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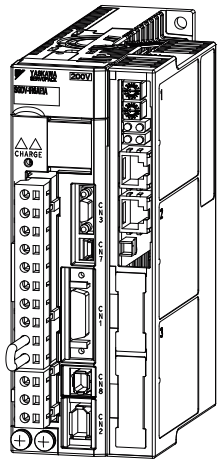
AC Servo Drives

Σ-V Series

USER'S MANUAL

EtherCAT (CoE) Network Module

Model: SGDV-OCA01A



Checking Products 1

Specifications 2

SERVOPACK Installation 3

Wiring and Connection 4

Operation 5

EtherCAT Communication 6

CiA402 Drive Profile 7

Object Dictionary 8

Troubleshooting 9

Appendix 10

MANUAL NO. SIEP C720829 04A

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About this Manual

This manual describes informations required for designing, and maintaining the EtherCAT (CoE) Network Module for Σ-V series SERVOPACKs.

Be sure to refer to this manual and perform design and maintenance to select devices correctly.

Keep this manual in a location where it can be accessed for reference whenever required.

■ Description of Technical Terms

The following table shows the meanings of terms used in this manual.

Term	Meaning
EtherCAT (CoE) Network Module	EtherCAT (CoE) Network Module for Σ-V series SERVOPACKs.
Cursor	A mark that indicates the input position of data displayed on the digital operator
Servomotor	Σ-V Series SGMJV, SGMAV, SGMPS, SGMGV, SGMSV, or SGMCS (Direct Drive) servomotor Linear Σ Series SGLGW, SGLFW, SGLTW, or SGLC servomotor
SERVOPACK	Σ-V Series SGDV SERVOPACK
Servo drive	A set including a servomotor and SERVOPACK (i.e., a servo amplifier)
Servo System	A servo control system that includes the combination of a servo drive with a host controller and peripheral devices
Servo ON	When power is being supplied to the servomotor
Servo OFF	When power is not being supplied to the servomotor
Base block	Turning OFF the power by shutting OFF the base current of the IGBT for the current amplifier

■ IMPORTANT Explanations

The following icon is displayed for explanations requiring special attention.



- Indicates important information that should be memorized, as well as precautions, such as alarm displays, that do not involve potential damage to equipment.

■ Notation Used in this Manual

- Reverse Symbol Notation

In this manual, the names of reverse signals (ones that are valid when low) are written with a forward slash (/) before the signal name, as shown in the following example:

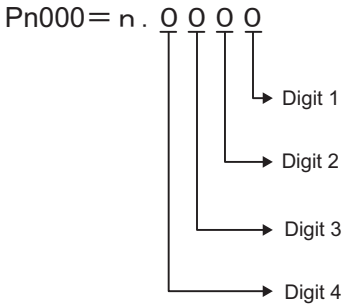
Example

The notation for $\overline{\text{BK}}$ is /BK.

- Parameter Notation

  The following two types of notations are used for parameter digit places and settings.

  Example



Notation Example for Pn000

Digit Notation		Set Value Notation	
Notation Method	Meaning	Notation Method	Meaning
Pn000.0	Indicates digit 1 of the parameter (Pn000).	Pn000.0 = x or n.□□□x	Indicates that digit 1 of the parameter (Pn000) is x.
Pn000.1	Indicates digit 2 of the parameter (Pn000).	Pn000.1 = x or n.□□x□	Indicates that digit 2 of the parameter (Pn000) is x.
Pn000.2	Indicates digit 3 of the parameter (Pn000).	Pn000.2 = x or n.□x□□	Indicates that digit 3 of the parameter (Pn000) is x.
Pn000.3	Indicates digit 4 of the parameter (Pn000).	Pn000.3 = x or n.x□□□	Indicates that digit 4 of the parameter (Pn000) is x.

■ Manuals Related to the Σ-V Series

Refer to the following manuals as required.

Name	Selecting Models and Peripheral Devices	Ratings and Specifications	Panels and Wiring	Trial Operation	Trial Operation and Servo Adjustment	Maintenance and Inspection
Σ-V Series User's Manual Design and Maintenance Rotational Motor Command Option Attachable Type (SIEP S800000 60)		✓		✓	✓	✓
Σ-V Series Option Module Safety Precautions (TOBP C720829 00)			✓			
Σ-V Series Command Option Module Installation Guide (TOBP C720829 01)			✓			
Σ-V Series User's Manual Setup Rotational Motor (SIEP S800000 43)			✓	✓		
Σ-V Series Product Catalog (KAEP S800000 42)	✓	✓				
Σ-V Series User's Manual Operation of Digital Operator (SIEP S800000 55)				✓	✓	✓
Σ-V Series AC SERVOPACK SGDV Safety Precautions (TOBP C710800 10)	✓		✓			✓
Σ Series Digital Operator Safety Precautions (TOBP C730800 00)						✓
AC SERVOMOTOR Safety Precautions (TOBP C230200 00)			✓			✓

■ Safety Information

The following conventions are used to indicate precautions in this manual. Failure to heed precautions provided in this manual can result in serious or possibly even fatal injury or damage to the products or to related equipment and systems.

⚠ WARNING	Indicates precautions that, if not heeded, could possibly result in loss of life or serious injury.
⚠ CAUTION	Indicates precautions that, if not heeded, could result in relatively serious or minor injury, damage to the product, or faulty operation. In some situations, the precautions indicated could have serious consequences if not heeded.
⃠ PROHIBITED	Indicates prohibited actions that must not be performed. For example, this symbol would be used to indicate that fire is prohibited as follows: 
MANDATORY	Indicates compulsory actions that must be performed. For example, this symbol would be used as follows to indicate that grounding is compulsory: 

Safety Precautions

These safety precautions are very important. Read them before performing any procedures such as checking products on delivery, storage and transportation, installation, wiring, operation and inspection, or disposal. Be sure to always observe these precautions thoroughly.

⚠ WARNING

- Never touch any rotating motor parts while the motor is running.
  Failure to observe this warning may result in injury.
- Before starting operation with a machine connected, make sure that an emergency stop can be applied at any time.
  Failure to observe this warning may result in injury or damage to the product.
- Never touch the inside of the SERVOPACKs.
  Failure to observe this warning may result in electric shock.
- Do not remove the cover of the power supply terminal block while the power is ON.
  Failure to observe this warning may result in electric shock.
- After the power is turned OFF or after a voltage resistance test, do not touch terminals while the charge indicator is ON.
  Residual voltage may cause electric shock.
- Follow the procedures and instructions provided in this manual for trial operation.
  Failure to do so may result not only in faulty operation and damage to equipment, but also in personal injury.
- The multi-turn serial data output range for the Σ-V Series absolute position detecting system is different from that of earlier systems with 15-bit and 12-bit encoders. In particular, change the system to configure the Σ Series infinite-length positioning system with the Σ-V Series.
- The multi-turn limit value need not be changed except for special applications.
  Changing it inappropriately or unintentionally can be dangerous.
- If the Multi-turn Limit Disagreement alarm occurs, check the setting of parameter Pn205 in the SERVOPACK to be sure that it is correct.
  If Fn013 is executed when an incorrect parameter value is set, an incorrect value will be set in the encoder. The alarm will disappear even if an incorrect value is set, but incorrect positions will be detected, resulting in a dangerous situation where the machine will move to unexpected positions.
- Do not remove the front cover, cables, connectors, or optional items from the upper front of the SERVOPACK while the power is ON.
  Failure to observe this warning may result in electric shock.
- Do not damage, press, exert excessive force on, or place heavy objects on the cables.
  Failure to observe this warning may result in electric shock, stopping operation of the product, or fire.
- Provide an appropriate stopping device on the machine side to ensure safety.
  The holding brake on a servomotor with a brake is not a braking device for ensuring safety.
  Failure to observe this warning may result in injury.



- Connect the ground terminal according to local electrical codes (100 Ω or less for a SERVOPACK with a 100 V, 200 V power supply, 10 Ω or less for a SERVOPACK with a 400 V power supply).
  Improper grounding may result in electric shock or fire.



- Installation, disassembly, or repair must be performed only by authorized personnel.
  Failure to observe this warning may result in electric shock or injury.
- The person who designs a system using the safety function (Hard Wire Baseblock function) must have full knowledge of the related safety standards and full understanding of the instructions in this manual.
  Failure to observe this warning may result in injury.

■ Storage and Transportation

⚠ CAUTION

- Do not store or install the product in the following locations.
  Failure to observe this caution may result in fire, electric shock, or damage to the product.
  - Locations subject to direct sunlight
  - Locations subject to ambient operating temperatures outside the range specified in the storage/installation temperature conditions
  - Locations subject to humidity outside the range specified in the storage/installation humidity conditions
  - Locations subject to condensation as the result of extreme changes in temperature
  - Locations subject to corrosive or flammable gases
  - Locations subject to dust, salts, or iron dust
  - Locations subject to exposure to water, oil, or chemicals
  - Locations subject to shock or vibration
- Do not hold the product by the cables, motor shaft or detector while transporting it.
  Failure to observe this caution may result in injury or malfunction.
- Do not place any load exceeding the limit specified on the packing box.
  Failure to observe this caution may result in injury or malfunction.
- If disinfectants or insecticides must be used to treat packing materials such as wooden frames, pallets, or plywood, the packing materials must be treated before the product is packaged, and methods other than fumigation must be used.
  Example: Heat treatment, where materials are kiln-dried to a core temperature of 56°C for 30 minutes or more.
  If the electronic products, which include stand-alone products and products installed in machines, are packed with fumigated wooden materials, the electrical components may be greatly damaged by the gases or fumes resulting from the fumigation process. In particular, disinfectants containing halogen, which includes chlorine, fluorine, bromine, or iodine can contribute to the erosion of the capacitors.

■ Installation

⚠ CAUTION

- Never use the product in an environment subject to water, corrosive gases, inflammable gases, or combustibles.
  Failure to observe this caution may result in electric shock or fire.
- Do not step on or place a heavy object on the product.
  Failure to observe this caution may result in injury.
- Do not cover the inlet or outlet ports and prevent any foreign objects from entering the product.
  Failure to observe this caution may cause internal elements to deteriorate resulting in malfunction or fire.
- Be sure to install the product in the correct direction.
  Failure to observe this caution may result in malfunction.
- Provide the specified clearances between the SERVOPACK and the control panel or with other devices.
  Failure to observe this caution may result in fire or malfunction.
- Do not apply any strong impact.
  Failure to observe this caution may result in malfunction.

■ Wiring

⚠ CAUTION

- Be sure to wire correctly and securely.
  Failure to observe this caution may result in motor overrun, injury, or malfunction.
- Do not connect a commercial power supply to the U, V, or W terminals for the servomotor connection.
  Failure to observe this caution may result in injury or fire.
- Securely connect the main circuit power supply terminal screws, control power supply terminal screws, and servomotor connection terminal screws.
  Failure to observe this caution may result in fire.
- Do not bundle or run the main circuit cables together with the input/output signal cables or the encoder cables in the same duct. Keep them separated by at least 30 cm.
  Failure to do so may result in malfunction.
- Use shielded twisted-pair wires or multi-core shielded twisted-pair wires for input/output signal cables and the encoder cables.
- I/O signal cables must be no longer than 3 m, encoder cables must be no longer than 50 m, and control power supply cables for the SERVOPACK with a 400 V power supply (+24 V, 0 V) must be no longer than 10 m.
- Do not touch the power terminals while the charge indicator is ON after turning power OFF because high voltage may still remain in the SERVOPACK.
  Make sure the charge indicator is off first before starting an inspection.
- Observe the following precautions when wiring main circuit terminal blocks of the SERVOPACK.
  - Remove the detachable main circuit terminal blocks from the SERVOPACK prior to wiring.
  - Insert only one main power line per opening in the main circuit terminals.
  - Make sure that no part of the core wire comes into contact with (i.e., short-circuit) adjacent wires.
- Install a battery at either the host controller or the SERVOPACK, but not both.
  It is dangerous to install batteries at both ends simultaneously, because that sets up a loop circuit between the batteries.
- Always use the specified power supply voltage.
  An incorrect voltage may result in fire or malfunction.
- Take appropriate measures to ensure that the input power supply is supplied within the specified voltage fluctuation range. Be particularly careful in places where the power supply is unstable.
  An incorrect power supply may result in damage to the product.
- Install external breakers or other safety devices against short-circuiting in external wiring.
  Failure to observe this caution may result in fire.
- Take appropriate and sufficient countermeasures for each form of potential interference when installing systems in the following locations.
  - Locations subject to static electricity or other forms of noise
  - Locations subject to strong electromagnetic fields and magnetic fields
  - Locations subject to possible exposure to radioactivity
  - Locations close to power supplies

  Failure to observe this caution may result in damage to the product.
- Do not reverse the polarity of the battery when connecting it.
  Failure to observe this caution may damage the battery, the SERVOPACK, the servomotor, or cause an explosion.
  Wiring or inspection must be performed by a technical expert.
- Use a 24-VDC power supply with double insulation or reinforced insulation.

■ Operation

⚠ CAUTION

- Always use the servomotor and SERVOPACK in one of the specified combinations.
  Failure to observe this caution so may result in fire or malfunction.
- Conduct trial operation on the servomotor alone with the motor shaft disconnected from the machine to avoid accidents.
  Failure to observe this caution may result in injury.
- During trial operation, confirm that the holding brake works correctly. Furthermore, secure system safety against problems such as signal line disconnection.
- Before starting operation with a machine connected, change the settings to match the parameters of the machine.
  Starting operation without matching the proper settings may cause the machine to run out of control or malfunction.
- Do not frequently turn power ON and OFF.
  Since the SERVOPACK has a capacitor in the power supply, a high charging current flows when power is turned ON. Frequently turning power ON and OFF causes main power devices like capacitors and fuses to deteriorate, resulting in unexpected problems.
- When using JOG operations (Fn002), search operations (Fn003), or EasyFFT operations (Fn206), the dynamic brake function does not work for reverse overtravel or forward overtravel. Take necessary precautions.
- When using the servomotor for a vertical axis, install safety devices to prevent workpieces from falling due to alarms or overtravels. Set the servomotor so that it will stop in the zero clamp state when overtravel occurs.
  Failure to observe this caution may cause workpieces to fall due to overtravel.
- When not using turning-less function, set to the correct moment of inertia ratio (Pn103).
  Setting to an incorrect moment of inertia ratio may cause machine vibration.
- Do not touch the SERVOPACK heatsinks, regenerative resistor, or servomotor while power is ON or soon after the power is turned OFF.
  Failure to observe this caution may result in burns due to high temperatures.
- Do not make any extreme adjustments or setting changes of parameters.
  Failure to observe this caution may result in injury or damage to the product due to unstable operation.
- When an alarm occurs, remove the cause, reset the alarm after confirming safety, and then resume operation.
  Failure to observe this caution may result in damage to the product, fire, or injury.
- Do not use the brake of the servomotor for braking.
  Failure to observe this caution may result in malfunction.
- An alarm or warning may be generated if communications are executed with the host controller during operation using SigmaWin+ or the digital operator.
  If an alarm or warning is generated, the process currently being executed may be aborted and the system may stop.

■ Maintenance and Inspection

⚠ CAUTION

- Do not disassemble the SERVOPACK.
  Failure to observe this caution may result in electric shock or injury.
- Do not change wiring while the power is ON.
  Failure to observe this caution may result in electric shock or injury.
- When replacing the SERVOPACK, resume operation only after copying the previous SERVOPACK parameters to the new SERVOPACK.
  Failure to observe this caution may result in damage to the product.

■ Disposal

⚠ CAUTION
• When disposing of the products, treat them as ordinary industrial waste.

■ General Precautions

Observe the following general precautions to ensure safe application.
• The products shown in illustrations in this manual are sometimes shown without covers or protective guards. Always replace the cover or protective guard as specified first, and then operate the products in accordance with the manual. • The drawings presented in this manual are typical examples and may not match the product you received. • If the manual must be ordered due to loss or damage, inform your nearest Yaskawa representative or one of the offices listed on the back of this manual.

Warranty

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(1) Details of Warranty

■ Period of Warranty

The period of warranty for a product that was purchased (hereafter “delivered product”) is one year from the time of delivery to the location specified by the customer or 18 months from the time of shipment from the Yaskawa factory, whichever is sooner.

■ Scope of Warranty

Yaskawa shall replace or repair a defective product free of change if a defect attributable to Yaskawa occurs during the period of warranty above. Defects due to the delivered product reaching the end of its service life and replacement of parts that require replacement or that have a limited service life are also outside the scope of this warranty.

Failures that occur for any of the following causes are outside the scope of the warranty.

1. Using or handling the product under conditions or in environments not described in product catalogs or manuals, or separately agreed-upon specifications
2. Causes not attributable to the delivered product itself
3. Modifications or repairs not performed by Yaskawa
4. Using the delivered product in a manner in which it was not originally intended
5. Causes that were not foreseeable with the scientific and technological understanding at the time of shipment from Yaskawa
6. Events for which Yaskawa is not responsible, such as natural or human-made disasters

(2) Limitations of Liability

1. Yaskawa shall in no event be responsible for any damage or loss of opportunity to the customer that arises due to failure of the delivered product.
2. Yaskawa shall not be responsible for programming (including parameter settings) or the results of program execution if a programmable Yaskawa product was programmed by the user or by a third party.

(3) Suitability for Use

1. It is the customer’s responsibility to confirm conformity with any standards, codes, or regulations that apply if the Yaskawa product is used in combination with any other products.
2. The customer must confirm that the Yaskawa product is suitable for the systems, machines, and equipment used by the customer.
3. Consult with Yaskawa to determine whether use in the following applications is acceptable. If use in the application is acceptable, use the product with extra allowance in ratings and specifications, and provide safety measures to minimize hazards in the event of failure.
   - Outdoor use, use involving potential chemical contamination or electrical interference, or use in conditions or environments not described in product catalogs or manuals
   - Nuclear energy control systems, combustion systems, railroad systems, aviation systems, vehicle systems, medical equipment, amusement machines, and installations subject to separate industry or government regulations
   - Systems, machines, and equipment that may present a risk to life or property
   - Systems that require a high degree of reliability, such as systems that supply gas, water, or electricity, or systems that operate continuously 24 hours a day
   - Other systems that require a similar high degree of safety
4. Never use the product for an application involving serious risk to life or property without first ensuring that the required safety has been designed into the system with risk warnings and redundancy, and that the Yaskawa product is properly rated and installed.
5. The circuit examples and other application examples described in product catalogs and manuals are for reference. Check the functionality and safety of the actual devices and equipment to be used before using the product.
6. Read and understand all use prohibitions and precautions, and operate the Yaskawa product correctly to prevent accidental harm to third parties.

(4) Changes to Specifications

The names, specifications, appearance, and accessories of products in product catalogs and manuals may be changed at any time based on improvements and other reasons. When a catalog or a manual is revised, the catalog or manual code is updated and the new catalog or manual is published as a next edition. Consult with your Yaskawa representative to confirm the actual specifications before purchasing a product.

Applicable Standards

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■ North American Safety Standards (UL)

	Model	UL* Standards (UL File No.)
SERVOPACK	• SGDV	UL508C (E147823)
Servomotor	• SGMJV • SGMAV • SGMPS • SGMGV • SGMSV	UL1004 (E165827)

* Underwriters Laboratories Inc.

Note: Applicable when the EtherCAT (CoE) Network Module is attached to the SERVOPACKs for the command option attachable type.

■ European Standards

	Model	Low Voltage Directive	EMC Directive		Safety Standards
			EMI	EMS	
SERVOPACK	• SGDV	EN50178 EN61800-5-1	EN55011/A2 group 1 class A EN61800-3	EN61800-3 EN61000-6-2	EN954-1 IEC61508-1 to 4
Servomotor	• SGMJV • SGMAV • SGMPS • SGMGV • SGMSV	IEC60034-1 IEC60034-5 IEC60034-8 IEC60034-9	EN55011/A2 group 1 class A EN61800-3	EN61800-3 EN61000-6-2	–

Note 1. Because SERVOPACKs and servomotors are built into machines, certification is required after installation in the final product.

2. Applicable when the EtherCAT (CoE) Network Module is attached to SERVOPACKs for the command option attachable type.

CONTENTS

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About this Manual . . . iii
Safety Precautions . . . vi
Warranty . . . xi
Applicable Standards . . . xii

Chapter 1 Checking Products . . . 1-1
1.1 Checking Products on Delivery . . . 1-2
1.2 Nameplate and Model Designation . . . 1-2
1.3 Nameplate Location . . . 1-3

Chapter 2 Specifications . . . 2-1
2.1 Overview . . . 2-2
2.2 CoE Technical Terms . . . 2-3
2.2.1 CoE Technical Terms . . . 2-3
2.2.2 Data Type . . . 2-4
2.2.3 Data Units . . . 2-4
2.3 Specifications of the EtherCAT (CoE) Network Module . . . 2-5
2.3.1 General Specifications . . . 2-5
2.3.2 Communication Specifications . . . 2-6
2.4 Part Names of the EtherCAT (CoE) Network Module . . . 2-7
2.5 LED Indicators . . . 2-8

Chapter 3 SERVOPACK Installation . . . 3-1
3.1 SERVOPACK Installation Environment and Applicable Standards . . . 3-2
3.1.1 Installation Environment . . . 3-2
3.1.2 Installation Conditions for Applicable Standards . . . 3-2
3.2 SERVOPACK Installation . . . 3-3
3.2.1 Orientation . . . 3-3
3.2.2 Installation Standards . . . 3-4
3.3 EMC Installation Conditions . . . 3-5

Chapter 4 Wiring and Connection . . . 4-1
4.1 System Configuration Diagram . . . 4-2
4.2 I/O Signal Connections . . . 4-3
4.2.1 I/O Signal (CN1) Names and Functions . . . 4-3
4.2.2 I/O Signal Connector (CN1) Terminal Layout . . . 4-4
4.2.3 Example of I/O Signal Connections . . . 4-5
4.3 I/O Signal Allocations . . . 4-6
4.3.1 Input Signal Allocations . . . 4-6
4.3.2 Output Signal Allocations . . . 4-8
4.4 Connection Example of EtherCAT Communication . . . 4-9
4.4.1 Connection Example . . . 4-9
4.4.2 EtherCAT Connector (RJ45) . . . 4-9
4.4.3 Ethernet Cable . . . 4-10
4.4.4 EtherCAT Secondary Address Settings . . . 4-10

Chapter 5 Operation 5-1
5.1 Settings for Common Basic Functions 5-2
5.2 Trial Operation 5-3
5.2.1 Inspection before Trial Operation 5-3
5.2.2 Trial Operation via EtherCAT (CoE) Communication 5-3
5.3 Test Without Motor Function 5-4
5.4 Limiting Torque 5-4
5.5 Absolute Encoders 5-5
5.6 Safety Function 5-6
5.7 Overtravel 5-7

Chapter 6 EtherCAT Communication 6-1
6.1 CANopen over EtherCAT Device Architecture 6-2
6.2 EtherCAT Slave Information 6-3
6.3 EtherCAT State Machine 6-4
6.4 PDO Mapping 6-5
6.5 Synchronization with Distributed Clocks 6-7
6.6 Emergency Messages 6-9

Chapter 7 CiA402 Drive Profile 7-1
7.1 Device Control 7-2
7.2 Modes of Operation 7-4
7.3 Position Control Modes 7-5
7.3.1 Profile Position Mode 7-5
7.3.2 Interpolated Position Mode 7-7
7.3.3 Cyclic Synchronous Position Mode 7-8
7.4 Homing 7-9
7.5 Velocity Control Modes 7-12
7.5.1 Profile Velocity Mode 7-12
7.5.2 Cyclic Synchronous Velocity Mode 7-13
7.6 Torque Control Modes 7-14
7.6.1 Profile Torque Mode 7-14
7.6.2 Cyclic Sync Torque Mode 7-15
7.7 Torque Limit Function 7-16
7.8 Digital Inputs and Outputs 7-16
7.9 Touch Probe Function 7-17
7.10 Fully-closed Control 7-19

Chapter 8 Object Dictionary 8-1
8.1 Object Dictionary List 8-2
8.2 General Objects 8-4
8.3 PDO Mapping Objects 8-8
8.4 Sync Manager Communication Objects 8-12
8.5 Manufacturer Specific Objects 8-15
8.6 Device Control 8-21
8.7 Profile Position Mode 8-30
8.8 Homing Mode 8-32
8.9 Position Control Function 8-34
8.10 Interpolated Position Mode 8-36
8.11 Cyclic Synchronous Position Mode 8-37
8.12 Profile Velocity/Cyclic Synchronous Velocity Mode 8-38
8.13 Profile Torque/Cyclic Synchronous Torque Mode 8-39
8.14 Torque Limit Function 8-40
8.15 Touch Probe Function 8-41
8.16 Digital Inputs/Outputs 8-43

Chapter 9 Troubleshooting 9-1
9.1 Troubleshooting 9-2
9.1.1 Alarm List for SERVOPACKs with Command Option Attachable Type 9-2
9.1.2 List of the EtherCAT (CoE) Network Module Alarms 9-6
9.1.3 Troubleshooting of the EtherCAT (CoE) Network Module Alarms 9-6
9.2 Warning Displays 9-10
9.3 Troubleshooting Malfunction Based on Operation and Conditions of the Servomotor 9-11

Chapter 10 Appendix 10-1
10.1 Object List 10-2
10.2 SERVOPACK Parameters 10-9
10.3 SDO Abort Code List 10-30

Index Index-1

Revision History

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1

Checking Products

This chapter describes how to check products upon delivery.

1.1 Checking Products on Delivery 1-2
1.2 Nameplate and Model Designation 1-2
1.3 Nameplate Location 1-3

1.1 Checking Products on Delivery

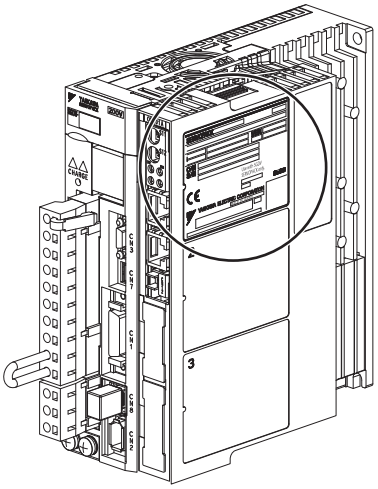
(1) When the EtherCAT (CoE) Network Module is Not Connected to the SERVOPACK

1. Mount the EtherCAT (CoE) Network Module to the SERVOPACK as described in the enclosed *Σ-V Series Command Option Module Installation Guide* (TOBP C720829 01).
   For the location of the nameplate, refer to *1.3 Nameplate Location*.
2. Check the nameplate to confirm that the product is the one that was ordered.
   For the nameplate, refer to *1.2 Nameplate and Model Designation*.

(2) When the EtherCAT (CoE) Network Module is Connected to the SERVOPACK

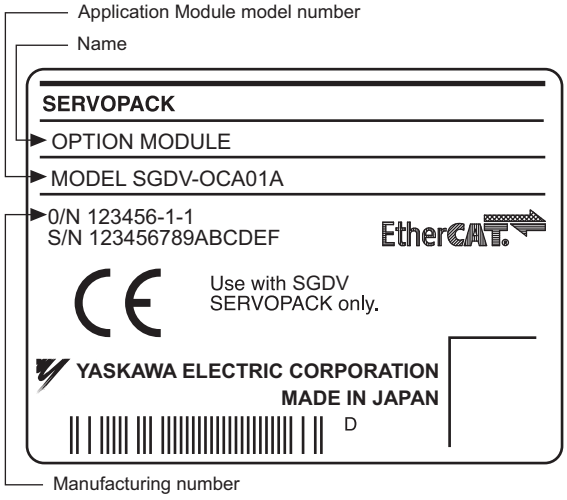
Check the nameplate to confirm that the Module that is mounted is the EtherCAT (CoE) Network Module.

The nameplate is located in the following position.



1.2 Nameplate and Model Designation

■ Nameplate Example



Nameplate

■ Model Designation

SGDV – OC A01 A

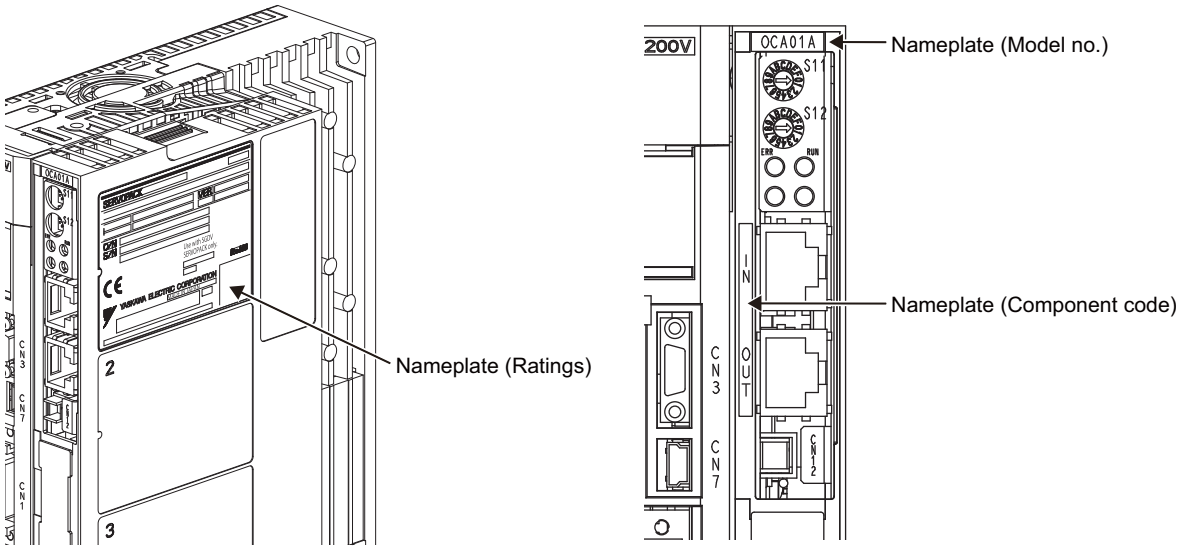
Series	
SGDV	Σ-V Series

1st + 2nd digits: Module Type	
Code	Module
OC	Command option module

3rd + 4th + 5th digits: Interface Specifications	
Code	Interface
A01	EtherCAT (CoE)

6th digit: Design Revision Order

1.3 Nameplate Location



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2

Specifications

This chapter gives an overview and describes the specifications of the EtherCAT (CoE) Network Module.

2.1 Overview 2-2

2.2 CoE Technical Terms 2-3

2.2.1 CoE Technical Terms 2-3

2.2.2 Data Type 2-4

2.2.3 Data Units 2-4

2.3 Specifications of the EtherCAT (CoE) Network Module 2-5

2.3.1 General Specifications 2-5

2.3.2 Communication Specifications 2-6

2.4 Part Names of the EtherCAT (CoE) Network Module 2-7

2.5 LED Indicators 2-8

2.1 Overview

The Σ-V series EtherCAT (CoE) Network Module implements the CANopen drive profile (CiA402) in EtherCAT communication (real-time Ethernet communication).
In addition to basic position, velocity, and torque control, synchronous position, velocity, and torque control can be performed. You can select the appropriate form of control for your system, from simple positioning to high-speed, high-precision locus control.

Moreover, the Σ-V high servo control performance, advanced tuning function, and wide range of actuator controls can be performed via EtherCAT.

2.2 CoE Technical Terms

2.2.1 CoE Technical Terms

This table lists the terms used in this manual for the EtherCAT and the CANopen.

Abbreviation	Description
APRD	Auto Increment Physical Read: a command of EtherCAT Data link layer
APWR	Auto Increment Physical Write: a command of EtherCAT Data link layer
APRW	Auto Increment Physical ReadWrite: a command of EtherCAT Data link layer
ARMW	Auto Increment Physical Read Multiple Write: a command of EtherCAT Data link layer
BRD	Broadcast Read: a command of EtherCAT Data link layer
BWR	Broadcast Write: a command of EtherCAT Data link layer
BRW	Broadcast ReadWrite: a command of EtherCAT Data link layer
CiA	CAN in Automation
CoE	CANopen over EtherCAT
DC	Distributed Clocks Mechanism to synchronize EtherCAT slaves and master
ECAT	EtherCAT
EEPROM	Electrically Erasable Programmable Read Only Memory
ESC	EtherCAT Slave Controller
ESM	EtherCAT State Machine
ETG	EtherCAT Technology Group (http://www.ethercat.org)
EtherCAT	Real-time Standard for Industrial Ethernet Control Automation Technology (Ethernet for Control Automation Technology)
FMMU	Fieldbus Memory Management Unit
FPRD	Configured Address Physical Read: a command of EtherCAT Data link layer
FPWR	Configured Address Physical Write: a command of EtherCAT Data link layer
FPRW	Configured Address Physical ReadWrite: a command of EtherCAT Data link layer
FRMW	Configured Address Physical Read Multiple Write: a command of EtherCAT Data link layer
INIT	INIT state of EtherCAT state machine
LRD	Logical Read: a command of EtherCAT Data link layer
LWR	Logical Write: a command of EtherCAT Data link layer
LRW	Logical ReadWrite: a command of EtherCAT Data link layer
OP	Operational state of EtherCAT state machine
OD	Object Dictionary
PDO	Process Data Object
PREOP	Pre-Operational state of EtherCAT state machine
Process data	Collection of application objects designated to be transferred cyclically for the purpose of measurement and control
RJ45	FCC Registered Jack, standard Ethernet connector
RXPDO	Receive PDO, i.e. Process Data that will be received by ESC
SAFEOP	Safe-Operational state of EtherCAT state machine
SDO	Service Data Object
SyncManager	ESC unit for coordinated data exchange between master and slave controller
TXPDO	Transmit PDO, i.e. Process Data that will be transmitted by ESC

2.2.2 Data Type

This table lists the data types and ranges used in this manual.

Code	Data Type	Range
SINT	Signed 8 bit	–128 to +127
INT	Signed 16 bit	–32768 to +32767
DINT	Signed 32 bit	–2147483648 to +2147483627
USINT	Unsigned 8 bit	0 to 255
UINT	Unsigned 16 bit	0 to 65535
UDINT	Unsigned 32 bit	0 to 4294967295
STRING	String value	–

2.2.3 Data Units

This table describes the data units used in this manual.

Units	Description
Pos. unit	This is the user-defined position reference unit set by object 2701h. 1 [Pos. unit] = 2701:01h/2701:02h [inc]
Vel. unit	This is the user-defined velocity reference unit set by object 2702h. 1 [Vel. unit] = 2702:01h/2702:02h [inc/sec]
Acc. unit	This is the user-defined acceleration reference unit set by object 2703h. 1 [Acc. unit] = 2703:01h/2703:02h $\times 10^4$ [inc/sec^2]
inc	This is the encoder pulse unit. For a 20-bit encoder, the resolution will be 1048576 [inc] per revolution.

2.3 Specifications of the EtherCAT (CoE) Network Module

2.3.1 General Specifications

This table lists the general specifications of the EtherCAT (CoE) Network Module.

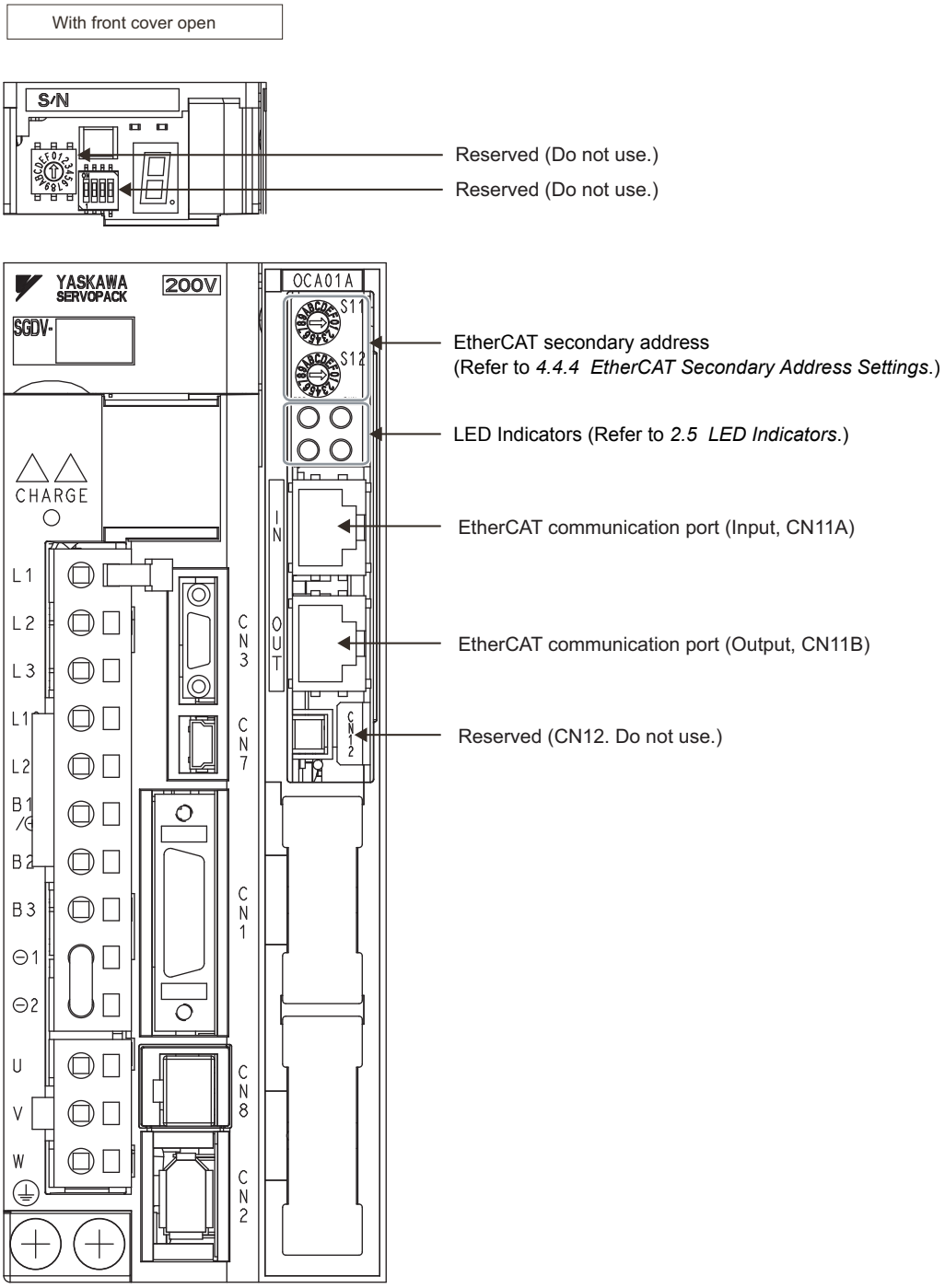
Applicable SERVOPACK			Σ-V Series SGDV-□□□□E1□ SERVOPACK (For rotational servomotor) Σ-V Series SGDV-□□□□E5□ SERVOPACK (For linear servomotor)	
Placement			Attached to the SERVOPACK	
Power Specification	Power Supply Method		Supplied from the control power supply of the SGDV SERVOPACK.	
Operating Conditions	Surrounding Air/Storage Temperature		0°C to +55°C/ -20°C to +85°C	
	Ambient/Storage Humidity		90% RH or less (with no condensation)	
	Vibration/Shock Resistance		4.9 m/s^2 / 19.6 m/s^2	
	Protection Class/ Pollution Degree		Protection class: IP10, Pollution degree: 2 An environment that satisfies the following conditions. • Free of corrosive or explosive gases • Free of exposure to water, oil or chemicals • Free of dust, salts or iron dust	
	Altitude		1000 m or less	
	Others		Free of static electricity, strong electromagnetic fields, magnetic fields or exposure to radioactivity	
I/O Signals	Sequence Input	Input Signals which can be allocated	Number of Channels	7 channels
			Functions	The signal allocation and positive/negative logic can be modified. Forward run prohibited (P-OT), reverse run prohibited (N-OT), probe 1 latch signal (SI4), probe 2 latch signal (SI5), home switch input signal (SI6), general-purpose input signal (/SI0, SI3)
	Sequence Output	Fixed Output	Servo alarm (ALM)	
		Output Signals which can be allocated	Number of Channels	3 channels
			Functions	The signal allocation and positive/negative logic can be modified. Positioning completion (/COIN), speed coincidence detection (/V-CMP), servomotor rotation detection (/TGON), servo ready (/S-RDY), torque limit detection (/CLT), speed limit detection (/VLT), brake (/BK), warning (/WARN), near (/NEAR)

2.3.2 Communication Specifications

EtherCAT Communication	Applicable Communication Standards	IEC 61158 Type12, IEC 61800-7 CiA402 Drive Profile
	Physical Layer	100BASE-TX (IEEE802.3)
	Fieldbus Connection	CN11A (RJ45): EtherCAT Signal IN CN11B (RJ45): EtherCAT Signal OUT
	Cable	CAT5 STP 4 pair Note: Cables are automatically recognized by the AUTO MDIX function.
	SyncManager	SM0: Mailbox output, SM1: Mailbox input SM2: Process data outputs, SM3: Process data inputs
	FMMU	FMMU0: Mapped to the process data output (RxPDO) area. FMMU1: Mapped to the process data input (TxPDO) area. FMMU2: Mapped to the mailbox status
	EtherCAT Commands (Data Link Layer)	APRD, FPRD, BRD, LRD, APWR, FPWR, BWR, LWR, ARMW, FRMW Note: APRW, FPRW, BRW, LRW Commands are not supported.
	Process Data	Variable PDO mapping
	Mailbox (CoE)	Emergency Message, SDO Request, SDO Response, SDO information Note: TxPDO/RxPDO and Remote TxPDO/RxPDO are not supported.
	Distributed Clocks	Free-run, DC mode (Can be selected.) Supported DC cycle: 125 µs to 4 ms (every 125-µs cycle)
	Slave Information IF	256 bytes (For reading only)
	LED Indicator	EtherCAT Link/Activity indicator (L/A) × 2 EtherCAT RUN indicator (RUN) × 1 EtherCAT ERR indicator (ERR) × 1
CiA402 Drive Profile		• Homing mode • Profile position mode • Interpolated position mode • Profile velocity mode • Profile torque mode • Cyclic synchronous position mode • Cyclic synchronous velocity mode • Cyclic synchronous torque mode • Touch probe function • Torque limit function

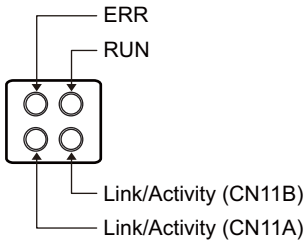
2.4 Part Names of the EtherCAT (CoE) Network Module

The following figure shows the part names of the EtherCAT (CoE) Network Module.



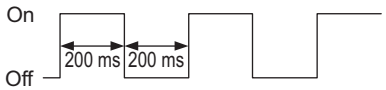
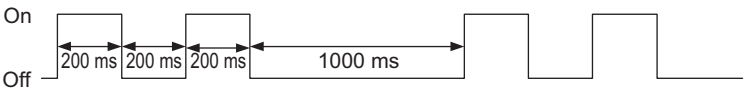
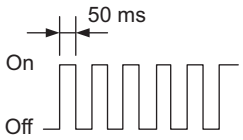
2.5 LED Indicators

This diagram shows details of the LED indicators.



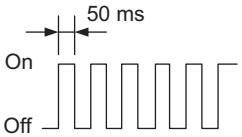
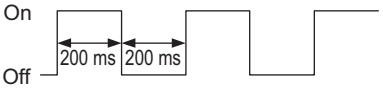
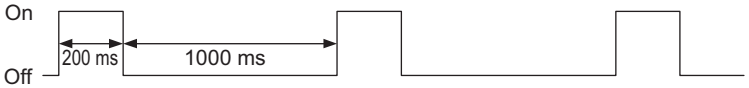
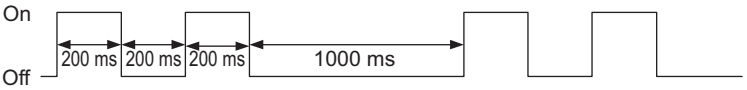
■ RUN

The RUN indicator shows the status of EtherCAT communication.

LED Indicator		Description
Display	Pattern	
Off	Continuously OFF	The EtherCAT (CoE) Network Module is in Init state.
Blinking		The EtherCAT (CoE) Network Module is in Pre-Operational state.
Double flash		The EtherCAT (CoE) Network Module is in Safe-Operational state.
On	Continuously ON	The EtherCAT (CoE) Network Module is in Operational state.
Flickering		The EtherCAT (CoE) Network Module is booting and has not yet entered the Init state.

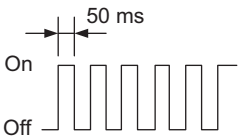
■ ERR

The ERR indicator shows the error status of EtherCAT communication.

LED Indicator		Description
Display	Pattern	
Off	Continuously OFF	The EtherCAT communication is in working condition.
Flickering		Booting Error was detected.
Blinking		State change commanded by master is impossible due to register or object settings.
Single flash		Synchronization Error, the EtherCAT (CoE) Network Module enters Safe-Operational state automatically.
Double flash		An application (Sync Manager) watchdog timeout has occurred.
On	Continuously ON	A PDI Watchdog timeout has occurred.

■ Link/Activity

The Link/Activity indicators show the status of the physical link and show activity on this link.

LED Indicator		Description
Display	Pattern	
Off	Continuously OFF	A communication cable is not physically connected. A EtherCAT controller is not started up.
Flickering		Data are being exchanged.
On	Continuously ON	A communication cable is physically connected, but no data being exchanged.

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3

SERVOPACK Installation

This chapter describes how to install the SERVOPACK.

3.1 SERVOPACK Installation Environment and Applicable Standards 3-2
3.1.1 Installation Environment 3-2
3.1.2 Installation Conditions for Applicable Standards 3-2
3.2 SERVOPACK Installation 3-3
3.2.1 Orientation 3-3
3.2.2 Installation Standards 3-4
3.3 EMC Installation Conditions 3-5

3.1 SERVOPACK Installation Environment and Applicable Standards

SERVOPACK installation environment and applicable standards are as follows.

3.1.1 Installation Environment

- Surrounding air temperature: 0 to 55°C
- Ambient humidity: 90% RH or less (with no condensation)
- Altitude: 1,000 m or less
- Vibration resistance: 4.9 m/s^2
- Shock resistance: 19.6 m/s^2
- Installation Precautions

  • Mounting in a Control Panel

  To prevent the temperature around the SERVOPACK from exceeding 55°C, take into account the size of the control panel, the layout of the SERVOPACK, and the cooling method. For details, refer to *3.2 SERVOPACK Installation*.

  • Mounting Near a Heating Unit

  To prevent the temperature around the SERVOPACK from exceeding 55°C, suppress radiant heat from the heating unit and temperature rise due to convection.

  • Mounting Near a Vibration Source

  To prevent vibration from being transmitted to the SERVOPACK, install a vibration isolator underneath the SERVOPACK.

  • Mounting to a Location Exposed to Corrosive Gas

  Take measures to prevent exposure to corrosive gas. Corrosive gases will not immediately affect the SERVOPACK, but will eventually cause electronic components and contactor-related devices to malfunction.

  • Other Locations

  Do not mount the SERVOPACK in locations subject to high temperatures, high humidity, dripping water, cutting oil, dust, iron filings, or radiation.

  <Note>

  When storing the SERVOPACK with the power OFF, store it in an environment with the following temperature and humidity:

  • -20 to +85°C, 90% RH or less (with no condensation)

3.1.2 Installation Conditions for Applicable Standards

Applicable Standards	UL508C EN50178, EN55011/A2 group1 classA, EN61000-6-2, EN61800-3, EN61800-5-1, EN954-1, IEC61508-1 to 4
Operating Conditions	Overvoltage category: III Pollution degree: 2 Protection class: IP10
Installation Conditions	UL Standard and Low Voltage Directive: Satisfy the conditions outlined in *Σ-V Series AC SERVOPACK SGDV Safety Precautions* (TOBP C710800 10) EMC Directive: Certification is required after installation in the user's machine under the conditions outlined in *3.3 EMC Installation Conditions*.

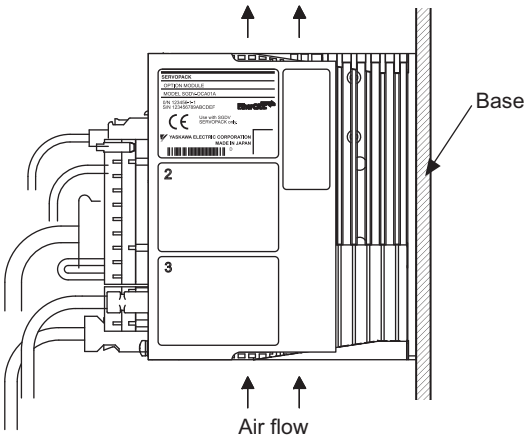
3.2 SERVOPACK Installation

3.2.1 Orientation

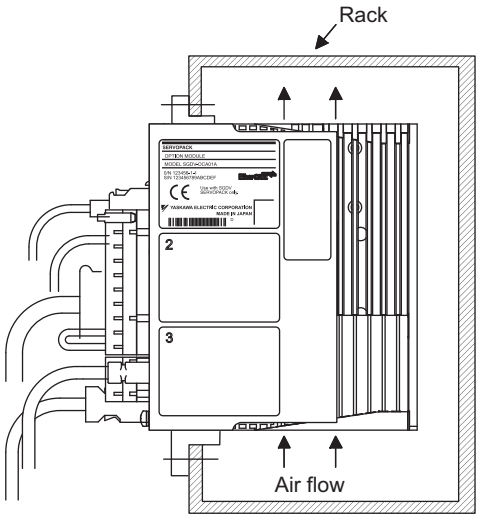
The SERVOPACK is available in models that are base-mounted, models that are rack-mounted, and models that are duct-ventilated. In any case, mount the SERVOPACK with a vertical orientation.

Firmly secure the SERVOPACK to the mounting surface, using either two or four mounting holes depending on the SERVOPACK capacity.

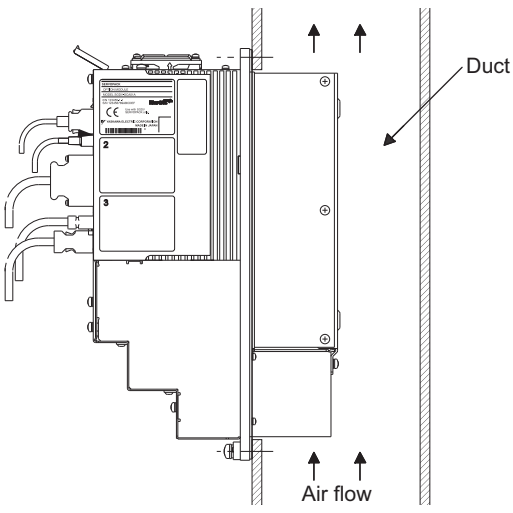
• Base-mounted



• Rack-mounted



• Duct-ventilated



3.2.2 Installation Standards

Observe the standards for mounting SERVOPACKs in control panels, including those for the mounting SERVOPACKs side by side in one control panel as shown in the following illustration.

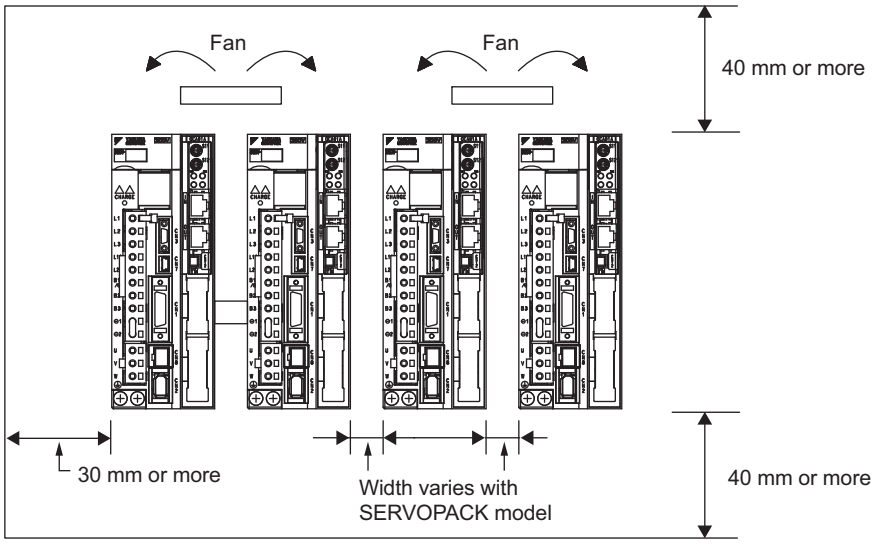
- SERVOPACK Mounting Orientation

  Mount the SERVOPACK vertically to the wall, with the front panel (the side with the panel operator display) facing out.

- Cooling

  Refer to the following diagram and leave sufficient space for cooling by fans and natural convection.

- Mounting SERVOPACKs Side by Side in a Control Panel



Leave sufficient space on each side and at the top and the bottom of each SERVOPACK. The width on each side varies in accordance with the models of the SERVOPACKs used.

SERVOPACK Model SGDV-	Side		Top and bottom
	Left	Right	
R70F, R90F, 2R1F, R70A, R90A, 1R6A, 2R8A	1 mm or more		40 mm or more
2R8F, 3R8A, 5R5A, 7R6A	1 mm or more	10 mm or more	
120A, 180A, 200A, 330A, 470A, 550A, 590A, 780A, 1R9D, 3R5D, 5R4D, 8R4D, 120D, 170D, 210D, 260D, 280D, 370D	10 mm or more		

Also install cooling fans above the SERVOPACKs to disperse local pockets of warmer air around the SERVOPACKs.

- Inside the Control Panel

  The conditions inside the control panel should be the same as the environmental conditions of the SERVOPACK. Refer to *3.1.1 Installation Environment*.

3.3 EMC Installation Conditions

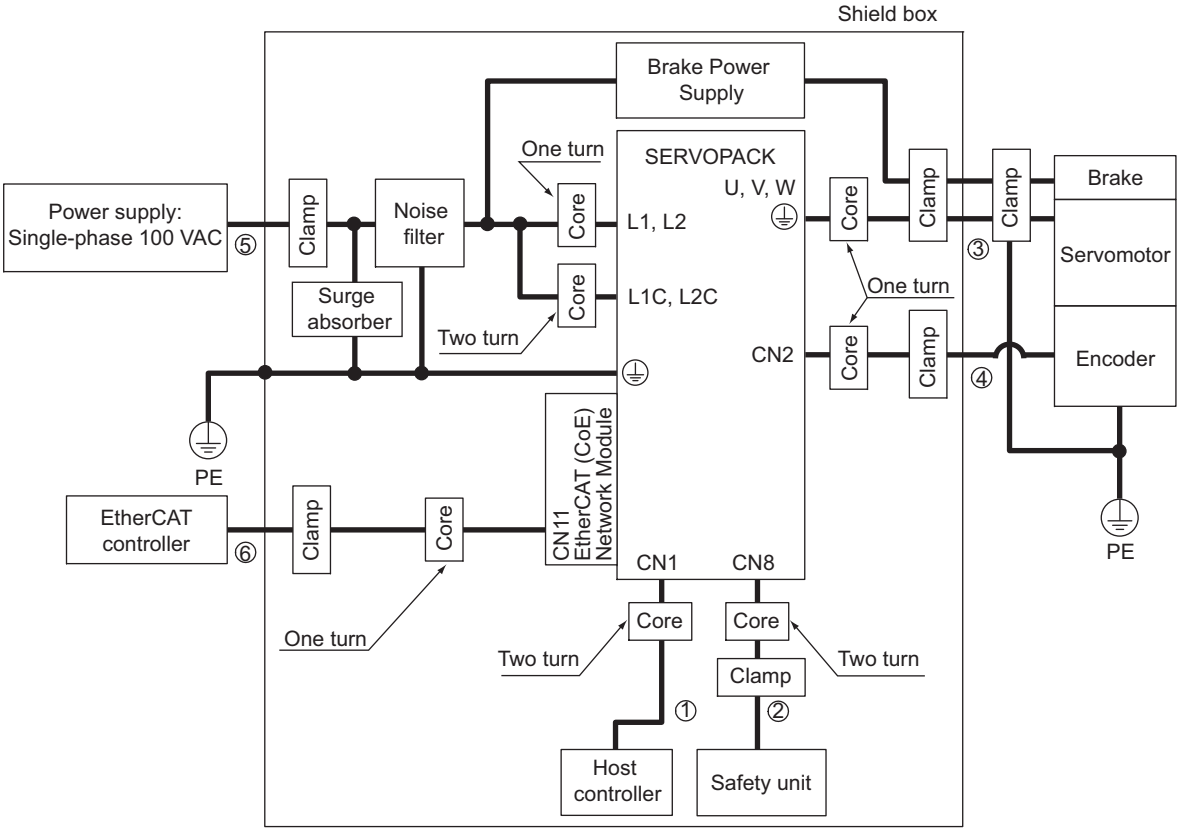
This section describes the recommended installation conditions that satisfy EMC guidelines for each model of the SGDV SERVOPACK. The conditions required for the standard type (base-mounted) of the SERVOPACK are described. Refer to this section for other SERVOPACK models such as the rack-mounted types as well.

This section describes the EMC installation conditions satisfied in test conditions prepared by Yaskawa. The actual EMC level may differ depending on the actual system's configuration, wiring, and other conditions. However, because this product is built-in, check that the following conditions are still met after being installed in the user's product.

The applicable standards are EN55011/A2 group 1 class A, EN61800-3, and EN61000-6-2.

■ Single-phase 100 V

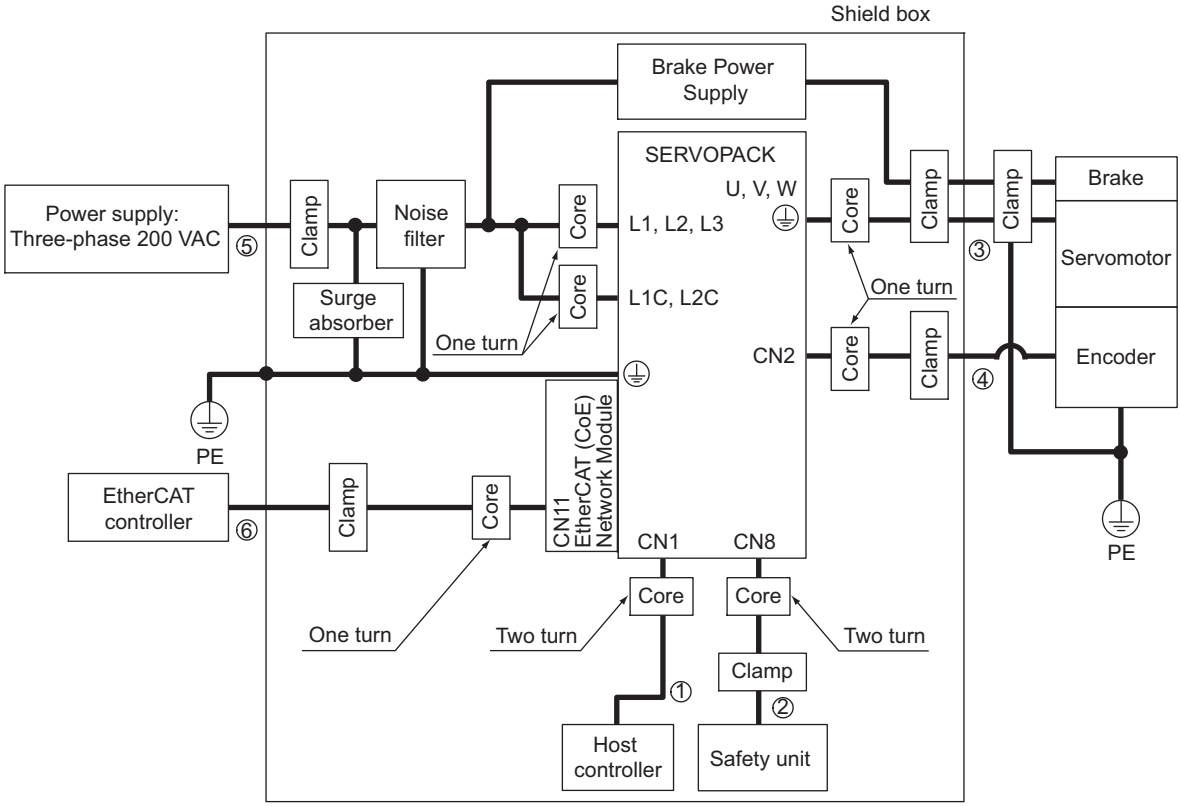
- SGDV-□□□FE1A (□□□ = R70, R90, 2R1, 2R8) + SGDV-OCA01A



Symbol	Cable Name	Specification
①	I/O signal cable	Shield cable
②	Safety signal cable	Shield cable
③	Motor main circuit cable	Shield cable
④	Encoder cable	Shield cable
⑤	Main circuit cable	Shield cable
⑥	Ethernet communication cable	Shield cable

■ Three-phase 200 V

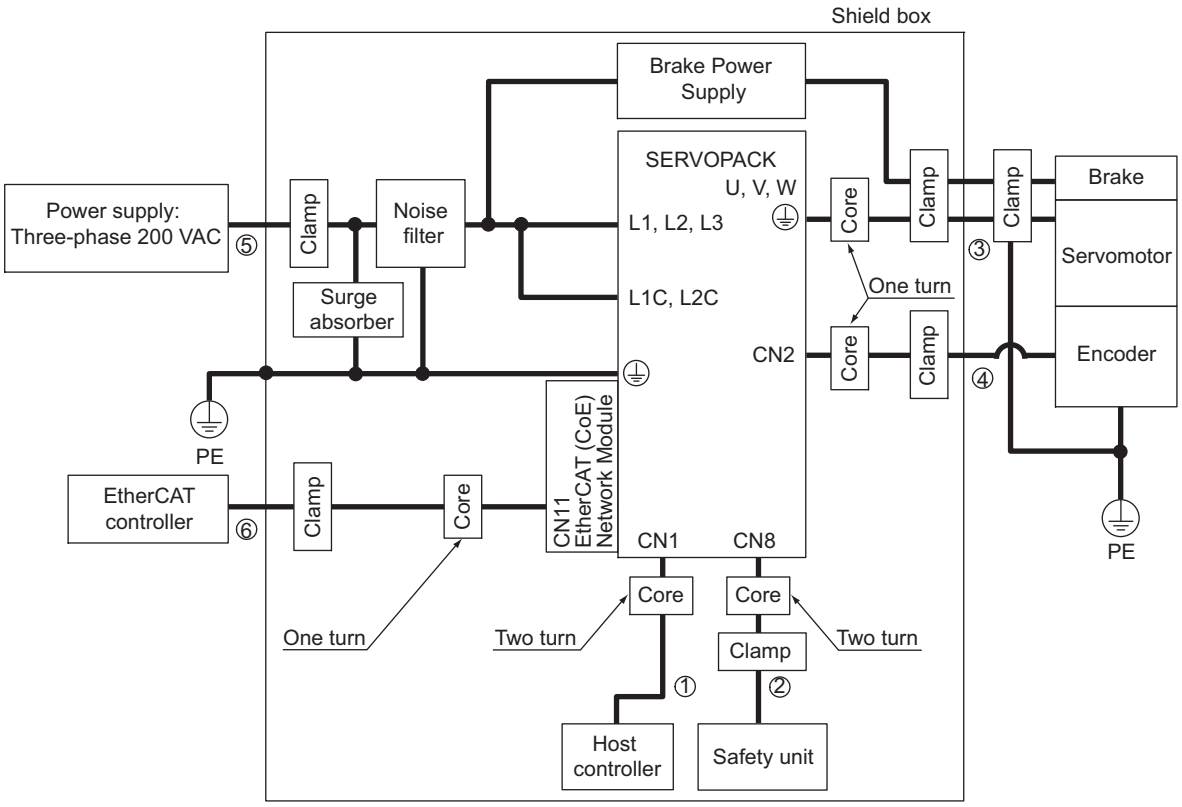
• SGDV-□□□AE1A (□□□ = R70, R90, 1R6, 2R8, 3R8, 5R5, 7R6) + SGDV-OCA01A



Symbol	Cable Name	Specification
①	I/O signal cable	Shield cable
②	Safety signal cable	Shield cable
③	Motor main circuit cable	Shield cable
④	Encoder cable	Shield cable
⑤	Main circuit cable	Shield cable
⑥	Ethernet communication cable	Shield cable

■ Three-phase 200 V

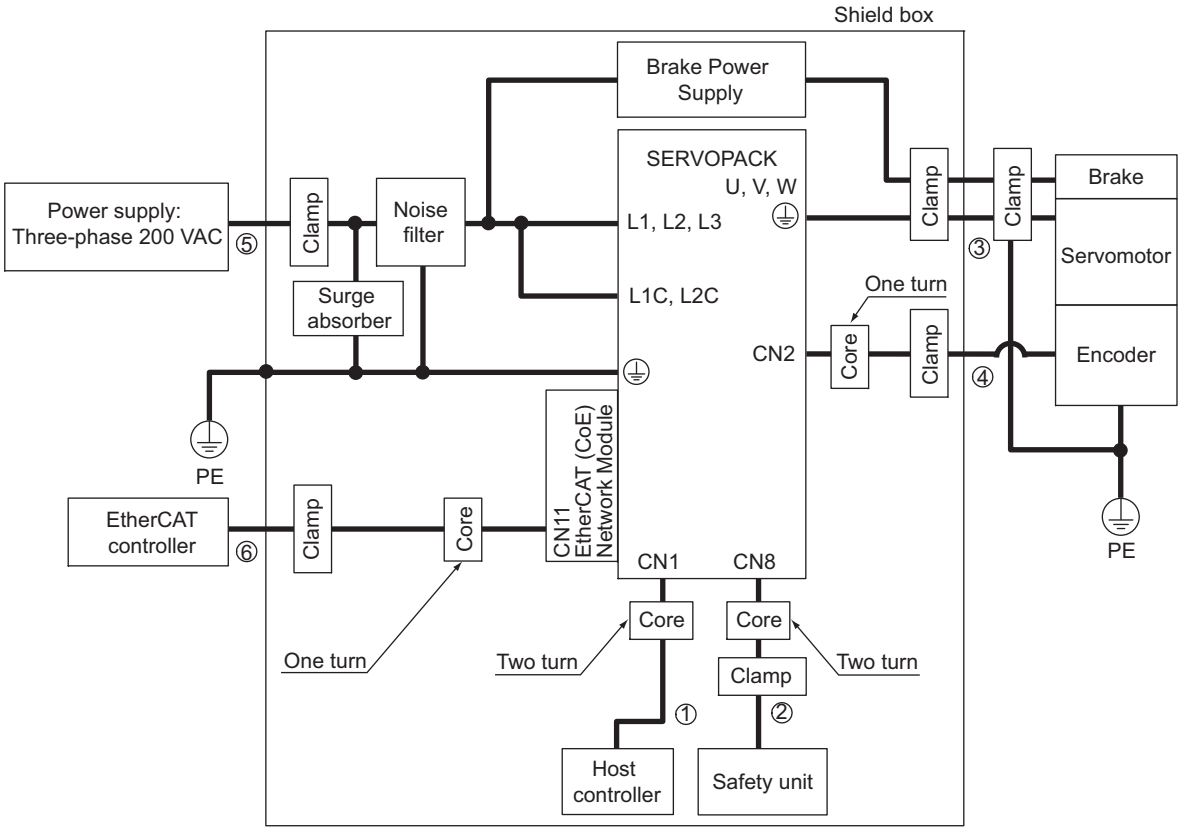
• SGDV-□□□AE1A (□□□ = 120) + SGDV-OCA01A



Symbol	Cable Name	Specification
①	I/O signal cable	Shield cable
②	Safety signal cable	Shield cable
③	Motor main circuit cable	Shield cable
④	Encoder cable	Shield cable
⑤	Main circuit cable	Shield cable
⑥	Ethernet communication cable	Shield cable

■ Three-phase 200 V

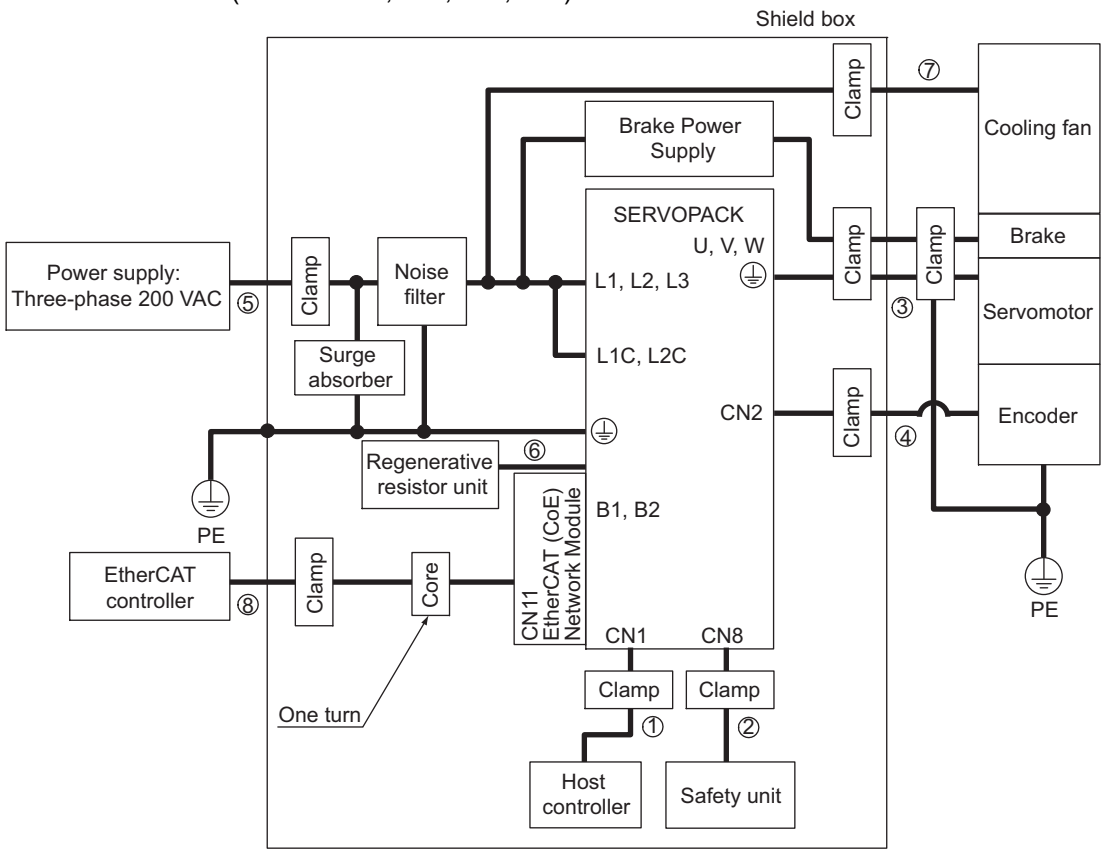
• SGDV-□□□AE1A (□□□ = 180, 200, 330) + SGDV-OCA01A



Symbol	Cable Name	Specification
①	I/O signal cable	Shield cable
②	Safety signal cable	Shield cable
③	Motor main circuit cable	Shield cable
④	Encoder cable	Shield cable
⑤	Main circuit cable	Shield cable
⑥	Ethernet communication cable	Shield cable

■ Three-phase 200 V

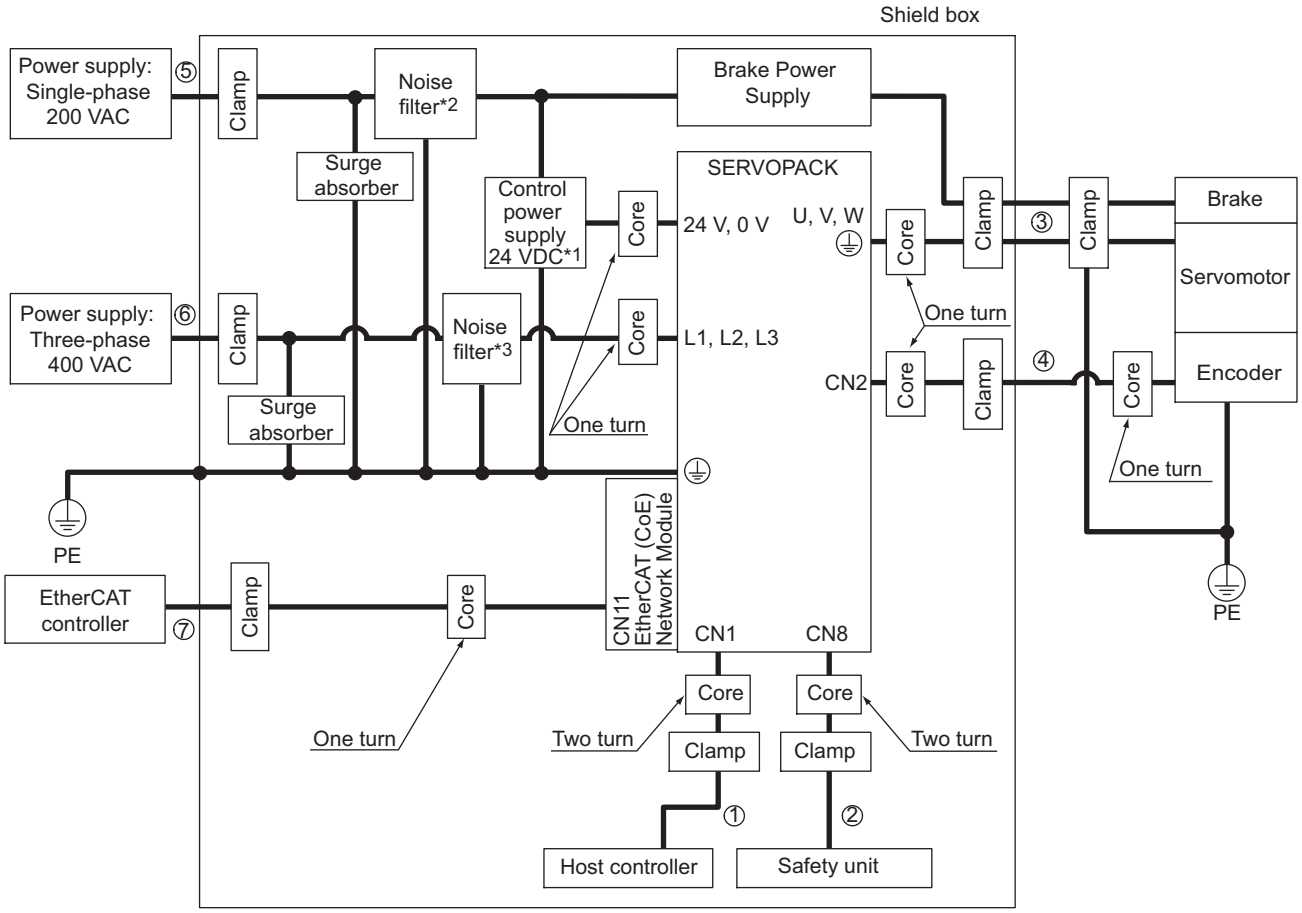
• SGDV-□□□AE1A (□□□ = 470, 550, 590, 780) + SGDV-OCA01A



Symbol	Cable Name	Specification
①	I/O signal cable	Shield cable
②	Safety signal cable	Shield cable
③	Motor main circuit cable	Shield cable
④	Encoder cable	Shield cable
⑤	Main circuit cable	Shield cable
⑥	Regenerative resistor unit cable	Non-shield cable
⑦	Cooling fan cable	Shield cable
⑧	Ethernet communication cable	Shield cable

■ Three-phase 400 V

- SGDV-□□□DE1A (□□□ = 1R9, 3R5, 5R4, 8R4, 120, 170) + SGDV-OCA01A

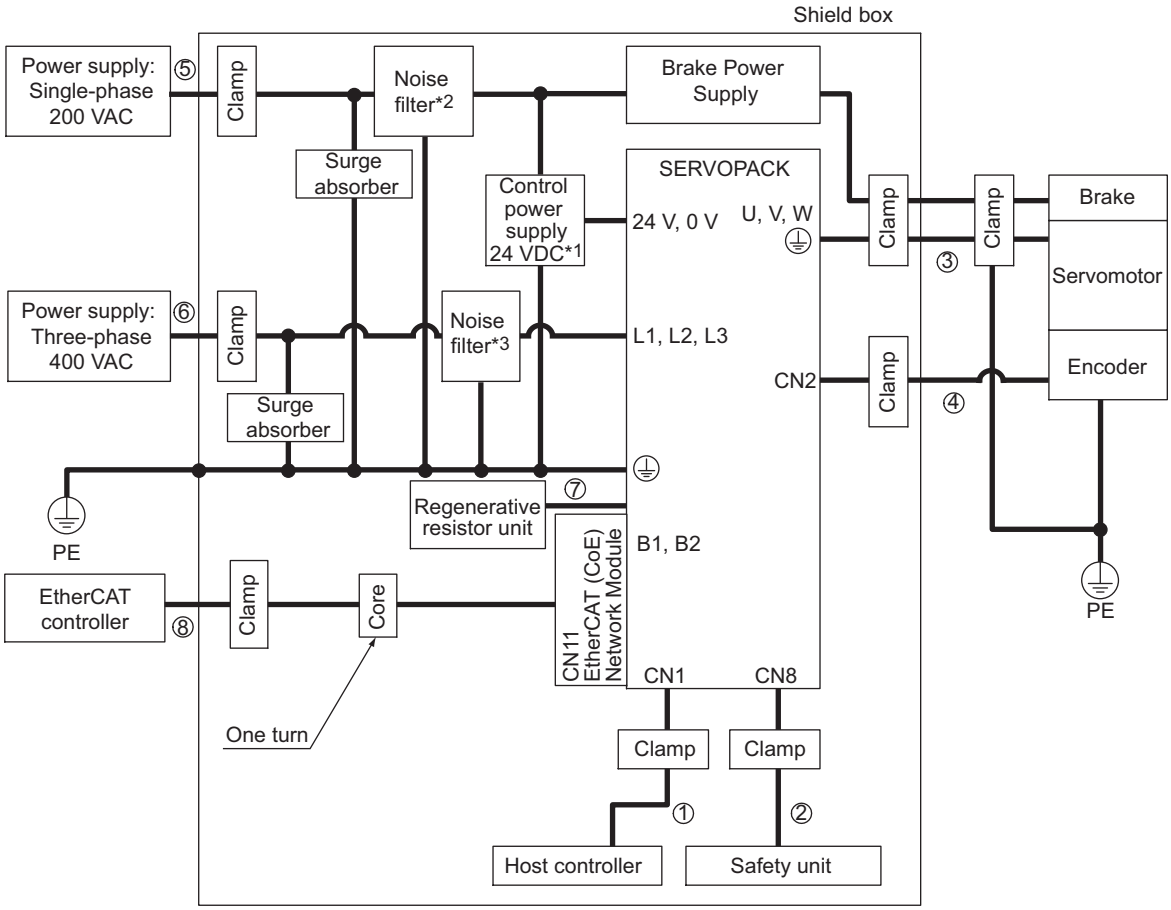


Symbol	Cable Name	Specification
①	I/O signal cable	Shield cable
②	Safety signal cable	Shield cable
③	Motor main circuit cable	Shield cable
④	Encoder cable	Shield cable
⑤	Control power cable	Shield cable
⑥	Main circuit cable	Shield cable
⑦	Ethernet communication cable	Shield cable

∗1. Products that have received CE marking are recommended for the 24 VDC power supply.
∗2. Install the following noise filter on the power line between the single-phase 200 V power supply and the 24 VDC power supply.
Model number: FN2070-6/07 (SCHAFFNER)
∗3. For more information on this filter, refer to *Σ-V Series Product Catalog*. (KAEP S800000 42)

■ Three-phase 400 V

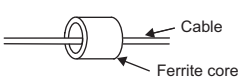
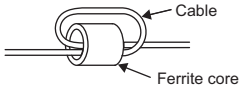
• SGDV-□□□DE1A (□□□ = 210, 260, 280, 370) + SGDV-OCA01A



Symbol	Cable Name	Specification
①	I/O signal cable	Shield cable
②	Safety signal cable	Shield cable
③	Motor main circuit cable	Shield cable
④	Encoder cable	Shield cable
⑤	Control power cable	Shield cable
⑥	Main circuit cable	Shield cable
⑦	Regenerative resistor unit cable	Non-shield cable
⑧	Ethernet communication cable	Shield cable

∗1. Products that have received CE marking are recommended for the 24 VDC power supply.
∗2. Install the following noise filter on the power line between the single-phase 200 V power supply and the 24 VDC power supply.
Model number: FN2070-6/07 (SCHAFFNER)
∗3. For more information on this filter, refer to Σ-*V Series Product Catalog*. (KAEP S800000 42)

■ Attachment Methods of Ferrite Cores

One turn	Two turn
	

■ Recommended Ferrite Core

Cable Name	Ferrite Core Model	Manufacturer
Motor main circuit cable	ESD-SR-250	NEC TOKIN Corp.

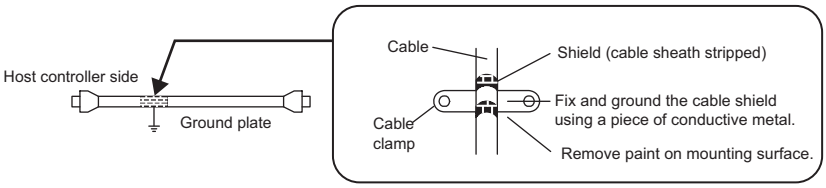
■ Recommended Noise Filter and Surge Absorber

For more information on recommended noise filters and surge absorbers, refer to *Σ-V Series Product Catalog.* (KAEP S800000 42)

■ Fixing the Cable

Fix and ground the cable shield using a piece of conductive metal.

• Example of Cable Clamp



■ Shield Box

A shield box, which is a closed metallic enclosure, is effective as reinforced shielding against electromagnetic interference (EMI) from SERVOPACKs. The structure of the box should allow the main body, door, and cooling unit to be attached to the ground. The box opening should be as small as possible.

<Note>
Do not connect the digital operator and the analog monitor cable to the SERVOPACK during operations. Connect them only when the machinery is stopped during maintenance.

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4

Wiring and Connection

This chapter describes an example of how a system is configured using the EtherCAT (CoE) Network Module, how the I/O signals are connected, and how the cable for EtherCAT communication is connected.
For details on the main circuit, encoders, safety devices, and regenerative resistors, refer to the following manual.
For more information on safe and stable usage of the servo system, be sure to read the precautions in the section labelled, "IMPORTANT," in the following manual.

- Σ-V Series User's Manual Design and Maintenance
  Rotational Motor/ Command Option Attachable Type
  Chapter 3 Wiring and Connection (SIEP S800000 60)

4.1 System Configuration Diagram 4-2

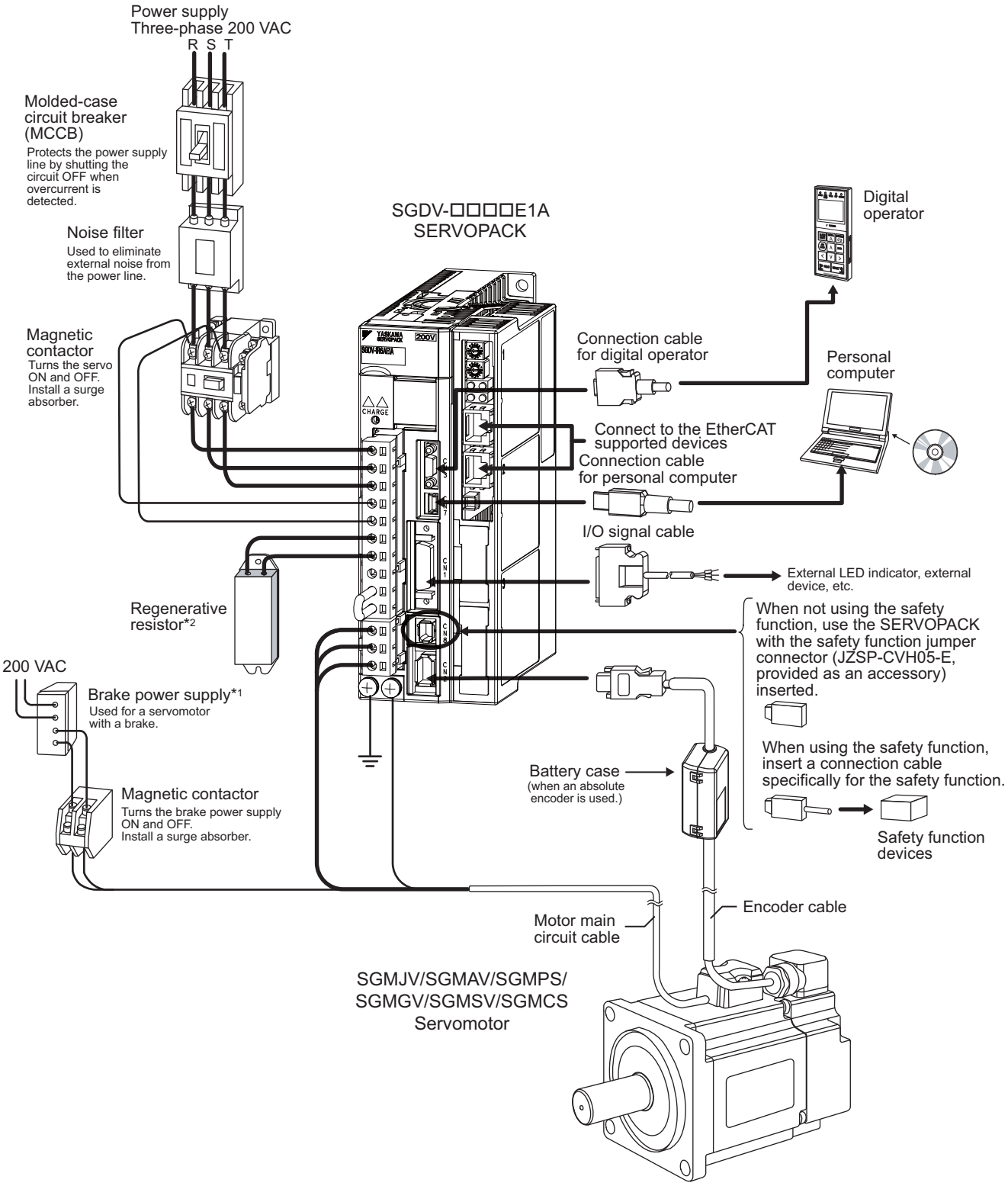
4.2 I/O Signal Connections 4-3
4.2.1 I/O Signal (CN1) Names and Functions 4-3
4.2.2 I/O Signal Connector (CN1) Terminal Layout 4-4
4.2.3 Example of I/O Signal Connections 4-5

4.3 I/O Signal Allocations 4-6
4.3.1 Input Signal Allocations 4-6
4.3.2 Output Signal Allocations 4-8

4.4 Connection Example of EtherCAT Communication 4-9
4.4.1 Connection Example 4-9
4.4.2 EtherCAT Connector (RJ45) 4-9
4.4.3 Ethernet Cable 4-10
4.4.4 EtherCAT Secondary Address Settings 4-10

4.1 System Configuration Diagram

■ Connecting to SGDV-□□□□E1A SERVOPACK



∗1. Use a 24-VDC power supply. (not included.)

∗2. Before connecting an external regenerative resistor to the SERVOPACK, refer to *Σ-V Series User's Manual Design and Maintenance Rotational Motor/ Command Option Attachable Type* (SIEP S800000 60).

Note: The connections and wiring of the power supply of the main circuit and that of the controls differ in accordance with the SERVOPACK to be used. For details, refer to *Σ-V Series User's Manual Design and Maintenance Rotational Motor/ Command Option Attachable Type* (SIEP S800000 60).

4.2 I/O Signal Connections

This section describes the names and functions of I/O signals (CN1). Also terminal layout and connection examples by control method are shown.

4.2.1 I/O Signal (CN1) Names and Functions

The following table shows the names and functions of I/O signals (CN1).

(1) Input Signals

Signal	Pin No.	Name	Function	Reference Section
P-OT N-OT	7 8	Forward run prohibited, Reverse run prohibited	Overtravel prohibited: Stops servomotor when movable part travels beyond the allowable range of motion.	5.7
/Probe1 (/SI4) /Probe2 (/SI5)	10 11	Probe 1 latch signal Probe 2 latch signal	Connects the Probe signals to latch the value of the feedback counter.	7.9
/Home (/SI6)	12	Home switch input signal	Connects the Home signal for homing.	7.4
+24VIN	6	Control power supply for sequence signal	Control power supply input for sequence signals: The 24 VDC power supply is not included. Allowable voltage fluctuation range: 11 to 25 V	–
BAT (+) BAT (-)	14 15	Battery (+) input signal Battery (–) input signal	Connecting pin for the absolute encoder backup battery.	–
/SI0 /SI3	13 9	General-purpose input signal	General-purpose input signal	8.16 (1)

Note 1. The functions allocated to P-OT, N-OT, /Probe1, /Probe2, and /Home input signals can be changed by using the parameters. Refer to *4.3.1 Input Signal Allocations*.

2. If the Forward run prohibited/ Reverse run prohibited function is used, the software can be used to stop the SERVOPACK. If the application does not satisfy the safety requirements, add an external circuit for safety reasons as required.

(2) Output Signals

Signal	Pin No.	Name	Function	Reference Section
ALM+ ALM-	3 4	Servo alarm output signal	Turns OFF when an error is detected.	–
/BK+ (/SO1+) /BK- (/SO1-)	1 2	Brake interlock signal	Controls the brake. The brake is released when the signal turns ON. Allocation can be changed to general-purpose output signals (/SO1+, /SO1-).	–
/SO2+ /SO2- /SO3+ /SO3-	23 24 25 26	General-purpose output signal	General-purpose output signal Note: Set the parameter to allocate a function.	8.16 (2)
PAO /PAO	17 18	Phase-A signal	Output signals of the 90° phase differential for the dividing pulse of the encoder	–
PBO /PBO	19 20	Phase-B signal		
PCO /PCO	21 22	Phase-C signal	Output signal for origin pulse of the encoder	
SG	16	Signal ground	Control circuit = 0 V	–
FG	Shell	Frame ground	Connected to frame ground if the shield wire of the I/O signal cable is connected to the connector shell.	–

Note: For more information on the allocation of /SO1, /SO2, and /SO3, refer to *4.3.2 Output Signal Allocations.*

4.2.2 I/O Signal Connector (CN1) Terminal Layout

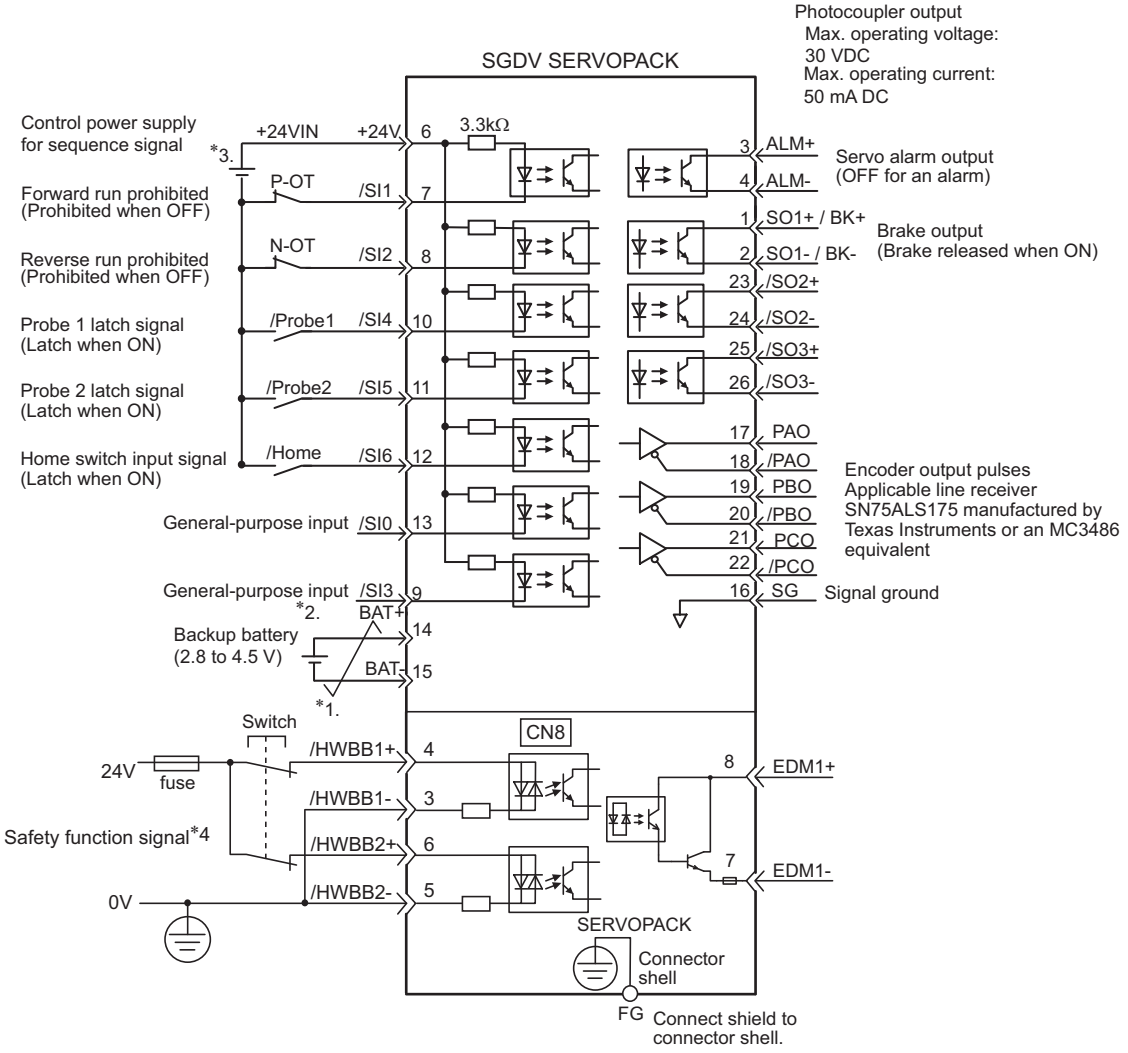
The following table shows the terminal layout of I/O signal connectors (CN1).

1	/BK+ (/SO1+)	Brake output	2	/BK- (/SO1-)	Brake output	14	BAT(+)	Battery (+) input	15	BAT(-)	Battery (-) input
3	ALM+	Servo alarm output	4	ALM-	Servo alarm output	16	SG	Signal ground	17	PAO	Encoder output pulse Phase A
5			6	+24VIN	Control power supply for sequence signal input	18	/PAO	Encoder output pulse Phase A	19	PBO	Encoder output pulse Phase B
7	P-OT (/SI1)	Forward run prohibited input	8	N-OT (/SI2)	Reverse run prohibited input	20	/PBO	Encoder output pulse Phase B	21	PCO	Encoder output pulse Phase C
9	/SI3	General-purpose input	10	/Probe1 (/SI4)	Probe 1 latch signal input	22	/PCO	Encoder output pulse Phase C	23	/SO2+	General-purpose input
11	/Probe2 (/SI5)	Probe 2 latch signal input	12	/Home (/SI6)	Home switch input	24	/SO2-	General-purpose input	25	/SO3+	General-purpose input
13	/SI0	General-purpose input				26	/SO3-	General-purpose input			

Note 1. Do not use unused terminals.
2. Connect the shield of the I/O signal cable to the connector shell.
Connect to the FG (frame ground) at the SERVOPACK connector.
3. The functions allocated to the following input signals can be changed by using the parameters.
Input signals: P-OT, N-OT, /Probe1, /Probe2, /Home
4. The output signals /SO1, /SO2, and /SO3 can be used as the output signal /COIN, /V-CMP, /TGON, /S-RDY, /CLT, /VLT, /BK, /WARN, or /NEAR by setting the parameter Pn50E, Pn50F, or Pn510. For details, refer to *4.3.2 Output Signal Allocations*.

4.2.3 Example of I/O Signal Connections

The following diagram shows a typical connection example.



∗1. ⫽ represents twisted-pair wires.

∗2. Connect when using an absolute encoder. When the encoder cable for the battery case is connected, do not connect a backup battery.

∗3. The 24 VDC power supply is not included. Use a power supply with double insulation or reinforced insulation.

∗4. To turn the servomotor power ON, a safety device must be connected and the wiring to activate the safety function must be done. When not using the safety function, use the SERVOPACK with the plug (JZSP-CVH05-E, provided as an accessory) inserted into the CN8.

Note: The functions allocated to the input signals P-OT, N-OT, /Probe1, /Probe2, and /Home and the output signals /SO1, /SO2, and /SO3 can be changed by using the parameters. Refer to *4.3.1 Input Signal Allocations* and *4.3.2 Output Signal Allocations*.

4.3 I/O Signal Allocations

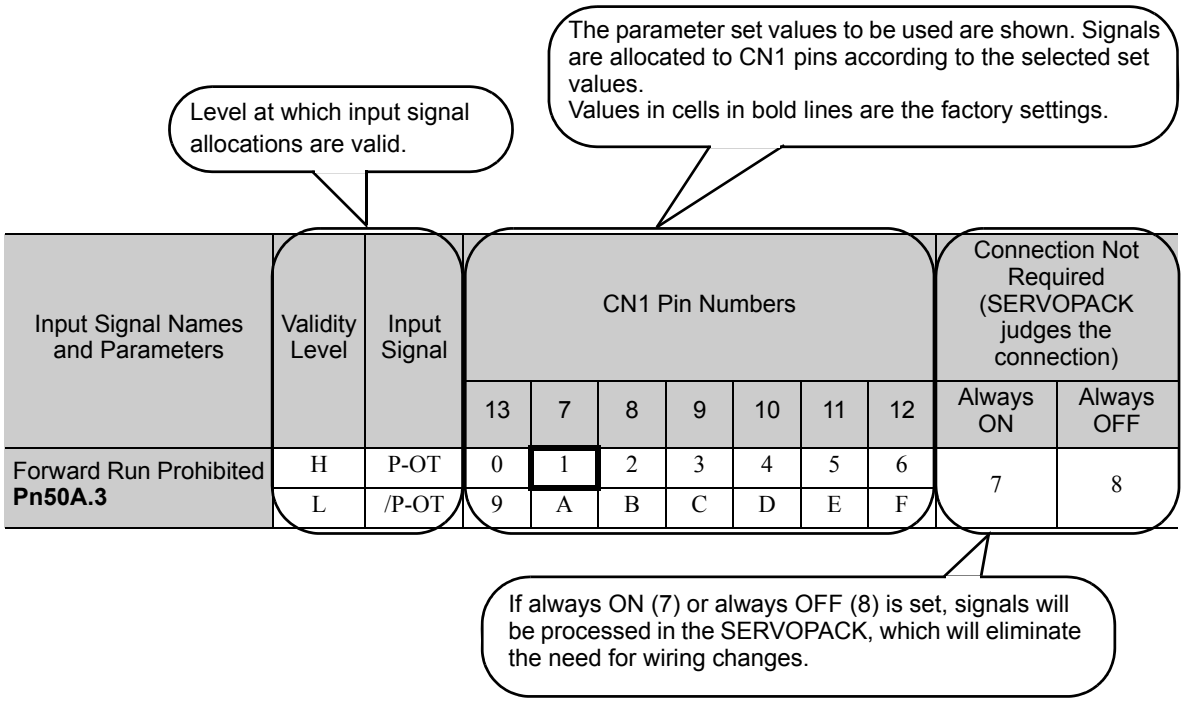
This section describes the I/O signal allocations.

4.3.1 Input Signal Allocations

Input signals are allocated as shown in the following table.

Refer to the *Interpreting the Input Signal Allocation Tables* and change the allocations accordingly.

<Interpreting the Input Signal Allocation Tables>



Input Signal Names and Parameters	Validity Level	Input Signal	CN1 Pin Numbers							Connection Not Required (SERVOPACK judges the connection)	
			13	7	8	9	10	11	12	Always ON	Always OFF
Forward Run Prohibited **Pn50A.3**	H	P-OT	0	**1**	2	3	4	5	6	7	8
	L	/P-OT	9	A	B	C	D	E	F		

Input Signal Names and Parameters	Validity Level	Input Signal	CN1 Pin Numbers							Connection Not Required (SERVOPACK judges the connection)	
			13	7	8	9	10	11	12	Always ON	Always OFF
Forward Run Prohibited **Pn50A.3**	H	P-OT	0	**1**	2	3	4	5	6	7	8
	L	/P-OT	9	A	B	C	D	E	F		
Reverse Run Prohibited **Pn50B.0**	H	N-OT	0	1	**2**	3	4	5	6	7	8
	L	/N-OT	0	A	B	C	D	E	F		
Forward External Torque Limit **Pn50B.2**	L	/P-CL	0	1	2	3	4	5	6	7	**8**
	H	P-CL	9	A	B	C	D	E	F		
Reserve External Torque Limit **Pn50B.3**	L	/N-CL	0	1	2	3	4	5	6	7	**8**
	H	N-CL	9	A	B	C	D	E	F		
Probe 1 Latch Signal **Pn511.1**	L	/Probe1	*	*	*	*	**4**	5	6	–	8
	H	Probe1	*	*	*	*	D	E	F		
Probe 2 Latch Signal **Pn511.2**	L	/Probe2	*	*	*	*	4	**5**	6	–	8
	H	Probe2	*	*	*	*	D	E	F		
Home Switch Signal **Pn511.3**	L	/Home	*	*	*	*	4	5	**6**	–	8
	H	Home	*	*	*	*	D	E	F		

* Always set to OFF.

IMPORTANT

1. Inverting the polarity of Forward Run Prohibited, and Reverse Run Prohibited signals, i.e. positive logic, will prevent the holding brake from working in case of its signal line disconnection.
   If this setting is absolutely necessary, check the operation and confirm that there are no safety problems.
2. When two or more signals are allocated to the same input circuit, input signal level is valid for all allocated signals.

4.3.2 Output Signal Allocations

Output signals are allocated as shown in the following table.

Refer to the *Interpreting the Output Signal Allocation Tables* and change the allocations accordingly.

<Interpreting the Output Signal Allocation Tables>

The parameter set values to be used are shown.
Signals are allocated to CN1 pins according to the selected set values.
Values in cells in bold lines are the factory settings.

Output Signal Names and Parameters	Output Signal	CN1 Pin Numbers			Invalid (not use)
		1/ (2)	23/ (24)	25/ (26)	
Brake **Pn50F.2**	/BK	1	2	3	0

Output Signal Names and Parameters	Output Signal	CN1 Pin Numbers			Invalid (not use)
		1/ (2)	23/ (24)	25/ (26)	
Positioning Completion **Pn50E.0**	/COIN	1	2	3	0
Speed Coincidence Detection **Pn50E.1**	/V-CMP	1	2	3	0
Rotation Detection **Pn50E.2**	/TGON	1	2	3	0
Servo Ready **Pn50E.3**	/S-RDY	1	2	3	0
Torque Limit Detection **Pn50F.0**	/CLT	1	2	3	0
Speed Limit Detection **Pn50F.1**	/VLT	1	2	3	0
Brake **Pn50F.2**	/BK	1	2	3	0
Warning **Pn50F.3**	/WARN	1	2	3	0
Near **Pn510.0**	/NEAR	1	2	3	0
Output signal polarity inversion **Pn512.0=1**	Polarity inversion of CN1-1(2)				0 (Not invert at factory setting)
Output signal polarity inversion **Pn512.1=1**	Polarity inversion of CN1-23(24)				
Output signal polarity inversion **Pn512.2=1**	Polarity inversion of CN1-25(26)				

IMPORTANT

- The signals not detected are considered as “Invalid.”
- Inverting the polarity of the brake output signal (/BK), i.e. positive logic, will prevent the holding brake from working in case of its signal line disconnection.
  If this setting is absolutely necessary, check the operation and confirm that there are no safety problems.
- If two or more signals are allocated to the same output circuit, a signal is output with OR logic circuit.
- If the output signals are used as general-purpose output signals for Digital Output (Object: 60FEh), disable the settings for Pn50E, Pn50F, and Pn510.

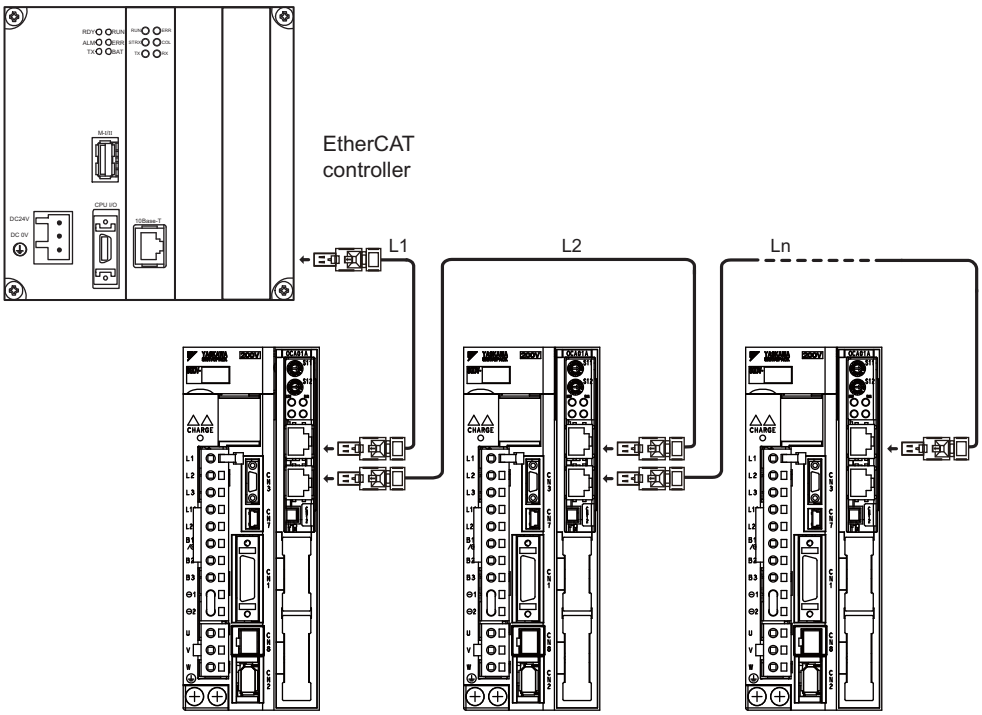
4.4 Connection Example of EtherCAT Communication

4.4.1 Connection Example

The following figure shows an example of connections between a host controller and a SERVOPACK using the EtherCAT communication.

Connect the connector of the EtherCAT communications cable to the connectors, CN11A and CN11B.

Connect CN11A to the master and CN11B to the slave. If reversed, communication will not be successfully performed.



Note: The maximum length of cables between stations (L1 to Ln) is 50 m.

4.4.2 EtherCAT Connector (RJ45)

Connector	Description
CN11A	EtherCAT signal input
CN11B	EtherCAT signal output

- Connector Pin Arrangement

Pin No.	Signal Name	Remarks
1	TD+	Send data
2	TD-	
3	RD+	Receive data
4	–	N.C.*
5	–	N.C.*
6	RD-	Receive data
7	–	N.C.*
8	–	N.C.*

* Pins denoted as N.C. do not connect to any signal.

4.4.3 Ethernet Cable

Ethernet cables in CAT5e quality can be used as the connection cables.
Also, requirements of a cable is follows.

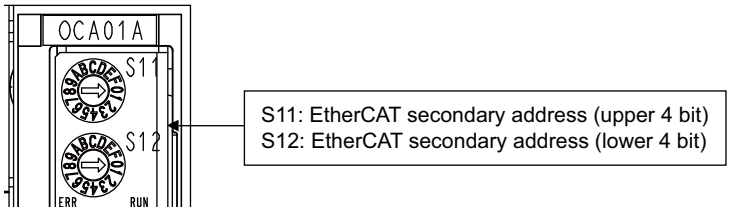
Shield type: S/STP or S/UTP
Length: Max. 50 m (between the nodes)

Recommended cables are shown below.

Manufacturer	Model
Beckhoff	ZB9020

4.4.4 EtherCAT Secondary Address Settings

The EtherCAT secondary address (Station Alias) can be used for identification or for addressing of a device.



(1) General Identification Process during Start Up

During start up the master detects the slaves by using the Auto Increment Addressing. The Identity object will be read from the slave and compared with the values from the master's configuration (which was provided by the EtherCAT configuration tool before). So the order of the slaves in the network has to be the same as in the master's configuration. To allow a different network topology a Station Alias is defined.

(2) Example Scenario

With a machining center there might be two identical drives to work in X and Y direction. It might happen that the cabling order is mixed up after a device replacement. To avoid that the drives receive wrong process data, an explicit address of the device is used with a Station Alias.

(3) Identification of Devices with Station Alias

The master reads the Station Alias by using the Auto Increment Addressing. The detected Station Alias will be compared with the values from the master's configuration to get the relation of the network topology and the configured topology.

- Station Alias in Register (0x0012)
  Station Alias is set to the Configured Station Alias register of ESC during power on.
  The value can be read with the following formula:
  Configured Station Alias = (S11 setting) × 16 + (S12 setting)

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5

Operation

5.1 Settings for Common Basic Functions 5-2
5.2 Trial Operation 5-3
5.2.1 Inspection before Trial Operation 5-3
5.2.2 Trial Operation via EtherCAT (CoE) Communication 5-3
5.3 Test Without Motor Function 5-4
5.4 Limiting Torque 5-4
5.5 Absolute Encoders 5-5
5.6 Safety Function 5-6
5.7 Overtravel 5-7

5.1 Settings for Common Basic Functions

The following table lists basic parameters to be set up for motor operation.

Step	Items		Reference	Objects (Parameters)
1	Servomotor Rotation Direction		*4.2.2 Servomotor Rotation Direction* in *Σ-V series User's Manual Design and Maintenance Rotational Motor/Command Option Attachable Type* (SIEP S800000 60)	Object 2000h (Pn000)
2	Overtravel		*5.7 Overtravel*	Object 250Ah (Pn50A) Object 250Bh (Pn50B) Object 2001h (Pn001) Object 2406h (Pn406)
3	Unit Settings	Position	*8.5 (6) Usage of User Units* Note: The SERVOPACK electronic gear function is not used with the EtherCAT (CoE) Network Module.	Object 2701:01h (PnB02) Object 2701:02h (PnB04)
		Velocity	*8.5 (6) Usage of User Units*	Object 2702:01h (PnB06) Object 2702:02h (PnB08)
		Acceleration	*8.5 (6) Usage of User Units*	Object 2703:01h (PnB0A) Object 2703:02h (PnB0C)
4	Encoder Output Pulses		*4.2.5 Encoder Output Pulses* and *4.2.6 Encoder Output Pulse Setting* in *Σ-V series User's Manual Design and Maintenance Rotational Motor/Command Option Attachable Type* (SIEP S800000 60)	Object 2212h (Pn212)
5	Holding Brakes		*4.2.7 Holding Brakes* in *Σ-V series User's Manual Design and Maintenance Rotational Motor/Command Option Attachable Type* (SIEP S800000 60)	Object 250Fh (Pn50F) Object 2506h (Pn506) Object 2507h (Pn507) Object 2508h (Pn508)
6	Stopping Servomotor after Servo OFF Command or Alarm Occurrence		*4.2.8 Stopping Servomotor after Servo OFF Command or Alarm Occurrence* in *Σ-V series User's Manual Design and Maintenance Rotational Motor/Command Option Attachable Type* (SIEP S800000 60)	Object 2001h (Pn001) Object 200Bh (Pn00B)
7	Instantaneous Power Interruption Settings		*4.2.9 Instantaneous Power Interruption Settings* in *Σ-V series User's Manual Design and Maintenance Rotational Motor/Command Option Attachable Type* (SIEP S800000 60)	Object 2509h (Pn509)
8	SEMI-F47 Function (Torque Limit Function for Low Power Supply Voltage for Main Circuit)		*4.2.10 SEMI-F47 Function (Torque Limit Function for Low Power Supply Voltage for Main Circuit)* in *Σ-V series User's Manual Design and Maintenance Rotational Motor/Command Option Attachable Type* (SIEP S800000 60)	Object 2008h (Pn008) Object 2424h (Pn424) Object 2425h (Pn425) Object 2509h (Pn509)
9	Setting Motor Overload Detection Level		*4.2.11 Setting Motor Overload Detection Level* in *Σ-V series User's Manual Design and Maintenance Rotational Motor/Command Option Attachable Type* (SIEP S800000 60)	Object 252Bh (Pn52B)

Note: After the above basic functions have been set, to activate these settings, you must turn the power supply OFF and ON or write 1 to object 2700h.

5.2 Trial Operation

5.2.1 Inspection before Trial Operation

Check the following items. If any problems exist, take appropriate measures before trial operation.

(1) Servomotors

- Are all wiring and connections correct?
- Are all nuts and bolts securely tightened?

Note: If a motor with an oil seal is used, check whether the oil shield is not damaged and if there is an oil coat. When performing operation on a servomotor that has been stored for a long period of time, perform the maintenance and inspection according to the procedures described in *Σ-V Series User's Manual Setup Rotational Motor* (SIEP S800000 43).

(2) SERVOPACKs

- Are all wiring and connections correct?
- Is the correct power supply voltage being supplied to the SERVOPACK?

5.2.2 Trial Operation via EtherCAT (CoE) Communication

An example of drive operation procedure via EtherCAT is shown below. This example is described in Profile Position mode.

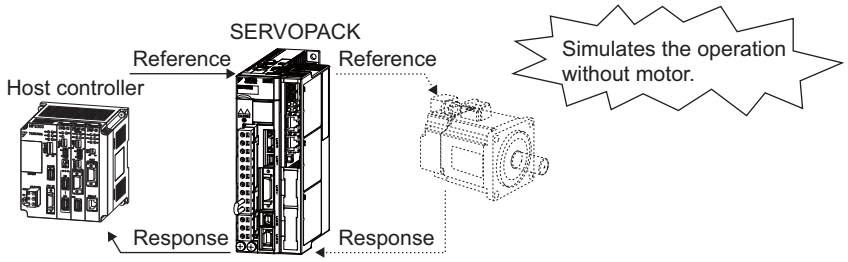
Step	Operation	Reference
1	Confirm whether the power line, Encoder, I/O signal and EtherCAT cables are correctly connected.	*4.2 I/O Signal Connections* *4.4 Connection Example of EtherCAT Communication*
2	Turn ON the power supply to the SERVOPACK. If the power supply is normal, the CHARGE indicator on the SERVOPACK will light.	–
3	Change the EtherCAT communication state to Operational.	*6.3 EtherCAT State Machine*
4	Set the Modes of operation to Profile Position mode.	*8.6 (9) Modes of Operation (6060h)*
5	Change the drive state to "Operation enabled" by command of the Controlword. When the power is supplied to the motor, the Statusword indicates "Operation enabled" state.	*Chapter 7 CiA402 Drive Profile* *7.1 Device Control* *8.6 (2) Controlword (6040h)* *8.6 (3) Statusword (6041h)*
6	Set the Target position, Profile velocity, Profile acceleration, and Profile acceleration, and then set Controlword to start positioning. *	*8.6 (2) Controlword (6040h)* *8.7 (1) Target Position (607Ah)* *8.7 (4) Profile Velocity (6081h)* *8.7 (5) Profile Acceleration (6083h)* *8.7 (6) Profile Deceleration (6084h)*
7	Check the following points while performing in step 6. • Check whether the motor is moving to the reference direction. If motor is moving to reverse direction to the reference, then change the setting of servomotor direction rotation. • Check to make sure that there is no abnormal vibration, noise, or heating. If any abnormality is found, refer to *9.3 Troubleshooting Malfunction Based on Operation and Conditions of the Servomotor* to clear the problem.	–

* Use PDO for objects that are PDO mapped.
The values will not be changed even if SDO is changed.
For details on PDO mapping, refer to *6.4 PDO Mapping*.

5.3 Test Without Motor Function

The test without motor function is used to check the operation of the host and peripheral devices by simulating the operation of the motor in the SERVOPACK, i.e., without actually operating the motor. This function enables checking wiring and verifying the system and parameters when errors occur while debugging the system, thus shortening the time required for setup work and preventing damage to the equipment that may result from possible malfunctions. The operation of the motor can be checked during performing this function regardless of whether the motor is actually connected or not.

For details, refer to *4.3 Test Without Motor Function* in *Σ-V series User's Manual Design and Maintenance Rotational Motor/Command Option Attachable Type* (SIEP S800000 60)



■ Related Parameters

The following parameters are used for the test without motor.

Object Index (Pn No.)		Meaning	When Enabled
200Ch (Pn00C)	n.□□□0	Disables the test without motor. [Factory setting]	After restart
	n.□□□1	Enables the test without motor.	
	n.□□0□	Sets 13 bits as encoder resolution for the test without motor. [Factory setting]	
	n.□□1□	Sets 20 bits as encoder resolution for the test without motor.	
	n.□0□□	Sets incremental encoder as encoder type for the test without motor. [Factory setting]	
	n.□1□□	Sets absolute encoder* as encoder type for the test without motor.	

* External encoders such as encoders for fully-closed loop control are used as incremental encoders.

5.4 Limiting Torque

The SERVOPACK provides the following four methods for limiting output torque to protect the machine. Each method uses the set minimum torque to limit the output.

Limiting Method	Reference	Objects (Parameters)
Torque limited by parameter setting only.	*4.4.1 Internal Torque Limit* in *Σ-V series User's Manual Design and Maintenance Rotational Motor/Command Option Attachable Type (SIEP S800000 60)*	Object 2402h (Pn402) Object 2403h (Pn403)
Torque limit set by parameter enabled by I/O input signal.	*4.4.2 External Torque Limit* in *Σ-V series User's Manual Design and Maintenance Rotational Motor/Command Option Attachable Type (SIEP S800000 60)*	Object 2404h (Pn404) Object 2405h (Pn405)
Torque limit set by parameter enabled by command from controller.	*8.6 (2) Controlword (6040h)*	Object 6040h (PnB11) Object 2404h (Pn404) Object 2405h (Pn405)
Torque limit controlled from controller.	*7.7 Torque Limit Function*	Object 6072h (PnB38) Object 60E0h (PnB80) Object 60E1h (PnB82)

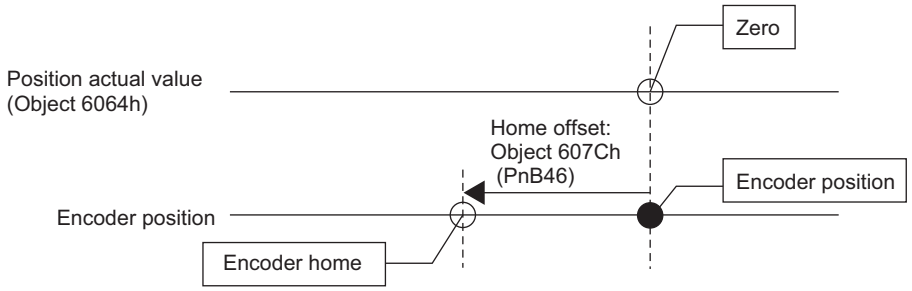
5.5 Absolute Encoders

For details on absolute encoder settings, refer to *4.5 Absolute Encoders* in *Σ-V series User's Manual Design and Maintenance Rotational Motor/Command Option Attachable Type (SIEP S800000 60)*.

■ Absolute Encoder Home Offset

When an absolute encoder is used, an offset can be set between the encoder position and the machine position (Position actual value: Object 6064h). The offset value is set by the reference unit and is added to the Position actual value (Object 6064h) after turning the power supply OFF and ON again or enabling the parameter with Object 2700h.

Index	Sub Index	Name	Data Type	Access	Setting Range	Default Value	EEPROM
607Ch	0	Home offset	DINT	RW	–536870912 to 536870911	0	Yes

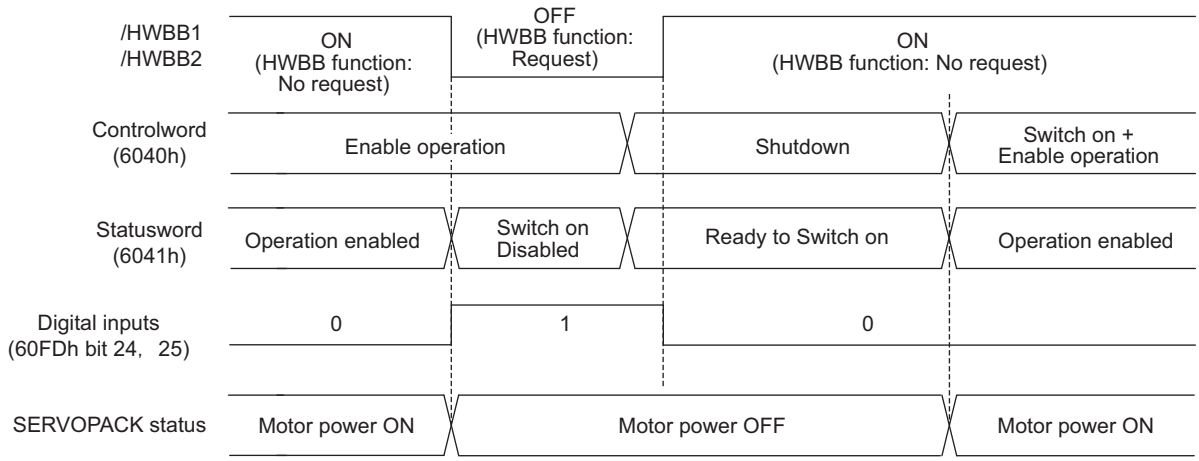


5.6 Safety Function

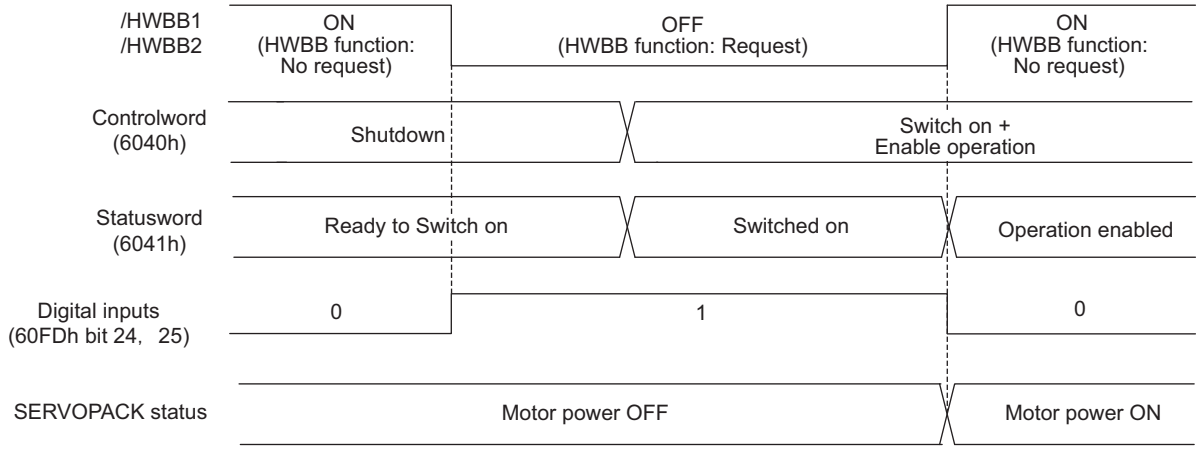
Safety functions are hard-wired into the SGDV SERVOPACK. If an /HWBB1 or /HWBB2 signal is input during motor operation, the power to the motor will be forcibly shut off and the motor will be stopped according to the setting of the 1 digit of parameter Pn001.

The following diagram shows the status of the safety functions when the EtherCAT (CoE) Network Module is connected.

[When an /HWBB Signal is Input during Motor Operation]



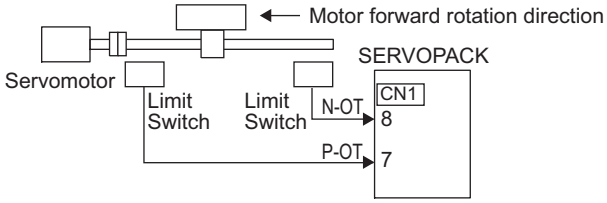
[When an /HWBB Signal is Input while Motor Power is OFF]



For details, refer to *4.6 Safety Function* in *Σ-V series User's Manual Design and Maintenance Rotational Motor/Command Option Attachable Type (SIEP S800000 60)*.

5.7 Overtravel

The overtravel limit function forces movable machine parts to stop by turning on a limit switch if they exceed the allowable range of motion.



<Note>

- Overtravel may not be required for rotating applications such as rotary tables and conveyors. If overtravel is not required, disable the overtravel signal allocations in parameters Pn50A and Pn50B.
- For details on overtravel wiring, signal settings, and stopping methods, refer to *4.2.3 Overtravel* in *Σ-V series User's Manual Design and Maintenance Rotational Motor/Command Option Attachable Type (SIEP S800000 60)*.

(1) Status during Overtravel

When an overtravel signal is input, the status of the following objects will be set to 1. Then the servomotor will stop according to the overtravel stop method selected in object 2001h (Pn001). If the overtravel signal is turned OFF, these statuses will change to 0 (zero).

- Statusword (Object 6041h), Internal limit active (bit 11)
- Digital Inputs (Object 60FDh), Negative limit switch (bit 0), or Positive limit switch (bit 1)

(2) Behavior for Overtravel in Each Mode

Operation Mode	Description
Profile position mode	• When an overtravel signal is input, the current positioning to the target position will be canceled. The motor will be stopped, and then Target reached in the Statusword will be set. • In the overtravel state, positioning (return operations) will start only when a target position is specified in the reverse direction of the present overtravel signal for Position actual value (e.g., for P-OT, a command to move in the negative direction).
Homing mode	• When Homing method 1, 11, 12, 13, 14, 28, or 34 is executed: When a P-OT signal is input, Homing error (bit 13) in Statusword (object 6041h) will turn 1, the homing will be canceled, and the operation will stop. • When Homing method 2, 7, 8, 9, 10, 24, or 33 is executed: When an N-OT signal is input, Homing error (bit 13) in Statusword (object 6041h) will turn 1, the homing will be canceled, and the operation will stop.
Interpolated position mode, Cyclic synchronous position mode	• When an overtravel signal is input, the current positioning to the target position will be canceled. The motor will be stopped, and then Target reached in the Statusword (object 6041h) will be set. • In the overtravel state, positioning (return operations) will start only when a target position is specified in the reverse direction of the present overtravel signal for Position actual value (e.g., for P-OT, a command to move in the negative direction).
Profile velocity mode, Cyclic synchronous velocity mode	• In the overtravel state, the motor will start only when a speed is specified in the reverse direction of the overtravel signal (e.g., for P-OT, a target velocity in the negative direction).
Profile torque mode, Cyclic synchronous torque mode	• In the overtravel state, torque will be generated only when torque is specified in the reverse direction of the overtravel signal (e.g., for P-OT, torque in the negative direction).

IMPORTANT

- For safety when using the overtravel function, monitor the Statusword (object 6041h) or OT signal status in *Digital Inputs* at the host controller, and use the Halt command (Controlword, bit 8: 1) to stop the motor if overtravel occurs. Do not output any other commands until the motor stops.
  After the motor stops, perform a reset operation.
- If the OT signal status changes within a short period, the host controller may not monitor the change of the OT signal. Be sure to correctly select, install, and wire the limit switch to prevent chattering, malfunction, and other problems.

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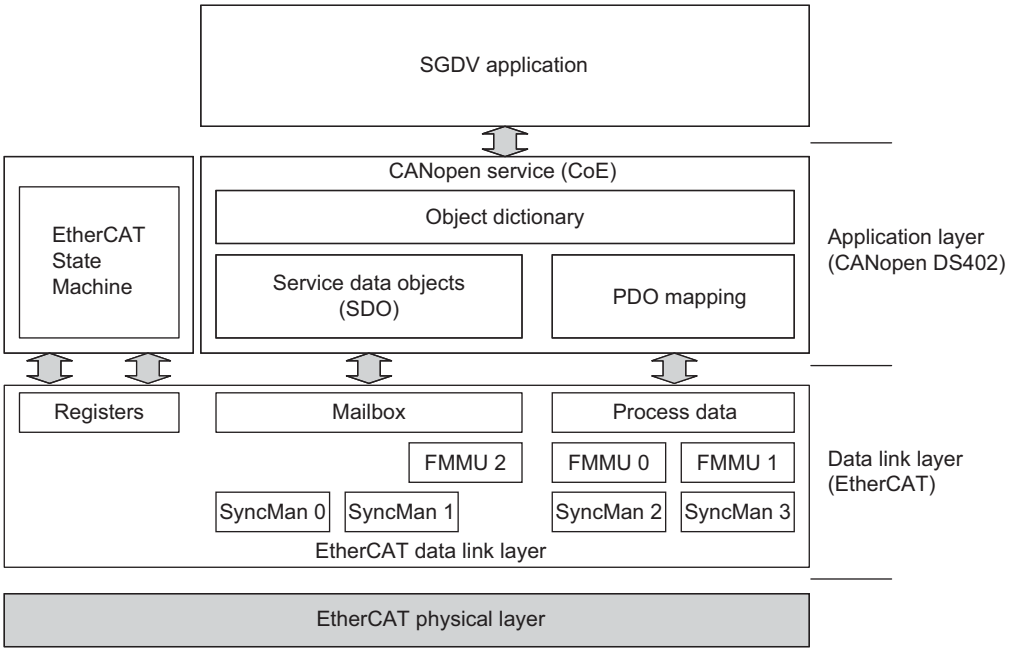
6

EtherCAT Communication

6.1 CANopen over EtherCAT Device Architecture 6-2
6.2 EtherCAT Slave Information 6-3
6.3 EtherCAT State Machine 6-4
6.4 PDO Mapping 6-5
6.5 Synchronization with Distributed Clocks 6-7
6.6 Emergency Messages 6-9

6.1 CANopen over EtherCAT Device Architecture

The following figure shows the device architecture of the SGDV CANopen over the EtherCAT (CoE) Network Module.



The EtherCAT (CoE) Network Module is composed of the EtherCAT communication in the data link layer and CANopen drive profile (DS402) in the application layer.
The object dictionary in the application layer includes parameters, application data, and PDO mapping information between the process data interface and the application data.

The process data object (PDO) is composed of objects in the object dictionary that can be mapped to the PDO, and the content of the process data is defined by the PDO mapping.
The process data communication is cyclic communication to write and read the PDO. The mailbox communication (SDO) is acyclic communication to write and read the data entry in the object dictionary.

Note 1. The EtherCAT (CoE) Network Module does not support EtherCAT ReadWrite commands (APRW, FPRW, BRW, LRW).
2. For SDO and PDO communication via EtherCAT data link layer, FMMU and Sync Manager have to configure as follows:

• Sync Manager Settings

Sync Manager	Assignment (Fixed)	Size	Start Address (Fixed)
Sync Manager 0	Assigned to Receive Mailbox	128byte (fixed)	0x1000
Sync Manager 1	Assigned to Transmit Mailbox	128byte (fixed)	0x1080
Sync Manager 2	Assigned to Receive PDO	0 to 200byte	0x1100
Sync Manager 3	Assigned to Transmit PDO	0 to 200byte	0x1358

• FMMU Settings

FMMU	Settings
FMMU 0	Mapped to Receive PDO
FMMU 1	Mapped to Transmit PDO
FMMU 2	Mapped to Fill Status of Transmit Mailbox

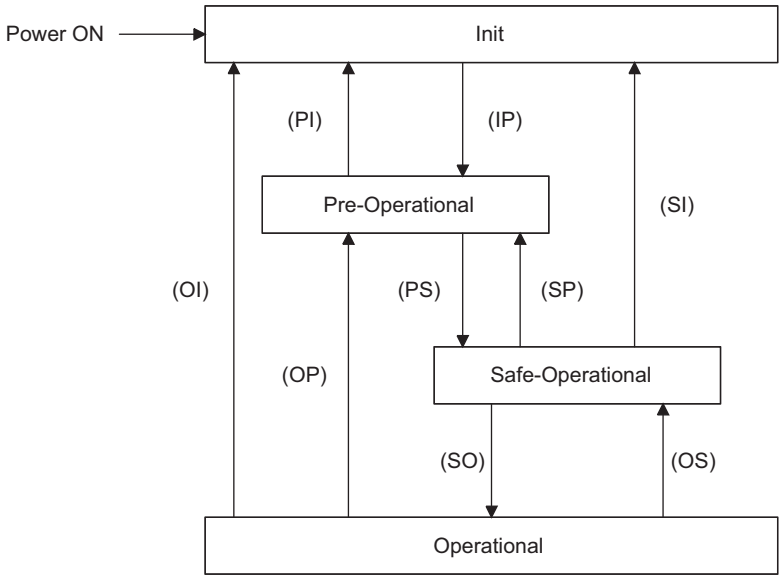
6.2 EtherCAT Slave Information

The EtherCAT Slave Information file (XML file) is available for configuring the EtherCAT master.
The XML-based file contains general information about EtherCAT communication settings when setting the SGDV SERVOPACK.
The following two files are provided for the SGDV SERVOPACK.

- For Rotary drive SGDV-****E1*: Yaskawa_SGDV-E1_CoE***.xml
- For Linear drive SGDV-****E5*: Yaskawa_SGDV-E5_CoE***.xml

6.3 EtherCAT State Machine

The EtherCAT State Machine (ESM) is responsible for the coordination of master and slave applications at start up and during operation. State changes are typically initiated by requests of the master.
The states of the EtherCAT State Machine are as follows.

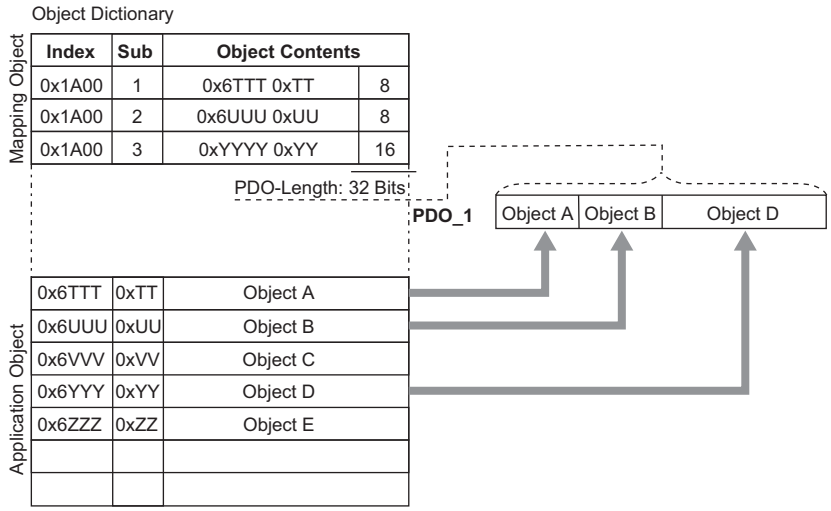


State	Description
Init	• No mailbox communication is possible. • No process data communication is possible.
Init to Pre-Op	• Master configures DL Address and SyncManager channels for Mailbox communication. • Master initializes DC clock synchronization. • Master requests 'Pre-Operational' state. • Master sets AL Control register. • Slave checks whether the mailbox was initialized correctly.
Pre-operational (Pre-Op)	• Mailbox communication is possible. • No process data communication is possible.
Pre-Op to Safe-Op	• Master configures SyncManager channels and FMMU channels for process data. • Master configures PDO mapping and the sync manager PDO assignment parameters via SDO. • Master requests 'Safe-Operational' state. • Slave checks whether the sync manager channels for process data communication and, if required, the distributed clocks settings are correct.
Safe-Operational (Safe-Op)	• Mailbox communication is possible. • Process Data communication is possible, but only Inputs are evaluated – Outputs remain in 'Safe' state.
Safe-Op to Op	• Master sends valid Outputs. • Master requests 'Operational' state.
Operational (Op)	• Mailbox communication is possible. • Process data communication is possible.

6.4 PDO Mapping

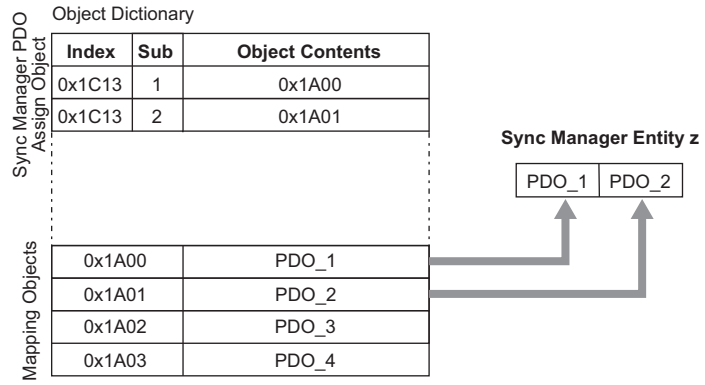
PDO mapping refers to the mapping of application objects (real time process data) from the object dictionary to the PDOs.
The PDO mapping tables are allocated to index 1600h to 1603h for the RxPDOs and 1A00h to 1A03h for the TxPDOs in the object dictionary.

The following figure shows an example of a PDO mapping.



In addition to above PDO mappings, PDOs have to be assigned to Sync Manager for the EtherCAT process data exchange.
The Sync Manager PDO Assign objects (1C12h and 1C13h) establish the relationship between these PDOs and the Sync Manager.

The following figure shows an example of Sync Manager PDO mappings.



⚠ CAUTION

The PDO mapping objects (index 1600h to 1603h, 1A00h to 1A03h) and the Sync Manager PDO assign objects (index 1C12h and 1C13h) can be written only in Pre-Operation state.

■ Setup Procedure of PDO Mapping

1. Disable the assignment of the Sync manager and PDO (Set subindex 0 of object 1C12h and 1C13h to 0).
2. Set all the mapping entry in PDO mapping objects (Set object 1600h to 1603h/1A00h to 1A03h).
3. Set the number of mapping entries in PDO mapping objects (Set subindex 0 of object 1600h to 1603h/1A00h to 1A03h).
4. Set the assignment of the Sync manager and PDO (Set subindex 1 of object 1C12h and 1C13h).
5. Enable the assignment of the Sync manager and PDO (Set subindex 0 of object 1C12h and 1C13h to 1).

■ Default PDO Mappings

The following table shows the default PDO mappings for the SGDV SERVOPACK.
The default is defined in the EtherCAT Slave Information file (XML file).

- 1st PDO Mapping (Position, Velocity, Torque, Torque limit, Touch probe)

RxPDO (1600h)	Controlword (6040h)	Target Position (607Ah)	Target Velocity (60FFh)	Target Torque (6071h)	Max. Torque (6072h)	Mode of Operation (6060h)	Padding (8bit)	Touch Probe Function (60B8h)
TxPDO (1A00h)	Statusword (6041h)	Position Actual Value (6064h)	Torque Actual Value (6077h)	Following Error Actual Value (60F4h)	Mode of Operation Display (6061h)	Padding (8bit)	Touch Probe Status (60B9h)	Touch Probe Value (60BAh)

- 2nd PDO Mapping (Cyclic synchronous Position): default PDO assignment

RxPDO (1601h)	Controlword (6040h)	Target Position (607Ah)
TxPDO (1A01h)	Statusword (6041h)	Position Actual Value (6064h)

- 3rd PDO Mapping (Cyclic synchronous Velocity)

RxPDO (1602h)	Controlword (6040h)	Target Velocity (60FFh)
TxPDO (1A02h)	Statusword (6041h)	Position Actual Value (6064h)

- 4th PDO Mapping (Cyclic synchronous Torque)

RxPDO (1603h)	Controlword (6040h)	Target Torque (6071h)	
TxPDO (1A03h)	Statusword (6041h)	Position Actual Value (6064h)	Torque Actual Value (6077h)

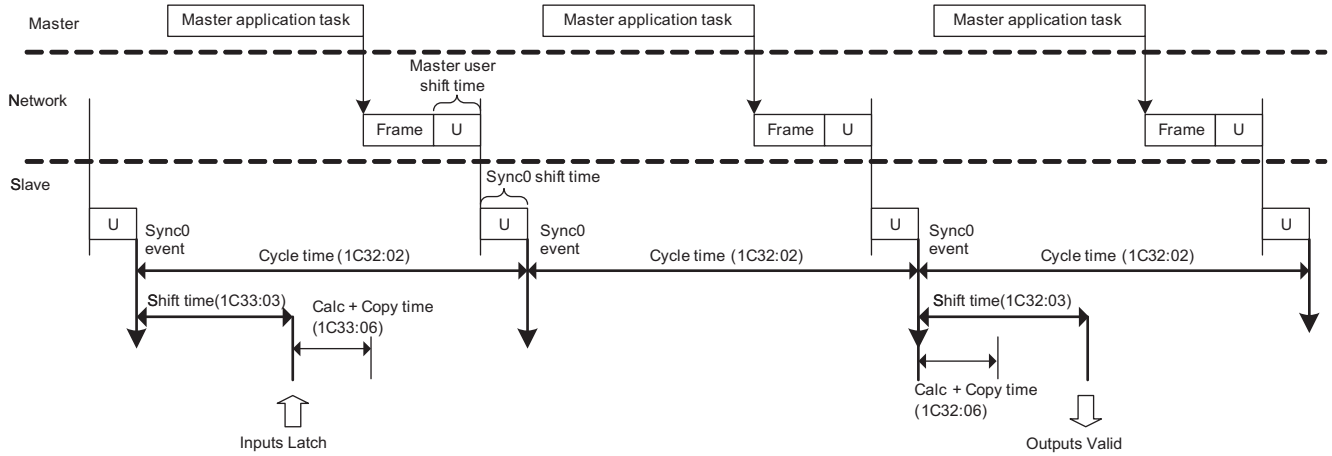
6.5 Synchronization with Distributed Clocks

The synchronization of EtherCAT communication is based on a mechanism called the Distributed Clock. With the Distributed Clock, all devices can be synchronized to each other by sharing the same reference clock (System Time). The slave devices synchronize internal applications to Sync0 event which are generated reference clock.

The following synchronization modes are available in the EtherCAT (CoE) Network Module for the SGDV SERVOPACK.
The synchronization mode can be changed by Sync Control registers (ESC register 0x980 and 981).

- Free-Run (ESC register: 0x980 = 0x0000)
  In Free Run mode, the local cycle runs independent from the communication cycle and master cycle.
- DC Mode (ESC register: 0x980 = 0x0300)
  In this mode, the SERVOPACK can be synchronized to the EtherCAT master with the Sync0 event.

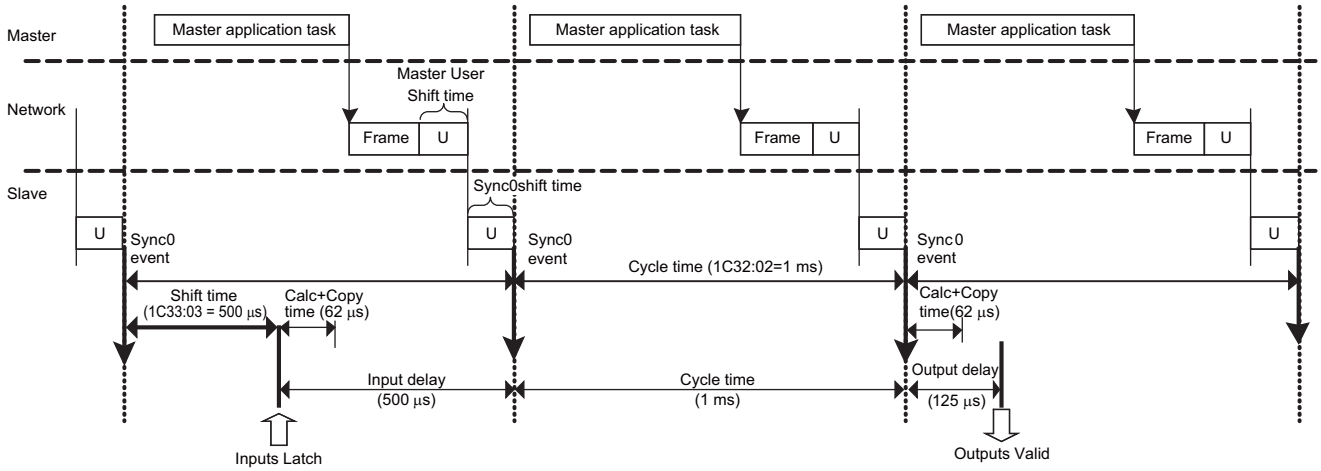
  The following figure shows timing chart of this DC synchronization.



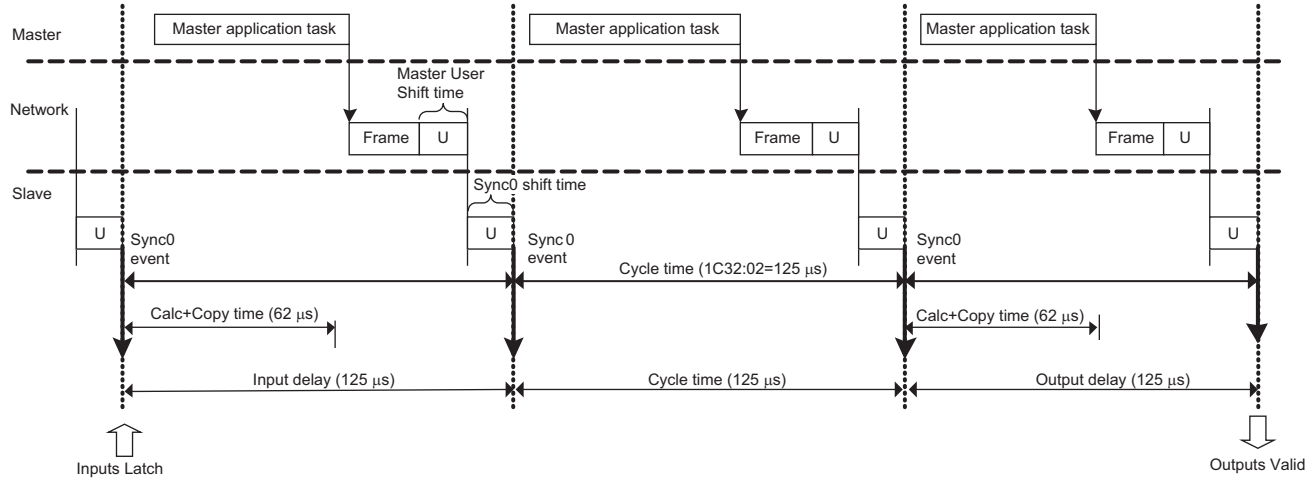
Index	Sub	Name	Access	PDO Mapping	Type	Value
1C32h	Sync Manager channel 2 (process data output) Synchronization					
	1	Synchronization type	RO	No	UINT	Current status of DC mode 0: Free-run 2: DC Mode (Synchronous with Sync0)
	2	Cycle time	RO	No	UDINT	Sync0 event cycle [ns] (The value is set by master via ESC register.) range: 125000*n (n = 1–32) [ns]
	3	Shift time	RO	No	UDINT	125000 [ns] (Fixed value) Time between Sync0 event and the Outputs Valid (At the Outputs Valid the outputs are available for the SERVOPACK.)
	6	Calc and copy time	RO	No	UDINT	62500 [ns] (Fixed value) Time for reading the outputs from SyncManager 2 at Sync0 event
1C33h	Sync Manager channel 3 (process data input) Synchronization					
	3	Shift time	RW	No	UDINT	125000*n (n = 1–32) [ns] Range: 0 to (Synq0 event cycle - 125000) [ns] Time between Sync0 event and the Inputs Latch. (At the Inputs Latch the inputs are acquired from the SERVOPACK.)
	6	Calc and copy time	RO	No	UDINT	62500 [ns] (Fixed value) Time for the copying of the input process data to the SyncManager 3 area.

■ Example of PDO Data Exchange Timing with DC Mode

• DC Cycle Time = 1ms, Input Shift Time = 500 μs



• DC Cycle Time = 125 μs, Input Shift Time = 0 μs



6.6 Emergency Messages

The emergency messages are triggered by the alarms and warnings detected within the SGDV servo drive. The transmission is executed via the mailbox interface.

The Emergency Telegram consists of eight bytes with the data as shown in table below:

Byte	0	1	2	3	4	5	6	7
Content	Emergency Error Code (FF00h)*1		Error Register (Object 1001h)	Reserved	Manufacturer Specific Error Field			
					SGDV Alarm/Warning Code*2		Reserved	

∗1. Manufacturer-specific error code FF00h is always used.
∗2. For details on alarms and warnings of the SERVOPACK, refer to *Chapter 9 Troubleshooting*.

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7

CiA402 Drive Profile

7.1 Device Control 7-2

7.2 Modes of Operation 7-4

7.3 Position Control Modes 7-5

7.3.1 Profile Position Mode 7-5
7.3.2 Interpolated Position Mode 7-7
7.3.3 Cyclic Synchronous Position Mode 7-8

7.4 Homing 7-9

7.5 Velocity Control Modes 7-12

7.5.1 Profile Velocity Mode 7-12
7.5.2 Cyclic Synchronous Velocity Mode 7-13

7.6 Torque Control Modes 7-14

7.6.1 Profile Torque Mode 7-14
7.6.2 Cyclic Sync Torque Mode 7-15

7.7 Torque Limit Function 7-16

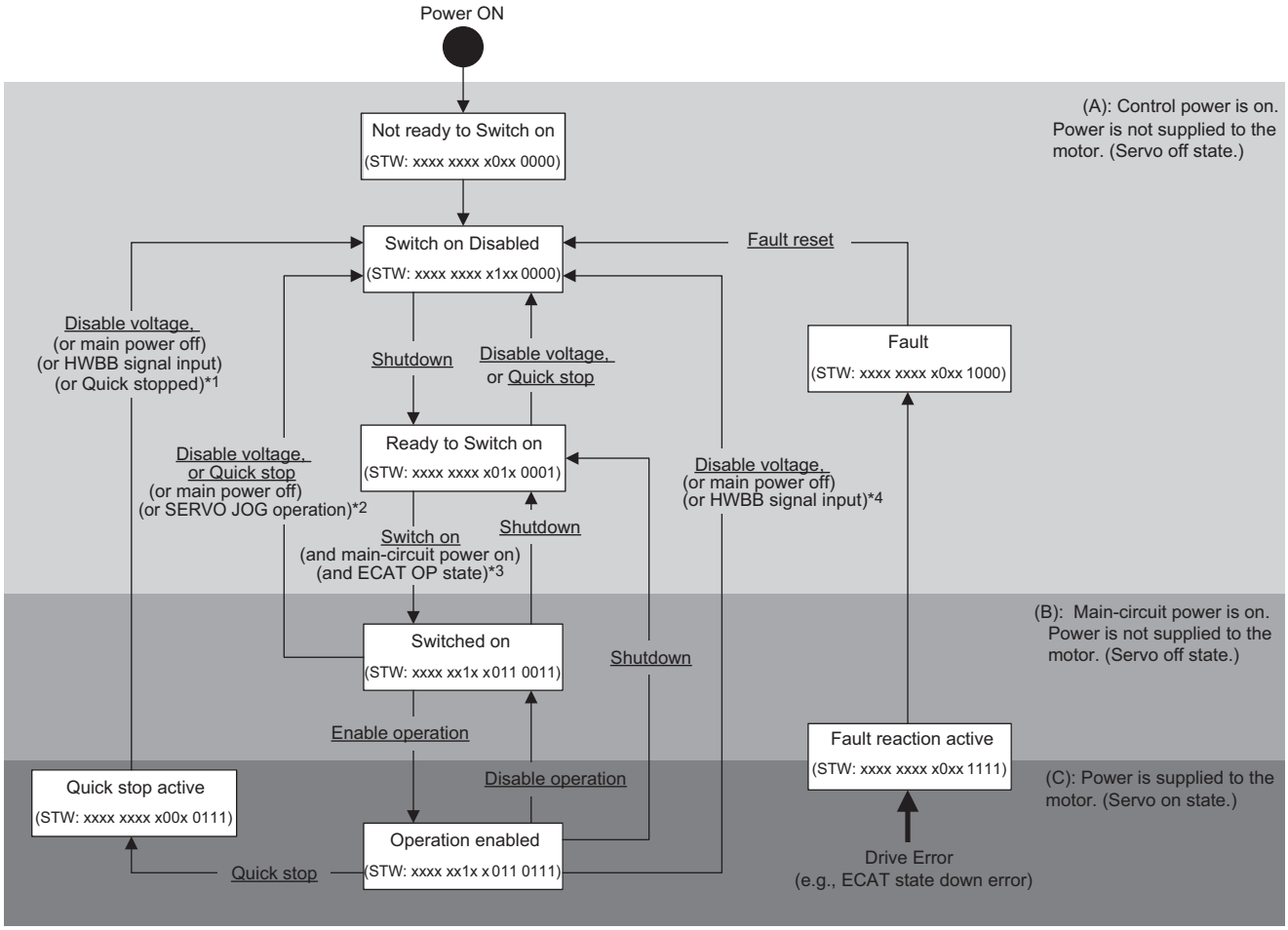
7.8 Digital Inputs and Outputs 7-16

7.9 Touch Probe Function 7-17

7.10 Fully-closed Control 7-19

7.1 Device Control

The device control of the SGDV SERVOPACK can be used to carry out all the motion functions in the corresponding modes. The state machine is controlled through the Controlword (Object 6040h). The status of the state machine can be revealed by using the Statusword (Object 6041h).



∗1. In Quick stop Active state, the SGDV SERVOPACK automatically transits to the Switch on Disabled state at the following cases:
-The main power supply was turned off.
-HWBB signal was inputted.
-The motor was stopped.

∗2. In Switched on state, the SGDV SERVOPACK automatically transits to the Switch on Disabled state at the following cases:
-The main power supply was turned off.
-Motor operation was already enabled by the digital operator or the engineering tool (SigmaWin+).

∗3. In Ready to Switch on state, the SGDV SERVOPACK transits to the next state in the following cases:
-The main power supply was turned on.
-EtherCAT State Machine (ESM) is in Operational state.
-The servomotor is not run by the digital operator on SigmaWin+ .

∗4. In Operation Enabled state, the SGDV SERVOPACK automatically transits to the Switch on Disabled state at the following cases:
-The main power supply was turned off.
-HWBB signal was inputted.

Note 1. ☐ shows state.
2. STW means the Statusword of Object 6041h.
3. _____ (underline) means the control command of Object 6040h.

(1) State Machine Controlling Command

Command	Bits of the Controlword (6040h)				
	Bit7	Bit3	Bit2	Bit1	Bit0
Shutdown	0	–	1	1	0
Switch on	0	0	1	1	1
Switch on + Enable operation	0	1	1	1	1
Disable voltage	0	–	–	0	–
Quick stop	0	–	0	1	–
Disable operation	0	0	1	1	1
Enable operation	0	1	1	1	1
Fault reset	0 → 1	–	–	–	–

(2) Bits of Statusword (6041h)

Bit No	Data Description	Note
0	Ready to switch on	For details, refer to *8.6 (3) Statusword (6041h)*.
1	Switched on	
2	Operation enabled	
3	Fault	
4	Voltage enabled	
5	Quick stop	
6	Switch on disabled	
7	Warning	
8	–	
9	Remote	
10	Target reached	
11	Internal limit active	
12	Operation mode specific	
13		
14	Torque limit active	
15	–	

(3) Related Objects

Index	Sub	Name	Access	PDO Mapping	Units	Type
6040h	–	Controlword	RW	Yes	–	UINT
6041h	–	Statusword	RO	Yes	–	UINT
605Ah	–	Quick Stop Option Code	RW	No	–	INT
605Bh	–	Shutdown Option Code	RW	No	–	INT
605Ch	–	Disable Operation Option Code	RW	No	–	INT
605Dh	–	Halt Option Code	RW	No	–	INT
605Eh	–	Fault Reaction Option Code	RW	No	–	INT

7.2 Modes of Operation

The SGDV SERVOPACK supports the following modes of operation:

- Profile Position mode
- Homing mode
- Interpolated Position mode
- Profile Velocity mode
- Torque Profile mode
- Cyclic Sync Position mode
- Cyclic Sync Velocity mode
- Cyclic Sync Torque mode

■ Related Objects

Index	Sub	Name	Access	PDO Mapping	Units	Type
6060h	–	Modes of Operation	RW	Yes	–	SINT
6061h	–	Modes of Operation Display	RO	Yes	–	SINT
6502h	–	Supported Drive Modes	RO	No	–	UDINT

■ Dynamic Mode Change

The operation mode can be switched by writing the Object 6060h. The master has the responsibility to update all operation mode specific process data objects together with the selection of the operation mode at the same time.
If the master selects a new operation mode, the SGDV SERVOPACK changes to the new operation mode immediately.
The following table shows the behavior at the changing a new operation mode from the other mode.

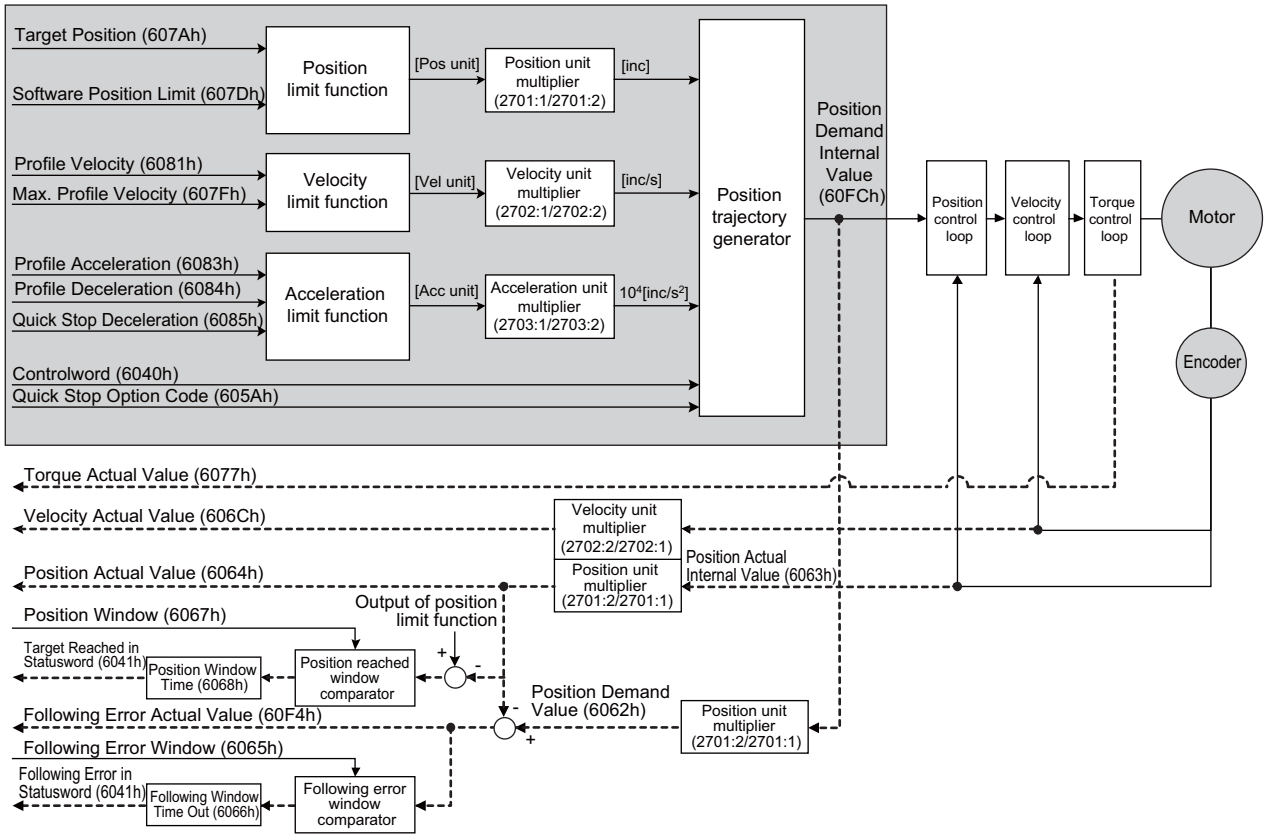
New Operation Mode	Behavior at the Changing a New Operation Mode
Profile Position mode	Controlword bit4 = 0: Operation mode is changed, but motor will be stopped. Controlword bit4 = 1: New positioning will be started immediately.
Homing mode	Controlword bit4 = 0: Operation mode is changed, but motor will be stopped. Controlword bit4 = 1: Homing will be started immediately.
Interpolated Position mode	Controlword bit4 = 0: Operation mode is changed, but motor will be stopped. Controlword bit4 = 1: New positioning will be started immediately.
Profile Velocity mode	New operation mode will be started immediately.
Torque Profile mode	New operation mode will be started immediately.
Cyclic Sync Position mode	New operation mode will be started immediately.
Cyclic Sync Velocity mode	New operation mode will be started immediately.
Cyclic Sync Torque mode	New operation mode will be started immediately.

7.3 Position Control Modes

7.3.1 Profile Position Mode

The Profile Position mode is used to start positioning to the Target position with the Profile velocity and the Profile acceleration.

The following figure shows the block diagram of the Profile Position mode.



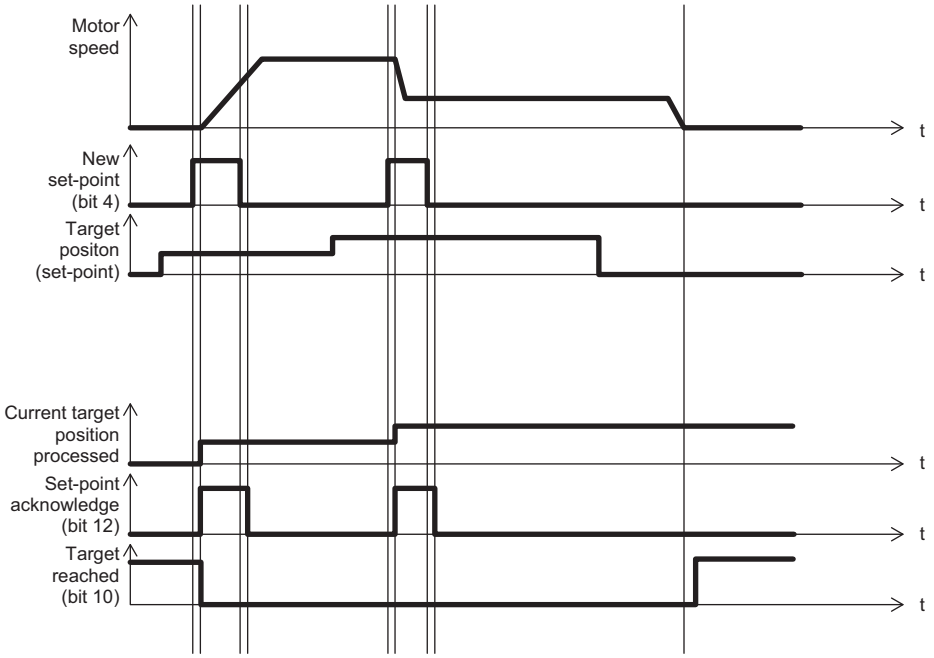
■ Related Objects

Index	Sub	Name	Access	PDO Mapping	Units	Type
6040h	–	Controlword	RW	Yes	–	UINT
6041h	–	Statusword	RO	Yes	–	UINT
607Ah	–	Target Position	RW	Yes	Pos units	DINT
607Dh	–	Software Position Limit	–	–	–	–
	1	Min. position limit	RW	No	Pos units	DINT
	2	Max. position limit	RW	No	Pos units	DINT
607Fh	–	Max. Profile Velocity	RW	No	Vel units	UDINT
6081h	–	Profile Velocity	RW	Yes	Vel units	UDINT
6083h	–	Profile Acceleration	RW	Yes	Acc units	UDINT
6084h	–	Profile Deceleration	RW	Yes	Acc units	UDINT
6085h	–	Quick Stop Deceleration	RW	Yes	Acc units	UDINT

In Profile Position mode, the following two methods can be used to start positioning.

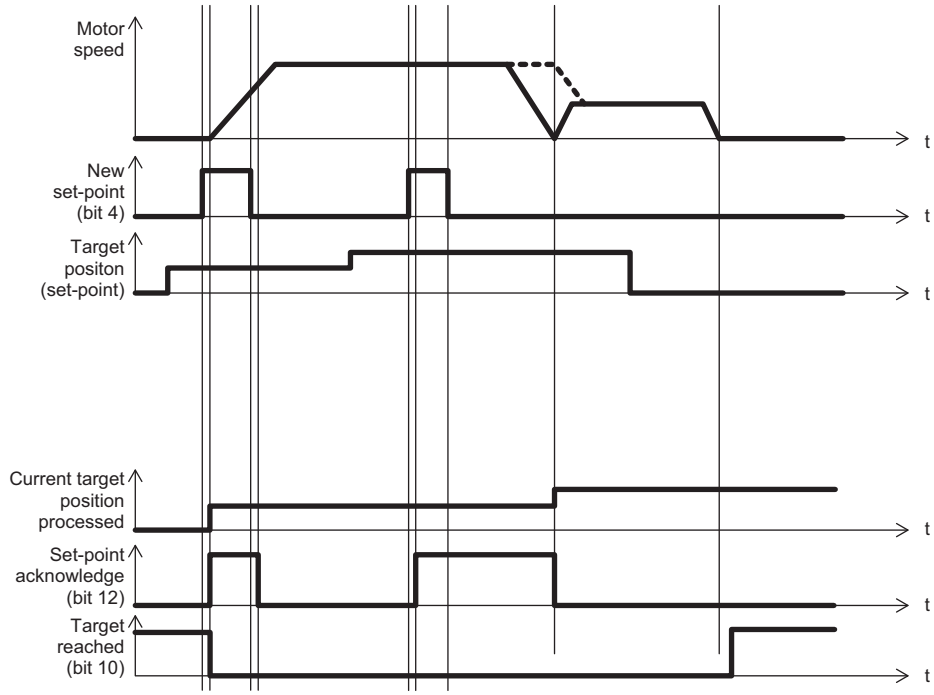
- Single Set-point (*change set immediately* bit of Controlword is 1)

  When a set-point is in progress and a new set-point is validated by the new set-point (bit 4) in the Controlword, the new set-point shall be processed immediately.



- Set of Set-points (*change set immediately* bit of Controlword is 0)

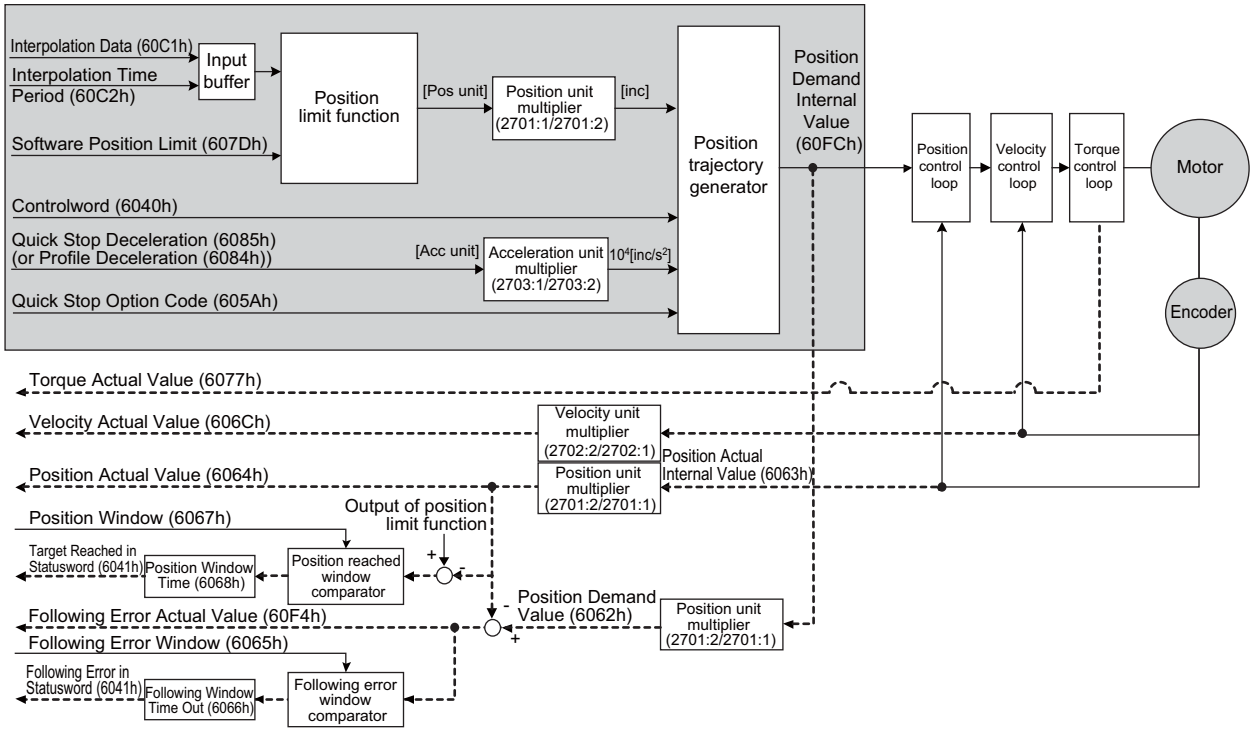
  When a set-point is in progress and a new set-point is validated by the new set-point (bit 4) in the Controlword, the new set-point shall be processed only after the previous has been reached.
  The additional dotted line segment in the following figure shows the actual speed if the *change of set point* bit (bit 9) is set to 1.



7.3.2 Interpolated Position Mode

The Interpolated Position mode is used to control multiple coordinated axes or a single axis with the need for time-interpolation of set-point data. The Interpolated Position mode normally uses time synchronization mechanisms for a time coordination of the related drive units.
The interpolation time period defines the update cycle of the interpolation data.
The intercycle interpolation will be performed based on this settings.
The interpolation data is interpreted as absolute value.

The following figure shows the block diagram of the Interpolated Position mode.



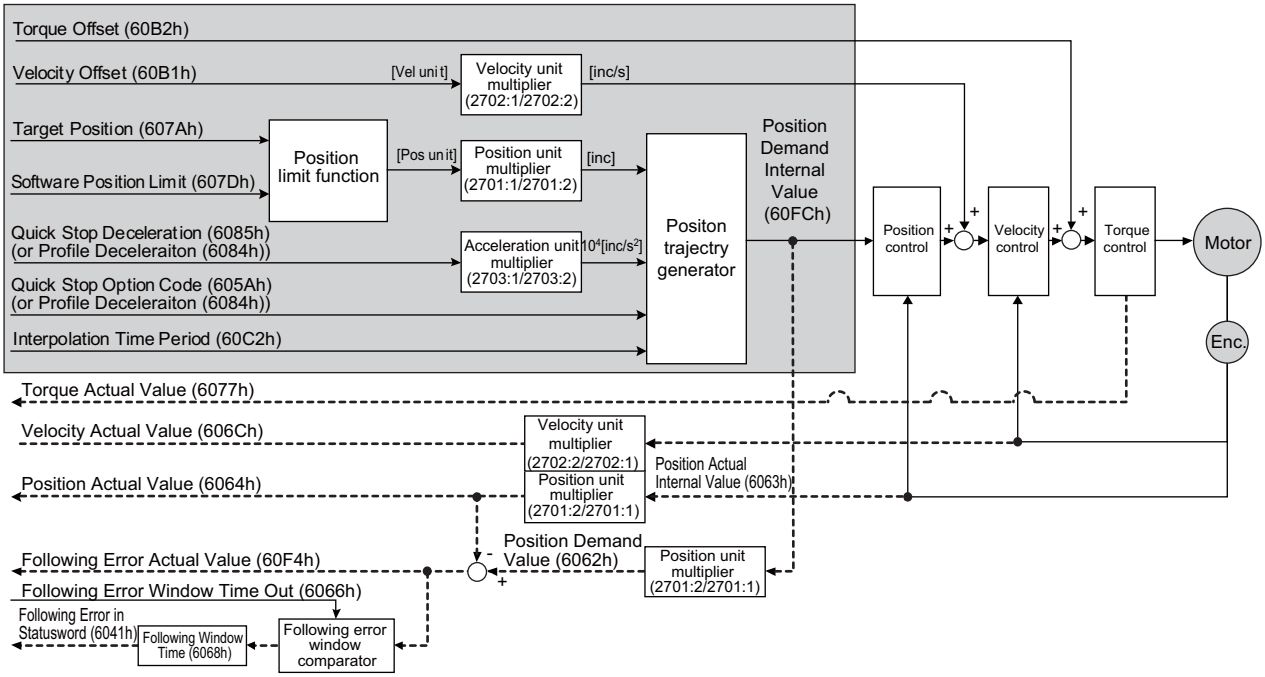
■ Related Objects

Index	Sub	Name	Access	PDO Mapping	Units	Type
6040h	–	Controlword	RW	Yes	–	UINT
6041h	–	Statusword	RO	Yes	–	UINT
60C1h	1	Interpolation Data	RW	Yes	Pos units	DINT
607Dh	–	Software Position Limit	–	–	–	–
	1	Min. position limit	RW	No	Pos units	DINT
	2	Max. position limit	RW	No	Pos units	DINT
6084h	–	Profile Deceleration	RW	Yes	Acc units	UDINT
6085h	–	Quick Stop Deceleration	RW	Yes	Acc units	UDINT
60C2h	–	Interpolation Time Period	–	–	–	–
	1	Interpolation time period	RO	No	–	USINT
	2	Interpolation time index	RO	No	–	SINT

7.3.3 Cyclic Synchronous Position Mode

The Cyclic Synchronous Position mode is used for the interpolated positioning in the same way as Interpolated Position mode. In this mode, additive velocity and torque values can be provided by the master to allow for velocity and torque feed forward.
The interpolation time period defines the interval at which the target position is updated. Interpolation is performed in accordance with this setting.
The target position is interpreted as absolute value.

The following figure shows the block diagram of the Cyclic Synchronous Position mode.



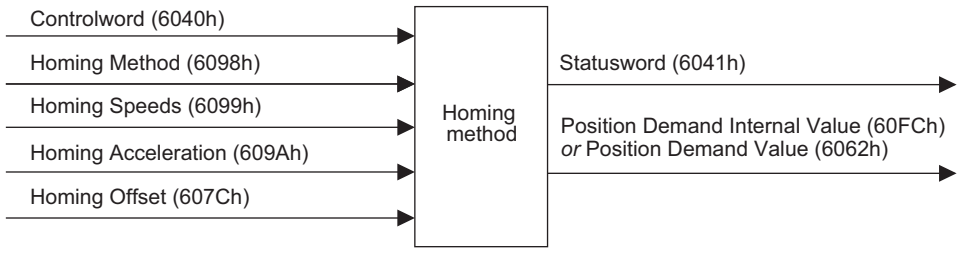
■ Related Objects

Index	Sub	Name	Access	PDO Mapping	Units	Type
607Ah	–	Target Position	RW	Yes	Pos units	DINT
607Dh	–	Software Position Limit	–	–	–	–
	1	Min. position limit	RW	No	Pos units	DINT
	2	Max. position limit	RW	No	Pos units	DINT
6084h	–	Profile Deceleration	RW	Yes	Acc units	UDINT
6085h	–	Quick Stop Deceleration	RW	Yes	Acc units	UDINT
60B1h	–	Velocity Offset	RW	Yes	Vel units	DINT
60B2h	–	Torque Offset	RW	Yes	0.1% *	INT
60C2h	–	Interpolation Time Period	–	–	–	–
	1	Interpolation time period	RO	No	–	USINT
	2	Interpolation time index	RO	No	–	SINT

* The motor rated torque is 100%.

7.4 Homing

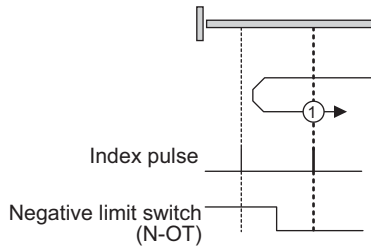
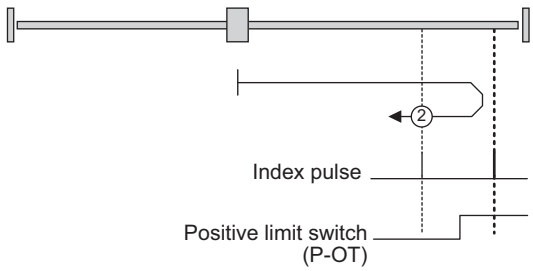
The following figure shows the defined input objects as well as the output objects. The user may specify the speeds, acceleration and the method of homing. There is a further object home offset, which allows the user to displace zero in the user's coordinate system from the home position.

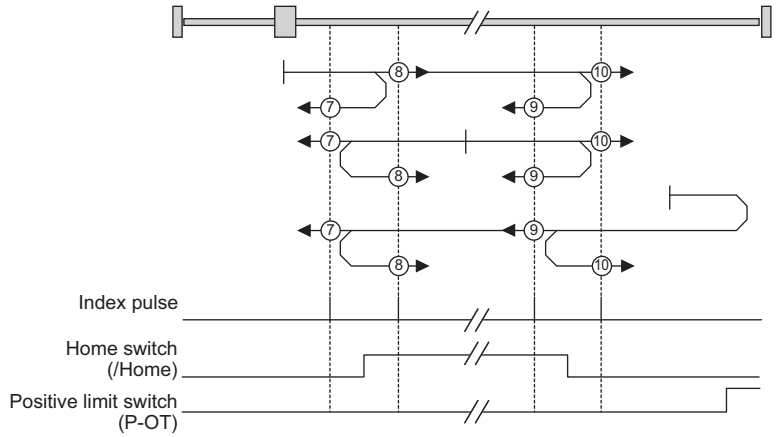
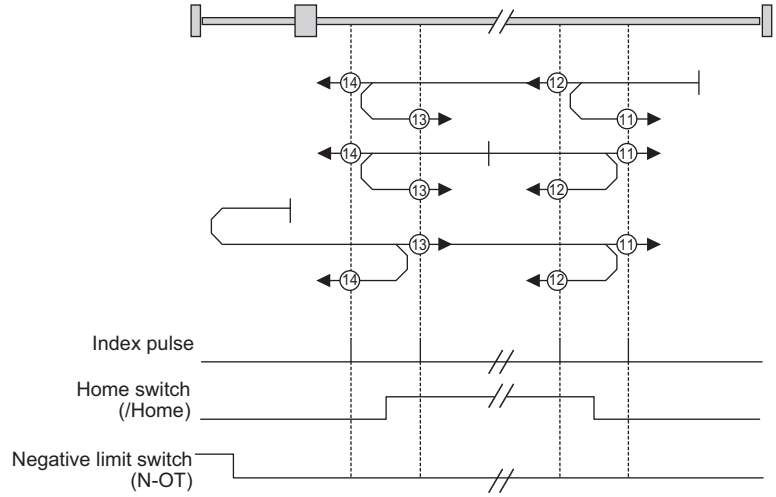
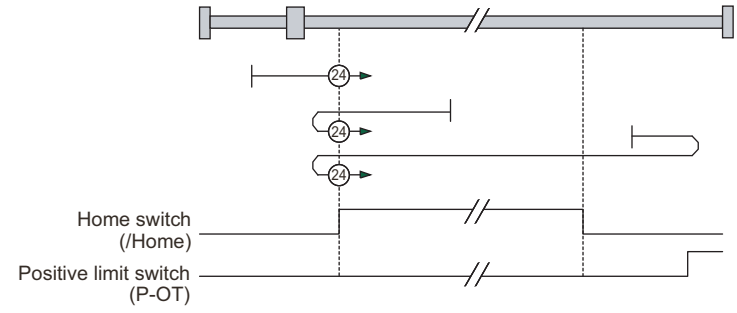


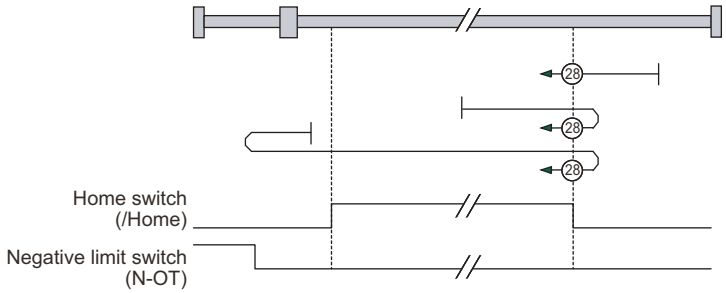
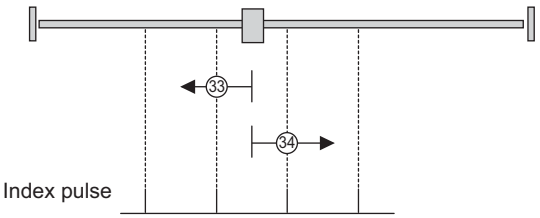
■ Related Objects

Index	Sub	Name	Access	PDO Mapping	Units	Type
6040h	–	Controlword	RW	Yes	–	UINT
6041h	–	Statusword	RO	Yes	–	UINT
607Ch	–	Home Offset	RW	No	Pos units	DINT
6098h	–	Homing Method	RW	Yes	–	SINT
6099h	–	Homing Speeds	–	–	–	–
	1	Speed during search for switch	RW	Yes	Vel units	UDINT
	2	Speed during search for zero	RW	Yes	Vel units	UDINT
609Ah	–	Homing Acceleration	RW	Yes	Acc units	UDINT

■ Homing Method (6098h)

Value	Definitions	Explanation
0	–	No homing (Default value)
1	Homing on the negative limit switch and index pulse	Using this method, the initial direction of movement shall be leftward if the negative limit switch is inactive. The home position shall be at the first index pulse to the right of the position where the negative limit switch becomes inactive. 
2	Homing on the positive limit switch and index pulse	Using this method, the initial direction of movement shall be rightward if the positive limit switch is inactive. The position of home shall be at the first index pulse to the left of the position where the positive limit switch becomes inactive. 

Value	Definitions	Explanation
7 to 10	Homing on home switch and index pulse -positive initial motion	Using the methods 7 to 10, the initial direction of movement shall be to the right except if the home switch is active at the start of the motion. In this case, the initial direction of motion shall be dependent on the edge being sought. The home position shall be at the index pulse on either side of the rising or falling edges of the home switch. If the initial direction of movement leads away from the home switch, the drive shall reverse on encountering the relevant limit switch. 
11 to 14	Homing on home switch and index pulse -negative initial motion	This method is similar to methods 7 to 10 except that the initial direction of movement shall be to the left. 
24	Homing on home switch -positive initial motion	This method is same as method 8 except that the home position does not depend on the index pulse but only depend on the relevant home or limit switch transitions. 

Value	Definitions	Explanation
28	Homing on home switch -negative initial motion	This method is same as method 12 except that the home position does not depend on the index pulse but only depend on the relevant home or limit switch transitions. 
33, 34	Homing on index pulse	
35	Homing on the current position	In this method, the current position shall be taken to be the home position. This method does not require the drive device to be in *operational enabled* state.

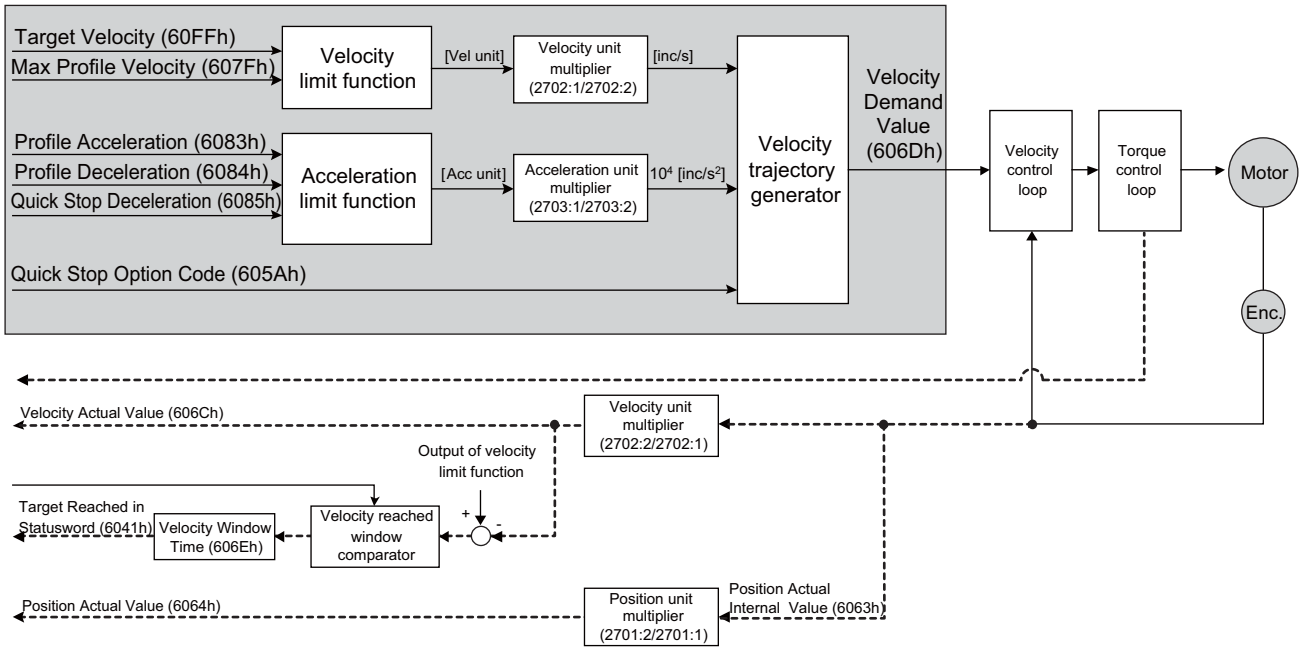
Note: The index pulse is recognized as the encoder zero signal (phase-C).

7.5 Velocity Control Modes

7.5.1 Profile Velocity Mode

In the Profile Velocity mode, the speed is output in accordance with the Profile acceleration and Profile deceleration, until it reaches the target velocity.

The following figure shows the block diagram of the Profile Velocity mode.



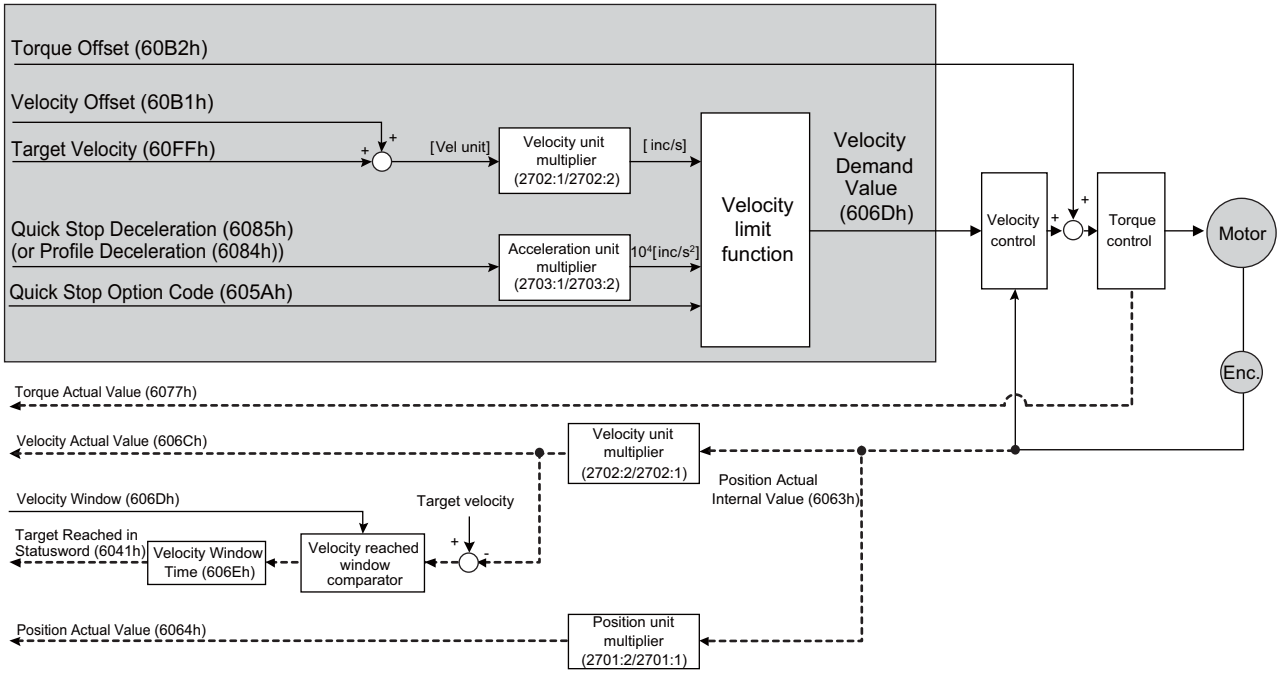
■ Related Objects

Index	Sub	Name	Access	PDO Mapping	Units	Type
60FFh	–	Target Velocity	RW	Yes	Vel units	DINT
607Fh	–	Max. Profile Velocity	RW	No	Vel units	UDINT
6083h	–	Profile Acceleration	RW	Yes	Acc units	UDINT
6084h	–	Profile Deceleration	RW	Yes	Acc units	UDINT
6085h	–	Quick Stop Deceleration	RW	Yes	Acc units	UDINT
606Bh	–	Velocity Demand Value	RO	Yes	Vel units	DINT
606Ch	–	Velocity Actual Value	RO	Yes	Vel units	DINT
606Dh	–	Velocity Window	RW	No	Vel units	UINT
606Eh	–	Velocity Window Time	RW	No	ms	UINT

7.5.2 Cyclic Synchronous Velocity Mode

In Cyclic Synchronous Velocity mode, the master provides a target velocity to the drive device, which performs velocity control. In this mode, additive torque values can be provided by the master to allow for torque feed forward.

The following figure shows the block diagram of the Cyclic Synchronous Velocity mode.



■ Related Objects

Index	Sub	Name	Access	PDO Mapping	Units	Type
60FFh	–	Target Velocity	RW	Yes	Vel units	DINT
60B1h	–	Velocity Offset	RW	Yes	Vel units	DINT
60B2h	–	Torque Offset	RW	Yes	0.1% *	INT
6084h	–	Profile Deceleration	RW	Yes	Acc units	UDINT
6085h	–	Quick Stop Deceleration	RW	Yes	Acc units	UDINT
606Bh	–	Velocity Demand Value	RO	Yes	Vel units	DINT
606Ch	–	Velocity Actual Value	RO	Yes	Vel units	DINT
606Dh	–	Velocity Window	RW	No	Vel units	UINT
606Eh	–	Velocity Window Time	RW	No	ms	UINT

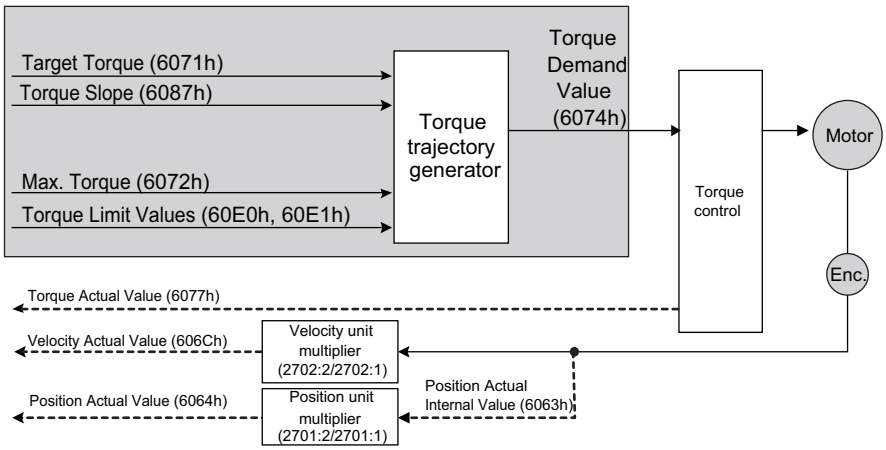
* The motor rated torque is 100%.

7.6 Torque Control Modes

7.6.1 Profile Torque Mode

In the Profile Torque mode, the torque is output to the target torque based on the torque slope setting.

The following figure shows the block diagram of the Profile Torque mode.



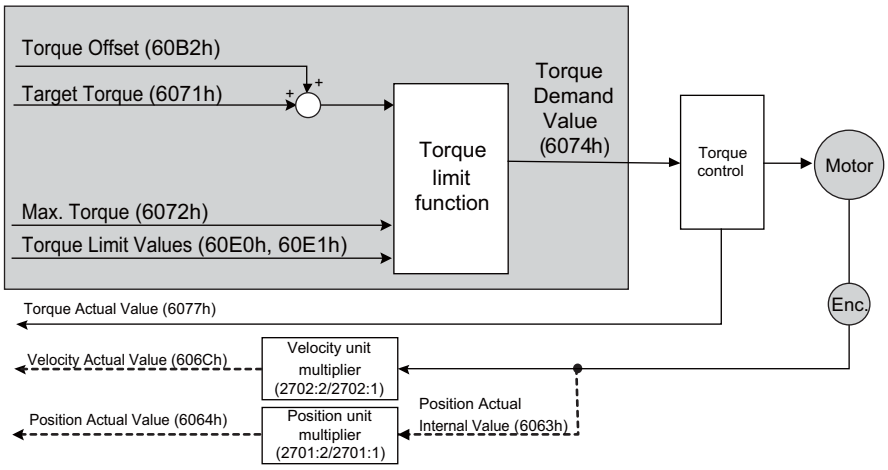
■ Related Objects

Index	Sub	Name	Access	PDO Mapping	Units	Type
6071h	–	Target Torque	RW	Yes	0.1% *	INT
6087h	–	Torque Slope	RW	Yes	0.1%/s *	UDINT
6074h	–	Torque Demand Value	RO	Yes	0.1% *	INT
6077h	–	Torque Actual Value	RO	Yes	0.1% *	INT
6072h	–	Max. Torque	RW	Yes	0.1% *	UINT
60E0h	–	Positive Torque Limit Value	RW	Yes	0.1% *	UINT
60E1h	–	Negative Torque Limit Value	RW	Yes	0.1% *	UINT

* The motor rated torque is 100%.

7.6.2 Cyclic Sync Torque Mode

In Cyclic Synchronous Torque mode, the master provides a target torque to the drive device, which performs torque control.



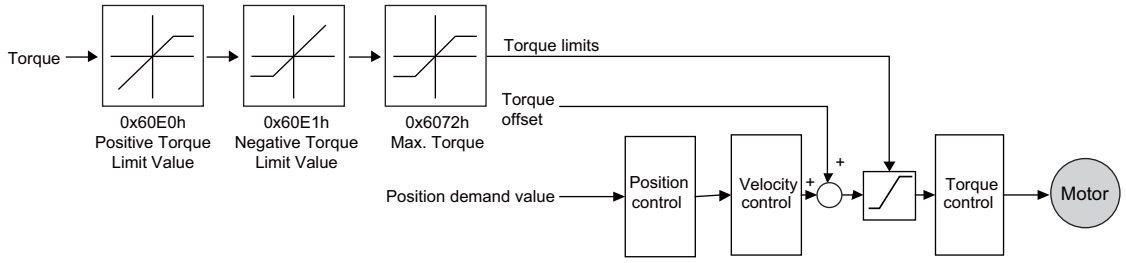
■ Related Objects

Index	Sub	Name	Access	PDO Mapping	Units	Type
6071h	–	Target Torque	RW	Yes	0.1% *	INT
6074h	–	Torque Demand Value	RO	Yes	0.1% *	INT
6077h	–	Torque Actual Value	RO	Yes	0.1% *	INT
60B2h	–	Torque Offset	RW	Yes	0.1% *	INT
6072h	–	Max. Torque	RW	Yes	0.1% *	UINT
60E0h	–	Positive Torque Limit Value	RW	Yes	0.1% *	UINT
60E1h	–	Negative Torque Limit Value	RW	Yes	0.1% *	UINT

* The motor rated torque is 100%.

7.7 Torque Limit Function

The following figure shows the block diagram of the torque limit function. The torque is limited by the lowest limiting values.



■ Related Objects

Index	Sub	Name	Access	PDO Mapping	Units	Type
6072h	–	Max. Torque	RW	Yes	0.1% *	UINT
60E0h	–	Positive Torque Limit Value	RW	Yes	0.1% *	UINT
60E1h	–	Negative Torque Limit Value	RW	Yes	0.1% *	UINT

* The motor rated torque is 100%.

7.8 Digital Inputs and Outputs

The Digital Inputs and Digital Outputs are used to control the I/O signals of the SERVOPACK CN1.

Index	Sub	Name	Access	PDO Mapping	Units	Type
60FDh	–	Digital Inputs	RO	Yes	–	UDINT
60FEh	–	Digital Outputs	–	–	–	–
	1	Physical outputs	RW	Yes	–	UDINT
	2	Bit mask	RW	No	–	UDINT

7.9 Touch Probe Function

The feedback position can be latched with the following trigger events:

- Trigger with touch probe 1 input (SERVOPACK CN1 /Probe1 (SI4) signal)
- Trigger with touch probe 2 input (SERVOPACK CN1 /Probe2 (SI5) signal)
- Trigger with encoder zero signal (C-phase)

The following two touch probe functions can be used at the same time.

<Touch Probe 1 Latch function>
- Latch Control object: 60B8h (Bit 0 to 7)
- Latch Status object: 60B9h (Bit 0 to 7)
- Latch Position is always stored to the Touch Probe1 Position Value (60BAh).
- Trigger signal: Encoder zero signal or /Probe1 signal (SI4)

<Touch Probe 2 Latch function>
- Latch Control object: 60B8h (Bit 8 to 15)
- Latch Status object: 60B9h (Bit 8 to 15)
- Latch Position is always stored to the Touch Probe2 Position Value (60BCh).
- Trigger signal: /Probe2 signal (SI5)

Connector pin allocations and positive/negative logics of /Probe1 (SI4) and /Probe2 (SI5) signals can be changed on the SERVOPACK object 2511h (Pn511).

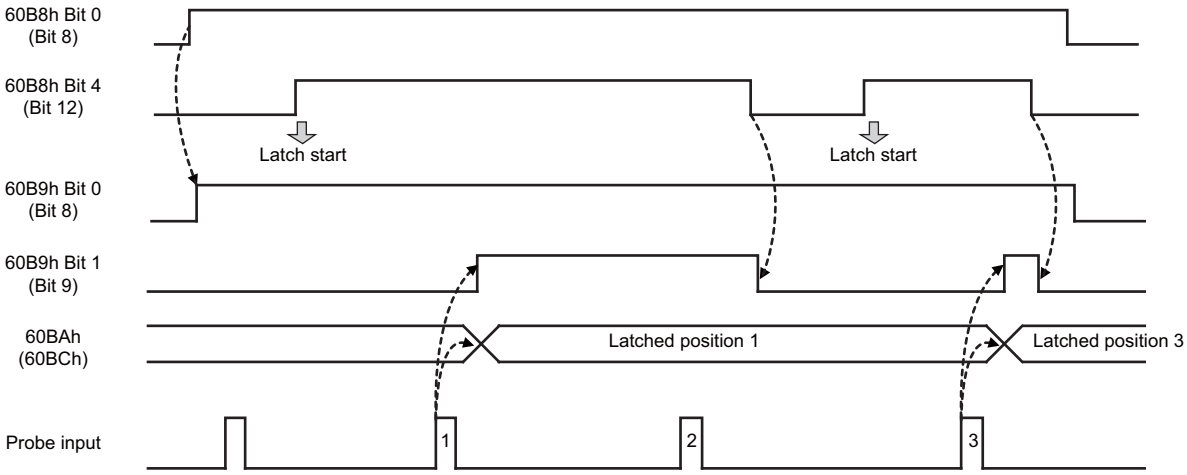
Note: When the homing function is executing, touch probe 1 function cannot be used. If touch probe 1 function was already enabled, touch probe 1 will be switched off.

■ Related Objects

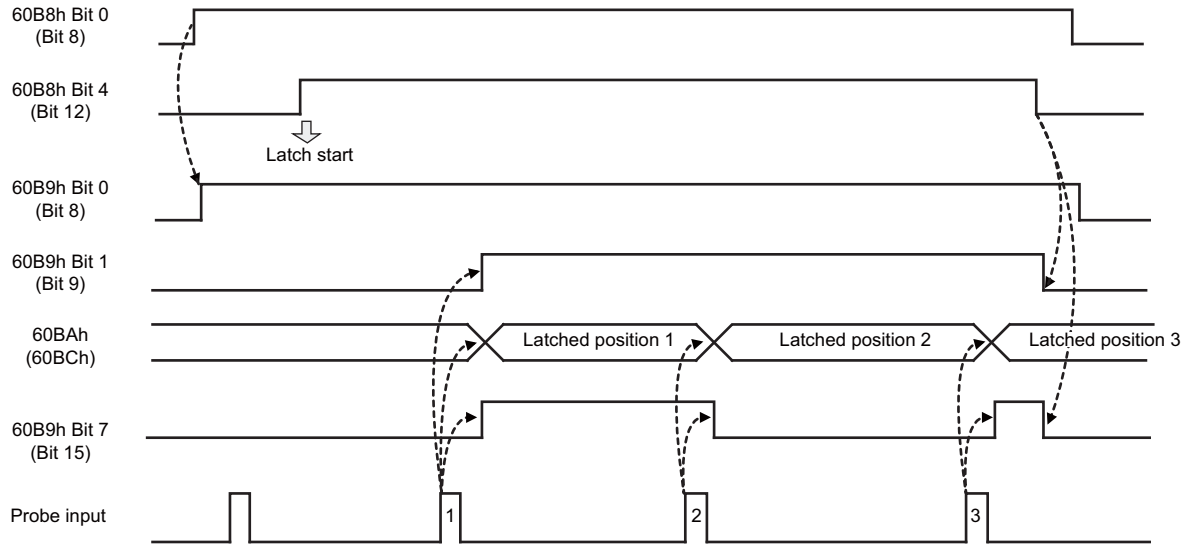
Index	Sub	Name	Access	PDO Mapping	Units	Type
60B8h	–	Touch Probe Function	RW	Yes	–	UINT
60B9h	–	Touch Probe Status	RO	Yes	–	UINT
60BAh	–	Touch Probe 1 Position Value	RO	Yes	Pos units	DINT
60BCh	–	Touch Probe 2 Position Value	RO	Yes	Pos units	DINT

■ Example of Handshaking Procedure for the Touch Probe Function

- Single Trigger Mode (60B8h bit1 = 0, or bit9 = 0)

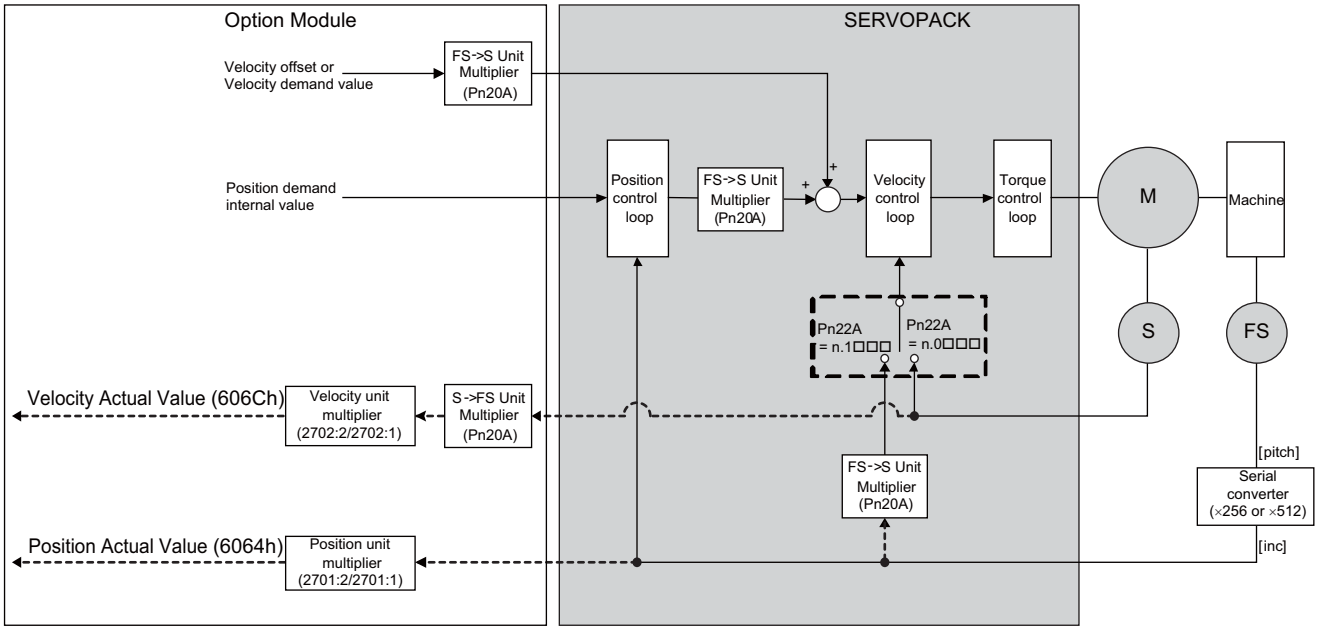


- Continuous Trigger Mode (60B8h bit1 = 1, or bit9 = 1)



7.10 Fully-closed Control

The following figure shows the block diagram of the fully-closed control.



■ Setting Parameters

The basic setting procedure of related parameters is shown below.

Step	Description	Setting Parameters
1	Set the speed feedback method during fully-closed loop control.	Object 222Ah (Pn22A)
2	Set the motor rotating direction.	Object 2000h (Pn000.0) Object 2002h (Pn002.3)
3	Set the number of pitches (cycles) of the sine wave for the external scale.	Object 220Ah (Pn20A)
4	Set the electronic gear.	Object 2701:01h (PnB02) Object 2701:02h (PnB04)
5	Set the alarm detection level for the external encoder.	Object 251Bh (Pn51B) Object 252Ah (Pn52A)

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8

Object Dictionary

8.1 Object Dictionary List 8-2
8.2 General Objects 8-4
8.3 PDO Mapping Objects 8-8
8.4 Sync Manager Communication Objects 8-12
8.5 Manufacturer Specific Objects 8-15
8.6 Device Control 8-21
8.7 Profile Position Mode 8-30
8.8 Homing Mode 8-32
8.9 Position Control Function 8-34
8.10 Interpolated Position Mode 8-36
8.11 Cyclic Synchronous Position Mode 8-37
8.12 Profile Velocity/Cyclic Synchronous Velocity Mode 8-38
8.13 Profile Torque/Cyclic Synchronous Torque Mode 8-39
8.14 Torque Limit Function 8-40
8.15 Touch Probe Function 8-41
8.16 Digital Inputs/Outputs 8-43

8.1 Object Dictionary List

The following table shows the object dictionaries.

Object Dictionaries		Refer to
General Objects	Device Type (1000h)	8.2
	Error Register (1001h)	8.2
	Manufacturer Device Name (1008h)	8.2
	Manufacturer Software Version (100Ah)	8.2
	Store Parameters (1010h)	8.2
	Restore Default Parameters (1011h)	8.2
	Identity Object (1018h)	8.2
PDO Mapping Objects	Receive PDO Mapping (1600h to 1603h)	8.3
	Transmit PDO Mapping (1A00h to 1A03h)	8.3
Sync Manager Communication Objects	Sync Manager Communication Type (1C00h)	8.4
	Sync Manager PDO Assignment (1C10h to 1C13h)	8.4
	Sync Manager Synchronization (1C32h, 1C33h)	8.4
	Sync Error Setting (1F01h)	8.4
Manufacturer Specific Objects	SERVOPACK Parameters (2000h to 26FFh)	8.5
	User Parameter Configuration (2700h)	8.5
	Position User Unit (2701h)	8.5
	Velocity User Unit (2702h)	8.5
	Acceleration User Unit (2703h)	8.5
	SERVOPACK Adjusting Command (2710h)	8.5
Device Control	Error Code (603Fh)	8.6
	Controlword (6040h)	8.6
	Statusword (6041h)	8.6
	Quick Stop Option Code (605Ah)	8.6
	Shutdown Option Code (605Bh)	8.6
	Disable Operation Option Code (605Ch)	8.6
	Halt Option Code (605Dh)	8.6
	Fault Reaction Option Code (605Eh)	8.6
	Modes of Operation (6060h)	8.6
	Modes of Operation Display (6061h)	8.6
	Supported Drive Modes (6502h)	8.6
Profile Position Mode	Target Position (607Ah)	8.7
	Software Position Limit (607Dh)	8.7
	Max. Profile Velocity (607Fh)	8.7
	Profile Velocity (6081h)	8.7
	Profile Acceleration (6083h)	8.7
	Profile Deceleration (6084h)	8.7
	Quick Stop Deceleration (6085h)	8.7
Homing Mode	Home Offset (607Ch)	8.8
	Homing Method (6098h)	8.8
	Homing Speeds (6099h)	8.8
	Homing Acceleration (609Ah)	8.8

Object Dictionaries		Refer to
Position Control Function	Position Demand Value (6062h)	8.9
	Position Actual Internal Value (6063h)	8.9
	Position Actual Value (6064h)	8.9
	Position Demand Internal Value (60FCh)	8.9
	Following Error Window (6065h)	8.9
	Following Error Time Out (6066h)	8.9
	Following Error Actual Value (60F4h)	8.9
	Position Window (6067h)	8.9
	Position Window Time (6068h)	8.9
Interpolated Position Mode	Interpolation Data Record (60C1h)	8.10
	Interpolation Time Period (60C2h)	8.10
Cyclic Synchronous Position Mode	Velocity Offset (60B1h)	8.11
	Torque Offset (60B2h)	8.11
Profile Velocity/Cyclic Synchronous Velocity Mode	Velocity Demand Value (606Bh)	8.12
	Velocity Actual Value (606Ch)	8.12
	Velocity Window (606Dh)	8.12
	Velocity Window Time (606Eh)	8.12
	Target Velocity (60FFh)	8.12
Profile Torque/Cyclic Synchronous Velocity Mode	Target Torque (6071h)	8.13
	Torque Demand Value (6074h)	8.13
	Torque Slope (6087h)	8.13
	Motor Rated Torque (6076h)	8.13
	Torque Actual Value (6077h)	8.13
Torque Limit Function	Max. Torque (6072h)	8.14
	Positive Torque Limit Value (60E0h)	8.14
	Negative Torque Limit Value (60E1h)	8.14
Touch Probe Function	Touch Probe Function (60B8h)	8.15
	Touch Probe Status (60B9h)	8.15
	Touch Probe 1 Position Value (60BAh)	8.15
	Touch Probe 2 Position Value (60BCh)	8.15
Digital Inputs/Outputs	Digital Inputs (60FDh)	8.16
	Digital Outputs (60FEh)	8.16

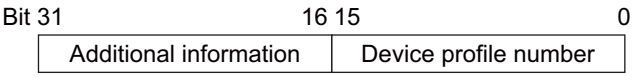
8.2 General Objects

(1) Device Type (1000h)

The object at index 1000h describes the type of device and its functionality.

Index	Sub	Name	Data Type	Access	PDO Mapping	Value	EEPROM
1000h	0	Device Type	UDINT	RO	No	0x00020192	No

■ Data Description



Additional information: 0002 (Servo drive)
Device profile number: 0192 (DS402)

(2) Error Register (1001h)

This object is an error register for the device. The value of this object is stored in a part of emergency message.

Index	Sub	Name	Data Type	Access	PDO Mapping	Value	EEPROM
1001h	0	Error Register	USINT	RO	No	0x00	No

■ Data Description

Bit	Data Meaning	Explanation
0	Generic error	0: No error, 1: Error
1-7	Reserved	0: Always

(3) Manufacturer Device Name (1008h)

This object contains the SERVOPACK model name, such as SGDV-1R6AE1A.

Index	Sub	Name	Data Type	Access	PDO Mapping	Value	EEPROM
1008h	0	Manufacturer Device Name	STRING	RO	No	–	No

(4) Manufacturer Software Version (100Ah)

This object contains the software version of the SERVOPACK.

Index	Sub	Name	Data Type	Access	PDO Mapping	Value	EEPROM
100Ah	0	Manufacturer Software Version	STRING	RO	No	–	No

■ Data Description

The following string is stored.
“xxxx.**** (D:oooo)”

xxxx.****: software version of the EtherCAT (CoE) Network Module
oooo: software version of the SERVOPACK

(5) Store Parameters (1010h)

With this object, the setting value of parameters can be stored in the non-volatile memory.

Index	Sub	Name	Data Type	Access	PDO Mapping	Value	EEPROM
1010h	0	Largest subindex supported	USINT	RO	No	4	No
	1	Save all parameters	UDINT	RW	No	0x00000000 to 0xFFFFFFFF (Default: 0x00000001)	No
	2	Save communication parameters	UDINT	RW	No	0x00000000 to 0xFFFFFFFF (Default: 0x00000001)	No
	3	Save application parameters	UDINT	RW	No	0x00000000 to 0xFFFFFFFF (Default: 0x00000001)	No
	4	Save manufacturer defined parameters	UDINT	RW	No	0x00000000 to 0xFFFFFFFF (Default: 0x00000001)	No

By reading data of an object entry, the SERVOPACK provides its capability to save parameters.

Bit	Value	Meaning
1	0	The SGDV SERVOPACK does not save parameters autonomously
0	0	The SGDV SERVOPACK does not save parameters on command
	1	The SGDV SERVOPACK saves parameters on command

In order to avoid storage of parameters by mistake, storage is only executed when a specific signature is written to the appropriate sub-index. The signature that shall be written is “save.”

Signature	MSB			LSB
ASCII	e	v	a	s
hex	65h	76h	61h	73h

By writing “save” to Sub-Index 1, all parameters are stored.
By writing “save” to Sub-Index 2, the communication parameters (Object 1000h to 1FFFh) are stored.
By writing “save” to Sub-Index 3, the application parameters (Object 27xxh and 6xxxh) are stored.
By writing “save” to Sub-Index 4, the SERVOPACK parameters (Object 2000h to 26FFh) are stored

Note 1. If a wrong signature is written, the SGDV SERVOPACK refuses to store and responds with Abort SDO Transfer.
2. If the storing parameters are executing, 0 will be returned by read this object.
3. Sub-Index 1 and Sub-Index 4 can be written only in Switch on Disabled state (Servo off state).
4. After the storing parameters by Sub-Index 1 or Sub-Index 4, power on reset or executing the parameter configuration (Object 2700h) is necessary to transit into the Operation Enabled state.

(6) Restore Default Parameters (1011h)

With this object, the default values of parameters can be restored.

Index	Sub	Name	Data Type	Access	PDO Mapping	Value	EEPROM
1011h	0	Largest subindex supported	USINT	RO	No	4	No
	1	Restore all default parameters	UDINT	RW	No	0x00000000 to 0xFFFFFFFF (Default: 0x00000001)	No
	2	Restore communication default parameters	UDINT	RW	No	0x00000000 to 0xFFFFFFFF (Default: 0x00000001)	No
	3	Restore application default parameters	UDINT	RW	No	0x00000000 to 0xFFFFFFFF (Default: 0x00000001)	No
	4	Restore manufacturer defined default parameters	UDINT	RW	No	0x00000000 to 0xFFFFFFFF (Default: 0x00000001)	No

By reading data of an object entry, the SERVOPACK provides its capability to restore default parameters.

Bit	Value	Meaning
0	0	Device does not restore default parameters
	1	Device restores default parameters

In order to avoid restoring of parameters by mistake, restoring is only executed when a specific signature is written to the appropriate sub-index. The signature that shall be written is “load.”

Signature	MSB			LSB
ASCII	d	a	o	l
hex	64h	61h	6Fh	6Ch

By writing “load” to Sub-Index 1, all default parameter values are restored.
By writing “load” to Sub-Index 2, the default values of communication parameters (Object 1xxxh) are restored.
By writing “load” to Sub-Index 3, the default values of application parameters (Object 27xxh and 6xxxh) are restored.
By writing “load” to Sub-Index 4, the default values of SERVOPACK parameters (Object 2000h to 26FFh) are restored.

Note 1. If a wrong signature is written, the SGDV SERVOPACK refuses to restore and responds with Abort SDO Transfer.
2. Sub-Index 1 and Sub-Index 4 can be written only in Switch on Disabled state (Servo off state).
3. If the restoring parameters are executing, 0 will be returned by read this object.
4. The default values are set as valid after the SGDV SERVOPACK has been reset or power cycled.

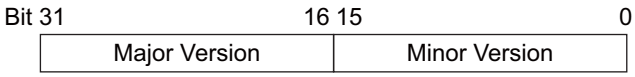
(7) Identity Object (1018h)

The object contains general information about the device.

Index	Sub	Name	Data Type	Access	PDO Mapping	Value	EEPROM
1018h	0	Number of entries	USINT	RO	No	4	No
	1	Vendor ID	UDINT	RO	No	0x00000539	No
	2	Product code *1	UDINT	RO	No	0x0220000*1	No
	3	Revision number *2	UDINT	RO	No	–	No
	4	Serial number *3	UDINT	RO	No	0x00000000	No

∗1. The following product code is stored:
SGDV-****E1*(Rotary drive type): 0x02200001
SGDV-****E5*(Linear drive type): 0x02200002

∗2. The revision number is stored as follows:



The major version identifies a specific CANopen over EtherCAT (CoE) behavior. If the CoE functionality is expanded, the major version has to be increased. The minor version number identifies different versions with the same behavior.

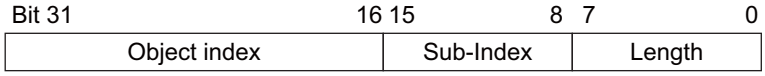
∗3. Serial number is not used. (always 0)

8.3 PDO Mapping Objects

The CANopen over EtherCAT protocol allows the user to map objects into Process Data Objects (PDOs) to use these PDOs for real time data transfer.

PDO Mapping configuration defines which objects in a PDO will include.

Each Mapping entry (Sub-Index 1 to 8) is defined as follows.



Bit 0-7: Length of the mapped objects in bits (for a gap in a PDO: shall have the bit length of the gap)
Bit 8-15: Sub-index of the mapped object (0 in case of a gap in a PDO)
Bit 16-31: Index of the mapped object (for a gap in a PDO: shall be zero)

PDO mapping objects can be changed only in the EtherCAT Pre-Operational state.
Mapping entries (Sub-Index 1 - 8) has to be set after Sub-Index 0 was written to 0.

(1) Receive PDO Mapping (1600h to 1603h)

■ 1st Receive PDO Mapping

Index	Sub	Name	Data Type	Access	PDO Mapping	Value	EEPROM
1600h	0	Number of objects in this PDO	USINT	RW	No	0 to 8 (Default: 8)	Yes
	1	Mapping entry 1	UDINT	RW	No	0 to 0xFFFFFFFF (Default: 0x60400010)	Yes
	2	Mapping entry 2	UDINT	RW	No	0 to 0xFFFFFFFF (Default: 0x607A0020)	Yes
	3	Mapping entry 3	UDINT	RW	No	0 to 0xFFFFFFFF (Default: 0x60FF0020)	Yes
	4	Mapping entry 4	UDINT	RW	No	0 to 0xFFFFFFFF (Default: 0x60710010)	Yes
	5	Mapping entry 5	UDINT	RW	No	0 to 0xFFFFFFFF (Default: 0x60720010)	Yes
	6	Mapping entry 6	UDINT	RW	No	0 to 0xFFFFFFFF (Default: 0x60600008)	Yes
	7	Mapping entry 7	UDINT	RW	No	0 to 0xFFFFFFFF (Default: 0x00000008)	Yes
	8	Mapping entry 8	UDINT	RW	No	0 to 0xFFFFFFFF (Default: 0x60B80010)	Yes

■ 2nd Receive PDO Mapping

Index	Sub	Name	Data Type	Access	PDO Mapping	Value	EEPROM
1601h	0	Number of objects in this PDO	USINT	RW	No	0 to 8 (Default: 2)	Yes
	1	Mapping entry 1	UDINT	RW	No	0 to 0xFFFFFFFF (Default: 0x60400010)	Yes
	2	Mapping entry 2	UDINT	RW	No	0 to 0xFFFFFFFF (Default: 0x607A0020)	Yes
	3 to 8	Mapping entry 3 to Mapping entry 8	UDINT	RW	No	0 to 0xFFFFFFFF (Default: 0)	Yes

■ 3rd Receive PDO Mapping

Index	Sub	Name	Data Type	Access	PDO Mapping	Value	EEPROM
1602h	0	Number of objects in this PDO	USINT	RW	No	0 to 8 (Default: 2)	Yes
	1	Mapping entry 1	UDINT	RW	No	0 to 0xFFFFFFFF (Default: 0x60400010)	Yes
	2	Mapping entry 2	UDINT	RW	No	0 to 0xFFFFFFFF (Default: 0x60FF0020)	Yes
	3 to 8	Mapping entry 3 to Mapping entry 8	UDINT	RW	No	0 to 0xFFFFFFFF (Default: 0)	Yes

■ 4th Receive PDO Mapping

Index	Sub	Name	Data Type	Access	PDO Mapping	Value	EEPROM
1603h	0	Number of objects in this PDO	USINT	RW	No	0 to 8 (Default: 2)	Yes
	1	Mapping entry 1	UDINT	RW	No	0 to 0xFFFFFFFF (Default: 0x60400010)	Yes
	2	Mapping entry 2	UDINT	RW	No	0 to 0xFFFFFFFF (Default: 0x60710010)	Yes
	3 to 8	Mapping entry 3 to Mapping entry 8	UDINT	RW	No	0 to 0xFFFFFFFF (Default: 0)	Yes

(2) Transmit PDO Mapping (1A00h to 1A03h)

■ 1st Transmit PDO Mapping

Index	Sub	Name	Data Type	Access	PDO Mapping	Value	EEPROM
1A00h	0	Number of objects in this PDO	USINT	RW	No	0 to 8 (Default: 8)	Yes
	1	Mapping entry 1	UDINT	RW	No	0 to 0xFFFFFFFF (Default: 0x60410010)	Yes
	2	Mapping entry 2	UDINT	RW	No	0 to 0xFFFFFFFF (Default: 0x60640020)	Yes
	3	Mapping entry 3	UDINT	RW	No	0 to 0xFFFFFFFF (Default: 0x60770010)	Yes
	4	Mapping entry 4	UDINT	RW	No	0 to 0xFFFFFFFF (Default: 0x60F40020)	Yes
	5	Mapping entry 5	UDINT	RW	No	0 to 0xFFFFFFFF (Default: 0x60610008)	Yes
	6	Mapping entry 6	UDINT	RW	No	0 to 0xFFFFFFFF (Default: 0x00000008)	Yes
	7	Mapping entry 7	UDINT	RW	No	0 to 0xFFFFFFFF (Default: 0x60B90010)	Yes
	8	Mapping entry 8	UDINT	RW	No	0 to 0xFFFFFFFF (Default: 0x60BA0020)	Yes

■ 2nd Transmit PDO Mapping

Index	Sub	Name	Data Type	Access	PDO Mapping	Value	EEPROM
1A01h	0	Number of objects in this PDO	USINT	RW	No	0 to 8 (Default: 2)	Yes
	1	Mapping entry 1	UDINT	RW	No	0 to 0xFFFFFFFF (Default: 0x60410010)	Yes
	2	Mapping entry 2	UDINT	RW	No	0 to 0xFFFFFFFF (Default: 0x60640020)	Yes
	3 to 8	Mapping entry 3 to Mapping entry 8	UDINT	RW	No	0 to 0xFFFFFFFF (Default: 0)	Yes

■ 3rd Transmit PDO Mapping

Index	Sub	Name	Data Type	Access	PDO Mapping	Value	EEPROM
1A02h	0	Number of objects in this PDO	USINT	RW	No	0 to 8 (Default: 2)	Yes
	1	Mapping entry 1	UDINT	RW	No	0 to 0xFFFFFFFF (Default: 0x60410010)	Yes
	2	Mapping entry 2	UDINT	RW	No	0 to 0xFFFFFFFF (Default: 0x60640020)	Yes
	3 to 8	Mapping entry 3 to Mapping entry 8	UDINT	RW	No	0 to 0xFFFFFFFF (Default: 0)	Yes

■ 4th Transmit PDO Mapping

Index	Sub	Name	Data Type	Access	PDO Mapping	Value	EEPROM
1A03h	0	Number of objects in this PDO	USINT	RW	No	0 to 8 (Default: 3)	Yes
	1	Mapping entry 1	UDINT	RW	No	0 to 0xFFFFFFFF (Default: 0x60410010)	Yes
	2	Mapping entry 2	UDINT	RW	No	0 to 0xFFFFFFFF (Default: 0x60640020)	Yes
	3	Mapping entry 3	UDINT	RW	No	0 to 0xFFFFFFFF (Default: 0x60770010)	Yes
	4 to 8	Mapping entry 4 to Mapping entry 8	UDINT	RW	No	0 to 0xFFFFFFFF (Default: 0)	Yes

8.4 Sync Manager Communication Objects

(1) Sync Manager Communication Type (1C00h)

Index	Sub	Name	Data Type	Access	PDO Mapping	Value	EEPROM
1C00h	0	Number of used Sync Manager channels	USINT	RO	No	4	No
	1	Communication type sync manager 0	USINT	RO	No	1: mailbox receive (Master to slave)	No
	2	Communication type sync manager 1	USINT	RO	No	2: mailbox send (Slave to master)	No
	3	Communication type sync manager 2	USINT	RO	No	3: process data output (Master to slave)	No
	4	Communication type sync manager 3	USINT	RO	No	4: process data input (Slave to master)	No

(2) Sync Manager PDO Assignment (1C10h to 1C13h)

Sync Manager PDO Assignment configuration defines which PDOs will be transferred for the process data communication.

Index	Sub	Name	Data Type	Access	PDO Mapping	Value	EEPROM
1C10h	0	Sync Manager PDO assignment 0	USINT	RO	No	0	No
1C11h	0	Sync Manager PDO assignment 1	USINT	RO	No	0	No
1C12h	0	Number of assigned PDOs	USINT	RW	No	0 to 2 (Default: 1)	Yes
	1	PDO Mapping object index of assigned RxPDO 1	UINT	RW	No	1600h to 1603h (Default: 1601h)	Yes
	2	PDO Mapping object index of assigned RxPDO 2	UINT	RW	No	1600h to 1603h (Default: 1600h)	Yes
1C13h	0	Number of assigned PDOs	USINT	RW	No	0 to 2 (Default: 1)	Yes
	1	PDO Mapping object index of assigned TxPDO 1	UINT	RW	No	1A00h to 1A03h (Default: 1A01h)	Yes
	2	PDO Mapping object index of assigned TxPDO 2	UINT	RW	No	1A00h to 1A03h (Default: 1A00h)	Yes

The object 1C12h/1C13h can be changed only in the EtherCAT Pre-Operational state.
Sub-Index 1 or 2 has to be set after Sub-Index 0 was written to 0 (no assigned PDOs).

(3) Sync Manager Synchronization (1C32h, 1C33h)

■ Sync Manager 2 (Process Data Output) Synchronization

Index	Sub	Name	Data Type	Access	PDO Mapping	Value	EEPROM
1C32h	0	Number of Synchronization Parameters	USINT	RO	No	10	No
	1	Synchronization type	UINT	RO	No	0: Free-Run (DC unused) 2: DC Sync0 (DC used)	No
	2	Cycle time	UDINT	RO	No	Time between Sync0 events [ns]	No
	3	Shift time	UDINT	RO	No	125000 [ns]	No
	4	Synchronization types supported	UINT	RO	No	Bit 0 = 1: Free-Run supported Bit 4:2 = 001: DC Sync0 supported Bit 6:5 = 00: No Output Shift supported	No
	5	Minimum cycle time	UDINT	RO	No	62500 [ns]	No
	6	Calc and copy time	UDINT	RO	No	62500 [ns]	No
	7	Reserved	UDINT	RO	No	–	No
	8	Reserved	UINT	RO	No	–	No
	9	Delay time	UDINT	RO	No	0 [ns]	No
	10	Sync0 cycle time	UDINT	RO	No	same as 1C32h:02	No
	11	Reserved	UDINT	RO	No	–	No
	12	SM2 event miss count	UDINT	RO	No	–	No

■ Sync Manager 3 (Process Data Input) Synchronization

Index	Sub	Name	Data Type	Access	PDO Mapping	Value	EEPROM
1C33h	0	Number of Synchronization Parameters	USINT	RO	No	10	No
	1	Synchronization type	UINT	RO	No	same as 1C32:01	No
	2	Cycle time	UDINT	RO	No	same as 1C32:02	No
	3	Shift time	UDINT	RW	No	125000*n [ns] (n = 1, 2, 3...) Range: 0 to (Sync0 event cycle time – 125000)	Yes
	4	Synchronization types supported	UINT	RO	No	Bit 0 = 1: Free-Run supported Bit 4:2 = 001: DC Sync0 supported Bit 6:5 = 01: Input Shift with local timer supported	No
	5	Minimum cycle time	UDINT	RO	No	same as 1C32h:05	No
	6	Calc and copy time	UDINT	RO	No	62500 [ns]	No
	7	Reserved	UDINT	RO	No	–	No
	8	Reserved	UINT	RO	No	–	No
	9	Delay time	UDINT	RO	No	0	No
	10	Sync0 cycle time	UDINT	RO	No	same as 1C32h:10	No

(4) Sync Error Setting (1F01h)

Index	Sub	Name	Data Type	Access	PDO Mapping	Value	EEPROM
1F01h	0	Number of entries	USINT	RO	No	2	No
	1	Reserved	UDINT	RO	No	0	No
	2	Sync Error Count Limit	UDINT	RW	No	0 to 15 (Default: 9)	Yes

■ 0x10F1:2 Sync Error Count Limit

This object defines the tolerable level of failure when receiving the process data. If the value of the Internal Error Counter in the SERVOPACK exceeds the value of this object, the SERVOPACK will issue an alarm (A12h) and change the ESM state to SAFEOP.

The Internal Error Counter is incremented by 3 if the process output data is not updated (a no Receive (SM2) event occurs) at Sync0 event. When the process output data is normally updated, the Internal Error Counter is decremented by 1. The Internal Error Counter is reset when the ESM state is transited to OP from SAFEOP.

An example of Internal Error Counter is shown below.

Receive (SM2) Event	1	0	1	0	1	0	1	0	1	0	1
SERVOPACK Internal Error Counter (Error Counter Limit = 9)	0	3	2	5	4	7	6	9 (error)	9	9	9

In this example, a failure in receiving the process data repeats in each DC (Sync0) cycle. After 8 DC cycles, the internal error count reaches the Sync Error Count Limit, and the SERVOPACK issued an alarm.

No alarm will be detected when the DC mode is disabled and/or when the Sync error count limit is set to 0.

8.5 Manufacturer Specific Objects

(1) SERVOPACK Parameters (2000h-26FFh)

Object 2000h to 26FFh are mapped to SGDV SERVOPACK parameters (Pnxxx).

An object index 2xxxh is corresponding to a Pnxxx in SGDV SERVOPACK parameter. (e.g., Object 2100h is same as Pn100)

(2) User Parameter Configuration (2700h)

This object enables all User parameter settings, and initializes the all position values.

Before restarting operation without turning the power supply OFF and then ON again after having changed the following objects, this object must be executed to enable new settings.

- Object 2701h, 2702h and 2703h
- SERVOPACK parameters which need power on reset.

Index	Sub	Name	Data Type	Access	PDO Mapping	Value	EEPROM
2700h	0	User Parameter Configuration	UDINT	RW	No	0 to 0xFFFFFFFF (Default: 0)	No

■ Procedure

1. Change FSA state to “Switch on Disabled.”
2. Set new parameter setting value.
3. Set object 2700h to 1 for activating the “new” user settings.
   When processing is completed, the value of object 2700h is reset to 0.

(3) Position User Unit (2701h)

This object sets the user defined position reference unit [Pos unit].

The user defined position reference unit is calculated by the following formula:
1 [Pos unit] = (Numerator/Denominator) [inc]

Index	Sub	Name	Data Type	Access	PDO Mapping	Value	EEPROM
2701h	0	Number of entries	USINT	RO	No	2	No
	1	Numerator	UDINT	RW	No	1 to 1073741823 (Default: 1)	Yes
	2	Denominator	UDINT	RW	No	1 to 1073741823 (Default: 1)	Yes

Available value range: 1/4096 < Numerator / Denominator < 4096
(Alarm “A.A20” is detected when the setting value exceeds it.)

(4) Velocity User Unit (2702h)

This object sets the user defined velocity reference unit [Vel unit].

The user defined velocity reference unit is calculated by the following formula:
1 [Vel unit] = (Numerator / Denominator) [inc/sec]

Index	Sub	Name	Data Type	Access	PDO Mapping	Value	EEPROM
2702h	0	Number of entries	USINT	RO	No	2	No
	1	Numerator	UDINT	RW	No	1 to 1073741823 (Default: 1)	Yes
	2	Denominator	UDINT	RW	No	1 to 1073741823 (Default: 1)	Yes

Available value range: 1/128 ≤ Numerator / Denominator ≤ 524288
(Alarm "A.A20" is detected when the setting value exceeds it.)

(5) Acceleration User Unit (2703h)

This object sets the user defined acceleration reference unit [Acc unit].

The user defined acceleration reference unit is calculated by the following formula:
1 [Acc unit] = (Numerator / Denominator) × 10^4[inc/sec^2]

Index	Sub	Name	Data Type	Access	PDO Mapping	Value	EEPROM
2703h	0	Number of entries	USINT	RO	No	2	No
	1	Numerator	UDINT	RW	No	1 to 1073741823 (Default: 1)	Yes
	2	Denominator	UDINT	RW	No	1 to 1073741823 (Default: 1)	Yes

Available value range: 1/128 ≤ Numerator / Denominator ≤ 16384
(Alarm "A.A20" is detected when the setting value exceeds it.)

(6) Usage of User Units

The setting methods of user defined reference units are explained by using the following two cases as examples.

- Case 1: Linear mechanism system with ball screw
- Case 2: Rotary mechanism system with rotary table

■ Case 1: Linear Mechanism System with Ball Screw

- User Requirements and Application Assumptions
  - User defined position reference unit: 0.001 mm
  - User defined velocity reference unit: 0.1 mm/s
  - User defined acceleration reference unit: 0.1 mm/s^2
  - Application assumption data
    Encoder resolution: 20 bits (1048576 inc)
    Ball screw pitch: 6 mm
    Deceleration ratio: 2/1 (load shaft will rotate once for each time the motor shaft rotates twice.)

- Settings
  - Position User Unit (2701h)
    The number of encoder pulses for each user defined position reference unit:

$$\frac{\text{(Encoder resolution} \times \text{Deceleration ratio [inc]}}{\text{Movement amount per one rotation of load shaft [Pos unit]}}$$

$$= \frac{1048576\ \text{[inc]} \times (2/1)}{6\ \text{[mm]}/0.001\ \text{[mm]}}$$

$$= \frac{2097152}{6000}\ \text{[inc]}$$

    Therefore, the object is set as follows.
    Object 2701h:01 (Nominator) = 2097152
    Object 2701h:02 (Denominator) = 6000

  - Velocity User Unit (2702h)
    By converting one user defined velocity reference unit [0.1 mm/s] into [inc/s]:

$$1\ \text{[Vel unit]}$$

$$= \frac{1048576\ \text{[inc]} \times (2/1)}{6\ \text{[mm]}} \times 0.1\ \text{[mm/s]}$$

$$= \frac{2097152}{60}\ \text{[inc/s]}$$

    Therefore, the object is set as follows.
    Object 2702h:01 (Nominator) = 2097152
    Object 2702h:02 (Denominator) = 60

  - Acceleration User Unit (2703h)
    By converting one user defined acceleration reference unit [0.1 mm/s^2] into [10^4 inc/s^2]

$$1\ \text{[Acc unit]}$$

$$= \frac{1048576\ \text{[inc]} \times (2/1)}{6\ \text{[mm]}} \times 0.1\ \text{[mm/s}^2\text{]} \times 10^{-4}$$

$$= \frac{2097152}{6 \times 10^5}\ \text{[}10^4\ \text{inc/s}^2\text{]}$$

    Therefore, the object is set as follows.
    Object 2703h:01 (Nominator) = 2097152
    Object 2703h:02 (Denominator) = 600000

■ Case 2: Rotary Mechanism System with Rotary Table

- User Requirements and Application Assumptions
  - User defined position reference unit: 0.001 deg
  - User defined velocity reference unit: 1 deg/s
  - User defined acceleration reference unit: 1 deg/s^2
  - Application assumption data
    Encoder: 20 bits (1048576 inc)
    Degree of rotary table movement for each rotation of the load shaft: 360 deg
    Deceleration ratio: 3/1 (one load shaft rotation per three motor shaft rotations)

- Setting
  - Position User Unit (2701h)
    Number of encoder increments per one user defined position reference unit:

$$\frac{\text{(Encoder resolution} \times \text{Deceleration ratio [inc]}}{\text{Movement amount per one rotation of load shaft [Pos unit]}}$$

$$= \frac{1048576\ [\text{inc}] \times (3/1)}{360\ [\text{deg}]/0.001\ [\text{deg}]}$$

$$= \frac{3145728}{360000}\ [\text{inc}]$$

    Therefore, the object is set as follows.
    Object 2701h:01 (Nominator) = 3145728
    Object 2701h:02 (Denominator) = 360000

  - Velocity User Unit (2702h)
    By converting one user defined velocity reference unit [1 deg/s] into [inc/s],

$$1\ [\text{Vel unit}]$$

$$= \frac{1048576\ [\text{inc}] \times (3/1)}{360\ [\text{deg}]} \times 1\ [\text{deg/s}]$$

$$= \frac{3145728}{360}\ [\text{inc/s}]$$

    Therefore, the object is set as follows.
    Object 2702h:01 (Nominator) = 3145728
    Object 2702h:02 (Denominator) = 360

  - Acceleration User Unit (2703h)
    By converting one user defined acceleration reference unit into [inc/s^2],

$$1\ [\text{Acc unit}]$$

$$= \frac{1048576\ [\text{inc}] \times (3/1)}{360\ [\text{deg}]} \times 1\ [\text{deg/s}^2] \times 10^{-4}$$

$$= \frac{3145728}{360 \times 10^4}\ [10^4\ \text{inc/s}^2]$$

    Therefore, the object is set as follows.
    Object 2703h:01 (Nominator) = 3145728
    Object 2703h:02 (Denominator) = 3600000

(7) SERVOPACK Adjusting Command (2710h)

This object should be used for SERVOPACK adjusting services (e.g., Encoder setup, Multi-turn reset and so on). Writes the data into the Sub-Index 1 to start the command execution. Also, reads the Sub-Index 3 to accept the response. If the response is not available when reading Sub-Index 3, the first byte of the reply data could give information about the progress.

Index	Sub	Name	Data Type	Access	PDO Mapping	Value	EEPROM
2710h	0	Number of entries	USINT	RO	No	3	No
	1	Command	STRING [16]	RW	No	Byte 0 to n: Service Request Data A write access to the command data will execute the command	No
	2	Status	USINT	RO	No	0: last command completed, no errors, no reply 1: last command completed, no errors, reply there 2: last command completed, error, no reply 3: last command completed, error, reply there 255: command is executing	No
	3	Reply	STRING [16]	RO	No	Byte 0: as Subindex 2 Byte 1: unused 2 to n: Service Response Data	No

■ Command/Reply data format

Command data (Service Request data)	
Byte	Description
0	Reserved
1	Reserved
2	CCMD (Command code) 00: Read request 01: Write request
3	CSIZE (CDATA length in byte)
4 to 7	CADDRESS (Address)
8 to 15	CDATA (Writing data)

Reply data (Service Response data)	
Byte	Description
0	Status (As Subindex 2)
1	Reserved
2	RCMD (Echo back of CCMD)
3	RSIZE (R_DATA length in byte)
4 to 7	RADDRESS (Echo back of CADDRESS)
8 to 15	RDATA (Read data) /ERROCODE

■ Executable Adjustments

Adjustment	Request Code	Preparation before execution	Processing Time	Execution Conditions
Absolute encoder reset	1008H	Required	5 s max.	When using an incremental encoder, impossible to reset the encoder while the servo is ON.
Automatic offset adjustment of motor current detection signals	100EH	None	5 s max.	Adjustment is disabled: • While the main circuit power supply is OFF • While the servo is ON • While the servomotor is running
Multiturn limit setting	1013H	Required	5 s max.	When using an incremental encoder, the setting is disabled unless A.CC0 (Multiturn limit disagreement) occurs.

■ How to Send an Command for Adjustment

1. Send the following data and set the request code of the adjustment to be executed.
CCMD = 0001H
CADDRESS = 2000H
CSIZE = 0002H
CDATA = Request code of the adjustment to be executed
When the slave station receives the command normally, status field will be returned to 1.
If an error occurs, carry out the operation in step 4 to abort execution.

2. For adjustment that requires a preparation process, send the following data.
If the preparation before execution is not required, carry out the operation in step 3.
CCMD = 0001H
CADDRESS = 2001H
CSIZE = 0002H
CDATA = 0002H
When the slave station receives the command normally, status field will be returned to 1.
If an error occurs, carry out the operation in step 4 to abort execution.

3. Send the following data to execute adjustment.
CCMD = 0001H
CADDRESS = 2001H
CSIZE = 0002H
CDATA = 0001H
When the slave station receives the command normally, status field will be returned to 1.
If an error occurs, carry out the operation in step 4 to abort execution.

4. Send the following data to abort the execution.
CCMD = 0001H
CADDRESS = 2000H
CSIZE = 0002H
CDATA = 0000H
When the slave station receives the command normally, status field will be returned to 1.

Note: If no command can be received in 10 seconds after step1, adjustment operation will be automatically aborted.

8.6 Device Control

(1) Error Code (603Fh)

This provides the SGDV SERVOPACK's alarm/warning code of the last error which occurred in device.

Index	Sub	Name	Data Type	Access	PDO Mapping	Value	EEPROM
603Fh	0	Error Code	UINT	RO	Yes	0	No

(2) Controlword (6040h)

The Controlword consists of bits for the controlling of the drive state, the controlling of operating modes and manufacturer specific options.

Index	Sub	Name	Data Type	Access	PDO Mapping	Value	EEPROM
6040h	0	Controlword	UINT	RW	Yes	0 to 0xFFFF (Default: 0)	No

■ Controlword Bits

Bit No	Function	Description
0	Switch on	See <*Details on Bits 0 to 3*>.
1	Enable voltage	
2	Quick stop	
3	Enable operation	
4 to 6	Operation mode specific	See <*Details on Bits 4 to 9*>.
7	Fault reset	0 → 1: Alarm/Warning reset
8	Halt	See <*Details on Bits 4 to 9*>.
9	Operation mode specific	
10	– (Reserved)	–
11	Positive Torque Limit	0: Torque Limit parameter (Object 2404h) is inactive. 1: Torque Limit parameter (Object 2404h) is active.
12	Negative Torque Limit	0: Torque Limit parameter (Object 2405h) is inactive. 1: Torque Limit parameter (Object 2405h) is active.
13 to 15	– (Reserved)	–

<Details on Bits 0 to 3>

- Bit 0 to 3: for the controlling command of the drive state

Command	Bit of the Controlword				
	Bit7	Bit3	Bit2	Bit1	Bit0
Shutdown	0	–	1	1	0
Switch on	0	0	1	1	1
Switch on + Enable operation	0	1	1	1	1
Disable voltage	0	–	–	0	–
Quick stop	0	–	0	1	–
Disable operation	0	0	1	1	1
Enable operation	0	1	1	1	1

<Details on Bits 4 to 9>

- Bit 4, 5 and 9: for the controlling of Profile position mode

Bit9	Bit5	Bit4	Definition
0	0	0 → 1	Start the next positioning after the current positioning completes (target reached)
–	1	0 → 1	Start the next positioning immediately
1	0	0 → 1	Positioning with current profile velocity up to the current set-point is proceeded and then next positioning will be applied.

- Bit 6 and 8: for the controlling of Profile position mode

Bit	Function	Value	Definition
6	Abs/rel	0	Target position is an absolute value.
		1	Target position is a relative value.
8	Halt	0	Positioning is executed or continued.
		1	Stop axis according to halt option code (605Dh)

- Bit 4, 5, 6, 8 and 9: for the controlling of Homing mode

Bit	Function	Value	Definition
4	Homing operation start	0	Do not start homing procedure
		1	Start or continue homing procedure
5	–	0	Reserved
6	–	0	Reserved
8	Halt	0	Enable bit 4
		1	Stop axis according to halt option code (605Dh)
9	–	0	Reserved

- Bit 4, 5, 6, 8 and 9: for the controlling of Cyclic synchronous position/velocity/torque mode

Bit	Function	Value	Definition
4	–	0	Reserved
5	–	0	Reserved
6	–	0	Reserved
8	Halt	0	The motion is executed or continued.
		1	Stop axis according to halt option code (605Dh)
9	–	0	Reserved

- Bit 4, 5, 6, 8 and 9: for the controlling of Interpolated position mode

Bit	Function	Value	Definition
4	Enable interpolation	0	Disable interpolation
		1	Enable interpolation
5	–	0	Reserved
6	–	0	Reserved
8	Halt	0	Execute instruction of bit 4
		1	Stop axis according to halt option code (605Dh)
9	–	0	Reserved

• Bit 4, 5, 6, 8 and 9: for the controlling of Profile velocity/torque mode

Bit	Function	Value	Definition
4	–	0	Reserved
5	–	0	Reserved
6	–	0	Reserved
8	Halt	0	The motion is executed or continued.
		1	Stop axis according to halt option code (605Dh)
9	–	0	Reserved

(3) Statusword (6041h)

The Statusword indicates the current state of the drive. No bits are latched.

The Statusword consist of bits for the current state of the drive and the operating state of the mode.

Index	Sub	Name	Data Type	Access	PDO Mapping	Value	EEPROM
6041h	0	Statusword	UINT	RO	Yes	0	No

■ Statusword Bits

Bit	Status	Description
0	Ready to switch on	See <*Details on Bits 0 to 7*>.
1	Switched on	
2	Operation enabled	
3	Fault	
4	Voltage enabled	
5	Quick stop	
6	Switch on disabled	
7	Warning	
8	–	Reserved
9	Remote	Controlword (6040h) is processed
10	Operation mode specific	See <*Details on Bits 10, 12, and 13*>.
11	Internal limit active	See <*Details on Bit 11*>.
12 to 13	Operation mode specific	See <*Details on Bits 10, 12, and 13*>.
14	Torque limit active	= 0; no torque limit active = 1; torque limit active
15	–	Reserved

<Details on Bits 0 to 7>

• Bit 0 to 7: for the current state of the drive

Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0	Drive State
–	0	–	–	0	0	0	0	Not ready to switch on
–	1	–	–	0	0	0	0	Switch on disabled
–	0	1	–	0	0	0	1	Ready to switch on
–	0	1	–	0	0	1	1	Switched on
–	0	1	–	0	1	1	1	Operation enabled
–	0	0	–	0	1	1	1	Quick stop active
–	0	–	–	1	1	1	1	Fault reaction active
–	0	–	–	1	0	0	0	Fault
–	–	–	1	–	–	–	–	Main Power On
1	–	–	–	–	–	–	–	Warning is occurred

<Details on Bit 11>

- Bit11: Internal limit active

The internal limit is active in the following cases:

- Target position was limited with Software position limits
- N-OT / P-OT signals were activated
- Over Interpolation speed (only for Interpolated position and cyclic position mode)

If the reference speed of interpolation exceeds the following speed range, the target position will be ignored.

$$\frac{(\text{Target position} - \text{position demand value}) \times (2701\text{h:}01)/(2701\text{h:}02)}{\text{Interpolation time period}} < 4194304 \text{ [inc/ms]}$$

<Details on Bits 10, 12, and 13>

- Bit 10, 12 and13: for Profile position mode

Bit No	Description	Value	Definition
10	Target reached	0	Halt (Bit 8 in Controlword) = 0: Target position not reached Halt (Bit 8 in Controlword) = 1: Axis decelerates
		1	Halt (Bit 8 in Controlword) = 0: Target position reached Halt (Bit 8 in Controlword) = 1: Velocity of axis is 0
12	Set-point acknowledge	0	Previous set-point already processed, waiting for new set-point
		1	Previous set-point still in process, set-point overwriting shall be accepted
13	Following error	0	No following error
		1	Following error

- Bit 10, 12 and 13: for Homing mode

Bit13	Bit12	Bit10	Definition
Homing error	Homing attained	Target reached	
0	0	0	Homing procedure is in progress
0	0	1	Homing procedure is interrupted or not started
0	1	0	Homing is attained, but target is not reached
0	1	1	Homing procedure is completed successfully
1	0	0	Homing error occurred, velocity is not 0
1	0	1	Homing error occurred, velocity is 0

- Bit 10, 12 and 13: for Cyclic synchronous position, velocity and torque mode

Bit	Status	Value	Definition
10	Target reached	0	Target (position/velocity/torque) not (yet) reached
		1	Target (position/velocity/torque) reached
12	Target value ignored	0	Target value (position/velocity/torque) ignored
		1	Target value shall be used as input to position control loop
13	Following error	0	No following error (always 0 in cyclic velocity and torque mode)
		1	Following error

• Bit 10, 12 and 13: for Interpolated position mode

Bit	Status	Value	Definition
10	Target reached	0	Halt (Bit 8 in Controlword) = 0: Target position not reached Halt (Bit 8 in Controlword) = 1: Axis decelerates
		1	Halt (Bit 8 in Controlword) = 0: Target position reached Halt (Bit 8 in Controlword) = 1: Velocity of axis is 0
12	Ip mode active	0	Interpolation inactive
		1	Interpolation active
13	–	0	Reserved

• Bit 10, 12 and 13: for Profile velocity mode

Bit	Status	Value	Definition
10	Target reached	0	Halt (Bit 8 in Controlword) = 0: Target not reached Halt (Bit 8 in Controlword) = 1: Axis decelerates
		1	Halt (Bit 8 in Controlword) = 0: Target reached Halt (Bit 8 in Controlword) = 1: Velocity of axis is 0
12	Speed	0	Speed is not equal 0
		1	Speed is equal 0
13	–	0	Reserved

• Bit 10, 12 and 13: for Profile torque mode

Bit	Status	Value	Definition
10	Target reached	0	Halt (Bit 8 in Controlword) = 0: Target torque not reached Halt (Bit 8 in Controlword) = 1: Axis decelerates
		1	Halt (Bit 8 in Controlword) = 0: Target torque reached Halt (Bit 8 in Controlword) = 1: Velocity of axis is 0
12	–	0	Reserved
13	–	0	Reserved

(4) Quick Stop Option Code (605Ah)

The parameter quick stop option code determines what action should be taken if the Quick Stop function is executed.

Index	Sub	Name	Data Type	Access	PDO Mapping	Value	EEPROM
605Ah	0	Quick Stop Option Code	INT	RW	No	0 to 4 (Default: 2)	Yes

■ Data Description

Value	Data Description
0	Disable drive function (transit into Switch On Disabled).
1	Slow down on slow down ramp and transit into Switch On Disabled.*1, *2
2	Slow down on quick stop ramp and transit into Switch On Disabled.*1, *3
3	Slow down on the torque limit and transit into Switch On Disabled.*1

∗1. The drive always stops by option code 0 (switch-off the drive power stage) in Profile Torque and Cyclic Torque mode.

∗2. The slow down deceleration is defined as the following object.
- Profile Position, Interpolated Position, Cyclic Position, Cyclic Velocity mode: Object 6084h
- Homing mode : Object 609Ah

∗3. The Quick stop deceleration (Object 6085h) value is used as quick stop ramp in any mode.

(5) Shutdown Option Code (605Bh)

The parameter determines what action is performed if there is a transition from Operation Enable state to Ready to Switch On state.

Index	Sub	Name	Data Type	Access	PDO Mapping	Value	EEPROM
605Bh	0	Shutdown Option Code	INT	RW	No	0 to 1 (Default: 0)	Yes

■ Data Description

Value	Data Description
0	Disable drive function (transit into Switch On Disabled).
1	Slow down on slow down ramp and transit into Switch On Disabled.*1, *2

*1. The drive always stops by option code 0 (switch-off the drive power stage) in Profile Torque and Cyclic Torque mode.
*2. The slow down deceleration is defined as the following object.
- Profile Position, Interpolated Position, Cyclic Position, Cyclic Velocity mode: Object 6084h
- Homing mode : Object 609Ah

(6) Disable Operation Option Code (605Ch)

The parameter determines what action is performed if there is a transition from Operation Enable state to Switched On state.

Index	Sub	Name	Data Type	Access	PDO Mapping	Value	EEPROM
605Ch	0	Disable Operation Option Code	INT	RW	No	0 to 1 (Default: 1)	Yes

■ Data Description

Value	Data Description
0	Disable drive function (transit into Switch On Disabled).
1	Slow down on slow down ramp and transit into Switch On Disabled.*1, *2

*1. The drive always stops by option code 0 (switch-off the drive power stage) in Profile Torque and Cyclic Torque mode.
*2. The slow down deceleration is defined as the following object.
- Profile Position, Interpolated Position, Cyclic Position, Cyclic Velocity mode: Object 6084h
- Homing mode : Object 609Ah

(7) Halt Option Code (605Dh)

The parameter halt option code determines what action should be taken if the bit 8 (halt) in the Controlword is active.

Index	Sub	Name	Data Type	Access	PDO Mapping	Value	EEPROM
605Dh	0	Halt Option Code	INT	RW	No	0 to 4 (Default: 1)	Yes

■ Data Description

Value	Data Description
1	Slow down on slow down ramp and stay in Operation Enabled.*1, *2
2	Slow down on quick stop ramp and stay in Operation Enabled.*1, *3
3	Slow down on the torque limit and stay in Operation Enabled.*1

∗1. If the halt is active in Profile Torque and Cyclic Torque mode, the torque demand value is down to zero.
∗2. The slow down deceleration is defined as the following object.
- Profile Position, Interpolated Position, Cyclic Position, Cyclic Velocity mode: Object 6084h
- Homing mode : Object 609Ah

∗3. The Quick stop deceleration (Object 6085h) value is used as quick stop ramp in any mode.

(8) Fault Reaction Option Code (605Eh)

The parameter determines what action is performed when fault is detected in the SGDV drive system.

Index	Sub	Name	Data Type	Access	PDO Mapping	Value	EEPROM
605Eh	0	Fault Reaction Option Code	INT	RW	No	0	Yes

■ Data Description

Value	Data Description
0	Disable drive function, motor is free to rotate. (Turns the servo OFF.)

(9) Modes of Operation (6060h)

The master writes to the *modes of operation* object in order to select the operation mode. The drive device provides the *modes of operation display* object to indicate the actual activated operation mode.

Index	Sub	Name	Data Type	Access	PDO Mapping	Value	EEPROM
6060h	0	Modes of Operation	SINT	RW	Yes	0 to 10 (Default: 0)	Yes

■ Data Description

Value	Data Description
0	No mode change/no mode assigned
1	Profile Position mode
2	Reserved (keep last mode)
3	Profile Velocity mode
4	Torque Profile mode
6	Homing mode
7	Interpolated Position mode
8	Cyclic Sync Position mode
9	Cyclic Sync Velocity mode
10	Cyclic Sync Torque mode
Other	Reserved (keep last mode)

(10) Modes of Operation Display (6061h)

The modes of operation display show the current mode of operation.
The meaning of the returned value corresponds to that of the modes of operation option code (index 6060h).

Index	Sub	Name	Data Type	Access	PDO Mapping	Value	EEPROM
6061h	0	Modes of Operation Display	SINT	RO	Yes	0	No

(11) Supported Drive Modes (6502h)

This object gives an overview of the implemented operating modes in the device.

Index	Sub	Name	Data Type	Access	PDO Mapping	Value	EEPROM
6502h	0	Supported Drive Modes	UDINT	RO	No	03EDh	No

■ Data Description

Bit	Supported Modes	Definition
0	Pp (Profile Position mode)	1: Supported
1	Vl (Velocity mode)	0: Not supported
2	Pv (Profile Velocity mode)	1: Supported
3	Tq (Torque Profile mode)	1: Supported
4	Reserved	0
5	Hm (Homing mode)	1: Supported
6	Ip (Interpolated Position mode)	1: Supported
7	Csp (Cyclic Sync Position mode)	1: Supported
8	Csv (Cyclic Sync Velocity mode)	1: Supported
9	Cst (Cyclic Sync Torque mode)	1: Supported
10 to 31	Reserved	0

8.7 Profile Position Mode

(1) Target Position (607Ah)

This object is the target position in the Profile Position mode and Cyclic Synchronous Position mode.

In Profile Position mode, the value of this object is interpreted as either an absolute or relative value depending on the abs/rel flag of Controlword. In Cyclic Synchronous Position mode, it is always interpreted as an absolute value.

Index	Sub	Name	Data Type	Access	PDO Mapping	Value	EEPROM
607Ah	0	Target Position	DINT	RW	Yes	–2147483648 to +2147483647 (Default: 0) [Pos. unit]	No

(2) Software Position Limit (607Dh)

This object specifies the absolute position limit values for the position demand value. Every target position is checked against these limits.

The limit positions are specified in user defined position reference units, the same as for target position, and are always a relative value to the machine home position.

The limit values are corrected internally by the Home Offset as follows. The target positions are compared with the corrected values.

- Corrected min. position limit = min. position limit – home offset (Object 607Ch)
- Corrected max. position limit = max. position limit – home offset (Object 607Ch)

Software position limit is enabled at the following cases:

- Homing is completed.
- Absolute encoder is connected.

If the following setting, software limit is disabled:

- Min. position limit ≥ Max. position limit

Index	Sub	Name	Data Type	Access	PDO Mapping	Value	EEPROM
607Dh	0	Number of entries	USINT	RO	No	2	No
	1	Min. position limit	DINT	RW	No	–536870912 to 536870911 (Default: 0) [Pos. unit]	Yes
	2	Max. position limit	DINT	RW	No	–536870912 to 536870911 (Default: 0) [Pos. unit]	Yes

(3) Max. Profile Velocity (607Fh)

The max. profile velocity is the maximum allowed speed in either direction during a profiled move.

Index	Sub	Name	Data Type	Access	PDO Mapping	Value	EEPROM
607Fh	0	Max. Profile Velocity	UDINT	RW	Yes	0 to 4294967295 (Default: 2147483647) [Vel. unit]	Yes

(4) Profile Velocity (6081h)

The profile velocity is the velocity normally attained at the end of the acceleration ramp during a profiled move and is valid for both directions of motion.

Index	Sub	Name	Data Type	Access	PDO Mapping	Value	EEPROM
6081h	0	Profile Velocity	UDINT	RW	Yes	0 to 4294967295 (Default: 0) [Vel. unit]	Yes

(5) Profile Acceleration (6083h)

This object specifies the acceleration for profile modes.

Index	Sub	Name	Data Type	Access	PDO Mapping	Value	EEPROM
6083h	0	Profile Acceleration	UDINT	RW	Yes	0 to 4294967295 (Default: 1000) [Acc. unit]	Yes

(6) Profile Deceleration (6084h)

This object specifies the deceleration for profile modes.

Index	Sub	Name	Data Type	Access	PDO Mapping	Value	EEPROM
6084h	0	Profile Deceleration	UDINT	RW	Yes	0 to 4294967295 (Default: 1000) [Acc. unit]	Yes

(7) Quick Stop Deceleration (6085h)

The quick stop deceleration is the deceleration used to stop the motor if the ‘Quick Stop’ command is given and the Quick Stop Option Code (see 605Ah) is set to 2.

Index	Sub	Name	Data Type	Access	PDO Mapping	Value	EEPROM
6085h	0	Quick Stop Deceleration	UDINT	RW	Yes	0 to 4294967295 (Default: 1000) [Acc. unit]	Yes

8.8 Homing Mode

(1) Home Offset (607Ch)

The home offset is the difference between the zero position for the application and the machine home position (found during homing).

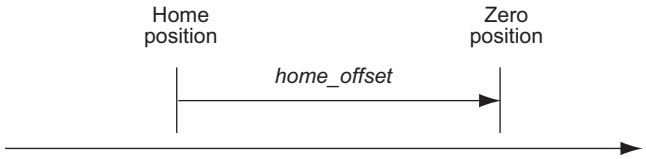
Index	Sub	Name	Data Type	Access	PDO Mapping	Value	EEPROM
607Ch	0	Home Offset	DINT	RW	No	–536870912 to +536870911 (Default: 0) [Pos. unit]	Yes

- For Incremental Encoder

  During the homing the machine home position is found and once the homing is completed the zero position is offset from the home position by adding the home offset to the home position.

- For Absolute Encoder

  When an absolute encoder is connected to the SERVOPACK, the home offset is added to the encoder absolute position (the position actual value) in power up phase.



(2) Homing Method (6098h)

This object specifies the homing method. For details, refer to *7.4 Homing*.

Index	Sub	Name	Data Type	Access	PDO Mapping	Value	EEPROM
6098h	0	Homing Method	SINT	RW	Yes	0 to 35 (Default: 35)	No

■ Data Description

Value (Method)	Data Description
0	No homing operation required
1	Homing on the negative limit switch and index pulse
2	Homing on the positive limit switch and index pulse
7 to 14	Homing on the home switch and index pulse
24	Homing on the home switch Same homing as Method 8 (without an index pulse)
28	Homing on the home switch Same homing as Method 12 (without an index pulse)
33, 34	Homing on index pulse
35	Homing on the current position

(3) Homing Speeds (6099h)

This object entries define the speeds used during homing and is given in user velocity units.

Index	Sub	Name	Data Type	Access	PDO Mapping	Value	EEPROM
6099h	0	Number of entries	USINT	RO	No	2	No
	1	Speed during search for switch	UDINT	RW	Yes	0 to 4294967295 (Default: 500000) [Vel. unit]	Yes
	2	Speed during search for zero	UDINT	RW	Yes	0 to 4294967295 (Default: 100000) [Vel. unit]	Yes

(4) Homing Acceleration (609Ah)

This object specifies the acceleration and deceleration for homing in user defined acceleration reference units.

Index	Sub	Name	Data Type	Access	PDO Mapping	Value	EEPROM
609Ah	0	Homing Acceleration	UDINT	RW	Yes	0 to 4294967295 (Default: 1000) [Acc. unit]	Yes

8.9 Position Control Function

(1) Position Demand Value (6062h)

This object provides the demanded position value in user position units.

Index	Sub	Name	Data Type	Access	PDO Mapping	Value	EEPROM
6062h	0	Position Demand Value	DINT	RO	Yes	– [Pos. unit]	No

(2) Position Actual Internal Value (6063h)

This object provides the current feedback position in encoder pulse units [inc].

Index	Sub	Name	Data Type	Access	PDO Mapping	Value	EEPROM
6063h	0	Position Actual Internal Value	DINT	RO	Yes	– [inc]	No

(3) Position Actual Value (6064h)

This object represents the actual value of the encoder position in defined user position units.

Index	Sub	Name	Data Type	Access	PDO Mapping	Value	EEPROM
6064h	0	Position Actual Value	DINT	RO	Yes	– [Pos. unit]	No

(4) Position Demand Internal Value (60FCh)

This object provides the output of the trajectory generator in position mode. This value is given in increments of the position encoder.

Index	Sub	Name	Data Type	Access	PDO Mapping	Value	EEPROM
60FCh	0	Position Demand Internal Value	DINT	RO	Yes	– [inc]	No

(5) Following Error Window (6065h)

This parameter specifies the accepted detection range for the following error (bit 13 of Statusword).

If the actual value is out of the following error window, a following error occurs. A following error may occur when a drive is blocked, unreachable profile velocity occurs, or at wrong closed-loop coefficients.

Index	Sub	Name	Data Type	Access	PDO Mapping	Value	EEPROM
6065h	0	Following Error Window	UDINT	RW	No	0 to 1073741823 (Default: 5242880) [Pos. unit]	Yes

(6) Following Error Time Out (6066h)

A *position actual value* outside the allowed range of the following error window around a *position demand value* for longer than the following error time out will result in setting bit 13 (*following error*) in the Statusword to 1.

Index	Sub	Name	Data Type	Access	PDO Mapping	Value	EEPROM
6066h	0	Following Error Time Out	UINT	RW	No	0 to 65535 (Default: 0) [ms]	Yes

(7) Following Error Actual Value (60F4h)

This object provides the actual value of the following error.

Index	Sub	Name	Data Type	Access	PDO Mapping	Value	EEPROM
60F4h	0	Following Error Actual Value	DINT	RO	Yes	– [Pos. unit]	No

(8) Position Window (6067h)

This object specifies the positioning completed width for the target position. When the drive complets outputting of the reference to the target position, and the time specified by object 6068h has passed after the distance between the Target Position and the Position Actual Value falls within the value of this object, bit 10 (Target reached) of Statusword is set to 1.

Index	Sub	Name	Data Type	Access	PDO Mapping	Value	EEPROM
6067h	0	Position Window	UDINT	RW	No	0 to 1073741823 (Default: 30) [Pos. unit]	Yes

(9) Position Window Time (6068h)

When the drive completed outputting the reference to the target position, and the time specified by this object has passed after the distance between the Target Position and the Position Actual Value became within the value of object 6067h, the bit 10 (Target reached) of Statusword is set to 1.

Index	Sub	Name	Data Type	Access	PDO Mapping	Value	EEPROM
6068h	0	Position Window Time	UINT	RW	No	0 to 65535 (Default: 0) [ms]	Yes

8.10 Interpolated Position Mode

(1) Interpolation Data Record (60C1h)

This object represents the interpolation position reference in Interpolated Position mode.

Index	Sub	Name	Data Type	Access	PDO Mapping	Value	EEPROM
60C1h	0	Number of entries	USINT	RO	No	1	No
	1	Interpolation data record	DINT	RW	Yes	–2147483648 to +2147483647 (Default: 0) [Pos. unit]	No

(2) Interpolation Time Period (60C2h)

This object defines the update cycle of the interpolated position reference.

If DC Sync0 mode is selected, the interpolation time period value is automatically stored as the Sync0 cycle time.

If DC Free-run mode is selected, the interpolation time period has to be set by the master as the master application cycle time.

This object can be changed only in Switch on Disabled state.

Index	Sub	Name	Data Type	Access	PDO Mapping	Value	EEPROM
60C2h	0	Highest sub-index supported	USINT	RO	No	2	No
	1	Interpolation time period	USINT	RW	No	1 to 250 (Default: 125)	No
	2	Interpolation time index	SINT	RW	No	–6 to –3 (Default: –3)	No

Interpolation time = (Object 60C1:01h) $\times 10^{(\text{Object 60C1:02h})}$ [sec]

8.11 Cyclic Synchronous Position Mode

(1) Velocity Offset (60B1h)

In Cyclic Synchronous Position mode, this object sets the velocity feed forward value.
In Cyclic Synchronous Velocity mode, this object sets the offset value to be added to the velocity reference.

Index	Sub	Name	Data Type	Access	PDO Mapping	Value	EEPROM
60B1h	0	Velocity Offset	DINT	RW	Yes	–2147483648 to +2147483647 (Default: 0) [Vel. unit]	No

(2) Torque Offset (60B2h)

In Cyclic Synchronous Position mode and Cyclic Synchronous Velocity mode, this object sets the torque feed forward value. In Cyclic Synchronous Torque mode, this object sets the offset value to be added to the torque reference.

Index	Sub	Name	Data Type	Access	PDO Mapping	Value	EEPROM
60B2h	0	Torque Offset	INT	RW	Yes	–32768 to +32767 (Default: 0) [0.1%]	No

8.12 Profile Velocity/Cyclic Synchronous Velocity Mode

(1) Velocity Demand Value (606Bh)

This object provides the output value of the velocity trajectory generator or the output value of the position control function.

Index	Sub	Name	Data Type	Access	PDO Mapping	Value	EEPROM
606Bh	0	Velocity Demand Value	DINT	RO	Yes	– [Vel. unit]	No

(2) Velocity Actual Value (606Ch)

This object provides the actual velocity value derived from the position encoder.

Index	Sub	Name	Data Type	Access	PDO Mapping	Value	EEPROM
606Ch	0	Velocity Actual Value	DINT	RO	Yes	– [Vel. unit]	No

(3) Velocity Window (606Dh)

This object indicates the configured velocity window.

When the time specified by the Velocity Window Time (Object 606Eh) has passed after the difference between the target velocity and the velocity actual value falls within the value of this object, bit 10 (Target reached) of Statusword is set to 1.

Index	Sub	Name	Data Type	Access	PDO Mapping	Value	EEPROM
606Dh	0	Velocity Window	UINT	RW	No	0 to 65535 (Default: 20000) [Vel. unit]	Yes

(4) Velocity Window Time (606Eh)

When the time specified by the Velocity Window Time (Object 606Eh) has passed after the difference between the target velocity and the velocity actual value falls within the value of this object, bit 10 (Target reached) of Statusword is set to 1.

Index	Sub	Name	Data Type	Access	PDO Mapping	Value	EEPROM
606Eh	0	Velocity Window Time	UINT	RW	No	0 to 65535 (Default: 0) [ms]	Yes

(5) Target Velocity (60FFh)

This object specifies the target velocity for Profile Velocity mode and Cyclic Synchronous Velocity mode in user defined velocity reference units.

Index	Sub	Name	Data Type	Access	PDO Mapping	Value	EEPROM
60FFh	0	Target Velocity	DINT	RW	Yes	–2147483648 to +2147483647 (Default: 0) [Vel. unit]	No

8.13 Profile Torque/Cyclic Synchronous Torque Mode

(1) Target Torque (6071h)

This object specifies the input value of torque reference value for Torque Control mode. Set the value in units of 0.1% of the motor rated torque.

Index	Sub	Name	Data Type	Access	PDO Mapping	Value	EEPROM
6071h	0	Target Torque	INT	RW	Yes	–32768 to +32767 (Default: 0) [0.1%]	No

(2) Torque Demand Value (6074h)

This object indicates the currently output torque reference value. The value is indicated in units of 0.1% of the motor rated torque.

Index	Sub	Name	Data Type	Access	PDO Mapping	Value	EEPROM
6074h	0	Torque Demand Value	INT	RO	Yes	– [0.1%]	No

(3) Torque Slope (6087h)

This object sets the torque output slope to be used in Profile Torque mode. Set the amount of change per second in units of 0.1% of the motor rated torque.

Index	Sub	Name	Data Type	Access	PDO Mapping	Value	EEPROM
6087h	0	Torque Slope	UDINT	RW	Yes	0 to 4294967295 (Default: 1000) [0.1%/s]	Yes

(4) Motor Rated Torque (6076h)

This object indicates the motor rated torque (rated force for linear servomotors). The value is indicated in units of m Nm for rotational servomotors, and m·N for linear servomotors.

Index	Sub	Name	Data Type	Access	PDO Mapping	Value	EEPROM
6076h	0	Motor Rated Torque	UDINT	RO	No	– [mNm] or [mN]	No

(5) Torque Actual Value (6077h)

For SGDV SERVOPACKs, this object specifies the same setting as the torque reference output value.

Index	Sub	Name	Data Type	Access	PDO Mapping	Value	EEPROM
6077h	0	Torque Actual Value	INT	RO	Yes	– [0.1%]	No

8.14 Torque Limit Function

(1) Max. Torque (6072h)

This object sets the maximum output torque to the motor. Set the value in units of 0.1% of the motor rated torque.

The maximum motor torque is automatically set in this object when the power is turned ON.

Index	Sub	Name	Data Type	Access	PDO Mapping	Value	EEPROM
6072h	0	Max. Torque	UINT	RW	Yes	0 to 65535 (Default: max. motor torque) [0.1%]	No

(2) Positive Torque Limit Value (60E0h)

This object sets the positive torque limit value. Set the value in units of 0.1% of the motor rated torque.

Index	Sub	Name	Data Type	Access	PDO Mapping	Value	EEPROM
60E0h	0	Positive Torque Limit Value	UINT	RW	Yes	0 to 65535 (Default: 8000) [0.1%]	Yes

(3) Negative Torque Limit Value (60E1h)

This object sets the negative torque limit value. Set the value in units of 0.1% of the motor rated torque.

Index	Sub	Name	Data Type	Access	PDO Mapping	Value	EEPROM
60E1h	0	Negative Torque Limit Value	UINT	RW	Yes	0 to 65535 (Default: 8000) [0.1%]	Yes

8.15 Touch Probe Function

(1) Touch Probe Function (60B8h)

This object indicates the configured function of the touch probe.

Index	Sub	Name	Data Type	Access	PDO Mapping	Value	EEPROM
60B8h	0	Touch Probe Function	UINT	RW	Yes	0 to 0xFFFF (Default: 0)	No

■ Data Description

Bit	Value	Definition
0	0	Switch off touch probe 1
	1	Enable touch probe 1
1	0	Single trigger mode (Latches the position at the first trigger event.)
	1	Continuous trigger mode (Latches the position every trigger event.)
2	0	Triggers with the probe 1 input (SERVOPACK CN1/Probe 1 (S14) signal).
	1	Triggers with the encoder zero signal (phase-C).
3	–	Reserved
4	0	Switch off sampling at touch probe 1
	1	Enable sampling at touch probe 1
5 to 7	–	Reserved
8	0	Switch off touch probe 2
	1	Enable touch probe 2
9	0	Single trigger mode (Latches the position at the first trigger event.)
	1	Continuous trigger mode (Latches the position every trigger event.)
10	0	Triggers with the probe 2 input (SERVOPACK CN1/Probe 2 (S15) signal).
	1	Reserved
11	–	Reserved
12	0	Switch off sampling at touch probe 2
	1	Enable sampling at touch probe 2
13 to 15	–	Reserved

Note: Bit 0 to 7: For touch probe 1
Bit 8 to 15: For touch probe 2

When the homing function is executing, touch probe 1 function cannot be used. If touch probe 1 function was already enabled, touch probe 1 will be disabled.

(2) Touch Probe Status (60B9h)

This object provides the status of the touch probe.

Index	Sub	Name	Data Type	Access	PDO Mapping	Value	EEPROM
60B8h	0	Touch Probe Status	UINT	RO	Yes	–	No

■ Data Description

Bit	Value	Definition
0	0	Touch probe 1 is switched off
	1	Touch probe 1 is enabled
1	0	Touch probe 1 no value stored
	1	Touch probe 1 value stored
2 to 6	–	Reserved
7	0, 1	toggle with every update of Touch probe 1 value stored *
8	0	Touch probe 2 is switched off
	1	Touch probe 2 is enabled
9	0	Touch probe 2 no value stored
	1	Touch probe 2 value stored
10 to 14	–	Reserved
15	1	toggle with every update of Touch probe 2 value stored *

* If the continuous latch is enabled (Object 60B8 bit1 = 1, or bit9 = 1), bit7 or bit15 of Object 60B9h is toggled with every update of touch probe value stored.

(3) Touch Probe 1 Position Value (60BAh)

This object provides the position value of the touch probe 1. The value is given in user position units.

Index	Sub	Name	Data Type	Access	PDO Mapping	Value	EEPROM
60BAh	0	Touch Probe 1 Position Value	DINT	RO	Yes	– [Pos. unit]	No

(4) Touch Probe 2 Position Value (60BCh)

This object provides the position value of the touch probe 2. The value is given in user position units.

Index	Sub	Name	Data Type	Access	PDO Mapping	Value	EEPROM
60BCh	0	Touch Probe 2 Position Value	DINT	RO	Yes	– [Pos. unit]	No

8.16 Digital Inputs/Outputs

(1) Digital Inputs (60FDh)

This object indicates the digital inputs state of CN1 of the SGDV SERVOPACK.

Index	Sub	Name	Data Type	Access	PDO Mapping	Value	EEPROM
60FDh	0	Digital Inputs	UDINT	RO	Yes	–	No

■ Data Description

Bit	Signal	Description
0	N-OT: Negative limit switch	0: Switched off, 1: Switched on
1	P-OT: Positive limit switch	0: Switched off, 1: Switched on
2	Home switch	0: Switched off, 1: Switched on
3 to 15	–	Reserved
16	SI0:CN1-13pin	0: Switched off (Open), 1: Switched on (Close)
17	SI1:CN1-7pin	0: Switched off (Open), 1: Switched on (Close)
18	SI2:CN1-8pin	0: Switched off (Open), 1: Switched on (Close)
19	SI3:CN1-9pin	0: Switched off (Open), 1: Switched on (Close)
20	SI4:CN1-10pin	0: Switched off (Open), 1: Switched on (Close)
21	SI5:CN1-11pin	0: Switched off (Open), 1: Switched on (Close)
22	SI6:CN1-12pin	0: Switched off (Open), 1: Switched on (Close)
23	–	Reserved
24	HWBB1	Hardwired base block signal input 1 (0: Open, 1: Close)
25	HWBB2	Hardwired base block signal input 2 (0: Open, 1: Close)
26 to 31	–	Reserved

(2) Digital Outputs (60FEh)

This object controls the digital outputs state of CN1 of the SGDV SERVOPACK.

Sub-index 1 is used to control the physical outputs state. Sub-index 2 determines which physical bits of Sub-Index 1 are enabled.

If the SERVOPACK status output functions in objects 250Eh, 250Fh, and 2510h (Pn50E, Pn50F, and Pn510) are assigned, the status will be output using the set value of this object as well as OR logic. If any of these signals are assigned to functions that are enabled by objects 250Eh, 250Fh, or 2510h, use the Bit mask (sub-Index 2) to disable the corresponding signals so that these signals do not overlap.

Index	Sub	Name	Data Type	Access	PDO Mapping	Value	EEPROM
60FEh	0	Number of entries	USINT	RO	No	2	No
	1	Physical outputs*1	UDINT	RW	Yes	0 to 0xFFFFFFFF (Default: 0)	No
	2	Bit mask*2	UDINT	RW	No	0 to 0xFFFFFFFF (Default: 0x000C0000)	Yes

∗1. Data description of Physical outputs:

Bit	Signal	Description
0 to 16	–	Reserved
17	SO1: CN1 1-2 pin	0: Switch off, 1: Switch on
18	SO2: CN1 23-24 pin	0: Switch off, 1: Switch on
19	SO3: CN1 25-26 pin	0: Switch off, 1: Switch on
20 to 31	–	Reserved

∗2. Data description of Output mask:

Bit	Signal	Description
0 to 16	–	Reserved
17	SO1: CN1 1-2 pin	0: Disable physical output, 1: Enable
18	SO2: CN1 23-24 pin	0: Disable physical output, 1: Enable
19	SO3: CN1 25-26 pin	0: Disable physical output, 1: Enable
20 to 31	–	Reserved

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9

Troubleshooting

9.1 Troubleshooting 9-2
9.1.1 Alarm List for SERVOPACKs with Command Option Attachable Type 9-2
9.1.2 List of the EtherCAT (CoE) Network Module Alarms 9-6
9.1.3 Troubleshooting of the EtherCAT (CoE) Network Module Alarms 9-6
9.2 Warning Displays 9-10
9.3 Troubleshooting Malfunction Based on Operation and Conditions of the Servomotor 9-11

9.1 Troubleshooting

The SERVOPACK stops the servomotor by one of the methods described below, and displays the alarm status.

■ Status Display

SERVOPACK Panel Display	The alarm code is displayed. Example: A. → 0 → 1 → 0
Digital Operator	The alarm code is displayed.
Statusword (Object 6041h)	Statusword bit 3 (Fault) turns 1. (Bit 3 is 0 when operation is normal.)
Error Code (Object 603Fh)	The alarm code for the current error is stored in object 603Fh.
Emergency Message	The controller is notified of the alarm that occurred. (When EtherCAT communication is not stable, the controller may not be notified.)

■ Alarm Stopping Method

Gr.1: The servomotor is stopped according to the setting in Pn001.0 if an alarm occurs. Pn001.0 is factory-set to stop the servomotor by applying the DB.

Gr.2: The servomotor is stopped according to the setting in Pn00B.1 if an alarm occurs. Pn00B.1 is factory-set to stop the servomotor by setting the speed reference to "0." The servomotor under torque control will always use the Gr.1 method to stop. By setting Pn00B.1 to 1, the servomotor stops using the same method as Gr.1. When coordinating a number of servomotors, use this alarm stop method to prevent machine damage that may result due to differences in the stop method.

9.1.1 Alarm List for SERVOPACKs with Command Option Attachable Type

The following table provides a list of SERVOPACK alarms.

For details on causes of SERVOPACK alarms, and countermeasures to take, refer to *Σ-V series User's Manual Design and Maintenance Rotational Motor/Command Option Attachable Type (SIEP S800000 60)*.

Alarm Code	Alarm Name	Meaning	Servomotor Stop Method	Alarm Reset
020h	Parameter Checksum Error 1	The data of the parameter in the SERVOPACK is incorrect.	Gr.1	N/A
021h	Parameter Format Error 1	The data of the parameter in the SERVOPACK is incorrect.	Gr.1	N/A
022h	System Checksum Error 1	The data of the parameter in the SERVOPACK is incorrect.	Gr.1	N/A
030h	Main Circuit Detector Error	Detection data for power circuit is incorrect.	Gr.1	Available
040h	Parameter Setting Error 1	The parameter setting is outside the allowable setting range.	Gr.1	N/A
041h	Encoder Output Pulse Setting Error	The encoder output pulse setting (pulse unit) (Pn212) is outside the allowable setting range or not satisfies the setting conditions.	Gr.1	N/A
042h	Parameter Combination Error	Combination of some parameters exceeds the setting range.	Gr.1	N/A
044h	Semi-closed/Fully-closed Loop Control Parameter Setting Error	The settings of the fully-closed option module and Pn00B.3, Pn002.3 do not match.	Gr.1	N/A
04Ah	Parameter Setting Error 2	There is an error in settings of parameters reserved by the system.	Gr.1	N/A
050h	Combination Error	The SERVOPACK and the servomotor capacities do not match each other.	Gr.1	Available
051h	Unsupported Device Alarm	The device unit unsupported was connected.	Gr.1	N/A
080h[*1]	Linear Scale Pitch Setting Error	The setting of the linear scale pitch (Pn282) has not been changed from the default setting.	Gr.1	N/A
0b0h	Cancelled Servo ON Command Alarm	The Host controller reference was sent to turn the Servo ON after the Servo ON function was used with the utility function.	Gr.1	Available

Alarm Code	Alarm Name	Meaning	Servomotor Stop Method	Alarm Reset
100h	Overcurrent or Heat Sink Overheated	An overcurrent flowed through the IGBT. Heat sink of the SERVOPACK was overheated.	Gr.1	N/A
300h	Regeneration Error	Regenerative circuit or regenerative resistor is faulty.	Gr.1	Available
320h	Regenerative Overload	Regenerative energy exceeds regenerative resistor capacity.	Gr.2	Available
330h	Main Circuit Power Supply Wiring Error	• Setting of AC input/DC input is incorrect. • Power supply wiring is incorrect.	Gr.1	Available
400h	Overvoltage	Main circuit DC voltage is excessively high.	Gr.1	Available
410h	Undervoltage	Main circuit DC voltage is excessively low.	Gr.2	Available
450h	Main-Circuit Capacitor Overvoltage	The capacitor of the main circuit has deteriorated or is faulty.	Gr.1	N/A
510h	Overspeed	The servomotor speed is excessively high.	Gr.1	Available
511h	Overspeed of Encoder Output Pulse Rate	The motor speed upper limit of the set encoder output pulse (pulse unit) (Pn212) is exceeded.	Gr.1	Available
520h	Vibration Alarm	Vibration at the motor speed was detected.	Gr.1	Available
521h	Autotuning Alarm	Vibration was detected while performing tuning-less function.	Gr.1	Available
550h[*1]	Maximum Speed Setting Error	The Pn385 setting is greater than the maximum speed.	Gr.1	Available
710h	Overload: High Load	The motor was operating for several seconds to several tens of seconds under a torque largely exceeding ratings.	Gr.2	Available
720h	Overload: Low Load	The motor was operating continuously under a torque largely exceeding ratings.	Gr.1	Available
730h **731h**	Dynamic Brake Overload	When the dynamic brake was applied, rotational energy exceeded the capacity of dynamic brake resistor.	Gr.1	Available
740h	Overload of Surge Current Limit Resistor	The main circuit power was frequently turned ON and OFF.	Gr.1	Available
7A0h	Heat Sink Overheated	The heat sink of the SERVOPACK exceeded 100°C.	Gr.2	Available
7ABh	Built-in Fan in SERVOPACK Stopped	The fan inside the SERVOPACK stopped.	Gr.1	Available
810h[*2]	Encoder Backup Error	All the power supplies for the absolute encoder have failed and position data was cleared.	Gr.1	N/A
820h	Encoder Checksum Error	The checksum results of encoder memory is incorrect.	Gr.1	N/A
830h[*2]	Absolute Encoder Battery Error	The battery voltage was lower than the specified value after the control power supply is turned ON.	Gr.1	Available
840h	Encoder Data Error	Data in the encoder is incorrect.	Gr.1	N/A
850h	Encoder Overspeed	The encoder was rotating at high speed when the power was turned ON.	Gr.1	N/A
860h	Encoder Overheated	The internal temperature of encoder is too high.	Gr.1	N/A
890h[*1]	Encoder Scale Error	A linear scale fault occurred.	Gr.1	N/A
891h[*1]	Encoder Module Error	An encoder fault occurred	Gr.1	N/A
8A0h[*3]	External Encoder Error	External encoder is faulty.	Gr.1	Available
8A1h[*3]	External Encoder Error of Module	Serial converter unit is faulty.	Gr.1	Available
8A2h[*3]	External Encoder Error of Sensor (Incremental)	External encoder is faulty.	Gr.1	Available
8A3h[*3]	External Encoder Error of Position (Absolute)	The external encoder position data is incorrect.	Gr.1	Available
8A5h[*3]	External Encoder Overspeed	The overspeed from the external encoder occurred.	Gr.1	Available
8A6h[*3]	External Encoder Overheated	The overheat from the external encoder occurred.	Gr.1	Available
b31h	Current Detection Error1 (Phase-U)	The current detection circuit for phase-U is faulty.	Gr.1	N/A

Alarm Code	Alarm Name	Meaning	Servomotor Stop Method	Alarm Reset
b32h	Current Detection Error 2 (Phase-V)	The current detection circuit for phase-V is faulty.	Gr.1	N/A
b33h	Current Detection Error 3 (Current detector)	The detection circuit for the current is faulty.	Gr.1	N/A
bF0h	System Alarm 0	“Internal program error 0" occurred in the SERVOPACK.	Gr.1	N/A
bF1h	System Alarm 1	“Internal program error 1" occurred in the SERVOPACK.	Gr.1	N/A
bF2h	System Alarm 2	“Internal program error 2" occurred in the SERVOPACK.	Gr.1	N/A
bF3h	System Alarm 3	“Internal program error 3" occurred in the SERVOPACK.	Gr.1	N/A
bF4h	System Alarm 4	“Internal program error 4" occurred in the SERVOPACK.	Gr.1	N/A
C10h	Servo Overrun Detected	The servomotor ran out of control.	Gr.1	Available
C20h[*1]	Phase Detection Error	An error occurred in phase detection.	Gr.1	N/A
C21h[*1]	Hall Sensor Error	A hall sensor error occurred.	Gr.1	N/A
C22h[*1]	Phase Information Disagreement	Magnetic detection failed.	Gr.1	N/A
C50h[*1]	Polarity Detection Error	Magnetic detection failed.	Gr.1	N/A
C51h[*1]	Overtravel Detection at Polarity Detection	An overtravel signal was detected during polarity detection.	Gr.1	Available
C52h[*1]	Polarity Detection Uncompleted	The servo has been turned ON while polarity detection was not yet complete.	Gr.1	Available
C53h[*1]	Out of Range for Polarity Detection	The moving distance exceeded the set value of Pn48E in middle of detection.	Gr.1	N/A
C54h[*1]	Polarity Detection Error 2	Magnetic detection failed.	Gr.1	N/A
C80h	Absolute Encoder Clear Error and Multi-turn Limit Setting Error	The multi-turn for the absolute encoder was not properly cleared or set.	Gr.1	N/A
C90h	Encoder Communications Error	Communications between the SERVOPACK and the encoder is not possible.	Gr.1	N/A
C91h	Encoder Communications Position Data Error	An encoder position data calculation error occurred.	Gr.1	N/A
C92h	Encoder Communications Timer Error	An error occurs in the communications timer between the encoder and the SERVOPACK.	Gr.1	N/A
CA0h	Encoder Parameter Error	Encoder parameters are faulty.	Gr.1	N/A
Cb0h	Encoder Echoback Error	Contents of communications with encoder is incorrect.	Gr.1	N/A
CC0h[*2]	Multi-turn Limit Disagreement	Different multi-turn limits have been set in the encoder and the SERVOPACK.	Gr.1	N/A
CF1h[*3]	Feedback Option Module Communications Error (Reception error)	Reception from the feedback option module is faulty.	Gr.1	N/A
CF2h[*3]	Feedback Option Module Communications Error (Timer stop)	Timer for communications with the feedback option module is faulty.	Gr.1	N/A
d00h	Position Error Pulse Overflow	Position error pulses exceeded parameter (Pn520).	Gr.1	Available
d01h	Position Error Pulse Overflow Alarm at Servo ON	Position error pulses accumulated too much.	Gr.1	Available
d02h	Position Error Pulse Overflow Alarm by Speed Limit at Servo ON	After a position error pulse has been input, Pn529 limits the speed if the Servo ON command is received. If Pn529 limits the speed in such a state, this alarm occurs when the position references are input and the number of position error pulses exceeds the value set for parameter Pn520 (Excessive Position Error Alarm Level).	Gr.2	Available
d10h[*3]	Motor-load Position Error Pulse Overflow	Position error between motor and load is excessive when fully-closed position control is used.	Gr.2	Available
d30h[*1]	Position Data Overflow	The position data exceeded ±1879048192.	Gr.1	N/A

Alarm Code	Alarm Name	Meaning	Servomotor Stop Method	Alarm Reset
E00h	Command Option Module IF Initialization Timeout Error	Communications initialization failed between the SERVOPACK and the command option module.	Gr.2	Available
E02h	Command Option Module IF Synchronization Error 1	A synchronization error occurred between the SERVOPACK and the command option module.	Gr.1	Available
E03h	Command Option Module IF Communications Data Error	An error occurred in the data of communications between the SERVOPACK and the command option module.	Gr.1	Available
E70h	Command Option Module Detection Failure Alarm	Detection of the command option module failed.	Gr.1	N/A
E71h	Safety Option Module Detection Failure Alarm	Detection of the safety option module failed.	Gr.1	N/A
E72h[*3]	Feedback Option Module Detection Failure Alarm	Detection of the feedback option module failed.	Gr.1	N/A
E73h	Unsupported Command Option Module Alarm	A non-supported command option module was connected.	Gr.1	N/A
E74h	Unsupported Safety Option Module Alarm	A non-supported safety option module was connected.	Gr.1	N/A
E75h[*3]	Unsupported Feedback Option Module Alarm	A non-supported feedback option module was connected.	Gr.1	N/A
E80h	Command Option Module Detection Disagreement Alarm	The command option module was replaced with a different model.	Gr.1	N/A
Eb1h	Safety Device Signal Input Timing Error	There is an error in the timing of the safety function input signal.	Gr.1	N/A
F10h	Main Circuit Cable Open Phase	With the main power supply ON, voltage was low for more than 1 second in phase-R, -S or -T.	Gr.2	Available
CPF00	Digital Operator Transmission Error 1	Digital operator (JUSP-OP05A) fails to communicate with the SERVOPACK (e.g., CPU error).	–	N/A
CPF01	Digital Operator Transmission Error 2		–	N/A

∗1. May occur if a linear servomotor is connected.
∗2. May occur if a rotational servomotor is connected.
∗3. May occur if a fully-closed option module is mounted.

9.1.2 List of the EtherCAT (CoE) Network Module Alarms

This table lists the alarms of the EtherCAT (CoE) Network Module.

Alarm Code	Alarm Name	Meaning	Servomotor Stop Method	Alarm Reset
0EA0h	Command-Option IF Servo Unit Initial Error	The initial sequence between the EtherCAT (CoE) Network Module and the SERVOPACK was not completed within 10s.	Gr.1	N/A
0EA1h	Command-Option IF Memory Check Error	The communication memory of the EtherCAT (CoE) Network Module and the SERVOPACK is broken.	Gr.1	N/A
0EA2h	Command-Option IF Servo Synchronization Error *	The data exchange between the EtherCAT (CoE) Network Module and the SERVOPACK was not synchronized.	Gr.1	Available
0EA3h	Command-Option IF Servo Data Error *	The communication data between the EtherCAT (CoE) Network Module and the SERVOPACK was inappropriate.	Gr.1	Available
0A10h	EtherCAT DC Synchronization Error *	The Sync0 event and the SERVOPACK cannot be synchronized.	Gr.1	Available
0A11h	EtherCAT State Error	The EtherCAT AL state became not “Operational” while the DS402 drive state is in “Operation enabled.”	Gr.1	Available
0A12h	EtherCAT Outputs Data Synchronization Error *	The events, receive process data and sync0, do not synchronize. (Failed to receive the process data.)	Gr.1	Available
0A20h	Parameter Setting Error	The parameter setting is out of range.	Gr.1	N/A
0A40h	System Initialization Error	The initialization at power on sequence was failed.	Gr.1	N/A
0A41h	Communication Device Initialization Error	The ESC initialization was failed.	Gr.1	N/A
0A47h	Loading Servo Information Error	The loading of SERVOPACK information was failed.	Gr.1	N/A
0A48h	EEPROM Parameter Data Error	The checksum in EEPROM is broken.	Gr.1	N/A

* If an error is detected, the status of EtherCAT communication changes to SAFEOP.

9.1.3 Troubleshooting of the EtherCAT (CoE) Network Module Alarms

Refer to the following table to identify the cause of an alarm and the action to be taken. Contact your Yaskawa representative if the problem cannot be solved by the described corrective action.

Alarm Code	Alarm Name	Cause	Investigative Action	Corrective Action
0EA0h	Command-Option IF Servo Unit Initial Error	Faulty connection between the SERVOPACK and the EtherCAT (CoE) Network Module.	Check the connection between the SERVOPACK and the EtherCAT (CoE) Network Module.	Reconnect the EtherCAT (CoE) Network Module.
		Fault occurred in the EtherCAT (CoE) Network Module.	–	Repair or replace the EtherCAT (CoE) Network Module.
		Fault occurred in the SERVOPACK.	–	Repair or replace the SERVOPACK.
0EA1h	Command-Option IF Memory Check Error	Faulty connection between the SERVOPACK and the EtherCAT (CoE) Network Module.	Check the connection between the SERVOPACK and the EtherCAT (CoE) Network Module.	Reconnect the EtherCAT (CoE) Network Module.
		Fault occurred in the EtherCAT (CoE) Network Module.	–	Repair or replace the EtherCAT (CoE) Network Module.
		Fault occurred in the SERVOPACK.	–	Repair or replace the SERVOPACK.

(cont'd)

Alarm Code	Alarm Name	Cause	Investigative Action	Corrective Action
0EA2h	Command-Option IF Servo Synchronization Error	The synchronous timing (Sync0) of the SERVOPACK and the EtherCAT (CoE) Network Module fluctuated due to a fluctuation in the synchronous timing of EtherCAT communication.	–	Turn the power supply OFF and ON again and then reestablish communication.
		Faulty connection between the SERVOPACK and the EtherCAT (CoE) Network Module.	Check the connection between the SERVOPACK and the EtherCAT (CoE) Network Module.	Reconnect the EtherCAT (CoE) Network Module.
		Fault occurred in the EtherCAT (CoE) Network Module.	–	Repair or replace the EtherCAT (CoE) Network Module.
		Fault occurred in the SERVOPACK.	–	Repair or replace the SERVOPACK.
0EA3h	Command-Option IF Servo Data Error	A communication error occurred between the SERVOPACK and the EtherCAT (CoE) Network Module due to noise.	–	Implement countermeasures for noise.
		Faulty connection between the SERVOPACK and the EtherCAT (CoE) Network Module.	Check the connection between the SERVOPACK and the EtherCAT (CoE) Network Module.	Reconnect the EtherCAT (CoE) Network Module.
		Fault occurred in the EtherCAT (CoE) Network Module.	–	Repair or replace the EtherCAT (CoE) Network Module.
		Fault occurred in the SERVOPACK.	–	Repair or replace the SERVOPACK.
0A10h	EtherCAT DC Synchronization Error	Synchronous timing (Sync0) fluctuated for EtherCAT communication.	–	Turn the power supply OFF and ON again and then reestablish communication.
0A11h	EtherCAT State Error	EtherCAT communication was not in Operational state while the servomotor was operating.	–	Reset the alarm and then reestablish communication.
0A12h	EtherCAT Outputs Data Synchronization Error	An EtherCAT communication error occurred due to noise.	–	Correct the EtherCAT wiring and apply countermeasures for noise.
		The controller did not update process data in the regular cycle interval.	Check the process data that the controller is outputting.	Correct the controller so that it updates the process data in the regular cycle interval.
		There is a fault in the EtherCAT cable or connector wiring.	Check the EtherCAT cable and connector wiring.	Correct the wiring.

(cont'd)

Alarm Code	Alarm Name	Cause	Investigative Action	Corrective Action
0A20h	Parameter Setting Error	The position unit is set out of range.	Check whether the setting is within the following range. 1/4096 < Object 2701:01/Object 2701:02 < 4096	Correct the setting of object 2701h.
		The velocity unit is set out of range.	Check whether the setting is within the following range. 1/128 ≤ Object 2702:01/Object 2702:02 ≤ 524288	Correct the setting of object 2702h.
		The acceleration unit is set out of range.	Check whether the setting is within the following range. 1/128 ≤ Object 2703:01/Object 2703:02 ≤ 16384	Correct the setting of object 2703h.
0A40h	System Initialization Error	Fault occurred in the EtherCAT (CoE) Network Module.	–	Repair or replace the EtherCAT (CoE) Network Module.
0A41h	Communication Device Initialization Error	Fault occurred in the EtherCAT (CoE) Network Module.	–	Repair or replace the EtherCAT (CoE) Network Module.
0A47h	Loading Servo Information Error	Object 2700h was executed while an utility function (Fn□□□) was being executed using the digital operator or SigmaWin+.	–	Turn the power supply OFF and ON again.
		The power supply was turned ON or object 2700h was executed while the encoder was not connected.	Check the wiring of the encoder.	Reconnect the encoder, and then turn ON the power supply again.
		The power supply was turned ON or object 2700h was executed while alarm 040h (Parameter Setting Error 1) occurred.	Check the setting of the parameter.	Reset the parameter, and then turn ON the power supply again.
		Fault occurred in the EtherCAT (CoE) Network Module.	–	Repair or replace the EtherCAT (CoE) Network Module.

(cont'd)

Alarm Code	Alarm Name	Cause	Investigative Action	Corrective Action
0A48h	EEPROM Parameter Data Error	The power supply was interrupted during parameter writing.	Check the timing of the power interruption.	Initialize the parameter set value (object 1011h), and then input the parameter again.
		The number of parameters written exceeded the maximum value.	–	Repair or replace the SERVOPACK. Correct the parameter writing method.
		The power supply voltage momentarily dropped.	Measure the power supply voltage.	Set the power supply voltage within the specifications, and initialize the parameter set value (object 1011h).
		Fault occurred in the EtherCAT (CoE) Network Module.	–	Repair or replace the EtherCAT (CoE) Network Module.
		Fault occurred in the SERVOPACK.	–	Repair or replace the SERVOPACK.

9.2 Warning Displays

When a warning is detected, the SERVOPACK indicates the warning status as described below, and continues operating the servomotor.

■ Status Display

SERVOPACK Panel Display	The warning code is displayed. Example: A. → 9 → 1 → 0
Digital Operator	The warning code is displayed.
Statusword (Object 6041h)	Statusword bit 7 (Warning) turns ON. (Bit 7 is OFF when operation is normal.)
Error Code (Object 603Fh)	The warning code for the current error is stored in object 603Fh.
Emergency Message	The controller is notified of the warning that occurred. (When EtherCAT communication is not stable, the controller may not be notified.)

■ List of Warnings

The following table provides a list of SERVOPACK warnings.

For details on causes of SERVOPACK warnings, and countermeasures to take, refer to *Σ-V series User's Manual Design and Maintenance Rotational Motor/Command Option Attachable Type (SIEP S800000 60)*.

Warning Code	Warning Name	Meaning
900h	Position Error Pulse Overflow	Position error pulse exceeded the parameter settings (Pn520 × Pn51E/100).
901h	Position Error Pulse Overflow Alarm at Servo ON	When the servo turns ON, the position error pulses exceeded the parameter setting (Pn526 × Pn528/100).
910h	Overload	This warning occurs before the overload alarms (710h or 720h) occur. If the warning is ignored and operation continues, an overload alarm may occur.
911h	Vibration	Abnormal vibration at the motor speed was detected. The detection level is the same as 520h. Set whether to output an alarm or warning by "Vibration Detection Switch" of Pn310.
920h	Regenerative Overload	This warning occurs before the regenerative overload alarm (320h) occurs. If the warning is ignored and operation continues, a regenerative overload alarm may occur.
921h	Dynamic Brake Overload	This warning occurs before Dynamic Brake Overload (731h) alarm occurs. If the warning is ignored and operation continues, a dynamic brake overload alarm may occur.
930h	Absolute Encoder Battery Error	This warning occurs when the absolute encoder battery voltage is lowered.
971h	Undervoltage	This warning occurs before Undervoltage (410h) alarm occurs. If the warning is ignored and operation continues, an undervoltage alarm may occur.

Note 1. Warning code is not outputted without setting Pn001.3 =1 (Outputs both Alarm Codes and Warning Codes.)
2. If Pn008.2 = 1 (Do not detect warning) is selected, no warnings will be detected.

9.3 Troubleshooting Malfunction Based on Operation and Conditions of the Servomotor

Troubleshooting for the malfunctions based on the operation and conditions of the servomotor is provided in this section.

Be sure to turn OFF the servo system before troubleshooting items shown in bold lines in the table.

Problem	Probable Cause	Investigative Actions	Corrective Actions
Servomotor Does Not Start	A servo ON command was not input.	Check that the Controlword (object 6040h) is set to *Operation enabled*.	Set the Controlword (object 6040h) value correctly.
	The torque limit reference is set too low.	Check the torque limit reference.	The torque limit reference is set too high.
	The Operation mode is not set.	Check whether the Operation mode (object 6060h) is set.	Set the Operation mode (object 6060h) correctly.
	A software limit is in effect.	Check whether the target position exceeds the limit.	Specify a target position within the limit range.
	The EtherCAT communication is not established.	Check whether the EtherCAT indicators show Operational state.	Change the EtherCAT communication state to *Operational*.
	The forward run prohibited (P-OT) and reverse run prohibited (N-OT) input signals are turned OFF.	Check the P-OT and N-OT input signals and the input signal allocation parameters (Pn50A, Pn50B).	Turn P-OT or N-OT input signal ON. Or, disable the P-OT and N-OT input signal allocations.
	The safety input signal (/HWBB1 or /HWBB2) remains OFF.	Check the /HWBB1 or /HWBB2 input signal.	Set the /HWBB1 or /HWBB2 input signal to ON. When not using the safety function, mount the safety function jumper connector (provided as an accessory) on the CN8.
	An alarm is occurring.	Check the panel display to see whether an alarm is occurring.	Remove the cause of the alarm, and then restart operation.
	Overloaded	Run under no load and check the load status.	Reduce load or replace with larger capacity servomotor.
	Servomotor or encoder wiring disconnected.	Check the wiring.	Correct the wiring.
	The main circuit power supply is not ON.	Check whether the main circuit power supply is connected.	Wire the main circuit power supply correctly.
	The control power supply is not ON.	Check whether the control power supply is connected.	Wire the control power supply correctly.
Servomotor Moves Instantaneously, and then Stops	Servomotor wiring is incorrect.	Check the servomotor wiring.	Correct the wiring.
Servomotor Speed Unstable	An EtherCAT communication error may have occurred, and the reference may not be updated.	Check the EtherCAT cable and connector wiring.	Correct the EtherCAT cable and connector wiring.
	The controller is not updating the reference data in the regular cycle.	Trace the reference data and check whether it is being updated in the regular cycle.	Send the reference data in the regular cycle.
	Wiring connection to servomotor is defective.	Check connections of main circuit cable (phases-U, -V, and -W) and encoder connectors.	Tighten any loose terminals or connectors.

Problem	Probable Cause	Investigative Actions	Corrective Actions
Dynamic Brake Does Not Operate	Improper Pn001.0 setting	Check the setting of parameter Pn001.0.	Correct the parameter setting.
	DB resistor disconnected	Check if excessive moment of inertia, motor overspeed, or DB frequently activated occurred. If any of these occurred, it is possible that DB resistance may have been disconnected.	Replace the SERVOPACK, and lighten the load. To prevent the resistor from being disconnected, take measures to reduce the load.
	DB drive circuit fault	–	Replace the SERVOPACK.
Abnormal Noise from Servomotor	The servomotor largely vibrated during execution of tuning-less function.	Check the servomotor speed waveform.	Reduce the load so that the moment of inertia ratio becomes within the allowable value, or increase the load level or lower the tuning level for the tuning-less level setting (Fn200).
	Mounting is not secured.	Check if there are any loose mounting screws.	Tighten the mounting screws.
		Check if there is misalignment of couplings.	Align the couplings.
		Check if there are unbalanced couplings.	Balance the couplings.
	Bearings are defective.	Check for noise and vibration around the bearings.	Replace the servomotor.
	Vibration source at the driven machine	Check for any foreign matter, damage, or deformations on the machinery's movable parts.	Contact the machine manufacturer.
	Noise interference due to incorrect input/output signal cable specifications	The input/output signal cables must be tinned annealed copper twisted-pair or shielded twisted-pair cables with a core of 0.12 mm^2 min.	Use the specified input signal wires.
	Noise interference due to length of input/output signal cable.	Check the length of the input/output cable.	The input/output cable length must be no more than 3 m.
	Noise interference due to incorrect encoder cable specifications.	The encoder cable must be tinned annealed copper twisted-pair or shielded twisted-pair cables with a core of 0.12 mm^2 min.	Use the specified encoder cable.
	Noise interference due to length of encoder cable wiring	Check the length of the encoder cable.	The encoder cable must be no more than 20 m.
	Noise interference due to damaged encoder cable	Check if the encoder cable is damaged or bent.	Replace the encoder cable and modify the encoder cable layout.
	Excessive noise to the encoder cable	Check if the encoder cable is bundled with high-current line or near a high-current line.	Correct the encoder cable layout so that no surge is applied.
	FG potential varies because of influence of machines such as welders at the servomotor.	Check if the machines are correctly grounded.	Ground machines correctly, and prevent diversion to the FG at the PG side.
	SERVOPACK pulse counting error due to noise interference	Check if there is noise interference on the input/output signal line from the encoder.	Take measures against noise in the encoder wiring.
	Excessive vibration and shock to the encoder	Check if vibration from the machine occurred or servomotor installation is incorrect (mounting surface accuracy, fixing, alignment, etc.).	Reduce vibration from the machine, or secure the servomotor installation.
	An encoder fault occurred.	–	Replace the servomotor.

Problem	Probable Cause	Investigative Actions	Corrective Actions
Servomotor Vibrates at Frequency of Approx 200 to 400 Hz	Unbalanced servo gains	Check to see if the servo gains have been correctly adjusted.	Execute the advanced autotuning.
	Speed loop gain value (Pn100) too high.	Check the speed loop gain value (Pn100). Factory setting: Kv = 40.0 Hz	Reduce the speed loop gain (Pn100).
	Position loop gain value (Pn102) too high.	Check the position loop gain value (Pn102). Factory setting: Kp = 40.0/s	Reduce the position loop gain (Pn102).
	Incorrect speed loop integral time constant (Pn101) setting	Check the speed loop integral time constant (Pn101). Factory setting: Ti = 20.0 ms	Correct the speed loop integral time constant (Pn101) setting.
	Incorrect moment of inertia ratio data (Pn103)	Check the moment of inertia ratio setting (Pn103).	Correct the moment of inertia ratio (Pn103) setting.
High Rotation Speed Overshoot on Starting and Stopping	Unbalanced servo gains	Check to see if the servo gains have been correctly adjusted.	Execute the advanced autotuning.
	Speed loop gain value (Pn100) too high	Check the speed loop gain value (Pn100). Factory setting: Kv = 40.0 Hz	Reduce the speed loop gain (Pn100).
	Position loop gain value (Pn102) too high	Check the position loop gain value (Pn102). Factory setting: Kp = 40.0/s	Reduce the position loop gain (Pn102).
	Incorrect speed loop integral time constant (Pn101) setting	Check the speed loop integral time constant (Pn101). Factory setting: Ti = 20.0 ms	Correct the speed loop integral time constant setting (Pn101).
	Incorrect moment of inertia ratio data (Pn103)	Check the moment of inertia ratio setting (Pn103).	Correct the moment of inertia ratio setting (Pn103).
Overtravel (OT)	Forward or reverse run prohibited signal is input.	Check the external power supply (+24 V) voltage for the input signal.	Correct the external power supply (+24 V) voltage.
		Check if the overtravel limit switch operates properly.	Correct the overtravel limit switch.
		Check if the overtravel limit switch is wired correctly.	Correct the overtravel limit switch wiring.
		Check the settings for Pn50A and Pn50B.	Set the parameters correctly.
	Forward or reverse run prohibited signal malfunctioning.	Check the fluctuation of the input signal external power supply (+24 V) voltage.	Stabilize the external power supply (+24 V) voltage.
		Check if the overtravel limit switch operates correctly.	Stabilize the operation of the over-travel limit switch.
		Check if the overtravel limit switch wiring is correct. (check for damaged cables or loose screws.)	Correct the overtravel limit switch wiring.
	Incorrect forward or reverse run prohibited signal (P-OT/N-OT) allocation (parameters Pn50A.3, Pn50B.0)	Check if the P-OT signal is allocated in Pn50A.3.	If another signal is allocated in Pn50A.3, select P-OT.
		Check if the N-OT signal is allocated in Pn50B.0.	If another signal is allocated in Pn50B.0, select N-OT.
	Incorrect servomotor stop method selection	Check Pn001.0 and Pn001.1 when the servomotor power is OFF.	Select a servo mode stop method other than “coast to stop.”
		Check Pn001.0 and Pn001.1 when in torque control.	Select a servo mode stop method other than “coast to stop.”
Servomotor Overheated	Ambient temperature too high	Measure the servomotor ambient temperature.	Reduce the ambient temperature to 40°C or less.
	Servomotor surface dirty	Visually check the surface.	Clean dust and oil from the surface.
	Servomotor overloaded	Check the load status with monitor.	If overloaded, reduce load or replace the SERVOPACK and the servomotor with larger capacity.

10

Appendix

10.1 Object List 10-2
10.2 SERVOPACK Parameters 10-9
10.3 SDO Abort Code List 10-30

10.1 Object List

Index	Sub Index	Name	Data Type	Access	PDO Mapping	EEPROM *1	Default Value	Lower Limit	Upper Limit	Unit	Pn No.*2
1000h	0	Device Type	UDINT	RO	No	No	0x00020192	–	–	–	–
1001h	0	Error Register	USINT	RO	No	No	–	–	–	–	–
1008h	0	Manufacturer Device Name	STRING	RO	No	No	–	–	–	–	–
100Ah	0	Manufacturer Software Version	STRING	RO	No	No	–	–	–	–	–
1010h	Store Parameters										
	0	Largest subindex supported	USINT	RO	No	No	4	–	–	–	–
	1	Save all parameters	UDINT	RW	No	No	0x00000001	0x00000000	0xFFFFFFFF	–	PnC00*3
	2	Save communication parameters	UDINT	RW	No	No	0x00000001	0x00000000	0xFFFFFFFF	–	PnC02*3
	3	Save application parameters	UDINT	RW	No	No	0x00000001	0x00000000	0xFFFFFFFF	–	PnC04*3
	4	Save manufacturer defined parameters	UDINT	RW	No	No	0x00000001	0x00000000	0xFFFFFFFF	–	PnC06*3
1011h	Restore Default Parameters										
	0	Largest subindex supported	USINT	RO	No	No	4	–	–	–	–
	1	Restore all default parameters	UDINT	RW	No	No	0x00000001	0x00000000	0xFFFFFFFF	–	PnC08*3
	2	Restore communication default parameters	UDINT	RW	No	No	0x00000001	0x00000000	0xFFFFFFFF	–	PnC0A*3
	3	Restore application default parameters	UDINT	RW	No	No	0x00000001	0x00000000	0xFFFFFFFF	–	PnC0C*3
	4	Restore manufacturer defined default parameters	UDINT	RW	No	No	0x00000001	0x00000000	0xFFFFFFFF	–	PnC0E*3
1018h	Identity Object										
	0	Number of entries	USINT	RO	No	No	4	–	–	–	–
	1	Vendor ID	UDINT	RO	No	No	0x539	–	–	–	–
	2	Product code	UDINT	RO	No	No	0x0220000*4	–	–	–	–
	3	Revision number	UDINT	RO	No	No	–	–	–	–	–
	4	Serial number	UDINT	RO	No	No	0	–	–	–	–
1600h	1st Receive PDO Mapping										
	0	Number of objects in this PDO	USINT	RW	No	Yes	8	0	8	–	PnCA0
	1	Mapping entry 1	UDINT	RW	No	Yes	0x60400010	0	0xFFFFFFFF	–	PnC20
	2	Mapping entry 2	UDINT	RW	No	Yes	0x607A0020	0	0xFFFFFFFF	–	PnC22
	3	Mapping entry 3	UDINT	RW	No	Yes	0x60FF0020	0	0xFFFFFFFF	–	PnC24
	4	Mapping entry 4	UDINT	RW	No	Yes	0x60710010	0	0xFFFFFFFF	–	PnC26
	5	Mapping entry 5	UDINT	RW	No	Yes	0x60720010	0	0xFFFFFFFF	–	PnC28
	6	Mapping entry 6	UDINT	RW	No	Yes	0x60600008	0	0xFFFFFFFF	–	PnC2A
	7	Mapping entry 7	UDINT	RW	No	Yes	0x00000008	0	0xFFFFFFFF	–	PnC2C
	8	Mapping entry 8	UDINT	RW	No	Yes	0x60B80010	0	0xFFFFFFFF	–	PnC2E

∗1. Write “Save” into the object 1010h. The current parameter data will be saved as a batch in the EEPROM.
If the objects are modified by the digital operator or SigmaWin+, the data will be directly stored in the EEPROM.
∗2. Pn No. is the number of the parameter used for the digital operator and SigmaWin+.
∗3. Cannot be written by digital operator.
∗4. For SGDV-□□□□E1: 0x02200001
For SGDV-□□□□E5: 0x02200002

Index	Sub Index	Name	Data Type	Access	PDO Mapping	EEPROM *1	Default Value	Lower Limit	Upper Limit	Unit	Pn No.*2
1601h	2nd Receive PDO Mapping										
	0	Number of objects in this PDO	USINT	RW	No	Yes	2	0	8	–	PnCA1
	1	Mapping entry 1	UDINT	RW	No	Yes	0x60400010	0	0xFFFFFFFF	–	PnC30
	2	Mapping entry 2	UDINT	RW	No	Yes	0x607A0020	0	0xFFFFFFFF	–	PnC32
	3	Mapping entry 3	UDINT	RW	No	Yes	0	0	0xFFFFFFFF	–	PnC34
	4	Mapping entry 4	UDINT	RW	No	Yes	0	0	0xFFFFFFFF	–	PnC36
	5	Mapping entry 5	UDINT	RW	No	Yes	0	0	0xFFFFFFFF	–	PnC38
	6	Mapping entry 6	UDINT	RW	No	Yes	0	0	0xFFFFFFFF	–	PnC3A
	7	Mapping entry 7	UDINT	RW	No	Yes	0	0	0xFFFFFFFF	–	PnC3C
	8	Mapping entry 8	UDINT	RW	No	Yes	0	0	0xFFFFFFFF	–	PnC3E
1602h	3rd Receive PDO Mapping										
	0	Number of objects in this PDO	USINT	RW	No	Yes	2	0	8	–	PnCA2
	1	Mapping entry 1	UDINT	RW	No	Yes	0x60400010	0	0xFFFFFFFF	–	PnC40
	2	Mapping entry 2	UDINT	RW	No	Yes	0x60FF0020	0	0xFFFFFFFF	–	PnC42
	3	Mapping entry 3	UDINT	RW	No	Yes	0	0	0xFFFFFFFF	–	PnC44
	4	Mapping entry 4	UDINT	RW	No	Yes	0	0	0xFFFFFFFF	–	PnC46
	5	Mapping entry 5	UDINT	RW	No	Yes	0	0	0xFFFFFFFF	–	PnC48
	6	Mapping entry 6	UDINT	RW	No	Yes	0	0	0xFFFFFFFF	–	PnC4A
	7	Mapping entry 7	UDINT	RW	No	Yes	0	0	0xFFFFFFFF	–	PnC4C
	8	Mapping entry 8	UDINT	RW	No	Yes	0	0	0xFFFFFFFF	–	PnC4E
1603h	4th Receive PDO Mapping										
	0	Number of objects in this PDO	USINT	RW	No	Yes	2	0	8	–	PnCA3
	1	Mapping entry 1	UDINT	RW	No	Yes	0x60400010	0	0xFFFFFFFF	–	PnC50
	2	Mapping entry 2	UDINT	RW	No	Yes	0x60710010	0	0xFFFFFFFF	–	PnC52
	3	Mapping entry 3	UDINT	RW	No	Yes	0	0	0xFFFFFFFF	–	PnC54
	4	Mapping entry 4	UDINT	RW	No	Yes	0	0	0xFFFFFFFF	–	PnC56
	5	Mapping entry 5	UDINT	RW	No	Yes	0	0	0xFFFFFFFF	–	PnC58
	6	Mapping entry 6	UDINT	RW	No	Yes	0	0	0xFFFFFFFF	–	PnC5A
	7	Mapping entry 7	UDINT	RW	No	Yes	0	0	0xFFFFFFFF	–	PnC5C
	8	Mapping entry 8	UDINT	RW	No	Yes	0	0	0xFFFFFFFF	–	PnC5E
1A00h	1st Transmit PDO Mapping										
	0	Number of objects in this PDO	USINT	RW	No	Yes	8	0	8	–	PnCA4
	1	Mapping entry 1	UDINT	RW	No	Yes	0x60410010	0	0xFFFFFFFF	–	PnC60
	2	Mapping entry 2	UDINT	RW	No	Yes	0x60640020	0	0xFFFFFFFF	–	PnC62
	3	Mapping entry 3	UDINT	RW	No	Yes	0x60770010	0	0xFFFFFFFF	–	PnC64
	4	Mapping entry 4	UDINT	RW	No	Yes	0x60F40020	0	0xFFFFFFFF	–	PnC66
	5	Mapping entry 5	UDINT	RW	No	Yes	0x60610008	0	0xFFFFFFFF	–	PnC68
	6	Mapping entry 6	UDINT	RW	No	Yes	0x00000008	0	0xFFFFFFFF	–	PnC6A
	7	Mapping entry 7	UDINT	RW	No	Yes	0x60B90010	0	0xFFFFFFFF	–	PnC6C
	8	Mapping entry 8	UDINT	RW	No	Yes	0x60BA0020	0	0xFFFFFFFF	–	PnC6E

∗1. Write “Save” into the object 1010h. The current parameter data will be saved as a batch in the EEPROM.
If the objects are modified by the digital operator or SigmaWin+, the data will be directly stored in the EEPROM.

∗2. Pn No. is the number of the parameter used for the digital operator and SigmaWin+.

Index	Sub Index	Name	Data Type	Access	PDO Mapping	EEPROM *1	Default Value	Lower Limit	Upper Limit	Unit	Pn No.*2
1A01h	2nd Transmit PDO Mapping										
	0	Number of objects in this PDO	USINT	RW	No	Yes	2	0	8	–	PnCA5
	1	Mapping entry 1	UDINT	RW	No	Yes	0x60410010	0	0xFFFFFFFF	–	PnC70
	2	Mapping entry 2	UDINT	RW	No	Yes	0x60640020	0	0xFFFFFFFF	–	PnC72
	3	Mapping entry 3	UDINT	RW	No	Yes	0	0	0xFFFFFFFF	–	PnC74
	4	Mapping entry 4	UDINT	RW	No	Yes	0	0	0xFFFFFFFF	–	PnC76
	5	Mapping entry 5	UDINT	RW	No	Yes	0	0	0xFFFFFFFF	–	PnC78
	6	Mapping entry 6	UDINT	RW	No	Yes	0	0	0xFFFFFFFF	–	PnC7A
	7	Mapping entry 7	UDINT	RW	No	Yes	0	0	0xFFFFFFFF	–	PnC7C
	8	Mapping entry 8	UDINT	RW	No	Yes	0	0	0xFFFFFFFF	–	PnC7E
1A02h	3rd Transmit PDO Mapping										
	0	Number of objects in this PDO	USINT	RW	No	Yes	2	0	8	–	PnCA6
	1	Mapping entry 1	UDINT	RW	No	Yes	0x60410010	0	0xFFFFFFFF	–	PnC80
	2	Mapping entry 2	UDINT	RW	No	Yes	0x60640020	0	0xFFFFFFFF	–	PnC82
	3	Mapping entry 3	UDINT	RW	No	Yes	0	0	0xFFFFFFFF	–	PnC84
	4	Mapping entry 4	UDINT	RW	No	Yes	0	0	0xFFFFFFFF	–	PnC86
	5	Mapping entry 5	UDINT	RW	No	Yes	0	0	0xFFFFFFFF	–	PnC88
	6	Mapping entry 6	UDINT	RW	No	Yes	0	0	0xFFFFFFFF	–	PnC8A
	7	Mapping entry 7	UDINT	RW	No	Yes	0	0	0xFFFFFFFF	–	PnC8C
	8	Mapping entry 8	UDINT	RW	No	Yes	0	0	0xFFFFFFFF	–	PnC8E
1A03h	4th Transmit PDO Mapping										
	0	Number of objects in this PDO	USINT	RW	No	Yes	3	0	8	–	PnCA7
	1	Mapping entry 1	UDINT	RW	No	Yes	0x60410010	0	0xFFFFFFFF	–	PnC90
	2	Mapping entry 2	UDINT	RW	No	Yes	0x60640020	0	0xFFFFFFFF	–	PnC92
	3	Mapping entry 3	UDINT	RW	No	Yes	0x60770010	0	0xFFFFFFFF	–	PnC94
	4	Mapping entry 4	UDINT	RW	No	Yes	0	0	0xFFFFFFFF	–	PnC96
	5	Mapping entry 5	UDINT	RW	No	Yes	0	0	0xFFFFFFFF	–	PnC98
	6	Mapping entry 6	UDINT	RW	No	Yes	0	0	0xFFFFFFFF	–	PnC9A
	7	Mapping entry 7	UDINT	RW	No	Yes	0	0	0xFFFFFFFF	–	PnC9C
	8	Mapping entry 8	UDINT	RW	No	Yes	0	0	0xFFFFFFFF	–	PnC9E
1C00h	Sync Manager Communication Type										
	0	Number of used Sync Manager channels	USINT	RO	No	No	4	–	–	–	–
	1	Communication type sync manager 0	USINT	RO	No	No	1	–	–	–	PnCB0
	2	Communication type sync manager 1	USINT	RO	No	No	2	–	–	–	PnCB1
	3	Communication type sync manager 2	USINT	RO	No	No	3	–	–	–	PnCB2
	4	Communication type sync manager 3	USINT	RO	No	No	4	–	–	–	PnCB3
1C10h	0	Sync Manager PDO assignment 0	USINT	RO	No	No	0	–	–	–	–
1C11h	0	Sync Manager PDO assignment 1	USINT	RO	No	No	0	–	–	–	–

∗1. Write “Save” into the object 1010h. The current parameter data will be saved as a batch in the EEPROM.
If the objects are modified by the digital operator or SigmaWin+, the data will be directly stored in the EEPROM.

∗2. Pn No. is the number of the parameter used for the digital operator and SigmaWin+.

Index	Sub Index	Name	Data Type	Access	PDO Mapping	EEPROM *1	Default Value	Lower Limit	Upper Limit	Unit	Pn No.*2
1C12h	Sync Manager PDO Assignment2										
	0	Number of assigned PDOs	USINT	RW	No	Yes	1	0	2	–	PnCB5
	1	Index of assigned RxPDO 1	UINT	RW	No	Yes	0x1601	0x1600	0x1603	–	PnCB6
	2	Index of assigned RxPDO 2	UINT	RW	No	Yes	0x1600	0x1600	0x1603	–	PnCB7
1C13h	Sync Manager PDO Assignment3										
	0	Number of assigned PDOs	USINT	RW	No	Yes	1	0	2	–	PnCBB
	1	Index of assigned TxPDO 1	UINT	RW	No	Yes	0x1A01	0x1A00	0x1A03	–	PnCBC
	2	Index of assigned TxPDO 2	UINT	RW	No	Yes	0x1A00	0x1A00	0x1A03	–	PnCBD
1C32h	Sync Manager 2 (process data output) Synchronization										
	0	Number of synchronization parameters	USINT	RO	No	No	10	–	–	–	–
	1	Synchronization type	UINT	RO	No	No	–	–	–	–	PnCC0
	2	Cycle time	UDINT	RO	No	No	–	–	–	–	PnCC2
	3	Shift time	UDINT	RO	No	No	125000	–	–	–	PnCC4
	4	Synchronization types supported	UINT	RO	No	No	0x0005	–	–	–	–
	5	Minimum cycle time	UDINT	RO	No	No	62500	–	–	–	–
	6	Calc and copy time	UDINT	RO	No	No	62500	–	–	–	–
	7	Reserved	UDINT	RO	No	No	0	–	–	–	–
	8	Reserved	UINT	RO	No	No	0	–	–	–	–
	9	Delay time	UDINT	RO	No	No	0	–	–	–	–
	10	Sync0 cycle time	UDINT	RO	No	No	–	–	–	–	PnCC6
	11	Reserved	UDINT	RO	No	No	0				–
	12	SM2 event miss count	UDINT	RO	No	No	–				PnCC8
1C33h	Sync Manager 3 (process data input) Synchronization										
	0	Number of synchronization parameters	USINT	RO	No	No	10	–	–	–	–
	1	Synchronization type	UINT	RO	No	No	–	–	–	–	–
	2	Cycle time	UDINT	RO	No	No	–	–	–	–	–
	3	Shift time	UDINT	RW	No	Yes	0	0	Sync0 event cycle - 125000	–	PnCCA
	4	Synchronization types supported	UINT	RO	No	No	0x0025	–	–	–	–
	5	Minimum cycle time	UDINT	RO	No	No	62500	–	–	–	–
	6	Calc and copy time	UDINT	RO	No	No	62500	–	–	–	–
	7	Reserved	UDINT	RO	No	No	0	–	–	–	–
	8	Reserved	UINT	RO	No	No	0	–	–	–	–
	9	Delay time	UDINT	RO	No	No	0	–	–	–	–
	10	Sync0 cycle time	UDINT	RO	No	No	–	–	–	–	–
1F01h	Sync Error Settings										
	0	Number of entries	USINT	RO	No	No	2	–	–	–	–
	1	Reserved	UDINT	RO	No	No	0	–	–	–	–
	2	Sync error count limit	UDINT	RW	No	No	9	0	15	–	PnCCC
2000h to 26FFh	0	SERVOPACK Parameter (Pn000 - Pn6FF)	–	–	–	–	–	–	–	–	Pn000 – Pn6FF
2700h	0	User Parameter Configuration	UDINT	RW	No	No	0	0	0xFFFFFFFF	–	PnB00

∗1. Write “Save” into the object 1010h. The current parameter data will be saved as a batch in the EEPROM.
If the objects are modified by the digital operator or SigmaWin+, the data will be directly stored in the EEPROM.

∗2. Pn No. is the number of the parameter used for the digital operator and SigmaWin+.

Index	Sub Index	Name	Data Type	Access	PDO Mapping	EEPROM *1	Default Value	Lower Limit	Upper Limit	Unit	Pn No.*2
2701h	Position User Unit										
	0	Number of entries	USINT	RO	No	No	2	–	–	–	–
	1	Numerator	UDINT	RW	No	Yes	1	1	1073741823	–	PnB02
	2	Denominator	UDINT	RW	No	Yes	1	1	1073741823	–	PnB04
2702h	Velocity User Unit										
	0	Number of entries	USINT	RO	No	No	2	–	–	–	–
	1	Numerator	UDINT	RW	No	Yes	1	1	1073741823	–	PnB06
	2	Denominator	UDINT	RW	No	Yes	1	1	1073741823	–	PnB08
2703h	Acceleration User Unit										
	0	Number of entries	USINT	RO	No	No	2	–	–	–	–
	1	Numerator	UDINT	RW	No	Yes	1	1	1073741823	–	PnB0A
	2	Denominator	UDINT	RW	No	Yes	1	1	1073741823	–	PnB0C
2710h	SERVOPACK Adjusting Command										
	0	Number of entries	USINT	RO	No	No	3	–	–	–	–
	1	Command	STRING	RW	No	No	0	0	0xFF	–	–
	2	Status	USINT	RO	No	No	–	–	–	–	–
	3	Reply	STRING	RO	No	No	–	–	–	–	–
27E0h	–	Diag.Mode	UINT	RW	No	No	0	0	0xFFFF	–	PnCFE
603Fh	0	Error Code	UINT	RO	Yes	No	–	–	–	–	PnB10
6040h	0	Controlword	UINT	RW	Yes	No	0	0	0xFFFF	–	PnB11
6041h	0	Statusword	UINT	RO	Yes	No	–	–	–	–	PnB12
605Ah	0	Quick Stop Option Code	INT	RW	No	Yes	2	0	4	–	PnB13
605Bh	0	Shutdown Option Code	INT	RW	No	Yes	0	0	1	–	PnB14
605Ch	0	Disable Operation Option Code	INT	RW	No	Yes	1	0	1	–	PnB15
605Dh	0	Halt Option Code	INT	RW	No	Yes	1	0	4	–	PnB16
605Eh	0	Fault Reaction Option Code	INT	RW	No	Yes	0	0	0	–	PnB17
6060h	0	Modes of Operation	SINT	RW	Yes	Yes	0	0	10	–	PnB18
6061h	0	Modes of Operation Display	SINT	RO	Yes	No	0	–	–	–	PnB19
6062h	0	Position Demand Value	DINT	RO	Yes	No	–	–	–	Pos. unit	PnB20
6063h	0	Position Actual Internal Value	DINT	RO	Yes	No	–	–	–	Inc	PnB22
6064h	0	Position Actual Value	DINT	RO	Yes	No	–	–	–	Pos. unit	PnB24
6065h	0	Following Error Window	UDINT	RW	No	Yes	5242880	0	1073741823	Pos. unit	PnB26
6066h	0	Following Error Time Out	UINT	RW	No	Yes	0	0	65535	ms	PnB28
6067h	0	Position Window	UDINT	RW	No	Yes	30	0	1073741823	Pos. unit	PnB2A
6068h	0	Position Window Time	UINT	RW	No	Yes	0	0	65535	ms	PnB2C
606Bh	0	Velocity Demand Value	DINT	RO	Yes	No	–	–	–	Vel. Unit	PnB2E
606Ch	0	Velocity Actual Value	DINT	RO	Yes	No	–	–	–	Vel. Unit	PnB30
606Dh	0	Velocity Window	UINT	RW	No	Yes	20000	0	65535	Vel. Unit	PnB32

∗1. Write “Save” into the object 1010h. The current parameter data will be saved as a batch in the EEPROM.
If the objects are modified by the digital operator or SigmaWin+, the data will be directly stored in the EEPROM.

∗2. Pn No. is the number of the parameter used for the digital operator and SigmaWin+.

Index	Sub Index	Name	Data Type	Access	PDO Mapping	EEPROM *1	Default Value	Lower Limit	Upper Limit	Unit	Pn No.*2
606Eh	0	Velocity Window Time	UINT	RW	No	Yes	0	0	65535	ms	PnB34
6071h	0	Target Torque	INT	RW	Yes	No	0	–32768	32767	0.1%	PnB36
6072h	0	Max. Torque	UINT	RW	Yes	No	Motor max. torque	0	65535	0.1%	PnB38
6074h	0	Torque Demand Value	INT	RO	Yes	No	–	–	–	0.1%	PnB3A
6076h	0	Motor Rated Torque	UDINT	RO	No	No	–	–	–	mNm, mN	PnB3C
6077h	0	Torque Actual Value	INT	RO	Yes	No	–	–	–	0.1%	PnB3E
607Ah	0	Target Position	DINT	RW	Yes	No	0	–2147483648	2147483647	Pos. unit	PnB40
607Ch	–	Home Offset	DINT	RW	No	Yes	0	–536870912	536870911	Pos. unit	PnB46
607Dh	Software Position Limit										
	0	Number of entries	USINT	RO	No	No	2	–	–	–	–
	1	Min. position limit	DINT	RW	No	Yes	0	–536870912	536870911	Pos. unit	PnB48
	2	Max. position limit	DINT	RW	No	Yes	0	–536870912	536870911	Pos. unit	PnB4A
607Fh	0	Max. Profile Velocity	UDINT	RW	Yes	Yes	2147483647	0	4294967295	Vel. Unit	PnB4C
6081h	0	Profile Velocity	UDINT	RW	Yes	Yes	0	0	4294967295	Vel. Unit	PnB4E
6083h	0	Profile Acceleration	UDINT	RW	Yes	Yes	1000	0	4294967295	Acc. Unit	PnB50
6084h	0	Profile Deceleration	UDINT	RW	Yes	Yes	1000	0	4294967295	Acc. Unit	PnB52
6085h	0	Quick Stop Deceleration	UDINT	RW	Yes	Yes	1000	0	4294967295	Acc. Unit	PnB54
6087h	0	Torque Slope	UDINT	RW	Yes	Yes	1000	0	4294967295	0.1 %/s	PnB56
6098h	0	Homing Method	SINT	RW	Yes	No	35	0	35	–	PnB58
6099h	Homing Speeds										
	0	Number of entries	USINT	RO	No	No	2	–	–	–	–
	1	Speed during search for switch	UDINT	RW	Yes	Yes	500000	0	4294967295	Vel. Unit	PnB5A
	2	Speed during search for zero	UDINT	RW	Yes	Yes	100000	0	4294967295	Vel. Unit	PnB5C
609Ah	0	Homing Acceleration	UDINT	RW	Yes	Yes	1000	0	4294967295	Acc. Unit	PnB5E
60B1h	0	Velocity Offset	DINT	RW	Yes	No	0	–2147483648	2147483647	Vel. Unit	PnB60
60B2h	0	Torque Offset	INT	RW	Yes	No	0	–32768	32767	0.1%	PnB62
60B8h	0	Touch Probe Function	UINT	RW	Yes	No	0	0	0xFFFF	–	PnB64
60B9h	0	Touch Probe Status	UINT	RO	Yes	No	–	–	–	–	PnB66
60BAh	0	Touch Probe 1 position Value	DINT	RO	Yes	No	–	–	–	Pos. unit	PnB68
60BCh	0	Touch Probe 2 position Value	DINT	RO	Yes	No	–	–	–	Pos. unit	PnB6A
60C1h	Interpolation Data Record										
	0	Number of entries	USINT	RO	No	No	1	–	–	–	–
	1	Interpolation data record	DINT	RW	Yes	No	0	–2147483648	2147483647	Pos. unit	PnB70

∗1. Write “Save” into the object 1010h. The current parameter data will be saved as a batch in the EEPROM.
If the objects are modified by the digital operator or SigmaWin+, the data will be directly stored in the EEPROM.

∗2. Pn No. is the number of the parameter used for the digital operator and SigmaWin+.

Index	Sub Index	Name	Data Type	Access	PDO Mapping	EEPROM *1	Default Value	Lower Limit	Upper Limit	Unit	Pn No.*2
60C2h	Interpolation Time Period										
	0	Highest sub-index supported	USINT	RO	No	No	2	–	–	–	–
	1	Interpolation time period	USINT	RW	No	No	125	1	250	–	PnB6E
	2	Interpolation time index	SINT	RW	No	No	–6	–6	–3	–	PnB6F
60E0h	0	Positive Torque Limit Value	UINT	RW	Yes	Yes	8000	0	65535	0.1%	PnB80
60E1h	0	Negative Torque Limit Value	UINT	RW	Yes	Yes	8000	0	65535	0.1%	PnB82
60F4h	0	Following Error Actual Value	DINT	RO	Yes	No	–	–	–	Pos. unit	PnB84
60FCh	0	Position Demand Internal Value	DINT	RO	Yes	No	–	–	–	Inc	PnB86
60FDh	0	Digital Inputs	UDINT	RO	Yes	No	–	–	–	–	PnB88
60FEh	Digital Outputs										
	0	Number of entries	USINT	RO	No	No	2	–	–	–	–
	1	Physical outputs	UDINT	RW	Yes	No	0	0	0xFFFFFFFF	–	PnB8A
	2	Bit mask	UDINT	RW	No	Yes	0x000C0000	0	0xFFFFFFFF	–	PnB8C
60FFh	0	Target Velocity	DINT	RW	Yes	No	0	–2147483648	2147483647	Vel. Unit	PnB8E
6502h	0	Supported Drive Modes	UDINT	RO	No	No	0x03ED	–	–	–	PnB90

∗1. Write “Save” into the object 1010h. The current parameter data will be saved as a batch in the EEPROM.
If the objects are modified by the digital operator or SigmaWin+, the data will be directly stored in the EEPROM.
∗2. Pn No. is the number of the parameter used for the digital operator and SigmaWin+.

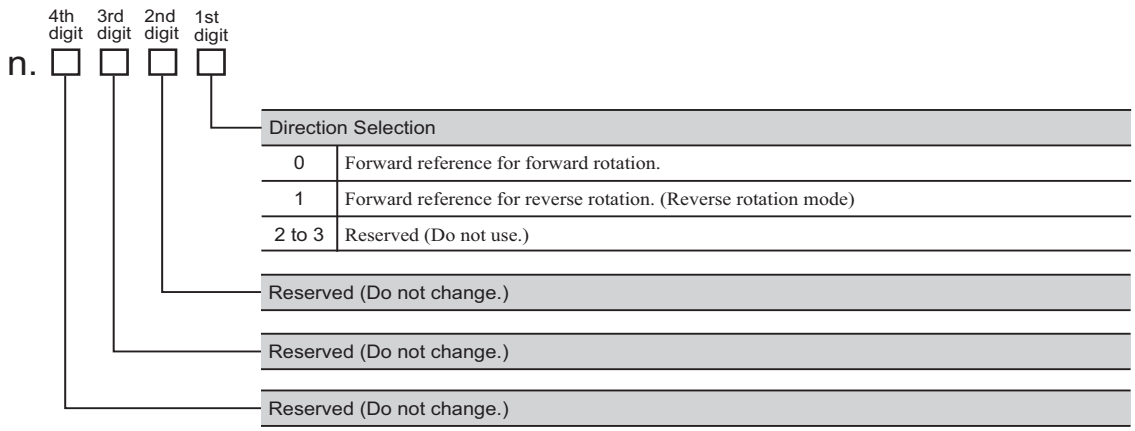
10.2 SERVOPACK Parameters

The following table lists the SERVOPACK parameters. All parameters can be accessed by SDO communication.

<Note>

- Use the object 1010h to write the parameters via SDO communication and store the setting values in the non-volatile memory in the SERVOPACK.
- If the parameters are modified by the digital operator or SigmaWin+, the data will be directly stored in the non-volatile memory.
- All SERVOPACK parameters have the following access attributes:
  - Read/Write enabled
  - PDO mapping disabled
  - Enabled to be stored in the EEPROM (non-volatile memory) excluding object 2587h (Pn587).
  - In the EtherCAT (CoE) Network Module, the reference units of the SERVOPACK parameters are encoder pulses (units: inc.).

Object Index (Pn No.)	Name	Setting Range	Units	Factory Setting	When Enabled	Data Type
2000h (Pn000)	Basic Function Select Switch 0	0000 to 00B3	–	0000	After restart	UINT



Object Index (Pn No.)	Name	Setting Range	Units	Factory Setting	When Enabled	Data Type
2001h (Pn001)	Application Function Select Switch 1	0000 to 1122	–	0000	After restart	UINT

n. □ □ □ □ (4th digit, 3rd digit, 2nd digit, 1st digit)

Servomotor power OFF or Alarm Gr.1 Stop Mode

0	Stops the motor by applying DB (dynamic brake).
1	Stops the motor by applying dynamic brake (DB) and then releases DB.
2	Makes the motor coast to a stop state without using the dynamic brake (DB).

Overtravel (OT) Stop Mode

0	Same setting as Pn001.0 (Stops the motor by applying DB or by coasting).
1	Sets the torque of Pn406 to the maximum value, decelerate the servomotor to a stop, and then sets it to servolock state.
2	Sets the torque of Pn406 to the maximum value, decelerates the servomotor to a stop, and then sets it to coasting state.

AC/DC Power Input Selection

0	Not applicable to DC power input: Input AC power supply through L1, L2 (, and L3) terminals.
1	Applicable to DC power input: Input DC power supply between B1/ + and －, or input DC power supply between B1 and －2.

Reserved (Do not change.)

Object Index (Pn No.)	Name	Setting Range	Units	Factory Setting	When Enabled	Data Type
2002h (Pn002)	Application Function Select Switch 2	0000 to 4113	–	0000	After restart	UINT

n. □ □ □ □ (4th digit, 3rd digit, 2nd digit, 1st digit)

Torque Limit Reference Selection for EtherCAT (CoE) Network Module

1	Enables the torque limit reference from the command option module. (Automatically set by the EtherCAT (CoE) Network Module.)

Speed Limit Reference Selection for EtherCAT (CoE) Network Module

0	Disables the speed limit reference when torque limit is used from the command option module. (Automatically set by the EtherCAT (CoE) Network Module.)

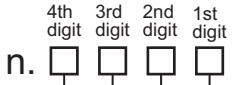
Absolute Encoder Usage

0	Uses absolute encoder as an absolute encoder.
1	Uses absolute encoder as an incremental encoder.

External Encoder Usage

0	Do not use external encoder.
1	Uses external encoder in forward rotation direction.
2	Reserved (Do not change.)
3	Uses external encoder in reversed rotation direction.
4	Reserved (Do not change.)

Object Index (Pn No.)	Name	Setting Range	Units	Factory Setting	When Enabled	Data Type
2006h (Pn006)	Application Function Select Switch 6	0000 to 005F	–	0002	Immediately	UINT



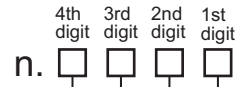
Analog Monitor 1 Signal Selection

00	Motor speed (1 V/1000 min^{-1})
01	Speed reference (1 V/1000 min^{-1})
02	Torque reference (1 V/100%)
03	Position error (0.05 V/1 reference unit) *1
04	Position amplifier error (after electronic gears) (0.05 V/ 1 encoder pulse unit)
05	Position reference speed (1 V/1000 min^{-1})
06	Reserved (Do not change.)
07	Motor-load position error (0.01 V/1 reference unit) *1
08	Positioning completion (positioning completed: 5 V, positioning not completed: 0 V)
09	Speed feedforward (1 V/1000 min^{-1})
0A	Torque feedforward (1 V/100%)
0B	Active gain (1st gain: 1 V, 2nd gain: 2 V)
0C	Completion of position reference (completed: 5 V, not completed: 0 V)
0D	External encoder speed (1 V/1000 min^{-1})

Reserved (Do not change.)

Reserved (Do not change.)

Object Index (Pn No.)	Name	Setting Range	Units	Factory Setting	When Enabled	Data Type
2007h (Pn007)	Application Function Select Switch 7	0000 to 005F	–	0000	Immediately	UINT



Analog Monitor 2 Signal Selection

00	Motor speed (1 V/1000 min^{-1})
01	Speed reference (1 V/1000 min^{-1})
02	Torque reference (1 V/100%)
03	Position error (0.05 V/1 reference unit) *1
04	Position amplifier error (after electronic gears) (0.05 V/ 1 encoder pulse unit)
05	Position reference speed (1 V/1000 min^{-1})
06	Reserved (Do not use.)
07	Motor-load position error (0.01 V/1 reference unit) *1
08	Positioning completion (positioning completed: 5 V, positioning not completed: 0 V)
09	Speed feedforward (1 V/1000 min^{-1})
0A	Torque feedforward (1 V/100%)
0B	Active gain (1st gain: 1 V, 2nd gain: 2 V)
0C	Completion of position reference (completed: 5 V not completed: 0 V)
0D	External encoder speed (1 V/1000 min^{-1})

Reserved (Do not change.)

Reserved (Do not change.)

*1. In the EtherCAT (CoE) Network Module, the reference units of the SERVOPACK parameters are encoder pulses (units: inc.).

Object Index (Pn No.)	Name	Setting Range	Units	Factory Setting	When Enabled	Data Type
2008h (Pn008)	Application Function Select Switch 8	0000 to 7121	–	4000	After restart	UNIT

n. □ (4th digit) □ (3rd digit) □ (2nd digit) □ (1st digit)

Lowered Battery Voltage Alarm/Warning Selection

0	Outputs alarm (A.830) for lowered battery voltage.
1	Outputs warning (A.930) for lowered battery voltage.

Function Selection for Insufficient voltage

0	Disables detection of insufficient voltages.
1	Detects warning and limits torque by host controller.
2	Detects warning and limits torque by Pn424 and Pn425.

Warning Detection Selection

0	Detects warning.
1	Does not detect warning.

Reserved (Do not change.)

Object Index (Pn No.)	Name	Setting Range	Units	Factory Setting	When Enabled	Data Type
2009h (Pn009)	Application Function Select Switch 9	0000 to 0111	–	0010	After restart	UINT

n. □ (4th digit) □ (3rd digit) □ (2nd digit) □ (1st digit)

Reserved (Do not change.)

Current Control Method Selection

0	Current control method 1
1	Current control method 2

Speed Detection Method Selection

0	Speed detection 1
1	Speed detection 2

Reserved (Do not change.)

Object Index (Pn No.)	Name	Setting Range	Units	Factory Setting	When Enabled	Data Type
200Bh (Pn00B)	Application Function Select Switch B	0000 to 1111	–	0000	After restart	UINT

n. □ □ □ □ (4th digit, 3rd digit, 2nd digit, 1st digit)

Parameter Display Selection	
0	Setup parameters
1	All parameters

Alarm Gr.2 Stop Method Selection	
0	Stops the motor by setting the speed reference to "0."
1	Same setting as Pn001.0 (Stops the motor by applying DB or by coasting)

Power Supply Method for Three-phase SERVOPACK	
0	Three-phase power supply
1	Single-phase power supply

Semi-closed Encoder Usage Method	
0	Uses the encoder connected to the SERVOPACK.
1	Uses the encoder connected to the feedback option module.

Object Index (Pn No.)	Name	Setting Range	Units	Factory Setting	When Enabled	Data Type
200Ch (Pn00C)	Application Function Select Switch C	0000 to 0111	–	0000	After restart	UINT

n. □ □ □ □ (4th digit, 3rd digit, 2nd digit, 1st digit)

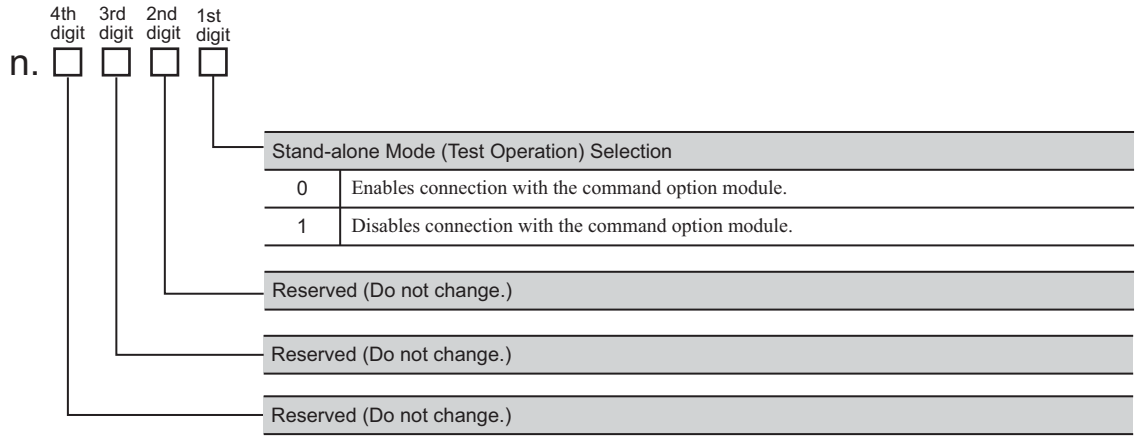
Selection of Test without Motor	
0	Test without motor disabled
1	Test without motor enabled

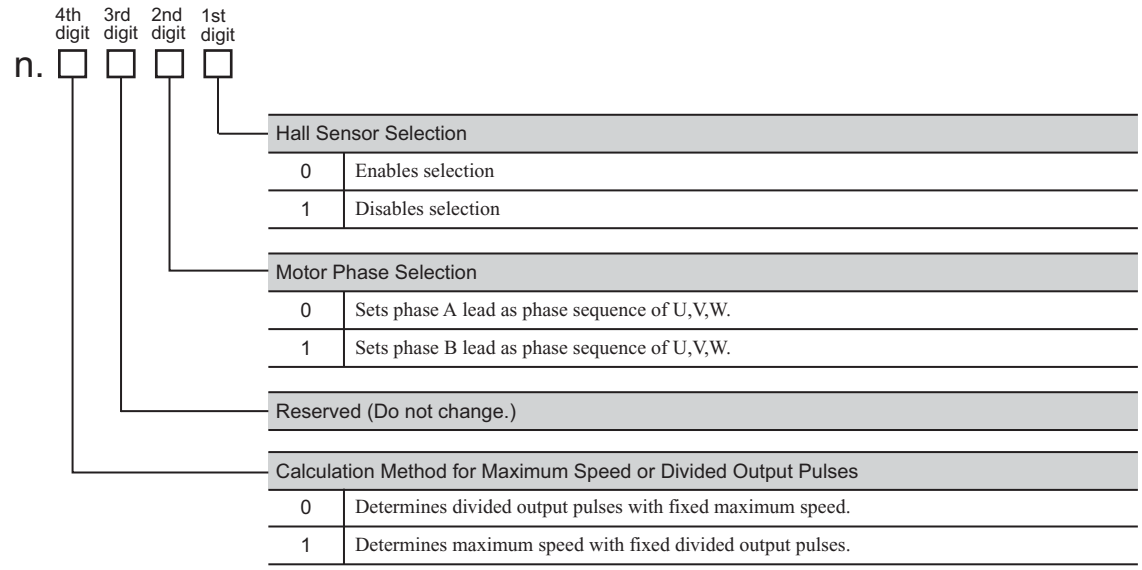
Encoder Resolution for Test without Motor	
0	13 bits
1	20 bits

Encoder Type for Test without Motor	
00	Incremental encoder
01	Absolute encoder

Reserved (Do not change.)

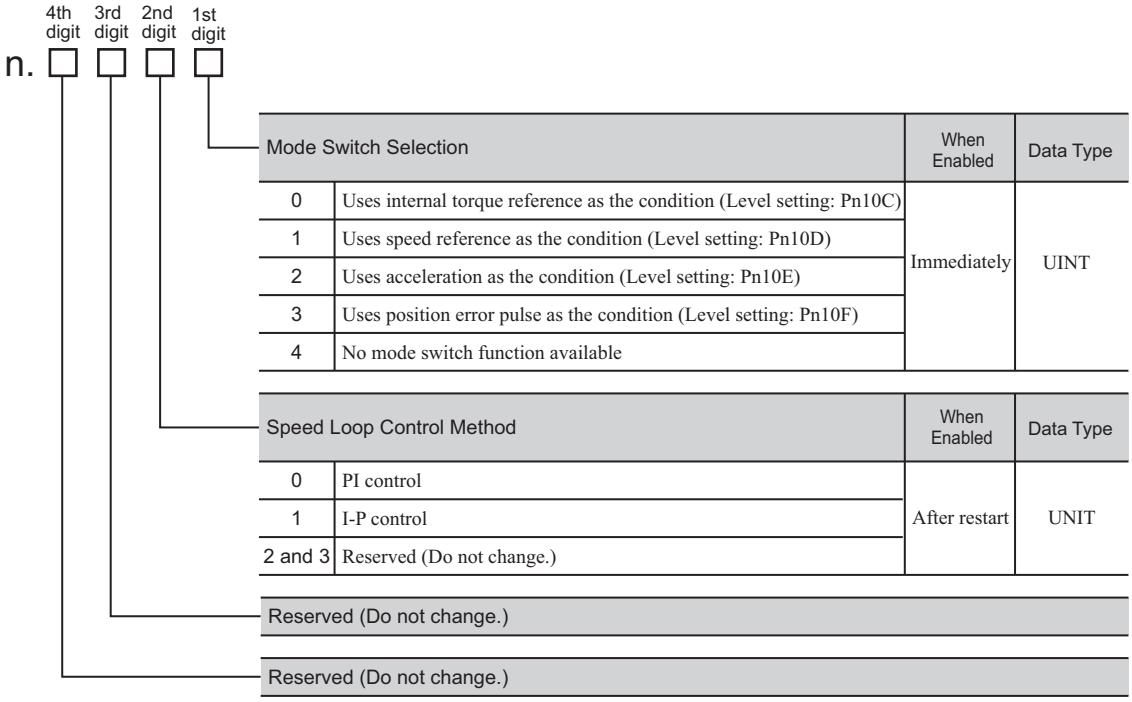
Object Index (Pn No.)	Name	Setting Range	Units	Factory Setting	When Enabled	Data Type
200Dh (Pn00D)	Application Function Select Switch D	0000 to 0001	–	0000	After restart	UINT
2010h (Pn010)	Axis Address Selection (for UART/USB communication)	0000 to 007F	–	0001	After restart	UINT
2080h*2 (Pn080)	Application Function Select Switch 80	0000 to 1111	–	0000	After restart	UINT
2100h (Pn100)	Speed Loop Gain	10 to 20000	0.1 Hz	400	Immediately	UINT
2101h (Pn101)	Speed Loop Integral Time Constant	15 to 51200	0.01 ms	2000	Immediately	UINT
2102h (Pn102)	Position Loop Gain	10 to 20000	0.1/s	400	Immediately	UINT
2103h (Pn103)	Moment of Inertia Ratio	0 to 20000	1%	100	Immediately	UINT
2104h (Pn104)	2nd Speed Loop Gain	10 to 20000	0.1 Hz	400	Immediately	UINT
2105h (Pn105)	2nd Speed Loop Integral Time Constant	15 to 51200	0.01 ms	2000	Immediately	UINT
2106h (Pn106)	2nd Position Loop Gain	10 to 20000	0.1/s	400	Immediately	UINT
2109h (Pn109)	Feedforward Gain	0 to 100	1%	0	Immediately	UINT





*2. This parameter is exclusive for SERVOPACKs to be used with linear servomotors (model: SGDV-□□□□E5).

Object Index (Pn No.)	Name	Setting Range	Units	Factory Setting	When Enabled	Data Type
210Ah (Pn10A)	Feedforward Filter Time Constant	0 to 6400	0.01 ms	0	Immediately	UINT
210Bh (Pn10B)	Application Function for Gain Select Switch	0000 to 5334	–	0000	–	UINT
210Ch (Pn10C)	Mode Switch (torque reference)	0 to 800	1%	200	Immediately	UINT
210Dh*3 (Pn10D)	Mode Switch (speed reference)	0 to 10000	1 min^{-1}	0	Immediately	UINT
210Eh*3 (Pn10E)	Mode Switch (acceleration)	0 to 30000	1 min^{-1}/ s	0	Immediately	UINT
210Fh (Pn10F)	Mode Switch (position error pulse)	0 to 10000	1 reference unit*1	0	Immediately	UNIT
211Fh (Pn11F)	Position Integral Time Constant	0 to 50000	0.1 ms	0	Immediately	UINT
2121h (Pn121)	Friction Compensation Gain	10 to 1000	1%	100	Immediately	UINT
2122h (Pn122)	2nd Gain for Friction Compensation	10 to 1000	1%	100	Immediately	UINT
2123h (Pn123)	Friction Compensation Coefficient	0 to 100	1%	0	Immediately	UINT
2124h (Pn124)	Friction Compensation Frequency Correction	-10000 to 10000	0.1 Hz	0	Immediately	UINT
2125h (Pn125)	Friction Compensation Gain Correction	1 to 1000	1%	100	Immediately	UINT
2131h (Pn131)	Gain Switching Time 1	0 to 65535	1 ms	0	Immediately	UINT
2132h (Pn132)	Gain Switching Time 2	0 to 65535	1 ms	0	Immediately	UINT



Mode Switch Selection		When Enabled	Data Type
0	Uses internal torque reference as the condition (Level setting: Pn10C)	Immediately	UINT
1	Uses speed reference as the condition (Level setting: Pn10D)		
2	Uses acceleration as the condition (Level setting: Pn10E)		
3	Uses position error pulse as the condition (Level setting: Pn10F)		
4	No mode switch function available		

Speed Loop Control Method		When Enabled	Data Type
0	PI control	After restart	UNIT
1	I-P control		
2 and 3	Reserved (Do not change.)		

Reserved (Do not change.)

Reserved (Do not change.)

∗1. In the EtherCAT (CoE) Network Module, the reference units of the SERVOPACK parameters are encoder pulses (units: inc.).
∗3. This parameter is exclusive for SERVOPACKs to be used with rotational servomotors (model: SGDV-□□□□E1).

Object Index (Pn No.)	Name	Setting Range	Units	Factory Setting	When Enabled	Data Type
2135h (Pn135)	Gain Switching Waiting Time 1	0 to 65535	1 ms	0	Immediately	UINT
2136h (Pn136)	Gain Switching Waiting Time 2	0 to 65535	1 ms	0	Immediately	UINT
2139h (Pn139)	Automatic Gain Changeover Related Switch 1	0000 to 0052	–	0000	Immediately	UINT
213Dh (Pn13D)	Current Gain Level	100 to 2000	1%	2000	Immediately	UINT

n. □ □ □ □ (4th digit, 3rd digit, 2nd digit, 1st digit)

Gain Switching Selection Switch*1

0	Manual gain switching (Cannot be used with the EtherCAT (CoE) Network Module.)
1	Reserved (Do not change.)
2	Automatic gain switching pattern 1 Changes automatically 1st gain to 2nd gain when the switching condition A is satisfied. Changes automatically 2nd gain to 1st gain when the switching condition A is not satisfied.

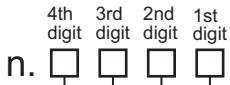
Gain Switching Condition A

0	Positioning completion signal (/COIN) ON
1	Positioning completion signal (/COIN) OFF
2	NEAR signal (/NEAR) ON
3	NEAR signal (/NEAR) OFF
4	Position reference filter output = 0 and reference input OFF
5	Position reference input ON

Reserved (Do not change.)

Reserved (Do not change.)

Object Index (Pn No.)	Name	Setting Range	Units	Factory Setting	When Enabled	Data Type
2140h (Pn140)	Model Following Control Related Switch	0000 to 1121	–	0100	Immediately	UINT



Model Following Control Selection

0	Does not use model following control.
1	Uses model following control.

Vibration Suppression Selection

0	Does not perform vibration suppression.
1	Performs vibration suppression over the specified frequency.
2	Performs vibration suppression over two different kinds of frequencies.

Vibration Suppression Adjustment Selection

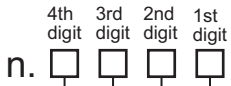
0	Does not adjust vibration suppression automatically using utility function.
1	Adjusts vibration suppression automatically using utility function.

Selection of Speed Feedforward (VFF) / Torque Feedforward (TFF)

0	Does not use model following control and speed/torque feedforward together.
1	Uses model following control and speed/torque feedforward together.

2141h (Pn141)	Model Following Control Gain	10 to 20000	0.1/s	500	Immediately	UINT
2142h (Pn142)	Model Following Control Gain Compensation	500 to 2000	0.1%	1000	Immediately	UINT
2143h (Pn143)	Model Following Control Bias (Forward Direction)	0 to 10000	0.1%	1000	Immediately	UINT
2144h (Pn144)	Model Following Control Bias (Reverse Direction)	0 to 10000	0.1%	1000	Immediately	UINT
2145h (Pn145)	Vibration Suppression 1 Frequency A	10 to 2500	0.1 Hz	500	Immediately	UINT
2146h (Pn146)	Vibration Suppression 1 Frequency B	10 to 2500	0.1 Hz	700	Immediately	UINT
2147h (Pn147)	Model Following Control Speed Feedforward Compensation	0 to 10000	0.1%	1000	Immediately	UINT
2148h (Pn148)	2nd Model Following Control Gain	10 to 20000	0.1/s	500	Immediately	UINT
2149h (Pn149)	2nd Model Following Control Gain Compensation	500 to 2000	0.1%	1000	Immediately	UINT
214Ah (Pn14A)	Vibration Suppression 2 Frequency	10 to 2000	0.1 Hz	800	Immediately	UINT
214Bh (Pn14B)	Vibration Suppression 2 Compensation	10 to 1000	1%	100	Immediately	UINT

Object Index (Pn No.)	Name	Setting Range	Units	Factory Setting	When Enabled	Data Type
2160h (Pn160)	Anti-Resonance Control Related Switch	0000 to 0011	–	0010	After restart	UINT



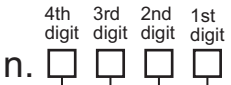
Anti-Resonance Control Selection	
0	Does not use anti-resonance control.
1	Uses anti-resonance control.

Anti-Resonance Control Adjustment Selection	
0	Does not use adjust anti-resonance control automatically using utility function.
1	Adjusts anti-resonance control automatically using utility function.

Reserved (Do not change.)

Reserved (Do not change.)

Object Index (Pn No.)	Name	Setting Range	Units	Factory Setting	When Enabled	Data Type
2161h (Pn161)	Anti-Resonance Frequency	10 to 20000	0.1 Hz	1000	Immediately	UINT
2162h (Pn162)	Anti-Resonance Gain Compensation	1 to 1000	1%	100	Immediately	UINT
2163h (Pn163)	Anti-Resonance Damping Gain	0 to 300	1%	0	Immediately	UINT
2164h (Pn164)	Anti-Resonance Filter Time Constant 1 Compensation	-1000 to 1000	0.01 ms	0	Immediately	UINT
2165h (Pn165)	Anti-Resonance Filter Time Constant 2 Compensation	-1000 to 1000	0.01 ms	0	Immediately	UINT
2170h (Pn170)	Tuning-less Function Rated Switch	0000 to 2411	–	1401	–	UINT



Tuning-less Function Selection		When Enabled	Data Type
0	Tuning-less function disabled	After restart	UINT
1	Tuning-less function enabled		

Control Method during Speed Control		When Enabled	Data Type
0	Uses as speed control.	After restart	UINT
1	Uses as speed control and uses the host controller for position control.		

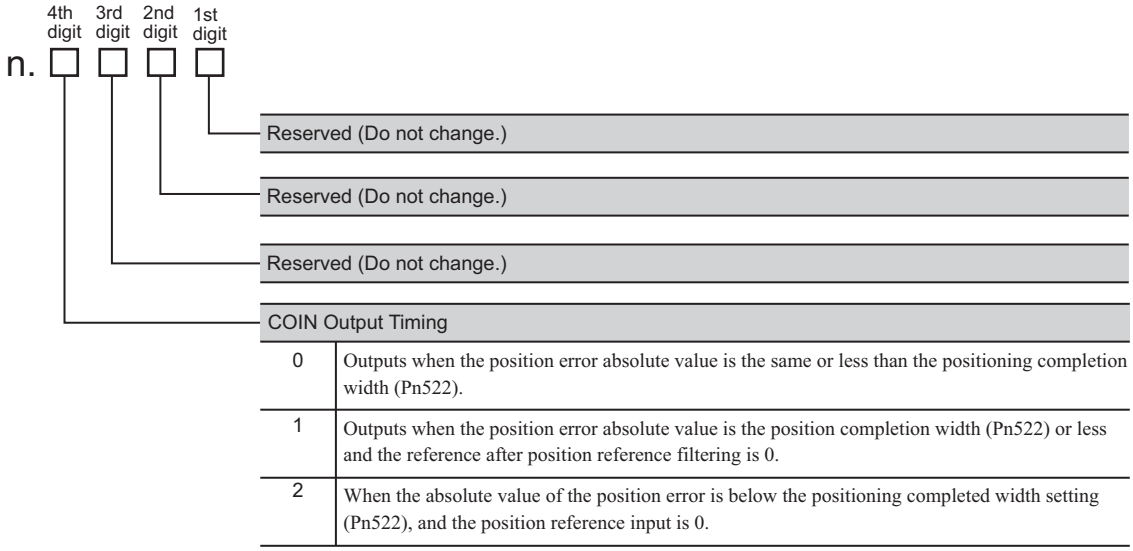
Tuning-less Tuning Level		When Enabled	Data Type
0 to 4	Sets tuning-less tuning level.	Immediately	UINT

Tuning-less Load Level		When Enabled	Data Type
0 to 2	Sets tuning-less load level.	Immediately	UINT

Object Index (Pn No.)	Name	Setting Range	Units	Factory Setting	When Enabled	Data Type
2181h*2 (Pn181)	Mode Switch (Speed Reference)	0 to 10000	1 mm/s	0	Immediately	UINT

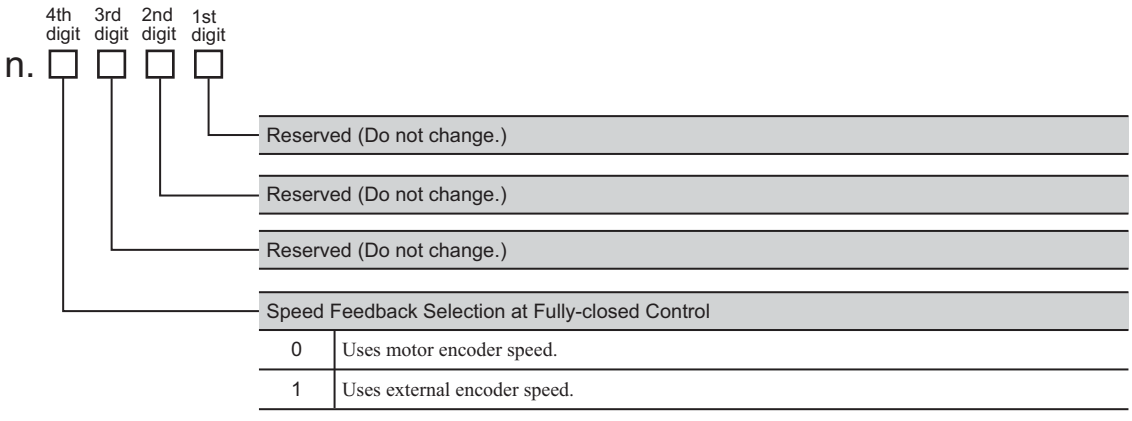
*2. This parameter is exclusive for SERVOPACKs to be used with linear servomotors (model: SGDV-□□□□E5).

Object Index (Pn No.)	Name	Setting Range	Units	Factory Setting	When Enabled	Data Type
2182h*2 (Pn182)	Mode Switch (Acceleration)	0 to 30000	1 mm/s^2	0	Immediately	UINT
2205h*3 (Pn205)	Multiturn Limit	0 to 65535	1 rev	65535	After restart	UINT
2207h (Pn207)	Position Control Function Switch	0000 to 2210	–	0010	After restart	UINT



0	Outputs when the position error absolute value is the same or less than the positioning completion width (Pn522).
1	Outputs when the position error absolute value is the position completion width (Pn522) or less and the reference after position reference filtering is 0.
2	When the absolute value of the position error is below the positioning completed width setting (Pn522), and the position reference input is 0.

220Ah*3 (Pn20A)	Number of External Encoder Pitch	4 to 1048576	1 pitch/rev	32768	After restart	UDINT
220Eh*4 (Pn20E)	Electronic Gear Ratio (Numerator)	1 to 1073741824 (2^{30})	1	4	After restart	UDINT
2210h*4 (Pn210)	Electronic Gear Ratio (Denominator)	1 to 1073741824 (2^{30})	1	1	After restart	UDINT
2212h*3 (Pn212)	Encoder Output Pulses	16 to 1073741824 (2^{30})	1 P/rev	2048	After restart	UDINT
222Ah (Pn22A)	Fully-closed Control Selection Switch	0000 to 1003	–	0000	After restart	UINT

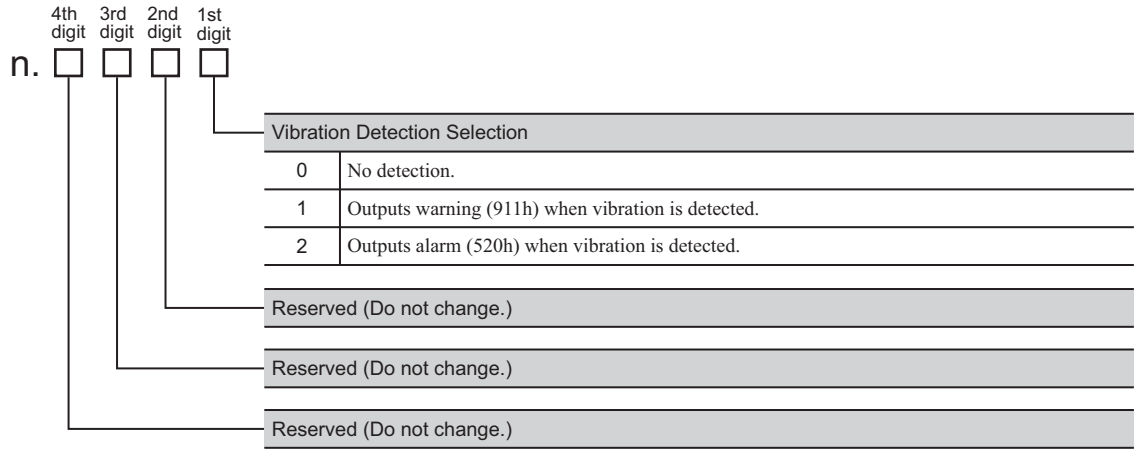


0	Uses motor encoder speed.
1	Uses external encoder speed.

2281h (Pn281)	Encoder Output Resolution	1 to 4096	1 P/pitch	20	After restart	UINT
2282h*2 (Pn282)	Linear Scale Pitch	0.00 to 65536.00	0.01 μm	0	After restart	UINT

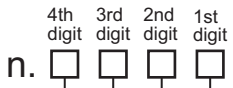
∗2. This parameter is exclusive for SERVOPACKs to be used with linear servomotors (model: SGDV-□□□□E5).
∗3. This parameter is exclusive for SERVOPACKs to be used with rotational servomotors (model: SGDV-□□□□E1).
∗4. This parameter is automatically set to 1 by the EtherCAT (CoE) Network Module.

Object Index (Pn No.)	Name	Setting Range	Units	Factory Setting	When Enabled	Data Type
2304h*3 (Pn304)	JOG Speed	0 to 10000	1 min^{-1}	500	Immediately	UINT
2305h (Pn305)	Soft Start Acceleration Time	0 to 10000	1 ms	0	Immediately	UINT
2306h (Pn306)	Soft Start Deceleration Time	0 to 10000	1 ms	0	Immediately	UINT
2310h (Pn310)	Vibration Detection Switch	0000 to 0002	–	0000	Immediately	UINT
2311h (Pn311)	Vibration Detection Sensibility	50 to 500	1%	100	Immediately	UINT
2312h*3 (Pn312)	Vibration Detection Level	0 to 5000	1 min^{-1}	50	Immediately	UINT
2324h (Pn324)	Moment of Inertia Calculating Start Level	0 to 20000	1%	300	Immediately	UINT
2383h*2 (Pn383)	JOG Speed	0 to 10000	1 mm/s	50	Immediately	UINT
2384h*2 (Pn384)	Vibration Detection Level	0 to 5000	1 mm/s	10	Immediately	UINT
2385h*2 (Pn385)	Motor Max. Speed	1 to 100	100 mm/s	50	After restart	UINT
2401h (Pn401)	1st Step 1st Torque Reference Filter Time Constant	0 to 65535	0.01 ms	100	Immediately	UINT
2402h*3 (Pn402)	Forward Torque Limit	0 to 800	1%	800	Immediately	UINT
2403h*3 (Pn403)	Reverse Torque Limit	0 to 800	1%	800	Immediately	UINT
2404h (Pn404)	Forward External Torque Limit	0 to 800	1%	100	Immediately	UINT
2405h (Pn405)	Reverse External Torque Limit	0 to 800	1%	100	Immediately	UINT
2406h (Pn406)	Emergency Stop Torque	0 to 800	1%	800	Immediately	UINT
2407h*3 (Pn407)	Speed Limit during Torque Control	0 to 10000	1 min^{-1}	10000	Immediately	UINT



∗2. This parameter is exclusive for SERVOPACKs to be used with linear servomotors (model: SGDV-□□□□E5).
∗3. This parameter is exclusive for SERVOPACKs to be used with rotational servomotors (model: SGDV-□□□□E1).

Object Index (Pn No.)	Name	Setting Range	Units	Factory Setting	When Enabled	Data Type
2408h (Pn408)	Torque Related Function Switch	0000 to 1111	–	0000	–	UNIT



1st Step Notch Filter Selection

		When Enabled	Data Type
0	N/A	Immediately	UINT
1	Uses 1st step notch filter for torque reference.		

Speed Limit Selection

		When Enabled	Data Type
0	Uses the smaller value between motor max. speed and parameter Pn407 as speed limit value.	After restart	UINT
1	Uses the smaller value between overspeed detection speed and parameter Pn407 as speed limit value.		

2nd Step Notch Filter Selection

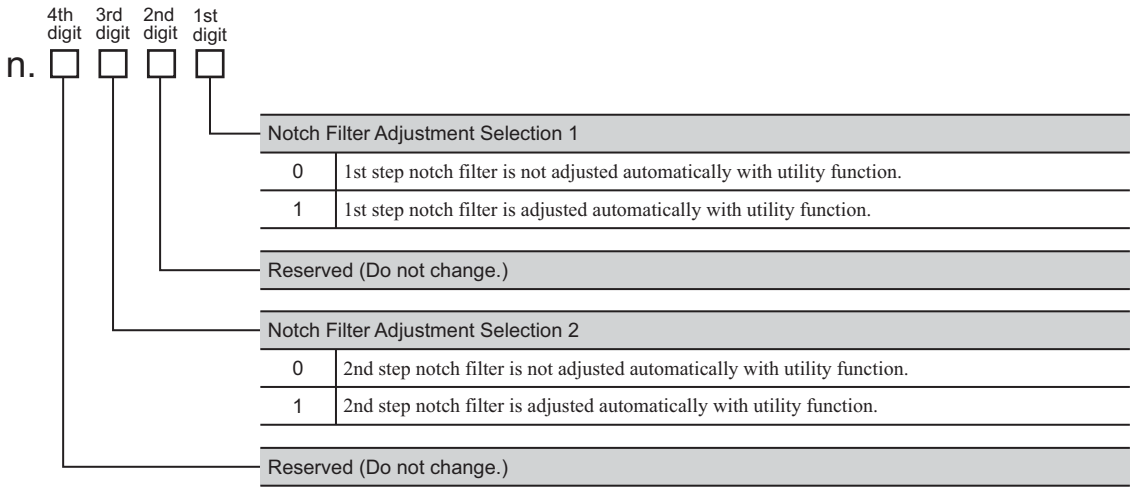
		When Enabled	Data Type
0	N/A	Immediately	UINT
1	Uses 2nd step notch filter for torque reference.		

Friction Compensation Function Selection

		When Enabled	Data Type
0	Disables use friction compesation function.	Immediately	UINT
1	Enables friction compsation function.		

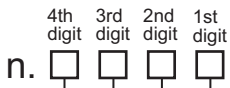
2409h (Pn409)	1st Notch Filter Frequency	50 to 5000	1 Hz	5000	Immediately	UINT
240Ah (Pn40A)	1st Notch Filter Q Value	50 to 1000	0.01	70	Immediately	UINT
240Bh (Pn40B)	1st Notch Filter Depth	0 to 1000	0.001	0	Immediately	UINT
240Ch (Pn40C)	2nd Notch Filter Frequency	50 to 5000	1 Hz	5000	Immediately	UINT
240Dh (Pn40D)	2nd Notch Filter Q Value	50 to 1000	0.01	70	Immediately	UINT
240Eh (Pn40E)	2nd Notch Filter Depth	0 to 1000	0.001	0	Immediately	UINT
240Fh (Pn40F)	2nd Step 2nd Torque Reference Filter Frequency	100 to 5000	1 Hz	5000	Immediately	UINT
2410h (Pn410)	2nd Step 2nd Torque Reference Filter Q Value	50 to 100	0.01	50	Immediately	UINT
2412h (Pn412)	1st Step 2nd Torque Reference Filter Time Constant	0 to 65535	0.01 ms	100	Immediately	UINT
2424h (Pn424)	Torque Limit at Main Circuit Voltage Drop	0 to 100	1%	50	Immediately	UINT
2425h (Pn425)	Release Time for Torque Limit at Main Circuit Voltage Drop	0 to 1000	1 ms	100	Immediately	UINT
2456h (Pn456)	Sweep Torque Reference Amplitude	1 to 800	1%	15	Immediately	UINT

Object Index (Pn No.)	Name	Setting Range	Units	Factory Setting	When Enabled	Data Type
2460h (Pn460)	Notch Filter Adjustment Switch	0000 to 0101	–	0101	Immediately	UINT
2480h*2 (Pn480)	Speed Limit during Force Control	0 to 10000	1 mm/s	10000	Immediately	UINT
2481h*2 (Pn481)	Polarity Detection Speed Loop Gain	1.0 to 2000.0	0.1 Hz	40.0	Immediately	UINT
2482h*2 (Pn482)	Polarity Detection Speed Loop Integral Time Constant	0.15 to 512.00	0.01 ms	30.00	Immediately	UINT
2483h*2 (Pn483)	Forward Force Limit	0 to 800	1%	30	Immediately	UINT
2484h*2 (Pn484)	Reverse Force Limit	0 to 800	1%	30	Immediately	UINT
2485h*2 (Pn485)	Polarity Detection Reference Speed	0 to 100	1 mm/s	20	Immediately	UINT
2486h*2 (Pn486)	Polarity Detection Reference Accel/Decel Time	0 to 100	1 ms	25	Immediately	UINT
2487h*2 (Pn487)	Polarity Detection Constant Speed Time	0 to 300	1 ms	0	Immediately	UINT
2488h*2 (Pn488)	Polarity Detection Reference Waiting Time	50Å`500	1 ms	100	Immediately	UINT
248Eh*2 (Pn48E)	Polarity Detection Range	1 to 65535	1 mm	10	Immediately	UINT
2490h*2 (Pn490)	Polarity Detection Load Level	0 to 20000	1%	100	Immediately	UINT
2495h*2 (Pn495)	Polarity Detection Confirmation Force Reference	0 to 200	1%	100	Immediately	UINT
2498h*2 (Pn498)	Polarity Detection Allowable Error Range	0 to 30	1 deg	10	Immediately	UINT
2502h*3 (Pn502)	Rotation Detection Level	1 to 10000	1 min^{-1}	20	Immediately	UINT
2503h*3 (Pn503)	Speed Coincidence Signal Output Width	0 to 100	1 min^{-1}	10	Immediately	UINT
2506h (Pn506)	Brake Reference - Servo OFF Delay Time	0 to 50	10 ms	0	Immediately	UINT



*2. This parameter is exclusive for SERVOPACKs to be used with linear servomotors (model: SGDV-□□□□E5).
*3. This parameter is exclusive for SERVOPACKs to be used with rotational servomotors (model: SGDV-□□□□E1).

Object Index (Pn No.)	Name	Setting Range	Units	Factory Setting	When Enabled	Data Type
2507h*3 (Pn507)	Brake Reference Output Speed Level	0 to 10000	1 min^{-1}	100	Immediately	UINT
2508h (Pn508)	Waiting Time for Brake Signal When Motor Running	10 to 100	10 ms	50	Immediately	UINT
2509h (Pn509)	Instantaneous Power Cut Hold time	20 to 1000	1 ms	20	Immediately	UINT
250Ah (Pn50A)	Input Signal Selection 1	0000 to FFF1	–	1881	After restart	UINT



Reserved (Do not change.)

Reserved (Do not change.)

Reserved (Do not change.)

P-OT Signal Mapping

0	Forward run allowed when CN1-13 input signal is ON (L-level)
1	Forward run allowed when CN1-7 input signal is ON (L-level)
2	Forward run allowed when CN1-8 input signal is ON (L-level)
3	Forward run allowed when CN1-9 input signal is ON (L-level)
4	Forward run allowed when CN1-10 input signal is ON (L-level)
5	Forward run allowed when CN1-11 input signal is ON (L-level)
6	Forward run allowed when CN1-12 input signal is ON (L-level)
7	Forward run prohibited
8	Forward run allowed
9	Forward run allowed when CN1-13 input signal is OFF (H-level)
A	Forward run allowed when CN1-7 input signal is OFF (H-level)
B	Forward run allowed when CN1-8 input signal is OFF (H-level)
C	Forward run allowed when CN1-9 input signal is OFF (H-level)
D	Forward run allowed when CN1-10 input signal is OFF (H-level)
E	Forward run allowed when CN1-11 input signal is OFF (H-level)
F	Forward run allowed when CN1-12 input signal is OFF (H-level)

∗3. This parameter is exclusive for SERVOPACKs to be used with rotational servomotors (model: SGDV-□□□□E1).

Object Index (Pn No.)	Name	Setting Range	Units	Factory Setting	When Enabled	Data Type
250Bh (Pn50B)	Input Signal Selection 2	0000 to FFFF	–	8882	After restart	UINT

n. □ □ □ □ (4th digit, 3rd digit, 2nd digit, 1st digit)

N-OT Signal Mapping (Refer to 4.2.3)

0	Reverse run allowed when CN1-13 input signal is ON (L-level).
1	Reverse run allowed when CN1-7 input signal is ON (L-level).
2	Reverse run allowed when CN1-8 input signal is ON (L-level).
3	Reverse run allowed when CN1-9 input signal is ON (L-level) .
4	Reverse run allowed when CN1-10 input signal is ON (L-level).
5	Reverse run allowed when CN1-11 input signal is ON (L-level).
6	Reverse run allowed when CN1-12 input signal is ON (L-level).
7	Reverse run prohibited.
8	Reverse run allowed.
9	Reverse run allowed when CN1-13 input signal is OFF (H-level).
A	Reverse run allowed when CN1-7 input signal is OFF (H-level).
B	Reverse run allowed when CN1-8 input signal is OFF (H-level).
C	Reverse run allowed when CN1-9 input signal is OFF (H-level).
D	Reverse run allowed when CN1-10 input signal is OFF (H-level).
E	Reverse run allowed when CN1-11 input signal is OFF (H-level).
F	Reverse run allowed when CN1-12 input signal is OFF (H-level).

Reserved (Do not change.)

/P-CL Signal Mapping

0	ON when CN1-13 input signal is ON (L-level)
1	ON when CN1-7 input signal is ON (L-level)
2	ON when CN1-8 input signal is ON (L-level)
3	ON when CN1-9 input signal is ON (L-level)
4	ON when CN1-10 input signal is ON (L-level)
5	ON when CN1-11 input signal is ON (L-level)
6	ON when CN1-12 input signal is ON (L-level)
7	Sets signal ON.
8	Sets signal OFF.
9	OFF when CN1-13 input signal is OFF (H-level)
A	OFF when CN1-7 input signal is OFF (H-level)
B	OFF when CN1-8 input signal is OFF (H-level)
C	OFF when CN1-9 input signal is OFF (H-level)
D	OFF when CN1-10 input signal is OFF (H-level)
E	OFF when CN1-11 input signal is OFF (H-level)
F	OFF when CN1-12 input signal is OFF (H-level)

/N-CL Signal Mapping

0 to F	Same as /P-CL signal mapping

Object Index (Pn No.)	Name	Setting Range	Units	Factory Setting	When Enabled	Data Type
250Eh (Pn50E)	Output Signal Selection 1	0000 to 3333	–	0000	After restart	UINT

n. □ (4th digit) □ (3rd digit) □ (2nd digit) □ (1st digit)

Positioning Completion Signal Mapping (/COIN)

0	Disabled (the above signal is not used.)
1	Outputs the signal from CN1-1, 2 output terminal.
2	Outputs the signal from CN1-23, 24 output terminal.
3	Outputs the signal from CN1-25, 26 output terminal.

Speed Coincidence Detection Signal Mapping (/V-CMP)

0 to 3	Same as /COIN

Servomotor Rotation Detection Signal Mapping (/TGON)

0 to 3	Same as /COIN

Servo Ready Signal Mapping (/S-RDY)

0 to 3	Same as /COIN

Object Index (Pn No.)	Name	Setting Range	Units	Factory Setting	When Enabled	Data Type
250Fh (Pn50F)	Output Signal Selection 2	0000 to 3333	–	0100	After restart	UINT

n. □ (4th digit) □ (3rd digit) □ (2nd digit) □ (1st digit)

Torque Limit Detection Signal Mapping (/CLT)

0	Disabled (the above signal is not used.)
1	Outputs the signal from CN1-1, 2 output terminal.
2	Outputs the signal from CN1-23, 24 output terminal.
3	Outputs the signal from CN1-25, 26 output terminal.

Speed Limit Detection Signal Mapping (/VLT)

0 to 3	Same as /CLT

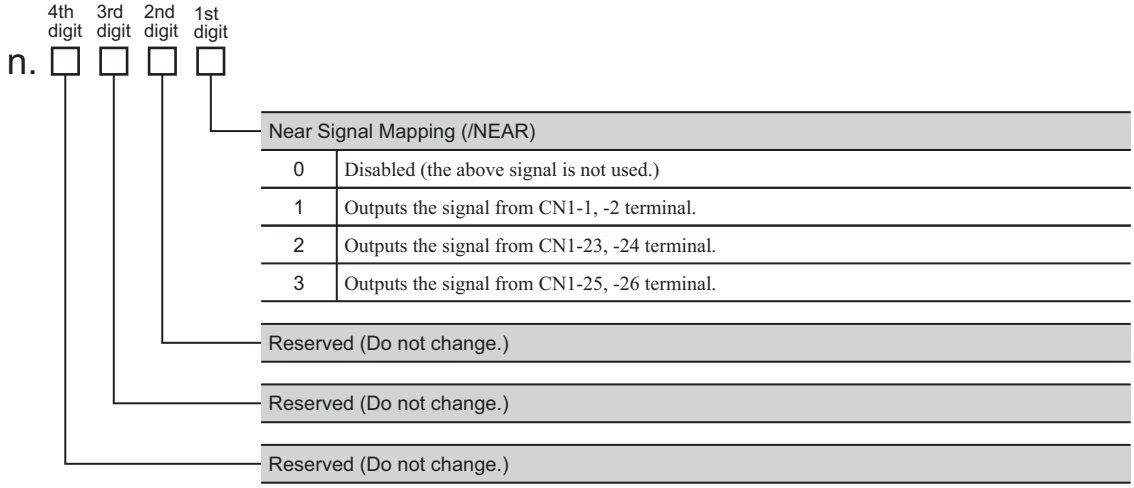
Brake Signal Mapping (/BK)

0 to 3	Same as /CLT

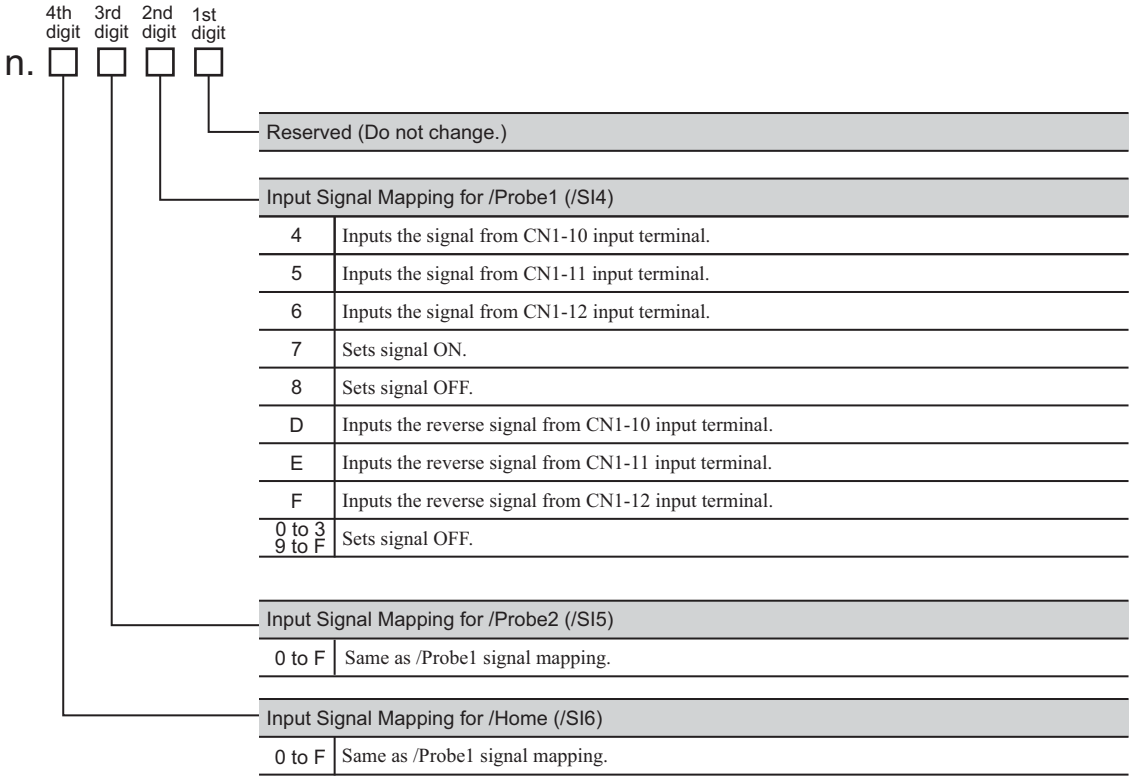
Warning Signal Mapping (/WARN)

0 to 3	Same as /CLT

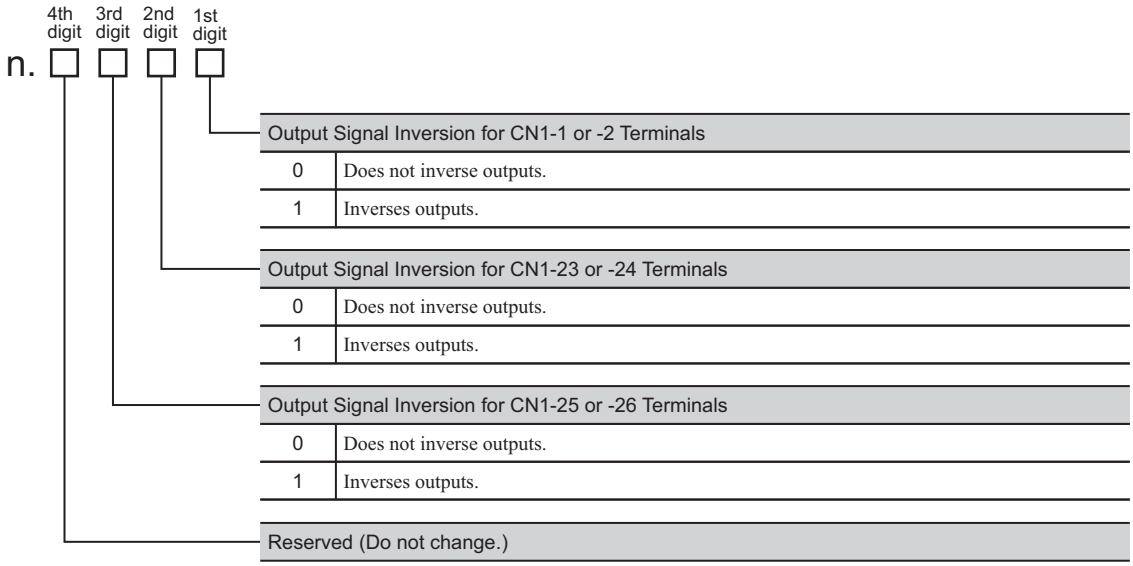
Object Index (Pn No.)	Name	Setting Range	Units	Factory Setting	When Enabled	Data Type
2510h (Pn510)	Output Signal Selection 3	0000 to 0033	–	0000	After restart	UINT



Object Index (Pn No.)	Name	Setting Range	Units	Factory Setting	When Enabled	Data Type
2511h (Pn511)	Input Signal Selection 5	0000 to FFFF	–	6543	After restart	UINT

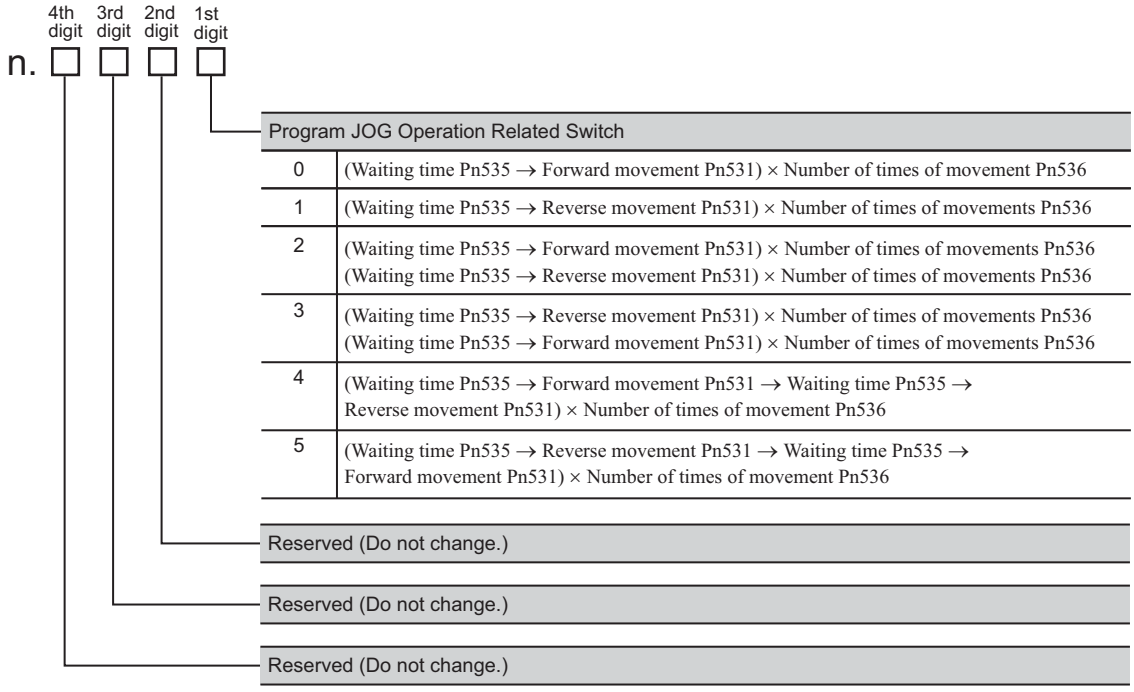


Object Index (Pn No.)	Name	Setting Range	Units	Factory Setting	When Enabled	Data Type
2512h (Pn512)	Output Signal Inverse Setting	0000 to 0111	–	0000	After restart	UINT
251Bh*3 (Pn51B)	Excessive Error Level Between Servomotor and Load Positions	1 to 1073741824 (2^{30})	1 reference unit*1	1000	Immediately	UDINT
251Eh (Pn51E)	Excessive Position Error Warning Level	10 to 100	1%	100	Immediately	UINT
2520h (Pn520)	Excessive Position Error Alarm Level	1 to 1073741823 (2^{30}-1)	1 reference unit*1	5242880	Immediately	UDINT
2522h (Pn522)	Positioning Completed Width	0 to 1073741824 (2^{30})	1 reference unit*1	7	Immediately	UDINT
2524h (Pn524)	NEAR Signal Width	1 to 1073741824 (2^{30})	1 reference unit*1	1073741824	Immediately	UDINT
2526h*5 (Pn526)	Excessive Position Error Alarm Level at Servo ON	1 to 1073741823 (2^{30}-1)	1 reference unit*1	5242880	Immediately	UDINT
2528h*5 (Pn528)	Excessive Position Error Warning Level at Servo ON	10 to 100	1%	100	Immediately	UINT
2529h*5 (Pn529)	Speed Limit Level at Servo ON	0 to 10000	1 min^{-1}	10000	Immediately	UINT
252Ah*3 (Pn52A)	Multiplier per One Fully-closed Rotation	0 to 100	1%	20	Immediately	UINT
252Bh (Pn52B)	Overload Warning Level	1 to 100	1%	20	Immediately	UINT
252Ch (Pn52C)	Derating of Base Current at Detecting Overload of Motor	10 to 100	1%	100	After restart	UINT



∗1. In the EtherCAT (CoE) Network Module, the reference units of the SERVOPACK parameters are encoder pulses (units: inc.).
∗3. This parameter is exclusive for SERVOPACKs to be used with rotational servomotors (model: SGDV-□□□□E1).
∗5. If the EtherCAT (CoE) Network Module is used, this parameter is not required to be set. Use the factory setting for this parameter.

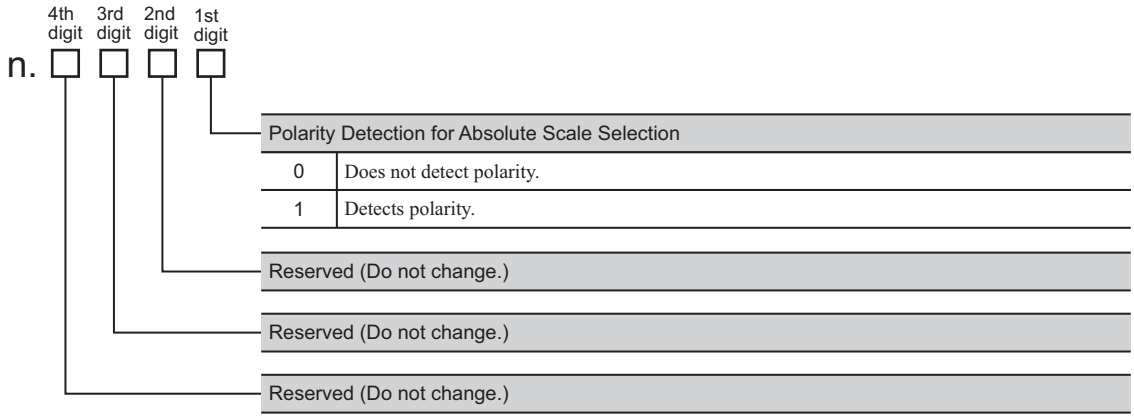
Object Index (Pn No.)	Name	Setting Range	Units	Factory Setting	When Enabled	Data Type
2530h (Pn530)	Program JOG Operation Related Switch	0000 to 0005	–	0000	Immediately	UINT



2531h (Pn531)	Program JOG Movement Distance	1 to 1073741824 (2^{30})	1 reference unit*1	32768	Immediately	UDINT
2533h*3 (Pn533)	Program JOG Movement Speed	1 to 10000	1 min^{-1}	500	Immediately	UINT
2534h (Pn534)	Program JOG Acceleration/Deceleration Time	2 to 10000	1 ms	100	Immediately	UINT
2535h (Pn535)	Program JOG Waiting Time	0 to 10000	1 ms	100	Immediately	UINT
2536h (Pn536)	Number of Times of Program JOG Movement	0 to 1000	1 time	1	Immediately	UINT
2550h (Pn550)	Analog Monitor 1 Offset Voltage	-10000 to 10000	0.1 V	0.0	Immediately	UNIT
2551h (Pn551)	Analog Monitor 2 Offset Voltage	-10000 to 10000	0.1 V	0.0	Immediately	UINT
2552h (Pn552)	Analog Monitor Magnification (×1)	-10000 to 10000	×0.01	100	Immediately	UINT
2553h (Pn553)	Analog Monitor Magnification (×2)	-10000 to 10000	×0.01	100	Immediately	UINT
2560h (Pn560)	Remained Vibration Detection Width	1 to 3000	0.1%	400	Immediately	UINT
2561h (Pn561)	Overshoot Detection Level	0 to 100	1%	100	Immediately	UINT
2582h*2 (Pn582)	Speed Coincidence Signal Output Width	0 to 100	1 mm/s	10	Immediately	UINT
2583h*2 (Pn583)	Brake Reference Output Speed Level	0 to 10000	1 mm/s	10	Immediately	UINT

∗1. In the EtherCAT (CoE) Network Module, the reference units of the SERVOPACK parameters are encoder pulses (units: inc.).
∗2. This parameter is exclusive for SERVOPACKs to be used with linear servomotors (model: SGDV-□□□□E5).
∗3. This parameter is exclusive for SERVOPACKs to be used with rotational servomotors (model: SGDV-□□□□E1).

Object Index (Pn No.)	Name	Setting Range	Units	Factory Setting	When Enabled	Data Type
2584h*2 (Pn584)	Speed Limit Level at Servo ON	0 to 10000	1 mm/s	10000	Immediately	UINT
2585h*2 (Pn585)	Program JOG Movement Speed	1 to 10000	1 mm/s	50	Immediately	UINT
2586h*2 (Pn586)	Motor Running Air-cooling Ratio	0 to 100	1%/maxvel	0	Immediately	UINT
2587h*2 (Pn587)	Polarity Detection for Absolute Scale Selection	0000 to 0001	–	0000	Immediately	UINT
2600h (Pn600)	Regenerative Resistor Capacity	Depends on SERVOPACK Capacity	10 W	0	Immediately	UINT



*2. This parameter is exclusive for SERVOPACKs to be used with linear servomotors (model: SGDV-□□□□E5).

10.3 SDO Abort Code List

The following table shows the SDO abort codes for SDO communication errors.

Value	Meaning
0x05 03 00 00	Toggle bit not changed
0x05 04 00 00	SDO protocol timeout
0x05 04 00 01	Client/Server command specifier not valid or unknown
0x05 04 00 05	Out of memory
0x06 01 00 00	Unsupported access to an object
0x06 01 00 01	Attempt to read to a write only object
0x06 01 00 02	Attempt to write to a read only object
0x06 02 00 00	The object does not exist in the object directory
0x06 04 00 41	The object cannot be mapped into the PDO
0x06 04 00 42	The number and length of the objects to be mapped would exceed the PDO length
0x06 04 00 43	General parameter incompatibility reason
0x06 04 00 47	General internal incompatibility in the device
0x06 06 00 00	Access failed due to a hardware error
0x06 07 00 10	Data type does not match, length of service parameter does not match
0x06 07 00 12	Data type does not match, length of service parameter too high
0x06 07 00 13	Data type does not match, length of service parameter too low
0x06 09 00 11	Subindex does not exist
0x06 09 00 30	Value range of parameter exceeded (only for write access)
0x06 09 00 31	Value of parameter written too high
0x06 09 00 32	Value of parameter written too low
0x06 09 00 36	Maximum value is less than minimum value
0x08 00 00 00	General error
0x08 00 00 20	Data cannot be transferred or stored to the application
0x08 00 00 21	Data cannot be transferred or stored to the application because of local control
0x08 00 00 22	Data cannot be transferred or stored to the application because of the present device

Index

Symbols

+24VIN - - -

Homing Speeds (6099h) - 8-33

I

I/O signals
  connection example - 4-5
  connector terminal layout - 4-4
  input signal allocations - 4-6
  input signals - 4-3
  names and functions - 4-3
  output signal allocations - 4-8
  output signals - 4-4
installation conditions - 3-2
interpolated position mode - 7-7, 8-36
interpolated positioning - 7-8
interpolation - 7-7
Interpolation Data Record (60C1h) - 8-36
Interpolation time period - 8-24
interpolation time period - 7-8
Interpolation Time Period (60C2h) - 8-36

L

LED indicators - 2-6, 2-7, 2-8
low voltage directive - xii, 3-2

M

mailbox - 2-6
Max. Profile Velocity (607Fh) - 8-30
Max. Torque (6072h) - 8-40
model designation - 1-3
modes of operation - 7-4
Modes of Operation (6060h) - 8-28
Modes of Operation Display (6061h) - - - - - - - - - - - - - - - - - - - 8-28
Motor Rated Torque (6076h) - 8-39
mounting SERVOPACKs side by side - - - - - - - - - - - - - - - - - - - 3-4

N

nameplate - 1-2
Negative Torque Limit Value (60E1h) - - - - - - - - - - - - - - - - - - 8-40
noise filter - 3-10, 3-11
  recommended noise filter - 3-12
N-OT - 4-3, 5-7

O

object dictionary - 6-5
object dictionary list - 8-2
object list - 10-2
over interpolation speed - 8-24
overtravel - 5-7

P

PAO - 4-4
parameters - 10-9
PBO - 4-4
PCO - 4-4
PDO mapping - 6-5, 8-8
  default PDO mappings - 6-6
  object dictionary - 6-5
  object dictionary list - 8-2
  setup procedure - 6-6
PDO mapping objects - 8-8
phase-A signal - 4-4
phase-B signal - 4-4
phase-C signal - 4-4
physical layer - 2-6
placement - 2-5
pollution degree - 2-5, 3-2
Position Actual Internal Value (6063h) - - - - - - - - - - - - - - - - - - 8-34
Position Actual Value (6064h) - 8-34
Position Demand Internal Value (60FCh) - - - - - - - - - - - - - - - - - 8-34
Position Demand Value (6062h) - 8-34
Position User Unit (2701h) - 8-15
Position Window (6067h) - 8-35
Position Window Time (6068h) - 8-35
Positive Torque Limit Value (60E0h) - - - - - - - - - - - - - - - - - - 8-40
P-OT - 4-3, 5-7
power specifications - 2-5
power supply method - 2-5
probe 1 latch signal - 4-3
probe 2 latch signal - 4-3
process data - 2-6
Profile Acceleration (6083h) - 8-31
Profile Deceleration (6084h) - 8-31
profile position mode - 7-5, 8-30
profile torque mode - 7-14
Profile Velocity (6081h) - 8-31
profile velocity mode - 7-12, 8-38
protection class - 2-5, 3-2

Q

quick stop command - 8-31
Quick Stop Deceleration (6085h) - 8-31
quick stop function - 8-25
Quick Stop Option Code (605Ah) - 8-25

R

rack-mounted - 3-3
receive (SM2) event - 8-14
receive PDO mapping - 8-8
reverse run prohibited - 4-3
RJ45 - 4-9

S

safety function - 5-6
SDO abort code list - 10-30
servo alarm output signal - 4-4
SERVOPACK
  alarm list - 9-2
  EMC installation conditions - 3-5
  installation conditions for applicable standards - - - - - - - - - - 3-2
  installation environment - 3-2
  installation precautions - 3-2
  installation standards - 3-4
  orientation - 3-3
  parameters - 10-9
SG - 4-4
shield box - 3-12
shock resistance - 2-5, 3-2
Shutdown Option Code (605Bh) - 8-26
signal ground - 4-4
slave information IF - 2-6
Software Position Limit (607Dh) - 8-30
state machine controlling command - 7-3
status display - 9-2, 9-10
Statusword (6041h) - 7-3, 8-23
storage humidity - 2-5
storage temperature - 2-5
Supported Drive Modes (6502h) - 8-29
surge absorber - 4-2
  recommended surge absorber - 3-12
surrounding air temperature - 2-5, 3-2
Sync Error Setting (1F01h) - 8-14
sync manager communication objects - - - - - - - - - - - - - - - - - - - 8-12

Sync Manager Communication Type (1C00h) ---------- 8-12
Sync Manager PDO Assignment (1C10h to 1C13h) ---------- 8-12
sync manager settings ---------- 6-2
Sync Manager Synchronization (1C32h, 1C33h) ---------- 8-13
Sync0 event ---------- 6-7
synchronization with distributed clocks ---------- 6-7
example of PDO data exchange timing with DC mode ----- 6-8
SyncManager ---------- 2-6
system configuration ---------- 4-2

T

Target Position (607Ah) ---------- 8-30
Target Torque (6071h) ---------- 8-39
Target Velocity (60FFh) ---------- 8-38
test without motor function ---------- 5-4
Torque Actual Value (6077h) ---------- 8-39
Torque Demand Value (6074h) ---------- 8-39
torque limit
forward external torque limit ---------- 4-6
limiting torque ---------- 5-4
reserve external torque limit ---------- 4-6
torque limit detection ---------- 4-8
torque limit function ---------- 5-2
torque limit function ---------- 7-16, 8-40
Torque Offset (60B2h) ---------- 8-37
Torque Slope (6087h) ---------- 8-39
Touch Probe 1 Position Value (60BAh) ---------- 8-42
Touch Probe 2 Position Value (60BCh) ---------- 8-42
touch probe function ---------- 7-17, 7-18
example of handshaking procedure ---------- 7-18
Touch Probe Function (60B8h) ---------- 8-41
Touch Probe Status (60B9h) ---------- 8-42
transmit PDO mapping ---------- 8-10
trigger events ---------- 7-17
troubleshooting ---------- 9-11

U

UL standards ---------- xii, 3-2
update cycle of the interpolated position reference ---------- 8-36

V

Velocity Actual Value (606Ch) ---------- 8-38
Velocity Demand Value (606Bh) ---------- 8-38
Velocity Offset (60B1h) ---------- 8-37
Velocity User Unit (2702h) ---------- 8-16
Velocity Window (606Dh) ---------- 8-38
Velocity Window Time (606Eh) ---------- 8-38
vibration resistance ---------- 2-5, 3-2
vibration source ---------- 3-2, 9-12

W

warning list ---------- 9-10

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USER'S MANUAL

EtherCAT (CoE) Network Module

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