	Reversed	-	-	-
	30	Reversed	-	-	-
	31	Reversed	-	-	-

Example:
P6-33 = 0x0080 will active error code 4102 or 4302 of error class 3 when overload (I^2T) happens
P6-33 = 0x0200 will store error code 3201 or 3202 in error memory of the device

Setting can only be changed if power stage is disabled.
Changed settings become active the next time the power stage is enabled.

6.9.3 Load-Dependent Position Deviation (Following Error)

The load-dependent position deviation is the difference between the reference position and the actual position caused by the load.

The maximum permissible load-dependent position deviation can be parameterized by parameter P0-20. In addition, user can set the error class by parameter P0-21.

P0-20	Maximum load-dependent position deviation	Min.	1	Unit	Relatd Mode		
		Default	393216	usr_p	P	-	-
		Max.	2147483647		DYC	-	-

Maximum load-dependent position deviation
The load-dependent position deviation is the difference between the reference position and the actual position caused by the load.

Changed settings become active immediately.

P0-21	Error response to excessivly high load-dependent position deviation	Min.	1	Unit	Relatd Mode		
		Default	3	-	P	-	-
		Max.	3		DYC	-	-

Error response to excessively high load-dependent position deviation
1 / Error Class 1: Error class 1
2 / Error Class 2: Error class 2
3 / Error Class 3: Error class 3

Setting can only be changed if power stage is disabled.
Changed settings become active the next time the power stage is enabled.

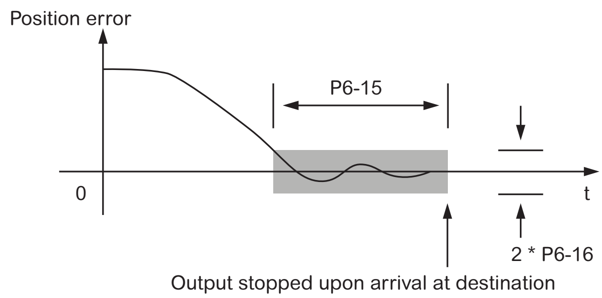
6.9.4 Target Position Standstill Window

The target position standstill window monitoring function allows you to monitor whether the motor has reached the target position.

If the difference between the target position and the actual position remains in a parameterizable standstill window during a certain time, the target position is considered to have been reached. Additionally, a parameter can be used to set the period of time after which a detected error is signaled if the standstill window was not reached.

Following parameters shall be parameterized where target position standstill window monitoring function is used:

- The target position standstill window is set via parameter P6-16
- The actual position must not exceed the position standstill window during the time set via parameter P6-16 until target position consider to be reached.
- Timeout time for position standstill window monitoring is set via parameter P6-17



P6-15	Target position reached: standstill window, time	Min.	0	Unit	Related Mode		
		Default	0	ms	P	-	-
		Max.	32767		DYC	-	-

Standstill window, time
0: Monitoring of standstill window deactivated
>0: Time in ms during which the control deviation must be in the standstill window defined in parameter P6-16

Changed settings become active immediately.

P6-16	Target position reached: standstill window, permissible control deviation	Min.	0	Unit	Related Mode		
		Default	128	usr_p	P	-	-
		Max.	2147483647		DYC	-	-

Standstill window, permissible control deviation
The control deviation for the standstill window time must be within this range for a standstill of the drive to be detected.
Processing of the standstill window must be activated via the parameter P6-15.
The minimum value, the factory setting and the maximum value depend on the scaling factor.

Changed settings become active immediately.

P6-17	Target position reached: timeout time for standstill window monitoring	Min.	0	Unit	Related Mode		
		Default	0	ms	P	-	-
		Max.	32767		DYC	-	-

Timeout time for standstill window monitoring
0: Timeout monitoring deactivated
>0: Timeout time in ms
Standstill window processing values are set via the parameter P6-15 and P6-16.
Time monitoring starts when the target position (reference position of position controller) is reached or when the profile generator has finished processing.

Changed settings become active immediately.

6.9.5 Position Deviation Window

The position deviation window monitoring function allows you to monitor whether the motor is within a parameterizable position deviation.

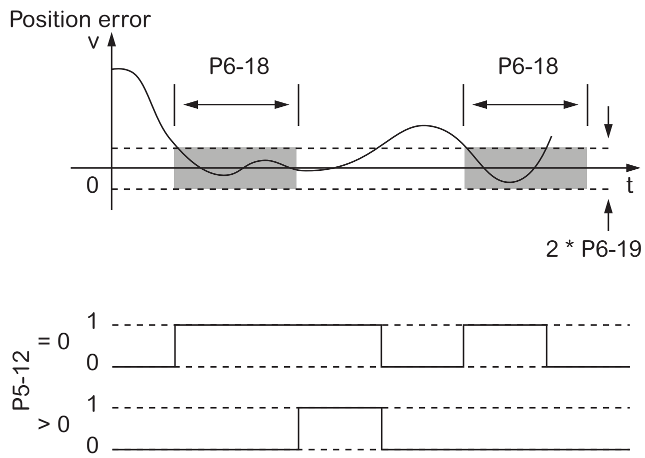
The position deviation is the difference between reference position and actual position. The system monitors whether the motor is within the defined position deviation during a certain time.

The position deviation window monitoring function is available in the following operating modes.
- Jog
- Electronic gear (position synchronization)
- Homing

In Easy Lexium 16 servo drive, the position deviation status is available via a signal output.

By factory default, the digital output IOfunc_DQ1 with pin 18 on CN1 is assigned as "In Position Deviation Window" function (NO). The "In Position Deviation Window" function can also be assigned to other digital outputs via parameters P3-06...P3-08.

Following parameters shall be parameterized where position deviation window monitoring function is used:
- The monitoring of time window is set via parameter P6-18
- The monitoring of position deviation threshold is set via parameter P6-19



P3-06 ~ P3-08	Function Output of DQx	Min.	1	Unit	Relatd Mode		
		Default	-	-	P	-	-
		Max.	125		DYC	-	-

Function Output of DQx

Function	Description	Code		Related Mode	
		NO	NC	P	DYC
In Position Deviation Window	Position deviation is within window	5	105	√	√

Setting can only be changed if power stage is disabled.
Changed settings become active the next time the product is powered on.

P6-18	Monitoring of time window	Min.	0	Unit	Related Mode		
		Default	0	ms	P	-	-
		Max.	9999		DYC	-	-

Monitoring of time window
Adjustment of a time for monitoring of position deviation, velocity deviation, velocity value and current value. If the monitored value is in the permissible range during the adjusted time, the monitoring function delivers a positive result.
The status can be output via a parameterizable output.

Changed settings become active immediately.

P6-19	Monitoring of position deviation	Min.	0	Unit	Related Mode		
		Default	128	usr_p	P	-	-
		Max.	2147483647		DYC	-	-

Monitoring of position deviation
The system checks whether the drive is within the defined deviation during the period set with parameter P6-18.
The status can be output via a parameterizable output.
The minimum value, the factory setting and the maximum value depend on the scaling factor.

Changed settings become active immediately.

6.9.6 Velocity Deviation Window

The velocity deviation window monitoring function allows you to monitor whether the motor is within a parameterizable velocity deviation.

The velocity deviation is the difference between the reference velocity and the actual velocity. The system monitors whether the motor is within the defined velocity deviation during a certain time.

The velocity deviation window monitoring function is available in the following operating modes.

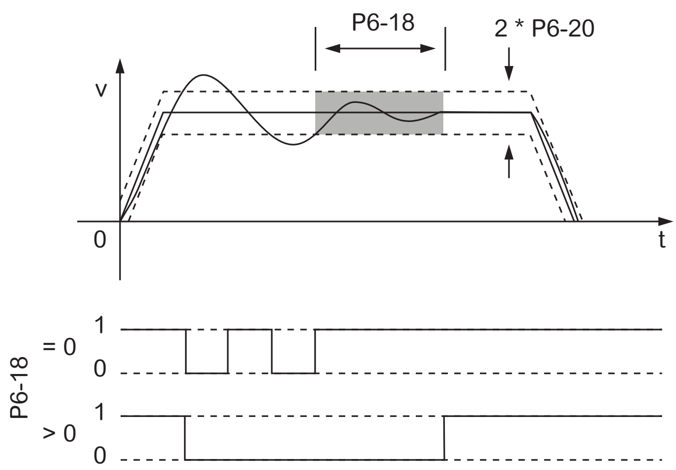
- Jog
- Electronic gear (speed synchronization)
- Homing

In Easy Lexium 16 servo drive, the velocity deviation status is available via a signal output.

The "In Velocity Deviation Window" function can be assigned to a digital output via parameters P3-06...P3-08.

Following parameters shall be parameterized where velocity deviation window monitoring function is used:

- The monitoring of time window is set via parameter P6-18
- The monitoring of velocity deviation threshold is set via parameter P6-20



P3-06 ~ P3-08	Function Output of DQx	Min.	1	Unit	Relatd Mode		
		Default	-	-	P	-	-
		Max.	125		DYC	-	-

Function Output of DQ0x

Function	Description	Code		Related Mode	
		NO	NC	P	DYC
In Velocity Deviation Window	Velocity deviation is within window	6	106	√	√

Setting can only be changed if power stage is disabled.
Changed settings become active the next time the product is powered on.

P6-18	Monitoring of time window	Min.	0	Unit	Related Mode		
		Default	0	ms	P	-	-
		Max.	9999		DYC	-	-

Monitoring of time window
Adjustment of a time for monitoring of position deviation, velocity deviation, velocity value and current value. If the monitored value is in the permissible range during the adjusted time, the monitoring function delivers a positive result.
The status can be output via a parameterizable output.

Changed settings become active immediately.

P6-20	Monitoring of velocity deviation	Min.	1	Unit	Related Mode		
		Default	10	usr_v	P	-	-
		Max.	2147483647		DYC	-	-

Monitoring of velocity deviation
The system monitors whether the drive is within the defined deviation during the period set with parameter P6-18.
The status can be output via a parameterizable output.

Changed settings become active immediately.

6.9.7 Velocity Threshold Value

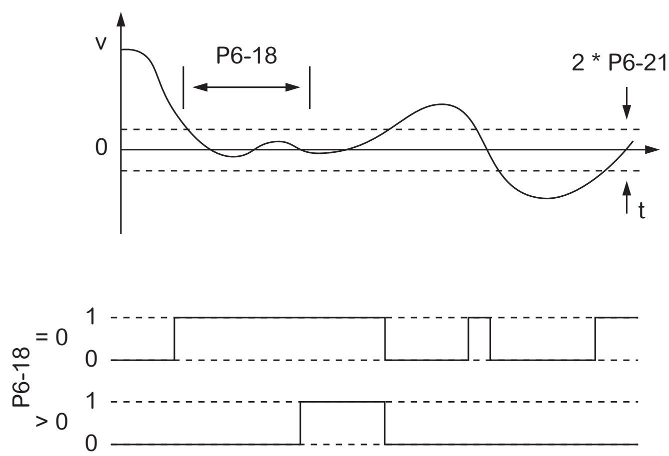
The velocity threshold value monitoring function allows you to monitor whether the actual velocity is below a parameterizable velocity value.

The system monitors whether the actual motor velocity is below the defined velocity threshold during a certain time.

In Easy Lexium 16 servo drive, the velocity threshold status is available via a signal output

The "Velocity Below Threshold" function can be assigned to a digital output via parameters P3-06...P3-08.

Following parameters shall be parameterized where velocity threshold value monitoring function is used:
- The monitoring of time window is set via parameter P6-18
- The monitoring of velocity threshold is set via parameter P6-21



P3-06 ~ P3-08	Function Output of DQx	Min.	1	Unit	Relatd Mode		
		Default	-	-	P	-	-
		Max.	125		DYC	-	-

Function Output of DQx

Function	Description	Code NO	Code NC	Related Mode P	Related Mode DYC
Velocity Below Threshold	Motor velocity below threshold	7	107	√	√

Setting can only be changed if power stage is disabled.
Changed settings become active the next time the product is powered on.

P6-18	Monitoring of time window	Min.	0	Unit	Related Mode		
		Default	0	ms	P	-	-
		Max.	9999		DYC	-	-

Monitoring of time window
Adjustment of a time for monitoring of position deviation, velocity deviation, velocity value and current value. If the monitored value is in the permissible range during the adjusted time, the monitoring function delivers a positive result.
The status can be output via a parameterizable output.

Changed settings become active immediately.

P6-21	Monitoring of velocity threshold	Min.	1	Unit	Related Mode		
		Default	10	usr_v	P	-	-
		Max.	2147483647		DYC	-	-

Monitoring of velocity threshold
The system monitors whether the drive is below the defined value during the period set with parameter P6-18.
The status can be output via a parameterizable output.

Changed settings become active immediately.

6.9.8 Current Threshold Value

The current threshold value monitoring function allows you to monitor whether the actual current is below or over a parameterizable current value.

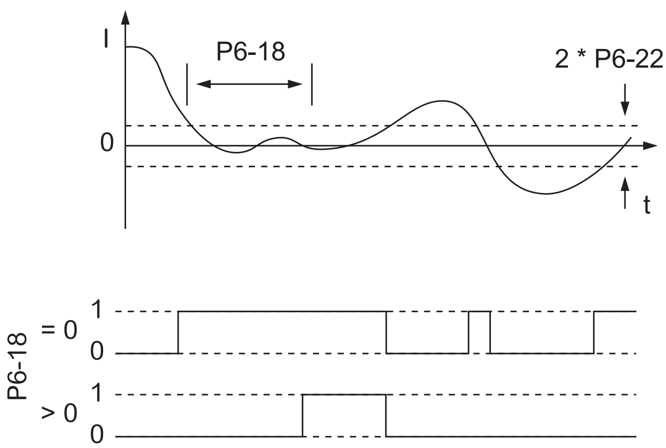
The system monitors whether the actual current is below or over the defined current threshold during a certain time.

In Easy Lexium 16 servo drive, the current threshold status is available via a signal output

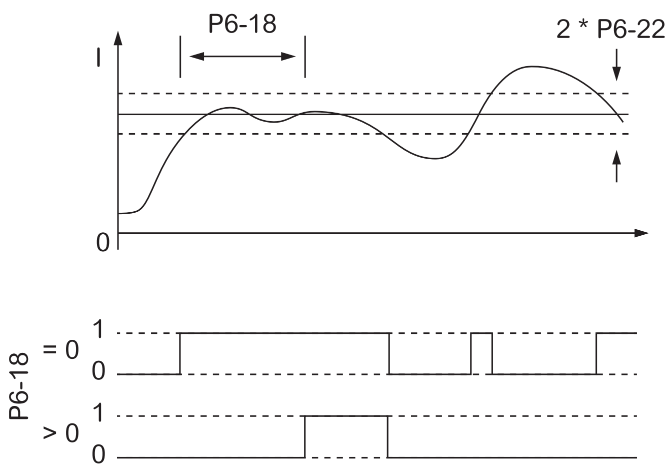
The "Current Below Threshold" function can be assigned to a digital output via Parameters P3-06...P3-08 to indicate the actual current is below the defined threshold, or the "Current Over Threshold" function can be assigned to a digital output via Parameter P3-06...P3-08 to indicate the actual current is over the defined threshold.

Following parameters shall be parameterized where current threshold value monitoring function is used

- The monitoring of time window is specified via parameter P6-18
- The monitoring of current threshold is specified via parameter P6-22



The motor current is below the set threshold



The motor current is above the set threshold

P3-06 ~ P3-08	Function Output of DQx	Min.	1	Unit	Relatd Mode		
		Default	-	-	P	-	-
		Max.	125		DYC	-	-

Function Output of DQx

Function	Description	Code		Related Mode	
		NO	NC	P	DYC
Current Below Threshold	Motor current below threshold	8	108	√	√
Current Over Threshold	Motor current over threshold	25	125	√	√

Setting can only be changed if power stage is disabled.
Changed settings become active the next time the product is powered on.

P6-18	Monitoring of time window	Min.	0	Unit	Related Mode		
		Default	0	ms	P	-	-
		Max.	9999		DYC	-	-

Monitoring of time window
Adjustment of a time for monitoring of position deviation, velocity deviation, velocity value and current value. If the monitored value is in the permissible range during the adjusted time, the monitoring function delivers a positive result.
The status can be output via a parameterizable output.

Changed settings become active immediately.

P6-22	Monitoring of current threshold	Min.	0	Unit	Related Mode		
		Default	20	0.01 Arms	P	-	-
		Max.	30000		DYC	-	-

Monitoring of current threshold
The system monitors whether the drive is below or over the defined value during the period set with parameter P6-18.
The status can be output via a parameterizable output.

In increments of 0.01 Arms.

Changed settings become active immediately.

6.9.9 Maximum Velocity Threshold Value while Enabling the Power Stage

The maximum velocity threshold value while enabling the power stage monitoring functions allows you to monitor whether the maximum velocity of the motor expired a parameterizable velocity value.

In case the maximum velocity threshold is expired while enabling the power stage, the drive will active fault 1B0F and stop the motor.

This monitoring function helps to suppress unexpected motor movement caused by incorrect motor wiring.

Following parameters shall be parameterized where maximum velocity threshold value while enabling the power stage monitoring function is used

- The monitoring of maximum velocity threshold value while enabling of the power stage is specified via parameter P6-35

<table>
<tr><td rowspan="3">P6-35</td><td rowspan="3">Maximum Velocity Threshold while Enabling the Power Stage</td><td>Min.</td><td>0</td><td>Unit</td><td colspan="3">Relatd Mode</td></tr>
<tr><td>Default</td><td>100</td><td rowspan="2">usr_v</td><td>P</td><td>-</td><td>-</td></tr>
<tr><td>Max.</td><td>500</td><td>DYC</td><td>-</td><td>-</td></tr>
<tr><td colspan="8">Maximum velocity threshold when enabling power stage
The system monitors whether the motor velocity expired the defined value while enabling the power stage. In case the threshold is expired the drive will active fault 1B0F and stop the motor.

Changed settings become active immediately.</td></tr>
</table>

Chap07. Commissioning

7.1 Tuning Methods and Basic Procedures

7.1.1 About Tuning

The purpose of tuning (commissioning) is to optimize the servo system response. The servo system response is dependent on the control loop gain set in servo drive. Higher the servo response will result in the servo drive to run the servo motor in least time delay and as faithful as possible against the commands given by controller.

The control loop gains are set using a combination of parameters (position controller P gain, velocity controller P gain, velocity feedforward, various filters, inertia ratio, etc.), by optimize the parameters the control loop can optimum the performance of the servo drive. These control loop parameters influence each other, so you must consider the balance between them.

Generally, the response of a machine with high rigidity can be improved by increasing the servo gain. If the servo gain of a machine with low rigidity is increased, however, the machine will vibrate and the response may not be improved. In such case, it is possible to suppress the vibration with a variety of vibration suppression functions

7.1.2 Tuning Methods

The servo gains are set to stable settings by factory default. Use the various tuning functions to increase the response even further for the conditions of your machine.

<table>
<tr><th rowspan="2">Tuning method</th><th rowspan="2">Description</th><th colspan="2">Tool</th></tr>
<tr><th>Integrated HMI</th><th>Commissioning software</th></tr>
<tr><td>Easy tuning</td><td>Easy tuning moves the motor without user intervention and optimizes the settings of the control loop parameters while running the motor.</td><td>√</td><td>√</td></tr>
<tr><td>Comfortable tuning</td><td>Comfort tuning moves the motor with user intervention, parameters for trajectory can be set by the user. Comfort tuning optimizes the settings of the control loop parameters while running the motor.</td><td>×</td><td>√</td></tr>
<tr><td>Auto adaptive tuning</td><td>The motor is driven by command given by either controller or Jog operation, the servo drive estimates the system real time inertia load ratio and tune the control loop parameter with respect to the stiffness been given.</td><td>√</td><td>√</td></tr>
<tr><td>Auto adaptive notch filters</td><td>The servo drive automatically measures and optimizes the notch filter (up to 2 sets) to suppress mechanical resonance.</td><td>√</td><td>√</td></tr>
<tr><td>Manual tuning</td><td>Tune the control loop gain and various filters manually</td><td>△</td><td>√</td></tr>
</table>

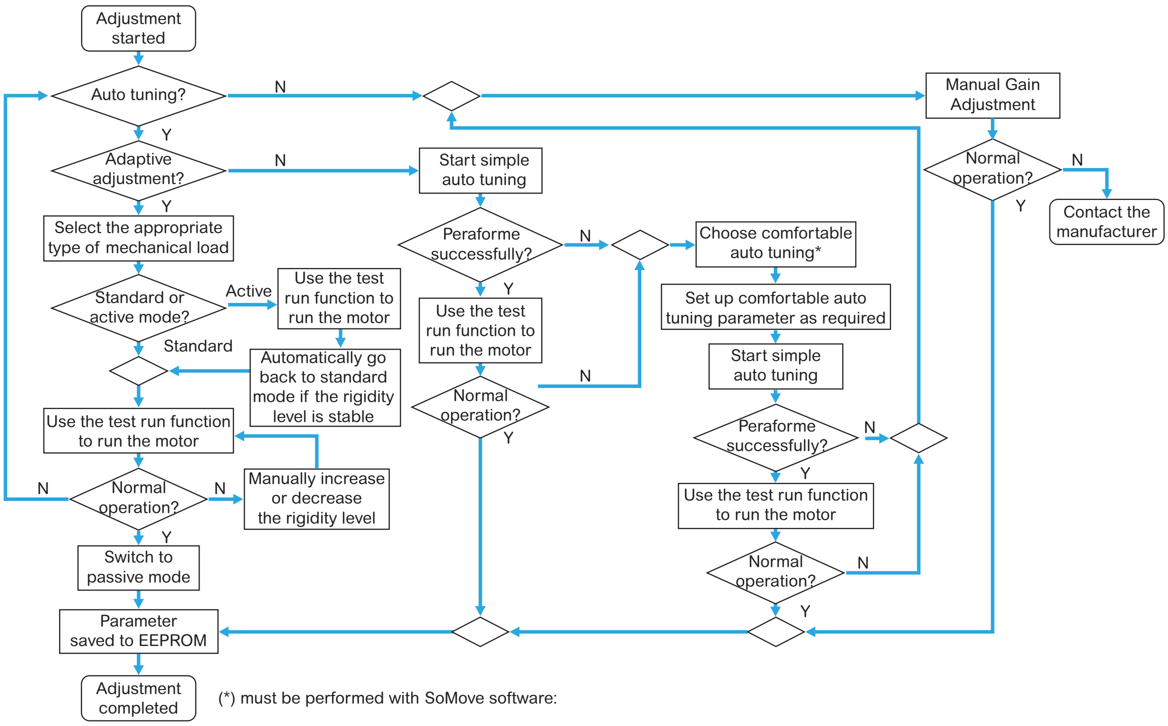
√- Available / × - Not Supported / △- Limited Function

The control loop types are different with respect to different tuning methods:

<table>
<tr><td>Control loop type</td><td>Cascade control loop</td><td colspan="3">Auto adaptive control loop</td></tr>
<tr><td>Mode selection</td><td>P0-01 = 0 - Invalid</td><td>P0-01 = 1 - Starndard</td><td>P0-01 = 2 - Passive</td><td>P0-01 = 3 - Adaptive</td></tr>
<tr><td rowspan="3">Control loop tuning method</td><td>Easy tuning (HMI / SoMove)</td><td>Realtime inertia ratio estimation (P0-03)</td><td>Manual setup of inertia ratio(P0-03)</td><td>Realtime inertia ratio estimation</td></tr>
<tr><td>Comfort tuning (SoMove)</td><td rowspan="2">Manual setup of stiffness</td><td rowspan="2">Manual setup of stiffness</td><td rowspan="2">Automatically find the most suitable stiffness (increase stiffness by 4 at the most)</td></tr>
<tr><td>Manual tuning (HMI / SoMove)</td></tr>
<tr><td rowspan="3">Parameter</td><td>Control loop parameter set 1 is used by default</td><td colspan="3">The load type parameter (P0-04) determines the default initial stiffness</td></tr>
<tr><td>Switch between control loop parameter set 1/2 by digital input function</td><td colspan="3">Map to Control loop parameter set 1/3 by software SoMove or via HMI</td></tr>
<tr><td colspan="4">Velocity feedforward gain P1-03 is valid</td></tr>
<tr><td rowspan="2">Control loop parameter set switch</td><td>Control loop parameter set 3 is used for lower gain</td><td colspan="3">Parameter P1-44 is used for lower stiffness</td></tr>
<tr><td>Switch condition: P1-36 ... P1-42</td><td colspan="3">Switch condition: P1-36 ... P1-42</td></tr>
<tr><td>Details</td><td>Chapter 7.2/7.3</td><td colspan="3">Chapter 7.4</td></tr>
</table>

7.1.3 Basic Tuning Procedures

The basic tuning procedure is shown as following, make suitable adjustments considering the conditions and operating requirements of the machine:



(*) must be performed with SoMove software:

7.1.4 Safety Precautions for Tuning

⚠ WARNING

UNINTENDED MOVEMENT
- Do not touch the rotating section of the servomotor while power is being supplied to the motor.
- Before starting the servomotor, make sure that the servo drive can come to an emergency stop at any time.
- Make sure that a Jog operation has been performed without any trouble.
- To make sure the safety, install a safety brake on the machine.

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

When tuning the servo control loop, following safety precautions must be followed:
- Set limit switch functions, make sure the movement can be stopped by and the operating state switched to "7 - Quick Stop Active" when either of positive limit switch or negative limit switch has been triggered.
  See chapter "6.4.3 Limit Switches" for detailed information.
- Enable load-dependent position deviation monitoring function.
  See chapter "6.9.3 Load-Dependent Position Deviation (Following Error)" for detailed information.
- Make sure there are no obstructions in the zone of tuning.

7.1.5 Control Loop Model Selection

Easy Lexium 16 servo drive provides two control loop models: the cascade PID control loop and auto adaptive control loop. Either of the two control loop models takes effective at one time. User can select which one is effective via parameter P0-01.

When parameter P0-01 = 0 / Invalid, the servo drive is controlled by PID control loop model. There are 3 PID control loop parameter sets in Easy Lexium 16 servo drive:

- P1-00 ... P1-06: Control loop parameter set 1.
- P1-07 ... P1-13: Control loop parameter set 2.
- P1-14 ... P1-18: Control loop parameter set 3.

Control loop parameter set 1		Control loop parameter set 2		Control loop parameter set 3	
P1-00	Position controller P gain	P1-07	Position controller P gain	P1-14	Position controller P gain
P1-01	Velocity controller P gain	P1-08	Velocity controller P gain	P1-15	Velocity controller P gain
P1-02	Velocity controller integral action time	P1-09	Velocity controller integral action time	P1-16	Velocity controller integral action time
P1-03	Velocity feed-forward control	P1-10	Velocity feed-forward control	P1-17	Filter time constant of the reference velocity value filter
P1-04	Filter time constant of the reference velocity value filter	P1-11	Filter time constant of the reference velocity value filter	P1-18	Filter time constant of the reference current value filter
P1-05	Filter time constant of the reference current value filter	P1-12	Filter time constant of the reference current value filter		
P1-06	Friction compensation gain	P1-13	Friction compensation gain		
P2-07	Notch filter 1: Damping	P2-15	Notch filter 1: Damping		
P2-08	Notch filter 1: Frequency	P2-16	Notch filter 1: Frequency		
P2-09	Notch filter 1: Bandwidth	P2-17	Notch filter 1: Bandwidth		
P2-10	Notch filter 2: Damping	P2-18	Notch filter 2: Damping		
P2-11	Notch filter 2: Frequency	P2-19	Notch filter 2: Frequency		
P2-12	Notch filter 2: Bandwidth	P2-20	Notch filter 2: Bandwidth		
P2-13	Overshoot suppression filter: Damping	P2-21	Overshoot suppression filter: Damping		
P2-14	Overshoot suppression filter: Time delay	P2-22	Overshoot suppression filter: Time delay		

When parameter P0-01 = 1 / Standard, 2 / Passive or 3 / Adaptive,the servo drive is controlled by auto adaptive control loop model.

There are 2 auto adaptive control stiffness in Easy Lexium 16 servo drive:

- P0-02: Stiffness index.
- P1-44: Dynamic gain switching: Stiffness for lower gain.

7.2 Easy Tuning

7.2.1 Overview

asy tuning moves the motor without user intervention and optimizes the settings of the control loop parameters while running the motor. Easy tuning determines the friction torque as a constantly acting load torque and considers it in the calculation of the moment of inertia of the entire system. External factors such as a load at the motor are considered. Easy tuning optimizes the settings of the control loop parameters. Easy tuning also supports vertical axes.

Easy tuning will optimize parameters P1-00 ... P1-06 (Control loop parameter set 1) as well as P1-14 ... P1-8 (Control loop parameter set 3) in parameter group “P1 – Gain”. Meanwhile estimation results of system characters can be monitored in parameter P6-26 ... P6-30.

Note, during easy tuning the motor is activated and small movements are made. Noise development and mechanical oscillations of the system are normal.

⚠ WARNING

UNINTENDED MOVEMENT

- Only start the system if there are no persons or obstructions in the zone of operation.
- Include in your calculations when determining the available movement range, the additional distance for the deceleration ramp in the case of an emergency stop.
- Verify that the parameter settings for a Quick Stop are correct.
- Verify correct operation of the limit switches
- Verify that a functioning emergency stop push-button is within reach of all persons involved in all phases of machine operation and maintenance involving this equipment.

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

7.2.2 Operating Methods

No parameter needed to be set prior to start an easy tuning.

Easy tuning can be started in two ways:

- Use the integrated HMI on the equipment:
  HMI -> oP -> tun -> tuSt
  See chapter "5.3.2 Simple Auto Tuning" for further information.
- Use commissioning software SoMove:
  SoMove -> Tuning -> Auto -> Start
  The tuning process is indicated by a progress bar. Upon successful completion of the tuning, use the SoMove software to save the control loop parameter into drive EEPROM.

7.3 Comfort Tuning

7.3.1 Overview

Comfort tuning moves the motor with user intervention, parameters for trajectory such as velocity, acceleration, distance, mechanical system can be set by the user with respect to the application, in order to further optimize the control loop parameters. Comfort tuning determines the friction torque as a constantly acting load torque and considers it in the calculation of the moment of inertia of the entire system. External factors such as a load at the motor are considered. Comfort tuning optimizes the settings of the control loop parameters. Comfort tuning also supports vertical axes.

Comfort tuning will optimize parameters P1-00 ... P1-06 (Control loop parameter set 1) as well as P1-14 ... P1-8 (Control loop parameter set 3) in parameter group “P1 – Gain”. Meanwhile estimation results of system characters can be monitored in parameter P6-26 ... P6-30.

Note, during easy tuning the motor is activated and small movements are made. Noise development and mechanical oscillations of the system are normal.

WARNING

UNINTENDED MOVEMENT

- Only start the system if there are no persons or obstructions in the zone of operation.
- Include in your calculations when determining the available movement range, the additional distance for the deceleration ramp in the case of an emergency stop.
- Verify that the parameter settings for a Quick Stop are correct.
- Verify correct operation of the limit switches
- Verify that a functioning emergency stop push-button is within reach of all persons involved in all phases of machine operation and maintenance involving this equipment.

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

7.3.2 Operation Methods

Comfortable tuning can only be started using commissioning software SoMove:
SoMove -> Tuning -> Comfort -> Set parameters for comfortable tuning trajectory -> Start
The tuning process is indicated by a progress bar. Upon successful completion of the tuning, use the SoMove software to save the control loop parameter into drive EEPROM.

7.4 Auto Adaptive Tuning

7.4.1 Overview

The auto adaptive tuning estimates the load inertia over rotor inertia in real time with respect to the load characteristics of the system in real time and tune the control loop parameters based on the stiffness automatically.

The Easy Lexium 16D servo drive supports 3 methods of auto adaptive tuning mode, user can select freely via parameter P0-01:

- P0-01 = 1 / Standard
- P0-01 = 2 / Passive
- P0-01 = 3 / Adaptive

Auto adaptive tuning will not move the servo motor. After the auto adaptive tuning function is enabled, it monitors the movement characteristics such as velocity and acceleration in real time. The movement can be driven either by commands from controller or by Jog operation. Please refer to chapter “6.5 Operation Mode Jog” for information about Jog operation.

By selecting different auto adaptive tuning mode via parameter P0-01, the auto adaptive tuning can either actively estimate the load inertia ratio or passively accept the load inertia ratio entered by user. Alternatively, it’s possible to actively try to optimize the most suitable stiffness (increase stiffness by 4 at the most) or passively accept the stiffness selected by user.

Note, the auto adaptive tuning may bring about a incorrect estimation result if the load inertia changes too quickly. Noise development and mechanical oscillations of the system are normal.

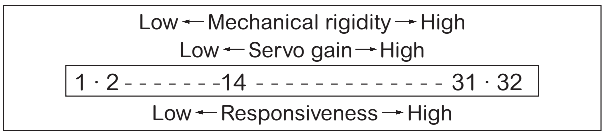
⚠ WARNING

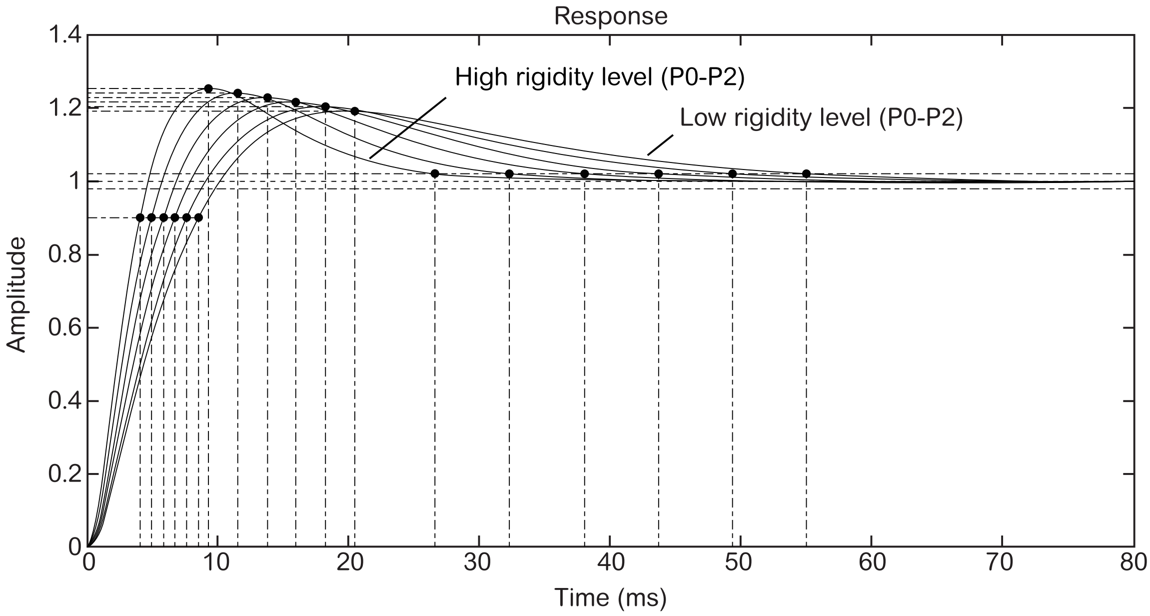
UNINTENDED MOVEMENT

- Only start the system if there are no persons or obstructions in the zone of operation.
- Include in your calculations when determining the available movement range, the additional distance for the deceleration ramp in the case of an emergency stop.
- Verify that the parameter settings for a Quick Stop are correct.
- Verify correct operation of the limit switches
- Verify that a functioning emergency stop push-button is within reach of all persons involved in all phases of machine operation and maintenance involving this equipment.

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

Different stiffnesses stands for different servo system response levels. Higher the stiffness value, higher the velocity response and servo rigidity will be achieved. However, when increasing the value, more system vibration could be expected. Gradually increase the stiffness value from lower to higher when selecting.





7.4.2 Conditions for Use

To assure the accuracy of auto adaptive tuning estimation, please note that auto adaptive tuning may not be executed properly under the conditions described below:

- The load is too large compared to the rotor inertia (more than 30 times).
- The machine rigidity is extremely low.
- Large backlash exists
- The motor is running continuously at low speed of 100 rpm or lower.
- Acceleration / deceleration is slower than 2000 rpm/s

Under these conditions, change the load condition or operation pattern, or perform manual tuning.

7.4.3 Standard Auto Adaptive Tuning Mode

Standard auto adaptive tuning mode is activated when P0-01 = 1 / Standard. In this mode, the servo drive automatically estimates the system load inertia ratio, while the stiffness needs to be set manually.

Standard auto adaptive tuning mode can be activated in two ways:

- Use the integrated HMI on the equipment:
  1. Select appropriate type of mechanical load via parameter P0-04 with respect to the application conditions.
  2. Set parameter P0-01 = 1 / Standard.
  3. Drive the servo motor either by command from controller or by Jog operation using HMI.
  4. After several cycles of movement including effective acceleration, plateau and deceleration phases , tune the stiffness via parameter P0-02 with respect to the system performance, then drive the servo motor again.
  5. If the system performance meets requirements, set parameter P0-01 to 2 and the real time estimation of system load inertia ratio is deactivated to prevent accidental incorrect estimation result because of quick inertia changes.
  6. After that the parameter P0-03 system load inertia ratio can be further tuned manually depending on system performance so that the servo system offers better response and stability.

- Use commissioning software SoMove:
  1. SoMove -> Tuning -> Adaptive
  2. Select type of mechanical load in “Load Type Selection” with respect to the application conditions.
  3. Select Standard mode in “Tuning Mode Selection”.
  4. Drive the servo motor either by command from controller or by Jog operation using auto adaptive tuning control panel in SoMove.
  5. After several cycles of movement including effective acceleration, plateau and deceleration phases , tune the stiffness in “Real Time Inertia Ratio” with respect to the system performance, then drive the servo motor again.
  6. If the system performance meets requirements, select Passive mode in “Tuning Mode Selection” and the real time estimation of system load inertia ratio is deactivated to prevent accidental incorrect estimation result because of quick inertia changes.
  7. After that the system load inertia ratio in “Real Time Inertia Ratio” can be further tuned manually depending on system performance so that the servo system offers better response and stability.

7.4.4 Passive Auto Adaptive Tuning Mode

Passive auto adaptive tuning mode is activated when P0-01 = 2 / Passive. In this mode, both system load inertia ratio and the stiffness need to be set manually.

Passive auto adaptive tuning mode can be activated in two ways:

- Use the integrated HMI on the equipment:
  1. Select appropriate type of mechanical load via parameter P0-04 with respect to the application conditions.
  2. Set parameter P0-01 to 2.
  3. Tune the stiffness via parameter P0-02 as well as system inertia ratio via parameter P0-03.
  4. Drive the servo motor either by command from controller or by Jog operation using HMI.
  5. Parameter P0-02 and P0-03 can be further tuned manually depending on system performance so that the servo system offers better response and stability.

- Use commissioning software SoMove:
  1. SoMove -> Tuning -> Adaptive
  2. Select type of mechanical load in “Load Type Selection” with respect to the application conditions.
  3. Select Passive mode in “Tuning Mode Selection”.
  4. Tune the system inertia ratio in “Real Time Inertia Ratio” and the stiffness in “Real Time Inertia Ratio”.
  5. Drive the servo motor either by command from controller or by Jog operation using auto adaptive tuning control panel in SoMove.
  6. After that the system load inertia ratio in “Real Time Inertia Ratio” can be further tuned manually depending on system performance so that the servo system offers better response and stability.

7.4.5 Adaptive Auto Adaptive Tuning Mode

Adaptive auto adaptive tuning mode is activated when P0-01 = 3 / Adaptive. In this mode, the servo drive automatically estimates the system load inertia ratio and try to optimize the most suitable stiffness (increase stiffness by 4 at the most).

Adaptive auto adaptive tuning mode can be activated in two ways:

- Use the integrated HMI on the equipment:
  1. Select appropriate type of mechanical load via parameter P0-04 with respect to the application conditions.
  2. Set parameter P0-01 to 3.
  3. Enter parameter P0-02 to observe the system stiffness.
  4. Drive the servo motor either by command from controller or by Jog operation using HMI.
  5. After several cycles of movement including effective acceleration, plateau and deceleration phases, check the variation of parameter P0-02. The adaptive auto adaptive tuning will try to gradually increase the stiffness to optimize the most suitable one with respect to the system performance. When the most suitable stiffness is achieved, parameter P0-01 will be set to 1 / Standard. Adaptive auto adaptive tuning will increase the stiffness by 4 at the most.
  6. If the system performance meets requirements, set parameter P0-01 to 2 and the real time estimation of system load inertia ratio is deactivated to prevent accidental incorrect estimation result because of quick inertia changes.
  7. After that the parameter P0-03 system load inertia ratio can be further tuned manually depending on system performance so that the servo system offers better response and stability.

- Use commissioning software SoMove:
  1. SoMove -> Tuning -> Adaptive
  2. Select type of mechanical load in “Load Type Selection” with respect to the application conditions.
  3. Select Adaptive mode in “Tuning Mode Selection”.
  4. Drive the servo motor either by command from controller or by Jog operation using auto adaptive tuning control panel in SoMove.
  5. After several cycles of movement including effective acceleration, plateau and deceleration phases, check the variation of stiffness in “Real Time Inertia Ratio” as well as the system inertia ratio in “Real Time Inertia Ratio”. The adaptive auto adaptive tuning will try to gradually increase the stiffness to optimize the most suitable one. When the most suitable stiffness is achieved, “Tuning Mode Selection” will be set to Standard. Adaptive auto adaptive tuning will increase the stiffness by 4 at the most.
  6. If the system performance meets requirements, select Passive mode in “Tuning Mode Selection” and the real time estimation of system load inertia ratio is deactivated to prevent accidental incorrect estimation result because of quick inertia changes.
  7. After that the system load inertia ratio in “Real Time Inertia Ratio” can be further tuned manually depending on system performance so that the servo system offers better response and stability.

7.5 Auto Adaptive Notch Filters

7.5.1 Overview

In case of low machine rigidity, high order vibration may be introduced during system movement and cause the mechanical resonance. As a result, oscillation and noise will occur. Notch filter can be used to damp the resonance at vicinity of resonance frequency so as to improve the system bandwidth.

The auto adaptive notch filters function estimates the resonance frequency out of vibration components presented in velocity characteristics in real time, then damp the resonance component by setting up the notch filter coefficient automatically, hence reduces the resonance vibration.

7.5.2 Operating Methods

Easy Lexium 16 servo drive supports two sets of auto adaptive notch filters. User can select the adaptive notch filter mode via parameter P2-00 to enable one or two sets of adaptive notch filters at a time.

If the resonance point affects the motor speed, parameters of auto adaptive notch filters are automatically set according to the how many adaptive notch filters have been enabled.

After successful set of the auto adaptive notch filters, P2-00 will return "8 / Finished" as an indication.

The auto adaptive notch filters can be activated in two ways:

- Use the integrated HMI on the equipment:
  1. Select mode of auto adaptive notch filter via parameter P2-00
  2. Drive the servo motor either by command from controller or by Jog operation using HMI.
  3. If the resonance point affects the motor speed, parameters of auto adaptive notch filters are automatically set.
  4. After successful set of the auto adaptive notch filters, P2-00 will return "8 / Finished" as an indication.

- Use commissioning software SoMove:
  1. SoMove -> Tuning -> Adaptive
  2. Select to Enable 1 or 2 adaptive notch filters in “Adaptive Notch Filter Mode Selection”.
  3. Drive the servo motor either by command from controller or by Jog operation using auto adaptive tuning control panel in SoMove.
  4. If the resonance point affects the motor speed, parameters of auto adaptive notch filters are automatically set.
  5. After successful set of the auto adaptive notch filters, P2-00 will return "8 / Finished" as an indication.

<table>
<tr><td rowspan="3">P2-00</td><td rowspan="3">Adaptive notch filter mode selection</td><td>Min.</td><td>0</td><td>Unit</td><td colspan="3">Relatd Mode</td></tr>
<tr><td>Default</td><td>0</td><td rowspan="2">-</td><td>P</td><td>-</td><td>-</td></tr>
<tr><td>Max.</td><td>3</td><td>DYC</td><td>-</td><td>-</td></tr>
<tr><td colspan="8">Selection of adaptive notch filter mode
0 / Invalid: The adaptive notch filters are not set automatically, parameters of adaptive notch filters remain unchanged
1 / Enable 1: Enable the 1st set of adaptive notch filters
2 / Enable 2: Enable the 1st and 2nd sets of adaptive notch filters
3 / Reset: Reset all adaptive notch filters
8 / Finished: Adaptive notch filters set finished

Changed settings become active immediately.</td></tr>
</table>

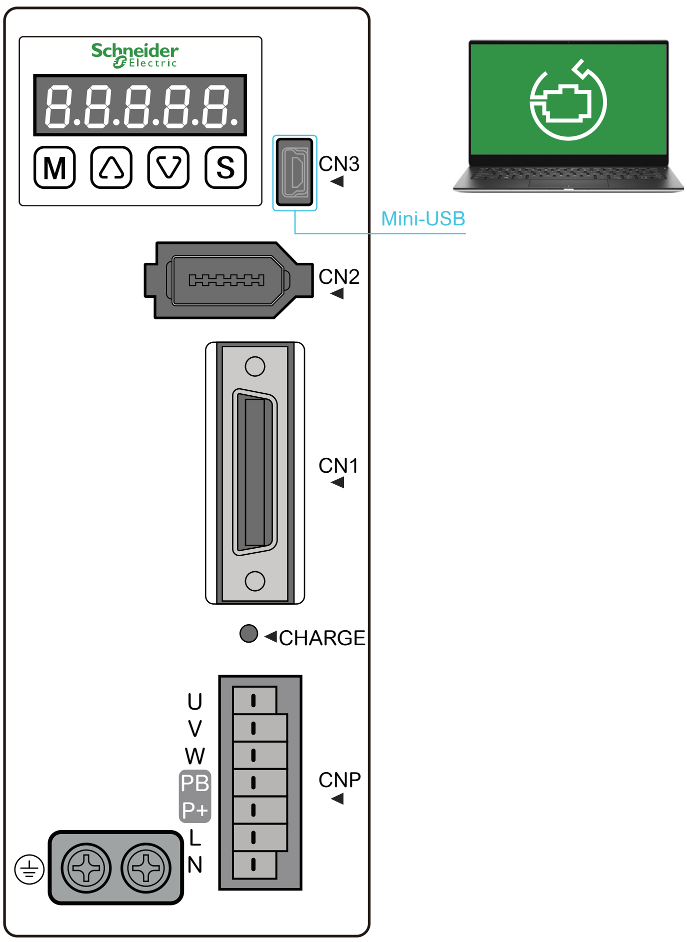
7.6 Manual Tuning (Basic)

7.6.1 Overview

Easy Lexium 16 offers good auto tuning functions which, for most applications, yields good, highly dynamic results. However, there might be some cases where auto tuning cannot deliver proper result depending on the limitation on load conditions. Or you might need to retune the system to obtain the optimum response or stability corresponding to each load. Here the manual tuning should be used.

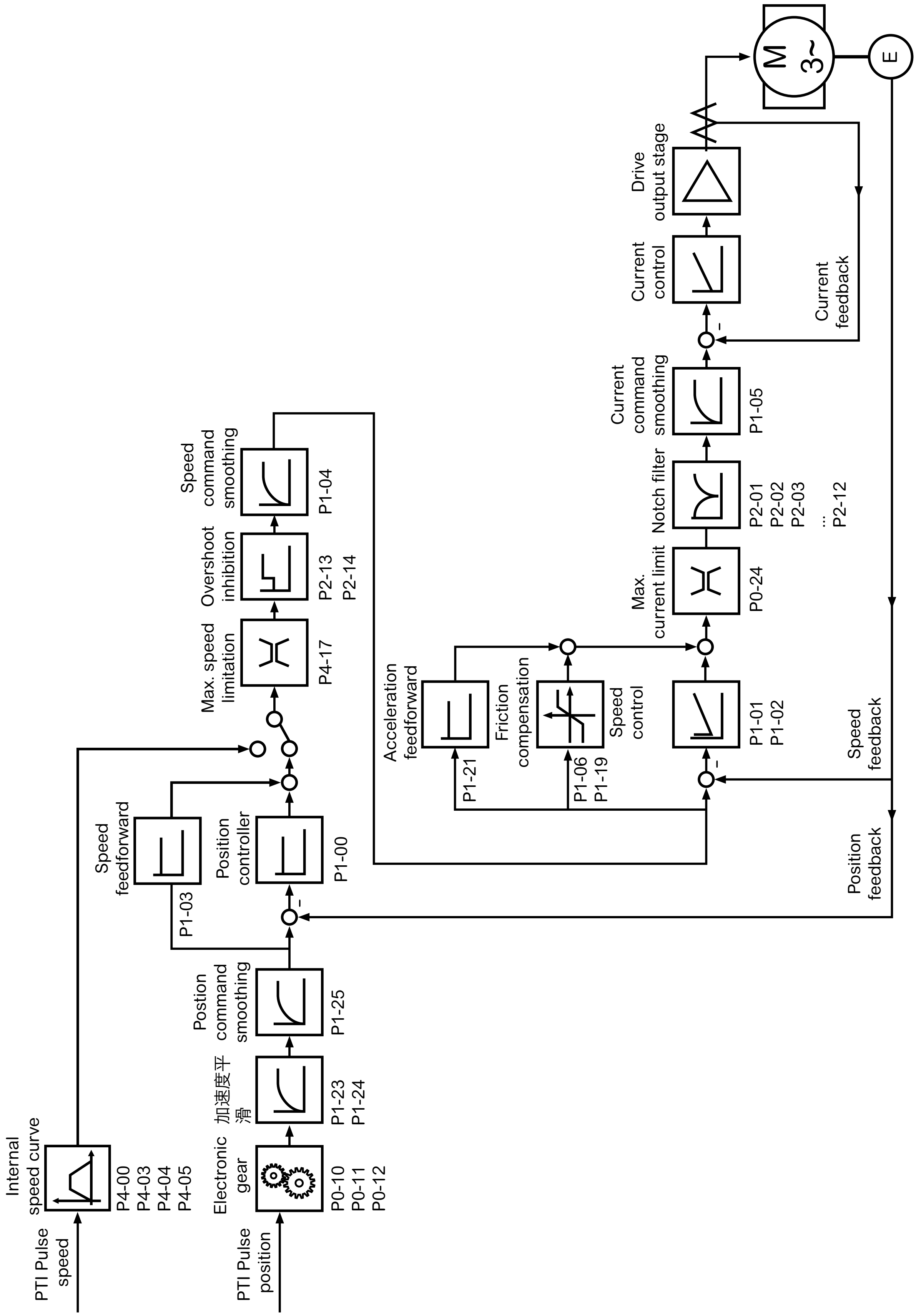
Commissioning software SoMove is recommended for manual tuning. By monitoring waveforms using the scope function of the commissioning software SoMove, accurate manual tuning can be positively, quickly and easily done when compared with that performed on the HMI on the equipment.

For the manual tuning of control loop parameters in position control mode, the controllers should be tuned in following sequence: first the velocity controller then the position controller.



7.6.2 Manual Tuning for Position Control Mode

The control loop structure of Easy Lexium 16 is shown as below:



7.6.3 Mapping of Auto Adaptive Control Loop to PID Control Loop

If auto adaptive tuning control has been done prior to manual tuning, it is possible to equivalently map the parameters of auto adaptive tuning into cascade PID control loop parameters then switch the control mode into cascade PID control loop.

There are two ways to map control loop parameter:

- SoMove:
  SoMove -> Tuning -> Adaptive -> Press button “Map” on the software panel and acknowledge the message box.
- Integrated HMI:
  Op -> Atu -> cPYA -> Press button "S" and all contents on HMI will flash once.

7.6.4 Optimize the Velocity Controller

Parameters in control loop parameter set 1 used for optimization of velocity controller:

- P1-01: Control set 1: Velocity controller P Gain
- P1-02: Control set 1: Velocity controller integral action time

<table>
<tr><td rowspan="3">P1-01</td><td rowspan="3">Control set 1: Velocity controller P gain</td><td>Min.</td><td>1</td><td>Unit</td><td colspan="3">Relatd Mode</td></tr>
<tr><td>Default</td><td>1</td><td rowspan="2">0.01 A/ (1/min)</td><td>P</td><td>-</td><td>-</td></tr>
<tr><td>Max.</td><td>25400</td><td>DYC</td><td>-</td><td>-</td></tr>
<tr><td colspan="8">Control set 1: Velocity controller P gain

In increments of 0.0001 A/(1/min)

Changed settings become active immediately.</td></tr>
</table>

<table>
<tr><td rowspan="3">P1-02</td><td rowspan="3">Control set 1: Velocity controller integral action time</td><td>Min.</td><td>0</td><td>Unit</td><td colspan="3">Relatd Mode</td></tr>
<tr><td>Default</td><td>0</td><td rowspan="2">0.01 ms</td><td>P</td><td>-</td><td>-</td></tr>
<tr><td>Max.</td><td>32767</td><td>DYC</td><td>-</td><td>-</td></tr>
<tr><td colspan="8">Control set 1: Velocity controller integral action time

In increments of 0.01 ms

Changed settings become active immediately.</td></tr>
</table>

Parameters in control loop parameter set 2 used for optimization of velocity controller:

- P1-08: Control set 2: Velocity controller P Gain
- P1-09: Control set 2: Velocity controller integral action time

<table>
<tr><td rowspan="3">P1-08</td><td rowspan="3">Control set 2: Velocity controller P gain</td><td>Min.</td><td>1</td><td>Unit</td><td colspan="3">Relatd Mode</td></tr>
<tr><td>Default</td><td>1</td><td rowspan="2">0.01 A/(1/min)</td><td>P</td><td>-</td><td>-</td></tr>
<tr><td>Max.</td><td>25400</td><td>DYC</td><td>-</td><td>-</td></tr>
<tr><td colspan="8">Control set 2: Velocity controller P gain

In increments of 0.0001 A/(1/min)

Changed settings become active immediately.</td></tr>
</table>

<table>
<tr><td rowspan="3">P1-09</td><td rowspan="3">Control set 2: Velocity controller integral action time</td><td>Min.</td><td>0</td><td>Unit</td><td colspan="3">Relatd Mode</td></tr>
<tr><td>Default</td><td>0</td><td rowspan="2">0.01 ms</td><td>P</td><td>-</td><td>-</td></tr>
<tr><td>Max.</td><td>32767</td><td>DYC</td><td>-</td><td>-</td></tr>
<tr><td colspan="8">Control set 2: Velocity controller integral action time

In increments of 0.01 ms

Changed settings become active immediately.</td></tr>
</table>

Parameters in control loop parameter set 3 used for optimization of velocity controller:

- P1-15: Control set 3: Velocity controller P Gain
- P1-16: Control set 3: Velocity controller integral action time

<table>
<tr><td rowspan="3">P1-15</td><td rowspan="3">Control set 3: Velocity controller P gain</td><td>Min.</td><td>1</td><td>Unit</td><td colspan="3">Relatd Mode</td></tr>
<tr><td>Default</td><td>1</td><td rowspan="2">0.01 A/(1/min)</td><td>P</td><td>-</td><td>-</td></tr>
<tr><td>Max.</td><td>25400</td><td>DYC</td><td>-</td><td>-</td></tr>
<tr><td colspan="8">Control set 3: Velocity controller P gain

In increments of 0.0001 A/(1/min)

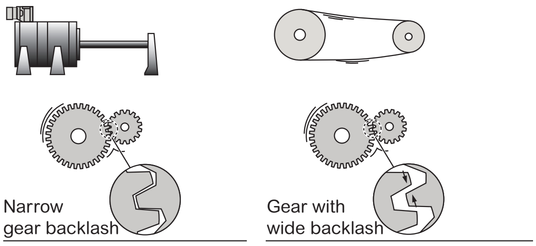
Changed settings become active immediately.</td></tr>
</table>

<table>
<tr><td rowspan="3">P1-16</td><td rowspan="3">Control set 3: Velocity controller integral action time</td><td>Min.</td><td>0</td><td>Unit</td><td colspan="3">Relatd Mode</td></tr>
<tr><td>Default</td><td>0</td><td rowspan="2">0.01 ms</td><td>P</td><td>-</td><td>-</td></tr>
<tr><td>Max.</td><td>32767</td><td>DYC</td><td>-</td><td>-</td></tr>
<tr><td colspan="8">Control set 3: Velocity controller integral action time

In increments of 0.01 ms

Changed settings become active immediately.</td></tr>
</table>

To assess and optimize the transient response behavior of your system, first identify if your mechanical system is a rigidity mechanical system with fast response or is a less rigidity mechanical system with slow response.



- Determining Values for Rigid Mechanical Systems:
  When moment of inertia of load and the motor are known and constant, determine the values the velocity controller P gain P1-01 and the integral action time P1-02 based on the following table, Where:
  JL: Moment of inertia of the load
  JM: Moment of inertia of the motor

	$J_L = J_M$		$J_L = 5 * J_M$		$J_L = 10 * J_M$	
J_L	P1-01	P1-02	P1-01	P1-02	P1-01	P1-02
1 $kgcm^2$	0.0125	8	0.008	12	0.007	16
2 $kgcm^2$	0.0250	8	0.015	12	0.014	16
5 $kgcm^2$	0.0625	8	0.038	12	0.034	16
10 $kgcm^2$	0.125	8	0.075	12	0.069	16
20 $kgcm^2$	0.250	8	0.150	12	0.138	16

- Determine values for less rigidity mechanical systems:
  For optimization purpose, determine a Velocity controller P gain at which the controller adjust the velocity as quickly as possible without overshoot. Consider the following procedures:

  1. Set the parameter P1-02 Velocity controller integral action time to infinite (327.67 ms).

     If a load torque acts on the motor when the motor is at a standstill causes unwanted change of motor position (e.g. vertical axes), the integral action time must not exceed, reduce the integral action time if the position deviation is unacceptable. However, reducing the integral action time can adversely affect optimization results.

⚠ WARNING

UNINTENDED MOVEMENT
- Only start the system if there are no persons or obstructions in the zone of operation.
- Verify that the values for the velocity and the time do not exceed the available movement range.
- Verify that a functioning emergency stop push-button is within reach of all persons involved in the operation.

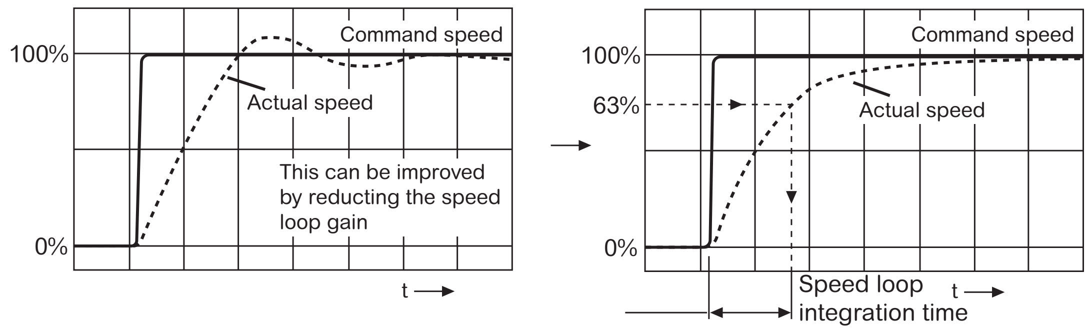
Failure to follow these instructions can result in death, serious injury, or equipment damage.

2. Trigger a step command for example, a parameterized velocity reference value using the Profile Velocity function of commissioning software SoMove. Meanwhile, start the scope feature of SoMove to trace the reference value for the current and actual velocity for the motor.

3. After the first test, verify the maximum amplitude for the reference value for the current Set the amplitude of the step velocity reference value just high enough so the reference value for the current remains below the maximum value. On the other hand, the value selected should not be too low, otherwise friction effects of the mechanical system will determine the performance of the control loop.

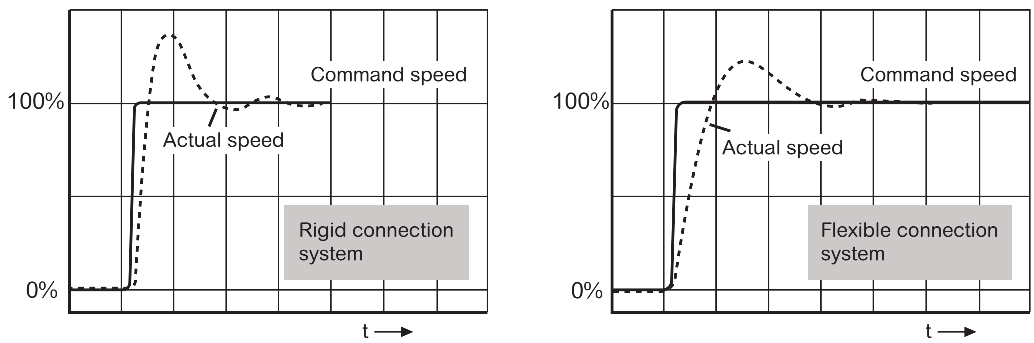
4. Trigger another step function if you had to modify the velocity reference and verify the amplitude of reference value for the current.

5. Increase or decrease the P1-01 Velocity controller P gain in small increments until actual velocity for the motor is obtained as fast as possible. The following diagram shows the step response where the velocity controller P gain is too much and the improvement by reducing velocity controller P gain. Differences between velocity reference and actual velocity for motor result from P1-02 Velocity controller integral action time.



In the case of drive systems in which oscillations occur before the aperiodic limit is reached, the velocity controller P gain must be reduced until oscillations can no longer be detected. This occurs frequently in the case of linear axes with a toothed belt drive.

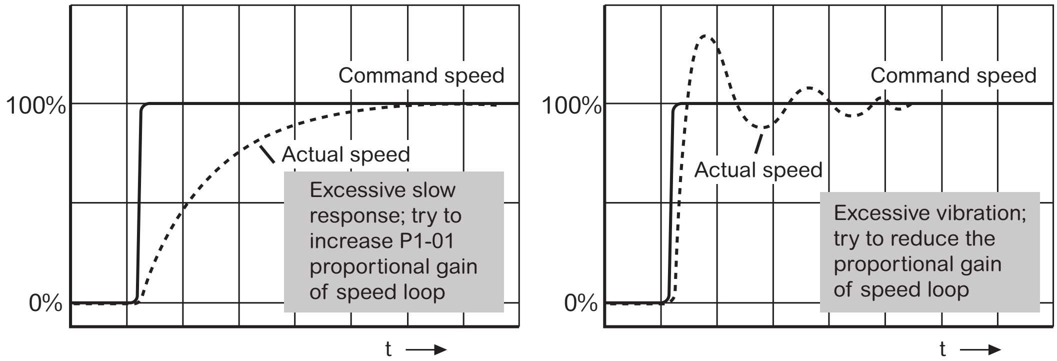
- Graphic Determination of the 63% Value
  Graphically determine the point at which the actual velocity reaches 63% of the final value. The integral action time P1-02 then results as a value on the time axis.



- Verifying and Optimizing the P Gain:
  The controller is properly set when the step response is approximately identical to the signal shown. Good control performance is characterized by:
  i. Fast transient response
  ii. Overshooting up to a maximum of 40%, 20%.

  If the control performance does not correspond to the curve shown, change P1-01 velocity controller P gain in increments of about 10% and then trigger another step function:
  i. If the control is too slow: Use a higher P1-01 velocity controller P gain value.
  i. If the control tends to oscillate: Use a lower P1-01 velocity controller P gain value.

  Oscillation ringing is characterized by continuous acceleration and deceleration of the motor.
  Optimizing insufficient velocity controller settings



7.6.5 Optimize the Position Controller

An optimized velocity controller is a prerequisite for optimization of the position controller. When tuning the position controller, you must optimize the position controller P gain:

- P gain too high: Overshooting, instability
- P gain too low: High position deviation

Parameters in control loop parameter set 1 used for optimization of position controller:

P1-00	Control set 1: Position controller P gain	Min.	20	Unit	Relatd Mode		
		Default	20	0.1 1/s	P	-	-
		Max.	9000		DYC	-	-

Control set 1: Position controller P gain

In increments of 0.1 1/s

Changed settings become active immediately.

Parameters in control loop parameter set 2 used for optimization of position controller:

P1-07	Control set 2: Position controller P gain	Min.	20	Unit	Relatd Mode		
		Default	20	0.1 1/s	P	-	-
		Max.	9000		DYC	-	-

Control set 2: Position controller P gain

In increments of 0.1 1/s

Changed settings become active immediately.

Parameters in control loop parameter set 3 used for optimization of position controller:

P1-14	Control set 3: Position controller P gain	Min.	20	Unit	Relatd Mode		
		Default	20	0.1 1/s	P	-	-
		Max.	9000		DYC	-	-

Control set 3: Position controller P gain

In increments of 0.1 1/s

Changed settings become active immediately.

To assess and optimize the transient response behavior of the position controller, you need to trigger a step command. For example, a parameterized step position reference value using the Profile Position function of commissioning software SoMove. Meanwhile, start the scope feature of SoMove to trace the reference value for the reference and actual position of the position controller, the current and actual velocity for the motor.

Note, the step function moves the motor at constant velocity until the movement finishes.

⚠ WARNING

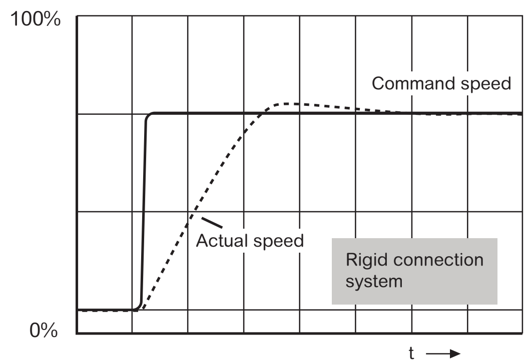
UNINTENDED MOVEMENT

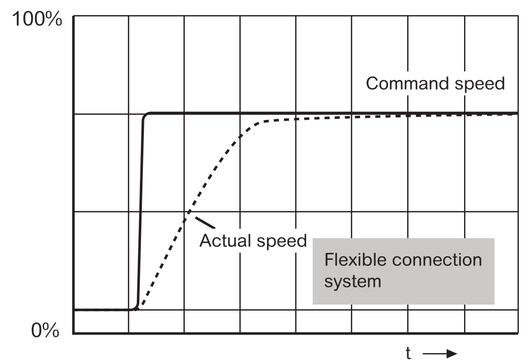
- Only start the system if there are no persons or obstructions in the zone of operation.
- Verify that the values for the velocity and the time do not exceed the available movement range.
- Verify that a functioning emergency stop push-button is within reach of all persons involved in the operation.

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

After the first test, verify the values achieved for actual velocity and reference current for current control and velocity control. The values must not reach the current and velocity limitation range.

Step responses of a position controller with good control performance with respect to different mechanical system are shown as below:

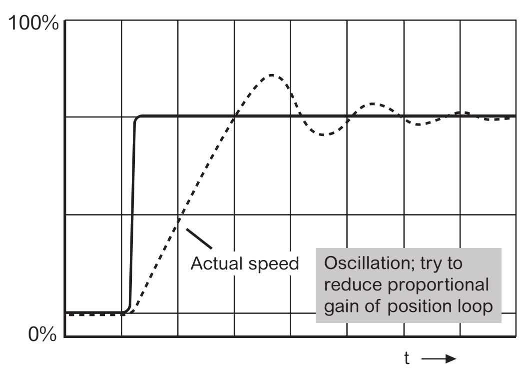


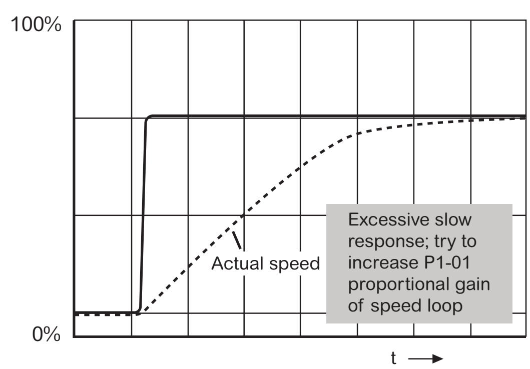


The position controller P gain setting is optimal if the reference value is reached rapidly and with little or no overshooting.

If the control performance does not correspond to the curve shown, change the position controller P gain in increments of approximately 10% and trigger another step function.

- If the control tends to oscillate: Use a lower P gain value.
- If the actual value is too slow reaching the reference value: Use a higher P gain value.





7.7 Gain Switching

Easy Lexium 16 servo drive can switch between 2 control loop parameter sets manually or automatically to deliver better performance with respect to various response requirements.

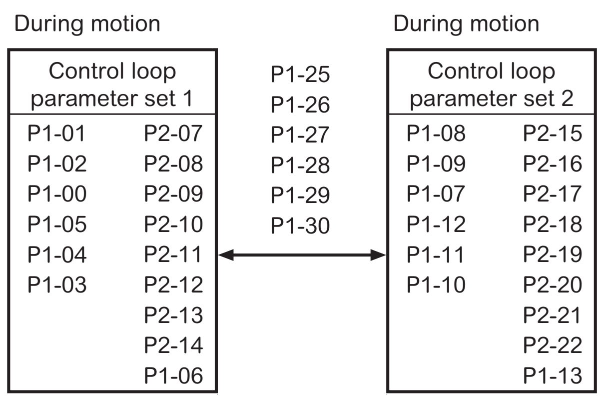
7.7.1 Auto Gain Switching Between Control Loop Parameter Sets 1 and 2

When parameter P0-01 is set to 0 / Invalid, the cascade PID control loops take effective. Easy Lexium 16 servo drive has three cascade PID control loop parameter sets:

- P1-00 .. P1-06: Control loop parameter set 1
- P1-07 .. P1-13: Control loop parameter set 2
- P1-14 .. P1-18: Control loop parameter set 3

Control loop parameter sets 1 and 2 take effective during motion, while control loop parameter set 3 is effective when servo motor is at low speed or rest.

It is possible to set criteria for switching between the control loop parameter sets 1 and 2.



The default control loop parameter set actived after power-on is selected via parameter P1-30

P1-30	Selection of control loop parameter set at power up	Min.	0	Unit	Relatd Mode		
		Default	1	-	P	-	-
		Max.	2		DYC	-	-

Selection of control loop parameter set at power up
0 / Switching Condition: The switching condition is used for control loop parameter set switching
1 / Parameter Set 1: Control loop parameter set 1 is used
2 / Parameter Set 2: Control loop parameter set 2 is used

Changed settings become active immediately.

The following criteria can be set for switching between the control loop parameter sets 1 and 2:
- Digital input signal
- Position deviation window
- Target velocity below parameterizable value
- Actual velocity below parameterizable value

The criteria for parameter set switching can be selected via parameter P1-31

P1-31	Condition for parameter set switching	Min.	0	Unit	Relatd Mode		
		Default	0	ms	P	-	-
		Max.	1000		DYC	-	-

Condition for parameter set switching
0 / None or Digital Input: None or digital input function selected
1 / Inside Position Deviation: Inside position deviation (value definition in parameter P1-33)
2 / Below Reference Velocity: Below reference velocity (value definition in parameter P1-34)
3 / Below Actual Velocity: Below actual velocity (value definition in parameter P1-33)
4 / Reversed: Reserved

In the case of parameter set switching, the values of the following parameters are changed gradually:
P1-00 / P1-07
P1-01 / P1-08
P1-02 / P1-09
P1-03 / P1-10
P1-04 / P1-11
P1-05 / P1-12
The following parameters are changed immediately after the time for parameter set switching (P1-35):
P2-07 / P2-15
P2-08 / P2-16
P2-09 / P2-17
P2-10 / P2-18
P2-11 / P2-19
P2-12 / P2-20
P2-13 / P2-21
P2-14 / P2-22
P1-06 / P1-13

Changed settings become active immediately.

When switching criteria is selected as position deviation or velocity threshold, parameters P1-32/P1-33/P1-34 can be used to set position deviation and velocity threshold, as well as the monitoring window time.

P1-32	Time window for parameter set switching	Min.	0	Unit	Relatd Mode		
		Default	0	ms	P	-	-
		Max.	1000		DYC	-	-

Control loop parameter set switches the time window for monitoring of position error and speed threshold:
0: Monitoring window disabled
>0: Window time for the parameters switching

Changed settings become active immediately.

P1-33	Position deviation for control loop parameter set switching	Min.	0	Unit	Relatd Mode		
		Default	1310	usr_p	P	-	-
		Max.	2147483647		DYC	-	-

Position deviation for parameter set switching
When parameter P1-31 = 1 / Inside Position Deviation, if the position error is smaller than this parameter value, control loop parameter set 2 will be used; otherwise, control loop parameter set 1 will be used

Changed settings become active immediately.

P1-34	Velocity threshold for control loop parameter set switching	Min.	0	Unit	Relatd Mode		
		Default	50	usr_v	P	-	-
		Max.	2147483647		DYC	-	-

Velocity threshold for parameter set switching
When parameter P1-31 = 2 / Below Reference Velocity, if the target speed is smaller than this parameter value, control loop parameter set 2 will be used, otherwise, control loop parameter set 1 will be used
When parameter P1-27 = 3 / Below Actual Velocity, if the target speed is smaller than this parameter value, control loop parameter set 2 will be used, otherwise, control loop parameter set 1 will be used

Changed settings become active immediately.

The linear switching between control loop parameter sets takes place during the period defined in parameter P1-35.

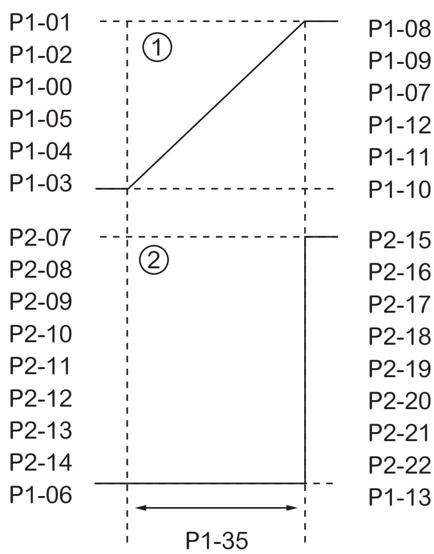
Other control loop parameters are directly changed to the values of the other control loop parameter set after the parameterizable time P1-35 has passed.

The figure below shows the time chart for switching the control loop parameters.

P1-35	Period of time for control loop parameter set switching	Min.	0	Unit	Relatd Mode		
		Default	0	ms	P	-	-
		Max.	2000		DYC	-	-

Period of time for parameter switching
In the case of control loop parameter set switching, the values of the following parameters are changed gradually:
P1-00 / P1-07
P1-01 / P1-08
P1-02 / P1-09
P1-03 / P1-10
P1-04 / P1-11
P1-05 / P1-12

Changed settings become active immediately.



7.7.2 Auto Gain Switching to Control Loop Parameter Set 3

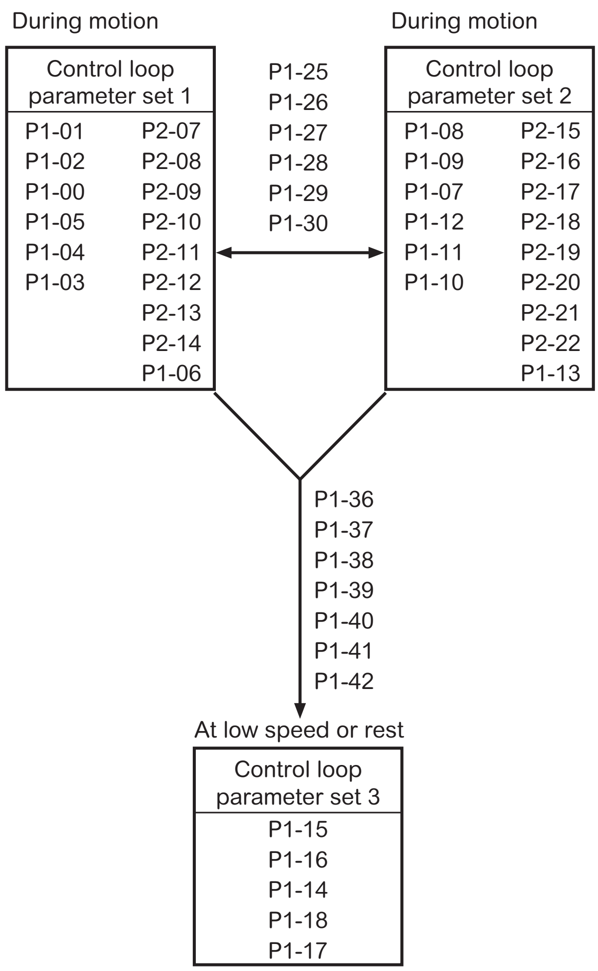
When parameter P0-01 is set to 0 / Invalid, the cascade PID control loops take effective. Easy Lexium 16 servo drive has three cascade PID control loop parameter sets:

- P1-00 .. P1-06: Control loop parameter set 1
- P1-07 .. P1-13: Control loop parameter set 2
- P1-14 .. P1-18: Control loop parameter set 3

Control loop parameter sets 1 and 2 take effective during motion, while control loop parameter set 3 is effective when servo motor is at low speed or rest.

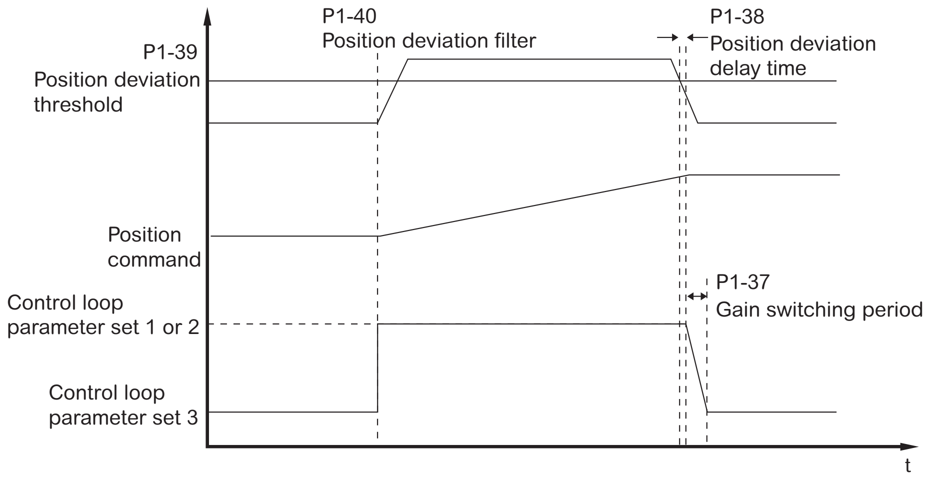
It is possible to set criteria for switching between the control loop parameter sets 1 and 2. See chapter "7.7.1 Auto Gain Switching Between Control Loop Parameter Sets 1 and 2" for detailed information.

However, no matter control loop parameter set 1 or 2 is actived, control loop parameter set 3 will be actived when motor at low speed or rest.



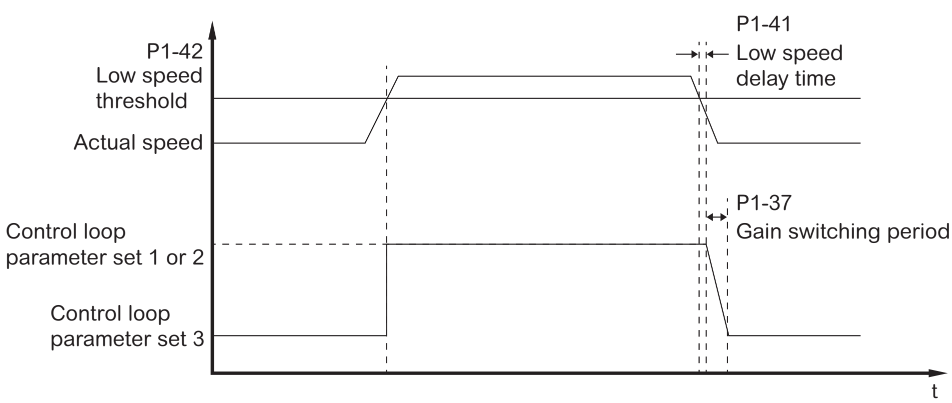
The conditions for switching to control loop parameter set 3 consists of position and velocity:

- Position condition for switching to control loop parameter set 3



Upon completion of the movement, if the position deviation filtered by filter defined by parameter P1-40 is less than the position deviation threshold in parameter P1-39 for longer than the period defined in parameter P1-38, the position condition for switching to control loop parameter set 3 is met.

- Velocity condition for switching to control loop parameter set 3



Upon completion of the movement, if the actual velocity for motor is lower than the velocity threshold in parameter P1-42 for longer than the period defined in parameter P1-41, the position condition for switching to control loop parameter set 3 is met.

P1-38	Dynamic gain switching: Position deviation delay time	Min.	0	Unit	Relatd Mode		
		Default	20	0.1 ms	P	-	-
		Max.	2000		DYC	-	-

Period of time for position detection after motion is finished.
When motion is finished, if the position deviation after filtering by the filter defined in P1-40 is within the position thresholds defined in P1-39 for a period of time longer than the value given in this parameter, dynamic gain switching "Position" condition is met.

In increments of 0.1 ms

Changed settings become active immediately.

P1-39	Dynamic gain switching: Position deviation threshold	Min.	2	Unit	Relatd Mode		
		Default	50	0.1 deg	P	-	-
		Max.	100		DYC	-	-

Position deviation thresholds for dynamic gain switching.
Refer to parameter P1-38

In increments of 0.1 deg

Changed settings become active immediately.

P1-40	Dynamic gain switching: Filter time constant for position deviation	Min.	0	Unit	Relatd Mode		
		Default	100	0.1 ms	P	-	-
		Max.	2000		DYC	-	-

Filter time constant for position deviation for dynamic gain switching.
Refer to parameter P1-38

In increments of 0.1 ms

Changed settings become active immediately.

P1-41	Dynamic gain switching: Low speed delay time	Min.	0	Unit	Relatd Mode		
		Default	20	0.1 ms	P	-	-
		Max.	2000		DYC	-	-

Period of time for speed detection after motion is finished.
When motion is finished, if the actual speed is lower than the thresholds defined in P1-42 for a period of time longer than the value given in this parameter, dynamic gain switching "Speed" condition is met.

In increments of 0.1 ms

Changed settings become active immediately.

P1-42	Dynamic gain switching: Low speed threshold	Min.	0	Unit	Relatd Mode		
		Default	20	1/min	P	-	-
		Max.	50		DYC	-	-

Low speed threshold for dynamic gain switching.
Refer to parameter P1-41

Changed settings become active immediately.

Following methods of switching to control loop parameter set 3 can be set via parameter P1-36:

- P1-36 = 0 / Dynamic Gain Switch Disable:
  Disable the adaptive stiffness index switching
- P1-36 = 1 / Dynamic Gain Switch No Ramp:
  Direct parameter switching for adaptive stiffness index switching
- P1-36 = 2 / Dynamic Gain Switch Deep Sleep Mode:
  Switching to stiffness index even lower than the lower stiffness in P1-44
- P1-36 = 3 / Dynamic Gain Switch With Ramp:
  Adaptive stiffness index switching with slope

When parameter P1-36 = 3 / Dynamic Gain Switch With Ramp is select and when the switching conditions are met, linear switching of dynamic gain takes place during the period defined in parameter P1-37.

<table>
<tr><td rowspan="3">P1-36</td><td rowspan="3">Dynamic gain switching: Selection of switching method</td><td>Min.</td><td>0</td><td>Unit</td><td colspan="3">Relatd Mode</td></tr>
<tr><td>Default</td><td>1</td><td rowspan="2">-</td><td>P</td><td>-</td><td>-</td></tr>
<tr><td>Max.</td><td>3</td><td>DYC</td><td>-</td><td>-</td></tr>
<tr><td colspan="8">Dynamic gain switching selection
0 / Dynamic Gain Switch Disable: Disable the adaptive stiffness index switching
1 / Dynamic Gain Switch No Ramp: Direct parameter switching for adaptive stiffness index switching
2 / Dynamic Gain Switch Deep Sleep Mode: Switching to stiffness index even lower than the lower stiffness in P1-44
3 / Dynamic Gain Switch With Ramp: Adaptive stiffness index switching with slope

When parameter P0-01 = 0 / Invalid, when the switching conditions are met, the values of the following parameters are changed gradually:
P1-00 / P1-14
P1-01 / P1-15
P1-02 / P1-16
P1-04 / P1-17
P1-05 / P1-18
When parameter P0-01 = 1 / Standard, 2 / Passive or 3 / Adaptive, when the switching conditions are met, the values of the following parameters are changed gradually:
P0-02 / P1-44

When this parameter is set to 2 / Dynamic Gain Switch Deep Sleep Mode, after the switch of dynamic gain to lower ones, the dynamic gain will further decrease to half of the lower gain.

Changed settings become active immediately.</td></tr>
</table>

<table>
<tr><td rowspan="3">P1-37</td><td rowspan="3">Dynamic gain switching: Period of time for dynamic gain switching</td><td>Min.</td><td>0</td><td>Unit</td><td colspan="3">Relatd Mode</td></tr>
<tr><td>Default</td><td>0</td><td rowspan="2">0.1 ms</td><td>P</td><td>-</td><td>-</td></tr>
<tr><td>Max.</td><td>2000</td><td>DYC</td><td>-</td><td>-</td></tr>
<tr><td colspan="8">Period of time for dynamic gain switching with ramp.
When parameter P1-36 = 3 / Dynamic Gain Switch With Ramp, when the switching conditions are met, values of dynamic gain will change gradually within the given period in this parameter.

In increments of 0.01 ms

Changed settings become active immediately.</td></tr>
</table>

The mode of switching to control loop parameter set 3 can be set via parameter P1-43:

- P1-43 = 0 / Position And Velocity:
  Control loop gain will switch when both dynamic gain switching "Position" and "Speed" conditions are met.

- P1-43 = 1 / Position Or Velocity:
  Position controller gain will switch seperately when dynamic gain switching "Position" condition is met, velocity controller gain will switch seperately when dynamic gain switching "Speed" condition is met.

<table>
<tr><td rowspan="3">P1-43</td><td rowspan="3">Dynamic gain switching: Selection of low speed optimization mode</td><td>Min.</td><td>0</td><td>Unit</td><td colspan="3">Relatd Mode</td></tr>
<tr><td>Default</td><td>0</td><td rowspan="2">-</td><td>P</td><td>-</td><td>-</td></tr>
<tr><td>Max.</td><td>1</td><td>DYC</td><td>-</td><td>-</td></tr>
<tr><td colspan="8">Selection of low speed optimization mode
0 / Position And Velocity: Control loop gain will switch when both dynamic gain switching "Position" and "Speed" conditions are met
1 / Position Or Velocity: Position controller gain will switch seperately when dynamic gain switching "Position" condition is met, velocity controller gain will switch seperately when dynamic gain switching "Speed" condition is met.

Changed settings become active immediately.</td></tr>
</table>

Upon receive new motion command again, the control loop parameter set 1 or 2 will be enabled.

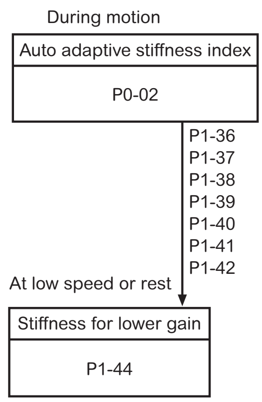
7.7.3 Auto Adaptive Control Stiffness Switching

When parameter P0-01 is set to 1 / Standard, 2 / Passive or 3 / Adaptive, the auto adaptive control loop takes effective. Easy Lexium 16 servo drive provides two auto adaptive control stiffnesses:

- P0-02 Auto adaptive stiffness index
- P1-44 Dynamic gain switching: stiffness for lower gain

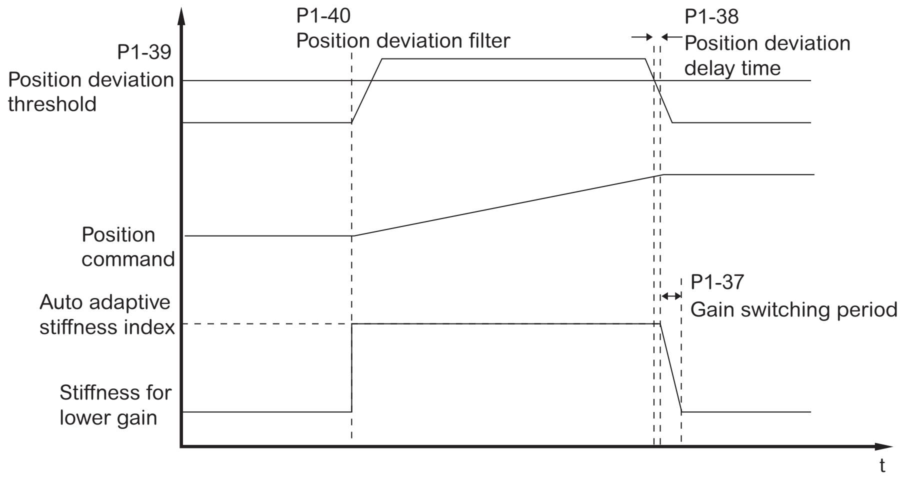
The auto adaptive control loop parameters are calculated based on either of the 2 stiffness indexes and the system inertia ratio in P0-03.

Auto adaptive stiffness index takes effective during motion, while stiffness for lower gain is effective when servo motor is at low speed or rest.



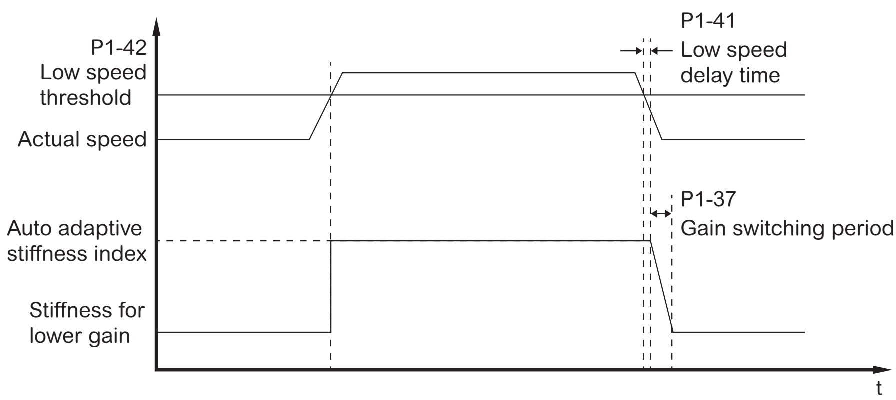
The conditions for switching to stiffness for lower gain consists of position and velocity:

- Position condition for switching to stiffness for lower gain



Upon completion of the movement, if the position deviation filtered by filter defined by parameter P1-40 is less than the position deviation threshold in parameter P1-39 for longer than the period defined in parameter P1-38, the position condition for switching to stiffness for lower gain is met.

- Velocity condition for switching to stiffness for lower gain



Upon completion of the movement, if the actual velocity for motor is lower than the velocity threshold in parameter P1-42 for longer than the period defined in parameter P1-41, the position condition for switching to stiffness for lower gain is met.

P1-38	Dynamic gain switching: Position deviation delay time	Min.	0	Unit	Relatd Mode		
		Default	20	0.1 ms	P	-	-
		Max.	2000		DYC	-	-

Period of time for position detection after motion is finished.
When motion is finished, if the position deviation after filtering by the filter defined in P1-40 is within the position thresholds defined in P1-39 for a period of time longer than the value given in this parameter, dynamic gain switching "Position" condition is met.

In increments of 0.1 ms

Changed settings become active immediately.

P1-39	Dynamic gain switching: Position deviation threshold	Min.	2	Unit	Relatd Mode		
		Default	50	0.1 deg	P	-	-
		Max.	100		DYC	-	-

Position deviation thresholds for dynamic gain switching.
Refer to parameter P1-38

In increments of 0.1 deg

Changed settings become active immediately.

P1-40	Dynamic gain switching: Filter time constant for position deviation	Min.	0	Unit	Relatd Mode		
		Default	100	0.1 ms	P	-	-
		Max.	2000		DYC	-	-

Filter time constant for position deviation for dynamic gain switching.
Refer to parameter P1-38

In increments of 0.1 ms

Changed settings become active immediately.

P1-41	Dynamic gain switching: Low speed delay time	Min.	0	Unit	Relatd Mode		
		Default	20	0.1 ms	P	-	-
		Max.	2000		DYC	-	-

Period of time for speed detection after motion is finished.
When motion is finished, if the actual speed is lower than the thresholds defined in P1-42 for a period of time longer than the value given in this parameter, dynamic gain switching "Speed" condition is met.

In increments of 0.1 ms

Changed settings become active immediately.

P1-42	Dynamic gain switching: Low speed threshold	Min.	0	Unit	Relatd Mode		
		Default	20	1/min	P	-	-
		Max.	50		DYC	-	-

Low speed threshold for dynamic gain switching.
Refer to parameter P1-41

Changed settings become active immediately.

Following methods of switching to stiffness for lower gain can be set via parameter P1-36:

- P1-36 = 0 / Dynamic Gain Switch Disable:
  Disable the adaptive stiffness index switching
- P1-36 = 1 / Dynamic Gain Switch No Ramp:
  Direct parameter switching for adaptive stiffness index switching
- P1-36 = 2 / Dynamic Gain Switch Deep Sleep Mode:
  Switching to stiffness index even lower than the lower stiffness in P1-44
- P1-36 = 3 / Dynamic Gain Switch With Ramp:
  Adaptive stiffness index switching with slope

When parameter P1-36 = 3 / Dynamic Gain Switch With Ramp is select and when the switching conditions are met, linear switching of dynamic gain takes place during the period defined in parameter P1-37.

P1-36	Dynamic gain switching: Selection of switching method	Min.	0	Unit	Relatd Mode		
		Default	1	-	P	-	-
		Max.	3		DYC	-	-

Dynamic gain switching selection
0 / Dynamic Gain Switch Disable: Disable the adaptive stiffness index switching
1 / Dynamic Gain Switch No Ramp: Direct parameter switching for adaptive stiffness index switching
2 / Dynamic Gain Switch Deep Sleep Mode: Switching to stiffness index even lower than the lower stiffness in P1-44
3 / Dynamic Gain Switch With Ramp: Adaptive stiffness index switching with slope

When parameter P0-01 = 0 / Invalid, when the switching conditions are met, the values of the following parameters are changed gradually:
P1-00 / P1-14
P1-01 / P1-15
P1-02 / P1-16
P1-04 / P1-17
P1-05 / P1-18
When parameter P0-01 = 1 / Standard, 2 / Passive or 3 / Adaptive, when the switching conditions are met, the values of the following parameters are changed gradually:
P0-02 / P1-44

When this parameter is set to 2 / Dynamic Gain Switch Deep Sleep Mode, after the switch of dynamic gain to lower ones, the dynamic gain will further decrease to half of the lower gain.

Changed settings become active immediately.

P1-37	Dynamic gain switching: Period of time for dynamic gain switching	Min.	0	Unit	Relatd Mode		
		Default	0	0.1 ms	P	-	-
		Max.	2000		DYC	-	-

Period of time for dynamic gain switching with ramp.
When parameter P1-36 = 3 / Dynamic Gain Switch With Ramp, when the switching conditions are met, values of dynamic gain will change gradually within the given period in this parameter.

In increments of 0.01 ms

Changed settings become active immediately.

The mode of switching to stiffness for lower gain can be set via parameter P1-43:

- P1-43 = 0 / Position And Velocity:
  Control loop gain will switch when both dynamic gain switching "Position" and "Speed" conditions are met.

- P1-43 = 1 / Position Or Velocity:
  Position controller gain will switch seperately when dynamic gain switching "Position" condition is met, velocity controller gain will switch seperately when dynamic gain switching "Speed" condition is met.

<table>
<tr><td rowspan="3">P1-43</td><td rowspan="3">Dynamic gain switching: Selection of low speed optimization mode</td><td>Min.</td><td>0</td><td>Unit</td><td colspan="3">Relatd Mode</td></tr>
<tr><td>Default</td><td>0</td><td rowspan="2">-</td><td>P</td><td>-</td><td>-</td></tr>
<tr><td>Max.</td><td>1</td><td>DYC</td><td>-</td><td>-</td></tr>
<tr><td colspan="8">Selection of low speed optimization mode
0 / Position And Velocity: Control loop gain will switch when both dynamic gain switching "Position" and "Speed" conditions are met
1 / Position Or Velocity: Position controller gain will switch seperately when dynamic gain switching "Position" condition is met, velocity controller gain will switch seperately when dynamic gain switching "Speed" condition is met.

Changed settings become active immediately.</td></tr>
</table>

Upon receive new motion command again, the auto adaptive stiffness index will be enabled.

7.8 Manual Tuning (Advanced)

7.8.1 Feedforward Tuning

In cascade control loop, the position controller compares the difference between reference position and the actual position of the motor, then calculates the reference value for velocity controller based on the deviation. With velocity feedforward control, additional velocity command calculated based on velocity controller reference value will be added on the velocity controller reference value. Thus, position deviation can be further reduced also better system response can be achieved.

Moreover, additional current feedforward command calculated based on current controller reference value can be added to the current controller reference value, in order to optimize the response time of the velocity controller.

Easy Lexium 16 servo drive provides both velocity feedforward and current feedforward functions. There are 2 individual velocity feedforward parameters in Ctrl1 and Ctrl2 respectively, and 1 current feedforward parameter for all control parameter sets.

By using of velocity feedforward control the position deviation at a constant velocity can be further reduced as shown in the equation below in proportion to the value of velocity feedforward gain:

Position deviation = Velocity command / Position controller proportion gain * (100% - Velocity feedforward gain)

With the gain set at 100% the calculated position deviation is 0, but significant overshoot occurs during acceleration and deceleration. Meanwhile, the operating noise may increase while the velocity feedforward gain is increasing. In such a case, please use PTI command smooth filter via parameter P1-23 and P1-24 or reduce the velocity feedforward gain.

<table>
<tr><td rowspan="3">P1-03</td><td rowspan="3">Control set 1: Velocity feed-forward control</td><td>Min.</td><td>0</td><td>Unit</td><td colspan="3">Relatd Mode</td></tr>
<tr><td>Default</td><td>550</td><td rowspan="2">0.1 %</td><td>P</td><td>-</td><td>-</td></tr>
<tr><td>Max.</td><td>2000</td><td>DYC</td><td>-</td><td>-</td></tr>
<tr><td colspan="8">Parameter set 1: Velocity feed-forward control

In increments of 0.1%

Changed settings become active immediately.</td></tr>
</table>

<table>
<tr><td rowspan="3">P1-10</td><td rowspan="3">Control set 2: Velocity feed-forward control</td><td>Min.</td><td>0</td><td>Unit</td><td colspan="3">Relatd Mode</td></tr>
<tr><td>Default</td><td>550</td><td rowspan="2">0.1 %</td><td>P</td><td>-</td><td>-</td></tr>
<tr><td>Max.</td><td>2000</td><td>DYC</td><td>-</td><td>-</td></tr>
<tr><td colspan="8">Parameter set 2: Velocity feed-forward control

In increments of 0.1%

Changed settings become active immediately.</td></tr>
</table>

P1-23	Activation of jerk limitation	Min.	0	Unit	Relatd Mode		
		Default	0	-	P	-	-
		Max.	1		DYC	-	-

Activation of jerk limitation
0 / Off: Jerk limitation deactivated
1 / PosSyncOn: Jerk limitation active

The time for jerk limitation must be set via parameter P1-24.

Setting can only be changed if power stage is disabled.
Changed settings become active the next time the power stage is enabled.

P1-24	Jerk limitation of the motion profile for velocity	Min.	0	Unit	Relatd Mode		
		Default	0	-	P	-	-
		Max.	1		DYC	-	-

Jerk limitation of the motion profile for velocity
0 / Off: Off
1 / 1: 1 ms
2 / 2: 2 ms
4 / 4: 4 ms
8 / 8: 8 ms
16 / 16: 16 ms
32 / 32: 32 ms
64 / 64: 64 ms
128 / 128: 128 ms

Changed settings become active the next time the motor moves.

P1-26	Acceleration feed-forward control	Min.	0	Unit	Relatd Mode		
		Default	0	0.1 %	P	-	-
		Max.	3000		DYC	-	-

Acceleration feed-forward control

In increments of 0.1 %

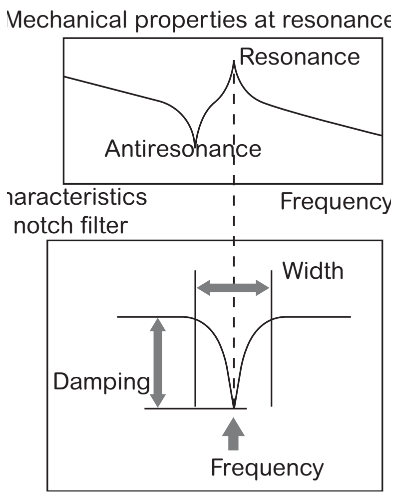
Changed settings become active immediately.

7.8.2 Manual Notch Filters

In case of mechanical resonance, you cannot set up a higher gain because of vibration and noise occur due to oscillation. By suppressing the resonance peak at the notch filter, higher gain can be obtained or the level of vibration and noise can be lowered.

Easy Lexium 16 servo drive supports 4 sets of manual notch filters, each control loop parameter set contains 2 sets respectively. Depending on the control loop parameter set enabled, 2 manual notch filters are enabled at a time.

CTRL1 / Control Loop Parameter Set 1		CTRL2 / Control Loop Parameter Set 2	
P2-07	Control Set 1 Notch filter 1: Damping	P2-15	Control Set 2 Notch filter 1: Damping
P2-08	Control Set 1 Notch filter 1: Frequency	P2-16	Control Set 2 Notch filter 1: Frequency
P2-09	Control Set 1 Notch filter 1: Bandwidth	P2-17	Control Set 2 Notch filter 1: Bandwidth
P2-10	Control Set 1 Notch filter 2: Damping	P2-18	Control Set 2 Notch filter 2: Damping
P2-11	Control Set 1 Notch filter 2: Frequency	P2-19	Control Set 2 Notch filter 2: Frequency
P2-12	Control Set 1 Notch filter 2: Bandwidth	P2-20	Control Set 2 Notch filter 2: Bandwidth



When setting the manual notch filters, it is necessary to estimate the mechanical resonance frequency. It is recommended to use the scope function of commissioning software SoMove for the estimation:

- Start the scope function of commissioning software SoMove, add the actual velocity for motor in the channel list.
- Set sampling interval of scope. According to the law of sampling, the sampling period of scope determines the maximum range frequency domain. The sampling period shall be set to a smaller value for higher frequency domain estimation and a larger value for lower frequency domain estimation.
- Drive the servo motor either by command from controller or by Jog operation, transmit the trace of actual velocity for motor into frequency domain by FFT and try to identify the resonance frequency.
- Gradually increase P1-01 Velocity controller P gain of speed or P0-02 auto adaptive tuning stiffness, trace the actual velocity for motor and transmit it into frequency by FFT again, then try to identify the resonance frequency.
- After the resonance frequency is identified, set the notch filters parameters with the frequency identified as well as the bandwidth and damping. Drive the servo motor again to see if the mechanical resonance has been suppressed successfully.

P2-07	Control Set 1 Notch filter 1: Damping	Min.	550	Unit	Relatd Mode		
		Default	900	0.1 %	P	-	-
		Max.	990		DYC	-	-

Control Set 1 Notch filter 1: Damping

In increments of 0.1 %

Changed settings become active immediately.

P2-08	Control Set 1 Notch filter 1: Frequency	Min.	500	Unit	Relatd Mode		
		Default	15000	0.1 Hz	P	-	-
		Max.	15000		DYC	-	-

Control Set 1 Notch filter 1: Frequency

In increments of 0.1 Hz

Changed settings become active immediately.

P2-09	Control Set 1 Notch filter 1: Bandwidth	Min.	10	Unit	Relatd Mode		
		Default	700	0.1 %	P	-	-
		Max.	900		DYC	-	-

Control Set 1 Notch filter 1: Bandwidth

In increments of 0.1 %

Changed settings become active immediately.

P2-10	Control Set 1 Notch filter 2: Damping	Min.	550	Unit	Relatd Mode		
		Default	900	0.1 %	P	-	-
		Max.	990		DYC	-	-

Control Set 1 Notch filter 2: Damping

In increments of 0.1 %

Changed settings become active immediately.

P2-11	Control Set 1 Notch filter 2: Frequency	Min.	500	Unit	Relatd Mode		
		Default	15000	0.1 Hz	P	-	-
		Max.	15000		DYC	-	-

Control Set 1 Notch filter 2: Frequency

In increments of 0.1 Hz

Changed settings become active immediately.

P2-12	Control Set 1 Notch filter 2: Bandwidth	Min.	10	Unit	Relatd Mode		
		Default	700	0.1 %	P	-	-
		Max.	900		DYC	-	-

Control Set 1 Notch filter 2: Bandwidth

In increments of 0.1 %

Changed settings become active immediately.

P2-15	Control Set 2 Notch filter 1: Damping	Min.	550	Unit	Relatd Mode		
		Default	900	0.1 %	P	-	-
		Max.	990		DYC	-	-

Control Set 2 Notch filter 1: Damping

In increments of 0.1 %

Changed settings become active immediately.

P2-16	Control Set 2 Notch filter 1: Frequency	Min.	500	Unit	Relatd Mode		
		Default	15000	0.1 Hz	P	-	-
		Max.	15000		DYC	-	-

Control Set 2 Notch filter 1: Frequency

In increments of 0.1 Hz

Changed settings become active immediately.

P2-17	Control Set 2 Notch filter 1: Bandwidth	Min.	10	Unit	Relatd Mode		
		Default	700	0.1 %	P	-	-
		Max.	900		DYC	-	-

Control Set 2 Notch filter 1: Bandwidth

In increments of 0.1 %

Changed settings become active immediately.

P2-18	Control Set 2 Notch filter 2: Damping	Min.	550	Unit	Relatd Mode		
		Default	900	0.1 %	P	-	-
		Max.	990		DYC	-	-

Control Set 2 Notch filter 2: Damping

In increments of 0.1 %

Changed settings become active immediately.

P2-19	Control Set 2 Notch filter 2: Frequency	Min.	500	Unit	Relatd Mode		
		Default	15000	0.1 Hz	P	-	-
		Max.	15000		DYC	-	-

Control Set 2 Notch filter 2: Frequency

In increments of 0.1 Hz

Changed settings become active immediately.

P2-20	Control Set 2 Notch filter 2: Bandwidth	Min.	10	Unit	Relatd Mode		
		Default	700	0.1 %	P	-	-
		Max.	900		DYC	-	-

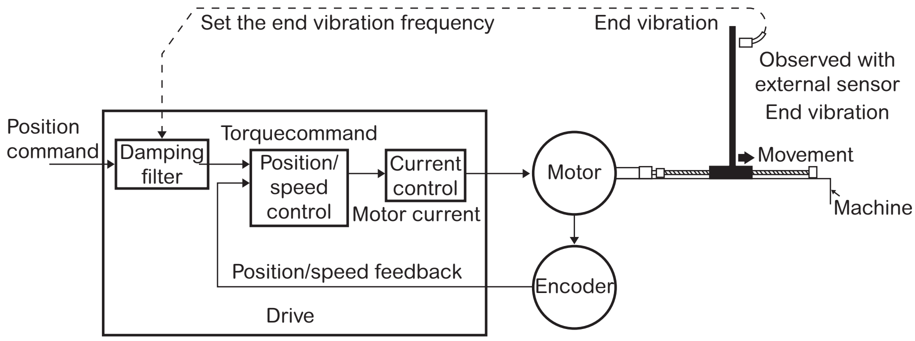
Control Set 2 Notch filter 2: Bandwidth

In increments of 0.1 %

Changed settings become active immediately.

7.8.3 Vibration Suppression

This function reduces vibration at the top of the long rod-shaped load by removing the vibration frequency components specified by the position command.



Easy Lexium 16 servo drive supports 2 sets of anti-vibration filters:

P2-26	Frequency for anti vibration filter 1	Min.	0	Unit	Relatd Mode		
		Default	500	0.1 %	P	-	-
		Max.	3000		DYC	-	-

Frequency for anti vibration filter 1

In increments of 0.1 %

Changed settings become active immediately.

P2-27	Damping fator for anti vibration filter 1	Min.	0	Unit	Relatd Mode		
		Default	0	0.1 Hz	P	-	-
		Max.	2000		DYC	-	-

Damping fator for anti vibration filter 1

In increments of 0.1 Hz

Changed settings become active immediately.

P2-28	Frequency for anti vibration filter 2	Min.	0	Unit	Relatd Mode		
		Default	500	0.1 %	P	-	-
		Max.	3000		DYC	-	-

Frequency for anti vibration filter 2

In increments of 0.1 %

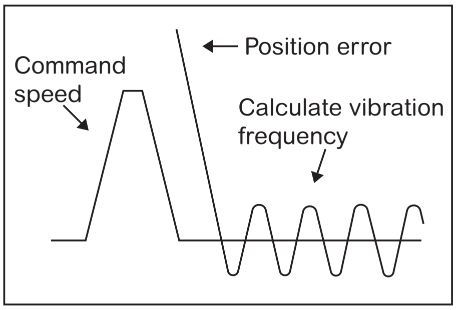
Changed settings become active immediately.

P2-29	Damping fator for anti vibration filter 2	Min.	0	Unit	Relatd Mode		
		Default	0	0.1 Hz	P	-	-
		Max.	2000		DYC	-	-
Damping fator for anti vibration filter 2 In increments of 0.1 Hz Changed settings become active immediately.							

The vibration suppression function does not work properly, or no effect is obtained under the following conditions:

- Vibration is triggered by other factors than command (such as external disturbance).
- The vibration frequency is out of the range of 1~200Hz

Where vibration suppression filter is used, first measure the vibration frequency at the top of the load with displacement sensor, read out the vibration frequency in unit of Hz, set the frequency as well as the damping factor in the parameters based on the measured result. If no measuring device is available, measure the frequency based on the residual vibration of the position deviation waveform using the scope function of the commissioning software SoMove, then continue the settings accordingly.



Chap08. Diagnostics

8.1 Diagnostics via HMI

8.1.1 Indicating the Operation State

The integrated HMI provides the user with operating states.
With the factory setting, the 7-segment display shows the operating states. The table below provides an overview of information about the operating states that can be displayed.

HMI Display	Operation State	Description
init	1 Initialize	Electronics are initialized
nrdy	2 Not ready to start	The power stage is not ready to switch on
dis	3 Cannot start	Impossible to enable the power stage
rdy	4 Ready to start	The power stage is ready to switch on.
son	5 Start	Power stage is switched on
run	6 Equipment enable	Power stage is enabled / Selected operating mode is active
stop	7 Quick stop started	"Quick Stop" is being executed
flt	8 Fault response started	Error response is active
flt	9 Fault	Error response terminated / Power stage is disabled

8.1.2 Reading of Last Warning or Error Message

In the case of a detected error of error class 1, the error code and "stop" are alternately shown on the 7-segment display. In the case of a detected error of error class 2 ... 4, the error code and flt are alternately shown on the 7-segment display. Please refer to chapter “8.4.2 Table of Error Messages” for detailed meaning of error codes.

User can read last detected error of error class 2 ... 4 via HMI:

Step	HMI Display	Operation	Description
0	rdy	M ▲ ▼ **S**	Press S key, HMI shows "oP".
1	oP	M **▲** **▼** S	Press S key, HMI shows "Mon".
2	Mon	M ▲ ▼ **S**	Press S key, HMI shows "SuPV".
3	SuPV	M **▲** **▼** S	Press UP or DOWN key to select "LFLT".
4	LFLt	M ▲ ▼ **S**	Press S key to display last detected error of error class 2 ... 4.
5	A320		

In the case of a detected warning of error class 0, no interruption of the movement will happen.

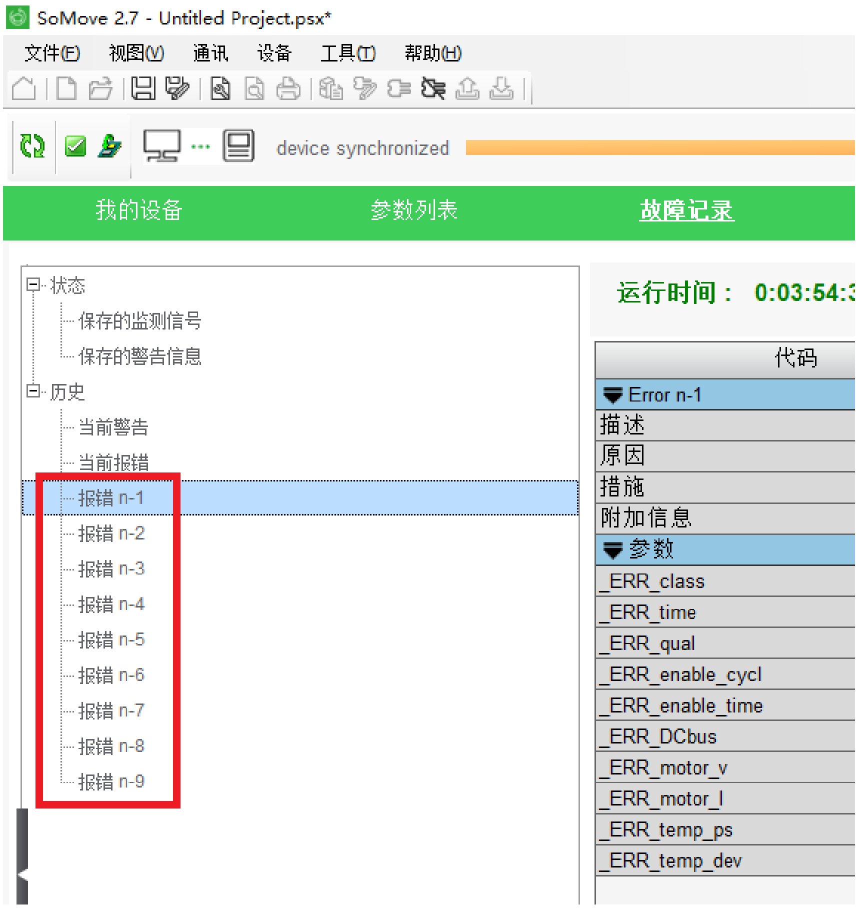
User can however read last detected warning of error class 0 via HMI:

Step	HMI Display	Operation	Description
0	rdy	M ▲ ▼ **S**	Press S key, HMI shows "oP".
1	oP	M **▲** **▼** S	Press S key, HMI shows "Mon".
2	Mon	M ▲ ▼ **S**	Press S key, HMI shows "SuPV".
3	SuPV	M **▲** **▼** S	Press UP or DOWN key to select "LWrn".
4	LWrn	M ▲ ▼ **S**	Press S key to display last detected warning of error class 0.
5	3206		

Users can also read last warning of error class 0 or last error of error class 1 ... 4 in "Error Memory" tab in SoMove with more detiled information.

8.1.3 Reading of Saved Error Messages

Users can read last 10 error of error messages of error class 1 ... 4 in "Error Memory" tab in SoMove with more detailed information in chronological order.
Note, the number of sub-nodes under "History" are dynamic in nature. If the number of errors are more than one, then the sub-nodes are Error n-1, Error n-2 ... Error n-9.



8.2 Diagnostics via Signal Output

8.2.1 Indicating the Operation State

Information on the operating state is available via the signal outputs.
The table below provides an overview:

	Signal output function	
Operating state	"No fault"	"Active"
1 Start	0	0
2 Not Ready To Switch On	0	0
3 Switch On Disabled	0	0
4 Ready To Switch On	1	0
5 Switched On	1	0
6 Operation Enabled	1	1
7 Quick Stop Active	0	0
8 Fault Reaction Active	0	0
9 Fault	0	0

P3-06~08	Function Output of DQx	Min.	1	Unit	Related Mode		
		Default	-	-	P	-	-
		Max.	125		DYC	-	-

Function output of DQx

Function	Description	Code		Related Mode	
		NO	NC	P	DYC
No Fault	No fault found on device	2	102	√	√
Active	Device power stage is enabled	3	103	√	√

Setting can only be changed if power stage is disabled.
Changed settings become active the next time the product is powered on.

8.2.2 Indicating Error Message

Selected error messages can be output via the signal outputs.
In order to output an error message via a signal output, you must first parameterizes the signal output functions “Selected Warning” or “Selected Error” via parameters P3-06 ... P3-08.
The parameters P6-07 and P6-08 are used to specify error codes with the error classes 1 ... 4. If an error with error classes 1 ... 4 specified in these parameters is detected the corresponding signal output with function “Selected Error” is to be set.
The parameters P6-09 and P6-10 are used to specify error codes with the error classes 0. If an error with error classes 0 specified in these parameters is detected the corresponding signal output with function “Selected Warning” is to be set.
Please refer to chapter “8.4.2 Table of Error Messages” for detailed meaning of error codes.

P3-06~08	Function Output of DQx	Min.	1	Unit	Related Mode		
		Default	-	-	P	-	-
		Max.	125		DYC	-	-

Function output of DQx

Function	Description	Code		Related Mode	
		NO	NC	P	DYC
Selected Error	One of the specified errors of error classes 1 … 4 is active	14	114	√	√
Selected Warning	One of the specified errors of error class 0 is active	16	116	√	√

Setting can only be changed if power stage is disabled.
Changed settings become active the next time the product is powered on.

P6-07	First number for the signal output function Selected Error	Min.	0	Unit	Related Mode		
		Default	0	-	P	-	-
		Max.	65535		DYC	-	-

First number for the signal output function Selected Error
This parameter specifies the error code of an error of error classes 1...4 which is to activate the signal output function.

Changed settings become active immediately.

P6-08	Second number for the signal output function Selected Error	Min.	0	Unit	Related Mode		
		Default	0	-	P	-	-
		Max.	65535		DYC	-	-

Second number for the signal output function Selected Error
This parameter specifies the error code of an error of error classes 1...4 which is to activate the signal output function.

Changed settings become active immediately.

<table>
<tr><td rowspan="3">P6-09</td><td rowspan="3">First error code for the signal output function Selected Warning</td><td>Min.</td><td>0</td><td>Unit</td><td colspan="3">Related Mode</td></tr>
<tr><td>Default</td><td>0</td><td rowspan="2">-</td><td>P</td><td>-</td><td>-</td></tr>
<tr><td>Max.</td><td>65535</td><td>DYC</td><td>-</td><td>-</td></tr>
<tr><td colspan="8">First error code for the signal output function Selected Warning
This parameter specifies the error code of an error of error class 0 which is to activate the signal output function.

Changed settings become active immediately.</td></tr>
</table>

<table>
<tr><td rowspan="3">P6-10</td><td rowspan="3">Second error code for the signal output function Selected Warning</td><td>Min.</td><td>0</td><td>Unit</td><td colspan="3">Related Mode</td></tr>
<tr><td>Default</td><td>0</td><td rowspan="2">-</td><td>P</td><td>-</td><td>-</td></tr>
<tr><td>Max.</td><td>65535</td><td>DYC</td><td>-</td><td>-</td></tr>
<tr><td colspan="8">Second error code for the signal output function Selected Warning
This parameter specifies the error code of an error of error class 0 which is to activate the signal output function.

Changed settings become active immediately.</td></tr>
</table>

8.3 Acknowledge Error Message

8.3.1 Acknowledge Error Message via HMI

In the case of an error, it can be reset via HMI through the following operations:

Step	HMI Display	Operation	Description
0	FLt A320		The error code and flt are alternately shown on the HMI. After remedy of the error cause, press S key, HMI shows "FrES"
1	FrES		Press S key, try to reset error.
2	rdy		If the error has been reset successfully, HMI shows "rdy", servo drive is now ready for operation.

8.3.2 Acknowledge Error Message via Signal Input

In the case of an error, it can be reset via signal input through following steps:

- Assign function "Fault Reset" to one of the signal inputs via parameter P3-00 ... P3-05.
- After remedy of the error cause,the error will be reset when an input is detected on the signal input assigned as "Fault Reset".

P3-00~05	Function Input of DIx	Min.	1	Unit	Related Mode		
		Default	-	-	P	-	-
		Max.	141		DYC	-	-

Function input of DIx

Function	Description	Code		Related Mode	
		NO	NC	P	DYC
Fault Reset	Reset after error	2	102	√	√

Setting can only be changed if power stage is disabled.
Changed settings become active the next time the product is powered on.

It is also possible to add an additional "Fault Reset" with rising or falling edge of the detected input on the signal input assigned as "Enable" via parameter P3-17.

P3-00~05	Function Input of DIx	Min.	1	Unit	Related Mode		
		Default	-	-	P	-	-
		Max.	141		DYC	-	-

Function input of DIx

Function	Description	Code		Related Mode	
		NO	NC	P	DYC
Enable	Enables the power stage	3	103	√	√

Setting can only be changed if power stage is disabled.
Changed settings become active the next time the product is powered on.

P3-17	Additional 'Fault Reset' with the signal input function 'Enable'	Min.	0	Unit	Related Mode		
		Default	0	-	P	-	-
		Max.	2		DYC	-	-

Additional 'Fault Reset' with the signal input function 'Enable'
0 / Off: No additional 'Fault Reset'
1 / OnFallingEdge: Additional 'Fault Reset' with falling edge
2 / OnRisingEdge: Additional 'Fault Reset' with rising edge

Changed settings become active the next time the power stage is enabled.

8.4 Error Messages

8.4.1 Error Messages Overview

If monitoring functions of the drive detect an error, the drive generates an error message. Each fault message is identified by an error code.

The error messages are classified according to the following error classes:

Error class	State transition(1)	Error response	Resetting the error message
0	-	No interruption of the movement	• Fault reset via HMI • Fault reset via signal input
1	T11	Stop movement with “Quick Stop”	
2	T13, T14	Stop movement with “Quick Stop” and disable the power stage when the motor has come to a standstill	
3	T13, T14	Disable the power stage immediately without stopping the movement first	
4	T13, T14	Disable the power stage immediately without stopping the movement first	Restart device
(1) Please refer to chapter “6.2.3 Error Class and Response” for further information.			

The table below summarizes the error codes classified by range:

Error code	Range
E 1xxx	General
E 2xxx	Overcurrent
E 3xxx	Voltage
E 4xxx	Temperature
E 5xxx	Hardware
E 6xxx	Software
E 7xxx	Interface, wiring
E Axxx	Motor movement
E Bxxx	Communication
E Cxxx	DYC
E Exxx	User defined error in DYC mode

8.4.2 Table of Error Messages

The following information is available for each error message:

- Error code
- Error class
- Error description
- Possible cause
- Recommended remedies

E 1xxx: General				
Error code	Error class	Error description	Possible cause	Recommended remedies
1100	0	Parameter out of permissible value range	The value entered was outside of the permissible value range for this parameter.	The entered value must be within the permissible value range.
1101	0	Parameter does not exist	Error detected by parameter management: Parameter (subindex) does not exist.	Select a different parameter (index).
1102	0	Parameter does not exist	Error detected by parameter management: Parameter (subindex) does not exist.	Select a different parameter (sub-index).
1103	0	Parameter write not permissible (READ only)	Write access to read only parameter.	Write only to parameters that are not read-only.
1104	0	Write access denied (no access authorization)	Parameter only accessible at expert level.	The write access level expert is required.
1105	0	Block upload / Download not initialized		
1106	0	Command not permissible while power stage is active	Command not permissible while the power stage is enabled (operating state Operation Enabled or Quick Stop Active).	Disable the power stage and repeat the command.
1107	0	Access via other interfaces blocked	Access occupied by another channel (for example: Commissioning software is active and fieldbus access was tried at the same time).	Verify the channel that blocks access.
1108	0	File cannot be uploaded: Incorrect file ID		
1109	1	Data stored after a power outage is invalid		
110A	0	System error detected: No Bootloader available		
110B	3	Configuration download error detected (additional info=Modbus register address)	Error detected during parameter check (for example, reference velocity value for operating mode Profile Position is greater than maximum permissible velocity of drive).	Value in additional error information shows the Modbus register address of the parameter where the initialization error was detected.
110D	1	Basic configuration of drive required after factory setting	“The "First Setup" (FSU) was not run at all or not completed.	Perform a First Setup.

(Continue)				
Error code	Error class	Error description	Possible cause	Recommended remedies
110E	0	Parameter changed that requires a restart of the drive	Only displayed by the commissioning software. A parameter modification requires the drive to be powered off and on.	Restart the drive to activate the parameter functionality. See the chapter Parameters for the parameter that requires a restart of the drive.
110F	0	Function not available in this type of device	The specific type of device does not support this function or this parameter value.	Verify that you have the correct device type, in particular type of motor, type of encoder, holding brake.
1110	0	Incorrect file ID for upload or download	The specific type of device does not support this kind of file.	Verify that you have the correct device type or the correct configuration file.
1111	0	File transfer not correctly initialized	A previous file transfer has been aborted.	
1112	0	Locking of configuration denied	An external tool has tried to lock the configuration of the drive for upload or download. This may not work because another tool had already locked the configuration of the drive or the drive is in an operating state that does not allow locking.	
1113	0	System not locked for configuration transfer	An external tool has tried to transfer the configuration without locking the drive.	
1114	4	Configuration download aborted	During a configuration download, a communication error or an error in the external tool was detected. The configuration was only partially transferred to the drive and might be inconsistent now.	Power the drive off/on and retry to download the configuration or restore the factory settings.
1115	0	Incorrect configuration file format	An external tool has downloaded a configuration which has an incorrect format.	
1116	0	Request is processed asynchronously		
1117	0	Asynchronous request blocked	Request to a module is blocked because the module is currently processing another request.	
1118	0	Configuration data incompatible with device	The configuration data contains data from a different device.	Verify device type including type of power stage.
1119	0	Incorrect data length, too many bytes		
111A	0	Incorrect data length, insufficient number of bytes		

(Continue)				
Error code	Error class	Error description	Possible cause	Recommended remedies
111B	4	Configuration download error detected (additional info=Modbus register address)	During a configuration download, one or more configuration values were not accepted by the drive.	Verify that the configuration file is valid and matches the type and version of the drive. The value in the additional error info shows the Modbus register address of the parameter where the initialization error was detected.
111C	1	Not possible to initialize recalculation for scaling	A parameter could not be initialized.	The address of the parameter that caused the detected error can be read via the parameter _PAR_ScalingError.
111D	3	Original state of a parameter cannot be restored after an error was detected during recalculation of parameters with user-defined units.	The drive contained an invalid configuration before the recalculation was started. An error was detected during the recalculation.	Power the drive off and on again. This may help you to identify the affected parameter(s). Change the parameters as required. Verify that the parameter configuration is valid before starting the recalculation procedure.
1123	0	Parameter cannot be changed	Recalculation for scaling is running.	Wait for the running recalculation for scaling to finish.
1124	1	Timeout during recalculation for scaling	The time between the initialization of the recalculation and the start of the recalculation has been exceeded (30 seconds).	Recalculation must be started within 30 seconds after initialization.
1125	1	Scaling not possible	The scaling factors for position, velocity or acceleration/deceleration are beyond internal calculation limits.	Retry with different scaling factors.
1126	0	Configuration is blocked by another access channel		Close other access channel (for example, other instance of commissioning software).
1127	0	Invalid key received		
112D	0	Configuration of edges is not supported	The selected capture input does not support rising and falling edge at the same time.	Set the edge to either "rising" or "falling".
1130	0	PTI pulse conflicts with home return in gear mode	Home return is not allowable when PTI has pulse	Don't perform home return when PTI has pulse
1131	0	PTI pulse conflicts with Jog test run in gear mode	Jog test run is not allowable when PTI has pulse	Don't perform Jog test run when PTI has pulse
1310	2	Frequency of the external reference value signal too high	The frequency of the external reference signals (A/B signals, P/D signals or CW/CCW signals) is higher than the permissible value.	Verify the frequency of the external reference values. Verify the gear ratio in the operating mode Electronic Gear.

(Continue)				
Error code	Error class	Error description	Possible cause	Recommended remedies
1311	0	The selected signal input function or signal output function cannot be configured	The selected signal input function or signal output function cannot be used in the selected operating mode.	Select another function or change the operating mode.
1312	0	Limit switch or reference switch signal not defined for signal input function	Reference movements require limit switches. These limit switches are not assigned to inputs.	Assign the signal input functions Positive Limit Switch, Negative Limit Switch, and Reference Switch.
1313	0	Configured debounce time not possible for this signal input function	The signal input function does not support the selected debounce time.	Set the debounce time to a valid value.
1314	4	At least two inputs have the same signal input function.	The same signal input function has been assigned to at least two inputs.	Reconfigure the inputs.
1315	0	Frequency of reference value signal is too high.	The frequency of the pulse signal (A/B, Pulse/Direction, CW/CCW) exceeds the specified range. Received pulses may be lost. Received pulses may be lost.	Adapt the frequency of the reference value signal to match the input specification of the drive. Also adapt the gear ratio in the operating mode Electronic Gear to the application requirements (position accuracy and velocity).
1317	0	Interference at PTI input	Interfering pulses or impermissible edge transitions (A and B signal simultaneously) have been detected.	Verify cable specifications, shield connection and EMC.
1600	0	Oscilloscope: No additional data available		
1601	0	Oscilloscope: Parameterization incomplete		
1602	0	Oscilloscope: Trigger variable not defined		
1606	0	Logging still active		
1607	0	Logging: No trigger defined		
1608	0	Logging: Invalid trigger option		
1609	0	Logging: No channel selected		
160A	0	Logging: No data available		
160B	0	Parameter cannot be logged		
160C	1	Autotuning: Moment of inertia outside permissible range	The load inertia is too high.	Verify that the system can easily be moved. Verify the load. Use a differently rated drive.
160E	1	Autotuning: Test movement could not be started		
160F	1	Autotuning: Power stage cannot be enabled	Autotuning was not started in the operating state Ready to Switch On.	Start Autotuning when the drive is in the operating state Ready to Switch On.

(Continue)				
Error code	Error class	Error description	Possible cause	Recommended remedies
1610	1	Autotuning: Processing stopped	Autotuning stopped by user command or by detected error (see additional error message in error memory, for example, DC bus undervoltage, limit switches triggered)	Remove the cause of the stop and restart Autotuning.
1611	1	System error detected: Parameter could not be written during Autotuning		
1612	1	System error detected: Parameter could not be read during Autotuning		
1613	1	Autotuning: Maximum permissible movement range exceeded	The movement exceeded the adjusted movement range during Autotuning.	Increase the movement range value
1614	0	Autotuning: Already active	Autotuning has been started twice simultaneously or an Autotuning parameter is modified during Autotuning.	Wait for Autotuning to finish before restarting Autotuning.
1615	0	Autotuning: This parameter cannot be changed while Autotuning is active	Parameter AT_gain or AT_J are written during Autotuning.	Wait for Autotuning to finish before changing the parameter.
1617	1	Autotuning: Friction torque or load torque too great	The current limit has been reached (parameter P4-08).	Verify that the system can easily be moved. Verify the load. Use a differently rated drive.
1618	1	Autotuning: Optimization aborted	The internal Autotuning sequence has not been finished, there may have been a following error.	See the additional information provided in the error memory.
1619	0	Autotuning: Velocity jump in parameter AT_n_ref is not sufficient	Parameter AT_n_ref < 2 * AT_n_tolerance. The drive only checks this for the first velocity jump.	Modify the parameter AT_n_ref or AT_n_tolerance to meet the required condition.
1620	1	Autotuning: Load torque too high	Product rating is not suitable for the machine load. Detected machine inertia is too high compared to the inertia of the motor.	Reduce load, verify rating.
1621	1	System error detected: Calculation error		
1622	0	Autotuning: Not possible to perform Autotuning	Autotuning can only be performed if no operating mode is active.	Terminate the active operating mode or disable the power stage.
1623	1	Autotuning: HALT request has stopped the autotuning process	Autotuning can only be performed if no operating mode is active.	Terminate the active operating mode or disable the power stage.
1624	0	Auto adaptive tuning: The acceleration and deceleration below the lower limit: 2,000 rpm	Acceleration below lower limit; inaccurate identification of real-time auto tuning	Increase the operational acceleration and deceleration
1625	0	Adaptive notch filter: Oscillation frequency below the lower limit: 150Hz	When the oscillation frequency is less than 150Hz, the adaptive notch filter exhibits no obvious suppression effect	

(Continue)				
Error code	Error class	Error description	Possible cause	Recommended remedies
1A00	0	System error detected: FIFO memory overflow		
1A01	3	Motor has been changed (different type of motor)	Detected motor type is different from previously detected motor.	Confirm the change.
1A03	4	System error detected: Hardware and firmware do not match		
1A04	0	System error detected: SDFM value not read in time		Please contact the Technical Support Department
1B00	3	System error detected: Incorrect parameters for motor and power stage	Incorrect manufacturer parameter value (data) non-volatile memory of device.	Replace device.
1B02	3	Target value too high.		
1B04	2	Product of encoder simulation resolution and the maximum velocity is too high	Value in parameter P4-07 or resolution or the encoder simulation P0-18 are too high.	Reduce the resolution of the encoder simulation in parameter P0-18 or the maximum velocity in parameter P4-07.
1B05	2	Error detected during parameter switching		
1B0B	3	The operating state at the beginning of the commutation offset identification must be Ready To Switch On.		Set the operating state to Ready To Switch On and restart commutation offset identification.
1B0C	3	Motor velocity too high.		
1B0F	3	Velocity deviation too high		

E 2xxx: Overcurrent				
Error code	Error class	Error description	Possible cause	Recommended remedies
2201	3	System error detected: DC bus transfer error		
2300	3	Power stage overcurrent	Motor short circuit and disabling of the power stage. Motor phases are inverted.	Verify the motor power connection.
2301	3	Braking resistor overcurrent	Braking resistor short circuit.	If you use an external braking resistor, verify correct wiring and rating of the braking resistor.
2302	3	Output stage U-phase Sigma Delta overcurrent	Short circuit of the U phase of motor to the ground and other phases occurs or the output stage is disabled. Wrong wiring of phase line for motor	Eliminate the short circuit and ensure the power cable connection of motor is correct.
2303	3	Output stage W-phase Sigma Delta overcurrent	Short circuit of the W phase of motor to the ground and other phases occurs or the output stage is disabled. Wrong wiring of phase line for motor	Eliminate the short circuit and ensure the power cable connection of motor is correct.
2304	3	Output stage U- and W-phase Sigma Delta overcurrent	Short circuit of the U and W phases of motor to the ground and other phases occurs or the output stage is disabled. Wrong wiring of phase line for motor	Eliminate the short circuit and ensure the power cable connection of motor is correct.
2305	3	Excessively large output stage current offset	Excessively high load, motor stalling, loss of encoder connection, or incorrect connection of motor phase lines	Check the connection between motor and load; check the encoder connection; check the power cable connection of motor

E 3xxx: Voltage				
Error code	Error class	Error description	Possible cause	Recommended remedies
3100	2	Absence of power supply, undervoltage or overvoltage	The absence of phase lasts longer than 50 ms. The supply voltage is outside the valid range. The supply frequency is outside the valid range	Assure the consistency of supply voltage with technical parameters.
3101	0	Absence of 24V output of switching power supply	Switching power supply is out of service	Please contact the Technical Support Department
3200	3	DC bus overvoltage	Excessively regeneration during deceleration.	Verify correct deceleration ramp, rating of drive and braking resistor.
3201	3	DC bus undervoltage (shutdown threshold)	Power supply outage, insufficient power supply.	Verify mains supply.
3202	2	DC bus undervoltage (Quick Stop threshold)	Power supply outage, insufficient power supply.	Verify mains supply.
3206	0	Undervoltage DC bus, missing mains supply, undervoltage mains supply or overvoltage mains supply	Lack of power supply or excessively high supply voltage	Verify that the values of the mains power supply network comply with the technical data.

E 4xxx: Temperature				
Error code	Error class	Error description	Possible cause	Recommended remedies
4100	3	Power stage overtemperature	Transistors overtemperature: Ambient temperature is too high, fan is inoperative, dust.	Verify the fan, improve the heat dissipation in the cabinet.
4101	0	Power stage overtemperature	Transistors overtemperature: Ambient temperature is too high, fan is inoperative, dust.	Verify the fan, improve the heat dissipation in the cabinet.
4102	0 or 3	Power stage overload (I^2t)	The current has exceeded the nominal value for an extended period of time.	Verify rating, reduce cycle time.
4200	3	Device overtemperature	Excessively high ambient temperature due to, for example, dust.	Improve heat dissipation in the control cabinet. If a fan is installed, verify correct operation of the fan. Install a fan in the control cabinet.. Improve heat transfer from the rear wall of the device to the control cabinet.
4201	0	Excessively high temperature of CPU	Excessively high ambient temperature, dust or other factors impair the heat dissipation.	Improve the heat dissipation of control cabinet. Please assure the proper functioning of fan (if any). Please install a fan in the control cabinet. Please improve the thermal conductivity from the back of equipment to the control cabinet.
4302	0 or 3	Motor overload (I^2t)	The current has exceeded the nominal value for an extended period of time.	Verify that the system can easily be moved. Verify the load. Use a differently sized motor, if necessary.
4402	0	Braking resistor overload (I^2t > 75%)	Regeneration energy too high. External loads too high. Motor velocity too high. Deceleration too fast. Insufficient braking resistor.	Reduce load, velocity, deceleration. Verify correct braking resistor rating
4403	0	Braking resistor overload (I^2t > 100%)	Regeneration energy too high. External loads too high. Motor velocity too high. Deceleration too fast. Insufficient braking resistor.	Reduce load, velocity, deceleration. Verify correct braking resistor rating

E 5xxx: Hardware				
Error code	Error class	Error description	Possible cause	Recommended remedies
5207	1	Function is not supported	The hardware revision does not support the function.	
5430	4	System error detected: EEPROM read error		
5431	3	System error: EEPROM write error		
5432	3	System error: EEPROM state machine		
5433	3	System error: EEPROM address error		
5434	3	System error: EEPROM incorrect data length		
5435	4	System error: EEPROM not formatted		
5436	4	System error: EEPROM incompatible structure		
5437	4	System error detected: EEPROM checksum error (manufacturer data)		
5438	3	System error detected: EEPROM checksum error (user parameters)		
543B	4	System error detected: No valid manufacturer data		
543E	3	System error detected: EEPROM checksum error		
543F	3	System error detected: EEPROM checksum error (motor parameters)		
5441	4	System error detected: EEPROM checksum error (global control loop parameter set)		
5442	4	System error detected: EEPROM checksum error (control loop parameter set 1)		
5443	4	System error detected: EEPROM checksum error (control loop parameter set 2)		
5444	4	System error detected: EEPROM checksum error (NoReset parameter)		
5445	4	System error detected: EEPROM checksum error (hardware information)		
5446	4	System error detected: EEPROM checksum error (used for power outage data)	Internal EEPROM not operative.	Restart the drive. If the detected error persists, contact Technical Support.
544A	4	System error detected: EEPROM checksum error (administration data)		
544C	4	System error detected: EEPROM is write protected		

(Continue)				
Error code	Error class	Error description	Possible cause	Recommended remedies
5468	4	System error detected: EEPROM checksum error (control loop parameter set 3)		
5469	4	System error detected: EEPROM checksum error (real-time auto tuning parameter set)		
5600	3	Motor connection phase error detected	Missing motor phase.	Verify connection of motor phases.
5603	3	Commutation error detected	Incorrect wiring of motor cable. Encoder signals are lost or subject to interference. The load torque is greater than the motor torque. The encoder EEPROM contains incorrect data (encoder phase offset is incorrect). Motor is not adjusted.	Verify motor phases, verify encoder wiring. Improve EMC, verify grounding and shield connection. Use a differently sized motor that can withstand the load torque. Verify the motor data. Contact Technical Support.
5604	3	Output stage overcurrent is detected; the current loop command is equal to the max. current threshold (300%) for a period of time that is longer than the time set in P6-24	Incorrect encoder signal/ incorrect connection of motor phase line/motor overload	Assure the correct connection of encoder/ ensure the correct power connection for motor/check the mechanical system to avoid stalling; check the matching between motor and load; check the acceleration ramp

E 6xxx: Software				
Error code	Error class	Error description	Possible cause	Recommended remedies
6102	4	System error detected: Internal software error		
6103	4	System error detected: System stack overflow		
6104	0	System error detected: Division by zero (internal)		
6105	0	System error detected: Overflow during 32 bit operation (internal)		
6106	4	System error detected: Size of data interface does not match		
6107	0	Parameter outside of value range (calculation error detected)		
6108	0	Function not available		
6109	0	System error detected: Internal range exceeded		
610A	2	System error detected: Calculated value cannot be represented as a 32 bit value		
610D	0	Error detected in selection parameter	Incorrect parameter value selected.	Verify the value to be written.
610E	4	System error detected: 24 VDC, below undervoltage threshold for shutdown		
610F	4	System error detected: Internal timer basis missing (Timer0)		
6111	2	System error detected: Memory area locked		
6112	2	System error detected: Out of memory		
6113	1	System error detected: Calculated value cannot be represented as a 16 bit value		
6114	4	System error detected: Impermissible function call from interrupt service routine	Incorrect programming	

E 7xxx: Interface, wiring				
Error code	Error class	Error description	Possible cause	Recommended remedies
7100	4	System error detected: Invalid power stage data	Error detected in power stage data stored in device (incorrect CRC), error detected in internal memory data.	Contact Technical Support or replace the device.
7111	0	Parameter cannot be changed because the external braking resistor is active.	An attempt is made to change one of the parameters P0-22, P0-23 or P0-24 even though the external braking resistor is active.	Verify that the external braking resistor is not active if one of the parameters P0-22, P0-23 or P0-24 has to be changed.
7122	4	Invalid motor data parameter	Error detected in motor data stored in motor encoder, error detected in internal memory data.	Contact Technical Support or replace the motor.
712D	4	Motor model data not configured	Motor model data not configured	Perform FSU “first setup” or set the parameter P6-00
712F	0	No data segment of the electronic motor nameplate		
7132	0	System error detected: Motor configuration cannot be written		
7133	0	Not possible to write motor configuration		
7134	4	Incomplete motor configuration		
7135	4	Format is not supported		
7136	4	Incorrect encoder type selected with parameter P6-01		Perform FSU “first setup” or set the parameter P6-01
7137	4	Error detected during the internal conversion of the motor configuration		
7138	4	Parameter of the motor configuration out of permissible range		
7139	0	Encoder offset: Data segment in encoder is incorrect.		
713B	4	Motor has been changed (different type of motor)	Detected motor type is different from previously detected motor.	Power-on the servo drive again. Restore the servo drive to factory default. Contact Technical Support or replace the device.
7200	4	System error detected: Calibration analog/ digital converter during manufacturing / incorrect BLE file		
7347	0	System error detected: Position initialization not possible	Analog and digital encoder signals subject to massive interference.	Reduce encoder signal interference, verify shield connection. Contact Technical Support.
734D	0	Index pulse is not available for the encoder		
7500	0	RS485/Modbus: Overflow error detected	EMC, cabling.	Verify cables.

(Continue)				
Error code	Error class	Error description	Possible cause	Recommended remedies
7501	0	RS485/Modbus: Framing error detected	EMC, cabling.	Verify cables.
7502	0	RS485/Modbus: Parity error detected	EMC, cabling.	Verify cables.
7503	0	RS485/Modbus: Receive error detected	EMC, cabling.	Verify cables.
7601	4	System error detected: Indeterminable type of encoder		
760C	2	Maximum encoder frequency exceeded	Velocity too high for the encoder.	
7619	4	Incorrect communication between module and encoder	Incorrect encoder wiring/adjustment or incorrect encoder parameter settings	Verify encoder cable: wiring and shield connection.. Verify encoder parameter settings. Verify encoder adjustment.
761A	0	Incorrect communication between module and encoder	Incorrect encoder wiring.	Verify encoder cable: wiring and shield connection.
761D	3	Maximum velocity of the encoder is exceeded	Velocity too high for the encoder.In the case of BISS, the reason may also be a detected encoder communication error.	
762A	3	Incremental encoder initialization failed	Encoder is not connected or the communication is disturbed, EMC	Please check the cable connection. Please check the cable specifications, shield connection and EMC
762B	3	Incremental encoder initialization failed: The motor rotates when powered on	The motor rotates when the drive is powered on, which results in the failure of initial position identification	Stop and perform the power-on again
762C	3	Motor velocity detected by incremental encoder exceeds maximum threshold.	Encoder signal is disturbed, velocity is too high for the encoder.	Reduce encoder signal interference, verify shield connection. Reduce motor velocity.
762D	3	Encoder internal communication error		

E Axxx: Motor movement				
Error code	Error class	Error description	Possible cause	Recommended remedies
A061	2	Position change in reference value for operating mode Electronic Gear too high	Position reference change is too high. Error detected at signal input for reference value.	Reduce the resolution of the master. Verify signal input for reference value signal.
A065	0	Parameter cannot be written	A data set is still active.	Wait until the currently active data set has been terminated.
A068	0	Offset positioning not possible	Operating mode Electronic Gear inactive or no gear method selected.	Start operating mode Electronic Gear and/or select a gear method.
A069	0	Setting the offset position is not possible	If offset positioning is active, it is not possible to set the position offset.	Wait until ongoing offset positioning has finished.
A06B	2	Position deviation in operating mode Electronic Gear too high	The position deviation has become excessively high due to a velocity limitation or the release of direction.	Verify the velocity of the external reference values and the velocity limitation. Verify release of direction.
A300	0	Deceleration after HALT request still running	HALT was removed too soon. New command was sent before motor standstill was reached after a HALT request.	Wait for complete stop before removing HALT signal. Wait until motor has come to a complete standstill.
A301	0	Drive in operating state Quick Stop Active	Error with error class 1 detected. Drive stopped with Quick Stop.	
A302	1	Stop by positive limit switch	The positive limit switch was activated because movement range was exceeded, incorrect operation of limit switch or signal disturbance.	Verify application. Verify limit switch function and connection.
A303	1	Stop by negative limit switch	The negative limit switch was activated because movement range was exceeded, incorrect operation of limit switch or signal disturbance.	Verify application. Verify limit switch function and connection.
A304	1	Stop by reference switch		
A306	1	Stop by user-initiated software stop	Drive is in operating state Quick Stop Active due to a software stop request. The activation of a new operating mode is not possible, the error code is sent as the response to the activation command.	Clear break condition with command Fault Reset.
A307	0	Interruption by internal software stop	In the operating modes Homing and Jog, the movement is internally interrupted by an internal software stop. The activation of a new operating mode is not possible, the error code is sent as the response to the activation command.	Perform a Fault Reset.

(Continue)				
Error code	Error class	Error description	Possible cause	Recommended remedies
A308	0	Drive is in operating state Fault or Fault Reaction Active	Error with error class 2 or higher detected.	Verify the error code (HMI or commissioning software), remove the cause and perform a Fault Reset.
A309	0	Drive not in operating state Operation Enabled	A command was sent that requires the drive to be in the operating state Operation Enabled (for example, a command to change the operating mode).	Set drive to operating state Operation Enabled and repeat the command.
A310	0	Power stage not enabled	Command cannot be used because the power stage is not enabled (operating state Operation Enabled or Quick Stop Active).	Set drive to an operating state in which the power stage is enabled, see state diagram.
A311	0	Operating mode change active	A start request for an operating mode has been received while a change of the operating mode was active.	
A312	0	Profile generation interrupted		
A313	0	Position overflow, zero point is therefore no longer valid (ref_ok=0)	The movement range limits were exceeded and the zero point is no longer valid. An absolute movement requires a valid zero point.	Define a valid zero point by means of the operating mode Homing.
A316	0	Overflow during calculation of acceleration		
A317	0	Motor is not at a standstill	Command sent which is not permissible when the motor is not at a standstill. For example: - Change of software limit switches - Change of handling of monitoring signals - Setting of reference point	Wait until the motor has come to a standstill (x_end = 1).
A318	0	Operating mode active (x_end=0)	Activation of a new operating mode is not possible while another operating mode is still active.	Wait until the command in the operating mode has finished (x_end=1) or terminate active operating mode with HALT command.
A319	1	Manual tuning/Autotuning: Movement out of range	The movement exceeds the parameterized maximum movement range.	Verify permissible movement range value and time interval.
A31A	0	Manual tuning/Autotuning: Amplitude/offset too high	Amplitude plus offset for tuning exceed internal velocity or current limitation.	Choose lower amplitude and offset values.
A31B	0	Halt requested	Command not permissible while Halt is requested.	Clear Halt request and repeat command.
A31C	0	Invalid position setting with software limit switch	Value for negative (positive) software limit switch is greater (less) than value for positive (negative) software limit switch.	Set correct position values.

(Continue)				
Error code	Error class	Error description	Possible cause	Recommended remedies
A31D	0	Velocity range exceeded parameter P4-07	The velocity was set to a value greater than the maximum permissible velocity in parameter P4-07 or current motor maximum velocity, whichever is lower.	Reduce the velocity value.
A31E	1	Stop by positive software limit switch	Not possible to execute command because positive software limit switch was triggered.	Return to the permissible movement range.
A31F	1	Stop by negative software limit switch	Not possible to execute command because negative software limit switch was triggered.	Return to the permissible movement range.
A320	3	Permissible position deviation exceeded	External load or acceleration are too high.	Reduce external load or acceleration. Use a differently rated drive, if necessary. Error response can be adjusted via parameter P0-20
A321	0	Invalid setting for RS422 position interface		
A322	0	Error detected in ramp calculation		
A323	3	System error detected: Processing error detected during generation of profile		
A324	1	Error detected during homing (additional info = detailed error code)	Homing movement was stopped in response to a detected error, the detailed reason is indicated by the additional info in the error memory.	Possible sub-error codes: E A325, E A326, E A327, EA328 or E A329.
A325	1	Limit switch to be approached not enabled	Homing to positive limit switch or negative limit switch is disabled.	Enable limit switch via 'IOsigLimP' or 'IOsigLimN'.
A326	1	Reference switch not found between positive limit switch and negative limit switch	Reference switch inoperative or not correctly connected.	Verify the function and wiring of the Reference switch.
A329	1	More than one signal positive limit switch/negative limit switch/reference switch active	Reference switch or limit switch not connected correctly or supply voltage for switches too low.	Verify the wiring and 24 VDC supply voltage.
A32A	1	Positive limit switch triggered with negative direction of movement	Start reference movement with negative direction (for example, reference movement to negative limit switch) and activate the positive limit switch (switch in opposite direction of movement).	Verify correct connection and function of limit switch. Activate a jog movement with negative direction of movement (target limit switch must be connected to the negative limit switch).
A32B	1	Negative limit switch triggered with positive direction of movement	Start reference movement with positive direction (for example, reference movement to positive limit switch) and activate the negative limit switch (switch in opposite direction of movement).	Verify correct connection and function of limit switch. Activate a jog movement with positive direction of movement (target limit switch must be connected to the positive limit switch).

(Continue)				
Error code	Error class	Error description	Possible cause	Recommended remedies
A32C	1	Reference switch error detected (switch signal briefly enabled or switch overtraveled)	Switch signal disturbance. Motor subjected to vibration or shock when stopped after activation of the switch signal.	Verify supply voltage, cabling and function of switch. Verify motor response after stopping and optimize control loop settings.
A32D	1	Positive limit switch error detected (switch signal briefly enabled or switch overtraveled)	Switch signal disturbance. Motor subjected to vibration or shock when stopped after activation of the switch signal.	Verify supply voltage, cabling and function of switch. Verify motor response after stopping and optimize control loop settings.
A32E	1	Negative limit switch error detected (switch signal briefly enabled or switch overtraveled)	Switch signal disturbance. Motor subjected to vibration or shock when stopped after activation of the switch signal.	Verify supply voltage, cabling and function of switch. Verify motor response after stopping and optimize control loop settings.
A32F	1	Index pulse not found	Index pulse signal not connected or not working properly.	Verify index pulse signal and connection.
A330	0	Reference movement to index pulse cannot be Reproduced. Index pulse is too close to the switch Parameter	The position difference between the index pulse and the switching point is insufficient.	Increase the distance between the index pulse and the switching point. If possible, the distance between the index pulse and the switching point should be a half motor revolution.
A332	1	Jog error detected (additional info = detailed error code)	Jog movement was stopped in response to a detected error.	For additional info, verify the detailed error code in the error memory.
A334	2	Timeout Standstill Window monitoring	Position deviation after movement greater than standstill window. This may have been caused by an external load.	Verify load. Verify settings for standstill window (parameter P6-15, P6-16 and P6-17). Optimize control loop settings.
A336	1	System error detected: Jerk limitation with position offset after end of movement (additional info = offset in Inc.)		
A338	0	Operating mode unavailable	The selected operating mode is not available.	
A33A	0	No valid zero point (ref_ ok=0)	No zero point defined by means of operating mode Homing. Zero point no longer valid due to movement beyond permissible movement range. Motor does not have an absolute encoder.	Use operating mode Homing to define a valid zero point. Use a motor with an absolute encoder.
A33C	0	Function not available in this operating mode	Activation of a function which is not available in the active operating mode. Example: Start of backlash compensation while autotuning/manual tuning is active.	
A347	0	Permissible position deviation exceeded	External load or acceleration are too high.	Reduce external load or acceleration. Threshold value can be adjusted via the parameter P0-20.

(Continue)				
Error code	Error class	Error description	Possible cause	Recommended remedies
A349	0	Position setting exceeds system limits	Position scaling of P5-01 and P5-02 results in a scaling factor that is too small.	Change P5-01 and P5-02 in such a way as to increase the resulting scaling factor.
A350	1	Change for jerk filter input position too great	Operating mode Electronic Gear with processing method 'Position synchronization with compensation movement' has been activated which resulted in a position change greater than 0.25 revolutions.	Deactivate jerk filter processing for Electronic Gear or use processing method 'Position synchronization without compensation movement'.
A351	1	Function cannot be executed with this position scaling factor	The positions scaling factor is set to a value less than 1rev/131072usr_p, which is less than the internal resolution.	Use a different position scaling factor or deactivate the selected function.
A35C	1	The triggered limit switch fails to move to the new reference position, even if the error has been reset	The limit switch trigger signal holds, and the motor fails to move any more	Remove the limit switch signal

E Bxxx: Communicaiton				
Error code	Error class	Error description	Possible cause	Recommended remedies
B100	0	RS485/Modbus: Indeterminable service	Unsupported Modbus service was received.	Verify application on the Modbus master.
B101	1	Incorrect I/O data configuration (additional info = Modbus register address)	The I/O data configuration or the Modbus I/O scanning configuration contains an invalid parameter.	Verify the configuration of the I/O data.
B200	0	RS485/Modbus: Protocol error detected	Logical protocol error detected: Incorrect length or unsupported subfunction.	Verify application on the Modbus master.
B201	2	RS485/Modbus: Interruption of the connection	Connection monitoring has detected an interruption of the connection.	Verify all connections and cables used for data exchange. Verify that the device is on.
B202	0	RS485/Modbus: Interruption of the connection	Connection monitoring has detected an interruption of the connection.	Verify all connections and cables used for data exchange. Verify that the device is on.
B203	0	RS485/Modbus: Incorrect number of monitor objects		

E Cxxx: DYC				
Error code	Error class	Error description	Possible cause	Recommended remedies
C200	3	One of the MD index exceeds border	One of the MD index exceed border. Available MD index is between 0 ... 47.	Please check script content.
C201	3	Error when loading script from EEPROM	Error when loading script from EEPROM	Power-on servo drive angain. Perform factory restore to device. Contact Technical Support or replace the device.
C202	3	No script available.	No script available.	Download script to servo drive again. Contact Technical Support or replace the device.
C203	3	Script operation cycletime is exceeded.	Too much script content, script can not be finished within cycletime defined in parameter P7-00.	Increase value of parameter P7-00 or set P7-00 to 0.
C204	3	Insufficient RAM when saving script to EEPROM.	Insufficient RAM when saving script to EEPROM.	Try to simplify script content. Contact Technical Support or replace the device.
C205	3	Illegal operation of divided by 0 found in script.	Illegal operation of divided by 0 found in script.	Check script content.
C206	3	One of the timer base exceeds border	One of the timer base exceeds border. Available timer base is between 1 ... 20000 ms.	Check script content.

E Exxx: User defined error in DYC mode				
Error code	Error class	Error description	Possible cause	Recommended remedies
Exxx	3	User defined error in DYC mode		

Chap09. Parameters

9.1 Parameter Overview

- Parameter NO.

  Parameter Group — P0.00 — Sub Index

- Related Mode

  P: Electronic Gear Position

  D: Dynamic PLC (Internal motion task)

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	03	Control set 1: Velocity feed-forward control	O	O	
	04	Control set 1: Filter time constant of the reference velocity value filter	O	O	
	05	Control set 1: Filter time constant of the reference current value filter	O	O	9-11
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	09	Control set 2: Velocity controller integral action time	O	O	
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	24	Jerk limitation of the motion profile for velocity	O	O	9-15
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Parameter No.		Description	Related Mode		Page
Group	Sub		P	D	
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	17	Control Set 2 Notch filter 1: Bandwidth	o	o	
	18	Control Set 2 Notch filter 2: Damping	o	o	
	19	Control Set 2 Notch filter 2: Frequency	o	o	
	20	Control Set 2 Notch filter 2: Bandwidth	o	o	9-25
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	24	Vibration detection level	o	o	
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Parameter No.		Description	Related Mode		Page
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Parameter No.		Description	Related Mode		Page
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Parameter No.		Description	Related Mode		Page
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	09	Homing: Preferred homing method	o	o	9-37
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	11	Relative offset position 2 for offset movement	o	-	9-39
	12	Target velocity for offset movement	o	-	
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	14	Halt option code	o	o	
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	18	Current for Quick Stop	o	o	
	19	Enable dynamic braking function	o	o	
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	18	Monitoring of time window	o	o	
	19	Monitoring of position deviation	o	o	
	20	Monitoring of velocity deviation	o	o	
	21	Monitoring of velocity threshold	o	o	
	22	Monitoring of current threshold	o	o	9-48
	23	Error response to 100% I2t external braking resistor	o	o	
	24	Current Saturation window time	o	o	
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	26	Autotuning: Moment of inertia of the entire system	o	o	

Parameter No.		Description	Related Mode		Page
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	30	Autotuning: Constant load torque	o	o	
	31	Firmware version of device	o	o	
	32	Firmware revision of device	o	o	
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Parameter No.		Description	Related Mode		Page
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Parameter No.		Description	Related Mode		Page
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Pu DYC User Defined	00	DYC user defined parameter 0	-	o	9-52
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	03	DYC user defined parameter 3	-	o	
	04	DYC user defined parameter 4	-	o	
	05	DYC user defined parameter 5	-	o	
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	07	DYC user defined parameter 7	-	o	
	08	DYC user defined parameter 8	-	o	
	09	DYC user defined parameter 9	-	o	
	10	DYC user defined parameter 10	-	o	
	11	DYC user defined parameter 11	-	o	
	12	DYC user defined parameter 12	-	o	
	13	DYC user defined parameter 13	-	o	9-54
	14	DYC user defined parameter 14	-	o	
	15	DYC user defined parameter 15	-	o	
	16	DYC user defined parameter 16	-	o	
	17	DYC user defined parameter 17	-	o	
	18	DYC user defined parameter 18	-	o	
	19	DYC user defined parameter 19	-	o	
	20	DYC user defined parameter 20	-	o	9-55
	21	DYC user defined parameter 21	-	o	
	22	DYC user defined parameter 22	-	o	
	23	DYC user defined parameter 23	-	o	

9.2 P0 - Basic Settings

P0-00	Operating mode	Min.	0	Unit	Relatd Mode		
		Default	3	-	P	-	-
		Max.	7		DYC	-	-

Operating mode
3 / Electronic Gear: Electronic Gear
7 / Dynamic PLC: Internal motion task

Setting can only be changed if power stage is disabled.
Changed settings become active the next time the product is powered on.

P0-01	Tuning mode selection	Min.	0	Unit	Relatd Mode		
		Default	0	-	P	-	-
		Max.	3		DYC	-	-

Tuning mode selection
0 / Invalid: Auto adaptive tuning is invalid; use the cascade PID control loop parameter
1 / Standard: Standard auto adaptive tuning mode: the system inertia ratio is estimated automatically, stiffness index is set manually, auto adaptive control loop takes effect.
2 / Passive: Passive auto adaptive tuning mode: both system inertia ratio and stiffness index are set manually, auto adaptive control loop takes effect.
3 / Adaptive: Adaptive auto adaptive tuning mode: the system inertia ratio is estimated automatically, stiffness index is also estimated automatically (increase 4 levels at the maximum), auto adaptive control loop takes effect

Changed settings become active immediately.

P0-02	Stiffness index	Min.	1	Unit	Relatd Mode		
		Default	14	-	P	-	-
		Max.	32		DYC	-	-

Set the rigidity level for auto adaptive control loop parameters
The control loop parameter is automatically calculated in combination of this parameter and system load inertia ratio when auto adaptive tuning control loop mode is active.
Higher the stiffness index selected, higher the system response will be achieved. However, when increasing the value, more system vibration could be expected. Lower the stiffness index selected, lower the system response will be achieved. Also, there will be less system vibration.
Please change the set values in ascending order.

Changed settings become active immediately

P0-03	Real time inertia ratio	Min.	10	Unit	Relatd Mode		
		Default	250	0.01	P	-	-
		Max.	10000		DYC	-	-

Show / set the ratio of load inertia over rotor inertia for auto adaptive control.
This parameter is invalid when parameter P0-01 is set to 0 - invalid.
When auto adaptive control loop is in standard mode (P0-01=1) or active mode (P0-01=3), the drive automatically estimates the system inertia ratio. The adjustment of this parameter therefore takes no effect at this moment.
When auto adaptive control loop is in passive mode (P0-01=2), the drive does not estimate the system inertia ratio, but this parameter still takes effect in the calculation of control loop parameters. User could manually adjust this parameter.

Changed settings become active immediately.

P0-04	Load Type Selection	Min.	0	Unit	Relatd Mode		
		Default	1	-	P	-	-
		Max.	3		DYC	-	-

Set the load type for auto adaptive tuning
0 / Rotary Disk: Direct connection
1 / Ball Screw: Lead screw
2 / Belt: Belt
3 / Large Inertia: Large inertia
The default of P0-02 auto adaptive tuning stiffness index varies depending on the type of load selected.

Changed settings become active immediately.

P0-05	Control table selection	Min.	0	Unit	Relatd Mode		
		Default	0	-	P	-	-
		Max.	1		DYC	-	-

Auto adaptive control table selection
0 / Standard Mode (Table 1): Standard mode that balances system overshoot and steady-state time
1 / Positioning Mode (Table 2): Position priority mode; the control loop parameter set employs long integration time, and the system positioning is free of overshoot
When this parameter is set to “1 / Positioning Mode (Table 2)”, parameter P1-22 can be set and used to replace the integration time in current parameter set

Changed settings become active immediately.

P0-06	Inversion of direction of movement	Min.	0	Unit	Relatd Mode		
		Default	0	-	P	-	-
		Max.	1		DYC	-	-

Inversion of direction of movement
0 / Inversion Off: Inversion of direction of movement is off
1 / Inversion On: Inversion of direction of movement is on

Setting can only be changed if power stage is disabled.
Changed settings become active the next time the product is powered on.

P0-07	Enabled direction of movement for operating mode Electronic Gear	Min.	1	Unit	Relatd Mode		
		Default	3	-	P	-	-
		Max.	3		DYC	-	-

Choose whether the motor is allowed to move in forward, reverse or both directions
1 / POSITIVE: Positive direction
2 / NEGATIVE: Negative direction
3 / BOTH: Both directions
This allows you to activate a return movement lock function.

Changed settings become active immediately.

<table>
<tr><td rowspan="3">P0-08</td><td rowspan="3">Type of reference value signal for PTI interface</td><td>Min.</td><td>0</td><td>Unit</td><td colspan="3">Relatd Mode</td></tr>
<tr><td>Default</td><td>1</td><td rowspan="2">-</td><td>P</td><td>-</td><td>-</td></tr>
<tr><td>Max.</td><td>2</td><td>DYC</td><td>-</td><td>-</td></tr>
<tr><td colspan="8">Type of reference value signal for PTI interface
0 / A/B Signals: Phase A + Phase B orthogonal signal, with quadruplicated frequency
1 / P/D Signals: Signals PULSE and DIR
2 / CW/CCW Signals: Signals CW and CCW

Setting can only be changed if power stage is disabled.
Changed settings become active the next time the product is powered on.</td></tr>
</table>

<table>
<tr><td rowspan="3">P0-09</td><td rowspan="3">Filter time for input signals at the PTI interface</td><td>Min.</td><td>0</td><td>Unit</td><td colspan="3">Relatd Mode</td></tr>
<tr><td>Default</td><td>0</td><td rowspan="2">-</td><td>P</td><td>-</td><td>-</td></tr>
<tr><td>Max.</td><td>2000</td><td>DYC</td><td>-</td><td>-</td></tr>
<tr><td colspan="8">A signal at the PTI interface is only evaluated if it is available for a time that is longer than the set filter time.
0 / Without filter: Invalid low pass filter
2000 / 2000 kHz: The max. frequency of low pass filter is 2000 kHz
1000 / 1000 kHz: The max. frequency of low pass filter is 1000 kHz
500 / 500 kHz: The max. frequency of low pass filter is 500 kHz
250 / 250 kHz: The max. frequency of low pass filter is 250 kHz
125 / 125 kHz: The max. frequency of low pass filter is 125 kHz
50 / 50kHz: The max. frequency of low pass filter is 50 kHz

When parameter P0-06 is set to 0, since phase A + phase B orthogonal signal has quadruplicated frequency, the minimum value of this parameter shall start from 250kHz

Setting can only be changed if power stage is disabled.
Changed settings become active the next time the power stage is enabled.</td></tr>
</table>

<table>
<tr><td rowspan="3">P0-10</td><td rowspan="3">Selection of gear ratio</td><td>Min.</td><td>0</td><td>Unit</td><td colspan="3">Relatd Mode</td></tr>
<tr><td>Default</td><td>8</td><td rowspan="2">-</td><td>P</td><td>-</td><td>-</td></tr>
<tr><td>Max.</td><td>11</td><td>DYC</td><td>-</td><td>-</td></tr>
<tr><td colspan="8">Selection of predefined gear ratios
0 / Gear Factor: Usage of gear ratio adjusted with GERRnum / GERRdenom
1 / 200: 200
2 / 400: 400
3 / 500: 500
4 / 1000: 1000
5 / 2000: 2000
6 / 4000: 4000
7 / 5000: 5000
8 / 10000: 10000
9 / 4096: 4096
10 / 8192: 8192
11 / 16384: 16384

Changed settings become active immediately.</td></tr>
</table>

P0-11	1st Denominator of gear ratio	Min.	1	Unit	Relatd Mode		
		Default	10000	-	P	-	-
		Max.	2147483647		DYC	-	-

Denominator of the 1st set of electronic gear parameters
Electronic gear ratio = P0-12 (GEAR Numerator) / P0-11 (GEAR Denominator)
Number of input PTI pulses * P0-12 (GEAR Numerator) / P0-11 (GEAR Denominator) = Motor location (unit: revolution) * 131072
The new gear ratio is applied when the numerator value is supplied.

Changed settings become active immediately.

P0-12	1st Numerator of gear ratio	Min.	1	Unit	Relatd Mode		
		Default	131072	-	P	-	-
		Max.	2147483647		DYC	-	-

Numerator of the 1st set of electronic gear parameters
Refer to parameter P0-11

Changed settings become active immediately.

P0-13	2nd Denominator of gear ratio	Min.	1	Unit	Relatd Mode		
		Default	10000	-	P	-	-
		Max.	2147483647		DYC	-	-

Denominator of the 2nd set of electronic gear parameters
Electronic gear ratio = P0-14 (GEAR Numerator) / P0-13 (GEAR Denominator)
Number of input PTI pulses * P0-14 (GEAR Numerator) / P0-13 (GEAR Denominator) = Motor location (unit: revolution) * 131072
The new gear ratio is applied when the numerator value is supplied.

Changed settings become active immediately.

P0-14	2nd Numerator of gear ratio	Min.	1	Unit	Relatd Mode		
		Default	131072	-	P	-	-
		Max.	2147483647		DYC	-	-

Numerator of the 2nd set of electronic gear parameters
Refer to parameter P0-13

Changed settings become active immediately.

P0-15	Processing mode for operating mode Electronic Gear	Min.	1	Unit	Relatd Mode		
		Default	1	-	P	-	-
		Max.	3		DYC	-	-

Processing mode for operating mode Electronic Gear
1 / Position Synchronization Immediate: Position synchronization without compensation movement
2 / Position Synchronization Compensated: Position synchronization with compensation movement
3 / Velocity Synchronization: Velocity synchronization

Changed settings become active the next time the motor moves.

P0-16	Treatment of position changes with inactive power stage	Min.	0	Unit	Relatd Mode		
		Default	0	-	P	-	-
		Max.	1		DYC	-	-

Treatment of position changes with inactive power stage
0 / Off: Position changes in states with disabled power stage are ignored.
1 / On: Position changes in states with disabled power stage are taken into account.

This parameter is effective only when P0-015 is set to "2 - Position synchronization with position compensation”

Changed settings become active the next time the product is powered on.

P0-17	Velocity limitation for the method Position Synchronization	Min.	0	Unit	Relatd Mode		
		Default	0	usr_v	P	-	-
		Max.	2147483647		DYC	-	-

Velocity limitation for the method Position Synchronization
0: No velocity limitation
>0: Velocity limitation in usr_v

Changed settings become active immediately.

P0-18	Resolution of encoder simulation	Min.	0	Unit	Relatd Mode		
		Default	10000	EncInc	P	-	-
		Max.	65535		DYC	-	-

Resolution of encoder simulation
Resolution defines the number of increments per revolution (AB signal with quadruple evaluation). The index pulse is created once per revolution at an interval where signal A and signal B are high.

Setting can only be changed if power stage is disabled.
Changed settings become active the next time the product is powered on.

P0-19	Inversion of direction of encoder simulation	Min.	0	Unit	Relatd Mode		
		Default	0	-	P	-	-
		Max.	1		DYC	-	-

Set whether the analog encoder output direction is opposite to the rotation direction of motor
0 / Inversion Off: Analog encoder output direction is the same with the rotation direction of motor
1 / Inversion On: Analog encoder output direction is opposite to the rotation direction of motor

Setting can only be changed if power stage is disabled.
Changed settings become active the next time the product is powered on.

P0-20	Maximum load-dependent position deviation	Min.	1	Unit	Relatd Mode		
		Default	393216	usr_p	P	-	-
		Max.	2147483647		DYC	-	-

Maximum load-dependent position deviation
The load-dependent position deviation is the difference between the reference position and the actual position caused by the load.

Changed settings become active immediately.

P0-21	Error response to excessivly high load-dependent position deviation	Min.	1	Unit	Relatd Mode		
		Default	3	-	P	-	-
		Max.	3		DYC	-	-

Error response to excessively high load-dependent position deviation
1 / Error Class 1: Error class 1
2 / Error Class 2: Error class 2
3 / Error Class 3: Error class 3

Setting can only be changed if power stage is disabled.
Changed settings become active the next time the power stage is enabled.

P0-22	Nominal power of external braking resistor	Min.	1	Unit	Relatd Mode		
		Default	10	W	P	-	-
		Max.	32767		DYC	-	-

Nominal power of external braking resistor

Setting can only be changed if power stage is disabled.
Changed settings become active the next time the power stage is enabled.

P0-23	Resistance value of external braking resistor	Min.	0	Unit	Relatd Mode		
		Default	10000	0.01 Ω	P	-	-
		Max.	32767		DYC	-	-

Resistance value of external braking resistor
The minimum value depends on the type of drive

In increments of 0.01 Ω

Setting can only be changed if power stage is disabled.
Changed settings become active the next time the power stage is enabled.

P0-24	Maximum permissible switch-on time of external braking resistor	Min.	1	Unit	Relatd Mode		
		Default	100	ms	P	-	-
		Max.	30000		DYC	-	-

Maximum permissible switch-on time of external braking resistor

Setting can only be changed if power stage is disabled.
Changed settings become active the next time the power stage is enabled.

P0-25	Selection of type of braking resistor	Min.	0	Unit	Relatd Mode		
		Default	0	-	P	-	-
		Max.	1		DYC	-	-

Selection of type of braking resistor
0 / No External Braking Resistor: External braking resistor not activated
1 / External Braking Resistor: External braking resistor activated

Setting can only be changed if power stage is disabled.
Changed settings become active the next time the power stage is enabled.

9.3 P1 - Motor Control

P1-00	Control set 1: Position controller P gain	Min.	20	Unit	Relatd Mode		
		Default	20	0.1 1/s	P	-	-
		Max.	9000		DYC	-	-

Control set 1: Position controller P gain

In increments of 0.1 1/s

Changed settings become active immediately.

P1-01	Control set 1: Velocity controller P gain	Min.	1	Unit	Relatd Mode		
		Default	1	0.01 A/ (1/min)	P	-	-
		Max.	25400		DYC	-	-

Control set 1: Velocity controller P gain

In increments of 0.0001 A/(1/min)

Changed settings become active immediately.

P1-02	Control set 1: Velocity controller integral action time	Min.	0	Unit	Relatd Mode		
		Default	0	0.01 ms	P	-	-
		Max.	32767		DYC	-	-

Control set 1: Velocity controller integral action time

In increments of 0.01 ms

Changed settings become active immediately.

P1-03	Control set 1: Velocity feed-forward control	Min.	0	Unit	Relatd Mode		
		Default	550	0.1 %	P	-	-
		Max.	2000		DYC	-	-

Parameter set 1: Velocity feed-forward control

In increments of 0.1%

Changed settings become active immediately.

P1-04	Control set 1: Filter time constant of the reference velocity value filter	Min.	0	Unit	Relatd Mode		
		Default	900	0.01 ms	P	-	-
		Max.	32767		DYC	-	-

Control set 1: Filter time constant of the reference velocity value filter

In increments of 0.01 ms

Changed settings become active immediately.

<table>
<tr><td rowspan="3">P1-05</td><td rowspan="3">Control set 1: Filter time constant of the reference current value filter</td><td>Min.</td><td>0</td><td>Unit</td><td colspan="3">Relatd Mode</td></tr>
<tr><td>Default</td><td>50</td><td rowspan="2">0.01 ms</td><td>P</td><td>-</td><td>-</td></tr>
<tr><td>Max.</td><td>400</td><td>DYC</td><td>-</td><td>-</td></tr>
<tr><td colspan="8">Control set 1: Filter time constant of the reference current value filter

In increments of 0.01 ms

Changed settings become active immediately.</td></tr>
</table>

<table>
<tr><td rowspan="3">P1-06</td><td rowspan="3">Control set 1: Friction compensation gain</td><td>Min.</td><td>0</td><td>Unit</td><td colspan="3">Relatd Mode</td></tr>
<tr><td>Default</td><td>0</td><td rowspan="2">0.01 Arms</td><td>P</td><td>-</td><td>-</td></tr>
<tr><td>Max.</td><td>1000</td><td>DYC</td><td>-</td><td>-</td></tr>
<tr><td colspan="8">Control set 1: Friction compensation gain

In increments of 0.01 Arms

Changed settings become active immediately.</td></tr>
</table>

<table>
<tr><td rowspan="3">P1-07</td><td rowspan="3">Control set 2: Position controller P gain</td><td>Min.</td><td>20</td><td>Unit</td><td colspan="3">Relatd Mode</td></tr>
<tr><td>Default</td><td>20</td><td rowspan="2">0.1 1/s</td><td>P</td><td>-</td><td>-</td></tr>
<tr><td>Max.</td><td>9000</td><td>DYC</td><td>-</td><td>-</td></tr>
<tr><td colspan="8">Control set 2: Position controller P gain

In increments of 0.1 1/s

Changed settings become active immediately.</td></tr>
</table>

<table>
<tr><td rowspan="3">P1-08</td><td rowspan="3">Control set 2: Velocity controller P gain</td><td>Min.</td><td>1</td><td>Unit</td><td colspan="3">Relatd Mode</td></tr>
<tr><td>Default</td><td>1</td><td rowspan="2">0.01 A/ (1/min)</td><td>P</td><td>-</td><td>-</td></tr>
<tr><td>Max.</td><td>25400</td><td>DYC</td><td>-</td><td>-</td></tr>
<tr><td colspan="8">Control set 2: Velocity controller P gain

In increments of 0.0001 A/(1/min)

Changed settings become active immediately.</td></tr>
</table>

<table>
<tr><td rowspan="3">P1-09</td><td rowspan="3">Control set 2: Velocity controller integral action time</td><td>Min.</td><td>0</td><td>Unit</td><td colspan="3">Relatd Mode</td></tr>
<tr><td>Default</td><td>0</td><td rowspan="2">0.01 ms</td><td>P</td><td>-</td><td>-</td></tr>
<tr><td>Max.</td><td>32767</td><td>DYC</td><td>-</td><td>-</td></tr>
<tr><td colspan="8">Control set 2: Velocity controller integral action time

In increments of 0.01 ms

Changed settings become active immediately.</td></tr>
</table>

<table>
<tr><td rowspan="3">P1-10</td><td rowspan="3">Control set 2: Velocity feed-forward control</td><td>Min.</td><td>0</td><td>Unit</td><td colspan="3">Relatd Mode</td></tr>
<tr><td>Default</td><td>550</td><td rowspan="2">0.1 %</td><td>P</td><td>-</td><td>-</td></tr>
<tr><td>Max.</td><td>2000</td><td>DYC</td><td>-</td><td>-</td></tr>
<tr><td colspan="8">Parameter set 2: Velocity feed-forward control

In increments of 0.1%

Changed settings become active immediately.</td></tr>
</table>

<table>
<tr><td rowspan="3">P1-11</td><td rowspan="3">Control set 2: Filter time constant of the reference velocity value filter</td><td>Min.</td><td>0</td><td>Unit</td><td colspan="3">Relatd Mode</td></tr>
<tr><td>Default</td><td>900</td><td rowspan="2">0.01 ms</td><td>P</td><td>-</td><td>-</td></tr>
<tr><td>Max.</td><td>32767</td><td>DYC</td><td>-</td><td>-</td></tr>
<tr><td colspan="8">Control set 2: Filter time constant of the reference velocity value filter

In increments of 0.01 ms

Changed settings become active immediately.</td></tr>
</table>

<table>
<tr><td rowspan="3">P1-12</td><td rowspan="3">Control set 2: Filter time constant of the reference current value filter</td><td>Min.</td><td>0</td><td>Unit</td><td colspan="3">Relatd Mode</td></tr>
<tr><td>Default</td><td>50</td><td rowspan="2">0.01 ms</td><td>P</td><td>-</td><td>-</td></tr>
<tr><td>Max.</td><td>400</td><td>DYC</td><td>-</td><td>-</td></tr>
<tr><td colspan="8">Control set 2: Filter time constant of the reference current value filter

In increments of 0.01 ms

Changed settings become active immediately.</td></tr>
</table>

<table>
<tr><td rowspan="3">P1-13</td><td rowspan="3">Control set 2: Friction compensation gain</td><td>Min.</td><td>0</td><td>Unit</td><td colspan="3">Relatd Mode</td></tr>
<tr><td>Default</td><td>0</td><td rowspan="2">0.01 Arms</td><td>P</td><td>-</td><td>-</td></tr>
<tr><td>Max.</td><td>1000</td><td>DYC</td><td>-</td><td>-</td></tr>
<tr><td colspan="8">Control set 2: Friction compensation gain

In increments of 0.01 Arms

Changed settings become active immediately.</td></tr>
</table>

<table>
<tr><td rowspan="3">P1-14</td><td rowspan="3">Control set 3: Position controller P gain</td><td>Min.</td><td>20</td><td>Unit</td><td colspan="3">Relatd Mode</td></tr>
<tr><td>Default</td><td>20</td><td rowspan="2">0.1 1/s</td><td>P</td><td>-</td><td>-</td></tr>
<tr><td>Max.</td><td>9000</td><td>DYC</td><td>-</td><td>-</td></tr>
<tr><td colspan="8">Control set 3: Position controller P gain

In increments of 0.1 1/s

Changed settings become active immediately.</td></tr>
</table>

P1-15	Control set 3: Velocity controller P gain	Min.	1	Unit	Relatd Mode		
		Default	1	0.01 A/ (1/min)	P	-	-
		Max.	25400		DYC	-	-

Control set 3: Velocity controller P gain

In increments of 0.0001 A/(1/min)

Changed settings become active immediately.

P1-16	Control set 3: Velocity controller integral action time	Min.	0	Unit	Relatd Mode		
		Default	0	0.01 ms	P	-	-
		Max.	32767		DYC	-	-

Control set 3: Velocity controller integral action time

In increments of 0.01 ms

Changed settings become active immediately.

P1-17	Control set 3: Filter time constant of the reference velocity value filter	Min.	0	Unit	Relatd Mode		
		Default	900	0.01 ms	P	-	-
		Max.	32767		DYC	-	-

Control set 3: Filter time constant of the reference velocity value filter

In increments of 0.01 ms

Changed settings become active immediately.

P1-18	Control set 3: Filter time constant of the reference current value filter	Min.	0	Unit	Relatd Mode		
		Default	50	0.01 ms	P	-	-
		Max.	400		DYC	-	-

Control set 3: Filter time constant of the reference current value filter

In increments of 0.01 ms

Changed settings become active immediately.

P1-19	Speed of rotation up to which the friction compensation is linear	Min.	0	Unit	Relatd Mode		
		Default	5	1/min	P	-	-
		Max.	20		DYC	-	-

Speed of rotation up to which the friction compensation is linear

Changed settings become active immediately.

P1-20	PID velocity controller: D gain	Min.	0	Unit	Relatd Mode		
		Default	0	0.1 %	P	-	-
		Max.	4000		DYC	-	-

PID velocity controller: D gain

In increments of 0.1 %

Changed settings become active immediately.

P1-21	PID velocity controller: Time constant of D term smoothing filter	Min.	1	Unit	Relatd Mode		
		Default	25	0.01 ms	P	-	-
		Max.	1000		DYC	-	-

PID velocity controller: Time constant of D term smoothing filter

In increments of 0.1 %

Changed settings become active immediately.

P1-22	Velocity controller integral action time of positioning mode (table 2)	Min.	0	Unit	Relatd Mode		
		Default	0	0.01 ms	P	-	-
		Max.	32767		DYC	-	-

Velocity controller integral action time of positioning mode (table 2)
When parameter P0-05 = 1 / Positioning Mode (Table 2), this parameter is used as the integration time of auto adaptive control loop
0: Use the default integration time of auto adaptive control loop in position mode
>0: This parameter is used as the integration time of auto adaptive control loop in positioning mode

This parameter takes effect when P0-01 = 1 / Standard, 2 / Passive or 3 / Adaptive.

In increments of 0.01 ms

Changed settings become active immediately.

P1-23	Activation of jerk limitation	Min.	0	Unit	Relatd Mode		
		Default	0	-	P	-	-
		Max.	1		DYC	-	-

Activation of jerk limitation
0 / Off: Jerk limitation deactivated
1 / PosSyncOn: Jerk limitation active

The time for jerk limitation must be set via parameter P1-24.

Setting can only be changed if power stage is disabled.
Changed settings become active the next time the power stage is enabled.

P1-24	Jerk limitation of the motion profile for velocity	Min.	0	Unit	Relatd Mode		
		Default	0	-	P	-	-
		Max.	1		DYC	-	-

Jerk limitation of the motion profile for velocity
0 / Off: Off
1 / 1: 1 ms
2 / 2: 2 ms
4 / 4: 4 ms
8 / 8: 8 ms
16 / 16: 16 ms
32 / 32: 32 ms
64 / 64: 64 ms
128 / 128: 128 ms

Changed settings become active the next time the motor moves.

P1-25	Filter time constant for Position Reference	Min.	0	Unit	Relatd Mode		
		Default	0	0.01 ms	P	-	-
		Max.	25600		DYC	-	-

Filter time constant for Position Reference

In increments of 0.01 ms

Changed settings become active immediately.

P1-26	Acceleration feed-forward control	Min.	0	Unit	Relatd Mode		
		Default	0	0.1 %	P	-	-
		Max.	3000		DYC	-	-

Acceleration feed-forward control

In increments of 0.1 %

Changed settings become active immediately.

P1-27	Torque load feed-forward control	Min.	0	Unit	Relatd Mode		
		Default	0	0.1 %	P	-	-
		Max.	3000		DYC	-	-

Torque feed-forward control

In increments of 0.1 %

Changed settings become active immediately.

P1-28	Filter time constant to smooth velocity of motor	Min.	0	Unit	Relatd Mode		
		Default	0	0.01 ms	P	-	-
		Max.	3000		DYC	-	-

Filter time constant to smooth velocity of motor

In increments of 0.01 ms

Changed settings become active immediately.

P1-29	Maximum current for field weakening (d component)	Min.	0	Unit	Relatd Mode		
		Default	0	0.01 Arms	P	-	-
		Max.	30000		DYC	-	-

Maximum current for field weakening (d component)
This value is only limited by the minimum/maximum parameter range (no limitation of this value by motor/power stage).
The actually effective field weakening current is the minimum of P1-29 and one half of the lower value of the nominal current of the power stage and the motor

In increments of 0.01 Arms

Setting can only be changed if power stage is disabled.
Changed settings become active the next time the power stage is enabled.

P1-30	Selection of control loop parameter set at power up	Min.	0	Unit	Relatd Mode		
		Default	1	-	P	-	-
		Max.	2		DYC	-	-

Selection of control loop parameter set at power up
0 / Switching Condition: The switching condition is used for control loop parameter set switching
1 / Parameter Set 1: Control loop parameter set 1 is used
2 / Parameter Set 2: Control loop parameter set 2 is used

Changed settings become active immediately.

P1-31	Condition for parameter set switching	Min.	0	Unit	Relatd Mode		
		Default	0	ms	P	-	-
		Max.	1000		DYC	-	-

Condition for parameter set switching
0 / None or Digital Input: None or digital input function selected
1 / Inside Position Deviation: Inside position deviation (value definition in parameter P1-33)
2 / Below Reference Velocity: Below reference velocity (value definition in parameter P1-34)
3 / Below Actual Velocity: Below actual velocity (value definition in parameter P1-33)
4 / Reversed: Reserved

In the case of parameter set switching, the values of the following parameters are changed gradually:
P1-00 / P1-07
P1-01 / P1-08
P1-02 / P1-09
P1-03 / P1-10
P1-04 / P1-11
P1-05 / P1-12
The following parameters are changed immediately after the time for parameter set switching (P1-35):
P2-07 / P2-15
P2-08 / P2-16
P2-09 / P2-17
P2-10 / P2-18
P2-11 / P2-19
P2-12 / P2-20
P2-13 / P2-21
P2-14 / P2-22
P1-06 / P1-13

Changed settings become active immediately.

P1-32	Time window for parameter set switching	Min.	0	Unit	Relatd Mode		
		Default	0	ms	P	-	-
		Max.	1000		DYC	-	-

Control loop parameter set switches the time window for monitoring of position error and speed threshold:
0: Monitoring window disabled
>0: Window time for the parameters switching

Changed settings become active immediately.

P1-33	Position deviation for control loop parameter set switching	Min.	0	Unit	Relatd Mode		
		Default	1310	usr_p	P	-	-
		Max.	2147483647		DYC	-	-

Position deviation for parameter set switching
When parameter P1-31 = 1 / Inside Position Deviation, if the position error is smaller than this parameter value, control loop parameter set 2 will be used; otherwise, control loop parameter set 1 will be used

Changed settings become active immediately.

P1-34	Velocity threshold for control loop parameter set switching	Min.	0	Unit	Relatd Mode		
		Default	50	usr_v	P	-	-
		Max.	2147483647		DYC	-	-

Velocity threshold for parameter set switching
When parameter P1-31 = 2 / Below Reference Velocity, if the target speed is smaller than this parameter value, control loop parameter set 2 will be used, otherwise, control loop parameter set 1 will be used
When parameter P1-31 = 3 / Below Actual Velocity, if the actual speed is smaller than this parameter value, control loop parameter set 2 will be used, otherwise, control loop parameter set 1 will be used

Changed settings become active immediately.

P1-35	Period of time for control loop parameter set switching	Min.	0	Unit	Relatd Mode		
		Default	0	ms	P	-	-
		Max.	2000		DYC	-	-

Period of time for parameter switching
In the case of control loop parameter set switching, the values of the following parameters are changed gradually:
P1-00 / P1-07
P1-01 / P1-08
P1-02 / P1-09
P1-03 / P1-10
P1-04 / P1-11
P1-05 / P1-12

Changed settings become active immediately.

P1-36	Dynamic gain switching: Selection of switching method	Min.	0	Unit	Relatd Mode		
		Default	1	-	P	-	-
		Max.	3		DYC	-	-

Dynamic gain switching selection
0 / Dynamic Gain Switch Disable: Disable the adaptive stiffness index switching
1 / Dynamic Gain Switch No Ramp: Direct parameter switching for adaptive stiffness index switching
2 / Dynamic Gain Switch Deep Sleep Mode: Switching to stiffness index even lower than the lower stiffness in P1-44
3 / Dynamic Gain Switch With Ramp: Adaptive stiffness index switching with slope

When parameter P0-01 = 0 / Invalid, when the switching conditions are met, the values of the following parameters are changed gradually:
P1-00 / P1-14
P1-01 / P1-15
P1-02 / P1-16
P1-04 / P1-17
P1-05 / P1-18
When parameter P0-01 = 1 / Standard, 2 / Passive or 3 / Adaptive, when the switching conditions are met, the values of the following parameters are changed gradually:
P0-02 / P1-44

When this parameter is set to 2 / Dynamic Gain Switch Deep Sleep Mode, after the switch of dynamic gain to lower ones, the dynamic gain will further decrease to half of the lower gain.

Changed settings become active immediately.

P1-37	Dynamic gain switching: Period of time for dynamic gain switching	Min.	0	Unit	Relatd Mode		
		Default	0	0.1 ms	P	-	-
		Max.	2000		DYC	-	-

Period of time for dynamic gain switching with ramp.
When parameter P1-36 = 3 / Dynamic Gain Switch With Ramp, when the switching conditions are met, values of dynamic gain will change gradually within the given period in this parameter.

In increments of 0.01 ms

Changed settings become active immediately.

P1-38	Dynamic gain switching: Position deviation delay time	Min.	0	Unit	Relatd Mode		
		Default	20	0.1 ms	P	-	-
		Max.	2000		DYC	-	-

Period of time for position detection after motion is finished.
When motion is finished, if the position deviation after filtering by the filter defined in P1-40 is within the position thresholds defined in P1-39 for a period of time longer than the value given in this parameter, dynamic gain switching "Position" condition is met.

In increments of 0.1 ms

Changed settings become active immediately.

P1-39	Dynamic gain switching: Position deviation threshold	Min.	2	Unit	Relatd Mode		
		Default	50	0.1 deg	P	-	-
		Max.	100		DYC	-	-

Position deviation thresholds for dynamic gain switching.
Refer to parameter P1-38

In increments of 0.1 deg

Changed settings become active immediately.

P1-40	Dynamic gain switching: Filter time constant for position deviation	Min.	0	Unit	Relatd Mode		
		Default	100	0.1 ms	P	-	-
		Max.	2000		DYC	-	-

Filter time constant for position deviation for dynamic gain switching.
Refer to parameter P1-38

In increments of 0.1 ms

Changed settings become active immediately.

P1-41	Dynamic gain switching: Low speed delay time	Min.	0	Unit	Relatd Mode		
		Default	20	0.1 ms	P	-	-
		Max.	2000		DYC	-	-

Period of time for speed detection after motion is finished.
When motion is finished, if the actual speed is lower than the thresholds defined in P1-42 for a period of time longer than the value given in this parameter, dynamic gain switching "Speed" condition is met.

In increments of 0.1 ms

Changed settings become active immediately.

P1-42	Dynamic gain switching: Low speed threshold	Min.	0	Unit	Relatd Mode		
		Default	20	1/min	P	-	-
		Max.	50		DYC	-	-

Low speed threshold for dynamic gain switching.
Refer to parameter P1-41

Changed settings become active immediately.

P1-43	Dynamic gain switching: Selection of low speed optimization mode	Min.	0	Unit	Relatd Mode		
		Default	0	-	P	-	-
		Max.	1		DYC	-	-

Selection of low speed optimization mode
0 / Position And Velocity: Control loop gain will switch when both dynamic gain switching "Position" and "Speed" conditions are met
1 / Position Or Velocity: Position controller gain will switch seperately when dynamic gain switching "Position" condition is met, velocity controller gain will switch seperately when dynamic gain switching "Speed" condition is met.

Changed settings become active immediately.

P1-44	Dynamic gain switching: Stiffness for lower gain	Min.	0	Unit	Relatd Mode		
		Default	20	1/min	P	-	-
		Max.	50		DYC	-	-

Stiffness for lower gain
When parameter P0-01 = 1 / Standard, 2 / Passive or 3 / Adaptive, when the switching conditions are met, the values of the following parameters are changed gradually:
P0-02 / P1-44

Changed settings become active immediately.

9.4 P2 - Damping

P2-00	Adaptive notch filter mode selection	Min.	0	Unit	Relatd Mode		
		Default	0	-	P	-	-
		Max.	3		DYC	-	-

Selection of adaptive notch filter mode
0 / Invalid: The adaptive notch filters are not set automatically, parameters of adaptive notch filters remain unchanged
1 / Enable 1: Enable the 1st set of adaptive notch filters
2 / Enable 2: Enable the 1st and 2nd sets of adaptive notch filters
3 / Reset: Reset all adaptive notch filters
8 / Finished: Adaptive notch filters set finished

Changed settings become active immediately.

P2-01	Adaptive Notch filter 1: Damping	Min.	550	Unit	Relatd Mode		
		Default	900	0.1 %	P	-	-
		Max.	990		DYC	-	-

Adaptive Notch filter 1: Damping

In increments of 0.1 %

Changed settings become active immediately.

P2-02	Adaptive Notch filter 1: Frequency	Min.	500	Unit	Relatd Mode		
		Default	15000	0.1 Hz	P	-	-
		Max.	15000		DYC	-	-

Adaptive Notch filter 1: Frequency

In increments of 0.1 Hz

Changed settings become active immediately.

P2-03	Adaptive Notch filter 1: Bandwidth	Min.	10	Unit	Relatd Mode		
		Default	700	0.1 %	P	-	-
		Max.	900		DYC	-	-

Adaptive Notch filter 1: Bandwidth

In increments of 0.1 %

Changed settings become active immediately.

P2-04	Adaptive Notch filter 2: Damping	Min.	550	Unit	Relatd Mode		
		Default	900	0.1 %	P	-	-
		Max.	990		DYC	-	-

Adaptive Notch filter 2: Damping

In increments of 0.1 %

Changed settings become active immediately.

P2-05	Adaptive Notch filter 2: Frequency	Min.	500	Unit	Relatd Mode		
		Default	15000	0.1 Hz	P	-	-
		Max.	15000		DYC	-	-

Adaptive Notch filter 2: Frequency

In increments of 0.1 Hz

Changed settings become active immediately.

P2-06	Adaptive Notch filter 2: Bandwidth	Min.	10	Unit	Relatd Mode		
		Default	700	0.1 %	P	-	-
		Max.	900		DYC	-	-

Adaptive Notch filter 2: Bandwidth

In increments of 0.1 %

Changed settings become active immediately.

P2-07	Control Set 1 Notch filter 1: Damping	Min.	550	Unit	Relatd Mode		
		Default	900	0.1 %	P	-	-
		Max.	990		DYC	-	-

Control Set 1 Notch filter 1: Damping

In increments of 0.1 %

Changed settings become active immediately.

P2-08	Control Set 1 Notch filter 1: Frequency	Min.	500	Unit	Relatd Mode		
		Default	15000	0.1 Hz	P	-	-
		Max.	15000		DYC	-	-

Control Set 1 Notch filter 1: Frequency

In increments of 0.1 Hz

Changed settings become active immediately.

P2-09	Control Set 1 Notch filter 1: Bandwidth	Min.	10	Unit	Relatd Mode		
		Default	700	0.1 %	P	-	-
		Max.	900		DYC	-	-

Control Set 1 Notch filter 1: Bandwidth

In increments of 0.1 %

Changed settings become active immediately.

P2-10	Control Set 1 Notch filter 2: Damping	Min.	550	Unit	Relatd Mode		
		Default	900	0.1 %	P	-	-
		Max.	990		DYC	-	-

Control Set 1 Notch filter 2: Damping

In increments of 0.1 %

Changed settings become active immediately.

P2-11	Control Set 1 Notch filter 2: Frequency	Min.	500	Unit	Relatd Mode		
		Default	15000	0.1 Hz	P	-	-
		Max.	15000		DYC	-	-

Control Set 1 Notch filter 2: Frequency

In increments of 0.1 Hz

Changed settings become active immediately.

P2-12	Control Set 1 Notch filter 2: Bandwidth	Min.	10	Unit	Relatd Mode		
		Default	700	0.1 %	P	-	-
		Max.	900		DYC	-	-

Control Set 1 Notch filter 2: Bandwidth

In increments of 0.1 %

Changed settings become active immediately.

P2-13	Control Set 1 Overshoot suppression filter: Damping	Min.	0	Unit	Relatd Mode		
		Default	0	0.1 %	P	-	-
		Max.	500		DYC	-	-

Control Set 1 Overshoot suppression filter: Damping

In increments of 0.1 %

Changed settings become active immediately.

P2-14	Control Set 1 Overshoot suppression filter: Time delay	Min.	0	Unit	Relatd Mode		
		Default	0	0.01 ms	P	-	-
		Max.	7500		DYC	-	-

Control Set 1 Overshoot suppression filter: Time delay

In increments of 0.1 ms

Changed settings become active immediately.

P2-15	Control Set 2 Notch filter 1: Damping	Min.	550	Unit	Relatd Mode		
		Default	900	0.1 %	P	-	-
		Max.	990		DYC	-	-

Control Set 2 Notch filter 1: Damping

In increments of 0.1 %

Changed settings become active immediately.

P2-16	Control Set 2 Notch filter 1: Frequency	Min.	500	Unit	Relatd Mode		
		Default	15000	0.1 Hz	P	-	-
		Max.	15000		DYC	-	-

Control Set 2 Notch filter 1: Frequency

In increments of 0.1 Hz

Changed settings become active immediately.

P2-17	Control Set 2 Notch filter 1: Bandwidth	Min.	10	Unit	Relatd Mode		
		Default	700	0.1 %	P	-	-
		Max.	900		DYC	-	-

Control Set 2 Notch filter 1: Bandwidth

In increments of 0.1 %

Changed settings become active immediately.

P2-18	Control Set 2 Notch filter 2: Damping	Min.	550	Unit	Relatd Mode		
		Default	900	0.1 %	P	-	-
		Max.	990		DYC	-	-

Control Set 2 Notch filter 2: Damping

In increments of 0.1 %

Changed settings become active immediately.

P2-19	Control Set 2 Notch filter 2: Frequency	Min.	500	Unit	Relatd Mode		
		Default	15000	0.1 Hz	P	-	-
		Max.	15000		DYC	-	-

Control Set 2 Notch filter 2: Frequency

In increments of 0.1 Hz

Changed settings become active immediately.

P2-20	Control Set 2 Notch filter 2: Bandwidth	Min.	10	Unit	Relatd Mode		
		Default	700	0.1 %	P	-	-
		Max.	900		DYC	-	-

Control Set 2 Notch filter 2: Bandwidth

In increments of 0.1 %

Changed settings become active immediately.

P2-21	Control Set 2 Overshoot suppression filter: Damping	Min.	0	Unit	Relatd Mode		
		Default	0	0.1 %	P	-	-
		Max.	500		DYC	-	-

Control Set 2 Overshoot suppression filter: Damping

In increments of 0.1 %

Changed settings become active immediately.

P2-22	Control Set 2 Overshoot suppression filter: Time delay	Min.	0	Unit	Relatd Mode		
		Default	0	0.01 ms	P	-	-
		Max.	7500		DYC	-	-

Control Set 2 Overshoot suppression filter: Time delay

In increments of 0.1 ms

Changed settings become active immediately.

P2-23	Vibration detection Cycle number	Min.	0	Unit	Relatd Mode		
		Default	2	-	P	-	-
		Max.	10		DYC	-	-

Vibration detection Cycle number

Changed settings become active immediately.

P2-24	Vibration detection level	Min.	0	Unit	Relatd Mode		
		Default	20	-	P	-	-
		Max.	10		DYC	-	-

Vibration detection level

Changed settings become active immediately.

P2-25	Vibration detection time delay	Min.	0	Unit	Relatd Mode		
		Default	2	-	P	-	-
		Max.	10		DYC	-	-

Vibration detection time delay

In increments of 0.1 ms

Changed settings become active immediately.

P2-26	Frequency for anti vibration filter 1	Min.	0	Unit	Relatd Mode		
		Default	500	0.1 %	P	-	-
		Max.	3000		DYC	-	-

Frequency for anti vibration filter 1

In increments of 0.1 %

Changed settings become active immediately.

P2-27	Damping fator for anti vibration filter 1	Min.	0	Unit	Relatd Mode		
		Default	0	0.1 Hz	P	-	-
		Max.	2000		DYC	-	-

Damping fator for anti vibration filter 1

In increments of 0.1 Hz

Changed settings become active immediately.

P2-28	Frequency for anti vibration filter 2	Min.	0	Unit	Relatd Mode		
		Default	500	0.1 %	P	-	-
		Max.	3000		DYC	-	-

Frequency for anti vibration filter 2

In increments of 0.1 %

Changed settings become active immediately.

P2-29	Damping fator for anti vibration filter 2	Min.	0	Unit	Relatd Mode		
		Default	0	0.1 Hz	P	-	-
		Max.	2000		DYC	-	-

Damping fator for anti vibration filter 2

In increments of 0.1 Hz

Changed settings become active immediately.

9.5 P3 - I/O

P3-00	Function Input of DI0	Min.	1	Unit	Relatd Mode		
		Default	3	-	P	-	-
		Max.	141		DYC	-	-

Function Input of DI0

Function	Description	Code		Related Mode	
		NO	NC	P	DYC
Freely Available	No function assigned, available as required	1	-	√	√
Fault Reset	Reset after error	2	102	√	√
Enable	Enables the power stage	3	103	√	√
Halt	Halt	4	104	√	√
Current Limitation	Limits the current to parameter value	6	106	√	√
Zero Clamp	Zero clamping	7	107	√	√
Velocity Limitation	Limits the velocity to parameter value	8	108	√	√
Jog Positive	Jog: Moves in positive direction	9	109	√	
Jog Negative	Jog: Moves in negative direction	10	110	√	
Jog Fast/Slow	Jog: Switches between slow and fast movement	11	111	√	
Gear Ratio Switch	Electronic Gear: Switches between two gear ratios	12	112	√	
Gear Offset 1	Electronic Gear: Adds first gear offset	19	119	√	
Gear Offset 2	Electronic Gear: Adds second gear offset	20	120	√	
Reference Switch (REF)	Reference switch	21	121	√	√
Positive Limit Switch(LIMP)	Positive limit switch	22	122	√	√
Negative Limit Switch(LIMN)	Negative limit switch	23	123	√	√
Switch Controller Parameter Set	Switches control loop parameter set	24	124	√	√
Velocity Controller Integral Off	Switches off velocity controller integral term	28	128	√	√
ORGP	Start homing movement	42	142	√	√

Setting can only be changed if power stage is disabled.
Changed settings become active the next time the product is powered on.

P3-01	Function Input of DI2	Min.	1	Unit	Relatd Mode		
		Default	2	-	P	-	-
		Max.	141		DYC	-	-

Function Input of DI0
Refer to parameter P3-00

Setting can only be changed if power stage is disabled.
Changed settings become active the next time the product is powered on.

1 Overview
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P3-02	Function Input of DI3	Min.	1	Unit	Relatd Mode		
		Default	122	-	P	-	-
		Max.	141		DYC	-	-

Function Input of DI2
Refer to parameter P3-00

Setting can only be changed if power stage is disabled.
Changed settings become active the next time the product is powered on.

P3-03	Function Input of DI4	Min.	1	Unit	Relatd Mode		
		Default	123	-	P	-	-
		Max.	141		DYC	-	-

Function Input of DI4
Refer to parameter P3-00

Setting can only be changed if power stage is disabled.
Changed settings become active the next time the product is powered on.

P3-04	Function Input of DI4	Min.	1	Unit	Relatd Mode		
		Default	12	-	P	-	-
		Max.	141		DYC	-	-

Function Input of DI4
Refer to parameter P3-00

Setting can only be changed if power stage is disabled.
Changed settings become active the next time the product is powered on.

P3-05	Function Input of DI5	Min.	1	Unit	Relatd Mode		
		Default	104	-	P	-	-
		Max.	141		DYC	-	-

Function Input of DI5
Refer to parameter P3-00

Setting can only be changed if power stage is disabled.
Changed settings become active the next time the product is powered on.

P3-06	Function Output of DQ0	Min.	1	Unit	Relatd Mode		
		Default	2	-	P	-	-
		Max.	125		DYC	-	-

Function Output of DQ0

Function	Description	Code		Related Mode	
		NO	NC	P	DYC
Freely Available	No function assigned, available as required	1	-	√	√
No Fault	No fault found on device	2	102	√	√
Active	Device power stage is enabled	3	103	√	√
In Position Deviation Window	Position deviation is within window	5	105	√	√
In Velocity Deviation Window	Velocity deviation is within window	6	106	√	√
Velocity Below Threshold	Motor velocity below threshold	7	107	√	√
Current Below Threshold	Motor current below threshold	8	108	√	√
Halt Acknowledge	Halt acknowledgement	9	109	√	√
Motor Standstill	Motor at a standstill	13	113	√	√
Selected Error	One of the specified errors of error classes 1 … 4 is active	14	114	√	√
Valid Reference (ref_ ok)	Zero point is valid (ref_ok)	15	115	√	√
Selected Warning	One of the specified errors of error class 0 is active	16	116	√	√
Motor Moves Positive	Motor moves in positive direction	22	122	√	√
Motor Moves Negative	Motor moves in negative direction	23	123	√	√
Release Brake	Motor holding brake control	24	124	√	√
Current Over Threshold	Motor current over threshold	25	125	√	√

Setting can only be changed if power stage is disabled.
Changed settings become active the next time the product is powered on.

P3-07	Function Output of DQ1	Min.	1	Unit	Relatd Mode		
		Default	5	-	P	-	-
		Max.	125		DYC	-	-

Function Output of DQ1
Refer to parameter P3-06

Setting can only be changed if power stage is disabled.
Changed settings become active the next time the product is powered on.

P3-08	Function Output of DQ2	Min.	1	Unit	Relatd Mode		
		Default	13	-	P	-	-
		Max.	125		DYC	-	-

Function Output of DQ2
Refer to parameter P3-06

Setting can only be changed if power stage is disabled.
Changed settings become active the next time the product is powered on.

P3-09	Debounce time of DI0	Min.	0	Unit	Relatd Mode		
		Default	6	-	P	-	-
		Max.	6		DYC	-	-

Debounce time of DI0
0 / No: No software debouncing
1 / 0.25 ms: 0.25 ms
2 / 0.5 ms: 0.5 ms
3 / 0.75 ms: 0.75 ms
4 / 1.0 ms: 1.0 ms
5 / 1.25 ms: 1.25 ms
6 / 1.50 ms: 1.50 ms

Setting can only be changed if power stage is disabled.
Changed settings become active immediately.

P3-10	Debounce time of DI1	Min.	0	Unit	Relatd Mode		
		Default	6	-	P	-	-
		Max.	6		DYC	-	-

Debounce time of DI1
0 / No: No software debouncing
1 / 0.25 ms: 0.25 ms
2 / 0.5 ms: 0.5 ms
3 / 0.75 ms: 0.75 ms
4 / 1.0 ms: 1.0 ms
5 / 1.25 ms: 1.25 ms
6 / 1.50 ms: 1.50 ms

Setting can only be changed if power stage is disabled.
Changed settings become active immediately.

P3-11	Debounce time of DI2	Min.	0	Unit	Relatd Mode		
		Default	6	-	P	-	-
		Max.	6		DYC	-	-

Debounce time of DI2
0 / No: No software debouncing
1 / 0.25 ms: 0.25 ms
2 / 0.5 ms: 0.5 ms
3 / 0.75 ms: 0.75 ms
4 / 1.0 ms: 1.0 ms
5 / 1.25 ms: 1.25 ms
6 / 1.50 ms: 1.50 ms

Setting can only be changed if power stage is disabled.
Changed settings become active immediately.

P3-12	Debounce time of DI3	Min.	0	Unit	Relatd Mode		
		Default	6	-	P	-	-
		Max.	6		DYC	-	-

Debounce time of DI3
0 / No: No software debouncing
1 / 0.25 ms: 0.25 ms
2 / 0.5 ms: 0.5 ms
3 / 0.75 ms: 0.75 ms
4 / 1.0 ms: 1.0 ms
5 / 1.25 ms: 1.25 ms
6 / 1.50 ms: 1.50 ms

Setting can only be changed if power stage is disabled.
Changed settings become active immediately.

P3-13	Debounce time of DI4	Min.	0	Unit	Relatd Mode		
		Default	6	-	P	-	-
		Max.	6		DYC	-	-

Debounce time of DI4
0 / No: No software debouncing
1 / 0.25 ms: 0.25 ms
2 / 0.5 ms: 0.5 ms
3 / 0.75 ms: 0.75 ms
4 / 1.0 ms: 1.0 ms
5 / 1.25 ms: 1.25 ms
6 / 1.50 ms: 1.50 ms

Setting can only be changed if power stage is disabled.
Changed settings become active immediately.

P3-14	Debounce time of DI5	Min.	0	Unit	Relatd Mode		
		Default	6	-	P	-	-
		Max.	6		DYC	-	-

Debounce time of DI5
0 / No: No software debouncing
1 / 0.25 ms: 0.25 ms
2 / 0.5 ms: 0.5 ms
3 / 0.75 ms: 0.75 ms
4 / 1.0 ms: 1.0 ms
5 / 1.25 ms: 1.25 ms
6 / 1.50 ms: 1.50 ms

Setting can only be changed if power stage is disabled.
Changed settings become active immediately.

<table>
<tr><td rowspan="3">P3-15</td><td rowspan="3">Enabling the power stage at PowerOn</td><td>Min.</td><td>0</td><td>Unit</td><td colspan="3">Relatd Mode</td></tr>
<tr><td>Default</td><td>0</td><td rowspan="2">-</td><td>P</td><td>-</td><td>-</td></tr>
<tr><td>Max.</td><td>2</td><td>DYC</td><td>-</td><td>-</td></tr>
<tr><td colspan="8">Enabling the power stage at PowerOn
0 / RisingEdge: A rising edge with the signal input function "Enable" enables the power stage
1 / HighLevel: An active signal input with signal input function "Enable" enables the power stage
2 / AutoOn: The power stage is automatically enabled

Changed settings become active the next time the power stage is enabled.</td></tr>
</table>

<table>
<tr><td rowspan="3">P3-16</td><td rowspan="3">Enabling the power stage as set via P3-15 even after error</td><td>Min.</td><td>0</td><td>Unit</td><td colspan="3">Relatd Mode</td></tr>
<tr><td>Default</td><td>0</td><td rowspan="2">-</td><td>P</td><td>-</td><td>-</td></tr>
<tr><td>Max.</td><td>1</td><td>DYC</td><td>-</td><td>-</td></tr>
<tr><td colspan="8">Action method of enabling the power stage as set via P3-15 even after error
0 / Off: Setting in parameter P3-15 is only used after start-up
1 / On: Setting in parameter P3-15 is used after start- up and after detected error

Changed settings become active the next time the power stage is enabled.</td></tr>
</table>

<table>
<tr><td rowspan="3">P3-17</td><td rowspan="3">Additional 'Fault Reset' for the signal input function 'Enable'</td><td>Min.</td><td>0</td><td>Unit</td><td colspan="3">Relatd Mode</td></tr>
<tr><td>Default</td><td>0</td><td rowspan="2">-</td><td>P</td><td>-</td><td>-</td></tr>
<tr><td>Max.</td><td>2</td><td>DYC</td><td>-</td><td>-</td></tr>
<tr><td colspan="8">Additional 'Fault Reset' for the signal input function 'Enable'
0 / Off: No additional 'Fault Reset'
1 / OnFallingEdge: Additional 'Fault Reset' with falling edge
2 / OnRisingEdge: Additional 'Fault Reset' with rising edge

Changed settings become active the next time the power stage is enabled.</td></tr>
</table>

<table>
<tr><td rowspan="3">P3-18</td><td rowspan="3">Velocity limitation via input</td><td>Min.</td><td>0</td><td>Unit</td><td colspan="3">Relatd Mode</td></tr>
<tr><td>Default</td><td>10</td><td rowspan="2">usr_v</td><td>P</td><td>-</td><td>-</td></tr>
<tr><td>Max.</td><td>2147483647</td><td>DYC</td><td>-</td><td>-</td></tr>
<tr><td colspan="8">Velocity limitation via input
A velocity limitation can be activated via a digital input.

Changed settings become active the next time the product is powered on.</td></tr>
</table>

<table>
<tr><td rowspan="3">P3-19</td><td rowspan="3">Current limitation via input</td><td>Min.</td><td>0</td><td>Unit</td><td colspan="3">Relatd Mode</td></tr>
<tr><td>Default</td><td>20</td><td rowspan="2">0.01 Arms</td><td>P</td><td>-</td><td>-</td></tr>
<tr><td>Max.</td><td>30000</td><td>DYC</td><td>-</td><td>-</td></tr>
<tr><td colspan="8">Current limitation via input
A current limit can be activated via a digital input.

In increments of 0.01 Arms

Changed settings become active the next time the product is powered on.</td></tr>
</table>

9.6 P4 - Velocity / Torque

P4-00	Activation of the motion profile for velocity	Min.	0	Unit	Relatd Mode		
		Default	1	-	P	-	-
		Max.	1		DYC	-	-

Activation of the motion profile for velocity
0 / Profile Off: Profile off
1 / Profile On: Profile on

Setting can only be changed if power stage is disabled.
Changed settings become active immediately.

P4-01	Velocity for slow JOG movement	Min.	1	Unit	Relatd Mode		
		Default	100	usr_v	P	-	-
		Max.	2147483647		DYC	-	-

Velocity for slow JOG movement
The adjustable value is internally limited to the parameter setting in P4-03.

Changed settings become active immediately.

P4-02	Velocity for fast JOG movement	Min.	1	Unit	Relatd Mode		
		Default	100	usr_v	P	-	-
		Max.	2147483647		DYC	-	-

Velocity for fast JOG movement
The adjustable value is internally limited to the parameter setting in P4-03.

Changed settings become active immediately.

P4-03	Maximum velocity of the motion profile for velocity	Min.	1	Unit	Relatd Mode		
		Default	100	usr_v	P	-	-
		Max.	2147483647		DYC	-	-

Maximum velocity of the motion profile for velocity
If a greater reference velocity is set in one of these operating modes, it is automatically limited to value of this parameter.

Setting can only be changed if power stage is disabled.
Changed settings become active the next time the motor moves.

P4-04	Acceleration of the motion profile for velocity	Min.	1	Unit	Relatd Mode		
		Default	6000	usr_a	P	-	-
		Max.	2147483647		DYC	-	-

Acceleration of the motion profile for velocity
Writing the value 0 has no effect on the parameter.

Changed settings become active the next time the motor moves.

P4-05	Deceleration of the motion profile for velocity	Min.	1	Unit	Relatd Mode		
		Default	6000	usr_a	P	-	-
		Max.	2147483647		DYC	-	-

Deceleration of the motion profile for velocity
Writing the value 0 has no effect on the parameter.

Changed settings become active the next time the motor moves.

P4-06	Velocity limit for Zero Clamp	Min.	0	Unit	Relatd Mode		
		Default	10	usr_v	P	-	-
		Max.	2147483647		DYC	-	-

Velocity limit for Zero Clamp
The zero speed lock feature is applicable only when the given speed is lower than the low speed threshold of zero speed lock

Changed settings become active immediately.

P4-07	Velocity limitation	Min.	1	Unit	Relatd Mode		
		Default	13200	usr_v	P	-	-
		Max.	2147483647		DYC	-	-

Velocity limitation
During operation, the velocity limit is one of the following values (whichever is lowest):
- Value in this parameter
- Maximum velocity of the motor
- Value in parameter P3-18 when velocity is limited by input function

Changed settings become active immediately.

P4-08	Current limitation	Min.	0	Unit	Relatd Mode		
		Default	0	0.01 Arms	P	-	-
		Max.	46300		DYC	-	-

Current limitation
During operation, the actual current limit is one of the following values (whichever is lowest):
- Value in this parameter
- Maximum current of the motor
- Maximum current of the drive
- Value in parameter P3-19 when current is limited by input function

Limitations caused by I2T monitoring are also taken into account.

In increments of 0.01 Arms

Changed settings become active immediately.

9.7 P5 - External

P5-00	Lock HMI	Min.	0	Unit	Relatd Mode		
		Default	0	-	P	-	-
		Max.	1		DYC	-	-

Choose whether to lock the front panel HMI integrated with the drive
0 / Not Locked: HMI not locked
1 / Locked: HMI locked
The following functions can no longer be started when the HMI is locked:
- Parameter change
- Jog (test run)
- Easy tuning
- Fault Reset

Changed settings become active immediately.

P5-01	Position scaling (usr_p): Denominator	Min.	1	Unit	Relatd Mode		
		Default	131072	usr_p	P	-	-
		Max.	2147483647		DYC	-	-

Position scaling (usr_p): Denominator
Used to calculate the proportionality coefficient between the revolution count of motor (rev) and the desired internal position unit (usr_p):
Motor revolution count = Internal position unit (usr_p) * P5-02 / P5-01
A new scaling is activated when the numerator value is supplied.

Setting can only be changed if power stage is disabled.
Changed settings become active immediately.

P5-02	Position scaling (usr_p): Numerator	Min.	1	Unit	Relatd Mode		
		Default	1	revolution	P	-	-
		Max.	2147483647		DYC	-	-

Position scaling (usr_p): Numerator
Refer to parameter P5-01

Setting can only be changed if power stage is disabled.
Changed settings become active immediately.

P5-03	Homing: Target velocity for searching the switch (fast)	Min.	1	Unit	Relatd Mode		
		Default	60	usr_v	P	-	-
		Max.	2147483647		DYC	-	-

Target velocity for searching the switch (fast)
The available value is internally limited to the parameter setting in P4-03

Changed settings become active immediately.

P5-04	Homing: Target velocity for moving away from switch (slow)	Min.	1	Unit	Relatd Mode		
		Default	60	usr_v	P	-	-
		Max.	2147483647		DYC	-	-

Target velocity for moving away from switch (slow)
The available value is internally limited to the parameter setting in P4-03

Changed settings become active immediately.

P5-05	Homing: Maximum search distance after overtravel of switch	Min.	0	Unit	Relatd Mode		
		Default	0	usr_p	P	-	-
		Max.	2147483647		DYC	-	-

Maximum search distance after overtravel of switch
0: Search distance monitoring disabled
>0: Search distance
The switch must be activated again within this search distance, otherwise the reference movement is canceled.

Changed settings become active the next time the motor moves.

P5-06	Homing: Maximum distance for search for switching point	Min.	0	Unit	Relatd Mode		
		Default	0	usr_p	P	-	-
		Max.	2147483647		DYC	-	-

Maximum distance for search for switching point
0: Monitoring of distance inactive
>0: Maximum distance
After detection of the switch, the drive starts to search for the defined switching point. If the defined switching point is not found within the distance defined here, the reference movement is canceled and an error is detected.

Changed settings become active the next time the motor moves.

P5-07	Homing: Distance from switching point	Min.	1	Unit	Relatd Mode		
		Default	200	usr_p	P	-	-
		Max.	2147483647		DYC	-	-

Distance from switching point
The distance from the switching point is defined as the reference point.
The parameter is only effective during a reference movement without index pulse.

Changed settings become active the next time the motor moves.

P5-08	Homing: Position at reference point	Min.	-2147483648	Unit	Relatd Mode		
		Default	0	usr_p	P	-	-
		Max.	2147483647		DYC	-	-

Position at reference point
After a successful reference movement, this position is automatically set at the reference point.

Changed settings become active the next time the motor moves.

<table>
<tr><td rowspan="3">P5-09</td><td rowspan="3">Homing: Preferred homing method</td><td>Min.</td><td>1</td><td>Unit</td><td colspan="3">Relatd Mode</td></tr>
<tr><td>Default</td><td>18</td><td rowspan="2">-</td><td>P</td><td>-</td><td>-</td></tr>
<tr><td>Max.</td><td>35</td><td>DYC</td><td>-</td><td>-</td></tr>
</table>

Preferred homing method

<table>
<tr><th>Switch type</th><th>Step 1</th><th>Step 2</th><th>Step 3</th><th>Step 4</th><th>Value</th></tr>
<tr><td rowspan="4">Limit switch</td><td rowspan="2">Move to LIMN in negative direction at velocity P5-03</td><td rowspan="2">Move to switch point of the LIMN switch in positive direction at velocity P5-04</td><td rowspan="2">-</td><td>Move to index pulse outside of LIMN switch in positive direction at velocity P5-04</td><td>1</td></tr>
<tr><td>Move to distance given in parameter P5-07 from switching point in positive direction at velocity P5-04</td><td>17</td></tr>
<tr><td rowspan="2">Move to LIMP in positive direction at velocity P5-03</td><td rowspan="2">Move to switch point of the LIMP switch in negative direction at velocity P5-04</td><td rowspan="2">-</td><td>Move to index pulse outside of LIMP switch in negative direction at velocity P5-04</td><td>2</td></tr>
<tr><td>Move to distance given in parameter P5-07 from switching point in negative direction at velocity P5-04</td><td>18</td></tr>
<tr><td rowspan="8">Reference switch</td><td rowspan="8">Move to REF in positive direction at velocity P5-03</td><td rowspan="4">Move to switch point of the REF switch in negative direction at velocity P5-04</td><td rowspan="2">-</td><td>Move to index pulse outside of REF switch in negative direction at velocity P5-04</td><td>7</td></tr>
<tr><td>Move to distance given in parameter P5-07 from switching point in negative direction at velocity P5-04</td><td>23</td></tr>
<tr><td rowspan="2">Move to REF in positive direction at velocity P5-04</td><td>Move to index pulse inside of REF switch in positive direction at velocity P5-04</td><td>8</td></tr>
<tr><td>Move to distance given in parameter P5-07 from switching point in positive direction at velocity P5-04</td><td>24</td></tr>
<tr><td rowspan="4">Move to switch point of the REF switch in positive direction at velocity P5-04</td><td rowspan="2">Move to REF in negative direction at velocity P5-04</td><td>Move to index pulse inside of REF switch in negative direction at velocity P5-04</td><td>9</td></tr>
<tr><td>Move to distance given in parameter P5-07 from switching point in negative direction at velocity P5-04</td><td>25</td></tr>
<tr><td rowspan="2">-</td><td>Move to index pulse outside of REF switch in positive direction at velocity P5-04</td><td>10</td></tr>
<tr><td>Move to distance given in parameter P5-07 from switching point in positive direction at velocity P5-04</td><td>26</td></tr>
</table>

Changed settings become active the next time the motor moves.

<table>
<tr><td rowspan="3">P5-09</td><td rowspan="3">Homing: Preferred homing method (Continue)</td><td>Min.</td><td>1</td><td>Unit</td><td colspan="3">Relatd Mode</td></tr>
<tr><td>Default</td><td>18</td><td rowspan="2">-</td><td>P</td><td>-</td><td>-</td></tr>
<tr><td>Max.</td><td>35</td><td>DYC</td><td>-</td><td>-</td></tr>
</table>

<table>
<tr><th>Switch type</th><th>Step 1</th><th>Step 2</th><th>Step 3</th><th>Step 4</th><th>Value</th></tr>
<tr><td rowspan="8">Reference switch</td><td rowspan="8">Move to REF in negative direction at velocity P5-03</td><td rowspan="4">Move to switch point of the REF switch in positive direction at velocity P5-04</td><td rowspan="2">-</td><td>Move to index pulse outside of REF switch in positive direction at velocity P5-04</td><td>11</td></tr>
<tr><td>Move to distance given in parameter P5-07 from switching point in positive direction at velocity P5-04</td><td>27</td></tr>
<tr><td rowspan="2">Move to REF in negative direction at velocity P5-04</td><td>Move to index pulse inside of REF switch in negative direction at velocity P5-04</td><td>12</td></tr>
<tr><td>Move to distance given in parameter P5-07 from switching point in negative direction at velocity P5-04</td><td>28</td></tr>
<tr><td rowspan="4">Move to switch point of the REF switch in negative direction at velocity P5-04</td><td rowspan="2">Move to REF in positive direction at velocity P5-04</td><td>Move to index pulse inside of REF switch in positive direction at velocity P5-04</td><td>13</td></tr>
<tr><td>Move to distance given in parameter P5-07 from switching point in positive direction at velocity P5-04</td><td>29</td></tr>
<tr><td rowspan="2">-</td><td>Move to index pulse outside of REF switch in negative direction at velocity P5-04</td><td>14</td></tr>
<tr><td>Move to distance given in parameter P5-07 from switching point in negative direction at velocity P5-04</td><td>30</td></tr>
<tr><td rowspan="2">Index pulse</td><td>Move to index pulse in negative direction at velocity P5-04</td><td>-</td><td>-</td><td>-</td><td>33</td></tr>
<tr><td>Move to index pulse in positive direction at velocity P5-04</td><td>-</td><td>-</td><td>-</td><td>34</td></tr>
<tr><td></td><td>Position setting</td><td>-</td><td>-</td><td>-</td><td>35</td></tr>
</table>

Changed settings become active the next time the motor moves.

<table>
<tr><td rowspan="3">P5-10</td><td rowspan="3">Relative offset position 1 for offset movement</td><td>Min.</td><td>-2147483648</td><td>Unit</td><td colspan="3">Relatd Mode</td></tr>
<tr><td>Default</td><td>0</td><td rowspan="2">Inc</td><td>P</td><td>-</td><td>-</td></tr>
<tr><td>Max.</td><td>2147483647</td><td>-</td><td>-</td><td>-</td></tr>
</table>

Relative offset position 1 for offset movement

Changed settings become active immediately.

P5-11	Relative offset position 2 for offset movement	Min.	-2147483648	Unit	Relatd Mode		
		Default	0	Inc	P	-	-
		Max.	2147483647		-	-	-

Relative offset position 2 for offset movement

Changed settings become active immediately.

P5-12	Target velocity for offset movement	Min.	1	Unit	Relatd Mode		
		Default	60	usr_v	P	-	-
		Max.	2147483647		-	-	-

Target velocity for offset movement

Changed settings become active immediately.

P5-13	Acceleration and deceleration for offset movement	Min.	1	Unit	Relatd Mode		
		Default	600	usr_a	P	-	-
		Max.	2147483647		DYC	-	-

Acceleration and deceleration for offset movement

Setting can only be changed if power stage is disabled.
Changed settings become active the next time the power stage is enabled

P5-14	Halt option code	Min.	1	Unit	Relatd Mode		
		Default	1	-	P	-	-
		Max.	3		DYC	-	-

Halt option code
1 / Deceleration Ramp: Deceleration ramp
3 / Torque Ramp: Torque ramp
When P5-14 = 1 / Deceleration Ramp, the stop mode will be based on the deceleration curve set up through parameter P4-05
When P5-14 = 3 / Torque Ramp, the stop mode will be based on the deceleration torque set up through parameter P5-15

If a deceleration ramp is already active, the parameter cannot be written.

Changed settings become active immediately.

P5-15	Current for Halt	Min.	1	Unit	Relatd Mode		
		Default	1	0.01 Arms	P	-	-
		Max.	46300		DYC	-	-

Current for Halt
This value is only limited by the minimum/maximum value range (no limitation of this value by motor/power stage).
In the case of a Halt, the current limit is one of the following values (whichever is lowest):
- Value in this parameter
- Maximum current of the motor
- Maximum current of the drive

In increments of 0.01 Arms

Changed settings become active immediately.

P5-16	Quick Stop option code	Min.	-2	Unit	Relatd Mode		
		Default	6	-	P	-	-
		Max.	7		DYC	-	-

Choose the stop mode when quick stop is activated
-2 / Torque Ramp (Fault): Use torque ramp and transit to operating state 9 Fault
-1 / Deceleration Ramp (Fault): Use deceleration ramp and transit to operating state 9 Fault
6 / Deceleration Ramp (Quick Stop): Use deceleration ramp and remain in operating state 7 Quick Stop
7 / Torque Ramp (Quick Stop): Use torque ramp and remain in operating state 7 Quick Stop

When P5-16 = -1 / Deceleration Ramp (Fault) or 6 / Deceleration Ramp (Quick Stop), the motion will be stopped based on the deceleration curve set by parameter P5-17
When P5-16 = -2 / Torque Ramp (Fault) and 7 or Torque Ramp (Quick Stop), the motion will be stopped based on the deceleration torque set by parameter P5-18

If a deceleration ramp is already active, the parameter cannot be written.

Changed settings become active immediately.

P5-17	Deceleration ramp for Quick Stop	Min.	1	Unit	Relatd Mode		
		Default	6000	usr_a	P	-	-
		Max.	2147483647		DYC	-	-

Deceleration ramp for Quick Stop
Deceleration ramp for a software stop or an error with error class 1 or 2.

Changed settings become active the next time the motor moves.

P5-18	Current for Quick Stop	Min.	1	Unit	Relatd Mode		
		Default	1	0.01 Arms	P	-	-
		Max.	46300		DYC	-	-

Current value for Quick Stop
In the case of a Quick Stop, the current limit is one of the following values (whichever is lowest):
- Value in this parameter
- Maximum current of the motor
- Maximum current of the drive

Further current limitations caused by I2t monitoring are also taken into account during a Quick Stop

In increments of 0.01 Arms

Changed settings become active immediately.

P5-19	Motor Stopping modes for Servo Off and Faults	Min.	0	Unit	Relatd Mode		
		Default	0	-	P	-	-
		Max.	22		DYC	-	-

Motor stopping modes for servo off and faults

Digital	Function	Value	Stopping mode	Status after Motor Stops
L XXXX[ ]	Stopping methods for faults of error class 2, 3 and 4	0	Free coasting	Free coasting
		1	Dynamic brake (DB)	Dynamic brake (DB)
		2	Dynamic brake (DB)	Free coasting
L XXX[ ]X	Stopping methods for servo off	0	Free coasting	Free coasting
		1	Dynamic brake (DB)	Dynamic brake (DB)
		2	Dynamic brake (DB)	Free coasting

Example:
When P5-19 = 0021:
- In case a fault of error class 2, 3 and 4 happens, the motor will start deceleration in stopping mode of dynamic brake (DB). After motor stops it will stay in dynamic brake (DB) status.
- If servo off happens when motor is running, the motor will start deceleration in stopping mode of dynamic brake (DB). After motor stops it will stay in free coasting status.

Changed settings become active immediately.

P5-20	Additional time delay for releasing the holding brake	Min.	0	Unit	Relatd Mode		
		Default	0	ms	P	-	-
		Max.	400		DYC	-	-

Additional time delay for applying the holding brake
The overall time delay for applying the holding brake is the time delay from the motor holding brake and the additional time delay in this parameter.

Setting can only be changed if power stage is disabled.
Changed settings become active the next time the power stage is enabled.

P5-21	Additional time delay for applying the holding brake	Min.	0	Unit	Relatd Mode		
		Default	0	ms	P	-	-
		Max.	1000		DYC	-	-

Additional time delay for releasing the holding brake
The overall time delay for releasing the holding brake is the time delay from the motor holding brake and the additional time delay in this parameter.

Setting can only be changed if power stage is disabled.
Changed settings become active the next time the power stage is enabled.

P5-22	Processing mode of backlash compensation	Min.	0	Unit	Relatd Mode		
		Default	0	-	P	-	-
		Max.	3		DYC	-	-

Processing mode of backlash compensation
0 / Off: Backlash compensation is off
1 / OnAfterPositiveMovement: Backlash compensation is on, last movement was in positive direction
2 / OnAfterNegativeMovement: Backlash compensation is on, last movement was in negative direction
3 / OnAfterBothMovement: Backlash compensation is on, last movement was in both positive and negative direction

Changed settings become active immediately.

P5-23	Position value for backlash compensation	Min.	0	Unit	Relatd Mode		
		Default	0	usr_p	P	-	-
		Max.	2147483647		DYC	-	-

Position value for backlash compensation

Setting can only be changed if power stage is disabled.
Changed settings become active the next time the power stage is enabled.

P5-24	Processing time for backlash compensation	Min.	0	Unit	Relatd Mode		
		Default	0	ms	P	-	-
		Max.	16383		DYC	-	-

Processing time for backlash compensation
0: Immediate backlash compensation
>0: Processing time for backlash compensation

Setting can only be changed if power stage is disabled.
Changed settings become active the next time the power stage is enabled.

9.8 P6 - Special

P6-00	Motor type	Min.	0	Unit	Related Mode		
		Default	0	-	P	-	-
		Max.	65535		DYC	-	-

Motor file name
Noest / Not Exist: Motor type doesn't exist
None / No Motor Selected: No motor selected
LB01A / BCH16LB013*0A5C*: 0.1 kW motor, low inertia, 40 mm flange, 8 mm shaft diameter, rated speed 3000 rpm, 2500 ppr incremental encoder, no holding brake, plastic connector, Asian style mounting interface
LB01F / BCH16LB013*0F5C*: 0.1 kW motor, low inertia, 40 mm flange, 8 mm shaft diameter, rated speed 3000 rpm, 2500 ppr incremental encoder, with holding brake, plastic connector, Asian style mounting interface
LB01A / BCH16LB013*2A5C*: 0.1 kW motor, low inertia, 40 mm flange, 8 mm shaft diameter, rated speed 3000 rpm, 23 bit high resolution encoder, no holding brake, plastic connector, Asian style mounting interface
LB01F / BCH16LB013*2F5C*: 0.1 kW motor, low inertia, 40 mm flange, 8 mm shaft diameter, rated speed 3000 rpm, 23 bit high resolution encoder, with holding brake, plastic connector, Asian style mounting interface
HC02A / BCH16HC023*0A5C*: 0.2 kW motor, high inertia, 60 mm flange, 11 mm shaft diameter, rated speed 3000 rpm, 2500 ppr incremental encoder, no holding brake, plastic connector, Asian style mounting interface
HC02F / BCH16HC023*0F5C*: 0.2 kW motor, high inertia, 60 mm flange, 11 mm shaft diameter, rated speed 3000 rpm, 2500 ppr incremental encoder, with holding brake, plastic connector, Asian style mounting interface
HC02A / BCH16HC023*2A5C*: 0.2 kW motor, high inertia, 60 mm flange, 11 mm shaft diameter, rated speed 3000 rpm, 23 bit high resolution encoder, no holding brake, plastic connector, Asian style mounting interface
HC02F / BCH16HC023*2F5C*: 0.2 kW motor, high inertia, 60 mm flange, 11 mm shaft diameter, rated speed 3000 rpm, 23 bit high resolution encoder, with holding brake, plastic connector, Asian style mounting interface
HD02A / BCH16HD023*0A5C*: 0.2 kW motor, high inertia, 60 mm flange, 14 mm shaft diameter, rated speed 3000 rpm, 2500 ppr incremental encoder, no holding brake, plastic connector, Asian style mounting interface
HD02F / BCH16HD023*0F5C*: 0.2 kW motor, high inertia, 60 mm flange, 14 mm shaft diameter, rated speed 3000 rpm, 2500 ppr incremental encoder, with holding brake, plastic connector, Asian style mounting interface
HD02A / BCH16HD023*2A5C*: 0.2 kW motor, high inertia, 60 mm flange, 14 mm shaft diameter, rated speed 3000 rpm, 23 bit high resolution encoder, no holding brake, plastic connector, Asian style mounting interface
HD02F / BCH16HD023*2F5C*: 0.2 kW motor, high inertia, 60 mm flange, 14 mm shaft diameter, rated speed 3000 rpm, 23 bit high resolution encoder, with holding brake, plastic connector, Asian style mounting interface
HD04A / BCH16HD043*0A5C*: 0.4 kW motor, high inertia, 60 mm flange, 14 mm shaft diameter, rated speed 3000 rpm, 2500 ppr incremental encoder, no holding brake, plastic connector, Asian style mounting interface
HD04F / BCH16HD043*0F5C*: 0.4 kW motor, high inertia, 60 mm flange, 14 mm shaft diameter, rated speed 3000 rpm, 2500 ppr incremental encoder, with holding brake, plastic connector, Asian style mounting interface
HD04A / BCH16HD043*2A5C*: 0.4 kW motor, high inertia, 60 mm flange, 14 mm shaft diameter, rated speed 3000 rpm, 23 bit high resolution encoder, no holding brake, plastic connector, Asian style mounting interface
HD04F / BCH16HD043*2F5C*: 0.4 kW motor, high inertia, 60 mm flange, 14 mm shaft diameter, rated speed 3000 rpm, 23 bit high resolution encoder, with holding brake, free leads, Asian style mounting interface

P6-00	Motor type (continue)	Min.	0	Unit	Related Mode		
		Default	0	-	P	-	-
		Max.	65535		DYC	-	-

HF07A / BCH16HF073*0A5C*: 0.75 kW motor, high inertia, 80 mm flange, 19 mm shaft diameter, rated speed 3000 rpm, 2500 ppr incremental encoder, no holding brake, plastic connector, Asian style mounting interface
HF07F / BCH16HF073*0F5C*: 0.75 kW motor, high inertia, 80 mm flange, 19 mm shaft diameter, rated speed 3000 rpm, 2500 ppr incremental encoder, with holding brake, plastic connector, Asian style mounting interface
HF07A / BCH16HF073*2A5C*: 0.75 kW motor, high inertia, 80 mm flange, 19 mm shaft diameter, rated speed 3000 rpm, 23 bit high resolution encoder, no holding brake, plastic connector, Asian style mounting interface
HF07F / BCH16HF073*2F5C*: 0.75 kW motor, high inertia, 80 mm flange, 19 mm shaft diameter, rated speed 3000 rpm, 23 bit high resolution encoder, with holding brake, plastic connector, Asian style mounting interface
LF10A / BCH16LF103*0A5C*: 1.0 kW motor, high inertia, 80 mm flange, 19 mm shaft diameter, rated speed 3000 rpm, 2500 ppr incremental encoder, no holding brake, plastic connector, Asian style mounting interface
LF10F / BCH16LF103*0F5C*: 1.0 kW motor, high inertia, 80 mm flange, 19 mm shaft diameter, rated speed 3000 rpm, 2500 ppr incremental encoder, with holding brake, plastic connector, Asian style mounting interface
LF10A / BCH16LF103*2A5C*: 1.0 kW motor, high inertia, 80 mm flange, 19 mm shaft diameter, rated speed 3000 rpm, 23 bit high resolution encoder, no holding brake, plastic connector, Asian style mounting interface
LF10F / BCH16LF103*2F5C*: 1.0 kW motor, high inertia, 80 mm flange, 19 mm shaft diameter, rated speed 3000 rpm, 23 bit high resolution encoder, with holding brake, plastic connector, Asian style mounting interface
LH10A / BCH16LH103*0A6C*: 1.0 kW motor, high inertia, 100 mm flange, 19 mm shaft diameter, rated speed 3000 rpm, 2500 ppr incremental encoder, no holding brake, MIL connector, Asian style mounting interface
LH10F / BCH16LH103*0F6C*: 1.0 kW motor, high inertia, 100 mm flange, 19 mm shaft diameter, rated speed 3000 rpm, 2500 ppr incremental encoder, with holding brake, MIL connector, Asian style mounting interface
LH10A / BCH16LH103*2A6C*: 1.0 kW motor, high inertia, 100 mm flange, 19 mm shaft diameter, rated speed 3000 rpm, 23 bit high resolution encoder, no holding brake, MIL connector, Asian style mounting interface
LH10F / BCH16LH103*2F6C*: 1.0 kW motor, high inertia, 100 mm flange, 19 mm shaft diameter, rated speed 3000 rpm, 23 bit high resolution encoder, with holding brake, MIL connector, Asian style mounting interface
LJ10A / BCH16LJ103*0A6C*: 1.0 kW motor, high inertia, 100 mm flange, 22 mm shaft diameter, rated speed 3000 rpm, 2500 ppr incremental encoder, no holding brake, MIL connector, Asian style mounting interface
LJ10F / BCH16LJ103*0F6C*: 1.0 kW motor, high inertia, 100 mm flange, 22 mm shaft diameter, rated speed 3000 rpm, 2500 ppr incremental encoder, with holding brake, MIL connector, Asian style mounting interface
LJ10A / BCH16LJ103*2A6C*: 1.0 kW motor, high inertia, 100 mm flange, 22 mm shaft diameter, rated speed 3000 rpm, 23 bit high resolution encoder, no holding brake, MIL connector, Asian style mounting interface
LJ10F / BCH16LJ103*2F6C*: 1.0 kW motor, high inertia, 100 mm flange, 22 mm shaft diameter, rated speed 3000 rpm, 23 bit high resolution encoder, with holding brake, MIL connector, Asian style mounting interface
HM10A / BCH16HM102*0A6C*: 1.0 kW motor, high inertia, 130 mm flange, 22 mm shaft diameter, rated speed 2000 rpm, 2500 ppr incremental encoder, no holding brake, MIL connector, Asian style mounting interface

P6-00	Motor type (continue)	Min.	0	Unit	Related Mode		
		Default	0	-	P	-	-
		Max.	65535		DYC	-	-

HM10F / BCH16HM102*0F6C*: 1.0 kW motor, high inertia, 130 mm flange, 22 mm shaft diameter, rated speed 2000 rpm, 2500 ppr incremental encoder, with holding brake, MIL connector, Asian style mounting interface
HM10A / BCH16HM102*2A6C*: 1.0 kW motor, high inertia, 130 mm flange, 22 mm shaft diameter, rated speed 2000 rpm, 23 bit high resolution encoder, no holding brake, MIL connector, Asian style mounting interface
HM10F / BCH16HM102*2F6C*: 1.0 kW motor, high inertia, 130 mm flange, 22 mm shaft diameter, rated speed 2000 rpm, 23 bit high resolution encoder, with holding brake, MIL connector, Asian style mounting interface
HM08A / BCH16HM081*0A6C*: 0.85 kW motor, high inertia, 130 mm flange, 22 mm shaft diameter, rated speed 1500 rpm, 2500 ppr incremental encoder, no holding brake, MIL connector, Asian style mounting interface
HM08F / BCH16HM081*0F6C*: 0.85 kW motor, high inertia, 130 mm flange, 22 mm shaft diameter, rated speed 1500 rpm, 2500 ppr incremental encoder, with holding brake, MIL connector, Asian style mounting interface
HM08A / BCH16HM081*2A6C*: 0.85 kW motor, high inertia, 130 mm flange, 22 mm shaft diameter, rated speed 1500 rpm, 23 bit high resolution encoder, no holding brake, MIL connector, Asian style mounting interface
HM08F / BCH16HM081*2F6C*: 0.85 kW motor, high inertia, 130 mm flange, 22 mm shaft diameter, rated speed 1500 rpm, 23 bit high resolution encoder, with holding brake, MIL connector, Asian style mounting interface
HM15A / BCH16HM152*0A6C*: 1.5 kW motor, high inertia, 130 mm flange, 22 mm shaft diameter, rated speed 2000 rpm, 2500 ppr incremental encoder, no holding brake, MIL connector, Asian style mounting interface
HM15F / BCH16HM152*0F6C*: 1.5 kW motor, high inertia, 130 mm flange, 22 mm shaft diameter, rated speed 2000 rpm, 2500 ppr incremental encoder, with holding brake, MIL connector, Asian style mounting interface
HM15A / BCH16HM152*2A6C*: 1.5 kW motor, high inertia, 130 mm flange, 22 mm shaft diameter, rated speed 2000 rpm, 23 bit high resolution encoder, no holding brake, MIL connector, Asian style mounting interface
HM15F / BCH16HM152*2F6C*: 1.5 kW motor, high inertia, 130 mm flange, 22 mm shaft diameter, rated speed 2000 rpm, 23 bit high resolution encoder, with holding brake, MIL connector, Asian style mounting interface

Select reference of servo motor connected to servo drive by this parameter when P6-01 = 9 / 2500 ppr.
This parameter becomes read-only when P6-01 = 8 / BISS.

Setting can only be changed if power stage is disabled.
Changed settings become active the next time the product is powered on.

P6-01	Type of motor encoder	Min.	8	Unit	Related Mode		
		Default	9	-	P	-	-
		Max.	65535		DYC	-	-

Type of motor encoder:
8 / BISS: Communication high resolution encoder.
9 / 2500ppr: 2500 ppr incremental encoder.

Read-only parameter.

<table>
<tr><td rowspan="3">P6-07</td><td rowspan="3">First error code for the signal output function Selected Error</td><td>Min.</td><td>0</td><td>Unit</td><td colspan="3">Related Mode</td></tr>
<tr><td>Default</td><td>0</td><td rowspan="2">-</td><td>P</td><td>-</td><td>-</td></tr>
<tr><td>Max.</td><td>65535</td><td>DYC</td><td>-</td><td>-</td></tr>
<tr><td colspan="8">First number for the signal output function Selected Error
This parameter specifies the error code of an error of error classes 1...4 which is to activate the signal output function.

Changed settings become active immediately.</td></tr>
</table>

<table>
<tr><td rowspan="3">P6-08</td><td rowspan="3">Second error code for the signal output function Selected Error</td><td>Min.</td><td>0</td><td>Unit</td><td colspan="3">Related Mode</td></tr>
<tr><td>Default</td><td>0</td><td rowspan="2">-</td><td>P</td><td>-</td><td>-</td></tr>
<tr><td>Max.</td><td>65535</td><td>DYC</td><td>-</td><td>-</td></tr>
<tr><td colspan="8">Second number for the signal output function Selected Error
This parameter specifies the error code of an error of error classes 1...4 which is to activate the signal output function.

Changed settings become active immediately.</td></tr>
</table>

<table>
<tr><td rowspan="3">P6-09</td><td rowspan="3">First error code for the signal output function Selected Warning</td><td>Min.</td><td>0</td><td>Unit</td><td colspan="3">Related Mode</td></tr>
<tr><td>Default</td><td>0</td><td rowspan="2">-</td><td>P</td><td>-</td><td>-</td></tr>
<tr><td>Max.</td><td>65535</td><td>DYC</td><td>-</td><td>-</td></tr>
<tr><td colspan="8">First error code for the signal output function Selected Warning
This parameter specifies the error code of an error of error class 0 which is to activate the signal output function.

Changed settings become active immediately.</td></tr>
</table>

<table>
<tr><td rowspan="3">P6-10</td><td rowspan="3">Second error code for the signal output function Selected Warning</td><td>Min.</td><td>0</td><td>Unit</td><td colspan="3">Related Mode</td></tr>
<tr><td>Default</td><td>0</td><td rowspan="2">-</td><td>P</td><td>-</td><td>-</td></tr>
<tr><td>Max.</td><td>65535</td><td>DYC</td><td>-</td><td>-</td></tr>
<tr><td colspan="8">Second error code for the signal output function Selected Warning
This parameter specifies the error code of an error of error class 0 which is to activate the signal output function.

Changed settings become active immediately.</td></tr>
</table>

<table>
<tr><td rowspan="3">P6-11</td><td rowspan="3">Activation of software limit switches</td><td>Min.</td><td>0</td><td>Unit</td><td colspan="3">Related Mode</td></tr>
<tr><td>Default</td><td>0</td><td rowspan="2">-</td><td>P</td><td>-</td><td>-</td></tr>
<tr><td>Max.</td><td>3</td><td>DYC</td><td>-</td><td>-</td></tr>
<tr><td colspan="8">Activation of software limit switches
0 / None: Deactivated
1 / SWLIMP: Activation of software limit switches positive direction
2 / SWLIMN: Activation of software limit switches negative direction
3 / SWLIMP + SWLIMN: Activation of software limit switches both directions
Software limit switches can only be activated if the zero point is valid.

Changed settings become active immediately.</td></tr>
</table>

P6-12	Behavior when position limit is reached	Min.	0	Unit	Related Mode		
		Default	0	-	P	-	-
		Max.	1		DYC	-	-

Behavior when position limit is reached
0 / Standstill Behind Position Limit: Quick Stop is triggered at position limit and standstill is reached behind position limit
1 / Standstill At Position Limit: Quick Stop is triggered in front of position limit and standstill is reached at position limit

Changed settings become active immediately.

P6-13	Positive position limit for software limit switch	Min.	-2147483648	Unit	Related Mode		
		Default	2147483647	-	P	-	-
		Max.	2147483647		DYC	-	-

Positive position limit for software limit switch
If a user-defined value entered is outside of the permissible range, the limit switch limits are automatically set to the maximum permissible value.

Setting can only be changed if power stage is disabled.
Changed settings become active the next time the power stage is enabled.

P6-14	Negative position limit for software limit switch	Min.	-2147483648	Unit	Related Mode		
		Default	2147483647	-	P	-	-
		Max.	2147483647		DYC	-	-

Negative position limit for software limit switch
If a user-defined value entered is outside of the permissible range, the limit switch limits are automatically set to the maximum permissible value.

Setting can only be changed if power stage is disabled.
Changed settings become active the next time the power stage is enabled.

P6-15	Target position reached: standstill window, time	Min.	0	Unit	Related Mode		
		Default	0	ms	P	-	-
		Max.	32767		DYC	-	-

Standstill window, time
0: Monitoring of standstill window deactivated
>0: Time in ms during which the control deviation must be in the standstill window defined in parameter P6-16

Changed settings become active immediately.

P6-16	Target position reached: standstill window, permissible control deviation	Min.	0	Unit	Related Mode		
		Default	128	usr_p	P	-	-
		Max.	2147483647		DYC	-	-

Standstill window, permissible control deviation
The control deviation for the standstill window time must be within this range for a standstill of the drive to be detected.
Processing of the standstill window must be activated via the parameter P6-15.
The minimum value, the factory setting and the maximum value depend on the scaling factor.

Changed settings become active immediately.

P6-17	Target position reached: timeout time for standstill window monitoring	Min.	0	Unit	Related Mode		
		Default	0	ms	P	-	-
		Max.	32767		DYC	-	-

Timeout time for standstill window monitoring
0: Timeout monitoring deactivated
>0: Timeout time in ms
Standstill window processing values are set via the parameter P6-15 and P6-16.
Time monitoring starts when the target position (reference position of position controller) is reached or when the profile generator has finished processing.

Changed settings become active immediately.

P6-18	Monitoring of time window	Min.	0	Unit	Related Mode		
		Default	0	ms	P	-	-
		Max.	9999		DYC	-	-

Monitoring of time window
Adjustment of a time for monitoring of position deviation, velocity deviation, velocity value and current value. If the monitored value is in the permissible range during the adjusted time, the monitoring function delivers a positive result.
The status can be output via a parameterizable output.

Changed settings become active immediately.

P6-19	Monitoring of position deviation	Min.	0	Unit	Related Mode		
		Default	128	usr_p	P	-	-
		Max.	2147483647		DYC	-	-

Monitoring of position deviation
The system checks whether the drive is within the defined deviation during the period set with parameter P6-18.
The status can be output via a parameterizable output.
The minimum value, the factory setting and the maximum value depend on the scaling factor.

Changed settings become active immediately.

P6-20	Monitoring of velocity deviation	Min.	1	Unit	Related Mode		
		Default	10	usr_v	P	-	-
		Max.	2147483647		DYC	-	-

Monitoring of velocity deviation
The system monitors whether the drive is within the defined deviation during the period set with parameter P6-18.
The status can be output via a parameterizable output.

Changed settings become active immediately.

P6-21	Monitoring of velocity threshold	Min.	1	Unit	Related Mode		
		Default	10	usr_v	P	-	-
		Max.	2147483647		DYC	-	-

Monitoring of velocity threshold
The system monitors whether the drive is below the defined value during the period set with parameter P6-18.
The status can be output via a parameterizable output.

Changed settings become active immediately.

P6-22	Monitoring of current threshold	Min.	0	Unit	Related Mode		
		Default	20	0.01 Arms	P	-	-
		Max.	30000		DYC	-	-

Monitoring of current threshold
The system monitors whether the drive is below or over the defined value during the period set with parameter P6-18.
The status can be output via a parameterizable output.

In increments of 0.01 Arms.

Changed settings become active immediately.

P6-23	Error response to 100% I^2t braking resistor	Min.	0	Unit	Related Mode		
		Default	0	-	P	-	-
		Max.	2		DYC	-	-

Error response to 100% I^2t braking resistor
0 / Error Class 0: Error class 0
1 / Error Class 1: Error class 1
2 / Error Class 2: Error class 2

Setting can only be changed if power stage is disabled.
Changed settings become active the next time the power stage is enabled.

P6-24	Current Saturation window time	Min.	0	Unit	Related Mode		
		Default	5000	ms	P	-	-
		Max.	10000		DYC	-	-

Current saturation window time
The drive reports an error when the current command of current loop is at or beyond the max. current threshold (300%) for a time that is longer than defined in this parameter

Setting can only be changed if power stage is disabled.
Changed settings become active the next time the power stage is enabled.

P6-25	Current limitation of the system	Min.	0	Unit	Related Mode		
		Default	0	0.01 Arms	P	-	-
		Max.	65535		DYC	-	-

Current limitation of the system
This parameter specifies the maximum system current. This is the lower value of the maximum motor current and the maximum drive power stage current.

In increments of 0.01 Arms.

Read-only parameter

P6-26	Autotuning: Moment of inertia of the entire system	Min.	1	Unit	Related Mode		
		Default	1	0.1 $Kgcm^2$	P	-	-
		Max.	65535		DYC	-	-

Inertia of the entire system
The parameter value is automatically calculated during Autotuning.

In increments of 0.1 $kgcm^2$

Changed settings become active immediately.

P6-27	Autotuning: Additional information 1	Min.	0	Unit	Related Mode		
		Default	0	-	P	-	-
		Max.	4294967295		DYC	-	-

Auto tuning: Fault diagnosis message 1 for customer service

Read-only parameter.

P6-28	Autotuning: Additional information 2	Min.	0	Unit	Related Mode		
		Default	0	-	P	-	-
		Max.	4294967295		DYC	-	-

Auto tuning: Fault diagnosis message 2 for customer service

Read-only parameter.

P6-29	Autotuning: Friction torque of the system	Min.	1	Unit	Related Mode		
		Default	1	0.01 Arms	P	-	-
		Max.	65535		DYC	-	-

Friction torque of the system
The parameter value is automatically measured during auto tuning

In increments of 0.01 Arms

Read-only parameter.

P6-30	Autotuning: Constant load torque	Min.	-32768	Unit	Related Mode		
		Default	0	0.01 Arms	P	-	-
		Max.	32767		DYC	-	-

Constant load torque
The parameter value is automatically measured during auto tuning

In increments of 0.01 Arms

Read-only parameter.

P6-31	Firmware version of device	Min.	0	Unit	Related Mode		
		Default	0	-	P	-	-
		Max.	65535		DYC	-	-

Firmware version of device
The version format is ZZ.YY.ZZ.
Part XX.YY is contained in parameter P6-31 and part ZZ is contained in parameter P6-21

Read-only parameter.

P6-32	Firmware revision of device	Min.	0	Unit	Related Mode		
		Default	0	-	P	-	-
		Max.	65535		DYC	-	-

Firmware reversion of device
Refer to parameter P6-31

Read-only parameter.

P6-33	Suppressing errors	Min.	0	Unit	Relatd Mode		
		Default	0	-	P	-	-
		Max.	0x0280		DYC	-	-

Suppressing errors:

Digital	Bits	Description	Related Errors	Function	
L XXXX[ ]	0	Reversed	-	-	-
	1	Reversed	-	-	-
	2	Reversed	-	-	-
	3	Reversed	-	-	-
L XXX[ ]X	4	Reversed	-	-	-
	5	Reversed	-	-	-
	6	Reversed	-	-	-
	7	Power stage or motor overload (I^2T)	4102 4302	0	Limit power stage current output when overload (I^2T) happens
				1	Activate fault 4102 or 4302 of error class 3 when overload (I^2T) happens
L XX[ ]XX	8	Reversed	-	-	-
	9	DC bus undervoltage	3201 3202	0	Fault 3201 or 3202 will NOT be stored in error memory of the device
				1	Fault 3201 or 3202 will be stored in error memory of the device
	10	Reserved	-	-	-
	11	Reserved	-	-	-
L X[ ]XXX	12	Reserved	-	-	-
	13	Reserved	-	-	-
	14	Reserved	-	-	-
	15	Reserved	-	-	-
L [ ]XXXX	16	Reserved	-	-	-
	17	Reserved	-	-	-
	18	Reserved	-	-	-
	19	Reserved	-	-	-
H XXXX[ ]	20	Reserved	-	-	-
	21	Reserved	-	-	-
	22	Reserved	-	-	-
	23	Reserved	-	-	-
H XXX[ ]X	24	Reserved	-	-	-
	25	Reserved	-	-	-
	26	Reserved	-	-	-
	27	Reserved	-	-	-
H XX[ ]XX	28	Reserved	-	-	-
	29	Reserved	-	-	-
	30	Reserved	-	-	-
	31	Reserved	-	-	-

Example:
P6-33 = 0x0080 will active error code 4102 or 4302 of error class 3 when overload (I^2T) happens
P6-33 = 0x0200 will store error code 3201 or 3202 in error memory of the device

Setting can only be changed if power stage is disabled.
Changed settings become active the next time the power stage is enabled.

P6-34	Special Function Settings	Min.	0	Unit	Relatd Mode		
		Default	0	-	P	-	-
		Max.	1		DYC	-	-

Special function settings:

Digital	Bit	Description	Function	
L XXXX[ ]	0	Auto limit switch fault reset method	0	Limit switch fault A302 / A303 will be latched until receives an additional Fault Reset signal.
			1	Limit switch fault A302 / A303 can be reset automatically when receives motion command in opposite direction of the triggered limit switch.
	1	Reserved	-	-
	2	Reserved	-	-
	3	Reserved	-	-
L XXX[ ]X	4	Reserved	-	-
	5	Reserved	-	-
	6	Reserved	-	-
	7	Reserved	-	-
L XX[ ]XX	8	Reserved	-	-
	9	Reserved	-	-
	10	Reserved	-	-
	11	Reserved	-	-
L X[ ]XXX	12	Reserved	-	-
	13	Reserved	-	-
	14	Reserved	-	-
	15	Reserved	-	-
L [ ]XXXX	16	Reserved	-	-
	17	Reserved	-	-
	18	Reserved	-	-
	19	Reserved	-	-
H XXXX[ ]	20	Reserved	-	-
	21	Reserved	-	-
	22	Reserved	-	-
	23	Reserved	-	-
H XXX[ ]X	24	Reserved	-	-
	25	Reserved	-	-
	26	Reserved	-	-
	27	Reserved	-	-
H XX[ ]XX	28	Reserved	-	-
	29	Reserved	-	-
	30	Reserved	-	-
	31	Reserved	-	-

Setting can only be changed if power stage is disabled.
Changed settings become active the next time the power stage is enabled.

P6-35	Maximum Velocity Threshold while Enabling the Power Stage	Min.	0	Unit	Relatd Mode		
		Default	100	usr_v	P	-	-
		Max.	500		DYC	-	-

Maximum velocity threshold when enabling power stage
The system monitors whether the motor velocity expired the defined value while enabling the power stage. In case the threshold is expired the drive will active fault 1B0F and stop the motor.

Changed settings become active immediately.

9.9 P7 - Motion Task

<table>
<tr><td rowspan="3">P7-00</td><td rowspan="3">DYC mode cycle time</td><td>Min.</td><td>0</td><td>Unit</td><td colspan="3">Relatd Mode</td></tr>
<tr><td>Default</td><td>0</td><td rowspan="2">ms</td><td>-</td><td>-</td><td>-</td></tr>
<tr><td>Max.</td><td>2147483647</td><td>DYC</td><td>-</td><td>-</td></tr>
<tr><td colspan="8">DYC mode cycle time
0: Free cycle time of main task
>0: Fixed cycle time in ms

Setting can only be changed if power stage is disabled.
Changed settings become active immediately.</td></tr>
</table>

<table>
<tr><td rowspan="3">P7-01</td><td rowspan="3">DYC script version No.</td><td>Min.</td><td>-2147483648</td><td>Unit</td><td colspan="3">Relatd Mode</td></tr>
<tr><td>Default</td><td>0</td><td rowspan="2">-</td><td>-</td><td>-</td><td>-</td></tr>
<tr><td>Max.</td><td>2147483647</td><td>DYC</td><td>-</td><td>-</td></tr>
<tr><td colspan="8">DYC script version No

Read-only parameter</td></tr>
</table>

9.10 Pu - DYC User Defined

				Unit	Relatd Mode		
Pu-00	DYC user defined parameter 0	Min.	-2147483648	Unit	Relatd Mode		
		Default	0	-	-	-	-
		Max.	2147483647		DYC	-	-

DYC user defined parameter 0

Changed settings become active immediately.

				Unit	Relatd Mode		
Pu-01	DYC user defined parameter 1	Min.	-2147483648	Unit	Relatd Mode		
		Default	0	-	-	-	-
		Max.	2147483647		DYC	-	-

DYC user defined parameter 1

Changed settings become active immediately.

				Unit	Relatd Mode		
Pu-02	DYC user defined parameter 2	Min.	-2147483648	Unit	Relatd Mode		
		Default	0	-	-	-	-
		Max.	2147483647		DYC	-	-

DYC user defined parameter 2

Changed settings become active immediately.

				Unit	Relatd Mode		
Pu-03	DYC user defined parameter 3	Min.	-2147483648	Unit	Relatd Mode		
		Default	0	-	-	-	-
		Max.	2147483647		DYC	-	-

DYC user defined parameter 3

Changed settings become active immediately.

				Unit	Relatd Mode		
Pu-04	DYC user defined parameter 4	Min.	-2147483648	Unit	Relatd Mode		
		Default	0	-	-	-	-
		Max.	2147483647		DYC	-	-

DYC user defined parameter 4

Changed settings become active immediately.

				Unit	Relatd Mode		
Pu-05	DYC user defined parameter 5	Min.	-2147483648	Unit	Relatd Mode		
		Default	0	-	-	-	-
		Max.	2147483647		DYC	-	-

DYC user defined parameter 5

Changed settings become active immediately.

Pu-06	DYC user defined parameter 6	Min.	-2147483648	Unit	Relatd Mode		
		Default	0	-	-	-	-
		Max.	2147483647		DYC	-	-

DYC user defined parameter 6

Changed settings become active immediately.

Pu-07	DYC user defined parameter 7	Min.	-2147483648	Unit	Relatd Mode		
		Default	0	-	-	-	-
		Max.	2147483647		DYC	-	-

DYC user defined parameter 7

Changed settings become active immediately.

Pu-08	DYC user defined parameter 8	Min.	-2147483648	Unit	Relatd Mode		
		Default	0	-	-	-	-
		Max.	2147483647		DYC	-	-

DYC user defined parameter 8

Changed settings become active immediately.

Pu-09	DYC user defined parameter 9	Min.	-2147483648	Unit	Relatd Mode		
		Default	0	-	-	-	-
		Max.	2147483647		DYC	-	-

DYC user defined parameter 9

Changed settings become active immediately.

Pu-10	DYC user defined parameter 10	Min.	-2147483648	Unit	Relatd Mode		
		Default	0	-	-	-	-
		Max.	2147483647		DYC	-	-

DYC user defined parameter 10

Changed settings become active immediately.

Pu-11	DYC user defined parameter 11	Min.	-2147483648	Unit	Relatd Mode		
		Default	0	-	-	-	-
		Max.	2147483647		DYC	-	-

DYC user defined parameter 11

Changed settings become active immediately.

Pu-12	DYC user defined parameter 12	Min.	-2147483648	Unit	Relatd Mode		
		Default	0	-	-	-	-
		Max.	2147483647		DYC	-	-

DYC user defined parameter 12

Changed settings become active immediately.

Pu-13	DYC user defined parameter 13	Min.	-2147483648	Unit	Relatd Mode		
		Default	0	-	-	-	-
		Max.	2147483647		DYC	-	-

DYC user defined parameter 13

Changed settings become active immediately.

Pu-14	DYC user defined parameter 14	Min.	-2147483648	Unit	Relatd Mode		
		Default	0	-	-	-	-
		Max.	2147483647		DYC	-	-

DYC user defined parameter 14

Changed settings become active immediately.

Pu-15	DYC user defined parameter 15	Min.	-2147483648	Unit	Relatd Mode		
		Default	0	-	-	-	-
		Max.	2147483647		DYC	-	-

DYC user defined parameter 15

Changed settings become active immediately.

Pu-16	DYC user defined parameter 16	Min.	-2147483648	Unit	Relatd Mode		
		Default	0	-	-	-	-
		Max.	2147483647		DYC	-	-

DYC user defined parameter 16

Changed settings become active immediately.

Pu-17	DYC user defined parameter 17	Min.	-2147483648	Unit	Relatd Mode		
		Default	0	-	-	-	-
		Max.	2147483647		DYC	-	-

DYC user defined parameter 17

Changed settings become active immediately.

Pu-18	DYC user defined parameter 18	Min.	-2147483648	Unit	Relatd Mode		
		Default	0	-	-	-	-
		Max.	2147483647		DYC	-	-

DYC user defined parameter 18

Changed settings become active immediately.

Pu-19	DYC user defined parameter 19	Min.	-2147483648	Unit	Relatd Mode		
		Default	0	-	-	-	-
		Max.	2147483647		DYC	-	-

DYC user defined parameter 19

Changed settings become active immediately.

Pu-20	DYC user defined parameter 20	Min.	-2147483648	Unit	Relatd Mode		
		Default	0	-	-	-	-
		Max.	2147483647		DYC	-	-

DYC user defined parameter 20

Changed settings become active immediately.

Pu-21	DYC user defined parameter 21	Min.	-2147483648	Unit	Relatd Mode		
		Default	0	-	-	-	-
		Max.	2147483647		DYC	-	-

DYC user defined parameter 21

Changed settings become active immediately.

Pu-22	DYC user defined parameter 22	Min.	-2147483648	Unit	Relatd Mode		
		Default	0	-	-	-	-
		Max.	2147483647		DYC	-	-

DYC user defined parameter 22

Changed settings become active immediately.

Pu-23	DYC user defined parameter 23	Min.	-2147483648	Unit	Relatd Mode		
		Default	0	-	-	-	-
		Max.	2147483647		DYC	-	-

DYC user defined parameter 23

Changed settings become active immediately.