

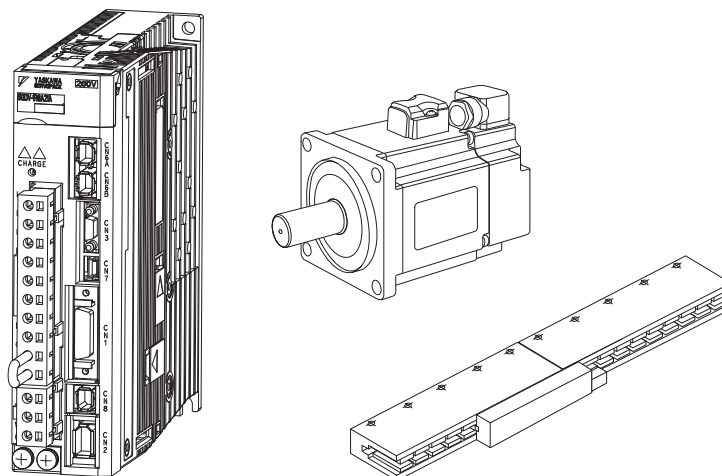
AC Servo Drives

Σ -V-EX Series USER'S MANUAL

Model: EX002

MECHATROLINK-III Communications Reference

SGDV- $\square\square\square\square2\square\square\square\square$ EX002 SERVOPACK
SGMMV/SGMJV/SGMAV/SGMPS/SGMGV/SGMSV/SGMCV/SGMCS/
SGLGW/SGLFW/SGLTW/SGLC/SGT Servomotor



Outline

1

Less Deviation Control

2

Parameters Specifically Related to
the Σ -V-EX-series EX002

3

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About this Manual

This manual contains information that is required to design, test, adjust, and maintain Σ -V-EX-series EX002 servo system. The EX002 servo system enables control operation with less deviation (called less deviation control).

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

When you use a Σ -V-EX-series EX002 servo system, read this manual together with the Σ -V Series User's Manual Design and Maintenance.

Also read the documents that are listed on the next page as required by the application.

■ Reference Table

Information on different items is provided in different user's manuals. Read the correct user's manual as given in the following table.

Item		This Manual	Σ -V Series User's Manual Design and Maintenance, MECHATROLINK-III Communications Reference	
			For Rotational Motors (Manual No.: SIEP S800000 64)	For Linear Motors (Manual No.: SIEP S800000 65)
Outline	Σ -V-EX-series EX002	1.1	–	
	Part Names	–	1.2	
	SERVOPACK Ratings and Specifications	1.2	–	
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Panel Display and Operation of Digital Operator		–	Chapter 2	
Wiring and Connection		–	Chapter 3	
Operation	Operation related to less deviation control	Chapter 2	–	
	Other types of operation	–	Chapter 4	
Adjustments	Operation related to less deviation control	Chapter 2	–	
	Other types of operation	–	Chapter 5	
Utility Functions (Fn□□□)		2.2.2	Chapter 6	
Monitor Displays (Un□□□)		–	Chapter 7	
Fully-closed Control		–	Chapter 8	–
Troubleshooting		–	Chapter 9	Chapter 8
List of Parameters	Σ -V-EX-series EX002 parameters	Chapter 3	–	
	Other parameters	–	Chapter 10	Chapter 9

■ Description of Technical Terms

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

Term	Meaning
Servomotor	Σ -V Series rotary servomotors (SGMMV, SGMJV, SGMAV, SGMPS, SGMGV, or SGMSV), and Σ -V Series direct drive servomotors (SGMCV or SGMCS)
Linear Servomotor	Σ -V Series SGLGW, SGLFW, SGLTW, SGLCW linear servomotor or SGT linear slider
SERVOPACK	Σ -V-EX Series EX002 servo amplifier
Σ -V Standard SERVOPACK	Σ -V Series SERVOPACKs for use with rotational or linear servomotors with MECHATROLINK-III communications reference
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	Power to motor ON
Servo OFF	Power to motor OFF
Base Block (BB)	Power supply to motor is turned OFF by shutting off the base current to the power transistor in the current amplifier.
Main Circuit Cable	Cables which connect to the main circuit terminals, including main circuit power supply cables, control power supply cables, servomotor main circuit cables, and others.

■ Specific Technical Terms

Different technical terms are used for rotational motors and linear motors, and the terms for rotational motors are used in this manual.

Rotational Motors	Linear Motors
torque	force
rotation	movement
moment of inertia	mass
forward rotation, reverse rotation	forward direction, reverse direction

■ 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.

■ Related Manuals

Refer to the following manuals as required.

Name	Selecting Models and Peripheral Devices	Ratings and Specifications	System Design	Panels and Wiring	Trial Operation	Trial Operation and Servo Adjustment	Maintenance and Inspection
Σ-V Series User's Manual Setup Rotational Motor (No.: SIEP S800000 43)				✓	✓		
Σ-V Series User's Manual Setup Linear Motor (No.: SIEP S800000 44)				✓	✓		
Σ-V Series Product Catalog (No.: KAEP S800000 42)	✓	✓	✓				
Σ-V-EX Series User's Manual Model: EX002 MECHATROLINK-III Communications Reference (this manual)			✓			✓	
Σ-V Series User's Manual Design and Maintenance Rotational Motor/ MECHATROLINK-III Communications Reference (No.: SIEP S800000 64)			✓		✓	✓	✓
Σ-V Series User's Manual Design and Maintenance Linear Motor/ MECHATROLINK-III Communications Reference (No.: SIEP S800000 65)			✓		✓	✓	✓
Σ-V Series User's Manual MECHATROLINK-III Standard Servo Profile Commands (No.: SIEP S800000 63)			✓		✓	✓	
Σ-V Series User's Manual Operation of Digital Operator (No.: SIEP S800000 55)					✓	✓	✓
Σ-V Series AC SERVOPACK SGD Safety Precautions (No.: TOBP C710800 10)	✓			✓			✓
Σ Series Digital Operator Safety Precautions (No.: TOBP C730800 00)							✓
AC SERVOMOTOR Safety Precautions (No.: TOBP C230200 00)				✓			✓

■ Trademarks

MECHATROLINK is a trademark of the MECHATROLINK Members Association.

■ 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.



Indicates precautions that, if not heeded, could possibly result in loss of life or serious injury.



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.



Indicates prohibited actions that must not be performed. For example, this symbol would be used to indicate that fire is prohibited as follows:



Indicates compulsory actions that must be performed. For example, this symbol would be used to indicate that grounding is compulsory as follows:



Safety Precautions

This section describes important precautions that must be followed during storage, transportation, installation, wiring, operation, maintenance, inspection, and disposal. Be sure to always observe these precautions thoroughly.



WARNING

- Never touch the servomotor, any rotating servomotor parts, or the machine during operation.
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 equipment.
- Install the SERVOPACK and servomotor before you wire them.
Failure to observe this caution may result in electric shock.
- 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 lamp is ON.
Residual voltage may cause electric shock.
- Follow the procedures and instructions provided in the manuals for the products being used in the trial operation.
Failure to do so may result not only in faulty operation and damage to equipment, but also in personal injury.
- Do not remove the top front cover, cables, connectors, or optional items from the SERVOPACK while the power is ON.
Failure to observe this warning may result in electric shock.
- Do not damage, pull, 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.
- Do not modify the product.
Failure to observe this warning may result in injury, damage to the equipment, or fire.
- Provide appropriate braking devices 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.
- Do not come close to the machine immediately after resetting an instantaneous power interruption to avoid an unexpected restart. Take appropriate measures to ensure safety against an unexpected restart.
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 or damage to the equipment.



Rotational Servomotors

- The output range of the rotational serial data for the Σ -V-EX absolute position detecting system is different from that of earlier systems for 12-bit and 15-bit encoders. As a result, the infinite-length positioning system of the Σ Series must be changed for use with products in the Σ -V-EX Series.
- The multiturn limit value need not be changed except for special applications.
Changing it inappropriately or unintentionally can be dangerous.
- If the Multiturn 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 value is set in Pn205, 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.

**WARNING****Linear Servomotors**

- If you have a pacemaker or any other electronic medical device, do not go near the magnetic way of the servomotor.
Failure to observe this warning may result in the malfunction of the medical device.
- Be sure to use nonmagnetic tools when installing or working close to the servomotor.
(Example: a beryllium-copper alloy hexagonal wrench set, made by NGK Insulators, Ltd.)

■ 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 equipment.
 - Locations subject to direct sunlight
 - Locations subject to 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 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.

Rotational Servomotors

- Do not hold the product by the cables, motor shaft, or encoder while transporting it.
Failure to observe this caution may result in injury or malfunction.

Linear Servomotors

- Be sure to store the magnetic way in the package that was used for delivery.
- Do not hold the servomotor by the cables while transporting it.
Failure to observe this caution may result in injury or malfunction.

■ Installation

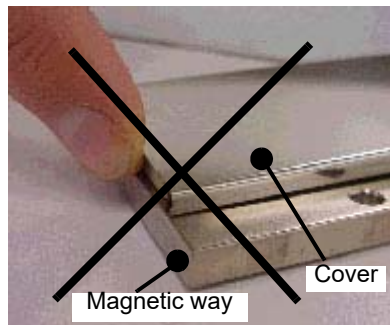


CAUTION

- Never use the product in an environment subject to water, corrosive gases, flammable 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 or malfunction.
- 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.

Linear Servomotors

- When unpacking and installing magnetic way, check that no metal fragments or magnetized objects near the magnetic because they may be affected by the magnetic attraction of the magnetic way.
Failure to observe this caution may result in injury or damage to the magnetic way's magnets.
- Do not use the magnetic way near metal or other magnetized objects.
Failure to observe this caution may result in injury.
- Do not place clocks, magnetic cards, floppy disks, or measuring instruments close to the magnetic way.
Failure to observe this caution may result in malfunction or damage to these items by the magnetic force.
- Securely mount the servomotor onto the machine.
If the servomotor is not mounted securely, it may loosen during operation.
- Do not carry the magnetic way by its magnet protection cover.
Failure to observe this caution may result in injury by the cover's edge or the shape of the cover may become distorted.



- When removing the dummy plate for reducing magnetic force used for the SGLFW magnetic way, pay attention to the magnetic attraction of the magnetic way. Do not place the removed plate close to the magnetic way.
Failure to observe this caution may result in injury or damage to the magnetic way's magnets or the magnet protection cover.
- Install SERVOPACKs, servomotors, and regenerative resistors on nonflammable objects.
Installation directly onto or near flammable objects may result in fire.

■ Wiring



CAUTION

- Be sure to wire correctly and securely.
Failure to observe this caution may result in motor overrun, injury, or malfunction.
- Securely tighten the cable connector screws and securing mechanism.
If the connector screws and securing mechanism are not secure, they may loosen during operation.
- Use cables with a radius, heat resistance, and flexibility suitable for the system.
- If the SERVOPACK malfunctions, turn OFF the main circuit's power supply of the SERVOPACK.
The continuous flow of a large current may cause fire.
- Use a noise filter to minimize the effects of electromagnetic damage.
Failure to observe this caution may result in electromagnetic damage to electronic devices used near the SERVOPACK.
- 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 terminals.
Failure to observe this caution may result in fire.
- Do not touch the power supply terminals while the CHARGE lamp 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 to do wiring or inspections.
- Be sure to observe the following precautions when wiring the SERVOPACK main circuit terminal blocks.
 - Do not turn the SERVOPACK power ON until all wiring, including the main circuit terminal blocks, has been completed.
 - Remove detachable main circuit terminals from the SERVOPACK prior to wiring.
 - Insert only one 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-circuits) adjacent wires.
- Do not connect a power supply that exceeds the power supply specifications.
Failure to observe this warning may result in damage to the SERVOPACK.
- When connecting an External Regenerative Resistor to the SGD V-3R8A, -5R5A, -7R6A, -120A, -180A, -200A, -330A, -1R9D, -3R5D, -5R4D, -8R4D, -120D, or -170D, first remove the lead wire between the B2 and B3 terminals on the SERVOPACK, and then connect the External Regenerative Resistor.
There is a risk of SERVOPACK failure.
- Always use the specified power supply voltage.
An incorrect voltage may result in fire or malfunction.
- Make sure that the polarity is correct.
Incorrect polarity may cause ruptures or damage.
- 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 equipment.
- 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 equipment.
- Wiring or inspection must be performed by a technical expert.
- Use a 24-VDC power supply with double insulation or reinforced insulation.



CAUTION

Rotational Servomotors

- Do not bundle or run the main circuit cables together with the I/O signal cables or the encoder cables in the same duct. Keep the main circuit cables separated from the I/O signal cables and the encoder cables with a gap of at least 30 cm.
Placing these cables too close to each other may result in malfunction.
- Use shielded twisted-pair cables or screened unshielded twisted-pair cables for I/O signal cables and the encoder cables.
- The maximum wiring length is 3 m for I/O signal cables, 50 m for encoder cables or servomotor main circuit cables, and 10 m for control power supply cables for the SERVOPACK with a 400-V power supply (+24 V, 0 V).
- 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.
- Do not reverse the polarity of the battery when connecting it.
Failure to observe this caution may damage the battery, the SERVOPACK or servomotor, or cause an explosion.

Linear Servomotors

- Do not bundle or run the main circuit cables together with the I/O signal cables or the linear scale connection cables in the same duct. Keep the main circuit cables separated from the I/O signal cables and the linear scale connection cables with a gap of at least 30 cm.
Placing these cables too close to each other may result in malfunction.
- Use shielded twisted-pair cables or screened unshielded twisted-pair cables for I/O signal cables and the linear scale connection cables.
- Make sure that the length of each cable is equal to or shorter than the maximum wiring length listed here.
 - I/O signal cables: 3 m
 - Connection cables for linear servomotor main circuit: 20 m
 - Connection cables for serial converter unit: 20 m
 - Connection cables for linear scale: 15 m
 - Connection cables for hall sensor: 15 m
 - Control power supply cables for the SERVOPACK with a 400-V power supply (+24 V, 0 V): 10 m

■ Operation



CAUTION

- Do not stand within the machine's range of motion during operation.
Failure to observe this caution may result in injury.
- Always use the servomotor and SERVOPACK in one of the specified combinations.
Failure to observe this caution may result in fire or malfunction.
- Before operation, install a limit switch or stopper on the end of the slider to prevent unexpected movement.
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 parameter 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 turn the power ON and OFF more than necessary.
 - Do not use the SERVOPACK for applications that require the power to turn ON and OFF frequently. Such applications will cause elements in the SERVOPACK to deteriorate.
 - As a guideline, at least one hour should be allowed between the power being turned ON and OFF once actual operation has been started.
- 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.
- Do not touch the SERVOPACK heat sinks, 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 equipment due to unstable operation.
- If an alarm occurs, shut down the main circuit power supply.
Failure to observe this caution may result in fire due to regenerative resistor overheating caused by regenerative transistor failure.
- 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 equipment, fire, or injury.

Rotational Servomotors

- 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.
- When carrying out JOG operation (Fn002), origin search (Fn003), or EasyFFT (Fn206), forcing movable machine parts to stop does not work for forward overtravel or reverse overtravel. Take necessary precautions.
Failure to observe this caution may result in damage to the equipment.
- When not using the turning-less function, set the correct moment of inertia ratio (Pn103).
Setting an incorrect moment of inertia ratio may cause machine vibration.
- Do not use the holding brake of the servomotor for braking.
Failure to observe this caution may result in malfunction.

Linear Servomotors

- When carrying out JOG operation (Fn002), origin search (Fn003), or EasyFFT (Fn206), forcing movable machine parts to stop does not work for forward overtravel or reverse overtravel. Take necessary precautions.
Failure to observe this caution may result in damage to the equipment.
- When not using the turning-less function, set the correct mass ratio (Pn103).
Setting an incorrect mass ratio may cause machine vibration.

■ Maintenance and Inspection



CAUTION

- Do not disassemble the SERVOPACK and the servomotor.
Failure to observe this caution may result in electric shock or injury.
- Do not attempt to 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 equipment.

■ Disposal Precautions



CAUTION

- Correctly discard the product as stipulated by regional, local, and municipal laws and regulations. Be sure to include these contents in all labelling and warning notifications on the final product as necessary.



■ 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

(1) Details of Warranty

■ Warranty Period

The warranty period for a product that was purchased (hereinafter called “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.

■ Warranty Scope

Yaskawa shall replace or repair a defective product free of charge if a defect attributable to Yaskawa occurs during the warranty period above. This warranty does not cover defects caused by the delivered product reaching the end of its service life and replacement of parts that require replacement or that have a limited service life.

This warranty does not cover failures that result from any of the following causes.

1. Improper handling, abuse, or use in unsuitable conditions or in environments not described in product catalogs or manuals, or in any separately agreed-upon specifications
2. Causes not attributable to the delivered product itself
3. Modifications or repairs not performed by Yaskawa
4. Abuse of 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 any programs (including parameter settings) or the results of program execution of the programs provided by the user or by a third party for use with programmable Yaskawa products.
3. The information described in product catalogs or manuals is provided for the purpose of the customer purchasing the appropriate product for the intended application. The use thereof does not guarantee that there are no infringements of intellectual property rights or other proprietary rights of Yaskawa or third parties, nor does it construe a license.
4. Yaskawa shall not be responsible for any damage arising from infringements of intellectual property rights or other proprietary rights of third parties as a result of using the information described in catalogs or manuals.

(3) Suitability for Use

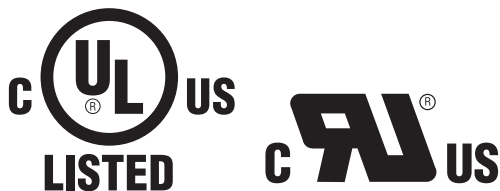
1. It is the customer's responsibility to confirm conformity with any standards, codes, or regulations that apply if the Yaskawa product is used in combination with any other products.
2. The customer must confirm that the Yaskawa product is suitable for the systems, machines, and equipment used by the 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 system is designed to secure the required level of safety 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) Specifications Change

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. The next editions of the revised catalogs or manuals will be published with updated code numbers. Consult with your Yaskawa representative to confirm the actual specifications before purchasing a product.

Compliance with UL Standards, EU Directives, UK Regulations, Other Safety Standards and China Energy Efficiency Regulations

■ North American Safety Standards (UL)



Product	Model	North American Safety Standards (UL File No.)
SERVOPACK	SGDV	UL508C (E147823)
Rotary Servomotor	<ul style="list-style-type: none"> • SGMMV • SGMJV • SGMAV • SGMPs • SGMGV • SGMSV 	UL 1004-1 UL 1004-6 (E165827) CSA C22.2 No.100
Direct Drive Servomotor	SGMCV	UL 1004-1 UL 1004-6 (E165827) CSA C22.2 No.100
Linear Servomotor	<ul style="list-style-type: none"> • SGLG^{*1} • SGLF^{*1} • SGLT^{*1*2} 	UL 1004-1 UL 1004-6 (E165827) CSA C22.2 No.100

*1. Only products with derating specifications are in compliance with the UL Standards. Estimates are available for those products. Contact your Yaskawa representative for details.

*2. SGLTW-35A□□□H and -50A□□□H (high-force type) are not in compliance with the UL Standards.

■ EU Directives



Product	Model	EU Directives	Harmonized Standards
SERVOPACK	SGDV	Machinery Directive 2006/42/EC	EN ISO 13849-1: 2015
		EMC Directive 2014/30/EU	EN 55011 Group 1, Class A EN 61000-6-2 EN 61000-6-4 EN 61800-3 (Category C2, Second environment)
		Low Voltage Directive 2014/35/EU	EN 61800-5-1
		RoHS Directive 2011/65/EU (EU)2015/863	EN IEC 63000
Rotary Servomotor	<ul style="list-style-type: none"> • SGMGV • SGMSV 	EMC Directive 2014/30/EU	EN 55011 Group 1, Class A EN 61000-6-2 EN 61800-3 (Category C2, Second environment)
		Low Voltage Directive 2014/35/EU	EN 60034-1 EN 60034-5
		RoHS Directive 2011/65/EU (EU)2015/863	EN IEC 63000
	<ul style="list-style-type: none"> • SGMJV • SGMAV • SGMMV • SGMPV 	EMC Directive 2014/30/EU	EN 55011 Group 1, Class A EN 61000-6-2 EN 61000-6-4 EN 61800-3 (Category C2, Second environment)
		Low Voltage Directive 2014/35/EU	EN 60034-1 EN 60034-5
		RoHS Directive 2011/65/EU (EU)2015/863	EN IEC 63000
Direct Drive Servomotor	<ul style="list-style-type: none"> • SGMCV • SGMCS -□□B -□□C -□□D -□□E (Small-capacity, Coreless servomotors) *1 	EMC Directive 2014/30/EU	EN 55011 Group 1, Class A EN 61000-6-2 EN 61000-6-4 EN 61800-3 (Category C2, Second environment)
		Low Voltage Directive 2014/35/EU	EN 60034-1 EN 60034-5
		RoHS Directive 2011/65/EU (EU)2015/863	EN IEC 63000
Linear Servomotor	<ul style="list-style-type: none"> • SGLG *2 • SGLF *2 • SGLT *2 	EMC Directive 2014/30/EU	EN 55011 Group 1, Class A EN 61000-6-2 EN 61000-6-4 EN 61800-3 (Category C2, Second environment)
		Low Voltage Directive 2014/35/EU	EN 60034-1
		RoHS Directive 2011/65/EU (EU)2015/863	EN IEC 63000

*1. For SGMCS, only models with “-E” at the end of model numbers are in compliance with the standards.

*2. Only Moving Coils of EU Directive-certified products (models with “-E” at the end of model numbers) are in compliance with the EU Directives. Estimates are available for those products. Contact your Yaskawa representative for details. For EU Directive-certified products for SGL□M (models with “-E” at the end of model numbers), the content of substances specified in 2011/65/EU as amended by (EU)2015/863 is below the standard value. However, these products are not marked since they are not subject to CE Marking requirements because they are not energized.

■ UK Conformity Assessed (UKCA)



Product	Model	UK Regulations	Designated Standards
SERVOPACK	SGDV	Supply of Machinery (Safety) Regulations S.I. 2008/1597	EN ISO 13849-1: 2015
		Electromagnetic Compatibility Regulations S.I. 2016/1091	EN 55011 Group 1, Class A EN 61000-6-2 EN 61000-6-4 EN 61800-3 (Category C2, Second environment)
		Electrical Equipment (Safety) Regulations S.I. 2016/1101	EN 61800-5-1
		Restriction of the Use of Certain Hazardous Substances in Electrical and Electronic Equipment Regulations S.I. 2012/3032	EN IEC 63000
Rotary Servomotor	• SGMGV • SGMSV	Electromagnetic Compatibility Regulations S.I. 2016/1091	EN 55011 Group 1, Class A EN 61000-6-2 EN 61800-3 (Category C2, Second environment)
		Electrical Equipment (Safety) Regulations S.I. 2016/1101	EN 60034-1 EN 60034-5
		Restriction of the Use of Certain Hazardous Substances in Electrical and Electronic Equipment Regulations S.I. 2012/3032	EN IEC 63000
	• SGMJV • SGMAV • SGMMV • SGMPS	Electromagnetic Compatibility Regulations S.I. 2016/1091	EN 55011 Group 1, Class A EN 61000-6-2 EN 61000-6-4 EN 61800-3 (Category C2, Second environment)
		Electrical Equipment (Safety) Regulations S.I. 2016/1101	EN 60034-1 EN 60034-5
		Restriction of the Use of Certain Hazardous Substances in Electrical and Electronic Equipment Regulations S.I. 2012/3032	EN IEC 63000
	• SGMCV • SGMCS -□□B -□□C -□□D -□□E (Small-capacity, Coreless servomotors) *1	Electromagnetic Compatibility Regulations S.I. 2016/1091	EN 55011 Group 1, Class A EN 61000-6-2 EN 61000-6-4 EN 61800-3 (Category C2, Second environment)
		Electrical Equipment (Safety) Regulations S.I. 2016/1101	EN 60034-1 EN 60034-5
		Restriction of the Use of Certain Hazardous Substances in Electrical and Electronic Equipment Regulations S.I. 2012/3032	EN IEC 63000

(cont'd)

Product	Model	UK Regulations	Designated Standards
Linear Servomotor	<ul style="list-style-type: none"> • SGLG^{*2} • SGLF^{*2} • SGLT^{*2} 	Electromagnetic Compatibility Regulations S.I. 2016/1091	EN 55011 Group 1, Class A EN 61000-6-2 EN 61000-6-4 EN 61800-3 (Category C2, Second environment)
		Electrical Equipment (Safety) Regulations S.I. 2016/1101	EN 60034-1
		Restriction of the Use of Certain Hazardous Substances in Electrical and Electronic Equipment Regulations S.I. 2012/3032	EN IEC 63000

*1. For SGMCS, only models with “-E” at the end of model numbers are in compliance with the standards.

*2. Only Moving Coils of EU Directive-certified products (models with “-E” at the end of model numbers) are in compliance with the EU Directives. Estimates are available for those products. Contact your Yaskawa representative for details. For EU Directive-certified products for SGL□M (models with “-E” at the end of model numbers), the content of substances specified in S.I. 2012/3032 is below the standard value. However, these products are not marked since they are not subject to UKCA Marking requirements because they are not energized.

Note: We declared the UKCA marking based on the designated standards in the above table.

■ Safety Standards

Product	Model	Safety Standards	Standards
SERVOPACK	SGDV	Safety of Machinery	EN ISO 13849-1: 2015 EN 60204-1
		Functional Safety	EN 61508 series EN 61800-5-2
		Functional Safety EMC	EN 61326-3-1

• Safety Performance

Items	Standards	Performance Level
Safety Integrity Level	EN 61508	SIL2
Probability of Dangerous Failure per Hour	EN 61508	PFH = 1.7×10^{-9} [1/h] (0.17% of SIL2)
Performance Level	EN ISO 13849-1	PL d (Category 3)
Mean Time to Dangerous Failure of Each Channel	EN ISO 13849-1	MTTFd: High
Average Diagnostic Coverage	EN ISO 13849-1	DCavg: Low
Stop Category	EN 60204-1	Stop category 0
Safety Function	EN 61800-5-2	STO
Proof test Interval	EN 61508	10 years

■ China Energy Label for Permanent-Magnet Synchronous Motors



Product	Model	Application Range	Laws and Standards
Rotary Servomotor	SGMJV SGMAV SGMGV SGMSV SGMPS	Rated Voltage 1000 V max.	law CEL 038-2020
		Rated Output 0.55 kW to 90 kW	regulation GB 30253-2013
		Rated Motor Speed 500 to 3000 min ⁻¹	

Note: The following products do not comply with the China Energy Label for permanent-magnet synchronous motors.

- Models with holding brakes
- Models with gears

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1.1 Σ -V-EX-series EX002

The Σ -V-EX-series EX002 SERVOPACK enables less deviation control.

For details on the less deviation control, refer to *Chapter 2 Less Deviation Control*.

1.2 SERVOPACK Ratings and Specifications

This section describes the ratings and specifications of SERVOPACKs.

1.2.1 Ratings

Ratings of SERVOPACKs are as shown below.

(1) SGDV with Single-phase, 100-V Rating: Rotational/Linear Motors

SGDV (Single-phase, 100 V)	R70	R90	2R1	2R8
Continuous Output Current [Arms]	0.66	0.91	2.1	2.8
Instantaneous Max. Output Current [Arms]	2.1	2.9	6.5	9.3
Regenerative Resistor*	None or external			
Main Circuit Power Supply	Single-phase, 100 to 115 VAC $\begin{smallmatrix} +10\% \\ -15\% \end{smallmatrix}$, 50/60 Hz			
Control Power Supply	Single-phase, 100 to 115 VAC $\begin{smallmatrix} +10\% \\ -15\% \end{smallmatrix}$, 50/60 Hz			
Overvoltage Category	III			

* For details, refer to 3.7 *Connecting Regenerative Resistors* in the Σ -V Series User's Manual *Design and Maintenance MECHATROLINK-III Communications Reference* (manual no.: SIEP S800000 64/65).

(2) SGDV with Single-phase, 200-V Rating: Rotational Motors

SGDV (Single-phase, 200 V)	120* ¹
Continuous Output Current [Arms]	11.6
Instantaneous Max. Output Current [Arms]	28
Regenerative Resistor* ²	Built-in or external
Main Circuit Power Supply	Single-phase, 220 to 230 VAC $\begin{smallmatrix} +10\% \\ -15\% \end{smallmatrix}$, 50/60 Hz
Control Power Supply	Single-phase, 220 to 230 VAC $\begin{smallmatrix} +10\% \\ -15\% \end{smallmatrix}$, 50/60 Hz
Overvoltage Category	III

*1. The official model number is SGDV-120A21A008EX002.

*2. For details, refer to 3.7 *Connecting Regenerative Resistors* in the Σ -V Series User's Manual *Design and Maintenance Rotational Motor/MECHATROLINK-III Communications Reference* (manual no.: SIEP S800000 64).

(3) SGDV with Three-phase, 200-V Rating: Rotational Motors

SGDV (Three-phase, 200 V)	R70	R90	1R6	2R8	3R8	5R5	7R6	120	180	200	330	470	550	590	780
Continuous Output Current [Arms]	0.66	0.91	1.6	2.8	3.8	5.5	7.6	11.6	18.5	19.6	32.9	46.9	54.7	58.6	78.0
Instantaneous Max. Output Current [Arms]	2.1	2.9	5.8	9.3	11.0	16.9	17	28	42	56	84	110	130	140	170
Regenerative Resistor*	None or external				Built-in or external							External			
Main Circuit Power Supply	Three-phase, 200 to 230 VAC $\begin{smallmatrix} +10\% \\ -15\% \end{smallmatrix}$, 50/60 Hz														
Control Power Supply	Single-phase, 200 to 230 VAC $\begin{smallmatrix} +10\% \\ -15\% \end{smallmatrix}$, 50/60 Hz														
Overvoltage Category	III														

* For details, refer to 3.7 *Connecting Regenerative Resistors* in the Σ -V Series User's Manual *Design and Maintenance Rotational Motor/MECHATROLINK-III Communications Reference* (manual no.: SIEP S800000 64).

(4) SGD V with Three-phase, 200-V Rating: Linear Motors

SGDV (Three-phase, 200 V)	R70	R90	1R6	2R8	3R8	5R5	7R6	120	180	200	330	550
Continuous Output Current [Arms]	0.66	0.91	1.6	2.8	3.8	5.5	7.6	11.6	18.5	19.6	32.9	54.7
Instantaneous Max. Output Current [Arms]	2.1	2.9	5.8	9.3	11.0	16.9	17	28	42	56	84	130
Regenerative Resistor*	None or external				Built-in or external							External
Main Circuit Power Supply	Three-phase, 200 to 230 VAC ^{+10%} _{-15%} , 50/60 Hz											
Control Power Supply	Single-phase, 200 to 230 VAC ^{+10%} _{-15%} , 50/60 Hz											
Overvoltage Category	III											

* For details, refer to 3.7 *Connecting Regenerative Resistors* in the *Σ -V Series User's Manual Design and Maintenance Linear Motor/MECHATROLINK-III Communications Reference* (manual no.: SIEP S800000 65).

(5) SGD V with Three-phase, 400-V Rating: Rotational Motors

SGDV (Three-phase, 400 V)	1R9	3R5	5R4	8R4	120	170	210	260	280	370
Continuous Output Current [Arms]	1.9	3.5	5.4	8.4	11.9	16.5	20.8	25.7	28.1	37.2
Instantaneous Max. Output Current [Arms]	5.5	8.5	14	20	28	42	55	65	70	85
Regenerative Resistor*	Built-in or external						External			
Main Circuit Power Supply	Three-phase, 380 to 480 VAC ^{+10%} _{-15%} , 50/60 Hz									
Control Power Supply	24 VDC ±15%									
Overvoltage Category	III									

* For details, refer to 3.7 *Connecting Regenerative Resistors* in the *Σ -V Series User's Manual Design and Maintenance Rotational Motor/MECHATROLINK-III Communications Reference* (manual no.: SIEP S800000 64).

(6) SGD V with Three-phase, 400-V Rating: Linear Motors

SGDV (Three-phase, 400 V)	1R9	3R5	5R4	8R4	120	170	260
Continuous Output Current [Arms]	1.9	3.5	5.4	8.4	11.9	16.5	25.7
Instantaneous Max. Output Current [Arms]	5.5	8.5	14	20	28	42	65
Regenerative Resistor*	Built-in or external						External
Main Circuit Power Supply	Three-phase, 380 to 480 VAC $^{+10\%}_{-15\%}$, 50/60 Hz						
Control Power Supply	24 VDC $\pm 15\%$						
Overvoltage Category	III						

* For details, refer to 3.7 *Connecting Regenerative Resistors* in the *Σ -V Series User's Manual Design and Maintenance Linear Motor/MECHATROLINK-III Communications Reference* (manual no.: SIEP S800000 65).

1.2.2 Basic Specifications

Basic specifications of SERVOPACKs are shown below.

Drive Method			Sine-wave current drive with PWM control of IGBT	
Feedback			Rotational Motor	Encoder: 17 and 20 bit (incremental/absolute)
			Linear Motor	Linear scale: The signal resolution depends on the linear scale that is used.*1 (incremental/absolute)
Operating Conditions	Surrounding Air Temperature		0°C to +55°C	
	Storage Temperature		-20°C to +85°C	
	Ambient Humidity		90% RH or less	With no freezing or condensation
	Storage Humidity		90% RH or less	
	Vibration Resistance		4.9 m/s ²	
	Shock Resistance		19.6 m/s ²	
	Protection Class		IP10	An environment that satisfies the following conditions. • Free of corrosive or flammable gases • Free of exposure to water, oil, or chemicals • Free of dust, salts, or iron dust
	Pollution Degree		2	
	Altitude		1000 m or less	
	Others		Free of static electricity, strong electromagnetic fields, magnetic fields or exposure to radioactivity	
Harmonized Standards			Refer to <i>Compliance with UL Standards, EU Directives, UK Regulations, Other Safety Standards and China Energy Efficiency Regulations</i> in the preface for details.	
Mounting			Standard: Base-mounted Optional: Rack-mounted or duct-ventilated	
Performance	Speed Control Range		1:5000 (The lower limit of the speed control range must be lower than the point at which the rated torque does not cause the servomotor to stop.)	
	Speed Regulation*2	Load Regulation	0% to 100% load: ±0.01% max. (at rated speed)	
		Voltage Regulation	Rated voltage ±10%: 0% (at rated speed)	
		Temperature Regulation	25 ± 25°C: ±0.1% max. (at rated speed)	
	Torque Control Tolerance (Repeatability)		±1%	
	Soft Start Time Setting		0 to 10 s (Can be set individually for acceleration and deceleration.)	

(cont'd)

I/O Signals	Encoder Output Pulse		Phase A, B, C: line driver Encoder output pulse: any setting ratio (Refer to 4.4.5*3.)	
	Sequence Input	Input Signals which can be allocated	Number of Channels	7 ch
			Functions	<ul style="list-style-type: none">• Homing deceleration switch (/DEC)• External latch (/EXT 1 to 3)• Forward run prohibited (P-OT), reverse run prohibited (N-OT)• Forward external torque limit (/P-CL), reverse external torque limit (/N-CL)• Polarity detection (/P-DET) only for linear motor Signal allocations can be performed, and positive and negative logic can be changed.
	Sequence Output	Fixed Output	Servo alarm (ALM) output	
		Output Signals which can be allocated	Number of Channels	3 ch
			Functions	<ul style="list-style-type: none">• Positioning completion (/COIN)• Speed coincidence detection (/V-CMP)• Rotation detection (/TGON)• Servo ready (/S-RDY)• Torque limit detection (/CLT)• Speed limit detection (/VLT)• Brake (/BK)• Warning (/WARN)• Near (/NEAR) Signal allocations can be performed, and positive and negative logic can be changed.
Communi- cations Function	RS422A Commu- nications (CN3)	Interface	Digital operator (model: JUSP-OP05A-1-E), personal computer (can be connected with SigmaWin+)	
		1:N Communica- tions	N = Up to 15 stations possible at RS422A	
		Axis Address Setting	Set by parameter	
	USB Commu- nications (CN7)	Interface	Personal computer (can be connected with SigmaWin+)	
		Communica- tions Standard	Complies with standard USB1.1. (12 Mbps)	
LED Display			Panel display (seven-segment), CHARGE, L1, L2, and CN indicators	
MECHATROLINK-III Communications Setting Switches			Rotary Switch (S1, S2)	Position: 16 positions × 2 (Refer to 4.1.2*3.)
			DIP Switch (S3)	Number of pins: Four pins (Refer to 4.1.1*3.)
Analog Monitor (CN5)			Number of points: 2 Output voltage: ± 10VDC (linearity effective range ± 8 V) Resolution: 16 bits Accuracy: ± 20 mV (Typ) Max. output current: ± 10 mA Settling time (± 1%): 1.2 ms (Typ)	
Dynamic Brake (DB)			Activated when a servo alarm or overtravelling occurs or when the power supply for the main circuit or servomotor is OFF.	
Regenerative Processing			Included*4	
Overtravel Prevention (OT)			Dynamic brake stop, deceleration to a stop, or free run to a stop at P-OT or N-OT	
Protective Function			Overcurrent, overvoltage, insufficient voltage, overload, regeneration error, and so on.	
Utility Function			Gain adjustment, alarm history, JOG operation, origin search, and so on.	

(cont'd)

Safety Function	Input	/HWBB1, /HWBB2: Baseblock signal for power module
	Output	EDM1: Monitoring status of internal safety circuit (fixed output)
	Standards*5	EN ISO13849-1 PL d (Category 3), IEC61508 SIL2
Option Module		Fully-closed module only for rotational motor or safety module

*1. For details, refer to 4.4.3 *Electronic Gear* in the *Σ-V Series User's Manual Design and Maintenance Linear Motor/ MECHATROLINK-III Communications Reference* (manual no.: SIEP S800000 65).

*2. Speed regulation by load regulation is defined as follows:

$$\text{Speed regulation} = \frac{\text{No-load motor speed} - \text{Total load motor speed}}{\text{Rated motor speed}} \times 100\%$$

*3. Refer to the *Σ-V Series User's Manual Design and Maintenance, MECHATROLINK-III Communications Reference* (manual no.: SIEP S800000 64/65).

*4. Refer to 1.2.1 *Ratings* for details on regenerative resistors.

*5. Perform risk assessment for the system and be sure that the safety requirements are fulfilled.

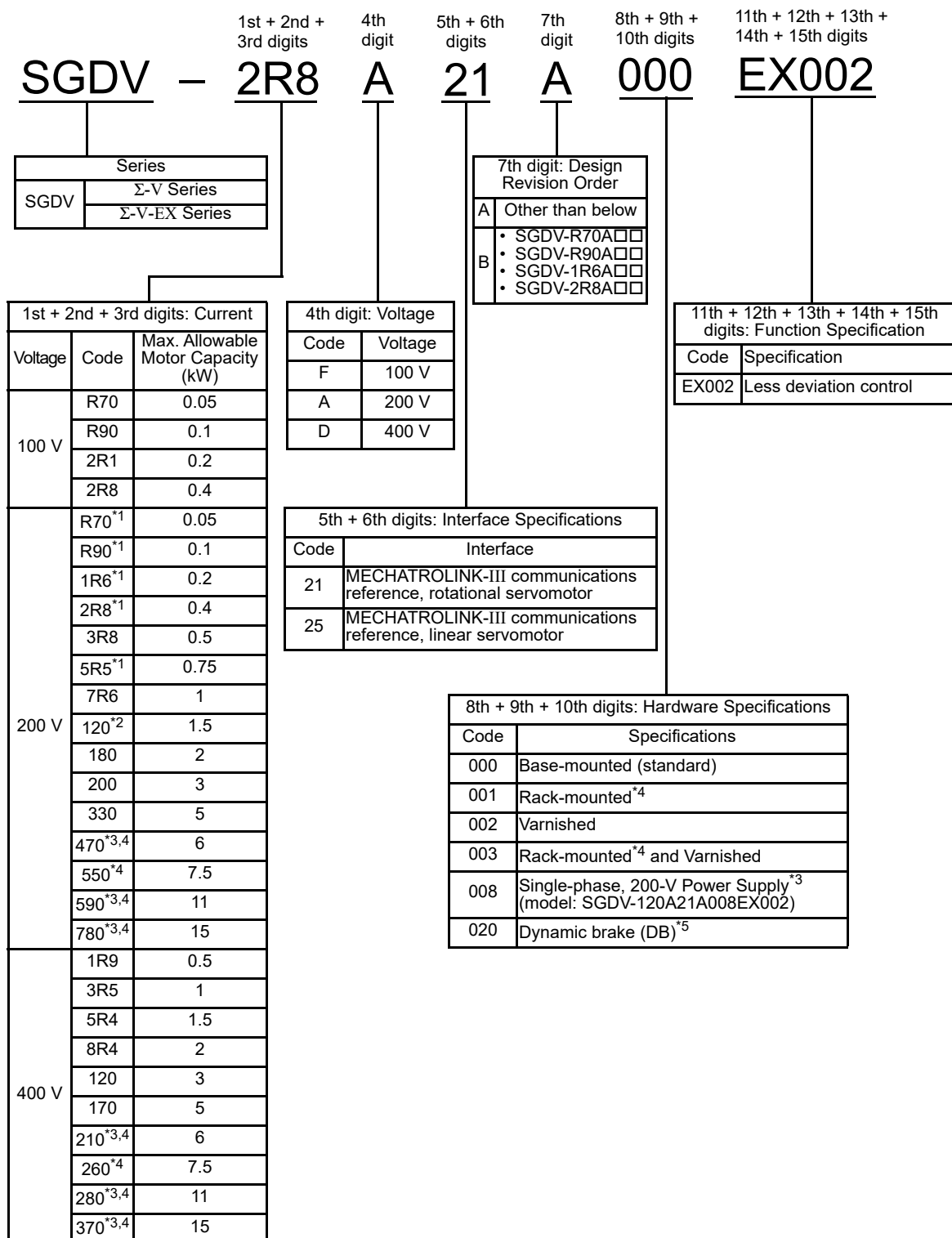
1.2.3 MECHATROLINK-III Function Specifications

The following table shows the specifications of MECHATROLINK-III.

Function		Specifications
MECHATROLINK-III Communication	Communication Protocol	MECHATROLINK-III
	Station Address	03H to EFH (Max. number of stations: 62) Use the rotary switches S1 and S2 to set the station address.
	Baud Rate	100 Mbps
	Transmission Cycle	125 μ s, 250 μ s, 500 μ s, 750 μ s, and 1.0 ms to 4.0 ms (increments of 0.5 ms)
	Number of Transmission Bytes	16, 32, or 48 bytes per station Use the DIP switch S3 to select the number of words.
Reference Method	Control Method	Position, speed, or torque control with MECHATROLINK-III communication
	Reference Input	MECHATROLINK commands (sequence, motion, data setting/reference, monitoring, or adjustment)
	Profile	MECHATROLINK-III standard servo profile MECHATROLINK-II-compatible profile

1.3 SERVOPACK Model Designation

This section shows SERVOPACK model designation.



*1. These amplifiers can be powered with single or three-phase.

*2. A SERVOPACK for signal-phase, 200 VAC can also be manufactured (model: SGD-V-120A21A008EX002), but only for rotational motors.

*3. Manufacture is possible only for rotational motors.

*4. SGD-V-470A, -550A, -590A, -780A, -210D, -260D, -280D, and -370D are duct-ventilated types.

*5. A resistor for the dynamic brake is not included. An external resistor for the dynamic brake can only be used with 400-V SERVOPACKs.

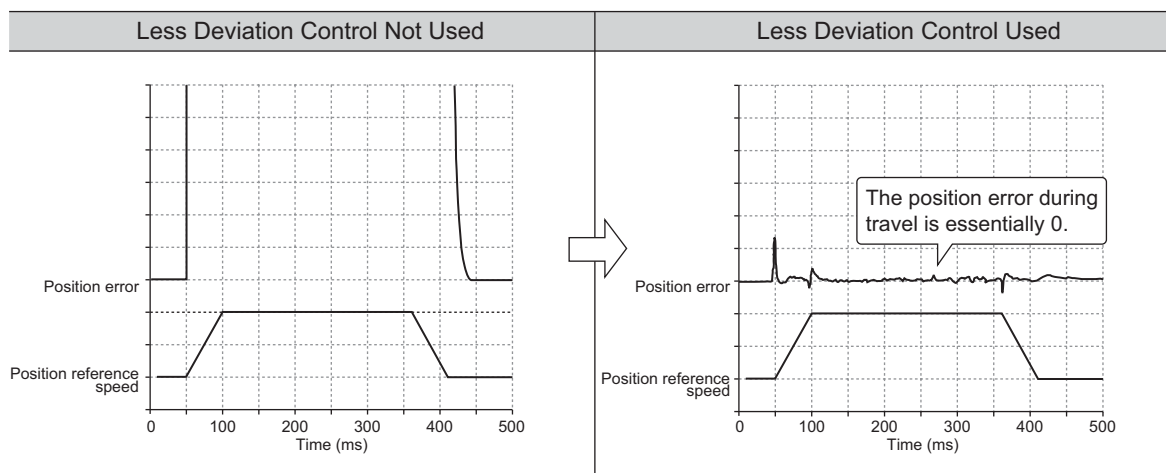
Less Deviation Control

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2.1 Overview

You can use less deviation control to reduce the error during travel and increase the locus tracking performance.

This SERVOPACK is used for applications that require reference tracking performance during travel, including the prevention of locus error and the prevention of interference between the equipment and moving parts, which can be caused by the influences of position response delay.



2.2 Restrictions

2.2.1 Control Mode Restrictions

Less deviation control can be used only in position control mode. It cannot be used in speed control mode or torque control mode.

If you change from speed control mode or torque control mode to position control mode, less deviation control will be enabled after the motor stops.

2.2.2 Functional Restrictions

There are restrictions to the following functions when less deviation control is used.

Function	Restriction
Tuning-less Function (Pn170.0)	The tuning-less function is given priority. Less deviation control will be disabled even if you set the parameter for less deviation control (Pn190.0).
Feedforward Gain (Pn109)	Feedforward control cannot be used. It will be disabled even if you set it in the parameters.
Automatic Gain Changeover (Pn139 = n.□□□2)	Automatic gain switching cannot be used. It will be disabled even if you set it in the parameters.
Model Following Control (Pn140.0)	Model following control cannot be used. It will be disabled even if you set it in the parameters and less deviation control will be given priority.
Tuning-less levels setting (Fn200)	The tuning-less level setting cannot be used.
Advanced autotuning (Fn201)	Advanced autotuning cannot be used.
Advanced autotuning by reference (Fn202)	Advanced autotuning by reference cannot be used.
One-parameter tuning (Fn203)	You can select only 0 or 1 for the tuning mode.
Vibration suppression function (Fn205)	Vibration suppression cannot be used.

2.3 Application Method

Less deviation control is enabled or disabled with Pn190 and then adjusted with Pn191 to Pn193.



IMPORTANT

If you use less deviation control under any of the following conditions, vibration, noise, or overshooting may occur.

- The machine has low rigidity. (with a point of large resonance in the frequency band at 300 Hz or lower.)
- The machine's load regulation is high.
- The encoder's resolution is low.

If the machine's rigidity is low or the load regulation is high, do not use less deviation control.

If the encoder's resolution is low, Yaskawa recommends using a motor with an encoder with a 20-bit resolution. For fully-closed control, use a linear scale with a resolution that is equivalent to that of the encoder.



IMPORTANT

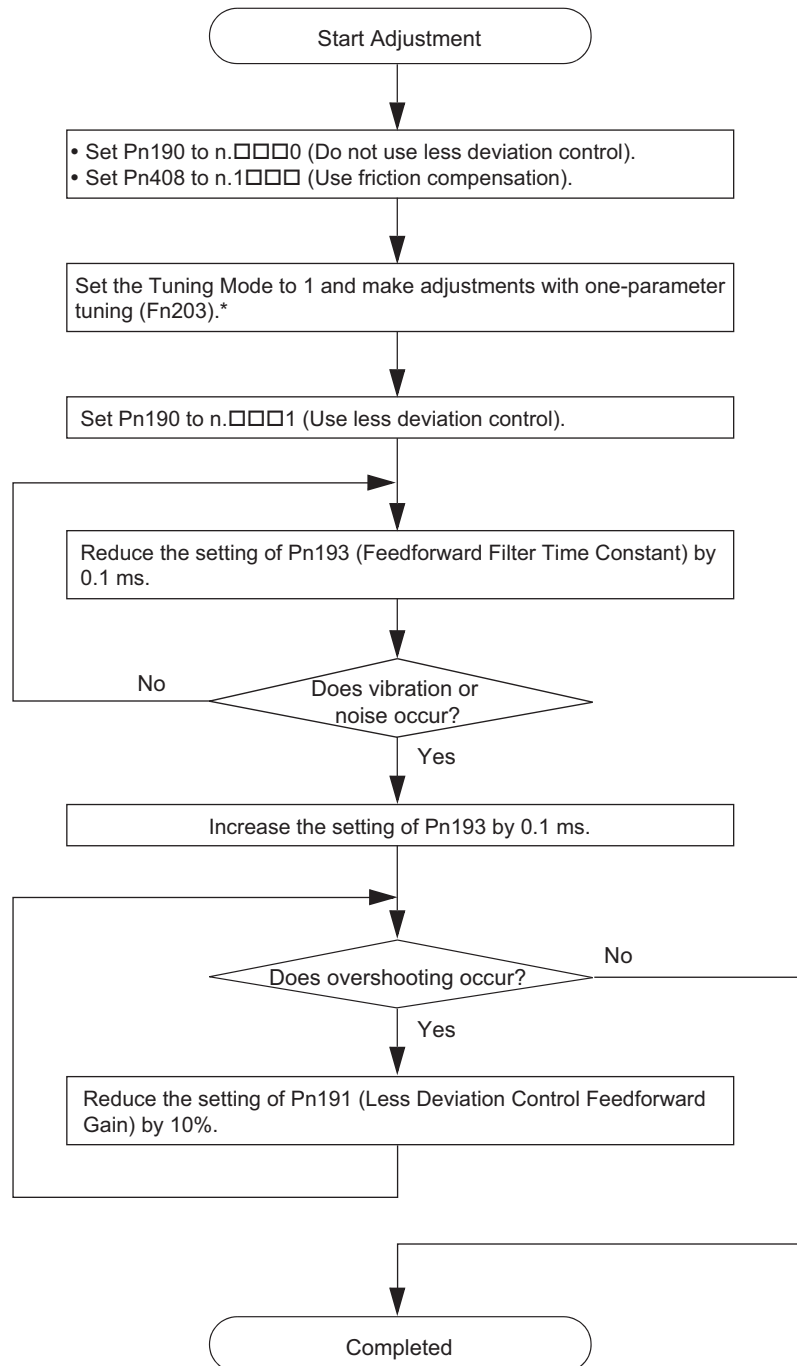
The optimum feedforward is set inside the SERVOPACK for less deviation control.

A speed feedforward input or torque feedforward input from the host controller is normally not used at the same time. However, they can be used together with less deviation control if necessary. If they are used together and an inappropriate feedforward value is input, overshooting may occur.

2.4 Adjustment

2.4.1 Adjustment Procedure

The basic adjustment flowchart is given in the following flowchart. Make adjustments according to the machine and operating conditions.



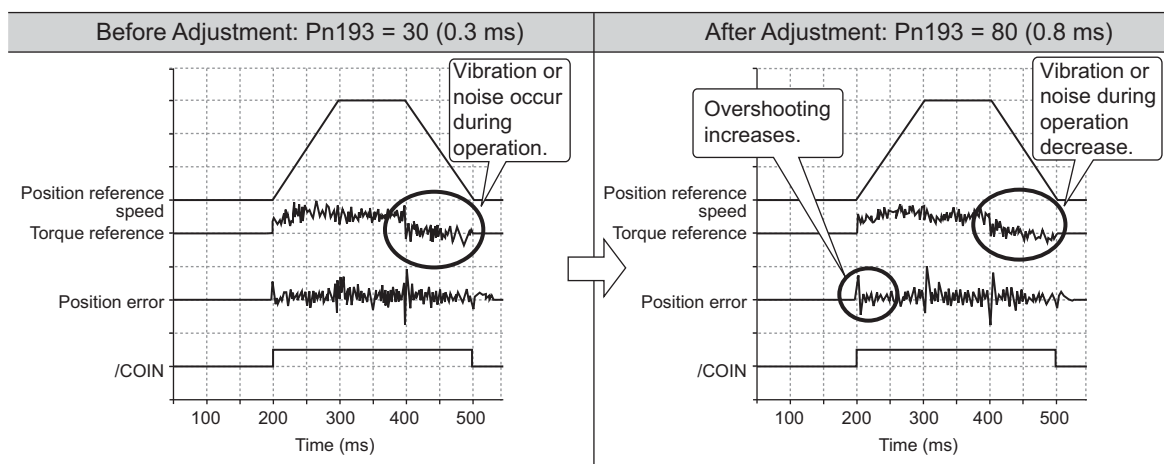
* For details, refer to *Σ-V Series User's Manual Design and Maintenance MECHATROLINK-III Communications Reference* (manual no.: SIEP S800000 64/65).

2.4.2 Adjustment Example

(1) Pn193 Adjustment Example

The affect of Pn193 (Feedforward Filter Time Constant) is shown here.

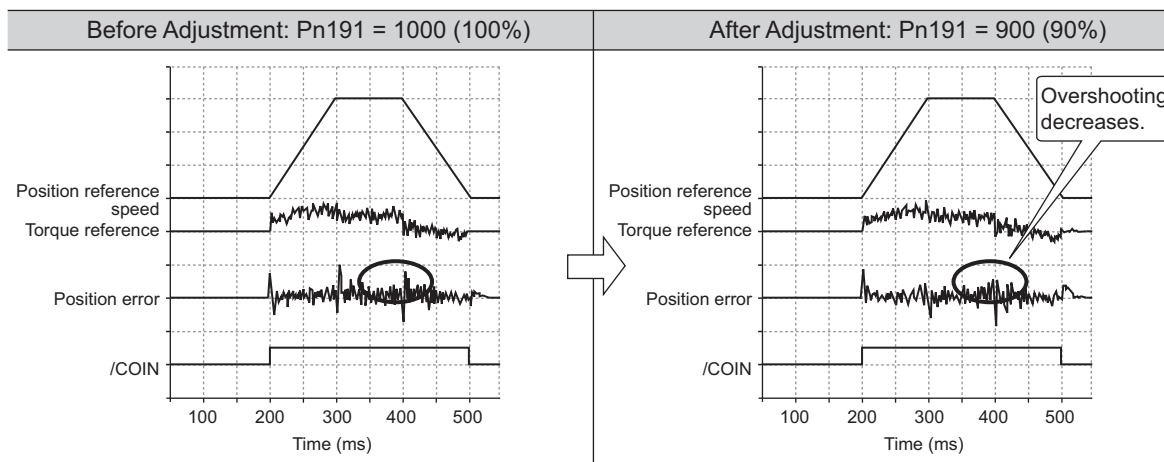
To decrease any vibration or noise that might occur during operation, increase the setting of Pn193. This, however, might increase overshooting.



(2) Pn191 Adjustment Example

The affect of Pn191 (Less Deviation Control Feedforward Gain) is shown below.

If the setting of Pn191 is decreased, overshooting decreases.



2.5 Gain Switching

You can switch the gain to increase the gain during positioning to reduce the positioning time and then to reduce the gain when stopping to suppress vibration.

2.5.1 Gain Combinations for Switching

Setting	Speed Loop Gain	Speed Loop Integral Time Constant	Position Loop Gain	Torque Reference Filter	Friction Compensation Gain	Less Deviation Control Torque Feedforward Gain
Gain Setting 1	Speed Loop Gain (Pn100)	Speed Loop Integral Time Constant (Pn101)	Position Loop Gain (Pn102)	Torque Reference Filter Time Constant (Pn401)	Friction Compensation Gain (Pn121)	Less Deviation Control Feedforward Gain (Pn191)
Gain Setting 2	2nd Speed Loop Gain (Pn104)	2nd Speed Loop Integral Time Constant (Pn105)	2nd Position Loop Gain (Pn106)	1st Step 2nd Torque Reference Filter Time Constant (Pn412)	2nd Gain for Friction Compensation (Pn122)	Less Deviation Control 2nd Feedforward Gain (Pn192)

2.5.2 Method to Switch the Gain

First, make sure that Pn139 is set to n.□□□0 (manual gain switching).

To switch between gain 1 and gain 2, use the G_SEL servo command output signal (SVCMD_IO).

When the motor is stopped, input the G_SEL signal and wait 2 ms or more to input a command (e.g., positioning).

Type	Command Name	Setting	Meaning
Input	G_SEL of the servo command output signals (SVCMD_IO)	0	Switches to gain setting 1.
		1	Switches to gain setting 2.

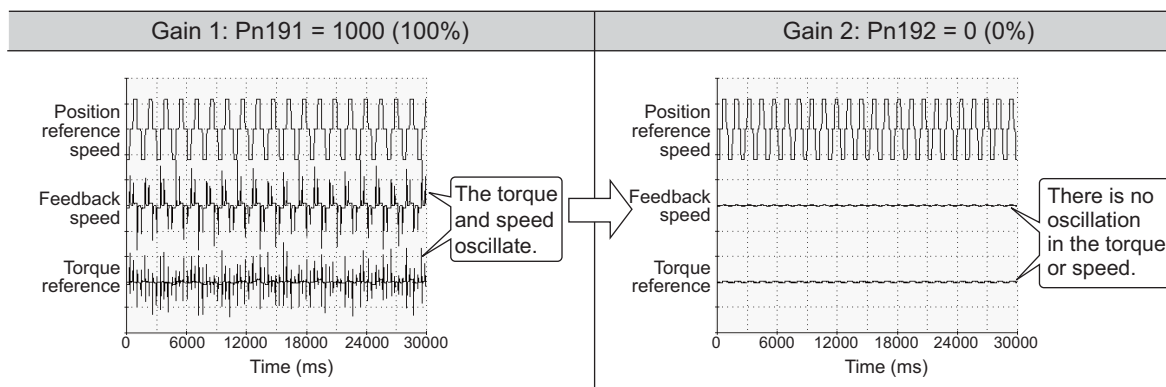
2.5.3 Settings at Low Speeds

If the position reference speed is input intermittently during homing or other low-speed operations, the machine may vibrate because the tracking ability to follow references of the less deviation control is high.

If that occurs, perform the following procedure.

1. Set Pn192 (Less Deviation Control 2nd Feedforward Gain) to 0.
2. During low-speed feeding, change the gain from gain 1 to gain 2.

The setting of Pn192 is applied, the reference following performance decreases, and vibration is reduced.



Parameters Specifically Related to the Σ -V-EX-series EX002

Here, the parameters that are added to the Σ -V-EX-series EX002 and the parameters that have different default settings than those of the Σ -V Standard SERVOPACKs are given. All parameters that are not given here are the same as for the Σ -V Standard SERVOPACKs. For details, refer to *Σ -V Series User's Manual Design and Maintenance MECHATROLINK-III Communications Reference* (manual no.: SIEP S800000 64/65).

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3.1 Special Parameters

The following table lists the parameters that differentiate the EX002 from the Σ -V Series standard SERVO-PACKs.

Pn190	Selection for Less Deviation Control				Position
	Setting Range	Setting Unit	Factory Setting	When Enabled	Classification
	0000 to 1001	—	0000	Afer restart	Setup
	<div style="display: flex; align-items: center;"> <div style="margin-right: 10px;"> 4th digit n. <input type="checkbox"/> 3rd digit <input type="checkbox"/> 2nd digit <input type="checkbox"/> 1st digit <input type="checkbox"/> </div> <div> <div>Less Deviation Control Selection</div> <div>0 Do not use less deviation control. (default)</div> <div>1 Use less deviation control.</div> <div>Reserved (Do not change.)</div> <div>Reserved (Do not change.)</div> <div>Speed Feedforward/Torque Feedforward Selection</div> <div>0 Less deviation control and speed/torque feedforward are not used together. (default)</div> <div>1 Less deviation control and speed/torque feedforward are used together.</div> </div> </div>				
Pn191	Less Deviation Control Feedforward Gain				Position
	Setting Range	Setting Unit	Factory Setting	When Enabled	Classification
	0 to 10000	0.1%	1000	Immediately	Setup
This is the feedforward gain for less deviation control when gain 1 is selected. Increase this setting to improve responsiveness and reduce position error during acceleration/deceleration.					
Pn192	Less Deviation Control 2nd Feedforward Gain				Position
	Setting Range	Setting Unit	Factory Setting	When Enabled	Classification
	0 to 10000	0.1%	1000	Immediately	Setup
This is the feedforward gain for less deviation control when gain 2 is selected.					
Pn193	Feedforward Filter Time Constant				Position
	Setting Range	Setting Unit	Factory Setting	When Enabled	Classification
	0 to 65535	0.01 ms	30	Immediately	Setup
Decrease this setting to improve responsiveness and reduce position error during acceleration/deceleration. If you decrease it too far, however, vibration will occur.					
Pn308	Speed Feedback Filter Time Constant				Position
	Setting Range	Setting Unit	Factory Setting	When Enabled	Classification
	0 to 65535	0.01 ms	0	Immediately	Setup

3.2 Changed Parameters

The default settings of the parameters that have changed in comparison with the Σ -V standard SERVOPACKs are listed in the following table.

Pn10B	Mode Switch Selection			
	Settings	Meanings	When Enabled	Classification
	n.□□□0	The internal torque reference is used as the condition (level setting: Pn10C).	Immediately	Setup
	n.□□□1	The speed reference is used as a condition. (level setting: Pn10D for rotational motors and Pn181 for linear motors).		
	n.□□□2	Acceleration rate is used as a condition (level setting: Pn10E for rotational motors and Pn182 for linear motors).		
	n.□□□3	The position error is used as the condition (level setting: Pn10F).		
n.□□□4 [Factory setting]	No mode switching.			
Pn170	Tuning-less Adjustment Selection			
	Settings	Meanings	When Enabled	Classification
	n.□□□0 [Factory setting]	Disables tuning-less function.	Afer restart	Setup
	n.□□□1	Enables tuning-less function.		
Pn207	/COIN Output Timing			
	Settings	Meanings	When Enabled	Classification
	n.0□□□	Outputs /COIN when the absolute value of position error is less than or equal to the positioning completed width (Pn522).	Afer restart	Setup
	n.1□□□ [Factory setting]	Outputs /COIN when the absolute value of position error is less than or equal to the positioning completed width (Pn522) and the reference after the position reference filter is 0.		
	n.2□□□	Outputs /COIN when the absolute value of position error is less than or equal to the positioning completed width (Pn522) and the position reference input is 0.		
	■ Supplemental Information			
To accurately output the positioning completed signal when less deviation control is enabled, set Pn207.3 to n.1□□□ or n.2□□□. When less deviation control is enabled, the position reference is followed. When the speed is constant, the deviation between the reference and the actual operation is essentially 0. Therefore, if you set Pn207 to n.0□□□, the positioning completed signal would be output even during operation.				

3.3 Precaution When Copying Parameters

The digital operator can be used to copy parameters between two EX002 SERVOPACKs in the Σ -V-EX series.

If you copy parameters between a Σ -V-EX-series EX002 SERVOPACK and a different model of SERVOPACK, alarms such as A.040 (Parameter Setting Error 1) will occur because different numbers of parameters are used.

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Revision History

The revision dates and numbers of the revised manuals are given on the bottom of the back cover.

MANUAL NO. SIEP S800001 07B <1>-0

WEB revision number

Revision number

Published in Japan January 2018

Date of publication

Date of Publication	Rev. No.	Web Rev. No.	Section	Revised Content
April 2024	<5>	0	All chapters	Addition: SGMCV
			Preface, 2.5.2	Partly revised
			Back cover	Revision: Address
March 2023	<4>	0	Preface	Partly revised
			Back cover	Revision: Address
March 2022	<3>	0	Preface	Revision: EU Directives
			Back cover	Revision: Address
January 2020	<2>	0	Preface	Revision: ■ Disposal precautions
			Back cover	Revision: Address
January 2018	<1>	0	All chapters	Partly revised
			Back cover	Revision: Address
June 2013	—	—	—	First edition

AC Servo Drives Σ -V-EX Series USER'S MANUAL

Model: EX002
MECHATROLINK-III Communications Reference

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MANUAL NO. SIEP S800001 07F <5>-0

Published in Japan April 2024

23-4-19

Original instructions