Lexium 18E

AC Servo Drive system

User Manual

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www.se.com

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Safety Information

Important Information

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 safety messages 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.

⚠ CAUTION

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

NOTICE

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

Please Note

Electrical equipment should 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 trained persons who are familiar with and understand the contents of this manual and all other pertinent product documentation are authorized to work on and with this product. 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 in or affected by the present document are, along with software, accessories and options, servo motors with an integrated drive.

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

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-related measures must be implemented.

Since the products are used as components in an overall machine or process, you must ensure the safety of persons by means of the design of this overall machine or process.

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.

Before You Begin

Do not use this product on machinery lacking effective point-of-operation guarding. Lack of effective point-of-operation guarding on a machine can result in serious injury to the operator of that machine.

⚠WARNING

UNGUARDED 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 automation equipment and related software is 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.

Start-up and Test

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

⚠WARNING

EQUIPMENT OPERATION HAZARD

- Verify that all installation and set up 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 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.

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 equipment.
- Close the equipment enclosure door.
- Remove all temporary grounds from incoming power lines.
- Perform all start-up tests recommended by the manufacturer.

Operation and Adjustments

The following precautions are from the NEMA Standards Publication ICS 7.1-1995:

(In case of divergence or contradiction between any translation and the English original, the original text in the English language will prevail.)

- 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 required by the operator should be accessible to the operator. Access to other controls should be restricted to prevent unauthorized changes in operating characteristics.

About the Book

Information on Non-Inclusive or Insensitive Terminology

As a responsible, inclusive company, Schneider Electric is constantly updating its communications and products that contain non-inclusive or insensitive terminology. However, despite these efforts, our content may still contain terms that are deemed inappropriate by some customers.

Document Scope

This manual describes technical characteristics, installation, commissioning, operation and maintenance of the servo drive Lexium 18E (LXM18E).

Validity Note

For product compliance and environmental information (RoHS, REACH, PEP, EOLI, etc.), go to www.se.com/ww/en/work/support/green-premium/.

The characteristics that are described in the present document, as well as those described in the documents included in the Related Documents section below, can be found online. To access the information online, go to the Schneider Electric home page www.se.com/ww/en/download/.

The characteristics that are described in the present document should be the same as those characteristics that appear online. In line with our policy of constant improvement, we may revise content over time to improve clarity and accuracy. If you see a difference between the document and online information, use the online information as your reference.

Product Related Information

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

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

You must also consider any applicable standards and/or regulations with respect to grounding of all equipment. Verify compliance with any safety information, different electrical requirements, and normative 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 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.
- Use only the specified voltage when operating this equipment and any associated products.

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

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

⚠DANGER

POTENTIAL FOR EXPLOSION

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

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

If the power stage is disabled unintentionally, for example as a result of power outage, errors or functions, the motor is no longer decelerated in a controlled way. Overload, errors or incorrect use may cause the holding brake to no longer operate properly and may result in premature wear.

⚠WARNING

UNINTENDED EQUIPMENT OPERATION

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

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

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

⚠WARNING

UNINTENDED 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

- Perform a Failure Mode and Effects Analysis (FMEA), or equivalent risk analysis, of your application, and apply preventive and detective controls before implementation.
- Provide a fallback state for undesired control events or sequences.
- Provide separate or redundant control paths wherever required.
- Supply appropriate parameters, particularly for limits.
- Review the implications of transmission delays and take actions to mitigate them.
- Review the implications of communication link interruptions and take actions to mitigate them.
- Provide independent paths for control functions (for example, emergency stop, over-limit conditions, and error conditions) according to your risk assessment, and applicable codes and regulations.
- Apply local accident prevention and safety regulations and guidelines.[1]
- Test each implementation of a system for proper operation before placing it 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, and refer to Cybersecurity Guidelines for EcoStruxure Machine Expert, Modicon and PacDrive Controllers and Associated Equipment.

For reasons of Internet security, for those devices that have a native Ethernet connection, TCP/IP forwarding is disabled by default. Therefore, you must manually enable TCP/IP forwarding. However, doing so may expose your network to possible cyberattacks if you do not take additional measures to protect your enterprise. In addition, you may be subject to laws and regulations concerning cybersecurity.

⚠WARNING

UNAUTHENTICATED ACCESS AND SUBSEQUENT NETWORK INTRUSION

- Observe and respect any and all pertinent national, regional and local cybersecurity and/or personal data laws and regulations when enabling TCP/IP forwarding on an industrial network.
- 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.

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

Consult the Schneider Electric Cybersecurity Best Practices for additional information.

During operation, the metal surface temperature of the product may be higher than 70°C (158°F).

⚠CAUTION

HOT SURFACES

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

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

⚠WARNING

UNEXPECTED ACTION DUE TO MECHANICAL DAMAGE TO THE MOTOR

- Do not exceed the maximum allowable axial and radial forces on the motor shaft.
- Protect the motor shaft from impact.
- Do not exceed the maximum allowable axial force when clamping parts on the motor shaft.

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

DC Bus Voltage Measurement

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

⚠⚠DANGER

ELECTRIC SHOCK, EXPLOSION OR ARC FLASH

- Disconnect the voltage supply to all connections.
- Wait 15 minutes to allow the DC bus capacitors to discharge.
- Use a properly rated voltage-measurement device for measuring (greater than 400 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.

Terminology Derived from Standards

The technical terms, terminology, symbols and the corresponding descriptions in this manual, or that appear in or on the products themselves, are generally derived from the terms or definitions of international standards.

In the area of functional safety systems, drives and general automation, this may include, but is not limited to, terms such as *safety*, *safety function*, *safe state*, *fault*, *fault reset*, *malfunction*, *failure*, *error*, *error message*, *dangerous*, etc.

Among others, these standards include:

Standard	Description
IEC 61131-2:2007	Programmable controllers, part 2: Equipment requirements and tests
ISO 13849-1:2015	Safety of machinery: Safety related parts of control systems. General principles for design.
EN 61496-1:2013	Safety of machinery: Electro-sensitive protective equipment. Part 1: General requirements and tests.
ISO 12100:2010	Safety of machinery - General principles for design - Risk assessment and risk reduction
EN 60204-1:2006	Safety of machinery - Electrical equipment of machines - Part 1: General requirements
ISO 14119:2013	Safety of machinery - Interlocking devices associated with guards - Principles for design and selection
ISO 13850:2015	Safety of machinery - Emergency stop - Principles for design
IEC 62061:2015	Safety of machinery - Functional safety of safety-related electrical, electronic, and electronic programmable control systems
IEC 61508-1:2010	Functional safety of electrical/electronic/programmable electronic safety-related systems: General requirements.
IEC 61508-2:2010	Functional safety of electrical/electronic/programmable electronic safety-related systems: Requirements for electrical/electronic/programmable electronic safety-related systems.
IEC 61508-3:2010	Functional safety of electrical/electronic/programmable electronic safety-related systems: Software requirements
IEC 61784-3:2016	Industrial communication networks - Profiles - Part 3: Functional safety fieldbuses - General rules and profile definitions
2006/42/EC	Machinery Directive
2014/30/EU	Electromagnetic Compatibility Directive
2014/35/EU	Low Voltage Directive

In addition, terms used in the present document may tangentially be used as they are derived from other standards such as:

Standard	Description
IEC 60034 series	Rotating eletrical machines
IEC 61800 series	Adjustable speed electrical power drive systems
IEC 61158 series	Digital data communications for measurement and control - Fieldbus for use in industrial control systems

Finally, the term *zone of operation* may be used in conjunction with the description of specific hazards, and is defined as it is for a *hazard zone* or *danger zone* in the *Machinery Directive* (*2006/42/EC*) and *ISO 12100:2010*.

NOTE: The aforementioned standards may or may not apply to the specific products cited in the present documentation. For more information concerning the individual standards applicable to the products described herein, see the characteristics tables for those product references.

Cyber Security

Schneider Electric is most focused on Cyber Security. Our security by design approach makes our products more resilient against cyberattacks. We implemented mechanisms to mitigate threats, reduce exploitable weaknesses, and defend against avoidable data breaches and cyberattacks. However, it is still strongly recommend to apply the following mitigations to reduce the risk of exploit.

- Use controllers and devices only in a protected environment to minimize network exposure and ensure that they are not accessible from outside.
- Use firewalls to protect and separate the control system network from other networks.
- Use VPN (Virtual Private Networks) tunnels if remote access is required.
- Limit the access to both development and control system by physical means, operating system features, etc.
- Protect both development and control system by using up to date virus detecting solutions.

To ensure you are informed of all updates, including details on affected products and remediation plans, subscribe to Schneider Electric's security notification service here: https://www.se.com/en/work/support/cybersecurity/security-notifications.jsp

Recommended Cyber Security Best Practices: https://www.se.com/ww/en/download/document/7EN52-0390/

Certification

CE

Product, Type	Directive	Harmonized standard
LXM18…motion servo drives BCH18…servo motors VW3…options	LV Directive 2014/35/EU	EN 61800-5-1:2007 + A1:2017 + A11:2021 EN 60034-1:2010/AC: 2010
	EMC Directive 2014/30/EU	EN 61800-3:2004/A1: 2012 EN 60034-1:2010/AC: 2010

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EU DECLARATION OF CONFORMITY

We : Schneider Electric Industries SAS
35 rue Joseph Monier
Rueil Malmaison 92500 – France

Hereby declare under our sole responsibility that the products:

Trademark	Schneider Electric
Product, Type	LXM18…motion servo drives BCH18…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+ A1:2017+ A11:2021** Adjustable speed electrical power drive systems – Part 5-1: Safety requirements –Electrical,thermal and energy. (IEC 61800-5-1:2016) **EN 60034-1:2010/AC:2010** Rotating electrical machines - Part 1: Rating and performance
EMC Directive 2014/30/EU	**EN 61800-3:2004/A1:2012** Adjustable speed electrical power drive systems – part 3: EMC requirements and specific test methods. (IEC 61800-3:2017) **EN 60034-1:2010/AC:2010** Rotating electrical machines - Part 1: Rating and performance
European Directive 2011/65/EU - "Restriction of Hazardous Substances" (RoHS) & Delegated Directive (EU) 2015/863 (RoHS 10)	**EN IEC 63000:2018** Technical documentation for the assessment of electrical and electronic products with respect to the restriction of hazardous substances. Specific offer compliance information about RoHS are publicized on *se.com*

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.se.com

Issued at Carros - FRANCE: March 20th, 2024

DocuSigned by:
alain.bernerd
BA19724817464EF...

Name : Alain BERNERD
Industrial Control & Drives
Customer Satisfaction & Quality
Vice President

MOTION - LXM18 - EU Declaration-V4

ORIGINAL DECLARATION, NO TRANSLATION WITHOUT WRITTEN AUTHORISATION

Internal

Introduction

Overview of Lexium 18E Servo Drive / Servo Motor Systems

As members of Lexium 18E servo product family, the portfolio consisting of the Lexium 18E servo drive and BCH18 AC servo motor pursue high performance, simple interface, and easy operation.

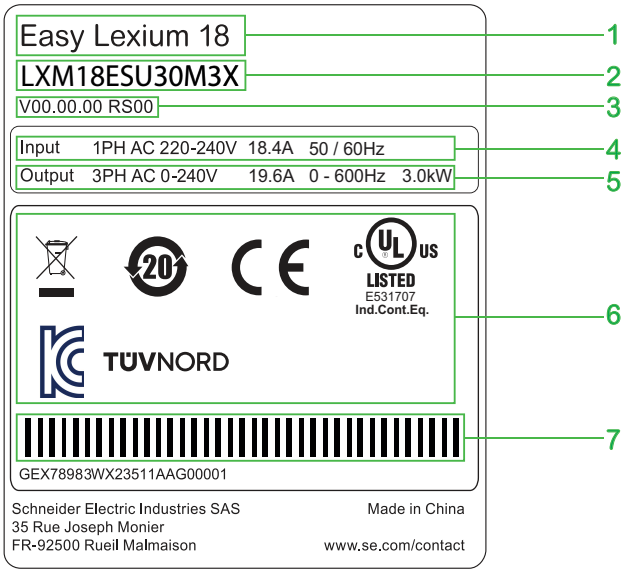
This series consists of a wide variety of servo drives and AC servo motors from 0.05 kW ~ 3.0 kW. This servo drive range integrates real-time adaptive tuning and adaptive notch filter functions, as well as rigid grade selection and automatic switching functions that accommodate various requirements such as stability for low-rigidity machines and high speed and high selectivity for high-rigidity machines, and is combined with AC servo motors using 23 bit high-precision optical encoders. It features simple interfaces and easy operations of mechanical and positioning driving, ideal for a wide range of machines.

This manual was prepared for your proper and effective use of the Lexium 18E servo drive range featuring the above advantages.



About the Servo Drive

Nameplate



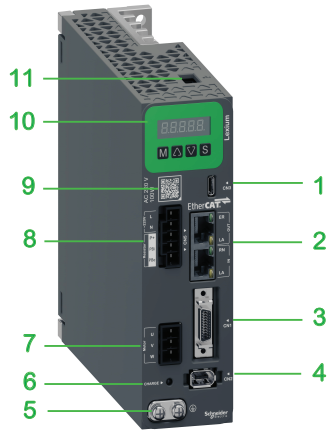
1. Product name
2. Type
3. Factory firmware version and hardware version of the device
4. Input parameters
5. Output parameters
6. Certification
7. Barcode

Description of Type Code

Item	1	2	3	4	5	6	7
Type code (example)	LXM	18	E	S	U30	M3	X

Item	Meaning
1	Product name LXM = Lexium AC-Servo Drive
2	Product range 18= AC-Servo drive LXM18
3	Product line E = EtherCAT
4	Interface N = EtherCAT with Digital I/O interface S = EtherCAT with Digital I/O interace, and STO function
5	Continuous power output U: x 0.1 kW e.g.: U30 = 3 kW
6	Input power stage supply [Vac] M2 = Single phase, 220 Vac M3 = Three phases, 220 Vac
7	Special function X=No built-in EMC filter

Designation of Each Part of the Servo Drive

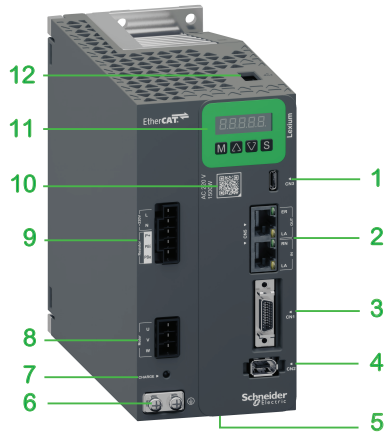


Dimensions 1: servo drive (0.1- 0.4 kW)

Front panel:

1. Connector CN3: Type-C connector
2. Connector CN5: EtherCAT fieldbus
3. Connector CN1: Digital I/O connection terminal
4. Connector CN2: Encoder connector
5. Grounding terminal
6. CHARGE: Drive charge indicator
7. Connector CNP: Motor connector
8. Connector CNP: External brake resistor and power connector
9. QR code, which can be scanned for detailed technical data, installation and wiring guides
10. HMI
11. Connector CN6: STO terminal

NOTE: Dimension 1: There is no cooling fan for size 1 servo drive

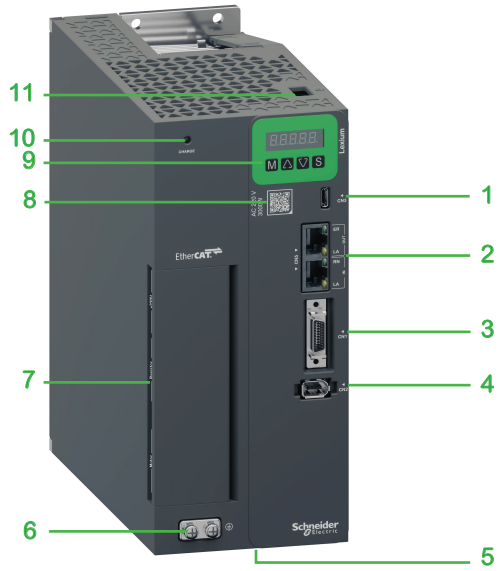


Dimension 2: servo drive (0.75- 1.5 kW)

Front panel:

1. Connector CN3: Type-C connector
2. Connector CN5: EtherCAT fieldbus
3. Connector CN1: Digital I/O connection terminal
4. Connector CN2: Encoder connector
5. Replaceable cooling fan
6. Grounding terminal
7. CHARGE: Drive charge indicator
8. Connector CNP: Motor connector
9. Connector CNP: External brake resistor and power connector
10. QR code, which can be scanned for detailed technical data, installation and wiring guides
11. HMI
12. Connector CN6: STO terminal

NOTE: There is no cooling fan for 0.75 kW servo drive



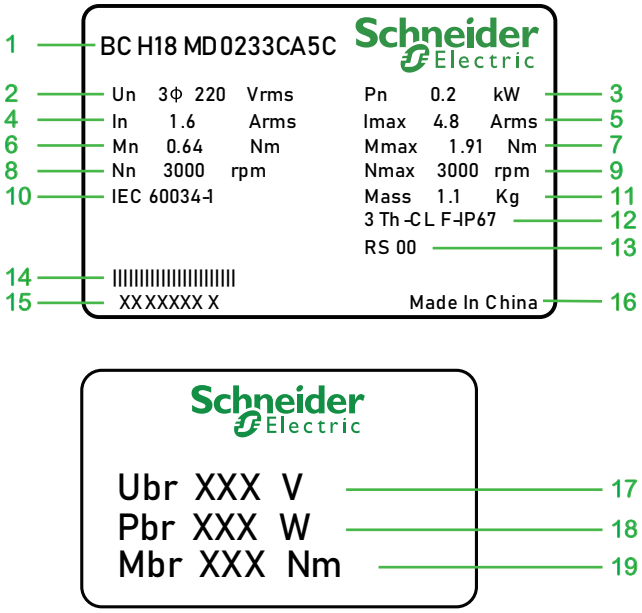
Dimension 3: servo drive (2.0- 3.0 kW)

Front panel:

1. Connector CN3: Type-C connector
2. Connector CN5: EtherCAT fieldbus
3. Connector CN1: Digital I/O connection terminal
4. Connector CN2: Encoder connector
5. Replaceable cooling fan
6. Grounding terminal
7. Motor connector, external brake resistor, and power connector
8. QR code, which can be scanned for detailed technical data, installation and wiring guides
9. HMI
10. CHARGE: Drive charge indicator
11. Connector CN6: STO terminal

About the Servo Motor

Nameplate



Nameplate:

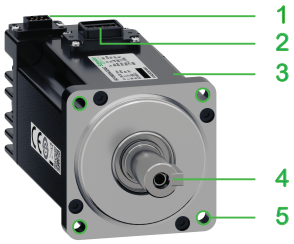
1. Motor model
2. Nominal voltage
3. Nominal power
4. Nominal current
5. Maximum current
6. Nominal torque
7. Max. torque
8. Nominal speed of rotation
9. Maximum speed of rotation allowed
10. Applicable standards
11. Quality
12. Number of motor phases, temperature rating, degree of protection
13. Hardware version
14. Barcode
15. Serial number
16. Country of origin
17. Holding brake voltage
18. Holding brake power
19. Holding brake torque

Description of Type Code

Item	1	2	3	4	5	6	7	8	9	10
Type code (example)	BCH18	L	D	04	3	3	C	A	5	C

Item	Meaning
1	Product name BCH18 = Brushless servo motor, equipped with Lexium 18E servo drive
2	Rotational inertia L = Low inertia M = Middle inertia
3	Flange size B = flange 40 mm (1.58 in) D = flange 60 mm (2.36 in) F = flange 80 mm (3.15 in) H = flange 100 mm (3.94 in) M = flange 130 mm (5.12 in) R =flange 180 mm (7.09 in)
4	Nominal power A5 = 0.05 kW 01 = 0.1 kW 02 = 0.2 kW 04 = 0.4 kW 07 = 0.75 kW 08 = 0.85 kW 10 = 1.0 kW 13 = 1.3 kW 15 = 1.5 kW 18 = 1.8 kW 20 = 2.0 kW 24 = 2.4 kW 30 = 3.0 kW
5	Winding type (Power supply 220 Vac) 1 = Optimized in terms of torque (1000 rpm / 1500 rpm) 2 = Optimized in terms of torque and speed of rotation (2000 rpm) 3 = Optimized in terms of speed of rotation (3000 rpm)
6	Shaft end 3 = Parallel keyed shaft (shaft & housing IP 67)
7	Encoder 2 = 23-bit optic incremental encoder C = 23-bit optic multi-turn absolute encoder
8	Holding brake A = without holding brake F = with holding brake
9	Connections 5 = Micro plastic connectors 6 = Military connectors
10	Mechanical interface C = Motor compatible with Asian style mounting standards

Designation of Each Part of Servo Motor



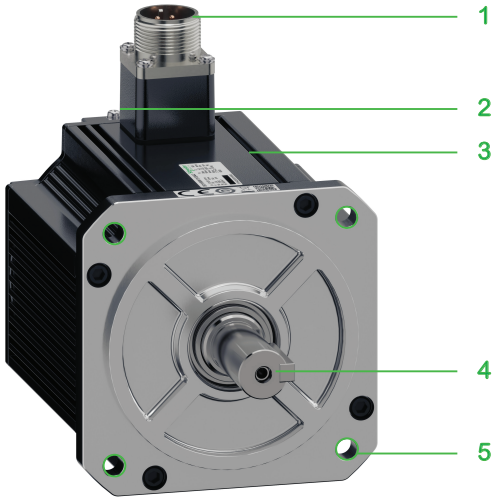
Size 1: flange servo motor 40/60/80 mm (1.57/2.36/3.15 in)

Servo motor interface:

1. Encoder interface, equipped with plastic connector
2. Power interface, equipped with plastic connector (1)
3. Casing, RAL 9005 opaque black
4. A keyed shaft end with oil seal
5. 4-point axial mounting screw hole (2)

(1): Holding brake interface is combined with the power interface

(2): 2-point axial mounting screw holes or flange motor 40 mm (1.57 in)



Size 2: flange servo motor 100/130/180 mm (3.94/5.12/7.09 in)

Servo motor interface:

1. Power interface, equipped with Military connector
2. Encoder interface, equipped with Military connector
3. Casing, RAL 9005 opaque black
4. A keyed shaft end with oil seal
5. 4-point axial mounting screw holes

Confirmation of a Servo Drive and its Related Servo Motor

Inertia and plug type	Drive type	Motor type	Nominal power	Nominal speed of rotation	Nominal torque	Rotational inertia	
			(kW)	(rpm)	(Nm)	Without holding brake/A ($kgcm^2$)	With holding brake/F ($kgcm^2$)
Micro plug for low inertia motor	LXM18E*U01M2X	BCH18LBA533※(1)*(2)5C	0.05	3000	0.16	0.02	0.027
	LXM18E*U01M2X	BCH18LB0133※(1)*(2)5C	0.1	3000	0.32	0.030	0.036
	LXM18E*U02M2X	BCH18LD0233※(1)*(2)5C	0.2	3000	0.64	0.15	0.21
	LXM18E*U04M2X	BCH18LD0433※(1)*(2)5C	0.4	3000	1.27	0.25	0.31
	LXM18E*U07M2X	BCH18LF0733※(1)*(2)5C	0.75	3000	2.39	0.78	0.93
	LXM18E*U10M2X	BCH18LF1033※(1)*(2)5C	1.0	3000	3.18	0.994	1.12
Micro plug for middle inertia motor	LXM18E*U01M2X	BCH18MBA533※(1)*(2)5C	0.05	3000	0.16	0.04	0.046
	LXM18E*U01M2X	BCH18MB0133※(1)*(2)5C	0.1	3000	0.32	0.07	0.076
	LXM18E*U01M2X	BCH18MD0133※(1)*(2)5C	0.1	3000	0.32	0.16	0.22
	LXM18E*U02M2X	BCH18MD0233※(1)*(2)5C	0.2	3000	0.64	0.268	0.328
	LXM18E*U04M2X	BCH18MD0433※(1)*(2)5C	0.4	3000	1.27	0.478	0.54
	LXM18E*U02M2X	BCH18MF0233※(1)*(2)5C	0.2	3000	0.64	0.55	0.68
	LXM18E*U04M2X	BCH18MF0433※(1)*(2)5C	0.4	3000	1.27	1.19	1.33
	LXM18E*U07M2X	BCH18MF0733※(1)*(2)5C	0.75	3000	2.39	1.79	1.90
	LXM18E*U10M2X	BCH18MF1033※(1)*(2)5C	1.0	3000	3.18	2.16	2.32
Military plug for low inertia motor	LXM18E*U10M2X	BCH18LH1033※(1)*(2)6C	1.0	3000	3.18	1.43	1.53
	LXM18E*U15M2X	BCH18LH1533※(1)*(2)6C	1.5	3000	4.77	2.09	2.21
	LXM18E*U20M3X	BCH18LH2033※(1)*(2)6C	2.0	3000	6.37	2.64	2.74
	LXM18E*U30M3X	BCH18LM3033※(1)*(2)6C	3.0	3000	9.8	7.63	8.3

Inertia and plug type	Drive type	Motor type	Nominal power	Nominal speed of rotation	Nominal torque	Rotational inertia	
			(kW)	(rpm)	(Nm)	Without holding brake/A (kgcm²)	With holding brake/F (kgcm²)
Military plug for low inertia, low speed, high torque motor	LXM18E*U10M2X	BCH18MM0813※(1)*(2)6C	0.85	1500	5.39	14	14.7
	LXM18E*U10M2X	BCH18MM1023※(1)*(2)6C	1.0	2000	4.77	14	14.7
	LXM18E*U15M2X	BCH18MM1313※(1)*(2)6C	1.3	1500	8.34	20.88	21.54
	LXM18E*U15M2X	BCH18MM1523※(1)*(2)6C	1.5	2000	7.16	20.88	21.54
	LXM18E*U20M3X	BCH18MM1813※(1)*(2)6C	1.8	1500	11.5	27.79	28.45
	LXM18E*U20M3X	BCH18MM2023※(1)*(2)6C	2.0	2000	9.55	27.79	28.45
	LXM18E*U30M3X	BCH18MR2413※(1)*(2)6C	2.4	1500	15.1	46.32	51.1
	LXM18E*U30M3X	BCH18MR3013※(1)*(2)6C	3.0	1500	19.1	46.32	51.1

(1)

- C=23-bit optic multi-turn absolute encoder
- 2=23-bit optic incremental encoder

(2):

- A=Without brake
- F=Brake

About EtherCAT

Fieldbus Devices on the EtherCAT Network

General

EtherCAT is an Ethernet-based fieldbus system. The technology is standardized as per the international standards IEC 61158 and IEC 61784 as well as ISO 15745-4.

EtherCAT is a real-time Ethernet system that lends itself for use in cycle-synchronous motion control applications.

EtherCAT® is a registered trademark and patented technology, licenced by Beckhoff Automation GmbH, Germany.

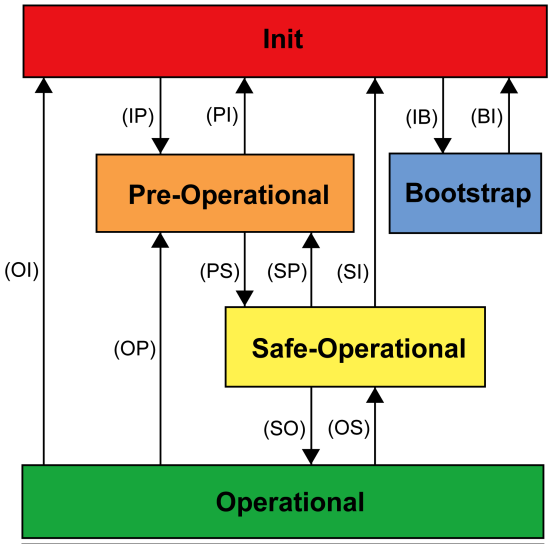
Features

Fieldbus protocol	EtherCAT
Physical interface	1 x RJ45 (CN5, IN) 1 x RJ45 (CN5, OUT)
Transmission rate	100 Mbit/s
Status indication	2 x LED Link/Activity 1 x LED Network RUN 1 x LED Network ERROR
Addressing methods	Position addressing Node addressing Logical addressing Second address
Communication profile	CoE (CANopen over EtherCAT)
Synchronization methods	DC synchronous (Distributed Clock, Jitter <1 µs) SM synchronous (SyncManager)
Communication cycle time	0.25 ms ... 20 ms (0.25 ms increments)
Input shift time	0 ms ... x (0.25 ms increments) x = Set communication cycle time minus 0.25 ms
CiA 402 operating modes	Cyclic Synchronous Position Mode Cyclic Synchronous Velocity Mode Cyclic Synchronous Torque Mode Profile Position Profile Velocity Profile Torque Homing
Vendor-specific operating modes	Jog

EtherCAT State Machine

Overview

According to IEC 61800-7-304, the following EtherCAT operating states have been defined for an EtherCAT network:



States

The operating state **Init** defines the foundation of the communication relationship between the master and the slaves at the application layer. Direct communication between the master and the slave is impossible at the application layer. The master uses the Init state to initialize a set of configuration registers of the EtherCAT slave controllers. If the slaves support mailbox services, the Sync Manager is also configured in this state.

In the operating state **Pre-Operational**, the mailbox is active. Both master and slave use the mailbox and the corresponding protocol to interchange application-specific initialization data and parameters. In this operating state, process data communication is not possible.

If the drive does not receive a valid mapping for the process data from the EtherCAT master, it remains in this operating state.

In the operating state **Safe-Operational**, the slave application provides input data such as limit switch data. Output data of the master are ignored in this operating state. This operating state is not a safety-related function.

In the operating state **Operational**, the slave applications deliver input data and the drive processes the output data from the master, such as target positions.

State Transitions

The following state transitions are defined:

State transition	Local management service
IP	Start Mailbox Communication
PI	Stop Mailbox Communication
PS	Start Input Update
SP	Stop Input Update
SO	Start Output Update
OS	Stop Output Update
OP	Stop Output Update and Stop Input Update
SI	Stop Input Update, Stop Mailbox Communication
OI	Stop Input Update, Stop Input Update, Stop Mailbox Communication
IB	Start Bootstrap Mode
BI	Restart Device

Functional Safety

Basics

Functional Safety

Automation and safety engineering are closely related. Engineering, installation and operation of complex automation solutions are simplified by safety-related functions and equipment.

Usually, the safety engineering requirements depend on the application. The level of the requirements results from, among other things, the risk and the hazard potential arising from the specific application and from the applicable standards and regulations.

The goal of designing machines safely is to protect people. The risk associated with machines with electrically controlled drives comes chiefly from moving machine parts and electricity itself.

Only you, the user, machine builder, or system integrator can be aware of all the conditions and factors realized in the design of your application for the machine. Therefore, only you can determine the automation equipment and the related safeties and interlocks which can be properly used, and validate such usage.

⚠WARNING

NON-CONFORMANCE TO SAFETY FUNCTION REQUIREMENTS

- Specify the requirements and/or measures to be implemented in the risk analysis you perform.
- Verify that your safety-related application complies to applicable safety regulations and standards.
- Make certain that appropriate procedures and measures (according to applicable sector standards) have been established to help avoid hazardous situations when operating the machine.
- Use appropriate safety interlocks where personnel and/or equipment hazards exist.
- Validate the overall safety-related function and thoroughly test the application.

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

Hazard and Risk Analysis

The standard IEC 61508 "Functional safety of electrical/electronic/programmable electronic safety-related systems" defines the safety-related aspects of systems. Instead of a single functional unit of a safety-related system, the standard treats all elements of a function chain as a unit. These elements must meet the requirements of the specific safety integrity level as a whole.

The standard IEC 61800-5-2 "Adjustable speed electrical power drive systems – Safety requirements – Functional" is a product standard that defines the safety-related requirements regarding drives. Among other things, this standard defines the safety-related functions for drives.

Based on the system configuration and utilization, a hazard and risk analysis must be carried out for the system (for example, according to EN ISO 12100 or EN ISO 13849-1). The results of this analysis must be considered when designing the machine, and subsequently applying safety-related equipment and safety-related functions. The results of your analysis may deviate from any application examples contained in the present or related documentation. For example, additional safety components may be required. In principle, the results from the hazard and risk analysis have priority.

⚠WARNING

UNINTENDED EQUIPMENT OPERATION

- Perform a hazard and risk analysis to determine the appropriate safety integrity level, and any other safety requirements, for your specific application based on all the applicable standards.
- Ensure that the hazard and risk analysis is conducted and respected according to EN/ISO 12100 during the design of your machine.

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

The EN ISO 13849-1 Safety of machinery - Safety-related parts of control systems - Part 1: General Principles for Design describes an iterative process for the selection and design of safety-related parts of controllers to reduce the risk to the machine to a reasonable degree.

To perform risk assessment and risk minimization according to EN ISO 12100, proceed as follows:

1. Defining the boundary of the machine.
2. Identifying risks associated with the machine.
3. Assessing risks.
4. Evaluating risks.
5. Minimizing risks by:
   - The design
   - Protective devices
   - User information (see EN ISO 12100)
6. Designing safety-related controller parts (SRP/CS, Safety-Related Parts of the Control System) in an interactive process.

To design the safety-related controller parts in an interactive process, proceed as follows:

Step	Action
1	Identify necessary safety functions that are executed via SRP/CS (Safety-Related Parts of the Control System).
2	Determine required properties for each safety function.
3	Determine the required performance level PL_r.
4	Identify safety-related parts executing the safety function.
5	Determine the performance level PL of the afore-mentioned safety-related parts.
6	Verify the performance level PL for the safety function ($PL \geq PL_r$).
7	Verify that all requirements have been met (validation).

Additional information is available on https://www.se.com.

Safety Integrity Level (SIL)

The standard IEC 61508 defines 4 safety integrity levels (Safety Integrity Level (SIL)). Safety integrity level SIL1 is the lowest level, safety integrity level SIL4 is the highest level. The safety integrity level required for a given application is determined on the basis of the hazard potential resulting from the hazard and risk analysis. This is used to decide whether the relevant function chain is to be considered as a safety-related function chain and which hazard potential it must cover.

Average Frequency of a Dangerous Failure per Hour (PFH)

To maintain the function of the safety-related system, the IEC 61508 standard requires various levels of measures for avoiding and controlling faults, depending on the required safety integrity level (Safety Integrity Level (SIL)). All components must be subjected to a probability assessment to evaluate the effectiveness of the measures implemented for controlling faults. This assessment determines the probability of a dangerous failure per hour PFH (Average Frequency of a Dangerous Failure per Hour (PFH)) for a safety-related system. This is the frequency per hour with which a safety-related system fails in a hazardous manner so that it can no longer perform its function correctly. Depending on the SIL, the average frequency of a dangerous failure per hour must not exceed certain values for the entire safety-related system. The individual PFH values of a function chain are added. The result must not exceed the maximum value specified in the standard.

SIL	PFH at high demand or continuous demand
4	$\geq 10^{-9}$ ... $<10^{-8}$
3	$\geq 10^{-8}$ ... $<10^{-7}$
2	$\geq 10^{-7}$ ... $<10^{-6}$
1	$\geq 10^{-6}$ ... $<10^{-5}$

Hardware Fault Tolerance (HFT) and Safe Failure Fraction (SFF)

Depending on the safety integrity level (Safety Integrity Level (SIL)) for the safety-related system, the IEC 61508 standard requires a specific hardware fault tolerance (Hardware Fault Tolerance (HFT)) in connection with a specific safe failure fraction (Safe Failure Fraction (SFF)). The hardware fault tolerance is the ability of a safety-related system to execute the required function even if one or more hardware faults are present. The safe failure fraction of a safety-related system is defined as the ratio of the rate of safe failures to the total failure rate of the safety-related system. As per IEC 61508, the maximum achievable safety

integrity level of a safety-related system is partly determined by the hardware fault tolerance and the safe failure fraction of the safety-related system.

IEC 61800-5-2 distinguishes two types of subsystems (type A subsystem, type B subsystem). These types are specified on the basis of criteria which the standard defines for the safety-related components.

SFF	HFT type A subsystem			HFT type B subsystem		
	0	1	2	0	1	2
<60 %	SIL1	SIL2	SIL3	—	SIL1	SIL2
60 ... <90 %	SIL2	SIL3	SIL4	SIL1	SIL2	SIL3
90 ... <99 %	SIL3	SIL4	SIL4	SIL2	SIL3	SIL4
≥99 %	SIL3	SIL4	SIL4	SIL3	SIL4	SIL4

Fault Avoidance Measures

Systematic errors in the specifications, in the hardware and the software, incorrect usage and maintenance of the safety-related system must be avoided to the maximum degree possible. To meet these requirements, IEC 61508 specifies a number of measures for fault avoidance that must be implemented depending on the required safety integrity level (Safety Integrity Level (SIL)). These measures for fault avoidance must cover the entire life cycle of the safety-related system, i.e. from design to decommissioning of the system.

Data for Maintenance Plan and the Calculations for Functional Safety

The safety-related function STO must be tested at regular intervals. The interval depends on the hazard and risk analysis of the total system. The minimum interval is 1 year (high demand mode as per IEC 61508).

Use the following data of the safety-related function STO for your maintenance plan and for the calculations for functional safety:

Standard	Input	STO input
IEC 61508 Ed.2	SFF	99.65%
	PFH in /h	1.50E-10
	PFDavg	1.31E-05
	Device Type	Type B
	Route	1H
	Architectural (MooN)	1oo2
	HFT	1
	T1	87600
	SIL capability	2
IEC 62061	SIL CL capability	2
ISO 13849–1	PL	d
	Category	3
	MTTFd in years	76051
	CCF	80
	DC avg	90%
IEC 60204–1	Category stop	Category stop 0

Contact your local Schneider Electric representative for additional data, if required.

Definitions

Integrated Safety-Related Function "Safe Torque Off" STO

The integrated safety-related function STO (IEC 61800-5-2) allows for a category 0 stop as per IEC 60204-1 without external power contactors. This reduces the system costs and the response times.

Category 0 Stop (IEC 60204-1)

In stop category 0 (Safe Torque Off, STO), the drive coasts to a stop (provided there are no external forces operating to the contrary). The safety-related function STO is intended to help prevent an unintended start-up, not stop a motor, and therefore corresponds to an unassisted stop in accordance with IEC 60204-1.

In circumstances where external influences are present, the coast down time depends on physical properties of the components used (such as weight, torque, friction, etc.), and additional measures such as external safety-related brakes may be necessary to help prevent any hazard from materializing. That is to say, if this means a hazard to your personnel or equipment, you must take appropriate measures.

⚠WARNING

UNINTENDED EQUIPMENT OPERATION

- Make certain that no hazards can arise for persons or material during the coast down period of the axis/machine.
- Do not enter the zone of operation during the coast down period.
- Ensure that no other persons can access the zone of operation during the coast down period.
- Use appropriate safety interlocks where personnel and/or equipment hazards exist.

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

Function

General

The safety-related function STO integrated into the product can be used to implement an "EMERGENCY STOP" (IEC 60204-1) for category 0 stops.

Function Principle

The safety-related function STO is triggered via two redundant signal inputs. The wiring of the two signal inputs must be separate.

The safety-related function STO is triggered if the level at one of the two signal inputs is 0. The power stage is disabled. The motor can no longer generate torque and coasts down without braking. An error of error class 3 is detected.

If, within one second, the level of the other output also becomes 0, the error class remains 3. If, within one second, the level of the other output does not become 0, the error class changes to 4.

Requirements for Using the Safety-Related Function STO

General

The safety-related function STO (Safe Torque Off) does not remove power from the DC bus. The safety-related function STO only removes power to the motor. The DC bus voltage and the mains voltage to the drive are still present.

⚠⚠DANGER

ELECTRIC SHOCK

- Do not use the safety-related function STO for any other purposes than its intended function.
- Use an appropriate switch, that is not part of the circuit of the safety-related function STO, to disconnect the drive from the mains power.

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

After the safety-related function STO is triggered, the motor can no longer generate torque and coasts down without braking.

⚠WARNING

UNINTENDED EQUIPMENT OPERATION

Install a dedicated, external safety-related brake if coasting does not meet the deceleration requirements of your application.

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

Logic Type

The inputs for the safety-related function STO (inputs $\overline{STO_A}$ and $\overline{STO_B}$) can only be wired for sinking inputs.

Holding Brake and Safety-Related Function STO

When the safety-related function STO is triggered, the power stage is immediately disabled. Applying the holding brake requires a certain amount of time. In the case of vertical axes or external forces acting on the load, you may have to take additional measures to bring the load to a standstill and to keep it at a standstill when the safety-related function STO is used, for example, by using a service brake.

⚠WARNING

FALLING LOAD

Ensure that all loads come to a secure standstill when the safety-related function STO is used.

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

If the suspension of hanging / pulling loads is a safety objective for the machine, then you can only achieve this objective by using an appropriate external brake as a safety-related measure.

⚠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.

NOTE: The drive does not provide its own safety-related output to connect an external brake to use as a safety-related measure.

Unintended Restart

⚠WARNING

UNINTENDED EQUIPMENT OPERATION

- Verify that your risk assessment covers all potential effects of automatic or unintended enabling of the power stage, for example, after power outage.
- Implement all measures such as control functions, guards, or other safety-related functions, required to reliably protect against all hazards that may result from automatic or unintended enabling of the power stage.
- Verify that a master controller cannot enable the power stage in an unintended way.

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

Degree of Protection when the Safety-Related Function STO is Used

You must ensure that conductive substances cannot get into the product (pollution degree 2). Moreover, conductive substances may cause the safety-related function to become inoperative.

⚠WARNING

INOPERABLE SAFETY-RELATED FUNCTION

Ensure that conductive substances (water, contaminated or impregnated oils, metal shavings, etc.) cannot get into the drive.

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

Protected Cable Installation

If short circuits and other wiring errors such as a cross circuit between the signals of the safety-related function STO can be expected in connection with safety-related signals, and if these short circuits and cross circuits are not detected by upstream devices, protected cable installation as per ISO 13849-2 is required.

In the case of an unprotected cable installation, the two signals (both channels) of a safety-related function may be connected to external voltage if a cable is damaged. If the two channels are connected to external voltage, the safety-related function is no longer operative.

ISO 13849-2 describes protected cable installation for cables for safety-related signals. The cables for the safety-related function STO must be protected against external voltage. A shield with ground connection helps to keep external voltage away from the cables for the signals of the safety-related function STO.

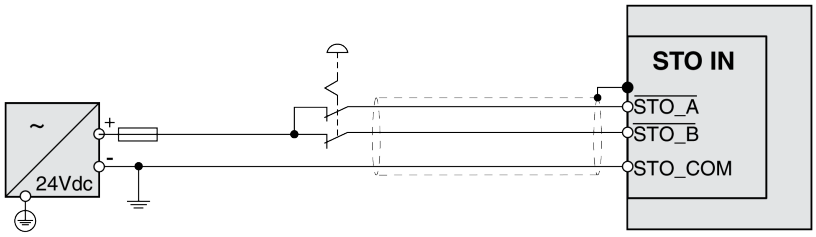
Ground loops can cause problems in machines. A shield connected at one end only is sufficient for grounding and does not create a ground loop.

- Use shielded cables for the signals of the safety-related function STO.
- Do not use the cable for the signals of the safety-related function STO for other signals.
- Connect one end of the shield.

Fuse

A fuse for the safety-related function STO is required.

Type of fuse: 0.5 A (type T)

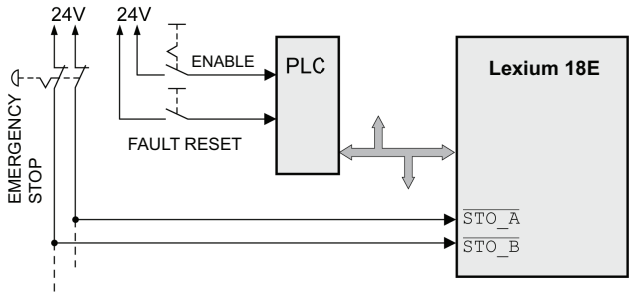


Application Examples STO

Example of Category 0 stop

Use without EMERGENCY STOP safety relay module, category 0 stop.

Example of category 0 stop:



In this example, when an EMERGENCY STOP is activated, it leads to a category 0 stop.

The safety-related function STO is triggered via a simultaneous 0-level at both inputs (time offset of less than 1 s). The power stage is disabled and an error of error class 3 is detected. The motor can no longer generate torque.

If the motor is not already at a standstill when the safety-related function STO is triggered, it decelerates under the salient physical forces (gravity, friction, etc.) active at the time until presumably coasting to a standstill.

If coasting of the motor and its potential load is unsatisfactory as determined by your risk assessment, an external safety-related brake may also be required.

⚠WARNING

UNINTENDED EQUIPMENT OPERATION

Install a dedicated, external safety-related brake if coasting does not meet the deceleration requirements of your application.

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

Refer to section Holding Brake and Safety-Related Function STO, page 39.

Selection

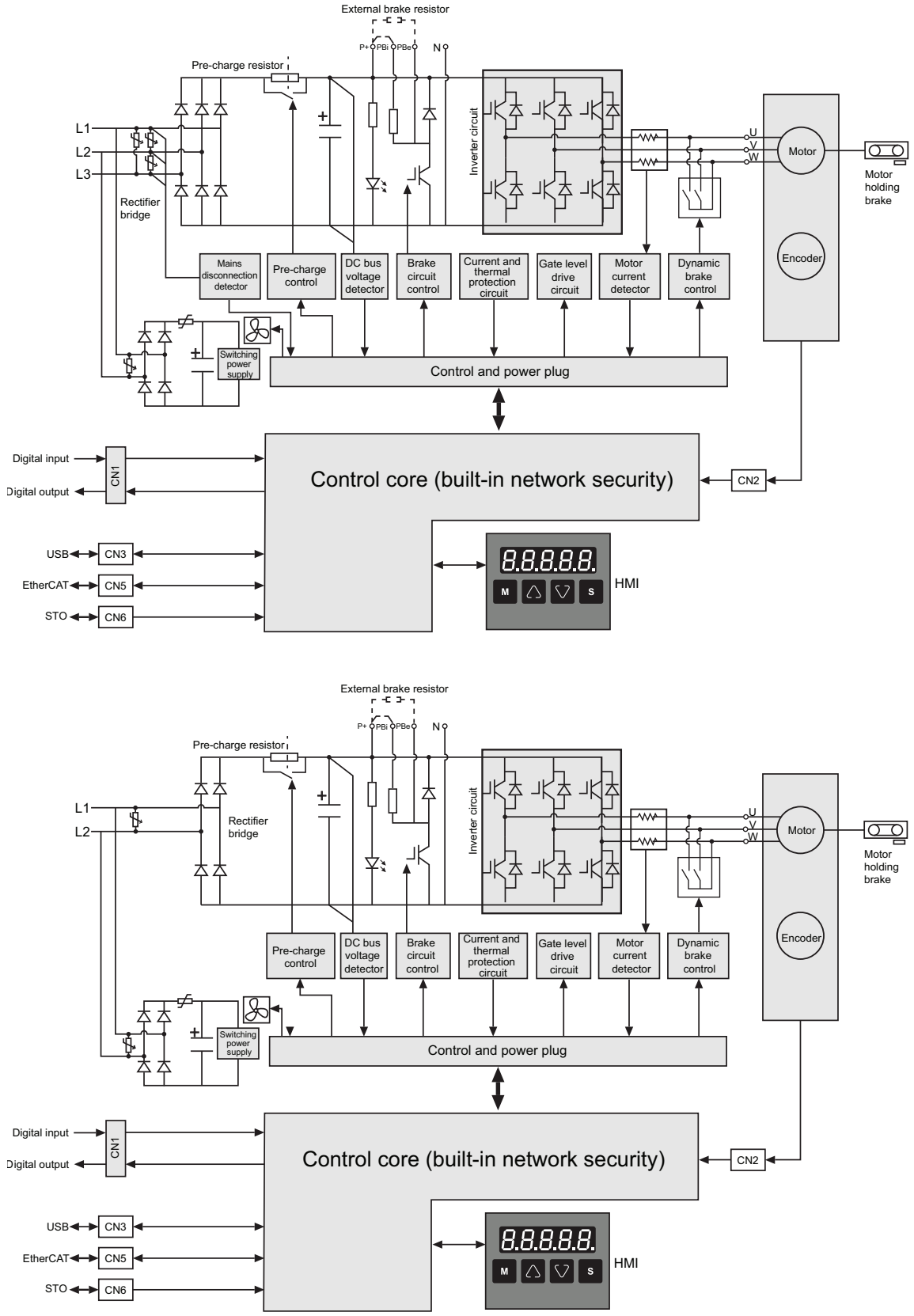
Selection of Servo Drive

Servo Drive Specifications

Item			Specification
Environmental condition	For operation	Temperature	-5 ℃...45 ℃: no derating 45 ℃...55 ℃: derating, capacity reduced by 2% for every 1 °C increased; capacity reduced to 80% at 55 °C
		Relative humidity	5%...95%, no condensing
		Altitude	≤1000 m (3280.83 ft) altitude above sea level without derating Capacity reduced by 1% per 100 m higher (328.08 ft) above 1000 m-2000 m; power supply overvoltage depending on overvoltage category III
		Shock	3M4, 15G, 11ms, category I area
		Vibration	3M4, 3 mm [2...9 Hz], 1G [9...200 Hz], category I area
		Temperature detection	Motor overtemperature sensing is required
		Installation	Install device in pollution degree 2 environment
	For storage	Temperature	-25 ℃...70 ℃
		Relative humidity	5%...95%, no condensing
		Vibration	2M2, 3.5 mm [2...9 Hz]/1G [9...200 Hz]/1.5G [200...500 Hz]
	Degree of protection		IP20 (exposed screw IP00)
	Environmental class		Class 2: No corrosive gas or combustible gas No oil, water, or chemical splashes Environment with little dust, dirt, salt, and metal powder
Input power	Voltage	Size 1 device	Single-phase 220 Vac, 200 Vac -15% to 240 Vac + 10%
		Size 2 device	
		Size 3 device	Three-phase 220 Vac, 200 Vac -15% to 240 Vac + 10%
	Frequency		50 Hz 5% to 60 Hz 5%
	Grounding type	TT Grounding system	Approved
		TN Grounding system	Approved
		IT Grounding system	Not approved
	Leakage current		<5 mA
Methods of heat dissipation			0.1 kW to 0.75 kW: Free cooling 1.0 kW to 3.0 kW: Fan cooling
Feedback interface			23 bit multi-turn absolute optical encoder
STO			Certified safety function STO, SIL 2 according to EN 61508, PLd according to EN 13849
Digital	Input		4 universal digital inputs, with bidirectional polarity 2 high-speed digital inputs, with bidirectional polarity Input functions can be parameterized
	Output		3 universal digital output Output functions can be parameterized

Item			Specification
Commissioning interface	USB		Type-C USB Commissioning and monitoring via host computer software
	HMI		5-bit 7-segment digital tube 4 buttons
Methods of braking	Regenerative braking		Built-in regenerative braking resistor
	Dynamic braking		Built-in dynamic braking function, which can be turned on via parameters
Control loop tuning	Self-tuning	Simple self-tuning	The drive drives the motor according to internal preset actions and measures the gain parameters.
		Comfortable self-tuning	Motor trajectory parameters can be set, and the drive drives the motor according to the custom trajectory and measures the gain parameters
		Dynamic self-adapting	The drive automatically tests load inertia ratios in real time and sets the corresponding gain parameters according to the selected rigid grade
		Automatic notch filter	The drive automatically detects the resonant frequency of the load and automatically sets one or two sets of built-in notch filters
	Manual tuning		Serial control loop
			End vibration suppression filter
			Manual / automatic notch filter
Others			Integral solid state short circuit protection does not provide branch circuit protection. Branch circuit protection must be provided in accordance with the National Electrical Code and any additional local codes” or the equivalent

Internal Block Diagram of the Servo Drive



The control core features built-in firmware signature and secure boot functions, effectively ensuring the security and robustness of the device and reaching security level 1.

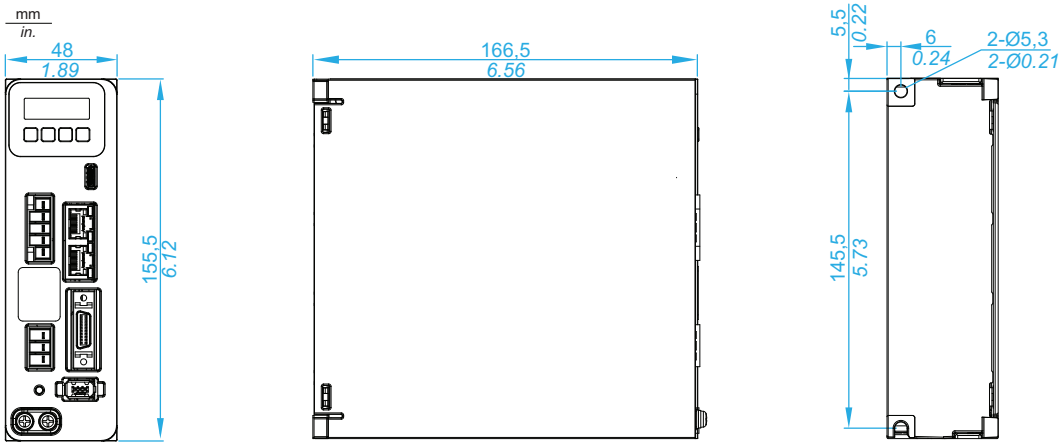
Servo Drive Ratings

Reference LXM18E*M2X	U01	U02	U04	U07	U10	U15
Input voltage / phase [Vac]	Single-phase 200...240Vac, - 15%...+ 10%					
Frequency	50 Hz - 5%...60 Hz + 5%					
Continuous input current [Arms]	1.4	2.7	4.9	8.5	11	15.8
Rated output [kW]	0.1	0.2	0.4	0.75	1.0	1.5
Nominal output current [Arms]	1.2	1.8	2.8	5.1	7.6	9.5
Peak output current [Arms]	3.9	5.9	9.6	17.3	22.8	29.2

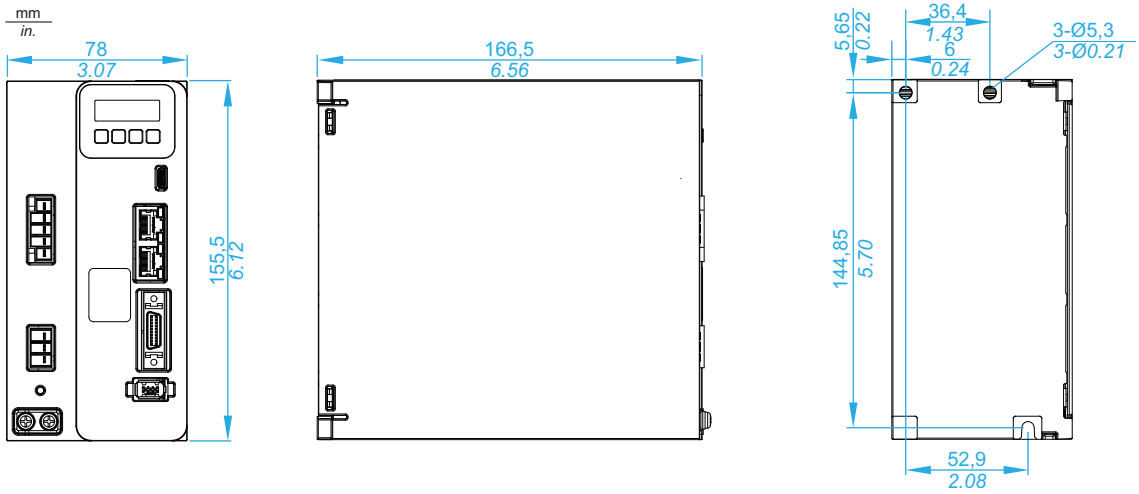
Reference LXM18E*M3X	U20	U30
Nominal input voltage [Vac]	Three-phase 200...240Vac, - 15%...+ 10%	
Frequency	50 Hz - 5%...60 Hz + 5%	
Continuous input current [Arms]	13.2	18.4
Rated output [kW]	2.0	3.0
Nominal output current [Arms]	18.5	19.6
Peak output current [Arms]	42	56

Servo Drive Dimensions

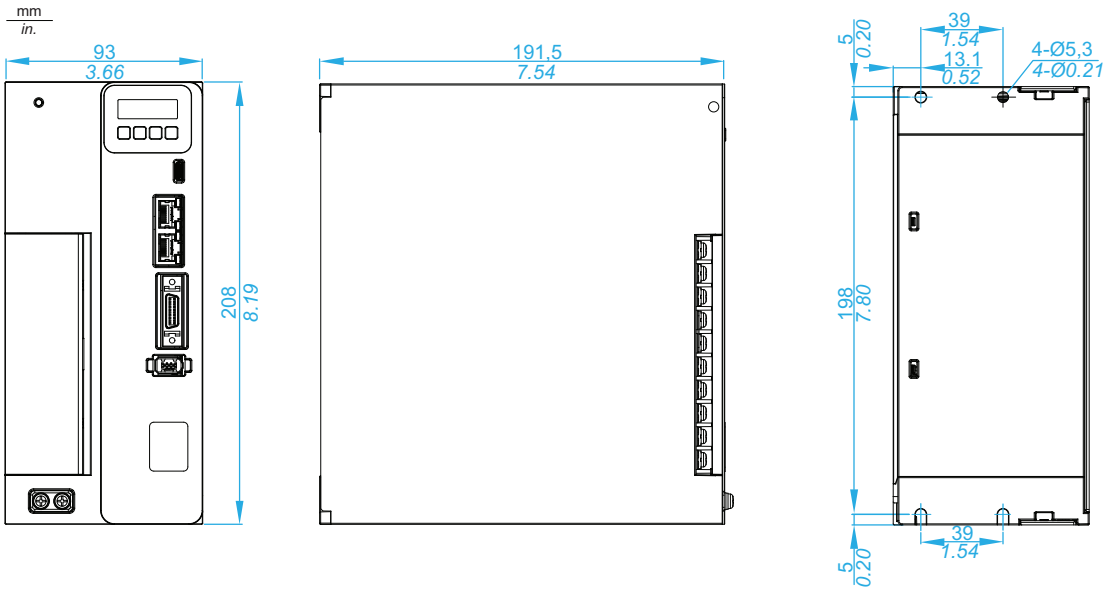
Size 1: 0.1 kW…0.4 kW (U01/ U02/ U04)



Size 2: 0.75 kW…1.5 kW (U07/ U10/ U15)



Size 3: 2.0 kW…3.0 kW (U20/ U30)



Selection of Servo Motor

Servo Motor Specifications

Item			Specification
Environmental condition	For operation	Temperature	-5℃...40℃: non-condensing, no icing 40℃...55℃: derating
		Relative humidity	5%- 80%, non-condensing
		Altitude	<=1000 m (3280.83 ft) above sea level without degrating 1000~ 2000 m(3280.83 ft~ 6561.66 ft) above sea level with degrating
		Shock	150 m / s^2
		Vibration	0.15 mm (10 Hz..60 Hz), 20 m/s^2 (10 Hz..60 Hz)
	For storage	Temperature	-20℃...60℃
		Relative humidity	<=75%, non-condensing
Installation	Installation direction		IM B5, IM V1, IM V3
	Degree of protection	Shaft end	IP67 (equipped with oil seal)
		Casing	IP67 (when connected with cable connector)
	Connection		Flange connection
Excitation			Permanent magnet synchronous
Insulation class			F (155℃)

Servo Motor Ratings

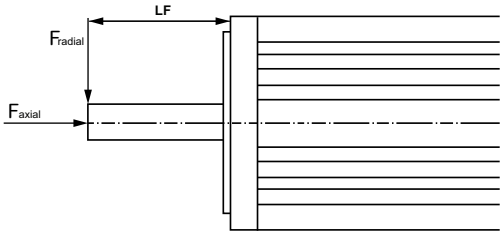
Type of inertia	Reference: BCH18		LBA5	LB01	LD02	LD04	LF07	LF10	LH10	LH15	LH20	LM30
Low inertia motor	Voltage class [Vac]		200...240 Vac									
	Nominal output [kW]		0.05	0.1	0.2	0.4	0.75	1.0	1.0	1.5	2.0	3.0
	Nominal torque [Nm]		0.16	0.32	0.64	1.27	2.39	3.18	3.18	4.77	6.37	9.8
	Max. torque [Nm]		0.48	0.96	1.92	3.81	7.17	9.54	9.54	14.3	19.1	29.4
	Nominal current [Arms]		1.1	1.1	1.6	2.8	5.1	6.8	7.3	9.2	13.2	18.6
	Maximum current [Arms]		3.4	3.4	5.1	8.5	15.6	21.5	22	28.8	41	56
	Nominal speed of rotation [rpm]		3000	3000	3000	3000	3000	3000	3000	3000	3000	3000
	Maximum speed of motor [rpm]		6000	6000	6000	6000	6000	6000	6000	6000	6000	6000
	Torque constant [Nm/Arms]		0.15	0.29	0.40	0.45	0.47	0.47	0.44	0.52	0.48	0.57
	Back electromotive force constant [V/krpm]		11.9	23.6	27.1	32.2	32.2	31	30	34.2	32.8	35.5
	Rotational inertia [kgcm^2]	Without holding brake	0.02	0.029	0.15	0.25	0.78	0.994	1.43	2.09	2.64	7.63
		With holding brake	0.027	0.036	0.21	0.31	0.93	1.12	1.53	2.21	2.74	8.3
	Degree of protection		Casing with free cooling, IP67									
	Flange size [mm/in]		40 (1.57)	40 (1.57)	60 (2.36)	60 (2.36)	80 (3.15)	80 (3.15)	100 (3.94)	100 (3.94)	100 (3.94)	130 (5.12)
	Specification for holding brake	Nominal voltage [V]	24 Vdc ±10%									
		Nominal current [A]	0.25	0.25	0.3	0.3	0.48	0.48	0.73	0.73	0.73	0.813
		Holding torque [Nm]	0.35	0.35	2.0	2.0	3.0	3.0	6.5	6.5	6.5	20
		Inertia [kgcm^2]	0.006	0.006	0.059	0.059	0.123	0.123	0.082	0.082	0.082	0.661
		Releasing time [ms]	20	20	20	20	20	20	20	20	20	60
		Closing time [ms]	50	50	50	50	60	60	60	60	60	120

Type of inertia	Reference: BCH18		MBA5	MB01	MD01	MD02	MD04	MF02	MF04	MF07	MF10
Middle inertia motor	Voltage class [Vac]		200...240 Vac								
	Nominal output [kW]		0.05	0.1	0.1	0.2	0.4	0.2	0.4	0.75	1.0
	Nominal torque [Nm]		0.16	0.32	0.32	0.64	1.27	0.64	1.27	2.39	3.18
	Max. torque [Nm]		0.56	1.12	0.96	2.24	4.45	1.92	4.45	8.37	11.1
	Nominal current [Arms]		1.1	1.1	1.1	1.6	2.6	1.6	2.6	4.9	6.5
	Maximum current [Arms]		3.9	3.9	3.4	5.9	9.3	5.1	9.3	17.3	22.8
	Nominal speed of rotation [rpm]		3000	3000	3000	3000	3000	3000	3000	3000	3000
	Maximum speed of motor [rpm]		6000	6000	6000	6000	6000	6000	6000	6000	6000
	Torque constant [Nm/Arms]		0.15	0.29	0.29	0.4	0.49	0.40	0.49	0.49	0.49
	Back electromotive force constant [V/krpm]		11	21	19.9	28.1	33.7	26.53	35	34.5	33.3
	Rotational inertia [kgcm^2]	Without holding brake	0.04	0.07	0.16	0.268	0.478	0.55	1.19	1.79	2.16
		With holding brake	0.046	0.076	0.22	0.328	0.54	0.68	1.33	1.90	2.32
	Degree of protection		Casing with free cooling, IP67								
	Flange size [mm/in]		40 (1.57)	40 (1.57)	60 (2.36)	60 (2.36)	60 (2.36)	80 (3.15)	80 (3.15)	80 (3.15)	80 (3.15)
	Specification for holding brake	Nominal voltage [V]	24 Vdc ±10%								
		Nominal current [A]	0.25	0.25	0.3	0.3	0.3	0.48	0.48	0.48	0.48
		Holding torque [Nm]	0.35	0.35	2.0	2.0	2.0	3.0	3.0	3.0	3.0
		Inertia [kgcm^2]	0.006	0.006	0.059	0.059	0.059	0.123	0.123	0.123	0.123
		Releasing time [ms]	20	20	20	20	20	20	20	20	20
		Closing time [ms]	50	50	50	50	50	60	60	60	60

Type of inertia	Reference: BCH18		MM08	MM10	MM13	MM15	MM18	MM20	MR24	MR30
Middle inertia low velocity large torque motor	Voltage class [Vac]		200...240 Vac							
	Nominal output [kW]		0.85	1.0	1.3	1.5	1.8	2.0	2.4	3.0
	Nominal torque [Nm]		5.39	4.77	8.34	7.16	11.5	9.55	15.1	19.1
	Max. torque [Nm]		16.17	14.31	25	21.48	32.2	28.65	43.5	55.39
	Nominal current [Arms]		7.3	6	9.6	8.24	14	11.7	18.6	18.9
	Maximum current [Arms]		22	18.3	29.2	25	42	36	56	54.6
	Nominal speed of rotation [rpm]		1500	2000	1500	2000	1500	2000	1500	1500
	Maximum speed of motor [rpm]		3000	3000	3000	3000	3000	3000	3000	3000
	Torque constant [Nm/Arms]		0.74	0.74	0.87	0.87	0.82	0.82	0.81	0.81
	Back electromotive force constant [V/krpm]		53.7	53.7	55.8	55.8	53.7	53.7	53.4	53.4
	Rotational inertia [kgcm^2]	Without holding brake	14	14	20.88	20.88	27.79	27.79	46.32	46.32
		With holding brake	14.7	14.7	21.54	21.54	28.45	28.45	51.1	51.1
	Degree of protection		Casing with free cooling, IP67							
	Flange size [mm/in]		130 (5.12)	130 (5.12)	130 (5.12)	130 (5.12)	130 (5.12)	130 (5.12)	180 (7.09)	180 (7.09)
	Specification for holding brake	Nominal voltage [V]	24 Vdc ±10%							
		Nominal current [A]	0.813	0.813	0.813	0.813	0.813	0.813	1.14	1.14
		Holding torque [Nm]	20	20	20	20	20	20	40	40
		Inertia [kgcm^2]	0.661	0.661	0.661	0.661	0.661	0.661	4.3	4.3
		Releasing time [ms]	60	60	60	60	60	60	80	80
		Closing time [ms]	120	120	120	120	120	120	200	200

Allowable Loads of Servo Motor Output Shaft

Max. allowable shaft load



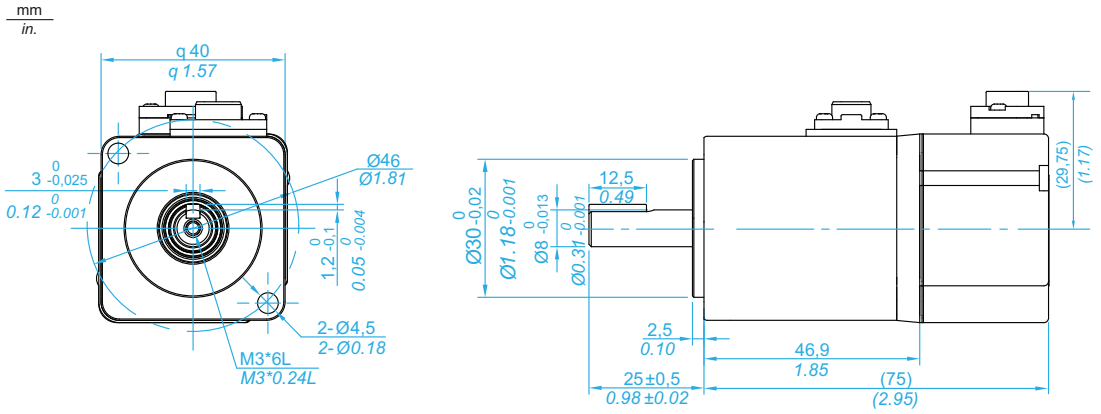
Reference: BCH18	LBA5	LB01	LD02	LD04	LF07	LF10	LH10	LH15	LH20	LM30
LF [mm]	20	20	25	25	35	35	45	45	45	63
Max. allowable radial load [N]*	78	78	245	245	392	392	686	686	686	980
Max. allowable axial load [N]*	54	54	74	74	147	147	196	196	196	392
*: Load [N]+/-10%										

Reference: BCH18	MBA5	MB01	MD01	MD02	MD04	MF02	MF04	MF07	MF10
LF [mm]	20	20	20	25	25	25	35	35	35
Max. allowable radial load [N]*	78	78	245	245	245	392	392	392	392
Max. allowable axial load [N]*	54	54	74	74	74	147	147	147	147
*: Load [N]+/-10%									

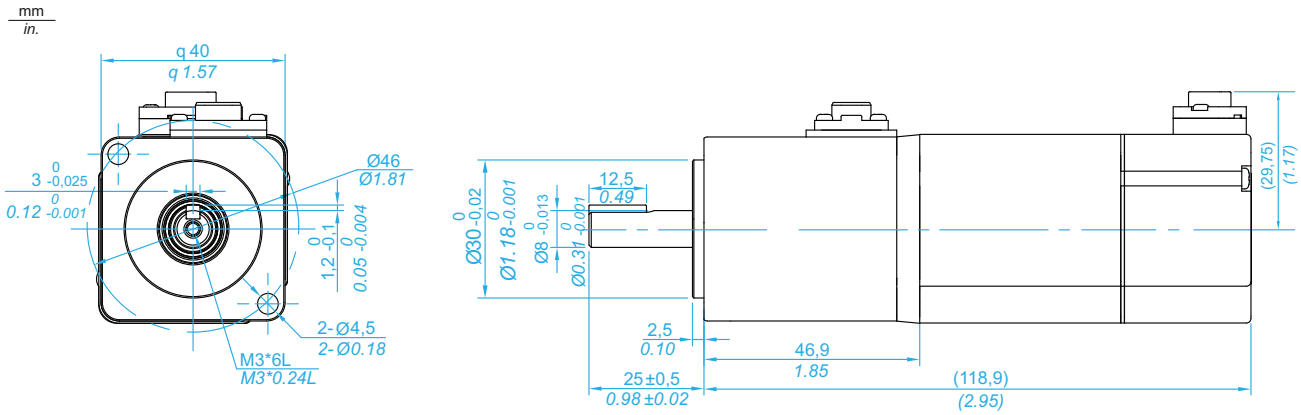
Reference: BCH18	MM08	MM10	MM13	MM15	MM18	MM20	MR24	MR30
LF [mm]	55	55	55	55	63	55	79	79
Max. allowable radial load [N]*	490	490	686	686	980	686	1470	1470
Max. allowable axial load [N]*	98	98	343	343	392	343	490	490
*: Load [N]+/-10%								

Servo Motor Dimensions/Overload Characteristics/Speed-Torque

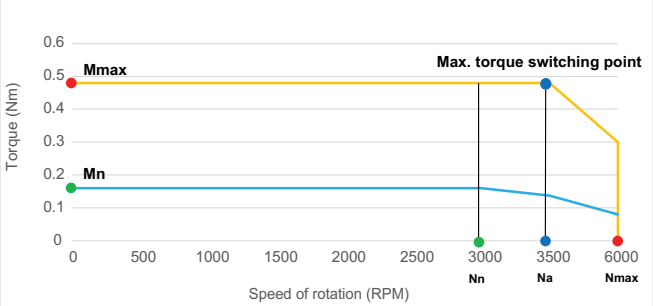
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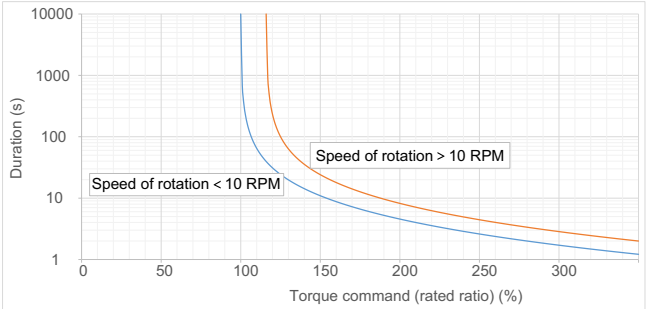


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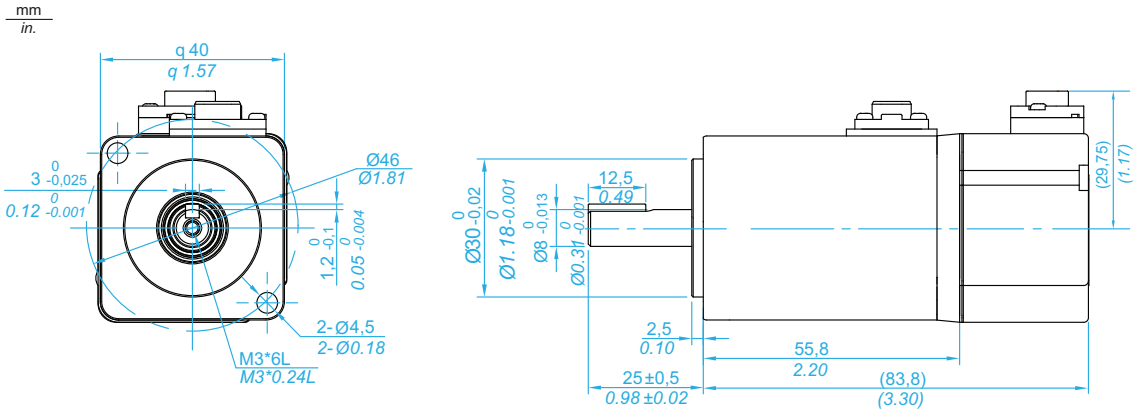


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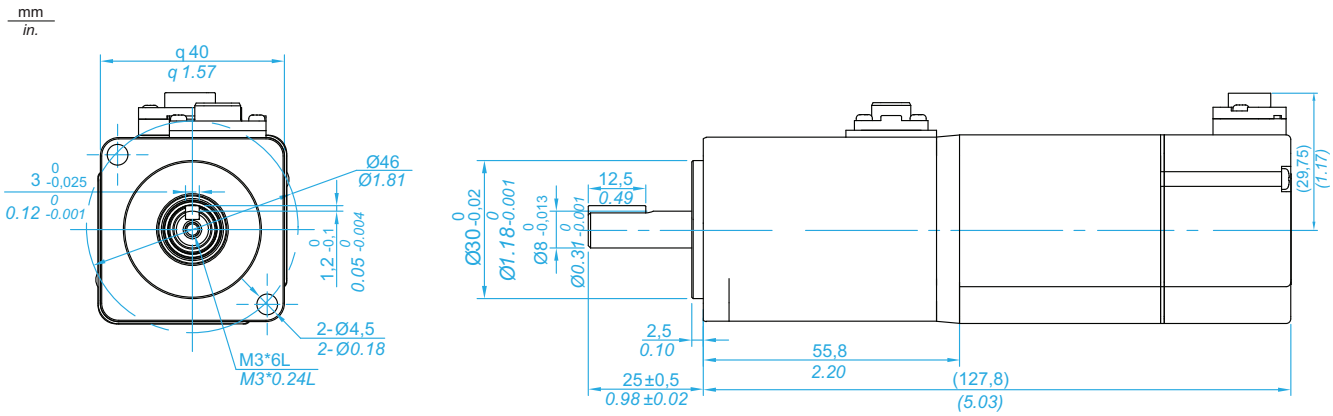




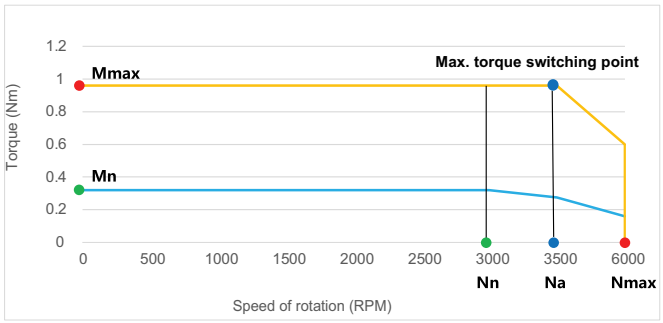
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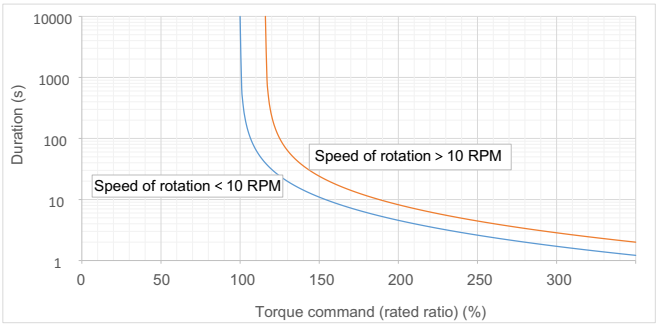


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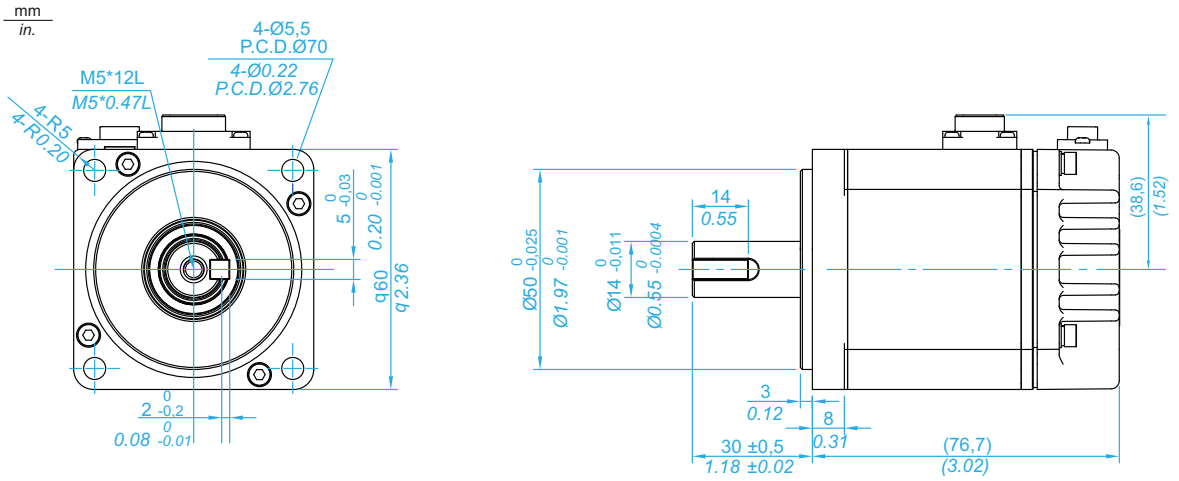


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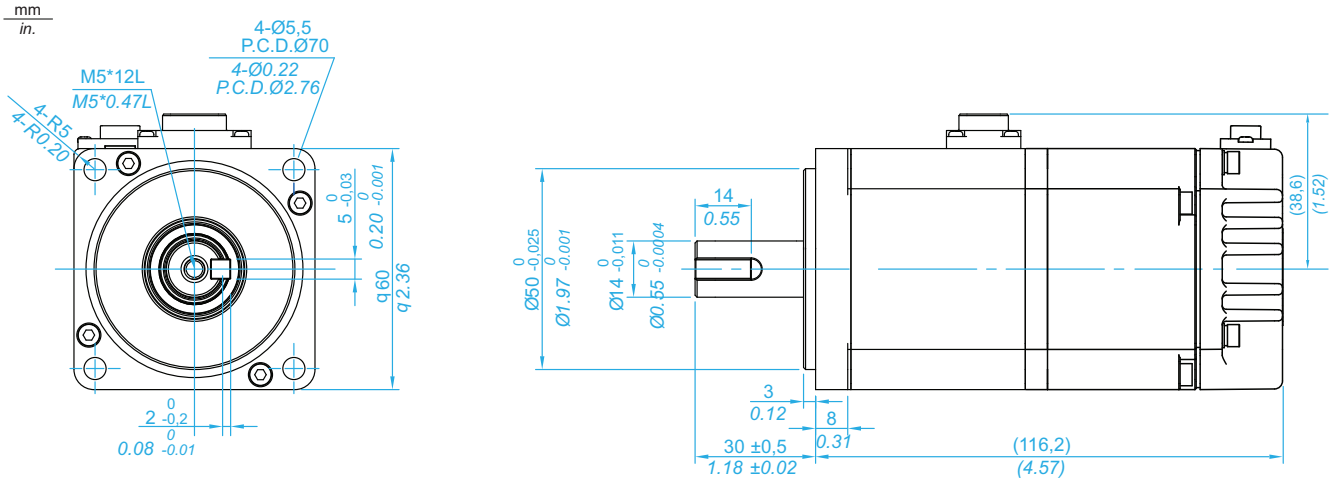




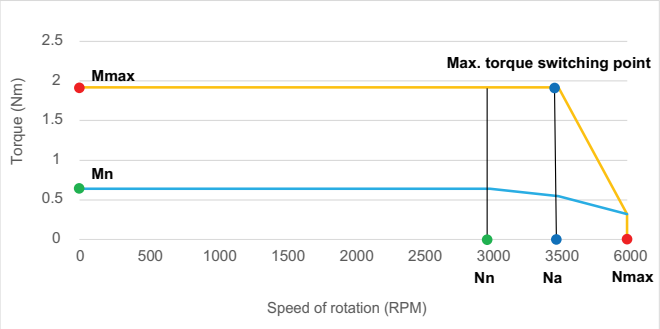
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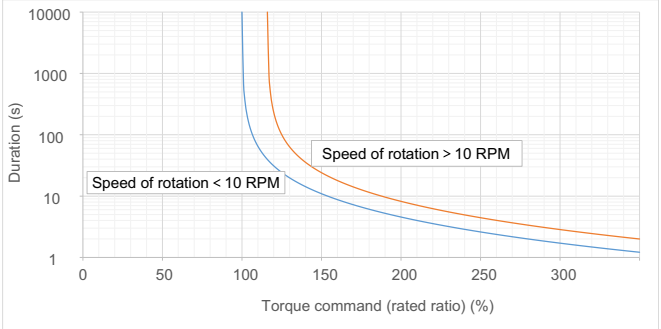


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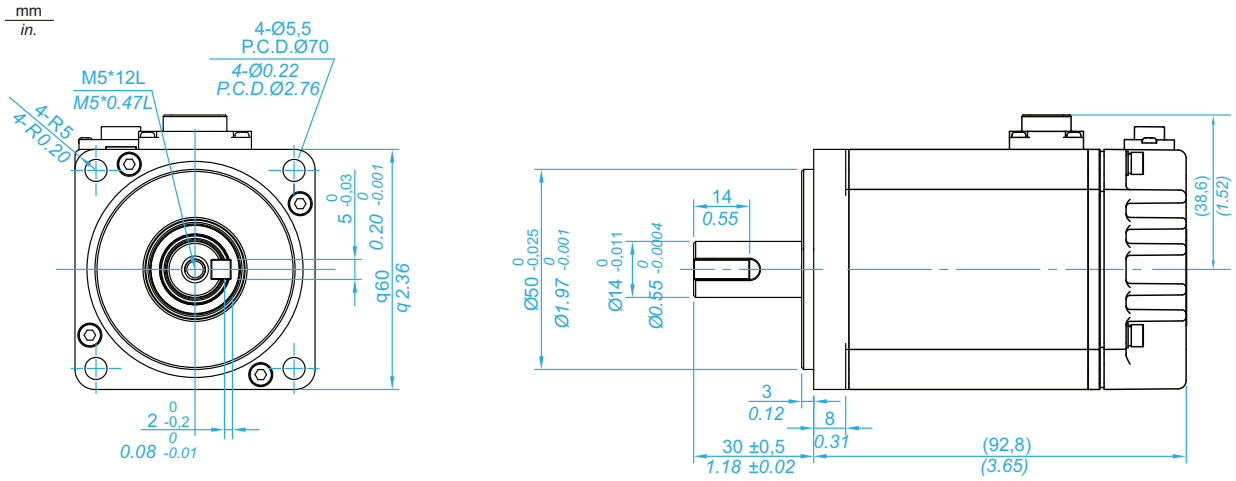


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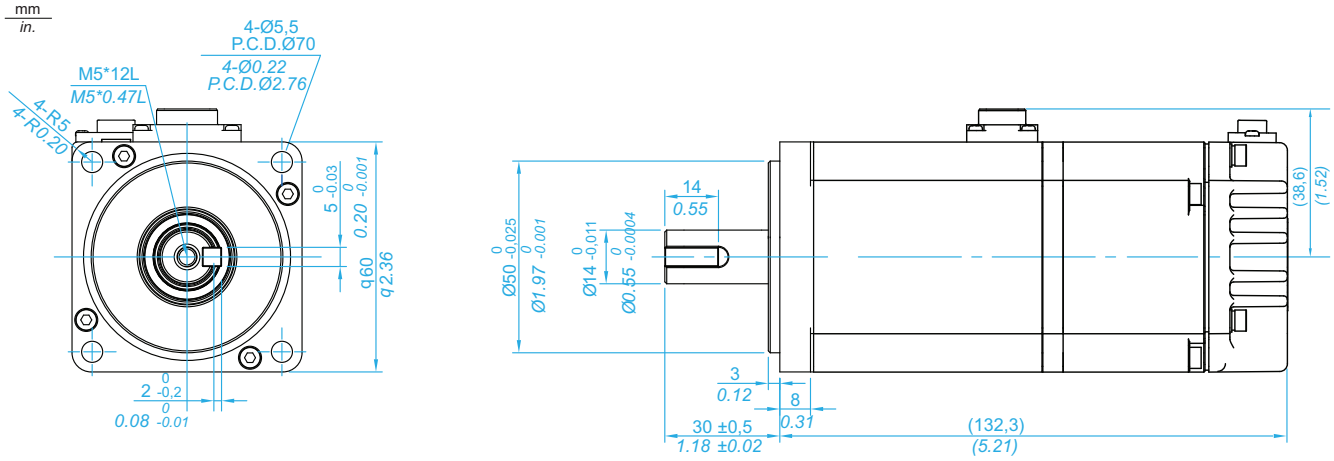




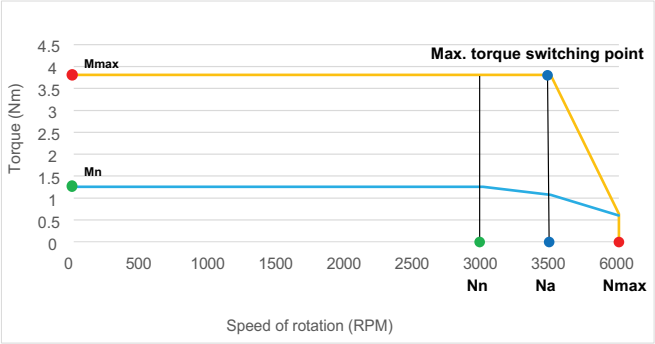
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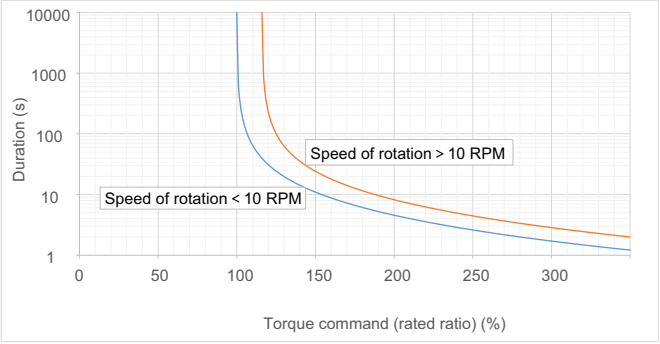


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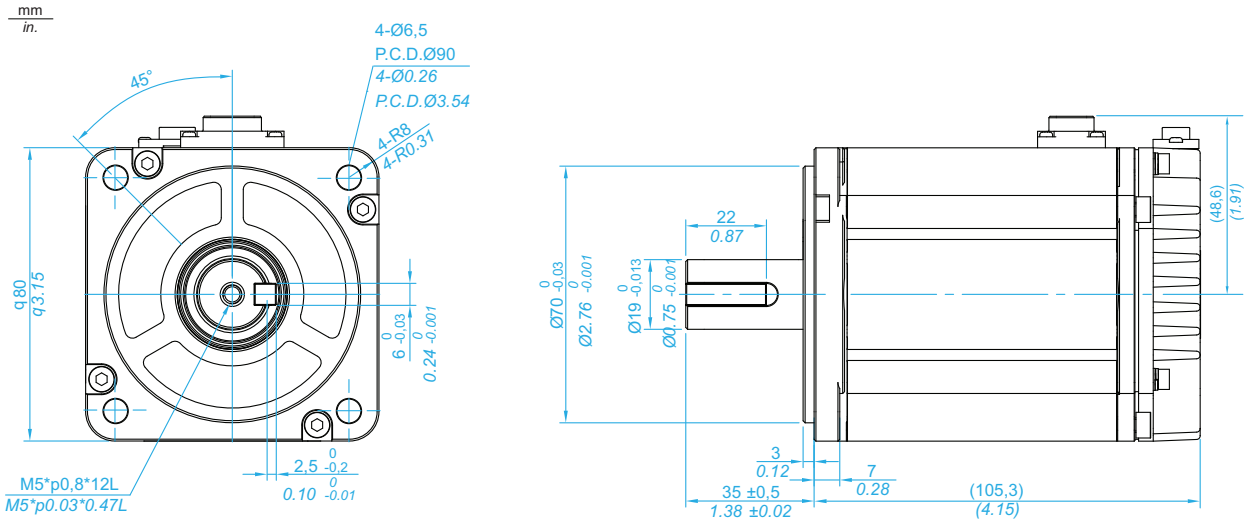


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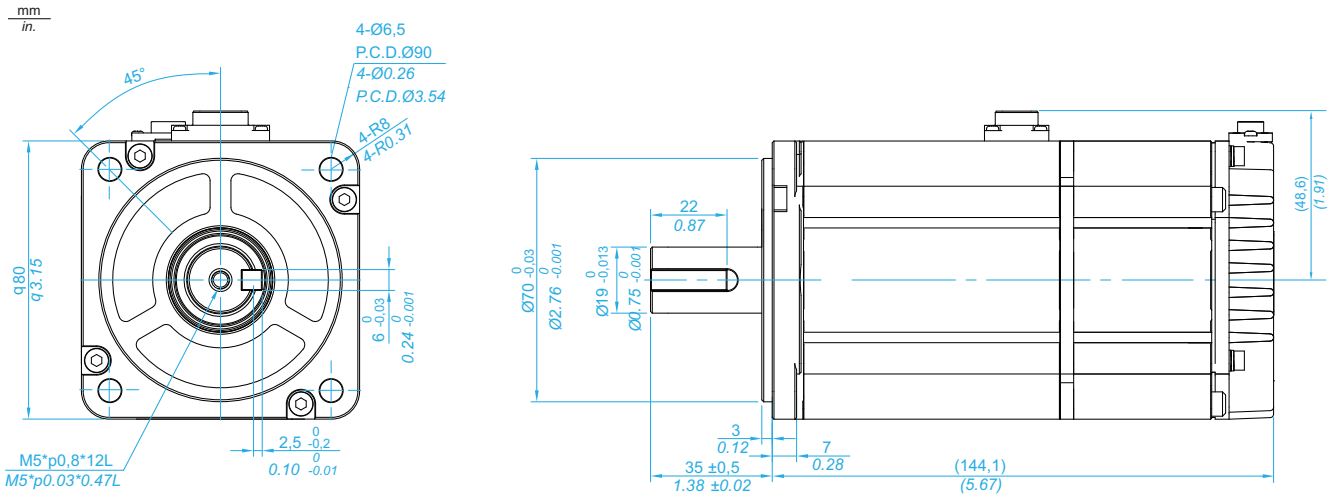




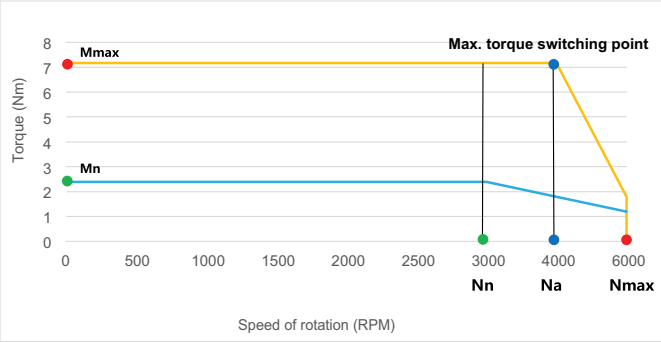
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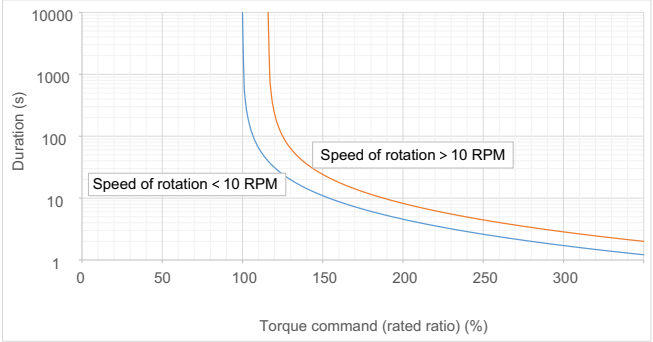


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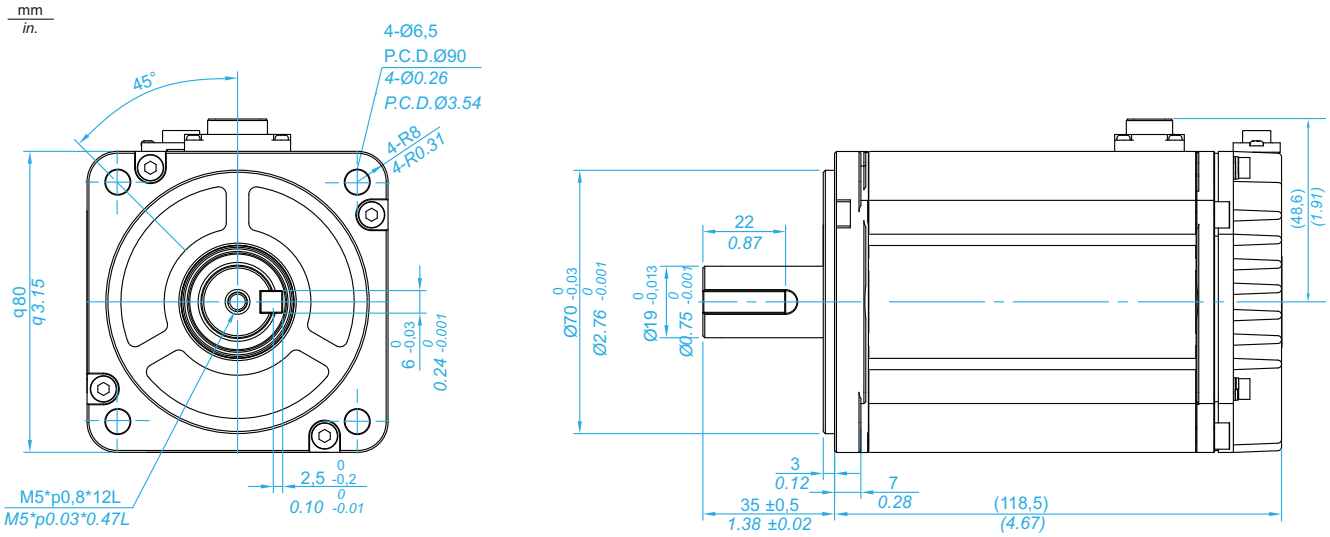


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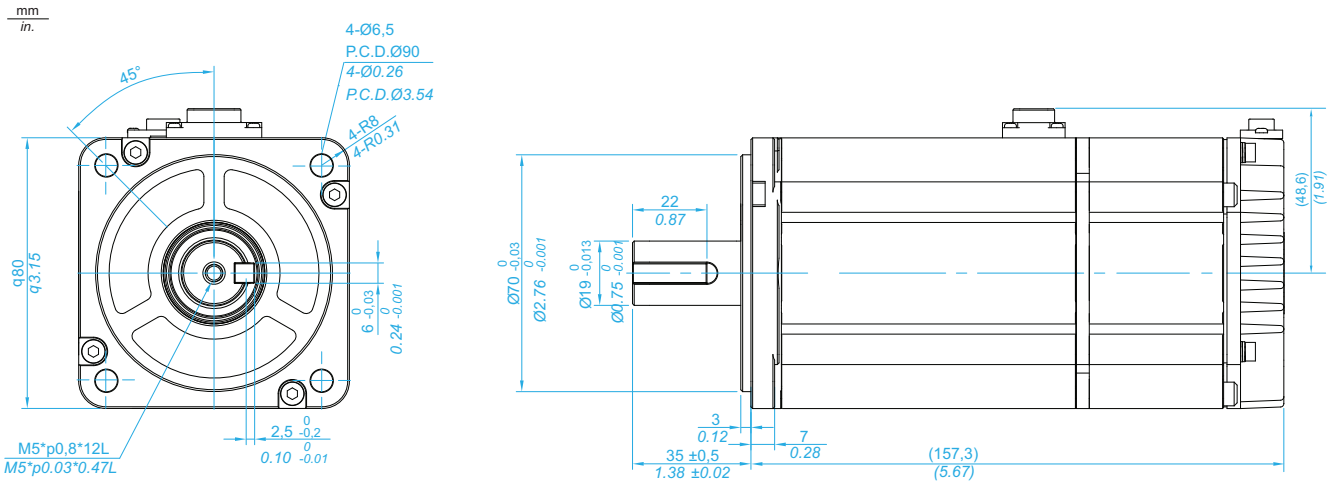




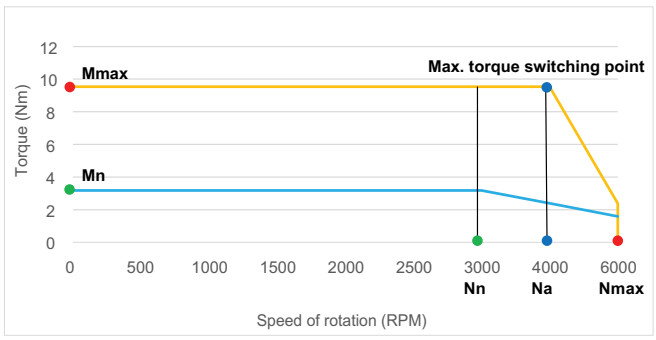
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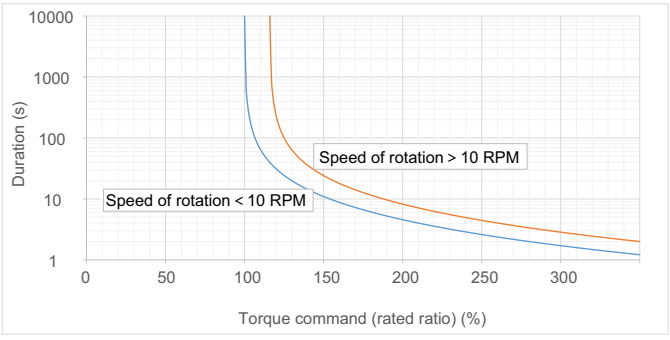


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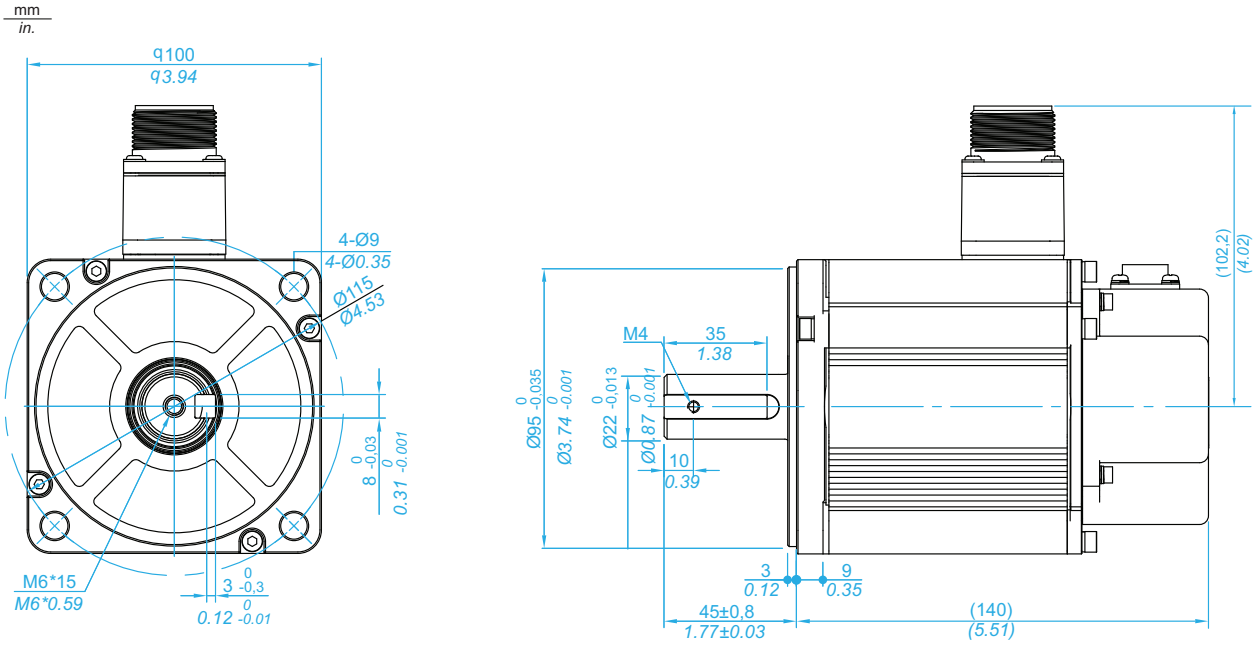


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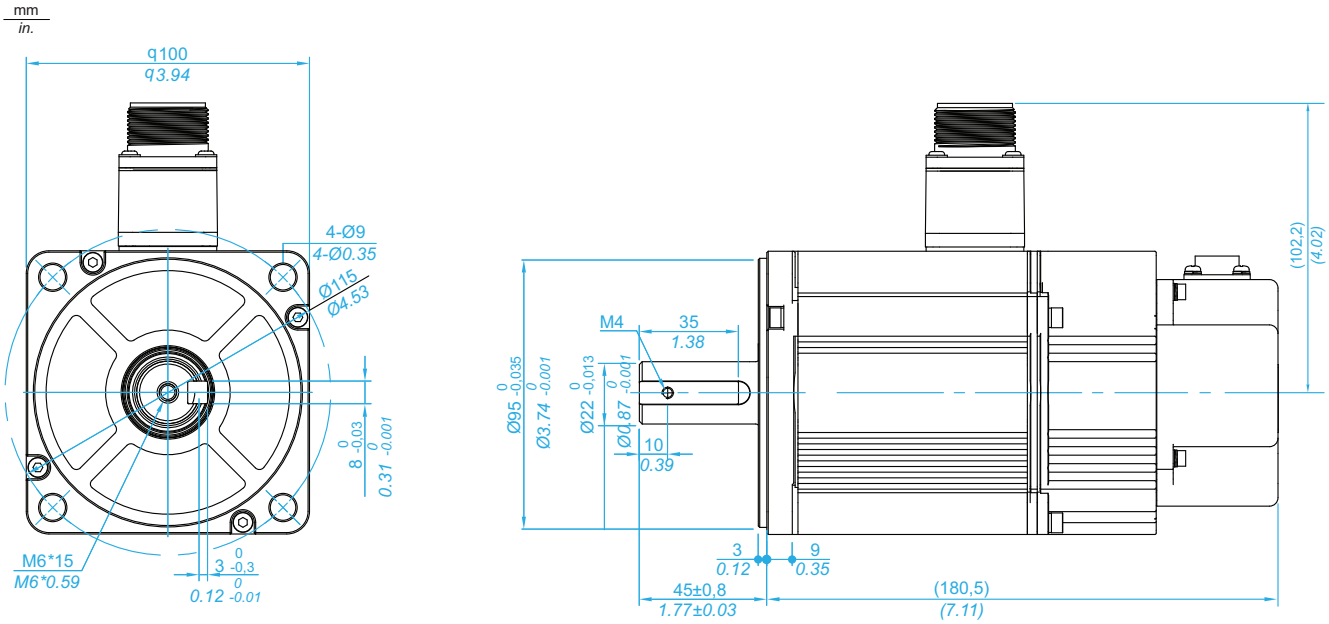




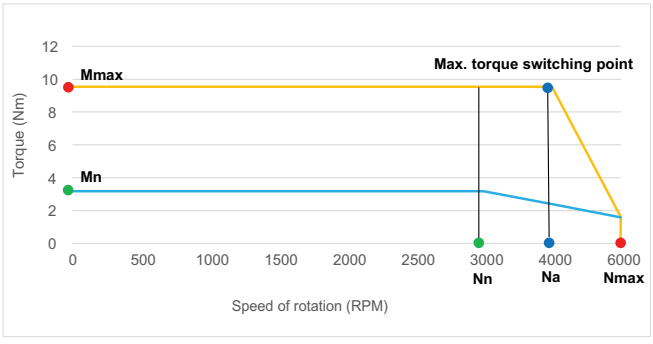
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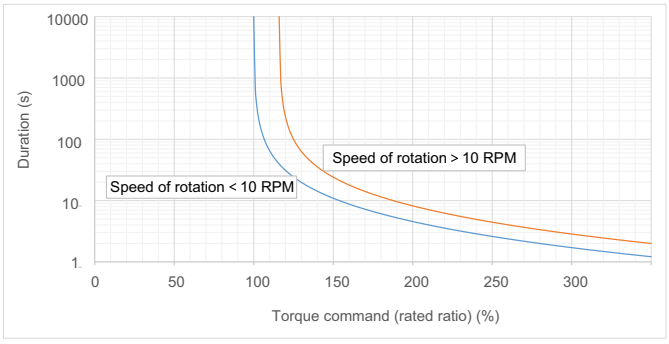


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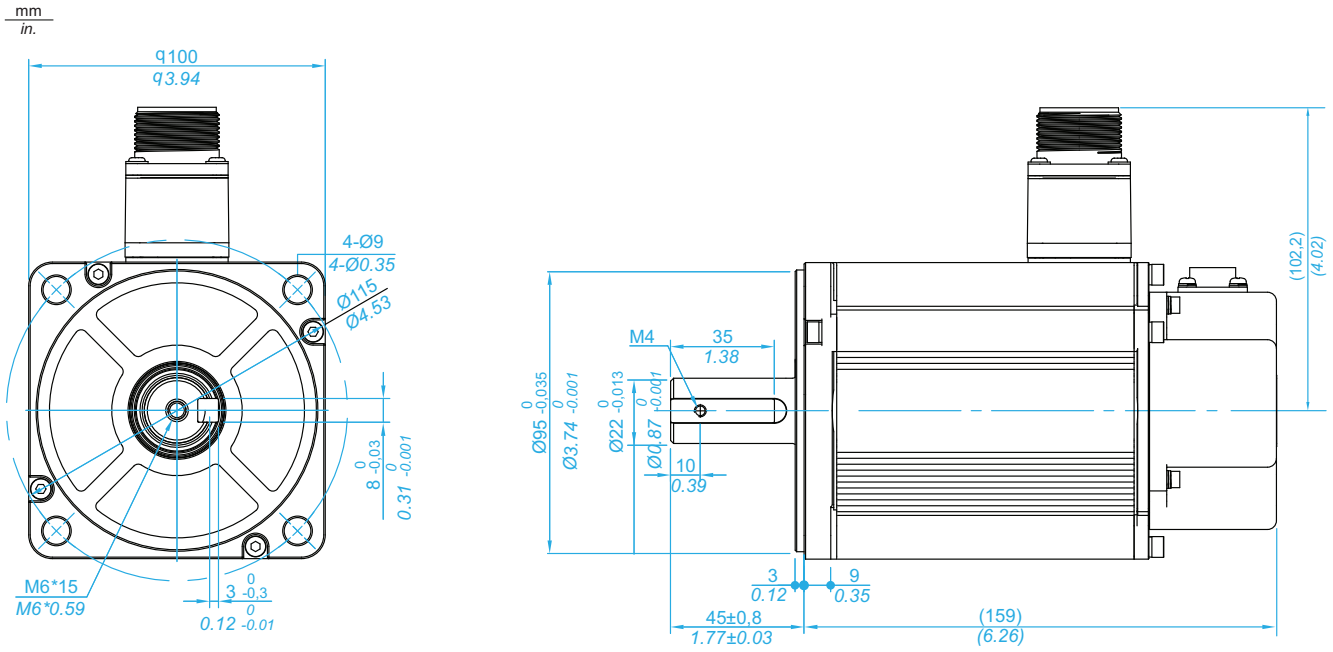


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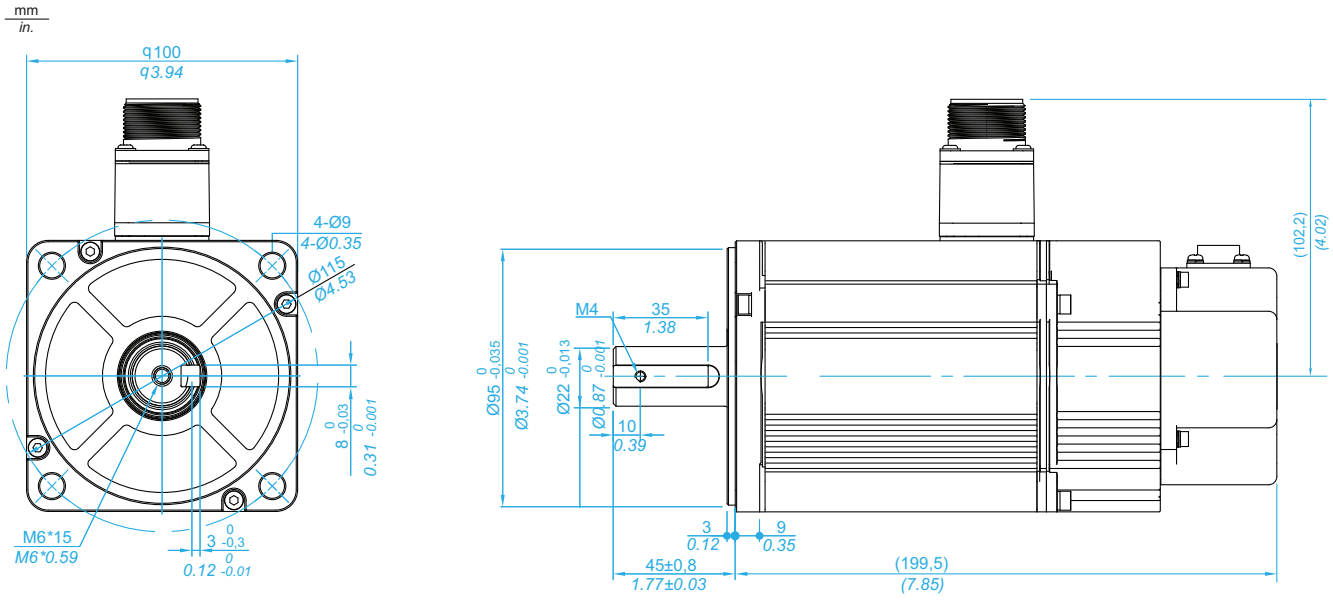




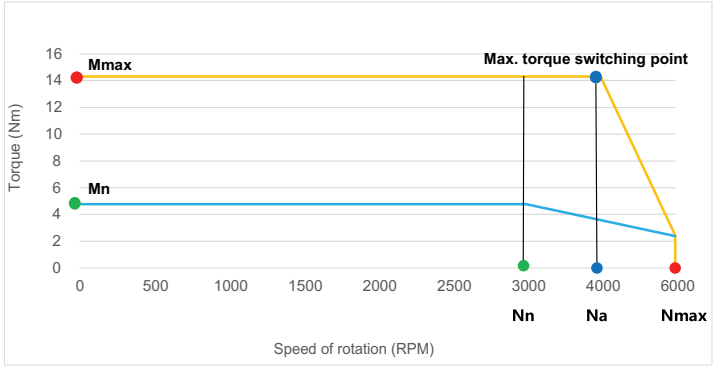
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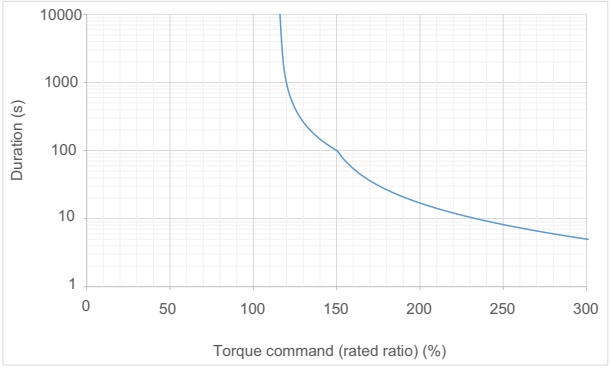


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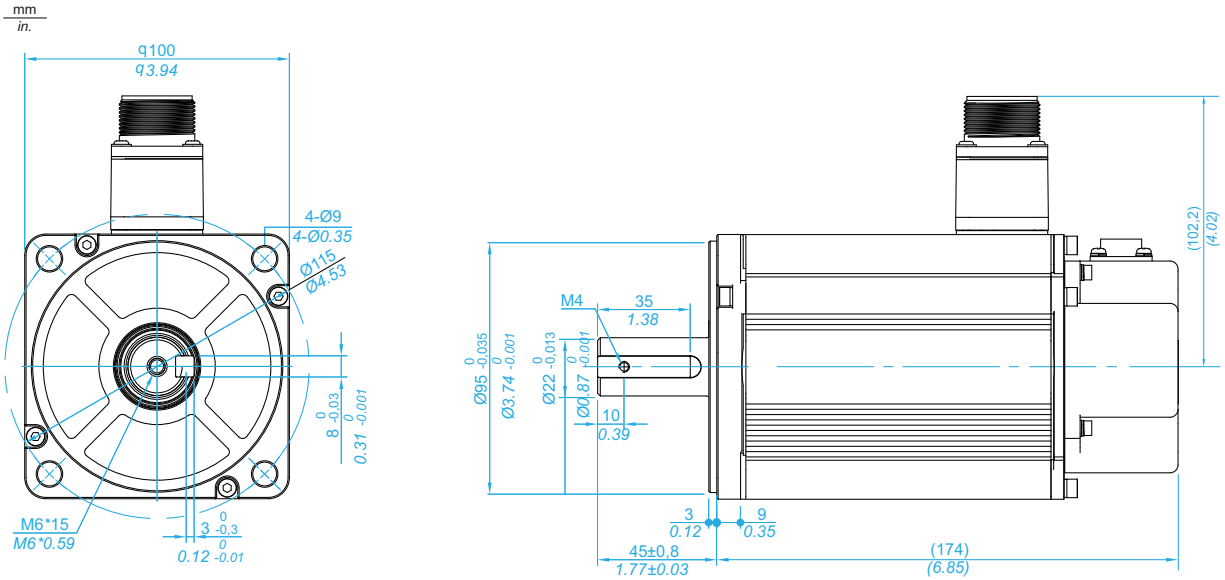


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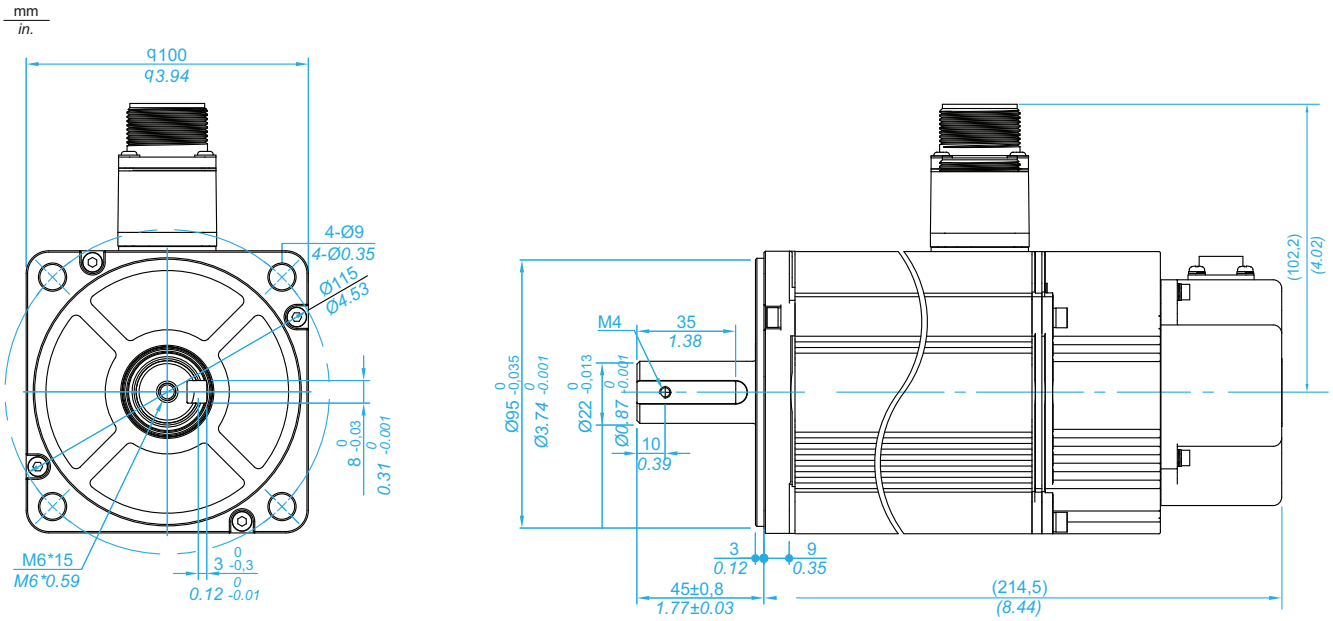




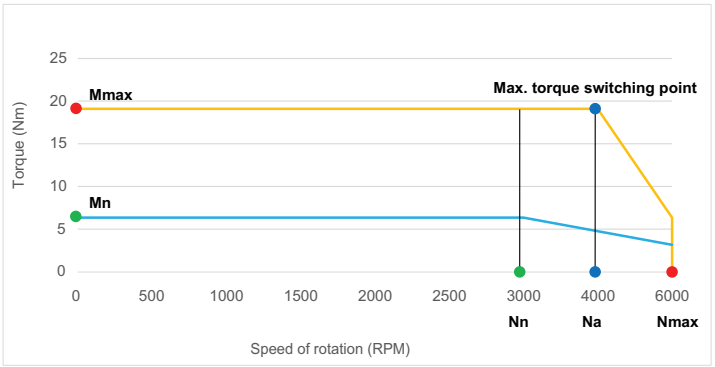
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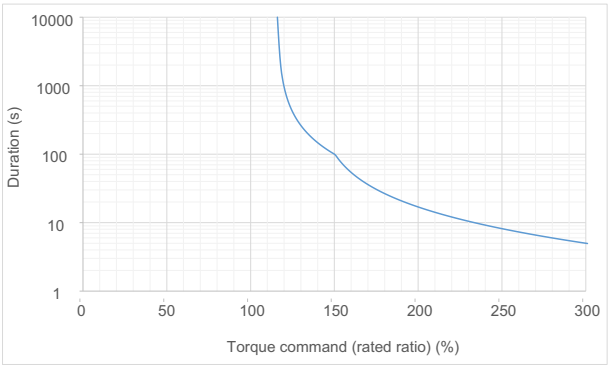


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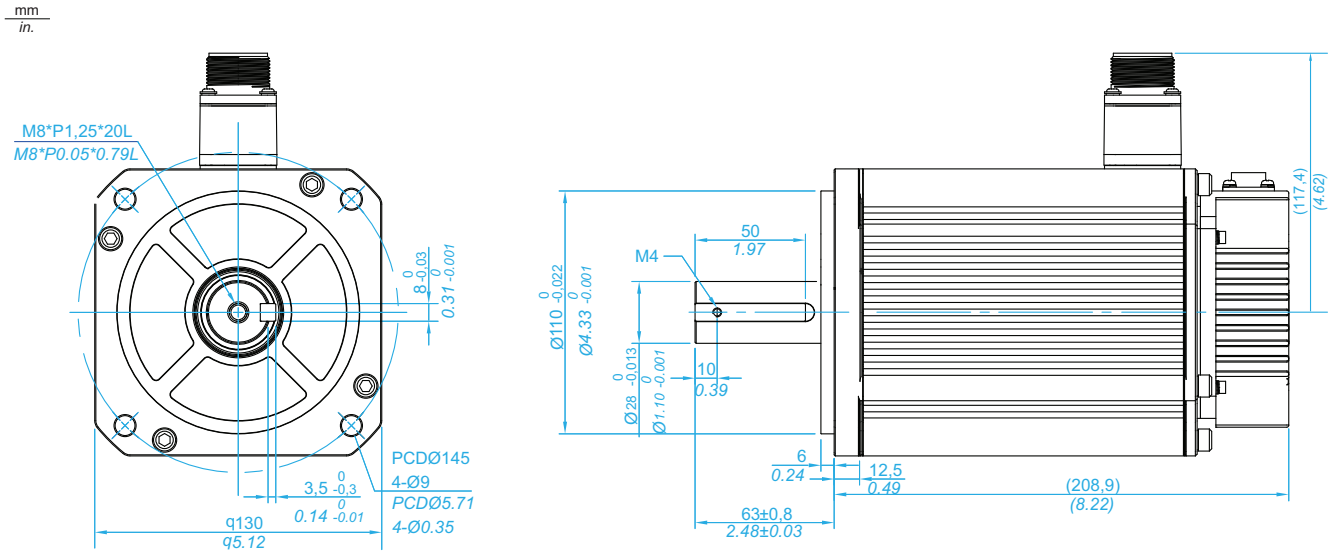


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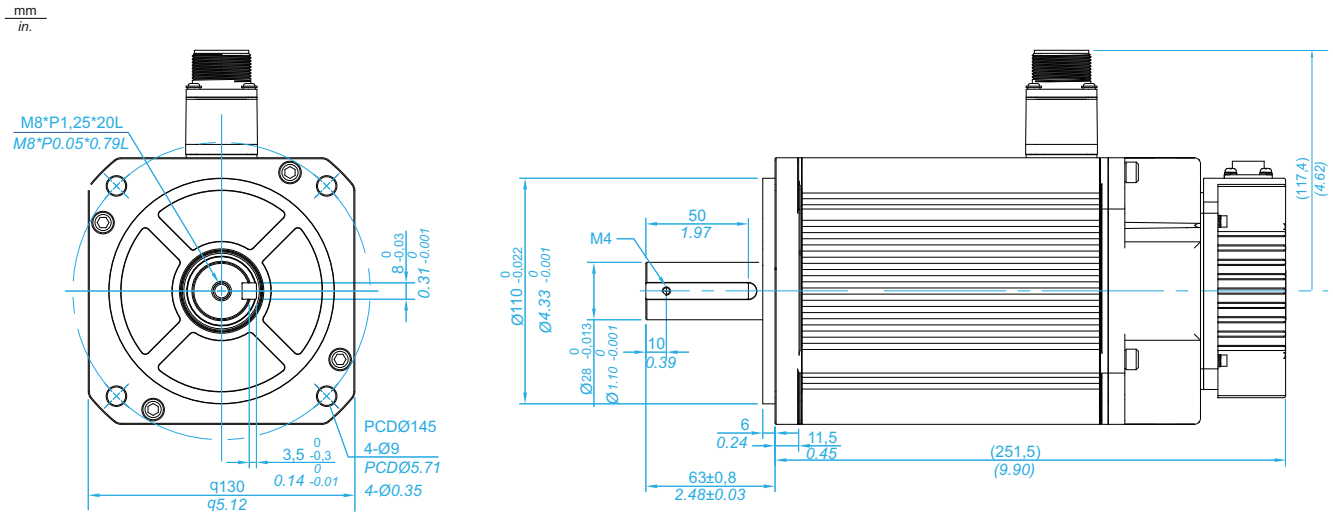




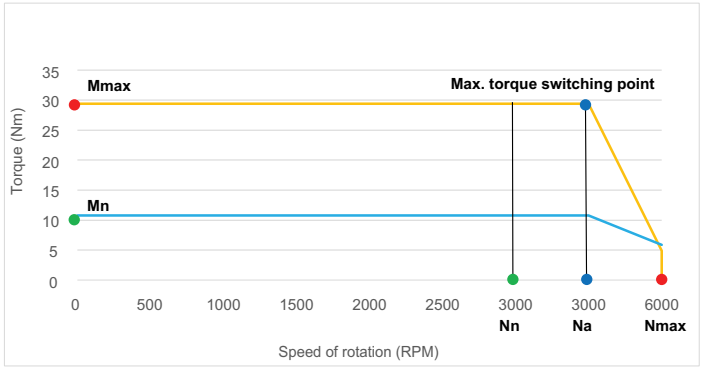
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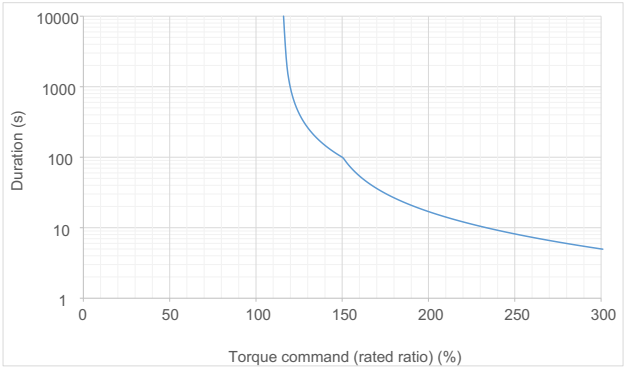


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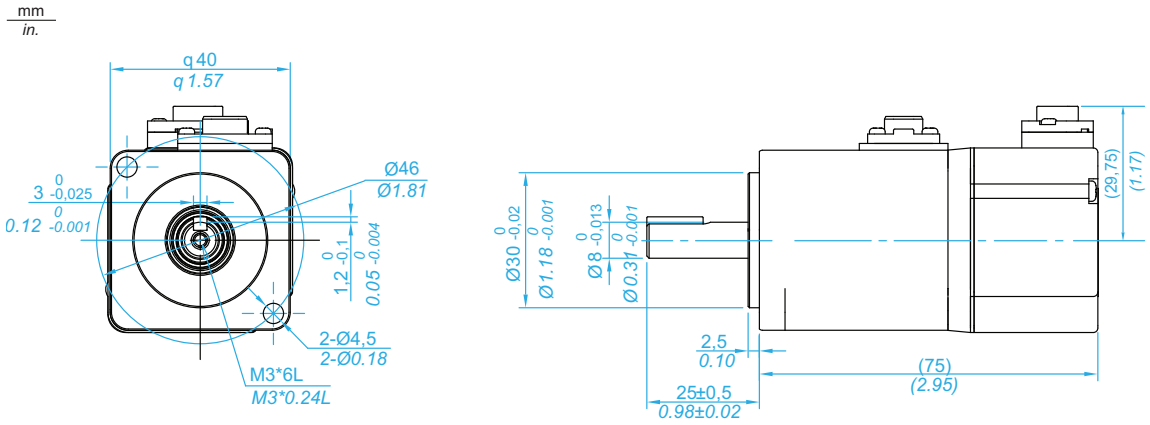


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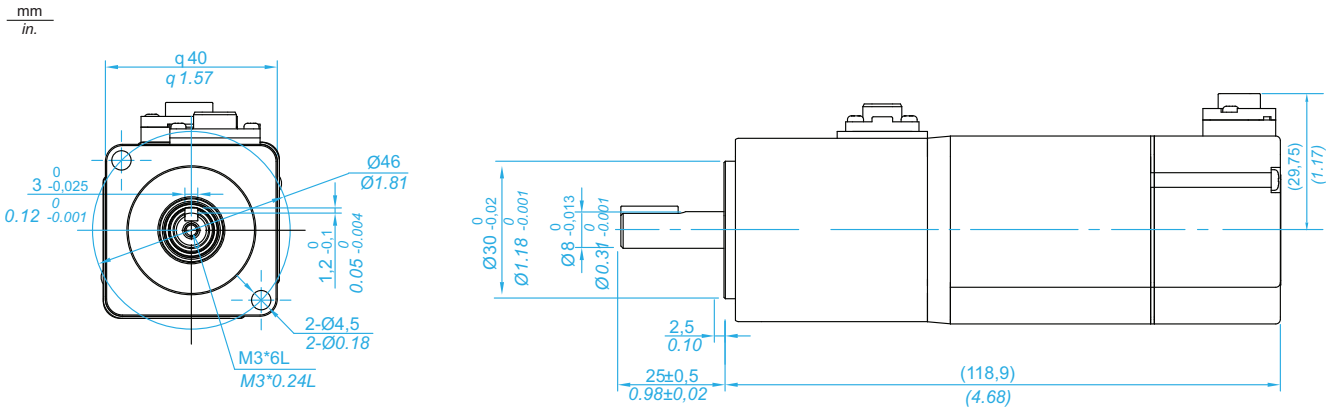




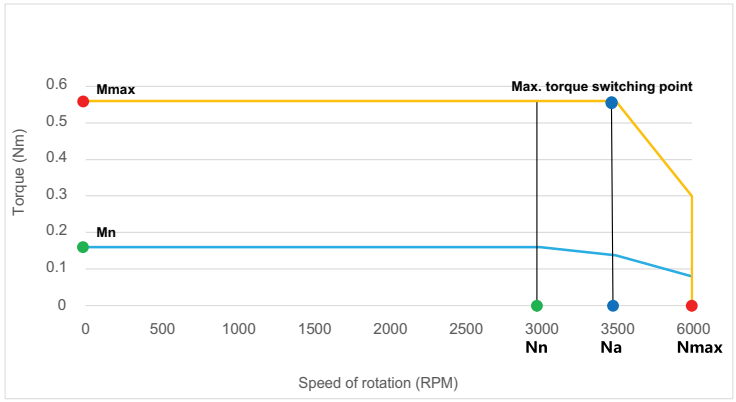
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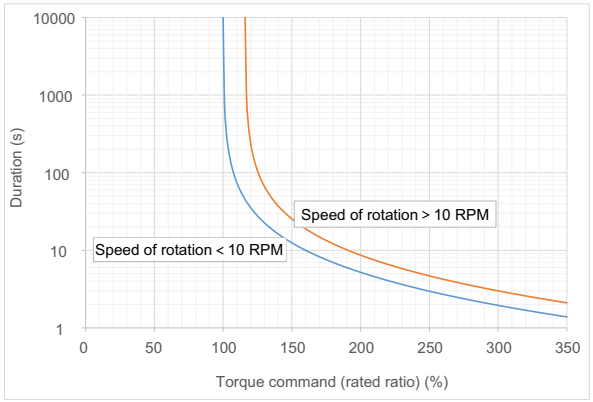


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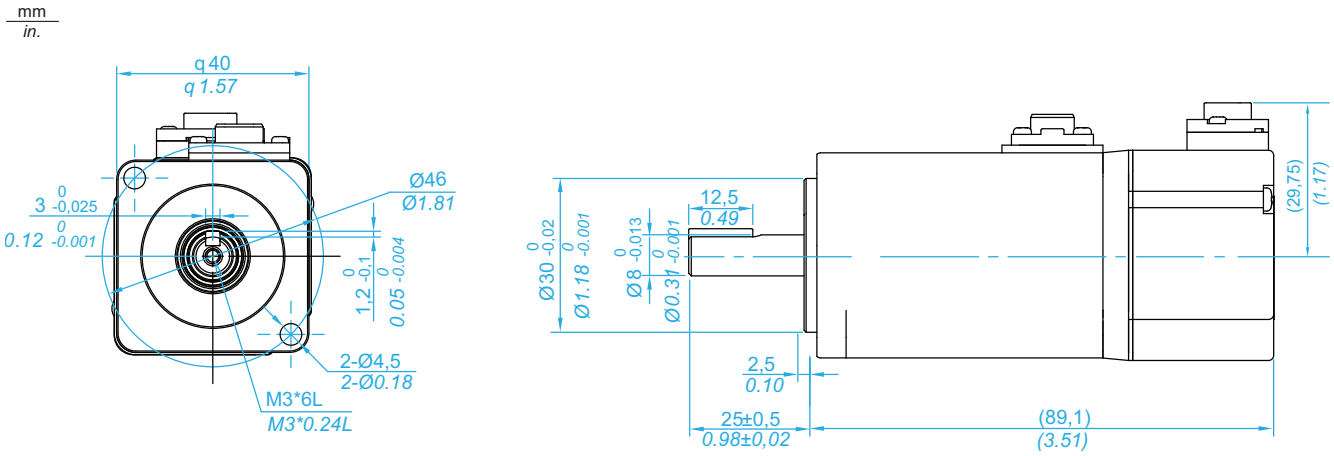


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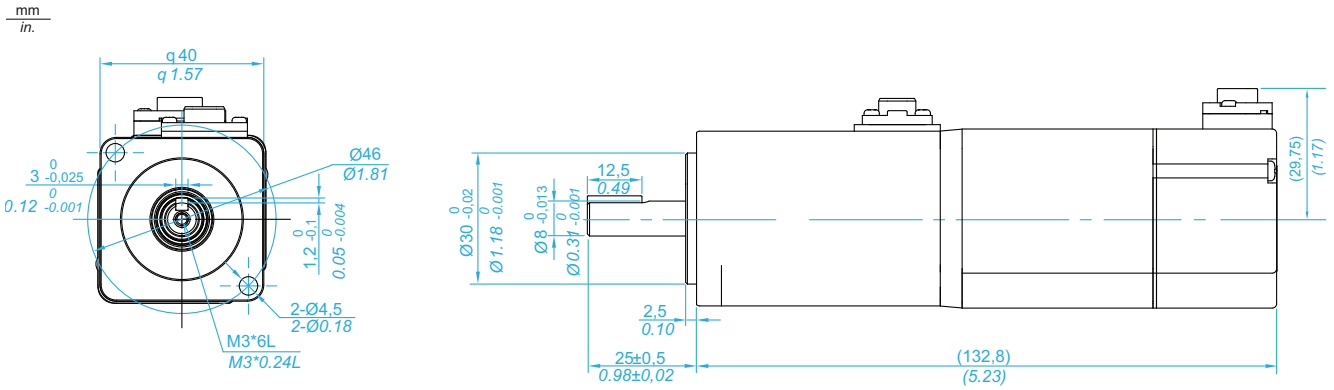




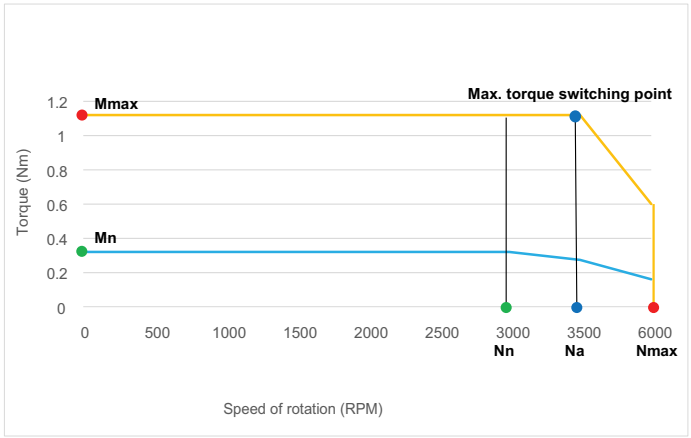
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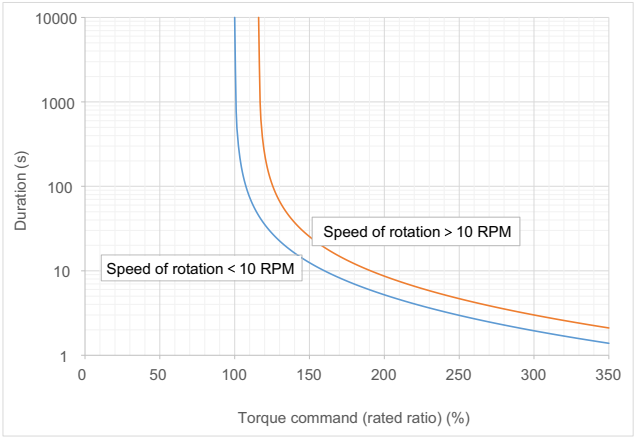


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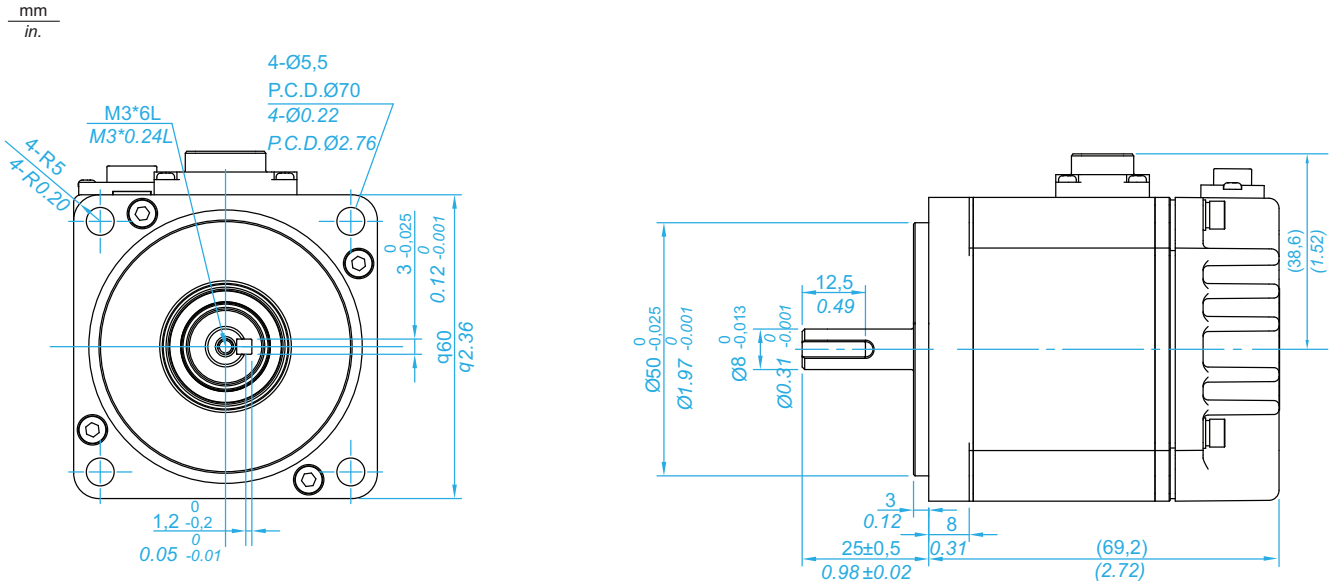


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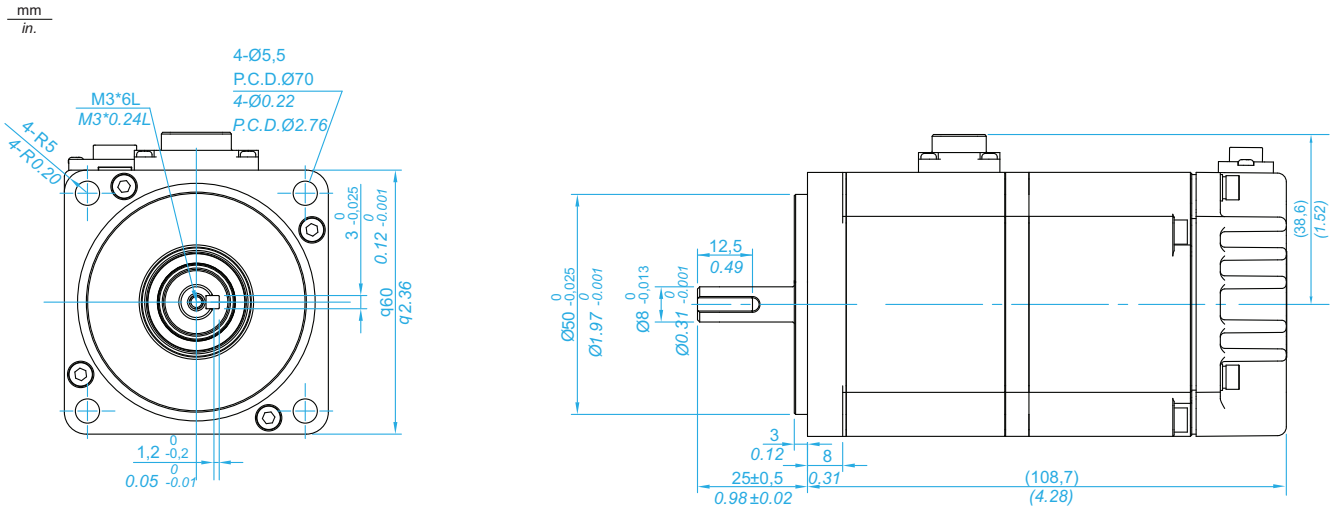




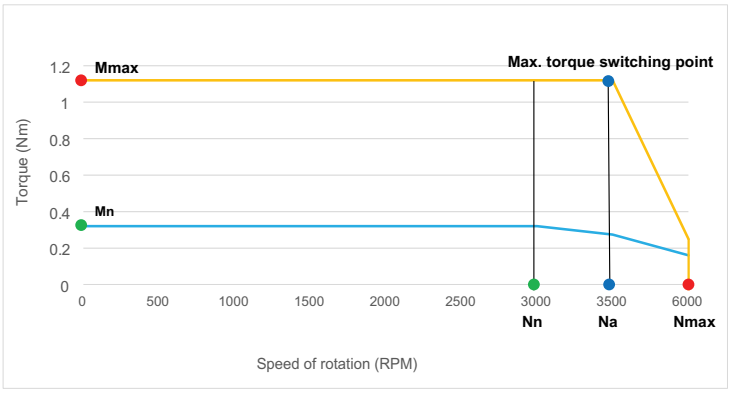
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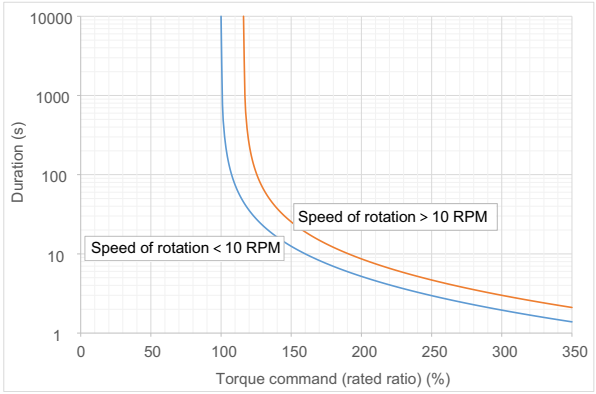


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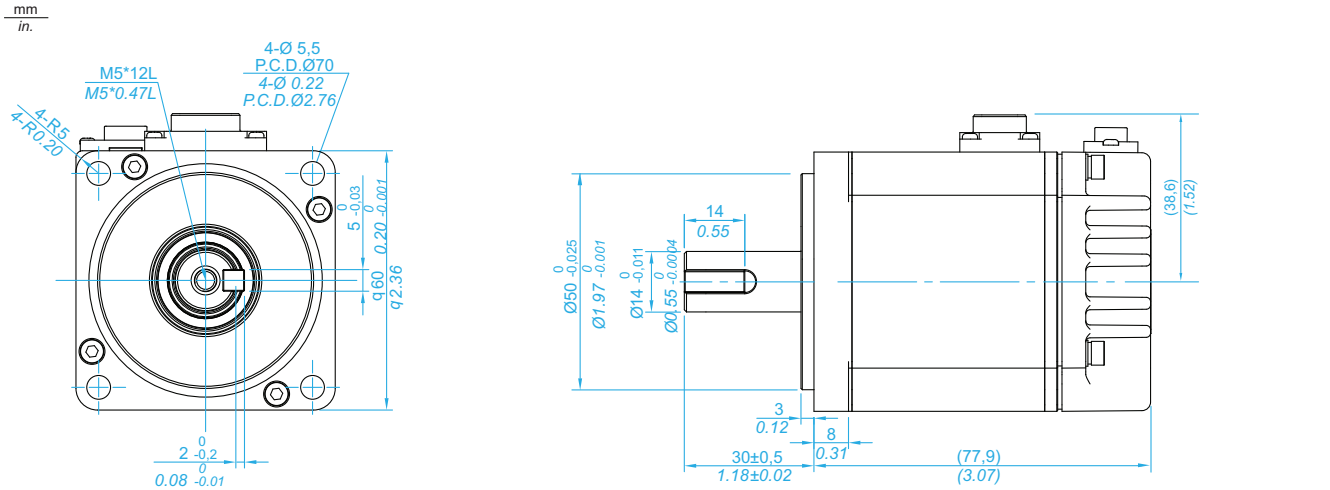


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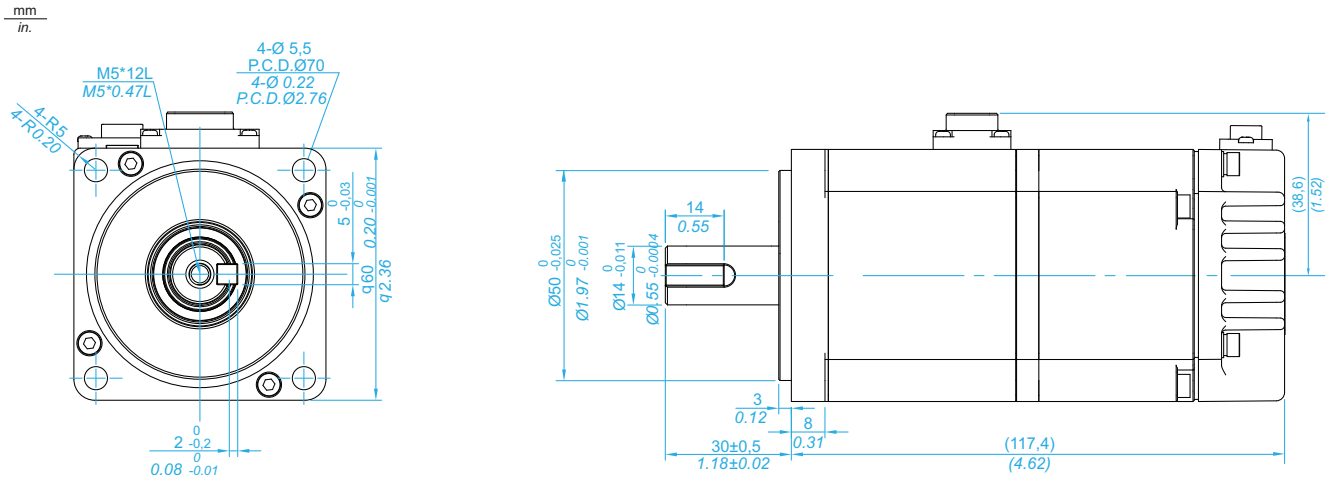




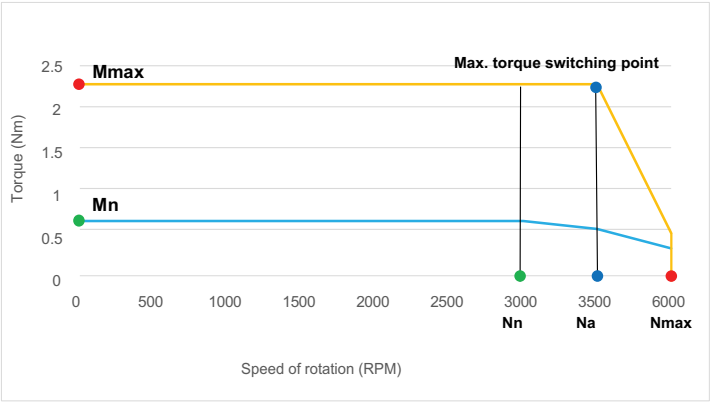
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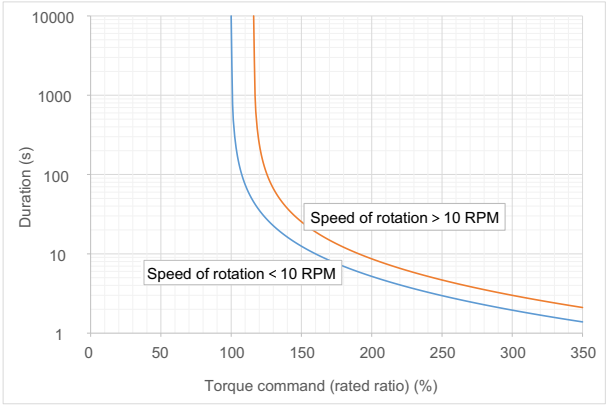


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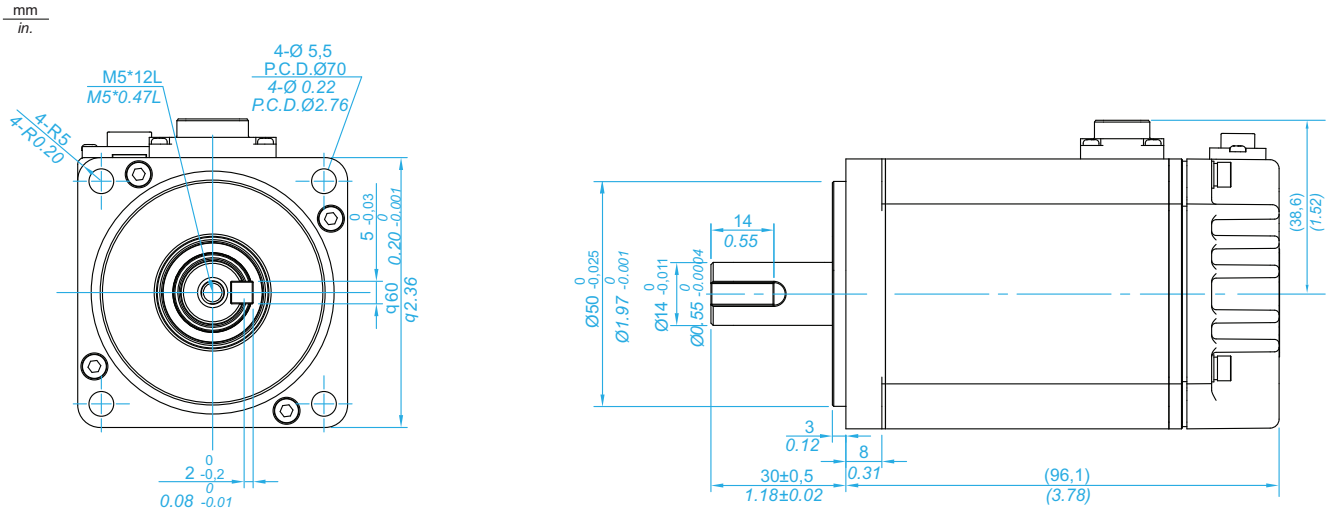


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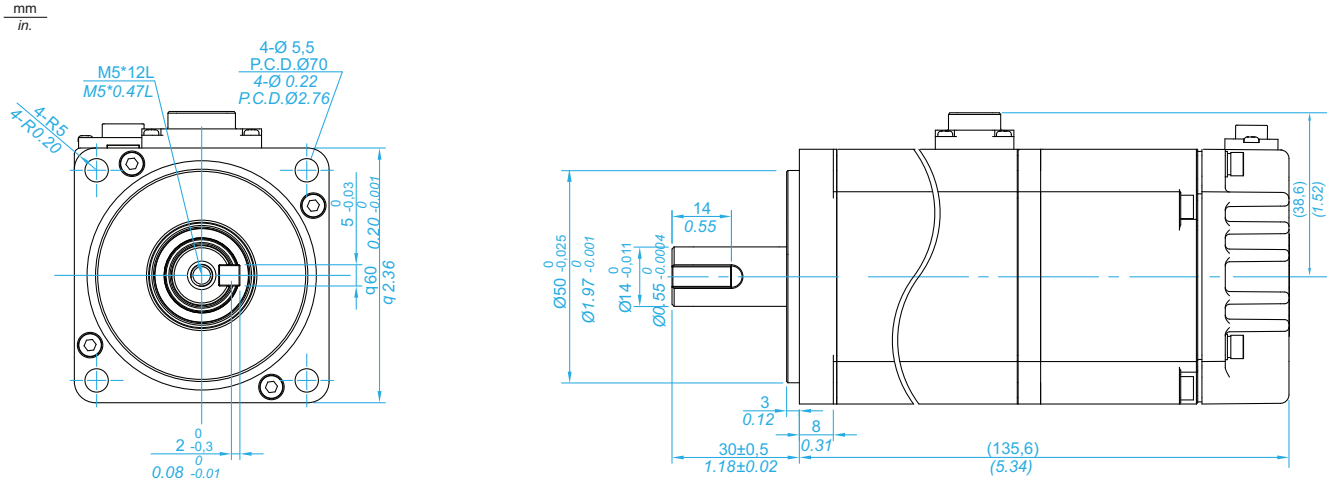




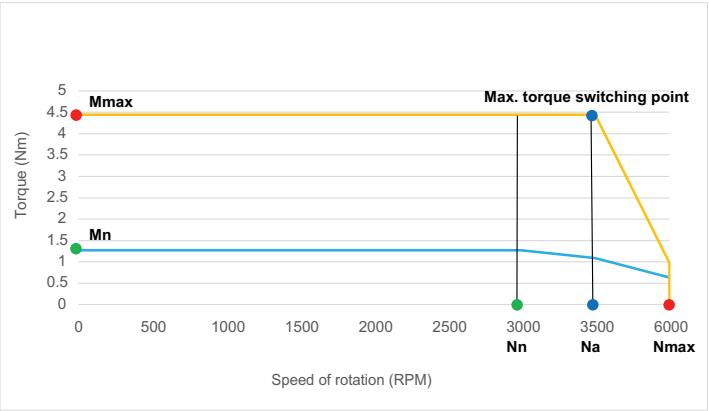
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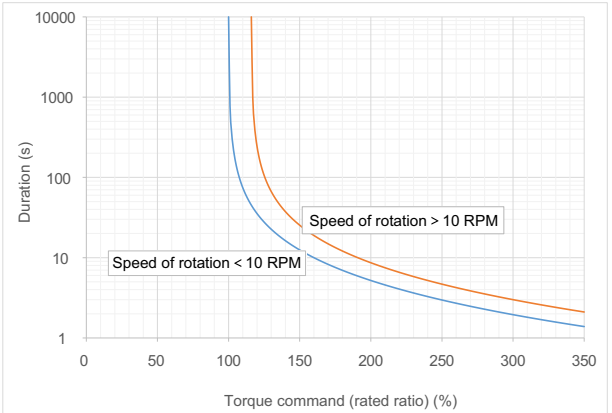


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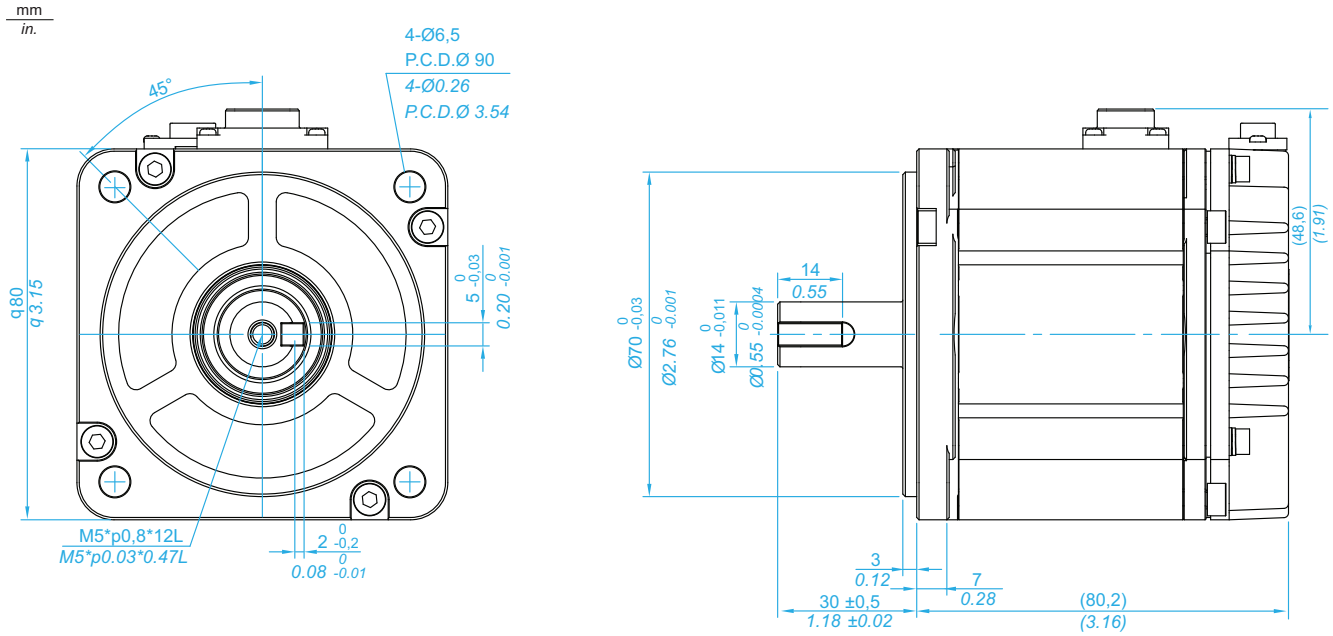


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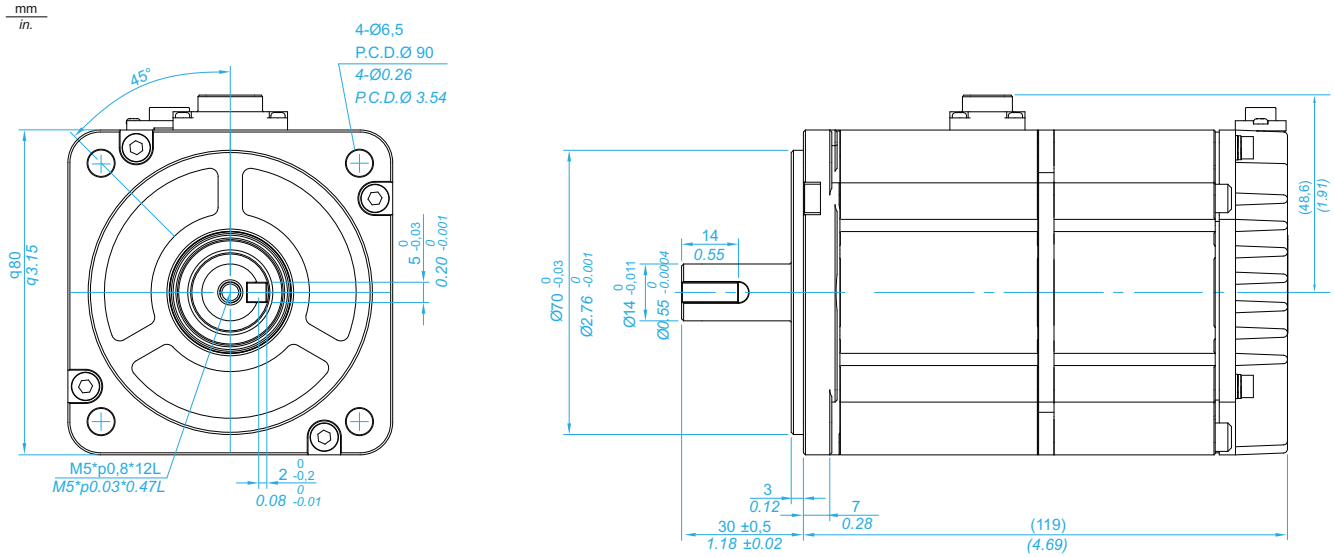




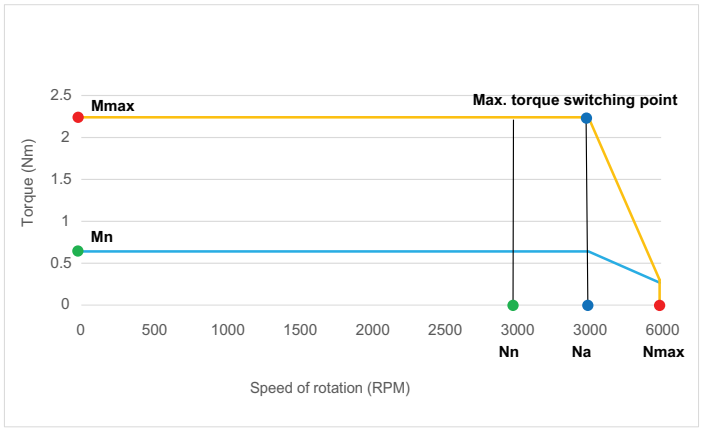
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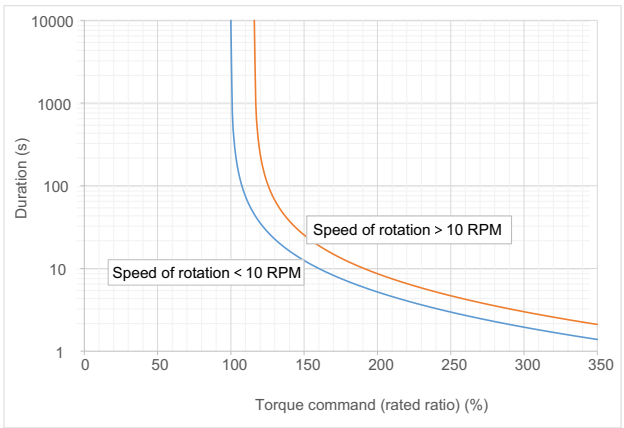


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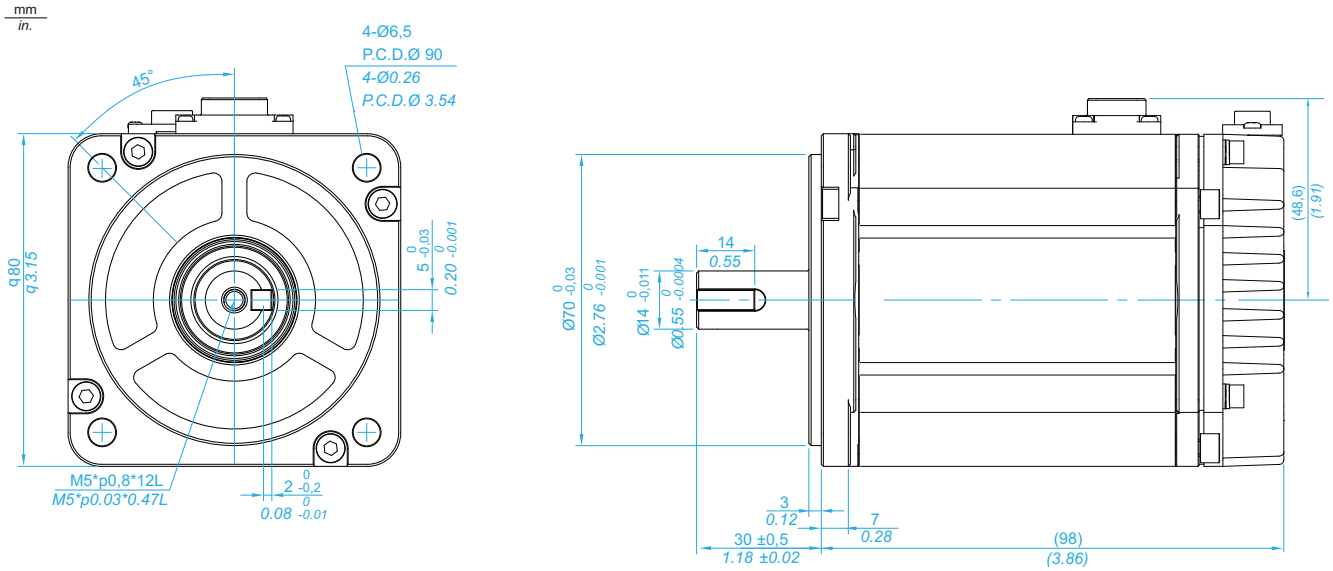


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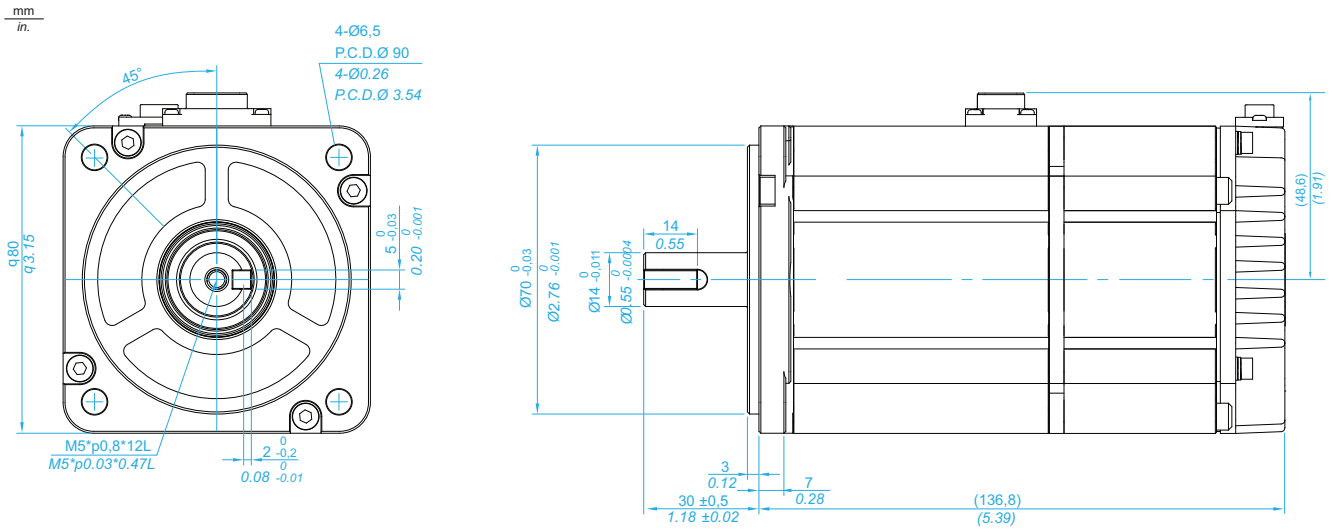




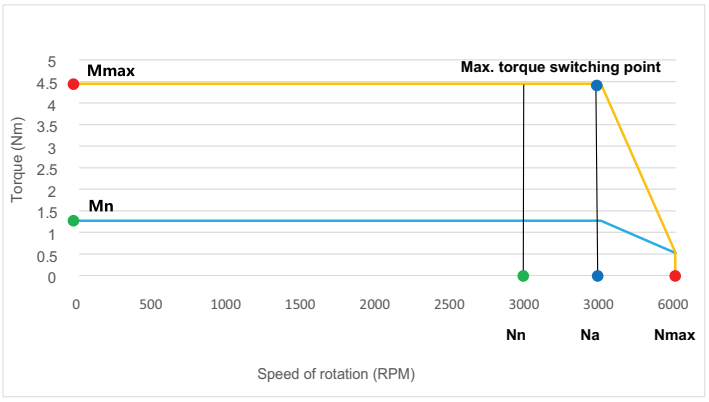
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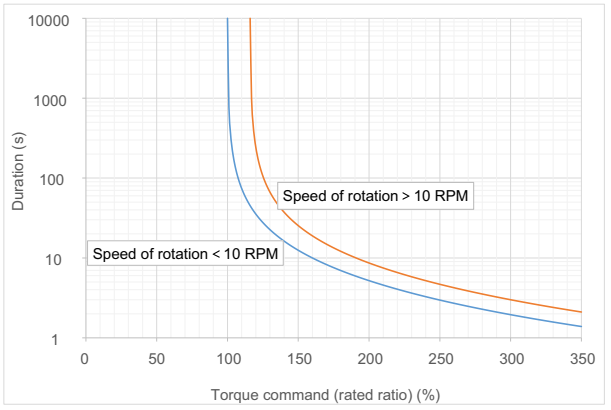


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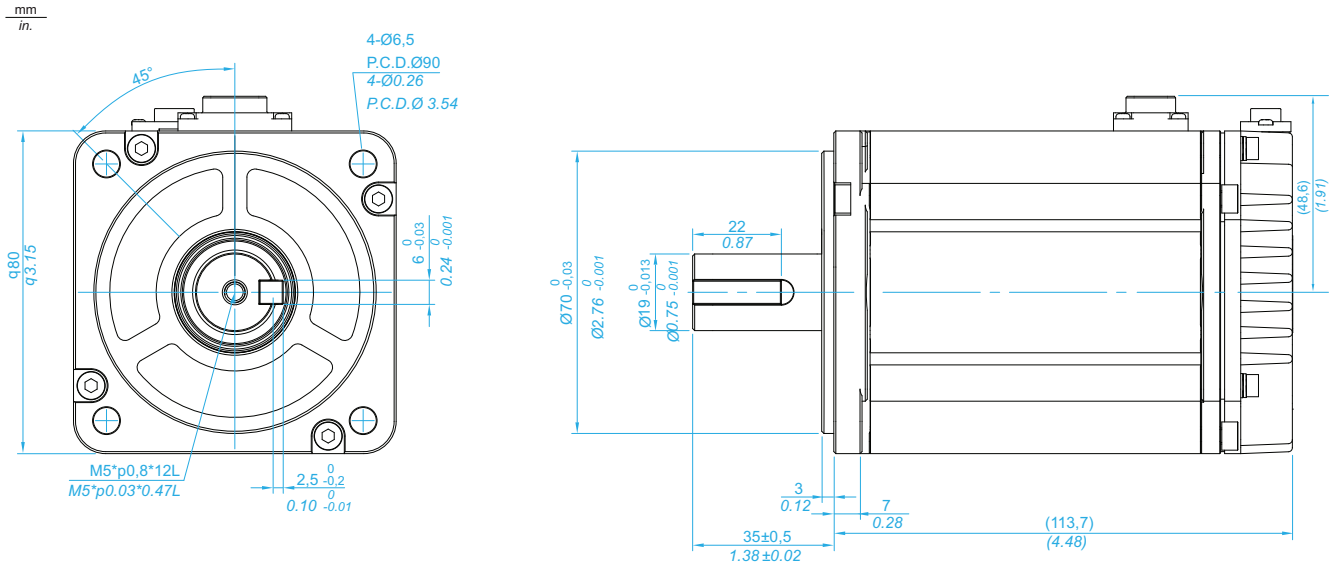


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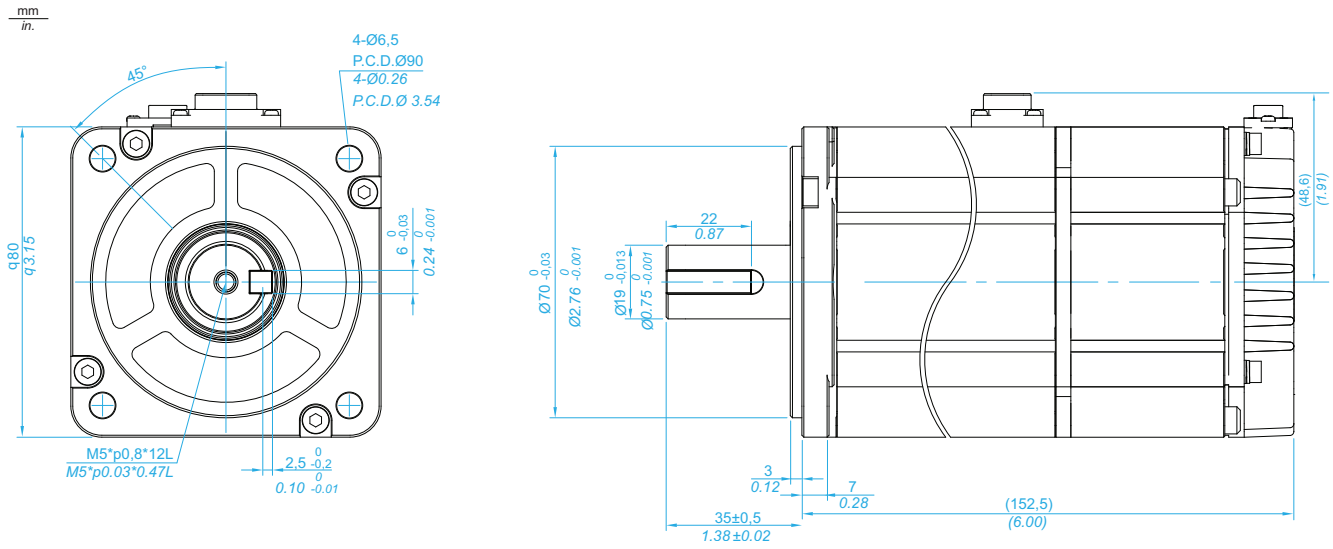




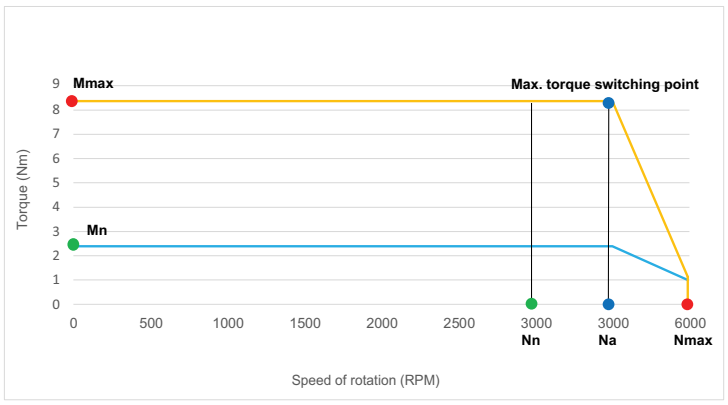
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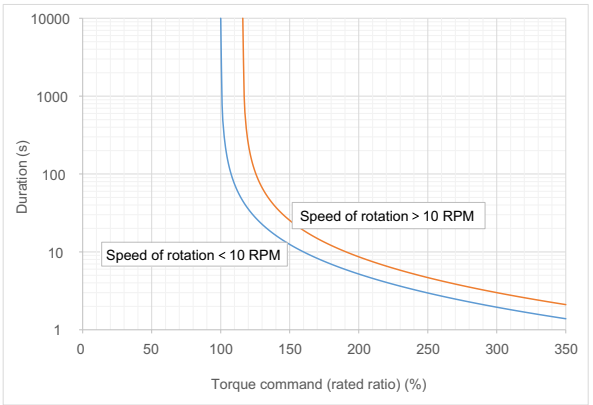


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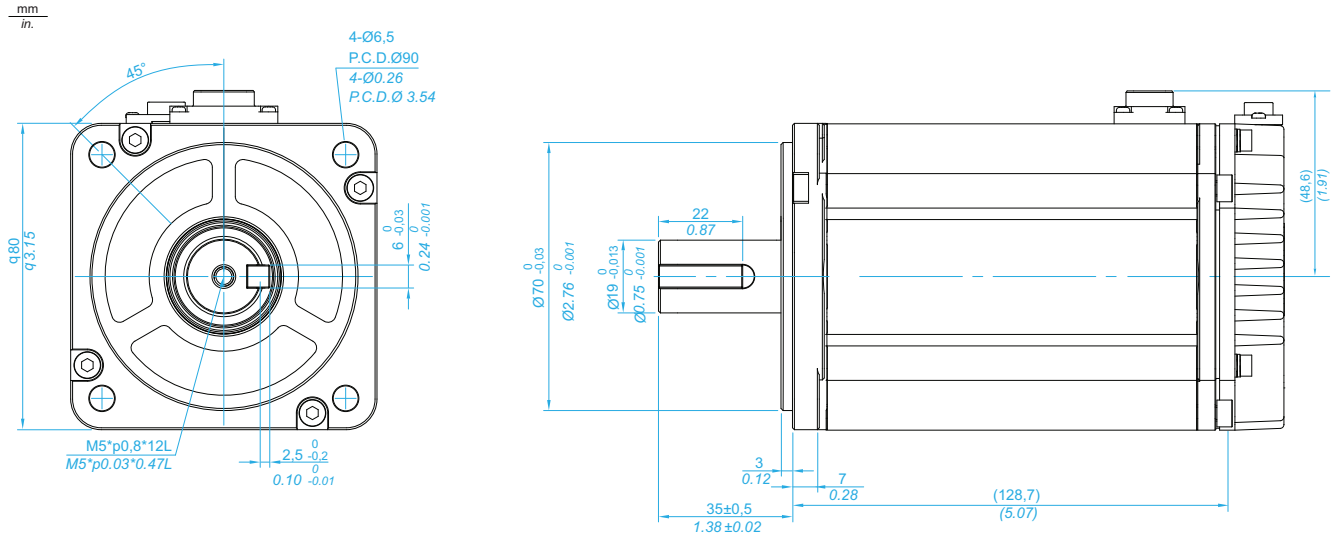


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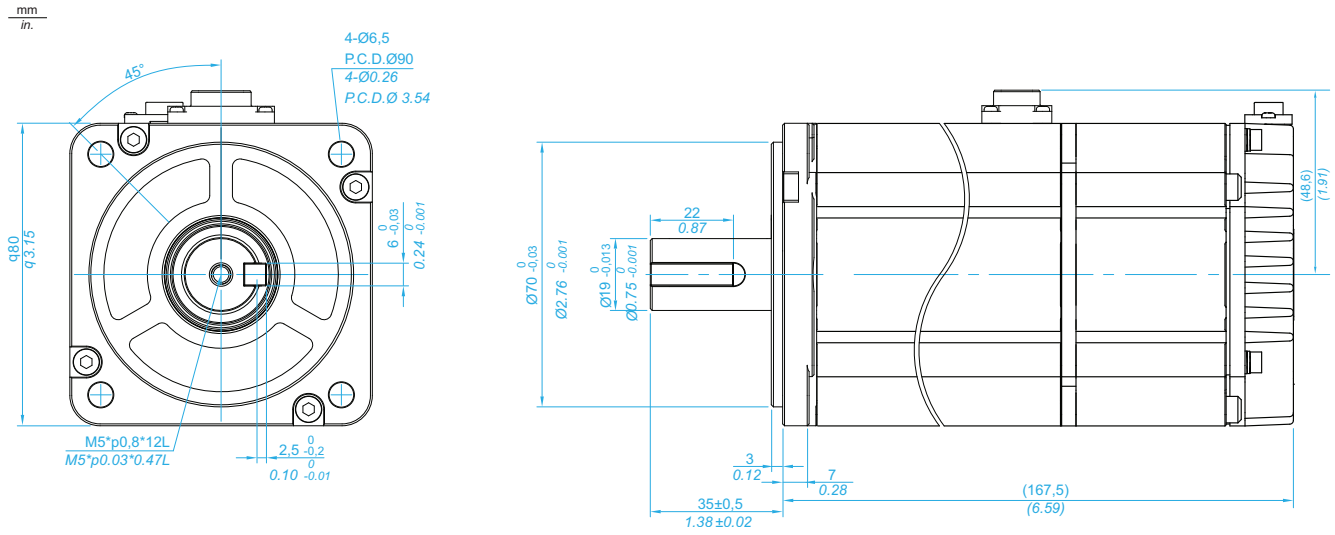




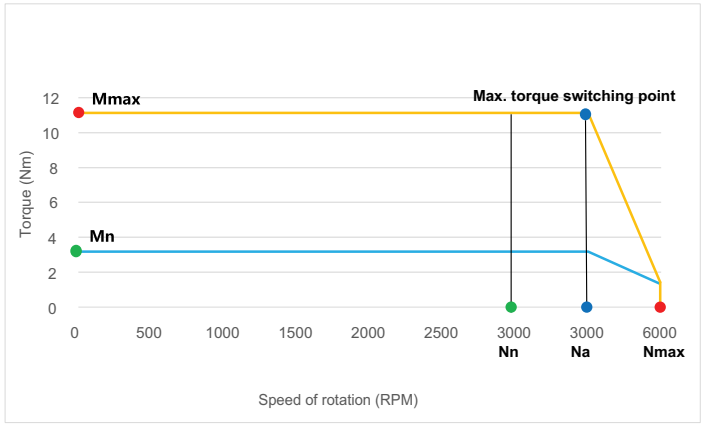
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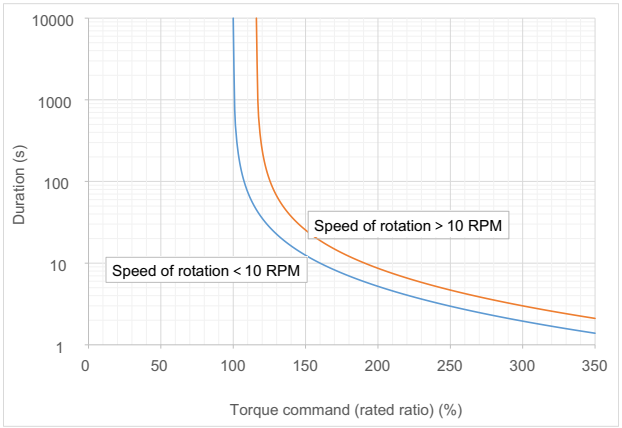


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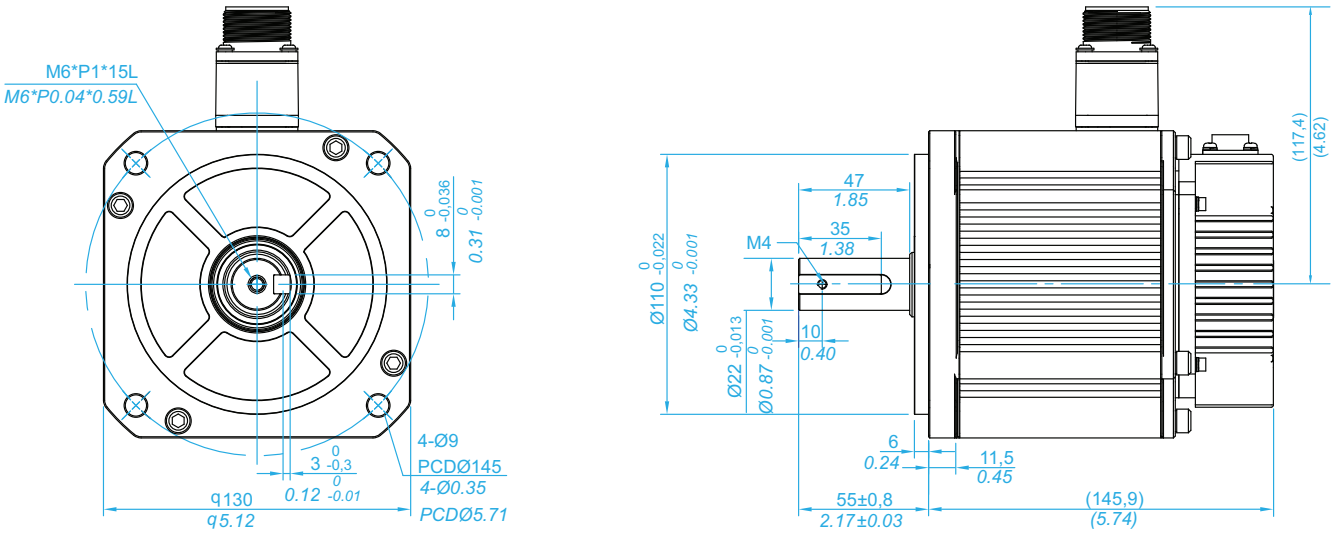
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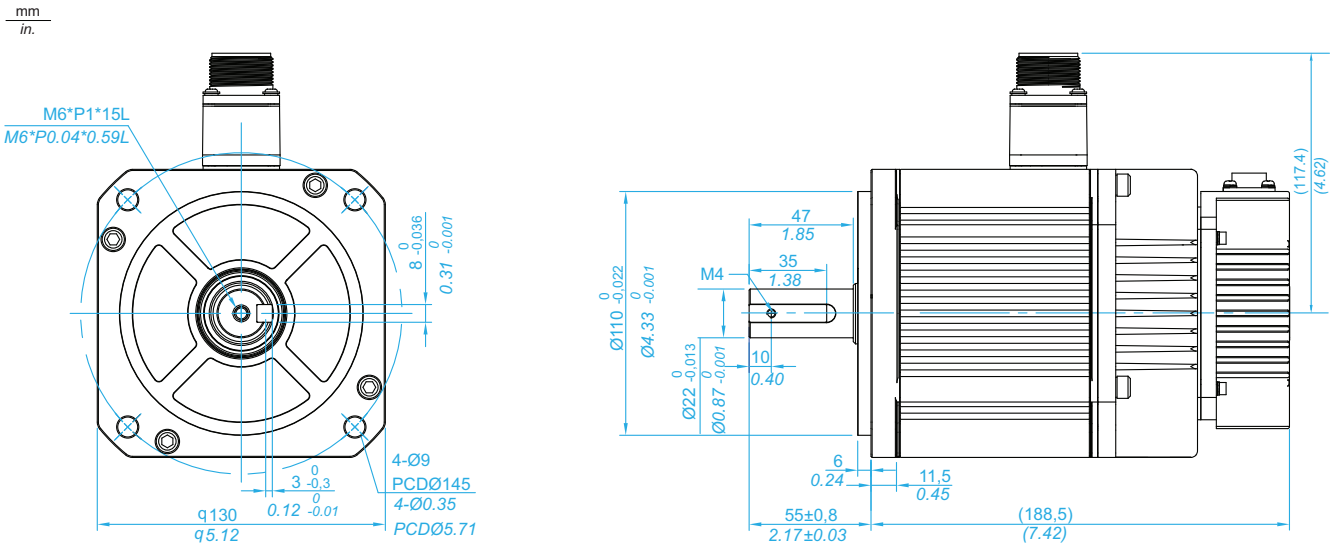
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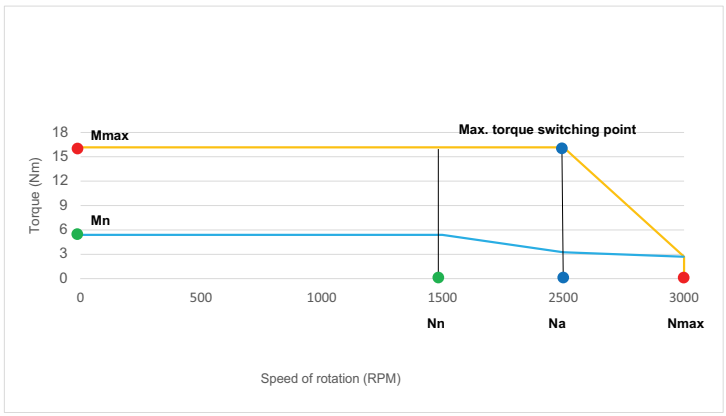


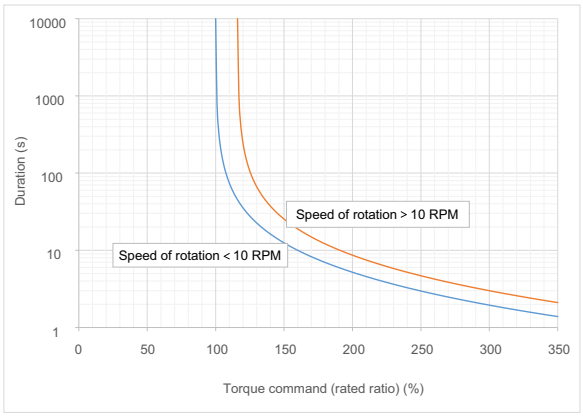
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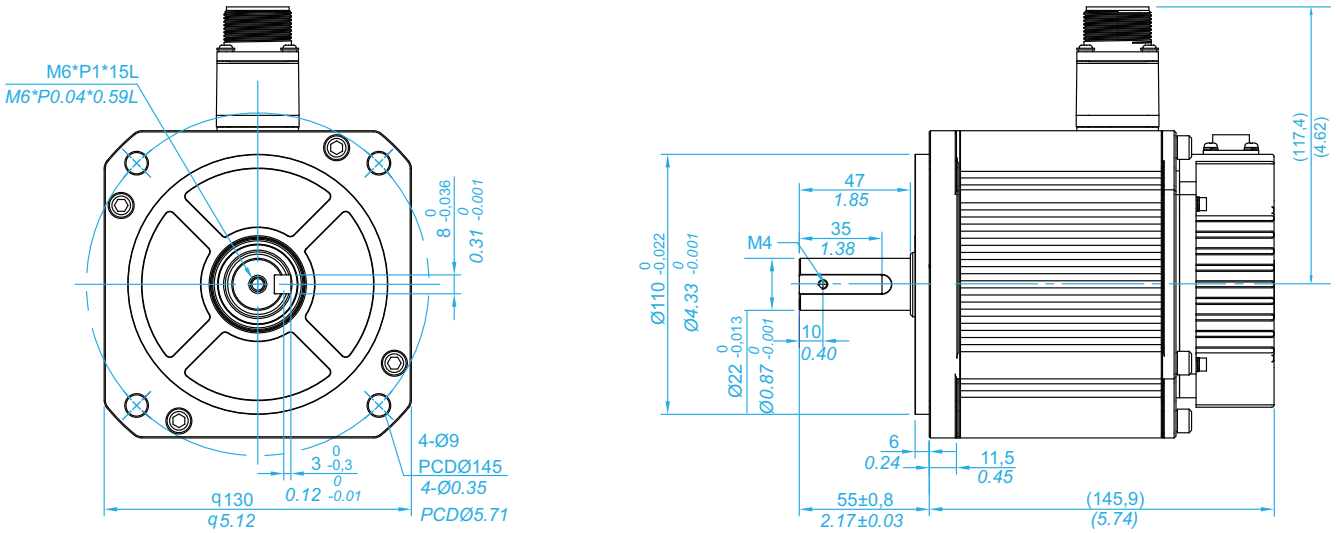
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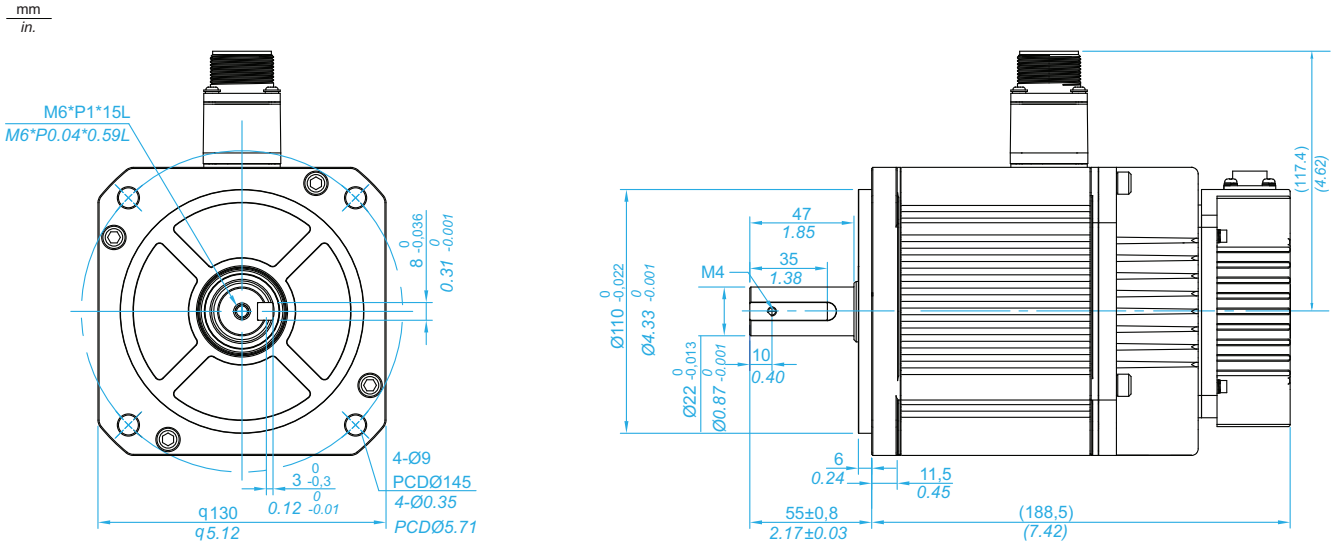
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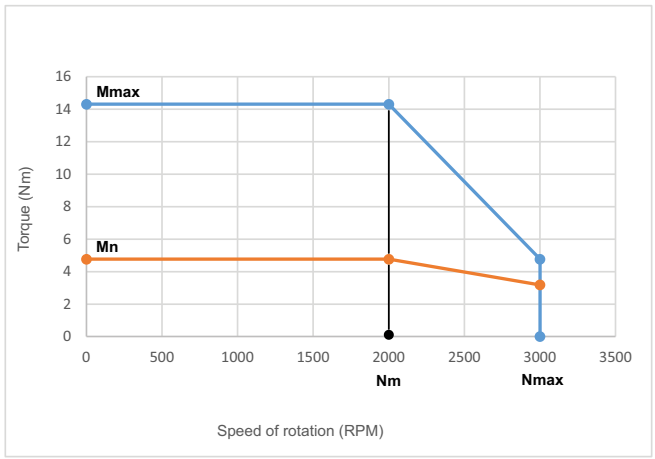


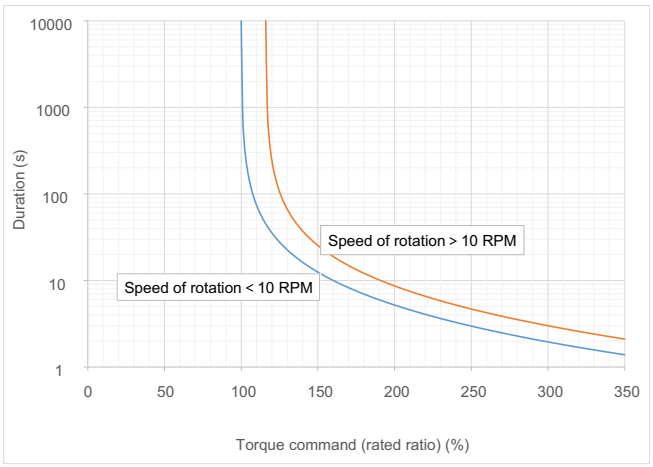
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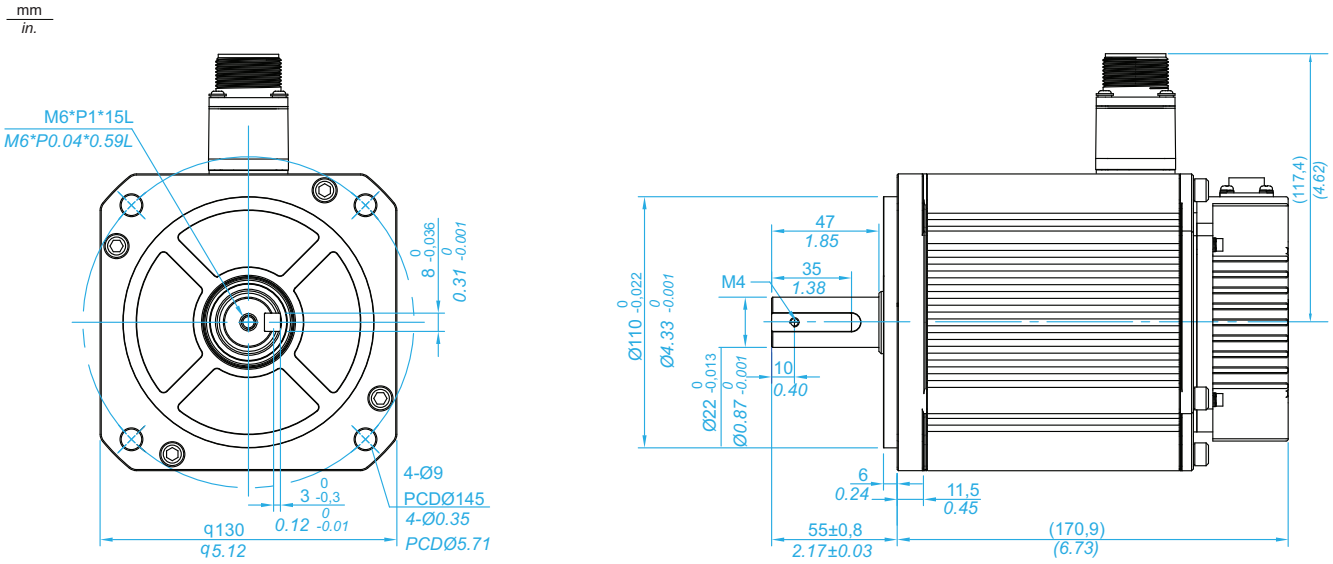


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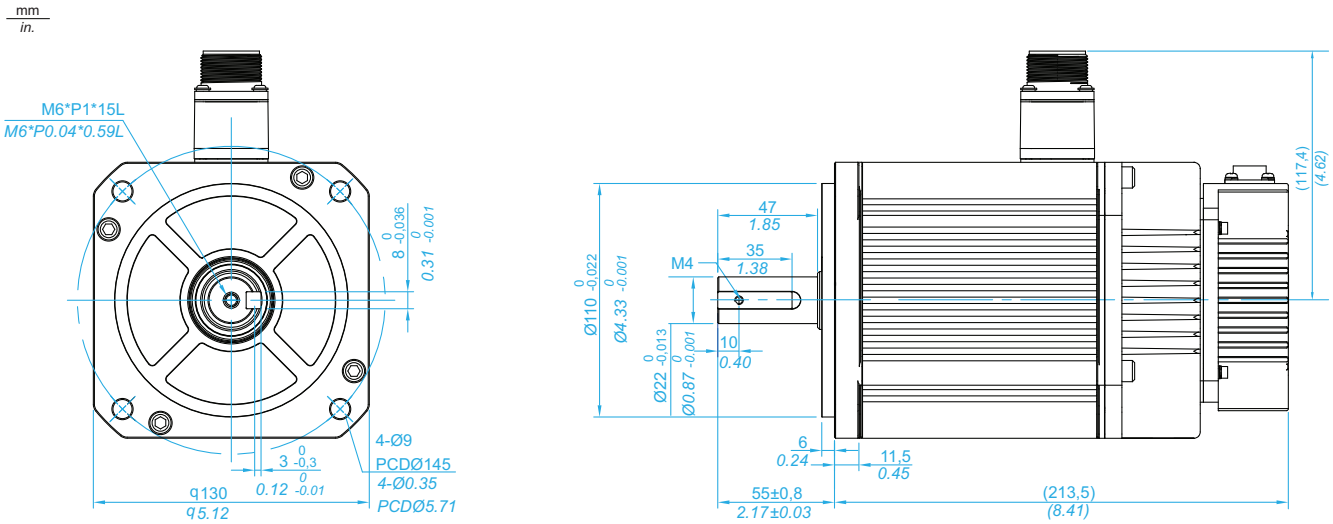




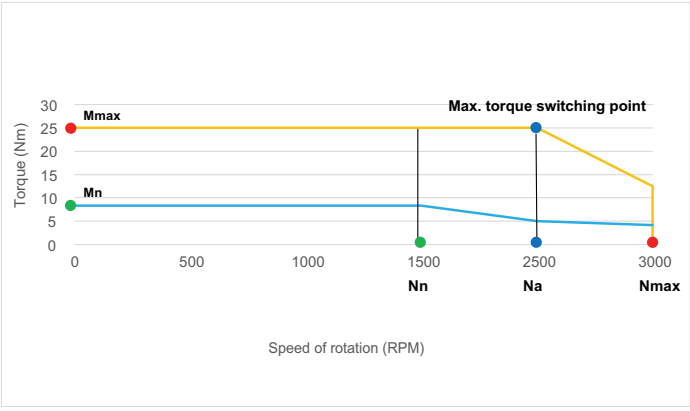
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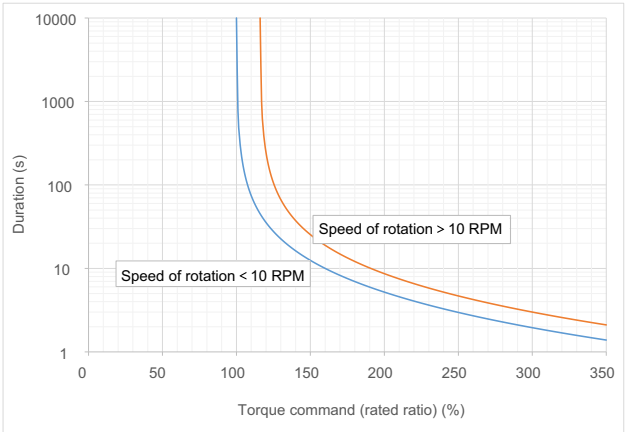


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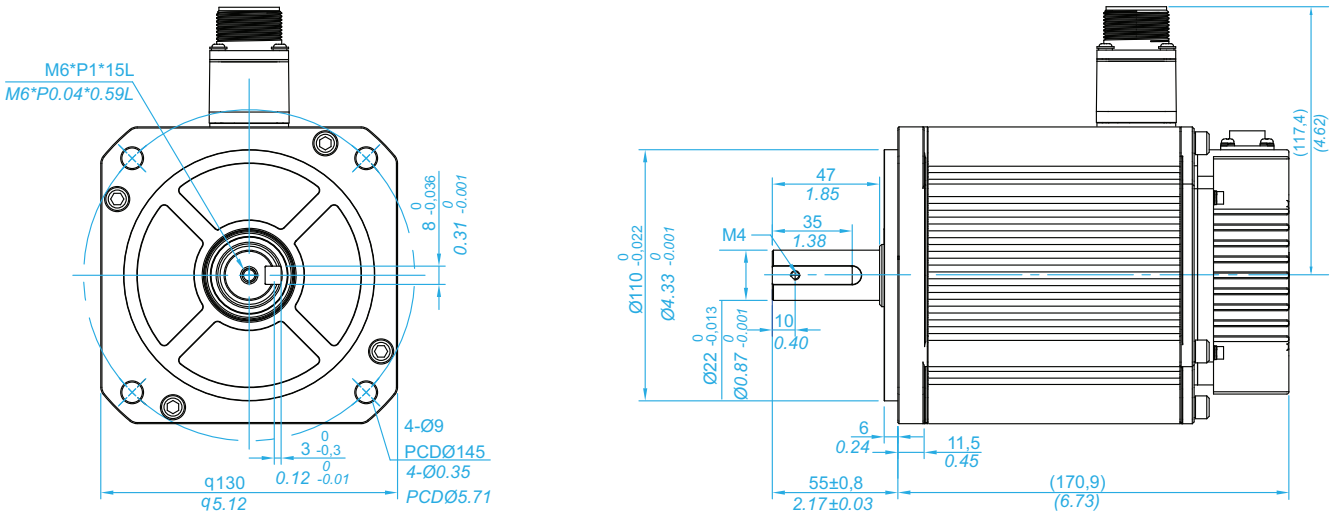
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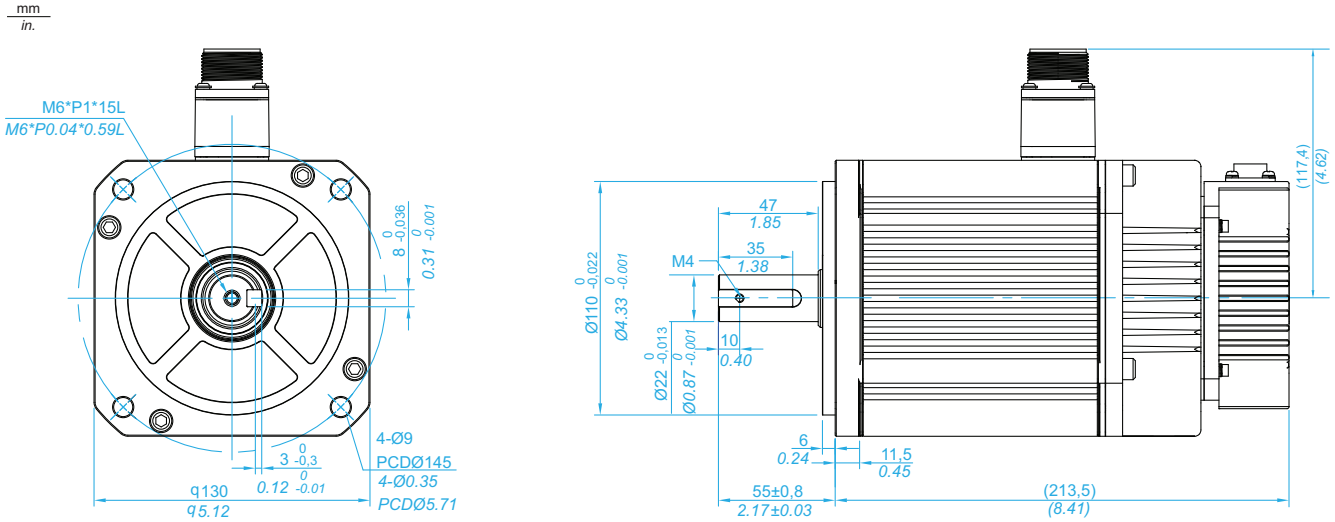
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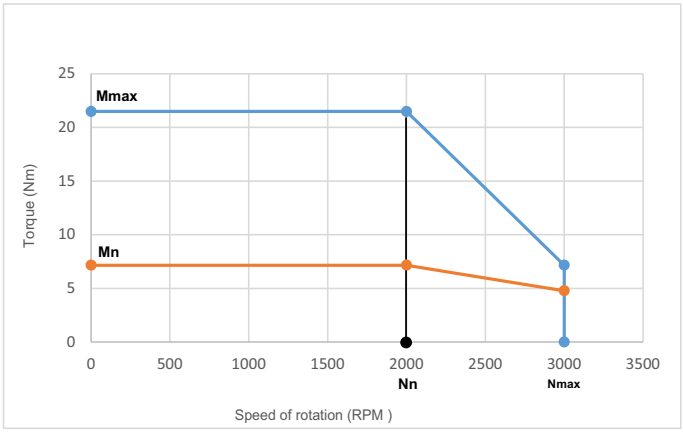


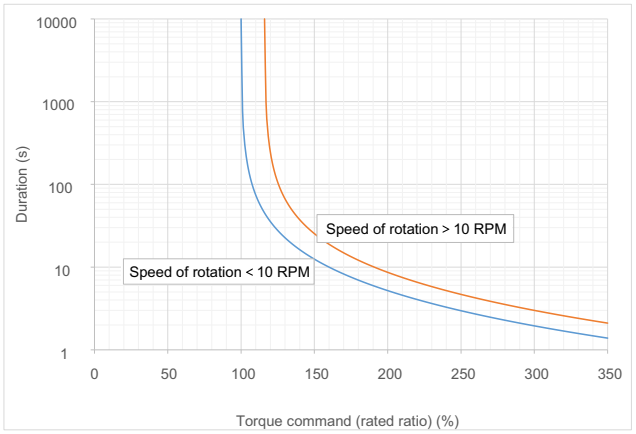
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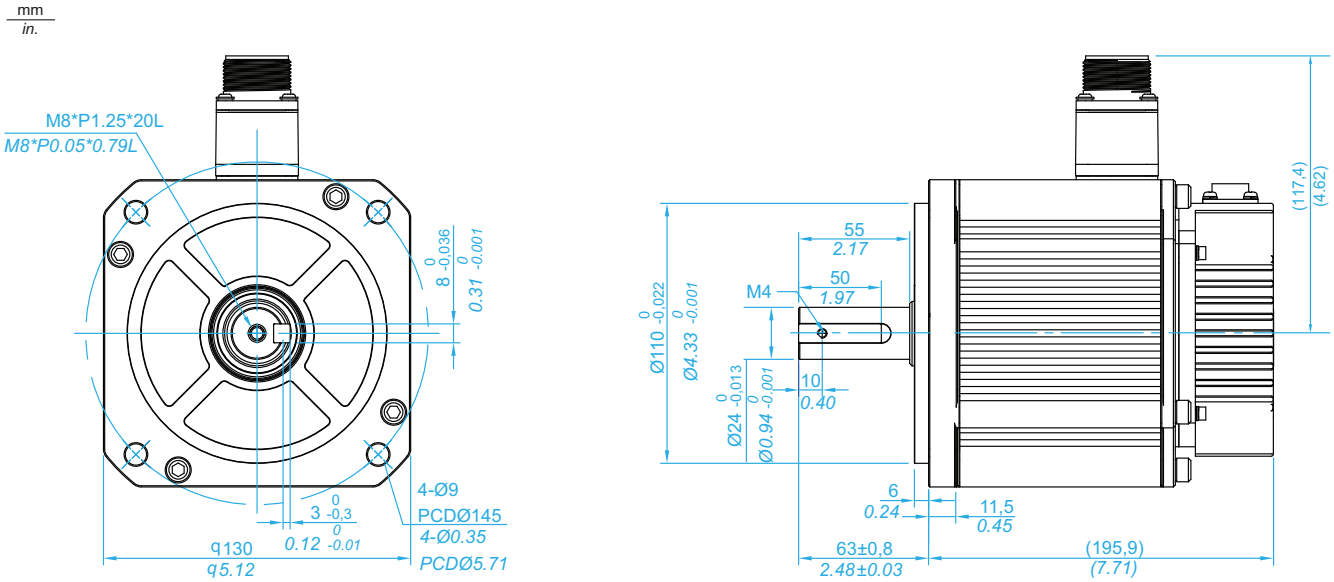


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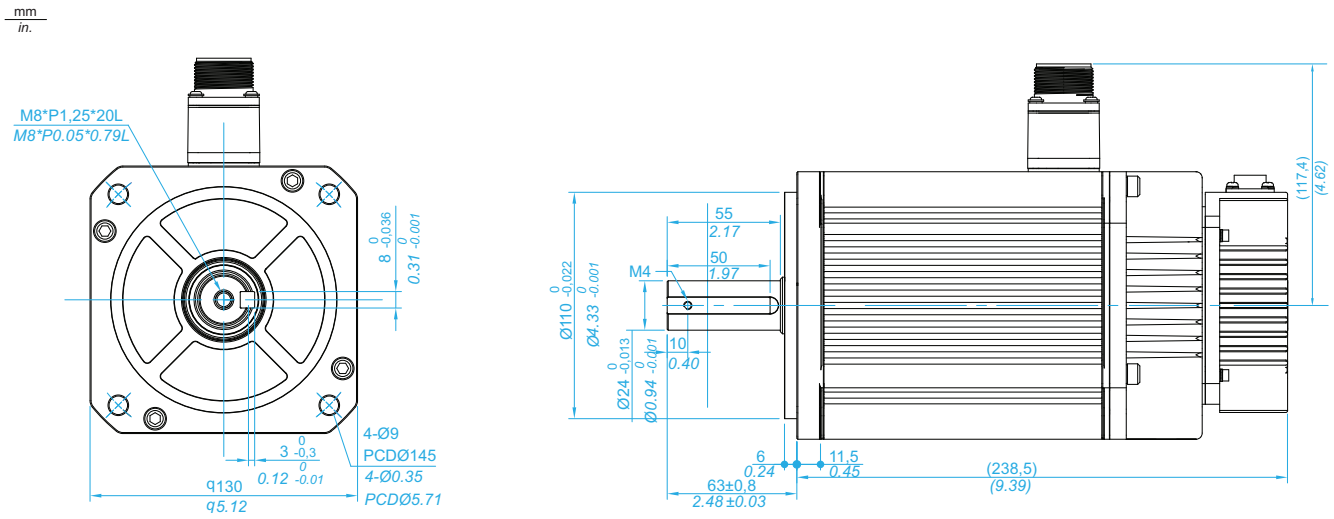




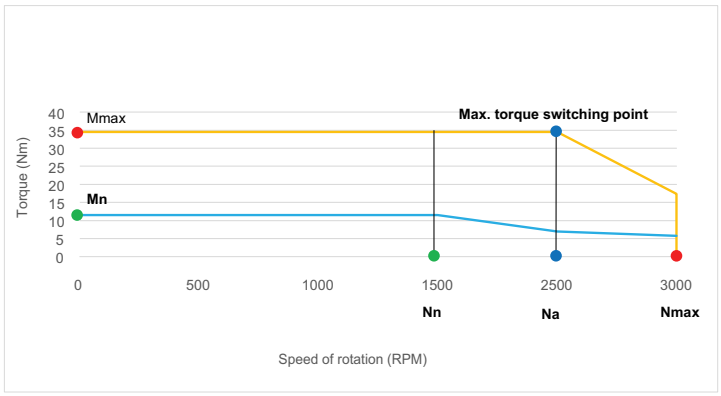
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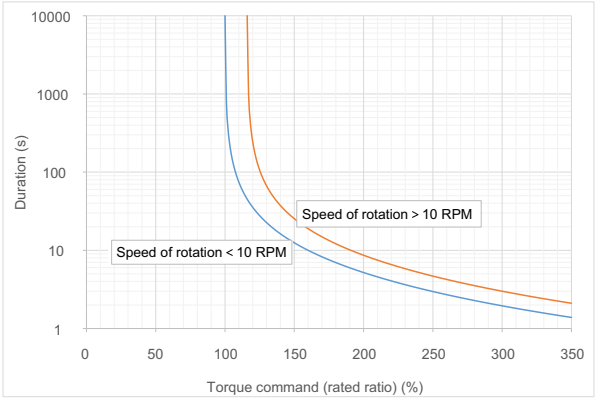


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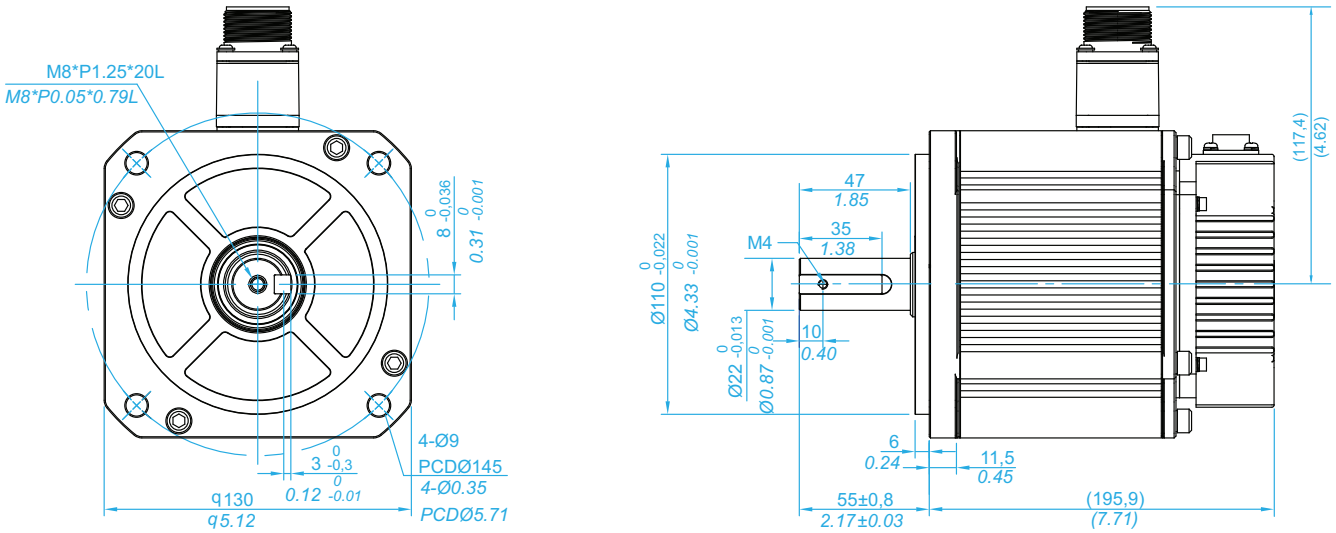
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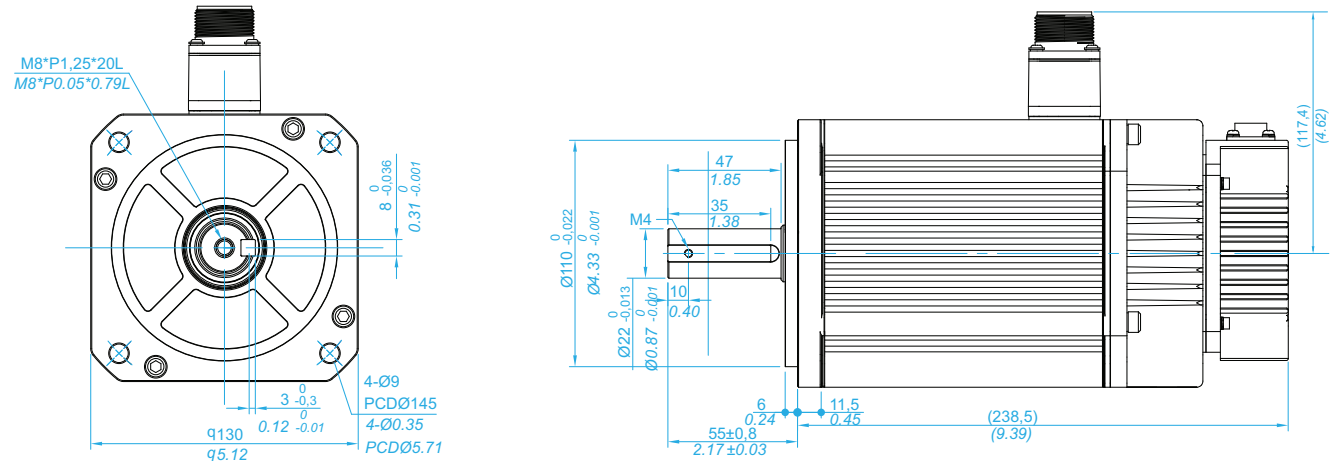
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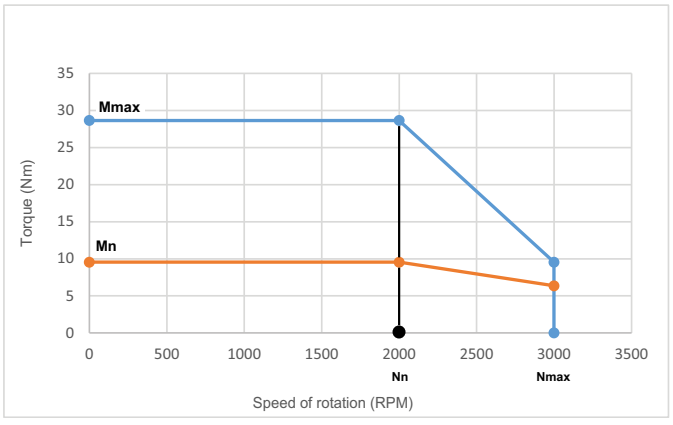


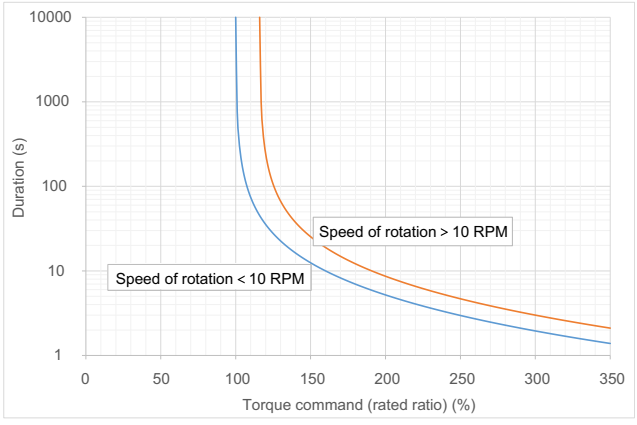
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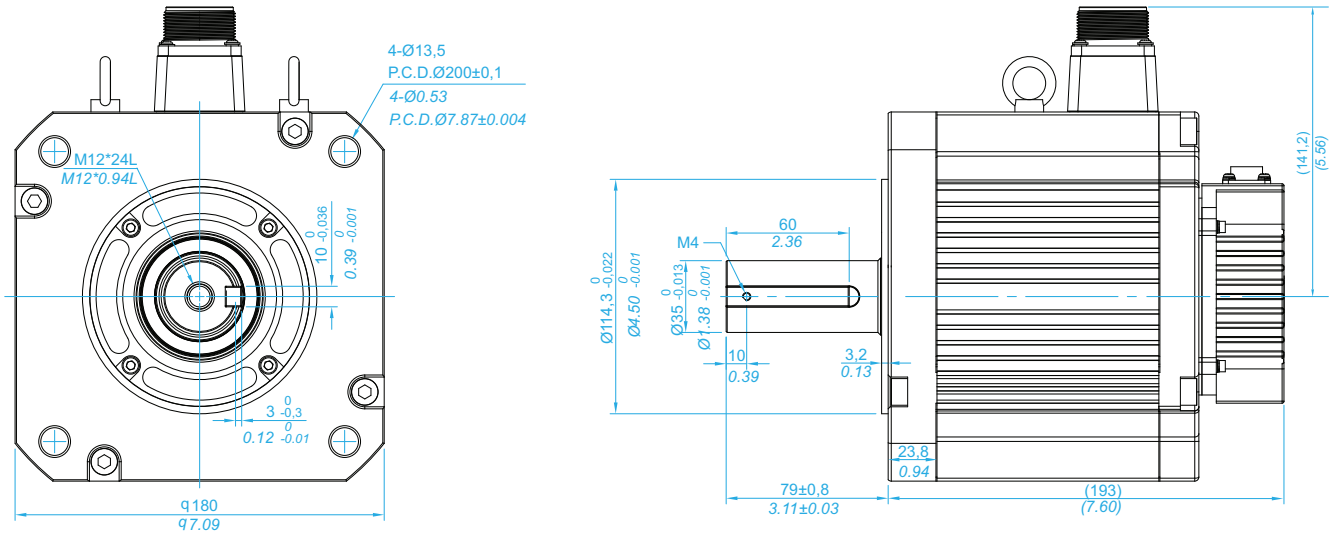
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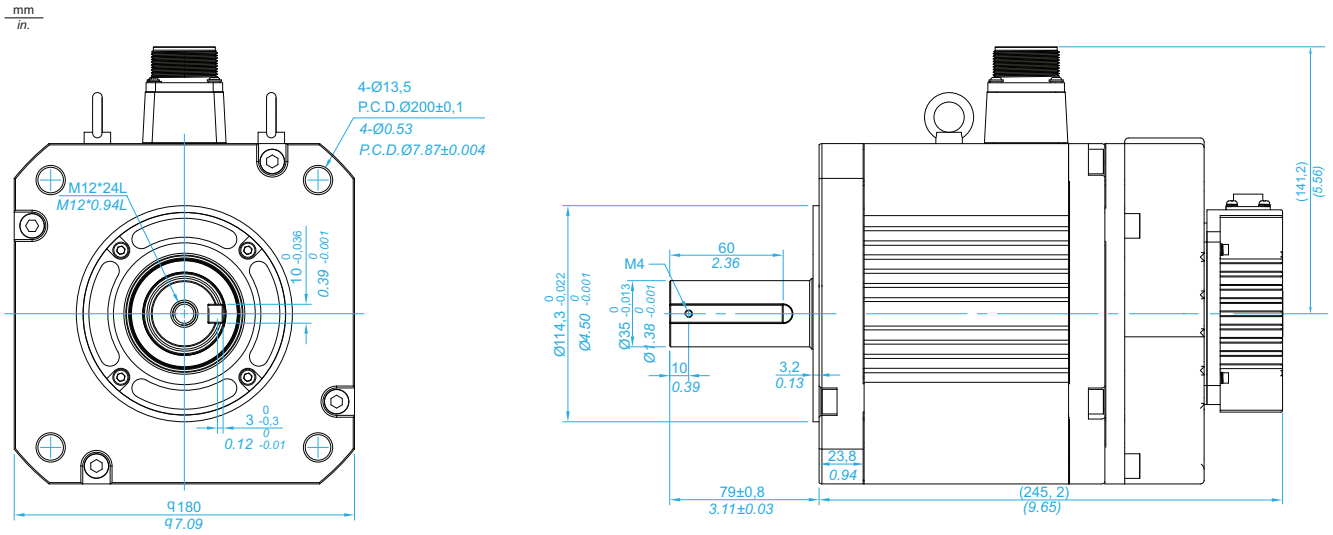
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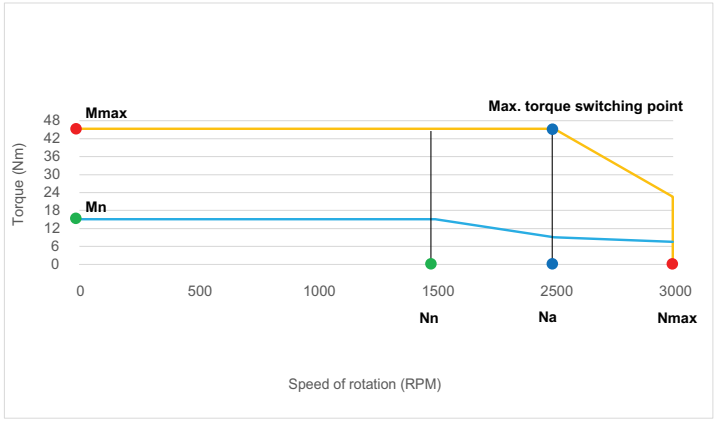


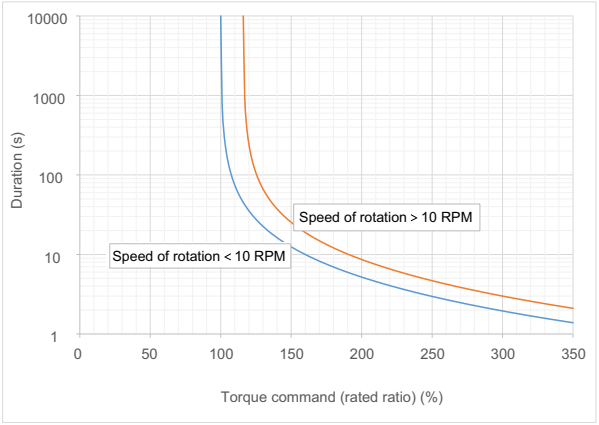
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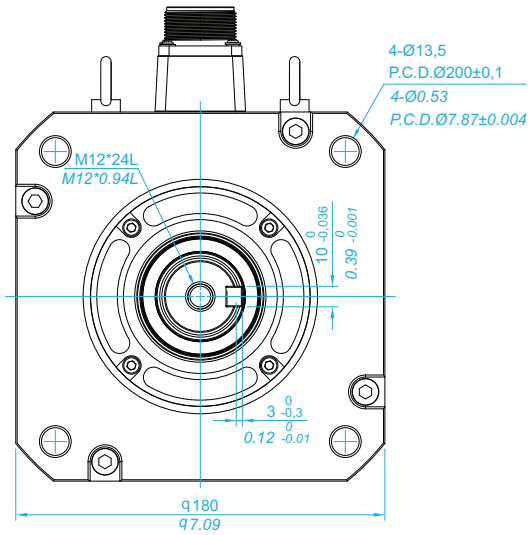
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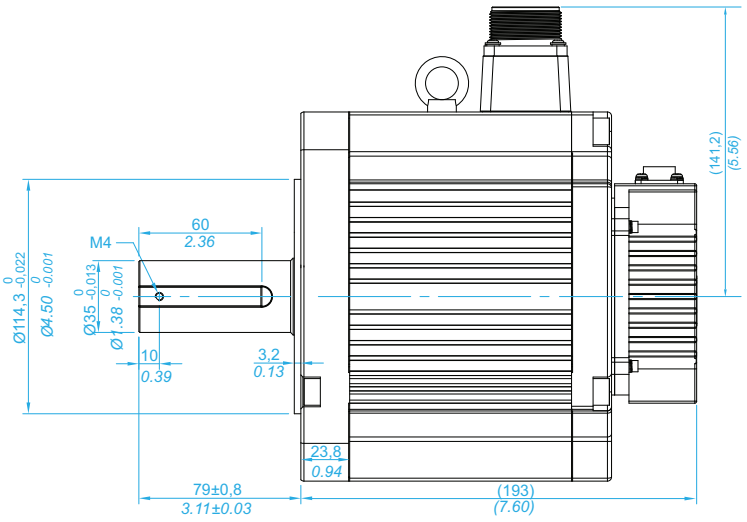




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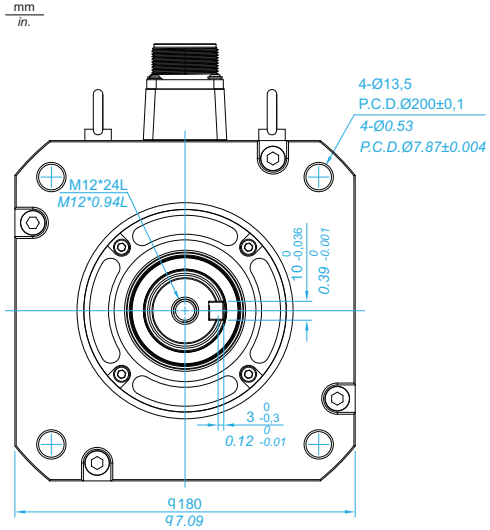
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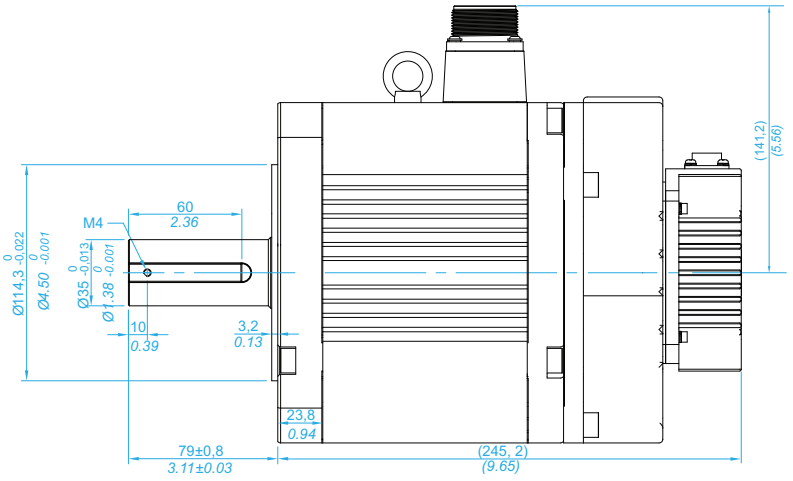




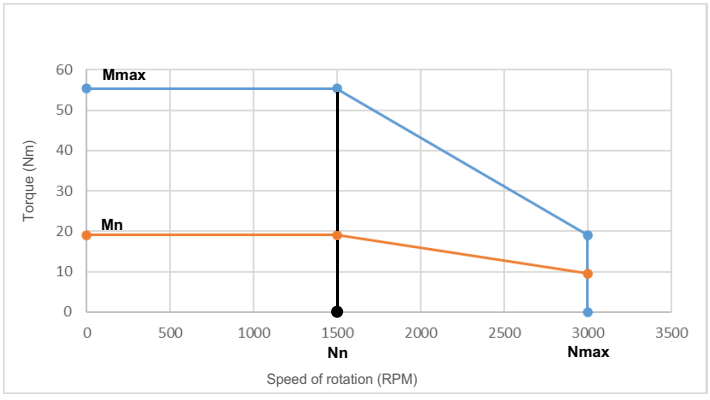
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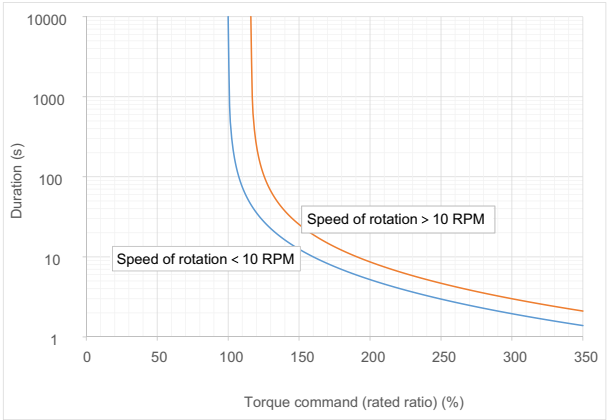
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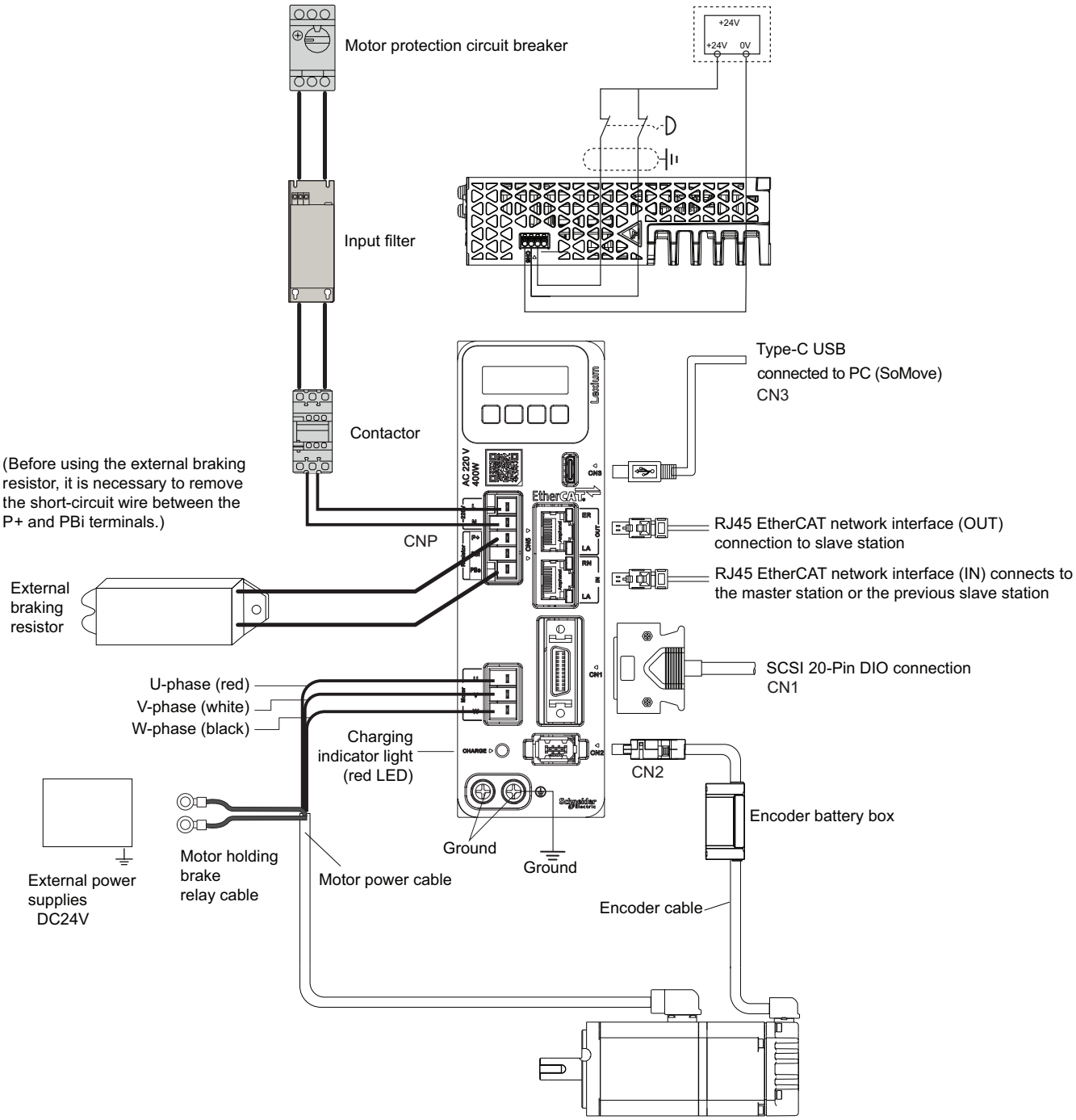
BCH18MR30





System Accessories

Example of Standard Connection Between Servo Systems and Peripheral Equipment



Designation	Description
CNP	Servo drive main circuit terminal
CN1	Servo drive signal interface
CN2	Servo drive encoder interface
CN3	Servo driver to host computer programming interface
CN5	EtherCAT interface
CN6	STO interface

List of Accessories

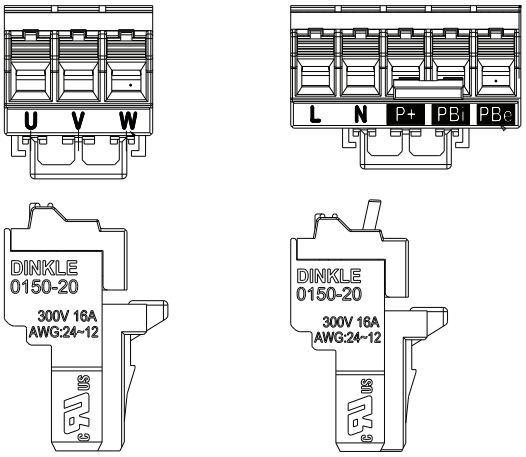
Type	Type	Description
Plug	VW3M4B01	Plug kit for servo drive power input and servo motor output
	VW3M4B12	Plug kit for servo drive CN1 control interfaces
	VW3M4B21	Plug kit for servo drive CN2 control interfaces
	VW3M5B10	Power plug kit for 40 mm (1.57 in) flange motors, plastic connector
	VW3M5B11	Power plug kit for 60-80 mm (2.36-3.15 in) flange motors, downstream forward, plastic connector
	VW3M5B12	Power plug kit for 60-80 mm (2.36-3.15 in) flange motors, downstream backward, plastic connector
	VW3M5B21	Power plug kit for 100-130 mm (3.94-5.12 in) flange motors, military connector
	VW3M5B22	Power plug kit for 180 mm (7.09 in) flange motors, military connector
	VW3M8B11	Encoder plug kit for 40-80 mm (1.57-3.15 in) flange motors, plastic connector
	VW3M8B21	Encoder plug kit for 100-180 mm (3.94-7.09 in) flange motors, military connector
	VW3M8B32	STO plug with insertion bridge

Type	Type	Description
Motor power cables	VW3M5B01R**	Motor power cables for 40 mm (1.57 in) flange motors, downstream forward, plastic connector 4G0.34 mm^2, optional length
	VW3M5B02R**	Motor power cables for 40 mm (1.57 in) flange motors, downstream forward, plastic connector, with holding brake control 6G0.34 mm^2, optional length
	VW3M5B03R**	Plastic connector motor power cables for 40 mm (1.57 in) flange motors, downstream backward 4G0.34 mm^2, optional length
	VW3M5B04R**	Motor power cables for 40 mm (1.57 in) flange motors, downstream backward, plastic connector, with holding brake control 6G0.34 mm^2, optional length
	VW3M5B11R**	Plastic connector motor power cables for 60...80 mm (2.36...3.15 in) flange motors, downstream forward 4G0.75 mm^2, optional length
	VW3M5B12R**	Motor power cables for 60...80 mm (2.36...3.15 in) flange motors, downstream forward, plastic connector, with holding brake control 4G0.75 mm^2+ 2*0.2 mm^2, optional length
	VW3M5B13R**	Plastic connector motor power cables for 60...80 mm (2.36...3.15 in) flange motors, downstream backward 4G0.75 mm^2, optional length
	VW3M5B14R**	Motor power cables for 60…80 mm (2.36...3.15 in) flange motors, downstream backward, plastic connector, with holding brake control 4G0.75 mm^2+ 2*0.2 mm^2, optional length
	VW3M5B21R**	Motor power cables for 100...130 mm (3.94...5.12 in) flange motors, military connector 4G1.5 mm^2, optional length
	VW3M5B22R**	Motor power cables for 100...130 mm (3.94...5.12 in) flange motors, military connector, with holding brake control 4G0.75 mm^2+ 2*0.2 mm^2, optional length
	VW3M5B31R**	Motor power cables for 100...130 mm (3.94...5.12 in) flange motors, military connector 4G2.5 mm^2, optional length
	VW3M5B32R**	Motor power cables for 100...130 mm (3.94...5.12 in) flange motors, military connector, with holding brake control 4G2.5 mm^2+ 2*0.5 mm^2, optional length
	VW3M5B41R**	Military connector motor power cables for 180 mm (7.09 in) flange motors 4G2.5 mm^2, optional length
	VW3M5B42R**	Military connector motor power cables for 180 mm (7.09 in) flange motors, with holding brake control 4G2.5 mm^2+ 2*0.5 mm^2, optional length

Type	Type	Description
Motor encoder cables	VW3M8B11R**	Encoder cable for 40…80 mm flange motors, downstream forward (single turn, without battery) 2*0.5 mm^2+ 2*0.25 mm^2, optional length
	VW3M8B12R**	Encoder cable for 40…80 mm flange motors, downstream forward (multi-turn)
		2*0.5 mm^2+ 4*0.25 mm^2, optional length
	VW3M8B13R**	Encoder cable for 40…80 mm flange motors, downstream backward (single turn, without battery) 2*0.5 mm^2+ 2*0.25mm^2, optional length
	VW3M8B14R**	Encoder cable for 40…80 mm flange motors, downstream backward (multi-turn)
		2*0.5 mm^2+ 4*0.25 mm^2, optional length
	VW3M8B16R**	Encoder cable for 40…80 mm flange motors, battery forward (multi-turn)
		2*0.5 mm^2+ 4*0.25 mm^2, optional length
	VW3M8B18R**	Encoder cable for 40…80 mm flange motors, battery backward (multi-turn)
		2*0.5 mm^2+ 4*0.25 mm^2, optional length
	VW3M8B21R**	Encoder cable for 100...180 mm flange motors (single turn, without battery) 2*0.5 mm^2+ 2*0.25mm^2, optional length
	VW3M8B22R**	Encoder cable for 100...180 mm flange motors (thread CMV1, multi-turn)
		2*0.5 mm^2+ 4*0.25 mm^2, optional length
	VW3M8B24R**	Encoder cable for 100...180 mm flange motors (thread CMV1–battery, multi-turn)
		2*0.5 mm^2+ 4*0.25 mm^2, optional length
External braking resistor	VW3A760*R**	External braking resistors with connecting cables, with optional cable length, resistor power and ohmic values
Input filter	VW3A442*	Servo drive external input filter, with optional current
Motor protection circuit breaker	GV2P**	Motor protection circuit breakers, with optional setting current
Contactor	LC1***	Mains supply contactor, with optional control voltage and control

Plug

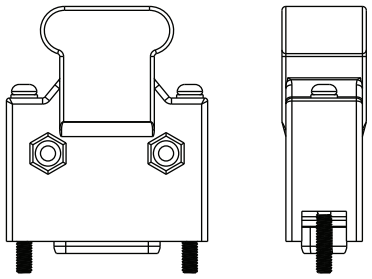
Description	Plug kit for servo drive power input and servo motor output		
Type	VW3M4B01	Related model	LXM18E*U01..15M2X



Constituent parts

Description	Type	Quantity	Manufacturer	Remark
Plug kit	0150-20-S1512903	1	Dinkle	For power input and motor power output
	0150-20-S1513005	1	Dinkle	

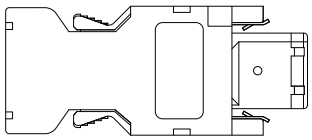
Description	Plug kit for servo drive CN1 control interfaces		
Type	VW3M4B12	Related model	LXM18E*U01..15M2X LXM18E*U20..30M3X



Constituent parts

Description	Type	Quantity	Manufacturer	Remark
Plug kit	SC-20-3	1	SUNCHU	For CN1 (SCSI-20)

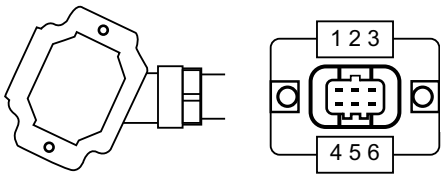
Description	Plug kit for servo drive CN2 control interfaces		
Type	VW3M4B21	Related model	LXM18E*U01..15M2X LXM18E*U20..30M3X



Constituent parts

Description	Type	Quantity	Manufacturer	Remark
Plug kit	SC-06B-2N00-702	1	SUNCHU	For CN2 (IEEE-1394, 6-pin)

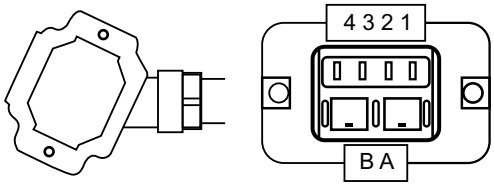
Description	Power plug kit for 40 mm (1.57 in) flange motors, plastic connector		
Type	VW3M5B10	Related model	BCH18*B*****



Constituent parts

Description	Type	Quantity	Manufacturer	Remark
Plug kit	SC-MC6S-AB20-20-01	1	SUNCHU	–

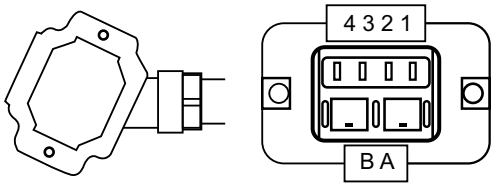
Description	Power plug kit for 60...80 mm (2.36...3.15 in) flange motors, downstream forward, plastic connector		
Type	VW3M5B11	Related model	BCH18*D / F*****



Constituent parts

Description	Type	Quantity	Manufacturer	Remark
Plug kit	SC-MC6S-AE20-00-01	1	SUNCHU	–

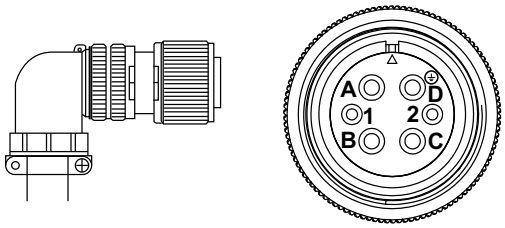
Description	Power plug kit for 60...80 mm (2.36...3.15 in) flange motors, downstream backward, plastic connector		
Type	VW3M5B12	Related model	BCH18*D / F*****



Constituent parts

Description	Type	Quantity	Manufacturer	Remark
Plug kit	SC-MC6S-AE20-00-02	1	SUNCHU	–

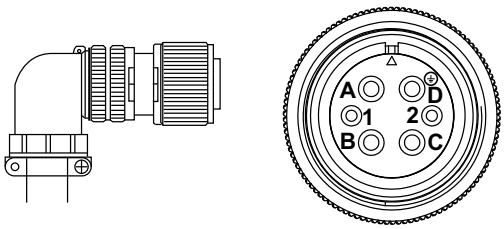
Description	Power plug kit for 100...130 mm (3.94...5.12 in) flange motors, military connector		
Type	VW3M5B21	Related model	BCH18*H / M*****



Constituent parts

Description	Type	Quantity	Manufacturer	Remark
Plug kit	CMS3108A18-A6SFI	1	SUNCHU	–

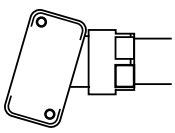
Description	Power plug kit for 180 mm (7.09 in) flange motors, military connector		
Type	VW3M5B22	Related model	BCH18*R*****

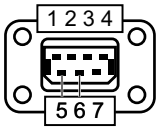


Constituent parts

Description	Type	Quantity	Manufacturer	Remark
Plug kit	CMS3108A22-A6SFI	1	SUNCHU	–

Description	Encoder plug kit for 40...80 mm (1.57...3.15 in) flange motors, plastic connector		
Type	VW3M8B11	Related model	BCH18*B / D / F*****

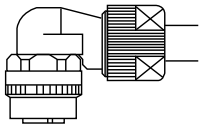


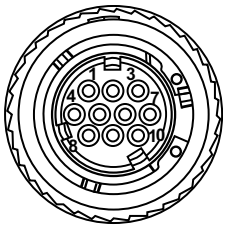


Constituent parts

Description	Type	Quantity	Manufacturer	Remark
Plug kit	SC-MC7S-AC20-00-01	1	SUNCHU	–

Description	Encoder plug kit for 100...180 mm (3.94...7.09 in) flange motors, military connector		
Type	VW3M8B21	Related model	BCH18*H / M / R*****



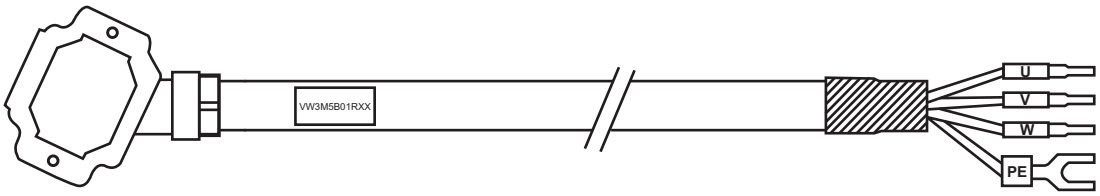


Constituent parts

Description	Type	Quantity	Manufacturer	Remark
Plug kit	SC-CMV1-AP10CT	1	SUNCHU	–

Motor Power Cables / Holding Brake Control Cables

Description	Motor power cables for 40 mm (1.57 in) flange motors, downstream forward, plastic connector		
Type	VW3M5B01R**	Related model	BCH18*B*****

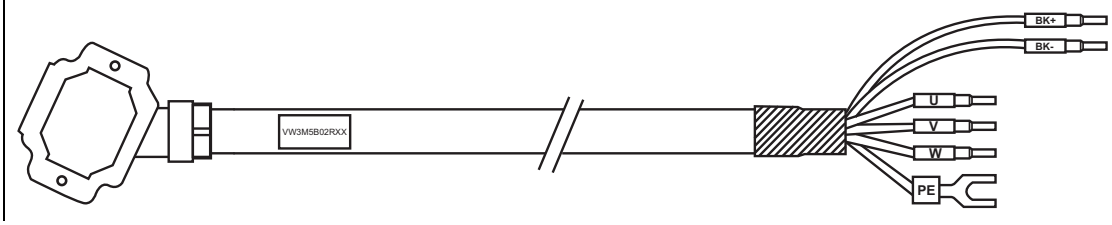


L (m/ft)	Type
1.5/4.92	VW3M5B01RA5
3/9.84	VW3M5B01R03
5/16.40	VW3M5B01R05
10/32.81	VW3M5B01R10
15/49.21	VW3M5B01R15
20/65.62	VW3M5B01R20
25/82.02	VW3M5B01R25

Constituent parts

Description	Type	Quantity	Manufacturer
Plug kit	SC-MC6S-AB20-20	1	SanChu
Cables	4G*0.34 mm²	–	–
Pin terminals	E0508	3	Phoenix Contact
Spade terminals	SV1.25-4S	1	Phoenix Contact

Description	Motor power cables for 40 mm (1.57 in) flange motors, downstream forward, plastic connector, with holding brake control		
Type	VW3M5B02R**	Related model	BCH18*B*****

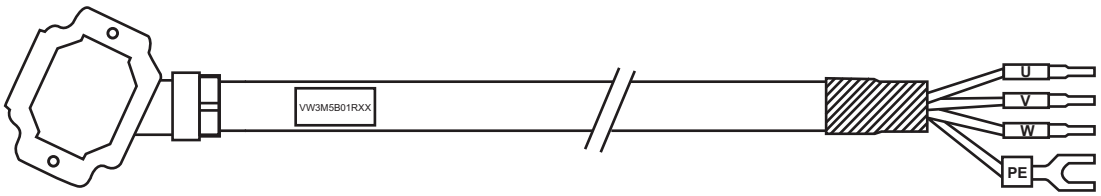


L (m/ft)	Type
1.5/4.92	VW3M5B02RA5
3/9.84	VW3M5B02R03
5/16.40	VW3M5B02R05
10/32.80	VW3M5B02R10
15/49.21	VW3M5B02R15
20/65.62	VW3M5B02R20
25/82.02	VW3M5B02R25

Constituent parts

Description	Type	Quantity	Manufacturer
Plug kit	SC-MC6S-AB20-20	1	SanChu
Cables	6G*0.34 mm²	–	–
Pin terminals	E0508	5	Phoenix Contact
Spade terminals	SV1.25-4S	1	Phoenix Contact

Description	Plastic connector motor power cables for 40 mm (1.57 in) flange motors, downstream backward		
Type	VW3M5B03R**	Related model	BCH18*B*****

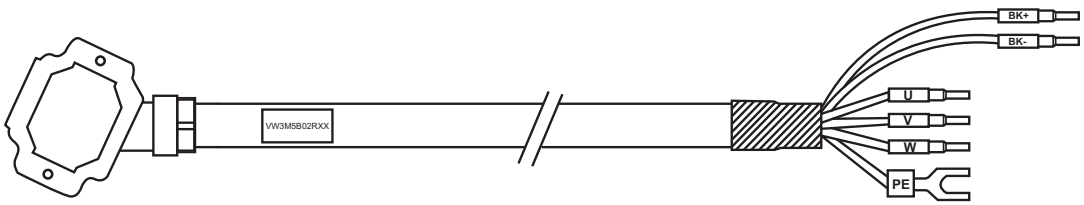


L (m/ft)	Type
1.5/4.92	VW3M5B03RA5
3/9.84	VW3M5B03R03
5/16.40	VW3M5B03R05
10/32.80	VW3M5B03R10
15/49.21	VW3M5B03R15
20/65.62	VW3M5B03R20
25/82.02	VW3M5B03R25

Constituent parts

Description	Type	Quantity	Manufacturer
Plug kit	SC-MC6S-AB20-20	1	SanChu
Cables	4G*0.34 mm²	–	–
Pin terminals	E0508	3	Phoenix Contact
Spade terminals	SV1.25-4S	1	

Description	Motor power cables for 40 mm (1.57 in) flange motors, downstream backward, plastic connector, with holding brake control		
Type	VW3M5B04R**	Related model	BCH18*B*****

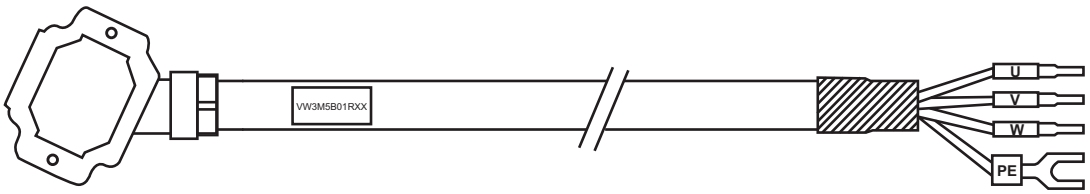


L (m/ft)	Type
1.5/4.92	VW3M5B04RA5
3/9.84	VW3M5B04R03
5/16.40	VW3M5B04R05
10/32.80	VW3M5B04R10
15/49.21	VW3M5B04R15
20/65.62	VW3M5B04R20
25/82.02	VW3M5B04R25

Constituent parts

Description	Type	Quantity	Manufacturer
Plug kit	SC-MC6S-AB20-20	1	SanChu
Cables	6G*0.34 mm²	–	–
Pin terminals	E0508	5	Phoenix Contact
Spade terminals	SV1.25-4S	1	

Description	Plastic connector motor power cables for 60...80 mm (2.36...3.15 in) flange motors, downstream forward		
Type	VW3M5B11R**	Related model	BCH18*D/F*****

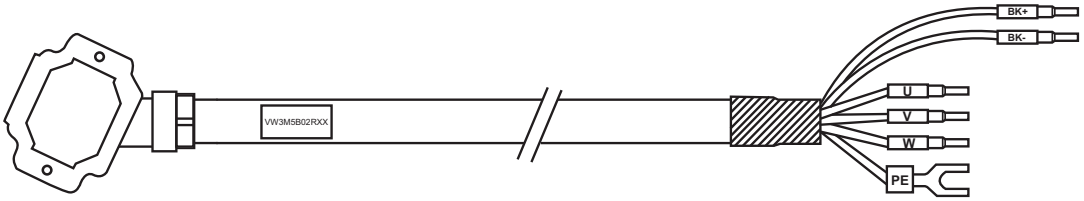


L (m/ft)	Type
1.5/4.92	VW3M5B11RA5
3/9.84	VW3M5B11R03
5/16.40	VW3M5B11R05
10/32.80	VW3M5B11R10
15/49.21	VW3M5B11R15
20/65.62	VW3M5B11R20
25/82.02	VW3M5B11R25

Constituent parts

Description	Type	Quantity	Manufacturer
Plug kit	SC-MC6S-AE20-00	1	SanChu
Cables	4G*0.75 mm^2	–	–
Pin terminals	E7508	3	Phoenix Contact
Spade terminals	SV1.25-4S	1	

Description	Motor power cables for 60...80 mm (2.36...3.15 in) flange motors, downstream forward, plastic connector, with holding brake control		
Type	VW3M5B12R**	Related model	BCH18*D/F*****

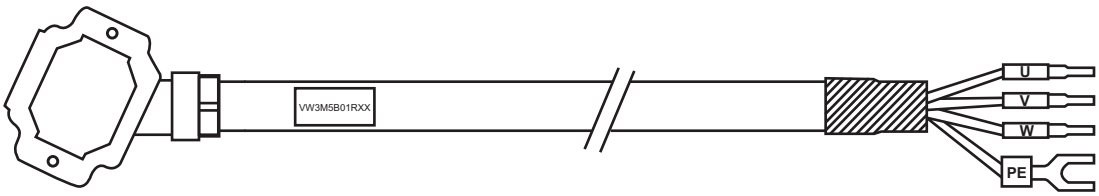


L (m/ft)	Type
1.5/4.92	VW3M5B12RA5
3/9.84	VW3M5B12R03
5/16.40	VW3M5B12R05
10/32.80	VW3M5B12R10
15/49.21	VW3M5B12R15
20/65.62	VW3M5B12R20
25/82.02	VW3M5B12R25

Constituent parts

Description	Type	Quantity	Manufacturer
Plug kit	SC-MC6S-AE20-00	1	SanChu
Cables	4G*0.75 mm^2+ 2*0.2 mm^2	–	–
Pin terminals	E7508	3	Phoenix Contact
Pin terminals	EVN0308	2	
Spade terminals	SV1.25-4S	1	

Description	Plastic connector motor power cables for 60...80 mm (2.36...3.15 in) flange motors, downstream backward		
Type	VW3M5B13R**	Related model	BCH18*D/F*****

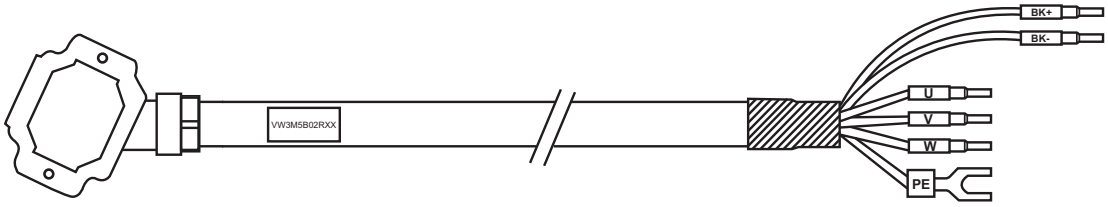


L (m/ft)	Type
1.5/4.92	VW3M5B13RA5
3/9.84	VW3M5B13R03
5/16.40	VW3M5B13R05
10/32.80	VW3M5B13R10
15/49.21	VW3M5B13R15
20/65.62	VW3M5B13R20
25/82.02	VW3M5B13R25

Constituent parts

Description	Type	Quantity	Manufacturer
Plug kit	SC-MC6S-AE20-00	1	SanChu
Cables	4G*0.75 mm^2	–	–
Pin terminals	E7508	3	Phoenix Contac
Spade terminals	SV1.25-4S	1	

Description	Motor power cables for 60…80 mm (2.36...3.15 in) flange motors, downstream backward, plastic connector, with holding brake control		
Type	VW3M5B14R**	Related model	BCH18*D/F*****

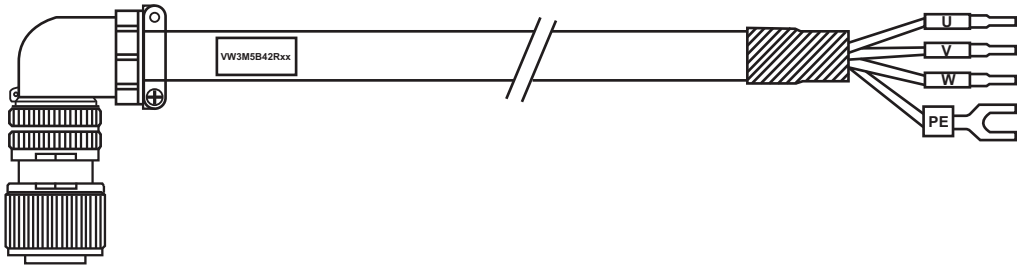


L (m/ft)	Type
1.5/4.92	VW3M5B14RA5
3/9.84	VW3M5B14R03
5/16.40	VW3M5B14R05
10/32.80	VW3M5B14R10
15/49.21	VW3M5B14R15
20/65.62	VW3M5B14R20
25/82.02	VW3M5B14R25

Constituent parts

Description	Type	Quantity	Manufacturer
Plug kit	SC-MC6S-AE20-00	1	SanChu
Cables	4G*0.75 mm^2+ 2*0.2 mm^2	–	–
Pin terminals	E7508	3	Phoenix Contact
Pin terminals	EVN0308	2	
Spade terminals	SV1.25-4S	1	

Description	Motor power cables for 100...130 mm (3.94...5.12 in) flange motors, military connector		
Type	VW3M5B21R**	Related model	BCH18*H/M*****

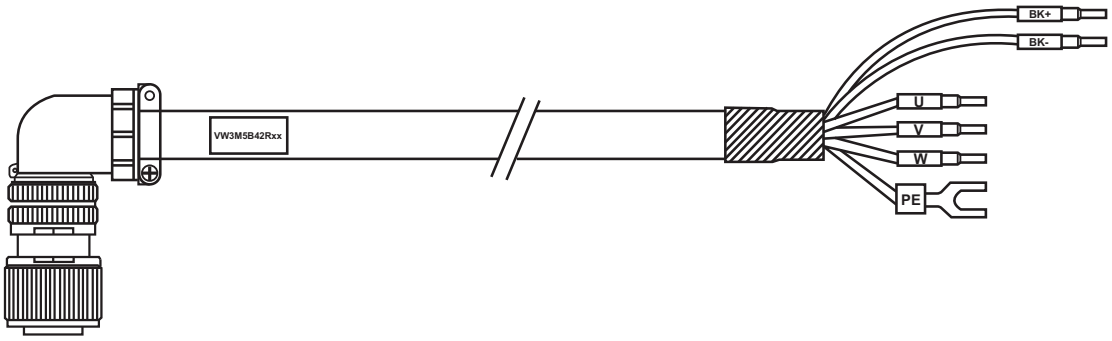


L (m/ft)	Type
1.5/4.92	VW3M5B21RA5
3/9.84	VW3M5B21R03
5/16.40	VW3M5B21R05
10/32.80	VW3M5B21R10
15/49.21	VW3M5B21R15
20/65.62	VW3M5B21R20
25/82.02	VW3M5B21R25

Constituent parts

Description	Type	Quantity	Manufacturer
Plug kit	CMS3108A18–A6SFI	1	SanChu
Cables	4G*1.5 mm^2	–	–
Pin terminals	E1512	3	Phoenix Contact
Spade terminals	SV2-4S	1	

Description	Motor power cables for 100...130 mm (3.94...5.12 in) flange motors, military connector, with holding brake control		
Type	VW3M5B22R**	Related model	BCH18*H/M*****

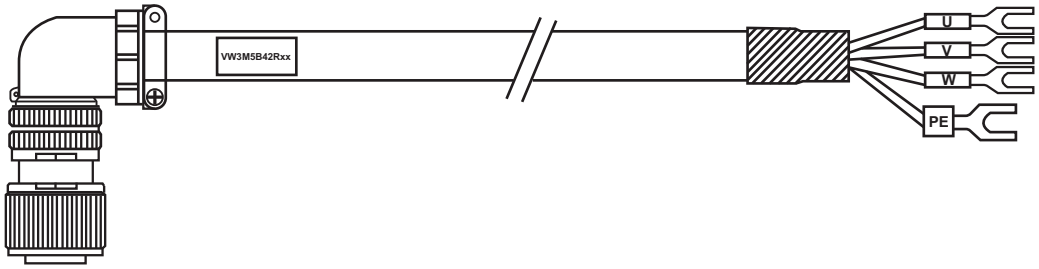


L (m/ft)	Type
1.5/4.92	VW3M5B21RA5
3/9.84	VW3M5B21R03
5/16.40	VW3M5B21R05
10/32.80	VW3M5B21R10
15/49.21	VW3M5B21R15
20/65.62	VW3M5B21R20
25/82.02	VW3M5B21R25

Constituent parts

Description	Type	Quantity	Manufacturer
Plug kit	CMS3108A18–A6SFI	1	SanChu
Cables	4G*1.5 mm^2+ 2*0.5 mm^2	–	–
Pin terminals	E1512	3	Phoenix Contact
Pin terminals	E0508	2	
Spade terminals	SV2-4S	1	

Description	Motor power cables for 100...130 mm (3.94...5.12 in) flange motors, military connector		
Type	VW3M5B31R**	Related model	BCH18*H/M*****

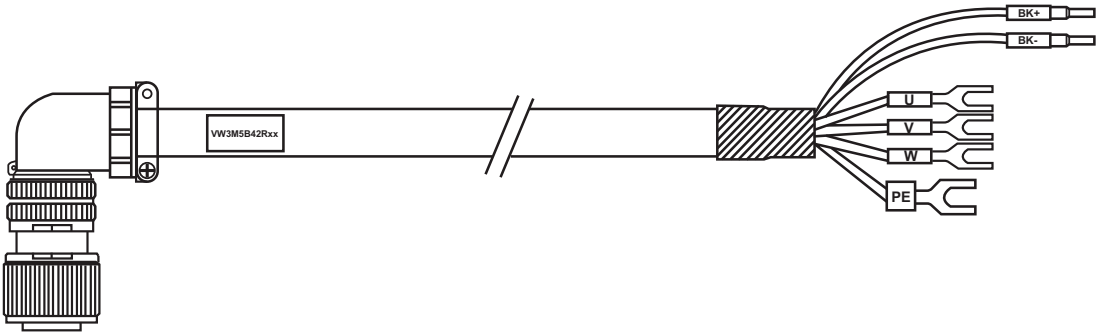


L (m/ft)	Type
1.5/4.92	VW3M5B31RA5
3/9.84	VW3M5B31R03
5/16.40	VW3M5B31R05
10/32.80	VW3M5B31R10
15/49.21	VW3M5B31R15
20/65.62	VW3M5B31R20
25/82.02	VW3M5B31R25

Constituent parts

Description	Type	Quantity	Manufacturer
Plug kit	CMS3108A18–A6SFI	1	SanChu
Cables	4G*2.5 mm²	–	–
Spade terminals	SV2-4S	4	Phoenix Contact

Description	Motor power cables for 100...130 mm (3.94...5.12 in) flange motors, military connector, with holding brake control		
Type	VW3M5B32R**	Related model	BCH18*H/M*****

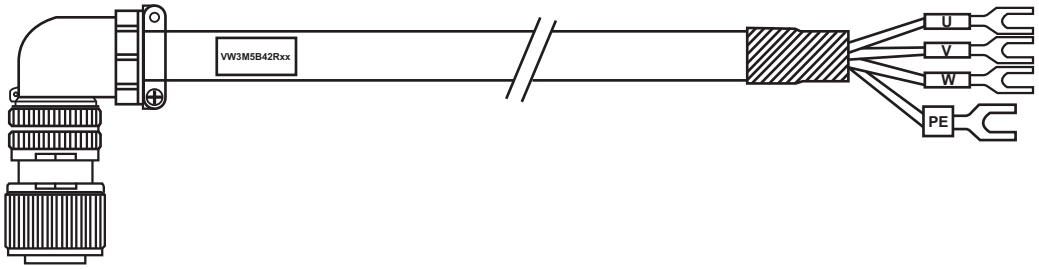


L (m/ft)	Type
1.5/4.92	VW3M5B32RA5
3/9.84	VW3M5B32R03
5/16.40	VW3M5B32R05
10/32.80	VW3M5B32R10
15/49.21	VW3M5B32R15
20/65.62	VW3M5B32R20
25/82.02	VW3M5B32R25

Constituent parts

Description	Type	Quantity	Manufacturer
Plug kit	CMS3108A18–A6SFI	1	SanChu
Cables	4G*2.5 mm²+ 2*0.5 mm²	–	–
Pin terminals	E0508	2	Phoenix Contact
Spade terminals	SV2-4S	4	

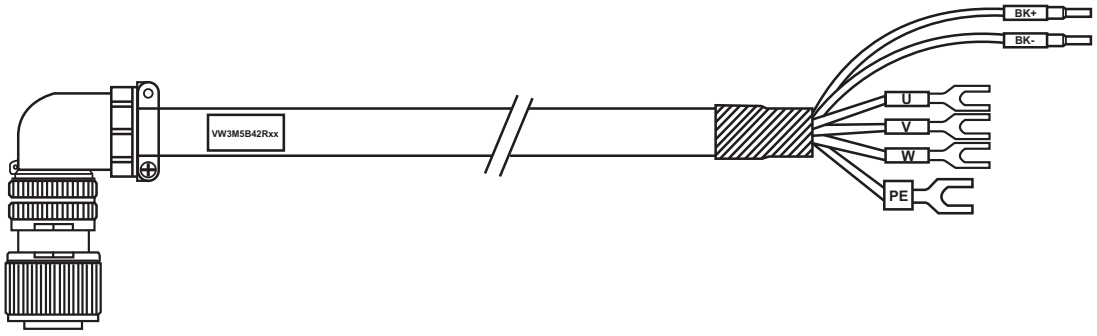
Description	Military connector motor power cables for 180 mm (7.09 in) flange motors		
Type	VW3M5B41R**	Related model	BCH18*R*****



L (m/ft)	Type
1.5/4.92	VW3M5B41RA5
3/9.84	VW3M5B41R03
5/16.40	VW3M5B41R05
10/32.80	VW3M5B41R10
15/49.21	VW3M5B41R15
20/65.62	VW3M5B41R20
25/82.02	VW3M5B41R25

Constituent parts				
Description	Type	Quantity	Manufacturer	
Plug kit	CMS3108A22-A6SFI	1	SanChu	
Cables	4G*2.5 mm²	–	–	
Spade terminals	SV2-4S	4	Phoenix Contact	

Description	Military connector motor power cables for 180 mm (7.09 in) flange motors		
Type	VW3M5B42R**	Related model	BCH18*R*****



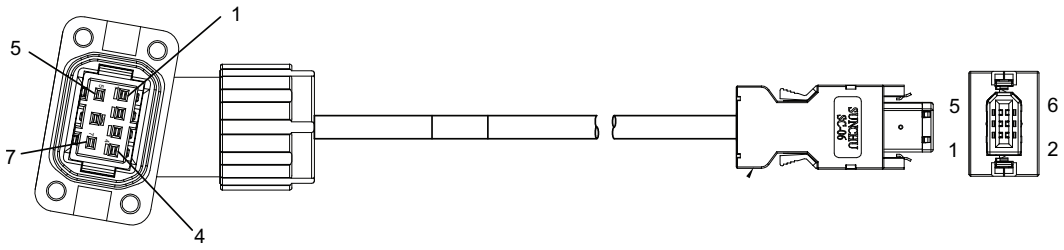
L (m/ft)	Type
1.5/4.92	VW3M5B42RA5
3/9.84	VW3M5B42R03
5/16.40	VW3M5B42R05
10/32.80	VW3M5B42R10
15/49.21	VW3M5B42R15
20/65.62	VW3M5B42R20
25/82.02	VW3M5B42R25

Constituent parts				
Description	Type	Quantity	Manufacturer	
Plug kit	CMS3108A22-A6SFI	1	SanChu	
Cables	4G*2.5 mm²+ 2*0.5 mm²	–	–	
Pin terminals	E0508	2	Phoenix Contact	
Spade terminals	SV2-4S	4		

Motor Encoder Cables

Single-turn Cables

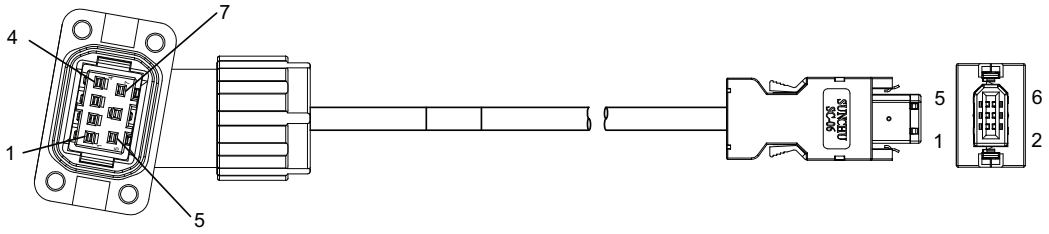
Description	Encoder cable for 40…80 mm flange motors, downstream forward (single turn, without battery)		
Type	VW3M8B11R**	Related model	BCH18*B/D/F*****



L (m/ft)	Type
1.5/4.92	VW3M8B11RA5
3/9.84	VW3M8B11R03
5/16.40	VW3M8B11R05
10/32.80	VW3M8B11R10
15/49.21	VW3M8B11R15
20/65.62	VW3M8B11R20
25/82.02	VW3M8B11R25

Constituent parts				
Description	Type	Quantity	Manufacturer	
plug kit (motor side)	SC-MC7S-AC20-00	1	SanChu	
Cables	2*0.5 mm^2+ 2*0.25 mm^2	–	–	
plug kit (drive side)	SC-6	1	SanChu	

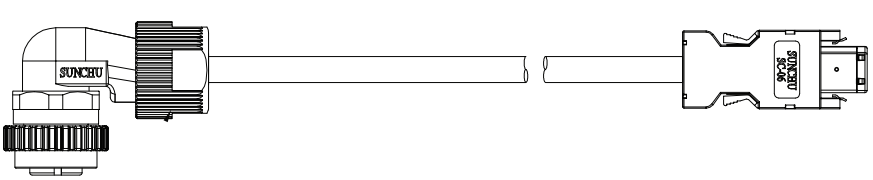
Description	Encoder cable for 40…80 mm flange motors, downstream backward (single turn, without battery)		
Type	VW3M8B13R**	Related model	BCH18*B/D/F*****

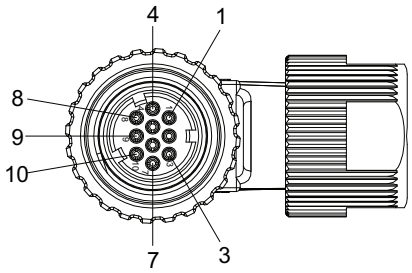


L (m/ft)	Type
1.5/.92	VW3M8B13RA5
3/9.84	VW3M8B13R03
5/16.40	VW3M8B13R05
10/32.80	VW3M8B13R10
15/49.21	VW3M8B13R15
20/65.62	VW3M8B13R20
25/82.02	VW3M8B13R25

Constituent parts				
Description	Type	Quantity	Manufacturer	
plug kit (motor side)	SC-MC7S-AC20-00	1	SanChu	
Cables	2*0.5 mm^2+ 2*0.25 mm^2	–	–	
plug kit (drive side)	SC-6	1	SanChu	

Description	Encoder cable for 100...180 mm flange motors (single turn, without battery)		
Type	VW3M8B21R**	Related model	BCH18*H/M/R*****





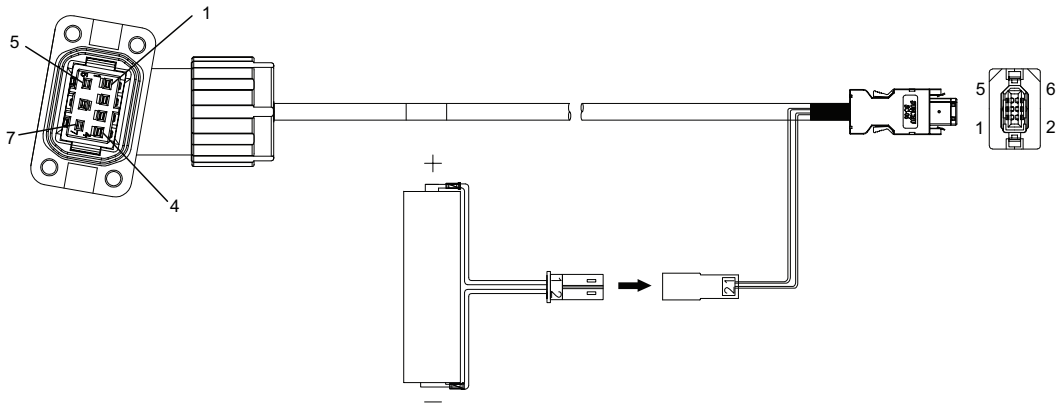
L (m/ft)	Type
1.5/4.92	VW3M8B21RA5
3/9.84	VW3M8B21R03
5/16.40	VW3M8B21R05
10/32.80	VW3M8B21R10
15/49.21	VW3M8B21R15
20/65.62	VW3M8B21R20
25/82.02	VW3M8B21R25

Constituent parts

Description	Type	Quantity	Manufacturer
Plug kit	SC-CMV1-AP10S-C	1	SanChu
Cables	2*0.5 mm^2+ 2*0.25 mm^2	–	–
plug kit (drive side)	SC-6	1	SanChu

Multi-turn Cables

Description	Encoder cable for 40…80 mm flange motors, downstream forward (multi-turn)		
Type	VW3M8B12R**	Related model	BCH18*B/D/F*****

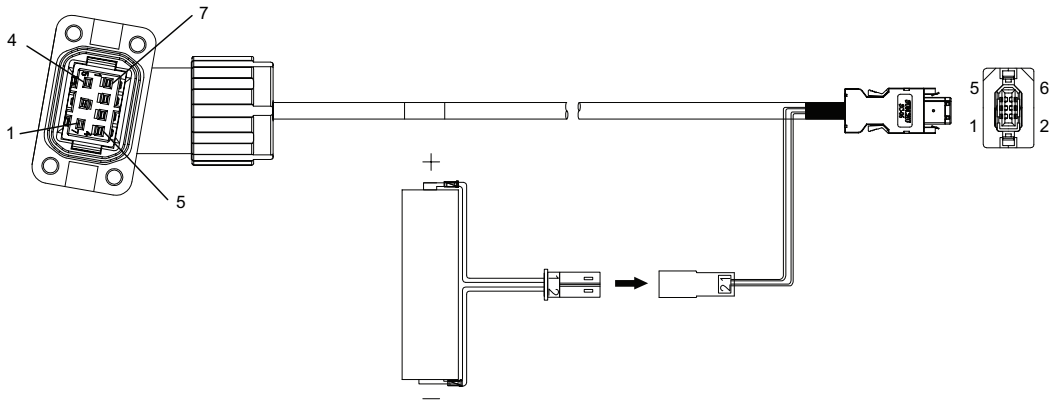


L (m/ft)	Type
1.5/4.92	VW3M8B12RA5
3/9.84	VW3M8B12R03
5/16.40	VW3M8B12R05
10/32.80	VW3M8B12R10
15/49.21	VW3M8B12R15
20/65.62	VW3M8B12R20
25/82.02	VW3M8B12R25

Constituent parts

Description	Type	Quantity	Manufacturer
plug kit (motor side)	SC-MC7S-AC20-00	1	SanChu
Cables	2*0.5 mm^2+ 4*0.25 mm^2	–	–
plug kit (drive side)	SC-6	1	SanChu

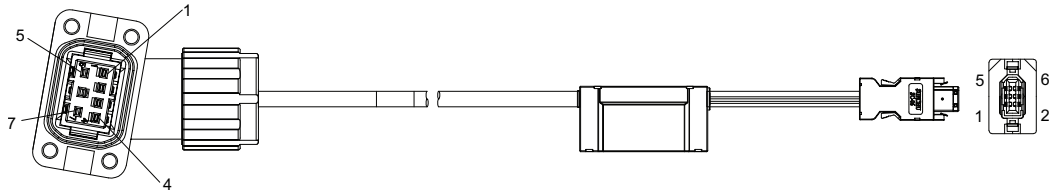
Description	Encoder cable for 40…80 mm flange motors, downstream backward (multi-turn)		
Type	VW3M8B14R**	Related model	BCH18*B/D/F*****



L (m/ft)	Type
1.5/4.92	VW3M8B14RA5
3/9.84	VW3M8B14R03
5/16.40	VW3M8B14R05
10/32.80	VW3M8B14R10
15/49.21	VW3M8B14R15
20/65.62	VW3M8B14R20
25/82.02	VW3M8B14R25

Constituent parts				
Description	Type	Quantity	Manufacturer	
plug kit (motor side)	SC-MC7S-AC20-00	1	SanChu	
Cables	2*0.5 mm^2+ 4*0.25 mm^2	–	–	
plug kit (drive side)	SC-6	1	SanChu	

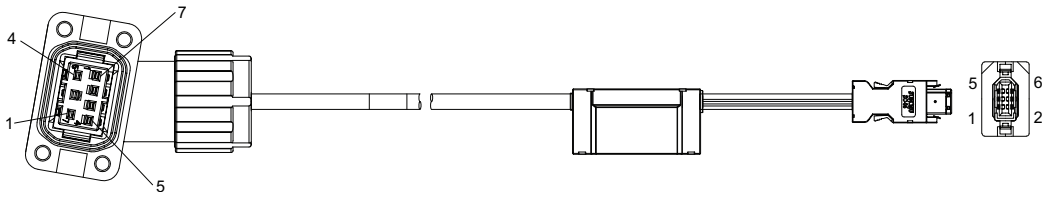
Description	Encoder cable for 40…80 mm flange motors, battery forward (multi-turn)		
Type	VW3M8B16R**	Related model	BCH18*B/D/F*****



L (m/ft)	Type
1.5/4.92	VW3M8B16RA5
3/9.84	VW3M8B16R03
5/16.40	VW3M8B16R05
10/32.80	VW3M8B16R10
15/49.21	VW3M8B16R15
20/65.62	VW3M8B16R20
25/82.02	VW3M8B16R25

Constituent parts				
Description	Type	Quantity	Manufacturer	
plug kit (motor side)	SC-MC7S-AC20-00	1	SanChu	
Cables	2*0.5 mm^2+ 4*0.25 mm^2	–	–	
plug kit (drive side)	SC-6	1	SanChu	

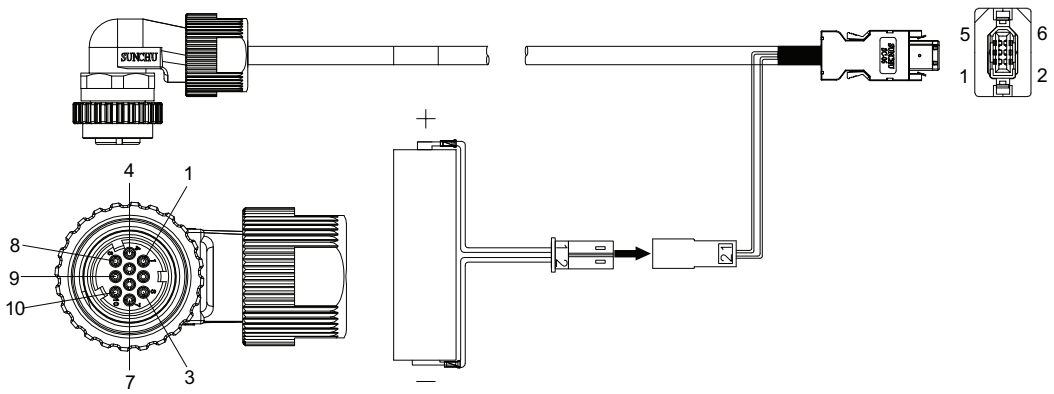
Description	Encoder cable for 40…80 mm flange motors, battery backward (multi-turn)		
Type	VW3M8B18R**	Related model	BCH18*B/D/F*****



L (m/ft)	Type
1.5/4.92	VW3M8B18RA5
3/9.84	VW3M8B18R03
5/16.40	VW3M8B18R05
10/32.80	VW3M8B18R10
15/49.21	VW3M8B18R15
20/65.62	VW3M8B18R20
25/82.02	VW3M8B18R25

Constituent parts				
Description	Type	Quantity	Manufacturer	
plug kit (motor side)	SC-MC7S-AC20-00	1	SanChu	
Cables	2*0.5 mm^2+ 4*0.25 mm^2	–	–	
plug kit (drive side)	SC-6	1	SanChu	

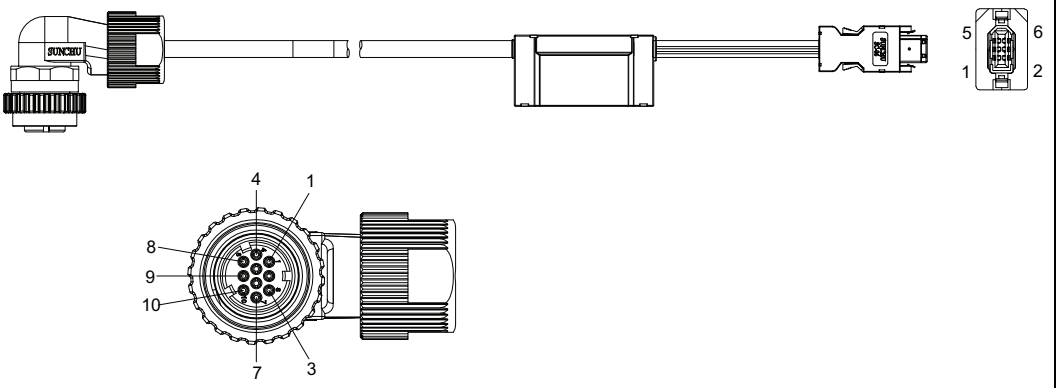
Description	Encoder cable for 100...180 mm flange motors (thread CMV1, multi-turn)		
Type	VW3M8B22R**	Related model	BCH18*H/M/R*****



L (m/ft)	Type
1.5/4.92	VW3M8B22RA5
3/9.84	VW3M8B22R03
5/16.40	VW3M8B22R05
10/32.80	VW3M8B22R10
15/49.21	VW3M8B22R15
20/65.62	VW3M8B22R20
25/82.02	VW3M8B22R25

Constituent parts				
Description	Type	Quantity	Manufacturer	
Plug kit	SC-CMV1-AP10S-C	1	SanChu	
Cables	2*0.5 mm^2+ 4*0.25 mm^2	–	–	
plug kit (drive side)	SC-6	1	SanChu	

Description	Encoder cable for 100...180 mm flange motors (thread CMV1–battery, multi-turn)		
Type	VW3M8B24R**	Related model	BCH18*H/M/R*****



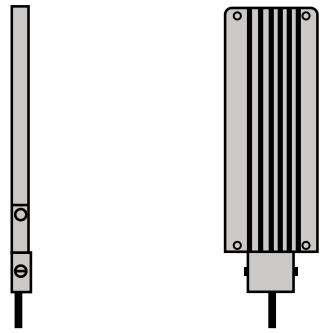
L (m/ft)	Type
1.5/4.92	VW3M8B24RA5
3/9.84	VW3M8B24R03
5/16.40	VW3M8B24R05
10/32.80	VW3M8B24R10
15/49.21	VW3M8B24R15
20/65.62	VW3M8B24R20
25/82.02	VW3M8B24R25

Constituent parts

Description	Type	Quantity	Manufacturer
Plug kit	SC-CMV1-AP10S-C	1	SanChu
Cables	2*0.5 mm^2+ 4*0.25 mm^2	–	–
plug kit (drive side)	SC-6	1	SanChu

External Braking Resistor

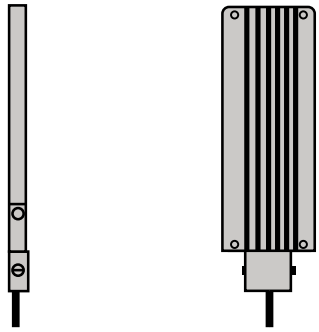
Description	External braking resistors with connecting cables		
Type	VW3A760*R**	Related model	LXM18E*U01..15M2X



Constituent parts

Description	Type	Quantity	Manufacturer	Remark
External braking resistor	VW3A7605R07	1	Schneider Electric	72 Ohm, 100 W, 0.75 m (2.46 ft) cable
	VW3A7605R20	1		72 Ohm, 100 W, 2.0 m (6.56 ft) cable
	VW3A7605R30	1		72 Ohm, 100 W, 3.0 m (9.84 ft) cable
	VW3A7606R07	1		72 Ohm, 200 W, 0.75 m (2.46 ft) cable
	VW3A7606R20	1		72 Ohm, 200 W, 2.0 m (6.56 ft) cable
	VW3A7606R30	1		72 Ohm, 200 W, 3.0 m (9.84 ft) cable
	VW3A7607R07	1		72 Ohm, 400 W, 0.75 m (2.46 ft) cable
	VW3A7607R20	1		72 Ohm, 400 W, 2.0 m (6.56 ft) cable
	VW3A7607R30	1		72 Ohm, 400 W, 3.0 m (9.84 ft) cable
	VW3A7608R07	1		100 Ohm, 100 W, 0.75 m (2.46 ft) cable
	VW3A7608R20	1		100 Ohm, 100 W, 2.0 m (6.56 ft) cable
	VW3A7608R30	1		100 Ohm, 100 W, 3.0 m (9.84 ft) cable

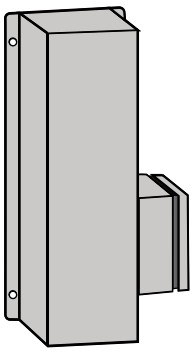
Description	External braking resistors with connecting cables		
Type	VW3A760*R**	Related model	LXM18E*U07/10/15M2X



Constituent parts

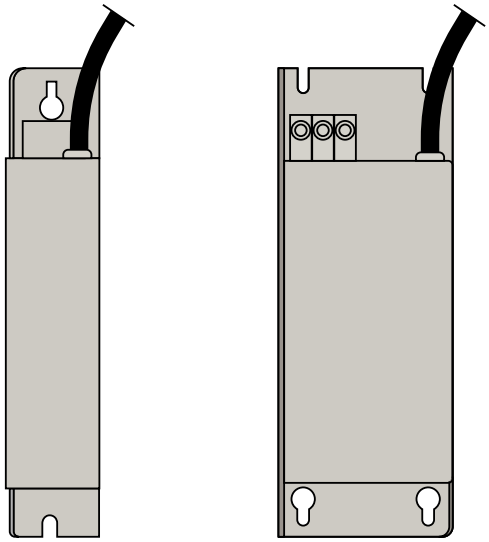
Description	Type	Quantity	Manufacturer	Remark
External braking resistor	VW3A7602R07	1	Schneider Electric	27 Ohm, 100 W, 0.75 m (2.46 ft) cable
	VW3A7602R20	1		27 Ohm, 100 W, 2.0 m (6.56 ft) cable
	VW3A7603R07	1		27 Ohm, 200 W, 0.75 m (2.46 ft) cable
	VW3A7603R20	1		27 Ohm, 200 W, 2.0 m (6.56 ft) cable
	VW3A7603R30	1		27 Ohm, 200 W, 3.0 m (9.84 ft) cable
	VW3A7604R07	1		27 Ohm, 400 W, 0.75 m (2.46 ft) cable
	VW3A7604R20	1		27 Ohm, 400 W, 2.0 m (6.56 ft) cable
	VW3A7604R30	1		27 Ohm, 400 W, 3.0 m (9.84 ft) cable

Description	External braking resistors with connecting cables		
Type	VW3A7733	Related model	LXM18E*U20/30M3X
Specification	16 Ohm，960 W		



Input Filter

Description	Servo drive external input filters
Type	VW3A442*



Constituent parts

Description	Type	Specification	Manufacturer	Related model
Single-phase mains filters	VW3A4420	9 A, 115/230 Vac	Schneider Electric	LXM18E*U01/02/04M2X
	VW3A4421	16 A, 115/230 Vac		LXM18E*U07/10/15M2X
	VW3A4423	25 A, 230 Vac		LXM18E*U20/30M3X

Motor Protection Circuit Breakers

Branch Circuit Protection:

Suitable For Use On A Circuit Capable Of Delivering Not More Than 5kA rms Symmetrical Amperes, 240V Maximum.

Field Wiring Terminal Markings – Wiring terminals shall be marked to indicate the proper connections for power supply and load, or a wiring diagram coded to the terminal marking shall be securely attached to the device:

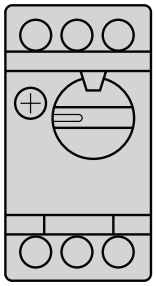
- Use 75°C wire only.
- Required wire type and range for single installation listed below:

Frame size	Model No.	Terminal type	Wire range (AWG)	Required torque (lb.in)
S1	LXM18E&U01M2X LXM18P#U01M2X	L, N, B2, B1, P, U, V, W	14	N/A
	LXM18E&U02M2X LXM18P#U02M2X	L, N, B2, B1, P, U, V, W	14	N/A
	LXM18E&U04M2X LXM18P#U04M2X	L, N, B2, B1, P, U, V, W	14	N/A
S2	LXM18E&U07M2X LXM18P#U07M2X	L, N, B2, B1, P, U, V, W	14	N/A
	LXM18E&U10M2X LXM18P#U10M2X	L, N, B2, B1, P, U, V, W	14	N/A
	LXM18E&U15M2X LXM18P#U15M2X	L, N, B2, B1, P, U, V, W	12	N/A
S3	LXM18E&U20M3X LXM18P#U20M3X	L1, L2, L3, N, B2, B1, P, U, V, W	10	10.6
	LXM18E&U30M3X LXM18P#U30M3X	L1, L2, L3, N, B2, B1, P, U, V, W	10	10.6

- Tightening torque and wire range for field grounding wiring with pressure terminals connectors are marked adjacent to the terminal or on the wiring diagram.

Frame size	Required torque (in-1bs)	Wire range (AWG)
S1	11.5	7
S2	11.5	7
S3	11.5	7

Description	Motor protection circuit breakers, with optional setting current
Type	GV2P**

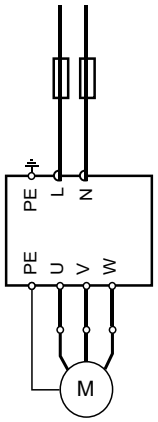


Constituent parts

Description	Type	Specification	Manufacturer	Related model
Contactor	GV2P10	6.3A	Schneider Electric	LXM18E*U01/02M2X
	GV2P14	10A		LXM18E*U04M2X
	GV2P16	14A		LXM18E*U07M2X
	GV2P20	18A		LXM18E*U10M2X
	GV2P22	25A		LXM18E*U15/20M2X
	GV2P32	32A		LXM18E*U30M2X

“Suitable For Use on A Circuit Capable Of Delivering Not More Than yyy rms Symmetrical Amperes, zzz Volts Maximum”..

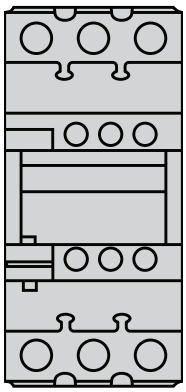
Description	Motor protection using class J fuses
Type	LPJ***



Constituent parts

Description	Type	Specification	Manufacturer	Related model
J fuses	LPJ·6SP	6A	Schneider Electric	LXM18E*U01/02M2X
	LPJ·10SP	10A		LXM18E*U04M2X
	LPJ·15SP	15A		LXM18E*U07M2X
	LPJ·20SP	20A		LXM18E*U10M2X
	LPJ·25SP	25A		LXM18E*U15/20M2X
	LPJ-35SP	35A		LXM18E*U30M2X

Description	Mains supply contactor, with optional control voltage and control
Type	LC1D****



Constituent parts

Description	Type	Specification	Manufacturer	Related model
Contactor	LC1D09**	9 A	Schneider Electric	LXM18E*U01/02/04/07M2X
	LC1D12**	12 A		LXM18E*U10M2X
	LC1D18**	18 A		LXM18E*U15M2X
	LC1D32**	32 A		LXM18E*U30M3X

(**) control voltage:

- B7-24 Vac
- M7-220 Vac
- BD-24 Vdc

Installation

Installation Precautions

About Electromagnetic Compatibility (EMC)

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

⚠WARNING

SIGNAL AND EQUIPMENT INTERFERENCE

- The drive is only operated with the specified external power filter.
- Install the wiring in accordance with the EMC requirements described in this document.
- Verify compliance with the EMC requirements described in this document.
- Verify compliance with all EMC regulations and requirements applicable in the country where the product is 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 drive meets the EMC requirements according to the standard IEC 61800-3 if the input filter is properly installed as described in System Accessories, page 80 of this manual.

⚠WARNING

ELECTROMAGNETIC DISTURBANCES OF SIGNALS AND DEVICES

Use proper EMI shielding techniques to help prevent unintended device operation according to the standard IEC 61800-3.

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

The product is 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 FREQUENCY 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 supplier, it is necessary for you to include these content in the documentation provided to the user.

Pay attention to the EMC requirements for the electrical cabinet when the device is installed in an electrical cabinet:

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 switchgear, the switchgear door and the mounting plate with grounding straps or grounding wires. The conductor cross section must be at least 10 mm^2 (AWG 7)	To reduce 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).	To reduce mutual interference coupling.
Do not install power components and control components adjacent to one another.	To reduce mutual interference coupling.

The following measures can improve the EMC-dependent values depending on the application:

EMC measures	Objective
Use power reactors.	To reduce power harmonic oscillation and prolong product service life.
Install in a closed switchgear and use shielding measures to attenuate interference from radiation.	To improve the EMC limit values.

Residual Current Devices

Direct current may be generated 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.
- For inverter, use a certified type B Residual Current Device (RCD/GFCI) or a Residual Current Monitor (RCM); for three-phase devices and for single-phase devices not connected to phase or neutral conductor, use a type B residual current device (RCD/CFCI) or residual current monitor (RCM) that is sensitive to each type of current.

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

After power-up, the drive may generate DC voltage in the protective conductor. During operation, a certain amount of high-frequency leakage current will occur. To prevent accidents due to electric shock and to minimize the risk of leakage fires, it is recommended to install a type B residual current device (RCD) according to IEC 61008-2-1, IEC/EN 62423 or EN 61008-2-1 on the primary side of the power supply for the servo amplifier. To avoid false tripping of the RCD, it is recommended that a Type B RCD with a minimum operating current of 30 mA be selected for each drive. If multiple drives are connected in parallel and share a single RCD, it is recommended that a Type B RCD with a minimum operating current of 300 mA be selected.

It is important to consider the total leakage current of the entire servo drive system (total leakage current = drive leakage current + motor cable leakage current + motor leakage current). In the event of tripping, re-evaluate the selection of a Type B RCD based on the operating conditions of the servo drive system.

- The drive has an increased leakage current at the moment power is applied. Use a residual current device (RCD / GFCI) or a residual current monitor (RCM) with a response delay.
- High-frequency currents must be filtered.

Required Cables

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

- Suitable for drag chain applications or not
- Temperature range
- Chemical resistance
- Whether open-wiring is needed
- Whether underground wiring is needed

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.*
- Route communications and I/O cables separated from power cables.

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

* 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 potential compensation conductor must be designed according to the maximum compensation current. Conductor cross sections are shown below:

- 16 mm^2 (AWG 5) for equipotential bonding conductors up to 200 m (656 ft) in length.
- 20 mm^2 (AWG 4) for equipotential bonding conductors over 200 m (656 ft) in length.

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

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

Cross section in mm² (AWG)(1)	Current-carrying capacity with method of installation B2 in A(2)	Current-carrying capacity with method of installation E in A(2)
0.75 (18)	8.5	10.4
1.0 (17)	10.1	12.4
1.5 (15)	13.1	16.1
2.5 (13)	17.4	22
4.0 (11)	23	30
6.0 (9)	30	37
10 (7)	40	52
16 (5)	54	70
25 (3)	70	88

(1) See section System Accessories, page 80 for required cables.

(2) Values as per IEC 60204-1 for continuous operation, copper conductors and ambient air temperature 40 °C (104 °F). See IEC 60204-1 for more information.

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

The conductors must have a sufficiently large cross section so that the upstream fuse can trip. In the case of longer cables, it may be necessary to use a larger conductor cross section to reduce the energy losses.

Mounting of the Drive

Unpacking and Checking

Verify the contents in time after unpacking.

- Consistency with the part type you ordered.
- Inspect the servo drive for visible damage.
- Inspect the intactness of the protective coating of heat dissipation holes on the servo driver.
- Check whether there are attached plugs for the servo drive for power supply, external brake resistor, and motor output.

(The plugs for I/O control interface and encoder interface are not included) Contact your local agent in time if there is any discrepancy.

Switchgear

The servo drive is a IP20 device. It should be installed in a switchgear (or enclosure) with the adequate degree of protection. The switchgear (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 switchgear (enclosure) must be sufficient to comply with the specified ambient conditions for the servo drives operated in the switchgear. Install and operate the drive in a switchgear (enclosure) rated for its intended environment and secured by a keyed or tooled locking mechanism.

Installation direction

Mount the servo drive vertically (±10°) on the base. Please firmly install the device to the mounting surface through 2 mounting holes (the location of the mounting holes varies depending on the servo drive reference).

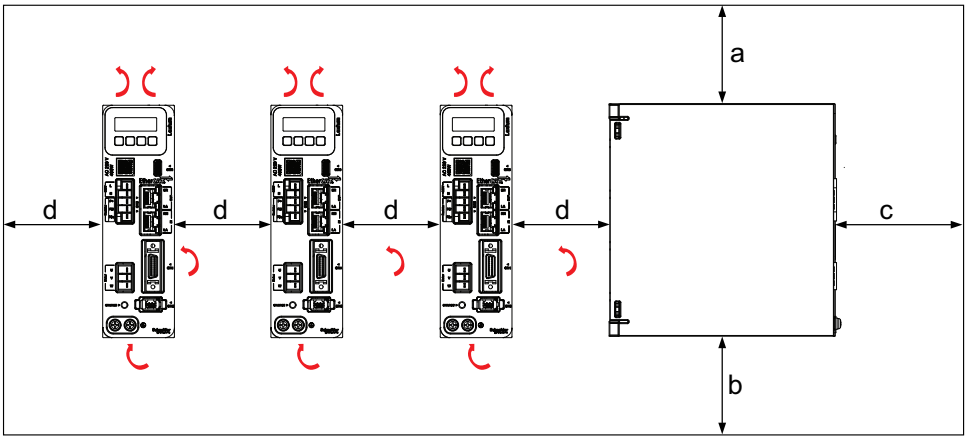
Painted surfaces may cause higher resistance to ground or insulation. Before mounting the device to a painted mounting surface, remove all paint across a large area of the mounting points.

Mounting Distances, Ventilation

When selecting the mounting point of the servo drive in the switchgear (or enclosure), note the following requirements. These requirements also apply when mounting multiple servo units side-by-side.

- Make sure that the front of the servo drive (the display side of the HMI) faces the operator.
- Mount the device vertically (±10°) on the base. This is conducive to cooling the device.
- Ensure the minimum required installation distances at least for cooling and avoiding heat accumulation.
- 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 front connection cables of the devices are routed upstream or downstream. The minimum required distances must be followed for air circulation and cable installation.

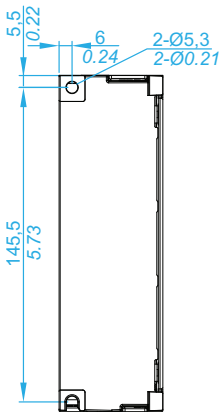
Distance	Unit	Value
Distance a, above the device	mm (in)	>=50 (1.97)
Distance b, below the device	mm (in)	>=50 (1.97)
Distance c, in front of the device*	mm (in)	>=70 (2.76)
Distance d, between the devices	mm (in)	>=50 (1.97)
* The distance should ensure adequate air circulation and be sufficient for plug installation and wiring.		



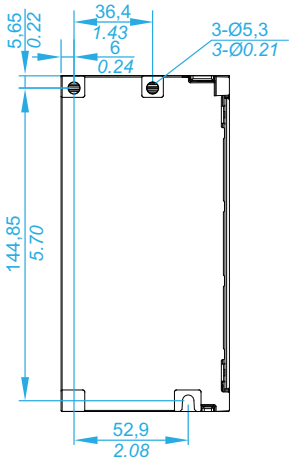
Dimensions of the Mounting Holes

Use the mounting holes to firmly install the servo drive on the mounting plate. When mounting the device, use a Phillips screwdriver whose length is greater than the depth of the servo drive.

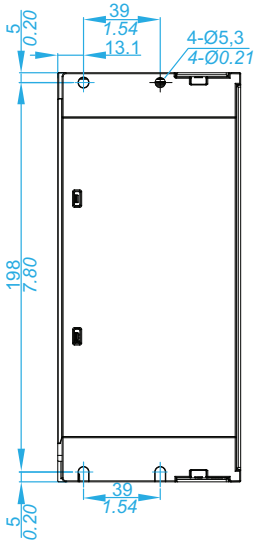
- **Size1: 0.1kW … 0.4kW** (**U01/ U02/ U04**) servo drive mounting hole size:



- **Size2: 0.75kW … 1.5kW** (**U07/ U10/ U15**) servo drive mounting hole size:



- **Size3: 2.0kW … 3.0kW** (**U20/ U30**) servo drive mounting hole size:



Mounting the Motor

Unpacking and Checking

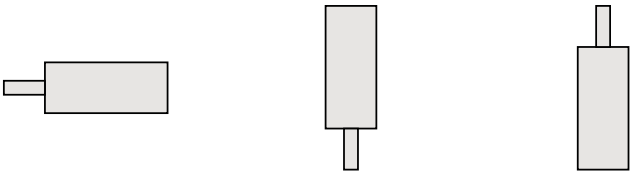
Verify the contents in time after unpacking.

- Consistency with the part type you ordered.
- Inspect the servo motor for visible damage.
- Verify that the *Safety and Environmental Declarations* is included.
- Verify that the output shaft of the servo motor is protected by a sleeve?

Contact your local agent in time if there is any discrepancy.

Installation direction

The following mounting directions are permitted for the servo motors as defined by IEC 60034-7:

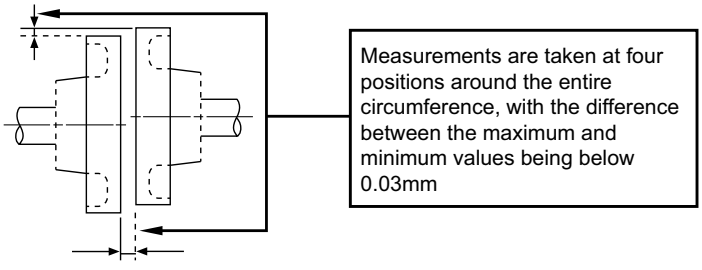


IM B5 IM V1 IM V3

For Use with Machinery

The servo motor has a very large mass. Be careful when mounting it to prevent personal injury or mechanical damage. The output shaft of the servo motor is coated with antirust oil at the factory. Remove the antirust oil before mounting the device.

When the servo motor is used with the machine, use a coupling to ensure the shaft core of the servo motor and that of the machine are in a straight line. Also, when mounting the servo motor, conform to the concentric accuracy requirements shown in the figure below. Lack of concentric accuracy may result in mechanical vibration, heating, damage to the bearings and encoder, and other problems.



When installing the device on the mounting plate, the servo motor and coupling must be accurately aligned in the axial and radial directions and tightened evenly against each other, and then the fixing bolts must be tightened evenly diagonally. The specified tightening torque must be used here.

For the dimensions of mounting plates and the type of fixing bolts to be used, see Servo Motor Dimensions/Overload Characteristics/Speed-Torque, page 53.

When installing the shaft coupling or installing the servo motor on the mounting plate, do not apply direct impact force to the shaft or the back, which may damage the bearings or encoder.

Additional Notes

Oil and water:

1. Ensure that the oil level at the mounting points does not exceed the bottom of the oil seal lip.
2. To prevent excessive wear of the oil seal, ensure that a small amount of grease is available on the lip of the servo motor oil seal as lubrication.
3. When mounting the servo motor facing upward (IM V3), avoid oil from accumulating on the lip of the oil seal.

Stress on the cables:

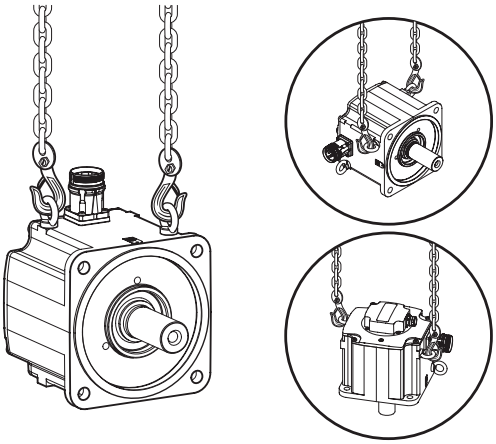
When handling or mounting the servo motor, always hold on to its main body. Holding on to the main circuit cables, holding brake control cables, or encoder cables only may cause the cables to break or the plugs to be damaged.
Be careful to avoid excessive stretching or bending the main circuit cables, brake control cables, or encoder cables when wiring.

After wiring, secure the main circuits, brake control cables or encoder cables so that it is not excessively bent, stretched, or stressed, and so that the cables do not shake and cause wear or damage due to fatigue.

Using the motor plugs:

When using the plugs, note the followings:

1. Visually inspect the plugs and the pins inside for damage, breakage, or bending deformation.
2. Verify that there are no impurities or foreign objects such as metal debris inside the plugs.
3. Verify that the plug wiring has no error.
4. Do not apply impact force to the plugs to prevent them from breaking and damage.
5. The cable connectors of the servo motor for 100 mm/130 mm/180 mm (5 3.94 in/5.12 in/7.09 in) flanges need to be securely locked to the socket. When mounting the 180 mm (7.09 in) flange mounted motors, consider the quality of the product. Suitable lifting equipment may be a need.



Radial and axial loads:

In mechanical design, it is necessary to consider the radial and axial loads applied to the servo motor shafts to prevent the loads from exceeding the allowable value. For the allowable value of radial and axial loads of the servo motors, see Allowable Loads of Servo Motor Output Shaft, page 52.

Wiring

Notes

Prior to mounting and wiring the servo drives, note the followings:

⚠DANGER

INSUFFICIENT GROUNDING

- A protective ground conductor with at least 10 mm^2 (AWG 7) or two protective ground conductors with the same cross section as 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 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:

⚠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.
- For inverter, use a certified type B Residual Current Device (RCD/GFCI) or a Residual Current Monitor (RCM); for three-phase devices and for single-phase devices not connected to phase or neutral conductor, use a type B residual current device (RCD/CFCI) or residual current monitor (RCC) that is sensitive to each type of current.

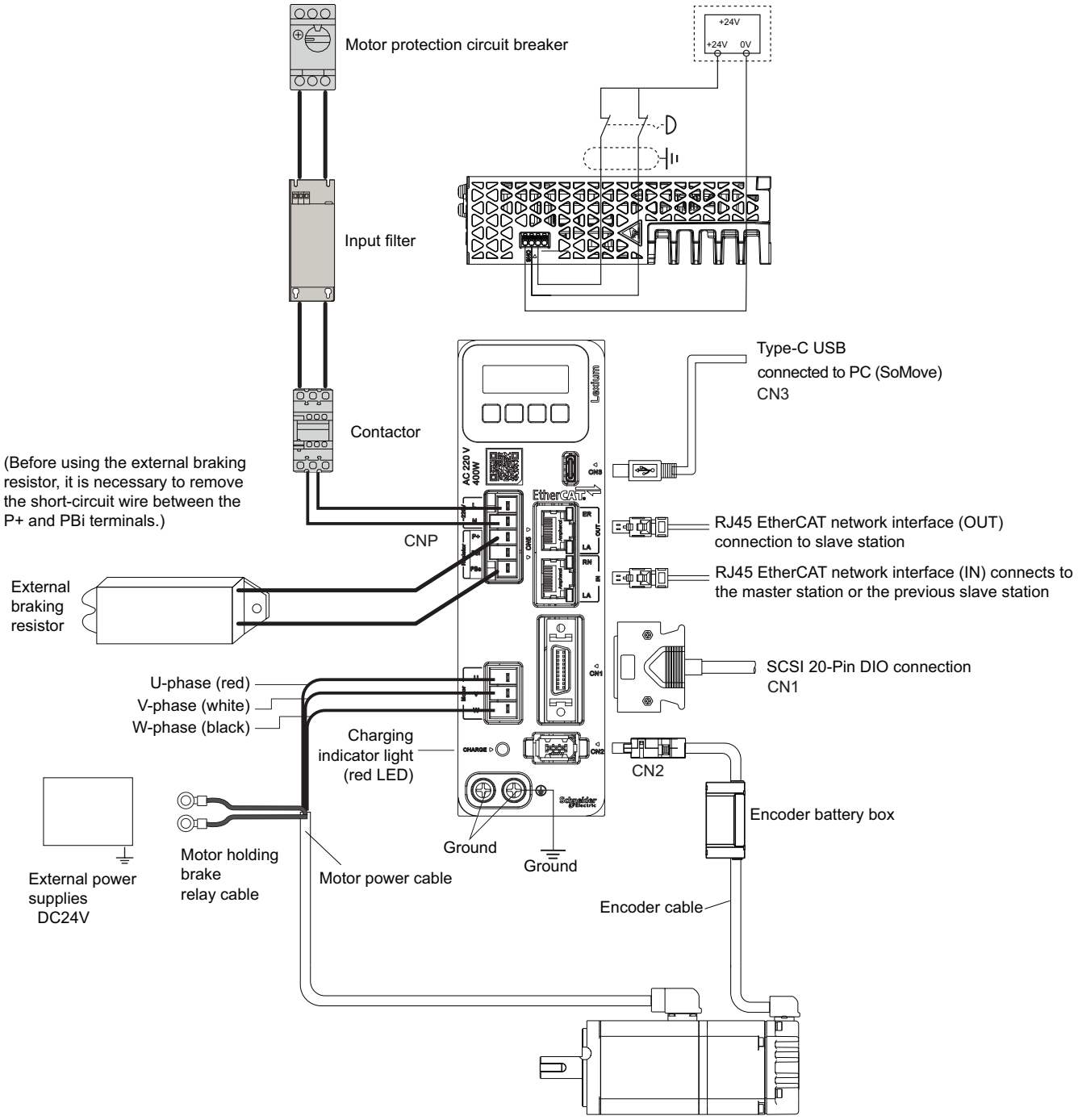
Failure to follow these instructions can result in death, serious injury, or equipment damage.

Make sure all wiring is done without voltage input.

For wiring of power terminal according to UL 61800-5-1, it meets with:

- Only use at least rated 75 °C (167 °F) copper conductors.
- Minimum cross section of copper conductors: AWG 14.

Overview of the Connections of the Servo Drives



Connectors and Terminals of the Servo Drives

Terminal marking	Function	Description	
L / N	Input circuit	For models with single-phase mains supply, connected to single-phase 220 V mains supply	
R / S / T	Input circuit	For models with three-phase mains supply, connected to three-phase 220 V mains supply	
P+ / PBi / PBe / N	Braking resistor connection terminal	N empty terminal for models with three-phase mains supply, without connection wires	
		Use internal braking resistors	Factory default, short wires to P+ and PBi
		Use external braking resistors	Remove the short wires and connect P+ and PBe
U / V / W	Motor output terminal	Connect motor power terminal	
CN1	I / O connection terminal	Connected to digital input/output	
CN2	Encoder connection terminal	Connected to the motor encoder	
CN3	Type-C USB connection terminal	Cable connection to the host computer for commissioning	
CN5	EtherCAT fieldbus	EtherCAT communication	
CN6	STO function	Safety torque off connection	
⏚ ✖2	Grounding	Connects power input grounding wires and motor grounding wires	

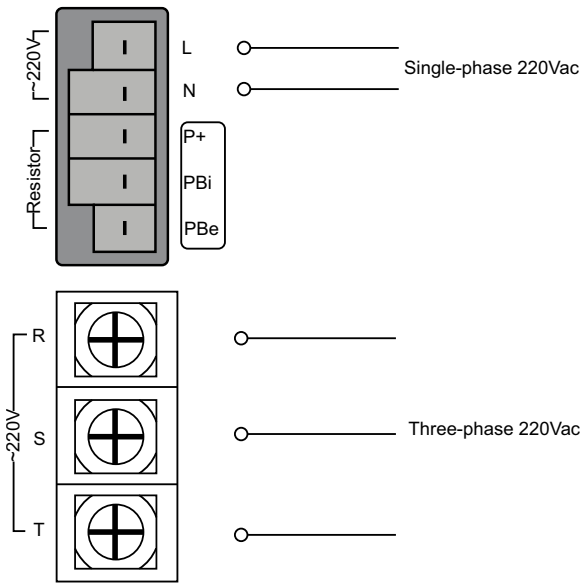
Connection Methods of the Mains Supply in a Main Circuit of the Servo Drives

The connections of the mains supply in a circuit of the servo drive include single-phase and three-phase connections according to the power of the device, with the single-phase connection used for 1.5 kW and below models.

Check that the mains power supply is of an approved type prior to connecting it, and do not operate until it is firmly connected.

- All Size 1 (0.1~0.4 kW) and Size 2 (0.75~1.5 kW) servo drives use single-phase 220 Vac input.
- All Size 3 (2~3 kW) servo drives use three-phase 220 Vac input
- The mains supply system supports TT/TN grounding, but does not support IT grounding.

Form factor and power rating	~220 V	Description
Size 1, 0.1~0.4 kW	L/N	Single-phase 220V
Size 2, 0.75~1.5 kW	L/N	Single-phase 220V
Size 3, 2~3 kW	R/S/T	Three-phase 220V



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

⚠DANGER

INSUFFICIENT GROUNDING

- A protective ground conductor with at least 10 mm² (AWG 7) or two protective ground conductors with the same cross section as 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 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.

⚠WARNING

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:

The conductors must have a sufficiently large cross section so that the fuse at the mains connection can protect the equipment if necessary.

Properties of terminals:

The terminals are approved for stranded conductors and solid conductors. Always use suitable ferrules if stranded conductors are used.

LXM18ES/N	Unit	U01 / U02 / U04M2X
Interface cross-section	mm² (AWG)	1 (17)
Ferrule type	–	Type I
Length of wire cable ends (ferrules)	mm (in)	10...15 (0.39...0.59)

LXM18ES/N	Unit	U07 / U10 / U15M2X
Interface cross-section	mm² (AWG)	2.5 (13)
Ferrule type	–	Type I
Length of wire cable ends (ferrules)	mm (in)	10...15 (0.39...0.59)

LXM18ES/N	Unit	U20 / U30M3X
Interface cross-section	mm² (AWG)	4 (11)
Ferrule type		Type Y
Length of wire cable ends (ferrules)	mm (in)	10...15 (0.39...0.59)

Connecting the Braking Resistor

⚠WARNING

UNINTENDED EQUIPMENT OPERATION

- 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 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.

About the internal braking resistor:

The device is shipped with the internal braking resistor, which can absorb braking energy active.

Drive specification LXM18ES/N	Resistance value of braking resistor in Ω	Power of braking resistor in W
U01 / 02 / 04 / 07M2X	–	–
U10 / 15M2X	20	60
U20 / 30M3X	15	80

About the external braking resistor:

An external braking resistor is required for applications in which the motor must be decelerated quickly and the bus capacitor of the servo drive or the internal braking resistor cannot absorb the excess braking energy.

⚠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.

When selecting the rating of the external braking resistor, note the following conditions:

Drive specification LXM18ES/N	Minimum resistance value of the external braking resistor in Ω
U01 / U02 / U04M2X	40
U07 / U10 / U15M2X	20
U20 / U30M3X	15

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

If the resistance value of the external brake resistance is too small, it may cause excessive brake current and damage the brake transistor.

Cable specifications of the external braking resistor:

- Minimum conductor cross-section of the cables should be the same as that of mains supply.
- Shielded cables should be selected.
- Heat-resistant cables must be selected.

Properties of terminals:

The terminals are approved for stranded conductors and solid conductors. Always use suitable ferrules if stranded conductors are used.

LXM18ES/N	Unit	U01 / U02 / U04M2X
Interface cross-section	mm^2 (AWG)	1 (17)
Ferrule type	–	Type I
Length of wire cable ends (ferrules)	mm (in)	10...15 (0.39...0.59)

LXM18ES/N	Unit	U07 / U10 / U15M2X
Interface cross-section	mm^2 (AWG)	1 (17)
Ferrule type	–	Type I
Length of wire cable ends (ferrules)	mm (in)	10...15 (0.39...0.59)

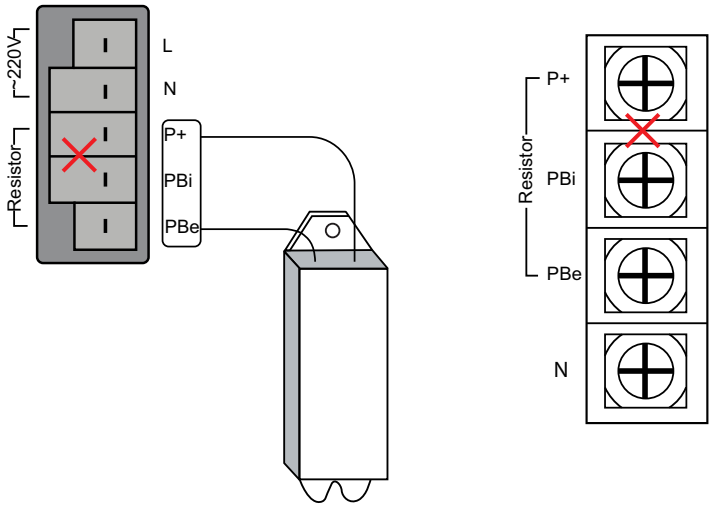
LXM18ES/N	Unit	U20 / U30M3X
Interface cross-section	mm^2 (AWG)	4 (11)
Ferrule type	–	Type Y
Length of wire cable ends (ferrules)	mm (in)	10...15 (0.39...0.59)

The braking resistors described in the External Braking Resistor, page 101 are shipped with 3-conductor heat-resistant cables, with the length from 0.75 m (2.46 ft) to 3 m (9.84 ft).

Method of connecting the external braking resistor:

- Power off all supply voltages. Observe the safety instructions concerning electrical installation.
- Verify that no voltages are present.
- Ground the grounding connection (PE) of the braking resistor.
- Remove the short-circuit jumper of the internal brake resistor between P+ and PBi on the terminal.
- Connect the external braking resistor to the drive.
- Connect the cable shield to the shield connection (large surface area contact).

Wiring diagram of the external braking resistor



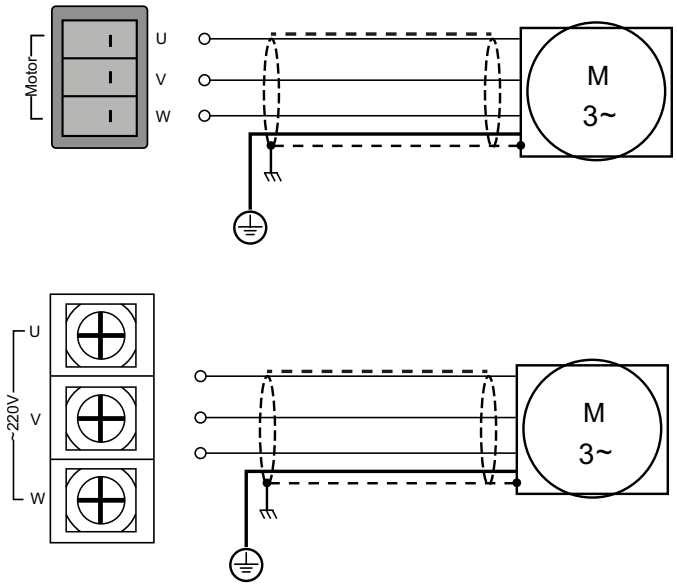
⚠⚠DANGER

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 (Charge 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.
- Install and fix all covers, accessories, hardware, cables, and wires and confirm a proper grounding before connecting to power.
- Use only the specified voltage when operating this equipment and any associated products.

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

Connecting the Motor Output Terminal



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

⚠DANGER

FIRES CAUSED BY IMPROPER CONNECTION

Only connect the motor to a matching, approved drive in the way described in the present document.

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

The motor itself generates voltage when the motor shaft is rotated. So, unexpected high voltages may be present at the motor side power input port. AC voltage in the motor cable can couple voltage to unused conductors.

⚠⚠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 earthing conductor with an additional protective earth 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 the drive system.

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

Incorrect motor connection will cause the live wire to be exposed outside the motor connector.

⚠⚠DANGER

ELECTRIC SHOCK CAUSED BY INSUFFICIENT ISOLATION

- Ensure that the protective ground conductor connection of the device is grounded.
- Ensure that the protective ground terminal is connected.
- When wiring the motor plug-in connector, ensure that the bare metal of the stranded conductors does not protrude from the plug-in connector housing.
- Generally, given vibration or other effects, ensure that motor connection is secured in the motor connector terminals as part of the maintenance program.

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

The drive system may move unexpectedly by using an unapproved combination of driver amplifier and motor. Even with similar motors, there nay be a risk due to the adjustment of the encoder system. Even if the plug-in connectors of the motor and encoder connectors are mechanically matched, this does not mean that the motor is allowed to be used.

⚠WARNING

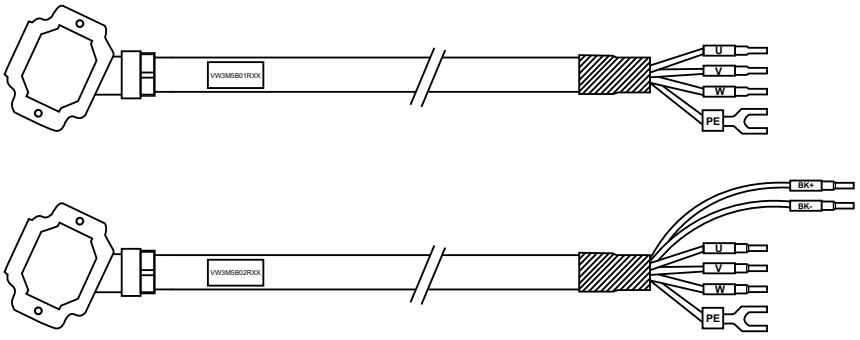
UNINTENDED EQUIPMENT OPERATION

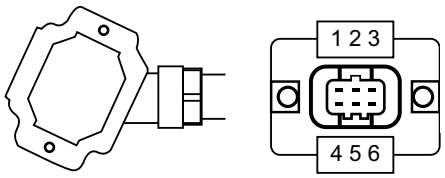
Only use approved combinations of driver amplifier and motor.

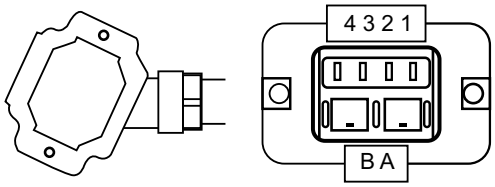
Failure to follow these instructions can result in death, serious injury, or equipment damage.

Power cables for the servo motors are available with different plug-in connector types depending on the motor to which they are connected.

Power cables with plastic waterproof plug-in connectors for small motors (flange 40...80 mm/1.57...3.15 in):

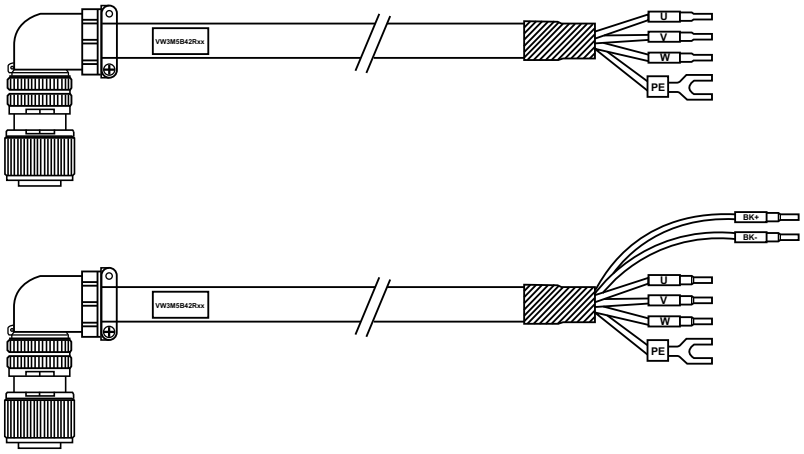


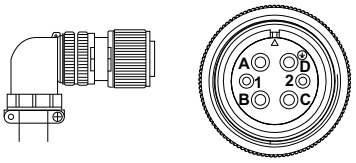
<table>
<tr><th>Applicable motor types</th><th>Plug-in connectors (motor side)</th></tr>
<tr><td>BCH18*B</td><td>
<table>
<tr><th>Signal</th><th>Pin</th></tr>
<tr><td>U</td><td>1</td></tr>
<tr><td>V</td><td>2</td></tr>
<tr><td>W</td><td>3</td></tr>
<tr><td>PE</td><td>4</td></tr>
<tr><td>(BK+)</td><td>5</td></tr>
<tr><td>(BK-)</td><td>6</td></tr>
</table>


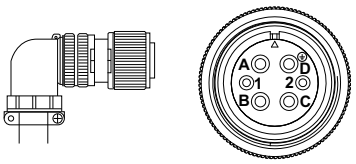
</td></tr>
<tr><td>BCH18*D
BCH18*F</td><td>
<table>
<tr><th>Signal</th><th>Pin</th></tr>
<tr><td>U</td><td>1</td></tr>
<tr><td>V</td><td>2</td></tr>
<tr><td>W</td><td>3</td></tr>
<tr><td>PE</td><td>4</td></tr>
<tr><td>(BK+)</td><td>A</td></tr>
<tr><td>(BK-)</td><td>B</td></tr>
</table>


</td></tr>
</table>

Power cables with military plug-in connectors for large motors (flange >100 mm/ 3.94 in):



<table>
<tr><th>Applicable motor types</th><th>Plug-in connectors (motor side)</th></tr>
<tr><td>BCH18*H
BCH18*M</td><td>
<table>
<tr><th>Signal</th><th>Pin</th></tr>
<tr><td>U</td><td>A</td></tr>
<tr><td>V</td><td>B</td></tr>
<tr><td>W</td><td>C</td></tr>
<tr><td>PE</td><td>D</td></tr>
<tr><td>(BK+)</td><td>1</td></tr>
<tr><td>(BK-)</td><td>2</td></tr>
</table>


</td></tr>
<tr><td>BCH18*R</td><td>
<table>
<tr><th>Signal</th><th>Pin</th></tr>
<tr><td>U</td><td>A</td></tr>
<tr><td>V</td><td>B</td></tr>
<tr><td>W</td><td>C</td></tr>
<tr><td>PE</td><td>D</td></tr>
<tr><td>(BK+)</td><td>1</td></tr>
<tr><td>(BK-)</td><td>2</td></tr>
</table>


</td></tr>
</table>

For the compatibility of servo motor power cables with the driver and motor, see the section Confirmation of a Servo Drive and its Related Servo Motor, page 29.

Cable specifications:

Item	Specification
Shield	–
Twisted pair	–
PELV	The conductors for the holding brake are PELV compliant.
Cable composition	The three conductors of the motor phase must have a sufficiently large cross section so that the fuse at the mains connection can protect the equipment Fuse
Maximum cable length	Depends on the required limit values for conducted interference. Maximum length: 25 m (82.02 ft).

Properties of terminals:

The terminals are approved for stranded conductors and solid conductors. Always use suitable ferrules if stranded conductors are used.

LXM18ES/N	Unit	U01 / U02 / U04M2X
Interface cross-section	mm^2 (AWG)	1 (17)
Ferrule type		Type I
Length of wire cable ends (ferrules)	mm (in)	10...15 (0.39...0.59)

LXM18ES/N	Unit	U07 / U10 / U15M2X
Interface cross-section	mm^2 (AWG)	1 (17)
Ferrule type		Type I
Length of wire cable ends (ferrules)	mm (in)	10...15 (0.39...0.59)

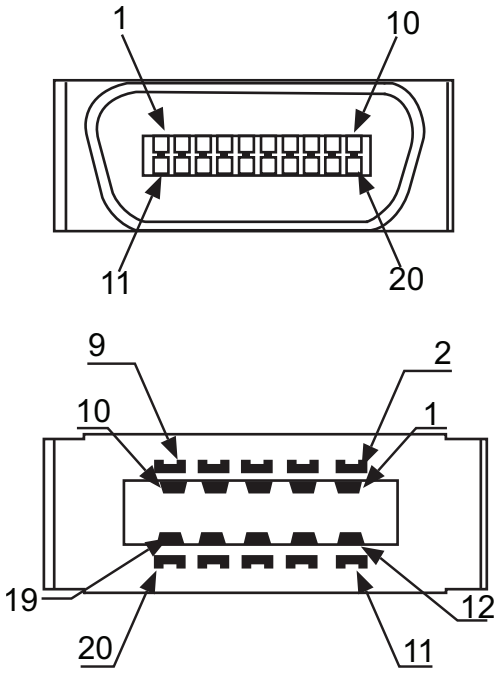
LXM18ES/N	Unit	U20 / U30M3X
Interface cross-section	mm^2 (AWG)	4 (11)
Ferrule type		Type Y
Length of wire cable ends (ferrules)	mm (in)	10...15 (0.39...0.59)

Signal Description of the Servo Drive Signal Connector (CN1)

The CN1 connector is a SCSI-20 pin plug-in connector for digital input and output connections.

Definition of CN1 plug-in connector pins:

Pin	Designation	Function	Pin	Designation	Function
1	DQ0+	Digital output 0+	2	DQ1+	Digital output 1+
3	DQ2+	Digital output 2+	4	–	(Reserved)
5	DI0	Digital input 0	6	DI1	Digital input 1
7	DI2	Digital input 2	8	DI3	Digital input 3
9	DI4	Digital input 4	10	DI5	Digital input 5
11	DQ0-	Digital output 0-	12	DQ1-	Digital output 1-
13	DQ2-	Digital output 2-	14	–	(Reserved)
15	–	(Reserved)	16	–	(Reserved)
17	–	(Reserved)	18	–	(Reserved)
19	–	(Reserved)	20	DI_COM	Digital input common end



Connection of the Servo Drive Signal Connector (CN1)

Digital input

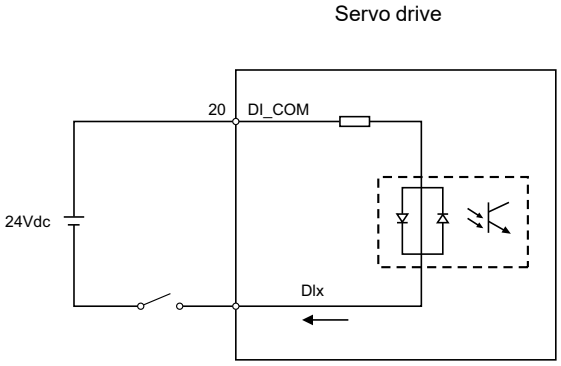
The servo drive supports 4 general-purpose digital input points (DI0...DI3) and two fast input points (DI4 / DI5) for position capture. The functions of the digital input points are configured via parameters, while the functions related to position capture are only allowed to be configured on the fast input points.

The digital input points of the servo drive share a common terminal and support both sourcing and sinking inputs (NPN & PNP).

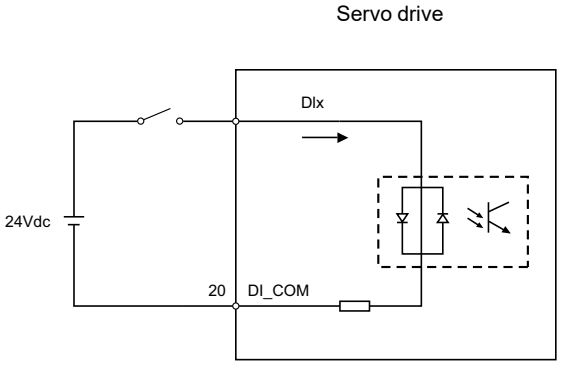
The level characteristics of the digital input signals are as follows:

Signal logic	Unit	DI0…5
Logic 0 / OFF	Vdc	- 3…+ 5
Logic 1 / ON	Vdc	+ 15…+ 30

Methods of the Input Connection for Sinking Output Points (NPN)



Methods of the Input Connection for Sourcing Output Points (PNP)



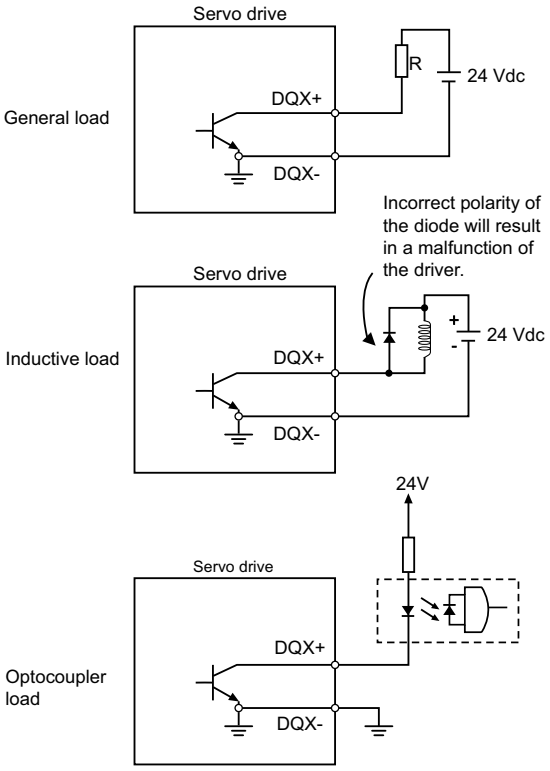
Digital output

The servo drive supports 3 general-purpose digital output points (DQ0...DQ2). The functions of the digital input points are configured via parameters.

The digital output points of the servo drives have limited current-carrying capacity and can only drive small loads such as relays or serve as signal feedback. When connecting inductive loads, a flyback diode should be assembled at the same time, otherwise it will cause damage to the internal components of the servo drives.

The level characteristics of the digital output signals are as follows:

Signal logic	Unit	DQ0...DQ2, OCZ
Output level	Vdc	<=30
Maximum load current	mA	<= 100



Connection of the Servo Drive Encoder Connector (CN2)

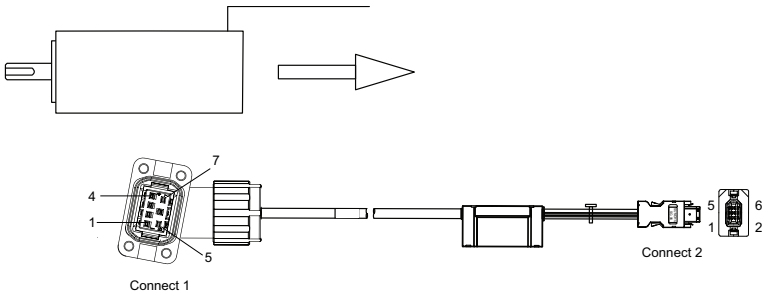
The CN2 connector is an IEEE-1394-6-pin plug-in connector for connecting servo motor encoders.

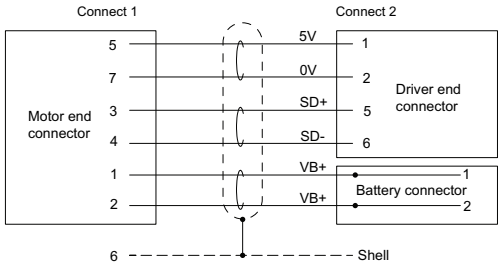
The encoder connectors at both ends are defined as below:

- Encoder cables with plastic waterproof plug-in connectors for small motors (flange 40...80 mm / 1.57...3.15 in.)

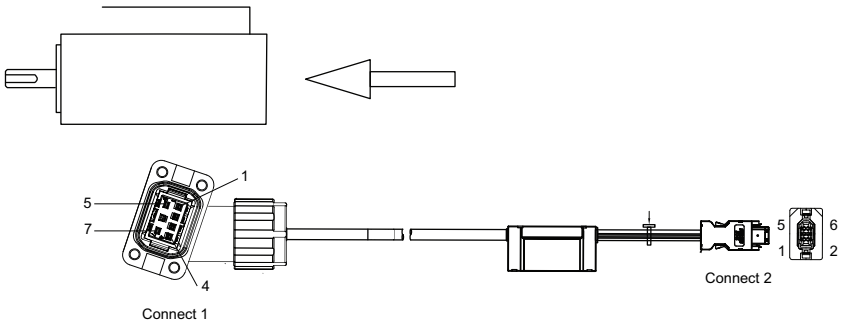
  If the customer does not use a multi-turn absolute motor, please choose the cable without a battery box, and ignore the battery wiring.

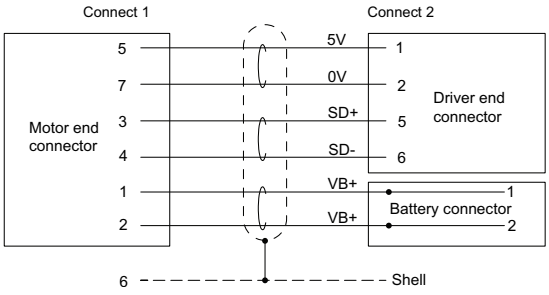
  1. Wiring diagram for backward outlet of the plastic plug



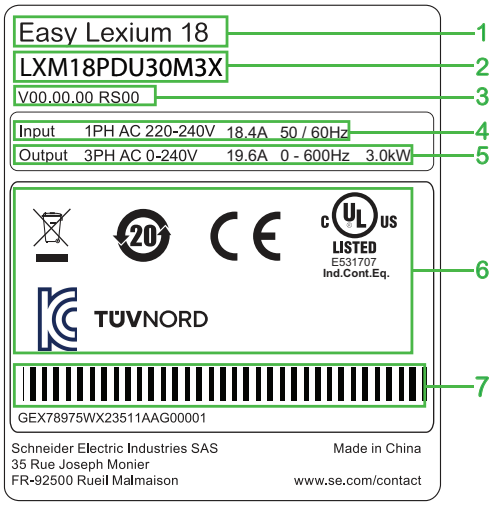


  2. Wiring diagram for forward outlet of the plastic plug

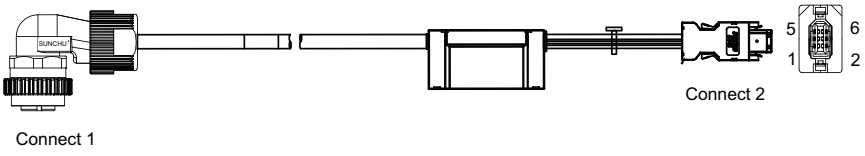


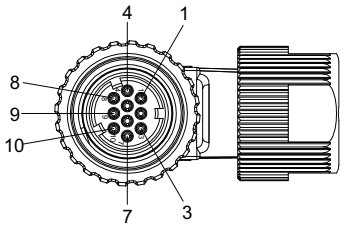


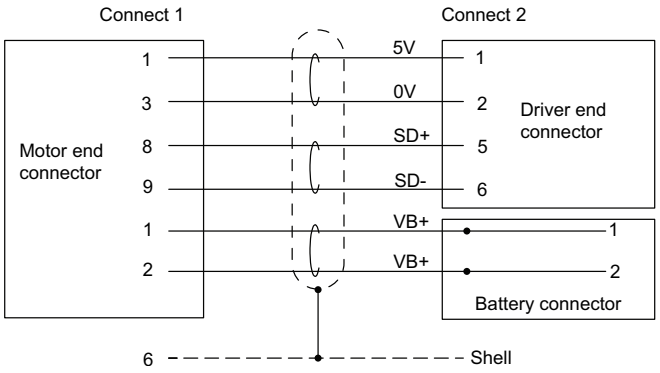
  3. Wiring diagram for forward outlet of the plastic plug



- Encoder cables with military plug-in connectors for large motors (flange >100 mm/3.94 in)
  1. Military plug wiring diagram







Cable specifications:

Item	Specification
Shield	Required, both ends grounded
Twisted pair	Required
Cable composition	2*0.5 mm^2+4*0.25 mm^2
Maximum cable length	Depends on the required limit values for conducted interference. Maximum length: 25 m (82.02 ft)

Connection of the Servo Drives to the Host Computer (CN3)

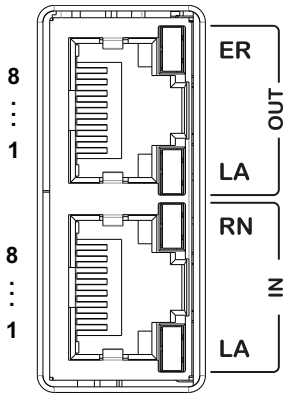
The programming interface (CN3) is a Type-C USB interface. It is only used for the connection of the servo drives to the host computer commissioning software, and cannot be used as a communication bus interface.

NOTICE
UNINTENDED EQUIPMENT OPERATION CN3 cannot be used as a communication bus interface. **Failure to follow these instructions can result in equipment damage.**

The servo drive is connected to the host computer with SoMove software via the CN3 interface for commissioning.

Connection of the Servo Drive EtherCAT Interface (CN5)

Overview



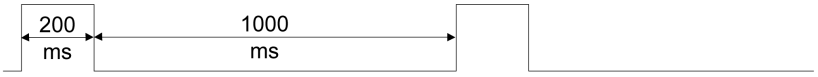
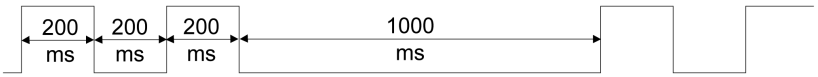
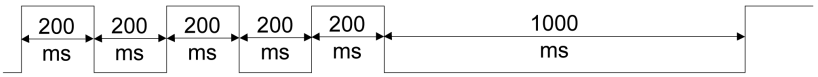
Pin No.	Signal (IN/OUT)	Function
1	Tx+	EtherCAT data transmission+
2	Tx-	EtherCAT data transmission-
3	Rx+	EtherCAT data reception+
4	–	Reserved
5	–	Reserved
6	Rx-	EtherCAT data reception-
7	–	Reserved
8	–	Reserved

LED instruction:

Display	Description	Status	Meaning
LED LA (IN) and LA (OUT)	EtherCAT IN/OUT connection indication, green light	Off	No link
		On	Link, no activity
		Fast flashing	Link, activity
LED RN	EtherCAT run indication, green light	Off	EtherCAT state INIT
		Flashing	EtherCAT state PRE-OPERATIONAL
		Single flash	EtherCAT state SAFE-OPERATIONAL
		On	EtherCAT state OPERATIONAL
LED ER	EtherCAT Communication error indication, red light	Double flash	Watchdog timeout
		Single flash	Local error (such as synchronization error)
		Flashing	Invalid configuration
		Off	No error

Meaning of the Status Signals

The table below summarizes the meaning of the flashing signals of the EtherCAT LEDs.

Status	Meaning
Fast flash	
Flashing	
Single flash	
Double flash	
Triple flash	

Connection of the Servo Drive STO Interface (CN6)

General

The 24 Vdc supply voltage is connected with many exposed signal connections in the drive system.

⚠WARNING

UNINTENDED EQUIPMENT OPERATION

- Use power supply units that meet the PELV (Protective Extra Low Voltage) requirements.
- Connect the 0 Vdc outputs of all power supply units to FE (functional earth/ functional ground), for example, for the VDC supply voltage and for the 24 Vdc voltage for the safety-related function STO.
- Interconnect all 0 Vdc outputs (reference potentials) of all power supply units used for the drive.

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

NOTICE

PERMANENT DAMAGE TO CONTACTS

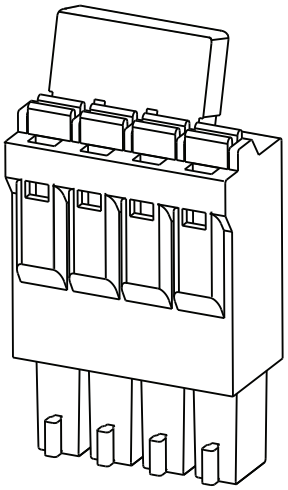
- Switch the power input (primary side) of the power supply unit.
- Do not switch the output voltage (secondary side) of the power supply unit.

Failure to follow these instructions can result in equipment damage.

Safety-Related Function STO

Information on the signals of the safety-related function STO can refer to section Functional Safety, page 34. The servo drive of type code LXM18ES****** is equipped with STO interface. The STO plug comes with the drive is short-circuited by default. If STO function is required, the insertion bridge must be plugged out and refer to .

NOTE: The +24 Vdc internal power supply in CN6 can not be used as the power supply for STO function.



Cable Specifications CN6

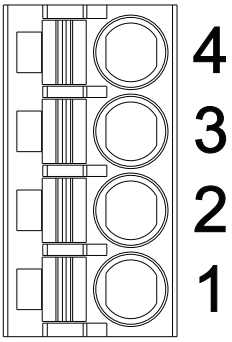
Shield:	–(1)
Twisted Pair:	–
PELV:	Required
Minimum conductor cross section:	0.75 mm^2 (AWG 18)
Maximum cable length:	100 m (328 ft)
(1) See Functional Safety, page 34.	

Properties of Connection Terminals CN6

Characteristic	Value
Voltage range	24 Vdc (±15%)
Input current	5.15 mA (Typ.)
Signal logic	Logic "Off" < 3 V Logic "On" > 15 V
Input impedance	4.42 kΩ

The terminals are approved for stranded conductors and solid conductors. Use wire cable ends (ferrules), if possible.

Wiring Diagram



Pin assignment:

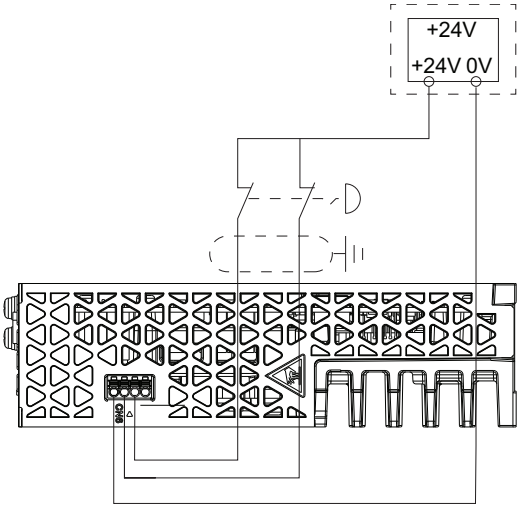
Pin No.	Signal	Function
1	GND	GND
2	STO_A	STO_A input
3	STO_B	STO_B input
4	+24 Vdc	Internal power supply

Connecting the Safety-Related Function STO

- Verify that wiring, cables and connected interfaces meet the PELV requirements.
- Connect the safety-related function STO in accordance with the specifications in section Functional Safety, page 34.

Connecting the 24 Vdc for STO

- Verify that wiring, cables and connected interfaces meet the PELV requirements.
- Route the 24 Vdc control supply from a power supply unit (PELV) to the drive.
- Ground the 0 Vdc output at the power supply unit.
- Note the maximum permissible terminal current when connecting several drives.



Verifying the Safety-Related Function STO

Operation with Safety-Related Function STO

Power off the power stage supply and the 24 Vdc for STO:

- Verify that the signal wires at the inputs (*STO_A*) and (*STO_B*) are isolated from each other. The two signal wires must not be electrically connected.

Power on the power stage supply and the 24 Vdc for STO:

- Enable the power stage without starting a motor movement.
- Trigger the safety-related function STO.

  If the power stage is now disabled and the error message 1300 is indicated, the safety-related function STO was triggered.

  If a different error message is indicated, the safety-related function STO was not triggered.
- Document all tests of the safety-related function STO in your acceptance protocol.

Operation without Safety-Related Function STO

If you do not want to use the safety-related function STO:

- Verify that the inputs *STO_A* and *STO_B* are connected to internal 24 Vdc by insertion bridge in STO plug..

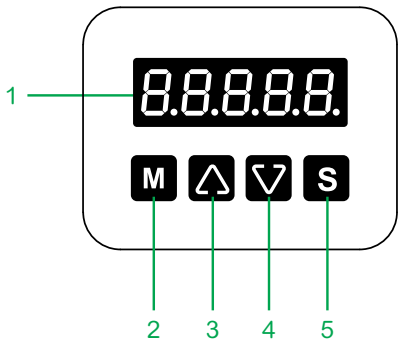
Front Panel

Front Panel

Overview of the Front Panel

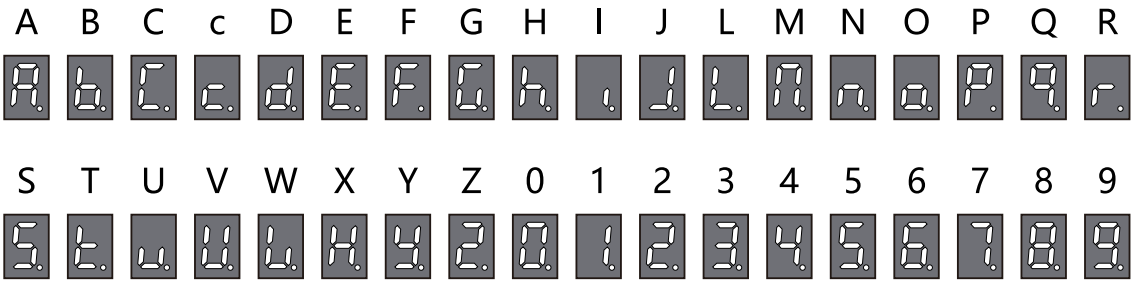
The device can set parameters and perform various operations via the integrated front panel Human Machine Interface (HMI). Diagnostic information (e.g. parameter values or error codes) can also be displayed.

The front panel contains:

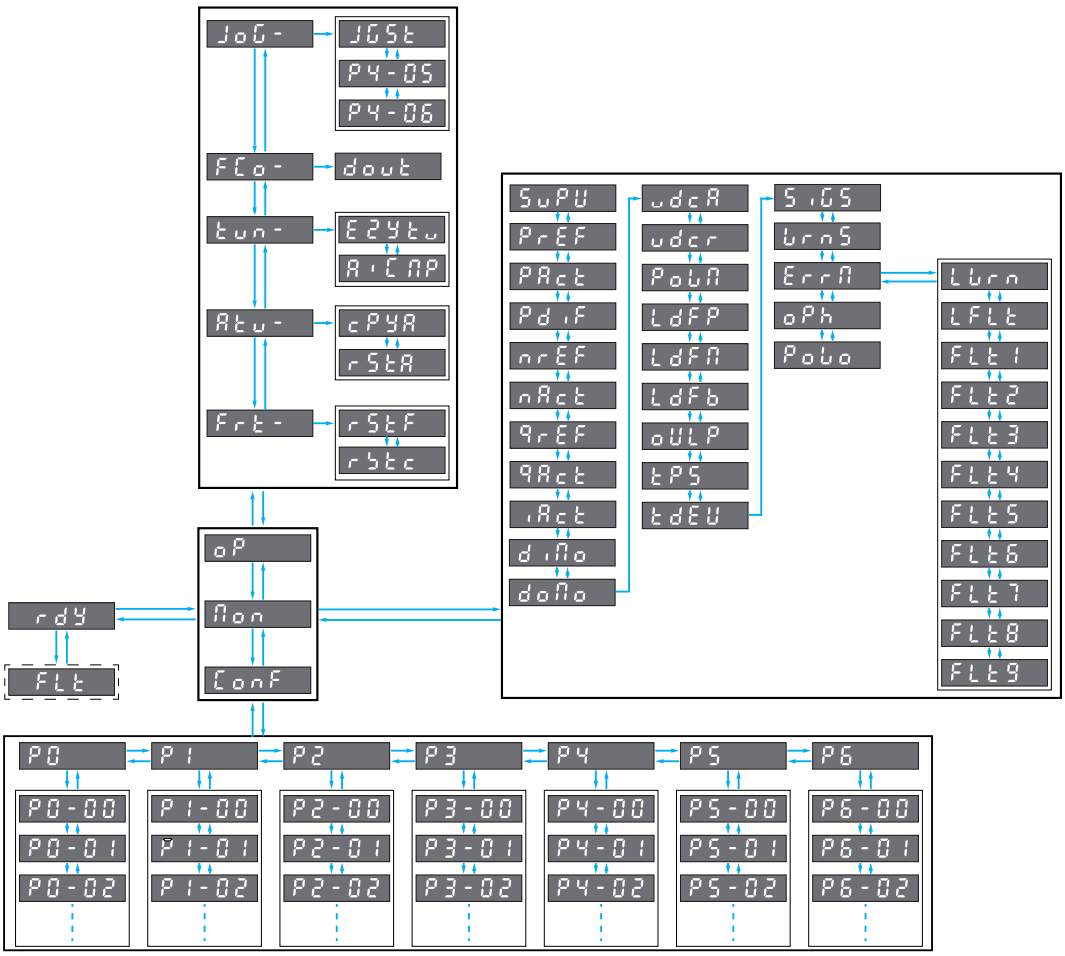


No.	Designation
1	5-digit 7-segment LED with 5 decimal points
2	M key
3	Page Up key
4	Page Down key
5	S key

Here is the status of the characters on the 5-digit 7-segment LED display:



Composition of Each Parameter Set on the Front Panel

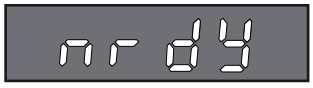
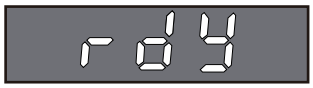
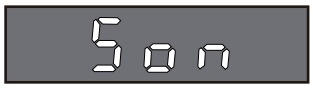
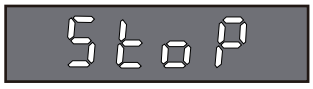


Operation of the Front Panel

Display	Key name	Function description
M	M	Press the M key to enable switching between the error message and parameter tree when the drive triggers an alarm.
		Press the M key to return to the upper parameter structure and invalidate unsaved parameter edits.
	Page Up	In the parameter structure, press the Page Up key to navigate through the parameters at the current parameter structure.
		When you are editing a parameter, press the Page Up key to increase the current set value.
	Page Down	In the parameter structure, press the Page Down key to navigate through the parameters at the current parameter structure.
		When you are editing a parameter, press the Page Down key to decrease the current set value.
S	S	In the parameter structure, press the S key to go to the next level of the current parameter structure.
		After entering the parameter setting, press the S key to start editing the current parameter.
		While you are editing a parameter, press the S key to move the cursor one character to the left.
		While you are editing a parameter, press and hold the S key for more than 1.5 seconds to save the current parameter setting and stop editing the current parameter.

7-Segment LED Display

The information on the display can indicate the current status of the device:

HMI display	Operating state	Description
	**1**Initiate	The device is initialized.
	**2** Not Ready To Switch On	Device Enable is not ready to switch on.
	**3**Disabled	Device Enable is disabled.
	**4** Ready To Switch On	Device Enable is ready.
	**5** Switched On	Device Enable is switched on.
	**6** Operation Enabled	The device is enabled / operating mode set is active.
	**7** Quick Stop Active	“Quick Stop” is active.
	**8** Fault Response Active	Fault Response is active.
	**9** Fault	Fault response is done/Device Enable is disabled.

When you attempt to perform an action by pressing the **S** key, or pressing and holding the **S** key for more than 1.5 seconds to save a new parameter value, feedback will be given on the display as to whether the current action is successful:

Display	Function description
Flash for three times	The new parameter value is saved successfully.
buSy	Drive access rights are busy (e.g. commissioning software).
Rd-oL	This parameter is a read-only parameter and does not support modification.
outr	The new parameter value is beyond the range allowed by this parameter, and saving of the new parameter value is disabled.
Prot	The parameter is locked, and saving of the new parameter value is disabled.
Sv-on	The new parameter value can only be saved if the drive power stage output is not enabled (disabled), and the saving of the new parameter value is disabled.
AdPon	The control loop adjustment mode is adaptive and simple auto-tuning cannot be activated.
noPoW	The drive mains supply is not energized and saving of the new parameter value is disabled.
dEnid	Saving of the new parameter value is denied.

A 5-digit value can be displayed directly on the display. Values exceeding 5 digits can be toggled between 5 displayed digits higher and lower than the value by using the Page Up or Page Down key. When the parameter is in Editing mode, each digit of the value can be selected one by one by pressing the S key.

The display indicates when the value is positive or negative by the first decimal point. A decimal point indicates a negative number.

Example:

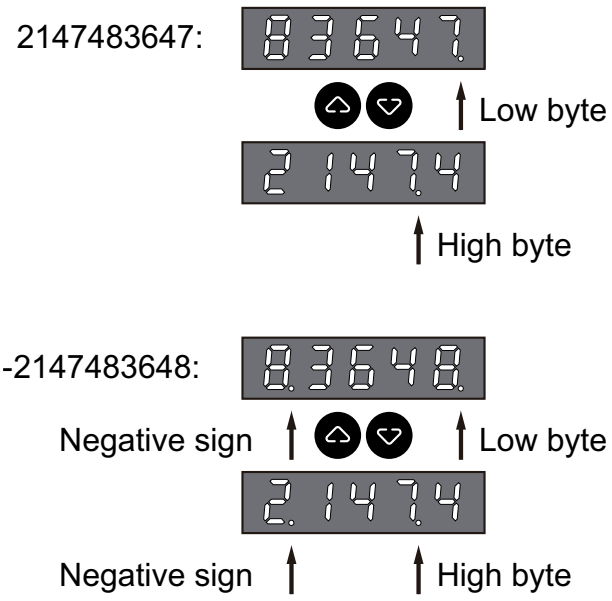
-1285: 



Negative sign

The display indicates the high and low positions of the current display by using the last two decimal points, the last decimal point indicating the low position and the penultimate decimal point indicating the high position.

Example:



Front Panel Locking

To prevent accidental operation from changing the parameter value settings, the front panel can be placed in a locked state.

P5-00	*HMIlocked*	Minimum value	0	Unit	–	Persistence	per.
		Factory setting	0	Data type	UINT16	MODBUS	14850
		Maximum value	1	Access	R/W	EtherCAT	303A:01$_h$

Description:

Lock 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
- Auto tuning
- Fault Reset

Modified settings become active immediately.

Operation of the Parameter Set OP on the Front Panel

The OP parameter set can be accessed by pressing the S key in the rdy state, or the M key in the FIt state. This parameter set allows manual operation of the drive, including the JOG operation, simple auto-tuning, adaptive control loop parameter operation, and factory reset of the drive.

JOG Operation

A jog refers to a JOG operation of a servo motor.

Usually, the purpose of JOG is to verify that the servo drive and servo motor are properly connected and that the servo motor can operate properly.

To perform the JOG operation safely and correctly, check and verify the following items prior to the JOG operation:

- Servo drive:

  Is the wiring and setting of the servo drive correct?

  Is the input mains voltage of the servo drive normal?

- Servo motor:

  Is the wiring from the servo motor to the servo driver correct?

  Are the connection fasteners secure?

If it is a servo motor with the holding brake, you should apply the specified voltage (24Vdc) to the servo motor holding brake to release it before starting the JOG operation.

⚠WARNING

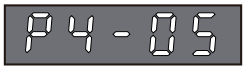
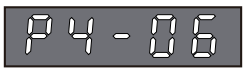
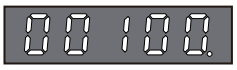
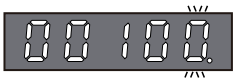
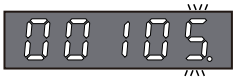
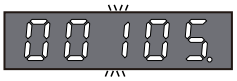
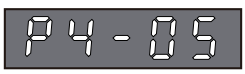
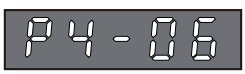
UNINTENDED EQUIPMENT OPERATION

- Start the system only if there is no person or obstruction in the zone of operation.
- An emergency stop switch must be available within the range of the servo motor.

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

The parameter set JOG on the panel allows you to edit and select the velocity and direction of JOG movement, and operate the motor.

- **To set JOG velocity:**

Step	Current display content on the panel	Key used	Operation
0			press the S key and the panel displays OP.
1			press the S key and the panel displays JOG.
2			press the S key and the panel displays JGSt.
3			press the Page Up or Page Down key to select the drive's JOG operation or configure JOG parameters.
4			press the S key and the panel displays the current value of the parameter P4-05.
			press the S key and the panel displays the current value of the parameter P4-06.
5			press the S key to start editing the parameter, and the first character of the parameter value starts flashing to indicate that it gets the cursor.
6			press the Page Up or Page Down key to edit the value of the character that gets the cursor. Each time you press the Page Up key, the value is added by 1, and each time you press the Page Down key, the value is subtracted by 1.
7			press the S key to move the cursor from right to left. Each time you press, the cursor is moved to left by 1 character.
8			press the Page Up or Page Down key to edit the value of the character that gets the cursor. Each time you press the Page Up key, the value is added by 1, and each time you press the Page Down key, the value is subtracted by 1.
9		 >1.5s	Press and hold the S key for more than 1.5 seconds, and then the current parameter value flashes once before fixing, indicating that the current parameter value is saved.
10			press the M key to exit the current parameter.
11			The panel displays P4-05 and the editing of the parameter value is done.
			The panel displays P4-06 and the editing of the parameter value is done.

- **Activate the JOG operation, and run the motor in this step:**

Step	Current display content on the panel	Key used	Operation
0			press the S key and the panel displays OP.
1			press the S key and the panel displays JOG.
2			press the S key and the panel displays JGSt.
3			press the S key to activate JOG operation. Now, the drive power stage is on and the drive enters the Enable state.
4	   		press the Page Up or Page Down key to select JOG velocity and direction.
5			Press and hold the S key and the motor moves in the positive direction at the velocity set in the parameter P4-05. Release the S key to stop the motor movement.
			Press and hold the S key and the motor moves in the positive direction at the velocity set in the parameter P4-06. Release the S key to stop the motor movement.
			Press and hold the S key and the motor moves in the positive direction at the velocity set in the parameter P4-05. Release the S key to stop the motor movement.
			Press and hold the S key and the motor moves in the positive direction at the velocity set in the parameter P4-06. Release the S key to stop the motor movement.
6	   		press the M key at any moment to exit the JOG operation.
7		–	Current display JOG Now, the drive power stage is off and the drive exits the Enable state.

- **Related parameters**

P4-05	***JOGv_slow***	**Minimum value**	**1**	**Unit**	**usr_v**	**Persistence**	**per.**
		Factory setting	**100**	**Data type**	**UINT32**	**MODBUS**	**10504**
		Maximum value	**2147483647**	**Access**	**R/W**	**EtherCAT**	**3029:04h**

Description:

Velocity for slow movement.

The adjustable value is internally limited to the parameter setting in *RAMP_v_max* (P4-01).

Modified settings become active immediately.

P4-06	***JOGv_fast***	**Minimum value**	**1**	**Unit**	**usr_v**	**Persistence**	**per.**
		Factory setting	**200**	**Data type**	**UINT32**	**MODBUS**	**10506**
		Maximum value	**2147483647**	**Access**	**R/W**	**EtherCAT**	**3029:05h**

Description:

Velocity for fast movement.

The adjustable value is internally limited to the parameter setting in *RAMP_v_max* (P4-01).

Modified settings become active immediately.

Force Output Operation (FCo)

In menu group FCo, the following operation can be carried out:

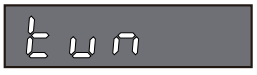
- Force the digital outputs.

The FCo menu operation is shown as:



Auto Tuning

The simple auto-tuning operation of the servo control loop can be active via the parameter set tun on the panel.

Step	Current display content on the panel	Key used	Operation
0			Press the S key, and the panel displays OP.
1			Press the S key, and the panel displays JOG.
2			Press the Page Up or Page Down key to select tun.
3			Press the S key, and the panel displays tuSt.
4			Press the S key, and the panel displays EZYtu.
5			Press the S key to activate simple auto-tuning. Now, the drive power stage is on and the drive enters the Enable state. The servo motor will make several forward and reverse movements according to the preset program and try to measure the optimal control loop parameters.
6		–	During the simple auto-tuning operation, the panel will display the auto-tuning progress, expressed as a percentage figure. After the auto-tuning is done, the panel displays donE.
7			Press the S key to save the auto-tuning result. At the same time, the drive power stage is off and the drive exits the Enable state.
8		–	The panel displays tun and the auto-tuning is done.

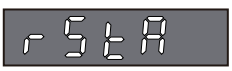
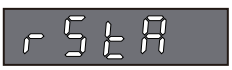
Operation of the Adaptive Control Loop Parameters

The parameter set Atu displayed on the panel allows you to map the adaptive control loop parameters to the PID control loop parameters in < P1-Gain Setting >. It is also possible to reset the adaptive control loop parameters to their factory settings.

- **To map the adaptive control loop parameters**

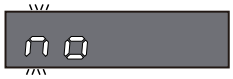
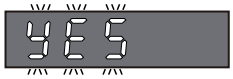
Step	Current display content on the panel	Key used	Operation
0			Press the S key and the panel displays OP.
1			Press the S key and the panel displays JOG.
2			Press the Page Up and Page Down keys to select Atu.
3			Press the S key, and the panel displays cPYA.
4			Press the S key and the panel displays that the characters flash once. Now, the adaptive control loop parameters is mapped to the PID control loop parameters in < P1 - Gain Setting >.
5		–	–

- **To reset the adaptive control loop parameters**

Step	Current display content on the panel	Key used	Operation
0			Press the S key and the panel displays OP.
1			Press the S key and the panel displays JOG.
2			Press the Page Up and Page Down keys to select Atu.
3			Press the S key, and the panel displays cPYA.
4			Press the Page Up or Page Down key to select rStA.
5			Press the S key and the panel displays that the characters flash once. Now, the adaptive control loop parameters is reset to the factory settings.
6		–	–

Drive Factory Reset

The drive can be factory reset through the parameter set Frt on the panel.

Step	Current display content on the panel	Key used	Operation
0			Press the S key and the panel displays OP.
1			Press the S key and the panel displays JOG.
2			Press the Page Up or Page Down key to select Frt.
3			Press the S key and the panel displays rStF.
4			Press the S key and the panel displays no.
5			Press the S key and the panel displays that the characters begin to flash.
6			Press the Page Up key and the panel displays YES and that the character flashes.
7		 >1.5s	Press and hold the S key for more than 1.5 seconds, the panel display that the character flashes once and then exits, and the panel displays reset. Now the drive is factory reset.
8			–

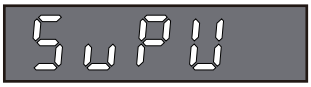
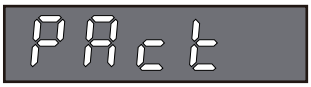
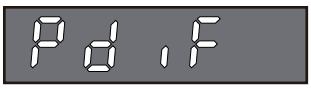
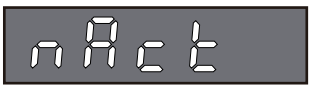
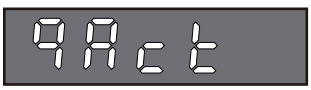
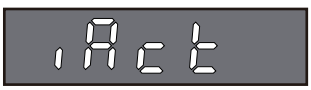
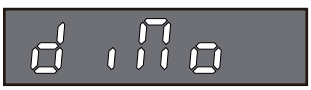
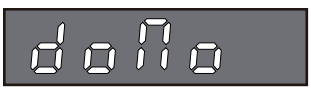
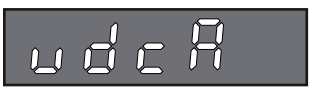
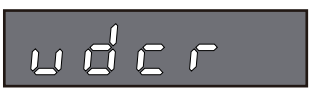
Operation of the Parameter Set MON on the Front Panel

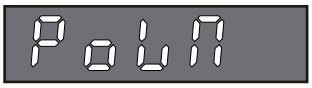
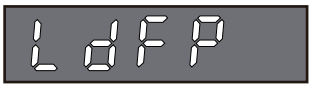
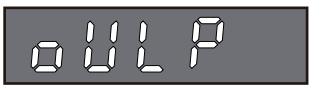
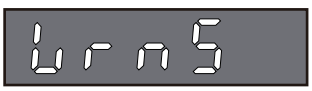
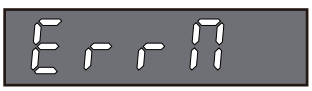
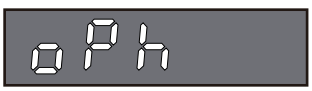
When the drive is powered on, status information can be displayed via the display.

In addition to the information displayed by default, specific parameter values can be displayed via the parameter set MON.

It is also possible to set the content of the information displayed by default at power-up through the parameters.

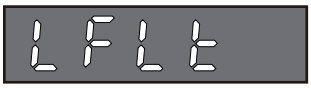
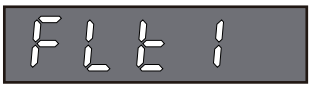
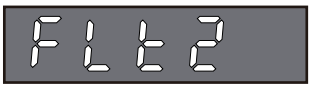
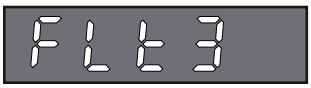
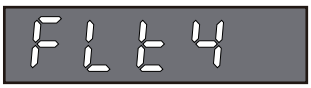
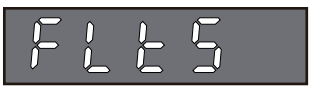
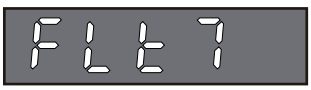
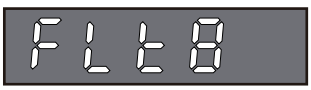
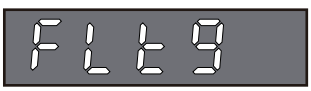
Displayable Drive Status Information

Current display content	Parameter name	Function description
	**SuPV**	The default message displayed on the front panel after the drive is powered on.
	**StAt**	The current status of the drive (only appears in SuPV).
	**PrEF**	Command position, use of internal position computing unit (usr_p).
	**PAct**	Actual position,use of internal position computing unit (usr_p).
	**Pdif**	Position deviation, use of internal position computing unit (usr_p).
	**nrEF**	Command velocity of the motor (rpm).
	**nAct**	Actual velocity of the motor (rpm).
	**qrEF**	Command current of the motor (“Q” current for producing torque) (Arms).
	**qAct**	Actual current of the motor (“Q” current for producing torque) (Arms).
	**iAct**	Actual total current of the motor (Arms).
	**diMo**	Drive input point status.
	**doMo**	Drive output point status.
	**udcA**	Current voltage of the drive DC bus (V).
	**udcr**	Usage of the drive DC bus (%).

Current display content	Parameter name	Function description
	**PoWM**	Average output power of the drive power stage (W).
	**LdFP**	Average load factor of the drive power stage (%).
	**LdFM**	Average load factor of the motor (%).
	**LdFb**	Average load factor of the braking resistor (%).
	**oVLP**	Overload rate of the drive power stage (%).
	**tPS**	Temperature of the drive power stage (℃).
	**tdEV**	Temperature of the drive equipment (℃).
	**SiGS**	Saved monitoring signal status.
	**Wrns**	All current warnings grouped in characters (fault level 0).
	**ErrM**	Drive error history. Details of status information of ErrM can refer to .
	**oPh**	Operation hours of the drive (s).
	**PoWo**	The power-on number of the drive.

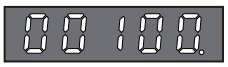
Status Information of ErrM

You can check the status information of ErrM by opening the menu group ErrM, and the details are shown as:

Current display content	Parameter name	Function description
	**Lwrn**	A warning that the current fault level is 0.
	**LFlt**	An error that the current fault level is 1...4.
	**Flt1**	A historical error that the level of the first fault stored is 1...4.
	**Flt2**	A historical error that the level of the second fault stored is 1...4.
	**Flt3**	A historical error that the level of the third fault stored is 1...4.
	**Flt4**	A historical error that the level of the fourth fault stored is 1...4.
	**Flt5**	A historical error that the level of the fifth fault stored is 1...4.
	**Flt6**	A historical error that the level of the sixth fault stored is 1...4.
	**Flt7**	A historical error that the level of the seventh fault stored is 1...4.
	**Flt8**	A historical error that the level of the eighth fault stored is 1...4.
	**Flt9**	A historical error that the level of the ninth fault stored is 1...4.

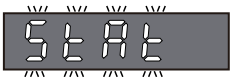
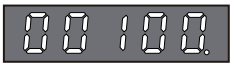
Selecting and Displaying Drive Status Information

Select and display the drive status information via the parameter set MON.

Step	Current display content on the panel	Key used	Operation
0			Press the S key and the panel displays OP.
1			Press the S key and the panel displays MON.
2			Press the S key and the panel displays SuPV.
3			Press the Page Up or Page Down key to select the drive status information, see Displayable Drive Status Information, page 153.
4			Press the S key and the panel displays the corresponding drive status information.
5		–	–

Setting the Factory Setting Status Information Displayed after Drive Power-on

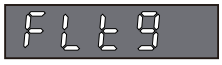
Set the default status information displayed after drive power-on via the parameter set **MON > StAt** on the panel.

Step	Current display content on the panel	Key used	Operation
0		M ⌃ ⌄ **S**	Press the S key and the panel displays OP.
1		M ⌃ ⌄ **S**	Press the S key and the panel displays MON.
2		M ⌃ ⌄ **S**	Press the S key and the panel displays SuPV.
3		M ⌃ ⌄ **S**	Press the S key and the panel displays StAt.
4		M ⌃ ⌄ **S**	Press the S key to edit the parameter. Now the panel displays that the character begins to flash.
5		M **⌃** **⌄** S	Press the Page Up or Page Down key to select the drive status information, see Displayable Drive Status Information, page 153.
6		M ⌃ ⌄ **S** >1.5s	Press and hold the S key for more than 1.5 seconds, the panel displays that the character flashes once before fixing, indicating that the current parameter value is saved.
7		**M** ⌃ ⌄ S	Press the S key multiple times to return to the previous menu till the panel displays the corresponding drive status information.
8		–	The drive status information selected in step 6 is also displayed by default when the drive is powered on.

Displaying the Current / Historical Error Records

The parameter set **MON > ErrM** on the panel allows to display the drive's current/ historical fault information:

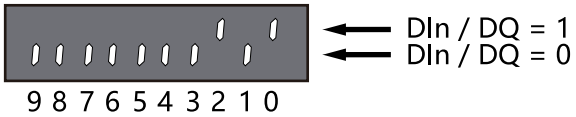
- Run the parameter **MON > ErrM > LWrn** to display a warning that the fault level is 0.
- Run the parameter **MON > ErrM > LFlt** to display an error that the fault level is 1...4.
- Run the parameter **MON > ErrM > Fltn** to display a historical error that a fault level displayed dynamically in the order of the occurrence of the fault is 1...4. Up to the first 9 historical errors are recorded, and the historical errors with higher n-number appear earlier.

Step	Current display content on the panel	Key used	Operation
0			Press the S key and the panel displays OP.
1			Press the S key and the panel displays MON.
2			Press the S key and the panel displays SuPV.
3			Press the Page Up or Page Down key to select the drive status information till the panel displays ErrM.
4			Press the S key to go to the fault record parameter set.
5	    		Press the Page Up or Page Down key to select the drive's current / historical fault records.
6			Press the S key and the panel displays the content of the drive's selected current / historical fault records.
7		–	–

Monitoring I/O Status Information

This device comes with functionally configurable input and output points.

The signal status of the input and output points can be monitored via the device's integrated HMI, but only the monitoring function is provided, and the status of the input and output points cannot be modified.



Input point:

- Go to the parameter set **MON > diMo** on the panel.

  The status of the input points is presented in bit-coded form.

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

Output point:

- Go to the parameter set **MON > doMo** on the panel.

  The status of the output points is presented in bit-coded form.

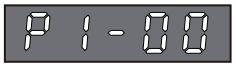
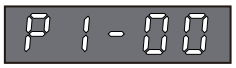
Bit	Output point
0	DQ0
1	DQ1
2	DQ2

Operation of the parameter set Conf on the Front Panel

Setting and Operating Numeric Parameters

When setting numeric parameters, you can edit the parameter value separately for each digit of the parameter.

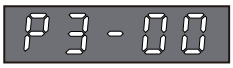
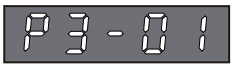
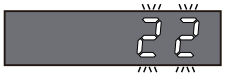
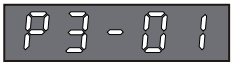
Here is an example of setting numeric parameter P1-00:

Step	Current display content on the panel	Key used	Operation
0			Press the S key and the panel displays OP.
1			Press the Page Up or Page Down key to select Conf.
2			Press the S key and the panel displays P0.
3			Press the Page Up or Page Down key to select P1.
4			Press the S key and the panel displays Parameter P1-00.
5			Press the S key and the panel displays the current value of the parameter P1-00.
6			Press the S key to start editing the parameter, and the first character of the parameter value starts flashing to indicate that it gets the cursor.
7			Press the S key to move the cursor from right to left. Each time you Press, the cursor is moved to left by 1 character.
8			Press the Page Up or Page Down key to edit the value of the character that gets the cursor. Each time you Press the Page Up key, the value is added by 1, and each time you Press the Page Down key, the value is subtracted by 1.
9			Press and hold the S key for more than 1.5 seconds, and then the current parameter value flashes once before fixing, indicating that the current parameter value is saved.
10			Press the M key to exit the current parameter.
11		–	The panel displays P1-00 and the editing of the parameter value is done.

Setting and Operating Selective Parameters

When setting a selective parameter, you need to make a selection in the option list.

Here is an example of setting the selective parameter P3–01:

Step	Current display content on the panel	Key used	Operation
0			Press the S key and the panel displays OP.
1			Press the Page Up or Page Down key to select Conf.
2			Press the S key and the panel displays P3.
3			Press the S key and the panel displays Parameter P3-00.
4			Press the Page Up or Page Down key to select P3-01.
5			Press the S key and the panel displays the current value of the parameter P3-01.
6			Press the S key to edit the parameter. Now the current value begins to flash.
7			Press the Page Up and Page Down key to make a selection in the option list of the current parameter.
8			Press and hold the S key for more than 1.5 seconds, and then the current parameter value flashes once before fixing, indicating that the current parameter value is saved.
9			Press the M key to exit the current parameter.
10		–	The panel displays P3-01 and the editing of the parameter value is done.

Warm Starting the Drive from the Front Panel

When the drive is not in the Enable state, the drive can be warm-started from the front panel:

Step	Current display content on the panel	Key used	Operation
0		 >2.5s	When the drive is not in the Enable state, press and hold both the M and S keys for more than 2.5 seconds. Now the panel displays Warm, indicating that the drive is ready to warm start.
1		–	Release both the M and S keys to restart the drive.
2		–	The panel displays rdy, indicating that the drive is ready.

Operation

Access Channels

Overview of the Access Channels

Lexium 18E series servo drives have a concept of access channels. They can be accessed via different types of access channels.

Access channels for the product are:

- Integrated HMI front panel
- EtherCAT interface
- Commissioning software
- Digital input signal

⚠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.

Exclusive Access Channels

Lexium 18E series servo drives can be accessed via exclusive channels. Only one channel can have access to the product when an exclusive channel is used. Only one access channel can have exclusive access to this product at any one time.

The exclusive access channels for this product include:

- Integrated HMI front panel:

  The JOG operation or simple auto-tuning can be performed via the integrated HMI front panel.
- EtherCAT interface:

  Setting specific internal parameters of the drive through EtherCAT interface allows EtherCAT interface to gain exclusive access to the device.
- Commissioning software:

  The commissioning software receives exclusive access by setting the control button in position ON.

When the drive is powered on, there is no exclusive access via an access channel.

EtherCAT Setting

Preparation

This chapter describes how to commission the product.

⚠WARNING

LOSS OF CONTROL

- Ensure that connection monitoring is enabled.
- Set the shortest, practical monitoring time cycles to detect communication interruptions as quickly as possible.

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

⚠WARNING

UNINTENDED EQUIPMENT OPERATION

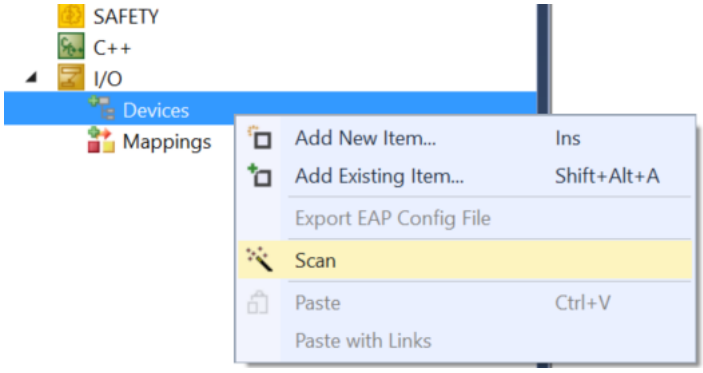
- Only start the system if there are no persons or obstructions in the zone of operation.
- Do not write values to reserved parameters.
- Do not write values to parameters unless you fully understand the function.
- Run initial tests without coupled loads.
- Verify correct word order for fieldbus communication.
- Do not establish a fieldbus connection unless you have fully understood the communication principles.

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

Add the Product as an NC Axis in the Beckhoff TwinCAT

Add the XML file to TwinCAT.

Scan the EtherCAT network to automatically add the product to TwinCAT.



Add the product to the NC(Numerical Control) configuration.

Settings

Setting the Process Data

4 predefined RxPDOs and 4 predefined TxPDOs are available.

Depending on the selected operating mode, one of the predefined RxPDOs and one of the predefined TxPDOs can be used:

Operating mode	Suitable PDO
Cyclic Synchronous Position	First Predefined PDO
Cyclic Synchronous Velocity	Second Predefined PDO
Cyclic Synchronous Torque	Third Predefined PDO
Any type of switch between: Cyclic Synchronous Position Cyclic Synchronous Velocity Cyclic Synchronous Torque	Fourth Predefined PDO

Only a single predefined RxPDO and only a single predefined TxPDO can be used simultaneously.

The PDOs can be adapted as required. A maximum of 10 parameters are possible per RxPDO and TxPDO.

Setting the Process Data of the First Predefined PDO

The first PDO is suitable for the operating mode Cyclic Synchronous Position.

Structure RxPDO 1600$_h$

Index	Parameter name (DS402 name)
6040:00$_h$	*DCOMcontrol* (Control word)
607A:00$_h$	*PPp_target* (Target position)
3008:11$_h$	*IO_DQ_set*

Structure TxPDO 1A00$_h$

Index	Parameter name (DS402 name)
6041:00$_h$	*_DCOMstatus* (Status word)
6064:00$_h$	*_p_act* (Position actual value)
603F:00$_h$	*_LastError* (Error code)
3008:01$_h$	*_IO_act*

Setting the Process Data of the Second Predefined PDO

The second PDO is suitable for the operating mode Cyclic Synchronous Velocity.

Structure RxPDO 1601_h

Index	Parameter name (DS402 name)
$6040:00_h$	*DCOMcontrol* (Control word)
$60FF:00_h$	*PVv_target* (Target velocity)
$3008:11_h$	*IO_DQ_set*

Structure TxPDO $1A01_h$

Index	Parameter name (DS402 name)
$6041:00_h$	*_DCOMstatus* (Status word)
$6064:00_h$	*_p_act* (Position actual value)
$603F:00_h$	*_LastError* (Error code)
$3008:01_h$	*_IO_act*

Setting the Process Data of the Third Predefined PDO

The third PDO is suitable for the operating mode Cyclic Synchronous Torque.

Structure RxPDO 1602_h

Index	Parameter name (DS402 name)
$6040:00_h$	*DCOMcontrol* (Control word)
$6071:00_h$	*PTtq_target* (Target torque)
$3008:11_h$	*IO_DQ_set*

Structure TxPDO $1A02_h$

Index	Parameter name (DS402 name)
$6041:00_h$	*_DCOMstatus* (Status word)
$6064:00_h$	*_p_act* (Position actual value)
$6077:00_h$	*_tq_act* (Torque actual value)
$603F:00_h$	*_LastError* (Error code)
$3008:01_h$	*_IO_act*

Setting the Process Data of the Fourth Predefined PDO

The fourth predefined PDO is suitable for the operating modes Cyclic Synchronous Position, Cyclic Synchronous Velocity and Cyclic Synchronous Torque. You can switch between the operating modes as required.

Structure RxPDO 1603_h

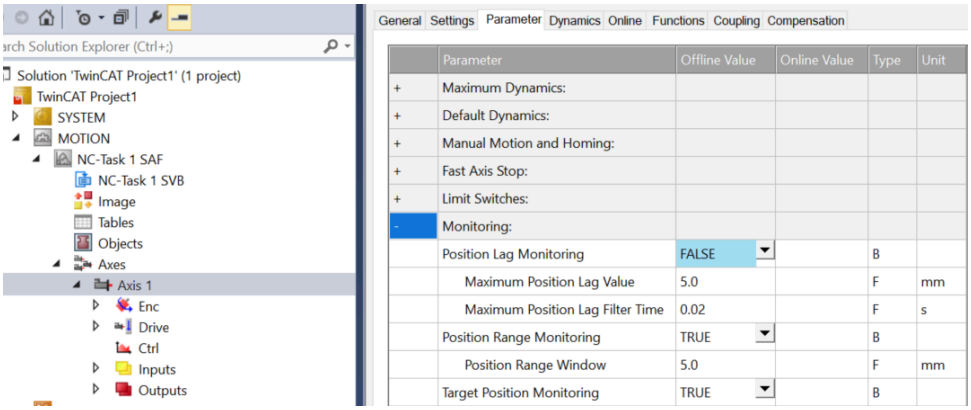
Index	Parameter name (DS402 name)
$6040:00_h$	*DCOMcontrol* (Control word)
$6060:00_h$	*DCOMopmode* (Mode of operation)
$607A:00_h$	*PPp_target* (Target position)
$60FF:00_h$	*PVv_target* (Target velocity)
$6071:00_h$	*PTtq_target* (Target torque)
$3008:11_h$	*IO_DQ_set*

Structure TxPDO $1A03_h$

Index	Parameter name (DS402 name)
$6041:00_h$	*_DCOMstatus* (Status word)
$6061:00_h$	*_DCOMopmd_act* (Mode of operation display)
$6064:00_h$	*_p_act* (Position actual value)
$60F4:00_h$	*_p_dif* (Following error actual value)
$6077:00_h$	*_tq_act* (Torque actual value)
$603F:00_h$	*_LastError* (Error code)
$3008:01_h$	*_IO_act*

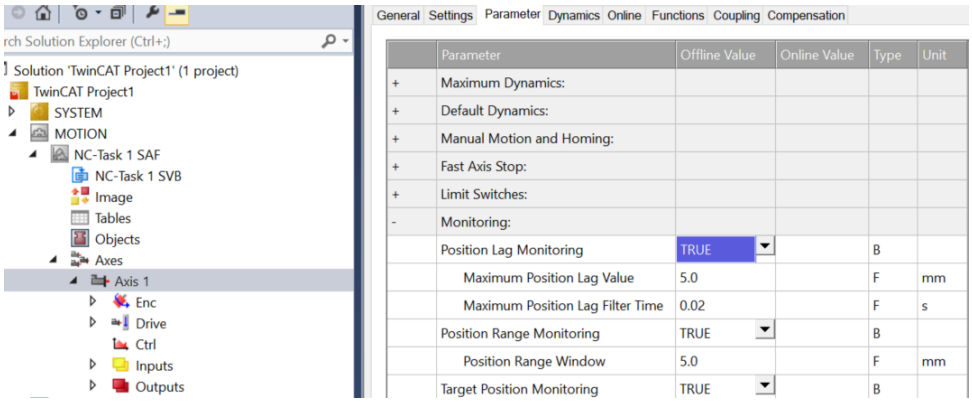
Setting Monitoring of the Position Deviation of Operating Mode Cyclic Synchronous Position

Monitoring of the position deviation must be deactivated for the operating mode Cyclic Synchronous Position since the position deviation is monitored in the drive.



If you use the operating mode Cyclic Synchronous Position, set "Position Lag Monitoring" to "FALSE".

Setting Monitoring of the Position Deviation of Operating Mode Cyclic Synchronous Velocity



If you use the operating mode Cyclic Synchronous Velocity, set "Position Lag Monitoring" to "TRUE".

Setting Monitoring of the Position Deviation of Operating Mode Cyclic Synchronous Torque

Monitoring of the position deviation depends on the application for the operating mode Cyclic Synchronous Torque.

Setting the Scaling Factor

The scaling factor must be set.

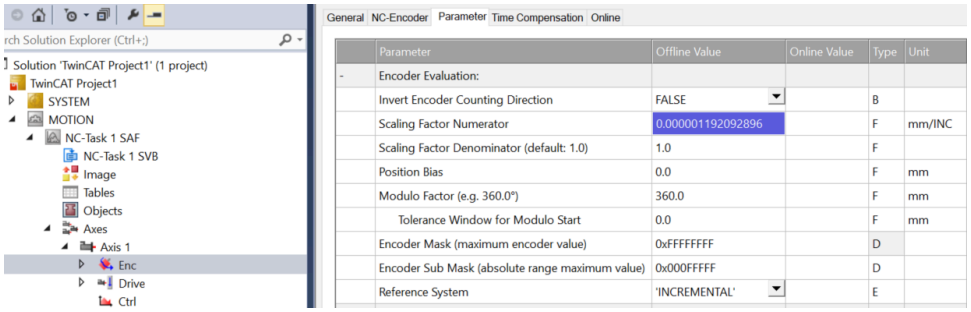
Formula: Scaling factor = 1 / (position scaling in the product / mechanical system)

Example:

Mechanical system: 1 revolution corresponds to 10 mm

Position scaling in the product: 1 revolution corresponds to 8388608 INC

Calculation: 1 / (8388608 INC / 10 mm) = 0.000001192092896 mm/INC



Set "Scaling Factor" to 0.000001192092896 (example).

Setting EtherCAT “Identification”

Overview

The following possibilities are available for an EtherCAT “Identification”:

- Selection of a value via a parameter
- Selection of a value via the TwinCAT system manager

In the TwinCAT system manager, the setting Slave-Register (ADO): 12_h is required (also known as Station Alias).

Setting via Parameter

A value for an EtherCAT “Identification” can be set via the parameter P6-46: *ECAT2ndaddress*.

If a value >0 has been set via the parameter *ECAT2ndaddress*, it is no longer possible to assign a value via the TwinCAT system manager.

P6-46	*ECAT2ndaddress*	Minimum value	0	Unit	–	Persistence	per.
		Factory setting	0	Data type	UNIT16	MODBUS	17676
		Maximum value	65535	Access	R/W	EtherCAT	$3045:06_h$

Description:

EtherCAT second address

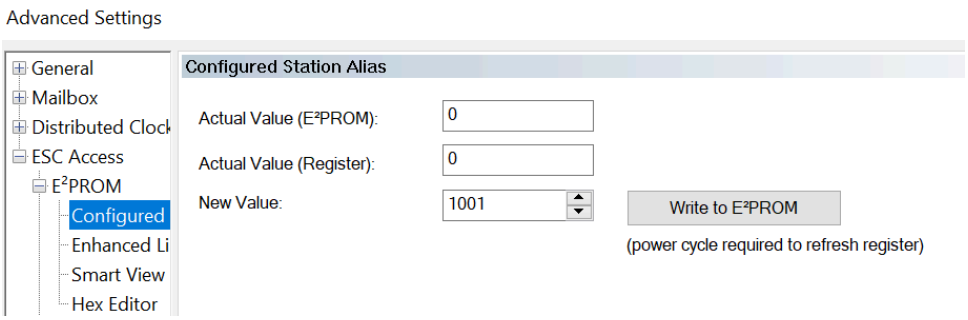
Value for an EtherCAT "Identification" (also known as "Station Alias"), for example, for the EtherCAT function Hot Connect.

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

Setting via TwinCAT System Manager

A value for an EtherCAT "Identification" can be set via the TwinCAT system manager.

The value is set by means of the menu item Configured Station Alias.



The value set via the TwinCAT system manager becomes effective when the parameter *ECAT2ndaddress* is set to the value 0 (factory setting).

Input and Output Settings

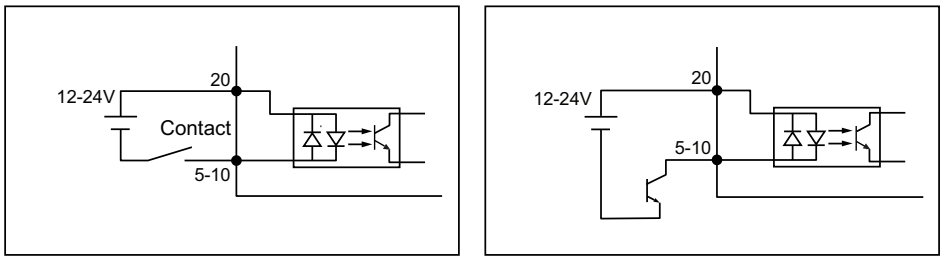
The input and output functions of the Lexium 18E servo drives can be configured via the parameters.

Connection Methods

When connecting the input points:

- Switch and relay contacts can be used, or transistors with open collector outputs can be used.
- For all input points, use a bidirectional optocoupler structure. Select the mains supply logic connected to the common terminal of the input according to the actual external circuit.
- To ensure sufficient current on the primary side of the optocoupler and protect the primary side of the optocoupler at the same time, ensure that the upper and lower voltage limits of the input points are kept between 12Vdc-15% and 24Vdc+15%.

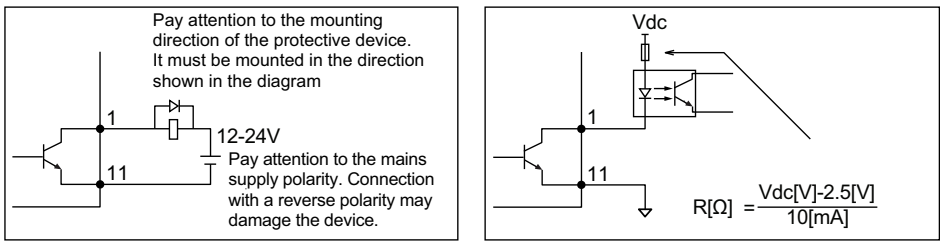
This is an example of typical input connection:



When connecting the output points:

- The point is an open-collector transistor-driven output, which can be connected to a load such as a relay coil or an optocoupler.
- When connecting inductive loads, you can use an appropriate external protection circuit or device (such as a flyback diode) to avoid possible damage to the device.
- When connecting an optocoupler load, take care to select the appropriate current-limiting resistor according to the connected mains supply. For a recommended value of 10mA for the primary side current of the optocoupler, use the formula shown in the figure below to calculate the resistance value.
- All output point transistors are structured with an independent collector and a common emitter. Also, pay attention to the mains supply polarity for connection. The common terminal of the output point should be connected to the negative terminal of the mains supply. Connection with a reverse polarity will damage the device.
- Pay attention to the maximum current load capacity of the output point transistors. Ensure that the output point load current does not exceed 100 mA (at 50°C).

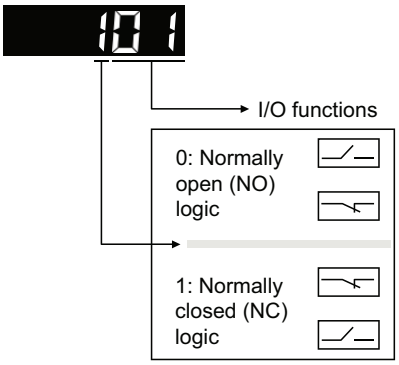
This is an example of typical output connection:



Setting Methods of I/O Parameters

The functions of the input points DI0...DI5 are configured by the parameters P3-00...P3-05, while those of the output points DQ0...DQ2 are configured with the parameters P3-24...P3-26.

The following diagram shows how the I/O point parameters are set:



⚠WARNING

UNINTENDED EQUIPMENT OPERATION

- Start the system only if there is no person or obstruction in the zone of operation.
- Verify that the connection complies with the setting requirements.
- 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.

List of Input Functions

The table below is an overview of available input functions:

Input point name	CN1 Pin NO.	Parameter
IOfunct_DI0	5	P3-00
IOfunct_DI1	6	P3-01
IOfunct_DI2	7	P3-02
IOfunct_DI3	8	P3-03
IOfunct_DI4	9	P3-04
IOfunct_DI5	10	P3-05

Function name	Function value	
	Normally open	Normally closed
Freely Available	1	–
Fault Reset	2	102
Halt	4	104
Start Profile Positioning	5	105
Reference Switch	21	121
Positive Limit Switch	22	122
Negative Limit Switch	23	123
Allow Servo On	41	141
Setting can only be modified if power stage is disabled. **Modified settings become active the next time the product is powered on.**		

List of Output Functions

The table below is an overview of available output functions:

Output point name	CN1 Pin NO.	Parameter
IOfunct_DQ0	1	P3-24
	11	
IOfunct_DQ1	2	P3-25
	12	
IOfunct_DQ2	3	P3-26
	13	

Function name	Function value	
	Normally open	Normally closed
Freely Available	1	–
No Fault	2	102
Active	3	103
In Position Deviation Window	5	105
In Velocity Deviation Window	6	106
Velocity Below Threshold	7	107
Torque Below Threshold	8	108
Halt Acknowledge	9	109
Motor Standstill	13	113
Selected Error	14	114
Drive Referenced (ref_ ok)	15	115
Selected Warning	16	116
Motor Moves Positive	22	122
Motor Moves Negative	23	123
Release Brake	24	124
Torque Below Threshold	25	125
In Position Deviation Window2	27	127
Target Position Reached	28	128
Target Velocity Reached	29	129
Target Torque Reached	30	130
Velocity Over Threshold	31	131
Setting can only be modified if power stage is disabled. **Modified settings become active the next time the product is powered on.**		

Factory Settings for I/O Functions

The Lexium 18E servo drives are delivered from the factory with default I/O functions assigned to them, or the user can reassign them at will to suit their needs.

The table below shows the factory settings for the input functions:

Signal	Parameter name	HMI name	Value	Signal input function
DI0	IOfunct_DI0	P3-00	1	Freely Available
DI1	IOfunct_DI1	P3-01	1	Freely Available
DI2	IOfunct_DI2	P3-02	1	Freely Available
DI3	IOfunct_DI3	P3-03	1	Freely Available
DI4	IOfunct_DI4	P3-04	1	Freely Available
DI5	IOfunct_DI5	P3-05	1	Freely Available

The table below shows the factory settings for the output functions:

Signal	Parameter name	HMI name	Value	Signal input function
DQ0	IOfunct_DQ0	P3-24	2	No Fault
DQ1	IOfunct_DQ1	P3-25	3	Active
DQ2	IOfunct_DQ2	P3-26	24	Release Brake

Parameterization of Software Debouncing

Signal input filtering comprises hardware filtering and software filtering. Hardware filtering time is permanently set, while software filtering time can be parameterized.

When a set signal function is modified, software filtering is reset to the factory setting on the next power cycle.

P3-12	***DI_x_Debounce***	**Minimum value**	**0**	**Unit**	**–**	**Persistence**	**per.**
...		**Factory setting**	**6**	**Data type**	**UINT16**	**MODBUS**	**–**
P3-15		**Maximum value**	**6**	**Access**	**R/W**	**EtherCAT**	**–**

Description:

Debounce time of DIx

0 / No: No software Filtering

1 / 0.25 ms

2 / 0.50 ms

3 / 0.75 ms

4 / 1.00 ms

5 / 1.25 ms

6 / 1.50 ms

Setting can only be modified if power stage is disabled.

Modified settings become active immediately.

The debouncing time of DI4 and DI5 have more options because DI4 and DI5 are touch probes.

P3-16	***DI_x_Debounce***	**Minimum value**	**0**	**Unit**	**–**	**Persistence**	**per.**
...		**Factory setting**	**6**	**Data type**	**UINT16**	**MODBUS**	**–**
P3-17		**Maximum value**	**13**	**Access**	**R/W**	**EtherCAT**	**–**

Description:

Debounce time of DIx

0 / No: No software Filtering

1 / 0.25 ms

2 / 0.50 ms

3 / 0.75 ms

4 / 1.00 ms

5 / 1.25 ms

6 / 1.50 ms

7 / 0.5 µs

8 / 1 µs

9 / 2 µs

10 / 4 µs

11 / 8 µs

12 / 20 µs

13 / 40 µs

Setting can only be modified if power stage is disabled.

Modified settings become active immediately.

Setting of Basic Operating Functions

Incorrect parameter settings may cause unexpected equipment operation, signal triggering, component damage, or monitoring functions to be disabled. The setting of some parameters must be powered down and restarted before the device will take effect.

⚠WARNING

UNINTENDED EQUIPMENT OPERATION

- Start the system only if there is no person or obstruction 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.

Selection of the Direction of Rotation of the Motors

The direction of rotation of the servo motor can be reversed without changing the wiring of the position command input or the polarity of the position command (command direction) by modifying the setting value of the parameter P0-06.

With the factory settings, the positive direction of rotation is set to “counterclockwise rotation (CCW)” of the shaft of the servo motor when viewed from the output shaft of the servo motor.

P0-06	***InvertDirOfMove***	**Minimum value**	**0**	**Unit**	**–**	**Persistence**	**per.**
		Factory setting	**0**	**Data type**	**UINT16**	**MODBUS**	**1560**
		Maximum value	**192**	**Access**	**R/W**	**EtherCAT**	**3006:0C$_h$**

Description:

Inversion of direction of movement

0 / Inversion Off: Inversion of direction of movement is off

192 / Inversion On: Inversion of direction of movement is on

The limit switch which is reached with a movement in positive direction must be connected to the positive limit switch input and vice versa.

Setting can only be modified if power stage is disabled.

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

Setting the Limit Switches

Movements can be monitored using limit switches. A positive limit switch and a negative limit switch can be used for monitoring. When the movement exceeds the safe range, the servo motor can be forced to stop the movement via the input signal from the limit switches.

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

NOTE: The use of limit switches can help protect against some hazards (for example, collision caused by incorrect command). To prevent accidents caused by poor contact or broken wires, use “NC logic” for the functions of the limit switches.

⚠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 end 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.

LIMP/LIMN functions can be assigned to other input terminals via the parameters P3-00...P3-05.

P3-00	***IOfunct_DIx***	**Minimum value**	**1**	**Unit**	**–**	**Persistence**	**per.**
...		**Factory setting**	**1**	**Data type**	**UINT16**	**MODBUS**	**–**
P3-05		**Maximum value**	**141**	**Access**	**R/W**	**EtherCAT**	**–**

Description:

Function Input DIx

Function name	Function value	
	Normally open	Normally closed
Position Limit Switch (LIMP)	22	122
Negative Limit Switch (LIMN)	23	123

Setting can only be modified if power stage is disabled.

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

Reset Limit Error

When a limit error occurs, the lowest bit of the parameter P6-41 can be used to set how to reset the error message:

- When the lowest bit of P6-41 is set to 0, the error message can be resetby a fault reset operation, and the operating state will switch to “6 - Device Enable”. Now, the movement can continue, but only in the opposite direction.
- When the lowest bit of P6-41 is set to 1, the movement command can be sent directly to the device in the opposite direction of the triggered limit, the error message is reset automatically, and the motor moves in the opposite direction directly.

For example, if the positive limit is triggered, an error message E A302 is generated and the operating state switches to “7 - Quick Stop Active”.

- If the lowest bit of P6-41 is set to 0, the error message E A302 can be reset by a fault reset operation, and the operating state switches to “6 - Device Enable”. Now, the movement can continue, but the subsequent movements can only be negative. If the subsequent movements are still positive, the error message E A302 appears again and the operating state switches to “7 - Fast Stop Active” again.
- If the lowest bit of P6-41 is set to 1, the inverse movement command can be sent directly to the drive, the error message E A302 is reset automatically, the operating state switches to “6 - Device Enable”, and at the same time the motor starts to move in the opposite direction.

P6-41	*MON_UserDefFunc*	Minimum value	0	Unit	–	Persistence	per.
		Factory setting	0	Data type	UINT16	MODBUS	1686
		Maximum value	65535	Access	R/W	EtherCAT	3006:4B$_h$

Description:

Special functions

Bit 0: Positive limit switch triggered during positive movement, or negative limit switch triggered during negative movement

- **0 /** The limit error E A302/E A303 shall be cleared by Fault Reset.
- **1/** The limit error E A302/E A303 can be cleared without Fault Reset, and the servo motor can directly run in reverse direction and automatically clear the limit fault automatically.

Bit 1: Positive limit switch triggered during negative movement, or negative limit switch triggered during positive movement

- **0 /** The limit error E A302/E A303 shall be cleared by Fault Reset.
- **1/** Drive does not stop without any error information.

Bit 2...31: Reserved

Setting can only be modified if power stage is disabled.

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

Reset Encoder Error

If the servo motor is mounted with a multi-turn encoder, an error message (0x7634: multi-turn encoder battery error) may be displayed when the servo drive is powered up for the first time.

The error message can be reset via parameter *ENCErrorMulTurnReset*(P6-47). This parameter can also be used to clear the encoder revolution value.

P6-47	*ENCErrorMulTurnReset*	Minimum value	0	Unit	–	Persistence	per.
		Factory setting	0	Data type	UNIT16	MODBUS	21016
		Maximum value	2	Access	R/W	EtherCAT	3052:0C$_h$

Description:

Encoder reset command

0 / Invalid

1 / Clear encoder faults

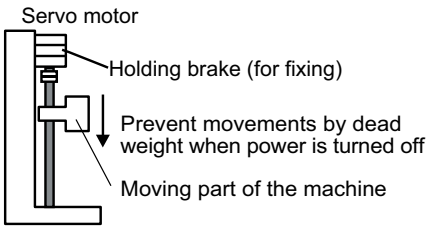
2 / Clear multi-turn values and encoder faults

Motor Holding Brake

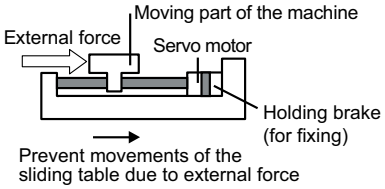
A motor holding brake is a built-in component of a servo motor with a holding brake. When the power stage of the servo drive is disabled, the motor brake secures the motor position so that the moving part of the machine will not move by its own gravity or by external force.

Use the motor holding brake in the following situations as shown in the figure:

Vertical shaft



Shaft subjected to external force



When using the motor holding brake, note the following:

- The motor holding brake is not a safety-related measure.
- The motor holding brake is used only to maintain the position of the motor in the Stop state and cannot be used to brake the motor.

⚠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 operation of the motor holding brake is normally-closed logically. When the brake is energized, the holding brake will be excited and then opened. When the holding brake current is disconnected, the brake will be closed. There is a time delay for releasing the holding brake, and the time for releasing and applying the brake is shown in the following table:

Motor type	Holding brake voltage	Time delay for releasing (ms)	Time delay for applying (ms)
BCH18*B**F*	24Vdc	20	50
BCH18*D**F*		20	50
BCH18*F**F*		20	60
BCH18*H**F*		20	60
BCH18*M**F*		60	120
BCH18*R**F*		80	200

It is possible to be set by the parameters P3-24...P3-26. The Release Brake function is assigned to one output terminal. Now, the device can automatically control the opening and closing of the motor holding brake, namely, to open the brake when the power stage is enabled and close the brake when the power stage is disabled.

NOTE: The function setting of the output points will be changed when restoring the factory settings, which may cause the brake to be released accidentally.

⚠WARNING

UNINTENDED EQUIPMENT OPERATION

- Ensure that the wiring and setting of the output assigned to the Release Brake signal output function of the brake are correct.
- Verify the output assigned to the Release Brake signal output function prior to restoring the factory settings to prevent accidental load movements caused by the opening of the brake. Or reassign it according to the machine requirements prior to starting the machine after restoring the factory settings.
- In all cases, the necessary measures must be taken to prevent accidental load movements caused by the opening of the brake.

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

P3-24 ... P3-26	*IOfunct_DQx*	Minimum value	1	Unit	–	Persistence	per.
		Factory setting	–	Data type	UINT16	MODBUS	–
		Maximum value	131	Access	R/W	EtherCAT	–

Description:

Function Output DQx

Function name	Function value	
	Normally open	Normally closed
Release Brake	24	124

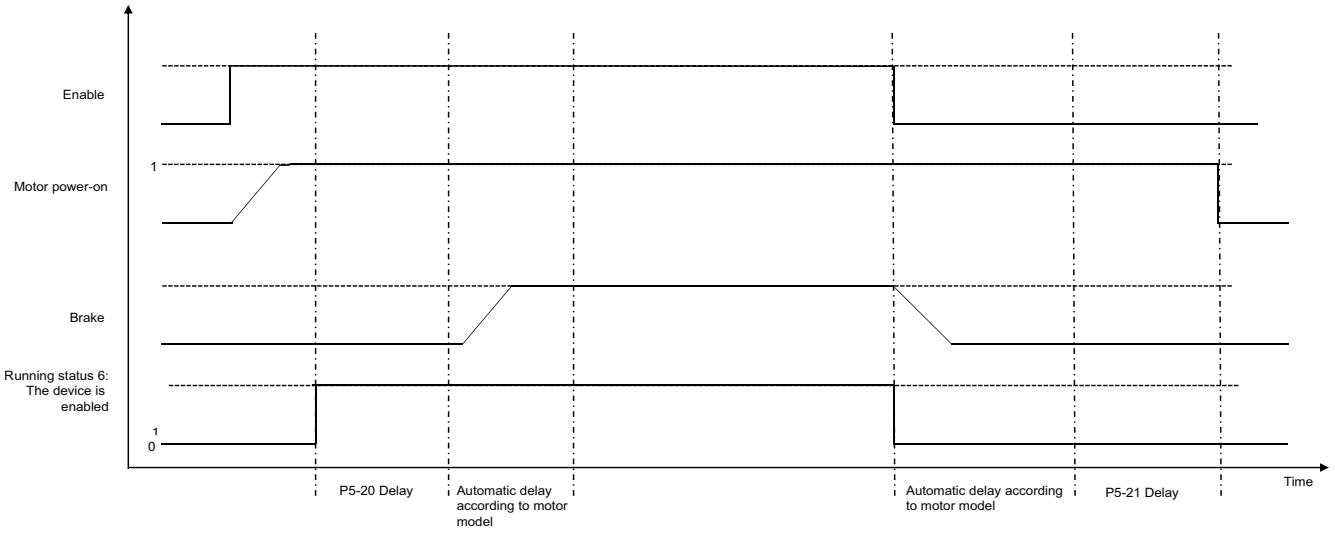
Setting can only be modified if power stage is disabled.

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

If the Lexium 18E servo drive is connected to a motor with a holding brake, when the machine is enabled, the machine is automatically delayed for a period of time until the holding brake is released and the machine's operating state switches to “6 - Device Enable”, during which the motor remains energized. It is possible to add an additional time delay for releasing the holding brake via the parameter P5-20, where the device switches to “6-Device Enable” only when the full time delay is completed.

Similarly, if the Lexium 18E servo drive is connected to a motor with a holding brake, when the device is enabled, the device is automatically delayed for a period of time, during which the motor remains energized. It is possible to add an additional time delay for applying the holding brake via the parameter P5-21, where the motor remains energized until the entire time delay is completed.

The time sequence of the brake releasing and applying is shown in the figure:



P5-20	*BRK_AddT_release*	Minimum value	0	Unit	1 ms	Persistence	per.
		Factory setting	0	Data type	INT16	MODBUS	1294
		Maximum value	400	Access	R/W	EtherCAT	3005:07$_h$

Description:

Additional time delay for releasing the holding brake

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

Setting can only be modified if power stage is disabled.

Modified settings become active the next time the power stage is enabled.

P5-21	*BRK_AddT_apply*	Minimum value	0	Unit	1 ms	Persistence	per.
		Factory setting	0	Data type	INT16	MODBUS	1296
		Maximum value	1000	Access	R/W	EtherCAT	3005:08$_h$

Description:

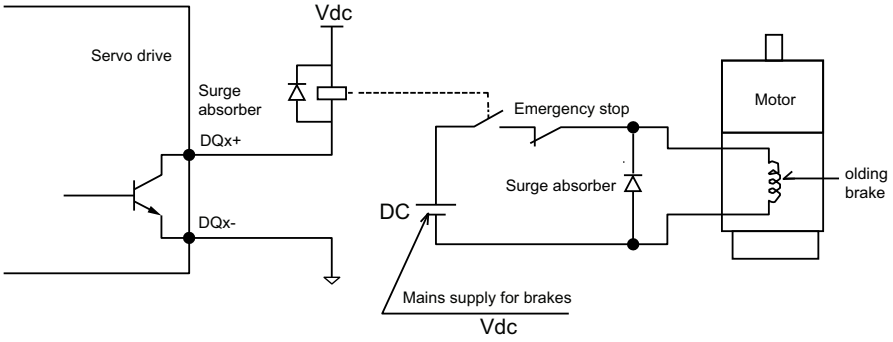
Additional time delay for applying the holding brake

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

Setting can only be modified if power stage is disabled.

Modified settings become active the next time the power stage is enabled.

Here is the standard wiring for motor holding brake control:



NOTICE

UNINTENDED EQUIPMENT OPERATION

- The motor holding brake coil is non-polarized.
- Design a relay circuit to control the motor holding brake. Do not connect the motor holding brake directly to the output points of the device, as this may cause damage to the device.
- Design an emergency stop switch so that the holding brake will be applied when the emergency stop is triggered.
- To suppress the surge voltage caused by the releasing/applying operation of the motor holding brake, design a surge protection unit in accordance with the standard wiring diagram. Note that the releasing time of the motor holding brake will be slightly longer than that in the situations where a surge protection unit is used if a flyback diode is used.
- Be sure to separate the 24Vdc mains supply used for the holding brake from the mains supply used for the I/O signals (CN1) of the device, otherwise the I/O signals may operate unintentionally.

Failure to follow these instructions can result in equipment damage.

Braking Resistors

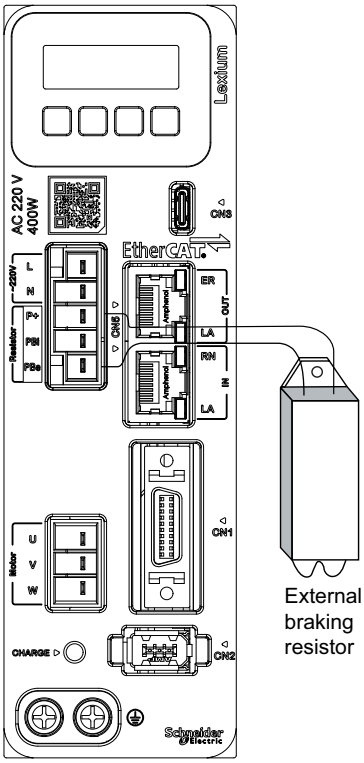
The Lexium 18E servo drive has a built-in braking resistor (above 750w). An external braking resistor is required when the device does not come with enough handling capacity for regeneration energy.

When selecting the rating of the external braking resistor, note the following conditions:

Drive specification	Minimum resistance value of the external braking resistor in Ω
LXM18E*U01/02/04	40
LXM18E*U07/10/15	20
LXM18E*U20/30	15

Method of connecting the external braking resistor is as below:

Remove the short-circuit jumper between the PB+ / PBi terminals on the servo drive plug-in connector, and connect an external braking resistor between the PB+ / PBe terminals on the plug-in connector.



After the external braking resistor is connected, you canset its capacity, resistance values, and protection parameters via parameters and enable the external braking resistor.

P0-22	*RESext_P*	Minimum value	1	Unit	W	Persistence	per.
		Factory setting	10	Data type	UNIT16	MODBUS	1316
		Maximum value	32767	Access	R/W	EtherCAT	3005:12$_h$

Description:

Nominal power of external braking resistor

The maximum value depends on the power stage.

Setting can only be modified if power stage is disabled.

Modified settings become active the next time the power stage is enabled.

P0-23	*RESext_R*	Minimum value	0	Unit	0.01 Ohm	Persistence	per.
		Factory setting	10000	Data type	UNIT16	MODBUS	1318
		Maximum value	32767	Access	R/W	EtherCAT	3005:13$_h$

Description:

Resistance value of external braking resistor

The minimum value depends on the power stage.

In increments of 0.01 Ω.

Setting can only be modified if power stage is disabled.

Modified settings become active the next time the power stage is enabled.

P0-24	*RESext_ton*	Minimum value	1	Unit	1 ms	Persistence	per.
		Factory setting	100	Data type	UNIT16	MODBUS	1314
		Maximum value	30000	Access	R/W	EtherCAT	3005:11$_h$

Description:

Maximum permissible switch-on time of external braking resistor

Setting can only be modified if power stage is disabled.

Modified settings become active the next time the power stage is enabled.

P0-25	*RESint_ext*	Minimum value	0	Unit	–	Persistence	per.
		Factory setting	0	Data type	UNIT16	MODBUS	1298
		Maximum value	1	Access	R/W	EtherCAT	3005:09$_h$

Description:

Selection of type of braking resistor

0 / Internal Braking Resistor: Internal braking resistor

1 / External Braking Resistor: External braking resistor

2 / Reserved: Reserved

Setting can only be modified if power stage is disabled.

Modified settings become active the next time the power stage is enabled.

Auxiliary Functions during Operation

Setting of the Halt Function

The Halt function allows you to interrupt a motion that is being executed. The interrupted motion can be resumed and continue.

The Halt function is enabled via the drive input point, or the Halt command can be sent to the device via the commissioning software.

When a Halt is activated, the motor motion can be stopped through two ways, and the motor stop mode can be selected via the parameter P5-14:

- The motor stops according to the deceleration ramp, which is set via the parameter P4-03
- The motor stops according to the torque ramp, which is set via the parameter P5-15

P5-14	*LIM_HaltReaction*	Minimum value	1	Unit	–	Persistence	per.
		Factory setting	1	Data type	INT16	MODBUS	1582
		Maximum value	3	Access	R/W	EtherCAT	3006:17$_h$

Description:

Halt option code

1 / Deceleration Ramp: Deceleration ramp

3 / Torque Ramp: Torque ramp

Set the deceleration ramp with parameter *RAMP_ v_dec* (P4-03).

Set the torque ramp with parameter *LIM_I_ maxHalt* (P5-15).

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

Modified settings become active immediately.

P4-03	*RAMP_v_dec*	Minimum value	1	Unit	usr_a	Persistence	per.
		Factory setting	6000	Data type	UINT32	MODBUS	1558
		Maximum value	2147483647	Access	R/W	EtherCAT	6084:00$_h$

Description:

Deceleration of the motion profile for velocity.

In Profile Velocity mode, the minimum value is 1.

Writing the value 0 has no effect on the parameter.

Modified settings become the next time motor moves.

P5-15	*LIM_I_maxHalt*	Minimum value	1	Unit	0.01 Arms	Persistence	per.
		Factory setting	1	Data type	UINT16	MODBUS	4380
		Maximum value	46300	Access	R/W	EtherCAT	3011:0E$_h$

Description:

Current value 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 (*_Imax_act*) is one of the following values (whichever is lowest):

- *LIM_I_maxHalt* (P5-15, current value for halt)

- *_M_I_max* (maximum current of motor)

- *_PS_I_max* (maximum current of power stage)

Further current limitations caused by I2t monitoring are also taken into account during a Halt.

In increments of 0.01 Arms.

Modified settings become active immediately.

Setting of the Quick Stop Function Settings

The Quick Stop function allows you to stop a motion that is being executed. The stopped motion cannot be resumed.

Quick Stop is triggered by a fault in error class 1 or 2. It is also possible to send a Quick Stop command to the device through the commissioning software.

When the Quick Stop function is activated, the motor motion can be stopped in two ways, which can be selected via the parameter P5-16:

- The motor stops according to the deceleration ramp, which is set via the parameter P5-17
- The motor stops according to the torque ramp, which is set via the parameter P5-18

In addition, the parameter P5-16 can be used to further set the operating state of the device after the motion has stopped to “7 - Quick Stop Active” or "9 - Error”.

P5-16	*LIM_QStopReact*	Minimum value	-2	Unit	–	Persistence	per.
		Factory setting	6	Data type	INT16	MODBUS	1584
		Maximum value	7	Access	R/W	EtherCAT	6085:00$_h$

Description:

Quick Stop option code

-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

Type of deceleration for Quick Stop.

Setting of deceleration ramp with parameter *RAMPquickstop* (P5-17).

Setting of torque ramp with parameter *LIM_I_ maxQSTP* (P5-18).

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

Modified settings become active immediately.

P5-17	*RAMPquickstop*	Minimum value	1	Unit	usr_a	Persistence	per.
		Factory setting	6000	Data type	UINT32	MODBUS	1572
		Maximum value	2147483647	Access	R/W	EtherCAT	3006:12$_h$

Description:

Deceleration ramp for Quick Stop

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

Modified settings become active the next time the motor moves.

P5-18	*LIM_I_maxQSTP*	Minimum value	1	Unit	0.01 Arms	Persistence	per.
		Factory setting	1	Data type	UINT16	MODBUS	4378
		Maximum value	46300	Access	R/W	EtherCAT	3011:0D$_h$

Description:

Current value for Quick Stop

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 Quick Stop, the current limit (*_Imax_act*) is one of the following values (whichever is lowest):

- *LIM_I_maxQSTP*(P5-18)

- *_M_I_max* (maximum current of motor)

- *_PS_I_max* (maximum current of power stage)

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

In increments of 0.01 Arms.

Modified settings become active immediately.

Setting of the Stop Mode in the Case of Disable and Error

You can set the stop mode of the motor when the servo drive reports an error and disable, and what mode the motor is in when it stops, by the ones and tens digits of the parameter P5-19 respectively:

- The stop mode available for the motor when the servo drive reports an error includes dynamic braking (DB) and free coasting, and the mode after the motor stops includes DB and free coasting.
- When the servo drive is disabled, the motor can be stopped by DB, free coasting and deceleration according to the deceleration curve, and others, and the mode after the motor stops includes DB and free coasting.

⚠CAUTION

UNINTENDED EQUIPMENT OPERATION

- The DB should only be used for emergency stops. When the DB function at high motor speed is used, it may cause mechanical shock and generate noise.
- Do not use the DB function frequently. When the DB function at high motor speed is used,
- If the servo motor is driven by an external force as a generator, a short-circuit current will pass through the device and servo motor when the DB function is active. If the servo motor is continuously driven by an external force, smoke and fire may occur.
- To prevent the system from unintended equipment operation, the servo motor with the holding brake function cannot select the stop mode when the servo drive is disabled. The system quickly stops the motor motion at a fixed deceleration speed, and then closes the holding brake control.

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

P5-19	*DYN_BRK_enable*	Minimum value	0	Unit	–	Persistence	per.
		Factory setting	0	Data type	UINT16	MODBUS	1680
		Maximum value	42	Access	R/W	EtherCAT	3006:48$_h$

Description:

Enable dynamic braking function

Parameter value	Function	Value	Stop mode of servo motor	State after the servo motor stops
L XXXX[]	Stop mode of the motor in case of a fault in Error Class 3...4	0	Free coasting	Free coasting
		1	Dynamic braking (DB)	Dynamic braking (DB)
		2	Dynamic braking (DB)	Free coasting
L XXX[]X	Stop mode of the motor after the servo is disabled	0	Free coasting	Free coasting
		1	Dynamic braking (DB)	Dynamic braking (DB)
		2	Dynamic braking (DB)	Free coasting
		3	Deceleration Ramp (DEC)	Dynamic braking (DB)
		4	Deceleration Ramp (DEC)	Free coasting

When 3 and 4 are selected as the stop mode of the motor after the servo is disabled, the motor stops using deceleration ramp set via the parameter P4-03.

For example:

When P5-19 = 0021:

- If an error of Error Class 3/4 occurs, the motor will decelerate and stop using DB, and remain in the DB state after stopping.
- If the motor is disabled during operation, the motor will decelerate and stop using DB, and remain in the free coasting state after stopping.

Modified settings become active immediately.

Setting the Motor's Maximum Continuous Load Rate

The user can set parameters to limit the maximum continuous current load rate of the motor at standstill and during motion to prevent excessive stator current from causing additional heat and to protect the motor.

This function also limits the continuous torque output performance when the motor is at standstill and during motion.

When the motor is at standstill, the motor continuous current load rate is up to 100% of the current rating.

When the motor is in motion, the motor continuous current load rate is up to 115% of the current rating.

P6-43	*I2T_MOT_I0PCT*	Minimum value	866	Unit	0.1%	Persis-tence	per.
		Factory setting	1000	Data type	UINT16	MODBUS	1394
		Maximum value	1000	Access	R/W	EtherCAT	3005:39$_h$

Description:

Maximum continuous current load percentage of motor (I2T) at standstill

The maximum current load rate when the motor is at standstill is limited to prevent excessive stator single-phase current from causing additional heating of the motor and to protect the motor.

This function also limits the torque output of the motor at standstill.

In increments of 0.1%.

Modified settings become active immediately.

P6-44	*I2T_MOT_INPCT*	Minimum value	1000	Unit	0.1%	Persistence	per.
		Factory setting	1000	Data type	UINT16	MODBUS	1396
		Maximum value	1150	Access	R/W	EtherCAT	3005:3A$_h$

Description:

Maximum continuous current load percentage of motor (I2T) at running

In increments of 0.1%.

Modified settings become active immediately.

Holding Brake Control Function

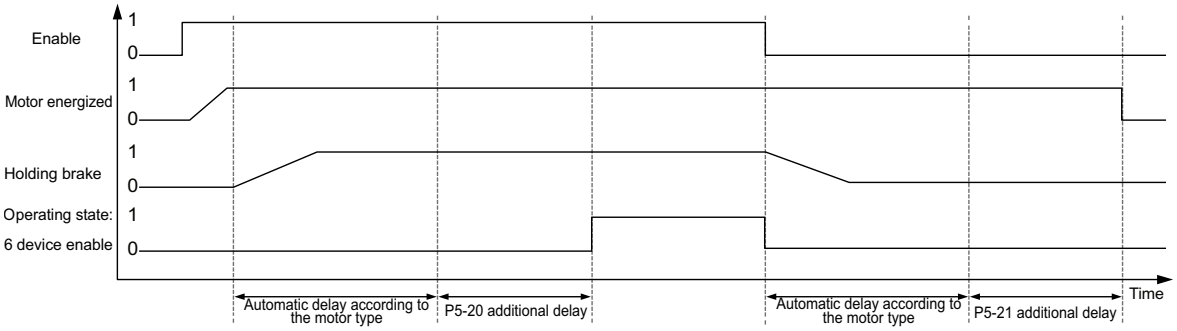
You can assign the function “24-Holding Brake Release” to an output terminal through the setting of the drive output parameters. Now, the device can automatically control the opening and closing of the motor holding brake, namely, to open the brake when the power stage is enabled and close the brake when the power stage is disabled.

> **NOTE:** The function setting of the output points will be changed when restoring the factory settings, which may cause the brake to be released accidentally.

If the Lexium 18E servo drive is connected to a motor with a holding brake, when the power stage of the machine is enabled, the machine is automatically delayed for a period of time until the holding brake is released and the machine's operating state switches to “6 - Device Enable”, during which the motor remains energized. It is possible to add an additional time delay for releasing the holding brake by parameter, where the device switches to “6-Device Enable” only when the full time delay is completed.

Similarly, if the servo drive is connected to a motor with a holding brake, when the device power stage is disabled, the device is automatically delayed for a period of time, during which the motor remains energized. It is possible to add an additional time delay for applying the holding brake by parameter, where the motor remains energized until the entire time delay is completed.

The time sequence of brake releasing and applying is shown in the figure:



P5-20	*BRK_AddT_release*	Minimum value	0	Unit	1 ms	Persistence	per.
		Factory setting	0	Data type	INT16	MODBUS	1294
		Maximum value	400	Access	R/W	EtherCAT	3005:07$_h$

Description:

Additional time delay for releasing the holding brake

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

Setting can only be modified if power stage is disabled.

Modified settings become active the next time the power stage is enabled.

P5-21	*BRK_AddT_apply*	Minimum value	0	Unit	1 ms	Persistence	per.
		Factory setting	0	Data type	INT16	MODBUS	1296
		Maximum value	1000	Access	R/W	EtherCAT	3005:08$_h$

Description:

Additional time delay for applying the holding brake

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

Setting can only be modified if power stage is disabled.

Modified settings become active the next time the power stage is enabled.

Software Limit Function

You can monitor the motion through the software limit function, which consists of a positive limit and a negative limit.

When either of the positive or negative limits is triggered, the Quick Stop function is triggered and motion is stopped. The servo drive displays an error message and switches the device's operating state to "7 - Quick Stop Active".

The limit triggering fault can be cleared by the Fault Reset function, after which the device's operating state switches to "6 - Device Enable".

After that, you can try to continue the device's movement, but only in the opposite direction. For example: If a positive limit is triggered, the subsequent movement can only be in the negative direction. If the subsequent motion is still in the positive direction, the servo drive displays the error message again and switches the device's operating state to "7 - Quick Stop Active".

Software limit switches can only be activated if the zero point is valid. it is not maintained after power-down, and it becomes active only after the zero-return operation.

When the software limit is used, the following parameters need to be set:

- Set which one of the positive or negative limit is activated by P6-11.
- Set via P6-12 whether the motion stop point is after the limit switch position or at the limit switch position when the limit is triggered. If you want the motion stop to be at the limit switch position, the parameter P5-16 must be set to "6 - Deceleration Ramp (Quick Stop)". And if the parameter value is set to "7 - Torque Ramp (Quick Stop)", the position of the motion stop is not guaranteed due to the difference in load.
- Set the position values of the positive and negative limits by P6-13 and P6-14.

P6-11	*MON_SW_Limits*	Minimum value	0	Unit	–	Persistence	per.
		Factory setting	0	Data type	UINT16	MODBUS	1542
		Maximum value	3	Access	R/W	EtherCAT	3006:03$_h$

Description:

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.

Modified settings become active immediately.

P6-12	*MON_SWLimMode*	Minimum value	0	Unit	–	Persistence	per.
		Factory setting	0	Data type	UINT16	MODBUS	1678
		Maximum value	1	Access	R/W	EtherCAT	3006:47$_h$

Description:

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

Modified settings become active immediately.

P6-13	*MON_swLimP*	Minimum value	-2147483648	Unit	usr_p	Persistence	per.
		Factory setting	2147483647	Data type	INT32	MODBUS	1544
		Maximum value	2147483647	Access	R/W	EtherCAT	3006:04$_h$

Description:

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 user-defined value.

Setting can only be modified if power stage is disabled.

Modified settings become active the next time the power stage is enabled.

P6-14	*MON_swLimN*	Minimum value	-2147483648	Unit	usr_p	Persistence	per.
		Factory setting	2147483647	Data type	INT32	MODBUS	1546
		Maximum value	2147483647	Access	R/W	EtherCAT	3006:05$_h$

Description:

Negative position limit for software limit switch

See description *MON_swLimP* (P6-13).

Setting can only be modified if power stage is disabled.

Modified settings become active the next time the power stage is enabled.

Hardware Limit Function

Movements can be monitored using limit switches. A positive limit switch and a negative limit switch can be used for monitoring. When the movement exceeds the safe range, the servo motor can be forced to stop the movement via the input signal from the limit switches.

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

When a limit error occurs, the lowest bit of the parameter P6-41 can be used to set how to reset the error message:

- When bit 0 of P6-41 is set to 0, the error message can be reset by a fault reset operation, and the operating state will switch to “6 - Device Enable”. Now, the movement can continue, but only in the opposite direction.
- When bit 0 of P6-41 is set to 1, the movement command can be sent directly to the device in the opposite direction of the triggered limit, the error message is reset automatically, and the motor moves in the opposite direction directly.

P6-41	*MON_UserDefFunc*	Minimum value	0	Unit	–	Persistence	per.
		Factory setting	0	Data type	UINT16	MODBUS	1686
		Maximum value	65535	Access	R/W	EtherCAT	3006:4B$_h$

Description:

Special functions

Bit 0: Positive limit switch triggered during positive movement, or negative limit switch triggered during negative movement

- **0 /** The limit error E A302/E A303 shall be cleared by Fault Reset.
- **1/** The limit error E A302/E A303 can be cleared without Fault Reset, and the servo motor can directly run in reverse direction and automatically clear the limit fault automatically.

Bit 1: Positive limit switch triggered during negative movement, or negative limit switch triggered during positive movement

- **0 /** The limit error E A302/E A303 shall be cleared by Fault Reset.
- **1/** Drive does not stop without any error information.

Bit 2...31: Reserved

Setting can only be modified if power stage is disabled.

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

Reference Switch Function

The reference switch is only active in the operating mode Homing.

The signal input function “Reference Switch (REF)” must have been parameterized, see List of Input Functions, page 172.

P3-00 ... P3-05	*IOfunct_DIx*	Minimum value	1	Unit	–	Persistence	per.
		Factory setting	1	Data type	UINT16	MODBUS	–
		Maximum value	141	Access	R/W	EtherCAT	–

Description:

Function Input DIx

Function name	Function value	
	Normally open	Normally closed
Reference Switch	21	121

Setting can only be modified if power stage is disabled.

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

Torque Limitation

The maximum torque can be set with the parameter *CTRL_tq_max* (6072_h, P4-35).

The device limits the maximum permissible torque on the basis of the motor data and the device data. Even if the value entered for the maximum torque in the parameter *CTRL_tq_max* (6072_h, P4-35) is too high, the value is limited.

P4-35	*CTRL_tq_max*	Minimum value	0	Unit	0.1%	Persistence	per.
		Factory setting	–	Data type	UINT16	MODBUS	4376
		Maximum value	3500	Access	R/W	EtherCAT	6072:00$_h$

Description:

Torque limitation.

During operation, the actual torque limit is one of the following values (whichever is lowest):

- *CTRL_tq_max* (P4-35)
- Maximum torque of motor

100.00 % of the torque setting correspond to the motor rated torque.

In increments of 0.1 %/s.

Modified settings become active immediately.

Velocity Limitation

The parameter *CTRL_v_max* ($3011:10_h$, P4-18) can be used to limit the maximum velocity.

NOTE: Values for positions, velocities, acceleration and deceleration are specified in the following user-defined unit:

- usr_p for positions
- usr_v for velocities
- usr_a for acceleration and deceleration

P4-18	*CTRL_v_max*	Minimum value	0	Unit	usr_v	Persistence	per.
		Factory setting	6000	Data type	UINT32	MODBUS	4384
		Maximum value	2147483647	Access	R/W	EtherCAT	3011:10$_h$

Description:

Velocity limitation.

During operation, the velocity limit is one of the following values (whichever is lowest):

- *CTRL_v_max* (P4-18)
- Maximum velocity of motor

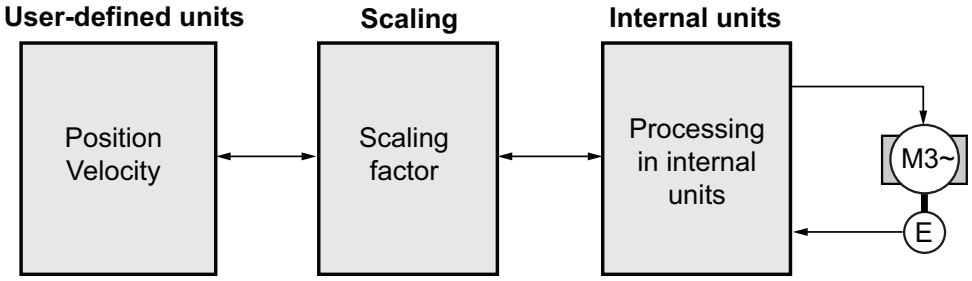
Modified settings become active immediately.

Scaling

General

Overview

Scaling converts user-defined units into internal units of the device, and vice versa.



User-Defined Units

Values for positions, velocities, acceleration and deceleration are specified in the following user-defined unit:

- usr_p for positions
- usr_v for velocities
- usr_a for acceleration and deceleration

⚠WARNING

UNINTENDED MOVEMENT

- Verify all parameters with user-defined units before modifying the scaling factor.
- Verify that a modification of the scaling factor cannot cause unintended movements.

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

Scaling Factor

The scaling factor is the relationship between the motor movement and the required user-defined units.

Configuration of Position Scaling

Description

Position scaling is the relationship between the number of motor revolutions and the required user-defined units (usr_p).

Scaling Factor

Position scaling is specified by means of scaling factor:

In the case of a rotary motor, the scaling factor is calculated as shown below:

$$\frac{\text{Number of revolutions of the motor}}{\text{Number of user-defined units [usr_p]}}$$

A new scaling factor is activated when you specify the numerator value.

With a scaling factor of < 1 / 131072, it is not possible to perform a movement outside of the movement range.

Factory Setting

The following factory settings are used:

1 motor revolution corresponds to 16384 user-defined units

P5-02	*ScalePOSnum*	Minimum value	1	Unit	revolution	Persistence	per.
		Factory setting	1	Data type	INT32	MODBUS	1552
		Maximum value	2147483647	Access	R/W	EtherCAT	3006:08$_h$

Description:

Position scaling: Numerator

Specification of the scaling factor:

$$\frac{\text{Number of revolutions of the motor}}{\text{Number of user-defined units [usr_p]}}$$

A new scaling is activated when the numerator value is supplied.

Setting can only be modified if power stage is disabled.

Modified settings become active immediately.

P5-01	*ScalePOSdenom*	Minimum value	1	Unit	usr_p	Persistence	per.
		Factory setting	8388608	Data type	INT32	MODBUS	1550
		Maximum value	2147483647	Access	R/W	EtherCAT	3006:07$_h$

Description:

Position scaling: Denominator

Refer to numerator *ScalePOSnum* (P5-02) for a description.

A new scaling is activated when the numerator value is supplied.

Setting can only be modified if power stage is disabled.

Configuration of Velocity Scaling

Description

Velocity scaling is the relationship between the number of motor revolutions per minute and the required user-defined units (usr_v).

Scaling Factor

Velocity scaling is specified by means of scaling factor:

In the case of a rotary motor, the scaling factor is calculated as shown below:

$$\frac{\text{Number of revolution of the motor per minute}}{\text{Number of user-defined units [usr_v]}}$$

Factory Setting

The following factory settings are used:

1 motor revolution per minute corresponds to 1 user-defined unit

P5-31	***ScaleVELnum***	**Minimum value**	**1**	**Unit**	**RPM**	**Persistence**	**per.**
		Factory setting	**1**	**Data type**	**INT32**	**MODBUS**	**1604**
		Maximum value	**2147483647**	**Access**	**R/W**	**EtherCAT**	**3006:22$_h$**

Description:

Velocity scaling: Numerator

Specification of the scaling factor:

$$\frac{\text{Speed of rotation of motor [RPM]}}{\text{User-defined units [usr_v]}}$$

A new scaling is activated when the numerator value is supplied.

Setting can only be modified if power stage is disabled.

Modified settings become active immediately.

P5-30	***ScaleVELdenom***	**Minimum value**	**1**	**Unit**	**usr_v**	**Persistence**	**per.**
		Factory setting	**1**	**Data type**	**INT32**	**MODBUS**	**1602**
		Maximum value	**2147483647**	**Access**	**R/W**	**EtherCAT**	**3006:21$_h$**

Description:

Velocity scaling: Denominator

See numerator *ScaleVELnum* (P5-31) for description.

A new scaling is activated when the numerator value is supplied.

Setting can only be modified if power stage is disabled.

Modulo Function

Setting a Modulo Range

Description

The modulo range supports applications with repeating arrangements of target positions (such as rotary indexing tables). The target positions are mapped to a parameterizable movement range.

Availability

The modulo function is available in the following operating modes:

- Profile Position
- Profile Velocity
- Profile Torque
- Homing

Direction of Movement

The direction of movement for absolute target positions can be adjusted to meet the requirements of the application.

- Shortest distance
- Positive direction of movement only
- Negative direction of movement only

Multiple Modulo Range

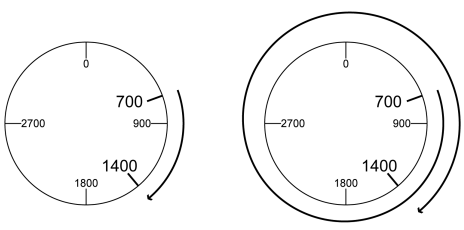
In addition, it is possible to set a multiple modulo range for absolute target positions. A movement with an absolute target position beyond the modulo range is performed in a way as if several modulo ranges had been arranged one after the other.

Example:

- Modulo range
  - Minimum position: 0 usr_p
  - Maximum position: 3600 usr_p
- Actual position: 700 usr_p
- Target positions absolute: 5000 usr_p
- Left: Without multiple modulo range

  Right: With multiple modulo range

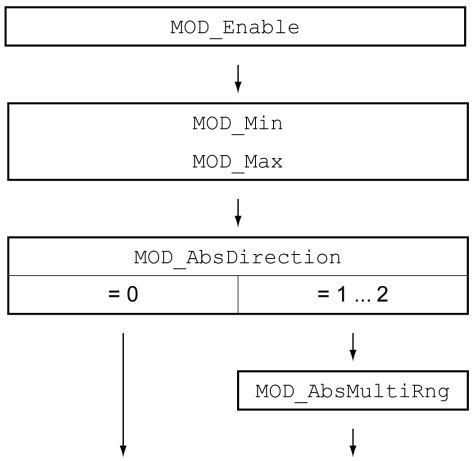
Multiple modulo range



Parameterization

Overview

Overview of parameters



Scaling

Using a modulo range requires the scaling to be adapted. The scaling of the motor must be adapted to the requirements of the application, see Scaling, page 195.

Activation

The modulo range is activated with the parameter *MOD_Enable*.

P5-32	*MOD_Enable*	Minimum value	0	Unit	–	Persistence	per.
		Factory setting	0	Data type	UNIT16	MODBUS	1648
		Maximum value	1	Access	R/W	EtherCAT	$3006:38_h$

Description:

Activation of Modulo function

0 / Modulo Off: Modulo is off

1 / Modulo On: Modulo is on

Setting can only be modified if power stage is disabled.

Modified settings become active immediately.

Modulo Range

The parameters *MOD_Min* and *MOD_Max* can be used to set the modulo range.

P5-33	*MOD_Min*	Minimum value	-2147483648	Unit	usr_p	Persistence	per.
		Factory setting	0	Data type	INT32	MODBUS	1650
		Maximum value	2147483647	Access	R/W	EtherCAT	3006:39$_h$

Description:

Minimum position of modulo range

The minimum position value of the modulo range must be less than the maximum position value of the modulo range.

Setting can only be modified if power stage is disabled.

Modified settings become active immediately.

P5-34	*MOD_Max*	Minimum value	-2147483648	Unit	usr_p	Persistence	per.
		Factory setting	3600	Data type	INT32	MODBUS	1652
		Maximum value	2147483647	Access	R/W	EtherCAT	3006:3A$_h$

Description:

Maximum position of modulo range

The maximum position value of the modulo range must be greater than the minimum position value of the modulo range.

Setting can only be modified if power stage is disabled.

Modified settings become active immediately.

Direction for Absolute Movements

The parameter *MOD_AbsDirection* lets you set the direction of movement for absolute movements.

P5-35	*MOD_AbsDirection*	Minimum value	0	Unit	usr_p	Persistence	per.
		Factory setting	0	Data type	UNIT16	MODBUS	1654
		Maximum value	2	Access	R/W	EtherCAT	3006:3B$_h$

Description:

Direction of absolute movement with modulo

0 / Shortest Distance: Movement with shortest distance

1 / Positive Direction: Movement only in positive direction

2 / Negative Direction: Movement only in negative direction

If the parameter is set to 0, the drive calculates the shortest way to the new target position and starts the movement in the corresponding direction. If the distance to the target position is identical in positive and negative directions, the movement takes place in positive direction.

Modified settings become active immediately.

Multiple Modulo Range for Absolute Movements

The parameter *MOD_AbsMultiRng* lets you set a multiple modulo range for absolute movements.

P5-36	***MOD_ABSMultiRng***	**Minimum value**	**0**	**Unit**	**usr_p**	**Persistence**	**per.**
		Factory setting	**0**	**Data type**	**UNIT16**	**MODBUS**	**1656**
		Maximum value	**1**	**Access**	**R/W**	**EtherCAT**	**3006:3C$_h$**

Description:

Multiple ranges for absolute movement with modulo

0 / Multiple Ranges Off: Absolute movement in one modulo range

1 / Multiple Ranges On: Absolute movement in multiple modulo ranges

Modified settings become active immediately.

Examples with Relative Movements

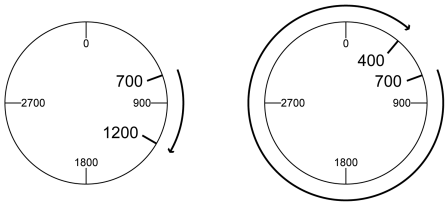
Assumptions

The settings below are assumed for the examples.

- Rotary motor
- Position scaling
  - *ScalePOSdenom* (P5-01, 3006:07$_h$) = 3600
  - *ScalePOSnum* (P5-02, 3006:08$_h$) = 1
- Modulo range
  - *MOD_Min* (P5-33, 3006:39$_h$) = 0 usr_p
  - *MOD_Max* (P5-34, 3006:3A$_h$) =3600 usr_p
- Actual position: 700 usr_p

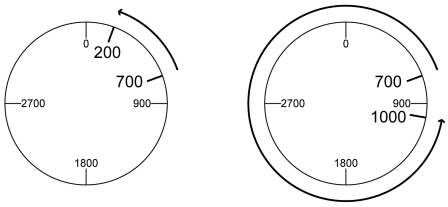
Example 1

Target positions relative: 500 usr_p and 3300 usr_p



Example 2

Target positions relative: -500 usr_p and -3300 usr_p



Examples with Absolute Movements and "Shortest Distance"

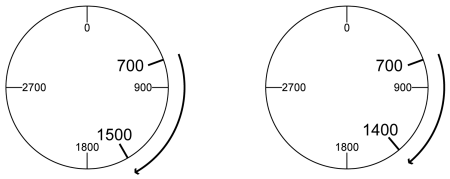
Assumptions

The settings below are assumed for the examples.

- Rotary motor
- Position scaling
  - *ScalePOSdenom* (P5-01, 3006:07$_h$) = 3600
  - *ScalePOSnum* (P5-02, 3006:08$_h$) = 1
- Modulo range
  - *MOD_Min* (P5-33, 3006:39$_h$) = 0 usr_p
  - *MOD_Max* (P5-34, 3006:3A$_h$) =3600 usr_p
- Actual position: 700 usr_p

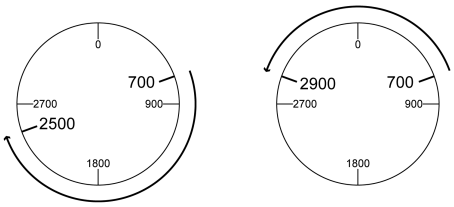
Example 1

Target positions absolute: 1500 usr_p and 5000 usr_p



Example 2

Target positions absolute: 2500 usr_p and 2900 usr_p



Examples with Absolute Movements and "Positive Direction"

Assumptions

The settings below are assumed for the examples.

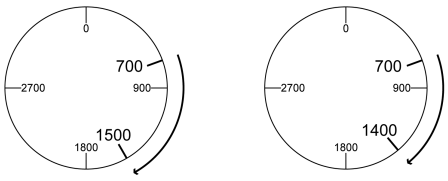
- Rotary motor
- Position scaling
  - *ScalePOSdenom* (P5-01, 3006:07$_h$) = 3600
  - *ScalePOSnum* (P5-02, 3006:08$_h$) = 1
- Modulo range
  - *MOD_Min* (P5-33, 3006:39$_h$) = 0 usr_p
  - *MOD_Max* (P5-34, 3006:3A$_h$) =3600 usr_p
- Actual position: 700 usr_p

Parameter *MOD_AbsDirection* (P5-35, 3006:3B$_h$) = 1/Positive Direction

Example 1

Parameter *MOD_AbsMultiRng* (P5-36, 3006:3C$_h$) = 0/Multiple Ranges Off

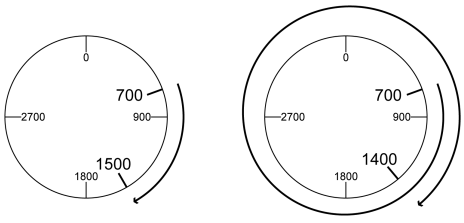
Target positions absolute: 1500 usr_p and 5000 usr_p



Example 2

Parameter *MOD_AbsMultiRng* (P5-36, 3006:3C$_h$) = 1/Multiple Ranges On

Target positions absolute: 1500 usr_p and 5000 usr_p



Examples with Absolute Movements and "Negative Direction"

Assumptions

The settings below are assumed for the examples.

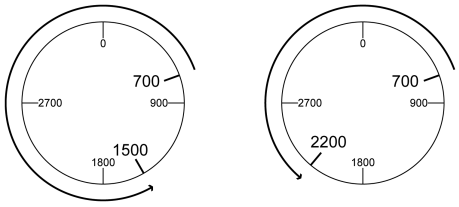
- Rotary motor
- Position scaling
  - *ScalePOSdenom* (P5-01, 3006:07$_h$) = 3600
  - *ScalePOSnum* (P5-02, 3006:08$_h$) = 1
- Modulo range
  - *MOD_Min* (P5-33, 3006:39$_h$) = 0 usr_p
  - *MOD_Max* (P5-34, 3006:3A$_h$) =3600 usr_p
- Actual position: 700 usr_p

Parameter *MOD_AbsDirection* (P5-35, 3006:3B$_h$) = 2/Negative Direction

Example 1

Parameter *MOD_AbsMultiRng* (P5-36, 3006:3C$_h$) = 0/Multiple Ranges Off

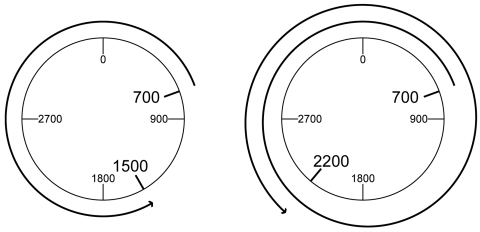
Target positions absolute: 1500 usr_p and -5000 usr_p



Example 2

Parameter *MOD_AbsMultiRng* (P5-36, 3006:3C$_h$) = 1/Multiple Ranges On

Target positions absolute: 1500 usr_p and -5000 usr_p



Operating States and Operating Modes

Operating States

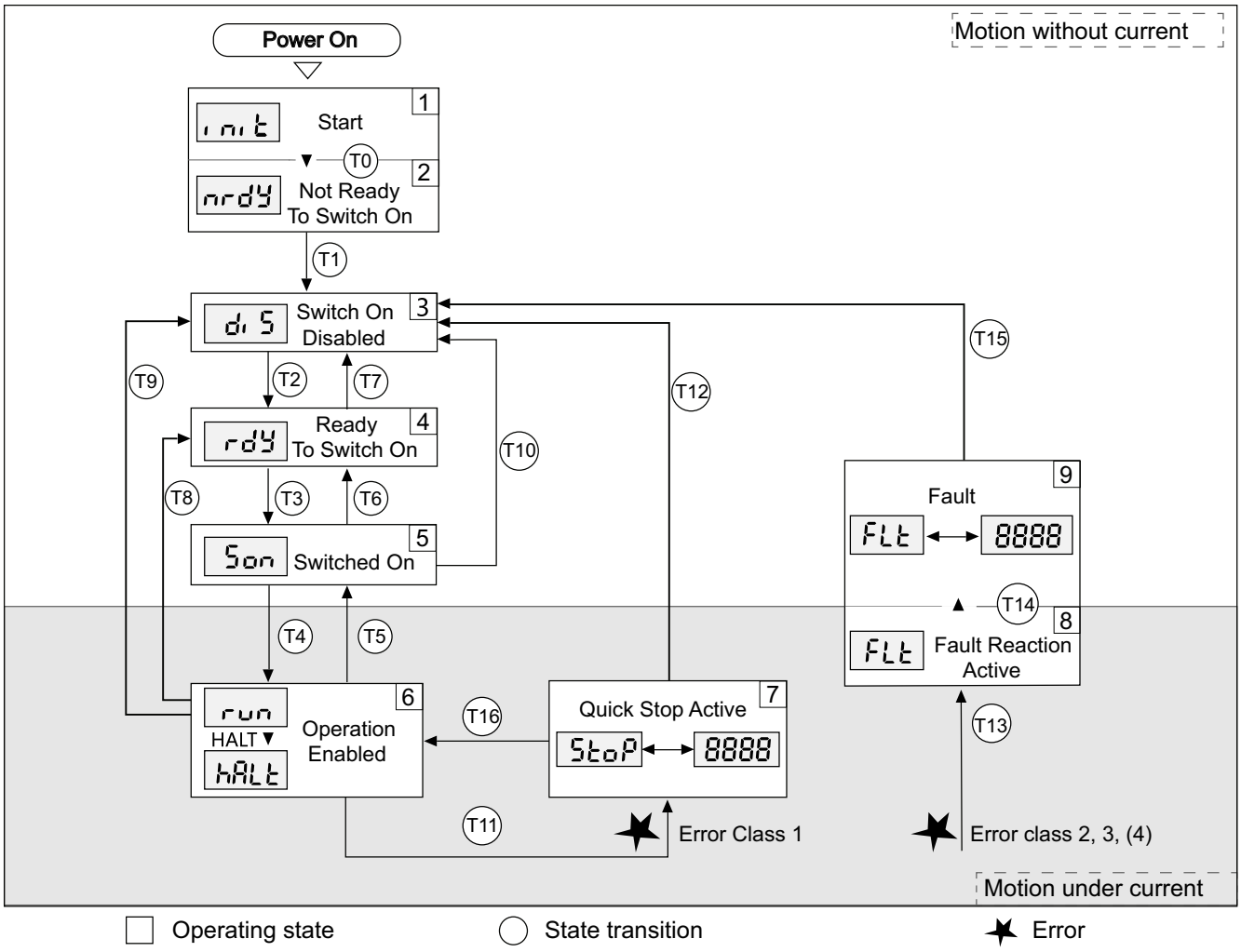
State Diagram and State Transitions

State Diagram

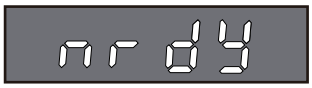
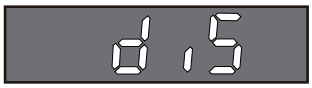
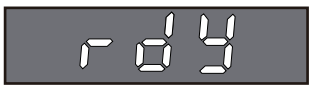
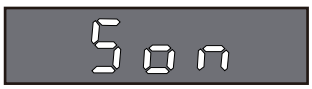
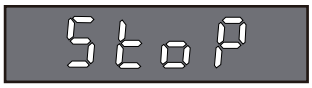
When the product is powered on and an operating mode starts, the product goes through a number of operating states.

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

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



Operating States

Operating state	HMI display	Description
1 Start		The electronics are initialized.
2 Not Ready To Switch On		The power stage is not ready to switch on.
3 Switch On Disabled		Impossible to enable the power stage.
4 Ready To Switch On		The power stage is ready to switch on.
5 Switched On		The power stage is switched on.
6 Operation Enabled		The power stage is enabled. The selected operating mode is active.
7 Quick Stop Active		“Quick Stop” is being executed.
8 Fault Reaction Active		The error response is active.
9 Fault		The error response is terminated. The power stage is disabled.

Error Class

The product triggers an error response if an error occurs. Depending on the severity of the error, the device responds in accordance with one of the following error classes:

Error class	State transition	Error response	Resetting an error message
0	–	No interruption of the movement.	Function “Fault Reset”
1	T11	Stop the movement with “Quick Stop”.	Function “Fault Reset”
2	T13, T14	Stop the movement with “Quick Stop” and disable the power stage when the motor comes to a standstill.	Function “Fault Reset”
3	T13, T14	Disable the power stage immediately, and the stopping method is set via *DYN_BRK_enable* (P5-19).	Function “Fault Reset”
4	T13, T14	Disable the power stage immediately, and the stopping method is set via *DYN_BRK_enable* (P5-19).	Power cycle

Error Response

The state transition T13 (error class 2, 3 or 4) initiates an error response as soon as the device must react to an error signal that occurs internally.

Error class	Response
2	Stop the movement with “Quick Stop”. The holding brake is applied. The power stage is disabled.
3, 4 or safety function STO	The stop method is set via *DYN_BRK_enable* (P5-19). The holding brake is applied. The power stage is immediately disabled.

Resetting an Error Message

A “Fault Reset” resets an error message.

In the event of a “Quick Stop” that triggered by a detected error of class 1 (operating state **7** Quick Stop Active), a “Fault Reset” causes a direct transition to operating state **6** Operation Enabled.

State Transitions

State transition is triggered by an input signal, EtherCAT command or be a response to a monitoring function.

State transition	Operating state	Description of state transition	Condition / event(1)	Response
T0	**1**-> **2**	Auto skip 0	• Device electronics successfully initialized	–
T1	**2**-> **3**	Auto skip 1	• Parameter successfully initialized	–
T2	**3** -> **4**	Shutdown	• No undervoltage and Encoder successfully checked and Actual velocity < 1000 rpm and STO signals = + 24 V and *DCOMcontrol* (6040h) = xxxx x110	–
T3	**4** -> **5**	Switch on	• *DCOMcontrol* (6040h) = xxxx x111	–
T4	**5** -> **6**	Enable operation	• *DCOMcontrol* (6040h) = xxxx 1111 • *DCOMcontrol* (6040h) = xxxx 1111 and 'Allow Servo On' = TRUE (If one DI function is set as 'allow servo on')	The power stage is enabled. The user parameters are checked. The holding brake is released (if available).
T5	**6** -> **5**	Disable operation	• *DCOMcontrol* (6040h) = xxxx 0111	The movement is canceled with "Halt". The holding brake is applied (if available). The power stage is disabled.
T6	**5** -> **4**	Shutdown	• *DCOMcontrol* (6040h) = xxxx x110	–
T7	**4** -> **3**	Disable voltage	• Undervoltage • STO signals = 0 V • Actual velocity > 1000 rpm (for example by external driving force) • *DCOMcontrol* (6040h) = xxxx xx0x	–
T8	**6** -> **4**	Shutdown	• *DCOMcontrol* (6040h) = xxxx x110	Disable the power stage immediately.
T9	**6** -> **3**	Disable voltage	• *DCOMcontrol* (6040h) = xxxx xx0x	Disable the power stage immediately, and the stop method is set via *DYN_BRK_enable* (P5-19).
T10	**5** -> **3**	Disable voltage	• *DCOMcontrol* (6040h) = xxxx xx0x	–
T11	**6** -> **7**	Quick stop	• Error of error class 1 • *DCOMcontrol* (6040h) = xxxx x01x	The movement is canceled with "Quick Stop".
T12	**7** -> **3**	Disable voltage	• *DCOMcontrol* (6040h) = xxxx xx0x	The power stage is disabled immediately, even if "Quick Stop" is still active.
T13	**x** -> **8**	Error occurs	• Error of error classes 2, 3 or 4	Error response is carried out, see Error Response, page 208.
T14	**8** -> **9**	Auto skip 2	• Error response terminated (error class 2) • Error of error classes 3 or 4	–
T15	**9** -> **3**	Fault reset	• Function: "Fault Reset"	Error is reset (cause of error must have been corrected).
T16	**7** -> **6**	Enable operation	• Function: "Fault Reset" • *DCOMcontrol* (6040h) = xxxx 1111	In the event of a "Quick Stop" that 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.

Indication of the Operating State

Indication of the Operating State via EtherCAT

The parameter *_DCOMstatus* (6041_h) provides information for the operating state of the device and the process status of the operating mode.

–	*_DCOMstatus*	Minimum value	–	Unit	–	Persistence	–
		Factory setting	–	Data type	UINT16	MODBUS	6916
		Maximum value	–	Access	R/-	EtherCAT	$6041:00_h$

Description:

Drive status word

Bit assignments:

Bit 0: Operating state Ready To Switch On

Bit 1: Operating state Switched On

Bit 2: Operating state Operation Enabled

Bit 3: Operating state Fault

Bit 4: Voltage Enabled

Bit 5: Operating state Quick Stop

Bit 6: Operating state Switch On Disabled

Bit 7: Error of error class 0

Bit 8: HALT request active

Bit 9: Remote

Bit 10: Target Reached

Bit 11: Internal Limit Active

Bit 12: Operating mode-specific

Bit 13: x_err

Bit 14: x_end

Bit 15: ref_ok

Bits 0,1,2,3,5 and 6 (Status Bits)

Bits 0, 1, 2, 3, 5 and 6 of the parameter *_DCOMstatus* (6041_h) provide information for the operating state of the device.

Operating state	Bit 6 Switch on disabled	Bit 5 Quick stop	Bit 3 Fault	Bit 2 Operation enabled	Bit 1 Switch on	Bit 0 Ready to switch on
2 Not Ready To Switch On	0	N/A	0	0	0	0
3 Switch On Disabled	1	N/A	0	0	0	0
4 Ready To Switch On	0	1	0	0	0	1
5 Switched On	0	1	0	0	1	1
6 Operation Enabled	0	1	0	1	1	1
7 Quick Stop Active	0	0	0	1	1	1
8 Fault Reaction Active	0	N/A	1	1	1	1
9 Fault	0	N/A	1	0	0	0

Bit 4 (Voltage Enabled)

“Bit 4 = 1” indicates that the DC bus voltage is correct.

If the voltage is insufficient, the device can not transition from operating state **3** Switch On Disabled to operating state **4** Ready To Switch On.

Bit 7 (Error of Error Class 0)

Bit 7 can be set to 1 as long as parameter *_WarnActive* (301C:B_h) contains an error message of error class 0, and the movement can not be interrupted.

The bit can be set to 1 for at least 100 ms, even if an error message of error class 0 is active for a shorter time.

Bit 7 can immediately reset to 0 in the case of a “Fault Reset”.

Bit 8 (Halt request Active)

“Bit 8 = 1” indicates that a “Halt” is active.

Bit 9 (Remote)

If bit 9 is set to 1, the device can carry out commands via EtherCAT.

If Bit 9 resets to 0, the device can be controlled via a different access channel. In such a case, it can still read or write parameters via EtherCAT.

Bit 10 (Target Reached)

Bit 10 is used for monitoring the operating mode. And the details can refer to Operating Modes, page 214.

Bit 11 (Internal Limit Active)

The meaning of bit 11 can be set via the parameter *DS402intLim* (301B:1E$_h$).

Bit 12 (Operating Mode-Specific)

Bit 12 is used for monitoring the operating mode. And the details can refer to Operating Modes, page 214 .

Bit 13 (x_err)

Bit 13 can only be set to 1 in the case of an error that needs to be corrected prior to further process.

The response of the device corresponds to the error class.

Bit 14 (x_end)

Bit 14 can switch to 0 if an operating mode starts.

If the process is terminated or interrupted by (for example, a “Halt”), bit 14 can switch back to 1 after the motor comes to a standstill.

The signal of bit 14 switching to 1 can be suppressed if the process is followed immediately by a new process in a different operating mode.

Bit 15 (ref_ok)

Bit 15 can be set to 1 if the motor has a valid zero point, for example, as a result of a reference movement.

A valid zero point remains to be valid even if the power stage is disabled.

Changing the Operating State

Changing the Operating State via EtherCAT

It can switch between operating states via the parameter *DCOMcontrol* (6040_h).

–	***DCOMcontrol***	**Minimum value**	**–**	**Unit**	**–**	**Persistence**	**–**
		Factory setting	**–**	**Data type**	**UINT16**	**MODBUS**	**6914**
		Maximum value	**–**	**Access**	**R/W**	**EtherCAT**	**6040:00$_h$**

Description:

DriveCom control word.

Bit 0: Operating state Switch On

Bit 1: Enable Voltage

Bit 2: Operating state Quick Stop

Bit 3: Enable Operation

Bits 4…6: Operating mode-specific

Bit 7: Fault Reset

Bit 8: Halt

Bit 9: Operating mode-specific

Bits 10…15: Reserved (must be 0)

Modified settings become active immediately.

Bits 0, 1, 2, 3 and 7 (Control Bits)

Bits 0, 1, 2, 3 and 7 of the parameter *DCOMcontrol* (6040_h) allow to switch between the operating states.

EtherCAT command	State transition	State transition to	Bit 7 Fault reset	Bit 3 Enable operation	Bit 2 Quick stop	Bit 1 Enable voltage	Bit 0 Switch on
Shutdown	T2, T6, T8	**4** Ready To Switch On	0	N/A	1	1	0
Switch On	T3	**5** Switched On	0	0	1	1	1
Disable Voltage	T7, T9, T10, T12	**3** Switch On Disabled	0	N/A	N/A	0	N/A
Quick Stop	T7, T10, T11	**3** Switch On Disabled **7** Quick Stop Active	0	N/A	0	1	N/A
Disable Operation	T5	**5** Switched On	0	0	1	1	1
Enable Operation	T4, T16	**6** Operation Enabled	0	1	1	1	1
Fault Reset	T15	**3** Switch On Disabled	0 –> 1	N/A	N/A	N/A	N/A

Bits 4...6 (Operating Mode-Specific)

Bits 4 to 6 are used for the settings of operating mode-specific.

Details can refer to Operating Modes, page 214.

Bit 8 (Halt)

Bit 8 is used for triggering a “Halt”.

You can set bit 8 to 1 for stopping a movement with “Halt”.

Bit 9 (Operating Mode-Specific)

Bit 9 is used for the settings of operating mode-specific.

Details can refer to Operating Modes, page 214.

Bits 10...15 (Must be 0)

Reserved.

Operating Modes

Starting and Changing an Operating Mode

Starting the Operating Mode

The parameter *DCOMopmode* (6060_h) is used for the setting of the operating mode.

–	***DCOMopmode***	**Minimum value**	**-1**	**Unit**	**–**	**Persistence**	**–**
		Factory setting	**–**	**Data type**	**INT16**	**MODBUS**	**6918**
		Maximum value	**10**	**Access**	**R/W**	**EtherCAT**	**6060:00$_h$**

Description:

Operating mode.

-1 / Jog*

0 / Reserved

1 / Profile Position

3 / Profile Velocity

4 / Profile Torque

6 / Homing

8 / Cyclic Synchronous Position

9 / Cyclic Synchronous Velocity

10 / Cyclic Synchronous Torque

* : JOG mode is available in EtherCAT Q3 2024.

Modified settings become active immediately.

The parameter *_DCOMopmd_act* (6061_h) can be used for reading the operating mode.

–	***_DCOMopmd_act***	**Minimum value**	**-1**	**Unit**	**–**	**Persistence**	**–**
		Factory setting	**–**	**Data type**	**INT16**	**MODBUS**	**6920**
		Maximum value	**10**	**Access**	**R/–**	**EtherCAT**	**6061:00$_h$**

Description:

Active operating mode.

-1 / Jog*

0 / Reserved

1 / Profile Position

3 / Profile Velocity

4 / Profile Torque

6 / Homing

8 / Cyclic Synchronous Position

9 / Cyclic Synchronous Velocity

10 / Cyclic Synchronous Torque

* : JOG mode is available in EtherCAT Q3 2024.

Modified settings become active immediately.

Changing the operating Mode

The operating mode can be changed after the active operating mode has been terminated.

In addition, some certain operating modes can also be changed during a running movement.

Operating Mode Jog

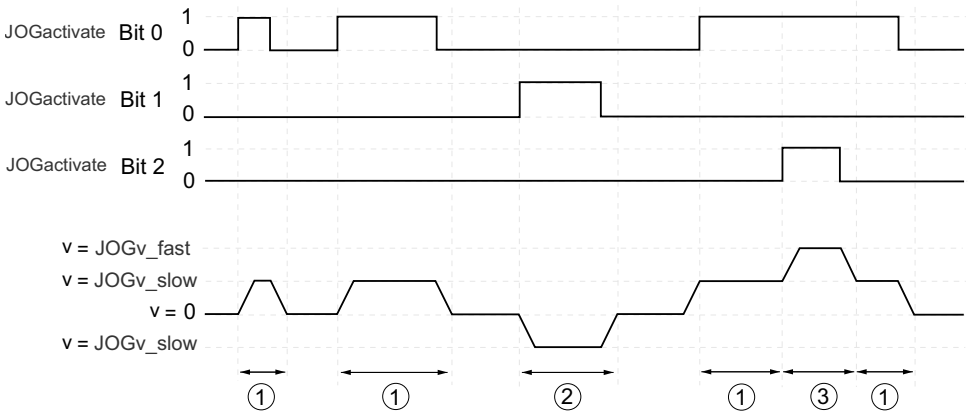
Overview

Description

In the operating mode Jog, a movement is made from the actual motor position in the specified direction.

As long as the signal for the direction is available, a continuous movement is made in the desired direction.

The illustration below provides an example of continuous movement via EtherCAT in Jog mode:



1 Slow movement in positive direction

2 Slow movement in negative direction

3 Fast movement in positive direction

Starting the operation mode

The operating mode is selected by writing -1 in parameter *DCOMopmode* (6060:00$_h$). Writing the parameter value causes the operating mode to start.

The parameter *JOGactivate* (301B:09$_h$) starts the movement.

Terminating the Operating Mode

The operating mode is terminated when one of the following conditions is met:

- Value of the jog control parameter *JOGactivate* (301B:09$_h$) is 0
- Stop caused by “Halt” or “Quick Stop”
- Stop caused by a detected error

Integrated HMI

It is also possible to start the operating mode via the HMI. Calling **OP > JOG- > JGST** enables the power stage and starts the operating mode.

The method Continuous Movement is controlled via the HMI.

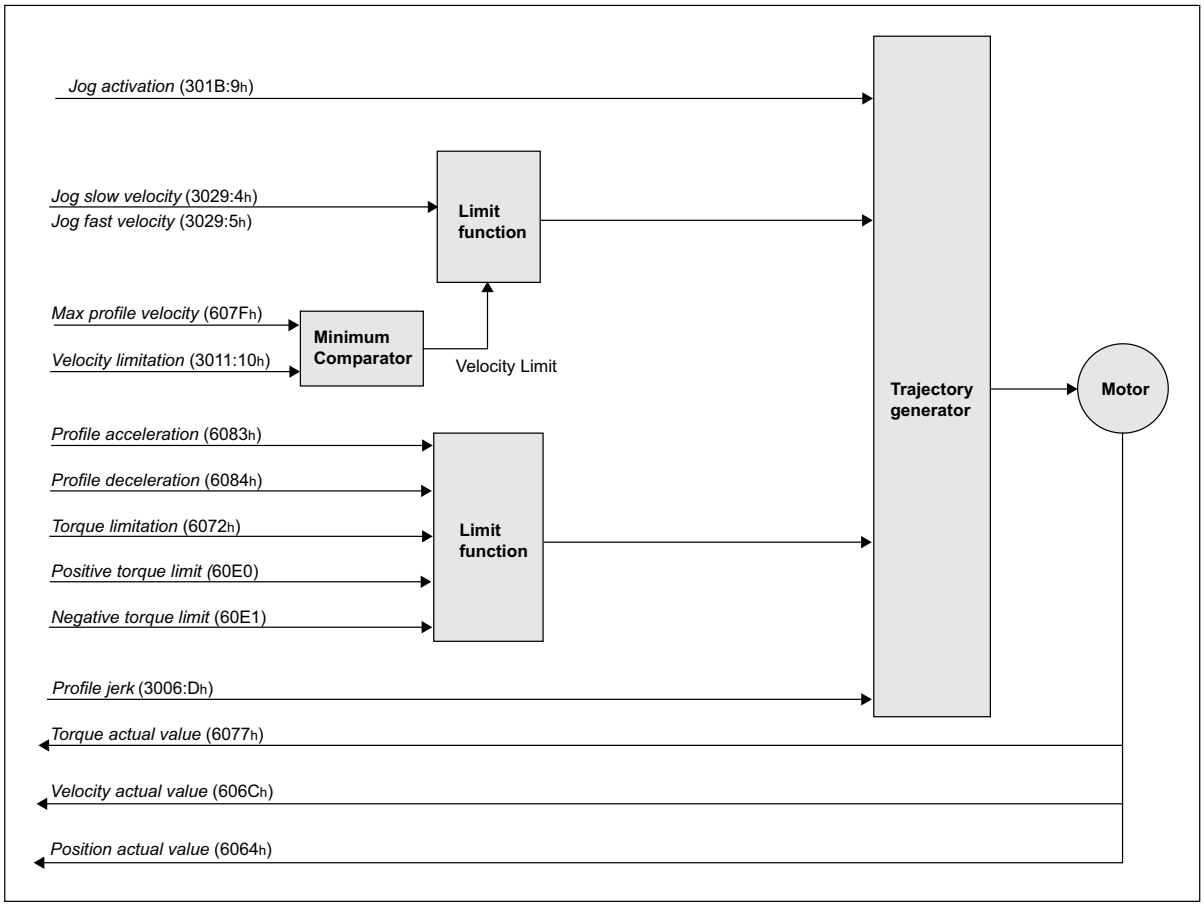
Turn the navigation button to select one of 4 types of movement:

- **JG-** : slow movement in positive direction
- **JG=** : fast movement in positive direction
- **-JG** : slow movement in negative direction
- **=JG** : fast movement in negative direction

Press the navigation button to start the movement.

Parameterization

The illustration below provides an overview of the parameters that can be adjusted in Jog mode.



An error occurred, the value exceeded 64 bits during the calculation process, and the final calculation result exceeded 32 bits.

Control Parameter

Parameter name		Index. Subindex	Description
DCOMcontrol		0x6040:00$_h$	Control word
JOGactivate		0x301B:09$_h$	Jog activation
JOGv_slow		0x3029:04$_h$	Jog slow velocity
JOGv_fast		0x3029:05$_h$	Jog fast velocity
Motion Profile for the Velocity, see Motion Profile for the Velocity, page 280.	*RAMP_v_max*	0x607F:00$_h$	Max profile velocity
	RAMP_v_acc	0x6083:00$_h$	Profile acceleration
	RAMP_v_dec	0x6084:00$_h$	Profile deceleration
Jerk Limitation, see Jerk Limitation, page 282.	*RAMP_v_jerk*	0x3006:0D$_h$	Profile jerk
Velocity Limitation, see Velocity Limitation, page 194.	*CTRL_v_max*	0x3011:10$_h$	Velocity limitation
Torque Limitation, see Torque Limitation, page 194.	*CTRL_tq_max*	0x6072:00$_h$	Torque limitation

Control Word

The operating mode-specific bits 4, 5, 6 and 9 are reserved in this operating mode and must be set to 0.

–	***DCOMcontrol***	**Minimum value**	**–**	**Unit**	**–**	**Persistence**	**–**
		Factory setting	**–**	**Data type**	**UINT16**	**MODBUS**	**6914**
		Maximum value	**–**	**Access**	**R/W**	**EtherCAT**	**6040:00$_h$**

Description:

DriveCom control word.

Bit 0: Operating state Switch On

Bit 1: Enable Voltage

Bit 2: Operating state Quick Stop

Bit 3: Enable Operation

Bits 4…6: Operating mode-specific

Bit 7: Fault Reset

Bit 8: Halt

Bit 9: Operating mode-specific

Bits 10…15: Reserved (must be 0)

Modified settings become active immediately.

Jog Activation

–	*JOGactivate*	Minimum value	0	Unit	–	Persistence	per.
		Factory setting	0	Data type	UINT16	MODBUS	6930
		Maximum value	7	Access	R/W	EtherCAT	301B:09$_h$

Description:

Activation of operating mode Jog.

Bit 0: Positive direction of movement

Bit 1: Negative direction of movement

Bit 2: 0 = slow 1 = fast

Modified settings become active immediately.

Jog Velocity

Two parameterizable velocities are available.

Set the desired values with the parameters *JOGv_slow* (3029:4$_h$, P4-05) and *JOGv_fast* (3029:5$_h$, P4-06) .

P4-05	*JOGv_slow*	Minimum value	1	Unit	usr_v	Persistence	per.
		Factory setting	100	Data type	UINT32	MODBUS	10504
		Maximum value	2147483647	Access	R/W	EtherCAT	3029:04$_h$

Description:

Velocity for slow movement.

The adjustable value is internally limited to the parameter setting in *RAMP_v_max* (P4-01).

Modified settings become active immediately.

P4-06	*JOGv_fast*	Minimum value	1	Unit	usr_v	Persistence	per.
		Factory setting	200	Data type	UINT32	MODBUS	10506
		Maximum value	2147483647	Access	R/W	EtherCAT	3029:05$_h$

Description:

Velocity for fast movement.

The adjustable value is internally limited to the parameter setting in *RAMP_v_max* (P4-01).

Modified settings become active immediately.

Status Parameter

Parameter name	Index. Subindex	Description
_DCOMstatus	0x6041:00$_h$	Status word
_p_act	0x6064:00$_h$	Position actual value
_v_act	0x606C:00$_h$	Velocity actual value
_tq_act	0x6077:00$_h$	Torque actual value

Status Word

The operating mode-specific bits 10 and 12 are reserved in this operating mode.

–	*_DCOMstatus*	Minimum value	–	Unit	–	Persistence	–
		Factory setting	–	Data type	UINT16	MODBUS	6916
		Maximum value	–	Access	R/-	EtherCAT	6041:00$_h$

Description:

Drive status word

Bit assignments:

Bit 0: Operating state Ready To Switch On

Bit 1: Operating state Switched On

Bit 2: Operating state Operation Enabled

Bit 3: Operating state Fault

Bit 4: Voltage Enabled

Bit 5: Operating state Quick Stop

Bit 6: Operating state Switch On Disabled

Bit 7: Error of error class 0

Bit 8: HALT request active

Bit 9: Remote

Bit 10: Target Reached

Bit 11: Internal Limit Active

Bit 12: Operating mode-specific

Bit 13: x_err

Bit 14: x_end

Bit 15: ref_ok

Torque Limit Value

–	*CTRL_TQ_LIMP*	Minimum value	0	Unit	0.1%	Persistence	–
		Factory setting	3500	Data type	INT16	MODBUS	4480
		Maximum value	3500	Access	R/W	EtherCAT	60E0:00$_h$

Description:

Positive torque limit value

–	*CTRL_TQ_LIMN*	**Minimum value**	**0**	**Unit**	**0.1%**	**Persistence**	**–**
		Factory setting	**3500**	**Data type**	**INT16**	**MODBUS**	**4482**
		Maximum value	**3500**	**Access**	**R/W**	**EtherCAT**	**60E1:00$_h$**
Description: Negative torque limit value							

Torque Actual Value

–	*_tq_act*	**Minimum value**	**–**	**Unit**	**0.1%**	**Persistence**	**–**
		Factory setting	**–**	**Data type**	**INT16**	**MODBUS**	**7752**
		Maximum value	**–**	**Access**	**R/-**	**EtherCAT**	**6077:00$_h$**
Description: Actual torque. 100.0 % correspond to the nominal torque.							

Velocity Actual Value

–	*_v_act*	**Minimum value**	**–**	**Unit**	**usr_v**	**Persistence**	**–**
		Factory setting	**–**	**Data type**	**INT32**	**MODBUS**	**7744**
		Maximum value	**–**	**Access**	**R/-**	**EtherCAT**	**606C:00$_h$**
Description: Actual velocity.							

Position Actual Value

–	*_p_act*	**Minimum value**	**–**	**Unit**	**usr_p**	**Persistence**	**–**
		Factory setting	**–**	**Data type**	**INT32**	**MODBUS**	**7706**
		Maximum value	**–**	**Access**	**R/-**	**EtherCAT**	**6064:00$_h$**
Description: Actual position.							

Monitoring Parameters

Function	Parameter name	Index. Subindex	Description
Following error, see Load-Dependent Position Deviation (Following Error), page 307.	*_p_dif_load_usr*	0x301E:16$_h$	Following error
	MON_p_dif_warn	0x3006:29$_h$	Max following error for error class 0
	MON_p_dif_load_usr	0x3006:3E$_h$	Max following error for error class 1,2,3
	ErrorResp_p_dif	0x3005:0B$_h$	Error class for high following error
Standstill window, see Standstill Window, page 292.	*MON_p_win_usr*	0x3006:40$_h$	Standstill window
	MON_p_winTime	0x6068:00$_h$	Standstill window time
	MON_p_winTout	0x3006:26$_h$	Stansitll window timeout

Example of DS402 Objects

Adapting the mapping of RxPDO

Address (hex)	Parameter name (DS402)
0x6040:00$_h$	*DCOMcontrol* (Control word)
0x301B:90$_h$	*JOGactivate*
0x6060:00$_h$	*DCOMopmode* (Mode of operation)

Adapting the mapping of TxPDO

Address (hex)	Parameter name (DS402)
0x6041:00$_h$	*_DCOMstatus* (Status word)
0x6061:00$_h$	*_DCOMopmd_act* (Mode of operation display)

Application

Meaning	Address (hex)	Parameter name (DS402)	Value (hex)
SDO: Set the velocity for slow movement (for example, 100 RPM)	0x3029:40$_h$	*JOGv_slow*	64
SDO: Set the velocity for fast movement (for example, 300 RPM)	0x3029:50$_h$	*JOGv_fast*	012C
RxPDO: Enable power stage	0x6040:00$_h$	*DCOMcontrol* (Control word)	00->06->0F
TxPDO: Verify whether power stage has been enabled	0x6041:00$_h$	*_DCOMstatus* (Status word)	4637
RxPDO: Set the operating mode	0x6060:00$_h$	*DCOMopmode* (Mode of operation)	FF
TxPDO: Verify whether operating mode has been set	0x6061:00$_h$	*_DCOMopmd_act* (Mode of operation display)	FF
RxPDO: Start movement (for example, slow movement in positive direction)	0x301B:90$_h$	*JOGactivate*	01
TxPDO: Get the state via status parameters	0x6041:00$_h$	*_DCOMstatus* (Status word)	0237
RxPDO: Terminate movement	0x301B:90$_h$	*JOGactivate*	00
TxPDO: Get the state via status parameters(wait for end of movement)	0x6041:00$_h$	*_DCOMstatus* (Status word)	4237

Operation Mode Profile Torque

Overview

Description

In the operating mode Profile Torque, a movement is made with a specified target torque *PTtq_target* (6071_h). The motion profile is generated by the drive, considering the target value received from the master controller.

Without a proper limit value, the motor can reach an unintentionally high velocity in this operating mode. The parameter *CTRL_v_max* (3011:10h, P4-18) can be used to limit the maximum velocity.

⚠WARNING

UNINTENTIONALLY HIGH VELOCITY

Verify that the parameterized velocity limitation is appropriate for the motor.

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

Starting the Operating Mode

The operating mode is selected by writing 4 in the *DCOMopmode* (6060_h). Writing the parameter value causes the operating mode to start.

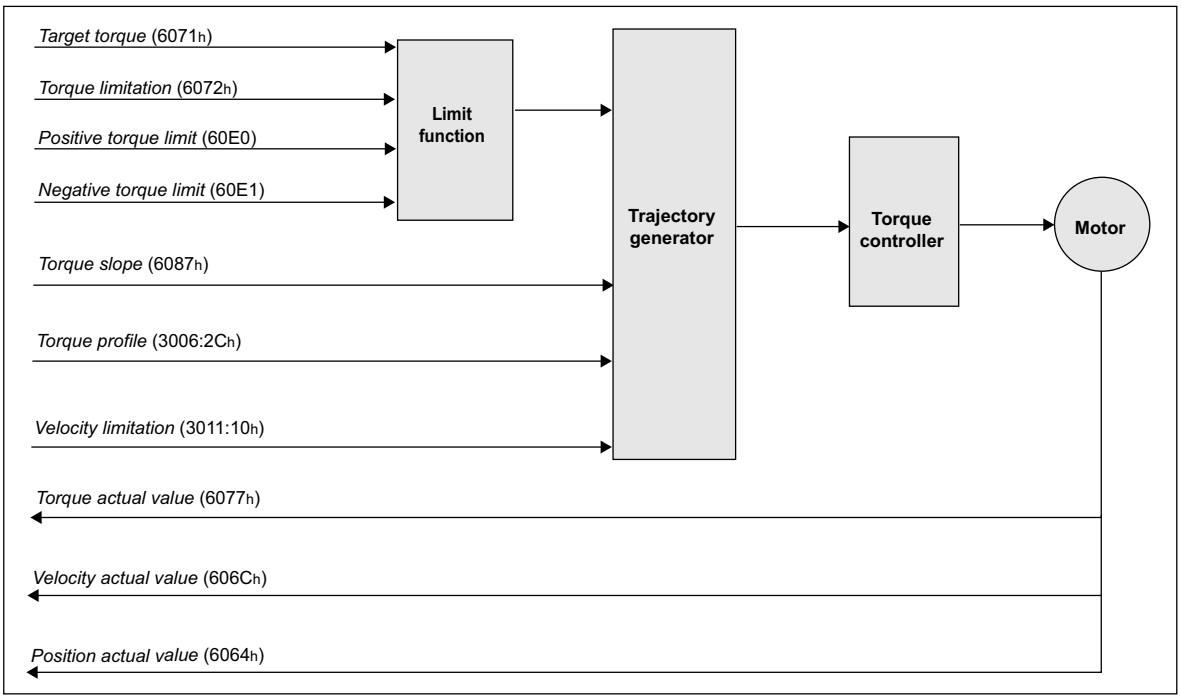
Terminating the Operating Mode

The operating mode is terminated when the motor is at a standstill and one of the following conditions is met:

- Stop caused by “Halt” or “Quick Stop”
- Stop caused by a detected error

Parameterization

The illustration below provides an overview of the parameters that can be adjusted in control mode Profile Torque.



Control Parameters

Parameter name		Index. Subindex	Description
DCOMcontrol		0x6040:00$_h$	Control word
PTtq_target		0x6071:00$_h$	Target torque
RAMP_tq_slope		0x6087:00$_h$	Torque slope
RAMP_tq_enable		0x3006:2C$_h$	Torque profile
Velocity Limitation, see Velocity Limitation, page 194.	*Ctrl_v_max*	0x3011:10$_h$	Velocity limitation
Torque Limitation, see Torque Limitation, page 194. ’	*Ctrl_tq_max*	0x6072:00$_h$	Torque limitation

Control Word

The operating mode-specific bits 4, 5, 6 and 9 of control word *DCOMcontrol* (6040$_h$) are reserved in this operating mode and must be set to 0.

–	***DCOMcontrol***	**Minimum value**	**–**	**Unit**	**–**	**Persistence**	**–**
		Factory setting	**–**	**Data type**	**UINT16**	**MODBUS**	**6914**
		Maximum value	**–**	**Access**	**R/W**	**EtherCAT**	**6040:00$_h$**

Description:

DriveCom control word.

Bit 0: Operating state Switch On

Bit 1: Enable Voltage

Bit 2: Operating state Quick Stop

Bit 3: Enable Operation

Bits 4…6: Operating mode-specific

Bit 7: Fault Reset

Bit 8: Halt

Bit 9: Operating mode-specific

Bits 10…15: Reserved (must be 0)

Modified settings become active immediately.

Target Torque

The parameter *PTtq_target* (6071$_h$) is used to set the target torque.

–	***PTtq_target***	**Minimum value**	**–30000**	**Unit**	**0.1%**	**Persistence**	**–**
		Factory setting	**0**	**Data type**	**INT16**	**MODBUS**	**6944**
		Maximum value	**30000**	**Access**	**R/W**	**EtherCAT**	**6071:00$_h$**

Description:

Target torque.

100.0 % correspond to the rated torque.

In increments of 0.1 %.

Modified settings become active immediately.

Motion Profile for the Torque

P4-22	*RAMP_tq_slope*	Minimum value	0	Unit	0.1 %/s	Persistence	per.
		Factory setting	100000	Data type	UINT32	MODBUS	1620
		Maximum value	30000000	Access	R/W	EtherCAT	6087:00$_h$

Description:

Slope setting of the motion profile for torque.

100.00 % of the torque setting correspond to the motor rated torque.

In increments of 0.1 %/s.

Modified settings become active immediately.

P4-23	*RAMP_tq_enable*	Minimum value	0	Unit	–	Persistence	per.
		Factory setting	1	Data type	UINT16	MODBUS	1624
		Maximum value	1	Access	R/W	EtherCAT	3006:2C$_h$

Description:

Activation of the motion profile for torque.

0 / Profile Off: Profile off

1 / Profile On: Profile on

In the operating mode Profile Torque, the motion profile for torque can be activated or deactivated.

In the other operating modes, the motion profile for torque is inactive.

Setting can only be modified if power stage is disabled.

Status Parameters

Parameter name	Index. Subindex	Description
_DCOMstatus	0x6041:00_h	Status word
_tq_act	0x6077:00_h	Torque actual value
_v_act	0x606C:00_h	Velocity actual value
_p_act	0x6064:00_h	Position actual value

Status Word

–	*_DCOMstatus*	Minimum value	–	Unit	–	Persistence	–
		Factory setting	–	Data type	UINT16	MODBUS	6916
		Maximum value	–	Access	R/-	EtherCAT	6041:00_h

Description:

Drive status word

Bit assignments:

Bit 0: Operating state Ready To Switch On

Bit 1: Operating state Switched On

Bit 2: Operating state Operation Enabled

Bit 3: Operating state Fault

Bit 4: Voltage Enabled

Bit 5: Operating state Quick Stop

Bit 6: Operating state Switch On Disabled

Bit 7: Error of error class 0

Bit 8: HALT request active

Bit 9: Remote

Bit 10: Target Reached

Bit 11: Internal Limit Active

Bit 12: Operating mode-specific

Bit 13: x_err

Bit 14: x_end

Bit 15: ref_ok

Information on the current movement is available via bit 10.

Parameter DCOMstatus	Meaning
Bit 10	0: Target torque not reached 1: Target torque reached
Bit 12	Reserved

Torque Limit Value

–	*CTRL_TQ_LIMP*	Minimum value	0	Unit	0.1%	Persistence	–
		Factory setting	3500	Data type	INT16	MODBUS	4480
		Maximum value	3500	Access	R/W	EtherCAT	60E0:00_h

Description:

Positive torque limit value

–	*CTRL_TQ_LIMN*	Minimum value	0	Unit	0.1%	Persistence	–
		Factory setting	3500	Data type	INT16	MODBUS	4482
		Maximum value	3500	Access	R/W	EtherCAT	60E1:00$_h$

Description:

Negative torque limit value

Torque Actual Value

–	*_tq_act*	Minimum value	–	Unit	0.1%	Persistence	–
		Factory setting	–	Data type	INT16	MODBUS	7752
		Maximum value	–	Access	R/-	EtherCAT	6077:00$_h$

Description:

Actual torque.

100.0 % correspond to the nominal torque.

Velocity Actual Value

–	*_v_act*	Minimum value	–	Unit	usr_v	Persistence	–
		Factory setting	–	Data type	INT32	MODBUS	7744
		Maximum value	–	Access	R/-	EtherCAT	606C:00$_h$

Description:

Actual velocity.

Position Actual Value

–	*_p_act*	Minimum value	–	Unit	usr_p	Persistence	–
		Factory setting	–	Data type	INT32	MODBUS	7706
		Maximum value	–	Access	R/-	EtherCAT	6064:00$_h$

Description:

Actual position.

Monitoring Parameters

Function	Parameter name	Index. Subindex	Description
Torque window, see Torque Window, page 288	*MON_tq_win*	0x3006:2D$_h$	Torque window
	MON_tq_winTime	0x3006:2E$_h$	Torque window time
Velocity threshold value, see Velocity Threshold Value, page 303	*MON_v_Threshold*	0x606F:00$_h$	Velocity threshold
	MON_v_ChkTime	0x6070:00$_h$	Velocity window time
Torque threshold value, see Torque Threshold Value, page 301	*MON_tq_Threshold*	0x3006:1C$_h$	Torque threshold
	MON_tq_Chktime	0x3006:57$_h$	Torque window time

Example of DS402 Objects

Adapting the mapping of RxPDO

Address (hex)	Parameter name (DS402)
0x6040:00$_h$	*DCOMcontrol* (Control word)
0x6071:00$_h$	*PTtq_target* (Target torque)
0x6060:00$_h$	*DCOMopmode* (Mode of operation)

Adapting the mapping of TxPDO

Address (hex)	Parameter name (DS402)
0x6041:00$_h$	*_DCOMstatus* (Status word)
0x6061:00$_h$	*_DCOMopmd_act* (Mode of operation display)

Application

Meaning	Address (hex)	Parameter name (DS402)	Value (hex)
SDO: Slope setting of the motion profile for torque (example 10.0 %/s)	0x6087:00$_h$	*RAMP_tq_slope* (Torque slope)	64
RxPDO: Enable power stage	0x6040:00$_h$	*DCOMcontrol* (Control word)	00->06->0F
TxPDO: Verify whether power stage has been enabled	0x6041:00$_h$	*_DCOMstatus* (Status word)	4637
RxPDO: Set the operating mode	0x6060:00$_h$	*DCOMopmode* (Mode of operation)	04
TxPDO: Verify whether operating mode has been set	0x6061:00$_h$	*_DCOMopmd_act* (Mode of operation display)	04
RxPDO: Start movement by transmitting a target torque (example 1.0 %)	0x6071:00$_h$	*PTtq_target* (Target torque)	0A
TxPDO: Verify whether target torque has been reached	0x6041:00$_h$	*_DCOMstatus* (Status word)	0637
RxPDO: Terminate movement (with Quick Stop)	0x6040:00$_h$	*DCOMcontrol* (Control word)	0B
RxPDO: Reset Quick Stop	0x6040:00$_h$	*DCOMcontrol* (Control word)	0F

Operating Mode Profile Velocity

Overview

Description

In the operating mode Profile Velocity, a movement is made with a specified target velocity *PVv_target* (60FF$_h$). The motion profile is generated by the drive, considering the target values received from the master controller.

Target values include target velocity, acceleration and deceleration.

Starting the Operating Mode

The operating mode is selected by writing 3 in the *DCOMopmode* (6060h).

Writing the parameter value causes the operating mode to start.

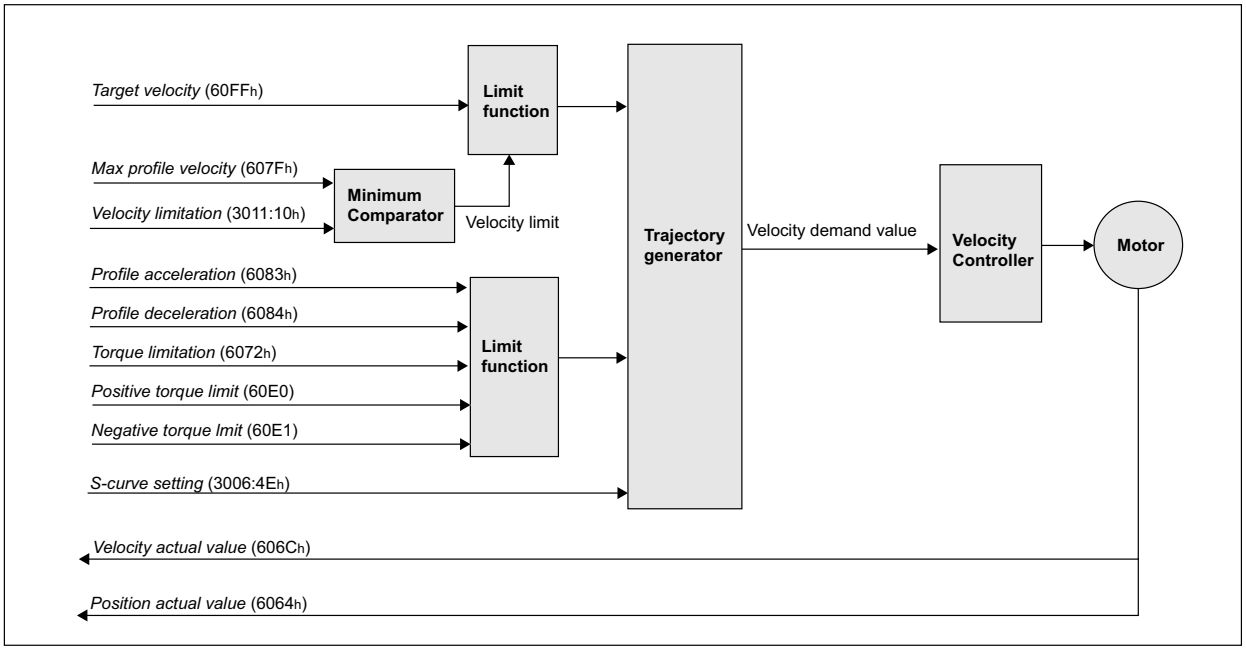
Terminating the Operating Mode

The operating mode is terminated when the motor is at a standstill and one of the following conditions is met:

- Stop caused by “Halt” or “Quick Stop”
- Stop caused by a detected error

Parameterization

The illustration below provides an overview of the parameters that can be adjusted in control mode Profile Velocity.



Control Parameters

Parameter name		Index. Subindex	Description
DCOMcontrol		0x6040:00$_h$	Control word
PVv_target		0x60FF:00$_h$	Target velocity
RAMP_v_Scurve		0x3006:4E$_h$	Curve setting
Motion Profile for the Velocity, see Motion Profile for the Velocity, page 280.	*RAMP_v_max*	0x607F:00$_h$	Max profile velocity
	RAMP_v_acc	0x6083:00$_h$	Profile acceleration
	RAMP_v_dec	0x6084:00$_h$	Profile deceleration
Velocity Limitation, see Velocity Limitation, page 194.	*Ctrl_v_max*	0x3011:10$_h$	Velocity limitation
Torque Limitation, see Torque Limitation, page 194.	*Ctrl_tq_max*	0x6072:00$_h$	Torque limitation

Control Word

The operating mode-specific bits 4, 5, 6 and 9 of control word *DCOMcontrol* (6040$_h$) are reserved in this operating mode and must be set to 0.

–	***DCOMcontrol***	**Minimum value**	**–**	**Unit**	**–**	**Persistence**	**–**
		Factory setting	**–**	**Data type**	**UINT16**	**MODBUS**	**6914**
		Maximum value	**–**	**Access**	**R/W**	**EtherCAT**	**6040:00$_h$**

Description:

DriveCom control word.

Bit 0: Operating state Switch On

Bit 1: Enable Voltage

Bit 2: Operating state Quick Stop

Bit 3: Enable Operation

Bits 4…6: Operating mode-specific

Bit 7: Fault Reset

Bit 8: Halt

Bit 9: Operating mode-specific

Bits 10…15: Reserved (must be 0)

Modified settings become active immediately.

Target Velocity

–	***PVv_target***	**Minimum value**	**–**	**Unit**	**usr_v**	**Persistence**	**–**
		Factory setting	**0**	**Data type**	**INT32**	**MODBUS**	**6938**
		Maximum value	**–**	**Access**	**R/W**	**EtherCAT**	**60FF:00$_h$**

Description:

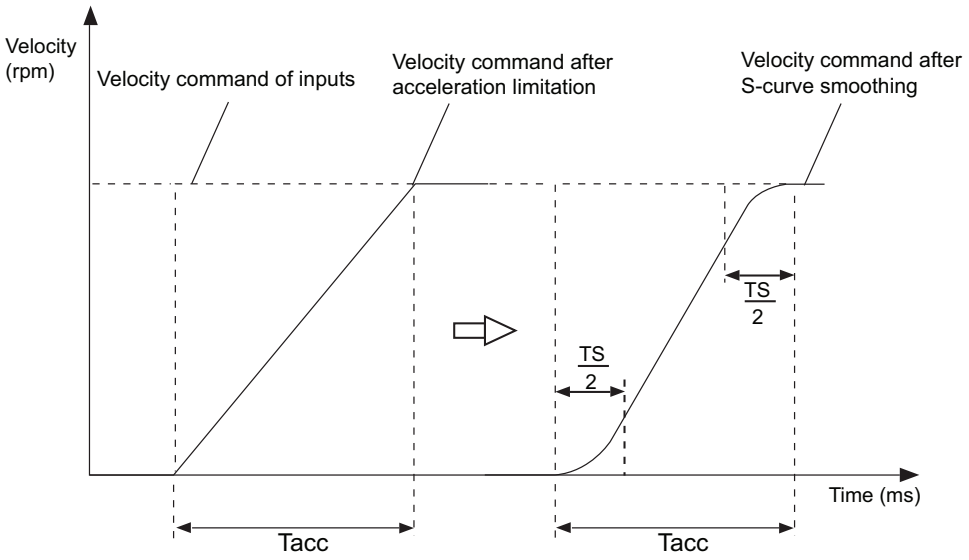
Target velocity.

The target velocity is limited to the setting in *CTRL_v_max* and *RAMP_v_max*.

Modified settings become active immediately.

“S-curve” Function

When internal parameters are used as velocity commands, the user can activate the “S-curve"” filter function to improve the smoothing performance during acceleration and deceleration. The “S-curve” filter function allows you to set the percentage of S-shaped smooth curves during acceleration and deceleration of the drive with internal movements, up to 100%. This function will re-plan the ramp of the acceleration and deceleration ramps to ensure that the total time of the acceleration and deceleration motion profile remain unchanged.



P4-04	*RAMP_v_Scurve*	Minimum value	0	Unit	1%	Persistence	per.
		Factory setting	0	Data type	UINT16	MODBUS	1692
		Maximum value	100	Access	R/W	EtherCAT	3006:4E$_h$

Description:

S-curve setting of motion profile command for velocity

When using an internal curve as the velocity command, the smoothing performance of acceleration and deceleration process is improved by setting the proportion of the S-shaped smooth curve during the acceleration and deceleration of motion profile for velocity.

This function will re-plan the ramp of the acceleration and deceleration ramps to ensure that the total time of the acceleration and deceleration motion profile remain unchanged.

Modified settings become active the next time the motor moves.

Status Parameters

Parameter name	Index. Subindex	Description
_DCOMstatus	0x6041:00_h	Status word
_v_act	0x606C:00_h	Velocity actual value
_p_act	0x6064:00_h	Position actual value

Status Word

–	*_DCOMstatus*	Minimum value	–	Unit	–	Persistence	–
		Factory setting	–	Data type	UINT16	MODBUS	6916
		Maximum value	–	Access	R/-	EtherCAT	6041:00_h

Description:

Drive status word

Bit assignments:

Bit 0: Operating state Ready To Switch On

Bit 1: Operating state Switched On

Bit 2: Operating state Operation Enabled

Bit 3: Operating state Fault

Bit 4: Voltage Enabled

Bit 5: Operating state Quick Stop

Bit 6: Operating state Switch On Disabled

Bit 7: Error of error class 0

Bit 8: HALT request active

Bit 9: Remote

Bit 10: Target Reached

Bit 11: Internal Limit Active

Bit 12: Operating mode-specific

Bit 13: x_err

Bit 14: x_end

Bit 15: ref_ok

Information on the current movement is available via bits 10 and 12.

Parameter DCOMstatus	Meaning
Bit 10	0: Target velocity not reached 1: Target velocity reached
Bit 12	0: Velocity ≠ 0 1: Velocity = 0

Torque Limit Value

–	*CTRL_TQ_LIMP*	Minimum value	0	Unit	0.1%	Persistence	–
		Factory setting	3500	Data type	INT16	MODBUS	4480
		Maximum value	3500	Access	R/W	EtherCAT	60E0:00_h

Description:

Positive torque limit value

–	*CTRL_TQ_LIMN*	Minimum value	0	Unit	0.1%	Persistence	–
		Factory setting	3500	Data type	INT16	MODBUS	4482
		Maximum value	3500	Access	R/W	EtherCAT	60E1:00$_h$

Description:

Negative torque limit value

Velocity Actual Value

–	*_v_act*	Minimum value	–	Unit	usr_v	Persistence	–
		Factory setting	–	Data type	INT32	MODBUS	7744
		Maximum value	–	Access	R/-	EtherCAT	606C:00$_h$

Description:

Actual velocity.

Position Actual Value

–	*_p_act*	Minimum value	–	Unit	usr_p	Persistence	–
		Factory setting	–	Data type	INT32	MODBUS	7706
		Maximum value	–	Access	R/-	EtherCAT	6064:00$_h$

Description:

Actual position.

Monitoring Parameters

Function	Parameter name	Index. Subindex	Description
Velocity window, see Velocity Window, page 290.	*MON_v_win*	0x606D:00$_h$	Velocity window
	MON_v_winTime	0x606E:00$_h$	Velocity window time
Velocity deviation window, see Velocity Deviation Window, page 294.	*MON_v_DiffWin*	0x3006:1A$_h$	Velocity Deviation
	MON_v_ChkTime	0x6070:00$_h$	Velocity window time
Velocity threshold value, see Velocity Threshold Value, page 303.	*MON_v_Threshold*	0x606F:00$_h$	Velocity threshold
	MON_v_ChkTime	0x6070:00$_h$	Velocity window time
Torque threshold value, see Torque Threshold Value, page 301.	*MON_tq_Threshold*	0x3006:1C$_h$	Torque threshold
	MON_tq_Chktime	0x3006:57$_h$	Torque window time
Load-Dependent Velocity deviation, see Load-Dependent Velocity Deviation, page 305.	*_v_dif_usr*	0x301E:2C$_h$	Velocity deviation
	MON_VelDiff	0x3006:4B$_h$	Max velocity deviation
	MON_VelDiff_Time	0x3006:4C$_h$	Window time for max velocity deviation
	ErrorResp_v_dif	0x3005:3C$_h$	Error response to velocity deviation

Example of DS402 Objects

Adapting the mapping of RxPDO

Address (hex)	Parameter name (DS402)
0x6040:00$_h$	*DCOMcontrol* (Control word)
0x60FF:00$_h$	*PVv_target* (Target velocity)
0x6083:00$_h$	*RAMP_v_acc* (Profile acceleration)
0x6084:00$_h$	*RAMP_v_dec* (Profile deceleration)
0x6060:00$_h$	*DCOMopmode* (Mode of operation)

Adapting the mapping of TxPDO

Address (hex)	Parameter name (DS402)
0x6041:00$_h$	*_DCOMstatus* (Status word)
0x6061:00$_h$	*_DCOMopmd_act* (Mode of operation display)

Application

Meaning	Address (hex)	Parameter name (DS402)	Value (hex)
RxPDO: Set acceleration (for example, 100 RPM/s)	0x6087:00$_h$	*RAMP_v_acc* (Profile acceleration)	64
RxPDO: Set deceleration (for example, 300 RPM/s)	0x6084:00$_h$	*RAMP_v_dec* (Profile deceleration)	012C
RxPDO: Enable power stage	0x6040:00$_h$	*DCOMcontrol* (Control word)	00->06->0F
TxPDO: Verify whether power stage has been enabled	0x6041:00$_h$	*_DCOMstatus* (Status word)	4637
RxPDO: Set the operating mode	0x6060:00$_h$	*DCOMopmode* (Mode of operation)	03
TxPDO: Verify whether operating mode has been set	0x6061:00$_h$	*_DCOMopmd_act* (Mode of operation display)	03
RxPDO: Start movement by setting a target velocity (for example, 600 RPM)	0x60FF:00$_h$	*PVv_target* (Target velocity)	0258
TxPDO: Verify whether target velocity has been reached	0x6041:00$_h$	*_DCOMstatus* (Status word)	0637
RxPDO: Terminate movement (with Quick Stop)	0x6040:00$_h$	*DCOMcontrol* (Control word)	0B
RxPDO: Reset Quick Stop	0x6040:00$_h$	*DCOMcontrol* (Control word)	0F

Operation Mode Profile Position

Overview

Description

In the operating mode Profile Position, a movement to a desired target position is performed. The motion profile is generated by the drive, considering the target values received from the master controller.

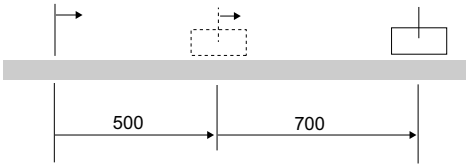
Target values include target position, target velocity, acceleration, and deceleration.

A movement can be made by using one of 2 methods:

- Relative movement
- Absolute movement

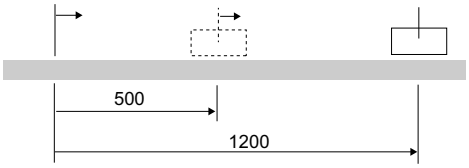
Relative Movement

In the case of a relative movement, the movement is relative with reference to the previous target position or the actual position of the motor.



Absolute Movement

In the case of an absolute movement, the movement is absolute with reference to the zero point. A zero point must be defined with the operating mode Homing prior to the first absolute movement.



Starting the Operating Mode

The operating mode is selected by writing 1 in parameter *DCOMopmode* (6060_h).

Writing the parameter value causes the operating mode to start.

The movement is started via the control word.

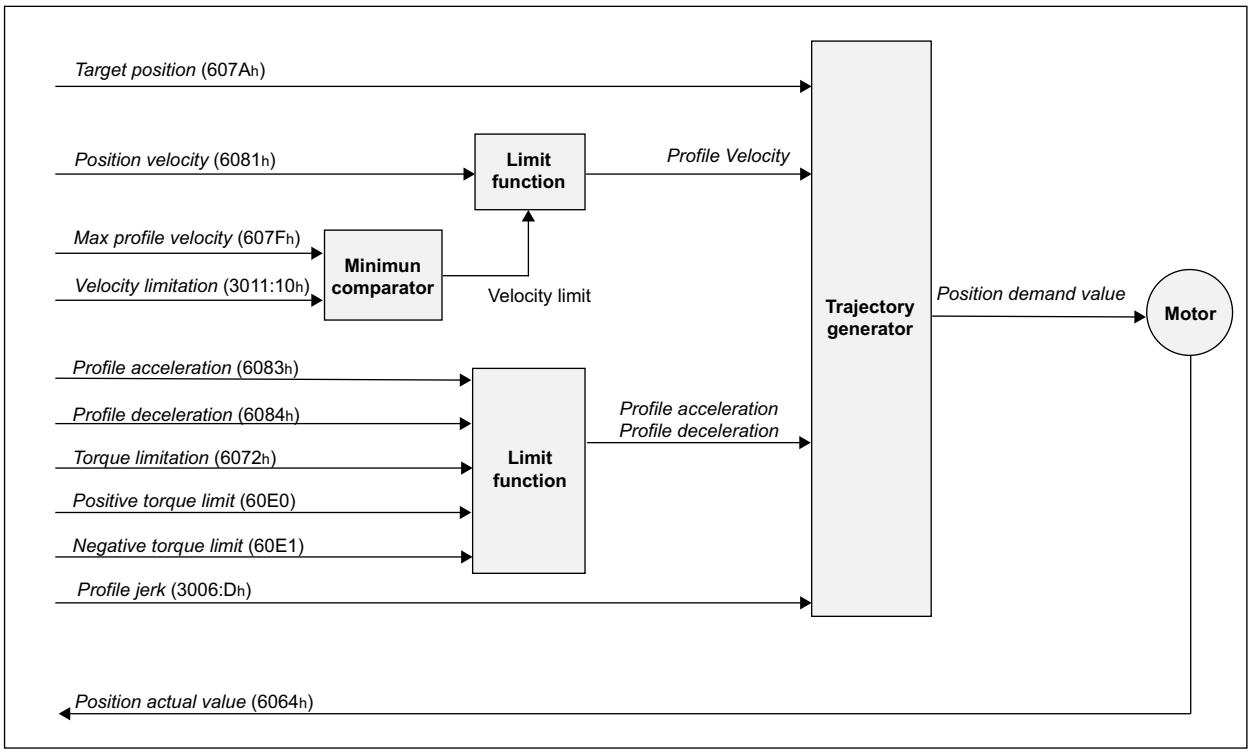
Terminating the Operating Mode

The operating mode is terminated when the motor is at a standstill and one of the following conditions is met:

- Target position reached
- Stop caused by “Halt” or “Quick Stop”
- Stop caused by a detected error

Parameterization

The illustration below provides an overview of the parameters that can be adjusted in control mode Profile Position.



Control Parameter

Parameter name		Index. Subindex	Description
DCOMcontrol		0x6040:00$_h$	Control word
PPp_target		0x607A:00$_h$	Target position
PPv_target		0x6081:00$_h$	Profile velocity
PPoption		0x6072:00$_h$	Positioning option code
Motion Profile for the Velocity, see Motion Profile for the Velocity, page 280.	*RAMP_v_max*	0x607f:00$_h$	Max profile velocity
	RAMP_v_acc	0x6083:00$_h$	Profile acceleration
	RAMP_v_dec	0x6084:00$_h$	Profile deceleration
Jerk Limitation, see Jerk Limitation, page 282.	*RAMP_v_jerk*	0x3006:0D$_h$	Profile jerk
Velocity Limitation, Velocity Limitation, page 194.	*Ctrl_v_max*	0x3011:10$_h$	Velocity limitation
Torque Limitation, Torque Limitation, page 194.	*Ctrl_tq_max*	0x6072:00$_h$	Torque limitation

Control Word

–	***DCOMcontrol***	**Minimum value**	**–**	**Unit**	**–**	**Persistence**	**–**
		Factory setting	**–**	**Data type**	**UINT16**	**MODBUS**	**6914**
		Maximum value	**–**	**Access**	**R/W**	**EtherCAT**	**6040:00$_h$**

Description:

DriveCom control word.

Bit 0: Operating state Switch On

Bit 1: Enable Voltage

Bit 2: Operating state Quick Stop

Bit 3: Enable Operation

Bits 4…6: Operating mode-specific

Bit 7: Fault Reset

Bit 8: Halt

Bit 9: Operating mode-specific

Bits 10…15: Reserved (must be 0)

Modified settings become active immediately.

In the operating mode, the bits 4,5,6,9 in the Control word 6040$_h$ start a movement.

Following transitions starts a movement to a target position.

Bit 9: Change on set point	Bit 5: Change setpoint immediately	Bit 4: New setpoint	Meaning
0	0	0->1	Starts a movement to a target position. Target values transmitted during a movement become effective immediately and are executed at the target. The movement is stopped at the target position.
1	0	0->1	Starts a movement to a target position. Target values transmitted during a movement become effective immediately and are executed at the target. The movement is not stopped at the target position.
N/A	1	0->1	Starts a movement to a target position. Target values transmitted during a movement become immediately effective and are immediately executed.

Parameter value	Meaning
Bit 6: Absolute/relative	0: Absolute movement 1: Relative movement

Target Position

–	*PPp_target*	Minimum value	–	Unit	usr_p	Persistence	–
		Factory setting	–	Data type	INT32	MODBUS	6940
		Maximum value	–	Access	R/W	EtherCAT	607A:00$_h$

Description:

Target position for operating mode Profile Position.

Minimum/maximum values depend on:

- Scaling factor
- Software limit switches (if they are activated)

Modified settings become active immediately.

Target Velocity

–	*PPv_target*	Minimum value	1	Unit	usr_v	Persistence	–
		Factory setting	60	Data type	UINT32	MODBUS	6942
		Maximum value	4294967295	Access	R/W	EtherCAT	6081:00$_h$

Description:

Target velocity for operating mode Profile Position.

The target velocity is limited to the setting in *CTRL_v_max* (P4-18) and *RAMP_v_max* (P4-01).

Modified settings become active the next time the motor moves.

Position Option Code

–	*PPoption*	Minimum value	0	Unit	–	Persistence	–
		Factory setting	0	Data type	UINT16	MODBUS	6960
		Maximum value	2	Access	R/W	EtherCAT	60F2:00$_h$

Description:

Options for operating mode Profile Position.

Determines the reference position for relative positioning:

0 / Relative with reference to the previous target position of the profile generator

1 / Not supported

2 / Relative with reference to the actual position of the motor

Modified settings become active the next time the motor moves.

Status Parameter

Parameter name	Index. Subindex	Description
_DCOMstatus	0x6041:00$_h$	Status word
_p_act	0x6064:00$_h$	Position actual value

Status Word

–	***_DCOMstatus***	**Minimum value**	**–**	**Unit**	**–**	**Persistence**	**–**
		Factory setting	**–**	**Data type**	**UINT16**	**MODBUS**	**6916**
		Maximum value	**–**	**Access**	**R/-**	**EtherCAT**	**6041:00$_h$**

Description:

Drive status word

Bit assignments:

Bit 0: Operating state Ready To Switch On

Bit 1: Operating state Switched On

Bit 2: Operating state Operation Enabled

Bit 3: Operating state Fault

Bit 4: Voltage Enabled

Bit 5: Operating state Quick Stop

Bit 6: Operating state Switch On Disabled

Bit 7: Error of error class 0

Bit 8: HALT request active

Bit 9: Remote

Bit 10: Target Reached

Bit 11: Internal Limit Active

Bit 12: Operating mode-specific

Bit 13: x_err

Bit 14: x_end

Bit 15: ref_ok

Information on the current movement is available via bits 10 and 12.

Parameter DCOMstatus	Meaning
Bit 10	0: Target position not reached 1: Target position reached
Bit 12	0: New position possible 1: New target position accepted

Torque Limit Value

–	***CTRL_TQ_LIMP***	**Minimum value**	**0**	**Unit**	**0.1%**	**Persistence**	**–**
		Factory setting	**3500**	**Data type**	**INT16**	**MODBUS**	**4480**
		Maximum value	**3500**	**Access**	**R/W**	**EtherCAT**	**60E0:00$_h$**

Description:

Positive torque limit value

–	*CTRL_TQ_LIMN*	Minimum value	0	Unit	0.1%	Persistence	–
		Factory setting	3500	Data type	INT16	MODBUS	4482
		Maximum value	3500	Access	R/W	EtherCAT	60E1:00$_h$

Description:

Negative torque limit value

Position Actual Value

–	*_p_act*	Minimum value	–	Unit	usr_p	Persistence	–
		Factory setting	–	Data type	INT32	MODBUS	7706
		Maximum value	–	Access	R/-	EtherCAT	6064:00$_h$

Description:

Actual position.

Monitoring Parameters

Function	Parameter name	Index. Subindex	Description
Following error, see Load-Dependent Position Deviation (Following Error), page 307.	*_p_dif_load_usr*	0x301E:16$_h$	Following error
	MON_p_dif_warn	0x3006:29$_h$	Max following error for error class 0
	MON_p_dif_load_usr	0x3006:3E$_h$	Max following error for error class 1,2,3
	ErrorResp_p_dif	0x3005:0B$_h$	Error class for high following error
Standstill window, see Standstill Window, page 292.	*MON_p_win_usr*	0x3006:40$_h$	Standstill window
	MON_p_winTime	0x6068:00$_h$	Standstill window time
	MON_p_winTout	0x3006:26$_h$	Standstill window timeout
Position deviation window, see Position Deviation Window, page 296.	*MON_p_DiffWin_usr1*	0x3006:3F$_h$	Position deviation 1
	MON_p_mode1	0x3006:55h$_h$	Position deviation monitoring mode 1
	MON_p_DiffWin_usr2	0x3006:52h$_h$	Position deviation 2
	MON_p_mode2	0x3006:56h$_h$	Position deviation monitoring mode 2
	MON_p_ChkTime	0x3006:1D$_h$	Position window time
Velocity deviation window, see Velocity Deviation Window, page 294.	*MON_v_DiffWin*	0x3006:1A$_h$	Velocity Deviation
	MON_v_ChkTime	0x6070:00$_h$	Velocity window time
Velocity threshold value, see Velocity Threshold Value, page 303.	*MON_v_Threshold*	0x606F:00$_h$	Velocity threshold
	MON_v_ChkTime	0x6070:00$_h$	Velocity window time
Torque threshold value, see Torque Threshold Value, page 301.	*MON_tq_Threshold*	0x3006:1C$_h$	Torque threshold
	MON_tq_Chktime	0x3006:57$_h$	Torque window time

Example of DS402 Objects

Adapting the mapping of RxPDO

Address (hex)	Parameter name (DS402)
0x6040:00$_h$	*DCOMcontrol* (Control word)
0x607A:00$_h$	*PPp_target* (Target position)
0x6081:00$_h$	*PPv_target* (Profile velocity)
0x6083:00$_h$	*RAMP_v_acc* (Profile acceleration)
0x6084:00$_h$	*RAMP_v_dec* (Profile deceleration)
0x6060:00$_h$	*DCOMopmode* (Mode of operation)

Adapting the mapping of TxPDO

Address (hex)	Parameter name (DS402)
0x6041:00$_h$	*_DCOMstatus* (Status word)
0x6061:00$_h$	*_DCOMopmd_act* (Mode of operation display)

Application

Meaning	Address (hex)	Parameter name (DS402)	Value (hex)
RxPDO: Set acceleration (for example, 100 RPM/s)	0x6083:00$_h$	*RAMP_v_acc* (Profile acceleration)	64
RxPDO: Set deceleration (for example, 300 RPM/s)	0x6084:00$_h$	*RAMP_v_dec* (Profile deceleration)	012C
RxPDO: Set target velocity (for example, 60 RPM)	0x6081:00$_h$	*PPv_target* (Profile velocity)	3C
RxPDO: Enable power stage	0x6040:00$_h$	*DCOMcontrol* (Control word)	00->06->0F
TxPDO: Verify whether power stage has been enabled	0x6041:00$_h$	*_DCOMstatus* (Status word)	4637
RxPDO: Set the operating mode	0x6060:00$_h$	*DCOMopmode* (Mode of operation)	01
TxPDO: Verify whether operating mode has been set	0x6061:00$_h$	*_DCOMopmd_act* (Mode of operation display)	01
RxPDO: Set target position (for example,10000_usr)	0x607A:00$_h$	*PPp_target* (Target position)	2710
RxPDO: Start relative movement	0x6040:00$_h$	*DCOMcontrol* (Control word)	5F
TxPDO: Verify whether target position has been reached	0x6041:00$_h$	*_DCOMstatus* (Status word)	5637
RxPDO: Reset bit "New setpoint"	0x6040:00$_h$	*DCOMcontrol* (Control word)	4F
TxPDO: Verify whether new target position has been accepted	0x6041:00$_h$	*_DCOMstatus* (Status word)	4637

Operation Mode Cyclic Synchronous Torque

Overview

Description

The drive synchronously follows the torque values transmitted on a cyclic basis. The motion profile is generated by the master controller, the transmitted values are linearly interpolated (internally).

Starting the Operation Mode

The operating mode is selected by writing 10 in the parameter *DCOMopmode* (6060_h).

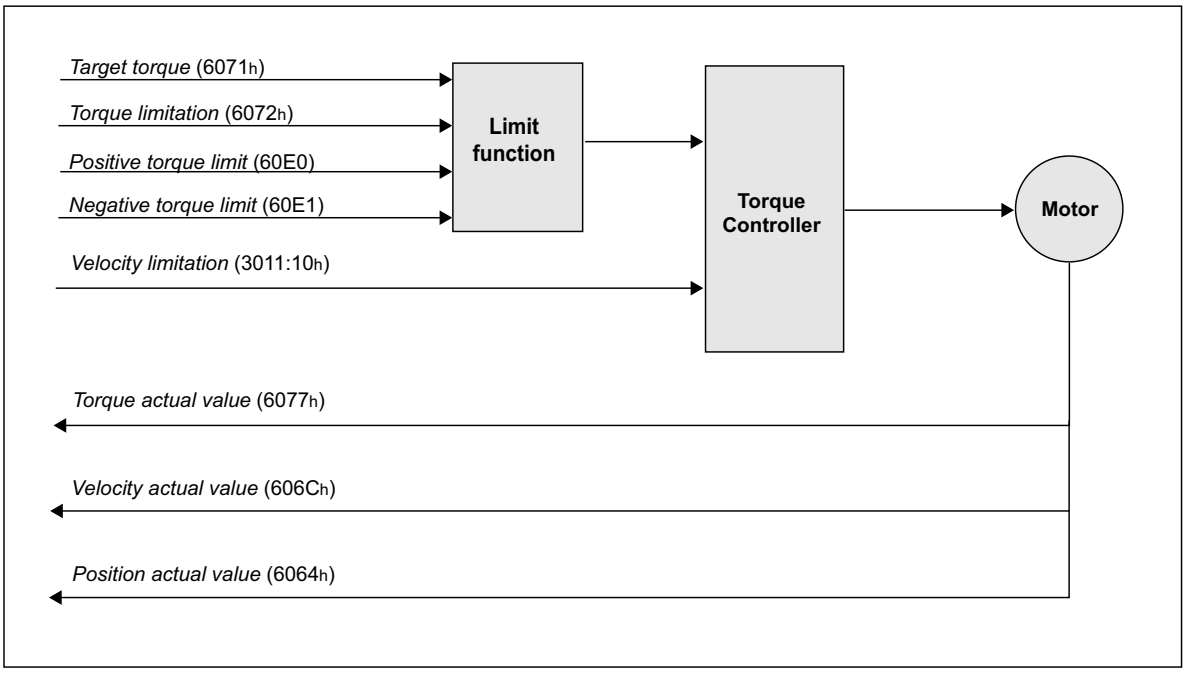
A transition to the operating state 6 Operation Enabled starts the set operating mode.

Terminating the Operating Mode

The operating mode is terminated when a different operating mode is selected or when the operating state 6 Operation Enabled is left.

Parameterization

The illustration below provides an overview of the parameters that can be adjusted in fieldbus control mode.



Control Parameters

Parameter name		Index.Subindex	Description
DCOMcontrol		0x6040:00$_h$	Control word
PTtq_target		0x6071:00$_h$	Target torque
Velocity Limitation, Velocity Limitation, page 194.	*Ctrl_v_max*	0x3011:10$_h$	Velocity limitation
Torque Limitation, Torque Limitation, page 194.	*Ctrl_tq_max*	0x6072:00$_h$	Torque limitation

Control Word

The operating mode-specific bits 4, 5, 6 and 9 of control word *DCOMcontrol* (6040$_h$) are reserved in this operating mode and must be set to 0.

–	***DCOMcontrol***	**Minimum value**	**–**	**Unit**	**–**	**Persistence**	**–**
		Factory setting	**–**	**Data type**	**UINT16**	**MODBUS**	**6914**
		Maximum value	**–**	**Access**	**R/W**	**EtherCAT**	**6040:00$_h$**

Description:

DriveCom control word.

Bit 0: Operating state Switch On

Bit 1: Enable Voltage

Bit 2: Operating state Quick Stop

Bit 3: Enable Operation

Bits 4…6: Operating mode-specific

Bit 7: Fault Reset

Bit 8: Halt

Bit 9: Operating mode-specific

Bits 10…15: Reserved (must be 0)

Modified settings become active immediately.

Target Torque

The parameter *PTtq_target* (6071$_h$) is used to set the target torque.

–	***PTtq_target***	**Minimum value**	**–30000**	**Unit**	**0.1%**	**Persistence**	**–**
		Factory setting	**0**	**Data type**	**INT16**	**MODBUS**	**6944**
		Maximum value	**30000**	**Access**	**R/W**	**EtherCAT**	**6071:00$_h$**

Description:

Target torque.

100.0 % correspond to the rated torque.

In increments of 0.1 %.

Modified settings become active immediately.

Status Parameters

Parameter name	Index. Subindex	Description
_DCOMstatus	0x6041:00$_h$	Status word
_tq_act	0x6077:00$_h$	Torque actual value

Status Word

–	*_DCOMstatus*	Minimum value	–	Unit	–	Persistence	–
		Factory setting	–	Data type	UINT16	MODBUS	6916
		Maximum value	–	Access	R/-	EtherCAT	6041:00$_h$

Description:

Drive status word

Bit assignments:

Bit 0: Operating state Ready To Switch On

Bit 1: Operating state Switched On

Bit 2: Operating state Operation Enabled

Bit 3: Operating state Fault

Bit 4: Voltage Enabled

Bit 5: Operating state Quick Stop

Bit 6: Operating state Switch On Disabled

Bit 7: Error of error class 0

Bit 8: HALT request active

Bit 9: Remote

Bit 10: Target Reached

Bit 11: Internal Limit Active

Bit 12: Operating mode-specific

Bit 13: x_err

Bit 14: x_end

Bit 15: ref_ok

Information on the current movement is available via bit 12.

Parameter DCOMstatus	Meaning
Bit 10	Reserved
Bit 12	0: Target torque ignored 1: Target torque shall be used as input to torque control loop

Torque Actual Value

–	*_tq_act*	Minimum value	–	Unit	0.1%	Persistence	–
		Factory setting	–	Data type	INT16	MODBUS	7752
		Maximum value	–	Access	R/-	EtherCAT	6077:00$_h$

Description:

Actual torque.

100.0 % correspond to the nominal torque.

Torque Limit Value

–	*CTRL_TQ_LIMP*	Minimum value	0	Unit	0.1%	Persistence	–
		Factory setting	3500	Data type	INT16	MODBUS	4480
		Maximum value	3500	Access	R/W	EtherCAT	60E0:00$_h$
Description: Positive torque limit value							

–	*CTRL_TQ_LIMN*	Minimum value	0	Unit	0.1%	Persistence	–
		Factory setting	3500	Data type	INT16	MODBUS	4482
		Maximum value	3500	Access	R/W	EtherCAT	60E1:00$_h$
Description: Negative torque limit value							

Velocity Actual Value

–	*_v_act*	Minimum value	–	Unit	usr_v	Persistence	–
		Factory setting	–	Data type	INT32	MODBUS	7744
		Maximum value	–	Access	R/-	EtherCAT	606C:00$_h$
Description: Actual velocity.							

Position Actual Value

–	*_p_act*	Minimum value	–	Unit	usr_p	Persistence	–
		Factory setting	–	Data type	INT32	MODBUS	7706
		Maximum value	–	Access	R/-	EtherCAT	6064:00$_h$
Description: Actual position.							

Monitoring Parameters

Function	Parameter name	Index. Subindex	Description
Velocity threshold value, see Velocity Threshold Value, page 303.	*MON_v_Threshold*	0x606F:00$_h$	Velocity threshold
	MON_v_ChkTime	0x6070:00$_h$	Velocity window time
Torque threshold value, see Torque Threshold Value, page 301.	*MON_tq_Threshold*	0x3006:1C$_h$	Torque threshold
	MON_tq_Chktime	0x3006:57$_h$	Torque window time

Example of DS402 Objects

Adapting the mapping of RxPDO

Address (hex)	Parameter name (DS402)
0x6040:00$_h$	*DCOMcontrol* (Control word)
0x6071:00$_h$	*PTtq_target* (Target torque)
0x3011:10$_h$	*Ctrl_v_max* (velocity limitation)
0x6060:00$_h$	*DCOMopmode* (Mode of operation)

Adapting the mapping of TxPDO

Address (hex)	Parameter name (DS402)
0x6041:00$_h$	*_DCOMstatus* (Status word)
0x6061:00$_h$	*_DCOMopmd_act* (Mode of operation display)
0x6077:00$_h$	*_tq_act* (actual torque)
0x606C:00$_h$	*_v_act* (actual velocity)

Application

Meaning	Address (hex)	Parameter name (DS402)	Value (hex)
RxPDO: Enable power stage	0x6040:00$_h$	*DCOMcontrol* (Control word)	00->06->0F
TxPDO: Verify whether power stage has been enabled	0x6041:00$_h$	*_DCOMstatus* (Status word)	4637
RxPDO: Set the operating mode	0x6060:00$_h$	*DCOMopmode* (Mode of operation)	0A
TxPDO: Verify whether operating mode has been set	0x6061:00$_h$	*_DCOMopmd_act* (Mode of operation display)	0A
RxPDO: Set the velocity limitation (for example, 600 RPM)	0x3011:10$_h$	*CTRL_v_max* (Velocity limitation)	0258
RxPDO: Start movement by transmitting target torque cyclically	0x6071:00$_h$	*PTtq_target* (Target torque)	Updated by master controller cyclically
RxPDO: Terminate movement (with Quick Stop)	0x6040:00$_h$	*DCOMcontrol* (Control word)	0B
RxPDO: Reset Quick Stop	0x6040:00$_h$	*DCOMcontrol* (Control word)	0F

Operation Mode Cyclic Synchronous Velocity

Overview

Description

The drive synchronously follows the velocity values transmitted on a cyclic basis. The motion profile is generated by the master controller, the transmitted values are linearly interpolated (internally).

Starting the Operation Mode

The operating mode is selected by writing 9 in the parameter *DCOMopmode* (6060_h).

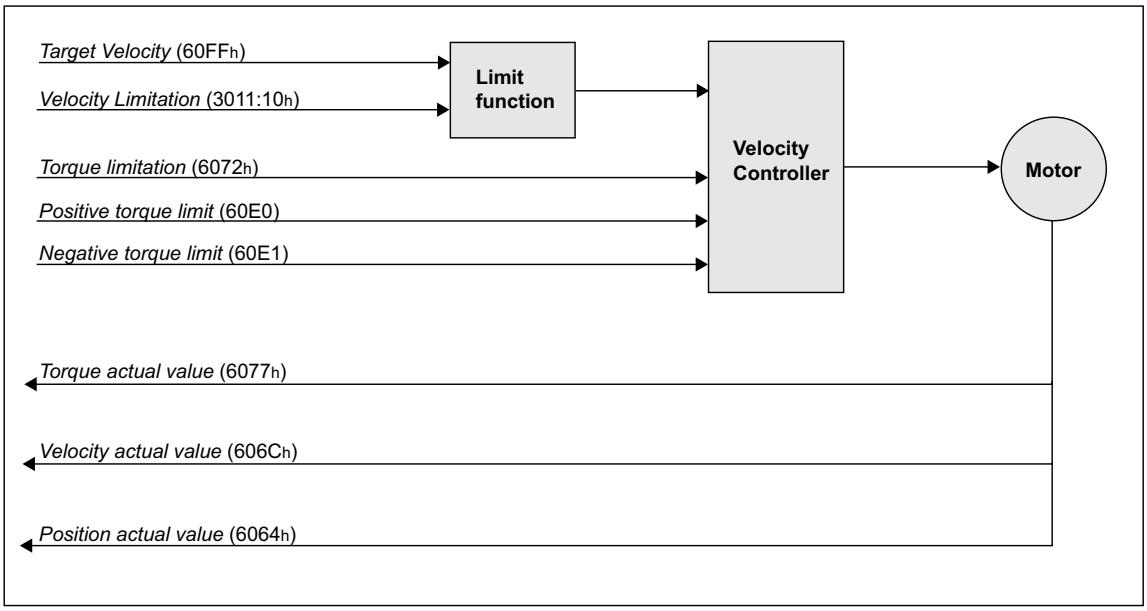
A transition to the operating state 6 Operation Enabled starts the set operating mode.

Terminating the Operating Mode

The operating mode is terminated when a different operating mode is selected or when the operating state 6 Operation Enabled is left.

Parameterization

The illustration below provides an overview of the parameters that can be adjusted in fieldbus control mode.



Control Parameters

Parameter name		Index. Subindex	Description
DCOMcontrol		0x6040:00$_h$	Control word
PPv_target		0x60FF:00$_h$	Target velocity
Velocity Limitation,Velocity Limitation, page 194.	*Ctrl_v_max*	0x3011:10$_h$	Velocity limitation
Torque Limitation, Torque Limitation, page 194.	*Ctrl_tq_max*	0x6072:00$_h$	Torque limitation

Control Word

The operating mode-specific bits 4, 5, 6 and 9 of control word *DCOMcontrol* (6040$_h$) are reserved in this operating mode and must be set to 0.

–	***DCOMcontrol***	**Minimum value**	**–**	**Unit**	**–**	**Persistence**	**–**
		Factory setting	**–**	**Data type**	**UINT16**	**MODBUS**	**6914**
		Maximum value	**–**	**Access**	**R/W**	**EtherCAT**	**6040:00$_h$**

Description:

DriveCom control word.

Bit 0: Operating state Switch On

Bit 1: Enable Voltage

Bit 2: Operating state Quick Stop

Bit 3: Enable Operation

Bits 4…6: Operating mode-specific

Bit 7: Fault Reset

Bit 8: Halt

Bit 9: Operating mode-specific

Bits 10…15: Reserved (must be 0)

Modified settings become active immediately.

Target Velocity

–	***PVv_target***	**Minimum value**	**–**	**Unit**	**usr_v**	**Persistence**	**–**
		Factory setting	**0**	**Data type**	**INT32**	**MODBUS**	**6938**
		Maximum value	**–**	**Access**	**R/W**	**EtherCAT**	**60FF:00$_h$**

Description:

Target velocity.

The target velocity is limited to the setting in *CTRL_v_max* and *RAMP_v_max*.

Modified settings become active immediately.

Status Parameters

Parameter name	Index. Subindex	Description
_DCOMstatus	0x6041:00_h	Status word
_tq_act	0x6077:00_h	Torque actual value
_v_act	0x606C:00_h	Velocity actual value
_p_act	0x6064:00_h	Position actual value

Status Word

–	*_DCOMstatus*	Minimum value	–	Unit	–	Persistence	–
		Factory setting	–	Data type	UINT16	MODBUS	6916
		Maximum value	–	Access	R/-	EtherCAT	6041:00_h

Description:

Drive status word

Bit assignments:

Bit 0: Operating state Ready To Switch On

Bit 1: Operating state Switched On

Bit 2: Operating state Operation Enabled

Bit 3: Operating state Fault

Bit 4: Voltage Enabled

Bit 5: Operating state Quick Stop

Bit 6: Operating state Switch On Disabled

Bit 7: Error of error class 0

Bit 8: HALT request active

Bit 9: Remote

Bit 10: Target Reached

Bit 11: Internal Limit Active

Bit 12: Operating mode-specific

Bit 13: x_err

Bit 14: x_end

Bit 15: ref_ok

Information on the current movement is available via bit 12.

Parameter DCOMstatus	Meaning
Bit 10	Reserved
Bit 12	0: Target velocity ignored 1: Target velocity shall be used as input to velocity control loop

Torque Actual Value

–	*_tq_act*	Minimum value	–	Unit	0.1%	Persistence	–
		Factory setting	–	Data type	INT16	MODBUS	7752
		Maximum value	–	Access	R/-	EtherCAT	6077:00$_h$

Description:

Actual torque.

100.0 % correspond to the nominal torque.

Torque Limit Value

–	*CTRL_TQ_LIMP*	Minimum value	0	Unit	0.1%	Persistence	–
		Factory setting	3500	Data type	INT16	MODBUS	4480
		Maximum value	3500	Access	R/W	EtherCAT	60E0:00$_h$

Description:

Positive torque limit value

–	*CTRL_TQ_LIMN*	Minimum value	0	Unit	0.1%	Persistence	–
		Factory setting	3500	Data type	INT16	MODBUS	4482
		Maximum value	3500	Access	R/W	EtherCAT	60E1:00$_h$

Description:

Negative torque limit value

Velocity Actual Value

–	*_v_act*	Minimum value	–	Unit	usr_v	Persistence	–
		Factory setting	–	Data type	INT32	MODBUS	7744
		Maximum value	–	Access	R/-	EtherCAT	606C:00$_h$

Description:

Actual velocity.

Position Actual Value

–	*_p_act*	Minimum value	–	Unit	usr_p	Persistence	–
		Factory setting	–	Data type	INT32	MODBUS	7706
		Maximum value	–	Access	R/-	EtherCAT	6064:00$_h$

Description:

Actual position.

Monitoring parameters

Function	Parameter name	Index. Subindex	Description
Load-Dependent Velocity deviation, see Load-Dependent Velocity Deviation, page 305.	*_v_dif_usr*	0x301E:2C$_h$	Velocity deviation
	MON_VelDiff	0x3006:4B$_h$	Max velocity deviation
	MON_VelDiff_Time	0x3006:4C$_h$	Window time for max velocity deviation

Function	Parameter name	Index. Subindex	Description
	ErrorResp_v_dif	0x3005:3C$_h$	Error response to velocity deviation
Velocity deviation window, see Velocity Deviation Window, page 294.	*MON_v_DiffWin*	0x3006:1A$_h$	Velocity Deviation
	MON_v_ChkTime	0x6070:00$_h$	Velocity window time
Velocity threshold value, see Velocity Threshold Value, page 303.	*MON_v_Threshold*	0x606F:00$_h$	Velocity threshold
	MON_v_ChkTime	0x6070:00$_h$	Velocity window time
Torque threshold value, see Torque Threshold Value, page 301.	*MON_tq_Threshold*	0x3006:1C$_h$	Torque threshold
	MON_tq_Chktime	0x3006:57$_h$	Torque window time

Example of DS402 Objects

Adapting the mapping of RxPDO

Address (hex)	Parameter name (DS402)
0x6040:00$_h$	*DCOMcontrol* (Control word)
0x60FF:00$_h$	*PVv_target* (Target velocity)
0x6060:00$_h$	*DCOMopmode* (Mode of operation)

Adapting the mapping of TxPDO

Address (hex)	Parameter name (DS402)
0x6041:00$_h$	*_DCOMstatus* (Status word)
0x6061:00$_h$	*_DCOMopmd_act* (Mode of operation display)
0x606C:00$_h$	*_v_act* (actual velocity)

Application

Meaning	Address (hex)	Parameter name (DS402)	Value (hex)
RxPDO: Enable power stage	0x6040:00$_h$	*DCOMcontrol* (Control word)	00->06->0F
TxPDO: Verify whether power stage has been enabled	0x6041:00$_h$	*_DCOMstatus* (Status word)	4637
RxPDO: Set the operating mode	0x6060:00$_h$	*DCOMopmode* (Mode of operation)	09
TxPDO: Verify whether operating mode has been set	0x6061:00$_h$	*_DCOMopmd_act* (Mode of operation display)	09
RxPDO: Start movement by setting a target velocity	0x60FF:00$_h$	*PVv_target* (Target velocity)	Updated by master controller cyclically
RxPDO: Terminate movement (with Quick Stop)	0x6040:00$_h$	*DCOMcontrol* (Control word)	0B
RxPDO: Reset Quick Stop	0x6040:00$_h$	*DCOMcontrol* (Control word)	0F

Operation Mode Cyclic Synchronous Position

Overview

Description

The drive synchronously follows the position values transmitted on a cyclic basis. The motion profile is generated by the master controller, the transmitted values are linearly interpolated (internally).

Starting the Operation Mode

The operating mode is selected by writing 8 in the parameter *DCOMopmode* (6060_h).

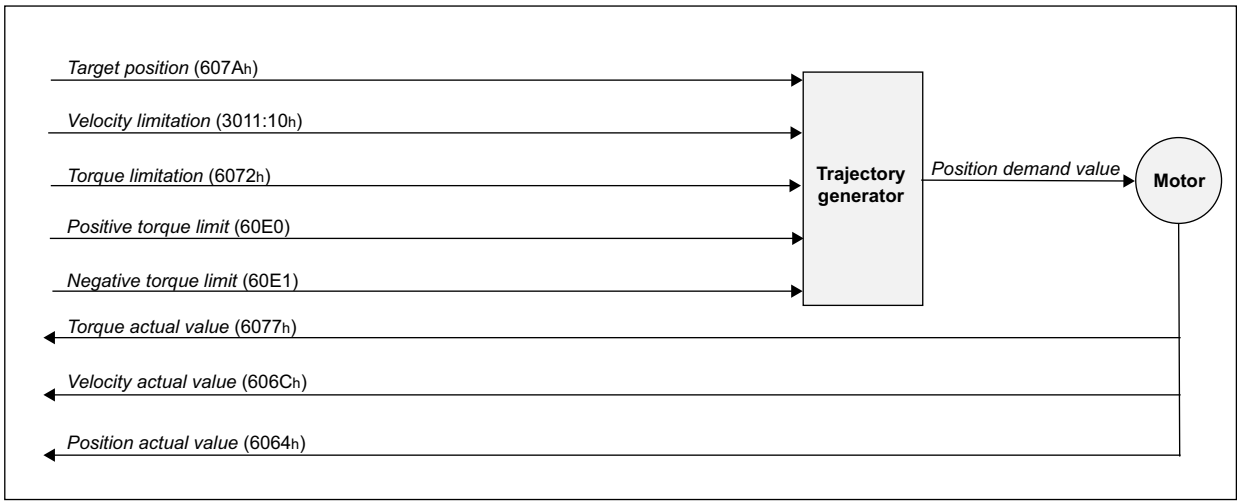
A transition to the operating state 6 Operation Enabled starts the set operating mode.

Terminating the Operating Mode

The operating mode is terminated when a different operating mode is selected or when the operating state 6 Operation Enabled is left.

Parameterization

The illustration below provides an overview of the parameters that can be adjusted in fieldbus control mode.



Control Parameter

Parameter name		Index. Subindex	Description
DCOMcontrol		0x6040:00$_h$	Control word
PPp_target		0x607A:00$_h$	Target position
Velocity Limitation, see Velocity Limitation, page 194.	*Ctrl_v_max*	0x3011:10$_h$	Velocity limitation
Torque Limitation, see Torque Limitation, page 194.	*Ctrl_tq_max*	0x6072:00$_h$	Torque limitation

Control Word

The operating mode-specific bits 4, 5, 6 and 9 of control word *DCOMcontrol* (6040$_h$) are reserved in this operating mode and must be set to 0.

–	***DCOMcontrol***	**Minimum value**	**–**	**Unit**	**–**	**Persistence**	**–**
		Factory setting	**–**	**Data type**	**UINT16**	**MODBUS**	**6914**
		Maximum value	**–**	**Access**	**R/W**	**EtherCAT**	**6040:00$_h$**

Description:

DriveCom control word.

Bit 0: Operating state Switch On

Bit 1: Enable Voltage

Bit 2: Operating state Quick Stop

Bit 3: Enable Operation

Bits 4…6: Operating mode-specific

Bit 7: Fault Reset

Bit 8: Halt

Bit 9: Operating mode-specific

Bits 10…15: Reserved (must be 0)

Modified settings become active immediately.

Target Position

–	***PPp_target***	**Minimum value**	**–**	**Unit**	**usr_p**	**Persistence**	**–**
		Factory setting	**–**	**Data type**	**INT32**	**MODBUS**	**6940**
		Maximum value	**–**	**Access**	**R/W**	**EtherCAT**	**607A:00$_h$**

Description:

Target position for operating mode Profile Position.

Minimum/maximum values depend on:

- Scaling factor
- Software limit switches (if they are activated)

Modified settings become active immediately.

Status Parameter

Parameter name	Index. Subindex	Description
_DCOMstatus	0x6041:00$_h$	Status word
_p_act	0x6064:00$_h$	Position actual value
_v_act	0x606C:00$_h$	Velocity actual value
_tq_act	0x6077:00$_h$	Torque actual value

Status Word

–	***_DCOMstatus***	**Minimum value**	**–**	**Unit**	**–**	**Persistence**	**–**
		Factory setting	**–**	**Data type**	**UINT16**	**MODBUS**	**6916**
		Maximum value	**–**	**Access**	**R/-**	**EtherCAT**	**6041:00$_h$**

Description:

Drive status word

Bit assignments:

Bit 0: Operating state Ready To Switch On

Bit 1: Operating state Switched On

Bit 2: Operating state Operation Enabled

Bit 3: Operating state Fault

Bit 4: Voltage Enabled

Bit 5: Operating state Quick Stop

Bit 6: Operating state Switch On Disabled

Bit 7: Error of error class 0

Bit 8: HALT request active

Bit 9: Remote

Bit 10: Target Reached

Bit 11: Internal Limit Active

Bit 12: Operating mode-specific

Bit 13: x_err

Bit 14: x_end

Bit 15: ref_ok

Information on the current movement is available via bit 12.

Parameter *DCOMstatus*	Meaning
Bit 10	Reserved
Bit 12	0: Target position ignored 1: Target position shall be used as input to position control loop

Torque Actual Value

–	*_tq_act*	Minimum value	–	Unit	0.1%	Persistence	–
		Factory setting	–	Data type	INT16	MODBUS	7752
		Maximum value	–	Access	R/-	EtherCAT	6077:00$_h$

Description:

Actual torque.

100.0 % correspond to the nominal torque.

Torque Limit Value

–	*CTRL_TQ_LIMP*	Minimum value	0	Unit	0.1%	Persistence	–
		Factory setting	3500	Data type	INT16	MODBUS	4480
		Maximum value	3500	Access	R/W	EtherCAT	60E0:00$_h$

Description:

Positive torque limit value

–	*CTRL_TQ_LIMN*	Minimum value	0	Unit	0.1%	Persistence	–
		Factory setting	3500	Data type	INT16	MODBUS	4482
		Maximum value	3500	Access	R/W	EtherCAT	60E1:00$_h$

Description:

Negative torque limit value

Velocity Actual Value

–	*_v_act*	Minimum value	–	Unit	usr_v	Persistence	–
		Factory setting	–	Data type	INT32	MODBUS	7744
		Maximum value	–	Access	R/-	EtherCAT	606C:00$_h$

Description:

Actual velocity.

Position Actual Value

–	*_p_act*	Minimum value	–	Unit	usr_p	Persistence	–
		Factory setting	–	Data type	INT32	MODBUS	7706
		Maximum value	–	Access	R/-	EtherCAT	6064:00$_h$

Description:

Actual position.

How to Configure the PDO Manually

Taking the default fourth group PDO configuration 1603h and 1A03h of LXM 18E as an example, the setting sequence and method are as follows:

1. Ensure that the LXM18E EtherCAT communication state machine is in the Pre Operational running state.
2. Disable PDO configuration, 1C12h sub0=0(RxPDO), 1C13h sub0=0(TxPDO).
3. Disable PDO mapping settings, 1603h sub=0(RxPDO), 1A01h sub0=0 (TxPDO).

4. Set the content and number of RxPDO mapping objects, 1603 sub0=6, 1603h sub1~sub6 (RxPDOMap object content).

RxPDO mapping parameter setting	Content	Object length	Description
1603h sub1	6040:00h	10h	DCOMcontrol (Control word)
1603h sub2	6060:00h	08h	DCOMopmode (Mode of operation)
1603h sub3	607A:00h	20h	PPp_target (Target position)
1603h sub4	60FF:00h	20h	PVv_target (Target velocity)
1603h sub5	6071:00h	10h	PTtq_target (Target torque)
1603h sub6	3008:11h	10h	IO_DQ_set
1603h sub0	6		Set the number of 6 RxPDO mappings

5. Set the content and number of TxPDO mapping objects, 1A03 sub0=7, 1603h sub1–sub7 (TxPDO mapping objects) Content.

TxPDO mapping parameter setting	Content	Object length	Description
1A03h sub1	6041:00h	10h	_DCOMstatus (Status word)
1A03h sub2	6061:00h	08h	_DCOMopmd_act (Mode of operation display)
1A03h sub3	6064:00h	20h	_p_act (Position actual value)
1A03h sub4	60F4:00h	20h	_p_dif (Following error actual value)
1A03h sub5	6077:00h	10h	_tq_act (Torque actual value)
1A03h sub6	603F:00h	10h	_LastError (Error code)
1A03h sub7	3008:01h	10h	_IO_act
1A03h sub0	7		Set the number of 7 RxPDO mappings

6. Set PDO mapping configuration, 1C12h sub1=0x1603(RxPDO), 1C13h sub= 0x1A03(TxPDO).
7. Enable PDO configuration, 1C12h sub0=1(RxPDO), 1C13h sub0=1(TxPDO).
8. Add Object Dictionary, 0x3006:3D (Compatibility for sync operation) =0x0001, and activate automatic mode.

Monitoring Parameters

function	Parameter name	Index. Subindex	Description
Following error, see Load-Dependent Position Deviation (Following Error), page 307.	*_p_dif_load_usr*	0x301E:16$_h$	Following error
	MON_p_dif_warn	0x3006:29$_h$	Max following error for error class 0
	MON_p_dif_load_usr	0x3006:3E$_h$	Max following error for error class 1,2,3
	ErrorResp_p_dif	0x3005:0B$_h$	Error class for high following error
Position deviation window, see Position Deviation Window, page 296.	*MON_p_DiffWin_usr1*	0x3006:3F$_h$	Position deviation 1
	MON_p_mode1	0x3006:55h$_h$	Position deviation monitoring mode 1
	MON_p_DiffWin_usr2	0x3006:52h$_h$	Position deviation 2
	MON_p_mode2	0x3006:56h$_h$	Position deviation monitoring mode 2
	MON_p_ChkTime	0x3006:1D$_h$	Position window time
Velocity deviation window, see Velocity Deviation Window, page 294.	*MON_v_DiffWin*	0x3006:1A$_h$	Velocity Deviation
	MON_v_ChkTime	0x6070:00$_h$	Velocity window time
Velocity threshold value, see Velocity Threshold Value, page 303.	*MON_v_Threshold*	0x606F:00$_h$	Velocity threshold
	MON_v_ChkTime	0x6070:00$_h$	Velocity window time
Torque threshold value, see Torque Threshold Value, page 301.	*MON_tq_Threshold*	0x3006:1C$_h$	Torque threshold
	MON_tq_Chktime	0x3006:57$_h$	Torque window time

Example of DS402 Objects

Adapting the mapping of RxPDO

Address (hex)	Parameter name (DS402)
0x6040:00_h	*DCOMcontrol* (Control word)
0x607A:00_h	*PPp_target* (Target position)
0x6060:00_h	*DCOMopmode* (Mode of operation)

Adapting the mapping of TxPDO

Address (hex)	Parameter name (DS402)
0x6041:00_h	*_DCOMstatus* (Status word)
0x6061:00_h	*_DCOMopmd_act* (Mode of operation display)
0x6064:00_h	*_p_act* (Actual position)

Application

Meaning	Address (hex)	Parameter name (DS402)	Value (hex)
RxPDO: Enable power stage	0x6040:00_h	*DCOMcontrol* (Control word)	00->06->0F
TxPDO: Verify whether power stage has been enabled	0x6041:00_h	*_DCOMstatus* (Status word)	4637
RxPDO: Set the operating mode	0x6060:00_h	*DCOMopmode* (Mode of operation)	08
TxPDO: Verify whether operating mode has been set	0x6061:00_h	*_DCOMopmd_act* (Mode of operation display)	08
RxPDO: Start movement by setting a target velocity	0x607A:00_h	*PPp_target* (Target position)	Updated by master controller cyclically
RxPDO: Terminate movement (with Quick Stop)	0x6040:00_h	*DCOMcontrol* (Control word)	0B
RxPDO: Reset Quick Stop	0x6040:00_h	*DCOMcontrol* (Control word)	0F

Operation Mode Homing

Overview

Description

In the operating mode Homing, a reference is generated between a mechanical position and the actual position of the motor.

A reference between a mechanical position and the actual position of the motor is generated by means of a reference movement or by means of position setting.

A successful reference movement or position setting homes the motor and the zero point becomes valid.

The zero point of the movement range is the point of reference for absolute movements in the operating modes Profile Position and Motion Sequence.

Methods

Different methods are available:

- **Reference movement to a limit switch**

  In the case of a reference movement to a limit switch, a movement to the negative limit switch or the positive limit switch is performed.

  When the limit switch is reached, the movement is stopped and then a movement is made back to the switching point of the limit switch.

  From the switching point of the limit switch, a movement is made to the next index pulse of the motor or to a parameterizable distance from the switching point.

  The position of the index pulse or the position of the parameterizable distance from the switching point is the reference point.

- **Reference movement to the reference switch**

  In the case of a reference movement to the reference switch, a movement to the reference switch is performed.

  When the reference switch is reached, the movement is stopped and then a movement is made to the switching point of the reference switch.

  From the switching point of the reference switch, a movement is made to the next index pulse of the motor or to a parameterizable distance from the switching point.

  The position of the index pulse or the position of the parameterizable distance from the switching point is the reference point.

- **Reference movement to the index pulse**

  In the case of a reference movement to the index pulse, a movement is made from the actual position to the next index pulse. The position of the index pulse is the reference point.

- **Position setting**

  In the case of position setting, the actual position of the motor is set to a desired position value.

  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.

  Motors with multi-turn encoder deliver a valid zero point after they are powered on.

Starting the Operating Mode

The operating mode is selected by writing 6 in parameter *DCOMopmode* (6060_h). Writing the parameter value causes the operating mode to start.

The movement is started via the control word.

Terminating the Operating Mode

The operating mode is terminated when the motor is at a standstill and one of the following conditions is met:

- Homing successful
- Stop caused by “Halt” or “Quick Stop”
- Stop caused by a detected error

Mechanical Blocking without Index Pulse

Homing methods -3 and -4:

These methods reference a mechanical limit position.

With Mode -3 the drive moves negative and with -4 positive toward the mechanical stop.

- Phase 1

  Approaching the mechanical stop at the referencing speed. The torque will be limited at the start of homing to HMtq_Lim (Homing torque limit).

  To recognize the mechanical stop, a test will be run to determine whether the drive is 1) at the current limit at 2) zero speed. The mechanical stop is considered to be recognized when both conditions have been met through HMblock_time (Homing blocking time).

- Phase 2

  If the mechanical stop has been recognized, the home position will be set at this position and the torque limit HMtq_Lim (Homing torque limit) will be canceled again.

Mechanical Blocking with Index Pulse

Homing methods -1 and -2:

These methods are used to move to a mechanical stop and finally referenced to index pulse.

With Mode -1 the drive moves negative and with -2 positive toward the mechanical stop.

- Phase 1

  Identical with homings -3 and -4

- Phase 2

  When the mechanical stop is recognized, the torque limit HMtq_Lim (Homing torque limit) is canceled again and referenced in the reverse direction of travel with HMv_out to the index pulse.

  During homing to a mechanical stop, specific monitoring procedures may trigger a error due to the mechanical blocking. This includes the position error monitoring, monitoring of speed difference and block monitoring.

  Deactivate the three monitoring procedures for the period of homing, which means from the start of homing to the recognition of the mechanical stop after expiration of the HMblock_time (Homing blocking time).

Homing Methods

Reference Movement to a Limit Switch

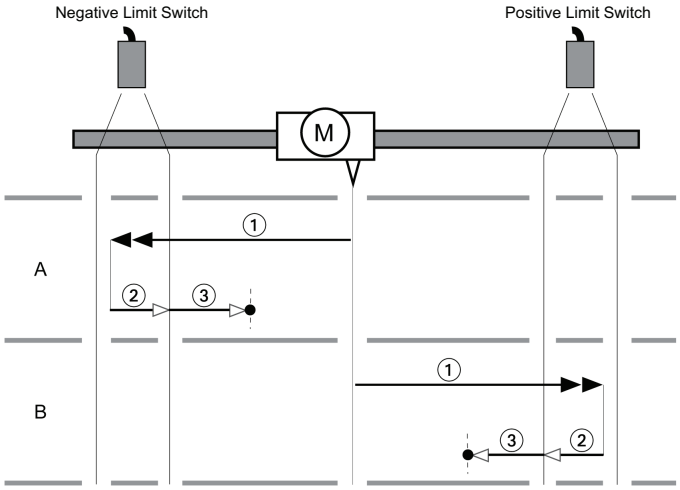
In the case of a reference movement to a limit switch, a movement to the negative limit switch or the positive limit switch is performed.

When the limit switch is reached, the movement is stopped and then a movement is made back to the switching point of the limit switch.

From the switching point of the limit switch, a movement is made to the next index pulse of the motor or to a parameterizable distance from the switching point.

The position of the index pulse or the position of the parameterizable distance from the switching point is the reference point.

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



1 Movement to limit switch at velocity *HMv* (6099:1$_h$, P5-03)

2 Movement to the switching point of the limit switch at velocity *HMv_out* (6099:2$_h$, P5–04)

3 Movement to index pulse or movement to a distance from the switching point at velocity *HMv_out* (6099:2$_h$, P5–04)

TYPE A

Method 1: Movement to the index pulse.

Method 17: Movement to distance from switching point.

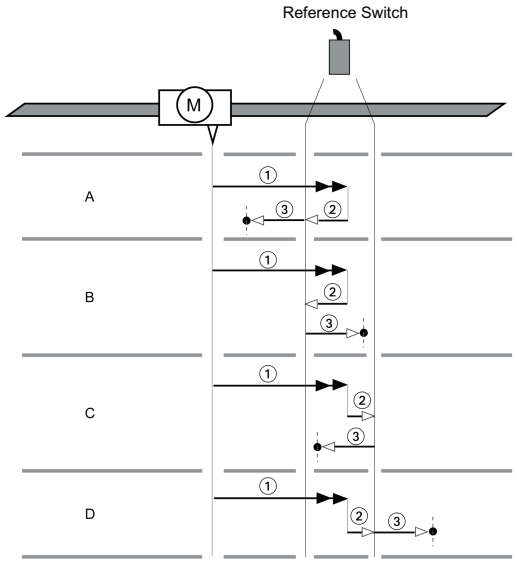
TYPE B

Method 2: Movement to the index pulse.

Method 18: Movement to distance from switching point.

Reference Movement to the Reference Switch in Positive Direction

The illustration below shows a reference movement to the reference switch in positive direction.



1 Movement to reference switch at velocity *HMv* (6099:1$_h$, P5-03)

2 Movement to the switching point of the reference switch at velocity *HMv_out* (6099:2$_h$, P5–04)

3 Movement to index pulse or movement to a distance from the switching point at velocity *HMv_out* (6099:2$_h$, P5–04)

Type A

Method 7: Movement to the index pulse.

Method 23: Movement to distance from switching point.

Type B

Method 8: Movement to the index pulse.

Method 24: Movement to distance from switching point.

Type C

Method 9: Movement to the index pulse.

Method 25: Movement to distance from switching point.

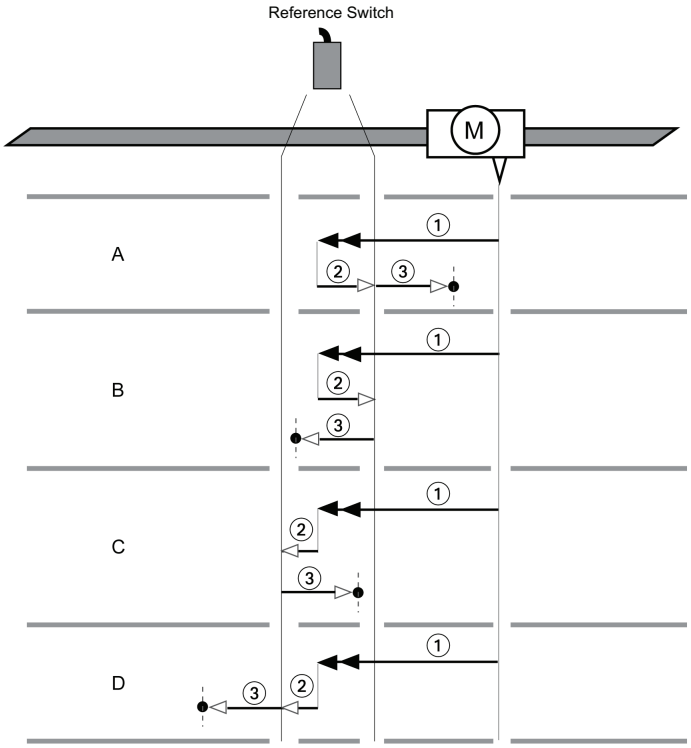
Type D

Method 10: Movement to the index pulse.

Method 26: Movement to distance from switching point.

Reference Movement to the Reference Switch in Negative Direction

The illustration below shows a reference movement to the reference switch in negative direction.



1 Movement to reference switch at velocity *HMv* (6099:1$_h$, P5-03)

2 Movement to the switching point of the reference switch at velocity *HMv_out* (6099:2$_h$, P5–04)

3 Movement to index pulse or movement to a distance from the switching point at velocity *HMv_out* (6099:2$_h$, P5–04)

Type A

Method 11: Movement to the index pulse.

Method 27: Movement to distance from switching point.

Type B

Method 12: Movement to the index pulse.

Method 28: Movement to distance from switching point.

Type C

Method 13: Movement to the index pulse.

Method 29: Movement to distance from switching point.

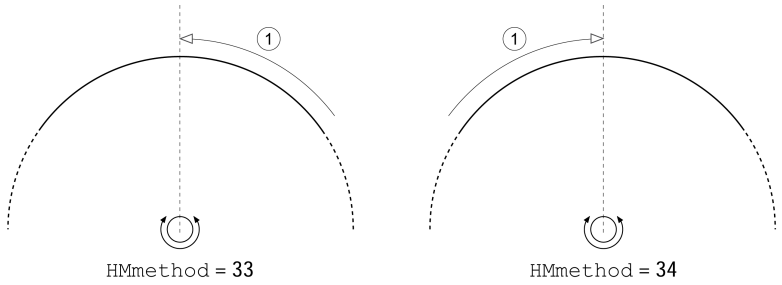
Type D

Method 14: Movement to the index pulse.

Method 30: Movement to distance from switching point.

Reference Movement to the Index Pulse

The illustration below shows a reference movement to the index pulse.



1 Movement to index pulse at velocity *HMv_out* (6099:2_h, P5–04)

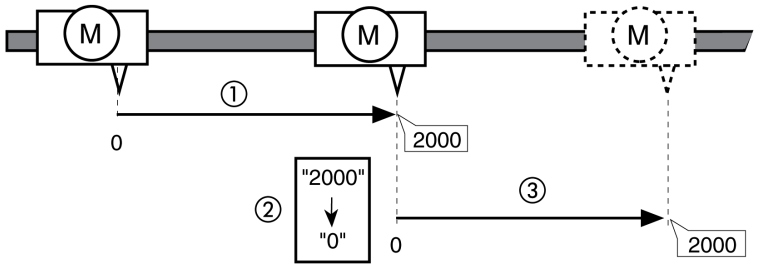
Position Setting

By means of position setting, the actual position of the motor is set to the position value in parameter *HMp_setP* (301B:16_h). 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.

Example

Movement by 4000 user-defined units with position setting



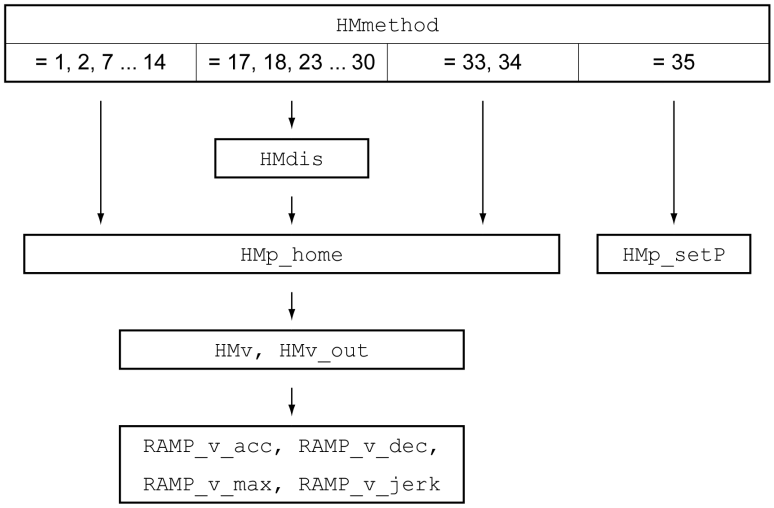
1 The motor is positioned by 2000 user-defined units.

2 By means of position setting to 0, the actual position of the motor is set to position value 0 which, at the same time, defines a new zero point.

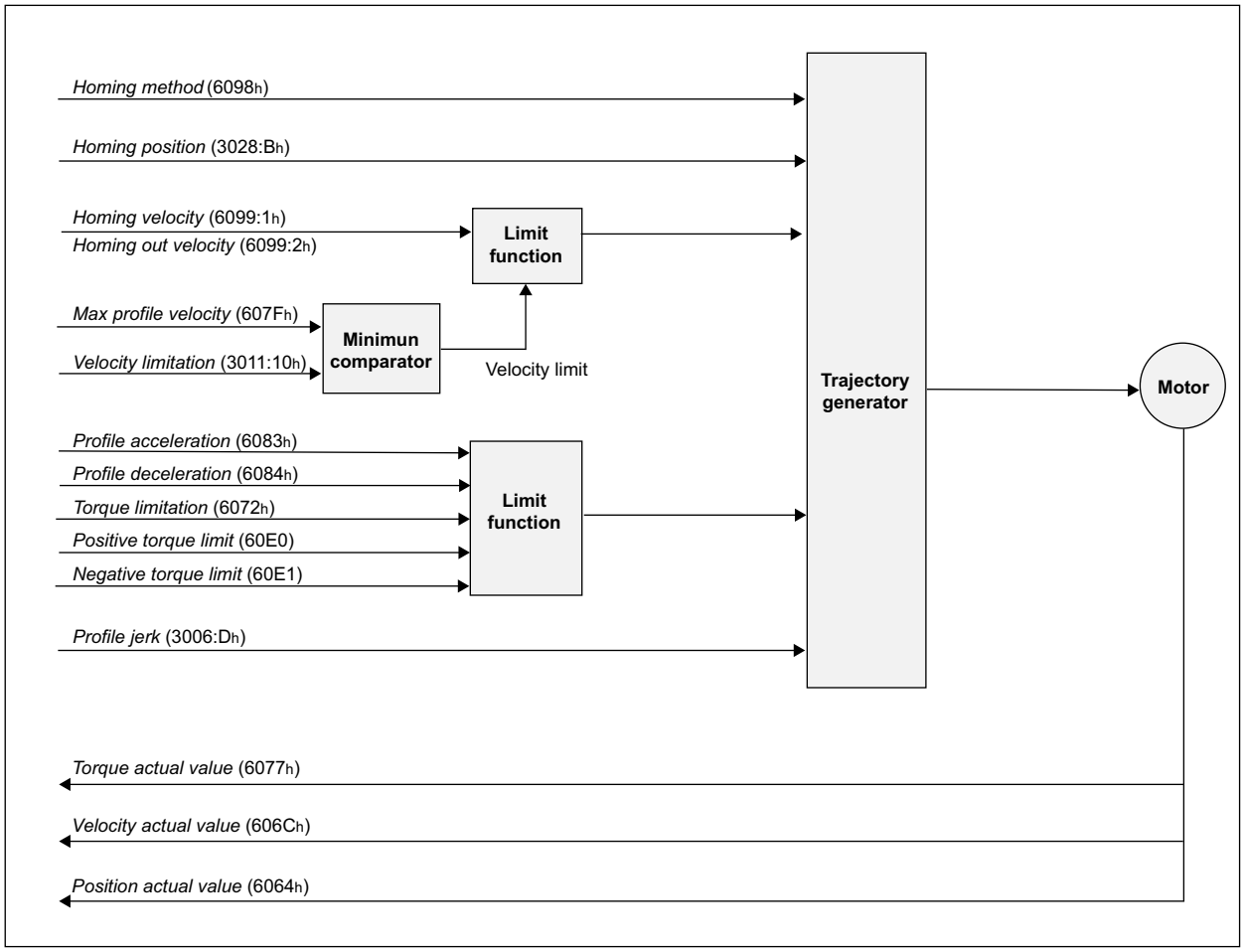
3 When a new movement by 2000 user-defined units is triggered, the new target position is 2000 user-defined units.

Parameterization

The illustration below provides an overview of the adjustable parameters in different homing methods.



The illustration below provides an overview of the adjustable parameters in Homing mode.



An error occurred, the value exceeded 64 bits during the calculation process, and the final calculation result exceeded 32 bits.

Control Parameters

Parameter name		Index. Subindex	Description
DCOMcontrol		0x6040:00$_h$	Control word
HMmethod		0x6098:00$_h$	Homing method
HMprefmethod		0x3028:0A$_h$	Preferred homing method
HMp_home		0x3028:0B$_h$	Homing position
HMdis		0x3028:07$_h$	Distance from switch
HMp_setP		0x301B:16$_h$	Position Setting
HMv		0x6099:01$_h$	Homing velocity
HMv_out		0x6099:02$_h$	Homing out velocity
Motion Profile for the Velocity, see Motion Profile for the Velocity, page 280.	*RAMP_v_max*	0x607f:00$_h$	Max profile velocity
	RAMP_v_acc	0x6083:00$_h$	Profile acceleration
	RAMP_v_dec	0x6084:00$_h$	Profile deceleration
Jerk Limitation, see Jerk Limitation, page 282.	*RAMP_v_jerk*	0x3006:0D$_h$	Profile jerk
Velocity Limitation, see Velocity Limitation, page 194.	*Ctrl_v_max*	0x3011:10$_h$	Velocity limitation
Torque Limitation, see Torque Limitation, page 194.	*Ctrl_tq_max*	0x6072:00$_h$	Torque limitation
HMblock_time		0x3028:10	Homing blocking time
HMtq_Lim		0x3028:11	Homing torque limit
HMtimeout		0x3028:12	Homing timeout

Control Word

–	***DCOMcontrol***	**Minimum value**	**–**	**Unit**	**–**	**Persistence**	**–**
		Factory setting	**–**	**Data type**	**UINT16**	**MODBUS**	**6914**
		Maximum value	**–**	**Access**	**R/W**	**EtherCAT**	**6040:00$_h$**

Description:

DriveCom control word.

Bit 0: Operating state Switch On

Bit 1: Enable Voltage

Bit 2: Operating state Quick Stop

Bit 3: Enable Operation

Bits 4…6: Operating mode-specific

Bit 7: Fault Reset

Bit 8: Halt

Bit 9: Operating mode-specific

Bits 10…15: Reserved (must be 0)

Modified settings become active immediately.

In the operating mode, the bit 4 in the Control word 6040$_h$ start a movement, bits 5, 6, 9 must be set to 0.

Parameter DCOMcontrol	Meaning
Bit 4	Start Homing
Bit 5,6 and 9	Reserved (must be set to 0)

Homing Method

The operating mode Homing establishes an absolute position reference between the motor position and a defined axis position. There are various Homing methods which can be selected via the parameter *HMmethod* (6098_h).

The *HMprefmethod* ($3028:A_h$, P5-09) parameter is used to save the preferred method to the nonvolatile memory (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. The value to be entered corresponds to the value in the *HMmethod* (6098_h) parameter.

–	*HMmethod*	Minimum value	1	Unit	–	Persistence	–
		Factory setting	18	Data type	INT16	MODBUS	6936
		Maximum value	35	Access	R/W	EtherCAT	6098:00$_h$

Description:

Homing method.

-4: Mechanical Stop+

-3: Mechanical Stop -

-2: Mechanical Stop+, Index, inv

-1: Mechanical Stop -, Index, inv

1: LIMN with index pulse

2: LIMP with index pulse

7: REF+ with index pulse, inv., outside

8: REF+ with index pulse, inv., inside

9: REF+ with index pulse, not inv., inside

10: REF+ with index pulse, not inv., outside

11: REF- with index pulse, inv., outside

12: REF- with index pulse, inv., inside

13: REF- with index pulse, not inv., inside

14: REF- with index pulse, not inv., outside

17: LIMN

18: LIMP

23: REF+, inv., outside

24: REF+, inv., inside

25: REF+, not inv., inside

26: REF+, not inv., outside

27: REF-, inv., outside

28: REF-, inv., inside

29: REF-, not inv., inside

30: REF-, not inv., outside

33: Index pulse negative direction

34: Index pulse positive direction

35: Position setting

Abbreviations:

REF+: Search movement in positive direction

REF-: Search movement in negative direction

inv.: Invert direction in switch

not inv.: Direction not inverted in switch

outside: Index pulse / distance outside switch

inside: Index pulse / distance inside switch

Modified settings become active immediately.

P5-09	*HMprefmethod*	Minimum value	1	Unit	–	Persistence	per.
		Factory setting	18	Data type	INT16	MODBUS	10260
		Maximum value	35	Access	R/W	EtherCAT	3028:0A$_h$

Description:

Preferred homing method.

Modified settings become active immediately.

Homing Position

The parameter *HMp_home* (3028:B$_h$, 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	*HMp_home*	Minimum value	-2147483648	Unit	usr_p	Persistence	per.
		Factory setting	0	Data type	INT32	MODBUS	10262
		Maximum value	2147483647	Access	R/W	EtherCAT	3028:0B$_h$

Description:

Position at reference point.

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

Modified settings become active the next time the motor moves.

Distance From the Switching Point

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 *HMdis* (3028:7$_h$, P5-07) lets you set the distance to the switching limit switch or the reference switch.

P5-07	*HMdis*	Minimum value	1	Unit	usr_p	Persistence	per.
		Factory setting	200	Data type	INT32	MODBUS	10254
		Maximum value	2147483647	Access	R/W	EtherCAT	3028:07$_h$

Description:

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.

Modified settings become active the next time the motor moves.

Position for Position Setting

–	*HMp_setP*	Minimum value	–	Unit	usr_p	Persistence	–
		Factory setting	0	Data type	INT32	MODBUS	6956
		Maximum value	–	Access	R/W	EtherCAT	301B:16$_h$

Description:

Position for Position Setting.

Position for operating mode Homing, method 35.

Modified settings become active immediately.

Homing Velocities

The parameters *HMv* (6099:1$_h$, P5-03) and *HMv_out* (6099:2$_h$, P5–04) are used to set the velocities for searching the switch and for moving away from the switch.

P5-03	*HMv*	Minimum value	1	Unit	usr_v	Persistence	per.
		Factory setting	60	Data type	UINT32	MODBUS	10248
		Maximum value	2147483647	Access	R/W	EtherCAT	6099:01$_h$

Description:

Target velocity for searching the switch.

The adjustable value is internally limited to the parameter setting in *RAMP_v_max* (P4-01).

Modified settings become active the next time the motor moves.

P5-04	*HMv_out*	Minimum value	1	Unit	usr_v	Persistence	per.
		Factory setting	6	Data type	UINT32	MODBUS	10250
		Maximum value	2147483647	Access	R/W	EtherCAT	6099:02$_h$

Description:

Target velocity for moving away from switch.

The adjustable value is internally limited to the parameter setting in *RAMP_v_max* (P4-01).

Modified settings become active the next time the motor moves.

–	*HMblock_time*	Minimum value	10	Unit	ms	Persistence	–
		Factory setting	1000	Data type	INT16	MODBUS	–
		Maximum value	10000	Access	R/W	EtherCAT	3028:10$_h$

Description:

Blocking time for homing method to the mechanical stop.

The parameter indicates the time after which the mechanical stop is recognized

When the drive is blocked. The conditions for blocking are 1) at the current limit at 2) zero speed.

–	*HMtq_Lim*	Minimum value	0.0	Unit	%	Persistence	–
		Factory setting	25.0	Data type	INT16	MODBUS	–
		Maximum value	350.0	Access	R/W	EtherCAT	3028:11$_h$

Description:

Value of the limited torque for homing method with mechanical blocking.

–	*HMtimeout*	Minimum value	10	Unit	s	Persistence	–
		Factory setting	60	Data type	INT16	MODBUS	–
		Maximum value	65535	Access	R/W	EtherCAT	3028:12$_h$

Description:

Timeout for homing method with mechanical blocking.

Monitoring in accordance with the input in homing active.

Status Parameters

Parameter name	Index. Subindex	Description
_DCOMstatus	0x6041:00$_h$	Status word
_p_act	0x6064:00$_h$	Position actual value
_v_act	0x606C:00$_h$	Velocity actual value
_tq_act	0x6077:00$_h$	Torque actual value

Status Word

–	***_DCOMstatus***	**Minimum value**	**–**	**Unit**	**–**	**Persistence**	**–**
		Factory setting	**–**	**Data type**	**UINT16**	**MODBUS**	**6916**
		Maximum value	**–**	**Access**	**R/-**	**EtherCAT**	**6041:00$_h$**

Description:

Drive status word

Bit assignments:

Bit 0: Operating state Ready To Switch On

Bit 1: Operating state Switched On

Bit 2: Operating state Operation Enabled

Bit 3: Operating state Fault

Bit 4: Voltage Enabled

Bit 5: Operating state Quick Stop

Bit 6: Operating state Switch On Disabled

Bit 7: Error of error class 0

Bit 8: HALT request active

Bit 9: Remote

Bit 10: Target Reached

Bit 11: Internal Limit Active

Bit 12: Operating mode-specific

Bit 13: x_err

Bit 14: x_end

Bit 15: ref_ok

Information on the operating state and the ongoing movement is available via EtherCAT and the signal outputs.

the table below shows the status word in EtherCAT, information on the current movement is available via bits 10 and 12.

Parameter DCOMstatus	Meaning
Bit 10	0: Homing not completed 1: Homing completed
Bit 12	1: Homing successfully completed

Torque Limit Value

–	*CTRL_TQ_LIMP*	Minimum value	0	Unit	0.1%	Persistence	–
		Factory setting	3500	Data type	INT16	MODBUS	4480
		Maximum value	3500	Access	R/W	EtherCAT	60E0:00$_h$

Description:

Positive torque limit value

–	*CTRL_TQ_LIMN*	Minimum value	0	Unit	0.1%	Persistence	–
		Factory setting	3500	Data type	INT16	MODBUS	4482
		Maximum value	3500	Access	R/W	EtherCAT	60E1:00$_h$

Description:

Negative torque limit value

Torque Actual Value

–	*_tq_act*	Minimum value	–	Unit	0.1%	Persistence	–
		Factory setting	–	Data type	INT16	MODBUS	7752
		Maximum value	–	Access	R/-	EtherCAT	6077:00$_h$

Description:

Actual torque.

100.0 % correspond to the nominal torque.

Velocity Actual Value

–	*_v_act*	Minimum value	–	Unit	usr_v	Persistence	–
		Factory setting	–	Data type	INT32	MODBUS	7744
		Maximum value	–	Access	R/-	EtherCAT	606C:00$_h$

Description:

Actual velocity.

Position Actual Value

–	*_p_act*	Minimum value	–	Unit	usr_p	Persistence	–
		Factory setting	–	Data type	INT32	MODBUS	7706
		Maximum value	–	Access	R/-	EtherCAT	6064:00$_h$

Description:

Actual position.

Monitoring Parameters

Function	Parameter name	Index. Subindex	Description
Following error, see Load-Dependent Position Deviation (Following Error), page 307.	*_p_dif_load_usr*	0x301E:16$_h$	Following error
	MON_p_dif_warn	0x3006:29$_h$	Max following error for error class 0
	MON_p_dif_load_usr	0x3006:3E$_h$	Max following error for error class 1,2,3
	ErrorResp_p_dif	0x3005:0B$_h$	Error class for high following error
Standstill window, see Standstill Window, page 292.	*MON_p_win_usr*	0x3006:40$_h$	Standstill window
	MON_p_winTime	0x6068:00$_h$	Standstill window time
	MON_p_winTout	0x3006:26$_h$	Stansitll window timeout
Position deviation window, see Position Deviation Window, page 296.	*MON_p_DiffWin_usr1*	0x3006:3F$_h$	Position deviation 1
	MON_p_mode1	0x3006:55h$_h$	Position deviation monitoring mode 1
	MON_p_DiffWin_usr2	0x3006:52h$_h$	Position deviation 2
	MON_p_mode2	0x3006:56h$_h$	Position deviation monitoring mode 2
	MON_p_ChkTime	0x3006:1D$_h$	Position window time
Velocity deviation window, see Velocity Deviation Window, page 294.	*MON_v_DiffWin*	0x3006:1A$_h$	Velocity Deviation
	MON_v_ChkTime	0x6070:00$_h$	Velocity window time
Velocity threshold value, see Velocity Threshold Value, page 303.	*MON_v_Threshold*	0x606F:00$_h$	Velocity threshold
	MON_v_ChkTime	0x6070:00$_h$	Velocity window time
Torque threshold value, see Torque Threshold Value, page 301.	*MON_tq_Threshold*	0x3006:1C$_h$	Torque threshold
	MON_tq_Chktime	0x3006:57$_h$	Torque window time

Additionally, the parameters *HMoutdis* (3028:B$_h$, P5-06) and *HMsrchdis* (3028:D$_h$, P5-05) allow you to activate monitoring of the limit switches and the reference switch.

P5-06	*HMoutdis*	Minimum value	0	Unit	usr_p	Persistence	per.
		Factory setting	0	Data type	INT32	MODBUS	10252
		Maximum value	2147483647	Access	R/W	EtherCAT	3028:0B$_h$

Description:

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.

Modified settings become active the next time the motor moves.

P5-05	*HMsrchdis*	Minimum value	0	Unit	usr_p	Persistence	per.
		Factory setting	0	Data type	INT32	MODBUS	10266
		Maximum value	2147483647	Access	R/W	EtherCAT	3028:0D$_h$

Description:

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.

Modified settings become active the next time the motor moves.

Example of DS402 Objects

Adapting the mapping of RxPDO

Address (hex)	Parameter name (DS402)
0x6040:00$_h$	*DCOMcontrol* (Control word)
0x6060:00$_h$	*DCOMopmode* (Mode of operation)

Adapting the mapping of TxPDO

Address (hex)	Parameter name (DS402)
0x6041:00$_h$	*_DCOMstatus* (Status word)
0x6061:00$_h$	*_DCOMopmd_act* (Mode of operation display)

Application

Meaning	Address (hex)	Parameter name (DS402)	Value (hex)
SDO: Set homing method (for example 17)	0x6098:00$_h$	*HMmethod* (Homing method)	11
SDO: Set target velocity for searching the switch (for example, 100 RPM)	0x6099:01th	*HMv* (Homing speed during search for switch)	64
SDO: Target velocity for moving away from switch (for example 6 RPM)	0x6099:02th	*HMv_out* (Speed during search for zero)	6
RxPDO: Enable power stage	0x6040:00$_h$	*DCOMcontrol* (Control word)	00->06->0F
TxPDO: Verify whether power stage has been enabled	0x6041:00$_h$	*_DCOMstatus* (Status word)	4637
RxPDO: Set the operating mode	0x6060:00$_h$	*DCOMopmode* (Mode of operation)	01
TxPDO: Verify whether operating mode has been set	0x6061:00$_h$	*_DCOMopmd_act* (Mode of operation display)	01
RxPDO: Start Homing	0x6040:00$_h$	*DCOMcontrol* (Control word)	1F
TxPDO: Verify whether Homing has beensuccessful	0x6041:00$_h$	*_DCOMstatus* (Status word)	D637

Functions for Target Value Processing

Motion Profile for the Velocity

Description

Target position and target velocity are input values specified by the user. A motion profile for the velocity is calculated on the basis of these input values.

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.

Availability

The availability of the motion profile for the velocity depends on the operating mode.

In the following operating modes, the motion profile for the velocity is permanently active:

- Jog
- Profile Position
- Homing

In the following operating modes, the motion profile for the velocity can be activated and deactivated:

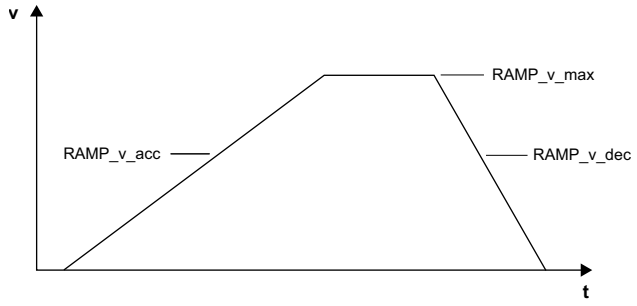
- Profile Velocity

In the following operating modes, the motion profile for the velocity is unavailable:

- Profile Torque

Ramp Slope

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



P4-00	*RAMP_v_enable*	Minimum value	0	Unit	–	Persistence	per.
		Factory setting	1	Data type	UINT16	MODBUS	1622
		Maximum value	1	Access	R/W	EtherCAT	3006:2B$_h$

Description:

Activation of the motion profile for velocity.

0 / Profile Off: Profile off

1 / Profile On: Profile on

Setting can only be modified if power stage is disabled.

Modified settings become active immediately.

P4-01	*RAMP_v_max*	Minimum value	1	Unit	usr_v	Persistence	per.
		Factory setting	13200	Data type	UINT32	MODBUS	1554
		Maximum value	2147483647	Access	R/W	EtherCAT	607F:00$_h$

Description:

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 *RAMP_v_max* (P4-01).

This way, commissioning at limited velocity is easier to perform.

Setting can only be modified if power stage is disabled.

Modified settings become active immediately.

P4-02	*RAMP_v_acc*	Minimum value	1	Unit	usr_a	Persistence	per.
		Factory setting	6000	Data type	UINT32	MODBUS	1556
		Maximum value	2147483647	Access	R/W	EtherCAT	6083:00$_h$

Description:

Acceleration of the motion profile for velocity.

Writing the value 0 has no effect on the parameter.

Modified settings become the next time motor moves.

P4-03	*RAMP_v_dec*	Minimum value	1	Unit	usr_a	Persistence	per.
		Factory setting	6000	Data type	UINT32	MODBUS	1558
		Maximum value	2147483647	Access	R/W	EtherCAT	6084:00$_h$

Description:

Deceleration of the motion profile for velocity.

In Profile Velocity mode, the minimum value is 1.

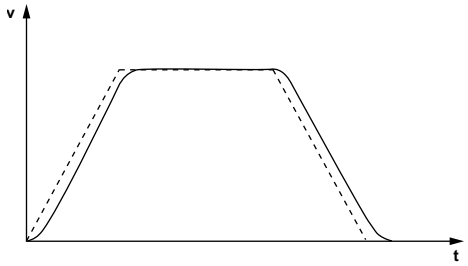
Writing the value 0 has no effect on the parameter.

Modified settings become the next time motor moves.

Jerk Limitation

Description

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



Availability

Jerk limitation is available in the following operating modes:

- Jog
- Profile Position
- Homing

Settings

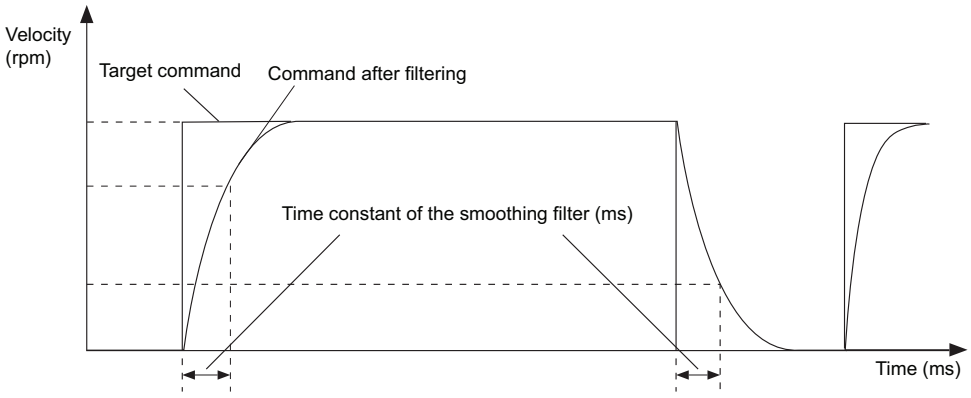
Jerk limitation is activated and set via the parameter *RAMP_v_jerk* (P1-27).

P1-27	***RAMP_v_jerk***	**Minimum value**	**0**	**Unit**	**ms**	**Persistence**	**per.**
		Factory setting	**0**	**Data type**	**UINT16**	**MODBUS**	**1562**
		Maximum value	**128**	**Access**	**R/W**	**EtherCAT**	**3006:0D$_h$**
Description: Jerk limitation of the motion profile for velocity. Adjustments can only be made if the operating mode is inactive (x_end=1). **Modified settings become the next time motor moves.**							

Velocity Loop Command Low-pass Filters

You can use the velocity loop command low-pass filter to attenuate high-frequency noise on the velocity loop command, thereby reducing velocity fluctuations, and at the same time providing a smoothing effect on the velocity loop command.

The use of a velocity loop command low-pass filter reduces the responsive bandwidth of the velocity loop.



P1-04	*CTRL1_TAUnref*	Minimum value	0	Unit	0.01 ms	Persistence	per.
		Factory setting	0	Data type	UINT16	MODBUS	4616
		Maximum value	32767	Access	R/W	EtherCAT	3012:04$_h$

Description:

Filter time constant of the reference velocity value filter.

In the case of switching between the two control loop parameter sets, the values are changed linearly over the time defined in the parameter *CTRL_ParChgTime* (P1-38).

In increments of 0.01 ms.

Modified settings become active immediately.

P1-11	*CTRL2_TAUnref*	Minimum value	0	Unit	0.1 ms	Persistence	per.
		Factory setting	0	Data type	UINT16	MODBUS	4872
		Maximum value	32767	Access	R/W	EtherCAT	3013:04$_h$

Description:

Filter time constant of the reference velocity value filter

In the case of switching between the two control loop parameter sets, the values are changed linearly over the time defined in the parameter *CTRL_ParChgTime* (P1-38).

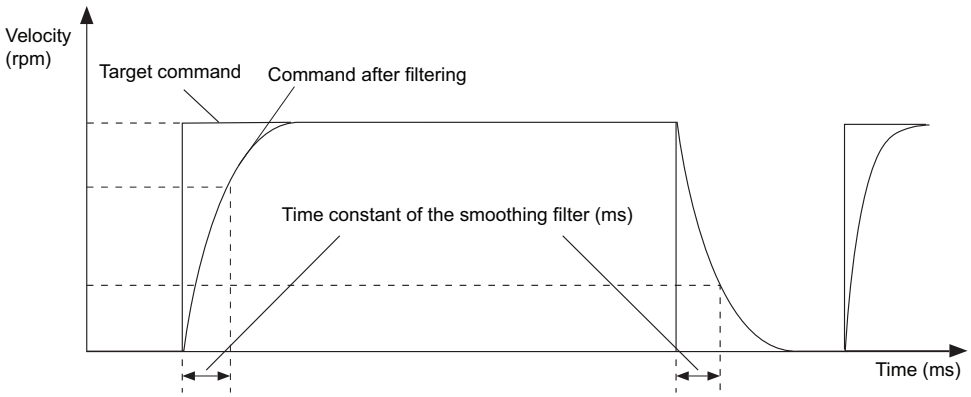
In increments of 0.01 ms.

Modified settings become active immediately.

Current Loop Command Low-pass Filters

You can use the current loop command low-pass filter to attenuate high-frequency noise on the current loop command, thereby reducing torque fluctuations, and at the same time providing a smoothing effect on the current loop command.

The use of a current loop command low-pass filter reduces the responsive bandwidth of the current loop.



P1-05	*CTRL1_TAUiref*	Minimum value	0	Unit	0.01 ms	Persistence	per.
		Factory setting	1	Data type	UINT16	MODBUS	4618
		Maximum value	400	Access	R/W	EtherCAT	3012:05$_h$

Description:

Filter time constant of the reference current value filter

In the case of switching between the two control loop parameter sets, the values are changed linearly over the time defined in the parameter *CTRL_ParChgTime* (P1-38).

In increments of 0.01 ms.

Modified settings become active immediately.

P1-12	*CTRL2_TAUiref*	Minimum value	0	Unit	0.01 ms	Persistence	per.
		Factory setting	10	Data type	UINT16	MODBUS	4874
		Maximum value	400	Access	R/W	EtherCAT	3013:05$_h$

Description:

Filter time constant of the reference current value filter

In the case of switching between the two control loop parameter sets, the values are changed linearly over the time defined in the parameter *CTRL_ParChgTime* (P1-38).

In increments of 0.01 ms.

Modified settings become active immediately.

Position Capture via Signal Input (DS402 Profile)

Overview

Description

The motor position can be captured when a signal is detected at a Capture input.

Number of Capture Inputs

Two Capture inputs are available under DS402 profile.

- Capture input: *DI4/CAP1*
- Capture input: *DI5/CAP2*
- Capture input: *Zero Pulse of Encoder*

Selection of the Method

The motor position can be captured in 2 different ways:

- One-time position capture

  One-time capture means that the position is captured at the first edge.
- Continuous motor position capture

  Continuous capture means that the motor position is captured anew at every edge. The previously captured value is lost.

The motor position can be captured when the edge at the Capture input rises or falls. If the capture input is zero pulse of encoder, the trigger edge must be positive edge.

Accuracy

A jitter of 2 µs results in an inaccuracy of the captured position of approximately 0.036° at a velocity of 3000 RPM.

(3000 RPM = (3000*360°) / (60*10^6)* 2 = 0.036 °)

The captured motor position is less accurate during the acceleration phase and the deceleration phase.

Parameters

Overview

Parameter name	Index. Subindex	Description
TouchProbeFct	0x60B8:00_h	Touch Probe Function
TouchProbeStat	0x60B9:00_h	Touch Probe Status
_Cap1PosRisEdge	0x60BA:00_h	Probe 1 positive edge
_Cap1PosFallEdge	0x60BB:00_h	Probe 1 negative edge
_Cap2PosRisEdge	0x60BC:00_h	Probe 2 positive edge
_Cap2PosFallEdge	0x60BD:00_h	Probe 2 negative edge

Adjusting and Starting Position Capture

–	***TouchProbeFct***	**Minimum value**	**–**	**Unit**	**–**	**Persistence**	**–**
		Factory setting	**–**	**Data type**	**UNIT16**	**MODBUS**	**7028**
		Maximum value	**–**	**Access**	**R/W**	**EtherCAT**	**60B8:00_h**

Description:

Touch Probe function (DS402)

Bit	Value 0	Value 1
0	Deactivate Capture input 1	Activate Capture input 1
1	One-time capture	Continuous capture
2	Trigger with Capture Input 1	Trigger with zero pulse signal
3	Reserved (must be 0)	–
4	Disabling capture input 1 with rising edge	Enabling capture input 1 with rising edge
5	Disabling capture input 1 with falling edge	Enabling capture input 1 with falling edge
6 ... 7	Reserved (must be 0)	–
8	Deactivate Capture input 2	Activate Capture input 2
9	One-time capture	Continuous capture
10	Trigger with capture Input 2	Trigger with zero pulse signal
11	Reserved (must be 0)	–
12	Disabling capture input 2 with rising edge	Enabling capture input 2 with rising edge
13	Disabling capture input 2 with falling edge	Enabling capture input 2 with falling edge
14 ... 15	Reserved (must be 0)	–

Modified settings become active immediately.

Status Messages

–	*_TouchProbeStat*	Minimum value	–	Unit	–	Persistence	–
		Factory setting	–	Data type	UINT16	MODBUS	7030
		Maximum value	–	Access	R/–	EtherCAT	60B9:00$_h$

Description:

Touch Probe status (DS402)

Bit	Value 0	Value 1
0	Capture input 1 deactivated	Capture input 1 activated
1	Capture input 1 no value captured for rising edge	Capture input 1 value captured for rising edge
2	Capture input 1 no value captured for falling edge	Capture input 1 value captured for falling edge
3 ... 7	Reserved	–
8	Capture input 2 deactivated	Capture input 2 activated
9	Capture input 2 no value captured for rising edge	Capture input 2 value captured for rising edge
10	Capture input 2 no value captured for falling edge	Capture input 2 value captured for falling edge
11 ... 15	Reserved	–

Captured Position

–	*_Cap1PosRisEdge*	Minimum value	–	Unit	usr_p	Persistence	–
		Factory setting	–	Data type	INT32	MODBUS	2634
		Maximum value	–	Access	R/–	EtherCAT	60BA:00$_h$

Description:

Capture input 1 captured position at rising edge (DS402).

This parameter contains the position captured at the point in time a rising edge was detected.

The captured position is recalculated after “Position Setting” or “Reference Movement”.

–	*_Cap1PosFallEdge*	Minimum value	–	Unit	usr_p	Persistence	–
		Factory setting	–	Data type	INT32	MODBUS	2636
		Maximum value	–	Access	R/–	EtherCAT	60BB:00$_h$

Description:

Capture input 1 captured position at falling edge (DS402).

This parameter contains the position captured at the point in time a falling edge was detected.

The captured position is recalculated after “Position Setting” or “Reference Movement”.

–	*_Cap2PosRisEdge*	Minimum value	–	Unit	usr_p	Persistence	–
		Factory setting	–	Data type	INT32	MODBUS	2638
		Maximum value	–	Access	R/–	EtherCAT	60BC:00$_h$

Description:

Capture input 2 captured position at rising edge (DS402).

This parameter contains the position captured at the point in time a rising edge was detected.

The captured position is recalculated after “Position Setting” or “Reference Movement”.

–	*_Cap2PosFallEdge*	**Minimum value**	–	**Unit**	usr_p	**Persistence**	–
		Factory setting	–	**Data type**	INT32	**MODBUS**	2640
		Maximum value	–	**Access**	R/–	**EtherCAT**	60BD:00$_h$

Description:

Capture input 2 captured position at falling edge (DS402).

This parameter contains the position captured at the point in time a falling edge was detected.

The captured position is recalculated after “Position Setting” or “Reference Movement”.

Functions of Monitoring Movements

Torque Window

Description

The velocity window allows you to monitor whether the motor has reached the target velocity.

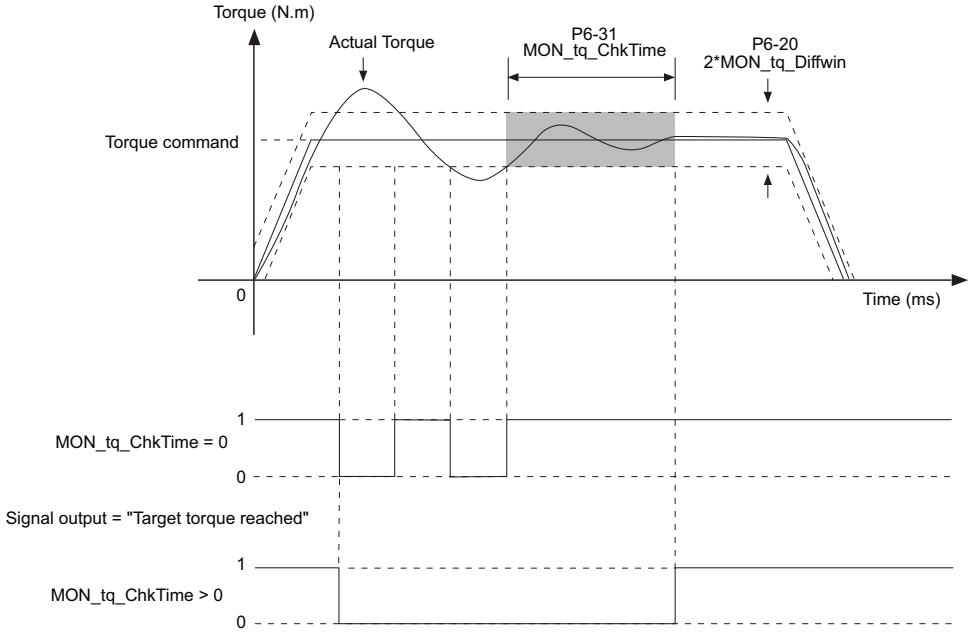
If the difference between the target velocity and the actual velocity remains in the velocity window for the time *MON_v_winTime* ($606E_h$, P6-19), the target velocity is considered to have been reached.

Availability

The torque window is available in the following operating modes:

- Profile Torque

Settings



The parameters *MON_tq_win* (3006:2D$_h$, P6–20) and *MON_tq_winTime* (3006:2E$_h$, P6–21) specify the size of the window.

P6-20	*MON_tq_win*	Minimum value	0	Unit	0.1%	Persistence	per.
		Factory setting	30	Data type	UINT16	MODBUS	1626
		Maximum value	30000	Access	R/W	EtherCAT	3006:2D$_h$

Description:

Torque window, permissible deviation.

The torque window can only be activated in operating mode Profile Torque.

In increments of 0.1 %.

Modified settings become active immediately.

P6-21	*MON_tq_winTime*	Minimum value	0	Unit	ms	Persistence	per.
		Factory setting	0	Data type	UINT16	MODBUS	1628
		Maximum value	16383	Access	R/W	EtherCAT	3006:2E$_h$

Description:

Torque window, time.

Value 0: Torque window monitoring deactivated

Value > 0: Time in *ms* during which the control deviation must be in the standstill window.

Changing the value causes a restart of torque monitoring.

Torque window is only used in operating mode Profile Torque.

Modified settings become active immediately.

Velocity Window

Description

The velocity window allows you to monitor whether the motor has reached the target velocity.

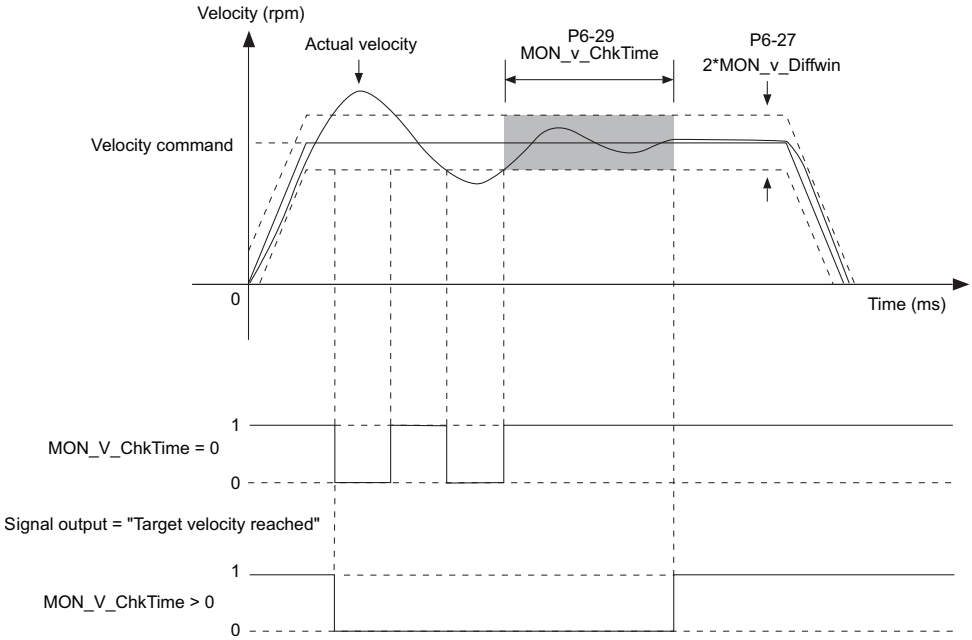
If the difference between the target velocity and the actual velocity remains in the velocity window for the time *MON_v_winTime* ($606E_h$, P6–19), the target velocity is considered to have been reached.

Availability

The velocity window is available in the following operating modes:

- Profile Velocity

Settings



The parameters *MON_v_win* ($606D_h$, P6–18) and *MON_v_winTime* ($606E_h$, P6–19) specify the size of the window.

P6-18	*MON_v_win*	Minimum value	1	Unit	usr_v	Persistence	per.
		Factory setting	10	Data type	UINT32	MODBUS	1576
		Maximum value	2147483647	Access	R/W	EtherCAT	606D:00$_h$

Description:

Velocity window, permissible 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 *MON_v_winTime* (P6-19).

Modified settings become active immediately.

P6-19	*MON_v_winTime*	Minimum value	0	Unit	ms	Persistence	per.
		Factory setting	0	Data type	UINT16	MODBUS	1578
		Maximum value	16383	Access	R/W	EtherCAT	606E:00$_h$

Description:

Velocity window, time.

Value 0: Velocity window monitoring deactivated

Value > 0: Time in *ms* during which the control deviation must be in the standstill window.

Changing the value causes a restart of velocity monitoring.

Modified settings become active immediately.

Standstill Window

Description

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

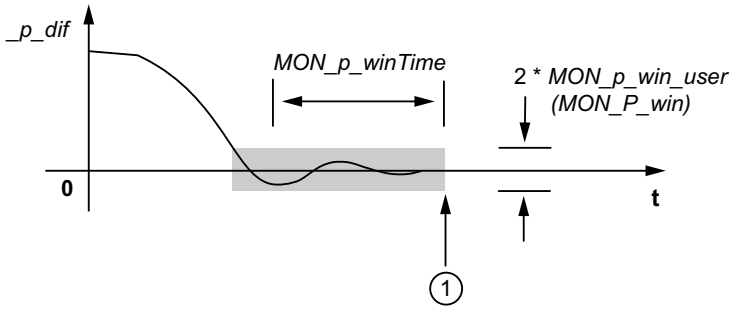
If the difference between the target position and the actual position remains in the standstill window for the time *MON_p_winTime* (6068_h, P6–16), the target position is considered to have been reached.

Availability

The standstill window is available in the following operating modes:

- Jog
- Profile Position
- Homing

Settings



1 Target position reached (the actual position did not exceed the permissible deviation *MON_p_win_usr* ($3006:40_h$, P6-15) during time *MON_p_winTime* (6068_h, P6–16)).

The parameters *MON_p_win_usr* (3006:40$_h$, P6-15) and *MON_p_winTime* (6068$_h$, P6–16) specify the size of the window.

The parameter *MON_p_winTout* (3006:26$_h$, P6-17) can be used to set the period of time after which a detected error is signaled if the standstill window was not reached.

P6-15	*MON_p_win_usr*	Minimum value	0	Unit	usr_p	Persistence	per.
		Factory setting	16	Data type	INT32	MODBUS	1664
		Maximum value	2147483647	Access	R/W	EtherCAT	3006:40$_h$

Description:

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 *MON_p_winTime* (P6-16).

The minimum value, the factory setting and the maximum value depend on the scaling factor.

Modified settings become active immediately.

P6-16	*MON_p_winTime*	Minimum value	0	Unit	ms	Persistence	per.
		Factory setting	0	Data type	UINT16	MODBUS	1610
		Maximum value	32767	Access	R/W	EtherCAT	6068:00$_h$

Description:

Standstill window, time.

Value =0: Monitoring of standstill window deactivated

Value >0: Time in *ms* during which the control deviation must be in the standstill window

Modified settings become active immediately.

P6-17	*MON_p_winTout*	Minimum value	0	Unit	ms	Persistence	per.
		Factory setting	0	Data type	UINT16	MODBUS	1612
		Maximum value	16000	Access	R/W	EtherCAT	3006:26$_h$

Description:

Time-out time for standstill window monitoring.

Value =0: Time-out monitoring deactivated

Value >0: Time-out time in *ms*

Standstill window processing values are set via *MON_p_win_usr* (P6-15) and *MON_p_winTime* (P6-16).

Time monitoring starts when the target position (reference position of position controller) is reached or when the profile generator has finished processing.

Modified settings become active immediately.

Velocity Deviation Window

Description

The velocity deviation window 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.

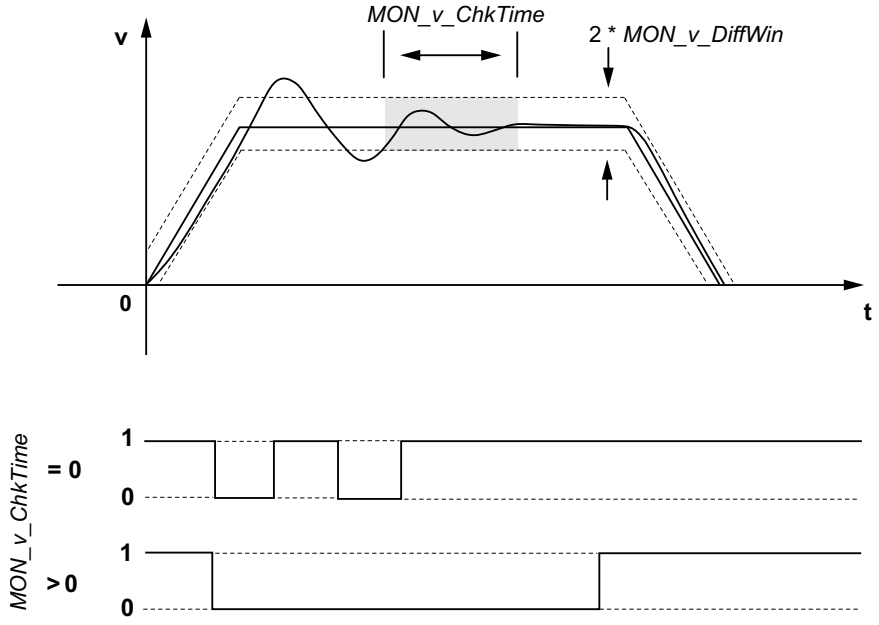
The velocity deviation window comprises velocity deviation and monitoring time.

Availability

The velocity deviation window is available in the following operating modes:

- Jog
- Profile Velocity
- Profile Position
- Homing
- Cyclic Synchronous Position
- Cyclic Synchronous Velocity

Settings



The parameters *MON_v_DiffWin* (3006:1A$_h$) and *MON_v_ChkTime* (6070$_h$) specify the size of the window.

Status Indication

The status is available via a signal output or via EtherCAT.

In order to read the status via a signal output, you must first parameterize the signal output function “In Velocity Deviation Window”, see List of Output Functions, page 173.

In order to read the status via EtherCAT, you must set the status bits of the status parameters, see Adjustable Bits of the Status Parameters, page 309.

P6-27	*MON_v_DiffWin*	Minimum value	1	Unit	usr_v	Persistence	per.
		Factory setting	10	Data type	UINT32	MODBUS	1588
		Maximum value	2147483647	Access	R/W	EtherCAT	3006:1A$_h$

Description:

Monitoring of velocity deviation.

The system monitors whether the drive is within the defined deviation during the period set with *MON_v_ChkTime* (P6-29).

The status can be output via a parameterizable output.

Modified settings become active immediately.

P6-29	*MON_v_ChkTime*	Minimum value	0	Unit	ms	Persistence	per.
		Factory setting	0	Data type	UINT16	MODBUS	1696
		Maximum value	9999	Access	R/W	EtherCAT	6070:00$_h$

Description:

Time window for velocity monitoring.

Adjustment of a time for monitoring of velocity deviation and velocity 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.

Modified settings become active immediately.

Position Deviation Window

Description

The position deviation window 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.

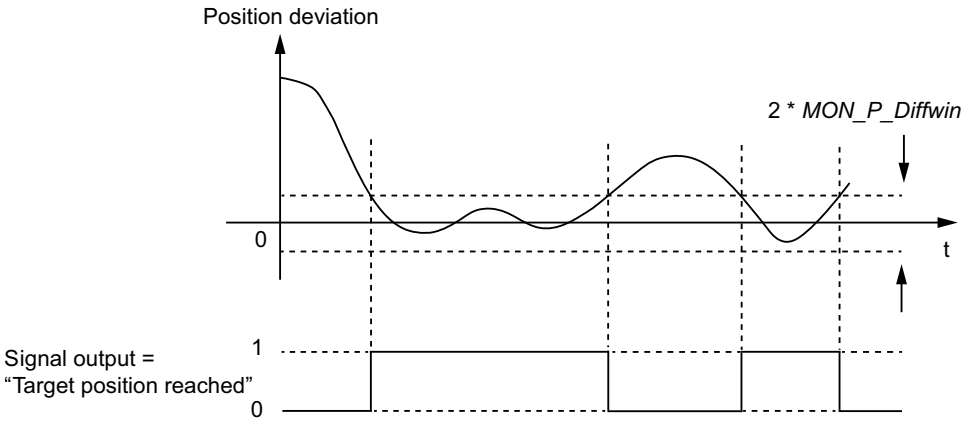
The position deviation window comprises position deviation and monitoring time.

Availability

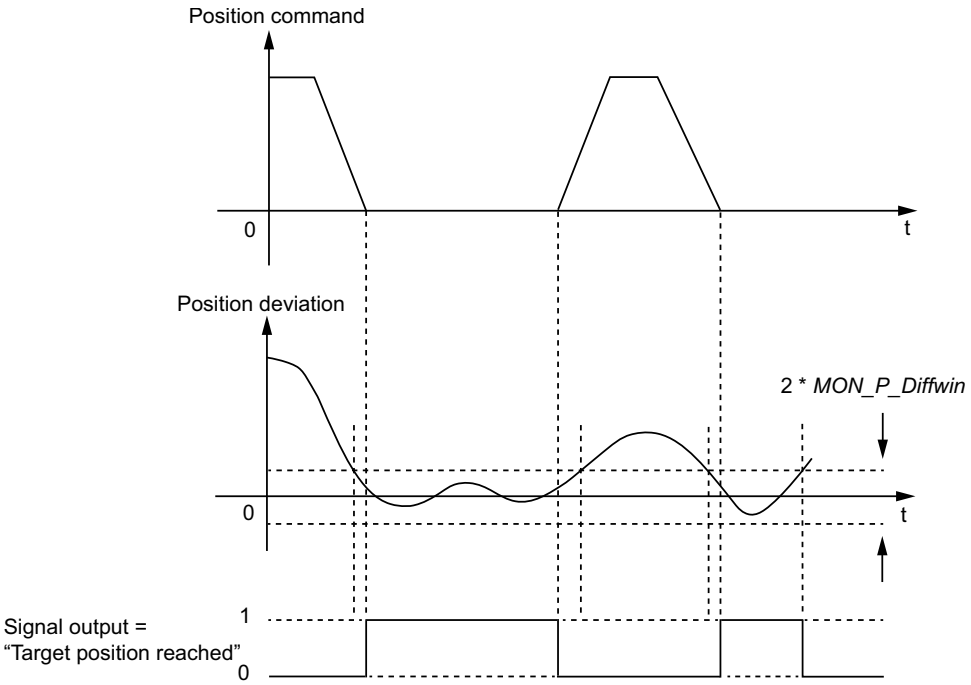
The position deviation window is available in the following operating modes:

- Jog
- Cyclic Synchronous Position
- Profile Position
- Homing

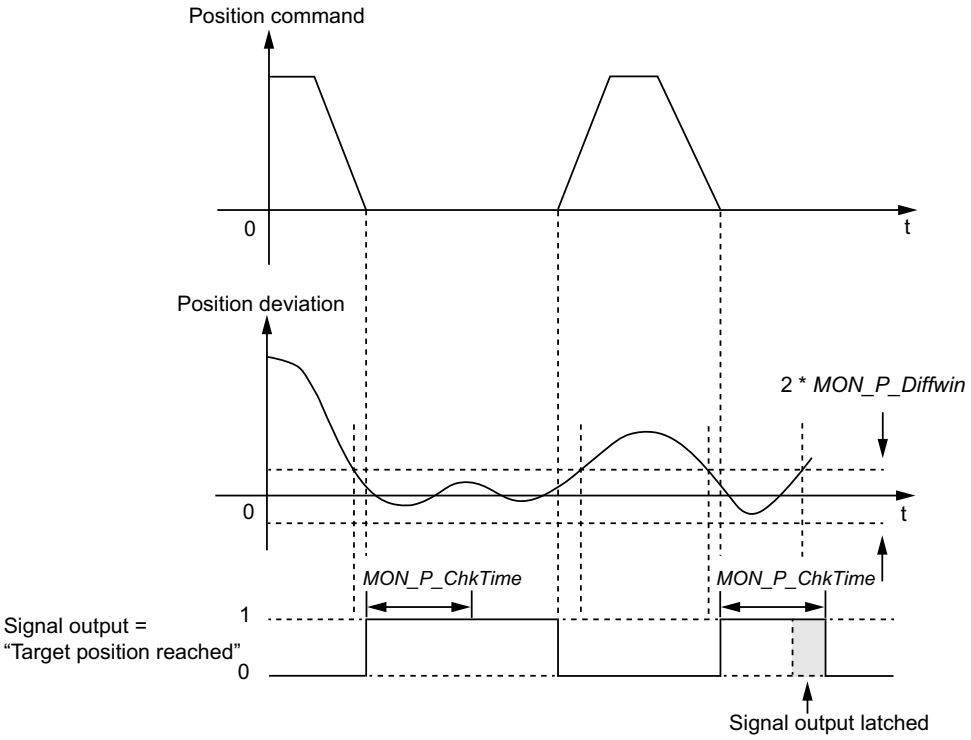
Settings



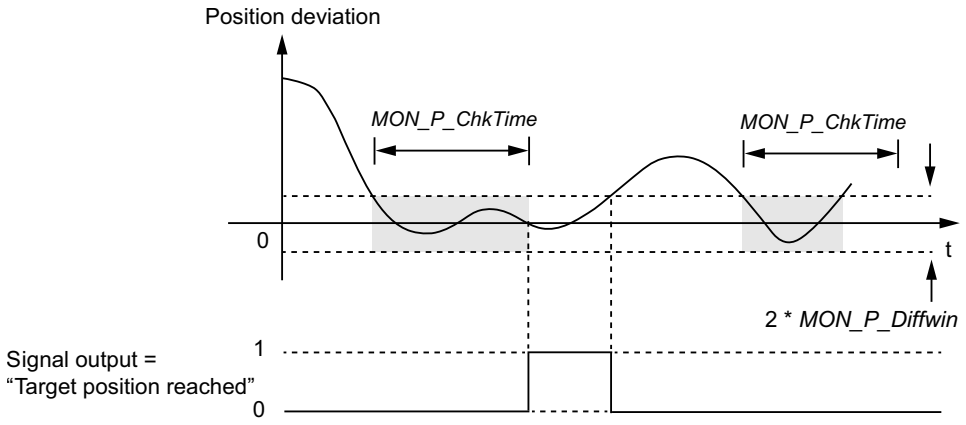
MON_P_Mode = 0: Position reached
Signal output is on when position deviation is within window



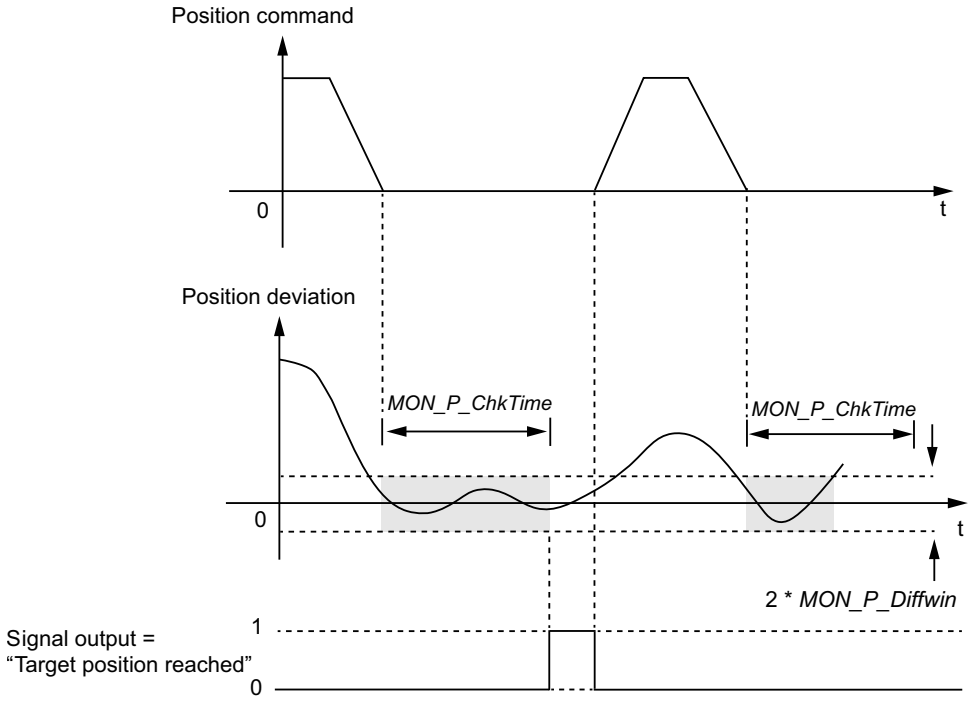
MON_P_Mode = 1: Command reached
No position command received + Position deviation is within window



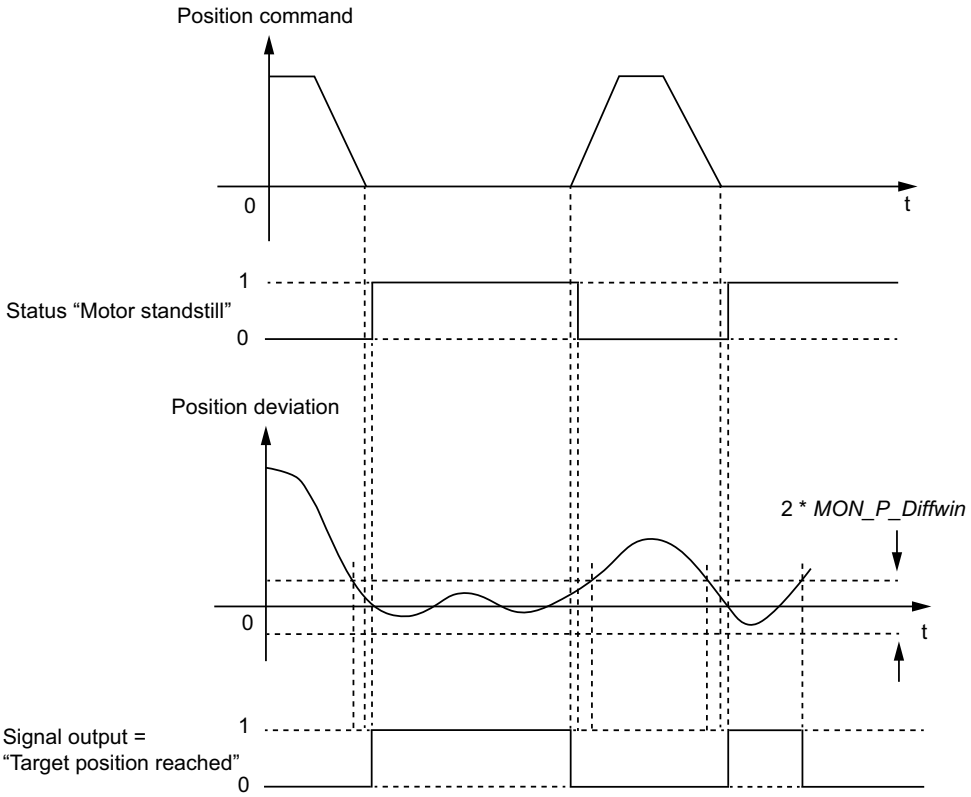
MON_P_Mode = 2: Command reached with output latched
No position command received + Position deviation is within window,
signal output will be latched for time set in P6-26



MON_P_Mode = 3: Position reached with time window
Position deviation is within window for time set in P6-26



MON_P_Mode = 4: Command reached with time window
No position command received + Position deviation is within window for time set in P6-26



MON_P_Mode = 5: Motion finished
No position command received + Motor is at standstill
+ Position deviation is within window

Status Indication

The status is available via a signal output or via EtherCAT.

In order to read the status via a signal output, you must first parameterize the signal output function “In Position Deviation Window”, see List of Output Functions, page 173.

In order to read the status via EtherCAT, you must set the status bits of the status parameters, see Adjustable Bits of the Status Parameters, page 309.

P6-22	*MON_p_DiffWin_usr1*	Minimum value	0	Unit	usr_p	Persistence	per.
		Factory setting	128	Data type	INT32	MODBUS	1662
		Maximum value	2147483647	Access	R/W	EtherCAT	3006:3F$_h$

Description:

Monitoring of position deviation 1.

The system verifies whether the drive is within the defined deviation during the period set with *MON_p_ChkTime* (P6-26).

The status can be output via a parameterizable output.

The minimum value, the factory setting and the maximum value depend on the scaling factor.

Modified settings become active immediately.

P6-23	*MON_p_mode1*	Minimum value	0	Unit	–	Persistence	per.
		Factory setting	0	Data type	UINT16	MODBUS	1706
		Maximum value	5	Access	R/W	EtherCAT	3006:55$_h$

Description:

Position following error monitoring output mode 1

0 / Position reached

1 / Command reached

2 / Command reached with output latched

3 / Position reached with time window

4 / Command reached with time window

5 / Motion finished: Movement finished

Modified settings become active immediately.

P6-24	*MON_p_DiffWin_usr2*	Minimum value	0	Unit	–	Persis-tence	per.
		Factory setting	128	Data type	INT32	MODBUS	1700
		Maximum value	2147483647	Access	R/W	EtherCAT	3006:52$_h$

Description:

Monitoring of position deviation 2.

The system verifies whether the drive is within the defined deviation during the period set with *MON_p_ChkTime* (P6-26).

The status can be output via a parameterizable output.

The minimum value, the factory setting and the maximum value depend on the scaling factor.

Modified settings become active immediately.

P6-25	*MON_p_mode2*	Minimum value	0	Unit	–	Persistence	per.
		Factory setting	0	Data type	UINT16	MODBUS	1708
		Maximum value	5	Access	R/W	EtherCAT	3006:56$_h$

Description:

Position following error monitoring output mode 2.

0 / Position reached

1 / Command reached

2 / Command reached with output latched

3 / Position reached with time window

4 / Command reached with time window

5 / Motion finished: Movement finished

Modified settings become active immediately.

P6-26	*MON_p_ChkTime*	Minimum value	0	Unit	ms	Persis-tence	per.
		Factory setting	0	Data type	UINT16	MODBUS	1594
		Maximum value	9999	Access	R/W	EtherCAT	3006:1D$_h$

Description:

Time window for position monitoring.

Adjustment of a time for monitoring of position deviation.

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.

Modified settings become active immediately.

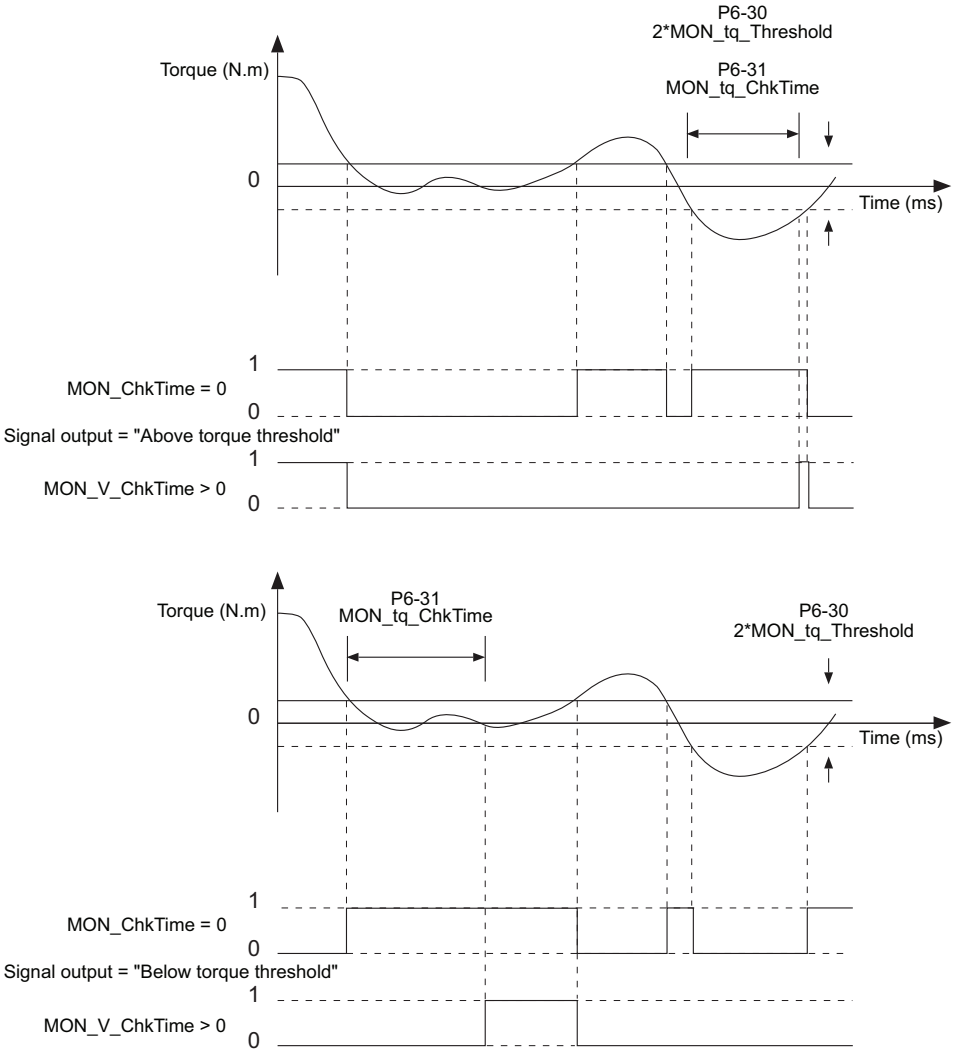
Torque Threshold Value

Description

The torque threshold value allows you to monitor whether the actual torque is below a parameterizable torque value.

The torque threshold value comprises the torque value and the monitoring time.

Settings



The parameters *MON_tq_Threshold* (3006:1C$_h$, P6-30) and *MON_tq_ChkTime* (3006:57$_h$, P6-31) specify the size of the window.

Status Indication

The status is available via a signal output or via EtherCAT.

In order to read the status via a signal output, you must first parameterize the signal output function “Torque Below Threshold”, see List of Output Functions, page 173.

In order to read the status via EtherCAT, you must set the status bits of the status parameters, see Adjustable Bits of the Status Parameters, page 309.

P6-30	*MON_tq_Threshold*	Minimum value	0	Unit	0.1 %	Persistence	per.
		Factory setting	600	Data type	UINT16	MODBUS	1592
		Maximum value	30000	Access	R/W	EtherCAT	3006:1C$_h$

Description:

Monitoring of torque threshold.

The system monitors whether the drive is below the defined value during the period set with *MON_tq_ChkTime* (P6-31).

The status can be output via a parameterizable output.

100.0 % correspond to the motor rated torque.

In increments of 0.1 %.

Modified settings become active immediately.

P6-31	*MON_tq_ChkTime*	Minimum value	0	Unit	ms	Persistence	per.
		Factory setting	0	Data type	UINT16	MODBUS	1710
		Maximum value	9999	Access	R/W	EtherCAT	3006:57$_h$

Description:

Time window for torque monitoring.

Adjustment of a time for monitoring oftorque 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.

Modified settings become active immediately.

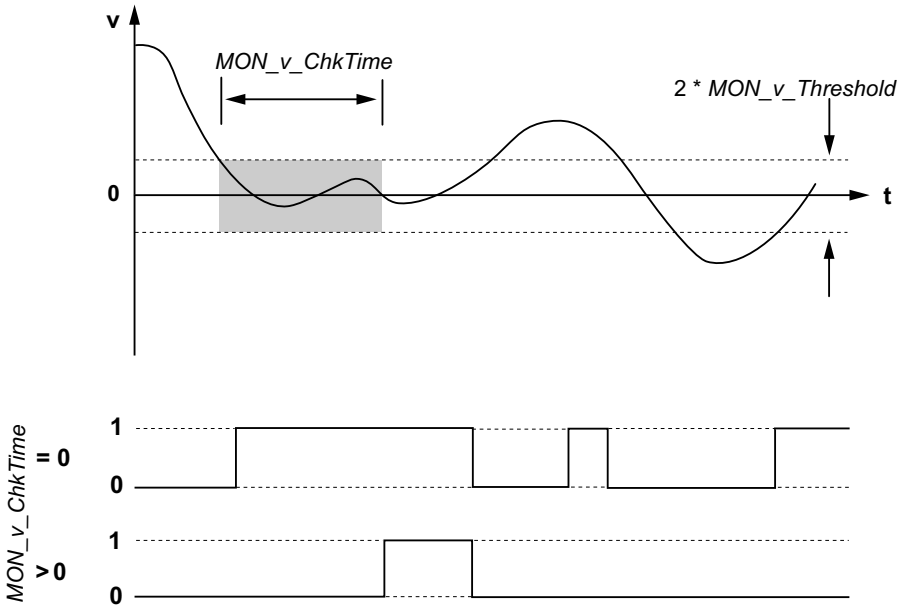
Velocity Threshold Value

Description

The velocity threshold value allows you to monitor whether the actual velocity is below a parameterizable velocity value.

The velocity threshold value comprises the velocity and the monitoring time.

Settings



The parameters *MON_v_Threshold* ($606F_h$, P6-28) and *MON_v_ChkTime* (6070_h, P6-29) specify the size of the window.

Status Indication

The status is available via a signal output or EtherCAT.

In order to read the status via a signal output, you must first parameterize the signal output function “Velocity Below Threshold”, see List of Output Functions, page 173.

In order to read the status via EtherCAT, you must set the status bits of the status parameters, see Adjustable Bits of the Status Parameters, page 309.

P6-28	*MON_v_Threshold*	Minimum value	1	Unit	usr_v	Persistence	per.
		Factory setting	10	Data type	UINT32	MODBUS	1590
		Maximum value	2147483647	Access	R/W	EtherCAT	606F:00$_h$

Description:

Monitoring of velocity threshold.

The system monitors whether the drive is below the defined value during the period set with *MON_v_ChkTime* (P6-29).

The status can be output via a parameterizable output.

Modified settings become active immediately.

P6-29	*MON_v_ChkTime*	Minimum value	0	Unit	ms	Persistence	per.
		Factory setting	0	Data type	UINT16	MODBUS	1696
		Maximum value	9999	Access	R/W	EtherCAT	6070:00$_h$

Description:

Time window for velocity monitoring.

Adjustment of a time for monitoring of velocity deviation and velocity 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.

Modified settings become active immediately.

Load-Dependent Velocity Deviation

Description

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

The maximum permissible load-dependent velocity deviation can be parameterized. In addition, you can set the error class.

Availability

Monitoring of the load-dependent velocity deviation is available in the following operating modes:

- Profile Velocity
- CSV

Reading the Velocity Deviation

The following parameters let you read the load-dependent velocity deviation.

–	*_v_dif_usr*	**Minimum value**	**-2147483648**	**Unit**	**usr_v**	**Persistence**	**–**
		Factory setting	**–**	**Data type**	**INT32**	**MODBUS**	**7768**
		Maximum value	**2147483647**	**Access**	**R/-**	**EtherCAT**	**301E:2C$_h$**

Description:

Load-dependent velocity deviation.

The load-dependent velocity deviation is the difference between reference velocity and actual velocity.

Setting the Maximum Values for the Velocity Deviation

The following parameters let you specify the size of the window for the maximum load-dependent velocity deviation at which a movement is canceled.

P6-34	*MON_VelDiff*	Minimum value	0	Unit	usr_v	Persis-tence	per.
		Factory setting	0	Data type	UINT32	MODBUS	1712
		Maximum value	2147483647	Access	R/W	EtherCAT	3006:58$_h$

Description:

Maximum load-dependent velocity deviation.

Value 0: Monitoring deactivated

Value >0: Maximum value

Modified settings become active immediately.

P6-35	*MON_VelDiff_Time*	Minimum value	0	Unit	ms	Persis-tence	per.
		Factory setting	10	Data type	UINT16	MODBUS	1714
		Maximum value	–	Access	R/W	EtherCAT	3006:59$_h$

Description:

Time window for maximum load-dependent velocity deviation.

Value 0: Monitoring deactivated

Value >0: Time window for maximum value

Modified settings become active immediately.

Setting the Error Class

The following parameter lets you set the error class for an excessively high load-dependent velocity deviation.

P6-36	*ErrorResp_v_dif*	Minimum value	1	Unit	–	Persistence	per.
		Factory setting	3	Data type	UINT16	MODBUS	1716
		Maximum value	3	Access	R/W	EtherCAT	3006:5A$_h$

Description:

Error response to excessively high load dependent velocity 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 modified if power stage is disabled.

Modified settings become active immediately.

Load-Dependent Position Deviation (Following Error)

Description

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

Parameters are available to read the load-dependent position deviation during operation and the maximum position deviation reached since the last power cycle.

The maximum permissible load-dependent position deviation can be parameterized. In addition, you can set the error class.

Availability

Monitoring of the load-dependent position deviation is available in the following operating modes:

- Jog
- Profile Position
- Homing
- Cyclic Synchronous Position

Reading the Position Deviation

The following parameters let you read the load-dependent position deviation.

–	*_p_dif_load_usr*	**Minimum value**	**-2147483648**	**Unit**	**usr_p**	**Persis-tence**	**–**
		Factory setting	**–**	**Data type**	**INT32**	**MODBUS**	**7724**
		Maximum value	**2147483647**	**Access**	**R/-**	**EtherCAT**	**301E:16$_h$**

Description:

Load-dependent position deviation between reference and actual positions.

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

This value is used for following error monitoring.

The following parameter lets you set the threshold for the maximum load-dependent position deviation that is to trigger an error of error class 0.

P6-32	***MON_p_dif_warn***	**Minimum value**	**0**	**Unit**	**%**	**Persistence**	**per.**
		Factory setting	**75**	**Data type**	**UINT16**	**MODBUS**	**1618**
		Maximum value	**100**	**Access**	**R/W**	**EtherCAT**	**3006:29$_h$**

Description:

Advisory limit of the load-dependent position deviation (error class 0).

100.0 % correspond to the maximum position deviation (following error) as specified by means of parameter *MON_p_dif_load_usr* (P0-21).

Modified settings become active immediately.

Setting the Maximum Values for the Position Deviation

The following parameters let you set the maximum load-dependent position deviation at which a movement is canceled with an error of error classes 1, 2, or 3.

P0-21	*MON_p_dif_load_usr*	Minimum value	1	Unit	usr_p	Persistence	per.
		Factory setting	25165824	Data type	INT32	MODBUS	1660
		Maximum value	2147483647	Access	R/W	EtherCAT	3006:3E$_h$

Description:

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.

The minimum value, the factory setting and the maximum value depend on the scaling factor.

Modified settings become active immediately.

Setting the Error Class

The following parameter lets you set the error class for an excessively high load-dependent position deviation.

P6-33	*ErrorResp_p_dif*	Minimum value	1	Unit	–	Persistence	per.
		Factory setting	3	Data type	UINT16	MODBUS	1302
		Maximum value	3	Access	R/W	EtherCAT	3005:0B$_h$

Description:

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 modified if power stage is disabled.

Modified settings become active the next time the power stage is enabled.

Adjustable Bits of the Status Parameters

Overview

The status bits of the following parameters can be adjusted:

- Parameter *_actionStatus*
  - Setting of bit 9 via parameter *DPL_intLim*
  - Setting of bit 10 via parameter *DS402intLim*
- Parameter *_DPL_motionStat*
  - Setting of bit 9 via parameter *DPL_intLim*
  - Setting of bit 10 via parameter *DS402intLim*
- Parameter *_DCOMstatus*
  - Setting of bit 10 via parameter *DS402intLim*

Status Parameter

–	***_actionStatus***	**Minimum value**	**–**	**Unit**	**–**	**Persistence**	**–**
		Factory setting	**–**	**Data type**	**UINT16**	**MODBUS**	**7176**
		Maximum value	**–**	**Access**	**R/-**	**EtherCAT**	**301C:04$_h$**

Description:

Action word.

Signal state:

0: Not activated

1: Activated

Bit assignments:

Bit 0: Error class 0

Bit 1: Error class 1

Bit 2: Error class 2

Bit 3: Error class 3

Bit 4: Error class 4

Bit 5: Reserved

Bit 6: Motor is at a standstill (*_n_act* < 9 RPM)

Bit 7: Motor movement in positive direction

Bit 8: Motor movement in negative direction

Bit 9: Assignment can be set via parameter *DPL_intLim*

Bit 10: Assignment can be set via parameter *DS402intLim*

Bit 11: Profile generator idle (reference velocity is 0)

Bit 12: Profile generator decelerates

Bit 13: Profile generator accelerates

Bit 14: Profile generator moves at constant speed

Bit 15: Reserved

–	*_DPL_motionStat*	Minimum value	–	Unit	–	Persistence	–
		Factory setting	–	Data type	UINT16	MODBUS	6990
		Maximum value	–	Access	R/-	EtherCAT	301B:27$_h$

Description:

Drive Profile

Lexium motionStat.

–	*_DCOMstatus*	Minimum value	–	Unit	–	Persistence	–
		Factory setting	–	Data type	UINT16	MODBUS	6916
		Maximum value	–	Access	R/-	EtherCAT	6041:00$_h$

Description:

Drive status word

Bit assignments:

Bit 0: Operating state Ready To Switch On

Bit 1: Operating state Switched On

Bit 2: Operating state Operation Enabled

Bit 3: Operating state Fault

Bit 4: Voltage Enabled

Bit 5: Operating state Quick Stop

Bit 6: Operating state Switch On Disabled

Bit 7: Error of error class 0

Bit 8: HALT request active

Bit 9: Remote

Bit 10: Target Reached

Bit 11: Internal Limit Active

Bit 12: Operating mode-specific

Bit 13: x_err

Bit 14: x_end

Bit 15: ref_ok

Parameter for Setting the Status Bits

–	*DPL_intLim*	Minimum value	0	Unit	–	Persistence	per.
		Factory setting	11	Data type	UINT16	MODBUS	7018
		Maximum value	11	Access	R/W	EtherCAT	301B:35$_h$

Description:

Setting for bit 9 of *_DPL_motionStat* and *_actionStatus*.

0 / None: Not used (reserved)

1 / Current Below Threshold: Current threshold value

2 / Velocity Below Threshold: Velocity threshold value

3 / In Position Deviation Window1: Position deviation window

4 / In Velocity Deviation Window: Velocity deviation window

9 / Hardware Limit Switch: Hardware limit switch

11 / Position Window: Position window

Setting for:

Bit 9 of the parameter *_actionStatus*

Bit 9 of the parameter *_DPL_motionStat*

Modified settings become active immediately.

–	*DS402intLim*	Minimum value	0	Unit	–	Persistence	per.
		Factory setting	0	Data type	UINT16	MODBUS	6972
		Maximum value	11	Access	R/W	EtherCAT	301B:1E$_h$

Description:

DS402 status word: Setting for bit 11 (internal limit).

0 / None: Not used (reserved)

1 / Current Below Threshold: Current threshold value

2 / Velocity Below Threshold: Velocity threshold value

3 / In Position Deviation Window1: Position deviation window

4 / In Velocity Deviation Window: Velocity deviation window

9 / Hardware Limit Switch: Hardware limit switch

11 / Position Window: Position window

Setting for:

Bit 11 of the parameter *_DCOMstatus*

Bit 10 of the parameter *_actionStatus*

Bit 10 of the parameter *_DPL_motionStat*

Adjustment

Types and Basic Procedure of Tuning

Tuning

The purpose of tuning (adjustment) is to optimize the function of servo responsiveness. The servo responsiveness depends on the control loop gain set in the servo drive. Higher servo responsiveness allows the motor to move as close to the command as possible, reducing various errors and delays.

The control loop gain is set by a combination of parameters (position loop gain, velocity loop gain, feed-forward control, various filters, inertia ratio settings, etc.) and affects the performance of the servo. The setting of control loop gain of the servo should also take into account the fit and balance between the parameters.

In general, machinery with high rigidity can set relatively high servo gain to improve responsiveness. However, for machinery with low rigidity, relatively high servo gain may lead to vibration instead, thus failing to improve responsiveness. In this case, you can consider using various vibration suppression functions of the servo to inhibit vibration.

Type of Tuning

The default control loop gain set for the servo at the factory is mainly stable, but the user can set the control loop gain in the following ways to further improve the responsiveness according to the actual machine condition.

Type of tuning	Outline	Operation tool	
		Drive panel	Debug software
Simple auto-tuning	Drive the motor on a preset motion profile, and measure and set the control loop parameters while the motor is running.	√	√
Comfortable auto-tuning	The motion profile parameters can be set. The motor can be driven according to the profile that better meets the actual needs, and the control loop parameters can be measured and set while the motor is running.	×	√
Adaptive control	Input motion command from the host computer or drive the motor motion by test run. The servo drive automatically presumes the load inertia ratio while moving, and set the control loop parameters by combining the rigidity parameters.	√	√
Adaptive notch filter	The servo drive automatically measures and sets notch filters (up to 2 sets) for suppressing mechanical resonance.	√	√
Manual gain adjustment	Manually set the control loop gain and various filters.	△	√

√: Available

×: Not supported

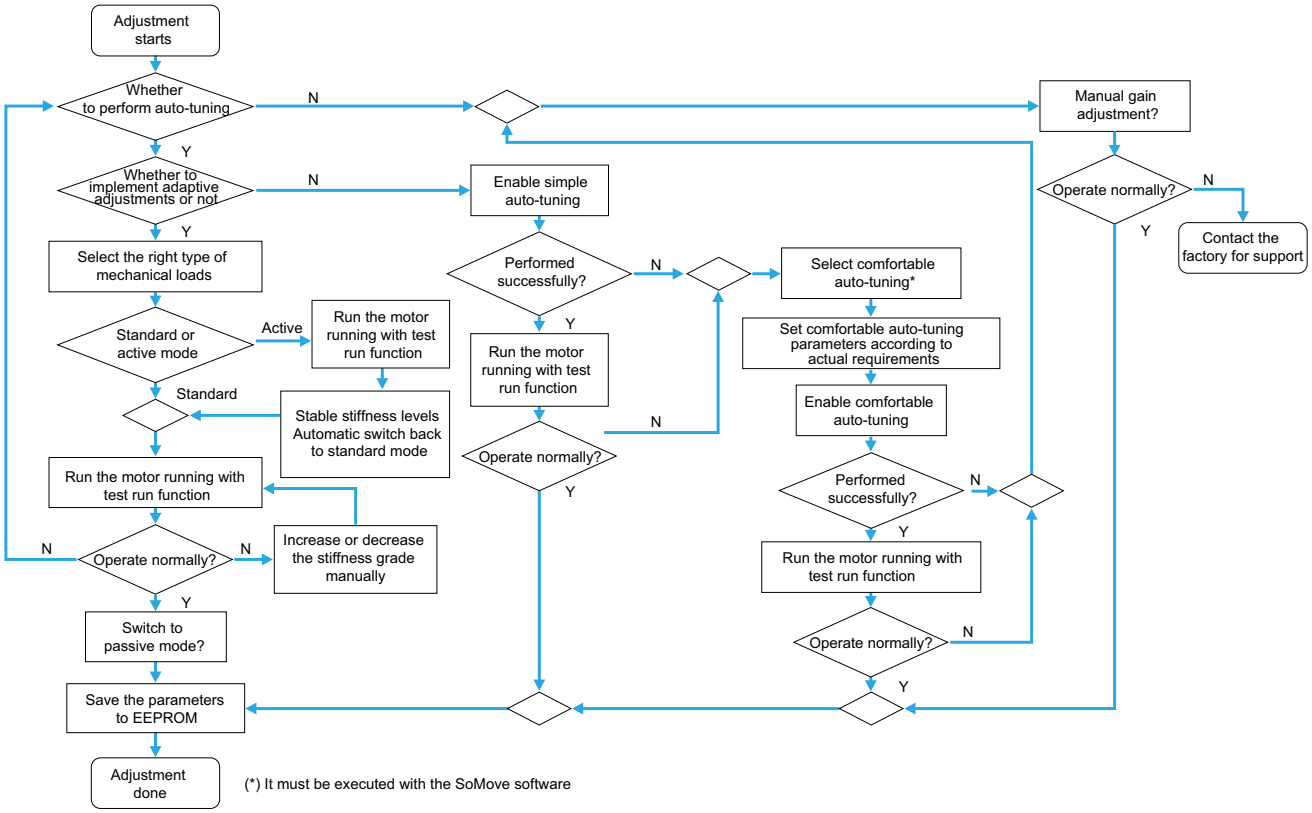
△: Limited function

The type of control loops varies from different types of tuning, as shown in the following table:

Control loop type	Serial control loop mode	Adaptive control loop mode		
Mode selection	P0-01= 0 - Invalid	P0-01= 1 - Standard	P0-01= 2 - Passive	P0-01= 3 - Adaptive
Control loop parameter tuning method	Simple auto-tuning (Drive HMI / SoMove)	Online measurement of the system's inertia ratio P0-03	Manual setting of the system's inertia ratio P0-03	Online measurement of the system's inertia ratio P0-03
	Comfortable auto-tuning (SoMove)	Manual setting of the rigid grade P0-02	Manual setting of the rigid grade P0-02	Try to find the best rigid grade (up to 4 times increased) P0-02
	Manual gain adjustment (Drive HMI / SoMove)	-	-	-
Parameter	The Ctrl1 control loop parameter set 1 is used by default	The load type parameter P0-04 determines the default initial rigid grade		
	The input point function can be used to switch between Ctrl1 and Ctrl2 control loop parameter sets	Equivalent mapping to Ctrl1/Ctrl3 control loop parameter set can be achieved via the SoMove software And		
	The speed loop feed-forward parameter P1-03 is valid			
Transition of control loop parameters	The Ctrl3 control loop parameter set is used for low gains	The parameter P1-47 is used for low rigid grades		
	Transition conditions for parameters: P1-39...P1-45	Transition conditions for parameters: P1-39...P1-45		
Details	Easy Tuning, page 316/ Comfort Tuning, page 317	Adaptive Control, page 318		

Basic Procedure for Tuning

The following diagram shows the flow chart of the basic procedure for tuning. Make appropriate adjustments according to the actual conditions of the machine and the operating conditions.



Safety Precautions for Tuning

⚠WARNING

UNINTENDED EQUIPMENT OPERATION

- Do not touch the rotating part of the motor when the servo is ON or the motor is rotating.
- When the servo motor is running, keep it in a state where it can be stopped in an emergency at any time.
- Ensure that the test run is completed properly before making adjustments.
- To ensure safety, mount a stop device on the mechanical side.

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

Observe the following safety precautions when performing the tuning:

- Set the limit function so that when either positive or negative limit is triggered, the Quick Stop function is triggered and the motion stops. Refer to Setting the Limit Switches, page 177.
- Set the alarm for excessive follow error. Refer to Position Deviation Window, page 296.
- Note that there are no obstacles within the travel range of the auto-tuning operation.

Selecting the Control Loop Parameter Model

The Lexium 18E servo drive supports two types of control loop models, the serial PID model and adaptive control model.

When the parameter P0-01 is set to “0/ Invalid”, the servo drive uses the PID control loop model.

There are three control loop parameter sets for the Lexium 18E 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.

CTRL1 / Control loop parameter set 1		**CTRL2 / Control loop parameter set 2**		**CTRL3 / 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	Time constant of velocity loop command filtering
P1-04	Time constant of velocity loop command filtering	P1-11	Time constant of velocity loop command filtering	P1-18	Time constant of current loop command filtering
P1-05	Time constant of current loop command filtering	P1-12	Time constant of current loop command filtering	–	–
P1-06	Friction compensation gain	P1-13	Friction compensation gain	–	–
P2-07	Control parameter set 1: Notch filter 1: Damping.	P2-15	Control parameter set 2: Damping of the 1st set of notch filters	–	–
P2-08	Control parameter set 1: Notch filter 1: Damping.	P2-16	Control parameter set 2: Frequency of the 1st set of notch filters	–	–
P2-09	Control parameter set 1: Notch filter 1: Bandwidth	P2-17	Control parameter set 2: Bandwidth of the 1st set of notch filters	–	–
P2-10	Control parameter set 1: Damping of the 2nd set of notch filters	P2-18	Control parameter set 2: Damping of the 2nd set of notch filters	–	–
P2-11	Control parameter set 1: Frequency of the 2nd set of notch filters	P2-19	Control parameter set 2: Frequency of the 2nd set of notch filters	–	–
P2-12	Control parameter set 1: Bandwidth of the 2nd set of notch filters	P2-20	Control parameter set 2: Bandwidth of the 2nd set of notch filters	–	–
P2-13	Control parameter set 1: overshoot suppression filter: Damping	P2-21	Control parameter set 2: overshoot suppression filter: Damping	–	–
P2-14	Control parameter set 1: Delay of overshoot suppression filters	P2-22	Control parameter set 2: Delay of overshoot suppression filters	–	–

When the parameter P0-01 is set to “1/ Standard”, “2/ Passive” or “3/ Adaptive”, the servo drive uses the adaptive control loop model.

There are two adaptive control rigid grades for the Lexium 18E servo drive:

- P0-02: Adaptive control rigid grade.
- P1-47: Adaptive rigidity transition: Target low rigidity.

Easy Tuning

Overview

Easy Tuning drives the motor along the preset motion trajectory, and measures and sets the control loop parameters during operation. Easy Tuning determines the frictional resistance as a constantly acting load and considers it in the calculation of the inertia ratio of the entire system. Autotuning will take into account all external factors, for example the motor load, and measure an optimal control loop parameter on this basis. Easy Tuning function also supports vertical axes.

Easy Tuning function sets the parameters of P1-00...P1-06 (CTRL1) and P1-14... P1-18(CTRL3) in the “P1-Gain Setting” parameter set.

NOTE: When performing Easy Tuning, the servo motor will move. Incorrect parameters may cause unintended movements or the loss of monitoring functions. With the adjustment of control loop parameters, the system may produce noise or mechanical oscillations. Noise development and mechanical oscillations of the system are normal.

⚠WARNING

UNINTENDED EQUIPMENT OPERATION

- Start the system only if there is no person or obstruction in the zone of operation.
- Consider the travel of deceleration ramp during 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.

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

Operation Method

If you want to perform Easy Tuning, no additional parameters need to be adjusted.

There are two ways of starting Easy Tuning:

- Start via the HMI front panel integrated with the device: **HMI > OP > tun > EZYTU > tuSt**.

  Refer to Easy Tuning, page 316 for details.
- Start via SoMove of the commissioning software: **SoMove > Parameter Tuning > Easy Tuning > Start**.

  The tuning process is displayed by the progress bar. When the tuning is completed, please use the SoMove software function to save the control loop parameters to the drive EEPROM.

Comfort Tuning

Overview

The motion trajectory parameters of Comfort Tuning can be set, so that the parameters such as velocity, direction, distance and mechanical connection type of Autotuning can better adapt to the actual applications, and more accurate control loop parameters can be obtained. Comfort Tuning determines the frictional resistance as a constantly acting load and considers it in the calculation of the inertia ratio of the entire system. Autotuning will take into account all external factors, for example the motor load, and measure an optimal control loop parameter on this basis. Comfort Tuning function also supports vertical axes.

Comfort Tuning function sets the parameters of P1-00...P1-06 (CTRL1) and P1-14...P1-18 (CTRL3) in the “P1-gain setting” parameter set.

NOTE: When performing Comfort Tuning, the servo motor will move. Incorrect parameters may cause unintended movements or the loss of monitoring functions. With the adjustment of control loop parameters, the system may produce noise or mechanical oscillations. Noise development and mechanical oscillations of the system are normal.

⚠WARNING

UNINTENDED EQUIPMENT OPERATION

- Start the system only if there is no person or obstruction in the zone of operation.
- Consider the travel of deceleration ramp during 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.

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

Operation Method

Comfort Tuning must be operated via SoMove software: **SoMove > Parameter Tuning > Comfort Tuning > Set Comfort Tuning Parameters > Start**.

The tuning process is displayed by the progress bar. When the tuning is completed, please use the SoMove software function to save the control loop parameters to the drive EEPROM.

Adaptive Control

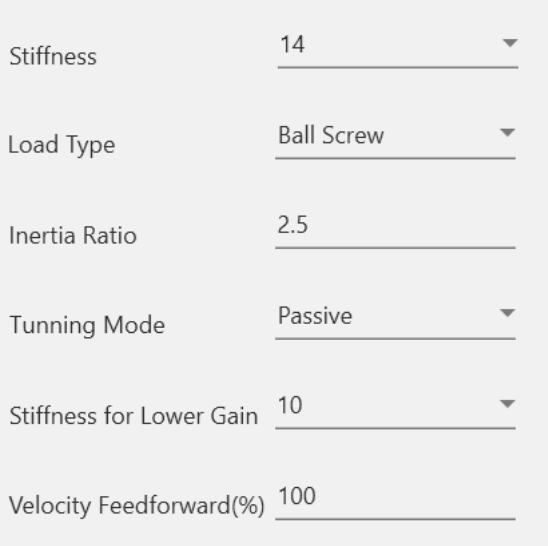
Overview

Adaptive Control will calculate the load characteristics of the system in real time according to the actual operating characteristics of the system and automatically set the appropriate control loop parameters according to the stiffness level.

Optimize the default parameters, which are consistent with the default adaptive mode.

Code	ShortLabel	Curret Value
P1-00	CTRL1_KPp	65 1/s
P1-01	CTRL1_KPn	0.042 A/(1/min)
P1-02	CTRL1_TNn	16 ms
P1-03	CTRL1_KFPp	55%
P1-04	CTRL1_TAUnref	0 ms
P1-05	CTRL1_TAUiref	0.25 ms
P1-06	CTRL1_Kfric	0 Arms
P1-07	CTRL2_KPp	65 1/s
P1-08	CTRL2_KPn	0.042 A/(1/min)
P1-09	CTRL2_TNn	16 ms
P1-10	CTRL2_KFPp	55%
P1-11	CTRL2_TAUnref	0 ms
P1-12	CTRL2_TAUiref	0.25 ms
P1-13	CTRL2_Kfric	0 Arms
P1-14	CTRL3_KPp	20 1/s
P1-15	CTRL3_KPn	0.0168 A/(1/min)
P1-16	CTRL3_TNn	40 ms
P1-17	CTRL3_TAUnref	0 ms
P1-18	CTRL3_TAUiref	0.1 ms
P1-19	RTATU_TnnUser2FRC	50 ms
P1-27	RAMP_v_jerk	0 ms
P1-28	CTRL_TAUpref	0 ms
P1-29	CTRL_SPDMOVEAVG	0 ms
P1-30	CTRL_SpdFric	5 1/min
P1-31	CTRL_TAUnact	0.1 ms
P1-39	CTRL_DYNGNSWSET	Dynamic Gain Switch Disable

Default control mode: Passive adaptive mode



3 adaptive control modes are optional via the parameter P0-01, including:

- P0-01= 1/Standard adaptive control mode
- P0-01= 2/Passive adaptive control mode
- P0-01= 3/Active adaptive control mode

Adaptive control will not drive the servo motor. When the adaptive control function is enable, it will monitor the velocity, acceleration and other operating characteristics of the load system in real time. This operating command may derive from the motion command issued from the host computer controller or the motion driven by the test run. For test run, see JOG Operation, page 145.

According to the different adaptive control modes selected via the parameter P0-01, the adaptive control can actively measure the load-to-motor inertia ratio or passively accept the load-to-motor inertia ratio input by the user. It can also actively set the appropriate stiffness level (up to 4 times) or passively accept the stiffness level selected by the user.

NOTE: When performing adaptive control, it is possible to measure an incorrect result due to fluctuations in actual load conditions. Incorrect parameters may cause unintended movements or the loss of monitoring functions. With the adjustment of control loop parameters, the system may produce noise or mechanical oscillations. Noise development and mechanical oscillations of the system are normal.

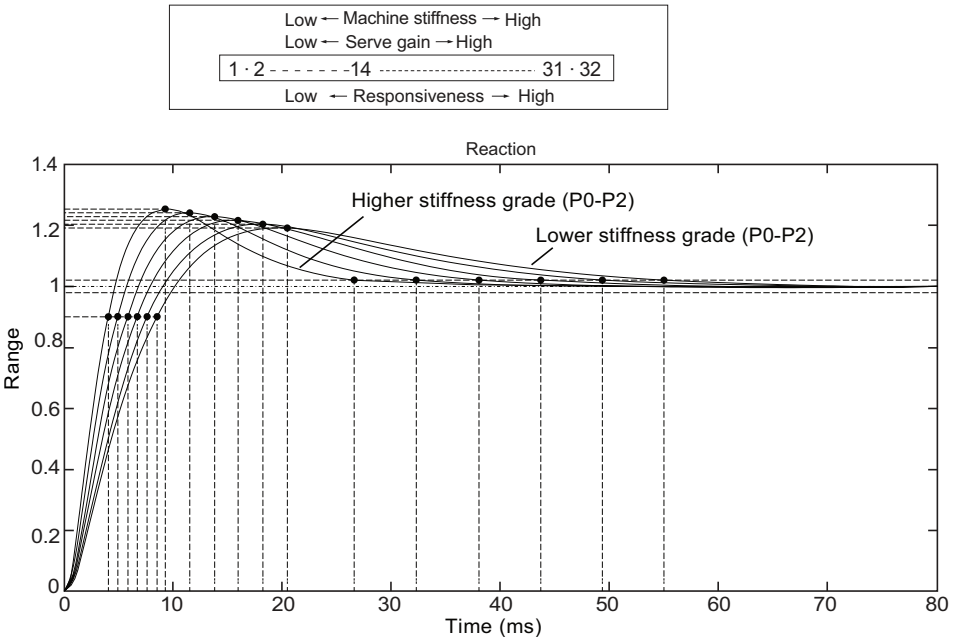
⚠WARNING

UNINTENDED EQUIPMENT OPERATION

- Start the system only if there is no person or obstruction in the zone of operation.
- Consider the travel of deceleration ramp during 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.

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

Different stiffness levels represent different levels of servo system response. As the stiffness level becomes higher, the servo system response and the servo stiffness will be higher. However, vibrations are likely to occur. When setting the stiffness, change the set value from low to high.



Service Conditions

In order to ensure the accuracy of adaptive control measurement, the motion under adaptive control must meet certain conditions.

Pay special attention when facing the following application conditions:

- Load-to-motor inertia ratio is too large (more than 30 times)
- Mechanical stiffness is extremely low
- Large backlash
- Motion velocity is less than 100 rpm
- Acceleration and deceleration of motion are less than 2000 rpm/s

Under any of the above circumstances, change the load conditions, increase the movement velocity and acceleration, or use manual gain adjustment.

NOTE: For the motors with adaptive power less than 200W, it is recommended that the movement velocity be greater than 200 rpm and the acceleration be greater than 20000 rpm if conditions permit so as to increase the accuracy of inertia identification.

Standard Adaptive Control Mode

Enable the standard adaptive control mode by setting the parameter P0-01 to “1 / Standard”. In this mode, the servo drive automatically measures the system load-to-motor inertia ratio and the system stiffness level is set manually.

Start via the HMI front panel integrated with the device:

- Start via the HMI front panel integrated with the device:
  1. Select the appropriate mechanical load type via the parameter P0-04 according to actual load type.

     Default values of four typical loads and stiffness levels:

     0 / Direct Coupling: 18

     1 / Ball Screw: 14

     2 / Belt: 10

     3 / Large Inertia: 6
  2. Set the parameter P0-01 to 1.
  3. The host computer controller sends a motion command to drive the motor, or the HMI test run function is used to drive the motor.
     a. After the motor starts and stops several times, increase or decrease the stiffness level of the system appropriately via the parameter P0-02 according to the operating state of the system, and drive the motor again.
     b. If the operating state of the system can meet the requirements, set the parameter P0-01 to 2, and disable the automatic measurement of the system load inertia ratio to prevent measuring an incorrect result due to the fluctuation in actual load conditions.
     c. Under such circumstance, the load inertia ratio can be further fine-tuned via the parameter P0-03 according to the system operating state, so that the servo system will have a better response and stability.
- Start via the SoMove software:
  1. Enter the interface **Parameter Tuning> > Automatic Adaptive Adjustment**.
  2. Select the “Adaptive Control Load Type” (P0-04) according to actual load type.
  3. Select “Standard” in “Adaptive Control Mode Selection.
  4. The motor is driven by the motion command issued from the host computer controller, or via the control panel with SoMove automatic adaptive control.
  5. After the motor starts and stops several times, increase or decrease the “Adaptive Control stiffness Level” appropriately according to the operating state of the system, and drive the motor again.
  6. If the operating state of the system can meet the requirements, select “Passive” in the “Adaptive Mode Selection”, and disable the automatic measurement of the system load inertia ratio to prevent measuring an incorrect result due to the fluctuation in the actual load conditions.
  7. Under such circumstance, the value of “Adaptive Inertia Ratio” can be further fine-tuned according to the operating state of the system, so that the servo system will have a better response and stability.

Passive Adaptive Control Mode

Enable the active passive control mode by setting the parameter P0-01 to “2/ Passive”. In this mode, you need to manually set the load-to-motor inertia ratio and stiffness level of the system.

There are two ways of starting passive adaptive control:

- Start via the HMI front panel integrated with the device:
  1. Select the appropriate mechanical load type via the parameter P0-04 according to actual load type.
  2. Set the parameter P0-01 to 2.
  3. Set the system stiffness level via the parameter P0-02 the system load-to-motor inertia ratio via the parameter P0-03
  4. The host computer controller sends a motion command to drive the motor, or the HMI test run function is used to drive the motor.
  5. Further fine-tune the parameter P0-02 and P0-03 according to the operating state of the system so that the servo system will have a better response and stability.
- Start via the SoMove software:
  1. Enter the interface **Parameter Tuning> > Automatic Adaptive Adjustment**.
  2. Select the “Adaptive Control Load Type” (P0-04) according to actual load type.
  3. Select “Passive” in the “Adaptive Control Mode Selection”.
  4. Set the values in “Adaptive Control Stiffness Level” and “Adaptive Control Inertia Ratio”.
  5. The motor is driven by the command issued from host computer controller, or via the control panel with SoMove automatic adaptive control.
  6. According to the operating state of the system, further fine-tune the values in “Adaptive Control Stiffness Level” and “Adaptive Control Inertia Ratio”, so that the servo system will have a better response and stability. Under such circumstance, the value of “Adaptive Inertia Ratio” can be further fine-tuned according to the operating state of the system, so that the servo system will have a better response and stability.

Active Adaptive Control Mode

Enable the active adaptive control mode by setting the parameter P0-01 to “3 / Adaptive”. In this mode, the servo drive automatically measures the system load-to-motor inertia ratio and tries to automatically set the optimal system stiffness level (up to 4 times).

There are two ways of starting active adaptive control:

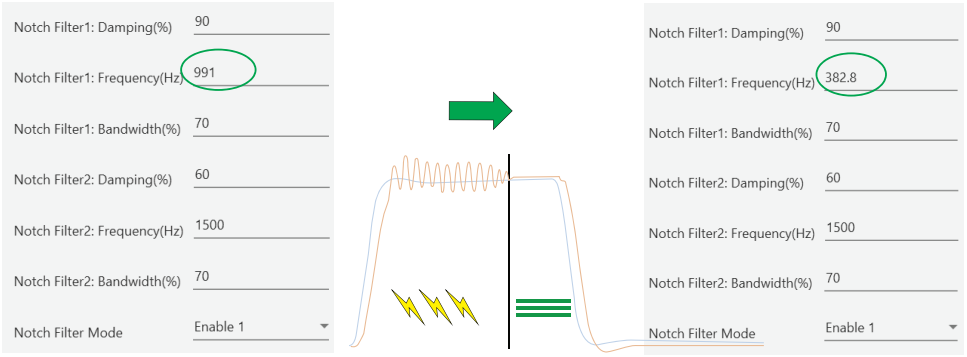
- Start via the HMI front panel integrated with the device:
  1. Select the appropriate mechanical load type via the parameter P0-04 according to actual load type.
  2. Set the parameter P0-01 to 3.
  3. Open the parameter P0-02 and observe the system stiffness level.
  4. The host computer controller sends a motion command to drive the motor, or the HMI test run function is used to drive the motor.
  5. After the motor starts and stops several times, observe the change of the parameter P0-02. Active adaptive control will try to gradually increase the system stiffness level according to the system operating state, and find out the most suitable system stiffness level. After finding out the most suitable system stiffness level, the parameter P0-01 will be set to “1/ Standard”. Active adaptive control increases the system stiffness by up to 4 levels.
  6. If the operating state of the system can meet the requirements, set the parameter P0-01 to 2, and disable the automatic measurement of the system load inertia ratio to prevent measuring an incorrect result due to the fluctuation in actual load conditions.
  7. Under such circumstance, the load inertia ratio can be further fine-tuned via the parameter P0-03 according to the system operating state, so that the servo system will have a better response and stability.
- Start via the SoMove software:
  1. Enter the interface **Parameter Tuning> > Automatic Adaptive Adjustment**.
  2. Select the “Adaptive Control Load Type” (P0-04) according to actual load type.
  3. Select “Adaptive” in the “Adaptive Control Mode Selection”.
  4. The motor is driven by the motion command issued from the host computer controller, or via the control panel with SoMove automatic adaptive control.
  5. After the motor starts and stops several times, observe the changes of the values in “Adaptive Control Stiffness Level” and “Adaptive Inertia Ratio”. Active adaptive control will try to gradually increase the system stiffness level according to the system operating state, and find out the most suitable system stiffness level. After finding out the most suitable system stiffness level, “Adaptive Control Mode Selection” will be set to “Standard”. Active adaptive control increases the system stiffness by up to 4 levels.
  6. If the operating state of the system can meet the requirements, select “Passive” in the “Adaptive Mode Selection”, and disable the automatic measurement of the system load inertia ratio to prevent measuring an incorrect result due to the fluctuation in the actual load conditions.
  7. Under such circumstance, the value of “Adaptive Inertia Ratio” can be further fine-tuned according to the operating state of the system, so that the servo system will have a better response and stability.

Adaptive Notch Filter

Overview

Due to the mechanical load characteristics, high-order vibration components are often superimposed in actual motion, which will produce mechanical resonance and cause jitter and noise during the system operation. In practical applications, notch filters can be used to reduce the resonance of the resonance frequency point and improve the stable bandwidth of the system.

The adaptive notch filter can reduce the resonance point by analyzing the vibration component in the motor velocity, automatically infer the resonance frequency point, and automatically set the notch filter parameters for the resonance component.



Operation Method

Lexium 18E servo drive supports two groups of adaptive notch filters, and the adaptive notch filter mode is selected via the parameter P2-00, and one group or two groups of adaptive notch filters can be activated at the same time.

When the resonance point is shown on the motor velocity, the servo drive will set the filter parameters according to the number of adaptive notch filters. If an offset occurs to the resonance point during motion, the servo drive automatically updates the filter parameters, thus adapting to the detected new resonance point. The adaptive notch filter parameters automatically detected by the servo drive are stored in the servo drive memory.

If the values of these parameters are not saved in the drive EEPROM, these parameters will be restored to the default values after the servo drive is restarted.

In particular, the servo drive will save the parameters of the servo drive into EEPROM every half hour:

- The servo drive will save the adaptive notch filter parameters at certain intervals to prevent these parameters from any failure after the drive is restarted
- If the system detects an incorrect resonance frequency point unexpectedly, causing the system to lose control, the user should immediately restart the servo drive to restore the adaptive notch filter parameters to the last saved values
- If you want to save manually through the HMI, you can select the parameter P2-02 to make it in the editing state, and then press and hold the S key to save the parameter afterwards.

P2-00	*RTATU_ANotchMode*	Minimum value	0	Unit	–	Persistence	per.
		Factory setting	0	Data type	UINT16	MODBUS	5390
		Maximum value	3	Access	R/W	EtherCAT	3015:07$_h$

Description:

Selection of adaptive notch filter mode

0 / Invalid: Automatic notch filter is not automatically set, and the parameters of the adaptive notch filter remain unchanged.

1 / Enable 1: Enable adaptive notch filter 1.

2 / Enable 2: Enable adaptive notch filters 1 and 2.

3 / Reset: Reset adaptive notch filters 1 and 2.

Modified settings become active immediately.

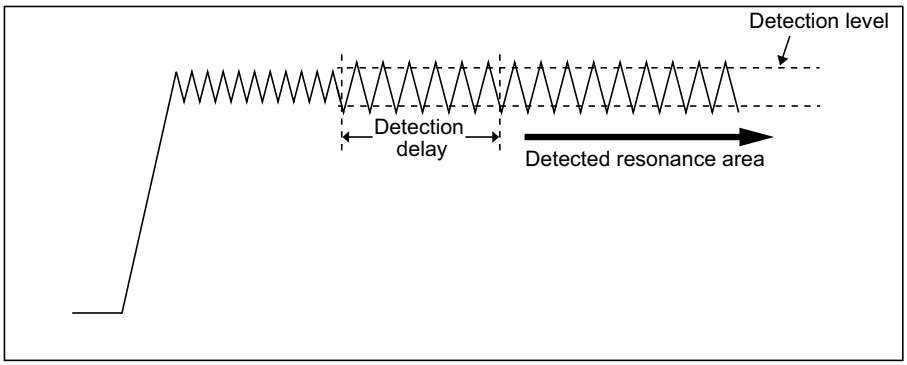
Resonance Detection Parameter Settings

The detection criterion of resonance points by adaptive notch filters can be set via the related parameters.

When the actual velocity vibration amplitude of the motor exceeds the vibration amplitude detection criteria and this situation continues for a certain period of time, resonance occurs.

There are two parameters in the detection criteria of resonance point, including the amplitude of vibration and the duration of vibration:

- Set the detection threshold of the vibration amplitude via the parameter P2-24.
- Set the detection threshold of the vibration duration via the parameter P2-25.



P2-24	*RTATU_VibDetLevel*	Minimum value	0	Unit	usr_v	Persistence	per.
		Factory setting	20	Data type	UINT16	MODBUS	5394
		Maximum value	100	Access	R/W	EtherCAT	3015:09$_h$

Description:

Vibration Detection Level

Modified settings become active immediately.

P2-25	*RTATU_VibDetTmDly*	Minimum value	0	Unit	0.1 ms	Persistence	per.
		Factory setting	100	Data type	UINT16	MODBUS	5396
		Maximum value	1000	Access	R/W	EtherCAT	3015:10$_h$

Description:

Vibration Detection Time Delay

Modified settings become active immediately.

Three Steps for Servo Commissioning

–	Parameter SN (LXM18E)	Parameter name	Adaptive parameters (Default value)
Key adaptive parameters	P0-01	Adaptive mode selection	2
	P0-02	Adaptive stiffness level	14
	P0-03	Adaptive inertia ratio	2.5
	P2-00	Automatic notch filter mode selection	0
	P0-05	Adaptive control mode selection	0
	P1-39	Adaptive stiffness switch: Adaptive stiffness switch mode	0
Key adaptive parameters	P1-03	Control parameter set 1: Velocity loop feed-forward gain	55
	P1-22	Time constant of velocity feed-forward filter	0
	P1-27	Time constant of the position command averaging filter	0
	P1-28	Time constant of the position loop command low-pass filter	0
	P1-19	Adaptive parameter integral action time 2	50
	P1-31	Filter time constant to smooth velocity of motor	0.1
	P1-23	Acceleration feed-forward control	0
Manually adjusted key PID parameters	P1-00	Control parameter set 1: Position controller P gain.	-
	P1-01	Control parameter set 1: Velocity controller P gain	-
	P1-02	Control parameter set 1: Velocity controller integral action time.	-
	P1-04	Control parameter set 1: Time constant of velocity loop command filter	0
	P1-05	Control parameter set 1: Time constants of the current loop command filter	0.1

Step 1: 4 most basic adaptive parameters

Mode selection (P0-01), stiffness level (P0-02), inertia ratio (P0-03) and automatic notch filter mode (P2-00)

Step 2: 4 feed-forward and filter parameters

Velocity loop feed-forward (P1-03), Time constant of velocity feed-forward filter (P1-22), Time constant of position command averaging filter (P1-27) and Time constant of the position loop command low-pass filter (P1-28)

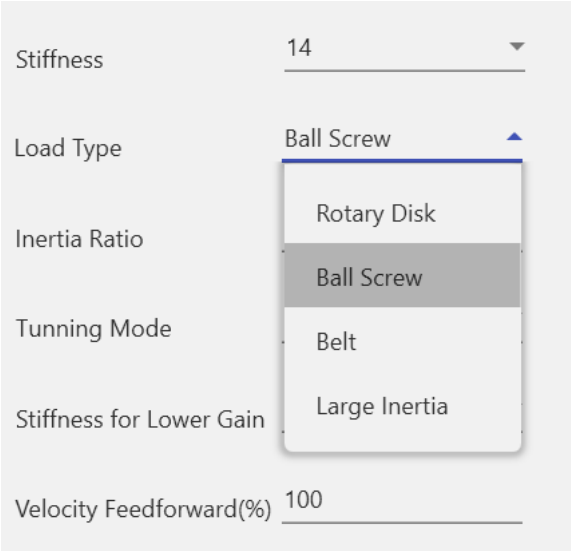
Step 3: 5 other key parameters

Adaptive control mode selection (P0-05), Adaptive stiffness switch: adaptive gain switch mode (P1-39), adaptive parameter integral action time 2 (P1-19), filter time constant to smooth velocity of motor (P1-31), acceleration feed-forward control (P1-23)

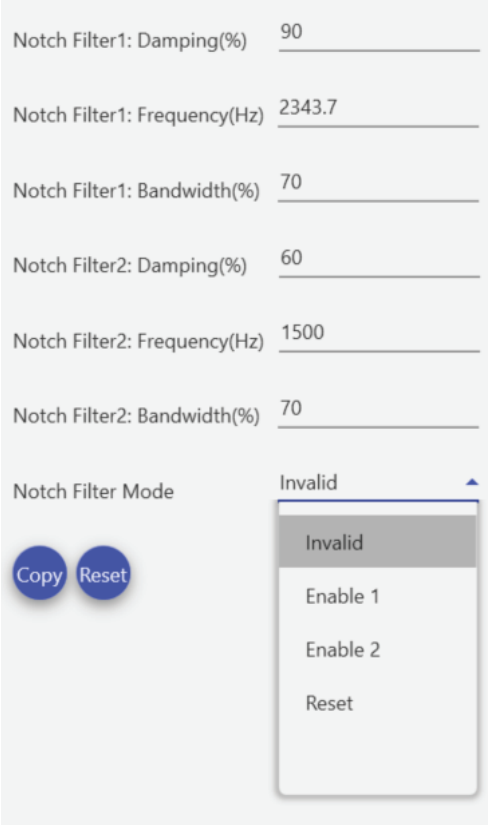
Step 1: The 4 most basic adaptive parameters

Mode selection (P0-01), stiffness level (P0-02), inertia ratio (P0-03) and automatic notch filter mode (P2-00)

- Adaptive Mode Step 1: Select load type (P0-01) and stiffness (P0-02)



- Adaptive Mode Step 2: Enable resonance suppression (P2-00)



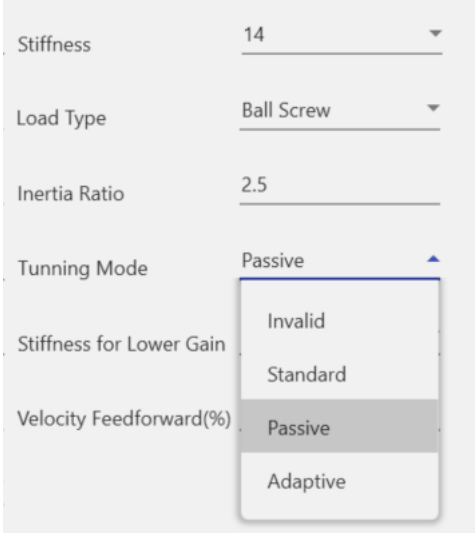
0 / Invalid: Automatic notch filter is not automatically set, and the parameters of the adaptive notch filter remain unchanged.

1 / Enable 1: Enable adaptive notch filter 1.

2 / Enable 2: Enable adaptive notch filters 1 and 2.

3 / Reset: Reset adaptive notch filters 1 and 2.

- Adaptive Mode Step 3: Select adaptive mode (P0-01)



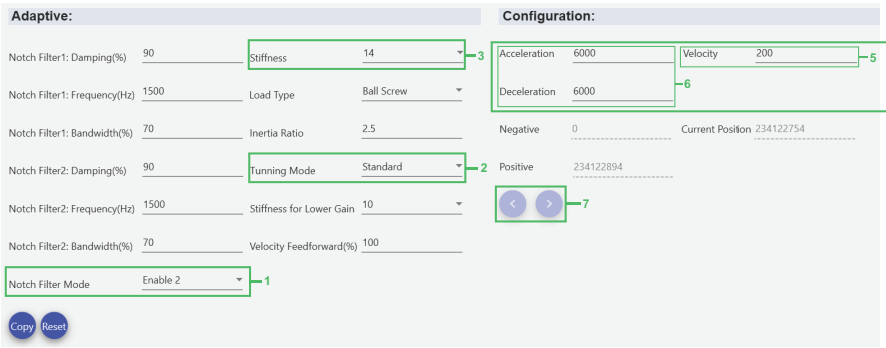
0 / Invalid: The adaptive operating mode is invalid and the serial PID control loop parameters via the parameter set P1 are used.

1 / Standard: In the standard adaptive operating mode, the servo drive automatically measures the system inertia ratio, the stiffness level is set manually, and adaptive control loop parameters are used.

2 / Passive: In the passive adaptive operating mode, the system inertia ratio and the stiffness level are set manually, and adaptive control loop parameters are used.

3 / Adaptive: In the active adaptive operating mode, the servo drive automatically measures the system inertia ratio, and tries to automatically set the best stiffness level (increase up to 4 stiffness levels); adaptive control loop parameters are used.

- Adaptive Mode Step 4: Test run (SoMove or your host computer)



4. Set test run conditions, velocity and acceleration&deceleration

5. Velocity > 100 rpm

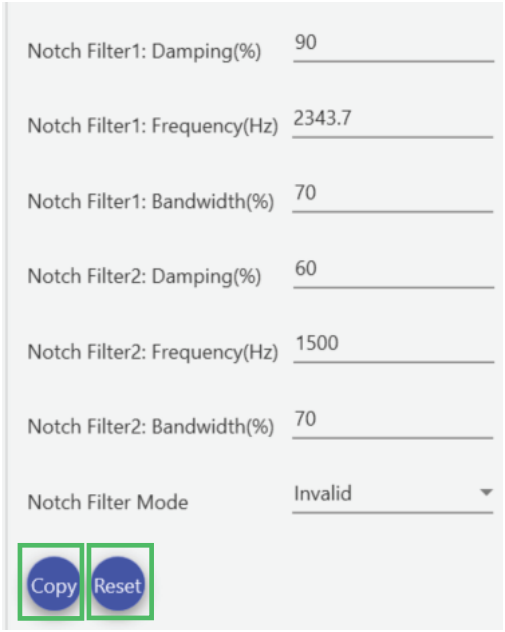
6. 1500 rpm/s < acceleration < (30000 rpm/s)

7. Operate several times (at least twice)

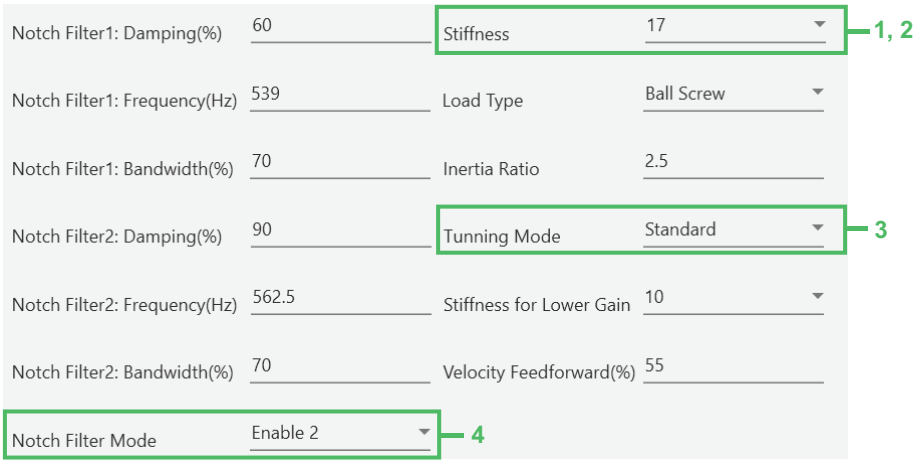
8. Independent identification in positive and negative directions; in most cases, operate to one direction several times

- Adaptive Mode Step 5: Parameter mapping

	Parameter	Designation	Current value
Control parameter set 1	P1-00	CTRL1_KPp	120 1/s
	P1-01	CTRL1_KPn	0.1404 A/(1/min)
	P1-02	CTRL1_TNn	11 ms
	P1-03	CTRL1_KFPp	55%
	P1-04	CTRL1_TAUnref	0 ms
	P1-05	CTRL1_TAUiref	0.1 ms
	P1-06	CTRL1_Kfric	0 Arms
Control parameter set 2	P1-07	CTRL2_KPp	65 1/s
	P1-08	CTRL2_KPn	0.042 A/(1/min)
	P1-09	CTRL2_TNn	16 ms
	P1-10	CTRL2_KFPp	55%
	P1-11	CTRL2_TAUnref	0 ms
	P1-12	CTRL2_TAUiref	0.25 ms
	P1-13	CTRL2_Kfric	0 Arms
Other key control parameters	P1-14	CTRL3_KPp	20 1/s
	P1-15	CTRL3_KPn	0.0315 A/(1/min)
	P1-16	CTRL3_TNn	40 ms
	P1-17	CTRL3_TAUnref	0 ms
	P1-18	CTRL3_TAUiref	0.1 ms
	P1-19	RTATU_TnnUser2FRC	50 ms
	P1-27	RAMP_v_jerk	0 ms
	P1-28	CTRL_TAUpref	0 ms
	P1-29	CTRL_SPDMOVEAVG	0 ms
	P1-30	CTRL_SpdFric	5 1/min
	P1-31	CTRL_TAUnact	0.1 ms
	P1-39	CTRL_DYNGNSWSET	Dynamic Gain Switch Disable



- Adaptive Mode Step 6: End



1. Manually increase or decrease stiffness
2. Observe the waveform, processing effect and machine condition, and adjust to the appropriate stiffness; in most cases, the stiffness of the machine micro-vibration is reduced by 1 level
3. Change the adaptive mode to the passive mode
4. Disable the automatic vibration suppression function

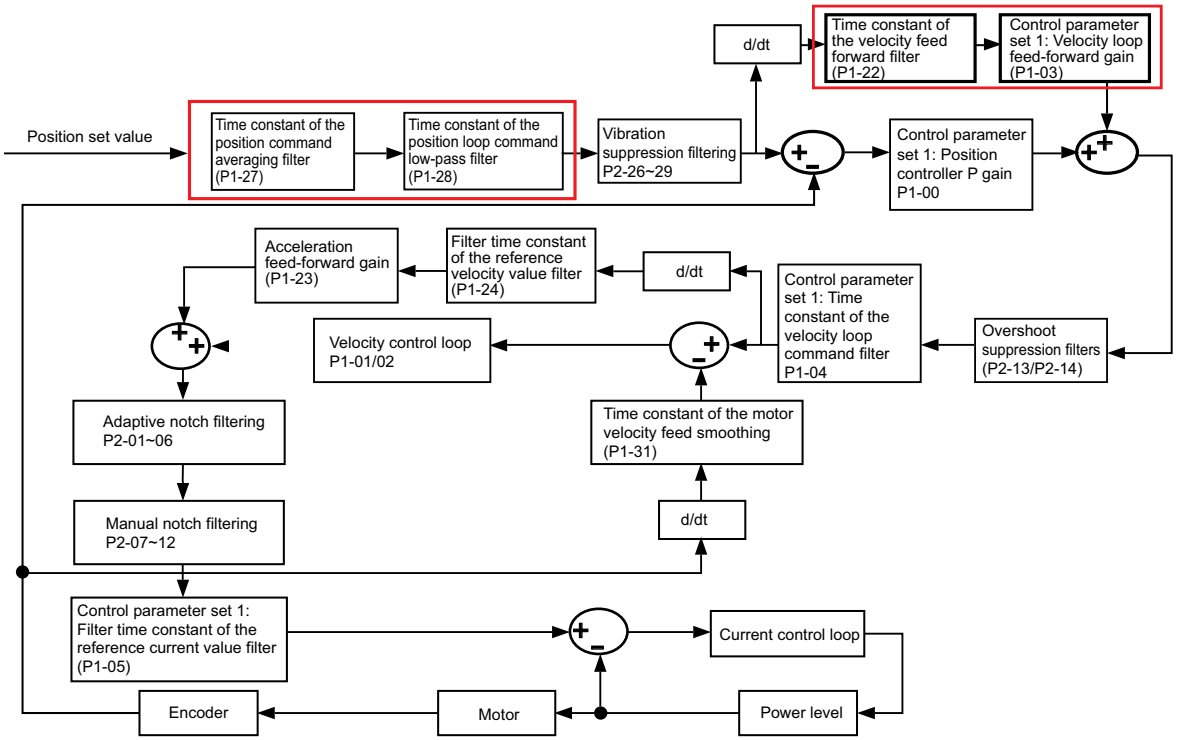
NOTE: It is recommended to reset the automatic vibration suppression function at the new stiffness level and then identify the stiffness again

Step 2: 4 key feed-forward and filter parameters

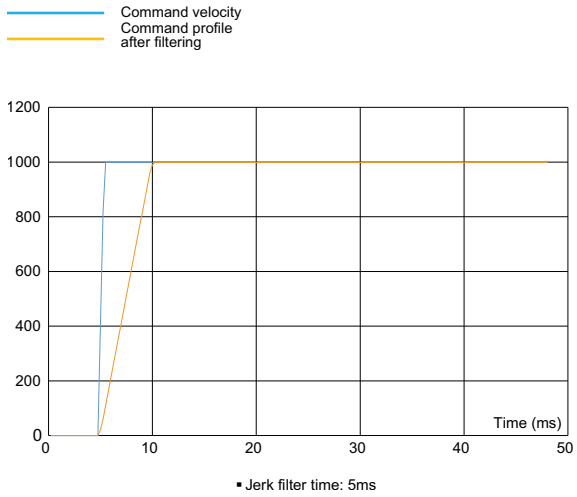
Control parameter set 1: Velocity loop feed-forward (P1-03), Time constant of velocity feed-forward filter (P1-22), Time constant of position command averaging filter (P1-27) and Time constant of the position loop command low-pass filter (P1-28)

Key feed-forward and filter parameters

Functional block diagram

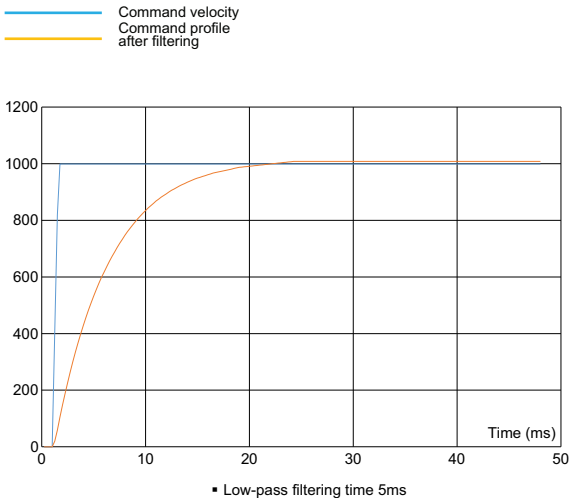


Time constant of position command averaging filter **P1-27**



▪ Jerk filter time: 5ms

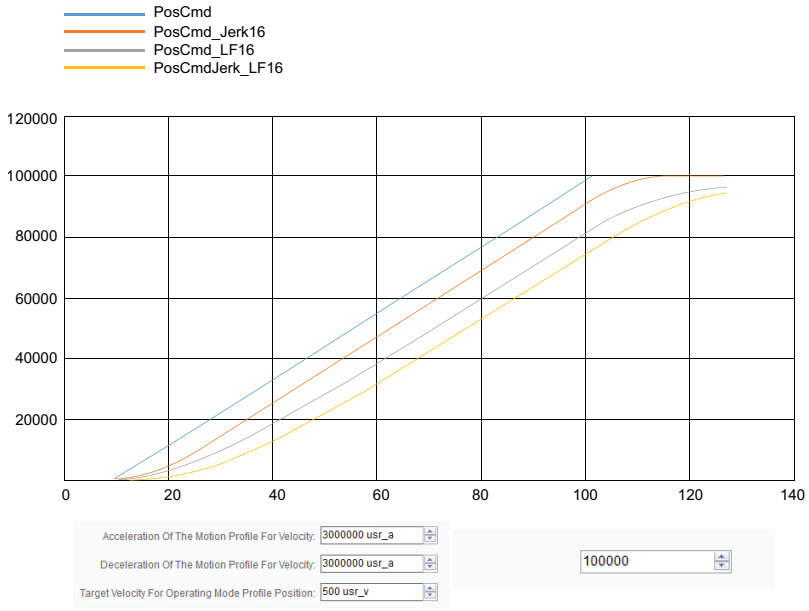
Time constant of the position loop command low-pass filter **P1-28**



▪ Low-pass filtering time 5ms

Filter effect: Time constant of position command averaging filter (P1-27) + Time constant of the position loop command low-pass filter (P1-28)

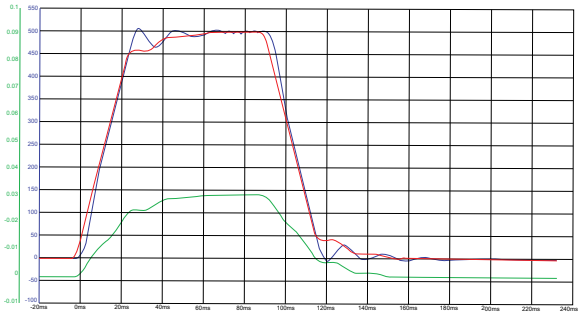
PosCmd	Position command
PosCmd_Jerk16	Position command + P1-27
PosCmd_LF16	Position command + P1-28
PosCmdJerk+LF16	Position command + P1-27 + P1-28



Time constant of position command averaging filter P1-27

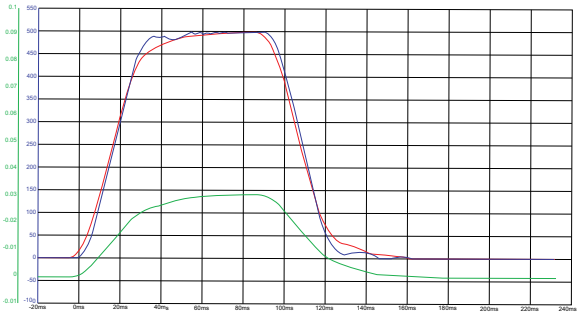
Command velocity
Actual velocity
Position error

Jerk filter (P1-27)	0
Low-pass filter (P1-28)	0
Velocity loop feed-forward (P1-03)	55%
Velocity loop feed-forward filter (P1-22)	0



P1-22	CTRL_TAUSPDFFD	0 ms
P1-23	CTRL_KFAcc	0 %
P1-24	CTRL_TAUACCFFD	0 ms
P1-25	CTRL_KFLoad	0 %
P1-27	RAMP_v_jerk	0 ms
P1-28	CTRL_TAUpref	0 ms
P1-29	CTRL_SPDMOVEAVG	0 ms
P1-30	CTRL_SpdFric	5.1/min
P1-31	CTRL_TAUnact	0.1 ms

Jerk filter (P1-27)	16 ms
Low-pass filter (P1-28)	0
Velocity loop feed-forward (P1-03)	55%
Velocity loop feed-forward filter (P1–22)	0

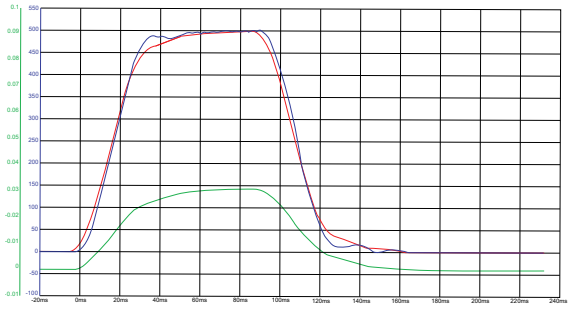


P1-22	CTRL_TAUSPDFFD	0 ms
P1-23	CTRL_KFAcc	0 %
P1-24	CTRL_TAUACCFFD	0 ms
P1-25	CTRL_KFLoad	0 %
P1-27	RAMP_v_jerk	16 ms
P1-28	CTRL_TAUpref	0 ms
P1-29	CTRL_SPDMOVEAVG	0 ms
P1-30	CTRL_SpdFric	5.1/min
P1-31	CTRL_TAUnact	0.1 ms

Time constant of position command averaging filter P1-27

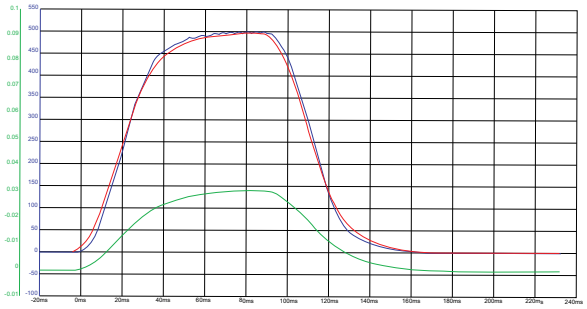
Command velocity
Actual velocity
Position error

Jerk filter (P1-27)	16 ms
Low-pass filter (P1-28)	0
Velocity loop feed-forward (P1-03)	55%
Velocity loop feed-forward filter (P1–22)	0



P1-22	CTRL_TAUSPDFFD	0 ms
P1-23	CTRL_KFAcc	0 %
P1-24	CTRL_TAUACCFFD	0 ms
P1-25	CTRL_KFLoad	0 %
P1-27	RAMP_v_jerk	16 ms
P1-28	CTRL_TAUpref	0 ms
P1-29	CTRL_SPDMOVEAVG	0 ms
P1-30	CTRL_SpdFric	5.1/min
P1-31	CTRL_TAUnact	0.1 ms

Jerk filter (P1-27)	16 ms
Low-pass filter (P1-28)	8 ms
Velocity loop feed-forward (P1-03)	55%
Velocity loop feed-forward filter (P1–22)	0

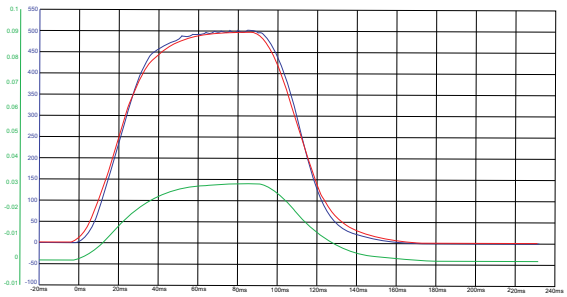


P1-22	CTRL_TAUSPDFFD	0 ms
P1-23	CTRL_KFAcc	0 %
P1-24	CTRL_TAUACCFFD	0 ms
P1-25	CTRL_KFLoad	0 %
P1-27	RAMP_v_jerk	16 ms
P1-28	CTRL_TAUpref	8 ms
P1-29	CTRL_SPDMOVEAVG	0 ms
P1-30	CTRL_SpdFric	5.1/min
P1-31	CTRL_TAUnact	0.1 ms

Velocity loop feed-forward effect: P1-03

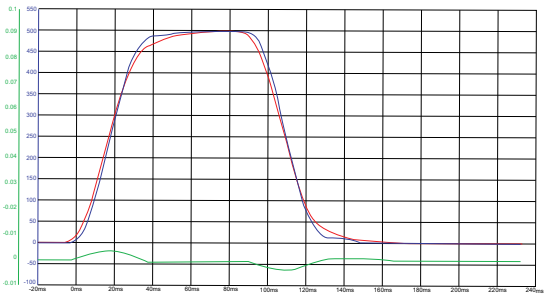
Command velocity
Actual velocity
Position error

Jerk filter (P1-27)	16 ms
Low-pass filter (P1-28)	8 ms
Velocity loop feed-forward (P1-03)	55%
Velocity loop feed-forward filter (P1–22)	0



P1-03	CTRL_KFPp	55 %
P1-22	CTRL_TAUSPDFFD	0 ms
P1-23	CTRL_KFAcc	0 %
P1-24	CTRL_TAUACCFFD	0 ms
P1-25	CTRL_KFLoad	0 %
P1-27	RAMP_v_jerk	16 ms
P1-28	CTRL_TAUpref	8 ms
P1-29	CTRL_SPDMOVEAVG	0 ms
P1-30	CTRL_SpdFric	5.1/min
P1-31	CTRL_TAUnact	0.1 ms

Jerk filter (P1-27)	16 ms
Low-pass filter (P1-28)	8 ms
Velocity loop feed-forward (P1-03)	100%
Velocity loop feed-forward filter (P1–22)	0

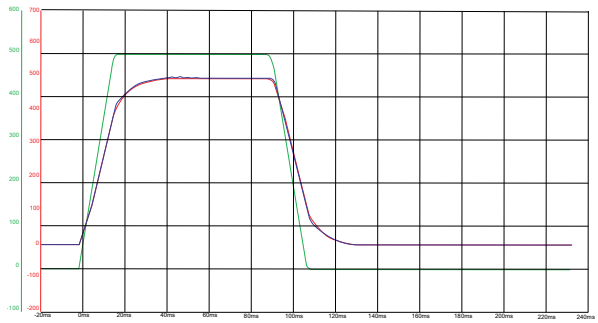


P1-03	CTRL_KFPp	100%
P1-22	CTRL_TAUSPDFFD	0 ms
P1-23	CTRL_KFAcc	0 %
P1-24	CTRL_TAUACCFFD	0 ms
P1-25	CTRL_KFLoad	0 %
P1-27	RAMP_v_jerk	16 ms
P1-28	CTRL_TAUpref	8 ms
P1-29	CTRL_SPDMOVEAVG	0 ms
P1-30	CTRL_SpdFric	5.1/min
P1-31	CTRL_TAUnact	0.1 ms

Time constant of velocity loop feed-forward filter P1-22

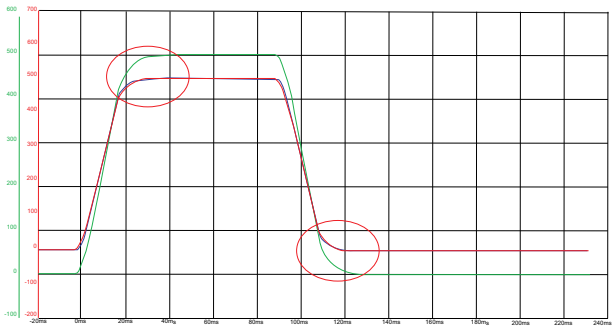
Command velocity
Actual velocity
Position error

Jerk filter (P1-27)	0
Low-pass filter (P1-28)	0
Velocity loop feed-forward (P1-03)	70%
Velocity loop feed-forward filter (P1–22)	0



P1-22	CTRL_TAUSPDFFD	0 ms
P1-23	CTRL_KFAcc	100 %
P1-24	CTRL_TAUACCFFD	0 ms
P1-25	CTRL_KFLoad	0 %
P1-27	RAMP_v_jerk	0 ms
P1-28	CTRL_TAUpref	0 ms
P1-29	CTRL_SPDMOVEAVG	0 ms

Jerk filter (P1-27)	0
Low-pass filter (P1-28)	0
Velocity loop feed-forward (P1-03)	70%
Velocity loop feed-forward filter (P1–22)	5 ms

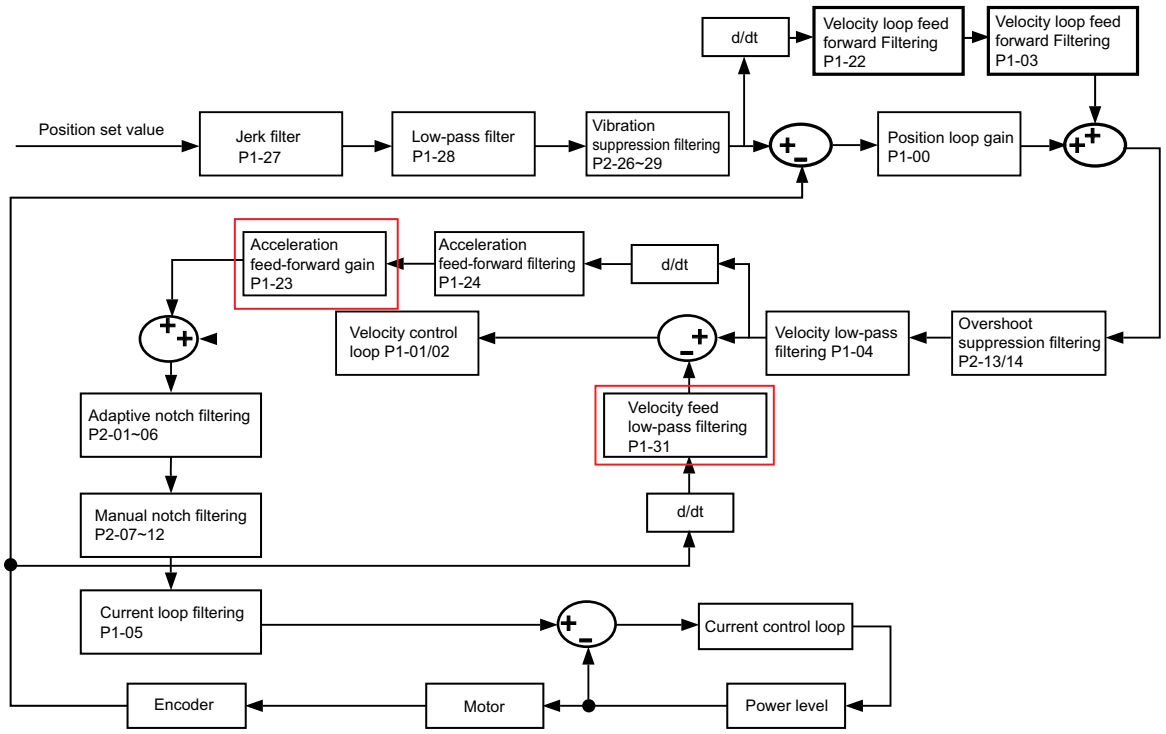


P1-22	CTRL_TAUSPDFFD	5 ms
P1-23	CTRL_KFAcc	100 %
P1-24	CTRL_TAUACCFFD	0 ms
P1-25	CTRL_KFLoad	0 %
P1-27	RAMP_v_jerk	0 ms
P1-28	CTRL_TAUpref	0 ms
P1-29	CTRL_SPDMOVEAVG	0 ms
P1-30	CTRL_SpdFric	5.1/min
P1-31	CTRL_TAUnact	0.1 ms

Step 3: 5 other key parameters

Adaptive control mode selection (P0-05), Adaptive stiffness switch: adaptive gain switch mode (P1-39), adaptive parameter integral action time 2 (P1-19), filter time constant to smooth velocity of motor (P1-31), acceleration feed-forward control (P1-23)

Functional block diagram

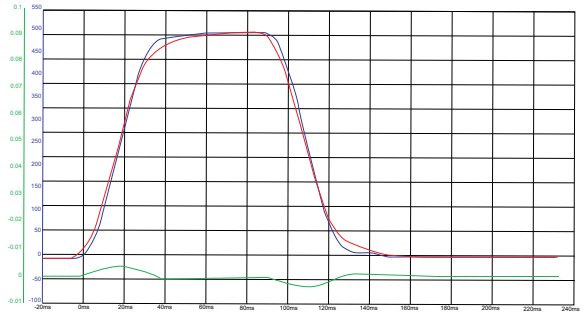


Acceleration feed-forward control P1-23

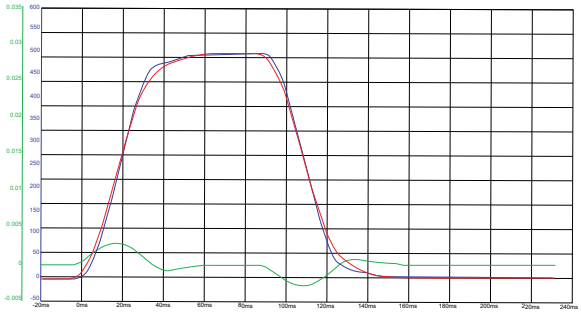
Command velocity
Actual velocity
Position error

Jerk filter (P1-27)	16 ms
Low-pass filter (P1-28)	8 ms
Velocity loop feed-forward (P1-03)	100%
Velocity loop feed-forward filter (P1–22)	0
Acceleration feed-forward (P1-23)	0

Jerk filter (P1-27)	16 ms
Low-pass filter (P1-28)	8 ms
Velocity loop feed-forward (P1-03)	100%
Velocity loop feed-forward filter (P1–22)	0
Acceleration feed-forward (P1-23)	50%



P1-22	CTRL_TAUSPDFFD	0 ms
P1-23	CTRL_KFAcc	0 %
P1-24	CTRL_TAUACCFFD	0 ms
P1-25	CTRL_KFLoad	0 %
P1-27	RAMP_v_jerk	16 ms
P1-28	CTRL_TAUpref	8 ms
P1-29	CTRL_SPDMOVEAVG	0 ms
P1-30	CTRL_SpdFric	5.1/min
P1-31	CTRL_TAUnact	0.1 ms



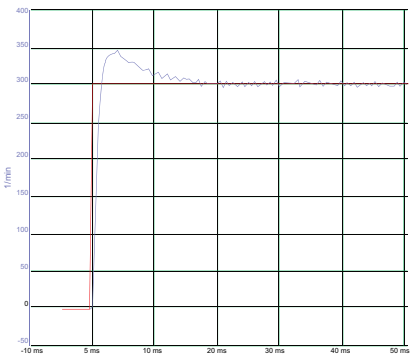
P1-22	CTRL_TAUSPDFFD	0 ms
P1-23	CTRL_KFAcc	50 %
P1-24	CTRL_TAUACCFFD	0 ms
P1-25	CTRL_KFLoad	0 %
P1-27	RAMP_v_jerk	16 ms
P1-28	CTRL_TAUpref	8 ms
P1-29	CTRL_SPDMOVEAVG	0 ms
P1-30	CTRL_SpdFric	5.1/min
P1-31	CTRL_TAUnact	0.1 ms

Filter time constant to smooth velocity of motor: P1-31

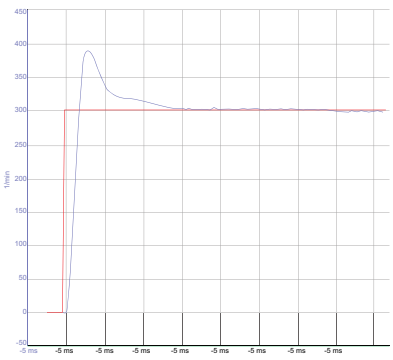


P1-19	RTATU_TnnUser2FRC	0 ms
P1-22	CTRL_TAUSPDFFD	0 ms
P1-23	CTRL_KFAcc	0 %
P1-24	CTRL_TAUACCFFD	0 ms
P1-25	CTRL_KFLoad	0 %
P1-27	RAMP_v_jerk	16 ms
P1-28	CTRL_TAUpref	0 ms
P1-29	CTRL_SPDMOVEAVG	0 ms
P1-30	CTRL_SpdFric	5.1/min
P1-31	CTRL_TAUnact	0.1 ms

Velocity feed filtering (P1-31) = 0.1ms



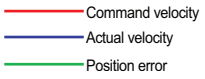
Velocity feed filtering (P1-31) = 0.38ms



P1-31	Tr(ms)	Tp(ms)	Ts(ms)	P.O(%)	Ripple
0.38 ms	1.25	2.75	12.5	29.67	(0,3)
0.1ms	1.25	4.25	12.5	15.33	(-3,5)

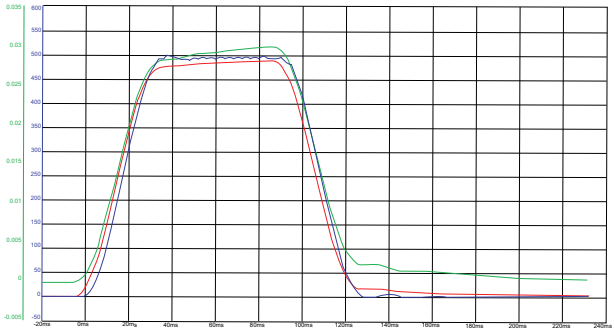
The velocity feedback filtering time constant smooths the velocity feedback filtering signal and filters out high-frequency components. The larger the filtering time constant, the smaller the velocity ripple, but the system's response bandwidth becomes narrower, which may cause system instability and machine vibration. Conversely, the smaller the filtering time constant, the larger the velocity ripple, but the system can achieve faster response performance and improve processing efficiency. Therefore, in practical servo debugging, the filtering time constant can be adjusted according to the requirements of the processing system, usually between 0 and 0.5 ms.

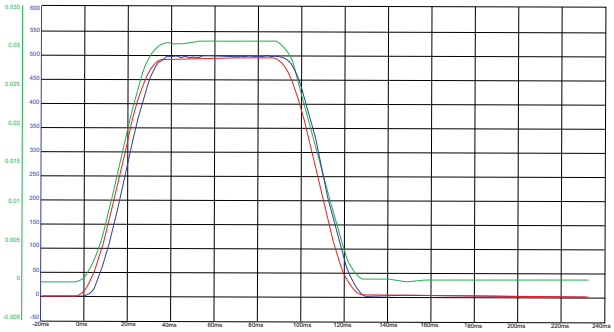
High positioning mode (large integral mode): Adaptive control mode selection P0-05 + adaptive parameter integral action time 2 P1-19



Jerk filter (P1-27)	16 ms
Low-pass filter (P1-28)	0ms
Velocity loop feed-forward (P1-03)	55%
Velocity loop feed-forward filter (P1–22)	0
Stiffness scale mode (P0-05)	1
Stiffness scale II integral time (P1-19)	50 ms

Jerk filter (P1-27)	16 ms
Low-pass filter (P1-28)	0 ms
Velocity loop feed-forward (P1-03)	55%
Velocity loop feed-forward filter (P1–22)	0
Stiffness scale mode (P0-05)	1
Stiffness scale II integral time (P1-19)	300 ms





P1-19	RTATU_TnnUser2FRC	50 ms
P1-22	CTRL_TAUSPDFFD	0 ms
P1-23	CTRL_KFAcc	0 %
P1-24	CTRL_TAUACCFFD	0 ms
P1-25	CTRL_KFLoad	0 %
P1-27	RAMP_v_jerk	16 ms
P1-28	CTRL_TAUpref	0 ms
P1-29	CTRL_SPDMOVEAVG	0 ms
P1-30	CTRL_SpdFric	5.1/min
P1-31	CTRL_TAUnact	0.1 ms

P1-19	RTATU_TnnUser2FRC	50 ms
P1-22	CTRL_TAUSPDFFD	0 ms
P1-23	CTRL_KFAcc	0 %
P1-24	CTRL_TAUACCFFD	0 ms
P1-25	CTRL_KFLoad	0 %
P1-27	RAMP_v_jerk	16 ms
P1-28	CTRL_TAUpref	0 ms
P1-29	CTRL_SPDMOVEAVG	0 ms
P1-30	CTRL_SpdFric	5.1/min
P1-31	CTRL_TAUnact	0.1 ms

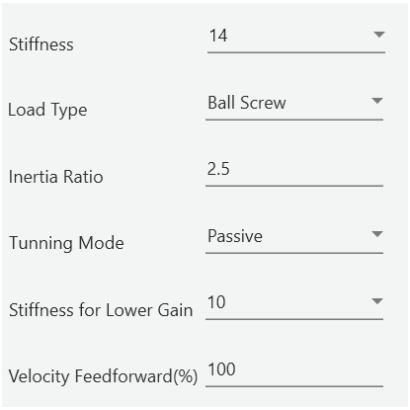
Adaptive stiffness switching: Adaptive stiffness switching mode: P1-39

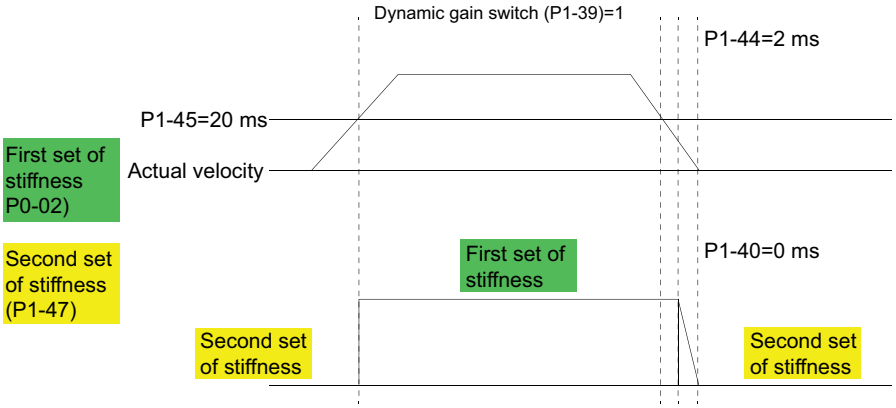
Two application scenarios

- The machine generates micro-vibrations under static conditions. Reduce the 2nd group of stiffness to eliminate oscillation
- The 1st stiffness scale adopts the large integral mode. In order to eliminate the accumulated error at a standstill, the 2nd group stiffness scale adopts the normal stiffness scale

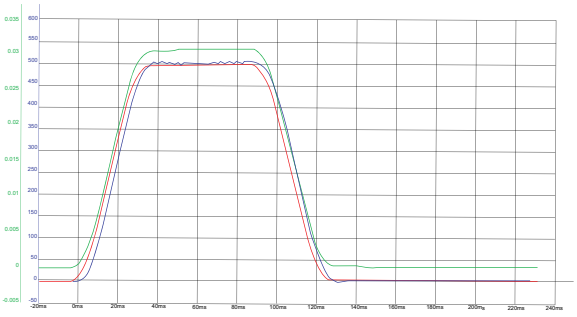
  NOTE: In a servo control system, stiffness refers to the system's ability to respond to input signals Specifically, stiffness is defined as the ability of the system to quickly and accurately respond to commands and maintain stable operation This means that the system can quickly adapt to different loads and disturbances and control the output in a stable manner.

Stiffness is related to the parameters of the servo driver. For LXM18E, a set of parameters related to servo response, represented by a number X, is called stiffness X. LXM18E provides 32 sets of standard stiffness, with each set corresponding to the combination of the position loop gain P1-00, velocity loop gain P1-01, velocity loop integration time P1-02 and current loop filtering P1-05.

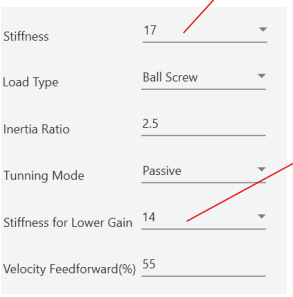


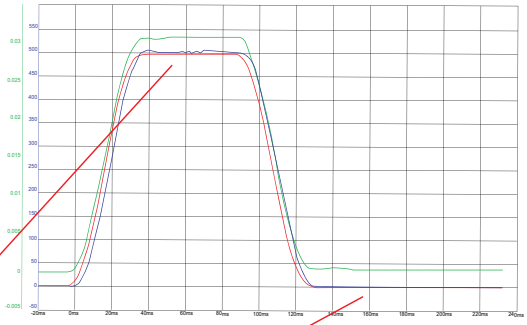


Dynamic gain and high positioning mode (large integral mode):



P1-19	RTATU_TnnUser2FRC	300 ms
P1-22	CTRL_TAUSPDFFD	0 ms
P1-23	CTRL_KFAcc	0 %
P1-24	CTRL_TAUACCFFD	0 ms
P1-25	CTRL_KFLoad	0 %
P1-27	RAMP_v_jerk	16 ms
P1-28	CTRL_TAUpref	0 ms
P1-29	CTRL_SPDMOVEAVG	0 ms
P1-30	CTRL_SpdFric	5.1/min
P1-31	CTRL_TAUnact	0.1 ms





P1-19	RTATU_TnnUser2FRC	300 ms
P1-22	CTRL_TAUSPDFFD	0 ms
P1-23	CTRL_KFAcc	0 %
P1-24	CTRL_TAUACCFFD	0 ms
P1-25	CTRL_KFLoad	0 %
P1-27	RAMP_v_jerk	16 ms
P1-28	CTRL_TAUpref	0 ms
P1-29	CTRL_SPDMOVEAVG	0 ms
P1-30	CTRL_SpdFric	5.1/min
P1-31	CTRL_TAUnact	0.1 ms

Manual Gain Adjustment (Basic)

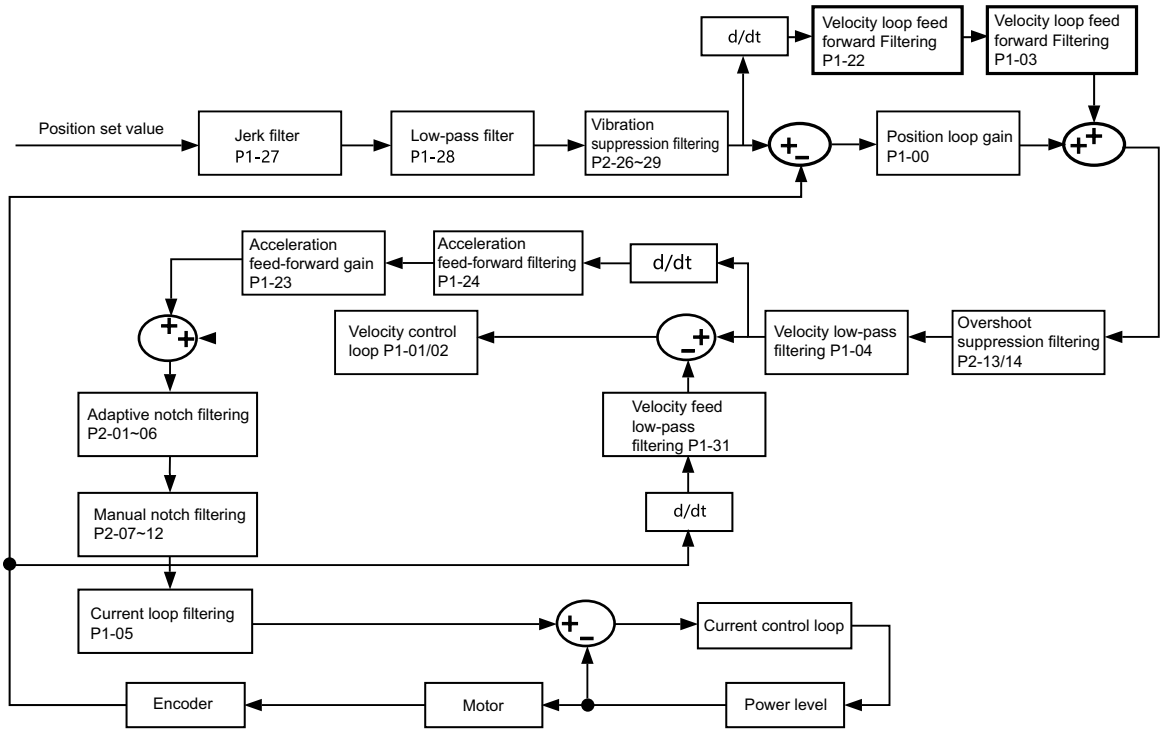
Overview

Lexium 18E has an effective function of automatic control loop parameter adjustment. However, limited by the actual load and other conditions, the operation of Autotuning function cannot effectively adjust the control loop parameters, or it is hoped that the servo system can have a better response and stability. Under such circumstance, you need to readjust the control loop parameters via manual gain adjustment.

Manual gain adjustment via SoMove software is recommended. SoMove software supports oscilloscope function and can visually display the operating state of the servo system. Compared with the manual gain adjustment via HMI front panel integrated with the device, the manual adjustment via SoMove software is more accurate and faster.

The control loop parameters of the position control mode are adjusted manually. Optimize the velocity loop and then the position loop.

Servo Control Loop Block Diagram Overview



Conversion of Adaptive Control Loop Parameters to Serial PID Control Loop Parameters

If the adaptive control loop mode is used before manually adjusting the control loop parameters, the adaptive control loop parameters can be equivalently converted to the parameters in the serial PID control loop, and then the control loop mode of the servo drive can be switched to the serial PID control loop mode.

You can also convert the adaptive control loop parameters to the parameters in the serial PID control loop via the front panel of the HMI integrated with the device, and then switch the control loop mode of the servo drive to the serial PID control loop.

There are two ways of converting the adaptive control loop parameters into serial PID control loop parameters:

- Convert via the HMI front panel integrated with the device:
  1. Enter the panel **OP > Atu > cPYA** Group.
  2. Press the S key and the content displayed on the panel flashes once, indicating the successful conversion of control loop parameter
- Convert via the SoMove software:
  1. Enter the interface **Parameter Tuning> > Automatic Adaptive Adjustment**.
  2. Click the “Mapping” key, the software starts the conversion of parameters and pops up a dialog box after conversion, click and confirm the contents of the dialog box, and the control loop parameters are successfully converted.

Optimization of Velocity Loop

Parameter used for optimization of velocity loop in Control parameter set 1:

- P1-01: Control parameter set 1: Velocity controller P gain.
- P1-02: Control parameter set 1: Velocity controller integral action time.

P0-01	*RTATU_TuningMode*	Minimum value	0	Unit	–	Persistence	per.
		Factory setting	2	Data type	UINT16	MODBUS	5386
		Maximum value	8	Access	R/W	EtherCAT	3015:05$_h$

Description:

Tuning Mode selection

0 / Invalid: The adaptive operating mode is invalid and the serial PID control loop parameters via the parameter set P1 are used.

1 / Standard: In the standard adaptive operating mode, the servo drive automatically measures the system inertia ratio, the stiffness level is set manually, and adaptive control loop parameters are used.

2 / Passive: In the passive adaptive operating mode, the system inertia ratio and the stiffness level are set manually, and adaptive control loop parameters are used.

3 / Adaptive: In the active adaptive operating mode, the servo drive automatically measures the system inertia ratio, and tries to automatically set the best stiffness level (increase up to 4 stiffness levels); adaptive control loop parameters are used.

Modified settings become active immediately.

P0-02	*RTATU_StiffIndex*	Minimum value	1	Unit	–	Persistence	per.
		Factory setting	14	Data type	UINT16	MODBUS	5378
		Maximum value	32	Access	R/W	EtherCAT	3015:01$_h$

Description:

Stiffness index

Set the system stiffness level when using the adaptive control loop and combine with the inertia ratio via the parameter *RTATU_InertiaRealTime* (P0-03) when the mode via the parameter *RTATU_TuningMode* (P0-01) is set to 1, 2 or 3 to jointly control the system response.

When the parameter *RTATU_TuningMode* (P0-01) is set to 1 or 2, the value via this parameter needs to be set manually.

When the parameter *RTATU_TuningMode* (P0-01) is set to 3, the system attempts to automatically set the best stiffness level (increase up to 4 stiffness levels). As the set value becomes higher, the system response becomes faster, but vibration and noise are likely to occur. As the set value becomes lower, the system response becomes slower, but vibration and noise are unlikely to occur.

Modified settings become active immediately.

Parameter used for optimization of velocity loop in Control parameter set 2:

- P1-08: Control parameter set 2: Velocity controller P gain.
- P1-09: Control parameter set 2: Velocity controller integral action time.

P1-08	*CTRL2_KPn*	Minimum value	1	Unit	0.0001 A/RPM	Persistence	per.
		Factory setting	1	Data type	UINT16	MODBUS	4866
		Maximum value	25400	Access	R/W	EtherCAT	3013:01$_h$

Description:

Parameter set 2: Velocity controller P gain

The default value is calculated on the basis of the motor parameters.

In the case of switching between the two control loop parameter sets, the values are changed linearly over the time defined in the parameter *CTRL_ParChgTime* (P1-38).

In increments of 0.0001 A/RPM.

Modified settings become active immediately.

P1-09	*CTRL2_TNn*	Minimum value	1	Unit	0.01 ms	Persistence	per.
		Factory setting	1600	Data type	UINT16	MODBUS	4868
		Maximum value	32767	Access	R/W	EtherCAT	3013:02$_h$

Description:

Parameter set 2: Velocity controller integral action time

The default value is calculated.

In the case of switching between the two control loop parameter sets, the values are changed linearly over the time defined in the parameter *CTRL_ParChgTime* (P1-38).

In increments of 0.01 ms.

Modified settings become active immediately.

Parameter used for optimization of velocity loop in Control parameter set 3:

- P1-15: Control parameter set 3: Velocity controller P gain.
- P1-16: Control parameter set 3: Velocity controller integral action time.

P1-15	*CTRL3_KPn*	Minimum value	1	Unit	0.0001 A/RPM	Persistence	per.
		Factory setting	1	Data type	UINT16	MODBUS	5122
		Maximum value	25400	Access	R/W	EtherCAT	3014:01$_h$

Description:

Parameter set 3: Velocity controller P gain

In increments of 0.0001 A/RPM.

Modified settings become active immediately.

P1-16	*CTRL3_TNn*	Minimum value	0	Unit	0.01 ms	Persistence	per.
		Factory setting	4000	Data type	UINT16	MODBUS	5124
		Maximum value	32767	Access	R/W	EtherCAT	3014:02$_h$

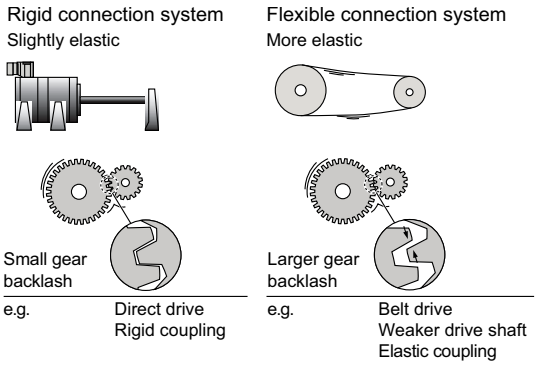
Description:

Parameter set 3: Velocity controller integral action time

In increments of 0.01 ms.

Modified settings become active immediately.

When optimizing the velocity loop, it is necessary to consider the characteristics of the load system, including it is the system with rigid coupling and quick response, or the system with flexible coupling and slow response:



- If the load system has a rigid coupling:

  When the load inertia of the motor shaft end is constant, you can set the velocity controller P gain via the parameter P1-01 and the velocity controller integral action time via the parameter P1-02 according to the recommendations in the table below. Including:

  J_L: Load inertia of motor shaft end

  J_M: Inertia of motor rotor

-	$J_L = J_M$		$J_L = 5*J_M$		$J_L = 10*J_M$	
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

- If the load system has a flexible coupling:

  With regard to the optimization logics of the system with flexible coupling, a velocity loop gain that ensures the fastest the velocity adjustment and does not cause velocity overshoot will be discovered. See the following steps to set the control loop parameters:

  1. Set the P1-02 velocity loop integral parameter to the maximum of 327.67ms.

     When an external force is applied to the motor at a standstill, the velocity controller integral action time value should be reduced if an unintended movement occurs to the movement (for example, the vertical axes). However, reduction of the velocity controller integral action time value can also adversely affect the optimization of the control loop performance.

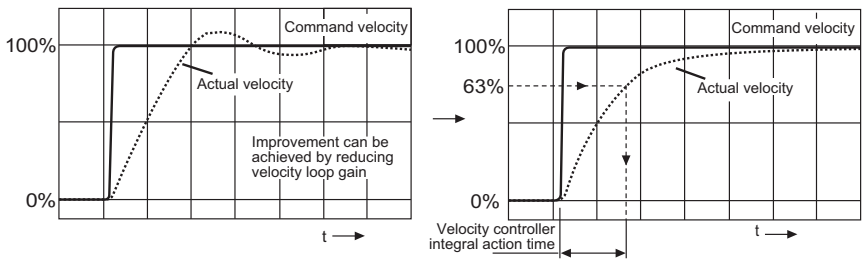
     ⚠WARNING

     UNINTENDED EQUIPMENT OPERATION

     - Start the system only if there is no person or obstruction in the zone of operation.
     - Verify that the velocity value and time value do not exceed the available range of motion.
     - Verify that a functioning emergency stop push-button is within reach of all persons working on the machine.

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

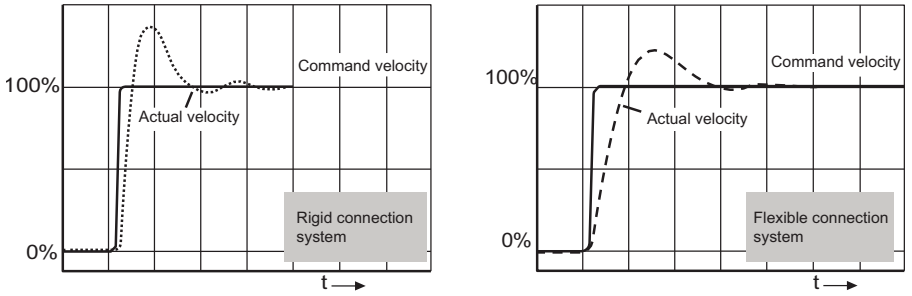
  2. Trigger a step command; for example, you can use the Profile Velocity function of SoMove software to set a velocity movement. At the same time, the oscilloscope function of SoMove software is used to observe the command current and actual velocity of the actual movement.
  3. After the first step movement, verify the maximum value of the command current. Modify the target velocity of the step command so that the maximum value of the command current is as close as possible to the maximum current of the drive. The command current value of the step command must not be too low, otherwise the friction of the mechanical system will dominate the motion effect.
  4. Trigger the step movement again after modifying the target velocity and verify the commanded current value via the oscilloscope.
  5. Slowly increase or decrease the P1-01 velocity controller P gain so that the actual velocity can reach the command velocity as soon as possible. The following figure shows the step response when the velocity loop gain is too large, and the ideal response when the velocity loop gain is reduced. The difference between the actual velocity and the commanded velocity in steady state is derived from the velocity loop integral:



If some load systems start to generate vibration before reaching periodic resonance, it is necessary to minimize the velocity loop gain to eliminate the vibration. This situation is more common in the toothed synchronous belt structure.

- Find out the point where the velocity value is 63% of the highest value:

  Find out the point on the velocity curve where the velocity value is 63% of the highest value, and then the value of this point obtained on the time axis is the P1-02 velocity controller integral action time.



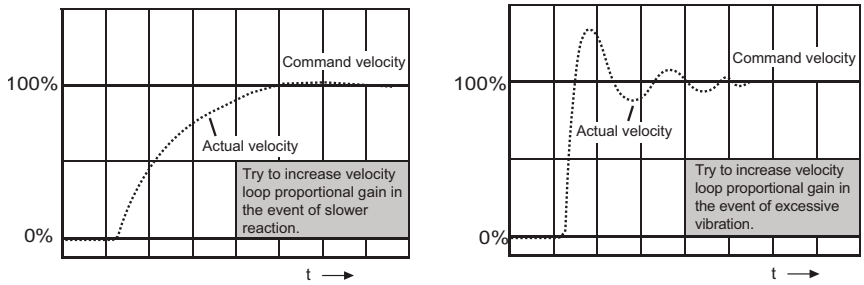
- Verify and further optimize the velocity controller P gain:

  For a properly optimized velocity loop, the step response curve of the velocity loop should have the following characteristics:

  1. Fast transient response
  2. The maximum overshoot value does not exceed 20%

- If the response curve of the actual system does not match the ideal curve shown in the figure below, try to change the P1-01 velocity controller P gain by 10% each time and trigger the step movement again:

  1. 1. If the response is too slow, try to increase the P1-01 velocity controller P gain.
  2. 2. If the response is accompanied by more vibrations, try to decrease the P1-01 velocity controller P gain.



Optimization of Position Loop

An optimized velocity loop is a prerequisite for the optimization of position loop. The optimization of position loop mainly involves the adjustment of position controller P gain via the parameter P1-00:

- • If the P1-00 position controller P gain is too large, overshoot will occur and the system will become unstable
- • If the P1-00 position controller P gain is too small, the following error will be too large

Parameter used for optimization of position loop in Control parameter set 1:

- P1-00: Control parameter set 1: Position controller P gain.

P1-00	*CTRL1_KPp*	Minimum value	20	Unit	0.1 1/s	Persistence	per.
		Factory setting	650	Data type	UINT16	MODBUS	4614
		Maximum value	9000	Access	R/W	EtherCAT	3012:03$_h$

Description:

Parameter set 1: Position controller P gain

The default value is calculated.

In the case of switching between the two control loop parameter sets, the values are changed linearly over the time defined in the parameter *CTRL_ParChgTime* (P1-38).

In increments of 0.1 1/s.

Modified settings become active immediately.

Parameter used for optimization of position loop in Control parameter set 2:

- P1-07: Control parameter set 2: Position controller P gain.

P1-07	*CTRL2_KPp*	Minimum value	20	Unit	0.1 1/s	Persistence	per.
		Factory setting	650	Data type	UINT16	MODBUS	4870
		Maximum value	9000	Access	R/W	EtherCAT	3013:03$_h$

Description:

Position controller P gain

The default value is calculated.

In the case of switching between the two control loop parameter sets, the values are changed linearly over the time defined in the parameter *CTRL_ParChgTime* (P1-38).

In increments of 0.1 1/s.

Modified settings become active immediately.

Parameter used for optimization of position loop in Control parameter set 3:

- P1-14: Control parameter set 3: Position controller P gain.

P1-14	*CTRL3_KPp*	Minimum value	20	Unit	0.1 1/s	Persistence	per.
		Factory setting	200	Data type	UINT16	MODBUS	5126
		Maximum value	9000	Access	R/W	EtherCAT	3014:03$_h$

Description:

Parameter set 3: Position controller P gain

In increments of 0.1 1/s

Modified settings become active immediately.

When optimizing the position loop, trigger an incremental movement; for example, use the Profile Position function of SoMove function to set an incremental movement. At the same time, the oscilloscope function of SoMove software is used to observe the command position, actual position, actual velocity and command current of the actual movement.

NOTE: Note: Incremental movement will cause the motor to operate at a constant velocity until the movement is completed.

⚠WARNING

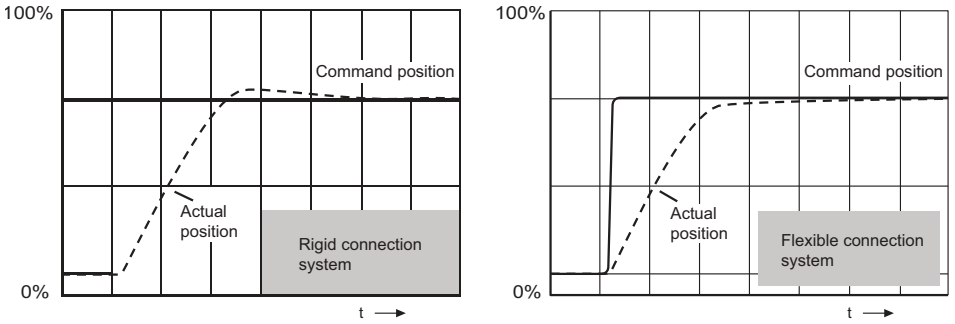
UNINTENDED EQUIPMENT OPERATION

- Start the system only if there is no person or obstruction in the zone of operation.
- Verify that the velocity value and time value do not exceed the available range of motion.
- Verify that a functioning emergency stop push-button is within reach of all persons working on the machine.

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

After triggering an incremental movement, verify the command current and actual velocity; these two values should not exceed the maximum current and velocity current of the servo drive.

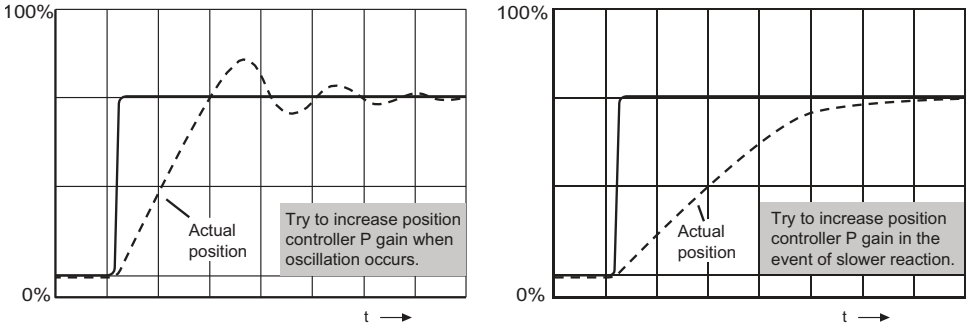
The ideal response curve of the load system with different characteristics is shown in the following figure:



A properly optimized position controller P gain should enable the actual position to reach the command position quickly with no or only slight overshoot.

If the response curve of the actual system does not match the ideal curve shown in the figure above, try to change the controller P gain by 10% each time and trigger the step movement again:

- If the control tends to oscillate, try to decrease the position controller P gain
- If the actual position reaches the command position too slowly, try to increase the position controller P gain



Gain Switching

Lexium 18E The servo drive can be switched manually or automatically between different control loop gains to accommodate different system response requirements.

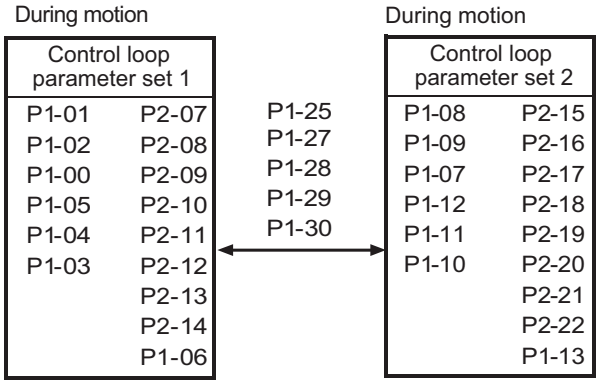
Switch control between control loop parameter sets 1 and 2

When the parameter P0-01 is set to “0/ Invalid”, the servo drive uses the PID control loop model. There are three control loop parameter sets for the Lexium 18E 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.

The control loop parameter set 1 and the control loop parameter set 2 are acting in motion, and the control loop parameter set 3 is acting in low-velocity operation and standstill state.

Set the conditions of switching between the control loop parameter 1 and the control loop parameter 2 via the related parameters.



Set the default control loop parameter set during power-on via the parameter P1-33:

P1-33	***CTRL_PwrUpParSet***	**Minimum value**	**0**	**Unit**	**0.1 1/s**	**Persistence**	**per.**
		Factory setting	**1**	**Data type**	**UINT16**	**MODBUS**	**4400**
		Maximum value	**2**	**Access**	**R/W**	**EtherCAT**	**3011:18$_h$**

Description:

Selection of controller 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

Modified settings become active immediately.

The condition of switching between the control loop parameter set 1 and the control loop parameter set 2 is as follows:

- Switch between control loop parameter sets via input signal
- Switch between parameter sets when the position error is below the set threshold
- Switch between parameter sets when the target velocity is lower than the set threshold
- Switch between parameter sets when the actual velocity is lower than the set threshold

You can select the methods of switching between control loop parameter sets via the parameter P1-34:

P1-34	*CLSET_ParSwiCond*	Minimum value	0	Unit	–	Persistence	per.
		Factory setting	0	Data type	UINT16	MODBUS	4404
		Maximum value	4	Access	R/W	EtherCAT	3011:26$_h$

Description:

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 *CLSET_p_DiffWin_usr*, P1-36)

2 / Below Reference Velocity: Below reference velocity (value definition in parameter *CLSET_v_Threshol*, P1-37)

3 / Below Actual Velocity: Below actual velocity (value definition in parameter *CLSET_v_Threshol*, P1-37)

4 / Reserved: Reserved

In the case of parameter set switching, the values of the following parameters are changed gradually:

- *CTRL1_KPp* (P1-00) / *CTRL2_KPp* (P1-07)

- *CTRL1_KPn* (P1-01) / *CTRL2_KPn* (P1-08)

- *CTRL1_TNn* (P1-02) / *CTRL2_TNn* (P1-09)

- *CTRL1_KFPp* (P1-03) / *CTRL2_KFPp* (P1-10)

- *CTRL1_TAUnref* (P1-04) / *CTRL2_TAUnref*(P1-11)

- *CTRL1_TAUiref*(P1-05) / *CTRL2_TAUiref*(P1-12)

The following parameters are changed immediately after the time for parameter set switching *CTRL_ParChgTime* (P1-38):

- *CTRL1_Nf1damp*(P2-07) / *CTRL2_Nf1damp*(P2-15)

- *CTRL1_Nf1freq*(P2-08) / *CTRL2_Nf1freq*(P2-16)

- *CTRL1_ Nf1bandw*(P2-09) / *CTRL2_ Nf1bandw*(P2-17)

- *CTRL1_Nf2damp*(P2-10) / *CTRL2_Nf2damp*(P2-18)

- *CTRL1_Nf2freq*(P2-11) / *CTRL2_Nf2freq*(P2-19)

- *CTRL1_ Nf2bandw*(P2-12) / *CTRL2_ Nf2bandw*(P2-20)

- *CTRL1_ Osupdamp*(P2-13) / *CTRL2_ Osupdamp*(P2-21)

- *CTRL1_ Osupdelay*(P2-14) / *CTRL2_ Osupdelay*(P2-22)

- *CTRL1_Kfric*(P1-06) / *CTRL2_Kfric*(P1-13)

Modified settings become active immediately.

When position error or velocity threshold is taken as the criteria to switch between control loop parameter sets, you can set the position error threshold, velocity threshold and monitoring window time via the parameter P1-35 / P1-36 / P1-37:

P1-35	*CLSET_winTime*	Minimum value	0	Unit	1 ms	Persistence	per.
		Factory setting	0	Data type	UINT16	MODBUS	4406
		Maximum value	1000	Access	R/W	EtherCAT	3011:27$_h$

Description:

Time window for parameter set switching

Value 0: Window monitoring deactivated.

Value >0: Window time for the parameters *CLSET_v_Threshol* (P1-37) and *CLSET_p_DiffWin_usr* (P1-36).

Modified settings become active immediately.

P1-36	*CLSET_p_DiffWin_usr*	Minimum value	0	Unit	usr_p	Persistence	per.
		Factory setting	1310	Data type	INT32	MODBUS	4426
		Maximum value	2147483647	Access	R/W	EtherCAT	3011:37$_h$

Description:

Position deviation for parameter set switching

If the position deviation of the position controller is less than the value of this parameter, control loop parameter set 2 is used. Otherwise, control loop parameter set 1 is used.

Modified settings become active immediately.

P1-37	*CLSET_v_Threshol*	Minimum value	0	Unit	usr_v	Persistence	per.
		Factory setting	50	Data type	UINT32	MODBUS	4410
		Maximum value	2147483647	Access	R/W	EtherCAT	3011:29$_h$

Description:

Velocity threshold for parameter set switching

If the reference velocity or the actual velocity are less than the value of this parameter, control loop parameter set 2 is used. Otherwise, control loop parameter set 1 is used.

Modified settings become active immediately.

Some control loop parameters in the control loop parameter sets can be switched linearly and the switching time can be set via the parameter P1-38.

Other control loop parameters are switched to the values in another parameter set directly after the time set via the parameter P1-38 is reached. The figure below shows the sequence of switching between control loop parameter sets.

P1-38	*CTRL_ParChgTime*	Minimum value	0	Unit	1 ms	Persistence	per.
		Factory setting	0	Data type	UINT16	MODBUS	4392
		Maximum value	2000	Access	R/W	EtherCAT	3011:20$_h$

Description:

Period of time for parameter switching

Modified settings become active immediately.

Automatic Switching to Control Loop Parameter Set 3

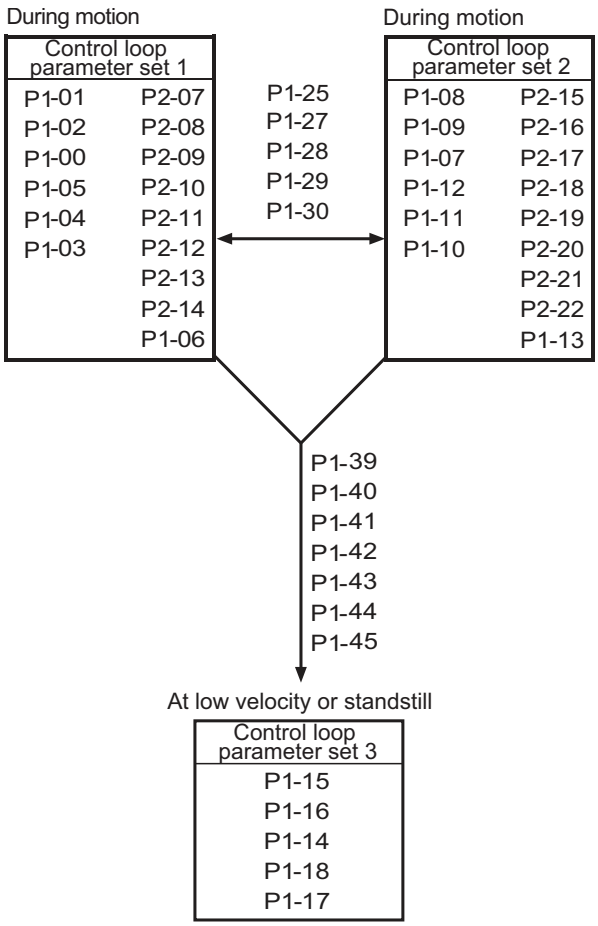
When the parameter P0-01 is set to “0 / Invalid”, the servo drive uses a serial PID control loop model. There are three control loop parameter sets for the Lexium 18E servo drive:

- 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 or control loop parameter set 2 is active when the servo motor is moving, while control loop parameter set 3 is active when the servo motor is in low-velocity operation or standstill state.

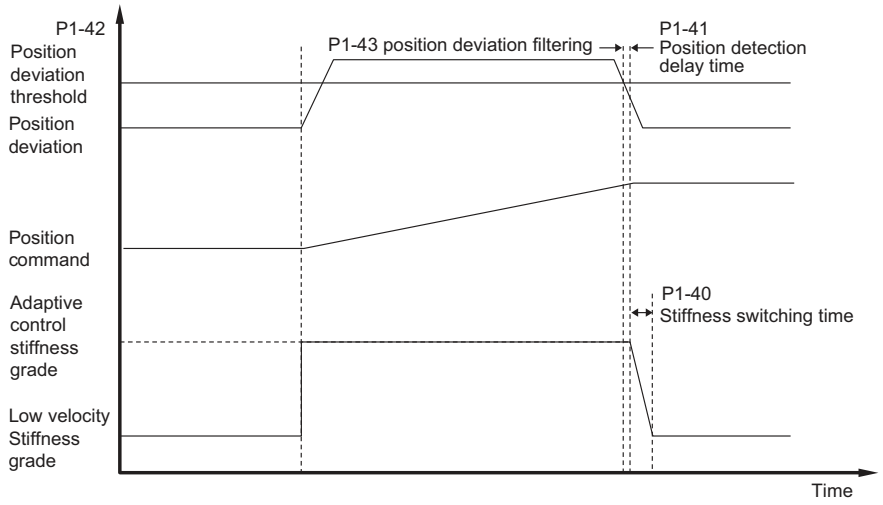
For details about the conditions, methods, and parameter settings of switching between control loop parameter set 1 and control loop parameter set 2, see Switch control between control loop parameter sets 1 and 2, page 349.

When the condition of motor velocity and position error is met, the servo motor will automatically switch from the currently active control loop parameter set 1 or control loop parameter set 2 to the control loop parameter set 3.



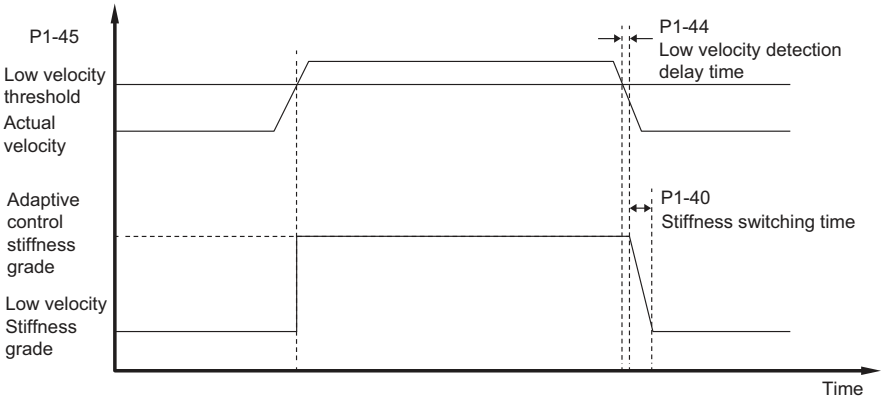
The judgment conditions for switching between control loop parameter sets are divided into position conditions and velocity position conditions:

- Judge and automatically switch between control loop parameter sets according to position conditions



The position condition of switching between control loop parameter sets is met when the position error defined via the parameter P1-43 is less than the position error threshold defined via the parameter P1-42 after being filtered by filter and stably exceeds the time defined via the parameter P4-41 after the completion of the movement.

- Judge and automatically switch between control loop parameter sets according to velocity conditions



The velocity condition of switching between control loop parameter sets is met when the actual velocity is lower than the low velocity threshold defined via the parameter P1-45 and the stably exceeds the times defined via the parameter P1-44 after the completion of the movement.

P1-41	*CTRL_DYNSWPOSDLYTM*	Minimum value	0	Unit	0.1 ms	Persistence	per.
		Factory setting	20	Data type	UINT16	MODBUS	4454
		Maximum value	2000	Access	R/W	EtherCAT	3011:33$_h$

Description:

Dynamic gain switching: Position deviation delay time

The condition of adaptive gain switch position deviation is met when the motion command is completed (electronic gear or internal motion), and the position deviation is lower than the position deviation threshold set via the parameter *CTRL_DYNSWPOSOKTHD* (P1-42) and exceeds the time set via this parameter.

Modified settings become active immediately.

P1-42	*CTRL_DYNSWPOSOKTHD*	Minimum value	2	Unit	0.1 deg	Persistence	per.
		Factory setting	50	Data type	UINT16	MODBUS	4456
		Maximum value	100	Access	R/W	EtherCAT	3011:34$_h$

Description:

Dynamic gain switching: Position deviation threshold

The condition of adaptive gain switch position deviation is met when the motion command is completed (electronic gear or internal motion), and the position deviation is lower than the position deviation threshold set via this parameter and exceeds the time set via parameter *CTRL_DYNSWPOSOKTHD* (P1-42) .

In increments of 0.1 deg.

Modified settings become active immediately.

P1-43	*CTRL_DYNSWTAUPOSDIF*	Minimum value	0	Unit	0.1 ms	Persistence	per.
		Factory setting	100	Data type	UINT16	MODBUS	4458
		Maximum value	2000	Access	R/W	EtherCAT	3011:35$_h$

Description:

Dynamic gain switching: Filter time constant for position deviation

In increments of 0.1 ms.

Modified settings become active immediately.

P1-44	*CTRL_DYNSWSPDLWTM*	Minimum value	0	Unit	0.1 ms	Persistence	per.
		Factory setting	20	Data type	UINT16	MODBUS	4460
		Maximum value	2000	Access	R/W	EtherCAT	3011:36$_h$

Description:

Dynamic gain switching: Low speed delay time

The adaptive gain switch velocity condition is met when the actual velocity is lower than the low velocity threshold set via the parameter *CTRL_DYNSWSPDLWTHD* (P1-45) and exceeds the time set via this parameter.

In increments of 0.1 ms.

Modified settings become active immediately.

P1-45	*CTRL_DYNSWSPDLWTHD*	Minimum value	0	Unit	usr_v	Persistence	per.
		Factory setting	20	Data type	UINT16	MODBUS	4462
		Maximum value	100	Access	R/W	EtherCAT	3011:37$_h$

Description:

Dynamic gain switching: Low speed threshold

The adaptive gain switch velocity condition is met when the actual velocity is lower than the low velocity threshold set via the parameter *CTRL_DYNSWSPDLWTM* (P1-44) and exceeds the time set via this parameter.

Modified settings become active immediately.

You can set the methods of switching between control loop parameter sets via the parameter P1-39:

- P1-39=0/Disable adaptive stiffness switching

  The servo drive disables the adaptive stiffness switching function.

- P1-39=1/Direct switching of adaptive stiffness parameters

  The servo drive switches to control loop parameter set 3 immediately after the condition of adaptive stiffness switching is met.

- P1-39 2 / Dynamic Gain Switch Deep Sleep Mode

  The servo drive switches to control loop parameter set 3 immediately after the condition of adaptive stiffness switching is met and further switches the control loop parameter set to the half of control loop parameter set 3 after a period of time.

- P1-39 = 3 / Dynamic Gain Switch With Ramp

  The servo drive switches to control loop parameter set 3 linearly within the time set via the parameter P1-40 after the condition of adaptive stiffness switching is met.

P1-39	*CTRL_DYNGNSWSET*	Minimum value	0	Unit	1 ms	Persistence	per.
		Factory setting	0	Data type	UINT16	MODBUS	4450
		Maximum value	3	Access	R/W	EtherCAT	3011:31$_h$

Description:

Dynamic gain switching: Selection of switching method

0 / Dynamic Gain Switch Disable

1 / Dynamic Gain Switch No Ramp

2 / Dynamic Gain Switch Deep Sleep Mode

3 / Dynamic Gain Switch With Ramp

When the parameter set via the parameter *RTATU_ TuningMode* (P0-01) is [0 / Invalid] and the adaptive gain switch

conditions are met, the following parameters will be switched according to the mode set via this parameter:

CTRL1_KPp(P1-00) / *CTRL3_KPp*(P1-14)

CTRL1_KPn(P1-01) / *CTRL3_KPn*(P1-15)

CTRL1_TNn(P1-02) / *CTRL3_TNn*(P1-16)

CTRL1_TAUiref(P1-05) / *CTRL3_TAUiref*(P1-18)

When the parameter set via the parameter *RTATU_ TuningMode* (P0-01) is [1 / Standard, 2 / Passive or 3 / Adaptive], and the adaptive gain switch conditions are met, the following parameters will be switched according to the mode set via this parameter:

RTATU_ StiffIndex(P0-02) / *CTRL_ DYNGNSTIFF*(P1-47)

When the parameter via this parameter is [2/ Dynamic Gain Switch Deep Sleep Mode], and the control parameter set is switched to the control loop parameter set 3, the parameter will be further switched to half of value via control loop parameter set 3.

Modified settings become active immediately.

P1-40	*CTRL_DYNGNSWTM*	Minimum value	0	Unit	0.1 ms	Persistence	per.
		Factory setting	0	Data type	UINT16	MODBUS	4452
		Maximum value	2000	Access	R/W	EtherCAT	3011:32$_h$

Description:

Dynamic gain switching: Period of time for dynamic gain switching

The control parameter set will be gradually switched within the time set via this parameter when the switching condition set via the parameter *CTRL_DYNGNSWSET* (P1-39) is [3/ Dynamic Gain Switch With Ramp] and the gain switch conditions are met.

In increments of 0.1 ms.

Modified settings become active immediately.

You can set the method of activating the judgment condition of switching between control loop parameter sets via the parameter P1-46:

- P1-46=0/Switch when both the position condition and velocity condition of adaptive stiffness switching are met

  Switch to the control loop parameter set 3 only when both the position condition and velocity condition are met in this switching mode.

- P1-46=1/Switch the position loop gain separately when the adaptive stiffness switching position condition is met, and switch the velocity loop gain separately when the adaptive stiffness switching velocity condition is met;

  in this switching mode, the position loop gain and velocity loop gain of the control loop parameter set can be switched separately. The position loop gain of control loop parameters will be switched to the position loop gain of the control loop parameter set 3 separately when the position condition of adaptive stiffness switching is met. The velocity loop gain of control loop parameters will be switched to the velocity loop gain of the control loop parameter set 3 separately when the velocity condition of adaptive stiffness switching is met.

P1-46	*CTRL_DYNGNMODE*	Minimum value	0	Unit	–	Persistence	per.
		Factory setting	0	Data type	UINT16	MODBUS	4466
		Maximum value	1	Access	R/W	EtherCAT	$3011:39_h$

Description:

Dynamic gain switching: Selection of low speed optimization mode

0 / Position And Velocity: Switch when both the position condition and the velocity condition of adaptive gain switch are met.

1 / Position Or Velocity: Switch the position loop gain separately when the adaptive gain switch position condition is met, and switch the velocity loop gain separately when the adaptive gain switch velocity condition is met.

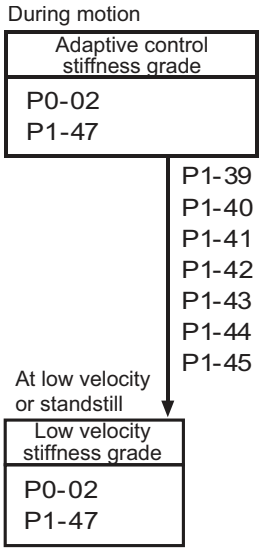
Modified settings become active immediately.

When receiving a motion command again, the control loop parameter set will be switched to the control loop parameter set 1 or control loop parameter set 2 immediately

Adaptive Control Loop Stiffness Switching

The servo drive uses an adaptive control loop model when the parameter P0-01 is set to “1/Standard”, “2/Passive” or “3/Adaptive”. Lexium 18E servo drive has 2 adaptive control stiffness levels:

- P0-02 adaptive control stiffness level
- P1-47 Adaptive stiffness switching: Target low stiffness

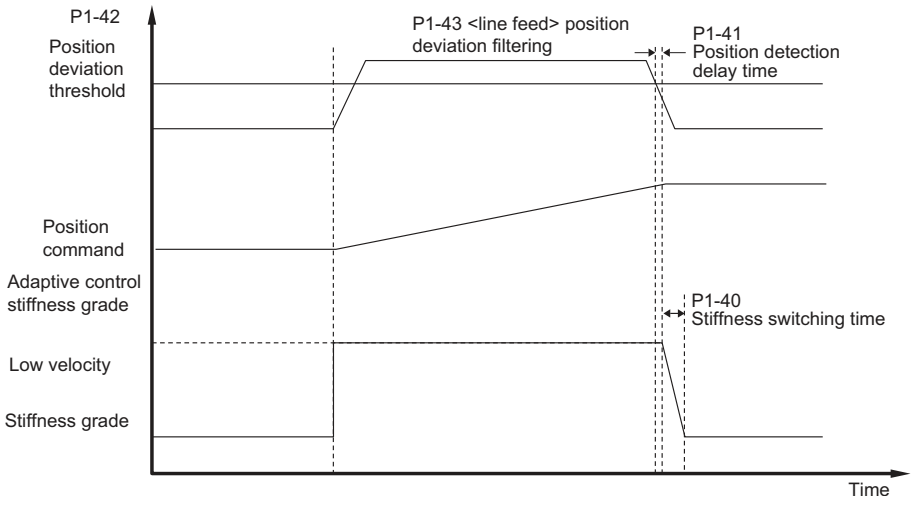


These two adaptive control stiffness level parameters will combine with the adaptive control inertia ratio in the parameter P0-03 to automatically set the control loop parameters.

The servo drive automatically switches to P1-47 adaptive control stiffness level, also the target low stiffness, from P0-02 adaptive control stiffness level when both the velocity and position error conditions of the motor are met.

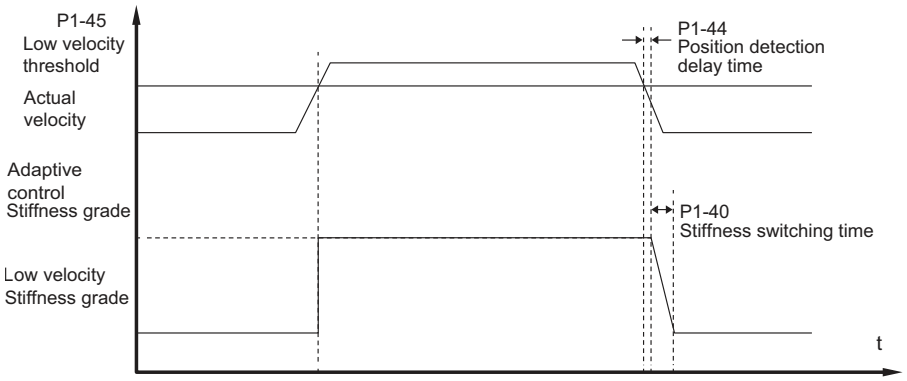
The judgment conditions for switching between control loop parameter sets are divided into position conditions and velocity position conditions:

- Judge and automatically switch between control loop parameter sets according to position conditions



The position condition of switching between control loop parameter sets is met when the position error defined via the parameter P1-43 is less than the position error threshold defined via the parameter P1-42 after being filtered by filter and stably exceeds the time defined via the parameter P4-41 after the completion of the movement.

- Judge and automatically switch between control loop parameter sets according to velocity conditions



The velocity condition of switching between control loop parameter sets is met when the actual velocity is lower than the low velocity threshold defined via the parameter P1-45 and the stably exceeds the times defined via the parameter P1-44 after the completion of the movement.

Manual gain adjustment (Advanced)

Feed-Forward Adjustment

When the serial control loop is executing position control, the position loop is compared with the position feedback via the position loop input command to calculate the velocity loop input command necessary for the movement. The velocity loop feed-forward is added and superimposed on the velocity loop input via the velocity loop input command, thereby better reducing position errors and improving the system response

Besides, the torque command given by the velocity loop can also be additionally added via the acceleration feed-forward and then superimposed on the current loop input to improve the response of velocity control.

Lexium 18E servo drive uses 2 feed-forward functions, including velocity loop feed-forward and acceleration feed-forward. There are 2 acceleration loop feed-forwards respectively held by each control loop parameter set. All control loop parameter sets share 1 acceleration feed-forward.

You can reduce the position error by increasing the gain of acceleration loop feed-forward, which is calculated as follows:

Following position error * position loop proportional gain = velocity command × (100% - velocity loop feed-forward gain)

If the gain of velocity loop feed-forward is set to 100%, the calculated following position error will be 0 but a great overshoot will occur during acceleration and deceleration.

In addition, increasing the gain of velocity loop feed-forward will increase the system noise. Under such condition, please increase P1-24 and P1-27 acceleration smoothing filter or P1-28 position command smoothing filter or decrease the velocity feed-forward gain.

P1-03	*CTRL1_KFPp*	Minimum value	0	Unit	0.1 %	Persistence	per.
		Factory setting	550	Data type	UINT16	MODBUS	4620
		Maximum value	2000	Access	R/W	EtherCAT	3012:06$_h$

Description:

Parameter set 1: Velocity feed-forward control

In the case of switching between the two control loop parameter sets, the values are changed linearly over the time defined in the parameter *CTRL_ParChgTime* (P1-38).

In increments of 0.1 %.

Modified settings become active immediately.

P1-10	*CTRL2_KFPp*	Minimum value	0	Unit	0.1 %	Persistence	per.
		Factory setting	550	Data type	UINT16	MODBUS	4876
		Maximum value	2000	Access	R/W	EtherCAT	3013:06$_h$

Description:

Parameter set 2: Velocity feed-forward control

In the case of switching between the two control loop parameter sets, the values are changed linearly over the time defined in the parameter *CTRL_ParChgTime* (P1-38).

In increments of 0.1 %.

Modified settings become active immediately.

P1-23	*CTRL_KFAcc*	Minimum value	0	Unit	0.1 %	Persistence	per.
		Factory setting	0	Data type	UINT16	MODBUS	4372
		Maximum value	30000	Access	R/W	EtherCAT	3011:0A$_h$

Description:

Acceleration feed-forward control

In increments of 0.1 %.

Modified settings become active immediately.

P1-27	*RAMP_v_jerk*	Minimum value	0	Unit	ms	Persistence	per.
		Factory setting	0	Data type	UINT16	MODBUS	1562
		Maximum value	128	Access	R/W	EtherCAT	3006:0D$_h$

Description:

Jerk limitation of the motion profile for velocity.

Adjustments can only be made if the operating mode is inactive (x_end=1).

Modified settings become the next time motor moves.

P1-28	*CTRL_TAUpref*	Minimum value	0	Unit	0.01 ms	Persis-tence	per.
		Factory setting	0	Data type	UINT16	MODBUS	4448
		Maximum value	25600	Access	R/W	EtherCAT	3011:30$_h$

Description:

Filter time constant for Position Reference

This parameter is active for both velocity loop feed-forward and acceleration feed-forward.

In increments of 0.01 ms.

Modified settings become active immediately.

Manual Mechanical Resonance Suppression

The resonance caused by the mechanical system will lead to the development of noise and disable the increase of the system gain settings. Noise and resonance can be reduced by suppressing the resonance point using notch filters, thereby further improving the system gain.

In addition to two groups of automatic notch filters, Lexium 18E servo drive supports four groups of manual notch filters and each control loop parameter set supports two groups of manual notch filters. Due to different control loop parameters selected by the servo controller, two manual notch filters are active each time.

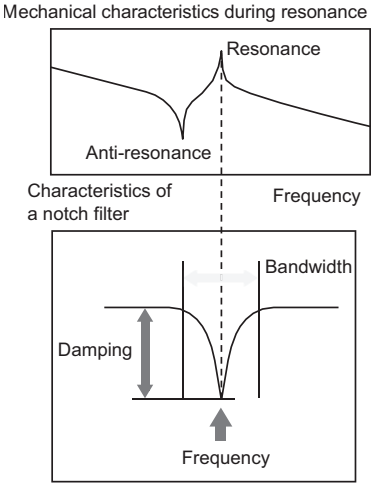
Parameter	Designation	Current value	Factory setting	Minimum value	Maximum value
P2-00	RTATU_ANotchMode	Enable 2	Invalid	–	–
P2-01	CTRL_ANf1damp	90%	90%	55%	99%
P2-02	CTRL_ANf1freq	210.9 Hz	1500 Hz	50 Hz	1500 Hz
P2-03	CTRL_ANf1bandw	70%	70%	1%	90%
P2-04	CTRL_ANf2damp	90%	90%	55%	99%
P2-05	CTRL_ANf2freq	156.2 Hz	1500 Hz	50 Hz	1500 Hz
P2-06	CTRL_ANf2bandw	70%	70%	1%	90%
P2-07	CTRL1_Nf1damp	60%	90%	55%	99%
P2-08	CTRL1_Nf1freq	546.8 Hz	1500 Hz	50 Hz	1500 Hz
P2-09	CTRL1_Nf1bandw	70%	70%	1%	90%
P2-10	CTRL_Nf2damp	90%	90%	55%	99%
P2-11	CTRL1_Nf2freq	531.2 Hz	1500 Hz	50 Hz	1500 Hz

Application Skills - How to realize the online resonance detection for more than two resonance points?

- Use two automatic notch filters to capture two resonance points online and fill them into the manual notch filter;
- Reset the automatic notch filter and proceed with online detection of resonance points

The parameters of each manual notch filter, such frequency, bandwidth and damping, can be manually adjusted.

CTRL1 / Control loop parameter set 1		CTRL2 / Control loop parameter set 2	
P2-07	Control parameter set 1: Notch filter 1: Damping.	P2-15	Control parameter set 2: Damping of the 1st set of notch filters
P2-08	Control parameter set 1: Notch filter 1: Frequency.	P2-16	Control parameter set 2: Notch filter 1: Frequency.
P2-09	Control parameter set 1: Notch filter 1: Bandwidth.	P2-17	Control parameter set 2: Notch filter 1: Bandwidth.
P2-10	Control parameter set 1: Notch filter 2: Damping.	P2-18	Control parameter set 2: Notch filter 2: Damping.
P2-11	Control parameter set 1: Notch filter 2: Frequency.	P2-19	Control parameter set 2: Notch filter 2: Damping.
P2-12	Control parameter set 1: Notch filter 2: Bandwidth.	P2-20	Control parameter set 2: Notch filter 2: Bandwidth.

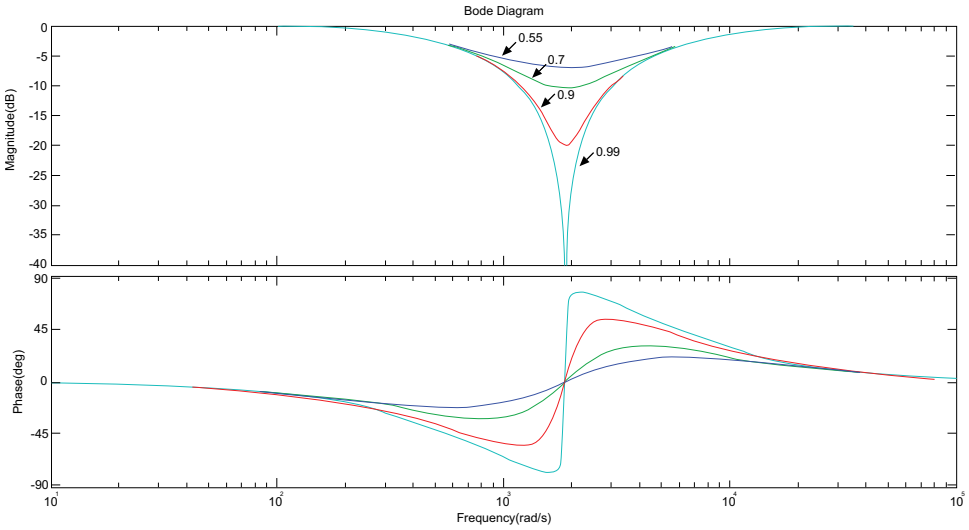


You need to find out the resonance frequency point of the machine when setting the manual notch filter. It is recommended to find out the resonance frequency point via the oscilloscope function of SoMove software:

- Enable the oscilloscope function of SoMove software and add the actual velocity to the monitoring function.
- Set the sampling cycle of the oscilloscope. According to the law of sampling, the sampling cycle of oscilloscope affects the highest value of the frequency domain. The sampling cycle should be set to a lower value while measuring a high frequency domain and to a higher value when measuring a low frequency domain
- Drive the servo motor using the test run function of the host motion controller or servo drive, perform FFT conversion to the actual velocity and try to find out the resonance frequency point.
- Gradually increase the P1-01 velocity loop proportional gain or gradually increase the P0-02 adaptive control stiffness level, repeat the measurement of actual velocity, perform FFT conversion and try to find out the resonance frequency point.
- After finding out the resonance frequency point, try to fill the frequency value of the resonance frequency point into the manual notch filter frequency, and set the filter bandwidth and damping. Drive the motor again and observe whether the mechanical resonance is suppressed.
- If the damping coefficient (d1) and bandwidth (b1) are larger, the effect of center frequency suppression will be better. However, the control phase may change faster, resulting in an instable control.

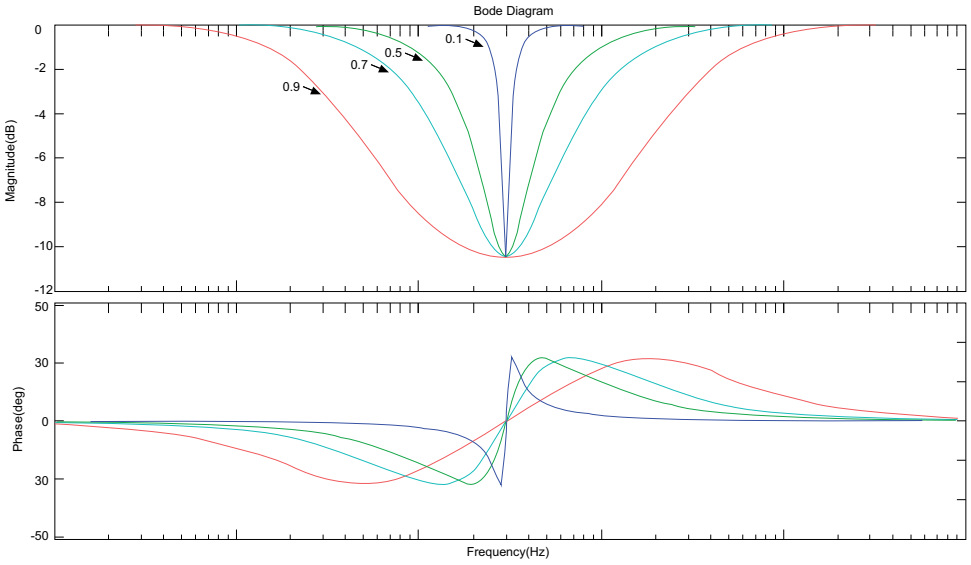
Key Parameters - Influence of Damping Coefficient

Center frequency: fn = 300Hz, damping coefficient: d1 = 0.55, 0.7, 0.9 and 0.99, bandwidth: b1 = 0.7



Key Parameters - Influence of Bandwidth

Center frequency: fn = 300Hz, damping coefficient: d1 = 0.7, bandwidth: b1 = 0.1, 0.5, 0.7 and 0.9



P2-07	*CTRL1_Nf1damp*	Minimum value	550	Unit	0.1 %	Persistence	per.
		Factory setting	900	Data type	UINT16	MODBUS	4624
		Maximum value	990	Access	R/W	EtherCAT	3012:08$_h$

Description:

Parameter set 1: Notch filter 1 Damping

In increments of 0.1 %.

Modified settings become active immediately.

P2-08	*CTRL1_Nf1freq*	Minimum value	500	Unit	0.1 Hz	Persistence	per.
		Factory setting	50000	Data type	UINT16	MODBUS	4626
		Maximum value	50000	Access	R/W	EtherCAT	3012:09$_h$

Description:

Parameter set 1: Notch filter 1 Frequency

The filter is deactivated at a value of 15000.

In increments of 0.1 Hz.

Modified settings become active immediately.

P2-09	*CTRL1_Nf1bandw*	Minimum value	10	Unit	0.1 %	Persistence	per.
		Factory setting	700	Data type	UINT16	MODBUS	4628
		Maximum value	900	Access	R/W	EtherCAT	3012:0A$_h$

Description:

Parameter set 1: Notch filter 1 Bandwidth

Definition of bandwidth: 1 - Fb/F0

In increments of 0.1 %.

Modified settings become active immediately.

P2-10	*CTRL1_Nf2damp*	Minimum value	550	Unit	0.1 %	Persistence	per.
		Factory setting	900	Data type	UINT16	MODBUS	4630
		Maximum value	990	Access	R/W	EtherCAT	3012:0B$_h$

Description:

Parameter set 1: Notch filter 2 Damping

In increments of 0.1 %.

Modified settings become active immediately.

P2-11	*CTRL1_Nf2freq*	Minimum value	500	Unit	0.1 Hz	Persistence	per.
		Factory setting	50000	Data type	UINT16	MODBUS	4632
		Maximum value	50000	Access	R/W	EtherCAT	3012:0C$_h$

Description:

Parameter set 1: Notch filter 2 Frequency

The filter is deactivated at a value of 15000.

In increments of 0.1 Hz.

Modified settings become active immediately.

P2-12	*CTRL1_Nf2bandw*	Minimum value	10	Unit	0.1 %	Persistence	per.
		Factory setting	700	Data type	UINT16	MODBUS	4634
		Maximum value	900	Access	R/W	EtherCAT	3012:0D$_h$

Description:

Parameter set 1: Notch filter 2 Bandwidth

Definition of bandwidth: 1 - Fb/F0

In increments of 0.1 %.

Modified settings become active immediately.

P2-15	*CTRL2_Nf1damp*	Minimum value	550	Unit	0.1 %	Persistence	per.
		Factory setting	900	Data type	UINT16	MODBUS	4880
		Maximum value	990	Access	R/W	EtherCAT	3013:08$_h$

Description:

Parameter set 2: Notch filter 1: Damping

In increments of 0.1 %.

Modified settings become active immediately.

P2-16	*CTRL2_Nf1freq*	Minimum value	500	Unit	0.1 Hz	Persistence	per.
		Factory setting	50000	Data type	UINT16	MODBUS	4882
		Maximum value	50000	Access	R/W	EtherCAT	3013:09$_h$

Description:

Parameter set 2: Notch filter 1: Frequency

The filter is deactivated at a value of 15000.

In increments of 0.1 Hz.

Modified settings become active immediately.

P2-17	*CTRL2_Nf1bandw*	Minimum value	10	Unit	0.1 %	Persistence	per.
		Factory setting	700	Data type	UINT16	MODBUS	4884
		Maximum value	900	Access	R/W	EtherCAT	3013:0A$_h$

Description:

Parameter set 2: Notch filter 1: Bandwidth

Definition of bandwidth: 1 - Fb/F0

In increments of 0.1 %.

Modified settings become active immediately.

P2-18	*CTRL2_Nf2damp*	Minimum value	550	Unit	0.1 %	Persistence	per.
		Factory setting	900	Data type	UINT16	MODBUS	4886
		Maximum value	990	Access	R/W	EtherCAT	3013:0B$_h$

Description:

Parameter set 2: Notch filter 2: Damping

In increments of 0.1 %.

Modified settings become active immediately.

P2-19	*CTRL2_Nf2freq*	Minimum value	500	Unit	0.1 %	Persistence	per.
		Factory setting	50000	Data type	UINT16	MODBUS	4888
		Maximum value	50000	Access	R/W	EtherCAT	3013:0C$_h$

Description:

Parameter set 2: Notch filter 2: Frequency

The filter is deactivated at a value of 15000.

In increments of 0.1 Hz.

Modified settings become active immediately.

P2-20	*CTRL2_Nf2bandw*	Minimum value	10	Unit	0.1%	Persistence	per.
		Factory setting	700	Data type	UINT16	MODBUS	4890
		Maximum value	900	Access	R/W	EtherCAT	3013:0D$_h$

Description:

Parameter set 2: Notch filter 2: Bandwidth

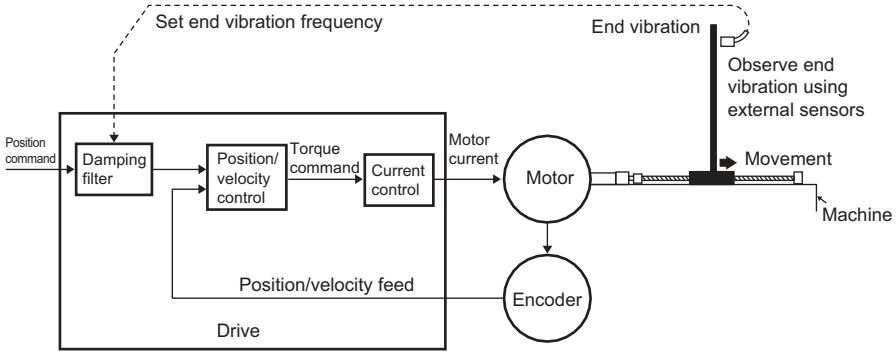
Definition of bandwidth: 1 - Fb/F0

In increments of 0.1 %.

Modified settings become active immediately.

End vibration Suppression

Long rod loads will shake when the motor starts and stops. For this problem, you can set the suppression filter to eliminate the same vibration frequency component in the position command, thus suppressing such vibration.



Lexium 18E servo drive supports 2 groups of vibration suppression filters:

P2-26	*CTRL_AnVibf1*	Minimum value	0	Unit	0.1 Hz	Persistence	per.
		Factory setting	0	Data type	UINT16	MODBUS	4440
		Maximum value	2000	Access	R/W	EtherCAT	3011:2C$_h$

Description:

Frequency for anti vibration filter 1

In increments of 0.1 Hz.

Modified settings become active immediately.

P2-27	*CTRL_AnVibdamp1*	Minimum value	0	Unit	0.1 %	Persistence	per.
		Factory setting	300	Data type	UINT16	MODBUS	4444
		Maximum value	500	Access	R/W	EtherCAT	3011:2E$_h$

Description:

Damping factor for anti vibration filter 1

In increments of 0.1%.

Modified settings become active immediately.

P2-28	*CTRL_AnVibf2*	Minimum value	0	Unit	0.1 Hz	Persistence	per.
		Factory setting	0	Data type	UINT16	MODBUS	4442
		Maximum value	2000	Access	R/W	EtherCAT	3011:2D$_h$

Description:

Frequency for anti vibration filter 2

In increments of 0.1 Hz.

Modified settings become active immediately.

P2-29	*CTRL_AnVibdamp2*	Minimum value	0	Unit	0.1 %	Persistence	per.
		Factory setting	300	Data type	UINT16	MODBUS	4446
		Maximum value	500	Access	R/W	EtherCAT	3011:2F$_h$

Description:

Damping factor for anti vibration filter 2

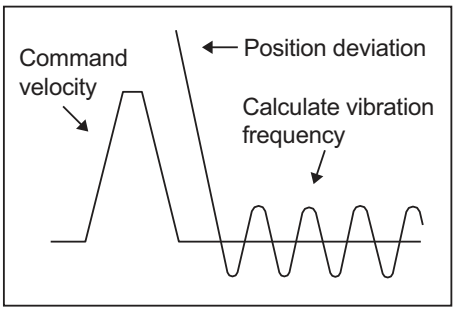
In increments of 0.1%.

Modified settings become active immediately.

In the following conditions, the end vibration suppression function may not work satisfactorily:

- Vibration due to factors other than commands (for example, external force)
- Vibration frequency beyond the range of 1~200Hz

When using the vibration suppression filter, first use an external device to measure the end vibration frequency of the long rod load, fill the measured vibration frequency into the frequency parameter of vibration suppression filter and set the vibration suppression filter damping. If it is not possible to use an external measuring device, you can also use the oscilloscope function of SoMove software to read the residual vibration frequency of the position error after the completion of the movement and then perform the corresponding settings.



Diagnosis

Diagnosis via EtherCAT

Most Recent Detected Error - Status Bits

Parameter *DCOMstatus*

The parameter *DCOMstatus* is a part of the process data communication. The parameter *DCOMstatus* is transmitted asynchronously and in an event-driven way whenever the status information changes.

In the case of an error of error class 0, bit 7 is set in the parameter *DCOMstatus*.

In the case of an error of error class 1, 2, 3 or 4, bit 13 is set in the parameter *DCOMstatus*.

–	***_DCOMstatus***	**Minimum value**	**–**	**Unit**	**–**	**Persistence**	**–**
		Factory setting	**–**	**Data type**	**UINT16**	**MODBUS**	**6916**
		Maximum value	**–**	**Access**	**R/-**	**EtherCAT**	**6041:00$_h$**

Description:

Drive status word

Bit assignments:

Bit 0: Operating state Ready To Switch On

Bit 1: Operating state Switched On

Bit 2: Operating state Operation Enabled

Bit 3: Operating state Fault

Bit 4: Voltage Enabled

Bit 5: Operating state Quick Stop

Bit 6: Operating state Switch On Disabled

Bit 7: Error of error class 0

Bit 8: HALT request active

Bit 9: Remote

Bit 10: Target Reached

Bit 11: Internal Limit Active

Bit 12: Operating mode-specific

Bit 13: x_err

Bit 14: x_end

Bit 15: ref_ok

Error Bits

The parameters *_WarnLatched* and *_SigLatched* contain information on errors of error class 0 and errors of error classes 1 ... 4.

–	*_WarnLatched*	Minimum value	–	Unit	–	Persistence	–
		Factory setting	–	Data type	UINT32	MODBUS	7192
		Maximum value	–	Access	R/-	EtherCAT	301C:0C$_h$

Description:

Saved errors of error class 0, bit-coded

The bits are set to 0 in the case of a Fault Reset.

Bits 10 and 13 are set to 0 automatically.

Signal state:

0: Not activated

1: Activated

Bit assignments:

Bit 0: General

Bit 1: Reserved

Bit 2: Out of range (software limit switches, tuning)

Bit 3: Reserved

Bit 4: Active operating mode

Bit 5: Commissioning interface (RS485)

Bit 6: Integrated fieldbus

Bit 7: Reserved

Bit 8: Following error

Bit 9: Reserved

Bit 10: Inputs STO_A and/or STO_B

Bits 11 ... 12: Reserved

Bit 13: Low voltage DC bus or mains phase missing

Bits 14...15: Reserved

Bit 16: Integrated encoder interface

Bit 17: Temperature of motor high

Bit 18: Temperature of power stage high

Bit 19 ... Bit 28: Reserved

Bit 29: Braking resistor overload (I2t)

Bit 30: Power stage overload (I2t)

Bit 31: Motor overload (I2t)

Monitoring functions are product-dependent.

–	*_SigLatched*	**Minimum value**	–	**Unit**	–	**Persis-tence**	–
		Factory setting	–	**Data type**	**UINT32**	**MODBUS**	**7184**
		Maximum value	–	**Access**	**R/-**	**EtherCAT**	**301C:08$_h$**

Description:

Saved status of monitoring signals.

Signal state:

0: Not activated

1: Activated

Bit assignments:

Bit 0: General error

Bit 1: Hardware limit switches (LIMP/LIMN/REF)

Bit 2: Out of range (software limit switches, tuning)

Bit 3: Quick Stop via fieldbus

Bit 4: Error in active operating mode

Bit 5: Commissioning interface (RS485)

Bit 6: Integrated fieldbus

Bit 7: Reserved

Bit 8: Following error

Bit 9: Reserved

Bit 10: Inputs STO are 0

Bit 11: Inputs STO different

Bit 12: Reserved

Bit 13: DC bus voltage low

Bit 14: DC bus voltage high

Bit 15: Mains phase missing

Bit 16: Integrated encoder interface

Bit 17: Over-temperature motor

Bit 18: Over-temperature power stage

Bit 19: Reserved

Bit 20: Memory card

Bit 21...25: Reserved

Bit 26: Motor connection

Bit 27: Motor overcurrent/short circuit

Bit 28: Frequency of reference signal too high

Bit 29: Nonvolatile memory error detected

Bit 30: System start-up (hardware or parameter)

Bit 31: System error detected (for example, watchdog, internal hardware interface)

Monitoring functions are product-dependent.

Most Recent Detected Error - Error Code

Description

If the controller receives information concerning a detected error via the process data communication, the following parameters can be used to read the error code.

The list of the error messages sorted by error code can be found in the section List of Error Messages, page 383.

Most Recent Detected Error with Error Class 0

The parameter *_LastWarning* allows you to read the error number of the last detected error with error class 0.

–	***_LastWarning***	**Minimum value**	**–**	**Unit**	**–**	**Persistence**	**–**
		Factory setting	**–**	**Data type**	**UINT16**	**MODBUS**	**7186**
		Maximum value	**–**	**Access**	**R/-**	**EtherCAT**	**301C:09$_h$**

Description:

Code of most recent error of error class 0.

If the error is no longer active, the code is stored until the next Fault Reset.

Value 0: No error of error class 0

Most Recent Detected Error with Error Class 1 ... 4

The parameter *_LastError* allows you to read the error number of the last detected error with error class 1 ... 4.

–	***_LastError***	**Minimum value**	**–**	**Unit**	**–**	**Persistence**	**–**
		Factory setting	**–**	**Data type**	**UINT16**	**MODBUS**	**7178**
		Maximum value	**–**	**Access**	**R/-**	**EtherCAT**	**603F:00$_h$**

Description:

Detected error causing a stop (error classes 1 to 4).

Error code of the most recent detected error.

Consecutive detected errors do not overwrite this error code.

Example: If an error response to a detected limit switch error causes overvoltage, this parameter contains the code of the detected limit switch error.

Exception: Detected errors of error class 4 overwrite existing entries.

Diagnosis via HMI

Displaying Operation State

You can get the information about the operation state from the output point.

An overview is provided in the table below:

Operation state	Signal output function	
	"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

P3-24 ... P3-26	*IOfunct_DQx*	Minimum value	1	Unit	–	Persistence	per.
		Factory setting	–	Data type	UINT16	MODBUS	–
		Maximum value	131	Access	R/W	EtherCAT	–

Description:

Function Output DQx

Function name	Function value	
	Normally open	Normally closed
No Fault	2	102
Active	3	103

Setting can only be modified if power stage is disabled.

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

Displaying Error Messages

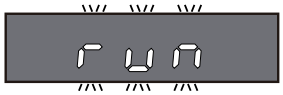
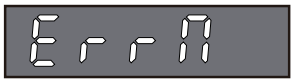
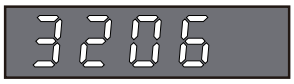
Displaying Errors of Error Class 0

When an error of error class 0 occurs on the servo drive, the content displayed on the HMI starts flashing as a prompt, and the motion of the servo motor is not interrupted.

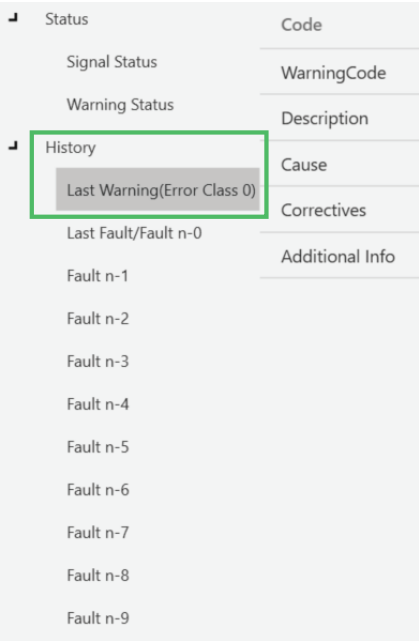
When an error of error class 0 occurs, you have two ways to get the message:

- Press and hold the S key for 2.5 seconds and the current error of error class 0 is displayed on the HMI.
- Display the current error of error class 0 via the parameter **MON > ErrM > LWrn**. See Displaying the Current / Historical Error Records, page 158.

For more information about the error message, see List of Error Messages, page 383.

Step	Current display content on the panel	key used	Operation
0			Press the S key, and the panel displays OP.
1			Press the S key, and the panel displays MON.
2			Press the S key, and the panel displays SuPV.
3			Press the Page Up or Page Down key to select the drive status information till the panel displays ErrM.
4			Press the S key to go to the error record parameter set.
5			Press the S key, and the panel displays the current error message of error class 0 of the drive.
6		–	–

You can also get the current error message of error class 1...0 via the error log function of the SoMove software:



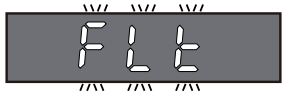
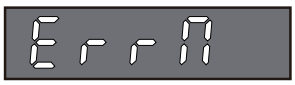
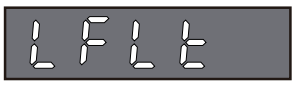
Displaying Errors of Error Class 1...4

When an error of error class 1 occurs on the servo drive, “Stop” is displayed on the HMI.

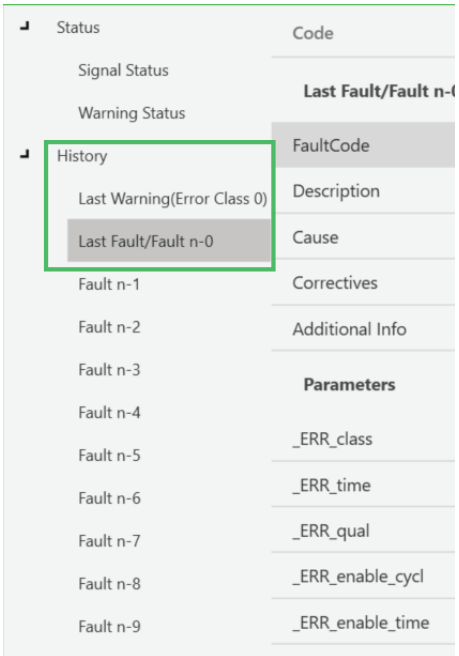
When an error of error class 2...4 occurs on the servo drive, “Flt” and the error code are alternatively displayed on the HMI.

Display the current error message of error class 1...4 via the parameter **MON > ErrM > LFlt**.

For more information about the error message, see List of Error Messages, page 383.

Step	Current display content on the panel	key used	Operation
0			Press the M key, and the panel displays OP.
1			Press the S key, and the panel displays MON.
2			Press the S key, and the panel displays SuPV.
3			Press the Page Up or Page Down key to select the drive status information till the panel displays ErrM.
4			Press the S key to go to the fault record parameter set.
5			Press the Up and Down key to select the current error record of the drive.
6			Press the S key, and the panel displays the current error content of the drive.
7		–	–

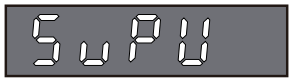
You can also get the current error message of error class 1...4 via the error log function of the SoMove software:



Displaying Historical Error Records

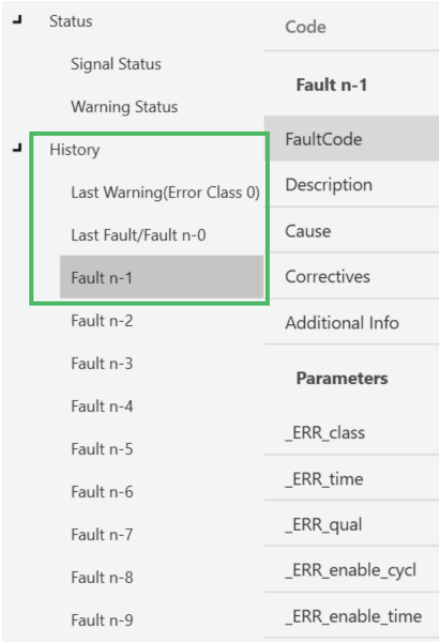
To run the parameter **MON > ErrM > FItn**, the historical errors are displayed about a fault level displayed dynamically in the order of the occurrence of the class 1...4. Up to the first 9 historical errors are recorded, and the historical errors with higher n-number appear earlier. Refer to Displaying the Current / Historical Error Records, page 158 for details.

For more information about the historical error, see List of Error Messages, page 383.

Step	Current display content on the panel	Key used	Operation
0			Press the S key and the panel displays OP.
1			Press the S key and the panel displays MON.
2			Press the S key and the panel displays SuPV.
3			Press the Page Up or Page Down key to select the drive status information till the panel displays ErrM.
4			Press the S key to go to the fault record parameter set.
5			Press the Up and Down key to select the historical error record of the drive.
6	  		Press the S key, and the panel displays the selected historical error record contents of the drive.
7		–	–

You can also get the information about the historical error records of error class 1...4 via the error log function of the SoMove software. The specific information is also listed in the historical error records.

The drive dynamically stores error messages in the order in which they occur. If the recorded error message exceeds 1 hour, the historical error message is recorded in error n-1...n-9 according to the order of occurrence.



Diagnosis via Signal Outputs

Acquisition of Operation State

You can obtain the operation state via output point.

An overview is given in the table below:

Operation state	Signal output function	
	"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

P3-24 ... P3-26	***IOfunct_DQx***	**Minimum value**	**1**	**Unit**	**–**	**Persistence**	**per.**
		Factory setting	**–**	**Data type**	**UINT16**	**MODBUS**	**–**
		Maximum value	**131**	**Access**	**R/W**	**EtherCAT**	**–**

Description:

Function Output DQx

Function name	Function value	
	Normally open	Normally closed
No Fault	2	102
Active	3	103

Setting can only be modified if power stage is disabled.

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

Acquisition of 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 parameterize the signal output functions “Selected Warning” or “Selected Error”, see List of Output Functions, page 173.

The parameters *MON_IO_SelWar1* (P6-09) and *MON_IO_SelWar2* (P6-10) are used to specify error codes with the error class 0.

The parameters *MON_IO_SelErr1* (P6-07)and *MON_IO_SelErr2* (P6-08) are used to specify error codes with the error classes 1 ... 4.

If an error specified in one of these parameters is detected, the corresponding signal output is to be set.

The list of the error messages sorted by error code can be found in the section List of Error Messages, page 383.

P3-24 ... P3-26	*IOfunct_DQx*	Minimum value	1	Unit	–	Persistence	per.
		Factory setting	–	Data type	UINT16	MODBUS	–
		Maximum value	131	Access	R/W	EtherCAT	–

Description:

Function Output DQx

Function name	Function value	
	Normally open	Normally closed
Selected Error	14	114
Selected Warning	16	116

Setting can only be modified if power stage is disabled.

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

P6-07	*MON_IO_SelErr1*	Minimum value	0	Unit	–	Persistence	per.
		Factory setting	0	Data type	UINT16	MODBUS	15116
		Maximum value	65535	Access	R/W	EtherCAT	$303B:06_h$

Description:

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.

Modified settings become active immediately.

P6-08	*MON_IO_SelErr2*	Minimum value	0	Unit	–	Persistence	per.
		Factory setting	0	Data type	UINT16	MODBUS	15118
		Maximum value	65535	Access	R/W	EtherCAT	$303B:07_h$

Description:

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.

Modified settings become active immediately.

P6-09	*MON_IO_SelWar1*	Minimum value	0	Unit	–	Persistence	per.
		Factory setting	0	Data type	UINT16	MODBUS	15120
		Maximum value	65535	Access	R/W	EtherCAT	303B:08$_h$

Description:

Signal output function Selected Warning (error class 0): First error code.

This parameter specifies the error code of an error of error class 0 which is to activate the signal output function.

Modified settings become active immediately.

P6-10	*MON_IO_SelWar2*	Minimum value	0	Unit	–	Persistence	per.
		Factory setting	0	Data type	UINT16	MODBUS	15122
		Maximum value	65535	Access	R/W	EtherCAT	303B:09$_h$

Description:

Signal output function Selected Warning (error class 0): Second error code.

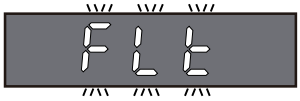
This parameter specifies the error code of an error of error class 0 which is to activate the signal output function.

Modified settings become active immediately.

Fault Reset Alarm

Fault Reset via HMI

If an error occurs, it can be reset using the following HMI operations:

Step	Current display content on the panel	Key used	Operation
0			Press the S key and the panel is displayed as FrES.
1			Press the S key to try to reset the error message. If the error message is successfully reset, the panel is displayed as rdy.
2		–	–

Fault Reset via Input Terminal

When a error occurs, it can be reset via the input terminal:

- The “Fault Reset” function can be assigned to an input terminal by setting the parameters of P3-00...P3-05.
- The current error message of the drive will be reset when there is an input on the input terminal assigned with Fault Reset function after the error cause is confirmed

P3-00 ... P3-05	*IOfunct_DIx*	Minimum value	1	Unit	–	Persistence	per.
		Factory setting	1	Data type	UINT16	MODBUS	–
		Maximum value	141	Access	R/W	EtherCAT	–

Description:

Function Input DIx

Function name	Function value	
	Normally open	Normally closed
Fault Reset	2	102

Setting can only be modified if power stage is disabled.

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

Error Message

Description of Error Messages

The drive generates a error message when the drive's monitoring function detects an error. Each error message is identified by an error code.

The error messages are classified into the following error classes:

Error class	State transition	Error response	Resetting the error message
0	–	No interruption of the movement	• "Fault Reset" via HMI • "Fault Reset" via input terminal
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	Power cycle

The following table shows the error ranges of error message:

Error code	Error 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

List of Error Messages

This chapter provides the following information for each error message:

- Error code
- Error class
- Description of error message
- Possible causes
- Recommended corrective measures

E 1xxx: General

Error code	Error class	Description	Cause	Measure
1100	0	Parameter exceeds the permissible range	The input value is beyond the permissible range of this parameter.	The input value must be within the permissible range.
1101	0	Parameter does not exist.	Parameter management system detected an error: the parameter (index) does not exist.	Please select another parameter (index).
1102	0	Parameter does not exist.	Parameter management system detected an error: the parameter (index) does not exist.	Please select another parameter (subindex).
1103	0	Not allowed to write this parameter (READ only)	Write access to the Read-Only parameter.	Write only writable parameters.
1104	0	Write access denied (no access authority)	Parameters can only be accessed in Expert mode.	Write access must be done by an expert.
1105	0	Block upload / download not initialized	–	–
1106	0	Command execution is not allowed when power stage is enabled	Command execution is not allowed (in the operating state of Operation Enabled or Quick Stop Active) when the power stage is enabled.	Disable the power stage and repeat the command execution.
1107	0	Prohibit the access to other interfaces	Access is occupied by other channels (for example, the commissioning software is enabled and access attempts are made via fieldbus).	Check for channels that block access.
1108	0	File cannot be uploaded: Incorrect file ID	–	–
1109	1	Invalid data saved after power failure	–	–
110A	0	System error detected: No Bootloader available	–	–
110B	3	Detected an error while downloading configuration (Auxiliary information = Modbus register address)	Detected an error while checking parameters (for example, the given velocity in the operating mode Profile Position is greater than the maximum allowed drive amplifier velocity).	The value in the error auxiliary information gives the Modbus register address of the parameter at which the initialization error was detected.
110D	1	After the factory settings are completed, basic configurations must be performed to the drive amplifier	“First Setup” (FSU) is not executed or is not fully executed.	Please execute First Setup.
110E	0	A parameter that requires the restart of the drive amplifier has been changed	It will be displayed only by the commissioning software. After any change occurs to the parameter, the drive amplifier must be shut down and restarted.	Restart the drive amplifier to enable the function of this parameter. Please see Chapter Parameter, page 411 for the information of the parameters that require a restart of the drive amplifier.
110F	0	Functions are not available for the device specification	This special device specification does not support this function or parameter.	Please make sure to use the correct device specifications, especially the motor model, encoder model and holding brake.
1110	0	Incorrect upload or download file ID	The specific device specification does not support this type of file.	Please make sure to use the correct type of device or correct configuration file.
1111	0	File transfer is not correctly initialized	The previous file transfer was interrupted.	–
1112	0	Unable to lock configuration	An external tool attempts to lock the drive amplifier configuration for upload or download. If another tool has locked the configuration of the drive amplifier, or the drive amplifier is in a operating state that cannot be locked, the configuration cannot be locked.	–

E 1xxx: General (Continued)

Error code	Error class	Description	Cause	Measure
1113	0	The system is not locked for configuration transfer	An external tool attempts to transfer the configuration of the drive amplifier without locking the drive amplifier.	–
1114	4	Configuration download is interrupted	Detected a communication error or errory external tool while downloading the configuration. Only part of the configuration has been transferred to the drive amplifier and conflicts may exist at present.	Please shut down and restart the drive amplifier, try to perform configuration download again or reset the drive amplifier to the factory settings.
1115	0	Configuration file format error	The configuration downloaded by the external tool has an invalid format.	–
1116	0	The query will be processed asynchronously	–	–
1117	0	Asynchronous request is locked	The module request is locked because the module is processing another request.	–
1118	0	Configuration data is not compatible with the device	The configuration data contains the data of other devices.	Verify the device type and the type of power stage.
1119	0	Data length error, too many bytes	–	–
111A	0	Data length error, fewer bytes	–	–
111B	4	Detected an error while downloading configuration (auxiliary information = Modbus register address)	One or more configuration values are not applied to the drive amplifier in the process of configuration download.	Please make sure that the configuration file is valid, and check whether the configuration file matches the model and version of the drive amplifier. The value in the error auxiliary information gives the Modbus register address of the parameter at which the initialization error was detected.
111C	1	Unable to initialize the scaling recalculation	Unable to initialize a parameter	The address of the parameter causing the detected error can be viewed on Trouble Logging page in Somove.
111D	3	Unable to restore the parameter to the initial state after detecting an error using the user-defined unit to recalculate the parameter.	An invalid configuration has ever occurred to the drive amplifier. Detected an error in the process of recalculation.	Please shut down and restart the drive amplifier. The relevant parameters may be identified in this way. Change parameter values as required. Make sure that the parameters are configured correctly before recalculation.
111E	1	The recalculation of the data set cannot be initiated.	A data set in the Motion Sequence operating mode cannot be recalculated.	The parameter address and data set number that cause this state can be retrieved using the *_PAR_ ScalingError* parameter.
111F	1	Recalculation is not possible.	Scaling factor is invalid.	Ensure that no unnecessary scaling factors are provided. Use alternative scaling factors. Reset the parameters to user-defined units before recalculating the scaling.
1120	1	Scaling recalculation cannot be initiated.	Parameters cannot be recalculated.	The parameter address that causes this state can be retrieved using the *_PAR_ ScalingError* parameter.
1121	0	The sequence of steps for calculating the scaling (fieldbus) is incorrect.	The recalculation has been initiated before the initialization is recalculated.	The recalculation needs to be initialized before starting the recalculation process.
1122	0	Scaling recalculation cannot be initiated.	Scaling recalculation is activated.	Wait for the completion of ongoing scaling recalculation.
1123	0	Unable to change parameters	Scaling recalculation is activated.	Wait for the completion of ongoing scaling recalculation.

E 1xxx: General (Continued)

Error code	Error class	Description	Cause	Measure
1124	1	Timeout while recalculating scaling	Exceeded the time (30 seconds) between initializing recalculation and starting recalculation.	After the recalculation is initialized, the recalculation must be started within 30 seconds.
1125	1	Unable to calculate scaling	The scaling factor of position, velocity or acceleration / acceleration exceeds the internal calculation limit.	Try again using the updated scaling factor.
1126	0	Configuration is locked by another access channel	–	Close the locking access channel (for example, other instances of the commissioning software).
1127	0	The received key is invalid	–	–
1129	0	The testing steps have not been initiated yet.	–	–
112A	–	The captured inputs cannot be enabled.	The location acquisition has not been enabled yet.	The location acquisition is enabled through "Probing cycle" (IDN170).
112B	–	Differential acquisition configuration is not possible.	The captured input 1 is not configured for both edges (IDN169).	The captured input 1 for both edges is configured.
112C	–	Differential acquisition configuration is not possible.	The captured input 2 is not configured for both edges (IDN169).	The captured input 2 for both edges is configured.
112D	0	Unable to support edge configuration	The selected capture input does not support simultaneous identification of rising and falling edges.	Set the edge to “Rising” or “Falling”.
112E	–	The current edge configuration cannot be changed.	The current edge configuration cannot be changed as the differential acquisition is active.	Disable differential acquisition.
112F	0	The settings of the time filter cannot be changed.	The position capture with time filter is already active. The filter settings cannot be changed.	Disable position capture.
1300	3	Safety function STO activated (STO_A, STO_B)	The safety-related function STO was activated in the operating state Operation Enabled.	Verify correct wiring of the inputs of the safety-related function STO and perform a Fault Reset.
1301	4	STO_A and STO_B different level	The levels of the inputs STO_A and STO_B were different for more than 1 second.	Verify correct wiring of the inputs of the safety function STO.
1302	0	Safety function STO activated (STO_A, STO_B)	Safety-related function STO was activated while the power stage was disabled.	Verify correct wiring of the inputs of the safety function STO.
1310	2	The frequency of external reference signal is too high	The frequency of the external reference signal (AqB signal, P/D signal or CW/ CCW) is higher than the allowed value.	Verify the frequency of the external reference signal. Verify the electronic gear ratio of the position operating mode.
1311	0	Unable to configure the selected signal input function or signal output function	Unable to use the selected signal input function or signal output function in the enabled operating mode.	Please select another function or change the operating mode.
1312	0	Limit switch signal or reference switch signal is not defined for the signal input function	A limit switch is required for reference point positioning operations. No limit switch is assigned to the signal input.	Please assign signal input functions to the Positive Limit Switch, Negative Limit Switch and Reference Switch.
1313	0	The signal input function cannot use the configured debounce time	The signal input function of this input does not support the selected debounce time.	Please set the debounce time to a valid value.
1314	4	At least two signal inputs have the same signal input function	At least two signal inputs have the same signal input function.	
1315	0	The frequency of reference signal is too high	The frequency of the pulse signal (AqB, pulse / direction and CW / CCW) is beyond the given range. The received pulse may be lost.	Adjust the frequency of the reference signal according to the input frequency of the drive amplifier. In addition, necessarily adjust the electronic gear ratio of the position operating mode according to the application requirements (position accuracy and velocity).

E 1xxx: General (Continued)

Error code	Error class	Description	Cause	Measure
1316	1	Position capture cannot be performed through the signal input now. Position capture is already used for	parameter *_SigLatched* Bit 28	–
1501	4	System error detected: Unable to determine the state of the DriveCom state machine.	–	–
1502	4	System error detected: Unable to determine the state of the HWL low-level state machine.	–	–
1503	1	Quick Stop is already triggered via the fieldbus.	Quick Stop is already triggered via the fieldbus. The option code for Quick Stop has been set to -1 or -2, which will cause the drive amplifier to enter operating state 9 - Fault, instead of operating state 7 Quick Stop Active.	–
1504	2	Unable to enable power stage Parameter *_SigLatched* Bit 4	The safety input function "Servo On" has been assigned to an input. However, there is still a 0 level present on the signal input.	A 1 level must be present on the signal input.
1600	0	Oscilloscope: No other data available	–	–
1601	0	Oscilloscope: Incomplete parameter settings	–	–
1602	0	Oscilloscope: Trigger variable not defined	–	–
1606	0	Record is still active	–	–
1607	0	Recording: Trigger not defined	–	–
1608	0	Recording: Invalid trigger option	–	–
1609	0	Recording: No channel selected	–	–
160A	0	Recording: No data available	–	–
160B	0	Unable to record parameters	–	–
160C	1	Auto-tuning: The moment of inertia is beyond the permissible range	The moment of inertia for the load is too high.	Verify whether the system can move freely. Verify the load. Please use the device of different power.
160E	1	Auto-tuning: Unable to start test motion	–	–
160F	1	Auto-tuning: Unable to enable power stage	Auto-tuning is not started in the operating state Ready to Switch On ”.	Enable auto-tuning when the drive amplifier is in the operating state Ready to Switch On.
1610	1	Auto-tuning: Processing stopped	Auto-tuning has been ended by a user command or has been interrupted due to an error detected in the drive amplifier (See the additional error information in the error memory, for example, DC bus undervoltage and limit switch triggered).	Troubleshoot the cause of the stop and restart the auto-tuning.
1611	1	System error detected: Unable to write parameters while performing auto-tuning	–	–
1612	1	System error detected: Unable to read parameters while performing auto-tuning	–	–

E 1xxx: General (Continued)

Error code	Error class	Description	Cause	Measure
1613	1	Auto-tuning: Exceeded the maximum permissible range of motion	When auto-setting, there is motion beyond the set range of motion.	Increase the value for the range of motion.
1614	0	Auto-tuning: Enabled	Auto-tuning has been started twice at the same time, or auto-tuning parameters have changed during auto-tuning.	Wait until auto-tuning ends and is restarted.
1615	0	Auto-tuning: Unable to change this parameter when the auto-tuning is enabled	The parameter AT_gain or AT_J will be written during auto-tuning.	Change parameters till the completion of auto-tuning.
1617	1	Auto-tuning: Friction torque or load torque is too high	Reached the maximum current (parameter P0-24 CTRL_I_max).	Verify whether the system can move freely. Verify the load. Please use the device of different power.
1618	1	Auto-tuning: 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	Auto-tuning: Auto-tuning velocity jump is not enough	Auto-tuning velocity <2 × AT_n_ tolerance. The drive amplifier is only checked at the first velocity jump.	Please change the auto-tuning velocity or the AT_ n_tolerance to achieve the desired state.
1620	1	Auto-tuning: Load torque is too high	The product power does not fit the machine load. The identified machine moment of inertia is too high compared to the motor moment of inertia.	Reduce the load and check the power of the product.
1621	1	System error detected: Calculation error	–	–
1622	0	Auto-tuning: Unable to perform auto-tuning	Auto-tuning can only be performed if no operating mode is enabled.	End the enabled operating mode or disable the power stage.
1623	1	Auto-tuning: Interrupt auto-tuning through stop request	Auto-tuning can only be performed if no operating mode is enabled.	End the enabled operating mode or disable the power stage.
1624	0	Real-time auto-tuning: acceleration and deceleration below the lower limit: 2,000 rpm	The acceleration is lower than the lower limit, and the real-time auto-tuning identification is inaccurate.	Increase the operating acceleration and deceleration.
1625	0	Adaptive notch filter: Oscillation frequency lower than the lower limit:150Hz	When the oscillation frequency is lower than 150Hz, the suppression effect of the adaptive notch filter is not significant.	–
16F0	0	Disable auto-tuning when the auto-tuning mode is invalid	The auto-tuning mode is invalid.	Activate auto-tuning after changing the auto-tuning mode to an valid mode.
1A00	0	System error detected: FIFO memory overflow	–	–
1A01	3	Motor replaced (other motor models)	The identified motor is not a previously identified motor.	Press S key to confirm the replacement.
1A03	4	System error detected: Mismatch between hardware and firmware	–	–
1A04	0	System error detected: SDFM value is not read timely	–	Please contact the Technical Support.
1A06	4	Initializing EtherCAT chip fail	1. Error of EtherCAT chip initialization 2. Abnormalities in the communication interface between MCU and EtherCAT	Replace the drive.
1B00	3	System error detected: Wrong motor and power stage parameters	Incorrect manufacturer parameter value (data) in the non-transitory memory of the device	Replace equipment.

E 1xxx: General (Continued)

Error code	Error class	Description	Cause	Measure
1B02	3	The target value of given torque is too high.	–	–
1B05	2	Detected an error while converting parameters	–	–
1B06	3	Unable to initiate Wake & Shake. Parameter *_SigLatched* Bit 30	The motor speed is too high when initiating Wake & Shake.	Check if the motor is in a stopped state when initiating Wake & Shake.
1B07	0	The motor speed is too high when ending Wake & Shake.	The motor is not in a stopped state when ending Wake & Shake. The commutation offset calculated during Wake & Shake may be inaccurate depending on the mechanical system.	Check the mechanical system.
1B08	3	There is a significant variation in the position of Wake & Shake.	The entered motor data is incorrect, especially motor resistance, motor inertia (for rotary motors), or motor mass (for linear motors). The settings in the *WakeAndShakeGain* parameter are incorrect.	Verify the motor data. Check the settings of the *WakeAndShakeGain* parameter.
1B09	0	The rated current during Wake & Shake has been reduced through I2t monitoring.	The current used during Wake & Shake is too high.	–
1B0A	0	The rated current for Wake & Shake may be too high for the output stage used.	Execute Wake & Shake with the rated current of the motor. When the rated current of the motor exceeds that of the output stage, the current used during Wake & Shake may be reduced through I2t monitoring of the output stage.	–
1B0B	1	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	The motor velocity is too high.	–	–
1B0D	3	The velocity value measured by the Velocity Observer is too high.	The system inertia calculated by the Velocity Observer is incorrect. The dynamics of the Velocity Observer are incorrect. During operation, the system inertia undergoes changes. In this case, it is not possible to use the Velocity Observer for operation. The Velocity Observer must be disabled.	The dynamics of the Velocity Observer can be modified by changing the parameter *CTRL_SpdObsDyn*. The system inertia used for Velocity Observer calculations can be modified by changing the parameter *CTRL_SpdObsInert*. If still not work, disable the Velocity Observer.
1B0E	3	The commutation angle cannot be determined when ending Wake & Shake.	The input motor data is incorrect, such as motor resistance, motor inertia (for rotary motors), or motor mass (for linear motors). The setting in the *WakeAndShakeGain* parameter is incorrect. The wiring of the holding brake is incorrect (if present).	Verify the motor data. Check the settings of the *WakeAndShakeGain* parameter. Ensure the wiring of the holding brake is correct.
1B0F	3	Too high velocity detected during power stage enabling, exceeding the velocity set by the parameter P6-42	Incorrect encoder signal / incorrect motor phase line connection.	Make sure that the encoder is connected correctly or the power supply of the motor is connected correctly.

E 2xxx: Overcurrent

Error code	Error class	Description	Cause	Measure
2201	3	System error detected: DC bus transfer error	–	–
2300	3	Power stage overcurrent	Motor short circuit and power stage disabled. Incorrect motor phase line connection.	Make sure that the power supply of the motor is connected correctly.
2301	3	Braking resistor overcurrent	Short circuit of brake resistor.	Make sure that the external braking resistor has the correct wiring and power.
2302	3	Power stage phase-U overcurrent	The phase U of the motor is short-circuited to ground or short circuit occurs between phase U and other phases and the power stage is disabled. Incorrect motor phase line connection.	Eliminate the short circuit and ensure that the motor power cables are connected correctly.
2303	3	Power stage phase-W overcurrent	The phase W of the motor is short-circuited to ground or short circuit occurs between phase W and other phases and the power stage is disabled. Incorrect motor phase line connection.	Eliminate the short circuit and ensure that the motor power cables are connected correctly.
2304	3	Power stage phase-U and phase-W overcurrent	The phase-U and phase-W of the motor is short-circuited to ground or short circuit occurs between phase-U and phase-W and other phases and the power stage is disabled. Incorrect motor phase line connection.	Eliminate the short circuit and ensure that the motor power cables are connected correctly.
2305	3	Power stage current offset is too large	The load is too large, the motor is locked, the encoder connection is lost, and the motor phase line is connected incorrectly.	Check the connection between the motor and the load, the encoder connection, and the connection of the motor power cable.
2306	3	Power stage phase-U current is abnormal during startup	Motor phase-U is short-circuited to ground and short circuit occurs between phase U and other phases or the power stage is disconnected.	Eliminate the short circuit and ensure that the motor power cables are connected correctly.
2307	3	Power stage phase-W current is abnormal during startup	Motor phase-W is short-circuited to ground and short circuit occurs between phase U and other phases or the power stage is disconnected.	Eliminate the short circuit and ensure that the motor power cables are connected correctly.

E 3xxx: Voltage

Error code	Error class	Description	Causes	Measure
3100	2	Power supply unavailable, undervoltage or overvoltage	The phase is missing for more than 50 ms. The supply voltage is not within the valid range. The supply frequency is not within the valid range.	Make sure that the supply voltage is consistent with the technical parameters.
3101	0	Switching power supply 24Vdc output is missing	Switching power supply does not work.	Please contact the Technical Support.
3200	3	DC bus overvoltage	The feedback during deceleration is too high.	Check the deceleration ramp and the power of the drive and braking resistor.
3201	3	DC bus undervoltage (Power-off threshold)	Supply voltage loss, poor voltage supply.	Guarantee power supply.
3202	2	DC bus undervoltage (Emergency stop threshold)	Supply voltage loss, poor voltage supply.	Guarantee power supply.
3203	3	DC bus overvoltage (during startup)	The power supply is abnormal or the motor phase is short-circuited to ground.	Check the power supply and motor output and ensure the correct power cable connection of the motor.
3206	0	DC bus undervoltage, power supply undervoltage, power supply overvoltage or lack of power supply	Lack of power supply or low supply voltage.	Verify the power supply and make sure that the supply voltage is consistent with the technical parameters.
3207	3	Three-phase power supply is missing	Three-phase power input is missing.	Check the power supply for correctness.
3300	0	The winding voltage of the motor is lower than the supply voltage of the drive amplifier.	If the winding voltage of the motor is lower than the supply voltage of the drive amplifier, it may lead to excessive electrical noise.	Check the motor temperature. When the temperature is too high, use a motor with higher winding voltage or a drive amplifier with lower supply voltage.

E 4xxx: Temperature

Error code	Error class	Description	Cause	Measure
4100	3	Power stage overheating	Transistor overheating: ambient over-temperature, fan error or dust.	Check the fan to improvedissipation performance of the control cabinet.
4101	0	Power stage overheating	Transistor overheating: ambient over-temperature, fan error or dust.	Check the fan to improve the heat dissipation performance of the control cabinet.
4102	0 or 3	Power supply power stage overload (I^2t)	The current exceeds the nominal value for a long time.	Check the size and reduce the cycle time.
4200	3	Device overheating	The ambient temperature is too high or the heat dissipation performance is degraded by dust.	Improve the heat dissipation performance of the control cabinet. If a fan is installed, make sure that it is functioning properly. Install a fan in the control cabinet. Please improve the thermal conductivity from the back of the device to the control cabinet.
4201	0	Excess temperature of CPU	The ambient temperature is too high or the heat dissipation performance is degraded by dust.	Improve the heat dissipation performance of the control cabinet. If a fan is installed, make sure that it is functioning properly. Install a fan in the control cabinet. Please improve the thermal conductivity from the back of the device to the control cabinet.
4300	2	Motor overheating. Parameter *_SigLatched* Bit 17	Excess ambient temperature. Excess turn-on time. Improper motor installation (insulation). Motor overload.	Check motor installation: Heat must be dissipated through mounting surface. Reduce ambient temperature. Ensure proper ventilation.
4301	0	Motor overheating. Parameter *_WarnLatched* Bit 17	Excess ambient temperature. Excess turn-on time. Improper motor installation (insulation). Motor overload.	Check motor installation: Heat must be dissipated through mounting surface. Reduce ambient temperature. Ensure proper ventilation.
4302	0 or 3	Motor overload (I^2t)	The current exceeds the nominal value for a long time.	Verify whether the system can move freely. Verify the load. Use a motor of different power if necessary.
4303	0	Motor temperature unmonitored.	Temperature parameters unavailable or invalid (in the motor's electronic nameplate, non-volatile memory of the encoder); parameter A12 equals 0.	Please consult your Schneider Electric service representative. Replace the motor.
4304	0	The encoder does not support motor temperature monitoring.	–	–
4402	0	Braking resistor overload (I^2t >75%)	The feedback energy is too high. The external load is too high. The motor velocity is too high. The deceleration value is too high. Insufficient braking resistor.	Reduce load, velocity and deceleration. Please make sure that the braking resistor has a large enough design capacity.
4403	0	Braking resistor overload (I^2t >100%)	The feedback energy is too high. The external load is too high. The motor velocity is too high. The deceleration value is too high. Insufficient braking resistor.	Reduce load, velocity and deceleration. Please make sure that the braking resistor has a large enough design capacity.
4404	3	Disable the brake when Tz mode is activated	The motor output is short-circuited when the braking resistor is connected.	Eliminate the short circuit and ensure that the motor power cables are connected correctly.

E 5xxx: Hardware

Error code	Error class	Description	Cause	Troubleshooting
5101	0	Insufficient Modbus voltage supply.	–	–
5102	4	Motor encoder supply voltage Parameter *_SigLatched* Bit 16	The encoder's voltage supply is not within the allowed range of 8V to 12V.	Replace the device. Please consult your Schneider Electric service representative.
5200	4	An error in the connection between the motor and the encoder detected. Parameter*_SigLatched* Bit 16	The encoder not properly connected, EMI.	–
5201	4	A communication failure with the motor encoder detected. Parameter*_SigLatched* Bit 16	The encoder not properly connected, EMI.	–
5202	4	Motor encoder not supported. Parameter*_SigLatched* Bit 16	An incompatible encoder connected.	–
5203	4	A connection error with the motor encoder detected. Parameter*_SigLatched* Bit 16	The encoder not properly connected	–
5204	3	The connection with the motor encoder lost. Parameter*_SigLatched* Bit 16	The encoder not properly connected	–
5206	0	A communication failure with the encoder detected. Parameter*_WarnLatched* Bit 16	The communication channel to the encoder experiencing interference.	Check the EMC measures.
5207	1	Unable to support this function	The current hardware version does not support this function.	If the error occurs, please • Restart the drive. • Perform a factory reset to the drive. • Contact the Technical Support or replace the drive.
5302	4	The motor requires a PWM frequency that is not supported by the output stage (16 kHz).	The motor can only operate at a PWM frequency of 16 kHz (as stated on the motor's electronic nameplate). However, the output stage does not support this PWM frequency.	Use a motor that operates at a PWM frequency of 8 kHz. Please consult your Schneider Electric service representative.
5430	4	System error detected: EEPROM read error	–	If the error occurs, please • Restart the drive. • Perform a factory reset to the drive. • Contact the Technical Support or replace the drive.
5431	3	System error: EEPROM write error	–	If the error occurs, please • Restart the drive. • Perform a factory reset to the drive. • Contact the Technical Support or replace the drive.
5432	3	System error: EEPROM state machine	–	If the error occurs, please • Restart the drive. • Perform a factory reset to the drive. • Contact the Technical Support or replace the drive.
5433	3	System error: EEPROM address error	–	If the error occurs, please • Restart the drive. • Perform a factory reset to the drive. • Contact the Technical Support or replace the drive.

E 5xxx: Hardware (Continued)

Error code	Error class	Description	Cause	Troubleshooting
5434	3	System error: EEPROM wrong data length	–	If the error occurs, please • Restart the drive. • Perform a factory reset to the drive. • Contact the Technical Support or replace the drive.
5435	4	System error: EEPROM unformatted	–	If the error occurs, please • Restart the drive. • Perform a factory reset to the drive. • Contact the Technical Support or replace the drive.
5436	4	System error: EEPROM incompatible structure	–	If the error occurs, please • Restart the drive. • Perform a factory reset to the drive. • Contact the Technical Support or replace the drive.
5437	4	System error detected: EEPROM checksum error (Manufacturer data)	–	If the error occurs, please • Restart the drive. • Perform a factory reset to the drive. • Contact the Technical Support or replace the drive.
5438	3	System error detected: EEPROM checksum error (User parameters)	–	If the error occurs, please • Restart the drive. • Perform a factory reset to the drive. • Contact the Technical Support or replace the drive.
5439	3	System error detected: Non-volatile memory checksum error (fieldbus parameters) Parameter_*SigLatched* Bit 29	–	–
543B	4	System error detected: No valid manufacturing data	–	If the error occurs, please • Restart the drive. • Perform a factory reset to the drive. • Contact the Technical Support or replace the drive.
543E	3	System error detected: EEPROM checksum error	–	If the error occurs, please • Restart the drive. • Perform a factory reset to the drive. • Contact the Technical Support or replace the drive.
543F	3	System error detected: EEPROM checksum error (Motor parameters)	–	If the error occurs, please • Restart the drive. • Perform a factory reset to the drive. • Contact the Technical Support or replace the drive.
5441	4	System error detected: EEPROM checksum error (Control loop parameter set)	–	If the error occurs, please • Restart the drive. • Perform a factory reset to the drive. • Contact the Technical Support or replace the drive.
5442	4	System error detected: EEPROM checksum error (Control loop parameter set 1)	–	If the error occurs, please • Restart the drive. • Perform a factory reset to the drive. • Contact the Technical Support or replace the drive.

E 5xxx: Hardware (Continued)

Error code	Error class	Description	Cause	Troubleshooting
5443	4	System error detected: EEPROM checksum error (Control loop parameter set 2)	–	If the error occurs, please • Restart the drive. • Perform a factory reset to the drive. • Contact the Technical Support or replace the drive.
5444	4	System error detected: EEPROM checksum error (NoReset parameters)	–	If the error occurs, please • Restart the drive. • Perform a factory reset to the drive. • Contact the Technical Support or replace the drive.
5445	4	System error detected: EEPROM checksum error (Hardware information)	–	If the error occurs, please • Restart the drive. • Perform a factory reset to the drive. • Contact the Technical Support or replace the drive.
5446	4	System error detected: EEPROM checksum error (for blackout data)	The internal EEPROM is not functioning properly.	If the error occurs, please • Restart the drive. • Perform a factory reset to the drive. • Contact the Technical Support or replace the drive.
5447	3	System error: EEPROM checksum error (data set operating mode motion sequence)	System error.	Restore the factory settings or replace the drive.
544A	4	System error detected: Non-volatile memory checksum error (management data) Parameter_*SigLatched* Bit 29	–	–
544C	4	System error detected: EEPROM with write protection	–	If the error occurs, please • Restart the drive. • Perform a factory reset to the drive. • Contact the Technical Support or replace the drive.
545B	4	FW error	Incompatibility of FW with hardware	Re-download the corresponding firmware for the product.
5468	4	System error detected: EEPROM checksum error (Control loop parameter set 3)	–	If the error occurs, please • Restart the drive. • Perform a factory reset to the drive. • Contact the Technical Support or replace the drive.
5469	4	System error detected: EEPROM checksum error (real-time auto-tuning parameter set)	–	–
546A	4	EPROM checksum exceeding motion sequence CRC error	System error.	Restore the factory settings or replace the drive.
5500	3	System error detected: Data transfer timeout	–	–
5502	2	System error detected: Read/write request timeout	–	–
5503	2	System error detected: Invalid response when issuing read/write request	–	–
5504	4	System error detected: Security module unavailable	–	–
5505	4	System error detected: Unable to determine the type of security module.	–	–

E 5xxx: Hardware (Continued)

Error code	Error class	Description	Cause	Troubleshooting
5506	1	An error is detected when writing access to the security module via the fieldbus. Additional information in the error memory indicates the detailed error code.	–	–
5600	3	Detected motor connection phase error	Motor phase line missing.	Verify the connection of the motor phase line.
5603	3	Rectification and commutation error found	Incorrect motor wiring. The encoder signal is lost due to interference coupling. The load torque is higher than the motor torque. The encoder EEPROM contains invalid data (the phase difference of the encoder is incorrect). The motor is not calibrated accurately.	Please the wiring of motor phase line and encoder. Verify the EMC to ensure that the grounding and shielding connections are correct. Use a motor with its power suitable for the load torque. Verify the motor data. Please contact the Technical Support.
5604	3	Power stage overcurrent is detected, current loop command reaches maximum current threshold (300%) and exceeds the time set by the parameter P6-24	Incorrect encoder signal / incorrect motor phase line connection / motor overload.	Make sure that the encoder is connected correctly / Make sure that the power supply of the motor is connected correctly / Check the mechanical system to eliminate locked rotor, check the match between the motor and load, and check the acceleration ramp.

E 6xxx: Software

Error code	Error class	Description	Cause	Measure
6102	4	System error detected: Internal software error	–	–
6103	4	System error detected: System stack overflow	–	–
6104	0	System error detected: divisor is 0 (internal)	–	–
6105	0	System error detected: overflow during 32-bit operation(Internal)	–	–
6106	4	System error detected: Data interface size not suitable	–	–
6107	0	Parameter out of range (calculation error detected)	The numerator or denominator of the electronic gear ratio exceeds 64 bits or the final calculation of the electronic gear ratio exceeds 32 bits.	Check the parameter value to be written.
6108	0	Function not available	–	–
6109	0	System error detected: Beyond the internal range	–	–
610A	2	System error detected: Calculated value cannot be expressed as a 32-bit number	–	–
610D	0	An error is detected in the selected parameters	A wrong parameter value is selected.	Check the parameter value to be written.
610E	4	System error detected: 24 Vdc below the power-off voltage threshold	–	–
610F	4	System error detected: internal Timer base is missing(Timer0)	–	–
6111	2	System error detected: Memory range locked	–	–
6112	2	System error detected: No memory	–	–
6113	1	System error detected: Calculated value cannot be expressed as a 16-bit number	–	–
6114	4	System error detected: Disable function call from interrupt service	Programming error.	–

E 7xxx: Interface, wiring

Error code	Error class	Description	Cause	Measure
7100	4	System error detected: Invalid power stage data	Incorrect power stage data stored in the device (CRC error), error detected in internal memory data.	Contact the Technical Support or replace the device.
7110	2	System error detected: Internal brake resistor	Internal brake resistor function abnormal or not connected.	Please consult your Schneider Electric service representative.
7111	0	External braking resistor is active and parameter value cannot be changed	When the external braking resistor is active, still try to change the value of a parameter in P0-22, P0-23 or P0-24.	To change the value of a parameter in P0-22, P0-23, or P0-24, the external braking resistor must not be active.
7112	2	No external braking resistor connected	External braking resistor activated (Parameter RESint_ext), but no external resistor is detected.	Verify wiring of the external braking resistor. Verify correct resistance.
7122	4	Invalid motor data	Incorrect motor data saved in the encoder, error detected in internal memory data.	Contact the Technical Support or replace the motor.
712D	4	Motor model data not configured	Motor model data not configured.	–
712F	0	No data field on the electronic nameplate of motor	–	–
7132	0	System error detected: Unable to write motor configuration	–	–
7133	0	Unable to write motor configuration	–	–
7134	4	Incomplete motor configuration	–	–
7135	4	Unable to support this format	–	–
7136	4	Incorrect encoder type selected in parameter P6-01	–	–
7137	4	Detected an error during internal conversion of motor configuration	–	–
7138	4	Parameter configured for the motor exceeds the permissible range	–	–
7139	0	Encoder offset: The data field in the encoder has an error.	–	–
713B	4	The encoder connected with the motor is changed	The motor connected after this power-on of the drive is different from the motor connected during the previous power-off.	Please restart the drive. Please perform a factory reset to the drive. Please contact the Technical Support.
7200	4	System error detected: Calibration analog / digital converter / BLE file error in production	–	–
7320	4	System error detected: Invalid encoder parameters. Parameter_*SigLatched* Bit 16	No parameter settings have been made for interference coupling on the communication channel (Hiperface) for connecting the encoder or motor encoder during factory production.	Please consult your Schneider Electric service representative.
7321	3	Timeout occurs when reading the absolute position from the encoder. Parameter_*SigLatched* Bit 16	Communication channel for connecting the encoder or motor encoder. The interference coupling function on (Hiperface) is not functioning properly.	Check the EMC measures.

E 7xxx: Interface, wiring (Continued)

Error code	Error class	Description	Cause	Measure
7347	0	System error detected: Unable to initialize position	The encoder signal is disturbed.	Please reduce the interference with the encoder signal. Check the shield connection. Please contact the Technical Support.
734C	par.	An error is detected in the quasi-absolute position. Parameter_*SigLatched* Bit 16	During the period when the drive amplifier is in a closed state, the motor shaft may have rotated. A quasi-absolute position was discovered beyond the allowable range of motor shaft movement.	When the quasi-absolute position feature is active, it is only permitted to deactivate the drive while the motor is in a stopped state. Do not allow the motor shaft to move during the period when the drive amplifier is closed.
734D	0	Index pulse not available for the encoder	–	–
7500	0	RS485 / Modbus: Overflow error detected	EMC and wiring.	Verify the cable.
7501	0	RS485 / Modbus: Framing error detected	EMC and wiring.	Verify the cable.
7502	0	RS485 / Modbus: Parity check error detected	EMC and wiring.	Verify the cable.
7503	0	RS485 / Modbus: Reception error detected	EMC and wiring.	Verify the cable.
7601	4	System error detected: Unidentified encoder type	–	–
760C	2	Maximum encoder frequency exceeded Parameter _*SigLatched* Bit 22	Velocity too high for the encoder.	–
760E	2	Position assessment error (an error is detected during signal identification). Parameter_*SigLatched* Bit 22	Encoder signal affected by EMI.	Check the wiring and cable shielding.
760F	0	Position assessment error (interference coupling detected). Parameter_*WarnLatched* Bit 22	Encoder signal affected by EMI.	Check the wiring and cable shielding.
7619	4	Incorrect encoder communication	Incorrect encoder wiring / adjustment or incorrect encoder parameter settings.	Verify the encoder cable: wiring and shield connection. Verify the adjustment of the encoder. Verify the parameter settings of the encoder.
761A	0	Incorrect encoder communication	Incorrect encoder wiring	Verify the encoder cable: wiring and shield connection.
761D	2	Maximum encoder velocity exceeded	Maximum encoder velocity exceeded For communication encoders, detection of an encoder communication error may also cause this error.	–
7621	1	Failed runtime compensation. Parameter_*SigLatched* Bit 22	–	Verify the encoder cable: wiring and shield connection.
7622	0	Rotary transformer timeout. Parameter_*WarnLatched* Bit 22	System malfunction identified.	Replace the encoder module.

E 7xxx: Interface, wiring (Continued)

Error code	Error class	Description	Cause	Measure
7623	0	Absolute encoder signal unavailable. Parameter_*WarnLatched* Bit 22	No available encoder on the specified input terminal (ENC_abs_ Source).	Check the wiring and inspect the encoder. Modify the value of the parameter ENC_ abs_source.
7625	0	Unable to set the absolute position of encoder 1. Parameter_*WarnLatched* Bit 22	Encoder not connected to input terminal of encoder 1.	Connect an encoder to the input terminal of encoder 1 before directly setting the absolute position using ENC1_abs_pos.
7626	4	Overflow error detected during encoder calibration. Parameter_*SigLatched* Bit 22	The multi-turn resolution of the machine encoder exceeds the system limits relative to the motor axis, for example, due to a mechanical gear ratio between the machine encoder and the motor encoder.	Reduce the number of bits used for position assessment of the multi-turn resolution by using parameter ENCDigResMulUsed.
762A	3	Failed to initialize the incremental encoder	The encoder is not connected or the communication is disturbed, EMC.	Verify the cable connection. Verify the cable specification, shield connection and EMC.
762B	3	Failed to initialize the incremental encoder: motor rotation during power-on.	The motor rotates during drive power-on, failing to identify the initial position.	Stop the motor and power it up again
762C	3	Motor velocity detected by incremental encoder is too high	The encoder signal is disturbed, or the motor velocity is too high.	Please reduce the interference with the encoder signal and verify the shield connection. Please reduce the motor velocity.
762D	3	An internal error occurs to the encoder communication	An internal error occurs to the encoder.	Verify the cable connection. Verify the cable specification, shield connection and EMC. If the encoder is damaged, replace the motor.
762E	–	In 5V power mode, the speed exceeds 6000rpm or the acceleration exceeds 80000rad/s^2 in the event of power disruption.	–	–
762F	–	Single-turn information decoding failure.	–	–
7630	–	The encoder resolution is too low during high-speed startup.	–	–
7631	–	Encoder count overflow.	–	–
7632	–	Encoder overheating.	–	–
7633	–	Multi-turn data lost, multi-turn count failed.	–	–
7634	–	Low battery voltage.	–	–
7635	–	Battery voltage below 3.1V.	–	–
7636	–	Encoder state machine error.	–	–
7701	4	System error detected: Output stage connection timeout. Parameter_*SigLatched* Bit 31	–	Please consult your Schneider Electric service representative.

E 7xxx: Interface, wiring (Continued)

Error code	Error class	Description	Cause	Measure
7702	4	System error detected: Invalid data received from the output stage. Parameter_*SigLatched* Bit 31	–	Please consult your Schneider Electric service representative.
7703	4	System error detected: Data exchange with the output stage lost. Parameter_*SigLatched* Bit 31	–	Please consult your Schneider Electric service representative.
7704	4	System error detected: Failed data exchange for the output stage recognition. Parameter_*SigLatched* Bit 31	–	Please consult your Schneider Electric service representative.
7705	4	System error detected: Incorrect checksum identification data for the output stage. Parameter_*SigLatched* Bit 31	–	Please consult your Schneider Electric service representative.
7706	4	System error detected: No identification frame received from the output stage. Parameter_*SigLatched* Bit 31	–	Please consult your Schneider Electric service representative.
7707	4	System error detected: Mismatching between the output stage type and the production data.	–	Please consult your Schneider Electric service representative.
7708	4	PIC supply voltage below level Parameter_*SigLatched* Bit 31	–	Please consult your Schneider Electric service representative.
7709	4	System error detected: Invalid quantity of received data. Parameter_*SigLatched* Bit 31	–	Please consult your Schneider Electric service representative.
770A	2	System error detected: PIC received data with incorrect checksum. Parameter_*SigLatched* Bit 31	–	Please consult your Schneider Electric service representative.
770B	–	The motor has been replaced.	–	–

E Axxx: Motor movement

Error code	Error class	Description	Cause	Measure
A065	0	Unable to write the parameter	A data set is still enabled.	Wait until the end of the currently enabled data set.
A066	0	Unable to adopt the teaching position. Parameter_*WarnLatched* Bit 4	The data set type is not 'MoveAbsolute'.	Set the data set type to 'MoveAbsolute'.
A067	1	The values in the data set are invalid. The additional information in the error memory indicates the data set number (low byte) and entry (high byte). Parameter_*SigLatched* Bit 4	The values in the data set are invalid.	For more information, refer to the parameters MSM_error num and _MSM_error_entry.
A300	0	The deceleration is still enabled after a stop request is made	The stop is canceled earlier than normal. A new command is issued after a stop request has been issued but before it reaches the motor stop	Wait for a full stop before canceling the stop signal. Wait until the motor realizes a full stop.
A301	0	The drive amplifier is in the operating mode “Quick Stop Active”	Detected a error of error class 1. The drive amplifier has been stopped by “Quick Stop”.	–
A302	1	Stop by positive limit switch	The positive limit switch has been enabled because it has left the range of motion, the limit switch is not functioning properly or the signal is disturbed.	Verify the application. Verify the function and connection of the limit switch.
A303	1	Stop by negative limit switch	The negative limit switch has been enabled because it has left the range of motion, the limit switch is not functioning properly or the signal is disturbed.	Verify the application. Verify the function and connection of the limit switch.
A304	1	Stop by reference switch	–	–
A305	0	Unable to enable power stage in current operating state	System error.	If the errorcannot be eliminated, reset or replace the drive.
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.	Execute a 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.
A308	0	Drive is in operating state Fault or Fault Reaction Active	Error with error class 2 or higher detected.	Verify the error code, remove the cause and perform a Fault Reset.
A309	0	Drive not inOperation Enabled	A command has been issued, and execute the command on the premise that the drive amplifier is in Operation Enabled (for example, the command changing operating mode).	Set the drive amplifier to Operation Enabled and repeat the command.
A310	0	Power stage not enabled	Unable to execute the command 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 switching is active	An operating mode start request is received while the operating mode switching is active.	–
A312	0	Interrupted the generation of characteristic curve	–	–
A313	0	Position overflow, making the zero point not valid any longer (ref_ok=0)	Exceeded the limit of the range of motion and the zero point is no longer valid. Absolute motion requires a valid zero point.	Please define a zero point that is valid in the operating mode Homing.

E Axxx: Motor movement (Continued)

Error code	Error class	Description	Cause	Measure
A314	0	No valid zero point	This command requires a valid zero point (ref_ok=1).	Please define a zero point that is valid in the operating mode Homing.
A315	0	The operating mode Homing is active	As long as the operating mode Homing is enabled, it has no response to other command.	Wait until reference movement is finished.
A316	0	Overflow when calculating acceleration	–	–
A317	0	The motor is not at a standstill	A command has been issued, and as long as the motor is not at a standstill, it has no response to other command. For example: • Change of software limit switches • Change of handling of monitoring signals • Setting of reference point • Teach in of data set	Wait until the motor has come to a standstill (x_end = 1).
A318	0	Operating mode enabled (x_end = 0)	A new operating mode cannot be activated as long as another operating mode is active.	Wait until the command processing in this operating mode ends (x_end = 1) or the current operating mode ends with a stop command.
A319	1	Manual tuning / Auto-tuning: Motion out of range	The motion exceeds the maximum range of motion set by the parameter.	Check the permissible range of motion and time interval.
A31A	0	Manual tuning / Auto-tuning: amplitude / offset is too high	The magnitude of the tuning plus the offset exceeds the internal limits for velocity or current.	Select a lower amplitude and offset value.
A31B	0	Stop Request Issued	Command execution is not allowed when there is a stop request.	End the stop request and repeat the 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.
A31D	0	Out of velocity range	The velocity command is set to a value that is greater than the maximum velocity P4-07 or the current maximum velocity of the connected motor.	If the value set in P4-07 is lower than the value of the current maximum velocity of the connected motor, increase the value set in P4-07. Please reduce the velocity command value.
A31E	1	Stop by positive software limit switch	This command may not be executed because the positive software limit switch is activated.	Return to the permissible range of motion.
A31F	1	Stop by negative software limit switch	This command may not be executed because the negative software limit switch is activated.	Return to the permissible range of motion.
A320	3	Exceeded the permissible position deviation	External load or acceleration is too high.	Reduce the external load or acceleration. Use a drive amplifier of different power if necessary. The error response can be set through the parameter ErrorResp_p_dif.
A322	0	Detected an error while calculating the ramp	–	–
A323	3	System error detected: detected a processing error during characteristic curve generation	–	–

E Axxx: Motor movement (Continued)

Error code	Error class	Description	Cause	Measure
A324	1	Error detected during homing. Additional information in the error memory indicates the detailed error code. Parameter *_SigLatched* Bit 4	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,E A328 or E A329.
A325	1	The proximate limit switch is not activated	Positioning of the reference point towards the positive limit switch or the negative limit switch has been disabled.	Enable the limit switch via 'IOsigLimP' or 'IOsigLimN'.
A326	1	Reference switch is not found between positive limit switch and negative limit switch	The reference switch is not functioning properly or is not connected properly.	Check the function and wiring of the reference switch.
A329	1	The signal of more than one positive limit switch / negative limit switch / reference switch is active	The reference switch or limit switch is not connected correctly, or the voltage of the switching power supply is too low.	Check the wiring of the 24 Vdc power supply.
A32A	1	When moving in the positive direction, the positive limit switch is triggered	Start the reference point positioning operation in the positive direction of movement (for example, the reference point positioning operation towards the negative limit switch) and enable the positive limit switch (the switch is in the direction opposite to the direction of movement).	Verify the function and connection of the limit switch. Enable JOG motion in the negative direction of movement (the target limit switch must be connected to the negative limit switch).
A32B	1	When moving in the negative direction, the negative limit switch is triggered	Start the reference point positioning operation in the positive direction of movement (for example, the reference point positioning operation towards the positive limit switch) and enable the negative limit switch (the switch is in the direction opposite to the direction of movement).	Verify the function and connection of the limit switch. Enable JOG motion in the positive direction of movement. (The target limit switch must be connected to the positive limit switch).
A32C	1	Detected a reference switch error (switch signal is triggered momentarily or exceeded by switch)	Limit switch signal interference. The motor will be under vibration or shock load if it stops after the switch signal is enabled.	Verify the supply voltage, wiring and switch function. Verify the response of the motor after stopping and optimize the settings of the control loop.
A32D	1	Detected a positive limit switch error (switch signal is triggered momentarily or exceeded by switch)	Limit switch signal interference. The motor will be under vibration or shock load if it stops after the switch signal is enabled.	Verify the supply voltage, wiring and switch function. Verify the response of the motor after stopping and optimize the settings of the control loop.
A32E	1	Detected a negative limit switch error (switch signal is triggered momentarily or exceeded by switch)	Limit switch signal interference. The motor will be under vibration or shock load if it stops after the switch signal is enabled.	Verify the supply voltage, wiring and switch function. Verify the response of the motor after stopping and optimize the settings of the control loop.
A32F	1	No index pulse found	The signal for the index pulse is not connected or not functioning properly.	Verify the index pulse signal and its connection.
A330	0	The reference point positioning operation towards the index pulse cannot be duplicated. Index pulse is too close to the switch	The difference in position between the index pulse and the switch-on point is small.	Increase the spacing between the index pulse and the switch-on point. If possible, select the half of one revolution as the spacing between the index pulse and the switch-on point.
A332	1	Jog error detected. Additional information in the error memory indicates the detailed error code. Parameter *_SigLatched* Bit 4	Jog movement was stopped in response to a detected error.	For additional info, verify the detailed error code in the error memory.

E Axxx: Motor movement (Continued)

Error code	Error class	Description	Cause	Measure
A333	3	System error detected: Invalid internal selection.	–	–
A334	2	Timed out while monitoring stop window	The position deviation after the motion ends is greater than the stop window. This situation may be caused by an external load.	Verify the external load. Check the parameters (P6-15, P6-16, and P6-17) related to stop window settings. Optimize the settings of the control loop parameters.
A336	1	System error detected: Impact limit with position offset after motion (auxiliary information = offset in increment list)	–	–
A337	0	Unable to continue executing the operating mode. Parameter_*WarnLatched* Bit 4	The interrupted motion cannot continue in the ProfilePosition operating mode because a different operating mode is enabled during this period.	Restart the operating mode.
A338	0	Operating mode not available	The selected operating mode is not available.	–
A339	0	No processing selected for motor encoder or fast position capture on motor index pulse already activated. Parameter_*WarnLatched* Bit 4	–	–
A33A	0	No valid zero point (ref_ OK=0) parameter _WarnLatched Bit 4	The zero point of the operating mode Homing is not defined. This zero point is no longer valid because the motor has been out of the range of motion The motor has no absolute encoder.	Please define a valid zero point for the operating mode Homing. Use a motor with an absolute encoder.
A33C	0	Functions are not available under this operating mode	The activated function is not available under the activated operating mode. Example: Start backlash compensation when auto-tuning / manual tuning is activated.	–
A33D	0	Hybrid motion has been enabled. Parameter_*WarnLatched* Bit 4	During operation of hybrid motion, changes to the hybrid motion occur (without reaching the end position of hybrid motion yet).	Wait for the completion of hybrid motion before setting the next position.
A33E	0	Motion is disabled. Parameter_*WarnLatched* Bit 4	Enable motionless hybrid motion.	Start motion before enabling hybrid motion.
A33F	0	The position of hybrid motion is not within the range of the ongoing motion. Parameter_*WarnLatched* Bit 4	The position of hybrid motion is outside the range of motion.	Check the position of hybrid motion and its range of motion.
A340	1	An error has been detected in the Motion Sequence operating mode. The additional information in the error memory indicates the detailed error code. Parameter_*SigLatched* Bit 4	As a response to the detected error, the Motion Sequence operating mode has been stopped. For detailed information about the detected error, refer to the auxiliary information in the error memory.	Refer to the auxiliary information for the detected error.
A341	0	The hybrid motion position has been exceeded. Parameter_*WarnLatched* Bit 4	The motion has moved beyond the hybrid motion position.	–

E Axxx: Motor movement (Continued)

Error code	Error class	Description	Cause	Measure
A342	1	The target velocity has not been reached at the hybrid motion position. Parameter_*SigLatched* Bit 4	The hybrid motion position has been exceeded without reaching the target velocity.	Lower the ramp velocity in order to achieve the target velocity at the hybrid motion position.
A343	0	Processing can only be performed on a linear ramp. Parameter_*WarnLatched* Bit 4	The hybrid motion position has been set using a non-linear ramp.	Set a linear ramp.
A344	par.	Position deviation between the maximum between the motor encoder and the machine encoders has been exceeded. Parameter_*SigLatched* Bit 8	Encoder cable error or malfunction. Machine encoder not properly connected or not powered correctly. The counting direction of the motor encoder differs from that of the machine encoder. Incorrect resolution coefficient setting for the machine encoder (numerator or denominator).	Check the encoder connection. Check the parameter settings of the machine encoder.
A347	0	Exceeded the permissible position deviation parameter (P6-22/P6-24)	External load or acceleration is too high.	Reduce the external load or acceleration.
A348	1	No analog reference source is selected	The analog input channel is not configured.	Select analog channel 1 or analog channel 2 as the analog reference.
A349	0	The position setting exceeds the limit value of the system	The position nominal scaling factor set in parameter P5-01 and P5-02 is too small.	Change the settings via the parameter P5-01 and P5-02 to increase the scaling factor.
A34A	0	The velocity setting exceeds the limit value of the system	The velocity ratio of 'VELscaleDenom' and 'VELscaleNum' leads to an excessively small scaling factor. The velocity has been set to a value higher than the maximum velocity (maximum velocity value is 13200 RPM).	Modify 'VELscaleDenom' and 'VELscaleNum' to increase the scaling factor.
A34B	0	The ramp setting exceeds the limit value of the system	The nominal ratio of 'RAMPscaleDenom' and 'RAMPscaleNum' for the ramp leads to an excessively small scaling factor.	Modify 'RAMPscaleDenom' and 'RAMPscaleNum' to increase the scaling factor.
A34C	0	The resolution of the ratio is too high (out of range).	–	–
A34D	0	The function is not available when the modulus is enabled.	This function is not available when the modulus is enabled.	To use this function, disable the modulus.
A34E	0	The target values for Move Absolute cannot be used with modulus processing and the defined modulus range.	When setting 'MOD_Absolute': Minimum distance: The target value is not within the defined modulus range. Positive direction: The target value is less than 'MOD_Min'. Negative direction: The target value is greater than 'MOD_Max'.	Set the correct target value for Move Absolute.
A34F	0	The target position is outside the modulus range. As an alternative, corresponding movement is performed within the modulus range.	Under the current 'MOD_AbsMultiRng' setting, movement is only allowed within the modulus range.	Modify the parameter 'MOD_AbsMultiRng' to allow movement outside the modulus range.
A350	1	Impact limit input position is changed greatly	The operating mode Gear Electronic is activated by the “Synchronize with the position of the compensating motion” method, resulting in a position change of more than 0.25 revolutions.	Disable the impact limit under the operating mode Electronic Gear or use the “Synchronize the position of compensating motion” method.

E Axxx: Motor movement (Continued)

Error code	Error class	Description	Cause	Measure
A351	1	Unable to perform this function with this position scaling factor	The position scaling factor is less than 1 revolution/131072 usr_p, which is less than the internal resolution. In the operating mode Cyclic Synchronous Position , the resolution is not set to 1 rev/131072usr_p.	Use another different scaling factor or disable the selected function.
A352	0	The position list is enabled.	–	–
A353	0	The position list is uncategorized.	–	–
A354	0	A3540 position list and modulus	–	–
A355	1	Errors are detected when Move Relative is performed after capture. The additional information in the error memory indicates the detailed error code. Parameter_*SigLatched* Bit 4	Motion has stopped due to a error.	Check the error memory.
A356	0	The Move Relative function after capture has not been assigned to any digital input.	–	Assign the relative motion function after capture to a digital input .
A357	0	Deceleration is still active.	Execution of this command is not allowed during deceleration operation.	Wait until the motor realizes a full stop.
A358	1	Exceeding the target position using the captured Move Relative function. Parameter_*SigLatched* Bit 4	When capture results are obtained, the braking distance is too short or the velocity is too high.	Reduce velocity.
A359	0	The request cannot be processed as the captured Move Relative function is still enabled.	–	–
A35A	1	Unable to start the selected data set. Parameter_*SigLatched* Bit 4	The selected data set with the given code is not available.	Check the data set number.
A35B	0	Unable to enable the modulus. Parameter_*WarnLatched* Bit 4	The set operating mode does not support the modulus.	–
A35C	1	Unable to move to the new specified position after triggering the limit switch and Fault Reset.	There is a significant deviation between the actual position and the desired position.	–
A35D	par.	Exceeding the permissible velocity deviation. Parameter_*SigLatched* Bit 8	The load or acceleration is too high.	Reduce the load or acceleration.

E Bxxx: Communication

Error code	Error class	Description	Cause	Measure
B100	0	RS485 / Modbus: Uncertain service	Unsupported Modbus service is received.	Check the application on the Modbus master station.
B101	1	I/O data configuration error (auxiliary information = Modbus register address)	The I / O data configuration contains incorrect parameters.	Check the I / O data configuration.
B102	1	Fieldbus module: General error detected. Parameter_*SigLatched* Bit 21	–	–
B103	2	Fieldbus module: Control communication channel has been closed. Parameter_*SigLatched* Bit 21	–	–
B104	2	Fieldbus module: Internal communication error detected. Parameter_*SigLatched* Bit 21	–	–
B105	2	Fieldbus module: I/O data timeout. Parameter_*SigLatched* Bit 21	–	–
B106	2	Fieldbus module: I/O data mapping error detected. Parameter_*SigLatched* Bit 21	–	–
B107	4	Fieldbus module: Non-volatile memory error detected. Parameter_*SigLatched* Bit 21	–	–
B108	1	Fieldbus module: The enabled IOC physical layer does not match the detected physical layer of the fieldbus module. Parameter_*SigLatched* Bit 21	The physical layer used for saving manufacturer data is not the usual physical layer used by the module.	Please consult your Schneider Electric service representative.
B109	4	Fieldbus module: Synchronization heartbeat between the module and the drive amplifier lost. Parameter_SigLatched Bit 21	–	–
B120	2	Cyclic communication: Incorrect cycle time. Parameter_*SigLatched* Bit 21	The drive amplifier does not support the configured cycle period, or there is a significant deviation between the configured cycle period and the measured cycle period.	Change the cycle period in the main control system to the supported cycle period by the drive amplifier, or check the synchronization request.
B121	2	Cyclic communication: Sync signal missing. Parameter_*SigLatched* Bit 21	Received two unsynchronized cycles.	Check communication.
B122	2	Cyclic communication: Incorrect synchronization. Parameter_*SigLatched* Bit 21	One signal is missing, and the expected second signal is received at the wrong timing. Possible reason is that the main control system is unable to prepare the necessary synchronization signal within the set cycle period due to insufficient processing speed.	Analyze the communication or increase the cycle period.
B123	2	Cyclic communication: Excessive tolerance in the selected cycle period. Parameter_*SigLatched* Bit 21	The tolerance of the cycle period should not exceed one-fourth of the set cycle period.	Enter the correct value.
B124	0	Cyclic communication: Drive amplifier out of sync with the main pulse. Parameter_*WarnLatched* Bit 21	The operating mode is activated, but the drive amplifier is not synchronized with the sync signal.	After the synchronization mechanism is started, wait for 120 cycles before activating the operating mode.

E Bxxx: Communication (Continued)

Error code	Error class	Description	Cause	Measure
B200	0	RS485 / Modbus: Record error detected	Detected a logical record error: Incorrect length or unsupported subfunction.	Check the application on the Modbus master station.
B201	2	RS485 / Modbus: Connection monitoring error	The connection monitoring system detects a connection interruption.	Check the cables and cable connections used for data exchange. Make sure that the device is connected.
B202	0	RS485/Modbus: Interruption of the connection Parameter *_WarnLatched* Bit 5	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 monitored objects	–	–
B610	2	EtherCAT: Fieldbus watchdog. Additional information in the error memory indicates the detailed error code. Parameter *_SigLatched* Bit 21	EtherCAT frames are lost, for example, due to inoperative cables or errors caused by the master.	Verify correct cabling and shield connection. Verify diagnostics info of EtherCAT master.
B611	2	EtherCAT: Invalid I/O data. Additional information in the error memory indicates the Modbus address. Parameter *_SigLatched* Bit 21	Incorrect input data or output data (such as object length, object type)	Verify correct PDO configuration (length, objects, etc.).
B612	2	EtherCAT: Link lost at input and output port Parameter *_SigLatched* Bit 21	EtherCAT cable. Link to connected devices lost.	Verify link LEDs. Verify cables and that the devices connected to input port and output port operate. Use EtherCAT master diagnostics for further troubleshooting.
B613	2	Ethernet: Ethernet carrier port 2 not available Parameter *_SigLatched* Bit 21	–	–
B614	1	EtherCAT: General error detected. Additional information in the error memory indicates the detailed error code. Parameter *_SigLatched* Bit 21	–	–
B615	2	EtherCAT Invalid Output Configuration	• Incorrect or incomplete configuration of EtheCAT slaves • EtherCAT Slave hardware error	1. Check the configuration to make sure it is correct and compatible with the master station. 2. Replace the drive
B616	2	EtherCAT Invalid Input Configuration	• Incorrect or incomplete configuration of EtheCAT slaves • EtherCAT Slave hardware error	1. Check the configuration to make sure it is correct and compatible with the master station. 2. Replace the drive
B617	2	EtherCAT Invalid DC SYNCH Configuration	• Incorrect or incomplete configuration of EtheCAT slaves • EtherCAT Slave hardware error	1. Check the configuration to make sure it is correct and compatible with the master station. 2. Replace the drive
B700	0	Drive characteristic profile Lexium: When activating the characteristic profile, there is no mapping for dmControl, refA, or refB.	There is no mapping for dmControl, refA, or refB.	Map dmControl, refA, and refB.
B702	1	The velocity ratio results in inadequate velocity resolution.	When using the configured velocity ratio, the velocity resolution in REFA16 is insufficient.	Change the velocity ratio.

HMI displays incorrect characters	Description
IIRQ	FATAL_ERR_ILLEGAL_IRQ Illegal interruption
DIRQ	FATAL_ERR_DEFAULT_IRQ Unsupported firmware interrupt occurred
WDOG	FATAL_ERR_WATCHDOG Watchdog
OPTR	FATAL_ERR_0PTR Uninitialized pointer
TIM0	FATAL_ERR_SCHEDULER0 Main loop task timeout of 2 ms
TIM1	FATAL_ERR_SCHEDULER1 1000us task timeout
TIM2	FATAL_ERR_SCHEDULER2 250us task timeout
TIM3	FATAL_ERR_SCHEDULER3 62,5Us task timeout
MEM0	FATAL_ERR_MEM0 Insufficient HEAP space
MEM1	FATAL_ERR_MEM1 HEAP space is locked. Unable to allocate memory space.
RAM2	FATAL_ERR_SHARED_RAM2 Partially shared RAM2 exceeds the limit.

Parameter

P0-Basic Settings

P0-01	*RTATU_TuningMode*	Minimum value	0	Unit	–	Persistence	per.
		Factory setting	2	Data type	UINT16	MODBUS	5386
		Maximum value	8	Access	R/W	EtherCAT	3015:05$_h$

Description:

Tuning Mode selection

0 / Invalid: The adaptive operating mode is invalid and the serial PID control loop parameters via the parameter set P1 are used.

1 / Standard: In the standard adaptive operating mode, the servo drive automatically measures the system inertia ratio, the stiffness level is set manually, and adaptive control loop parameters are used.

2 / Passive: In the passive adaptive operating mode, the system inertia ratio and the stiffness level are set manually, and adaptive control loop parameters are used.

3 / Adaptive: In the active adaptive operating mode, the servo drive automatically measures the system inertia ratio, and tries to automatically set the best stiffness level (increase up to 4 stiffness levels); adaptive control loop parameters are used.

Modified settings become active immediately.

P0-02	*RTATU_StiffIndex*	Minimum value	1	Unit	–	Persistence	per.
		Factory setting	14	Data type	UINT16	MODBUS	5378
		Maximum value	32	Access	R/W	EtherCAT	3015:01$_h$

Description:

Stiffness index

Set the system stiffness level when using the adaptive control loop and combine with the inertia ratio via the parameter *RTATU_InertiaRealTime* (P0-03) when the mode via the parameter *RTATU_TuningMode* (P0-01) is set to 1, 2 or 3 to jointly control the system response.

When the parameter *RTATU_TuningMode* (P0-01) is set to 1 or 2, the value via this parameter needs to be set manually.

When the parameter *RTATU_TuningMode* (P0-01) is set to 3, the system attempts to automatically set the best stiffness level (increase up to 4 stiffness levels). As the set value becomes higher, the system response becomes faster, but vibration and noise are likely to occur. As the set value becomes lower, the system response becomes slower, but vibration and noise are unlikely to occur.

Modified settings become active immediately.

P0–03	*RTATU_InertiaRealTime*	Minimum value	10	Unit	0.01	Persistence	per.
		Factory setting	350	Data type	UNIT16	MODBUS	5388
		Maximum value	10000	Access	R/W	EtherCAT	3015:06$_h$

Description:

Adaptive inertia ratio

Set the system inertia ratio when using the adaptive control loop, which combines with the adaptive stiffness level via the parameter *RTATU_StiffIndex* (P0-02) when the mode via the parameter *RTATU_TuningMode* (P0-01) is set to 1, 2 or 3 to jointly control the system response.

When the parameter *RTATU_TuningMode* (P0-01) is set to 1 or 3, the value via this parameter is automatically measured by the system.

When the parameter *RTATU_TuningMode* (P0-01) is set to 1 or 2, the value via this parameter needs to be set manually.

The parameter unit is 0.01.

Modified settings become active immediately.

P0–04	*RTATU_LoadType*	Minimum value	0	Unit	–	Persistence	per.
		Factory setting	1	Data type	UNIT16	MODBUS	5384
		Maximum value	4	Access	R/W	EtherCAT	3015:04$_h$

Description:

Adaptive load type

0 / Rotary Disk: Rotary disk load

1 / Ball Screw : Ball screw load

2 / Belt: Belt type load

3 / Large Inertia: Large inertia load

Setting can only be modified if power stage is disabled.

Modified settings become active immediately.

P0–05	*RTATU_CtrlTab*	Minimum value	0	Unit	–	Persistence	per.
		Factory setting	0	Data type	UNIT16	MODBUS	5380
		Maximum value	2	Access	R/W	EtherCAT	3011:29$_h$

Description:

Control Table Selection

0 / Standard Mode (Table 1): Standard mode, balancing overshoot and steady-state time.

1 / Positioning Mode (Table 2): Mode of position prioritized, the integral time used by the control loop parameters is longer, and there is no overshoot during positioning.

Modified settings become active immediately.

P0-06	*InvertDirOfMove*	Minimum value	0	Unit	–	Persistence	per.
		Factory setting	0	Data type	UINT16	MODBUS	1560
		Maximum value	192	Access	R/W	EtherCAT	3006:0C$_h$

Description:

Inversion of direction of movement

0 / Inversion Off: Inversion of direction of movement is off

192 / Inversion On: Inversion of direction of movement is on

The limit switch which is reached with a movement in positive direction must be connected to the positive limit switch input and vice versa.

Setting can only be modified if power stage is disabled.

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

P0-21	*MON_p_dif_load_usr*	Minimum value	1	Unit	usr_p	Persistence	per.
		Factory setting	25165824	Data type	INT32	MODBUS	1660
		Maximum value	2147483647	Access	R/W	EtherCAT	3006:3E$_h$

Description:

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.

The minimum value, the factory setting and the maximum value depend on the scaling factor.

Modified settings become active immediately.

P0-22	*RESext_P*	Minimum value	1	Unit	W	Persistence	per.
		Factory setting	10	Data type	UNIT16	MODBUS	1316
		Maximum value	32767	Access	R/W	EtherCAT	3005:12$_h$

Description:

Nominal power of external braking resistor

The maximum value depends on the power stage.

Setting can only be modified if power stage is disabled.

Modified settings become active the next time the power stage is enabled.

P0-23	*RESext_R*	Minimum value	0	Unit	0.01 Ohm	Persistence	per.
		Factory setting	10000	Data type	UNIT16	MODBUS	1318
		Maximum value	32767	Access	R/W	EtherCAT	3005:13$_h$

Description:

Resistance value of external braking resistor

The minimum value depends on the power stage.

In increments of 0.01 Ω.

Setting can only be modified if power stage is disabled.

Modified settings become active the next time the power stage is enabled.

P0-24	*RESext_ton*	Minimum value	1	Unit	1 ms	Persistence	per.
		Factory setting	100	Data type	UNIT16	MODBUS	1314
		Maximum value	30000	Access	R/W	EtherCAT	3005:11$_h$

Description:

Maximum permissible switch-on time of external braking resistor

Setting can only be modified if power stage is disabled.

Modified settings become active the next time the power stage is enabled.

P0-25	*RESint_ext*	Minimum value	0	Unit	–	Persistence	per.
		Factory setting	0	Data type	UNIT16	MODBUS	1298
		Maximum value	1	Access	R/W	EtherCAT	3005:09$_h$

Description:

Selection of type of braking resistor

0 / Internal Braking Resistor: Internal braking resistor

1 / External Braking Resistor: External braking resistor

2 / Reserved: Reserved

Setting can only be modified if power stage is disabled.

Modified settings become active the next time the power stage is enabled.

P1-Gain Settings

P1-00	*CTRL1_KPp*	Minimum value	20	Unit	0.1 1/s	Persistence	per.
		Factory setting	650	Data type	UINT16	MODBUS	4614
		Maximum value	9000	Access	R/W	EtherCAT	3012:03$_h$

Description:

Parameter set 1: Position controller P gain

The default value is calculated.

In the case of switching between the two control loop parameter sets, the values are changed linearly over the time defined in the parameter *CTRL_ParChgTime* (P1-38).

In increments of 0.1 1/s.

Modified settings become active immediately.

P1-01	*CTRL1_KPn*	Minimum value	1	Unit	0.0001 A/(1/min)	Persistence	per.
		Factory setting	1	Data type	UNIT16	MODBUS	4610
		Maximum value	25400	Access	R/W	EtherCAT	3012:01$_h$

Description:

Control parameter set 1 Velocity controller P gain.

In increments of 1 0.0001 A/(1/min).

Modified settings become active immediately.

P1-02	*CTRL1_TNn*	Minimum value	0	Unit	0.01 ms	Persistence	per.
		Factory setting	1600	Data type	UNIT16	MODBUS	4612
		Maximum value	32767	Access	R/W	EtherCAT	3012:02$_h$

Description:

Control parameter set 1 Velocity controller integral action time.

In increments of 0.01 ms.

Modified settings become active immediately.

P1-03	*CTRL1_KFPp*	Minimum value	0	Unit	0.1 %	Persistence	per.
		Factory setting	550	Data type	UINT16	MODBUS	4620
		Maximum value	2000	Access	R/W	EtherCAT	3012:06$_h$

Description:

Parameter set 1: Velocity feed-forward control

In the case of switching between the two control loop parameter sets, the values are changed linearly over the time defined in the parameter *CTRL_ParChgTime* (P1-38).

In increments of 0.1 %.

Modified settings become active immediately.

P1-04	*CTRL1_TAUnref*	Minimum value	0	Unit	0.01 ms	Persistence	per.
		Factory setting	0	Data type	UINT16	MODBUS	4616
		Maximum value	32767	Access	R/W	EtherCAT	3012:04$_h$

Description:

Filter time constant of the reference velocity value filter.

In the case of switching between the two control loop parameter sets, the values are changed linearly over the time defined in the parameter *CTRL_ParChgTime* (P1-38).

In increments of 0.01 ms.

Modified settings become active immediately.

P1-05	*CTRL1_TAUiref*	Minimum value	0	Unit	0.01 ms	Persistence	per.
		Factory setting	1	Data type	UINT16	MODBUS	4618
		Maximum value	400	Access	R/W	EtherCAT	3012:05$_h$

Description:

Filter time constant of the reference current value filter

In the case of switching between the two control loop parameter sets, the values are changed linearly over the time defined in the parameter *CTRL_ParChgTime* (P1-38).

In increments of 0.01 ms.

Modified settings become active immediately.

P1-06	*CTRL1_Kfric*	Minimum value	0	Unit	0.01 Arms	Persistence	per.
		Factory setting	0	Data type	UNIT16	MODBUS	4640
		Maximum value	1000	Access	R/W	EtherCAT	3012:10$_h$

Description:

Control parameter set 1 Friction compensation gain

In increments of 0.01 Arms

Modified settings become active immediately.

P1-07	*CTRL2_KPp*	Minimum value	20	Unit	0.1 1/s	Persistence	per.
		Factory setting	650	Data type	UINT16	MODBUS	4870
		Maximum value	9000	Access	R/W	EtherCAT	3013:03$_h$

Description:

Position controller P gain

The default value is calculated.

In the case of switching between the two control loop parameter sets, the values are changed linearly over the time defined in the parameter *CTRL_ParChgTime* (P1-38).

In increments of 0.1 1/s.

Modified settings become active immediately.

P1-08	*CTRL2_KPn*	Minimum value	1	Unit	0.0001 A/RPM	Persistence	per.
		Factory setting	1	Data type	UINT16	MODBUS	4866
		Maximum value	25400	Access	R/W	EtherCAT	3013:01$_h$

Description:

Parameter set 2: Velocity controller P gain

The default value is calculated on the basis of the motor parameters.

In the case of switching between the two control loop parameter sets, the values are changed linearly over the time defined in the parameter *CTRL_ParChgTime* (P1-38).

In increments of 0.0001 A/RPM.

Modified settings become active immediately.

P1-09	*CTRL2_TNn*	Minimum value	1	Unit	0.01 ms	Persistence	per.
		Factory setting	1600	Data type	UINT16	MODBUS	4868
		Maximum value	32767	Access	R/W	EtherCAT	3013:02$_h$

Description:

Parameter set 2: Velocity controller integral action time

The default value is calculated.

In the case of switching between the two control loop parameter sets, the values are changed linearly over the time defined in the parameter *CTRL_ParChgTime* (P1-38).

In increments of 0.01 ms.

Modified settings become active immediately.

P1-10	*CTRL2_KFPp*	Minimum value	0	Unit	0.1 %	Persistence	per.
		Factory setting	550	Data type	UINT16	MODBUS	4876
		Maximum value	2000	Access	R/W	EtherCAT	3013:06$_h$

Description:

Parameter set 2: Velocity feed-forward control

In the case of switching between the two control loop parameter sets, the values are changed linearly over the time defined in the parameter *CTRL_ParChgTime* (P1-38).

In increments of 0.1 %.

Modified settings become active immediately.

P1-11	*CTRL2_TAUnref*	Minimum value	0	Unit	0.1 ms	Persistence	per.
		Factory setting	0	Data type	UINT16	MODBUS	4872
		Maximum value	32767	Access	R/W	EtherCAT	3013:04$_h$

Description:

Filter time constant of the reference velocity value filter

In the case of switching between the two control loop parameter sets, the values are changed linearly over the time defined in the parameter *CTRL_ParChgTime* (P1-38).

In increments of 0.01 ms.

Modified settings become active immediately.

P1-12	*CTRL2_TAUiref*	Minimum value	0	Unit	0.01 ms	Persistence	per.
		Factory setting	10	Data type	UINT16	MODBUS	4874
		Maximum value	400	Access	R/W	EtherCAT	3013:05$_h$

Description:

Filter time constant of the reference current value filter

In the case of switching between the two control loop parameter sets, the values are changed linearly over the time defined in the parameter *CTRL_ParChgTime* (P1-38).

In increments of 0.01 ms.

Modified settings become active immediately.

P1-13	*CTRL2_Kfric*	Minimum value	0	Unit	0.01 Arms	Persistence	per.
		Factory setting	0	Data type	UNIT16	MODBUS	4896
		Maximum value	1000	Access	R/W	EtherCAT	3013:10$_h$

Description:

Control parameter set 2 Friction compensation gain

In increments of 0.01 Arms.

Modified settings become active immediately.

P1-14	*CTRL3_KPp*	Minimum value	20	Unit	0.1 1/s	Persistence	per.
		Factory setting	200	Data type	UINT16	MODBUS	5126
		Maximum value	9000	Access	R/W	EtherCAT	3014:03$_h$

Description:

Parameter set 3: Position controller P gain

In increments of 0.1 1/s

Modified settings become active immediately.

P1-15	*CTRL3_KPn*	Minimum value	1	Unit	0.0001 A/RPM	Persistence	per.
		Factory setting	1	Data type	UINT16	MODBUS	5122
		Maximum value	25400	Access	R/W	EtherCAT	3014:01$_h$

Description:

Parameter set 3: Velocity controller P gain

In increments of 0.0001 A/RPM.

Modified settings become active immediately.

P1-16	*CTRL3_TNn*	Minimum value	0	Unit	0.01 ms	Persistence	per.
		Factory setting	4000	Data type	UINT16	MODBUS	5124
		Maximum value	32767	Access	R/W	EtherCAT	3014:02$_h$

Description:

Parameter set 3: Velocity controller integral action time

In increments of 0.01 ms.

Modified settings become active immediately.

P1-17	*CTRL3_TAUnref*	Minimum value	0	Unit	0.01 ms	Persistence	per.
		Factory setting	0	Data type	UNIT16	MODBUS	5128
		Maximum value	32767	Access	R/W	EtherCAT	3014:04$_h$

Description:

Control parameter set 3: Time constant of velocity loop command filter

In increments of 0.01 ms.

Modified settings become active immediately.

P1-18	*CTRL3_TAUiref*	Minimum value	0	Unit	0.01 ms	Persistence	per.
		Factory setting	0	Data type	UNIT16	MODBUS	5128
		Maximum value	32767	Access	R/W	EtherCAT	3014:05$_h$

Description:

Control parameter set 3 Filter time constant of the reference current value filter.

In increments of 0.01 ms.

Modified settings become active immediately.

P1-19	*RTATU_TnnUser2FRC*	Minimum value	0	Unit	0.01 ms	Persistence	per.
		Factory setting	5000	Data type	UNIT16	MODBUS	5398
		Maximum value	32767	Access	R/W	EtherCAT	3015:0B$_h$

Description:

Velocity loop integral time for the adaptive operating mode of position prioritized

When the adaptive control optimization mode set via the parameter *CTRL1_TAUiref* (P0-05) is [1/Standard Mode (Table 1)], the value of this parameter can be used to override the default velocity loop integral time.

Value = 0: The corresponding default velocity loop integral time (100 ms) is used in the mode of position prioritized.

Value > 0: Velocity loop integral time set by this parameter in the mode of position prioritized.

The setting of this parameter is active when the operating mode set via the parameter *CTRL1_KPn* (P0-01) is [1 - Standard, 2 - Passive or 3 - Adaptive].

In increments of 0.01 ms.

Modified settings become active immediately.

P1-20	*CTRL_vPIDDPart*	Minimum value	0	Unit	%	Persistence	per.
		Factory setting	0	Data type	UNIT16	MODBUS	4364
		Maximum value	4000	Access	R/W	EtherCAT	3011:06$_h$

Description:

PID velocity controller: D gain

In increments of 0.1 %.

Modified settings become active immediately.

P1-21	*CTRL_vPIDDTime*	Minimum value	1	Unit	0.01 ms	Persistenc	per.
		Factory setting	25	Data type	UNIT16	MODBUS	4362
		Maximum value	1000	Access	R/W	EtherCAT	3011:05$_h$

Description:

PID velocity controller: PID velocity controller: Time constant of D gain smoothing filter

In increments of 0.01 ms.

Modified settings become active immediately.

P1-22	*CTRL_TAUSPDFFD*	Minimum value	0	Unit	0.01 ms	Persistence	per.
		Factory setting	0	Data type	UNIT16	MODBUS	4470
		Maximum value	25600	Access	R/W	EtherCAT	3011:3B$_h$

Description:

Time constant of velocity feed-forward filter

In increments of 0.01 ms.

Modified settings become active immediately.

P1-23	*CTRL_KFAcc*	Minimum value	0	Unit	0.1 %	Persistence	per.
		Factory setting	0	Data type	UINT16	MODBUS	4372
		Maximum value	30000	Access	R/W	EtherCAT	3011:0A$_h$

Description:

Acceleration feed-forward control

In increments of 0.1 %.

Modified settings become active immediately.

P1-24	*CTRL_TAUACCFFD*	Minimum value	0	Unit	0.01 ms	Persistence	per.
		Factory setting	0	Data type	UNIT16	MODBUS	4472
		Maximum value	25600	Access	R/W	EtherCAT	3011:3C$_h$

Description:

Time constant of acceleration feed-forward filter

In increments of 0.01 ms.

Modified settings become active immediately.

P1-25	*CTRL_KFLoad*	Minimum value	0	Unit	0.1%	Persistence	per.
		Factory setting	0	Data type	UNIT16	MODBUS	4386
		Maximum value	1000	Access	R/W	EtherCAT	3011:11$_h$

Description:

Load feed-forward control
In increments of 0.1%.

Modified settings become active immediately.

P1-27	*RAMP_v_jerk*	Minimum value	0	Unit	ms	Persistence	per.
		Factory setting	0	Data type	UINT16	MODBUS	1562
		Maximum value	128	Access	R/W	EtherCAT	3006:0D$_h$

Description:

Jerk limitation of the motion profile for velocity.

Adjustments can only be made if the operating mode is inactive (x_end=1).

Modified settings become the next time motor moves.

P1-28	*CTRL_TAUpref*	Minimum value	0	Unit	0.01 ms	Persis-tence	per.
		Factory setting	0	Data type	UINT16	MODBUS	4448
		Maximum value	25600	Access	R/W	EtherCAT	3011:30$_h$

Description:

Filter time constant for Position Reference

This parameter is active for both velocity loop feed-forward and acceleration feed-forward.

In increments of 0.01 ms.

Modified settings become active immediately.

P1-30	*CTRL_SpdFric*	Minimum value	0	Unit	1/min	Persis-tence	per.
		Factory setting	5	Data type	UNIT16	MODBUS	4370
		Maximum value	20	Access	R/W	EtherCAT	3011:09$_h$

Description:

Speed of rotation up to which the friction compensation is linear.

Speed of rotation up to which friction compensation increases linearly.

Modified settings become active immediately.

P1-31	*CTRL_TAUnact*	Minimum value	0	Unit	ms	Persis-tence	per.
		Factory setting	10	Data type	UNIT16	MODBUS	4368
		Maximum value	3000	Access	R/W	EtherCAT	3011:08$_h$

Description:

Motor velocity feedback smoothing filter time constant.

In increments of 0.01 ms.

Modified settings become active immediately.

P1-32	*CTRL_FLUXWEAKENENABLE*	Minimum value	0	Unit	–	Persistence	per.
		Factory setting	0	Data type	UNIT16	MODBUS	4382
		Maximum value	1	Access	R/W	EtherCAT	3011:0F$_h$

Description:

Enable flux weaken function

0 / Flux weaken function off: Disable the flux weaken function

1 / Flux weaken function on: Enable the flux weaken function

Setting can only be modified if power stage is disabled.

Modified settings become active immediately.

P1-33	*CTRL_PwrUpParSet*	Minimum value	0	Unit	0.1 1/s	Persistence	per.
		Factory setting	1	Data type	UINT16	MODBUS	4400
		Maximum value	2	Access	R/W	EtherCAT	3011:18$_h$

Description:

Selection of controller 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

Modified settings become active immediately.

P1-34	*CLSET_ParSwiCond*	Minimum value	0	Unit	–	Persistence	per.
		Factory setting	0	Data type	UINT16	MODBUS	4404
		Maximum value	4	Access	R/W	EtherCAT	3011:26$_h$

Description:

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 *CLSET_p_DiffWin_usr*, P1-36)

2 / Below Reference Velocity: Below reference velocity (value definition in parameter *CLSET_v_Threshol*, P1-37)

3 / Below Actual Velocity: Below actual velocity (value definition in parameter *CLSET_v_Threshol*, P1-37)

4 / Reserved: Reserved

In the case of parameter set switching, the values of the following parameters are changed gradually:

- *CTRL1_KPp* (P1-00) / *CTRL2_KPp* (P1-07)

- *CTRL1_KPn* (P1-01) / *CTRL2_KPn* (P1-08)

- *CTRL1_TNn* (P1-02) / *CTRL2_TNn* (P1-09)

- *CTRL1_KFPp* (P1-03) / *CTRL2_KFPp* (P1-10)

- *CTRL1_TAUnref* (P1-04) / *CTRL2_TAUnref*(P1-11)

- *CTRL1_TAUiref*(P1-05) / *CTRL2_TAUiref*(P1-12)

The following parameters are changed immediately after the time for parameter set switching *CTRL_ParChgTime* (P1-38):

- *CTRL1_Nf1damp*(P2-07) / *CTRL2_Nf1damp*(P2-15)

- *CTRL1_Nf1freq*(P2-08) / *CTRL2_Nf1freq*(P2-16)

- *CTRL1_ Nf1bandw*(P2-09) / *CTRL2_ Nf1bandw*(P2-17)

- *CTRL1_Nf2damp*(P2-10) / *CTRL2_Nf2damp*(P2-18)

- *CTRL1_Nf2freq*(P2-11) / *CTRL2_Nf2freq*(P2-19)

- *CTRL1_ Nf2bandw*(P2-12) / *CTRL2_ Nf2bandw*(P2-20)

- *CTRL1_ Osupdamp*(P2-13) / *CTRL2_ Osupdamp*(P2-21)

- *CTRL1_ Osupdelay*(P2-14) / *CTRL2_ Osupdelay*(P2-22)

- *CTRL1_Kfric*(P1-06) / *CTRL2_Kfric*(P1-13)

Modified settings become active immediately.

P1-35	*CLSET_winTime*	Minimum value	0	Unit	1 ms	Persistence	per.
		Factory setting	0	Data type	UINT16	MODBUS	4406
		Maximum value	1000	Access	R/W	EtherCAT	3011:27$_h$

Description:

Time window for parameter set switching

Value 0: Window monitoring deactivated.

Value >0: Window time for the parameters *CLSET_v_Threshol* (P1-37) and *CLSET_p_DiffWin_usr* (P1-36).

Modified settings become active immediately.

P1-36	*CLSET_p_DiffWin_usr*	Minimum value	0	Unit	usr_p	Persistence	per.
		Factory setting	1310	Data type	INT32	MODBUS	4426
		Maximum value	2147483647	Access	R/W	EtherCAT	3011:37$_h$

Description:

Position deviation for parameter set switching

If the position deviation of the position controller is less than the value of this parameter, control loop parameter set 2 is used. Otherwise, control loop parameter set 1 is used.

Modified settings become active immediately.

P1-37	*CLSET_v_Threshol*	Minimum value	0	Unit	usr_v	Persistence	per.
		Factory setting	50	Data type	UINT32	MODBUS	4410
		Maximum value	2147483647	Access	R/W	EtherCAT	3011:29$_h$

Description:

Velocity threshold for parameter set switching

If the reference velocity or the actual velocity are less than the value of this parameter, control loop parameter set 2 is used. Otherwise, control loop parameter set 1 is used.

Modified settings become active immediately.

P1-38	*CTRL_ParChgTime*	Minimum value	0	Unit	1 ms	Persistence	per.
		Factory setting	0	Data type	UINT16	MODBUS	4392
		Maximum value	2000	Access	R/W	EtherCAT	3011:20$_h$

Description:

Period of time for parameter switching

Modified settings become active immediately.

P1-39	*CTRL_DYNGNSWSET*	Minimum value	0	Unit	1 ms	Persistence	per.
		Factory setting	0	Data type	UINT16	MODBUS	4450
		Maximum value	3	Access	R/W	EtherCAT	3011:31$_h$

Description:

Dynamic gain switching: Selection of switching method

0 / Dynamic Gain Switch Disable

1 / Dynamic Gain Switch No Ramp

2 / Dynamic Gain Switch Deep Sleep Mode

3 / Dynamic Gain Switch With Ramp

When the parameter set via the parameter *RTATU_ TuningMode* (P0-01) is [0 / Invalid] and the adaptive gain switch

conditions are met, the following parameters will be switched according to the mode set via this parameter:

CTRL1_KPp(P1-00) / *CTRL3_KPp*(P1-14)

CTRL1_KPn(P1-01) / *CTRL3_KPn*(P1-15)

CTRL1_TNn(P1-02) / *CTRL3_TNn*(P1-16)

CTRL1_TAUiref(P1-05) / *CTRL3_TAUiref*(P1-18)

When the parameter set via the parameter *RTATU_ TuningMode* (P0-01) is [1 / Standard, 2 / Passive or 3 / Adaptive], and the adaptive gain switch conditions are met, the following parameters will be switched according to the mode set via this parameter:

RTATU_ StiffIndex(P0-02) / *CTRL_ DYNGNSTIFF*(P1-47)

When the parameter via this parameter is [2/ Dynamic Gain Switch Deep Sleep Mode], and the control parameter set is switched to the control loop parameter set 3, the parameter will be further switched to half of value via control loop parameter set 3.

Modified settings become active immediately.

P1-40	*CTRL_DYNGNSWTM*	Minimum value	0	Unit	0.1 ms	Persistence	per.
		Factory setting	0	Data type	UINT16	MODBUS	4452
		Maximum value	2000	Access	R/W	EtherCAT	3011:32$_h$

Description:

Dynamic gain switching: Period of time for dynamic gain switching

The control parameter set will be gradually switched within the time set via this parameter when the switching condition set via the parameter *CTRL_DYNGNSWSET* (P1-39) is [3/ Dynamic Gain Switch With Ramp] and the gain switch conditions are met.

In increments of 0.1 ms.

Modified settings become active immediately.

P1-41	*CTRL_DYNSWPOSDLYTM*	Minimum value	0	Unit	0.1 ms	Persistence	per.
		Factory setting	20	Data type	UINT16	MODBUS	4454
		Maximum value	2000	Access	R/W	EtherCAT	3011:33$_h$

Description:

Dynamic gain switching: Position deviation delay time

The condition of adaptive gain switch position deviation is met when the motion command is completed (electronic gear or internal motion), and the position deviation is lower than the position deviation threshold set via the parameter *CTRL_DYNSWPOSOKTHD* (P1-42) and exceeds the time set via this parameter.

Modified settings become active immediately.

P1-42	*CTRL_DYNSWPOSOKTHD*	Minimum value	2	Unit	0.1 deg	Persistence	per.
		Factory setting	50	Data type	UINT16	MODBUS	4456
		Maximum value	100	Access	R/W	EtherCAT	3011:34$_h$

Description:

Dynamic gain switching: Position deviation threshold

The condition of adaptive gain switch position deviation is met when the motion command is completed (electronic gear or internal motion), and the position deviation is lower than the position deviation threshold set via this parameter and exceeds the time set via parameter *CTRL_DYNSWPOSOKTHD* (P1-42) .

In increments of 0.1 deg.

Modified settings become active immediately.

P1-43	*CTRL_DYNSWTAUPOSDIF*	Minimum value	0	Unit	0.1 ms	Persistence	per.
		Factory setting	100	Data type	UINT16	MODBUS	4458
		Maximum value	2000	Access	R/W	EtherCAT	3011:35$_h$

Description:

Dynamic gain switching: Filter time constant for position deviation

In increments of 0.1 ms.

Modified settings become active immediately.

P1-44	*CTRL_DYNSWSPDLWTM*	Minimum value	0	Unit	0.1 ms	Persistence	per.
		Factory setting	20	Data type	UINT16	MODBUS	4460
		Maximum value	2000	Access	R/W	EtherCAT	3011:36$_h$

Description:

Dynamic gain switching: Low speed delay time

The adaptive gain switch velocity condition is met when the actual velocity is lower than the low velocity threshold set via the parameter *CTRL_DYNSWSPDLWTHD* (P1-45) and exceeds the time set via this parameter.

In increments of 0.1 ms.

Modified settings become active immediately.

P1-45	*CTRL_DYNSWSPDLWTHD*	Minimum value	0	Unit	usr_v	Persistence	per.
		Factory setting	20	Data type	UINT16	MODBUS	4462
		Maximum value	100	Access	R/W	EtherCAT	3011:37$_h$

Description:

Dynamic gain switching: Low speed threshold

The adaptive gain switch velocity condition is met when the actual velocity is lower than the low velocity threshold set via the parameter *CTRL_DYNSWSPDLWTM* (P1-44) and exceeds the time set via this parameter.

Modified settings become active immediately.

P1-46	*CTRL_DYNGNMODE*	Minimum value	0	Unit	–	Persistence	per.
		Factory setting	0	Data type	UINT16	MODBUS	4466
		Maximum value	1	Access	R/W	EtherCAT	3011:39$_h$

Description:

Dynamic gain switching: Selection of low speed optimization mode

0 / Position And Velocity: Switch when both the position condition and the velocity condition of adaptive gain switch are met.

1 / Position Or Velocity: Switch the position loop gain separately when the adaptive gain switch position condition is met, and switch the velocity loop gain separately when the adaptive gain switch velocity condition is met.

Modified settings become active immediately.

P1-47	*CTRL_DYNGNSTIFF*	Minimum value	1	Unit	–	Persistence	per.
		Factory setting	10	Data type	UNIT16	MODBUS	4464
		Maximum value	32	Access	R/W	EtherCAT	3011:38$_h$

Description:

Adaptive gain switch: Target low gain

When the parameter set via the parameter *RTATU_ TuningMode* (P0-01) is [1 / Standard, 2 / Passive or 3 / Adaptive], and the adaptive gain switch conditions are met, the following parameters will be switched according to the mode set via *CTRL_DYNGNSWSET* (P1-39).

Modified settings become active immediately.

P1-48	*CTRL_DYNSWSTLTM*	Minimum value	0	Unit	0.1 ms	Persistence	per.
		Factory setting	0	Data type	UNIT16	MODBUS	4468
		Maximum value	2000	Access	R/W	EtherCAT	3011:3A$_h$

Description:

In the adaptive mode, set the time threshold for the motor to be at a steady-state standstill.

Modified settings become active immediately.

P1-49	*CTRL_ADVCTRLMODE*	Minimum value	0	Unit	–	Persistence	per.
		Factory setting	0	Data type	UNIT16	MODBUS	4474
		Maximum value	256	Access	R/W	EtherCAT	3011:3D$_h$

Description:

Internal reservation

Modified settings become active immediately.

P2-Vibration Suppression Setting

P2-00	*RTATU_ANotchMode*	Minimum value	0	Unit	–	Persistence	per.
		Factory setting	0	Data type	UINT16	MODBUS	5390
		Maximum value	3	Access	R/W	EtherCAT	3015:07$_h$

Description:

Selection of adaptive notch filter mode

0 / Invalid: Automatic notch filter is not automatically set, and the parameters of the adaptive notch filter remain unchanged.

1 / Enable 1: Enable adaptive notch filter 1.

2 / Enable 2: Enable adaptive notch filters 1 and 2.

3 / Reset: Reset adaptive notch filters 1 and 2.

Modified settings become active immediately.

P2-01	*CTRL_ANf1damp*	Minimum value	550	Unit	%	Persistence	per.
		Factory setting	900	Data type	UNIT16	MODBUS	4428
		Maximum value	990	Access	R/W	EtherCAT	3011:26$_h$

Description:

Notch filter 1: Damping.

In increments of 0.1%.

Modified settings become active immediately.

P2-02	*CTRL_ANf1freq*	Minimum value	500	Unit	0.1 Hz	Persistence	per.
		Factory setting	50000	Data type	UNIT16	MODBUS	4430
		Maximum value	50000	Access	R/W	EtherCAT	3011:27$_h$

Description:

Frequency of automatic notch filter 1

In increments of 0.1 Hz.

Modified settings become active immediately.

P2-03	*CTRL_ANf1bandw*	Minimum value	10	Unit	0.1 %	Persistence	per.
		Factory setting	700	Data type	UNIT16	MODBUS	4432
		Maximum value	900	Access	R/W	EtherCAT	3011:28$_h$

Description:

Notch filter 1: Bandwidth

In increments of 0.1%.

Modified settings become active immediately.

P2-04	*CTRL_ANf2damp*	Minimum value	550	Unit	0.1 %	Persistence	per.
		Factory setting	900	Data type	UNIT16	MODBUS	4434
		Maximum value	900	Access	R/W	EtherCAT	3011:29$_h$

Description:

Damping of automatic notch filter 2

In increments of 0.1%.

Modified settings become active immediately.

P2-05	*CTRL_ANf2freq*	Minimum value	500	Unit	0.1 Hz	Persistence	per.
		Factory setting	50000	Data type	UNIT16	MODBUS	4436
		Maximum value	50000	Access	R/W	EtherCAT	3011:2A$_h$

Description:

Frequency of automatic notch filter 2

In increments of 0.1 Hz.

Modified settings become active immediately.

P2-06	*CTRL_ANf2bandw*	Minimum value	10	Unit	0.1 %	Persistence	per.
		Factory setting	700	Data type	UNIT16	MODBUS	4438
		Maximum value	900	Access	R/W	EtherCAT	3011:2B$_h$

Description:

Bandwidth of automatic notch filter 2

In increments of 0.1%.

Modified settings become active immediately.

P2-07	*CTRL1_Nf1damp*	Minimum value	550	Unit	0.1 %	Persistence	per.
		Factory setting	900	Data type	UINT16	MODBUS	4624
		Maximum value	990	Access	R/W	EtherCAT	3012:08$_h$

Description:

Parameter set 1: Notch filter 1 Damping

In increments of 0.1 %.

Modified settings become active immediately.

P2-08	*CTRL1_Nf1freq*	Minimum value	500	Unit	0.1 Hz	Persistence	per.
		Factory setting	50000	Data type	UINT16	MODBUS	4626
		Maximum value	50000	Access	R/W	EtherCAT	3012:09$_h$

Description:

Parameter set 1: Notch filter 1 Frequency

The filter is deactivated at a value of 15000.

In increments of 0.1 Hz.

Modified settings become active immediately.

P2-09	*CTRL1_Nf1bandw*	Minimum value	10	Unit	0.1 %	Persistence	per.
		Factory setting	700	Data type	UINT16	MODBUS	4628
		Maximum value	900	Access	R/W	EtherCAT	3012:0A$_h$

Description:

Parameter set 1: Notch filter 1 Bandwidth

Definition of bandwidth: 1 - Fb/F0

In increments of 0.1 %.

Modified settings become active immediately.

P2-10	*CTRL1_Nf2damp*	Minimum value	550	Unit	0.1 %	Persistence	per.
		Factory setting	900	Data type	UINT16	MODBUS	4630
		Maximum value	990	Access	R/W	EtherCAT	3012:0B$_h$

Description:

Parameter set 1: Notch filter 2 Damping

In increments of 0.1 %.

Modified settings become active immediately.

P2-11	*CTRL1_Nf2freq*	Minimum value	500	Unit	0.1 Hz	Persistence	per.
		Factory setting	50000	Data type	UINT16	MODBUS	4632
		Maximum value	50000	Access	R/W	EtherCAT	3012:0C$_h$

Description:

Parameter set 1: Notch filter 2 Frequency

The filter is deactivated at a value of 15000.

In increments of 0.1 Hz.

Modified settings become active immediately.

P2-12	*CTRL1_Nf2bandw*	Minimum value	10	Unit	0.1 %	Persistence	per.
		Factory setting	700	Data type	UINT16	MODBUS	4634
		Maximum value	900	Access	R/W	EtherCAT	3012:0D$_h$

Description:

Parameter set 1: Notch filter 2 Bandwidth

Definition of bandwidth: 1 - Fb/F0

In increments of 0.1 %.

Modified settings become active immediately.

P2-13	*CTRL1_Osupdamp*	Minimum value	0	Unit	0.1%	Persistence	per.
		Factory setting	0	Data type	UNIT16	MODBUS	4636
		Maximum value	500	Access	R/W	EtherCAT	3012:0E$_h$

Description:

Control parameter set 1: overshoot suppression filter: Damping

The filter is deactivated at a value of 0.

In increments of 0.1%.

Modified settings become active immediately.

P2-14	*CTRL1_Osupdelay*	Minimum value	0	Unit	ms	Persistence	per.
		Factory setting	0	Data type	UNIT16	MODBUS	4638
		Maximum value	7500	Access	R/W	EtherCAT	3012:0F$_h$

Description:

Parameter set 1: Overshoot suppression filter Time delay

The filter is deactivated at a value of 0.

In increments of 0.01 ms.

Modified settings become active immediately.

P2-15	*CTRL2_Nf1damp*	Minimum value	550	Unit	0.1 %	Persistence	per.
		Factory setting	900	Data type	UINT16	MODBUS	4880
		Maximum value	990	Access	R/W	EtherCAT	3013:08$_h$

Description:

Parameter set 2: Notch filter 1: Damping

In increments of 0.1 %.

Modified settings become active immediately.

P2-16	*CTRL2_Nf1freq*	Minimum value	500	Unit	0.1 Hz	Persistence	per.
		Factory setting	50000	Data type	UINT16	MODBUS	4882
		Maximum value	50000	Access	R/W	EtherCAT	3013:09$_h$

Description:

Parameter set 2: Notch filter 1: Frequency

The filter is deactivated at a value of 15000.

In increments of 0.1 Hz.

Modified settings become active immediately.

P2-17	*CTRL2_Nf1bandw*	Minimum value	10	Unit	0.1 %	Persistence	per.
		Factory setting	700	Data type	UINT16	MODBUS	4884
		Maximum value	900	Access	R/W	EtherCAT	3013:0A$_h$

Description:

Parameter set 2: Notch filter 1: Bandwidth

Definition of bandwidth: 1 - Fb/F0

In increments of 0.1 %.

Modified settings become active immediately.

P2-18	*CTRL2_Nf2damp*	Minimum value	550	Unit	0.1 %	Persistence	per.
		Factory setting	900	Data type	UINT16	MODBUS	4886
		Maximum value	990	Access	R/W	EtherCAT	3013:0B$_h$

Description:

Parameter set 2: Notch filter 2: Damping

In increments of 0.1 %.

Modified settings become active immediately.

P2-19	*CTRL2_Nf2freq*	Minimum value	500	Unit	0.1 %	Persistence	per.
		Factory setting	50000	Data type	UINT16	MODBUS	4888
		Maximum value	50000	Access	R/W	EtherCAT	3013:0C$_h$

Description:

Parameter set 2: Notch filter 2: Frequency

The filter is deactivated at a value of 15000.

In increments of 0.1 Hz.

Modified settings become active immediately.

P2-20	*CTRL2_Nf2bandw*	Minimum value	10	Unit	0.1%	Persistence	per.
		Factory setting	700	Data type	UINT16	MODBUS	4890
		Maximum value	900	Access	R/W	EtherCAT	3013:0D$_h$

Description:

Parameter set 2: Notch filter 2: Bandwidth

Definition of bandwidth: 1 - Fb/F0

In increments of 0.1 %.

Modified settings become active immediately.

P2-21	*CTRL2_Osupdamp*	Minimum value	0	Unit	0.1%	Persistence	per.
		Factory setting	0	Data type	UNIT16	MODBUS	4892
		Maximum value	500	Access	R/W	EtherCAT	3013:0E$_h$

Description:

Parameter set 2: Overshoot suppression filter: Damping

The filter is deactivated at a value of 0.

In increments of 0.1%.

Modified settings become active immediately.

P2-22	*CTRL2_Osupdelay*	Minimum value	0	Unit	0.01 ms	Persistence	per.
		Factory setting	0	Data type	UNIT16	MODBUS	4894
		Maximum value	7500	Access	R/W	EtherCAT	3013:0F$_h$

Description:

Control parameter set 2: Delay of overshoot suppression filters

The filter is deactivated at a value of 0.

In increments of 0.01 ms.

Modified settings become active immediately.

P2-23	*RTATU_VibDetCycleNum*	Minimum value	0	Unit	–	Persistence	per.
		Factory setting	2	Data type	UNIT16	MODBUS	5392
		Maximum value	10	Access	R/W	EtherCAT	3015:08$_h$

Description:

Vibration detection Cycle number

Modified settings become active immediately.

P2-24	*RTATU_VibDetLevel*	Minimum value	0	Unit	usr_v	Persistence	per.
		Factory setting	20	Data type	UINT16	MODBUS	5394
		Maximum value	100	Access	R/W	EtherCAT	3015:09$_h$

Description:

Vibration Detection Level

Modified settings become active immediately.

P2-25	*RTATU_VibDetTmDly*	Minimum value	0	Unit	0.1 ms	Persistence	per.
		Factory setting	100	Data type	UINT16	MODBUS	5396
		Maximum value	1000	Access	R/W	EtherCAT	3015:10$_h$

Description:

Vibration Detection Time Delay

Modified settings become active immediately.

P2-26	*CTRL_AnVibf1*	Minimum value	0	Unit	0.1 Hz	Persistence	per.
		Factory setting	0	Data type	UINT16	MODBUS	4440
		Maximum value	2000	Access	R/W	EtherCAT	3011:2C$_h$

Description:

Frequency for anti vibration filter 1

In increments of 0.1 Hz.

Modified settings become active immediately.

P2-27	*CTRL_AnVibdamp1*	Minimum value	0	Unit	0.1 %	Persistence	per.
		Factory setting	300	Data type	UINT16	MODBUS	4444
		Maximum value	500	Access	R/W	EtherCAT	3011:2E$_h$

Description:

Damping factor for anti vibration filter 1

In increments of 0.1%.

Modified settings become active immediately.

P2-28	*CTRL_AnVibf2*	Minimum value	0	Unit	0.1 Hz	Persistence	per.
		Factory setting	0	Data type	UINT16	MODBUS	4442
		Maximum value	2000	Access	R/W	EtherCAT	3011:2D$_h$

Description:

Frequency for anti vibration filter 2

In increments of 0.1 Hz.

Modified settings become active immediately.

P2-29	*CTRL_AnVibdamp2*	Minimum value	0	Unit	0.1 %	Persistence	per.
		Factory setting	300	Data type	UINT16	MODBUS	4446
		Maximum value	500	Access	R/W	EtherCAT	3011:2F$_h$

Description:

Damping factor for anti vibration filter 2

In increments of 0.1%.

Modified settings become active immediately.

P3-I/O Settings

P3-00	*IOfunct_DI0*	Minimum value	1	Unit	–	Persistence	per.
		Factory setting	1	Data type	UINT16	MODBUS	1794
		Maximum value	141	Access	R/W	EtherCAT	3007:01$_h$

Description:

Function Input DI0

1 / Freely Available: Available as required

2 / Fault Reset: Fault reset after error

4 / Halt: Halt

5 / Start Profile Positioning: Start request for movement

21 / Reference Switch (REF): Reference switch

22 / Positive Limit Switch (LIMP): Positive limit switch

23 / Negative Limit Switch (LIMN): Negative limit switch

41 / Allow Servo On

Setting can only be modified if power stage is disabled.

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

P3-01	*IOfunct_DI1*	Minimum value	1	Unit	–	Persistence	per.
		Factory setting	1	Data type	UNIT16	MODBUS	1796
		Maximum value	141	Access	R/W	EtherCAT	3007:02$_h$

Description:

Function of input point DI1

The default values are mode-dependent, and please see Factory Settings for I/O Functions, page 174.

Setting can only be modified if power stage is disabled.

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

P3-02	*IOfunct_DI2*	Minimum value	1	Unit	–	Persistence	per.
		Factory setting	1	Data type	UNIT16	MODBUS	1798
		Maximum value	141	Access	R/W	EtherCAT	3007:03$_h$

Description:

Function of input point DI2

The default values are mode-dependent, and please see Factory Settings for I/O Functions, page 174.

Setting can only be modified if power stage is disabled.

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

P3-03	*IOfunct_DI3*	Minimum value	1	Unit	–	Persistence	per.
		Factory setting	1	Data type	UNIT16	MODBUS	1800
		Maximum value	141	Access	R/W	EtherCAT	3007:04$_h$

Description:

Function of input point DI3

The default values are mode-dependent, and please see Factory Settings for I/O Functions, page 174.

Setting can only be modified if power stage is disabled.

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

P3-04	*IOfunct_DI4*	Minimum value	1	Unit	–	Persistence	per.
		Factory setting	1	Data type	UNIT16	MODBUS	1802
		Maximum value	141	Access	R/W	EtherCAT	3007:05$_h$

Description:

Function of input point DI4

The default values are mode-dependent, and please see Factory Settings for I/O Functions, page 174.

Setting can only be modified if power stage is disabled.

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

P3-05	*IOfunct_DI5*	Minimum value	1	Unit	–	Persistence	per.
		Factory setting	1	Data type	UNIT16	MODBUS	1804
		Maximum value	141	Access	R/W	EtherCAT	3007:06$_h$

Description:

Function of input point DI5

The default values are mode-dependent, and see Factory Settings for I/O Functions, page 174.

Setting can only be modified if power stage is disabled.

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

P3-12	*DI_0_Debounce*	Minimum value	0	Unit	–	Persistence	per.
		Factory setting	6	Data type	UNIT16	MODBUS	2112
		Maximum value	6	Access	R/W	EtherCAT	3008:20$_h$

Description:

Debounce time of DI0

0 / No: No software Filtering

1 / 0.25 ms

2 / 0.50 ms

3 / 0.75 ms

4 / 1.00 ms

5 / 1.25 ms

6 / 1.50 ms

7: 0.5 us

8: 1 us

9: 2 us

10: 4 us

11: 8 us

12: 20 us

13: 40 us

Setting can only be modified if power stage is disabled.

Modified settings become active immediately.

P3-13	*DI_1_Debounce*	Minimum value	0	Unit	–	Persistence	per.
		Factory setting	6	Data type	UNIT16	MODBUS	2114
		Maximum value	6	Access	R/W	EtherCAT	3008:21$_h$

Description:

Debounce time of DI1

See parameters *DI_0_Debounce* (P3-12).

Setting can only be modified if power stage is disabled.

Modified settings become active immediately.

P3-14	*DI_2_Debounce*	Minimum value	0	Unit	–	Persistence	per.
		Factory setting	6	Data type	UNIT16	MODBUS	2116
		Maximum value	6	Access	R/W	EtherCAT	3008:22$_h$

Description:

Debounce time of DI2

See parameters *DI_0_Debounce* (P3-12).

Setting can only be modified if power stage is disabled.

Modified settings become active immediately.

P3-15	*DI_3_Debounce*	Minimum value	0	Unit	–	Persistence	per.
		Factory setting	6	Data type	UNIT16	MODBUS	2118
		Maximum value	6	Access	R/W	EtherCAT	3008:23$_h$

Description:

Debounce time of DI3

See parameters *DI_0_Debounce* (P3-12).

Setting can only be modified if power stage is disabled.

Modified settings become active immediately.

P3-16	*DI_4_Debounce*	Minimum value	0	Unit	–	Persistence	per.
		Factory setting	6	Data type	UNIT16	MODBUS	2120
		Maximum value	13	Access	R/W	EtherCAT	3008:24$_h$

Description:

Debounce time of DI4

0 / No: No software Filtering

1 / 0.25 ms

2 / 0.50 ms

3 / 0.75 ms

4 / 1.00 ms

5 / 1.25 ms

6 / 1.50 ms

7 / 0.5 µs

8 / 1 µs

9 / 2 µs

10 / 4 µs

11 / 8 µs

12 / 20 µs

13 / 40 µs

Setting can only be modified if power stage is disabled.

Modified settings become active immediately.

P3-17	*DI_5_Debounce*	Minimum value	0	Unit	–	Persistence	per.
		Factory setting	6	Data type	UNIT16	MODBUS	2122
		Maximum value	13	Access	R/W	EtherCAT	3008:25$_h$

Description:

Debounce time of DI5

0 / No: No software Filtering

1 / 0.25 ms

2 / 0.50 ms

3 / 0.75 ms

4 / 1.00 ms

5 / 1.25 ms

6 / 1.50 ms

7 / 0.5 µs

8 / 1 µs

9 / 2 µs

10 / 4 µs

11 / 8 µs

12 / 20 µs

13 / 40 µs

Setting can only be modified if power stage is disabled.

Modified settings become active immediately.

P3-24	*IOfunct_DQ0*	Minimum value	1	Unit	–	Persistence	per.
		Factory setting	2	Data type	UNIT16	MODBUS	1810
		Maximum value	131	Access	R/W	EtherCAT	3007:09$_h$

Description:

Function of DQ0

Setting can only be modified if power stage is disabled.

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

P3-25	*IOfunct_DQ1*	Minimum value	1	Unit	–	Persistence	per.
		Factory setting	3	Data type	UNIT16	MODBUS	1812
		Maximum value	131	Access	R/W	EtherCAT	3007:0A$_h$

Description:

Function of DQ1

Setting can only be modified if power stage is disabled.

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

P3-26	*IOfunct_DQ2*	Minimum value	1	Unit	–	Persistence	per.
		Factory setting	24	Data type	UNIT16	MODBUS	1814
		Maximum value	131	Access	R/W	EtherCAT	3007:0B$_h$

Description:

Function of DQ2

Setting can only be modified if power stage is disabled.

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

P4-Velocity and Torque Settings

P4-00	*RAMP_v_enable*	Minimum value	0	Unit	–	Persistence	per.
		Factory setting	1	Data type	UINT16	MODBUS	1622
		Maximum value	1	Access	R/W	EtherCAT	3006:2B$_h$

Description:

Activation of the motion profile for velocity.

0 / Profile Off: Profile off

1 / Profile On: Profile on

Setting can only be modified if power stage is disabled.

Modified settings become active immediately.

P4-01	*RAMP_v_max*	Minimum value	1	Unit	usr_v	Persistence	per.
		Factory setting	13200	Data type	UINT32	MODBUS	1554
		Maximum value	2147483647	Access	R/W	EtherCAT	607F:00$_h$

Description:

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 *RAMP_v_max* (P4-01).

This way, commissioning at limited velocity is easier to perform.

Setting can only be modified if power stage is disabled.

Modified settings become active immediately.

P4-02	*RAMP_v_acc*	Minimum value	1	Unit	usr_a	Persistence	per.
		Factory setting	6000	Data type	UINT32	MODBUS	1556
		Maximum value	2147483647	Access	R/W	EtherCAT	6083:00$_h$

Description:

Acceleration of the motion profile for velocity.

Writing the value 0 has no effect on the parameter.

Modified settings become the next time motor moves.

P4-03	*RAMP_v_dec*	Minimum value	1	Unit	usr_a	Persistence	per.
		Factory setting	6000	Data type	UINT32	MODBUS	1558
		Maximum value	2147483647	Access	R/W	EtherCAT	6084:00$_h$

Description:

Deceleration of the motion profile for velocity.

In Profile Velocity mode, the minimum value is 1.

Writing the value 0 has no effect on the parameter.

Modified settings become the next time motor moves.

P4-04	*RAMP_v_Scurve*	Minimum value	0	Unit	1%	Persistence	per.
		Factory setting	0	Data type	UINT16	MODBUS	1692
		Maximum value	100	Access	R/W	EtherCAT	3006:4E$_h$

Description:

S-curve setting of motion profile command for velocity

When using an internal curve as the velocity command, the smoothing performance of acceleration and deceleration process is improved by setting the proportion of the S-shaped smooth curve during the acceleration and deceleration of motion profile for velocity.

This function will re-plan the ramp of the acceleration and deceleration ramps to ensure that the total time of the acceleration and deceleration motion profile remain unchanged.

Modified settings become active the next time the motor moves.

P4-05	*JOGv_slow*	Minimum value	1	Unit	usr_v	Persistence	per.
		Factory setting	100	Data type	UINT32	MODBUS	10504
		Maximum value	2147483647	Access	R/W	EtherCAT	3029:04$_h$

Description:

Velocity for slow movement.

The adjustable value is internally limited to the parameter setting in *RAMP_v_max* (P4-01).

Modified settings become active immediately.

P4-06	*JOGv_fast*	Minimum value	1	Unit	usr_v	Persistence	per.
		Factory setting	200	Data type	UINT32	MODBUS	10506
		Maximum value	2147483647	Access	R/W	EtherCAT	3029:05$_h$

Description:

Velocity for fast movement.

The adjustable value is internally limited to the parameter setting in *RAMP_v_max* (P4-01).

Modified settings become active immediately.

P4-18	*CTRL_v_max*	Minimum value	0	Unit	usr_v	Persistence	per.
		Factory setting	6000	Data type	UINT32	MODBUS	4384
		Maximum value	2147483647	Access	R/W	EtherCAT	3011:10$_h$

Description:

Velocity limitation.

During operation, the velocity limit is one of the following values (whichever is lowest):

- *CTRL_v_max* (P4-18)
- Maximum velocity of motor

Modified settings become active immediately.

P4-22	*RAMP_tq_slope*	Minimum value	0	Unit	0.1 %/s	Persistence	per.
		Factory setting	100000	Data type	UINT32	MODBUS	1620
		Maximum value	30000000	Access	R/W	EtherCAT	6087:00$_h$

Description:

Slope setting of the motion profile for torque.

100.00 % of the torque setting correspond to the motor rated torque.

In increments of 0.1 %/s.

Modified settings become active immediately.

P4-23	*RAMP_tq_enable*	Minimum value	0	Unit	–	Persistence	per.
		Factory setting	1	Data type	UINT16	MODBUS	1624
		Maximum value	1	Access	R/W	EtherCAT	3006:2C$_h$

Description:

Activation of the motion profile for torque.

0 / Profile Off: Profile off

1 / Profile On: Profile on

In the operating mode Profile Torque, the motion profile for torque can be activated or deactivated.

In the other operating modes, the motion profile for torque is inactive.

Setting can only be modified if power stage is disabled.

P4-35	*CTRL_tq_max*	Minimum value	0	Unit	0.1%	Persistence	per.
		Factory setting	–	Data type	UINT16	MODBUS	4376
		Maximum value	3500	Access	R/W	EtherCAT	6072:00$_h$

Description:

Torque limitation.

During operation, the actual torque limit is one of the following values (whichever is lowest):

- *CTRL_tq_max* (P4-35)
- Maximum torque of motor

100.00 % of the torque setting correspond to the motor rated torque.

In increments of 0.1 %/s.

Modified settings become active immediately.

P5-Extended Settings

P5-00	*HMIlocked*	Minimum value	0	Unit	–	Persistence	per.
		Factory setting	0	Data type	UINT16	MODBUS	14850
		Maximum value	1	Access	R/W	EtherCAT	303A:01$_h$

Description:

Lock 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
- Auto tuning
- Fault Reset

Modified settings become active immediately.

P5-01	*ScalePOSdenom*	Minimum value	1	Unit	usr_p	Persistence	per.
		Factory setting	8388608	Data type	INT32	MODBUS	1550
		Maximum value	2147483647	Access	R/W	EtherCAT	3006:07$_h$

Description:

Position scaling: Denominator

Refer to numerator *ScalePOSnum* (P5-02) for a description.

A new scaling is activated when the numerator value is supplied.

Setting can only be modified if power stage is disabled.

P5-02	*ScalePOSnum*	Minimum value	1	Unit	revolution	Persistence	per.
		Factory setting	1	Data type	INT32	MODBUS	1552
		Maximum value	2147483647	Access	R/W	EtherCAT	3006:08$_h$

Description:

Position scaling: Numerator

Specification of the scaling factor:

$$\frac{\text{Number of revolutions of the motor}}{\text{Number of user-defined units [usr_p]}}$$

A new scaling is activated when the numerator value is supplied.

Setting can only be modified if power stage is disabled.

Modified settings become active immediately.

P5-03	*HMv*	Minimum value	1	Unit	usr_v	Persistence	per.
		Factory setting	60	Data type	UINT32	MODBUS	10248
		Maximum value	2147483647	Access	R/W	EtherCAT	6099:01$_h$

Description:

Target velocity for searching the switch.

The adjustable value is internally limited to the parameter setting in *RAMP_v_max* (P4-01).

Modified settings become active the next time the motor moves.

P5-04	*HMv_out*	Minimum value	1	Unit	usr_v	Persistence	per.
		Factory setting	6	Data type	UINT32	MODBUS	10250
		Maximum value	2147483647	Access	R/W	EtherCAT	6099:02$_h$

Description:

Target velocity for moving away from switch.

The adjustable value is internally limited to the parameter setting in *RAMP_v_max* (P4-01).

Modified settings become active the next time the motor moves.

P5-05	*HMsrchdis*	Minimum value	0	Unit	usr_p	Persistence	per.
		Factory setting	0	Data type	INT32	MODBUS	10266
		Maximum value	2147483647	Access	R/W	EtherCAT	3028:0D$_h$

Description:

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.

Modified settings become active the next time the motor moves.

P5-06	*HMoutdis*	Minimum value	0	Unit	usr_p	Persistence	per.
		Factory setting	0	Data type	INT32	MODBUS	10252
		Maximum value	2147483647	Access	R/W	EtherCAT	3028:0B$_h$

Description:

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.

Modified settings become active the next time the motor moves.

P5-07	*HMdis*	Minimum value	1	Unit	usr_p	Persistence	per.
		Factory setting	200	Data type	INT32	MODBUS	10254
		Maximum value	2147483647	Access	R/W	EtherCAT	3028:07$_h$

Description:

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.

Modified settings become active the next time the motor moves.

P5-08	*HMp_home*	Minimum value	-2147483648	Unit	usr_p	Persistence	per.
		Factory setting	0	Data type	INT32	MODBUS	10262
		Maximum value	2147483647	Access	R/W	EtherCAT	3028:0B$_h$

Description:

Position at reference point.

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

Modified settings become active the next time the motor moves.

P5-09	*HMprefmethod*	Minimum value	1	Unit	–	Persistence	per.
		Factory setting	18	Data type	INT16	MODBUS	10260
		Maximum value	35	Access	R/W	EtherCAT	3028:0A$_h$

Description:

Preferred homing method.

Modified settings become active immediately.

P5-14	*LIM_HaltReaction*	Minimum value	1	Unit	–	Persistence	per.
		Factory setting	1	Data type	INT16	MODBUS	1582
		Maximum value	3	Access	R/W	EtherCAT	3006:17$_h$

Description:

Halt option code

1 / Deceleration Ramp: Deceleration ramp

3 / Torque Ramp: Torque ramp

Set the deceleration ramp with parameter *RAMP_ v_dec* (P4-03).

Set the torque ramp with parameter *LIM_I_ maxHalt* (P5-15).

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

Modified settings become active immediately.

P5-15	*LIM_I_maxHalt*	Minimum value	1	Unit	0.01 Arms	Persistence	per.
		Factory setting	1	Data type	UINT16	MODBUS	4380
		Maximum value	46300	Access	R/W	EtherCAT	3011:0E$_h$

Description:

Current value 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 (*_Imax_act*) is one of the following values (whichever is lowest):

- *LIM_I_maxHalt* (P5-15, current value for halt)

- *_M_I_max* (maximum current of motor)

- *_PS_I_max* (maximum current of power stage)

Further current limitations caused by I2t monitoring are also taken into account during a Halt.

In increments of 0.01 Arms.

Modified settings become active immediately.

P5-16	*LIM_QStopReact*	Minimum value	-2	Unit	–	Persistence	per.
		Factory setting	6	Data type	INT16	MODBUS	1584
		Maximum value	7	Access	R/W	EtherCAT	6085:00$_h$

Description:

Quick Stop option code

-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

Type of deceleration for Quick Stop.

Setting of deceleration ramp with parameter *RAMPquickstop* (P5-17).

Setting of torque ramp with parameter *LIM_I_ maxQSTP* (P5-18).

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

Modified settings become active immediately.

P5-17	*RAMPquickstop*	Minimum value	1	Unit	usr_a	Persistence	per.
		Factory setting	6000	Data type	UINT32	MODBUS	1572
		Maximum value	2147483647	Access	R/W	EtherCAT	3006:12$_h$

Description:

Deceleration ramp for Quick Stop

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

Modified settings become active the next time the motor moves.

P5-18	*LIM_I_maxQSTP*	Minimum value	1	Unit	0.01 Arms	Persistence	per.
		Factory setting	1	Data type	UINT16	MODBUS	4378
		Maximum value	46300	Access	R/W	EtherCAT	3011:0D$_h$

Description:

Current value for Quick Stop

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 Quick Stop, the current limit *(_Imax_act*) is one of the following values (whichever is lowest):

- *LIM_I_maxQSTP*(P5-18)

- *_M_I_max* (maximum current of motor)

- *_PS_I_max* (maximum current of power stage)

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

In increments of 0.01 Arms.

Modified settings become active immediately.

P5-19	*DYN_BRK_enable*	Minimum value	0	Unit	–	Persistence	per.
		Factory setting	0	Data type	UINT16	MODBUS	1680
		Maximum value	42	Access	R/W	EtherCAT	3006:48$_h$

Description:

Enable dynamic braking function

Parameter value	Function	Value	Stop mode of servo motor	State after the servo motor stops
L XXXX[]	Stop mode of the motor in case of a fault in Error Class 3...4	0	Free coasting	Free coasting
		1	Dynamic braking (DB)	Dynamic braking (DB)
		2	Dynamic braking (DB)	Free coasting
L XXX[]X	Stop mode of the motor after the servo is disabled	0	Free coasting	Free coasting
		1	Dynamic braking (DB)	Dynamic braking (DB)
		2	Dynamic braking (DB)	Free coasting
		3	Deceleration Ramp (DEC)	Dynamic braking (DB)
		4	Deceleration Ramp (DEC)	Free coasting

When 3 and 4 are selected as the stop mode of the motor after the servo is disabled, the motor stops using deceleration ramp set via the parameter P4-03.

For example:

When P5-19 = 0021:

- If an error of Error Class 3/4 occurs, the motor will decelerate and stop using DB, and remain in the DB state after stopping.
- If the motor is disabled during operation, the motor will decelerate and stop using DB, and remain in the free coasting state after stopping.

Modified settings become active immediately.

P5-20	*BRK_AddT_release*	Minimum value	0	Unit	1 ms	Persistence	per.
		Factory setting	0	Data type	INT16	MODBUS	1294
		Maximum value	400	Access	R/W	EtherCAT	3005:07$_h$

Description:

Additional time delay for releasing the holding brake

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

Setting can only be modified if power stage is disabled.

Modified settings become active the next time the power stage is enabled.

P5-21	*BRK_AddT_apply*	Minimum value	0	Unit	1 ms	Persistence	per.
		Factory setting	0	Data type	INT16	MODBUS	1296
		Maximum value	1000	Access	R/W	EtherCAT	3005:08$_h$

Description:

Additional time delay for applying the holding brake

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

Setting can only be modified if power stage is disabled.

Modified settings become active the next time the power stage is enabled.

P5-30	*ScaleVELdenom*	Minimum value	1	Unit	usr_v	Persistence	per.
		Factory setting	1	Data type	INT32	MODBUS	1602
		Maximum value	2147483647	Access	R/W	EtherCAT	3006:21$_h$

Description:

Velocity scaling: Denominator

See numerator *ScaleVELnum* (P5-31) for description.

A new scaling is activated when the numerator value is supplied.

Setting can only be modified if power stage is disabled.

P5-31	*ScaleVELnum*	Minimum value	1	Unit	RPM	Persistence	per.
		Factory setting	1	Data type	INT32	MODBUS	1604
		Maximum value	2147483647	Access	R/W	EtherCAT	3006:22$_h$

Description:

Velocity scaling: Numerator

Specification of the scaling factor:

$$\frac{\text{Speed of rotation of motor [RPM]}}{\text{User-defined units [usr_v]}}$$

A new scaling is activated when the numerator value is supplied.

Setting can only be modified if power stage is disabled.

Modified settings become active immediately.

P5-32	*MOD_Enable*	Minimum value	0	Unit	–	Persistence	per.
		Factory setting	0	Data type	UNIT16	MODBUS	1648
		Maximum value	1	Access	R/W	EtherCAT	3006:38$_h$

Description:

Activation of Modulo function

0 / Modulo Off: Modulo is off

1 / Modulo On: Modulo is on

Setting can only be modified if power stage is disabled.

Modified settings become active immediately.

P5-33	*MOD_Min*	Minimum value	-2147483648	Unit	usr_p	Persistence	per.
		Factory setting	0	Data type	INT32	MODBUS	1650
		Maximum value	2147483647	Access	R/W	EtherCAT	3006:39$_h$

Description:

Minimum position of modulo range

The minimum position value of the modulo range must be less than the maximum position value of the modulo range.

Setting can only be modified if power stage is disabled.

Modified settings become active immediately.

P5-34	*MOD_Max*	Minimum value	-2147483648	Unit	usr_p	Persistence	per.
		Factory setting	3600	Data type	INT32	MODBUS	1652
		Maximum value	2147483647	Access	R/W	EtherCAT	3006:3A$_h$

Description:

Maximum position of modulo range

The maximum position value of the modulo range must be greater than the minimum position value of the modulo range.

Setting can only be modified if power stage is disabled.

Modified settings become active immediately.

P5-35	*MOD_AbsDirection*	Minimum value	0	Unit	usr_p	Persistence	per.
		Factory setting	0	Data type	UNIT16	MODBUS	1654
		Maximum value	2	Access	R/W	EtherCAT	3006:3B$_h$

Description:

Direction of absolute movement with modulo

0 / Shortest Distance: Movement with shortest distance

1 / Positive Direction: Movement only in positive direction

2 / Negative Direction: Movement only in negative direction

If the parameter is set to 0, the drive calculates the shortest way to the new target position and starts the movement in the corresponding direction. If the distance to the target position is identical in positive and negative directions, the movement takes place in positive direction.

Modified settings become active immediately.

P5-36	*MOD_ABSMultiRng*	Minimum value	0	Unit	usr_p	Persistence	per.
		Factory setting	0	Data type	UNIT16	MODBUS	1656
		Maximum value	1	Access	R/W	EtherCAT	3006:3C$_h$

Description:

Multiple ranges for absolute movement with modulo

0 / Multiple Ranges Off: Absolute movement in one modulo range

1 / Multiple Ranges On: Absolute movement in multiple modulo ranges

Modified settings become active immediately.

P6-Special Settings

P6-00	*M_filename*	Minimum value	0	Unit	–	Persistence	–
		Factory setting	0	Data type	UNIT32	MODBUS	23342
		Maximum value	4294967295	Access	R/-	EtherCAT	305B:17$_h$

Description:

Motor model

Unselected motor = 0

BCH18LB0133CA5C=263

BCH18LB0133CF5C=264

BCH18LBA533CA5C=42245

BCH18LBA533CF5C=42246

BCH18LD0233CA5C=519

BCH18LD0233CF5C=520

BCH18LD0433CA5C=1031

BCH18LD0433CF5C=1032

BCH18LF0733CA5C=1797

BCH18LF0733CF5C=1798

BCH18LF1033CA5C=4103

BCH18LF1033CF5C=4104

BCH18LH1033CA6C=4105

BCH18LH1033CF6C=4112

BCH18LH1533CA6C=5379

BCH18LH1533CF6C=5380

BCH18LH2033CA6C=8195

BCH18LH2033CF6C=8196

BCH18LM3033CA6C=12291

BCH18LM3033CF6C=12292

BCH18MB0133CA5C=265

BCH18MB0133CF5C=272

BCH18MBA533CA5C=42247

BCH18MBA533CF5C=42248

BCH18MD0133CA5C=273

BCH18MD0133CF5C=274

BCH18MD0233CA5C=521

BCH18MD0233CF5C=528

BCH18MD0433CA5C=1033

BCH18MD0433CF5C=1040

BCH18MF0233CA5C=529

BCH18MF0233CF5C=530

BCH18MF0433CA5C=1041

BCH18MF0433CF5C=1042

BCH18MF0733CA5C=1799

BCH18MF0733CF5C=1800

BCH18MF1033CA5C=4113

P6-00	*M_filename*	*Minimum value*	*0*	*Unit*	–	*Persistence*	–
		Factory setting	0	Data type	UNIT32	MODBUS	23342
		Maximum value	4294967295	Access	R/-	EtherCAT	305B:17$_h$

Description:

BCH18MF1033CF5C=4114

BCH18MM0813CA6C=2051

BCH18MM0813CF6C=2052

BCH18MM1313CA6C=4867

BCH18MM1313CF6C=4868

BCH18MM1813CA6C=6147

BCH18MM1813CF6C=6148

BCH18MR2413CA6C=9219

BCH18MR2413CF6C=9220

BCH18MR3013CA6C=12295

BCH18MR3013CF6C=12296

BCH18MM1023CA6C=4117

BCH18MM1023CF6C=4118

BCH18MM1523CA6C=5383

BCH18MM1523CF6C=5384

BCH18MM2023CA6C=8199

BCH18MM2023CF6C=8200

Read-only parameters.

P6-01	*_M_Encoder*	Minimum value	8	Unit	–	Persistence	–
		Factory setting	8	Data type	UNIT16	MODBUS	3334
		Maximum value	8	Access	R/-	EtherCAT	300D:03$_h$

Description:

Motor encoder type

8 / BISS: Communication type high precision encoder.

Read-only parameters.

P6-02	*_prgVerDEV*	Minimum value	0	Unit	–	Persistence	–
		Factory setting	0	Data type	UNIT16	MODBUS	260
		Maximum value	65535	Access	R/-	EtherCAT	3001:02$_h$

Description:

Device firmware version

The device firmware version format is XX.YY.ZZ.

Where XX.YY is used to record the firmware version of the device and contained in this parameter. ZZ is used to record the device firmware revision and stored in *_prgRevDEV* (P6-03).

For example: V01.23.45

The value stored in this parameter is 123.

Read-only parameters.

P6-03	*_prgRevDEV*	Minimum value	0	Unit	–	Persistence	–
		Factory setting	0	Data type	UNIT16	MODBUS	264
		Maximum value	65535	Access	R/-	EtherCAT	3001:04$_h$

Description:

Device firmware revision

The device firmware version format is XX.YY.ZZ.

XX.YY is used to record the device firmware revision and stored in *_prgVerDEV* (P6-02).

ZZ is used to record the device firmware revision and stored in this parameter.

For example: V01.23.45

The value stored in this parameter is 45.

Read-only parameters.

P6-07	*MON_IO_SelErr1*	Minimum value	0	Unit	–	Persistence	per.
		Factory setting	0	Data type	UINT16	MODBUS	15116
		Maximum value	65535	Access	R/W	EtherCAT	303B:06$_h$

Description:

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.

Modified settings become active immediately.

P6-08	*MON_IO_SelErr2*	Minimum value	0	Unit	–	Persistence	per.
		Factory setting	0	Data type	UINT16	MODBUS	15118
		Maximum value	65535	Access	R/W	EtherCAT	303B:07$_h$

Description:

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.

Modified settings become active immediately.

P6-09	*MON_IO_SelWar1*	Minimum value	0	Unit	–	Persistence	per.
		Factory setting	0	Data type	UINT16	MODBUS	15120
		Maximum value	65535	Access	R/W	EtherCAT	303B:08$_h$

Description:

Signal output function Selected Warning (error class 0): First error code.

This parameter specifies the error code of an error of error class 0 which is to activate the signal output function.

Modified settings become active immediately.

P6-10	*MON_IO_SelWar2*	Minimum value	0	Unit	–	Persistence	per.
		Factory setting	0	Data type	UINT16	MODBUS	15122
		Maximum value	65535	Access	R/W	EtherCAT	303B:09$_h$

Description:

Signal output function Selected Warning (error class 0): Second error code.

This parameter specifies the error code of an error of error class 0 which is to activate the signal output function.

Modified settings become active immediately.

P6-11	*MON_SW_Limits*	Minimum value	0	Unit	–	Persistence	per.
		Factory setting	0	Data type	UINT16	MODBUS	1542
		Maximum value	3	Access	R/W	EtherCAT	3006:03$_h$

Description:

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.

Modified settings become active immediately.

P6-12	*MON_SWLimMode*	Minimum value	0	Unit	–	Persistence	per.
		Factory setting	0	Data type	UINT16	MODBUS	1678
		Maximum value	1	Access	R/W	EtherCAT	3006:47$_h$

Description:

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

Modified settings become active immediately.

P6-13	*MON_swLimP*	Minimum value	-2147483648	Unit	usr_p	Persistence	per.
		Factory setting	2147483647	Data type	INT32	MODBUS	1544
		Maximum value	2147483647	Access	R/W	EtherCAT	3006:04$_h$

Description:

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 user-defined value.

Setting can only be modified if power stage is disabled.

Modified settings become active the next time the power stage is enabled.

P6-14	*MON_swLimN*	Minimum value	-2147483648	Unit	usr_p	Persistence	per.
		Factory setting	2147483647	Data type	INT32	MODBUS	1546
		Maximum value	2147483647	Access	R/W	EtherCAT	3006:05$_h$

Description:

Negative position limit for software limit switch

See description *MON_swLimP* (P6-13).

Setting can only be modified if power stage is disabled.

Modified settings become active the next time the power stage is enabled.

P6-15	*MON_p_win_usr*	Minimum value	0	Unit	usr_p	Persistence	per.
		Factory setting	16	Data type	INT32	MODBUS	1664
		Maximum value	2147483647	Access	R/W	EtherCAT	3006:40$_h$

Description:

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 *MON_p_winTime* (P6-16).

The minimum value, the factory setting and the maximum value depend on the scaling factor.

Modified settings become active immediately.

P6-16	*MON_p_winTime*	Minimum value	0	Unit	ms	Persistence	per.
		Factory setting	0	Data type	UINT16	MODBUS	1610
		Maximum value	32767	Access	R/W	EtherCAT	6068:00$_h$

Description:

Standstill window, time.

Value =0: Monitoring of standstill window deactivated

Value >0: Time in *ms* during which the control deviation must be in the standstill window

Modified settings become active immediately.

P6-17	*MON_p_winTout*	Minimum value	0	Unit	ms	Persistence	per.
		Factory setting	0	Data type	UINT16	MODBUS	1612
		Maximum value	16000	Access	R/W	EtherCAT	3006:26$_h$

Description:

Time-out time for standstill window monitoring.

Value =0: Time-out monitoring deactivated

Value >0: Time-out time in *ms*

Standstill window processing values are set via *MON_p_win_usr* (P6-15) and *MON_p_winTime* (P6-16).

Time monitoring starts when the target position (reference position of position controller) is reached or when the profile generator has finished processing.

Modified settings become active immediately.

P6-18	*MON_v_win*	Minimum value	1	Unit	usr_v	Persistence	per.
		Factory setting	10	Data type	UINT32	MODBUS	1576
		Maximum value	2147483647	Access	R/W	EtherCAT	606D:00$_h$

Description:

Velocity window, permissible 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 *MON_v_winTime* (P6-19).

Modified settings become active immediately.

P6-19	*MON_v_winTime*	Minimum value	0	Unit	ms	Persistence	per.
		Factory setting	0	Data type	UINT16	MODBUS	1578
		Maximum value	16383	Access	R/W	EtherCAT	606E:00$_h$

Description:

Velocity window, time.

Value 0: Velocity window monitoring deactivated

Value > 0: Time in *ms* during which the control deviation must be in the standstill window.

Changing the value causes a restart of velocity monitoring.

Modified settings become active immediately.

P6-20	*MON_tq_win*	Minimum value	0	Unit	0.1%	Persistence	per.
		Factory setting	30	Data type	UINT16	MODBUS	1626
		Maximum value	30000	Access	R/W	EtherCAT	3006:2D$_h$

Description:

Torque window, permissible deviation.

The torque window can only be activated in operating mode Profile Torque.

In increments of 0.1 %.

Modified settings become active immediately.

P6-21	*MON_tq_winTime*	Minimum value	0	Unit	ms	Persistence	per.
		Factory setting	0	Data type	UINT16	MODBUS	1628
		Maximum value	16383	Access	R/W	EtherCAT	3006:2E$_h$

Description:

Torque window, time.

Value 0: Torque window monitoring deactivated

Value > 0: Time in *ms* during which the control deviation must be in the standstill window.

Changing the value causes a restart of torque monitoring.

Torque window is only used in operating mode Profile Torque.

Modified settings become active immediately.

P6-22	*MON_p_DiffWin_usr1*	Minimum value	0	Unit	usr_p	Persistence	per.
		Factory setting	128	Data type	INT32	MODBUS	1662
		Maximum value	2147483647	Access	R/W	EtherCAT	3006:3F$_h$

Description:

Monitoring of position deviation 1.

The system verifies whether the drive is within the defined deviation during the period set with *MON_p_ChkTime* (P6-26).

The status can be output via a parameterizable output.

The minimum value, the factory setting and the maximum value depend on the scaling factor.

Modified settings become active immediately.

P6-23	*MON_p_mode1*	Minimum value	0	Unit	–	Persistence	per.
		Factory setting	0	Data type	UINT16	MODBUS	1706
		Maximum value	5	Access	R/W	EtherCAT	3006:55$_h$

Description:

Position following error monitoring output mode 1

0 / Position reached

1 / Command reached

2 / Command reached with output latched

3 / Position reached with time window

4 / Command reached with time window

5 / Motion finished: Movement finished

Modified settings become active immediately.

P6-24	*MON_p_DiffWin_usr2*	Minimum value	0	Unit	–	Persis-tence	per.
		Factory setting	128	Data type	INT32	MODBUS	1700
		Maximum value	2147483647	Access	R/W	EtherCAT	3006:52$_h$

Description:

Monitoring of position deviation 2.

The system verifies whether the drive is within the defined deviation during the period set with *MON_p_ChkTime* (P6-26).

The status can be output via a parameterizable output.

The minimum value, the factory setting and the maximum value depend on the scaling factor.

Modified settings become active immediately.

P6-25	*MON_p_mode2*	Minimum value	0	Unit	–	Persistence	per.
		Factory setting	0	Data type	UINT16	MODBUS	1708
		Maximum value	5	Access	R/W	EtherCAT	3006:56$_h$

Description:

Position following error monitoring output mode 2.

0 / Position reached

1 / Command reached

2 / Command reached with output latched

3 / Position reached with time window

4 / Command reached with time window

5 / Motion finished: Movement finished

Modified settings become active immediately.

P6-26	*MON_p_ChkTime*	Minimum value	0	Unit	ms	Persis-tence	per.
		Factory setting	0	Data type	UINT16	MODBUS	1594
		Maximum value	9999	Access	R/W	EtherCAT	3006:1D$_h$

Description:

Time window for position monitoring.

Adjustment of a time for monitoring of position deviation.

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.

Modified settings become active immediately.

P6-27	*MON_v_DiffWin*	Minimum value	1	Unit	usr_v	Persistence	per.
		Factory setting	10	Data type	UINT32	MODBUS	1588
		Maximum value	2147483647	Access	R/W	EtherCAT	3006:1A$_h$

Description:

Monitoring of velocity deviation.

The system monitors whether the drive is within the defined deviation during the period set with *MON_v_ChkTime* (P6-29).

The status can be output via a parameterizable output.

Modified settings become active immediately.

P6-28	*MON_v_Threshold*	Minimum value	1	Unit	usr_v	Persistence	per.
		Factory setting	10	Data type	UINT32	MODBUS	1590
		Maximum value	2147483647	Access	R/W	EtherCAT	606F:00$_h$

Description:

Monitoring of velocity threshold.

The system monitors whether the drive is below the defined value during the period set with *MON_v_ChkTime* (P6-29).

The status can be output via a parameterizable output.

Modified settings become active immediately.

P6-29	*MON_v_ChkTime*	Minimum value	0	Unit	ms	Persistence	per.
		Factory setting	0	Data type	UINT16	MODBUS	1696
		Maximum value	9999	Access	R/W	EtherCAT	6070:00$_h$

Description:

Time window for velocity monitoring.

Adjustment of a time for monitoring of velocity deviation and velocity 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.

Modified settings become active immediately.

P6-30	*MON_tq_Threshold*	Minimum value	0	Unit	0.1 %	Persistence	per.
		Factory setting	600	Data type	UINT16	MODBUS	1592
		Maximum value	30000	Access	R/W	EtherCAT	3006:1C$_h$

Description:

Monitoring of torque threshold.

The system monitors whether the drive is below the defined value during the period set with *MON_tq_ChkTime* (P6-31).

The status can be output via a parameterizable output.

100.0 % correspond to the motor rated torque.

In increments of 0.1 %.

Modified settings become active immediately.

P6-31	*MON_tq_ChkTime*	Minimum value	0	Unit	ms	Persistence	per.
		Factory setting	0	Data type	UINT16	MODBUS	1710
		Maximum value	9999	Access	R/W	EtherCAT	3006:57$_h$

Description:

Time window for torque monitoring.

Adjustment of a time for monitoring of torque 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.

Modified settings become active immediately.

P6-32	*MON_p_dif_warn*	Minimum value	0	Unit	%	Persistence	per.
		Factory setting	75	Data type	UINT16	MODBUS	1618
		Maximum value	100	Access	R/W	EtherCAT	3006:29$_h$

Description:

Advisory limit of the load-dependent position deviation (error class 0).

100.0 % correspond to the maximum position deviation (following error) as specified by means of parameter *MON_p_dif_load_usr* (P0-21).

Modified settings become active immediately.

P6-33	*ErrorResp_p_dif*	Minimum value	1	Unit	–	Persistence	per.
		Factory setting	3	Data type	UINT16	MODBUS	1302
		Maximum value	3	Access	R/W	EtherCAT	3005:0B$_h$

Description:

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 modified if power stage is disabled.

Modified settings become active the next time the power stage is enabled.

P6-34	*MON_VelDiff*	Minimum value	0	Unit	usr_v	Persis-tence	per.
		Factory setting	0	Data type	UINT32	MODBUS	1712
		Maximum value	2147483647	Access	R/W	EtherCAT	3006:58$_h$

Description:

Maximum load-dependent velocity deviation.

Value 0: Monitoring deactivated

Value >0: Maximum value

Modified settings become active immediately.

P6-35	*MON_VelDiff_Time*	Minimum value	0	Unit	ms	Persis-tence	per.
		Factory setting	10	Data type	UINT16	MODBUS	1714
		Maximum value	–	Access	R/W	EtherCAT	3006:59$_h$

Description:

Time window for maximum load-dependent velocity deviation.

Value 0: Monitoring deactivated

Value >0: Time window for maximum value

Modified settings become active immediately.

P6-36	*ErrorResp_v_dif*	Minimum value	1	Unit	–	Persistence	per.
		Factory setting	3	Data type	UINT16	MODBUS	1716
		Maximum value	3	Access	R/W	EtherCAT	3006:5A$_h$

Description:

Error response to excessively high load dependent velocity 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 modified if power stage is disabled.

Modified settings become active immediately.

P6-38	*ErrorResp_I2tRES*	Minimum value	0	Unit	–	Persistence	per.
		Factory setting	0	Data type	UNIT16	MODBUS	1348
		Maximum value	2	Access	R/W	EtherCAT	3005:22$_h$

Description:

Error response to 100% I2t braking resistor.

0 / Error Class 0

1 / Error Class 1

2 / Error Class 2

Setting can only be modified if power stage is disabled.

Modified settings become active the next time the motor moves.

P6-39	*I_Sat_winTime*	Minimum value	0	Unit	ms	Persistence	per.
		Factory setting	5500	Data type	UNIT16	MODBUS	1392
		Maximum value	10000	Access	R/W	EtherCAT	3005:38$_h$

Description:

Drive power stage current command saturation alarm time

When the current command I_{cmd} of the drive power stage is equal to the saturation current I_{sat}, and the saturation current I_{sat} is greater than 115% of the motor rated current *M_In*, the system starts the drive power stage command current saturation monitoring countdown.

The saturation current I_{sat} is one of the following values (whichever is lowest):

- Current limit of the current system
- Max. motor current (M_I_{max})
- Max. output current of drive (PS_I_{max})

Countdown time is T = *M_Imax*^{2}* P6-24/ I_{sat}^2.

When the countdown is over, the system triggers an error 5604 of error class 3.

Once I_{cmd} is lower than I_{sat} during the countdown, the countdown is reset.

Setting can only be modified if power stage is disabled.

Modified settings become active immediately.

P6-40	*ErrorClearAll*	Minimum value	0	Unit	–	Persistence	per.
		Factory setting	128	Data type	UNIT32	MODBUS	16148
		Maximum value	4294967295	Access	R/W	EtherCAT	303F:0A$_h$

Description:

Suppressing errors

Bit 0...6: Reserved

Bit 7: Drive power stage or motor overload (I^2T)

- **0 /** The current output of the drive power stage is limited in the event of an overload (I^2T).
- **1 /** The error 4102 or error 4302 of error class 3 is triggered in the event of an overload (I^2T).

Bit 8: Reserved

Bit 9: DC bus under-voltage

- **0 /** The error number 3201 or the error number 3202 is not stored in the failure history storage area of the device.
- **1 /** The error number 3201 or the error number 3202 is stored in the failure history storage area of the device.

Bit 10...11: Reserved

Bit 12: Battery under-voltage for multi-turn absolute encoder

- **0 /** Unblock battery under-voltage error E7634
- **1 /** Block battery under-voltage error E7634

Bit 13...31: Reserved

Modified settings become active immediately.

P6-41	*MON_UserDefFunc*	Minimum value	0	Unit	–	Persistence	per.
		Factory setting	0	Data type	UINT16	MODBUS	1686
		Maximum value	65535	Access	R/W	EtherCAT	3006:4B$_h$

Description:

Special functions

Bit 0: Positive limit switch triggered during positive movement, or negative limit switch triggered during negative movement

- **0 /** The limit error E A302/E A303 shall be cleared by Fault Reset.
- **1/** The limit error E A302/E A303 can be cleared without Fault Reset, and the servo motor can directly run in reverse direction and automatically clear the limit fault automatically.

Bit 1: Positive limit switch triggered during negative movement, or negative limit switch triggered during positive movement

- **0 /** The limit error E A302/E A303 shall be cleared by Fault Reset.
- **1/** Drive does not stop without any error information.

Bit 2...31: Reserved

Setting can only be modified if power stage is disabled.

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

P6-42	*MON_v_max_enable*	Minimum value	0	Unit	usr_v	Persistence	per.
		Factory setting	500	Data type	UNIT32	MODBUS	1684
		Maximum value	1200	Access	R/W	EtherCAT	3006:4A$_h$

Description:

Maximum motor velocity during enable of power stage output

This parameter defines the maximum motor velocity allowed by the system during enable of power stage output. If the system detects the motor velocity exceeding this parameter during power stage output enabling, the error 1B0F of Error Class 3 will be triggered.

This parameter limits uncontrolled motor behavior during enabling of power stage due to abnormal conditions.

Modified settings become active immediately.

P6-43	*I2T_MOT_I0PCT*	Minimum value	866	Unit	0.1%	Persis-tence	per.
		Factory setting	1000	Data type	UINT16	MODBUS	1394
		Maximum value	1000	Access	R/W	EtherCAT	3005:39$_h$

Description:

Maximum continuous current load percentage of motor (I2T) at standstill

The maximum current load rate when the motor is at standstill is limited to prevent excessive stator single-phase current from causing additional heating of the motor and to protect the motor.

This function also limits the torque output of the motor at standstill.

In increments of 0.1%.

Modified settings become active immediately.

P6-44	*I2T_MOT_INPCT*	Minimum value	1000	Unit	0.1%	Persistence	per.
		Factory setting	1000	Data type	UINT16	MODBUS	1396
		Maximum value	1150	Access	R/W	EtherCAT	3005:3A$_h$

Description:

Maximum continuous current load percentage of motor (I2T) at running

In increments of 0.1%.

Modified settings become active immediately.

P6-46	*ECAT2ndaddress*	Minimum value	0	Unit	–	Persistence	per.
		Factory setting	0	Data type	UNIT16	MODBUS	17676
		Maximum value	65535	Access	R/W	EtherCAT	3045:06$_h$

Description:

EtherCAT second address

Value for an EtherCAT "Identification" (also known as "Station Alias"), for example, for the EtherCAT function Hot Connect.

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

P6-47	*ENCErrorMulTurnReset*	Minimum value	0	Unit	–	Persistence	per.
		Factory setting	0	Data type	UNIT16	MODBUS	21016
		Maximum value	2	Access	R/W	EtherCAT	3052:0C$_h$

Description:

Encoder reset command

0 / Invalid

1 / Clear encoder faults

2 / Clear multi-turn values and encoder faults

Other Parameters

–	*_actionStatus*	Minimum value	–	Unit	–	Persistence	–
		Factory setting	–	Data type	UINT16	MODBUS	7176
		Maximum value	–	Access	R/-	EtherCAT	301C:04$_h$

Description:

Action word.

Signal state:

0: Not activated

1: Activated

Bit assignments:

Bit 0: Error class 0

Bit 1: Error class 1

Bit 2: Error class 2

Bit 3: Error class 3

Bit 4: Error class 4

Bit 5: Reserved

Bit 6: Motor is at a standstill (*_n_act* < 9 RPM)

Bit 7: Motor movement in positive direction

Bit 8: Motor movement in negative direction

Bit 9: Assignment can be set via parameter *DPL_intLim*

Bit 10: Assignment can be set via parameter *DS402intLim*

Bit 11: Profile generator idle (reference velocity is 0)

Bit 12: Profile generator decelerates

Bit 13: Profile generator accelerates

Bit 14: Profile generator moves at constant speed

Bit 15: Reserved

–	*_DCOMopmd_act*	Minimum value	-1	Unit	–	Persistence	–
		Factory setting	–	Data type	INT16	MODBUS	6920
		Maximum value	10	Access	R/–	EtherCAT	6061:00$_h$

Description:

Active operating mode.

-1 / Jog*

0 / Reserved

1 / Profile Position

3 / Profile Velocity

4 / Profile Torque

6 / Homing

8 / Cyclic Synchronous Position

9 / Cyclic Synchronous Velocity

10 / Cyclic Synchronous Torque

* : JOG mode is available in EtherCAT Q3 2024.

Modified settings become active immediately.

–	*_DCOMstatus*	Minimum value	–	Unit	–	Persistence	–
		Factory setting	–	Data type	UINT16	MODBUS	6916
		Maximum value	–	Access	R/-	EtherCAT	6041:00$_h$

Description:

Drive status word

Bit assignments:

Bit 0: Operating state Ready To Switch On

Bit 1: Operating state Switched On

Bit 2: Operating state Operation Enabled

Bit 3: Operating state Fault

Bit 4: Voltage Enabled

Bit 5: Operating state Quick Stop

Bit 6: Operating state Switch On Disabled

Bit 7: Error of error class 0

Bit 8: HALT request active

Bit 9: Remote

Bit 10: Target Reached

Bit 11: Internal Limit Active

Bit 12: Operating mode-specific

Bit 13: x_err

Bit 14: x_end

Bit 15: ref_ok

–	*_DPL_motionStat*	Minimum value	–	Unit	–	Persistence	–
		Factory setting	–	Data type	UINT16	MODBUS	6990
		Maximum value	–	Access	R/-	EtherCAT	301B:27$_h$

Description:

Drive Profile

Lexium motionStat.

–	*_LastError*	Minimum value	–	Unit	–	Persistence	–
		Factory setting	–	Data type	UINT16	MODBUS	7178
		Maximum value	–	Access	R/-	EtherCAT	603F:00$_h$

Description:

Detected error causing a stop (error classes 1 to 4).

Error code of the most recent detected error.

Consecutive detected errors do not overwrite this error code.

Example: If an error response to a detected limit switch error causes overvoltage, this parameter contains the code of the detected limit switch error.

Exception: Detected errors of error class 4 overwrite existing entries.

–	*_LastWarning*	Minimum value	–	Unit	–	Persistence	–
		Factory setting	–	Data type	UINT16	MODBUS	7186
		Maximum value	–	Access	R/-	EtherCAT	301C:09$_h$

Description:

Code of most recent error of error class 0.

If the error is no longer active, the code is stored until the next Fault Reset.

Value 0: No error of error class 0

–	*_p_act*	Minimum value	–	Unit	usr_p	Persistence	–
		Factory setting	–	Data type	INT32	MODBUS	7706
		Maximum value	–	Access	R/-	EtherCAT	6064:00$_h$

Description:

Actual position.

–	*_p_dif_load_usr*	Minimum value	-2147483648	Unit	usr_p	Persis-tence	–
		Factory setting	–	Data type	INT32	MODBUS	7724
		Maximum value	2147483647	Access	R/-	EtherCAT	301E:16$_h$

Description:

Load-dependent position deviation between reference and actual positions.

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

This value is used for following error monitoring.

–	*_SigLatched*	Minimum value	–	Unit	–	Persis-tence	–
		Factory setting	–	Data type	UINT32	MODBUS	7184
		Maximum value	–	Access	R/-	EtherCAT	301C:08$_h$

Description:

Saved status of monitoring signals.

Signal state:

0: Not activated

1: Activated

Bit assignments:

Bit 0: General error

Bit 1: Hardware limit switches (LIMP/LIMN/REF)

Bit 2: Out of range (software limit switches, tuning)

Bit 3: Quick Stop via fieldbus

Bit 4: Error in active operating mode

Bit 5: Commissioning interface (RS485)

Bit 6: Integrated fieldbus

Bit 7: Reserved

Bit 8: Following error

Bit 9: Reserved

Bit 10: Inputs STO are 0

Bit 11: Inputs STO different

Bit 12: Reserved

Bit 13: DC bus voltage low

Bit 14: DC bus voltage high

Bit 15: Mains phase missing

Bit 16: Integrated encoder interface

Bit 17: Over-temperature motor

Bit 18: Over-temperature power stage

Bit 19: Reserved

Bit 20: Memory card

Bit 21...25: Reserved

Bit 26: Motor connection

Bit 27: Motor overcurrent/short circuit

Bit 28: Frequency of reference signal too high

Bit 29: Nonvolatile memory error detected

Bit 30: System start-up (hardware or parameter)

Bit 31: System error detected (for example, watchdog, internal hardware interface)

Monitoring functions are product-dependent.

–	*_tq_act*	Minimum value	–	Unit	0.1%	Persistence	–
		Factory setting	–	Data type	INT16	MODBUS	7752
		Maximum value	–	Access	R/-	EtherCAT	6077:00$_h$

Description:

Actual torque.

100.0 % correspond to the nominal torque.

–	*_v_act*	Minimum value	–	Unit	usr_v	Persistence	–
		Factory setting	–	Data type	INT32	MODBUS	7744
		Maximum value	–	Access	R/-	EtherCAT	606C:00$_h$

Description:

Actual velocity.

–	*_v_dif_usr*	Minimum value	-2147483648	Unit	usr_v	Persistence	–
		Factory setting	–	Data type	INT32	MODBUS	7768
		Maximum value	2147483647	Access	R/-	EtherCAT	301E:2C$_h$

Description:

Load-dependent velocity deviation.

The load-dependent velocity deviation is the difference between reference velocity and actual velocity.

–	*_WarnLatched*	Minimum value	–	Unit	–	Persistence	–
		Factory setting	–	Data type	UINT32	MODBUS	7192
		Maximum value	–	Access	R/-	EtherCAT	301C:0C$_h$

Description:

Saved errors of error class 0, bit-coded

The bits are set to 0 in the case of a Fault Reset.

Bits 10 and 13 are set to 0 automatically.

Signal state:

0: Not activated

1: Activated

Bit assignments:

Bit 0: General

Bit 1: Reserved

Bit 2: Out of range (software limit switches, tuning)

Bit 3: Reserved

Bit 4: Active operating mode

Bit 5: Commissioning interface (RS485)

Bit 6: Integrated fieldbus

Bit 7: Reserved

Bit 8: Following error

Bit 9: Reserved

Bit 10: Inputs STO_A and/or STO_B

Bits 11 ... 12: Reserved

Bit 13: Low voltage DC bus or mains phase missing

Bits 14...15: Reserved

Bit 16: Integrated encoder interface

Bit 17: Temperature of motor high

Bit 18: Temperature of power stage high

Bit 19 ... Bit 28: Reserved

Bit 29: Braking resistor overload (I2t)

Bit 30: Power stage overload (I2t)

Bit 31: Motor overload (I2t)

Monitoring functions are product-dependent.

–	*DCOMcontrol*	Minimum value	–	Unit	–	Persistence	–
		Factory setting	–	Data type	UINT16	MODBUS	6914
		Maximum value	–	Access	R/W	EtherCAT	6040:00$_h$

Description:

DriveCom control word.

Bit 0: Operating state Switch On

Bit 1: Enable Voltage

Bit 2: Operating state Quick Stop

Bit 3: Enable Operation

Bits 4…6: Operating mode-specific

Bit 7: Fault Reset

Bit 8: Halt

Bit 9: Operating mode-specific

Bits 10…15: Reserved (must be 0)

Modified settings become active immediately.

–	*DCOMopmode*	Minimum value	-1	Unit	–	Persistence	–
		Factory setting	–	Data type	INT16	MODBUS	6918
		Maximum value	10	Access	R/W	EtherCAT	6060:00$_h$

Description:

Operating mode.

-1 / Jog*

0 / Reserved

1 / Profile Position

3 / Profile Velocity

4 / Profile Torque

6 / Homing

8 / Cyclic Synchronous Position

9 / Cyclic Synchronous Velocity

10 / Cyclic Synchronous Torque

* : JOG mode is available in EtherCAT Q3 2024.

Modified settings become active immediately.

–	*DPL_intLim*	Minimum value	0	Unit	–	Persistence	per.
		Factory setting	11	Data type	UINT16	MODBUS	7018
		Maximum value	11	Access	R/W	EtherCAT	301B:35$_h$

Description:

Setting for bit 9 of *_DPL_motionStat* and *_actionStatus*.

0 / None: Not used (reserved)

1 / Current Below Threshold: Current threshold value

2 / Velocity Below Threshold: Velocity threshold value

3 / In Position Deviation Window1: Position deviation window

4 / In Velocity Deviation Window: Velocity deviation window

9 / Hardware Limit Switch: Hardware limit switch

11 / Position Window: Position window

Setting for:

Bit 9 of the parameter *_actionStatus*

Bit 9 of the parameter *_DPL_motionStat*

Modified settings become active immediately.

–	*DS402intLim*	Minimum value	0	Unit	–	Persistence	per.
		Factory setting	0	Data type	UINT16	MODBUS	6972
		Maximum value	11	Access	R/W	EtherCAT	301B:1E$_h$

Description:

DS402 status word: Setting for bit 11 (internal limit).

0 / None: Not used (reserved)

1 / Current Below Threshold: Current threshold value

2 / Velocity Below Threshold: Velocity threshold value

3 / In Position Deviation Window1: Position deviation window

4 / In Velocity Deviation Window: Velocity deviation window

9 / Hardware Limit Switch: Hardware limit switch

11 / Position Window: Position window

Setting for:

Bit 11 of the parameter *_DCOMstatus*

Bit 10 of the parameter *_actionStatus*

Bit 10 of the parameter *_DPL_motionStat*

–	*HMmethod*	Minimum value	1	Unit	–	Persistence	–
		Factory setting	18	Data type	INT16	MODBUS	6936
		Maximum value	35	Access	R/W	EtherCAT	6098:00$_h$

Description:

Homing method.

-4: Mechanical Stop+

-3: Mechanical Stop -

-2: Mechanical Stop+, Index, inv

-1: Mechanical Stop -, Index, inv

1: LIMN with index pulse

2: LIMP with index pulse

7: REF+ with index pulse, inv., outside

8: REF+ with index pulse, inv., inside

9: REF+ with index pulse, not inv., inside

10: REF+ with index pulse, not inv., outside

11: REF- with index pulse, inv., outside

12: REF- with index pulse, inv., inside

13: REF- with index pulse, not inv., inside

14: REF- with index pulse, not inv., outside

17: LIMN

18: LIMP

23: REF+, inv., outside

24: REF+, inv., inside

25: REF+, not inv., inside

26: REF+, not inv., outside

27: REF-, inv., outside

28: REF-, inv., inside

29: REF-, not inv., inside

30: REF-, not inv., outside

33: Index pulse negative direction

34: Index pulse positive direction

35: Position setting

Abbreviations:

REF+: Search movement in positive direction

REF-: Search movement in negative direction

inv.: Invert direction in switch

not inv.: Direction not inverted in switch

outside: Index pulse / distance outside switch

inside: Index pulse / distance inside switch

Modified settings become active immediately.

–	*HMp_setP*	Minimum value	–	Unit	usr_p	Persistence	–
		Factory setting	0	Data type	INT32	MODBUS	6956
		Maximum value	–	Access	R/W	EtherCAT	301B:16$_h$

Description:

Position for Position Setting.

Position for operating mode Homing, method 35.

Modified settings become active immediately.

–	*JOGactivate*	Minimum value	0	Unit	–	Persistence	per.
		Factory setting	0	Data type	UINT16	MODBUS	6930
		Maximum value	7	Access	R/W	EtherCAT	301B:09$_h$

Description:

Activation of operating mode Jog.

Bit 0: Positive direction of movement

Bit 1: Negative direction of movement

Bit 2: 0 = slow 1 = fast

Modified settings become active immediately.

–	*PPoption*	Minimum value	0	Unit	–	Persistence	–
		Factory setting	0	Data type	UINT16	MODBUS	6960
		Maximum value	2	Access	R/W	EtherCAT	60F2:00$_h$

Description:

Options for operating mode Profile Position.

Determines the reference position for relative positioning:

0 / Relative with reference to the previous target position of the profile generator

1 / Not supported

2 / Relative with reference to the actual position of the motor

Modified settings become active the next time the motor moves.

–	*PPp_target*	Minimum value	–	Unit	usr_p	Persistence	–
		Factory setting	–	Data type	INT32	MODBUS	6940
		Maximum value	–	Access	R/W	EtherCAT	607A:00$_h$

Description:

Target position for operating mode Profile Position.

Minimum/maximum values depend on:

- Scaling factor
- Software limit switches (if they are activated)

Modified settings become active immediately.

–	*PTtq_target*	Minimum value	–30000	Unit	0.1%	Persistence	–
		Factory setting	0	Data type	INT16	MODBUS	6944
		Maximum value	30000	Access	R/W	EtherCAT	6071:00$_h$

Description:

Target torque.

100.0 % correspond to the rated torque.

In increments of 0.1 %.

Modified settings become active immediately.

–	*PVp_target*	Minimum value	–	Unit	usr_p	Persistence	–
		Factory setting	0	Data type	INT32	MODBUS	6940
		Maximum value	–	Access	R/W	EtherCAT	607A:00$_h$

Description:

Target position for operating mode Profile Position.

Minimum/maximum values depend on:

- Scaling factor
- Software limit switches (if they are activated)

Modified settings become active immediately.

–	*PVv_target*	Minimum value	–	Unit	usr_v	Persistence	–
		Factory setting	0	Data type	INT32	MODBUS	6938
		Maximum value	–	Access	R/W	EtherCAT	60FF:00$_h$

Description:

Target velocity.

The target velocity is limited to the setting in *CTRL_v_max* and *RAMP_v_max*.

Modified settings become active immediately.

–	*PPv_target*	Minimum value	1	Unit	usr_v	Persistence	–
		Factory setting	60	Data type	UINT32	MODBUS	6942
		Maximum value	4294967295	Access	R/W	EtherCAT	6081:00$_h$

Description:

Target velocity for operating mode Profile Position.

The target velocity is limited to the setting in *CTRL_v_max* (P4-18) and *RAMP_v_max* (P4-01).

Modified settings become active the next time the motor moves.

–	*TouchProbeFct*	Minimum value	–	Unit	–	Persistence	–
		Factory setting	–	Data type	UNIT16	MODBUS	7028
		Maximum value	–	Access	R/W	EtherCAT	60B8:00$_h$

Description:

Touch Probe function (DS402)

Bit	Value 0	Value 1
0	Deactivate Capture input 1	Activate Capture input 1
1	One-time capture	Continuous capture
2	Trigger with Capture Input 1	Trigger with zero pulse signal
3	Reserved (must be 0)	–
4	Disabling capture input 1 with rising edge	Enabling capture input 1 with rising edge
5	Disabling capture input 1 with falling edge	Enabling capture input 1 with falling edge
6 ... 7	Reserved (must be 0)	–
8	Deactivate Capture input 2	Activate Capture input 2
9	One-time capture	Continuous capture
10	Trigger with capture Input 2	Trigger with zero pulse signal
11	Reserved (must be 0)	–
12	Disabling capture input 2 with rising edge	Enabling capture input 2 with rising edge
13	Disabling capture input 2 with falling edge	Enabling capture input 2 with falling edge
14 ... 15	Reserved (must be 0)	–

Modified settings become active immediately.

–	*_TouchProbeStat*	Minimum value	–	Unit	–	Persistence	–
		Factory setting	–	Data type	UINT16	MODBUS	7030
		Maximum value	–	Access	R/–	EtherCAT	60B9:00$_h$

Description:

Touch Probe status (DS402)

Bit	Value 0	Value 1
0	Capture input 1 deactivated	Capture input 1 activated
1	Capture input 1 no value captured for rising edge	Capture input 1 value captured for rising edge
2	Capture input 1 no value captured for falling edge	Capture input 1 value captured for falling edge
3 ... 7	Reserved	–
8	Capture input 2 deactivated	Capture input 2 activated
9	Capture input 2 no value captured for rising edge	Capture input 2 value captured for rising edge
10	Capture input 2 no value captured for falling edge	Capture input 2 value captured for falling edge
11 ... 15	Reserved	–

–	*_Cap1PosRisEdge*	Minimum value	–	Unit	usr_p	Persistence	–
		Factory setting	–	Data type	INT32	MODBUS	2634
		Maximum value	–	Access	R/–	EtherCAT	60BA:00$_h$

Description:

Capture input 1 captured position at rising edge (DS402).

This parameter contains the position captured at the point in time a rising edge was detected.

The captured position is recalculated after “Position Setting” or “Reference Movement”.

–	*_Cap1PosFallEdge*	Minimum value	–	Unit	usr_p	Persistence	–
		Factory setting	–	Data type	INT32	MODBUS	2636
		Maximum value	–	Access	R/–	EtherCAT	60BB:00$_h$

Description:

Capture input 1 captured position at falling edge (DS402).

This parameter contains the position captured at the point in time a falling edge was detected.

The captured position is recalculated after “Position Setting” or “Reference Movement”.

–	*_Cap2PosRisEdge*	Minimum value	–	Unit	usr_p	Persistence	–
		Factory setting	–	Data type	INT32	MODBUS	2638
		Maximum value	–	Access	R/–	EtherCAT	60BC:00$_h$

Description:

Capture input 2 captured position at rising edge (DS402).

This parameter contains the position captured at the point in time a rising edge was detected.

The captured position is recalculated after “Position Setting” or “Reference Movement”.

–	*_Cap2PosFallEdge*	Minimum value	–	Unit	usr_p	Persistence	–
		Factory setting	–	Data type	INT32	MODBUS	2640
		Maximum value	–	Access	R/–	EtherCAT	60BD:00$_h$

Description:

Capture input 2 captured position at falling edge (DS402).

This parameter contains the position captured at the point in time a falling edge was detected.

The captured position is recalculated after “Position Setting” or “Reference Movement”.

–	*HMblock_time*	Minimum value	10	Unit	ms	Persistence	–
		Factory setting	1000	Data type	INT16	MODBUS	–
		Maximum value	10000	Access	R/W	EtherCAT	3028:10$_h$

Description:

Blocking time for homing method to the mechanical stop.

The parameter indicates the time after which the mechanical stop is recognized

When the drive is blocked. The conditions for blocking are 1) at the current limit at 2) zero speed.

–	*HMtq_Lim*	Minimum value	0.0	Unit	%	Persistence	–
		Factory setting	25.0	Data type	INT16	MODBUS	–
		Maximum value	350.0	Access	R/W	EtherCAT	3028:11$_h$

Description:

Value of the limited torque for homing method with mechanical blocking.

–	*HMtimeout*	Minimum value	10	Unit	s	Persistence	–
		Factory setting	60	Data type	INT16	MODBUS	–
		Maximum value	65535	Access	R/W	EtherCAT	3028:12$_h$

Description:

Timeout for homing method with mechanical blocking.

Monitoring in accordance with the input in homing active.

–	*CTRL_TQ_LIMP*	Minimum value	0	Unit	0.1%	Persistence	–
		Factory setting	3500	Data type	INT16	MODBUS	4480
		Maximum value	3500	Access	R/W	EtherCAT	60E0:00$_h$

Description:

Positive torque limit value

–	*CTRL_TQ_LIMN*	Minimum value	0	Unit	0.1%	Persistence	–
		Factory setting	3500	Data type	INT16	MODBUS	4482
		Maximum value	3500	Access	R/W	EtherCAT	60E1:00$_h$

Description:

Negative torque limit value

Service, Maintenance, and Disposal

Maintenance

Maintenance Plan

Inspect the product for pollution or damage at regular intervals.

Repairs may only be made by the manufacturer.

Prior to any type of work on the drive system, consult the sections on Installation and Commissioning for information on the precautions and processes to be observed.

Include the following points in the maintenance plan of your machine.

Connections and Fastening

- Inspect all connection cables and connectors regularly for damage. Replace damaged cables immediately.
- Verify that all output elements are firmly seated.
- Tighten all mechanical and electrical threaded connections to the specified torque.

Lifetime Safety-Related Function STO

The safety-related function STO is designed for a lifetime of 10 years. After this period, the data of the safety-related function STO are no longer valid. The expiry date is determined by adding 10 years to the DOM shown on the nameplate of the product.

This date must be included in the maintenance plan of the system.

Do not use the safety-related function STO after this date.

Example:

The DOM on the nameplate of the product is shown in the format DD.MM.YY, for example 31.12.24. (31 December 2024). This means: Do not use the safety-related function STO after December 31, 2034.

Replacing the Product

Description

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.

Follow the procedure below for replacing devices:

- Save all parameter settings. To do so, save the data to a PC using the commissioning software.
- Power off all supply voltages. Verify that no voltages are present (safety instructions).
- Label all connections and remove all connection cables (unlock connector locks).
- Uninstall the product.
- Note the identification number and the serial number shown on the product nameplate for later identification.
- Install the new product as per section Installation, page 107.
- If the product to be installed has previously been used in a different system or application, you must restore the factory settings before commissioning the product.
- Commission the product by using the commissioning software.

Replacement of the Motor

Description

Drive systems may perform unintended movements if unapproved combinations of drive and motor are used. Though the connectors for motor connection and encoder connection may 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.

- Power off all supply voltages. Verify that no voltages are present (safety instructions).
- Label all connections and uninstall the product.
- Note the identification number and the serial number shown on the product nameplate for later identification.
- Install the new product as per section Installation, page 107.

If the connected motor is replaced by another motor, the motor data set is read again. If the device detects a different motor type, the control loop parameters are recalculated and the HMI displays `nOt`.

Shipping, Storage, Disposal

Shipping

The product must be protected against shocks during transportation. If possible, use the original packaging for shipping.

Storage

The product may only be stored in spaces where the specified permissible ambient conditions are met.

Protect the product from dust and dirt.

Disposal

The product consists of various materials that can be recycled. Dispose of the product in accordance with local regulations.

Visit https://www.se.com/green-premium for information and documents on environmental protection as per ISO 14025 such as:

- EoLi (Product End-of-Life Instructions)
- PEP (Product Environmental Profile)

Glossary

A

Actual value:

In control engineering, the actual value is the value of the controlled variable at a given instant (for example, actual velocity, actual torque, actual position, actual current, and so on). An actual value can be a measured value (for example, the actual position can be a value measured by an encoder) or a derived value (for example, the actual torque can be a value derived from the actual current). The actual value is an input value used by the control loops of the drive to reach the reference value. Definition as per IEC 61800-7 series and IEC 60050.

C

CCW:

Counter **C**lock**w**ise.

CW:

Clock**w**ise.

D

DC bus:

Circuit that supplies the power stage with energy (direct voltage).

Degree of protection:

The degree of protection is a standardized specification for electrical equipment that describes the protection against the ingress of foreign objects and water (for example: IP 20).

Direction of movement:

In the case of a rotary motors, direction of movement is defined in accordance with IEC 61800-7-204: Positive direction is when the motor shaft rotates clockwise as you look at the end of the protruding motor shaft.

DOM:

Date **o**f **m**anufacturing: The nameplate of the product shows the date of manufacture in the format DD.MM.YY or in the format DD.MM.YYYY. For example:

31.12.23 corresponds to December 31, 2023.

31.12.2023 corresponds to December 31, 2023.

Drive system:

System consisting of controller, drive and motor.

E

EMC:

Electromagnetic compatibility

Encoder:

Sensor that converts a measured distance or angle into an electrical signal. This signal is evaluated by the drive to determine the actual position of a shaft (rotor) or a driving unit.

Error class:

Classification of errors into groups. The different error classes allow for specific responses to errors, for example by severity.

Error:

Discrepancy between a detected (computed, measured or signaled) value or condition and the specified or theoretically correct value or condition.

F

Factory settings:

Settings when the product is shipped.

Fault Reset:

Function used to exit the operating state Fault. Before the function is used, the cause of the detected error must be removed.

Fault:

Fault is an operating state. If the monitoring functions detect an error, a transition to this operating state is triggered, depending on the error class. A "Fault Reset" or a power cycle are required to exit this operating state. Prior to this, the cause of the detected error must be removed. Further information can be found in the pertinent standards such as IEC 61800-7, ODVA Common Industrial Protocol (CIP).

I

I2t monitoring:

Anticipatory temperature monitoring. The expected temperature rise of components is calculated in advance on the basis of the motor current. If a limit value is exceeded, the drive reduces the motor current.

Inc:

Increments.

Index pulse:

Signal of an encoder to reference the rotor position in the motor. The encoder returns one index pulse per revolution.

I/O:

Inputs/outputs.

Internal units:

Resolution of the power stage at which the motor can be positioned. Internal units are specified in increments.

L

Limit switch:

Switches that signal overtravel of the permissible range of travel.

M

Monitoring function:

Monitoring functions acquire a value continuously or cyclically (for example, by measuring) in order to check whether it is within permissible limits. Monitoring functions are used for error detection. Monitoring functions are not safety functions.

P

Parameter:

Device data and values that can be read and set (to a certain extent) by the user.

PELV:

Protective Extra Low Voltage, low voltage with isolation. For more information: IEC 60364-4-41

Persistent:

Indicates whether the value of the parameter remains in the memory after the device is switched off.

Power stage:

The power stage controls the motor. The power stage generates current for controlling the motor on the basis of the motion signals from the controller.

Q

Quick Stop:

The function can be used for fast deceleration of a movement as a response to a detected error or via a command.

R

RCD:

RCD residual current device.

rms:

“Root Mean Square” value of a voltage (V_{rms}) or a current (A_{rms}).

S

Safety-related function:

Safety-related functions are defined in the standard IEC 61800-5-2 (for example, Safe Torque Off (STO), Safe Operating Stop (SOS) or Safe Stop 1 (SS1)).

Scaling factor:

This factor is the ratio between an internal unit and a user-defined unit.

U

User-defined unit:

Unit whose reference to motor movement can be determined by the user via parameters.

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