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Operation Manual

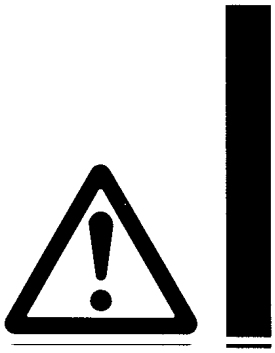
PRODUCT NAME

AC Servo Motor Driver

MODEL / Series/ Product Number

LECYM Series

SMC Corporation



LECYM2-□□ Series / Driver Safety Instructions

These safety instructions are intended to prevent hazardous situations and/or equipment damage.
These instructions indicate the level of potential hazard with the labels of “Caution,” “Warning” or “Danger.”
They are all important notes for safety and must be followed in addition to International Standards (ISO/IEC), Japan Industrial Standards (JIS)*1) and other safety regulations*2).

*1) ISO 4414: Pneumatic fluid power -- General rules relating to systems
ISO 4413: Hydraulic fluid power -- General rules relating to systems
IEC 60204-1: Safety of machinery -- Electrical equipment of machines (Part 1: General requirements)
ISO 10218-1992: Manipulating industrial robots -- Safety
JIS B 8370: General rules for pneumatic equipment.
JIS B 8361: General rules for hydraulic equipment.
JIS B 9960-1: Safety of machinery – Electrical equipment for machines. (Part 1: General requirements)
JIS B 8433-1993: Manipulating industrial robots - Safety. etc.

*2) Labor Safety and Sanitation Law, etc.

Caution	**Caution** indicates a hazard with a low level of risk which, if not avoided, could result in minor or moderate injury.
Warning	**Warning** indicates a hazard with a medium level of risk which, if not avoided, could result in death or serious injury.
Danger	**Danger** indicates a hazard with a high level of risk which, if not avoided, will result in death or serious injury.
IMPORTANT	Indicates **important** information that should be memorized, as well as precautions, such as alarm displays, that do not involve potential damage to equipment.

⚠Warning

1. The compatibility of the product is the responsibility of the person who designs the equipment or decides its specifications.
Since the product specified here is used under various operating conditions, its compatibility with specific equipment must be decided by the person who designs the equipment or decides its specifications based on necessary analysis and test results.
The expected performance and safety assurance of the equipment will be the responsibility of the person who has determined its compatibility with the product.
This person should also continuously review all specifications of the product referring to its latest catalog information, with a view to giving due consideration to any possibility of equipment failure when configuring the equipment.

2. Only personnel with appropriate training should operate machinery and equipment.
The product specified here may become unsafe if handled incorrectly.
The assembly, operation and maintenance of machines or equipment including our products must be performed by an operator who is appropriately trained and experienced.

3. Do not service or attempt to remove product and machinery/equipment until safety is confirmed.
The inspection and maintenance of machinery/equipment should only be performed after measures to prevent falling or runaway of the driven objects have been confirmed.
When the product is to be removed, confirm that the safety measures as mentioned above are implemented and the power from any appropriate source is cut, and read and understand the specific product precautions of all relevant products carefully.
Before machinery/equipment is restarted, take measures to prevent unexpected operation and malfunction.

4. Contact SMC beforehand and take special consideration of safety measures if the product is to be used in any of the following conditions.
1) Conditions and environments outside of the given specifications, or use outdoors or in a place exposed to direct sunlight.

2) Installation on equipment in conjunction with atomic energy, railways, air navigation, space, shipping, vehicles, military, medical treatment, combustion and recreation, or equipment in contact with food and beverages, emergency stop circuits, clutch and brake circuits in press applications, safety equipment or other applications unsuitable for the standard specifications described in the product catalog.
3) An application which could have negative effects on people, property, or animals requiring special safety analysis.
4) Use in an interlock circuit, which requires the provision of double interlock for possible failure by using a mechanical protective function, and periodical checks to confirm proper operation.

Note that the ⚠ CAUTION level may lead to a serious consequence according to conditions. Please follow the instructions of both levels because they are important to personnel safety.

What must not be done and what must be done are indicated by the following diagrammatic symbols.

Prohibition	Indicates what must not be done. For example, "No Fire" is indicated by
Compulsion	Indicates what must be done. For example, grounding is indicated by

In this Instruction Manual, instructions at a lower level than the above, instructions for other functions, and so on are classified into "POINT".

After reading this installation guide, always keep it accessible to the operator.

LECYU2-□□ Series / Driver
1. Safety Instructions

⚠Caution

The product is provided for use in manufacturing industries.
The product herein described is basically provided for peaceful use in manufacturing industries.
If considering using the product in other industries, consult SMC beforehand and exchange specifications or a contract if necessary.
If anything is unclear, contact your nearest sales branch.

Limited warranty and Disclaimer/Compliance Requirements

The product used is subject to the following “Limited warranty and Disclaimer” and “Compliance Requirements”.
Read and accept them before using the product.

Limited warranty and Disclaimer

The warranty period of the product is 1 year in service or 1.5 years after the product is delivered, whichever is first.*3)
Also, the product may have specified durability, running distance or replacement parts. Please consult your nearest sales branch.

For any failure or damage reported within the warranty period which is clearly our responsibility, a replacement product or necessary parts will be provided.
This limited warranty applies only to our product independently, and not to any other damage incurred due to the failure of the product.

Prior to using SMC products, please read and understand the warranty terms and disclaimers noted in the specified catalog for the particular products.

***3) Vacuum pads are excluded from this 1 year warranty.**
A vacuum pad is a consumable part, so it is warranted for a year after it is delivered.
Also, even within the warranty period, the wear of a product due to the use of the vacuum pad or failure due to the deterioration of rubber material are not covered by the limited warranty.

Compliance Requirements

When the product is exported, strictly follow the laws required by the Ministry of Economy, Trade and Industry (Foreign Exchange and Foreign Trade Control Law).

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 any electric actuators 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.
- Never touch the inside of the driver.
  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.
- 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 DRIVER 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.
- Do not remove the top front cover, cables, connectors, or optional items from the DRIVER 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 brake devices on the machine side to ensure safety. The holding lock on a electric actuators with a lock 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 DRIVER with a 100 V, 200 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.

- 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 hold the product by the cables, motor 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 30minutes 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, 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 DRIVER 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 electric actuators overrun, injury, or malfunction.
- Do not connect a commercial power supply to the U, V, or W terminals for the motor cable 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 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.
- 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 DRIVER.
  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 DRIVER main circuit terminal blocks.
  - Do not turn the DRIVER power ON until all wiring, including the main circuit terminal blocks, has been completed.
  - Remove detachable main circuit terminals from the DRIVER 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.
- Install a battery at either the host controller or the DRIVER, 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.
- 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.
- Do not reverse the polarity of the battery when connecting it.
  Failure to observe this caution may damage the battery, the DRIVER or electric actuaters, 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 electric actuators and DRIVER in one of the specified combinations.
  Failure to observe this caution may result in fire or malfunction.
- During trial operation, confirm that the holding lock 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 DRIVER for applications that require the power to turn ON and OFF frequently. Such applications will cause elements in the DRIVER 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 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 using the electric actuators 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 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 touch the DRIVER heat sinks, regenerative option, 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.
- 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.
- Do not use the holding lock of the electric actuators for braking.
  Failure to observe this caution may result in malfunction.
- An alarm or warning may occur if communications are performed with the host controller while the SigmaWin+ is operating. If an alarm or warning occurs, it may stop the current process and stop the system.

- Maintenance and Inspection

⚠Caution

- Do not disassemble the DRIVER 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 DRIVER, resume operation only after copying the previous DRIVER parameters to the new DRIVER.
  Failure to observe this caution may result in damage to the equipment.

- Disposal

⚠Caution

· When disposing of the products, treat them as ordinary industrial waste.

- General Precautions

⚠Caution

• 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.

Handling of batteries for the United Nations Recommendations on the Transport of Dangerous Goods

To transport lithium batteries, take action to comply with the instructions and regulations such as the United Nations (UN), the International Civil Aviation Organization (ICAO), and the International Maritime Organization (IMO).
The battery (LEC-JZ-CVBAT) uses an electric cell (lithium metal battery ER3).
The IATA Dangerous Goods Regulation are revised, and the requirements are changed annually.
When customers transport lithium batteries by themselves, the responsibility for the cargo lies with the customers.
Thus, be sure to check the latest version of the IATA Dangerous Goods Regulations.

Battery (Cell) : LEC-JZ-CVBAT
Lithium content : 0.31(g)

Harmonized Standards

- European Directives

CE

	Model	European Directives	Harmonized Standards
DRIVER	LECY□□-V□ (SGDV)	Machinery Directive 2006/42/EC	EN ISO13849-1: 2008 EN 954-1
		EMC Directive 2004/108/EC	EN 55011 /A2 group 1, class A EN 61000-6-2 EN 61800-3
		Low Voltage Directive 2006/95/EC	EN 50178 EN 61800-5-1
Servomotor	LE-V□-□ (SGMJV)	EMC Directive 2004/108/EC	EN 55011 /A2 group 1, class A EN 61000-6-2 EN 61800-3
		Low Voltage Directive 2006/95/EC	EN 60034-1 EN 60034-5

- Safety Standards

	Model	Safety Standards	Standards
DRIVER	LECY□□-V□ (SGDV)	Safety of Machinery	EN ISO13849-1: 2008 EN 954-1 IEC 60204-1
		Functional Safety	IEC 61508 series IEC 62061 IEC 61800-5-2
		EMC	IEC 61326-3-1

- Safe Performance

Items	Standards	Performance Level
Safety Integrity Level	IEC 61508	SIL2
	IEC 62061	SILCL2
Probability of Dangerous Failure per Hour	IEC 61508 IEC 62061	PFH $\Leftarrow 1.7\times10^{-9}$ [1/h] (0.17% of SIL2)
Category	EN 954-1	Category 3
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	DCave: Low
Stop Category	IEC 60204-1	Stop category 0
Safety Function	IEC 61800-5-2	STO
Proof test Interval	IEC 61508	10 years

Introduction

This manual describes information required for designing, testing, adjusting, and maintaining LECYM Series driver.

Keep this manual in a location where it can be accessed for reference whenever required. Manuals outlined on the following page must also be used as required by the application.

- Description of Technical Terms

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

Term	Meaning
M-II Model	MECHATROLINK-II communications reference used for driver interface
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
Servo Lock	A state in which the motor is stopped and is in position loop with a position reference of 0.
Main Circuit Cable	Cables which connect to the main circuit terminals, including main circuit power supply cables, control power supply cables, motor cables, and others.

- Notation Used in this Manual

  - Notation for Reverse Signals

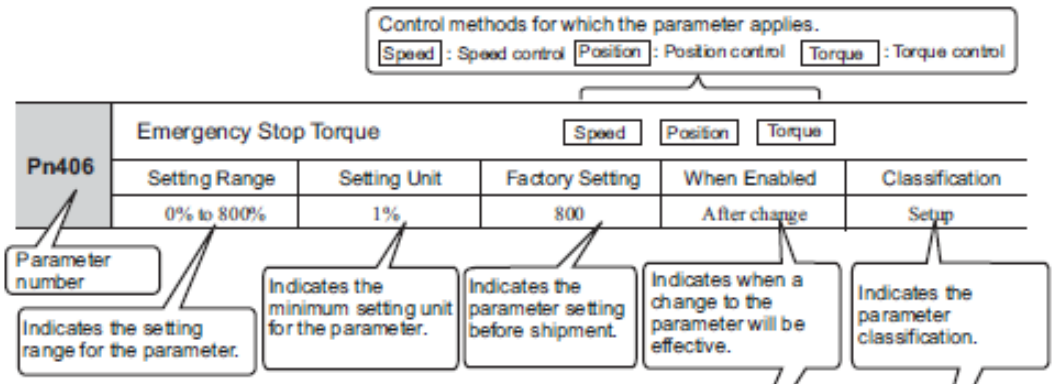
    The names of reverse signals (i.e., ones that are valid when low) are written with a forward slash (/) before the signal name.

    Notation Example
    $\overline{BK}$ = /BK

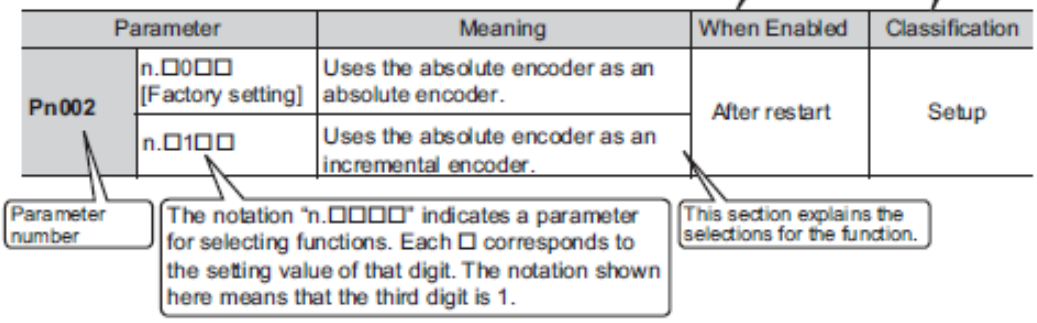
  - Notation for Parameters

    The notation depends on whether the parameter requires a value setting (parameter for numeric settings) or requires the selection of a function (parameter for selecting functions).

    - Parameters for Numeric Settings



    - Parameters for Selecting Functions



- Use the Sigma Win+

Select ΣV as an object series when you use Sigma Win+.
Refer to the table for the following type when you select the model (parameter edit at offline etc.).

Driver type		Driver select			Motor select	
		SMC		Sigma Win+	SMC	Sigma Win+
MECHATROLINKⅡ	100W	LECYM2-**	V5	SGDV-R90*11*Y572AA	V6	SGMJV-01A3A2*
	200W		V7	SGDV-1R6*11*Y572AA	V7	SGMJV-02A3A2*
	400W		V8	SGDV-2R8*11*Y572AA	V8	SGMJV-04A3A2*
MECHATROLINKⅢ	100W	LECYU2-**	V5	SGDV-R90*21*Y572AA	V6	SGMJV-01A3A2*
	200W		V7	SGDV-1R6*21*Y572AA	V7	SGMJV-02A3A2*
	400W		V8	SGDV-2R8*21*Y572AA	V8	SGMJV-04A3A2*

- Trademarks

MECHATROLINK is a trademark of the MECHATROLINK Members Association.

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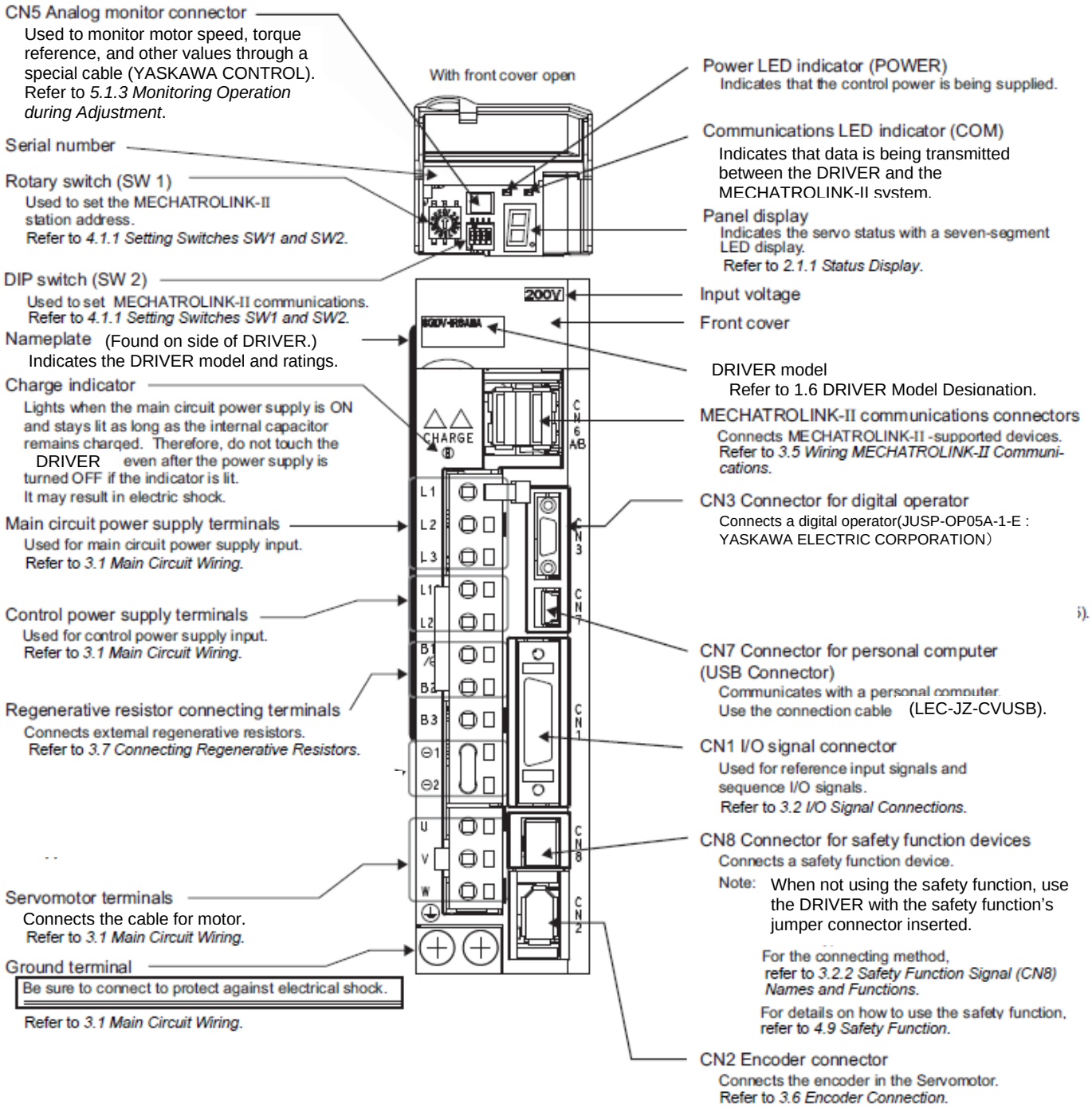
1. Outline

1.1 LECY Series DRIVERs

The LECY Series DRIVERs are designed for applications that require frequent high-speed, high-precision positioning. The DRIVER makes the most of machine performance in the shortest time possible, thus contributing to improving productivity.

1.2 Part Names

This section describes the part names of LECYM DRIVER for MECHATROLINK-II communications reference.



1.3 DRIVER Ratings and Specifications

This section describes the ratings and specifications of DRIVERs.

1.3.1 Ratings

Ratings of DRIVERs are as shown below.

LECYM (Three Phase, 200 V)	V5	V7	V8	V9
Continuous Output Current [Arms]	0.91	1.6	2.8	5.5
Instantaneous Max. Output Current [Arms]	2.9	5.8	9.3	16.9
Regenerative Resistor *1	None or external			Built-in or external
Main Circuit Power Supply *2	Three-phase, 200 to 230 VAC,–15% to +10% 50/60 Hz			
Control Power Supply	Single-phase, 200 to 230 VAC,–15% to +10% 50/60 Hz			
Overvoltage Category	III			

∗1. Refer to *3.7 Connecting Regenerative resistors* for details.

∗2. The driver will be damaged if 3-phase 400V AC is applied.

1.3.2 Basic Specifications

Basic specifications of DRIVERs are shown below.

Drive Method			Sine-wave current drive with PWM control of IGBT	
Feedback			Encoder: 20-bit (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			EN50178, EN55011/A2 group1 classA, EN61000-6-2, EN61800-3, EN61800-5-1, EN954-1, IEC61508-1 to 4	
Mounting			Base-mounted	
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*1	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*4		0 to 10 s (Can be set individually for acceleration and deceleration.)	

(cont'd)

I/O Signals	Encoder Output Pulse		Phase A, B, Z: line driver Encoder output pulse: any setting ratio (Refer to *4.4.5*.)	
	Sequence Input	Input Signals which can be allocated	Number of Channels	7 ch
			Functions	• 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) 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	• 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 (JUSP-OP05A-1-E : YASKAWA ELECTRIC CORPORATION） 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, POWER, and COM indicators	
MECHATROLINK-II Communications Setting Switches			Rotary Switch (SW1)	Position: 16 positions (Refer to *4.1.1*)
			DIP Switch (SW2)	Number of pins: Four pins (Refer to *4.1.1*)
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 *2	
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.	

(cont'd)

Utility Function		Gain adjustment, alarm history, JOG operation, origin search, and so on.
Safety Function	Input	/HWBB1, /HWBB2: Baseblock signal for power module
	Output	EDM1: Monitoring status of internal safety circuit (fixed output)
	Standards *3	EN954 Category 3, IEC61508 SIL2

∗1. Speed regulation by load regulation is defined as follows:

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

∗2. Refer to *1.3.1 Ratings* for details on regenerative resistors.
∗3. Perform risk assessment for the system and be sure that the safety requirements are fulfilled.
∗4. Refer to *8.13.10 Velocity Control (VEL CTRL: 3CH)* for details on the soft start function.

1.3.3 MECHATROLINK-II Function Specifications

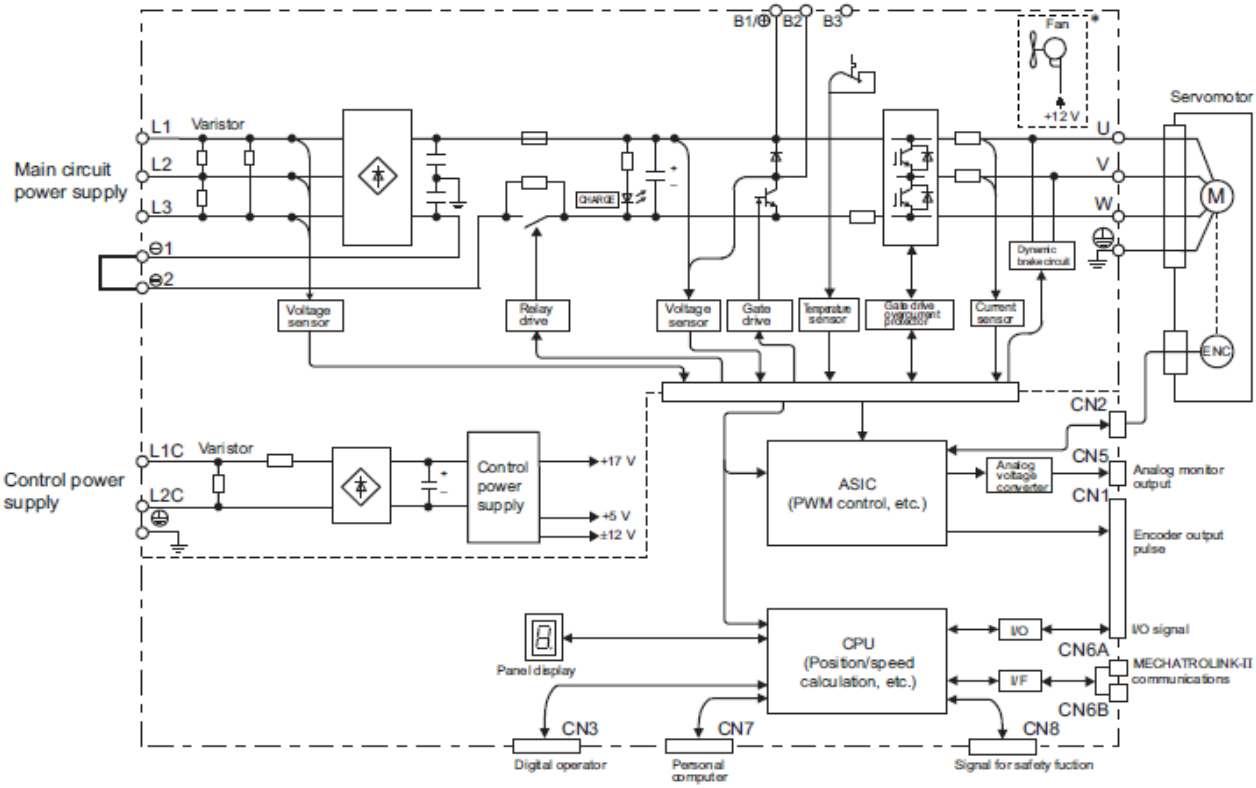
The following table shows the specifications of MECHATROLINK-II.

Function		Specifications
MECHATROLINK-II Communication	Communication Protocol	MECHATROLINK-II
	Station Address	41H to 5FH (Max. number of stations: 30) Can be selected by the combination of the rotary switch (SW1) and the DIP switch (SW2).
	Baud Rate	10 Mpbs, 4 Mpbs Can be selected by the DIP switch (SW2).
	Transmission Cycle	250 μs, 0.5 ms to 4.0 ms (Multiples of 0.5 ms) Can be selected by the DIP switch (SW2).
	Number of Transmission Bytes	17 bytes per station or 32 bytes per station Can be selected by the DIP switch (SW2).
Reference Method	Control Method	Position, speed, or torque control with MECHATROLINK-II communication
	Reference Input	MECHATROLINK-I, MECHATROLINK-II commands (sequence, motion, data setting/reference, monitoring, or adjustment)

1.4 DRIVER Internal Block Diagrams

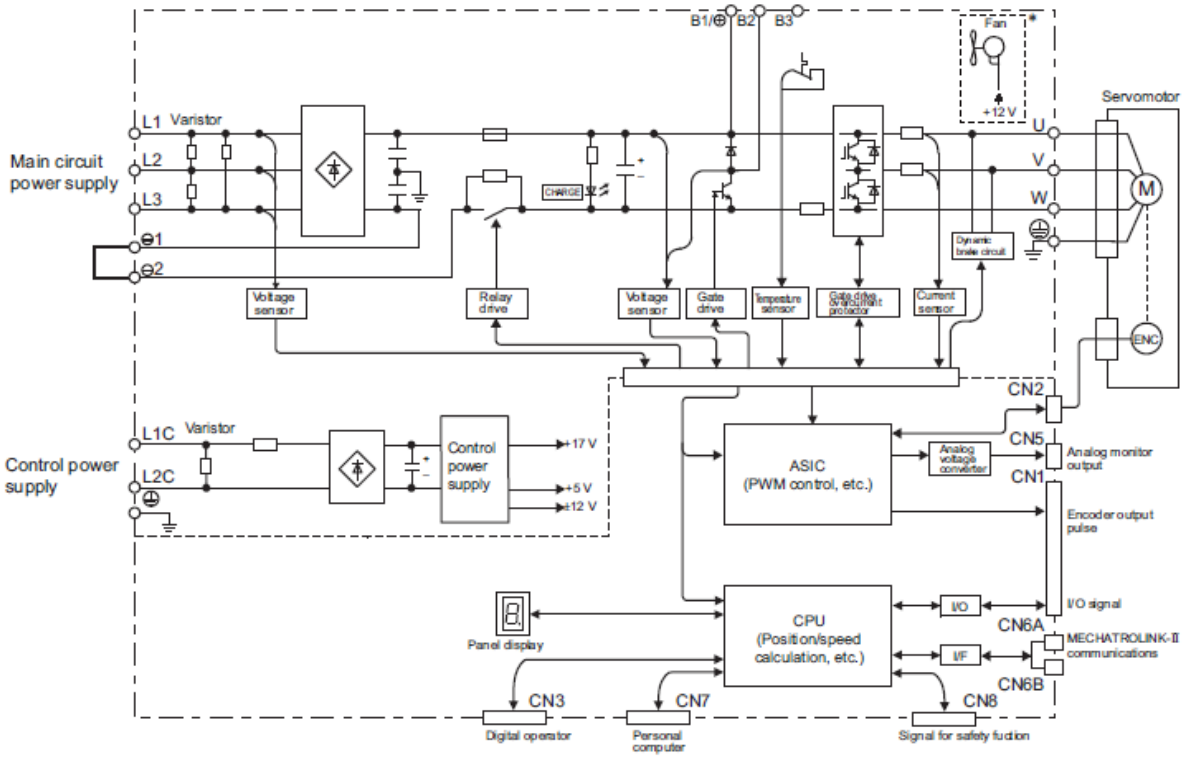
1.4.1 Three-phase 200 V, LECYM2-V5, LECYM2-V7 Models

Caution: The driver will be damaged if 3-phase 400V AC is applied.



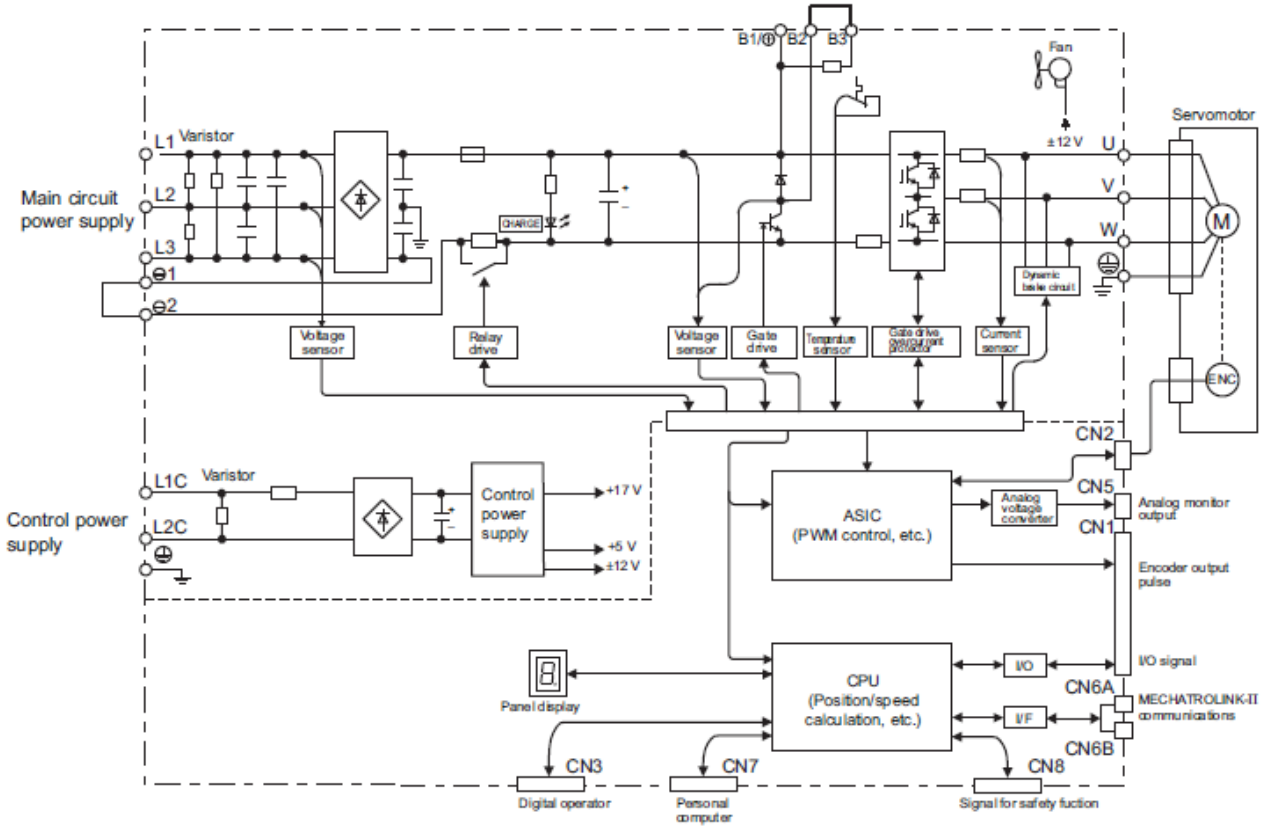
1.4.2 Three-phase 200 V, LECYM2-V8 Model

Caution: The driver will be damaged if 3-phase 400V AC is applied.



1.4.3 Three-phase 200 V, LECYM2-V9 Models

Caution: The driver will be damaged if 3-phase 400V AC is applied.



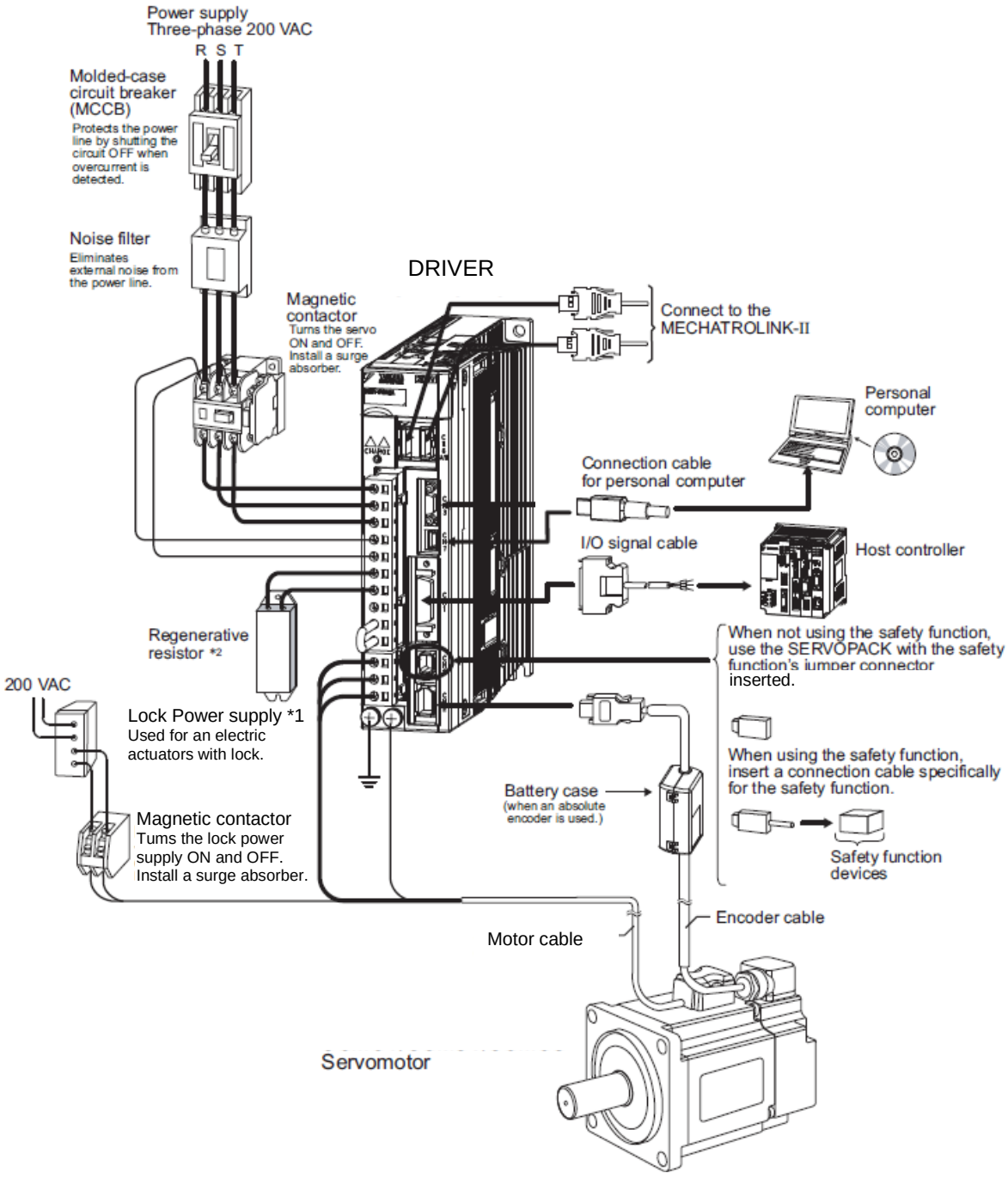
1.5 Examples of Servo System Configurations

This section describes examples of basic servo system configuration.

1.5.1 Connecting to LECYM2-V□ DRIVER

(1) Using a Three-phase, 200-V Power Supply

Caution: The driver will be damaged if 3-phase 400V AC is applied.

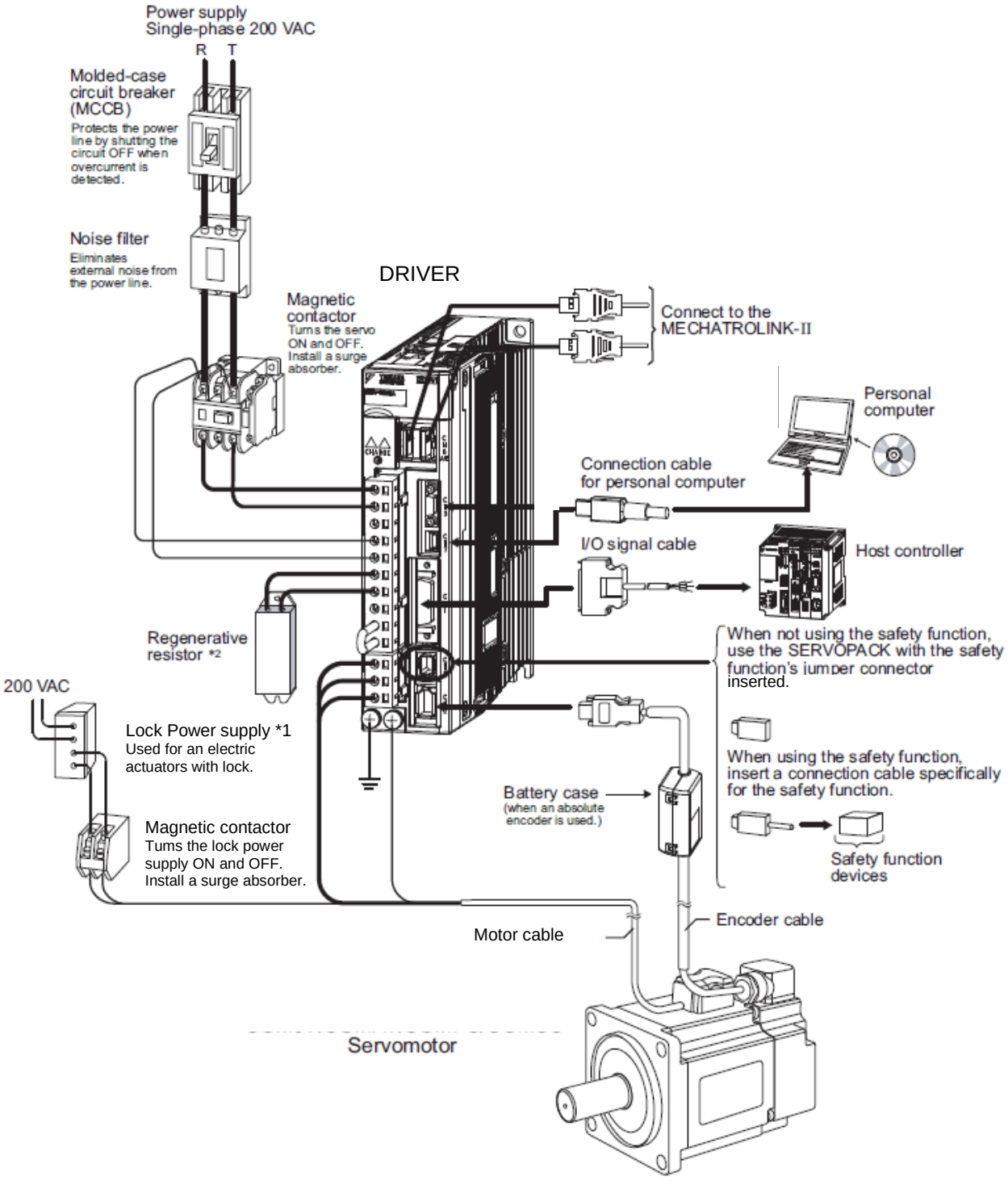


∗1. Use a 24-VDC power supply. (Not included.)

∗2. Before connecting a regenerative option to the DRIVER, refer to *3.7 Connecting Regenerative Resistors*.

(2) Using a Single-phase, 200-V Power Supply

The LECY Series 200 V DRIVER generally specifies a three-phase power input but this models can be used with a single-phase 200 V power supply. Refer to *3.1.3 Using the DRIVER with Single-phase, 200 V Power Input* for details.

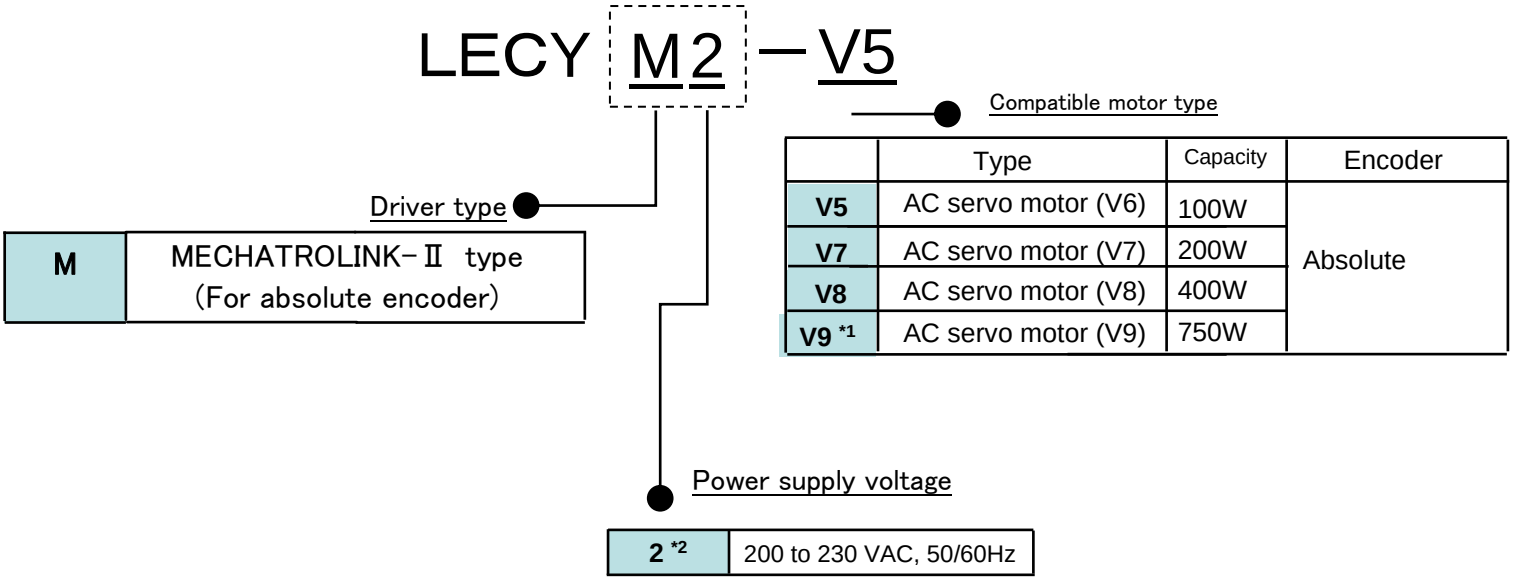


∗1. Use a 24-VDC power supply. (Not included.)

∗2. Before connecting a regenerative option to the DRIVER, refer to *3.7 Connecting Regenerative Resistors*.

1.6 DRIVER Model Designation

This section shows DRIVER model designation.



	Type	Capacity	Encoder
V5	AC servo motor (V6)	100W	Absolute
V7	AC servo motor (V7)	200W	
V8	AC servo motor (V8)	400W	
V9 *1	AC servo motor (V9)	750W	

*1. The lineup is done the standard item.

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

*If the I/O connector is required, please order product code "LE-CYNA". (The I/O connector is not included)

*If the I/O cable is required, please order product code "LEC-CSNA-1". (The I/O cable is not included)

1.7 Inspection and Maintenance

This section describes the inspection and maintenance of DRIVER.

(1) DRIVER Inspection

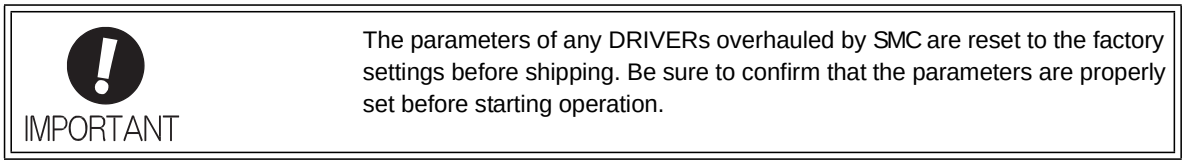
For inspection and maintenance of the DRIVER, follow the inspection procedures in the following table at least once every year. Other routine inspections are not required.

Item	Frequency	Procedure	Comments
Exterior	At least once a year	Check for dust, dirt, and oil on the surfaces.	Clean with compressed air.
Loose Screws		Check for loose terminal block and connector screws.	Tighten any loose screws.

(2) DRIVER's Parts Replacement Schedule

The following electric or electronic parts are subject to mechanical wear or deterioration over time. To avoid failure, replace these parts at the frequency indicated.

Refer to the standard replacement period in the following table and contact your Yaskawa representative. After an examination of the part in question, we will determine whether the parts should be replaced or not.



Part	Standard Replacement Period	Operating Conditions
Cooling Fan	4 to 5 years	• Surrounding Air Temperature: Annual average of 30°C • Load Factor: 80% max. • Operation Rate: 20 hours/day max.
Smoothing Capacitor	7 to 8 years	
Other Aluminum Electrolytic Capacitor	5 years	
Relays	–	
Fuses	10 years	
Battery	3 years*	

* It is a standard value in the state of no energizing (state not to turn on power to the driver).
The lifetime changes by condition and environment.

1.8 Installation Environment and Applicable Standards

1.8.1 DRIVER 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 DRIVER from exceeding 55°C, take into account the size of the control panel, the layout of the DRIVER, and the cooling method. For details, refer to 1.9 DRIVER Installation.

• Mounting Near a Heating Unit

To prevent the temperature around the DRIVER 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 DRIVER, install a vibration isolator underneath the DRIVER.

• Mounting to a Location Exposed to Corrosive Gas

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

• Other Locations

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

<Note>
When storing the DRIVER 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)

1.8.2 Installation Conditions for Applicable Standards

Applicable Standards	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	Low Voltage Directive: Satisfy the conditions outlined in *1.8.3 Conditions Corresponding to Low Voltage Directive* of this manual. EMC Directive: Certification is required after installation in the user's machine under the conditions outlined in *3.8.3 EMC Installation Conditions* of this manual.

1.8.3 Conditions Corresponding to Low Voltage Directive

To adapt DRIVERs to the Low Voltage Directive, make sure that the following environmental conditions are met.

- Installation category: III
- Pollution degree: 2
- Protection class: 10
- Altitude: 1000 m max.

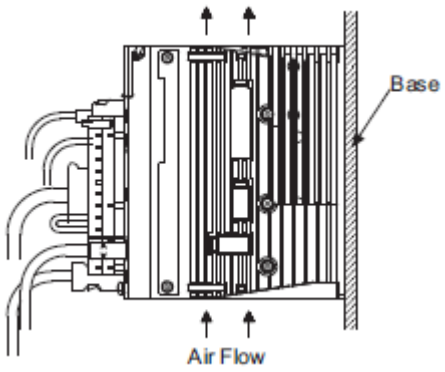
Be sure to install a fuse for the main circuit power-supply as well as meeting these environmental conditions. To choose the fuse capacity, refer to *3.1.2 Using a Standard Power Supply (Three-phase 200 V)*.

1.9 DRIVER Installation

1.9.1 Orientation

Mount the DRIVER with a vertical orientation.

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



1.9.2 Installation Standards

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

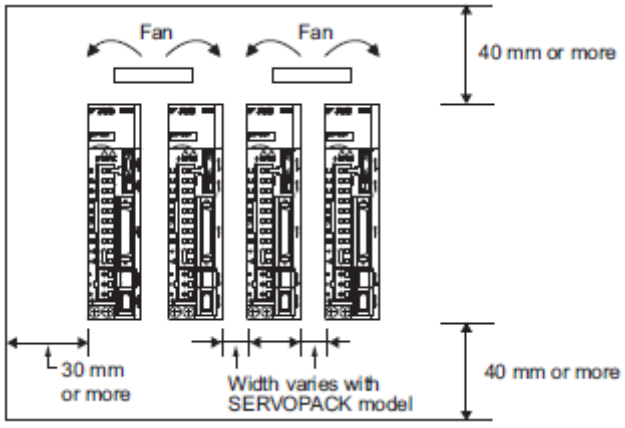
• DRIVER Mounting Orientation

Mount the DRIVER 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 DRIVERs Side by Side in a Control Panel



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

DRIVER Model LECY□2-	Side		Top and bottom
	Left	Right	
V5, V7, V8	1 mm or more		40 mm or more
V9	1 mm or more	10 mm or more	

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

• Inside the Control Panel

The conditions inside the control panel should be the same as the environmental conditions of the DRIVER. Refer to *1.8.1 DRIVER Installation Environment*.

The DRIVERs have an Installation Environment monitor. With this monitor, operation conditions in the nstallation environment can be observed and measured.

The value shown on this monitor should be equal to or less than 100% for optimum operating conditions. If this value is over 100%, one of the following measures must be taken to ensure safe operation and a long product life.

• Improve air circulation around DRIVERs.

Minimum Air Circulation Rate

Top (10 mm): 0.5 m/s

Bottom (10 mm): 0.2 m/s

To improve the air circulation to meet these minimum standards and to lower the percentage shown on the monitor, widen the space between the DRIVERs or lower the temperature of the surrounding air.

<Note>

For every increase of 10°C, the percentage shown on the monitor will also increase by approximately ten.

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2.1.2 Alarm and Warning Display 2
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2. Panel Display and SigmaWin+™

2.1 Panel Display

The servo status can be checked on the panel display of the DRIVER. Also, if an alarm or warning occurs, its alarm or warning number is displayed.

2.1.1 Status Display

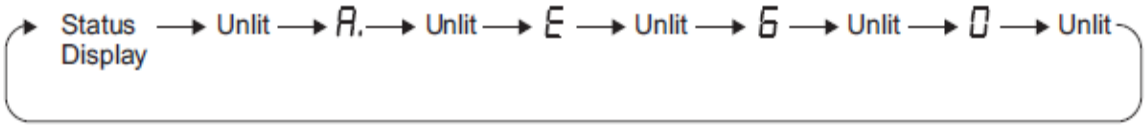
The display shows the following status.

Display	Meaning
	Rotation Detection (/TGON) Lights if motor speed exceeds the value set in Pn502. (Factory setting: 20 min^{-1})
	Baseblock Lights for baseblock (Servomotor power OFF).
	Reference Input Lights when a reference is being input.
	CONNECT Lights during connection.

2.1.2 Alarm and Warning Display

If an alarm or warning occurs, the display will change in the following order.

Example: Alarm A.E60



"6" of the figure, "b" of the alphabet, and "d" are displayed as follows.

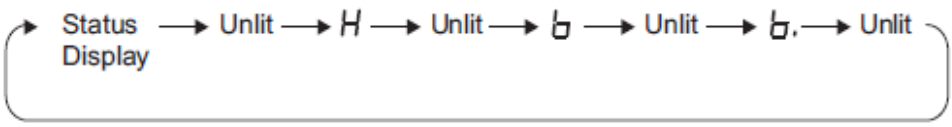
6→

b→

d→

2.1.3 Hard Wire Base Block Display

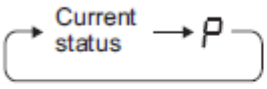
If a hard wire base block (HWBB) occurs, the display will change in the following order.



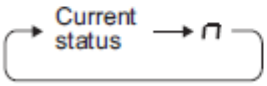
2.1.4 Overtravel Display

If overtravelling occurs, the display will change in the following order.

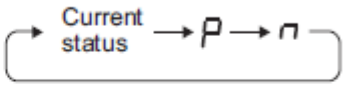
① Overtravel at forward rotation (P-OT)



② Overtravel at reverse rotation (N-OT)



③ Overtravel at forward/reverse rotation



2.2 SigmaWin+ ™

SigmaWin+ is a setup software for setup and optimum DRIVER tuning of LECY series.
Please download the install program from our home page.

SigmaWin+™ is the registered trademarks of YASKAWA ELECTRIC Corporation.

2.2.1 Compatible Devices

- LECYM series
- LECYU series

2.2.2 Hardware requirements

When using setup software (SigmaWin+™), use a DOS/V PC/AT compatible PC that meets the following operating conditions.

Equipment		Description
PC *1 *2 *3 *4	OS	・Windows® XP *5 ・Windows® Vista ・Windows® 7 (32 bit/ 64 bit)
	Hard Disk	350 MB or more of free space (When the software is installed, 400MB or more is empty recommended.)
	Communication interface	Use USB port
Display		XVGA monitor (1024×768 or more, “The small font is used.”) 256 color or more (65536 color or more is recommended) Connectable with the above personal computer.
Keyboard		Connectable with the above personal computer.
Mouse		Connectable with the above personal computer.
Printer		Connectable with the above personal computer.
USB cable		LEC-JZ-CVUSB *6
Other		Adobe Reader Ver.5.0 or more (∗Ver.6.0 is excluded.)

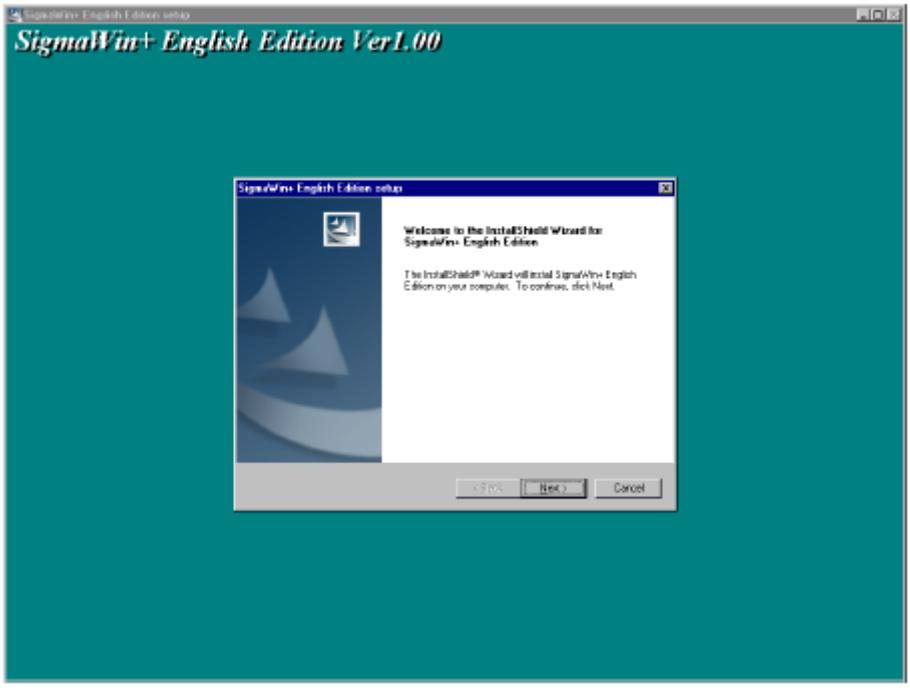
*1. Windows, Windows Vista and Windows 7 are the registered trademarks of Microsoft Corporation in the United States and other countries.
*2. On some personal computers, SigmaWin+ may not run properly.
*3. 64-bit Windows® XP and 64-bit Windows® Vista are not supported.
*4. Use Windows® XP: Please use it by the administrator authority (When installing and using it.).
*5. In PC that uses the program to correct the problem of HotfixQ328310, it is likely to fail in the installation. In that case, please use the program to correct the problem of HotfixQ329623.
*6. Order USB cable separately.

2.2.3 Installing SigmaWin+™ Program

To install SigmaWin+, run the setup file for SigmaWin+. And the installation process will begin. In this process, SigmaWin+ and the related files will be installed, or stored on the hard disk.
Operating conflicts may arise with the other programs during installation. Be sure to close all other programs before installing SigmaWin+.
Install the program using the following procedure.

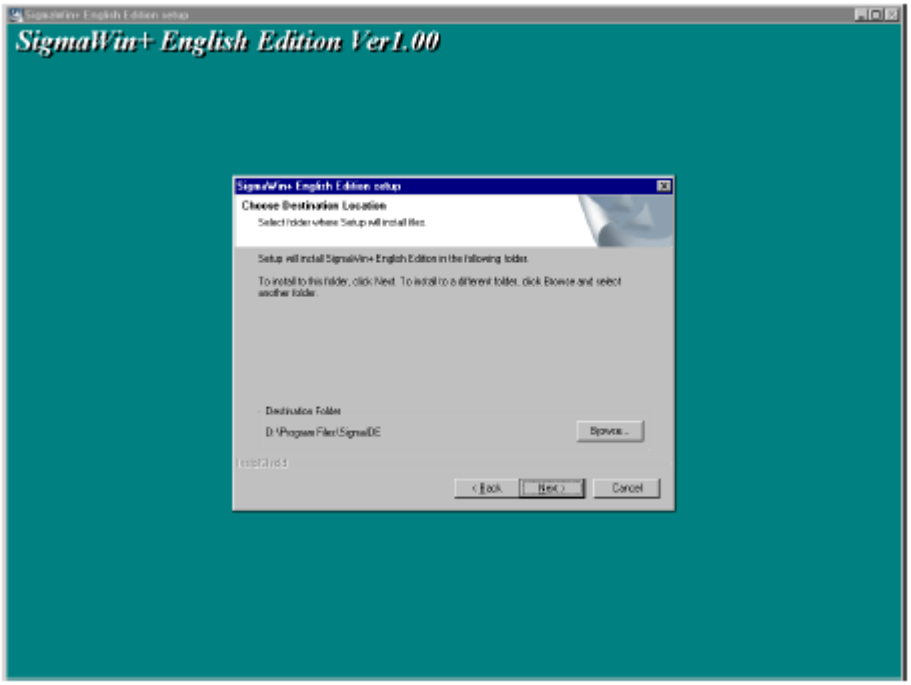
1. Please download the install program from our home page.

2. "SETUP.EXE" of the file is double-clicked.

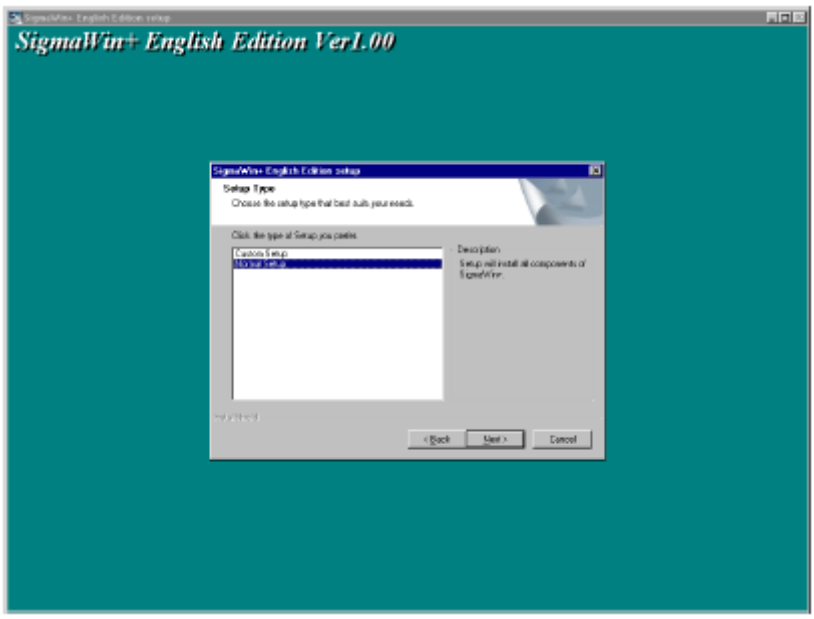


A message will appear, welcoming you to the SigmaWin+ program.

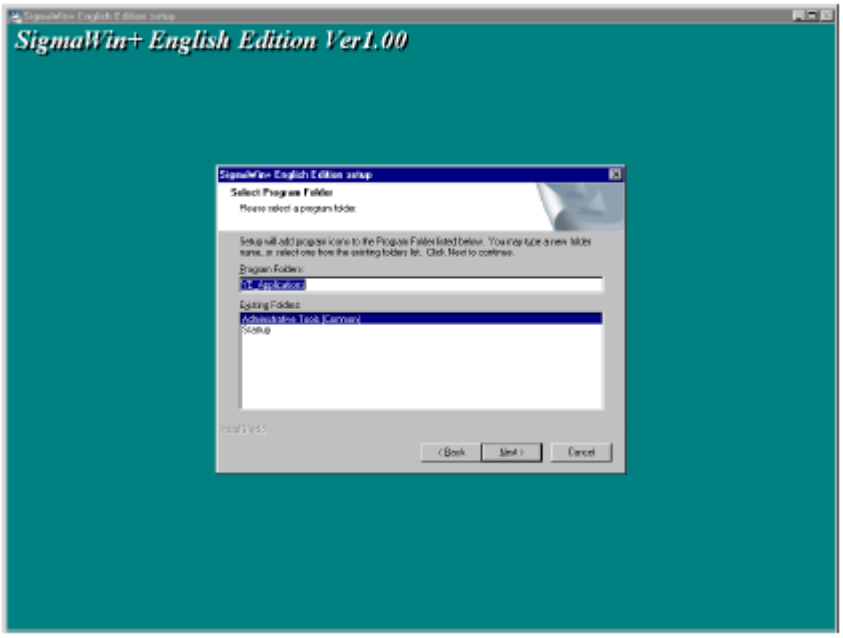
3. Click Next to continue.s



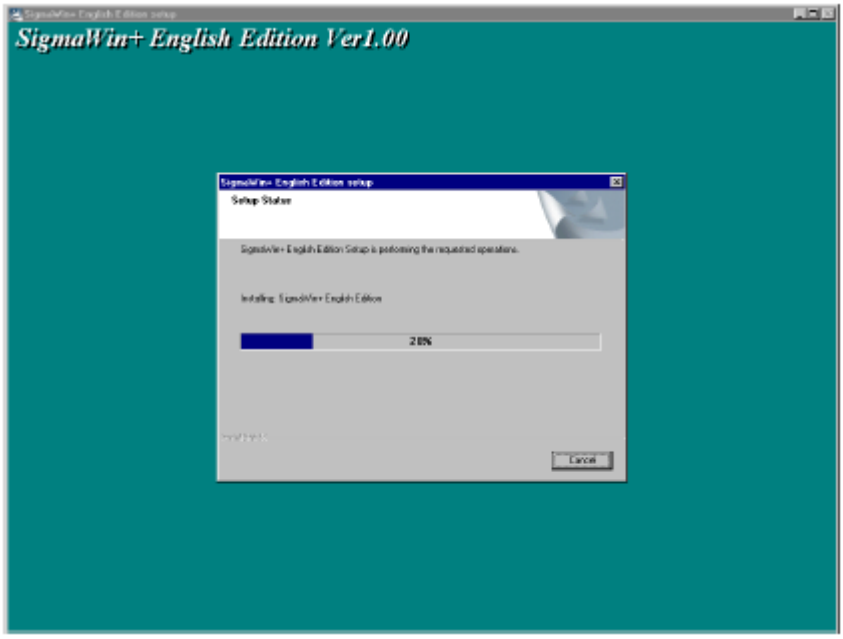
4. Follow the onscreen instructions to choose a destination folder to copy the SigmaWin+ file to, and click Next to continue.



5. Select the setup type. Choose "Normal Setup" and click **Next**.



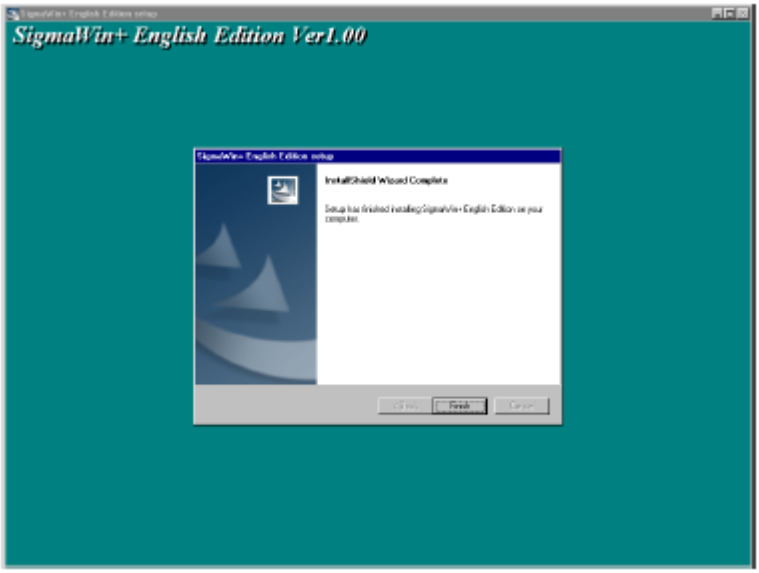
6. Select the program group to create the SigmaWin+ icon. "YE_Applications" is the default setting. After selecting the program group or folder, click **Next** to continue.



Then the PC files are copied. The percentage of the copying that has been completed is shown.

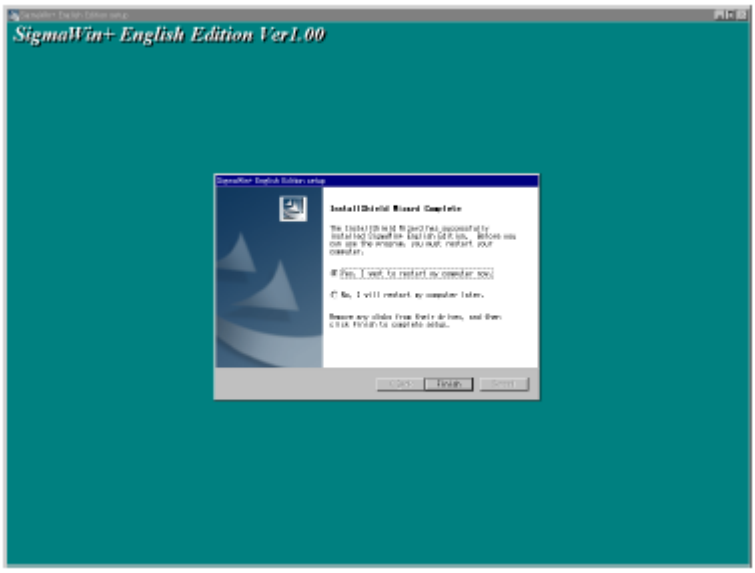
Note: If new versions of the PC support files are needed to install SigmaWin+, a window will appear asking whether to overwrite the current version or to cancel the installation. SigmaWin+ may not run correctly if the new versions of the support files are not installed.

If SigmaWin+ has been successfully installed, one of two dialog boxes is displayed.



(a)

If dialog box (a) is displayed, click **Finish** to complete the setup.



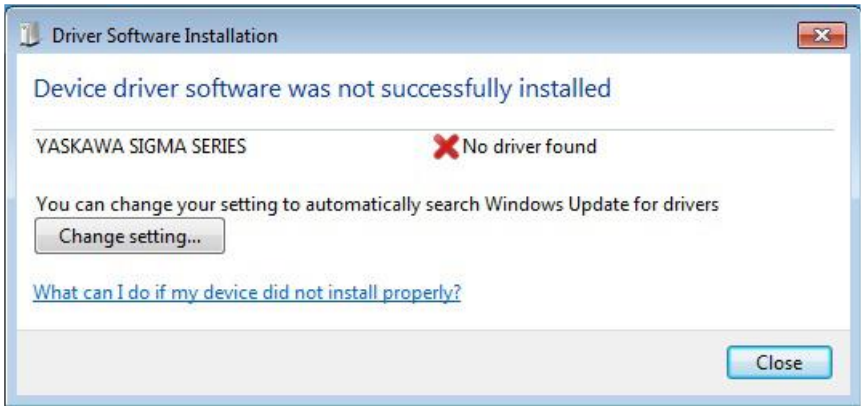
(b)

7. If dialog box (b) is displayed, select **Yes** when asked if you want to restart the computer and then click **Finish** to complete the setup.

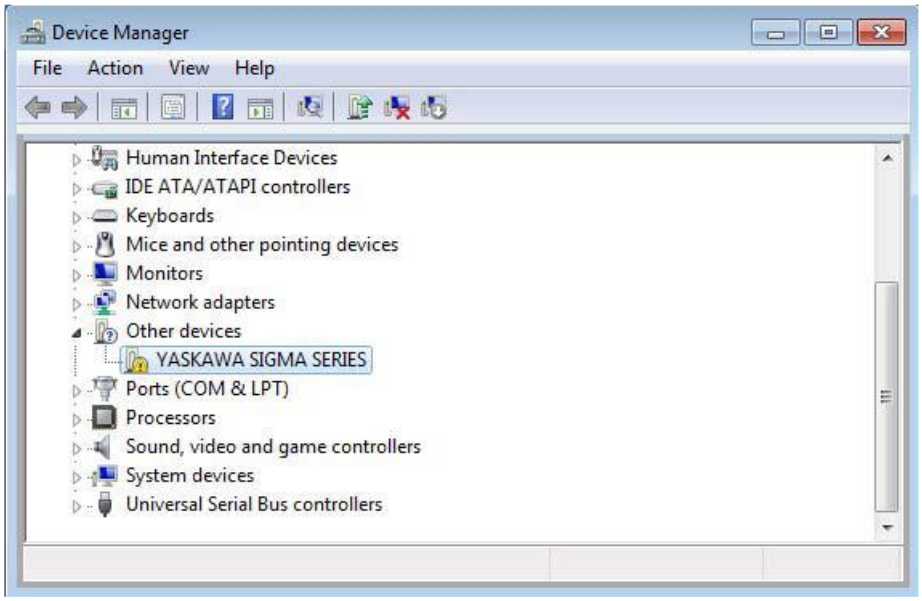
The LECY* USB driver cannot be installed by using the SigmaWin+ installer.
When a SigmaWin+ equipped PC is connected to the LECY* through a USB connection, use the following procedure to install the USB driver.
The installation method will vary depending on the operating system (hereinafter referred to as OS). Use the correct procedure for your OS.
The installation procedure is explained assuming that the SigmaWin+ installed folder directory is "C:¥Program Files¥SigmaIDE" and that the CD-ROM drive is D drive. Use the folder directory and drive according to the settings of your PC.

- For Windows 7/Vista

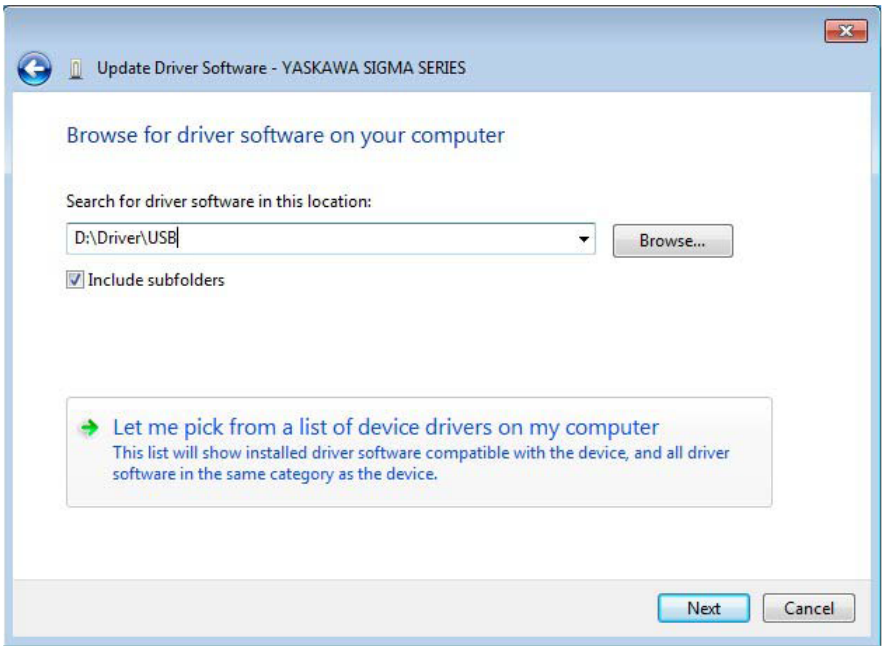
1. Turn on the power to the PC to start Windows 7 or Vista.
2. Confirm that SigmaWin+ has been installed. If it has not yet been installed, please install.
3. Connect the LECY* to the PC using a USB cable, and then turn on the power to the LECY*. The following message will appear.



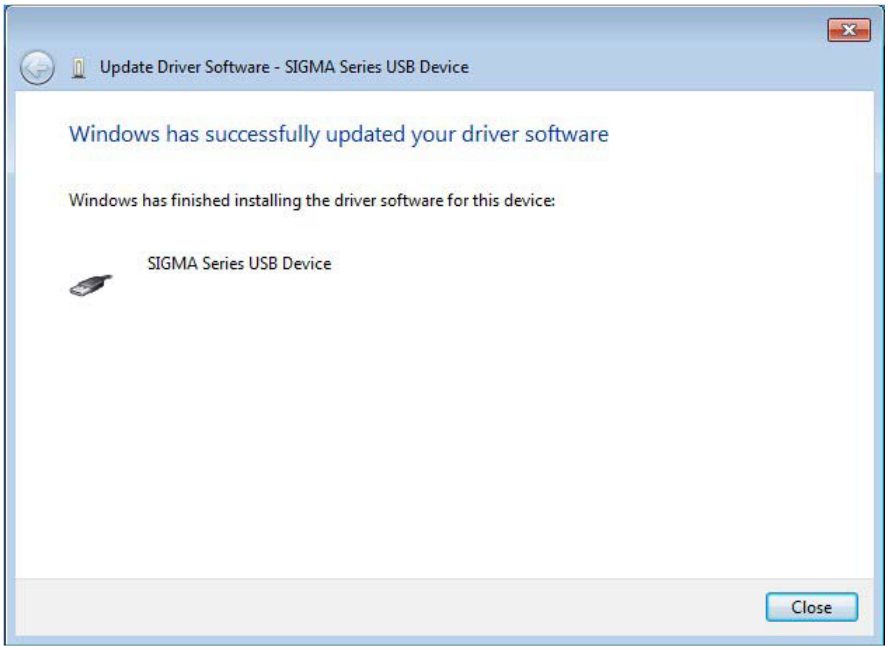
4. Click **Close**.
5. On the **Start** menu, right-click **Computer** and select **Properties**. The property window will appear.
6. Select **Device Manager**. The following window will appear.



7. Right-click YASKAWA SIGMA SERIES and select Update Drive Software...
8. Select Browse my computer for driver software. The following window will appear.



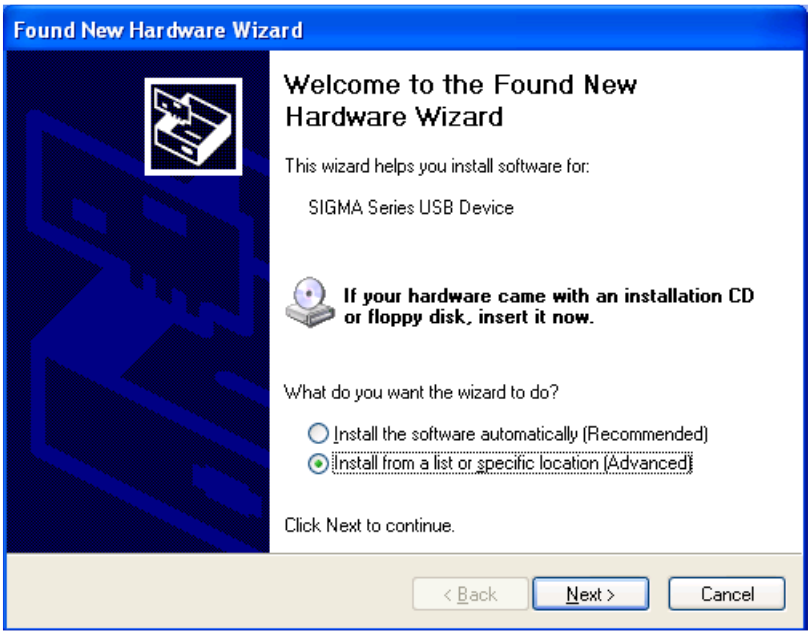
9. Select the **Include subfolders** check box. Click **Browse** to select the folder.
   < For Windows 7 (32 bit) or Windows Vista >
   "C:¥Program Files¥SigmaIDE¥SigmaWinPlus¥Driver¥USB"
   < For Windows 7 (64 bit) >
   "C:¥Program Files (x86)¥SigmaIDE¥SigmaWinPlus¥Driver¥USB¥x64"
10. Click **Next**.
    Installation starts by copying the necessary files. Wait until a message appears informing you that the installation is finished.
    < If a Security Error Message is Displayed >
    Select **Install this driver software anyway**.



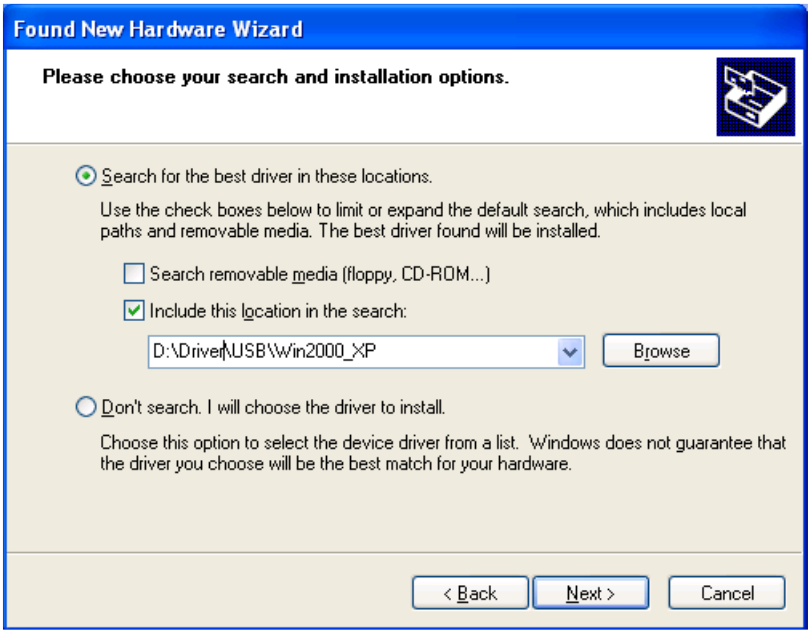
11. When the installation is finished, click **Close**. This completes the driver installation.

- For Windows XP

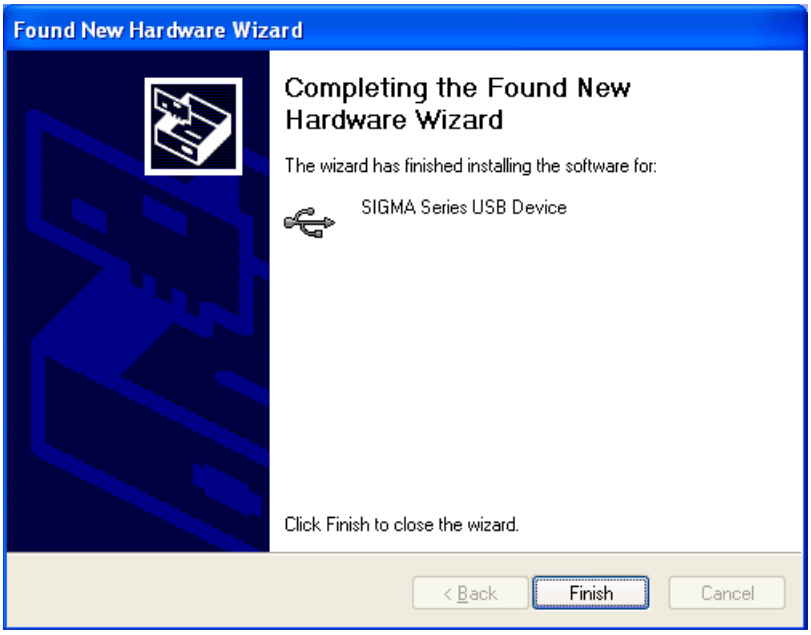
1. Turn on the power to the PC to start Windows XP.
2. Confirm that SigmaWin+ has been installed. If it has not yet been installed, please install.
3. Connect the LECY* to the PC using a USB cable, and then turn on the power to the LECY*. The Found New Hardware Wizard will appear.



4. Confirm that the Install from a list or specified location [Advanced] option is selected, and then click Next. The next Wizard will appear.



5. Select the **Search for the best driver in these locations.** option and then select the **Include this location in the search:** check box. Click **Browse** to select the folder "C:¥Program Files¥SigmaIDE¥SigmaWinPlus¥Driver¥USB".
6. Click **Next**. The Wizard starts installation by copying the necessary files. Wait until a message appears informing you that the installation is finished.

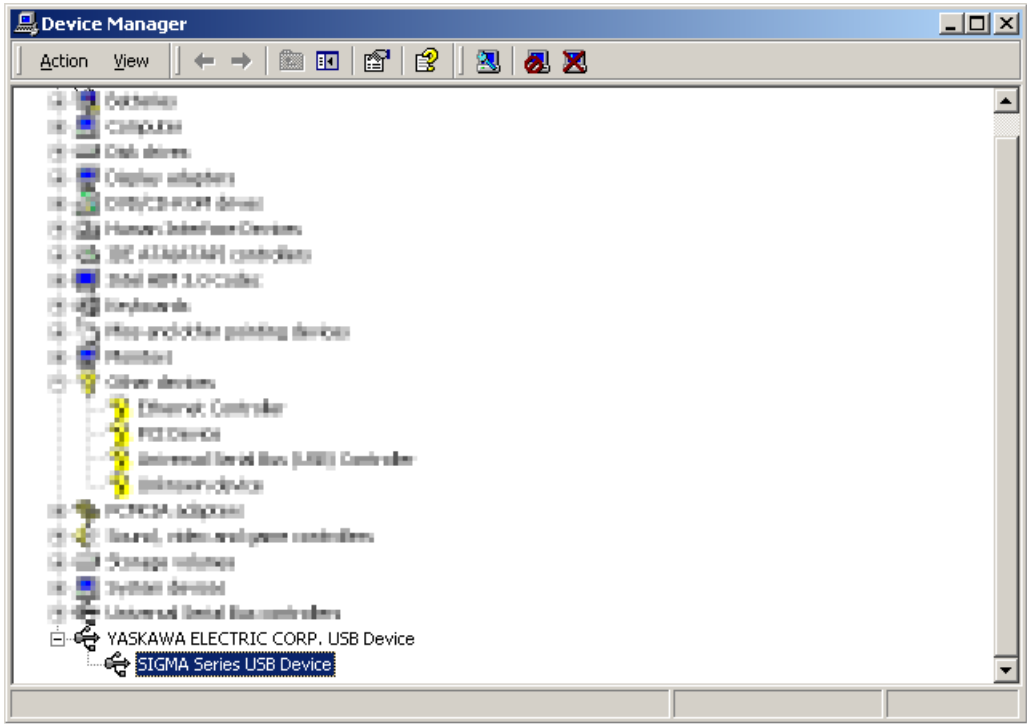


7. When the installation is finished, click **Finish**. This completes the driver installation.

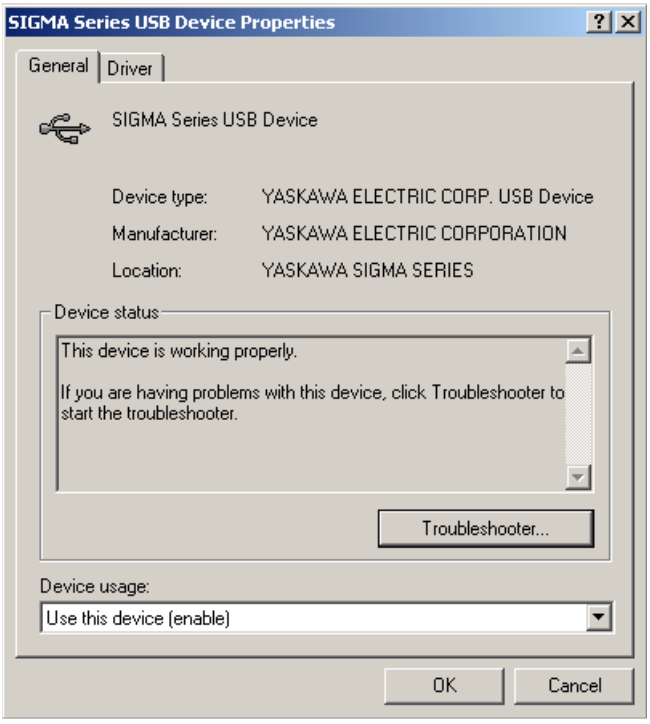
- Confirming the Installation Status

Use the following procedure to make sure that the system recognizes the LECY* as a USB device and that the USB driver is installed correctly.

1. Click the **Start** button, point to **Settings,** and click **Control Panel**.
2. Double-click the **System** icon. The System Properties window will appear.
3. Click the **Hardware** tab and then click **Device Manager.** The Device Manager window will appear.



4. Double-click SIGMA Series USB Device in the YASKAWA ELECTRIC CORP. USB Device folder. The SIGMA Series USB Device Properties window will appear.



5. Make sure "This device is working properly." is displayed in the **Device status** field.
   When "This device is working properly." is displayed, the LECY* is ready to be used through a USB connection. If it is not displayed, reinstall the USB driver.

2.2.4 Starting SigmaWin+ ™

(1) Start SigmaWin+

Start SigmaWin+:

- from the Start menu
- from a shortcut

- From the Start Menu

To start SigmaWin+ from the Start menu:

1. Click the Start button, and point to Programs.
2. Open the YE_Applications folder.
3. Click SigmaWin+.

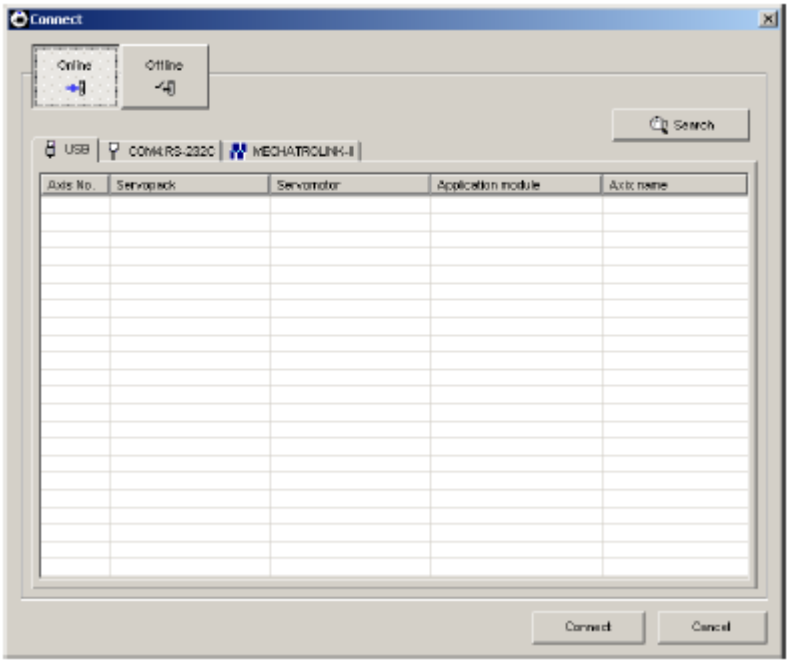
- From a Shortcut

To start SigmaWin+ from a shortcut on the desktop:

1. Open the YE_Applications folder on the desktop.
2. Click SigmaWin+.

(2) Selecting a DRIVER

When SigmaWin+ is in initially started, the Connect dialog box appears. Enter the settings for communications between SigmaWin+ and the DRIVER by means of a communication port.

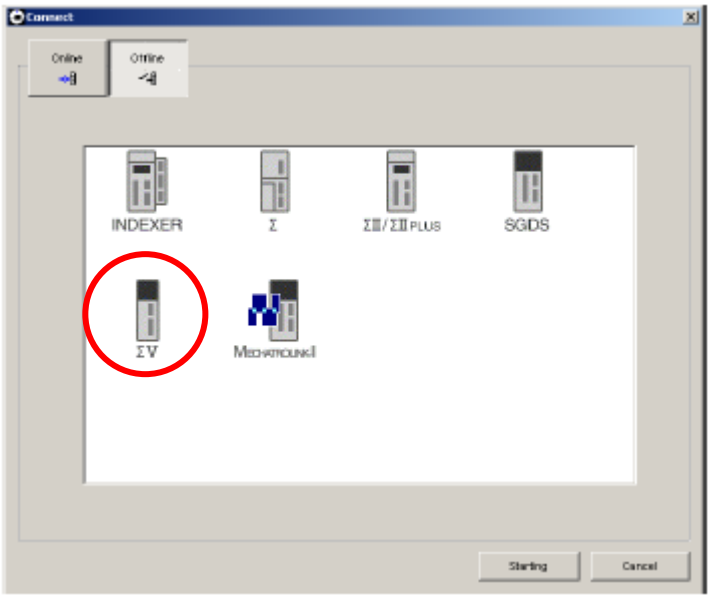


Select the method to set up the DRIVER: online or offline. Online is the default setting.

Online: Select when setting up or tuning the servo drive with the DRIVER connected

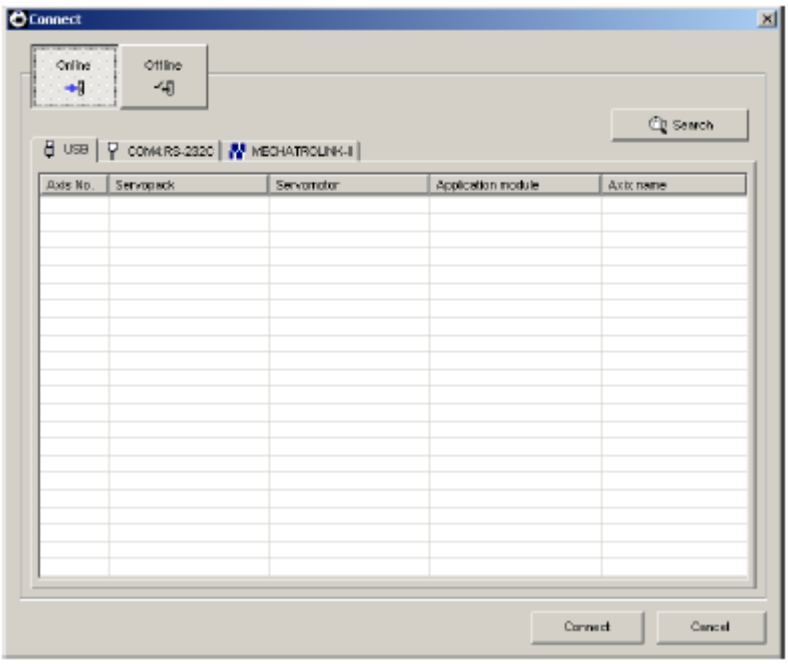
Offline: Select when editing parameters or checking screens for tracing or mechanical analysis without the DRIVER connected

<When Offline is selected>



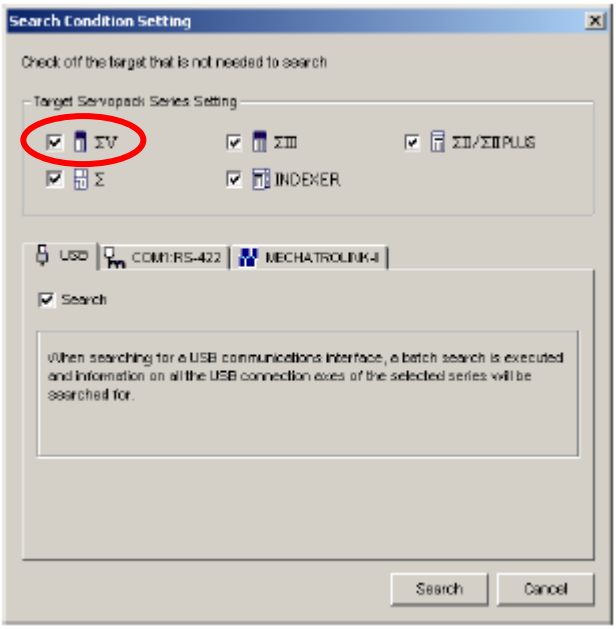
Select the ΣV and click Starting. The SigmaWin+ main window will appear.

<When Online is selected>

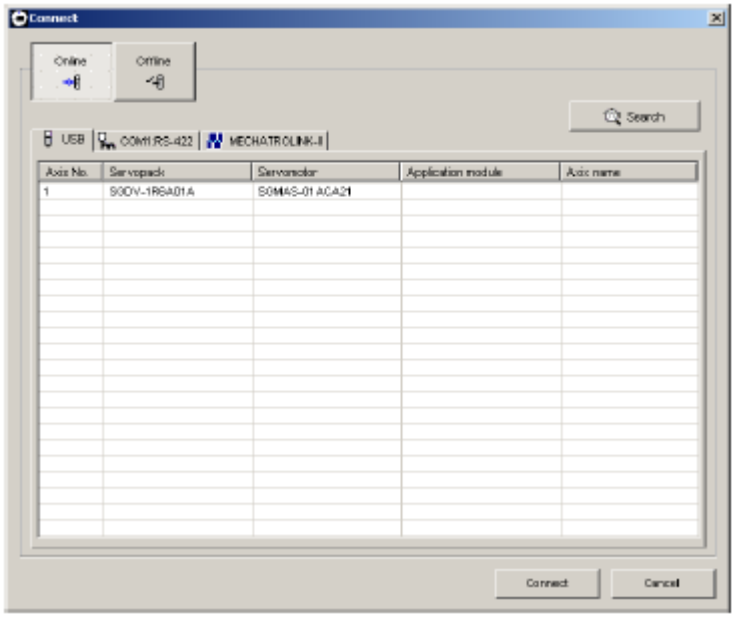


Enter the necessary settings for communication setup.

(1) Click Search.



(2) Click ΣV. Then Click Search.
After the DRIVERs have been successfully connected to SigmaWin+, a list of the connected DRIVERs will appear on the screen.



DRIVER Selection Box

(3) Select the DRIVER to be connected and then click Connect, or just doubleclick the DRIVER to be connected. The SigmaWin+ main window will appear.
Click Cancel to close the dialog box.

Operation examples of utility functions, parameters and monitor displays when using a SigmaWin+ are described in this chapter.

For more information on the usage of the SigmaWin+, refer to AC Servo Drives Engineering Tool Sigma Win+ ONLINE MANUAL Σ-V Component.

2.3 Utility Functions

The utility functions are related to the setup and adjustment of the DRIVER.
Refer to *6 utility functions* for details.

2.4 Parameters

This section describes the classifications, methods of notation, and settings for parameters given in this manual.

2.4.1 Parameter Classification

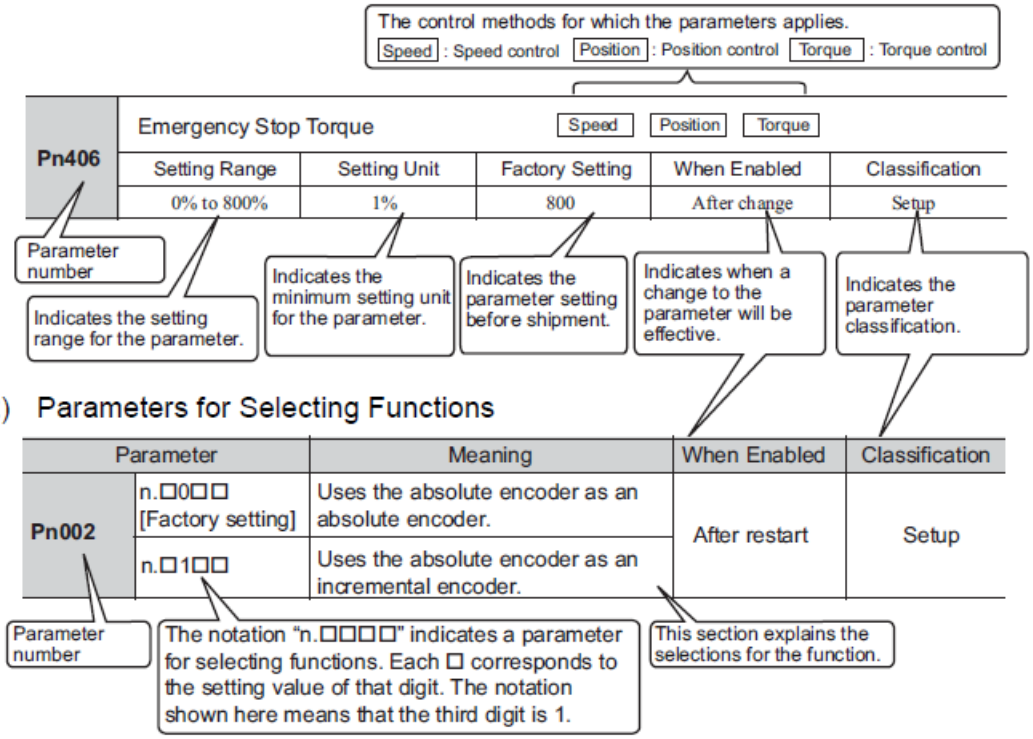
Parameters of the LECY Series DRIVER are classified into two types of parameters. One type of parameters is required for setting up the basic conditions for operation and the other type is required for tuning parameters that are required to adjust servomotor characteristics.

Classification	Meaning	Display Method	Setting Method
Setup Parameters	Parameters required for setup.	Always displayed (Factory setting: Pn00B.0 = 0)	Set each parameter individually.
Tuning Parameters	Parameters for tuning control gain and other parameters.	Set Pn00B.0 to 1.	There is no need to set each parameter individually.

There are two types of notation used for parameters, one for parameter that requires a value setting (parameter for numeric settings) and one for parameter that requires the selection of a function (parameter for selecting functions).
The notation and settings for both types of parameters are described next.

2.4.2 Notation for Parameters

(1) Parameters for Numeric Settings



(2) Parameters for Selecting Functions

2.4.3 Setting Parameters

In the SigmaWin+ Σ-V component main window, click **Parameters** and then click **Edit Parameters**. The Parameter Editing window for the online mode appears.
For more information on the usage of the setting parameters, refer to AC Servo Drives Engineering Tool Sigma Win+ ONLINE MANUAL Σ-V Component.

2.5 Monitor Displays

The monitor displays can be used for monitoring the reference values, I/O signal status, and DRIVER internal status.
The System Monitor window will automatically open when the SigmaWin+ starts. Or, in the SigmaWin+ Σ-V component window, click **Monitor**, point to **Monitor**, and then click **System Monitor**.
For more information on the usage of the monitor display, refer to AC Servo Drives Engineering Tool Sigma Win+ ONLINE MANUAL Σ-V Component.

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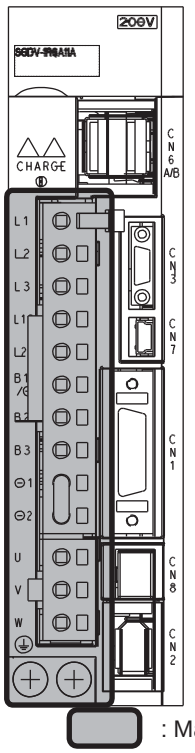
3. Wiring and Connection

3.1 Main Circuit Wiring

The names and specifications of the main circuit terminals are given below.
Also this section describes the general precautions for wiring and precautions under special environments.

3.1.1 Main Circuit Terminals



: Main circuit terminals

Terminal Symbols	Name	Specification
L1, L2, L3	Main circuit power input terminals	Three-phase 200 to 230 V, +10% to -15% (50/60 Hz)
L1C, L2C	Control power input terminals	Single-phase 200 to 230 V, +10% to -15% (50/60 Hz)
B1/⊕, B2*1	Regenerative resistor connection terminals	If the internal regenerative resistor is insufficient, connect a regenerative resistor between B1/⊕ and B2. If LECYM2-V9 is used, remove the lead or shorting bar between B2 and B3, and connect a regenerative resistor between B1/⊕ and B2. Note: The Regenerative resistor is not included.
⊖1, ⊖2	DC reactor connection terminal for power supply harmonic suppression	connection terminals are short-circuited when the DRIVER is shipped from the factory: ⊖1 and ⊖2.
B1/	Main circuit positive terminal	Use when DC power supply input is used.
⊖2 or⊖	Main circuit negative terminal	
U, V, W	Servomotor connection terminals	Use for connecting to the servomotor.
⏚	Ground terminals (× 2)	Use for connecting the power supply ground terminal and servomotor ground terminal.

∗1. Do not short-circuit between B1/⊕ and B2. It may damage the DRIVER.

3.1.2 Using a Standard Power Supply (Three-phase 200 V)

(1) Wire Types

Use the following type of wire for main circuit.

Cable Type		Allowable Conductor Temperature ˚C
Symbol	Name	
IV	600 V grade polyvinyl chloride insulated wire	60
HIV	600 V grade heat-resistant polyvinyl chloride insulated wire	75

The following table shows the wire sizes and allowable currents for three wires. Use wires with specifications equal to or less than those shown in the table.

- 600 V grade heat-resistant polyvinyl chloride insulated wire (HIV)

AWG Size	Nominal Cross Section Area [mm^2]	Configuration [Number of Wires/mm^2]	Conductive Resistance [Ω/km]	Allowable Current at Surrounding Air Temperature [A]		
				30˚C	40˚C	50˚C
20	0.5	19/0.18	39.5	6.6	5.6	4.5
19	0.75	30/0.18	26.0	8.8	7.0	5.5
18	0.9	37/0.18	24.4	9.0	7.7	6.0
16	1.25	50/0.18	15.6	12.0	11.0	8.5
14	2.0	7/0.6	9.53	23	20	16

Note: The values in the table are for reference only.

(2) Main Circuit Wires

This section describes the main circuit wires for DRIVERs.

IMPORTANT

- The specified wire sizes are for use when the three lead cables are bundled and when the rated electric current is applied with a surrounding air temperature of 40°C.
- Use a wire with a minimum withstand voltage of 600 V for the main circuit.
- If cables are bundled in PVC or metal ducts, take into account the reduction of the allowable current.
- Use a heat-resistant wire under high surrounding air or panel temperatures, where polyvinyl chloride insulated wires will rapidly deteriorate.

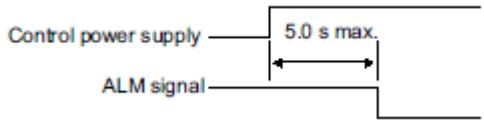
- Three-phase, 200 V

Terminal Symbols	Name	LECYM2-□□			
		V5	V7	V8	V9
L1, L2, L3	Main circuit power input terminals	HIV1.25		HIV2.0	
L1C, L2C	Control power input terminals	HIV1.25			
U, V, W	Servomotor connection terminals	HIV1.25		HIV2.0	
B1/⊕, B2	Regenerative option connection terminals	HIV1.25			
⏚	Ground terminal	HIV2.0 or larger			

(3) Typical Main Circuit Wiring Examples

Note the following points when designing the power ON sequence.

- Design the power ON sequence so that main power is turned OFF when a servo alarm signal (ALM) is output.
- The ALM signal is output for a maximum of five seconds when the control power is turned ON. Take this into consideration when designing the power ON sequence. Design the sequence so the ALM signal is activated and the alarm detection relay (1Ry) is turned OFF to stop the main circuit's power supply to the DRIVER.



- Select the power supply specifications for the parts in accordance with the input power supply.

IMPORTANT

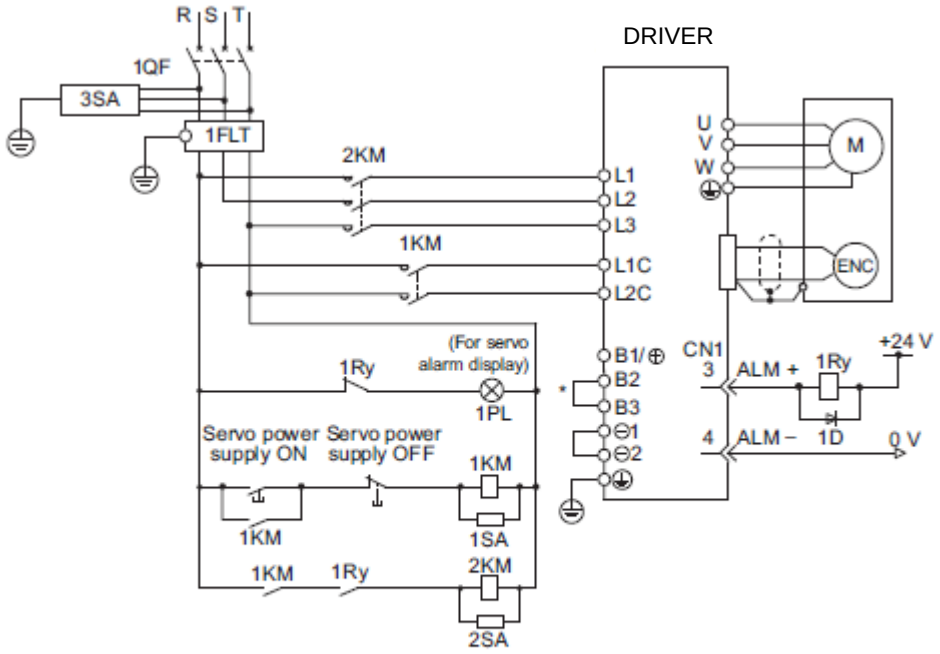
- When turning ON the control power supply and the main circuit power supply, turn them ON at the same time or turn the main circuit power supply after the control power supply. When turning OFF the power supplies, first turn the power for the main circuit OFF and then turn OFF the control power supply.

The typical main circuit wiring examples are shown below.

⚠ WARNING

- Do not touch the power supply terminals after turning OFF the power. High voltage may still remain in the DRIVER, resulting in electric shock. When the voltage is discharged, the charge indicator will turn OFF. Make sure the charge indicator is OFF before starting wiring or inspections.

- Three-phase 200 V, LECYM2-V□



∗ For the LECYM2-V5, V7, V8, terminals B2 and B3 are not short-circuited.

Do not short-circuit these terminals.

(4) Power Supply Capacities and Power Losses

The following table shows the DRIVER's power supply capacities and power losses.

Main Circuit Power Supply	Maximum Applicable Servomotor Capacity [kW]	DRIVER Model LECYM2-□□	Power Supply Capacity per DRIVER [kVA]	Output Current [Arms]	Main Circuit Power Loss [W]	Regenerative Resistor Power Loss [W]	Control Circuit Power Loss [W]	Total Power Loss [W]
Three-phase, 200 V	0.1	V5	0.3	0.91	7.3	-	17	24.3
	0.2	V7	0.6	1.6	13.5			30.5
	0.4	V8	1	2.8	24.0			41.0
	0.75	V9	1.6	5.5	43.8	8		68.8

Note 1. LECYM2-V5, V7, and V8 do not have built-in regenerative resistors. Connect an external Regenerative resistor if the regenerative energy exceeds the specified value.

2. Regenerative resistor power losses are the allowable losses. Take the following actions if this value is exceeded.
   • Remove the lead or shorting bar between terminals B2 and B3 on the DRIVER main circuit for LECYM2-V9.
   • Install an external Regenerative resistor. Refer to *3.7 Connecting Regenerative Resistors* for details.

3. Both the regenerative resistor unit and the external Regenerative resistor are not included.

(5) How to Select Molded-case Circuit Breaker and Fuse Capacities

The following table shows the DRIVER's current capacities and inrush current. Select a molded-case circuit breaker and fuses in accordance with these specifications.

Main Circuit Power Supply	Maximum Applicable Servomotor Capacity [kW]	DRIVER Model LECYM2 -□□	Power Supply Capacity per DRIVER [kVA]	Current Capacity		Inrush Current	
				Main Circuit [Arms]	Control Circuit [Arms]	Main Circuit [A0-p]	Control Circuit [A0-p]
Three-phase, 200 V	0.1	V5	0.3	1.0	0.2	33	70
	0.2	V7	0.6	2.0			
	0.4	V8	1	3.0			
	0.75	V9	1.6	6.0			33

Note 1. To comply with the EU low voltage directive, connect a fuse to the input side as protection against accidents caused by short-circuits.
Select fuses or molded-case circuit breakers that are compliant with UL standards.
The table above also provides the net values of current capacity and inrush current. Select a fuse and a molded-case circuit breaker which meet the breaking characteristics shown below.
- Main circuit, control circuit: No breaking at three times the current values shown in the table for 5 s.
- Inrush current: No breaking at the current values shown in the table for 20 ms.

3.1.3 Using the DRIVER with Single-phase, 200 V Power Input

LECYM2 series three-phase 200 V power input DRIVER can be used also with a single-phase 200 V power supply.

When using the DRIVER with single-phase, 200 V power input, set parameter Pn00B.2 to 1.

(1) Parameter Setting

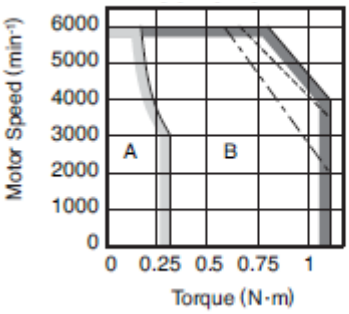
- Single-phase Power Input Selection

Parameter		Meaning	When Enabled	Classification
Pn00B	n.□0□□ [Factory setting]	Enables use of three-phase power supply for three-phase DRIVER.	After restart	Setup
	n.□1□□	Enables use of single-phase power supply for three-phase DRIVER.		

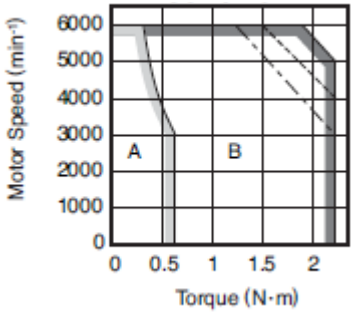
⚠ WARNING

- If single-phase 200 V is input to a DRIVER with a single-phase power input without changing the setting of Pn00B.2 to 1 (single-phase power input), a main circuit cable open phase alarm (A.F10) will be detected.
- When using a single-phase 200 V power supply, the DRIVER may not be able to produce the same servomotor torque-speed characteristics as using a three- phase 200 V power input. Refer to the diagram of each servomotor torque-speed characteristics.

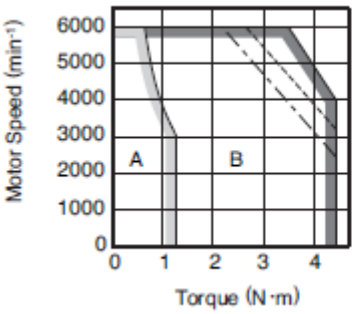
LECYM2-V5



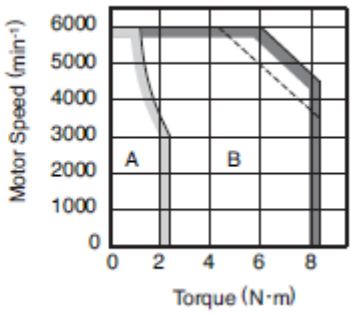
LECYM2-V7



LECYM2-V8



LECYM2-V9



(2) Main Circuit Power Input Terminals

Connect a single-phase 200 V power supply of the following specifications to L1 and L2 terminals.

The specifications of the power supplies other than the main circuit power supply are the same as for three- phase power supply input.

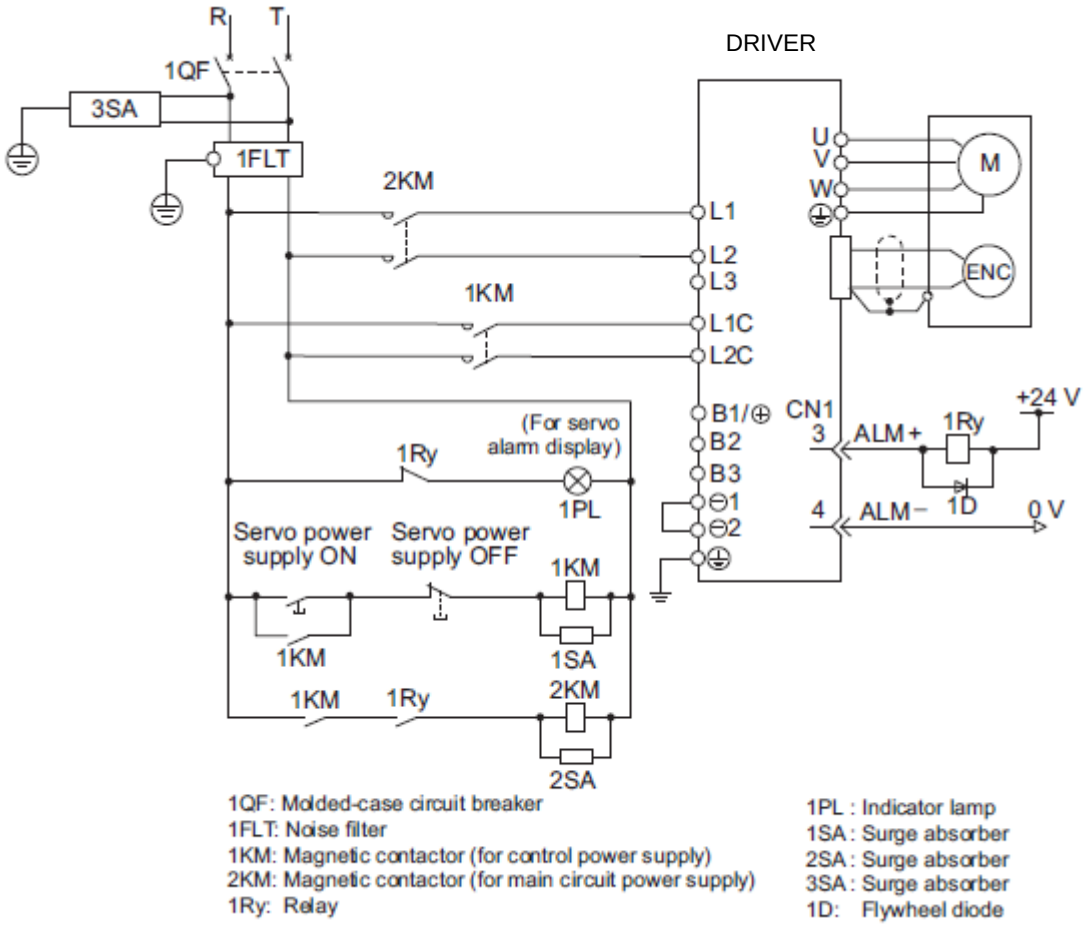
Terminal Symbols	Name	Specifications
L1, L2	Main circuit power input terminals	Single-phase 200 V to 230 V, +10% to -15% (50/60 Hz)
L3*1	–	None

*1. Do not use L3 terminal.

(3) Main Circuit Wire for DRIVERs

Terminal Symbols	Name	Model LECYM2-□□ (Unit: mm^2)			
		V5	V7	V8	V9
L1, L2	Main circuit power input terminals	HIV1.25		HIV2.0	
L1C, L2C	Control power input terminals	HIV1.25			
U, V, W	Servomotor connection terminals	HIV1.25			HIV2.0
B1/⊕, B2	External Regenerative resistor connection terminals	HIV1.25			
⏚	Ground terminal	HIV2.0 or larger			

(4) Wiring Example with Single-phase 200-V Power Supply Input
- DRIVER with Single-phase, 200-V Power Supply



(5) Power Supply Capacities and Power Losses

The following table shows DRIVER's power supply capacities and power losses when using single- phase 200 V power supply.

Main Circuit Power Supply	Maximum Applicable Servomotor Capacity [kW]	DRIVER Model LECYM2-□□	Power Supply Capacity per DRIVER [kVA]	Output Current [Arms]	Main Circuit Power Loss [W]	Regenerative Resistor Power Loss [W]	Control Circuit Power Loss [W]	Total Power Loss [W]
Single-phase, 200 V	0.1	V5	0.3	0.91	7.4	-	17	24.4
	0.2	V7	0.7	1.6	13.7			30.7
	0.4	V8	1.2	2.8	24.9			41.9
	0.75	V9	1.9	5.5	52.7	8		77.7

Note 1. LECYM2-V5, V7, and V8 DRIVERs do not have built-in regenerative resistors. If the regenerative energy exceeds the specified value, connect an external Regenerative resistor between B1/⊕ and B2.
2. Regenerative resistor power losses are allowable losses. Take the following action if this value is exceeded.
- Remove the lead or shorting bar between terminals B2 and B3 on the DRIVER main circuit of LECYM2-V9 DRIVER.
- Install an external Regenerative resistor between external Regenerative resistor connection terminals B1/⊕ and B2.

(6) How to Select Molded-case Circuit Breaker and Fuse Capacities

The following table shows the DRIVER's current capacities and inrush current when using single-phase 200 V power supply. Select a molded-case circuit breaker and fuses in accordance with these specifications.

Main Circuit Power Supply	Maximum Applicable Servomotor Capacity [kW]	DRIVER Model LECYM2-□□	Power Supply Capacity per DRIVER [kVA]	Current Capacity		Inrush Current	
				Main Circuit [Arms]	Control Circuit [Arms]	Main Circuit [A0-p]	Control Circuit [A0-p]
Single-phase, 200 V	0.1	V5	0.3	2	0.2	33	70
	0.2	V7	0.7	3			
	0.4	V8	1.2	5			
	0.75	V9	1.9	9			33

Note 1. To comply with the EU low voltage directive, connect a fuse to the input side as protection against accidents caused by short-circuits. Select the fuse for the input side that are compliant with UL standards.
The table above also provides the net values of current capacity and inrush current. Select a fuse and a molded- case circuit breaker which meet the breaking characteristics shown below.
•Main circuit, control circuit: No breaking at three times the current values shown in the table for 5 s.
•Inrush current: No breaking at the current values shown in the table for 20 ms.

3.1.4 Using the DRIVER with a DC Power Input

(1) Parameter Setting

When using a DC power supply, make sure to set the parameter Pn001.2 to 1 (DC power input supported) before inputting DC power.

Parameter		Meaning	When Enabled	Classification
Pn001	n.□0□□	Enables use of AC power input.	After restart	Setup
	n.□1□□	Enables use of DC power input.		

Observe the following precautions.

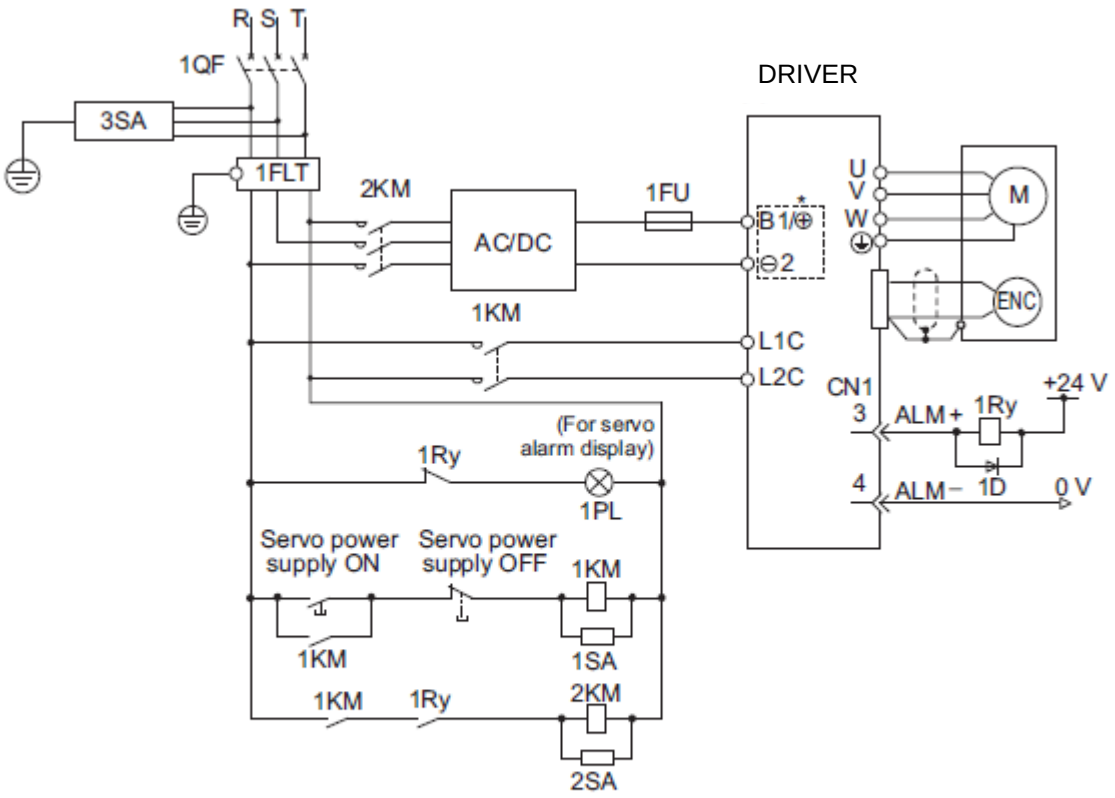
⚠ WARNING

- Either AC or DC power can be input to the 200-V DRIVERs. Always set Pn001.2 to 1 to specify a DC power input before inputting DC power. If DC power is input without changing the parameter setting, the DRIVER's internal elements will burn and may cause fire or damage to the equipment.
- With a DC power input, time is required to discharge electricity after the main power supply is turned OFF. A high residual voltage may remain in the DRIVER after the power supply is turned OFF. Be careful not to get an electric shock.
- Install fuses on the wires if DC power is used.
- Servomotor returns a regenerated energy to the power supply. The DRIVER that can use a DC power supply is not capable of processing the regenerated energy. Provide measures to process the regenerated energy on the power supply.
- With a DC power input, connect an external inrush current limit circuit.
  Failure to observe this caution may result in damage to the equipment.

(2) DC Power Supply Input Terminals for the Main and Control Circuits

Terminal Symbols	Name	Specifications
B1/⊕	Main circuit positive terminal	270 to 320 VDC
⊖2	Main circuit negative terminal	0 VDC
L1C, L2C	Control power input terminal	200 to 230 VAC

(3) Wiring Example with DC Power Supply Input



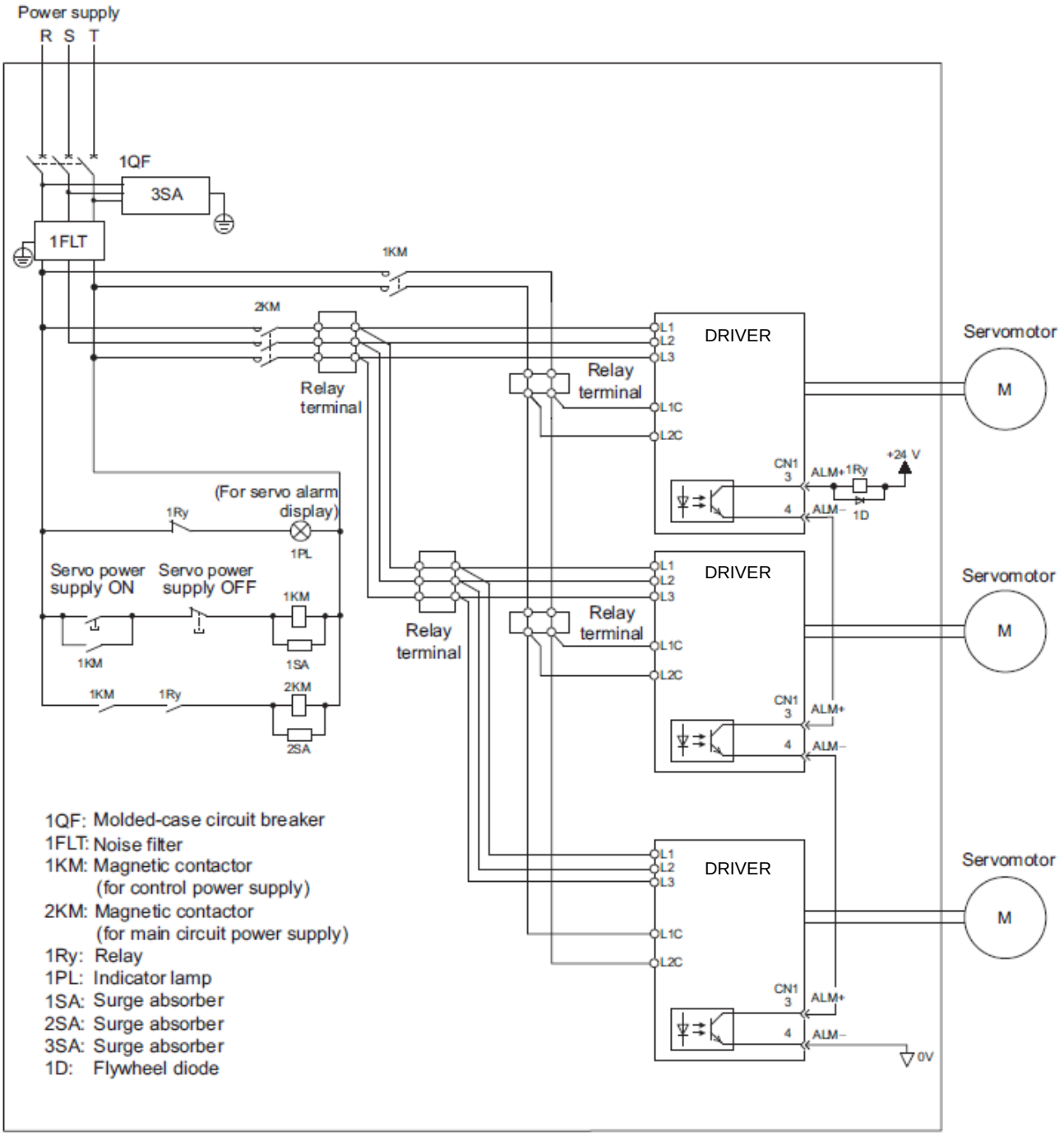
1QF: Molded-case circuit breaker
1FLT: Noise filter
1KM: Magnetic contactor (for control power supply)
2KM: Magnetic contactor (for main circuit power supply)
1Ry: Relay
1PL: Indicator lamp
1SA: Surge absorber
2SA: Surge absorber
3SA: Surge absorber
1D: Flywheel diode

3.1.5 Using More Than One DRIVER

This section shows an example of the wiring and the precautions when more than one DRIVER is used.

(1) Wiring Example

Connect the alarm output (ALM) terminals for three DRIVERs in series to enable alarm detection relay 1RY to operate. When the alarm occurs, the ALM output signal transistor is turned OFF.



(2) Precautions

Multiple DRIVERs can share a single molded-case circuit breaker (1QF) or noise filter. Always select a molded-case circuit breaker or noise filter that has enough capacity for the total power supply capacity (load conditions) of the DRIVERs.

3.1.6 General Precautions for Wiring

IMPORTANT

- Use a molded-case circuit breaker (1QF) or fuse to protect the main circuit.
  The DRIVER connects directly to a commercial power supply; it is not isolated through a transformer or other device.
  Always use a molded-case circuit breaker (1QF) or fuse to protect the servo system from accidents involving different power system voltages or other accidents.
- Install a ground fault detector.
  The DRIVER does not have a built-in protective circuit for grounding.
  To configure a safer system, install a ground fault detector against overloads and short-circuiting, or install a ground fault detector combined with a molded-case circuit breaker.
- Do not turn the power ON and OFF more than necessary.
- Do not use the DRIVER for applications that require the power to turn ON and OFF frequently. Such applications will cause elements in the DRIVER 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.

To ensure safe, stable application of the servo system, observe the following precautions when wiring.
Design and arrange the system so that each cable will be as short as possible.

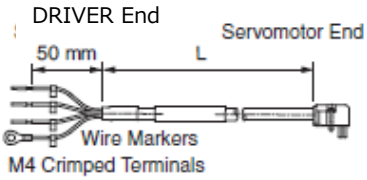
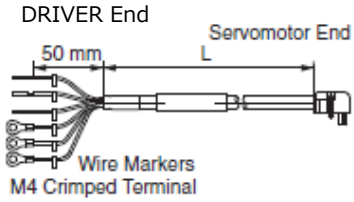
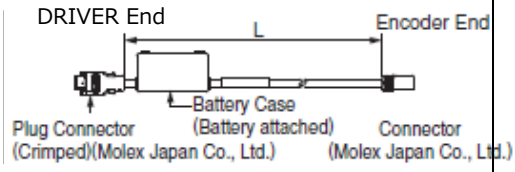
- Use shielded twisted-pair cables or screened unshielded twisted-pair cables for I/O signal cables and encoder cables.
- The maximum wiring length is 3 m for I/O signal cables, 50 m for encoder cables or motor cables.

Observe the following precautions when wiring the ground.

- Use a cable as thick as possible (at least 2.0 mm^2).
- Grounding to a resistance of 100 Ω or less for 200-V DRIVER is recommended.
- Be sure to ground at only one point.
- Ground the servomotor directly if the servomotor is insulated from the machine.

The signal cable conductors are as thin as 0.2 mm^2 or 0.3 mm^2. Do not impose excessive bending force or tension.

3.1.7 Specifications of motor cables and encoder cables

Name	Lock	Servo motor Rated Output	Length	Order No.		Specifications	Details
				Standard LE-CY□-S□A-□	Robot LE-CY□-R□A-□		
Motor cable	without lock	100W	3m	LE-CYM-S3A-5	LE-CYM-R3A-5		(1)
			5m	LE-CYM-S5A-5	LE-CYM-R5A-5		
			10m	LE-CYM-SAA-5	LE-CYM-RAA-5		
			20m	LE-CYM-SCA-5	LE-CYM-RCA-5		
		200W 400W	3m	LE-CYM-S3A-7	LE-CYM-R3A-7		
			5m	LE-CYM-S5A-7	LE-CYM-R5A-7		
			10m	LE-CYM-SAA-7	LE-CYM-RAA-7		
			20m	LE-CYM-SCA-7	LE-CYM-RCA-7		
		750W	3m	LE-CYM-S3A-9	LE-CYM-R3A-9		
			5m	LE-CYM-S5A-9	LE-CYM-R5A-9		
			10m	LE-CYM-SAA-9	LE-CYM-RAA-9		
			20m	LE-CYM-SCA-9	LE-CYM-RCA-9		
Motor cable for with lock	with lock	100W	3m	LE-CYB-S3A-5	LE-CYB-R3A-5		(2)
			5m	LE-CYB-S5A-5	LE-CYB-R5A-5		
			10m	LE-CYB-SAA-5	LE-CYB-RAA-5		
			20m	LE-CYB-SCA-5	LE-CYB-RCA-5		
		200W 400W	3m	LE-CYB-S3A-7	LE-CYB-R3A-7		
			5m	LE-CYB-S5A-7	LE-CYB-R5A-7		
			10m	LE-CYB-SAA-7	LE-CYB-RAA-7		
			20m	LE-CYB-SCA-7	LE-CYB-RCA-7		
		750W	3m	LE-CYB-S3A-9	LE-CYB-R3A-9		
			5m	LE-CYB-S5A-9	LE-CYB-R5A-9		
			10m	LE-CYB-SAA-9	LE-CYB-RAA-9		
			20m	LE-CYB-SCA-9	LE-CYB-RCA-9		
Encoder cable	100W 200W 400W 750W		3m	LE-CYE-S3A	LE-CYE-R3A		(3)
			5m	LE-CYE-S5A	LE-CYE-R5A		
			10m	LE-CYE-SAA	LE-CYE-RAA		
			20m	LE-CYE-SCA	LE-CYE-RCA		

(1) Wiring Specifications for Motor cable

DRIVER-end Leads

Wire Color	Signal
Green/yellow	FG
Blue	Phase W
White	Phase V
Red	Phase U

Servomotor-end Connector

Signal	Pin No.
FG	1
Phase W	2
Phase V	3
Phase U	4
–	5
–	6

(2) Wiring Specifications for Motor cable with lock

DRIVER-end Leads

Wire Color	Signal
Green/yellow	FG
Blue	Phase W
White	Phase V
Red	Phase U
Black	Lock
Black	Lock

Servomotor-end Connector

Signal	Pin No.
FG	1
Phase W	2
Phase V	3
Phase U	4
Lock	5
Lock	6

Note: No polarity for connection to a lock.

(3) Wiring Specifications for Encoder cable

- Standard type

DRIVER End

Pin No.	Signal
6	/PS
5	PS
4	BAT (–)
3	BAT (+)
2	PG 0V
1	PG 5V
Shell	FG

Encoder (Servomotor) End

Pin No.	Wire Color
5	Light blue/white
4	Light blue
8	Orange/white
9	Orange
3	Black
6	Red
Shell	FG

Shield Wire

Battery Case

Pin No.	Signal
2	BAT (–)
1	BAT (+)

- Robot type

DRIVER End

Pin No.	Signal
6	/PS
5	PS
4	BAT (–)
3	BAT (+)
2	PG 0V
1	PG 5V
Shell	FG

Encoder (Servomotor) End

Pin No.	Wire Color
5	Black/pink
4	Red/pink
8	Black/light blue
9	Red/light blue
3	Green
6	Orange
Shell	FG

Shield Wire

Battery Case

Pin No.	Signal
2	BAT (–)
1	BAT (+)

3.2 I/O Signal Connections

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

3.2.1 /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	Refer-ence Section
P-OT (/SI1) N-OT (/SI2)	7 8	Forward run prohibited, Reverse run prohibited	With overtravel prevention: Stops servomotor when movable part travels beyond the allowable range of motion.	4.3.1
/DEC (/SI3)	9	Homing deceleration switch signal	Connects the deceleration limit switch for homing.	–
/EXT 1 (/SI4) /EXT 2 (/SI5) /EXT 3 (/SI6)	10 11 12	External latch signal 1 External latch signal 2 External latch signal 3	Connects the external signals that latch the current feedback pulse counter.	–
/SI0	13	General-purpose input signal	Used for general-purpose input. Monitored in the I/O monitor field of MECHATROLINK-II.	–
+24VIN	6	Control power supply for sequence signal	Control power supply input for sequence signals. Allowable voltage fluctuation range: 11 to 25 V Note: The 24 VDC power supply is not included.	3.4.1
/P-CL /N-CL	Can be allocated	Forward external torque limit Reverse external torque limit	The allocation of an input signal to a pin can be changed in accordance with the function required.	–

Note 1. The allocation of the input signals (/SI1 to /SI6) can be changed. For details, refer to *3.3.1 Input Signal Allocations*.
2. If the Forward run prohibited/ Reverse run prohibited function is used, the DRIVER is stopped by software controls, not by electrical or mechanical means. 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	Lock interlock signal	Controls the lock. The lock is released when the signal turns ON. Allocation can be changed to general-purpose output signals (/SO1+, /SO1-).	4.3.2
/SO2+ /SO2- /SO3+ /SO3-	23 24 25 26	General-purpose output signal	Used for general-purpose output. Note: Set the parameter to allocate a function.	–
/COIN /V-CMP /TGON /S-RDY /CLT /VLT /WARN /NEAR	Can be allocated	Positioning completion Speed coincidence detection Rotation detection servo ready Torque limit Speed limit detection Warning Near	The allocation of an output signal to a pin can be changed in accordance with the function required.	–
PAO /PAO	17 18	Phase-A signal	Encoder output pulse signals for two-phase pulse train with 90˚ phase differential	4.4.4 4.7.8
PBO /PBO	19 20	Phase-B signal		
PCO /PCO	21 22	Phase-Z signal	Origin pulse output signal	
SG	16	Signal ground	Connects to the 0 V pin on the control circuit of the PC or PLC ... etc.	–
FG	Shell	Frame ground	Connected to frame ground if the shielded wire of the I/O signal cable is connected to the connector shell.	–

Note: The allocation of the output signals (/SO1 to /SO3) can be changed. For details, refer to *3.3.2 Output Signal Allocations.*

3.2.2 Safety Function Signal (CN8) Names and Functions

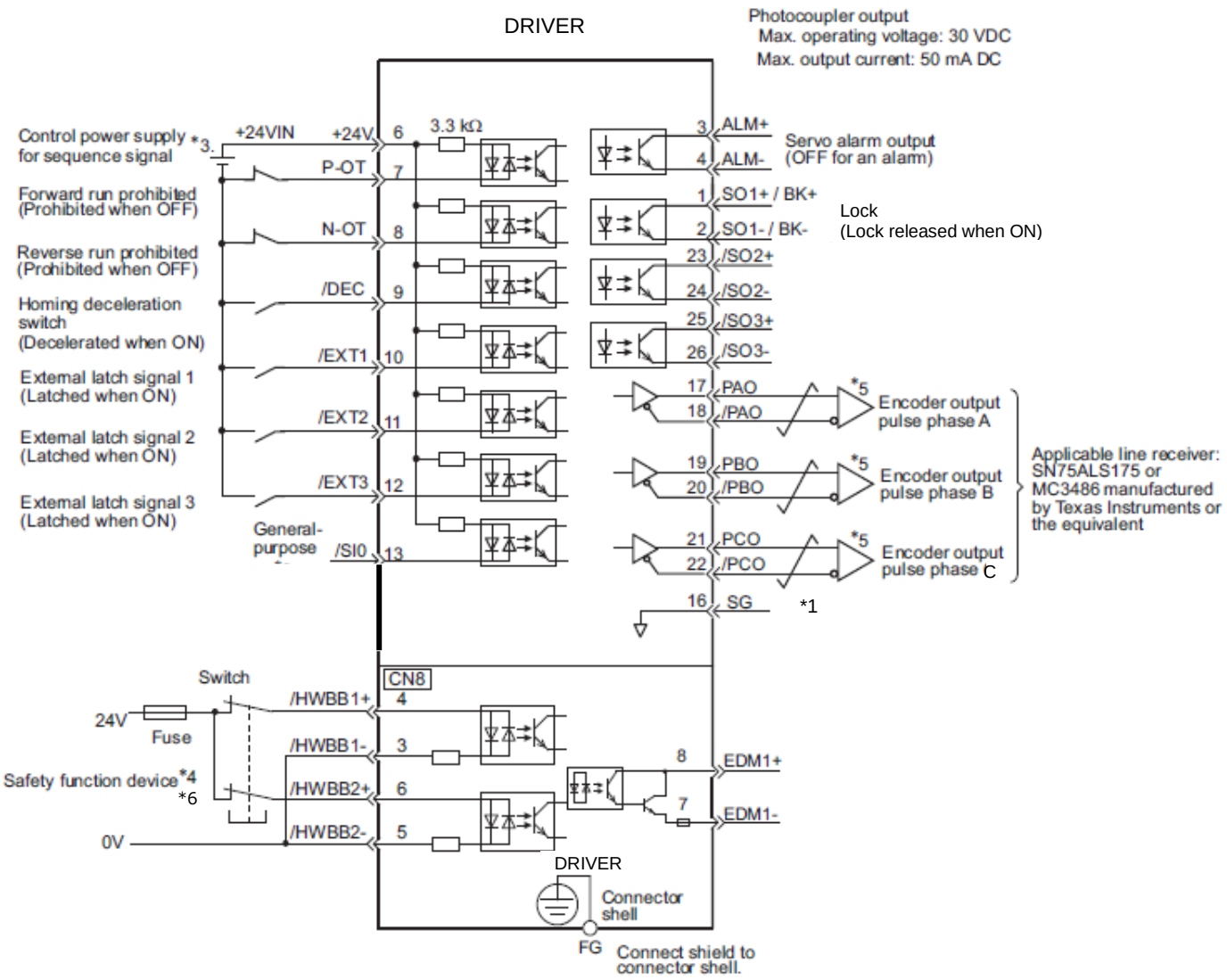
The following table shows the terminal layout of safety function signals (CN8).

Signal Name	Pin No.	Function	
/HWBB1+	4	Hard wire baseblock input 1	For hard wire baseblock input. Baseblock (motor current off) when OFF.
/HWBB1-	3		
/HWBB2+	6	Hard wire baseblock input 2	
/HWBB2-	5		
EDM1+	8	Monitored circuit status output 1	ON when the /HWBB1 and the /HWBB2 signals are input and the SERVOPACK enters a baseblock state.
EDM1-	7		
–	1*	–	
–	2*	–	

∗ Do not use pins 1 and 2 because they are connected to the internal circuits.

3.2.3 Example of I/O Signal Connections

The following diagram shows a typical connection example.



∗1. represents twisted-pair wires.

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

∗4. When using the safety function, a safety function device must be connected and the wiring that is necessary to activate the safety function must be done to turn ON the servomotor power. When not using the safety function, use the DRIVER with the Safety Jumper Connector (provided as an accessory) inserted into the CN8.

∗5. Always use line receivers to receive the output signals.

∗6. It is a safety function equivalent to the STO function (IEC 61800-5-2) using the hard wire base block function (HWBB).

Note: The functions allocated to the input signals /DEC, P-OT, N-OT, /EXT1, /EXT2, and /EXT3 and the output signals /SO1, /SO2, and /SO3 can be changed by using the parameters. Refer to *3.3.1 Input Signal Allocations* and *3.3.2 Output Signal Allocations*.

3.3 I/O Signal Allocations

This section describes the I/O signal allocations.

3.3.1 Input Signal Allocations

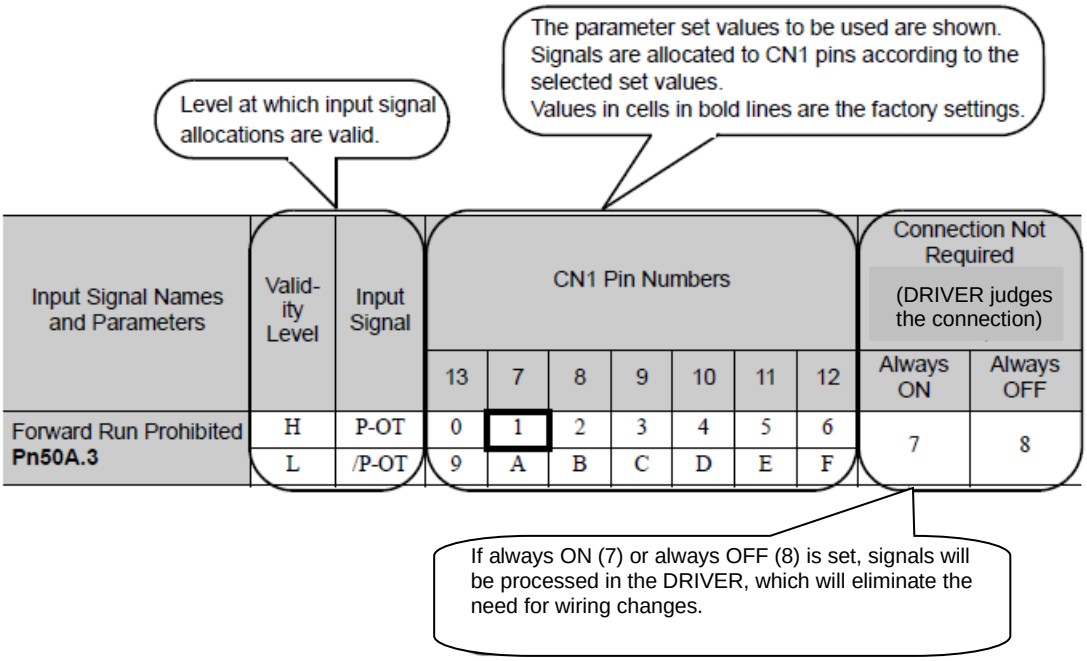
IMPORTANT

- Inverting the polarity of the forward run prohibited and reverse run prohibited signals nal line disconnections or other failures.from the factory setting will prevent the overtravel function from working in case of sigIf this setting is absolutely necessary, check the operation and confirm that there are no safety problems.
- When two or more signals are allocated to the same input circuit, input signal level is valid for all allocated signals, resulting in an unexpected machine operation.

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	Valid-ity Level	Input Signal	CN1 Pin Numbers							Connection Not Required (DRIVER 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	Valid-ity Level	Input Signal	CN1 Pin Numbers							Connection Not Required (DRIVER judges the connec-tion)	
			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 Prohibit-ed **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		
Homing Deceleration LS **Pn511.0**	L	/DEC	0	1	2	3	4	5	6	7	8
	H	DEC	9	A	B	C	D	E	F		
External Latch Signal 1 **Pn511.1**	L	EXT1	*	*	*	*	4	5	6	7	8
	H	/EXT1	*	*	*	*	D	E	F		
External Latch Signal 2 **Pn511.2**	L	EXT2	*	*	*	*	4	5	6	7	8
	H	/EXT2	*	*	*	*	D	E	F		
External Latch Signal 3 **Pn511.3**	L	EXT3	*	*	*	*	4	5	6	7	8
	H	/EXT3	*	*	*	*	D	E	F		

∗ Always set to "Invalid."

3.3.2 Output Signal Allocations

IMPORTANT

- The signals not detected are considered as "Invalid." For example, Positioning Completion (/COIN) signal in speed control is "Invalid."
- Inverting the polarity of the lock signal (/BK), i.e. positive logic, will prevent the holding lock 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.
- When two or more signals are allocated to the same output circuit, a signal is output with OR logic circuit.

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)	
Lock **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
Lock **Pn50F.2**	/BK	1	2	3	0
Warning **Pn50F.3**	/WARN	1	2	3	0
Near **Pn510.0**	/NEAR	1	2	3	0
Pn512.0=1	Polarity inversion of CN1-1(2)				0 (Not invert at factory setting)
Pn512.1=1	Polarity inversion of CN1-23(24)				
Pn512.2=1	Polarity inversion of CN1-25(26)				

3.4 Examples of Connection to PC or PLC ... etc

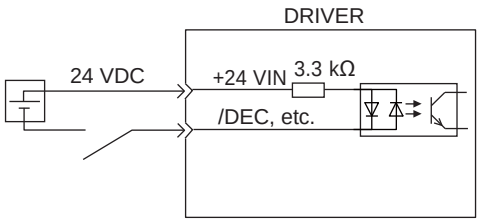
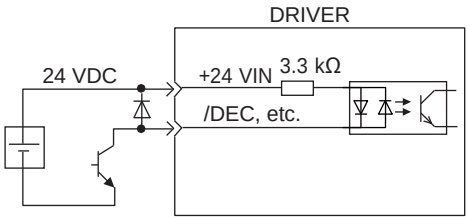
This section shows examples of DRIVER I/O signal connection to the PC or PLC ... etc.

3.4.1 Sequence Input Circuit

(1) Photocoupler Input Circuit

CN1 connector terminals 6 to 13 are explained below.

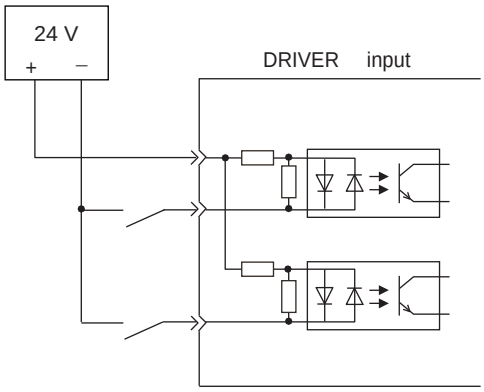
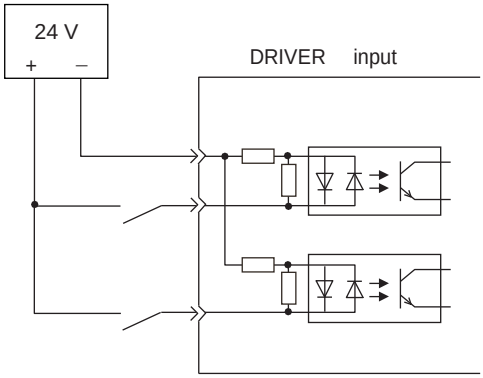
The sequence input circuit interface is connected through a relay or open-collector transistor circuit. When connecting through a relay, use a low-current relay. If a low-current relay is not used, a faulty contact may result.

Relay Circuit Example	Open-collector Circuit Example
	

Note: The 24 VDC external power supply capacity must be 50 mA minimum.

The DRIVER's input circuit uses bidirectional photocoupler. Select either the sink circuit or the source circuit according to the specifications required for each machine.

Note: - The connection example in *3.2.3* shows sink circuits.
- The ON/OFF polarity differs between when a sink circuit is connected and when a source circuit is connected.

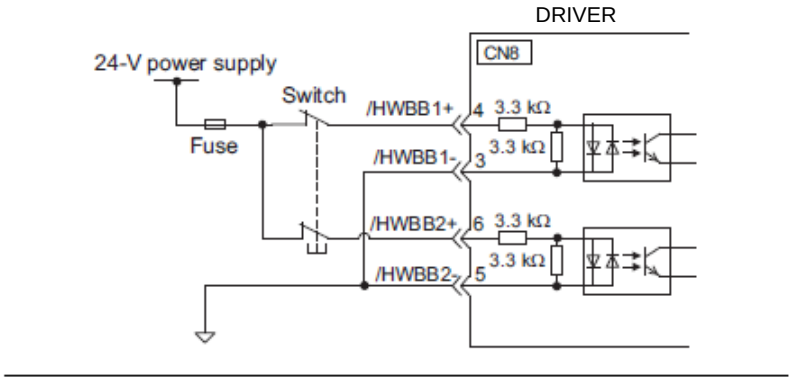
Sink Circuit	Source Circuit
	

Input Signal Polarities				Input Signal Polarities			
Signal	Level	Voltage Level	Contact	Signal	Level	Voltage Level	Contact
ON	Low (L) level	0 V	Close	ON	High (H) level	24 V	Close
OFF	High (H) level	24 V	Open	OFF	Low (L) level	0 V	Open

(2) Safety Input Circuit

As for wiring input signals for safety function, input signals make common 0 V. It is necessary to make an input signal redundant.

Input Signal Connection Example



3.4.2 Sequence Output Circuit

Three types of DRIVER output circuit are available.

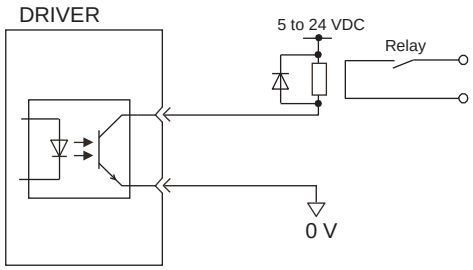
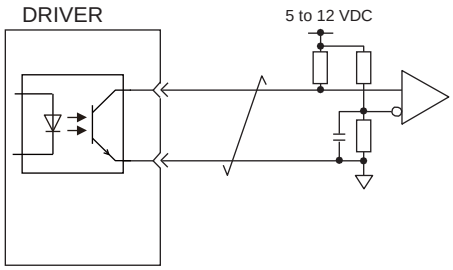
IMPORTANT

Incorrect wiring or incorrect voltage application to the output circuit may cause short-circuit.

If a short-circuit occurs as a result of any of these causes, the holding lock will not work. This could damage the machine or cause an accident resulting in death or injury.

(1) Photocoupler Output Circuit

Photocoupler output circuits are used for servo alarm (ALM), servo ready (/S-RDY), and other sequence output signal circuits. Connect a photocoupler output circuit through a relay or line receiver circuit.

Relay Circuit Example	Line Receiver Circuit Example
	

Note: The maximum allowable voltage and the allowable range of current capacity for photocoupler output circuits are as follows.

- Voltage: 30 VDC
- Current: 5 to 50 mA DC

(2) Line Driver Output Circuit

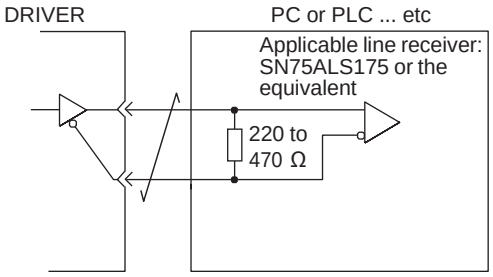
CN1 connector terminals, 17-18 (phase-A signal), 19-20 (phase-B signal), and 21-22 (phase-Z signal) are explained below.

These terminals output the following signals via the line-driver output circuits.

- Output signals for which encoder serial data is converted as two phases pulses (PAO, /PAO, PBO, /PBO)
- Origin pulse signals (PCO, /PCO)

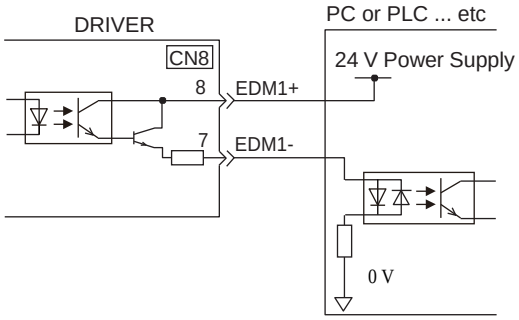
Connect the line-driver output circuit through a line receiver circuit at the PC or PLC ... etc.

Line Receiver Circuit Example



(3) Safety Output Circuit

The external device monitor (EDM1) for safety output signals is explained below.
A configuration example for the EDM1 output signal is shown in the following diagram.
Output signal is the source output. It is not able to use the sink output.



- Specifications

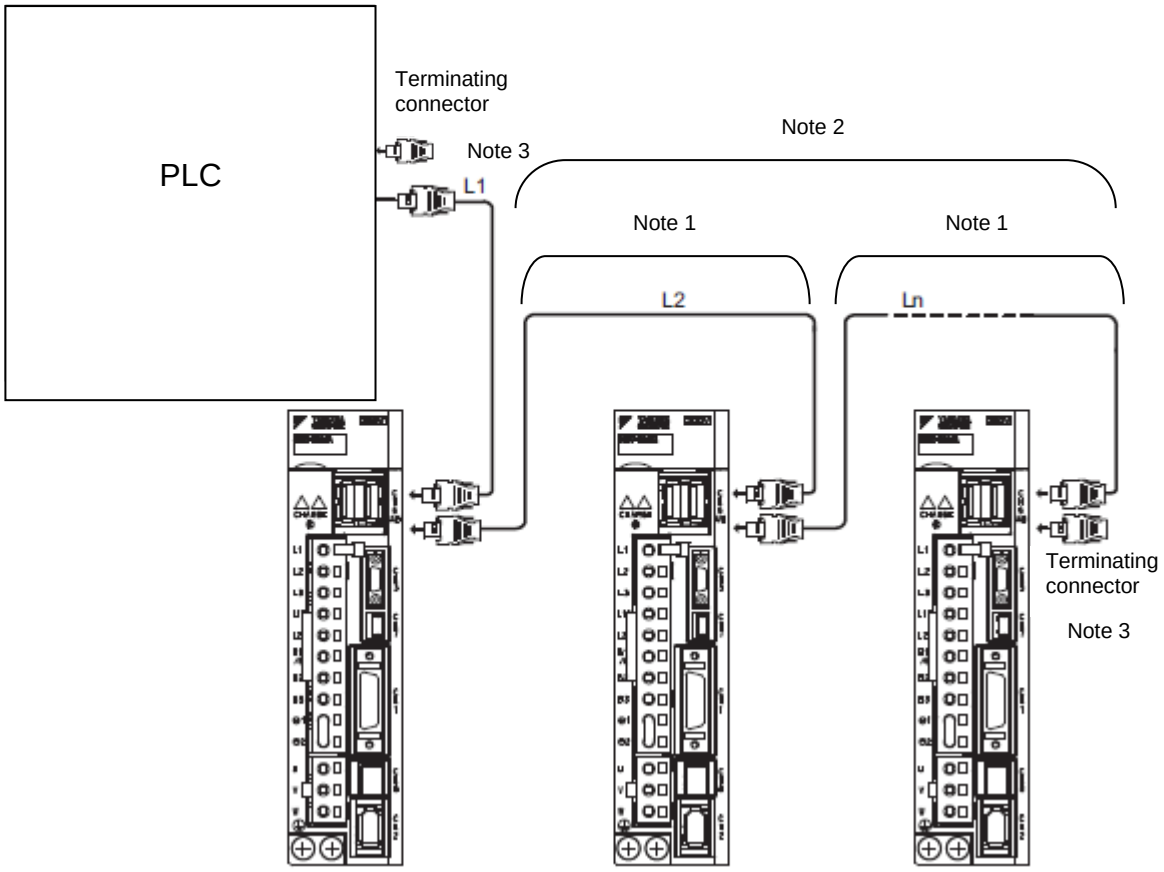
Type	Signal Name	Pin No.	Output Status	Meaning
Output	EDM1	CN8-8 CN8-7	ON	Both the /HWBB1 and /HWBB2 signals are working normally.
			OFF	The /HWBB1 signal, the /HWBB2 signal, or both are not working normally.

Electrical characteristics of EDM1 signal are as follows.

Items	Characteristic	Remarks
Maximum Allowable Voltage	30 VDC	–
Maximum Current	50 mADC	–
Maximum Voltage Drop at ON	1.0 V	Voltage between EDM1+ to EDM1- at current is 50 mA.
Maximum Delay Time	20 ms	Time from the change in /HWBB1 or /HWBB2 until the change in EDM1.

3.5 Wiring MECHATROLINK-II Communications

The following diagram shows an example of connections between a PC or PLC ... etc and a DRIVER using MECHATROLINK-II communications cables (CN6A, CN6B).



Note 1. The length of the cable between stations (L1, L2 ... Ln) must be 0.5 m or more.
2. The total cable length must be L1 + L2 ... + Ln ≤ 50.
3. When multiple DRIVERs are connected by MECHATROLINK-II communications cable, a terminating connector must be installed at the final DRIVER.

3.6 Encoder Connection

This section describes the encoder signal (CN2) names, functions, and connection examples.

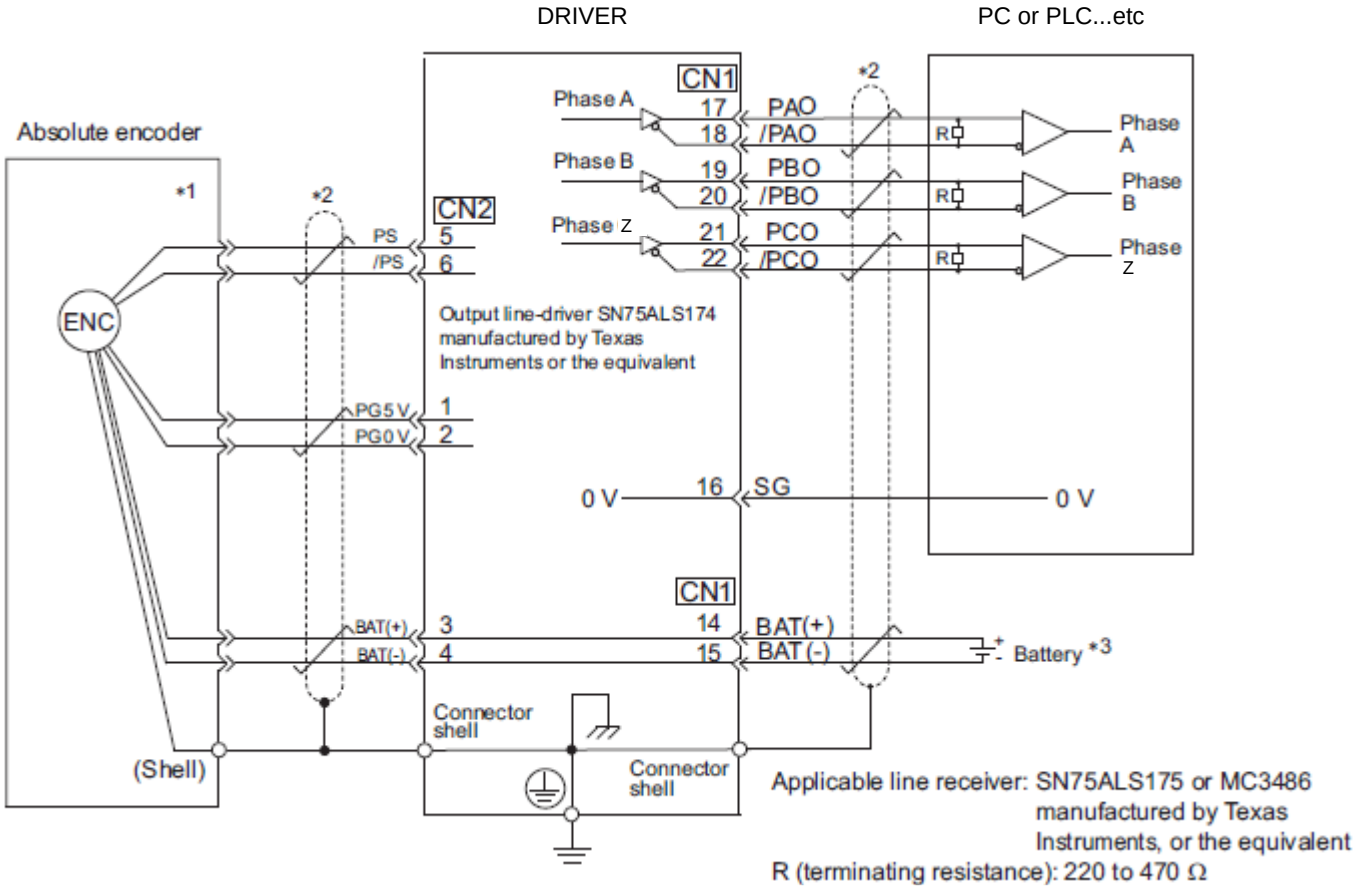
3.6.1 Encoder Signal (CN2) Names and Functions

The following table shows the names and functions of encoder signals (CN2).

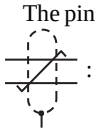
Signal Name	Pin No.	Function
PG 5 V	1	Encoder power supply +5 V
PG 0 V	2	Encoder power supply 0 V
BAT (+)	3	Battery (+)
BAT (-)	4	Battery (-)
PS	5	Serial data (+)
/PS	6	Serial data (-)
Shield	Shell	–

3.6.2 Encoder Connection Examples

The following diagrams show connection examples of the encoder, the DRIVER, and the PC or PLC ... etc.



∗1. The pin arrangement for wiring connectors varies in accordance with the servomotor that is used.

∗2.  : represents shielded twisted-pair wires.

∗3. Do not connect the battery with 14 and 15 pins (CN1).

3.7 Connecting Regenerative resistors

If the built-in regenerative resistor is insufficient, connect an external Regenerative resistor by one of the following methods and set the Regenerative resistor capacity (Pn600). Precautions on selecting a Regenerative resistor and its specifications are shown below.

⚠ WARNING

- Be sure to connect the regenerative resistor correctly. Do not short-circuit between B1/ ⊕and B2.
  Doing so may result in fire or damage to the regenerative resistor or DRIVER.

- Regenerative resistor Selection

Select Regenerative resistors in the following manner. External regenerative resistors are to be provided by users.

Voltage	DRIVER Model LECYM2-□□	Built-in Regenerative Resistor	Necessity of External Regenerative resistors	Necessity of External Regenerative resistors
Three-phase 200 V	V5, V7, V8	None	Basically Not Required	No built-in regenerative resistor is provided. Install external Regenerative resistors when the smoothing capacitor in DRIVER cannot process all the regenerative power.
	V9	Standard Equipment *		A built-in regenerative resistor is provided as standard. Install external Regenerative resistors when the built-in regenerative resistor cannot process all the regenerative power.

* For specifications of built-in Regenerative resistors, refer to the next.

- Specifications of Built-in Regenerative Resistor

The following table shows the specifications of the DRIVER's built-in resistor and the amount of regenerative power (average values) that it can process.

Applicable DRIVER LECYM2-□□		Specifications of Built-in Resistor		Regenerative Power Processed by Built-in Resistor [W] *	Minimum Allowable Resistance [Ω]
		Resistance [Ω]	Capacity [W]		
Three-phase 200 V	V5, V7, V8	-	-	-	40
	V9	50	40	8	40

*1: The average regenerative power that can be handled is 20% of the rated capacity of the regenerative resistor built into the DRIVER.

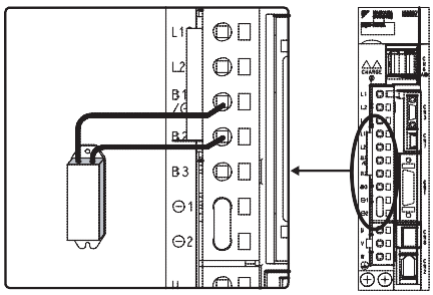
3.7.1 Connecting Regenerative Resistors

The following instructions show how to connect the regenerative resistors and DRIVERs.

(1) DRIVERs: Model LECYM2-V5, V7, V8

Connect an external Regenerative resistor between the B1/⊙ and B2 terminals on the DRIVER. After connecting a option, select the capacity. For more information on how to set the capacity of Regenerative resistors, refer to *3.7.2 Setting Regenerative resistorCapacity*.

Enlarged View

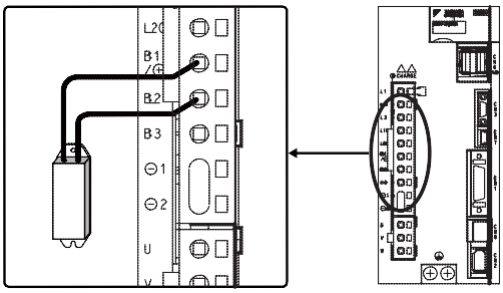


(2) DRIVER: Model LECYM2-V9

Disconnect the wiring between the DRIVER's B2 and B3 terminals and connect an external Regenerative resistor between the B1/⊙ and B2 terminals. After connecting the option, select the capacity. For more information on how to set the capacity of Regenerative resistors, refer to *3.7.2 Setting Regenerative resistor Capac ity*.

Note: Be sure to take out the lead wire between the B2 and B3 terminals.

Enlarged View



3.7.2 Setting Regenerative resistor Capacity

When using an external Regenerative resistor, set the Pn600 so that the Regenerative resistor capacity is equivalent to the resistor capacity.

⚠ WARNING

- If parameter Pn600 is set to 0 while an external Regenerative resistor is connected, the regenerative overload alarm (A.320) may not be detected. If the regenerative overload alarm (A.320) is not detected correctly, the external Regenerative resistor may be damaged and an injury or fire may result.

Pn600	Regenerative resistor Capacity [Speed] [Position] [Torque]				Classification
	Setting Range	Unit	Factory Setting	When Enabled	
	0 to DRIVER capacity	10 W	0	Immediately	Setup

Be sure to set the Regenerative resistor capacity (Pn600) to a value that is in accordance with the allowable capacity of the actual external Regenerative resistor being used.

The setting will vary with the cooling method of external Regenerative resistor:

- For natural convection cooling: Set the value to a maximum 20% of the actually installed regenerative option capacity (W).
- For forced convection cooling: Set the value to a maximum 50% of the actually installed regenerative option capacity (W).

Example: Set 20 W (100 W × 20%) for the 100-W external Regenerative resistor with natural convection cooling method: Pn600 = 2 (unit: 10 W)

Note 1. If Pn600 is not set to the optimum value, alarm A.320 will occur.
2. When set to the factory setting (Pn600 = 0), the DRIVER's built-in option has been used.

IMPORTANT

- When the external Regenerative resistors for power are used at the rated load ratio, the resistor temperature increases to between 200 ˚C and 300 ˚C. The resistors must be used at or below the rated values. Check with the manufacturer for the resistor's load characteristics.
- For safety, use the external Regenerative resistors with thermoswitches.

3.8 Noise Control and Measures for Harmonic Suppression

This section describes the wiring for noise control and the DC reactor for harmonic suppression.

3.8.1 Wiring for Noise Control

IMPORTANT

- Because the DRIVER is designed as an industrial device, it provides no mechanism to prevent noise interference.
- The DRIVER uses high-speed switching elements in the main circuit. Therefore peripheral devices may receive switching noise. If the equipment is to be used near private houses or if radio interference is a problem, take countermeasures against noise.
- If installation conditions by the EMC directive must be met, refer to 3.8.3 *EMC Installa tion Conditions*.

The DRIVER uses microprocessors. Therefore it may receive switching noise from peripheral devices.

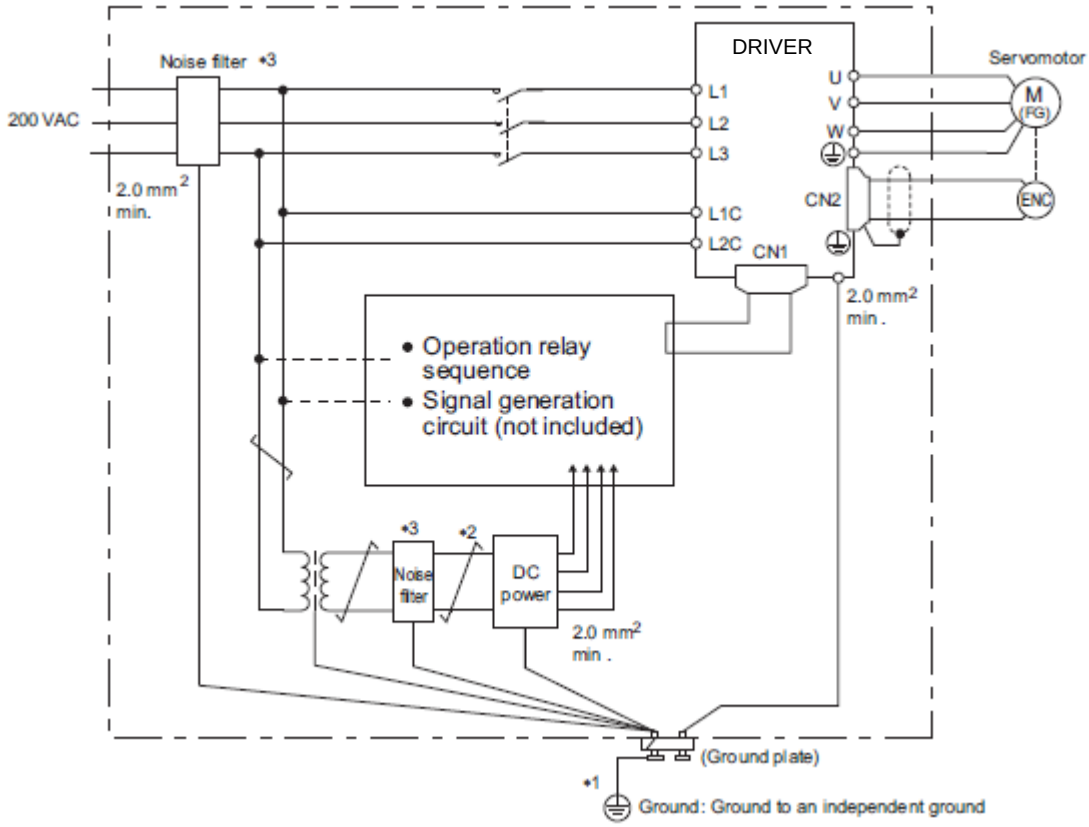
To prevent the noise from the DRIVER or the peripheral devices from causing a malfunction of any one of these devices, take the following precautions against noise as required.

- Position the input reference device and noise filter as close to the DRIVER as possible.
- Always install a surge absorber in the relay, solenoid and electromagnetic contactor coils.
- 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.
- Do not share the power supply with an electric welder or electrical discharge machine. When the DRIVER is placed near a high-frequency generator, install a noise filter on the input side of the main circuit power supply cables and control power supply cables. As for the wiring of noise filter, refer to *(1) Noise Fil- ter* shown below.
- Take the grounding measures correctly. As for the grounding, refer to *(2) Correct Grounding*.

(1) Noise Filter

The DRIVER has a built-in microprocessor (CPU), so protect it from external noise as much as possible by installing a noise filter in the appropriate place.

The following is an example of wiring for noise control.



∗1. For ground wires connected to the ground plate, use a thick wire with a thickness of at least 2.0 mm^2 (preferably, plain stitch cooper wire).

∗2. ⫽ should be twisted-pair wires.

∗3. When using a noise filter, follow the precautions in *3.8.2 Precautions on Connecting Noise Filter*.

(2) Correct Grounding

Take the following grounding measures to prevent the malfunction due to noise.

- Grounding the Motor Frame

Always connect servomotor frame terminal FG to the DRIVER ground terminal ⏚. Also be sure to ground the ground terminal ⏚ .

If the servomotor is grounded via the machine, a switching noise current will flow from the DRIVER main circuit through servomotor stray capacitance. The above grounding is required to prevent the adverse effects of switching noise.

- Noise on the I/O Signal Cable

If the I/O signal cable receives noise, ground the 0 V line (SG) of the I/O signal cable. If the motor cable is accommodated in a metal conduit, ground the conduit and its junction box. For all grounding, ground at one point only.

3.8.2 Precautions on Connecting Noise Filter

This section describes the precautions on installing a noise filter.

(1) Noise Filter Brake Power Supply

Use the following noise filter at the brake power input for 400-W or less servomotors with holding locks. MODEL: FN2070-6/07 (Manufactured by SCHAFFNER Electronic.)

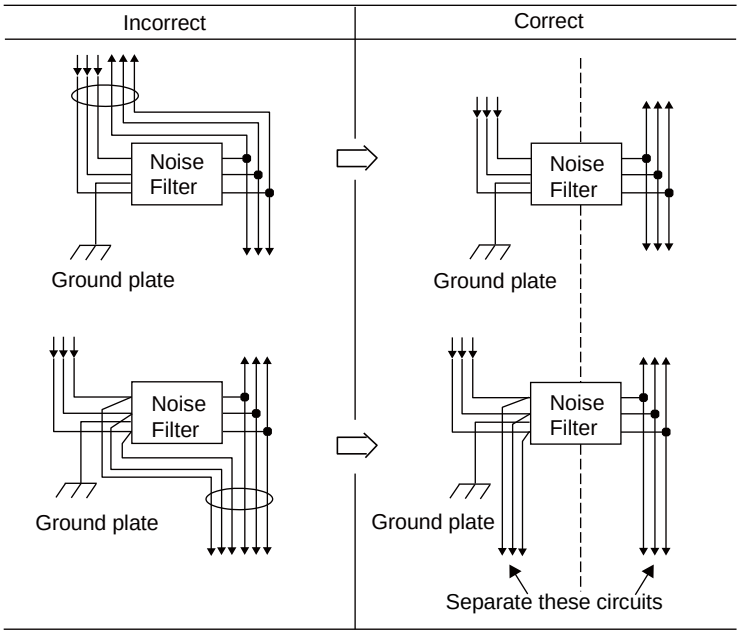
(2) Precautions on Using Noise Filters

Always observe the following installation and wiring instructions.

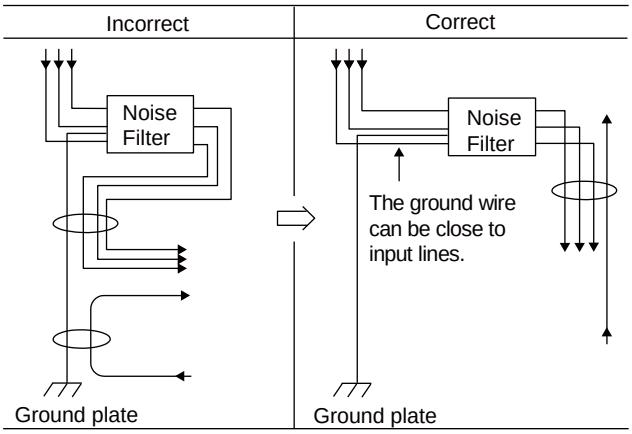
IMPORTANT

Some noise filters have large leakage currents. The grounding measures taken also affects the extent of the leakage current. If necessary, select an appropriate leakage current detector or leakage current breaker taking into account the grounding measures that are used and leakage current from the noise filter. Contact the manufacturer of the noise filter for details.

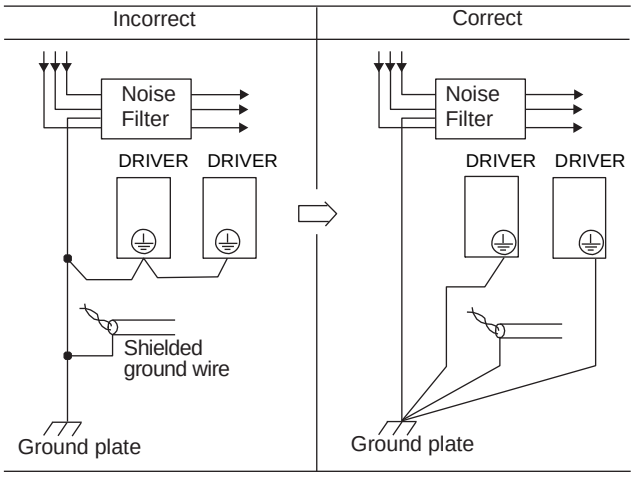
Do not put the input and output lines in the same duct or bundle them together.



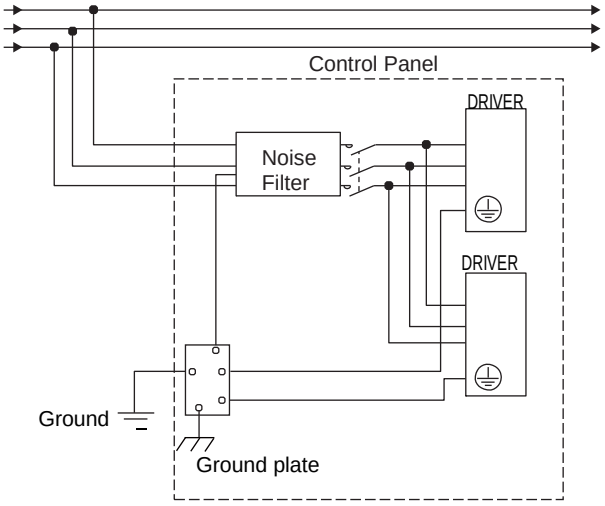
Separate the noise filter ground wire from the output lines.
Do not accommodate the noise filter ground wire, output lines and other signal lines in the same duct or bundle them together.



Connect the noise filter ground wire directly to the ground plate. Do not connect the noise filter ground wire to other ground wires.



If a noise filter is located inside a control panel, first connect the noise filter ground wire and the ground wires from other devices inside the control panel to the ground plate for the control panel, then ground the plates.



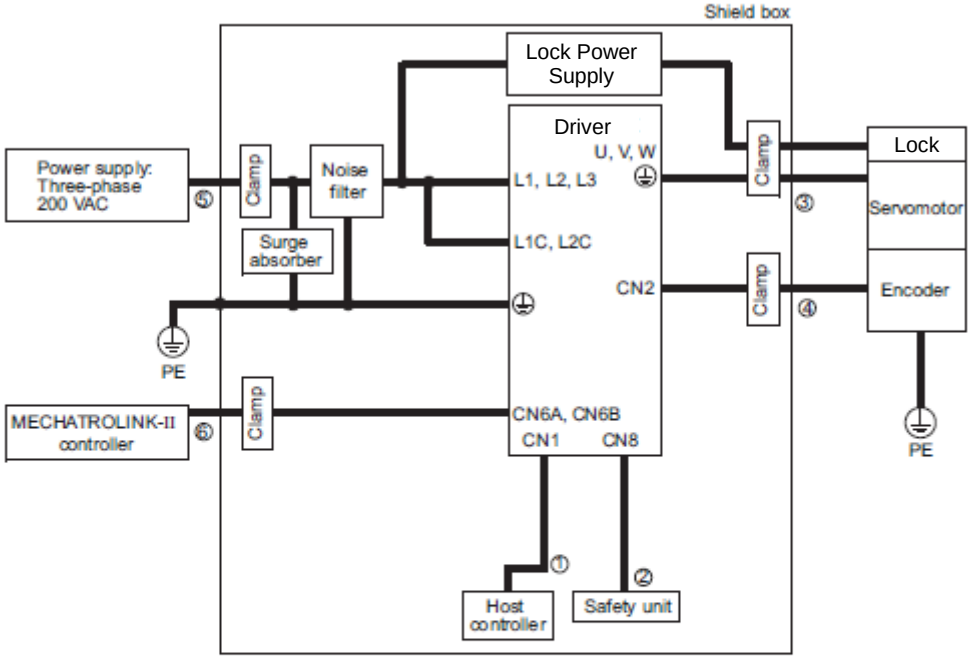
3.8.3 EMC Installation Conditions

This section describes the recommended installation conditions that satisfy EMC guidelines for each model of the DRIVER.

This section describes the EMC installation conditions. 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.

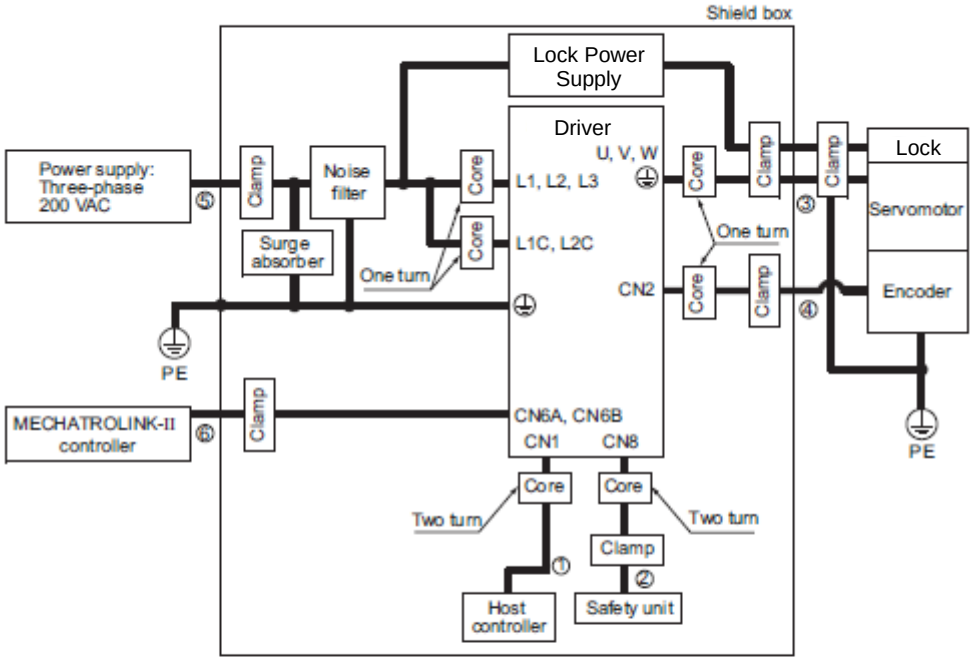
The applicable standards are EN55011/A2 group 1 class A, EN61800-3, and EN61000-6-2.

(1) Three-phase 200V (LECYM2-V5, V7, V8)



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

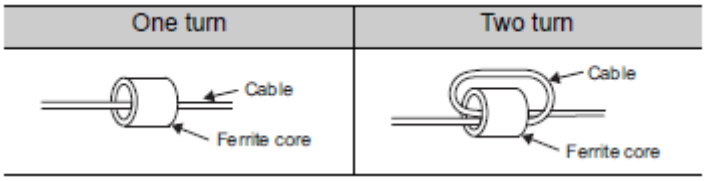
(2) Three-phase 200V (LECYM2-V9)



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

(3) Other Precautions

- Attachment Methods of Ferrite Cores



- Recommended Ferrite Core

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

- Recommended Noise Filter

Noise Filter Selection

Main Circuit Power Supply	Driver Model LECYM2-	Recommended Noise Filter			Details
		Model	Specifications	Leakage Current	
Single-phase 200 V	V5, V7	FN2070-6/07	Single-phase 250V 6A	0.734 mA 230VAC/50Hz	[1]
	V8	FN2070-10/07	Single-phase 250V 10A		
	V9	FN2070-16/07	Single-phase 250V 16A		
Three-phase 200 V	V5, V7, V8	FN258L-7/07	Three-phase 80V 7A	0.5 mA 440VAC/50Hz	[2]
	V9	FN258L-16/07	Three-phase 480V 16A	0.8 mA 440VAC/50Hz	

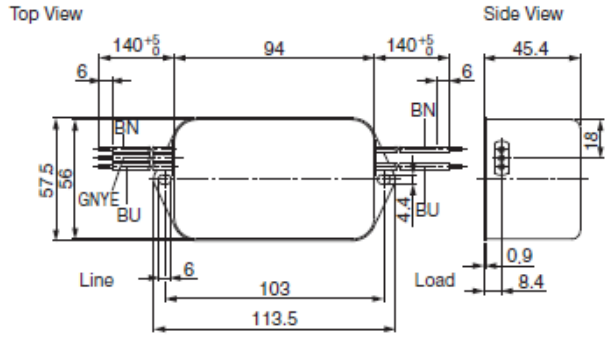
Note: RoHS-compliant models are not available. Contact the manufactures when in need of an RoHS-compliant model.

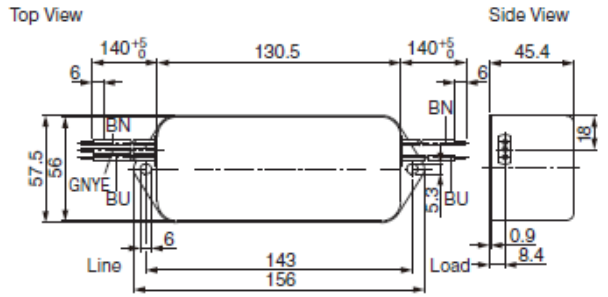
IMPORTANT

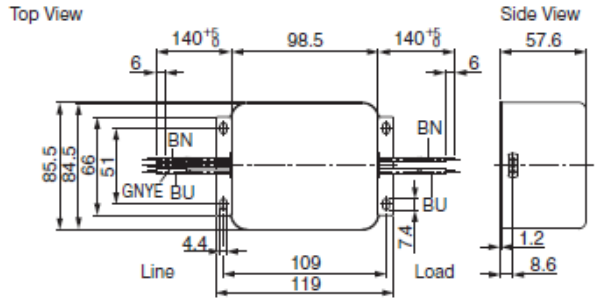
Some noise filters have large amounts of leakage current. The grounding measures taken also affect the extent of the leakage current. If necessary, select an appropriate current detector or leakage current breaker taking into account the grounding measures that are used and leakage current from the noise filter. Contact the manufacturer of the noise filter for details.

External Dimensions (Units: mm)

[1] FN Type (by Schaffner EMC, Inc.)

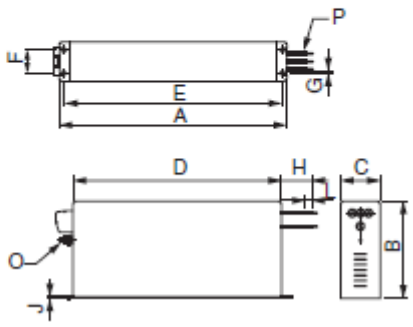
Model	FN2070-6/07
Dimensional Drawings	

Model	FN2070-10/07
Dimensional Drawings	

Model	FN2070-16/07
Dimensional Drawings	

Cable Color	Terminal	
	Line	Load
Brown (BN)	P	P'
Blue (BU)	N	N'
Green/yellow (GNYE)	E	–

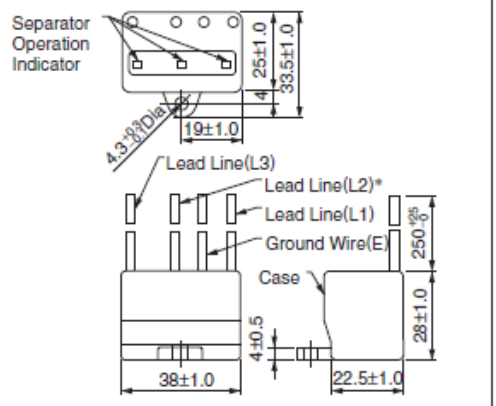
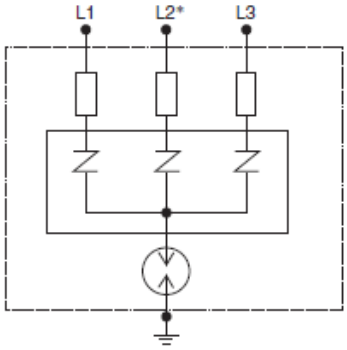
[2] FN Type

Model		FN Type [by Schaffner EMC, Inc.]	
		FN258L-7/07	FN258L-16/07
Dimensional Drawings			
External Dimensions	Code	Dimensions	
	A	255±1	305±1
	B	126±0.8	142±0.8
	C	50±0.6	55±0.6
	D	225±0.8	275±0.8
	E	240±0.5	290±0.5
	F	25±0.3	30±0.3
	G	6.5±0.2	
	H	300±10	
	J	1±0.1	
	K	–	
	L	9±1	
	M	–	
	N	–	
	O	M5	
	P	AWG16	AWG14
	Q	–	

- Recommended Surge Absorber

The surge absorber (for Lightning surge) absorbs lightning surge and prevents faulty operation in or damage to electronic circuits.

Main Circuit Power Supply	Recommended Surge Absorber
Single-phase 200V	LT-C12G801WS [by SOSHIN ELECTRIC CO., LTD.]
Three-phase 200V	LT-C32G801WS [by SOSHIN ELECTRIC CO., LTD.]

External Dimensions	Internal Connection Diagram
	

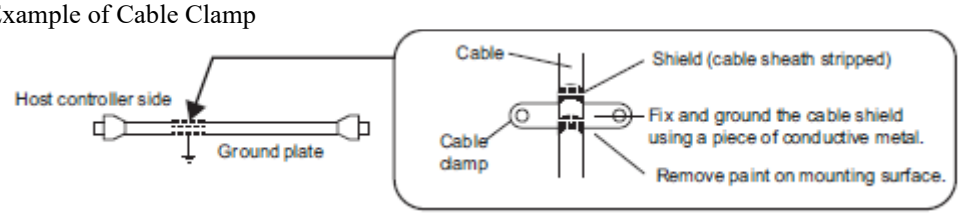
The wire size for all the lead lines (L1, L2, and L3) and the ground wire (E) is AWG16 (UL1015).

∗: No L2 is on the LT-C12G801WS surge absorber.

- 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 DRIVERs. The structure of the box should allow the main body, door, and cooling unit to be attached to the ground.

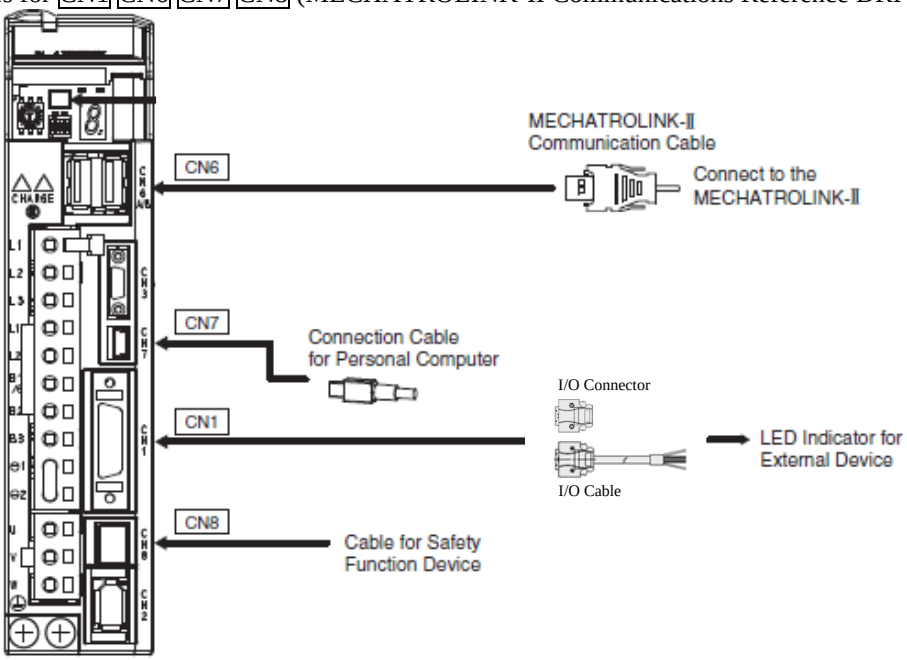
The box opening should be as small as possible.

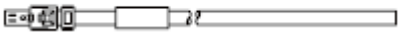
<Note>

Do not connect the the analog monitor cable to the DRIVER during operations. Connect them only when the machinery is stopped during maintenance.

3.9 Specification of option cables

- Cables for CN1 CN6 CN7 CN8 (MECHATROLINK-II Communications Reference DRIVERs)



Name		Length	Order No.	Specifications	Details
CN1 I/O Signals kit	I/O Connector (Non cable)		LE-CYNA	Soldered	(1)-1)
	I/O Cable	1.5m	LEC-CSNA-1		(1)-2)
CN7 Connection Cables for Personal Computer		2.5m	LEC-JZ-CVUSB	Cable with Connectors at Both Ends	(2)
CN6A CN6B MECHATROLINK-II Communication Cable	Cables with Connectors at Both Ends	0.5m ～ 3.0m	LEC-CYM-□		(3)
	Terminator		LEC-CYRM		(4)
CN8 Cable for Safety Function Device	Cables with Connector*1	3m	LEC-JZ-CVSAF		(5)

*1 : When using the safety function, connect this cable to the safety devices.
Even when not using the safety function, use DRIVERs with the Safe Jumper Connector connected.

(1) I/O Signals kit (CN1)

1) I/O Connector (Non cable) (LE-CYNA)

Use the following connector and cable to assemble the cable.

The CN1 connector kit includes one case and one connector.

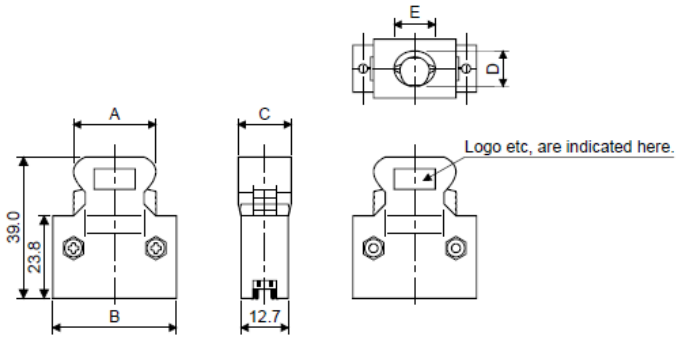
Connector Kit	Case		Connector	
	Model	Qty	Model	Qty
	10326-52F0-008*	1 set	10126-3000PE* (Soldered)	1

*: Manufactured by Sumitomo 3M Ltd.

Cable Size

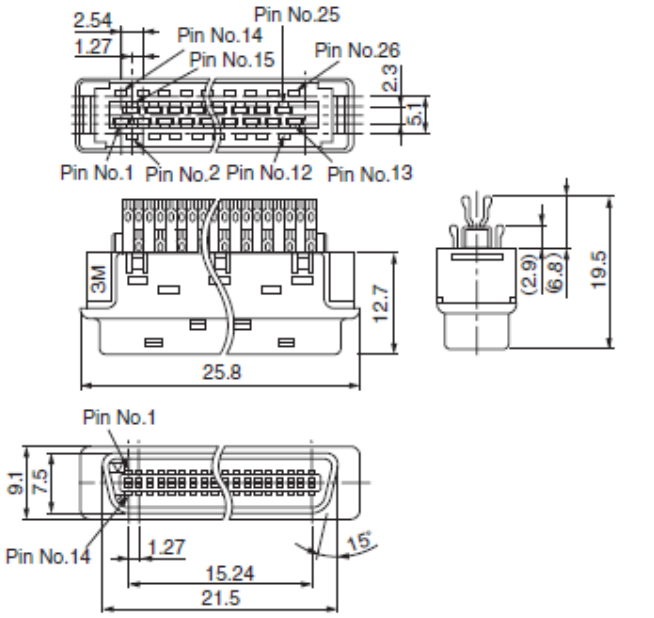
Item	Specifications
Cable	Use twisted-pair or twisted-pair shielded wire.
Applicable Wires	AWG24, 26, 28, 30
Cable Finished Diameter	16 dia. max.

· External Dimensions of Case (Units: mm)



Each type of dimension				
A	B	C	D	E
25.8	37.2	14.0	10.0	12.0

· External Dimensions of Connector (Units: mm)



2) I/O Cable (1.5m) (LEC-CSNA-1)

The I/O Cable includes one case and one connector.

Connector Kit	Case		Connector	
	Model	Qty	Model	Qty
	10326-52F0-008*	1 set	10126-3000PE* (Soldered)	1

*: Manufactured by Sumitomo 3M Ltd.

Cable Size

Item	Specifications
Cable	Use twisted-pair or twisted-pair shielded wire.
Applicable Wires	AWG24, 26, 28, 30
Cable Finished Diameter	16 dia. max.

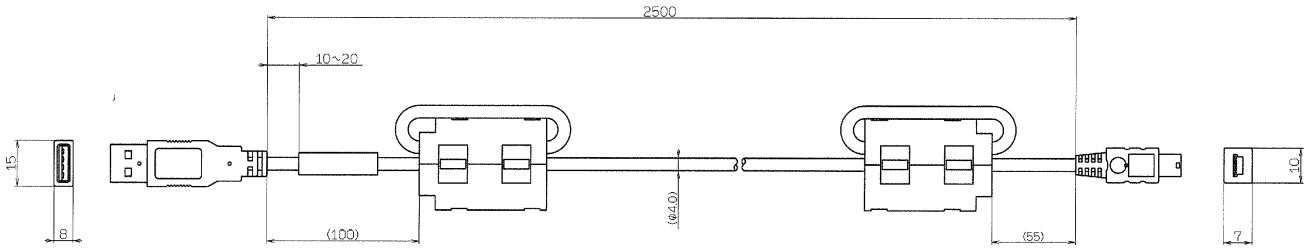
Wiring

LEC-CSNA-1: Pin no. 1 to 26

Connector pin no.	Pair no. of wire	Insulation color	Dot mark	Dot color
1	1	Orange	▬	Red
2			▬	Black
3	2	Light gray	▬	Red
4			▬	Black
5	3	White	▬	Red
6			▬	Black
7	4	Yellow	▬	Red
8			▬	Black
9	5	Pink	▬	Red
10			▬	Black
11	6	Orange	▬▬	Red
12			▬▬	Black
13	7	Light gray	▬▬	Red
14			▬▬	Black
15	8	White	▬▬	Red
16			▬▬	Black
17	9	Yellow	▬▬	Red
18			▬▬	Black

Connector pin no.	Pair no. of wire	Insulation color	Dot mark	Dot color
19	10	Pink	▬▬	Red
20			▬▬	Black
21	11	Orange	▬▬▬	Red
22			▬▬▬	Black
23	12	Light gray	▬▬▬	Red
24			▬▬▬	Black
25	13	White	▬▬▬	Red
26			▬▬▬	Black

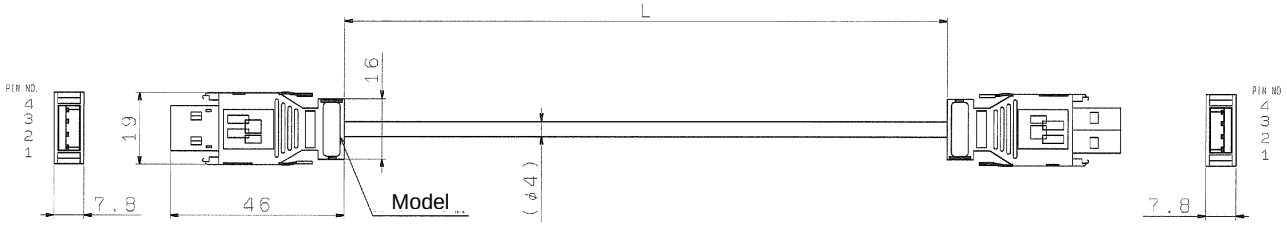
(2) Connection Cable for Personal Computer for CN7
(Model: LEC-JZ-CVUSB)
- External Dimensions (Units: mm)



IMPORTANT

Use a cable specified by this company.
When using other cables, operation cannot be guaranteed.

(3) Cable with Connectors at Both Ends for CN6
(Model: LEC-CYM-□)
- External Dimensions (Units: mm)

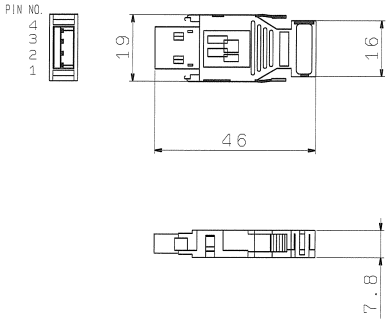


Model	Cable Length (L)
LEC-CYM-J	0.5m
LEC-CYM-1	1m
LEC-CYM-3	3m

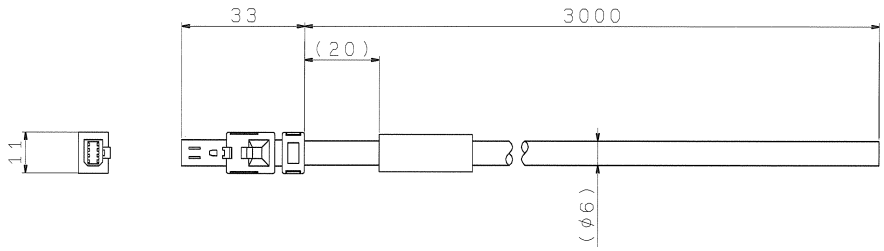
IMPORTANT

Use a MECHATROLINK-II communications cable specified by this company. When using other cables, noise resistance may be reduced, and operation cannot be guaranteed.

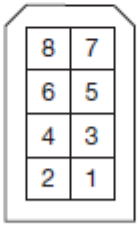
(4) MECHATROLINK-Ⅱ Terminator for CN6
(Model: LEC-CYRM)
- External Dimensions (Units: mm)



(5) Cable with Connector for CN8
(Model: LEC-JZ-CVSAF)
- External Dimensions (Units: mm)



Pin Layout



· Specifications

Pin No.	Signal	Lead Color	Marking Color
1	Not used	–	–
2	Not used	–	–
3	/HWBB1−	White	Black
4	/HWBB1+	White	Red
5	/HWBB2−	Gray	Black
6	/HWBB2+	Gray	Red
7	EDM1−	Orange	Black
8	EDM1+	Orange	Red

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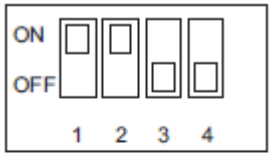
4 Operation

4.1 MECHATROLINK-II Communications Settings

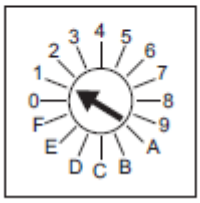
This section describes the switch settings necessary for MECHATROLINK-II communications.

4.1.1 Setting Switches SW1 and SW2

The SW2 DIP switch is used to make the settings for MECHATROLINK-II communications. The station address is set using the rotary switch (SW1) and the DIP switch (SW2).



SW2 (factory settings)



SW1 (factory setting)

(1) Settings for the SW2 DIP Switch

The following table shows the settings of the DIP switch (SW2).

SW2	Function	Setting	Description	Factory setting
Pin 1	Sets the baud rate.	OFF	4 Mbps (MECHATROLINK-I)	ON
		ON	10 Mbps (MECHATROLINK-II)	
Pin 2	Sets the number of transmission bytes.	OFF	17 bytes	ON
		ON	32 bytes	
Pin 3	Sets the station address.	OFF	Station address = 40H + SW1	OFF
		ON	Station address = 50H + SW1	
Pin 4	Reserved. (Do not change.)	OFF	–	OFF

IMPORTANT

- When connecting to a MECHATROLINK-I network, turn OFF pins 1 and 2.
- When using a MECHATROLINK-I network (Baud rate: 4 Mbps), the settings for the number of transmission bytes is disabled and the number of transmission bytes is always 17.

(2) Setting the Station Address

The following table lists the possible settings of the rotary switch (SW1) and the DIP switch (SW2) that can be combined to form a station address.

The factory setting for the station address is 41H (SW2 = OFF, SW1 = 1).

Bit 3 of SW2	SW1	Station Address
OFF	0	Disabled
OFF	1	41H
OFF	2	42H
OFF	3	43H
OFF	4	44H
OFF	5	45H
OFF	6	46H
OFF	7	47H
OFF	8	48H
OFF	9	49H
OFF	A	4AH
OFF	B	4BH
OFF	C	4CH
OFF	D	4DH
OFF	E	4EH
OFF	F	4FH

Bit 3 of SW2	SW1	Station Address
ON	0	50H
ON	1	51H
ON	2	52H
ON	3	53H
ON	4	54H
ON	5	55H
ON	6	56H
ON	7	57H
ON	8	58H
ON	9	59H
ON	A	5AH
ON	B	5BH
ON	C	5CH
ON	D	5DH
ON	E	5EH
ON	F	5FH

IMPORTANT

- Turn the power OFF and then ON again to validate the new settings.

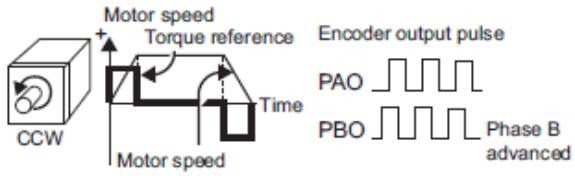
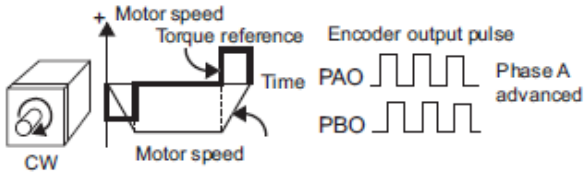
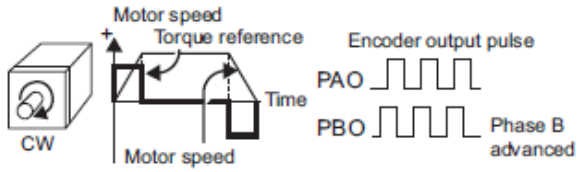
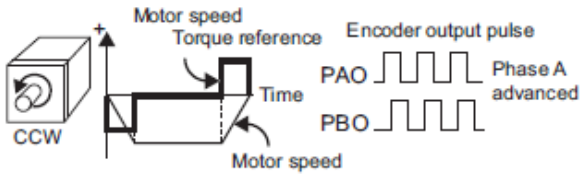
4.2 MECHATROLINK-II Commands

For information on the MECHATROLINK-II commands, refer to *8. Commands*.

4.3 Basic Functions Settings

4.3.1 Servomotor Rotation Direction

The servomotor rotation direction can be reversed with parameter Pn000.0 without changing the polarity of the speed/position reference. This causes the rotation direction of the servomotor to change, but the polarity of the signal, such as encoder output pulses, output from the DRIVER does not change. (refer to *4.4.4 Encoder Output Pulses*)

Parameter		Forward/ Reverse Reference	Direction of Motor Rotation and Encoder Output Pulse	Applicable Over-travel (OT)
Pn000	n.□□□0 Sets CCW as forward direction. [Factory setting]	Forward Reference		P-OT
		Reverse Reference		N-OT
	n.□□□1 Sets CW as forward direction. (Reverse Rotation Mode)	Forward Reference		P-OT
		Reverse Reference		N-OT

Note: SigmaWin+ trace waveforms are shown in the above table.

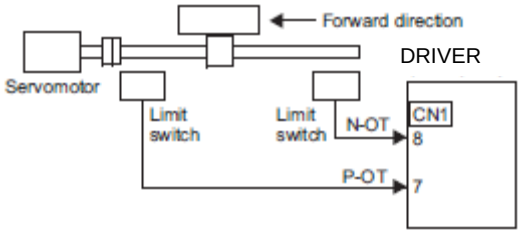
4.3.2 Overtravel

The overtravel limit function forces movable machine parts to stop if they exceed the allowable range of motion and turn ON a limit switch.

⚠ CAUTION

- Installing limit switches

  For machines that move using linear motion, connect limit switches to P-OT and N-OT of CN1 as shown below to prevent machine damage. To prevent a contact fault or disconnection from causing accidents, make sure that the limit switches are normally closed.



- Axes to which external force is applied in overtravel

  Vertical axes:

  Occurrence of overtravel may cause a workpiece to fall, because the /BK signal is on, that is when the lock is released. Set the parameter (Pn001 = n.□□1□) to bring the servomotor to zero clamp state after stopping to prevent a workpiece from falling.

  Other axes to which external force is applied:

  Overtravel will bring about a baseblock state after the servomotor stops, which may cause the servomotor to be pushed back by the load's external force. To prevent this, set the parameter (Pn001 = n.□□1□) to bring the servomotor to zero clamp state after stopping.

  For details on how to set the parameter, refer to *(3) Servomotor Stopping Method When Overtravel is Used*.

(1) Signal Setting

Type	Name	Connector Pin Number	Setting	Meaning
Input	P-OT	CN1-7	ON	Forward run allowed. Normal operation status.
			OFF	Forward run prohibited. Forward overtravel.
	N-OT	CN1-8	ON	Reverse run allowed. Normal operation status.
			OFF	Reverse run prohibited. Reverse overtravel.

Rotation in the opposite direction is possible during overtravel by inputting the reference.

(2) Overtravel Function Setting

Parameters Pn50A and Pn50B can be set to enable or disable the overtravel function.

If the overtravel function is not used, no wiring for overtravel input signals will be required.

Parameter		Meaning	When Enabled	Classification
Pn50A	n.1□□□ [Factory setting]	Inputs the Forward Run Prohibited (P-OT) signal from CN1-7.	After restart	Setup
	n.8□□□	Disables the Forward Run Prohibited (P-OT) signal. Allows constant forward rotation.		
Pn50B	n.□□□2 [Factory setting]	Inputs the Reverse Run Prohibited (N-OT) signal from CN1-8.		
	n.□□□8	Disables the Reverse Run Prohibited (N-OT) signal. Allows constant reverse rotation.		

A parameter can be used to re-allocate input connector number for the P-OT and N-OT signals. Refer to *3.3.1 Input Signal Allocations* for details.

(3) Servomotor Stopping Method When Overtravel is Used

There are three servomotor stopping methods when an overtravel is used.

- Dynamic brake
  By short-circuiting the electric circuits, the servomotor comes to a quick stop.
- Decelerate to a stop
  Stops by using emergency stop torque.
- Coast to a stop
  Stops naturally, with no control, by using the friction resistance of the servomotor in operation.

After servomotor stopping, there are two modes.

- Coast mode
  Stopped naturally, with no control, by using the friction resistance of the servomotor in operation.
- Zero clamp mode
  A mode forms a position loop by using the position reference zero.

The servomotor stopping method when an overtravel (P-OT, N-OT) signal is input while the servomotor is operating can be set with parameter Pn001.

Parameter		Stop Method	Mode After Stopping	When Enabled	Classification
Pn001	n.□□00 [Factory setting]	DB	Coast	After restart	Setup
	n.□□01				
	n.□□02	Coast			
	n.□□1□	Deceleration to a stop	Zero clamp		
	n.□□2□		Coast		

- A servomotor under torque control cannot be decelerated to a stop. The servomotor is stopped with the dynamic braking (DB) or coasts to a stop according to the setting of Pn001.0. After the servomotor stops, the servomotor will enter a coast state.
- For details on servomotor stopping methods after the SV_OFF command is received or an alarm occurs, refer to *4.3.5 Stopping Servomotors after SV_OFF Command or Alarm Occurrence*.

-When Servomotor Stopping Method is Set to Decelerate to Stop

Emergency stop torque can be set with Pn406.

Pn406	Emergency Stop Torque		Speed Position Torque		Classification
	Setting Range	Setting Unit	Factory Setting	When Enabled	
	0 to 800	1%	800	Immediately	Setup

- The setting unit is a percentage of the rated torque.
- The factory setting is 800% so that the setting is large enough a value to operate the servomotor at maximum torque. The maximum value of emergency stop torque that is actually available, however, is limited to the maximum torque of the servomotor.

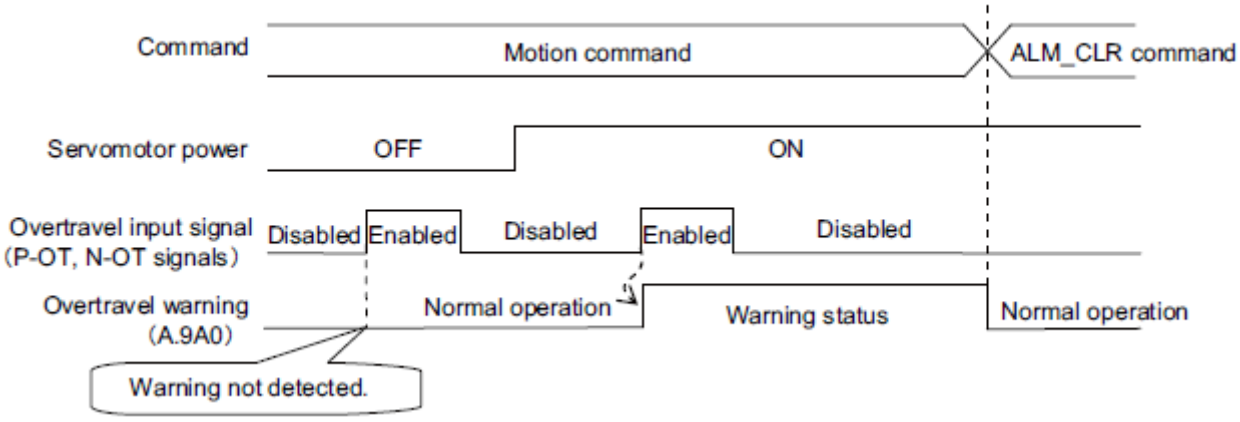
(4) Overtravel Warning Function

This function detects an overtravel warning (A.9A0) if overtravel occurs while the servomotor power is ON. Using this function enables notifying the host PC or PLC...etc when the DRIVER detects overtravel even if the overtravel signal is ON only momentarily.

To use the overtravel warning function, set digit 4 of Pn00D to 1 (detects overtravel warning).

Note: The overtravel warning function is supported by software version 001A or later. The software version can be checked with SigmaWin+. For details, refer to *6.13 Product Information Display (Fn012)*.

- Warning Output Timing



<Notes>

- Warnings are detected for overtravel in the same direction as the reference.
- Warnings are not detected for overtravel in the reverse direction from the reference.
  Example:A warning will not be output for a forward reference even if the N-OT signal (reverse run prohibited) turns ON.
- A warning can be detected in either the forward or reverse direction, when there is no reference.
- A warning will not be detected when the servomotor power is OFF even if overtravel occurs.
- A warning will not be detected when the servomotor power changes from OFF to ON even if overtravel status exists.
- To clear the overtravel warning, send a Clear Warning or Alarm command (ALM_CLR) regardless of the status of the servomotor power and the overtravel signal. If the warning is cleared by this method during an overtravel state, the occurrence of the warning will not be indicated until the overtravelling is corrected and reset.
- The overtravel warning will be detected when the software limit is in effect.

⚠ CAUTION

- The overtravel warning function only detects warnings. It does not affect on stopping for overtravel or motion operations at the host PC or PLC...etc. The next step (e.g., the next motion or other command) can be executed even if an overtravel warning exists. However, depending on the processing specifications and programming for warnings in the host PC or PLC...etc, operation may be affected when an overtravel warning occurs (e.g., motion may stop or not stop). Confirm the specifications and programming in the host PC or PLC...etc.
- When an overtravel occurs, the DRIVER will perform stop processing for overtravel. Therefore, when an overtravel warning occurs, the servomotor may not reach the target position specified by the host PC or PLC...etc. Check the feedback position to make sure that the axis is stopped at a safe position.

- Related Parameter

Parameter		Meaning	When Enabled	Classification
Pn00D	n.0□□□ [Factory setting]	Does not detect overtravel warning.	Immediately	Setup
	n.1□□□	Detects overtravel warning.		

4.3.3 Software Limit Settings

The software limits set limits in software for machine movement that do not use the overtravel signals (P-OT and N-OT). If a software limit is exceeded, an emergency stop will be executed in the same way as it is for overtravel.

(1) Software Limit Function

The software limit function can be enabled or disabled.

Use the parameter Pn801.0 to enable the software limit function.

The software limit function can be enabled under the following conditions. Under all other circumstances, the software limits will not be enabled even if a software limit is exceeded.

- The ZRET command has been executed.
- REFE = 1 using the POS_SET command.

Enable or disable the software limits using one of the following settings.

Parameter		Description	When Enabled	Classification
Pn801	n.□□□0	Software limits enabled in both direction.	Immediately	Setup
	n.□□□1	Forward software limit enabled.		
	n.□□□2	Reverse software limit enabled.		
	n.□□□3 [Factory setting]	Both software limits disabled.		

(2) Software Limit Check using References

Enable or disable software limit checks when target position references such as POSING or INTERPOLATE are input. When the input target position exceeds the software limit, a deceleration stop will be performed from the software limit set position.

Parameter		Description	When Enabled	Classification
Pn801	n.□0□□ [Factory setting]	No software limit check using references.	Immediately	Setup
	n.□1□□	Software limit check using references.		

(3) Software Limit Setting

Set software limits value in the positive and negative directions.

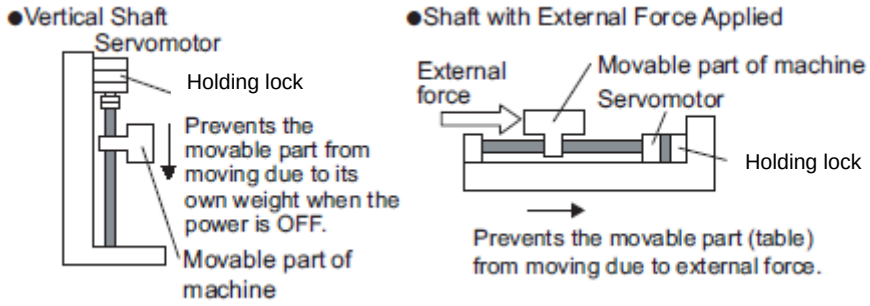
Because the limit zone is set according to the forward or reverse direction, the reverse limit must be less than the forward limit.

Pn804	Forward Software Limit			Position	Classification
	Setting Range	Setting Unit	Factory Setting	When Enabled	
	-1073741823 to 1073741823	1 Reference Unit	819191808	Immediately	Setup
Pn806	Reverse Software Limit			Position	Classification
	Setting Range	Setting Unit	Factory Setting	When Enabled	
	-1073741823 to 1073741823	1 Reference Unit	-819191808	Immediately	Setup

4.3.4 Holding Locks

A holding lock is a lock used to hold the position of the movable part of the machine when the DRIVER is turned OFF so that movable part does not move due to gravity or external forces. Holding locks are built into servomotors with locks.

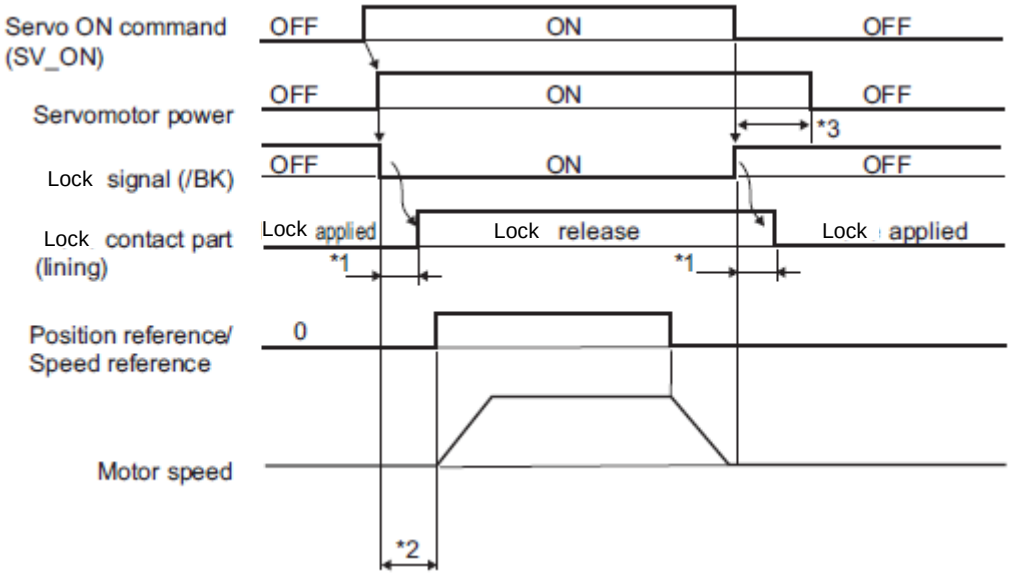
The holding lock is used in the following cases.



IMPORTANT

- The brake built into the servomotor with brakes is a de-energization brake, which is used only to hold and cannot be used for braking.
- Use the holding lock only to hold a stopped servomotor.

There is a delay in the braking operation. Set the following ON/OFF timing.



∗1. The operation delay time of the lock depends on the model. For details, refer to *Lock Operation Delay Time* shown below.

∗2. After the SV_ON command has been sent and 50 ms has passed since the lock was released, output the reference from the host PC or PLC...etc to the DRIVER.

∗3. Use Pn506, Pn507, and Pn508 to set the timing of when the lock will be activated and when the servomotor power will be turned OFF.

Lock Operation Delay Time

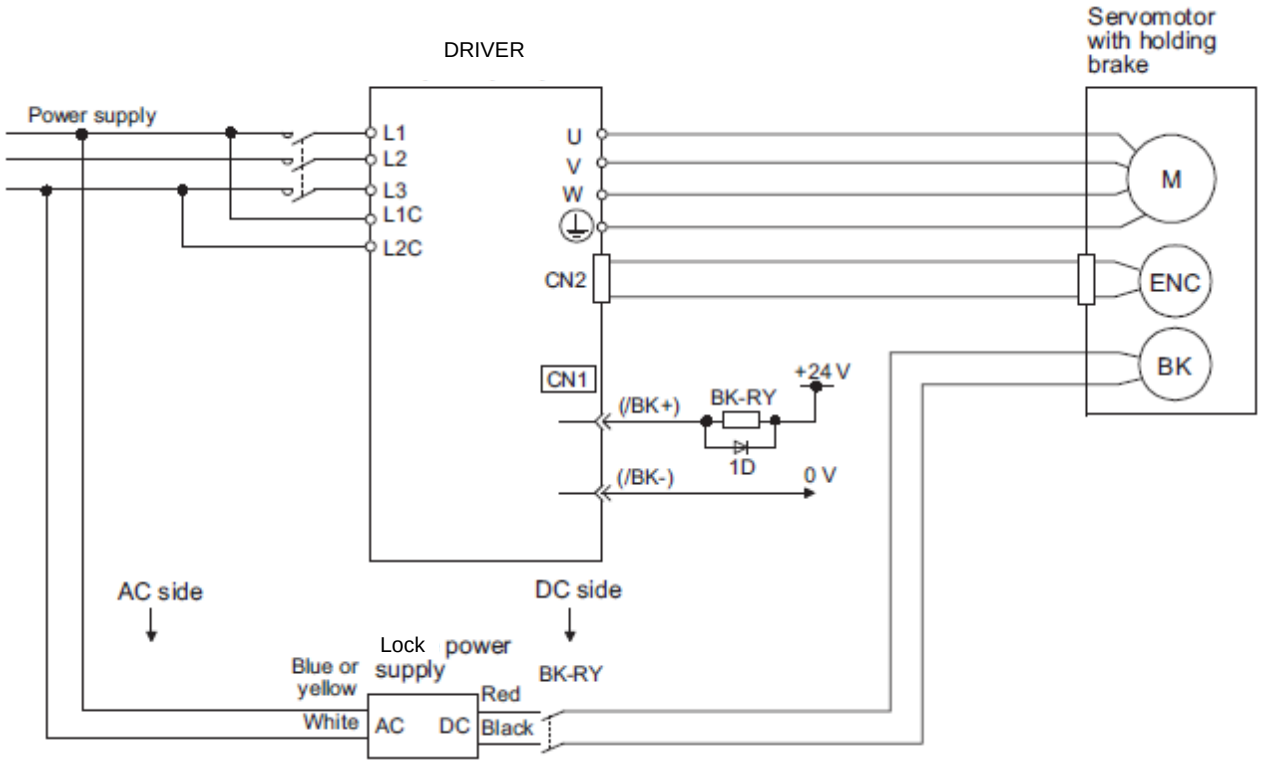
Model	Voltage	Lock Release Time (ms)	Lock Applied Time (ms)
LECYM2-V5, V7, V8	24VDC	60	100
LECYM2-V9		80	100

Note: The above operation delay time is an example when the power supply is turned ON and OFF on the DC side.
Be sure to evaluate the above times on the actual equipment before using the application.

(1) Wiring Example

Use the lock signal (/BK) and the lock power supply to form a lock ON/OFF circuit. The following diagram shows a standard wiring example.

The timing can be easily set using the lock signal (/BK).

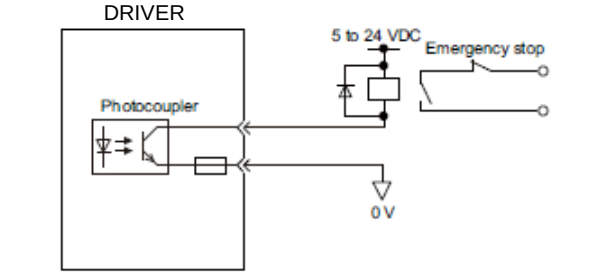


BK-RY: Lock control relay
24 VDC power supply is not included.

IMPORTANT

- Select the optimum surge absorber in accordance with the applied lock current and lock power supply.
  When using the 24-V power supply: Z15D121 (Made by SEMITEC Corporation)
- After the surge absorber is connected, check the total time the lock is applied for the system. Depending on the surge absorber, the total time the lock is applied can be changed.
- Configure the relay circuit to apply the holding lock by the emergency stop.

Relay Circuit Example



- The allocation of the /BK signal can be changed. Refer to *(3) Lock signal (/BK) Allocation* to set the parameter Pn50F.
- When using a 24-V lock, separate the 24-VDC power supply from other power supplies, such as the one used for the I/O signals of CN1 connectors. Always install the 24-VDC power supply separately. If the power supply is shared, the I/O signals might malfunction.

(2) Lock signal (/BK) Setting

This output signal controls the lock. The allocation of the /BK signal can be changed. Refer to *(3) Lock Signal (/BK) Allocation* for allocation.

The /BK signal turns OFF (applies the lock) when an alarm is detected or the SV_OFF command is received. The lock OFF timing can be adjusted with Pn506.

Type	Name	Connector Pin Number	Setting	Meaning
Output	/BK	CN1-1, CN1-2	ON (closed)	Releases the lock.
			OFF (open)	Applies the lock.

IMPORTANT

The /BK signal is still ON during overtravel and the lock is still released.

(3) Lock signal (/BK) Allocation

Use parameter Pn50F.2 to allocate the /BK signal.

Parameter		Connector Pin Number		Meaning	When Enabled	Classification
		+ Terminal	- Terminal			
Pn50F	n.□0□□	–	–	The /BK signal is not used.	After restart	Setup
	n.□1□□ [Factory setting]	CN1-1	CN1-2	The /BK signal is output from output terminal CN1-1, 2.		
	n.□2□□	CN1-23	CN1-24	The /BK signal is output from output terminal CN1-23, 24.		
	n.□3□□	CN1-25	CN1-26	The /BK signal is output from output terminal CN1-25, 26.		

IMPORTANT

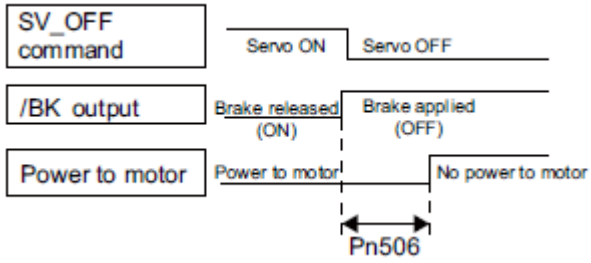
When multiple signals are allocated to the same output terminal, the signals are output with OR logic. For the /BK signal, do not use the output terminal that is already being used for another signal.

(4) Lock ON Timing after the Servomotor Stops

When the servomotor stops, the /BK signal turns OFF at the same time as the SV_OFF command is received. Use parameter Pn506 to change the timing to turn OFF the servomotor power after the SV_OFF command has been received.

Pn506	Lock Reference-Servo OFF Delay Time			Speed Position Torque	Classification
	Setting Range	Setting Unit	Factory Setting	When Enabled	
	0 to 50	10 ms	0	Immediately	Setup

- When using the servomotor to control a vertical axis, the machine movable part may shift slightly depending on the lock ON timing due to gravity or an external force. To eliminate this slight shift, set parameter so that the power to the servomotor turns OFF after the brake is applied.
- This parameter changes the lock ON timing while the servomotor is stopped.



IMPORTANT

The servomotor will turn OFF immediately when an alarm occurs, regardless of the setting of this parameter. The machine movable part may shift due to gravity or external force before the lock operates.

(5) Lock signal (/BK) Output Timing during Servomotor Rotation

If an alarm occurs while the servomotor is rotating, the servomotor will come to a stop and the lock signal (/BK) will be turned OFF. The timing of lock signal (/BK) output can be adjusted by setting the lock reference output speed level (Pn507) and the waiting time for lock signal when motor running (Pn508).

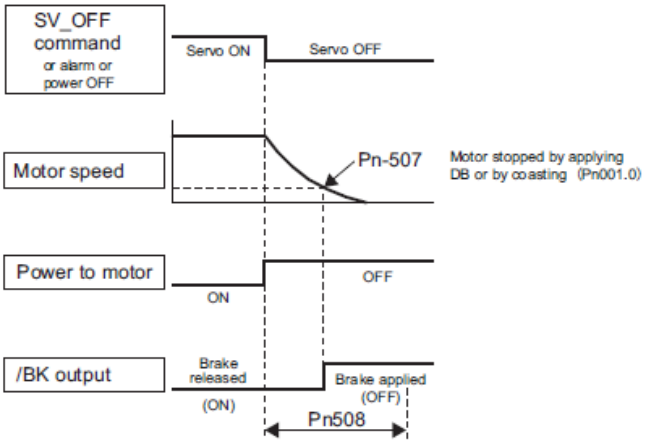
Note: If the servomotor is set so that it comes to a zero-speed stop for an alarm, follow the information in *(4) Lock ON Timing after the Servomotor Stops* after the servomotor comes to a stop for a zero position reference.

Pn507	Lock Reference Output Speed Level			Speed Position Torque	Classification
	Setting Range	Setting Unit	Factory Setting	When Enabled	
	0 to 10000	1 min^{-1}	100	Immediately	Setup
Pn508	Waiting Time for Lock signal When Motor Running			Speed Position Torque	Classification
	Setting Range	Setting Unit	Factory Setting	When Enabled	
	10 to 100	10 ms	50	Immediately	Setup

/BK Signal Output Conditions When Servomotor Rotating

The /BK signal goes to high level (lock ON) when either of the following conditions is satisfied:

- When the motor speed falls below the level set in Pn507 after the power to the servomotor is turned OFF.
- When the time set in Pn508 is exceeded after the power to the servomotor is turned OFF.



IMPORTANT

- The servomotor will be limited to its maximum speed even if the value set in Pn507 is higher than the maximum speed.
- Do not allocate the rotation detection signal (/TGON) and the lock signal (/BK) to the same terminal. The /TGON signal will otherwise be turned ON by the falling speed on a vertical axis, and the brake may not operate.
  For the /BK signal, do not use the terminal that is already being used for another signal.

4.3.5 Stopping Servomotors after SV_OFF Command or Alarm Occurrence

The servomotor stopping method can be selected after the SV_OFF command is received or an alarm occurs.

IMPORTANT

- Dynamic braking (DB) is used for emergency stops. The DB circuit will operate frequently if the power is turned ON and OFF or the SV_ON command and SV_OFF command are received with a reference input applied to start and stop the servomotor, which may result in deterioration of the internal elements in the DRIVER. Use speed input references or position references to start and stop the servomotor.
- If the main circuit power supply or the control power supply is turned OFF but the SV_OFF command has not been received, the stopping method for servomotor cannot be set in the parameters. Use the following method to stop the servomotor.

  If turning OFF the main circuit power supply, but the SV_OFF command has not been received, the servomotor will be stopped by dynamic braking.
- If turning OFF the control power supply, the servomotor will be stopped by dynamic braking.
- If the servomotor must be stopped by coasting rather than by dynamic braking when the main circuit power supply or the control power supply is turned OFF but the SV_OFF command has not been received, arrange the sequence externally so the current will be cut off for servomotor wires U, V, and W.
- To minimize the coasting distance of the servomotor to come to a stop when an alarm occurs, the zero-speed stopping method is factory-set for alarms to which the zero-speed stop method is applicable. The DB stopping method may be more suitable than the zero-speed stopping method, however, depending on the application.
  For example, for multiple axes coupling operation (a twin-drive operation), machinery damage may result if a zero-speed stop alarm occurs for one of the coupled shafts and the other shaft stops by dynamic brake. In such cases, change the method to the DB stopping method.

(1) Stopping Method for Servomotor after SV_OFF Command is Received

Use Pn001.0 to select the stopping method for the servomotor after the SV_OFF command is received.

Parameter		Stop Mode	Mode After Stopping	When Enabled	Classification
Pn001	n.□□□0 [Factory setting]	DB	DB	After restart	Setup
	n.□□□1		Coast		
	n.□□□2	Coast	Coast		

Note: Similar to the Coast Mode, the n.□□□0 setting (which stops the servomotor by dynamic braking and then holds it in Dynamic Brake Mode) does not generate any braking force when the servomotor stops or when it rotates at very low speed.

(2) Stopping Method for Servomotor When an Alarm Occurs

There are two types of alarms (Gr.1 and Gr.2) that depend on the stopping method when an alarm occurs. Select the stopping method for the servomotor when an alarm occurs using Pn001.0 and Pn00B.1.

The stopping method for the servomotor for a Gr.1 alarm is set to Pn001.0.
The stopping method for the servomotor for a Gr.2 alarm is set to Pn00B.1.
Refer to the information on alarm stopping methods in *9.1.1 List of Alarms*.

- Stopping Method for Servomotor for Gr.1 Alarms

The stopping method of the servomotor when a Gr.1 alarm occurs is the same as that in *(1) Stopping Method for Servomotor after SV_OFF Command is Received*.

Parameter		Stop Mode	Mode After Stopping	When Enabled	Classification
Pn001	n.□□□0 [Factory setting]	DB	DB	After restart	Setup
	n.□□□1		Coast		
	n.□□□2	Coast	Coast		

- Stopping Method for Servomotor for Gr.2 Alarms

Parameter		Stop Mode	Mode After Stopping	When Enabled	Classification
Pn00B	Pn001				
n.□□0□ [Factory setting]	n.□□□0 [Factory setting]	Zero-speed stopping*	DB	After restart	Setup
	n.□□□1		Coast		
	n.□□□2				
n.□□1□	n.□□□0 [Factory setting]	DB	DB		
	n.□□□1		Coast		
	n.□□□2	Coast			

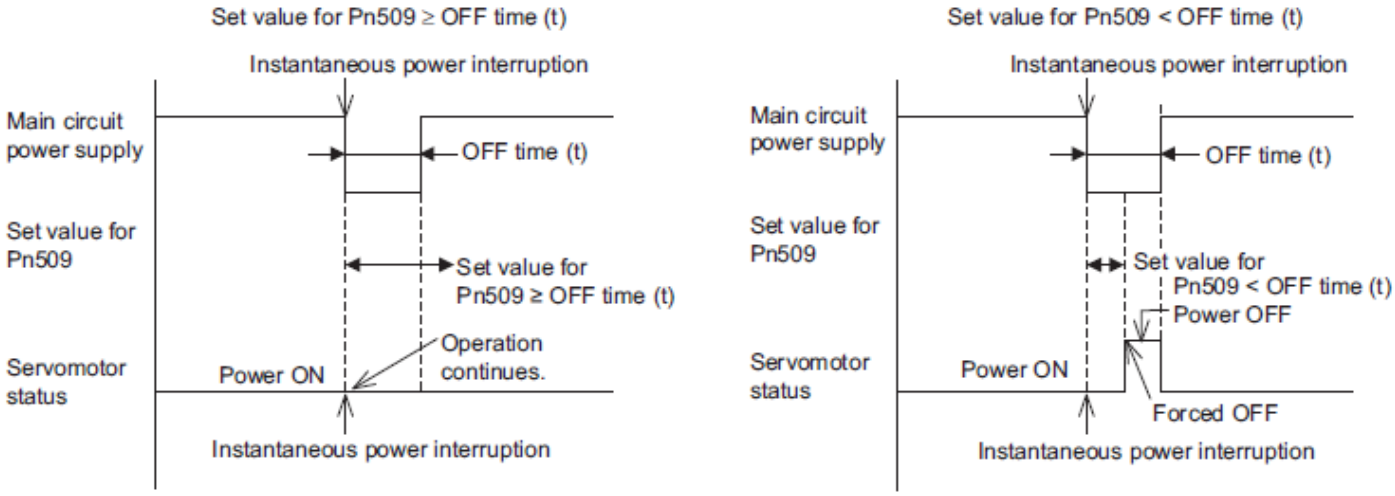
∗ Zero-speed stopping: The speed reference is set to 0 to stop quickly.
Note: The setting of Pn00B.1 is effective for position control and speed control. Pn00B.1 will be ignored for torque control and only the setting of Pn001.0 will be valid.

4.3.6 Instantaneous Power Interruption Settings

Determines whether to continue operation or turn OFF the servomotor's power when the power supply voltage to the DRIVER's main circuit is interrupted.

Pn509	Instantaneous Power Cut Hold Time			Speed Position Torque	Classification
	Setting Range	Setting Unit	Factory Setting	When Enabled	
	20 to 1000	1 ms	20	Immediately	Setup

If the power interruption time is shorter than the set value in Pn509, the servomotor will continue operation. If it is longer than the set value, the servomotor's power will be turned OFF during the power interruption. The servomotor is turned ON when power supply to the main circuit recovers.



Note: If the instantaneous power interruption is longer than the set value of Pn509, the /S-RDY signal turns OFF.

IMPORTANT

- The holding time of the control power supply for the 200-V DRIVERs is approximately 100 ms. If the control power supply makes control impossible during an instantaneous power interruption, the same operation will be performed as for normally turning OFF the power supply, and the setting of Pn509 will be ignored.
- The holding time of the main circuit power supply varies with the output of the DRIVER. If the load on the servomotor is large and an undervoltage alarm (A.410) occurs, the setting of Pn509 will be ignored.

If the uninterruptible power supplies are used for the control power supply and main circuit power supply, the DRIVER can withstand an instantaneous power interruption period in excess of 1000 ms.

4.3.7 SEMI F47 Function (Torque Limit Function for Low DC Power Supply Voltage for Main Circuit)

The torque limit function detects an undervoltage warning and limits the output current if the DC power sup- ply voltage for the main circuit in the DRIVER drops to a specified value because the power was momentarily interrupted or the power supply voltage for the main circuit was temporality lowered.

This function complies with SEMI F47 standards for semiconductor production equipment.

Combining this function with the parameter for Instantaneous Power Cut Hold Time allows the servomotor to continue operating without stopping for an alarm or without recovery work even if the power supply voltage drops.

IMPORTANT

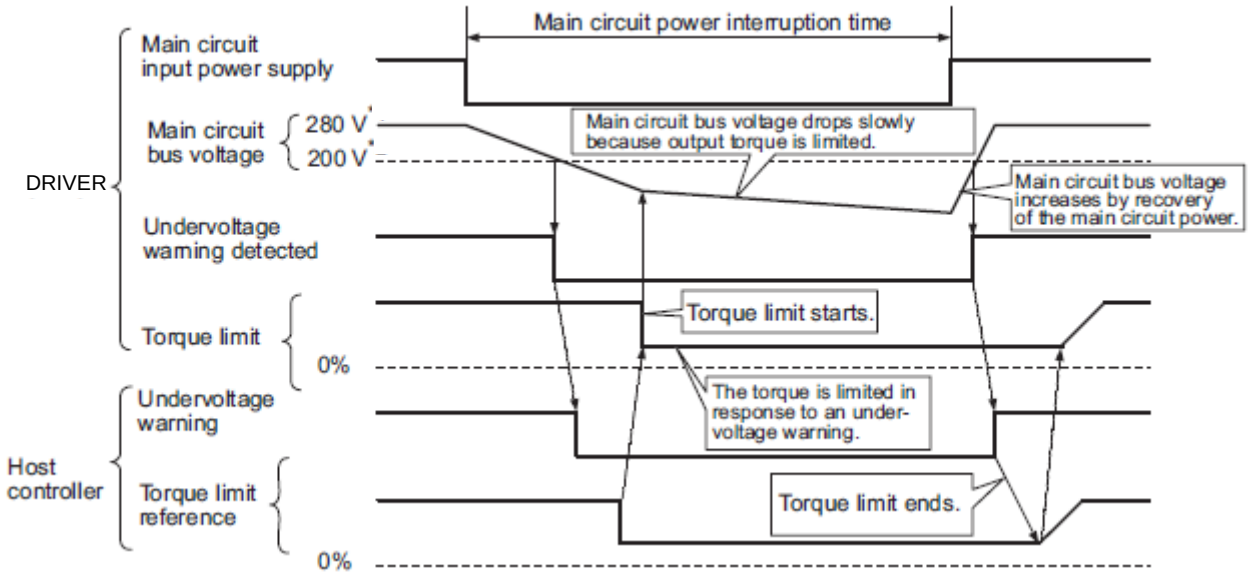
- This function is able to cope with instantaneous power interruptions in the voltage and time ranges stipulated in SEMI F47. An uninterruptible power supply (UPS) is required as a backup for instantaneous power interruptions that exceed these voltage and time ranges.
- This function is intended for voltage drops in the main circuit power supply.
- Set the host PC or PLC...etc and DRIVER torque limit so that a torque reference that exceeds the specified acceleration will not be output when the power supply for the main circuit is restored.
- Do not limit the torque to values lower than the holding torque for the vertical axis.
- This function limits torque within the range of the DRIVER's capability when the power is cut. It is not intended for use under all load and operating conditions. Use the actual machine to set parameters while confirming correct operation.
- Setting the Instantaneous Power Cut Hold Time lengthens the amount of time from when the power supply is turned OFF until the motor current turns OFF. Send the SV_OFF command to instantly stop the motor current.

(1) Execution Method

This function can be executed either with the host PC or PLC...etc and the DRIVER or with the DRIVER only.

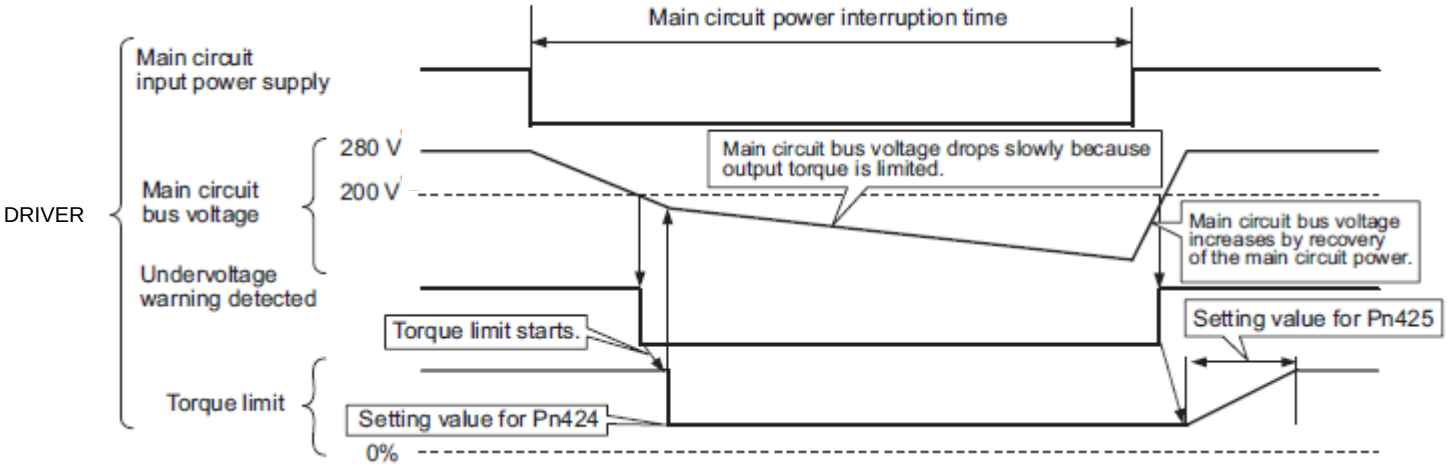
- With the Host PC or PLC...etc and the DRIVER

The host PC or PLC...etc limits the torque in response to an undervoltage warning.
The host PC or PLC...etc removes the torque limit after the undervoltage warning is cleared.



- With the DRIVER only

The torque is limited in the DRIVER in response to an undervoltage warning.
The DRIVER controls the torque limit value in the set time after the undervoltage warning is cleared.
Use Pn008.1 to specify whether the function is executed by the host PC or PLC...etc and DRIVER or by the DRIVER only.



(2) Related Parameters

Parameter		Meaning	When Enabled	Classification
Pn008	n.□□0□ [Factory setting]	Does not detect undervoltage.	After restart	Setup
	n.□□1□	Detects warning and limits torque by host PC or PLC...etc.		
	n.□□2□	Detects warning and limits torque by Pn424 and Pn425. (Only in the DRIVER)		

Pn424	Torque Limit at Main Circuit Voltage Drop			Speed Position Torque	Classification
	Setting Range	Setting Unit	Factory Setting	When Enabled	
	0 to 100	1%*	50	Immediately	Setup
Pn425	Release Time for Torque Limit at Main Circuit Voltage Drop			Speed Position Torque	Classification
	Setting Range	Setting Unit	Factory Setting	When Enabled	
	0 to 1000	1 ms	100	Immediately	Setup

* The setting unit is a percentage of the rated torque.

Pn509	Instantaneous Power Cut Hold Time			Speed Position Torque	Classification
	Setting Range	Setting Unit	Factory Setting	When Enabled	
	20 to 1000	1 ms	20	Immediately	Setup

Note: When using SEMI F47 function, set 1000 ms.

4.3.8 Setting Motor Overload Detection Level

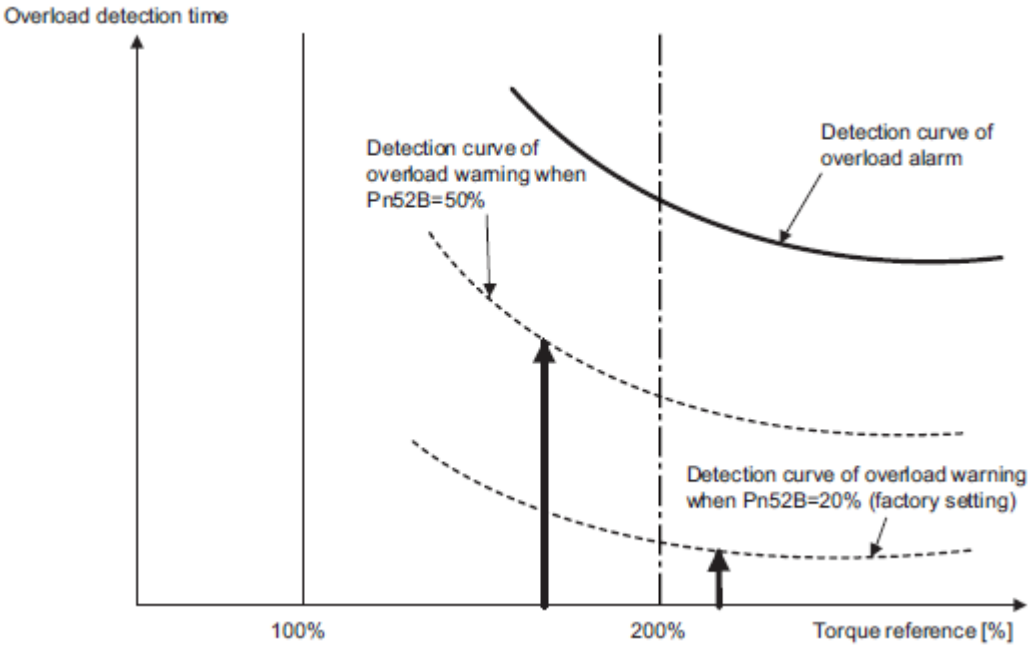
In this DRIVER, the detection timing of the warnings and alarms can be changed by changing how to detect an overload warning (A.910) and overload (low load) alarm (A.720).

The overload characteristics and the detection level of the overload (high load) alarm (A.710) cannot be changed.

(1) Changing Detection Timing of Overload Warning (A.910)

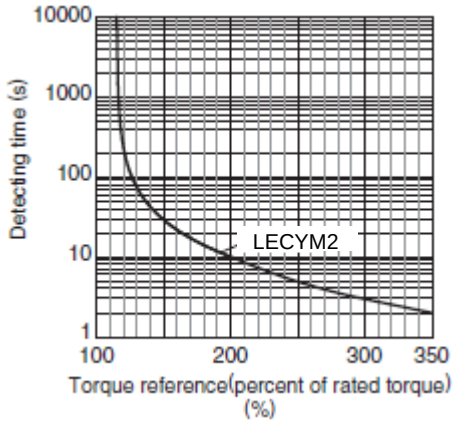
The overload warning level is set by default to 20% so that an overload warning is detected in 20% of the time required to detect an overload alarm. The time required to detect an overload warning can be changed by changing the setting of the overload warning level (Pn52B). This protective function enables the warning out- put signal (/WARN) to serve as a protective function and to be output at the best timing for your system.

The following graph shows an example of the detection of an overload warning when the overload warning level (Pn52B) is changed from 20% to 50%. An overload warning is detected in half of the time required to detect an overload alarm.



Pn52B	Overload Warning Level			Speed Position Torque	Classification
	Setting Range	Setting Unit	Factory Setting	When Enabled	
	1 to 100	1%	20	Immediately	Setup

Overload characteristics for LECYM2 series



(2) Changing Detection Timing of Overload (Low Load) Alarm (A.720)

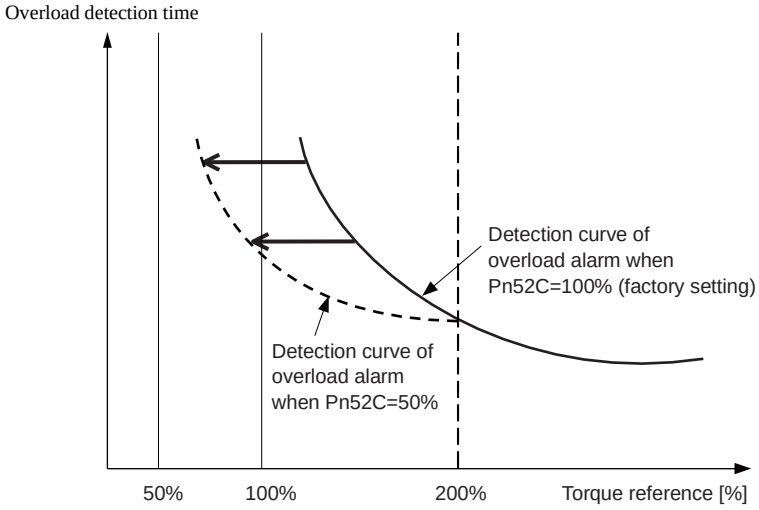
An overload (low load) alarm (A.720) can be detected earlier to protect the servomotor from overloading. The time required to detect an overload alarm can be shortened by using the derated motor base current obtained with the following equation.

Note: The detection level of the overload (high load) alarm (A.710) cannot be changed.

Motor base current × Derating of base current at detecting overload of motor (Pn52C)
= Derated motor base current

Motor base current: Threshold value of motor current to start calculation for overload alarm
Derating of base current at detecting overload of motor (Pn52C): Derating of motor base current

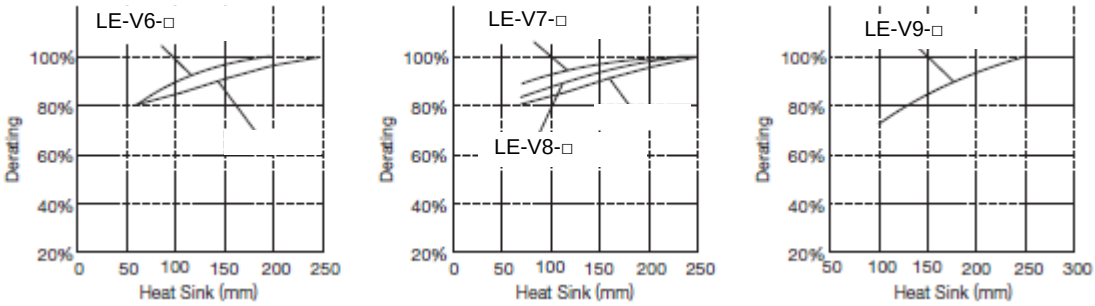
The following graph shows an example of the detection of an overload alarm when Pn52C is set to 50%. The calculation for the overload of motors starts at 50% of the motor base current and then an overload alarm will be detected earlier.
Changing the setting of Pn52C will change the detection timing of the overload alarm, so the time required to detect the overload warning will also be changed.



Note: Refer to *Overload Characteristics* listed in the *(1) Changing Detection Timing of Overload Warning (A.910)*.

Pn52C	Derating of Base Current at Detecting Overload of Motor [Speed] [Position] [Torque]				Classification
	Setting Range	Setting Unit	Factory Setting	When Enabled	
	10 to 100	1%	100	After restart	Setup

As a guideline of motor heating conditions, the relationship between the heat sink sizes and deratings of base current is shown in a graph.
Set Pn52C to a value in accordance with the heat sink size and derating shown in the graph, so that an overload alarm can be detected at the best timing to protect the servomotor from overloading.



4.4 Trial Operation

This section describes a trial operation using MECHATROLINK-II communications.

4.4.1 Inspection and Checking before Trial Operation

To ensure safe and correct trial operation, inspect and check the following items before starting trial operation.

(1) DRIVERs

Inspect and check the following items, and take appropriate measures before performing trial operation if any problem exists.

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

4.4.2 Trial Operation via MECHATROLINK-II

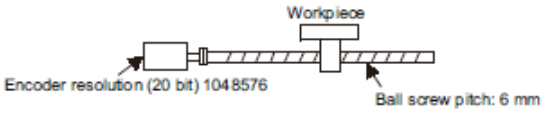
The following table provides the procedures for trial operation via MECHATROLINK-II.

Step	Description	Reference
1	Confirm that the wiring is correct, and then connect the I/O signal connector (CN1 connector).	*3 Wiring and Connection*
2	Turn ON the power to the DRIVER. If the DRIVER is receiving power, the CHARGE, the POWER, and the COM LED indicators on the DRIVER will light up. Note: If the COM LED does not turn ON, recheck the settings of MECHATROLINK-II setting switches (SW1, SW2) and then turn the power OFF and ON again.	–
3	Send the CONNECT command. In the response data from the DRIVER, the alarm code "00" is cleared to show normal operation. The response data from the DRIVER may be confirmed with the SMON command.	*8 MECHATROLINK-II Commands*
4	Check the product type using an ID_RD command. A reply showing the product type is received from the DRIVER.	
5	Set the following items to the necessary settings for a trial operation. • Electronic gear settings • Rotational direction of servomotor • Overtravel	*4.4.3 Electronic Gear* *4.3.1 Servomotor Rotation Direction* *4.3.2 Overtravel*
6	Save these settings (step 5). If saving the settings in the PC or PLC...etc, use the PRM_WR command. If saving settings in the DRIVER, use the PPRM_WR command.	*8 MECHATROLINK-II Commands*
7	Send the SV_ON command. A reply showing that the servomotor has switched to Drive status and that SVON=1 (servomotor power is ON) is received.	
8	Run the servomotor at low speed. <Example using a positioning command> Command used: POSING Command setting: Option = 0, Positioning position =10000 (If using the absolute encoder, add 10000 to the present position), rapid traverse speed= 400	–
9	Check the following points while running the servomotor at low speed (step 8). • Confirm that the rotational direction of the servomotor correctly coincides with the forward rotation or reverse rotation reference. If they do not coincide, reset the direction. • Confirm that no unusual vibrations, noises, or temperature rises occur. If any abnormalities are seen, correct the conditions. Note: Because the running-in of the load machine is not sufficient at the time of the trial operation, the servomotor may become over- loaded.	*4.3.1 Servomotor Rotation Direction* *9.4 Troubleshooting Malfunction Based on Operation and Conditions of the Servomotor*

4.4.3 Electronic Gear

The electronic gear enables the workpiece travel distance per reference unit input from the host PC or PLC...etc. The minimum unit of the position data moving a load is called a reference unit.

The section indicates the difference between using and not using an electronic gear when a workpiece is moved 10 mm in the following configuration.



When the Electronic Gear is Not Used:

① Calculate the revolutions.
1 revolution is 6 mm. Therefore, 10 ÷ 6 = 10/6 revolutions.

② Calculate the required reference units.
1048576 reference units is 1 revolution. Therefore, 10/6 × 1048576 = 1747626.66 reference units.

③ Input 1747627 references as reference units.

Reference units must be calculated per reference. → complicated

When the Electronic Gear is Used:

The reference unit is 1 µm. Therefore, to move the workpiece 10 mm (10000 µm),
1 reference unit = 1 µm, so 10000 ÷ 1 = 10000 reference units.
Input 10000 reference units.

Calculation of reference units per reference is not required. → simplified

(1) Electronic Gear Ratio

Set the electronic gear ratio using Pn20E and Pn210.

Pn20E	Electronic Gear Ratio (Numerator)			Position	Classification
	Setting Range	Setting Unit	Factory Setting	When Enabled	
	1 to 1073741824	1	4	After restart	Setup
Pn210	Electronic Gear Ratio (Denominator)			Position	Classification
	Setting Range	Setting Unit	Factory Setting	When Enabled	
	1 to 1073741824	1	1	After restart	Setup

If the gear ratio of the servomotor and the load shaft is given as n/m where m is the rotation of the servomotor and n is the rotation of the load shaft,

$$\text{Electronic gear ratio: } \frac{B}{A} = \frac{Pn20E}{Pn210} = \frac{\text{Encoder resolution}}{\text{Travel distance per load shaft revolution (reference units)}} \times \frac{m}{n}$$

- Encoder Resolution

Encoder resolution is 1048576.

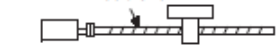
IMPORTANT

Electronic gear ratio setting range: 0.001 ≤ Electronic gear ratio (B/A) ≤ 4000

If the electronic gear ratio is outside this range, a parameter setting error 1 (A.040) will be output.

(2) Electronic Gear Ratio Setting Examples

The following examples show electronic gear ratio settings for different load configurations.

Step	Operation	Ball Screw
		Reference unit: 0.001 mm Load shaft  20-bit encoder Ball screw pitch: 6 mm
1	Check machine specifications.	· Ball screw pitch: 6 mm · Gear ratio: 1/1
2	Check the encoder resolution.	1048576 (20-bit)
3	Determine the reference unit used.	Reference unit: 0.001 mm (1 µm)
4	Calculate the travel distance per load shaft revolution. (Reference unit)	6 mm/0.001 mm=6000
5	Calculate the electronic gear ratio.	$\frac{B}{A} = \frac{1048576}{6000} \times \frac{1}{1}$
6	Set parameters.	Pn20E: 1048576 Pn210: 6000

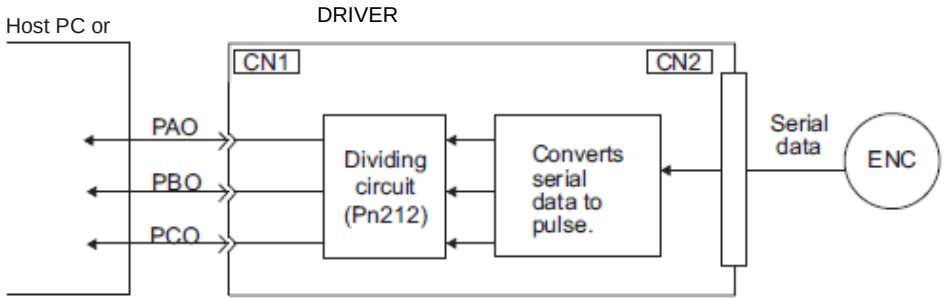
4.4.4 Encoder Output Pulses

The encoder pulse output is a signal that is output from the encoder and processed inside the DRIVER. It is then output externally in the form of two phase pulse signal (phases A and B) with a 90˚ phase differential. It is used as the position feedback to the host PC or PLC...etc.

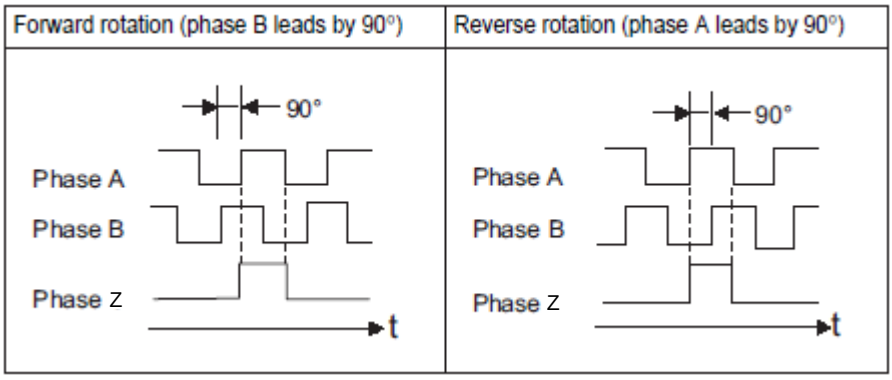
Signals and output phase form are as shown below.

(1) Signals

Type	Signal Name	Connector Pin Number	Name	Remarks
Output	PAO	CN1-17	Encoder output pulse: phase A	These encoder pulse output pins output the number of pulses per motor revolution that is set in Pn212. Phase A and phase B are different from each other in phase by an electric angle of 90˚.
	/PAO	CN1-18		
	PBO	CN1-19	Encoder output pulse: phase B	
	/PBO	CN1-20		
	PCO	CN1-21	Encoder output pulse: phase Z	One pulse is output per motor rotation.
	/PCO	CN1-22		



(2) Output Phase Form



Note: The pulse width for phase Z (origin pulse) changes according to the setting of the encoder output pulses (Pn212) and becomes the same as that for phase A.
Even in reverse rotation mode (Pn000.0 = 1), the output phase form is the same as that for the standard setting (Pn000.0 = 0) above.

IMPORTANT

If using the DRIVER's phase-Z pulse output for a zero point return, rotate the servomotor two or more times before starting a zero point return. If the servomotor cannot be rotated two or more times, perform a zero point return at a motor speed of 600 min^{-1} or below. If the motor speed is faster than 600 min^{-1}, the phase-Z pulse may not be output correctly.

4.4.5 Setting Encoder Output Pulse

Set the encoder output pulse using the following parameter.

Pn212	Encoder Output Pulses [Speed] [Position] [Torque]				Classification
	Setting Range	Setting Unit	Factory Setting	When Enabled	
	16 to 1073741824	1 P/rev	2048	After restart	Setup

Pulses from the encoder per revolution are divided inside the DRIVER by the number set in this parameter before being output. Set the number of encoder output pulses according to the system specifications of the machine or host PC or PLC...etc.

According to the encoder resolution, the number of encoder output pulses are limited.

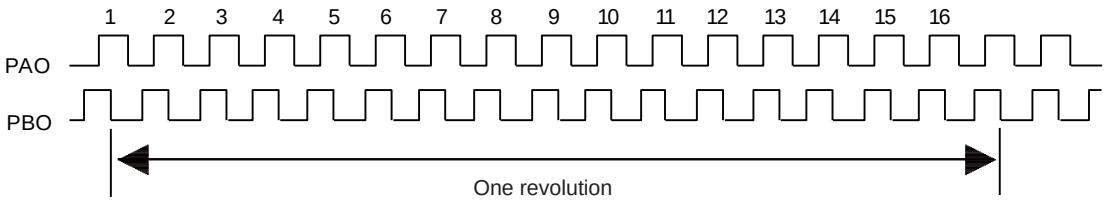
Setting Range of Encoder Output Pulses (P/Rev)	Setting Unit	Encoder Resolution	Upper Limit of Servomotor Speed for Set Encoder Output Pulses (min^{-1})
		20 bits (1,048,576 pulses)	
16 to 2048	1	–	6000
16 to 16384	1	○	6000
16386 to 32768	2	○	3000
32772 to 65536	4	○	1500
65544 to 131072	8	○	750
131088 to 262144	16	○	375

Note 1. The setting range varies with the encoder resolution for the servomotor used.
An encoder output pulse setting error (A.041) will occur if the setting is outside the allowable range or does not satisfy the setting conditions.
Pn212 = 25000 (P/Rev) is accepted, but
Pn212 = 25001 (P/Rev) is not accepted. The alarm A.041 is output because the setting unit differs from that in the above table.

2. The upper limit of the pulse frequency is approx. 1.6 Mpps.
The servomotor speed is limited if the setting value of the encoder output pulses (Pn212) is large.
An overspeed of encoder output pulse rate alarm (A.511) will occur if the motor speed exceeds the upper limit specified in the above table.

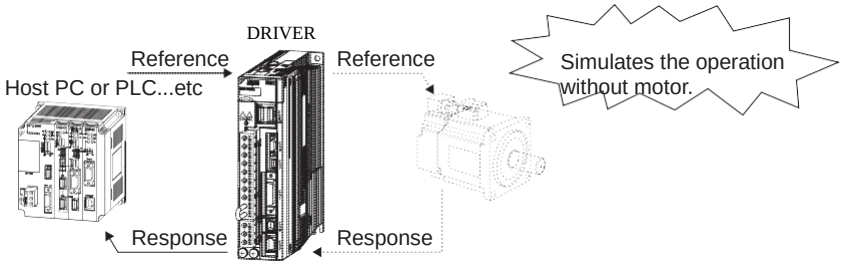
Output Example: When Pn212 = 16 (16-pulse output per one revolution), PAO and PBO are output as shown below.

Preset value: 16



4.5 Test Without Motor Function

The test without a motor is used to check the operation of the host PC or PLC...etc and peripheral devices by simulating the operation of the servomotor in the DRIVER, i.e., without actually operating a servomotor. This function enables you to check wiring, verify the system while debugging, and verify parameters, thus shortening the time required for setup work and preventing damage to the machine that may result from possible mal- functions. The operation of the motor can be checked during performing this function regardless of whether the motor is actually connected or not.



Use Pn00C.0 to enable or disable the test without a motor.

Parameter		Meaning	When Enabled	Classification
Pn00C	n.□□□0 [Factory setting]	Disables the test without a motor.	After restart	Setup
	n.□□□1	Enables the test without a motor.		

4.5.1 Motor Information

The motor information that is used for a test without a motor is given below.

(1) When Motor is Connected

If a motor is connected, the information from the connected motor is used for the motor and encoder scale information. The set values of Pn00C.1 and Pn00C.2 are not used.

(2) When Motor is Not Connected

The information for the virtual motor that is stored in the DRIVER is used. The set values of Pn00C.1 and Pn00C.2 are used for the encoder information.

-Encoder Resolution

The encoder information for the motor is set in Pn00C.1.

Parameter		Meaning	When Enabled	Classification
Pn00C	n.□□0□ [Factory setting]	Sets the encoder resolution for the test without a motor to 13 bits.	After restart	Setup
	n.□□1□	Sets the encoder resolution for the test without a motor to 20 bits.		

-Encoder Type

The encoder information for the motor is set in Pn00C.2.

Parameter		Meaning	When Enabled	Classification
Pn00C	n.□0□□ [Factory setting]	Sets an incremental encoder as an encoder type for the test without a motor.	After restart	Setup
	n.□1□□	Sets an absolute encoder as an encoder type for the test without a motor.		

4.5.2 Motor Position and Speed Responses

For the test without a motor, the following responses are simulated for references from the host PC or PLC...etc according to the gain settings for position or speed control.

- Servomotor position
- Servomotor speed

The load model, however, will be a rigid system with the moment of inertia ratio that is set in Pn103.

4.5.3 Limitations

The following functions cannot be used during the test without a motor.

- Regeneration and dynamic brake operation
- Brake output signal (The brake output signal can be checked with the I/O signal monitor function of the SigmaWin+.)
- Items marked with "×" in the following utility function table.

Contents	Can be used or not	
	Motor not connected	Motor connected
Alarm history display	○	○
JOG operation	○	○
Origin search	○	○
Program JOG operation	○	○
Initializing parameter settings	○	○
Clearing alarm history	○	○
Absolute encoder multiturn reset and encoder alarm reset	×	○
Offset adjustment of analog monitor output	○	○
Gain adjustment of analog monitor output	○	○
Automatic offset-signal adjustment of the motor current detection signal	×	○
Manual offset-signal adjustment of the motor current detection signal	×	○
Write prohibited setting	○	○
Product Information display	○	○
Multiturn limit value setting change when a multiturn limit disagreement alarm occurs	×	○
Resetting configuration error in option modules	○	○
Vibration detection level initialization	×	×
Origin setting	×	○
Software reset	○	○
Tuning-less levels setting	×	×
Advanced autotuning	×	×
Advanced autotuning by reference	×	×
One-parameter tuning	×	×
Anti-resonance control adjustment function	×	×
Vibration suppression function	×	×
EasyFFT	×	×
Online vibration monitor	×	×

Note: ○: Can be used
× : Cannot be used

4.6 Limiting Torque

The DRIVER provides the following four methods for limiting output torque to protect the machine.

Limiting Method	Description	Reference Section
Internal torque limit	Always limits torque by setting the parameter.	4.6.1
External torque limit	Limits torque by input signal from the host PC or PLC...etc.	4.6.2
Torque limit with P_TLIM, N_TLIM commands *	Limit torque by using the P_TLIM and N_TLIM commands.	–
Torque limit with P_CL/ N_CL signals of OPTION Field and P_TLIM/N_TLIM commands *	Combines torque limit methods by using an external input and P_TLIM and N_TLIM commands.	–

∗ For details, refer to *8 MECHATROLINK-II Commands*.

Note: The maximum torque of the servomotor is used when the set value exceeds the maximum torque.

4.6.1 Internal Torque Limit

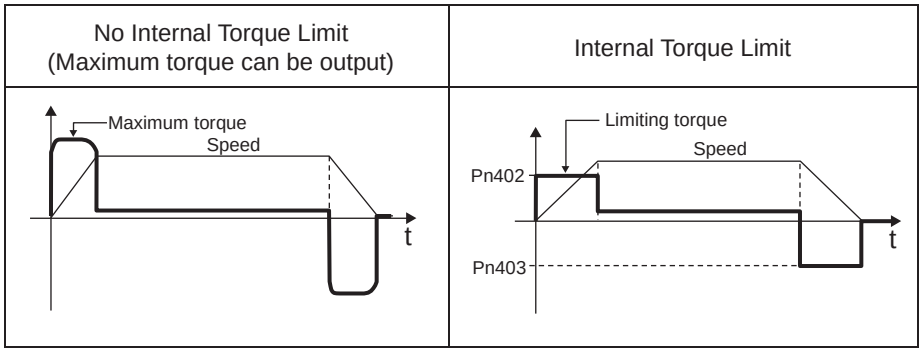
This function always limits maximum output torque by setting values of following parameters.

Pn402	Forward Torque Limit			Speed Position Torque	Classification
	Setting Range	Setting Unit	Factory Setting	When Enabled	
	0 to 800	1%	800	Immediately	Setup
Pn403	Reverse Torque Limit			Speed Position Torque	Classification
	Setting Range	Setting Unit	Factory Setting	When Enabled	
	0 to 800	1%	800	Immediately	Setup

The setting unit is a percentage of the rated torque.

Note: If the settings of Pn402 and Pn403 are too low, the torque may be insufficient for acceleration or deceleration of the servomotor.

Torque waveform



4.6.2 External Torque Limit

Use this function to limit torque by inputting a signal from the host PC or PLC...etc at specific times during machine operation. For example, some pressure must continually be applied (but not enough to damage the workpiece) when the robot is holding a workpiece or when a device is stopping on contact.

(1) Input Signals

Use the following input signals to limit a torque by external torque limit.

Type	Signal Name	Connector Pin Number	Setting	Meaning	Limit value
Input	/P-CL	Must be allocated	ON (closed)	Forward external torque limit ON	The smaller value of these settings: Pn402 or Pn404
			OFF (open)	Forward external torque limit OFF	Pn402
Input	/N-CL	Must be allocated	ON (closed)	Reverse external torque limit ON	The smaller value of these settings: Pn403 or Pn405
			OFF (open)	Reverse external torque limit OFF	Pn403

Note: Use parameter Pn50B.2 and Pn50B.3 to allocate the /P-CL signal and the /N-CL signal for use. For details, refer to *3.3.1 Input Signal Allocations.*

(2) Related Parameters

Set the following parameters for external torque limit.

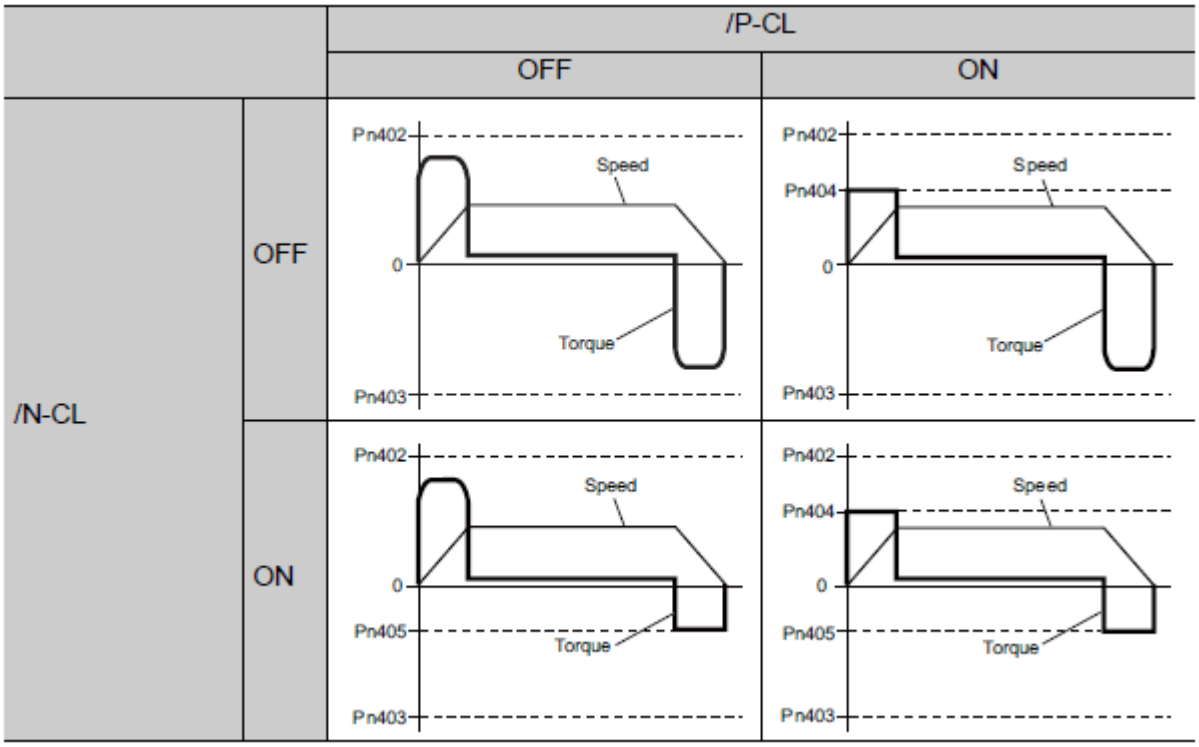
Pn402	Forward Torque Limit			Speed Position Torque	Classification
	Setting Range	Setting Unit	Factory Setting	When Enabled	
	0 to 800	1%	800	Immediately	Setup
Pn403	Reverse Torque Limit			Speed Position Torque	Classification
	Setting Range	Setting Unit	Factory Setting	When Enabled	
	0 to 800	1%	800	Immediately	Setup
Pn404	Forward External Torque Limit			Speed Position Torque	Classification
	Setting Range	Setting Unit	Factory Setting	When Enabled	
	0 to 800	1%	100	Immediately	Setup
Pn405	Reverse External Torque Limit			Speed Position Torque	Classification
	Setting Range	Setting Unit	Factory Setting	When Enabled	
	0 to 800	1%	100	Immediately	Setup

The setting unit is a percentage of the rated torque.

Note: If the settings of Pn402, Pn403, Pn404, and Pn405 are too low, the torque may be insufficient for acceleration or deceleration of the servomotor.

(3) Changes in Output Torque during External Torque Limiting

The following diagrams show the change in output torque when the internal torque limit is set to 800%. In this example, the servomotor rotation direction is Pn000.0 = 0 (Sets CCW as forward direction).



4.6.3 Checking Output Torque Limiting during Operation

The following signal can be output to indicate that the servomotor output torque is being limited.

Type	Signal Name	Connector Pin Number	Setting	Meaning
Output	/CLT	Must be allocated	ON (closed)	Servomotor output torque is being limited.
			OFF (open)	Servomotor output torque is not being limited.

Note: Use parameter Pn50F.0 to allocate the /CLT signal for use. For details, refer to *3.3.2 Output Signal Allocations*.

4.7 Absolute Encoders

If using an absolute encoder, a system to detect the absolute position can be designed for use with the host PC or PLC...etc. As a result, an operation can be performed without a zero point return operation immediately after the power is turned ON.

A battery case is required to save position data in the absolute encoder. The battery is attached to the battery case of the encoder cable.

Set Pn002.2 to 0 (factory setting) to use the absolute encoder.

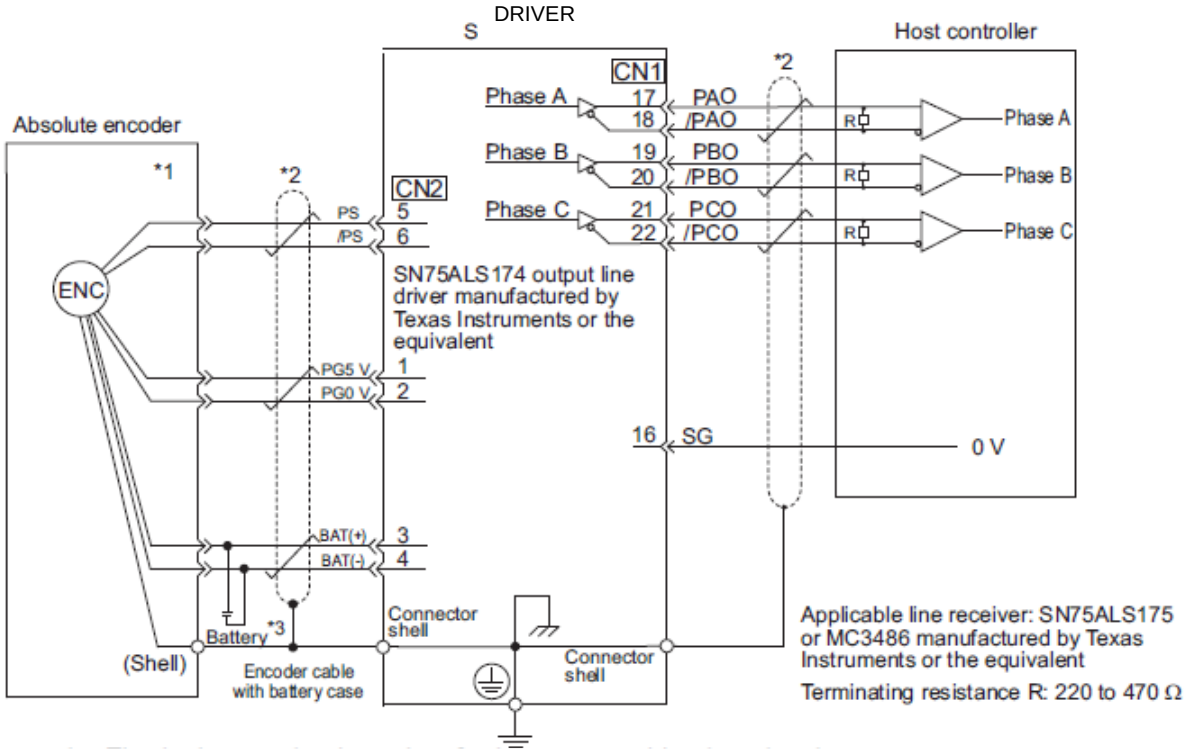
Parameter		Meaning	When Enabled	Classification
Pn002	n.□0□□ [Factory setting]	Uses the absolute encoder as an absolute encoder.	After restart	Setup
	n.□1□□	Uses the absolute encoder as an incremental encoder.		

A battery is not required when using the absolute encoder as an incremental encoder.

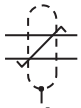
4.7.1 Connecting the Absolute Encoder

The following diagram shows the connection between a servomotor with an absolute encoder, the DRIVER, and the host PC or PLC...etc.

(1) Using an Encoder Cable with a Battery Case



∗1. The absolute encoder pin numbers for the connector wiring depend on the servomotors.

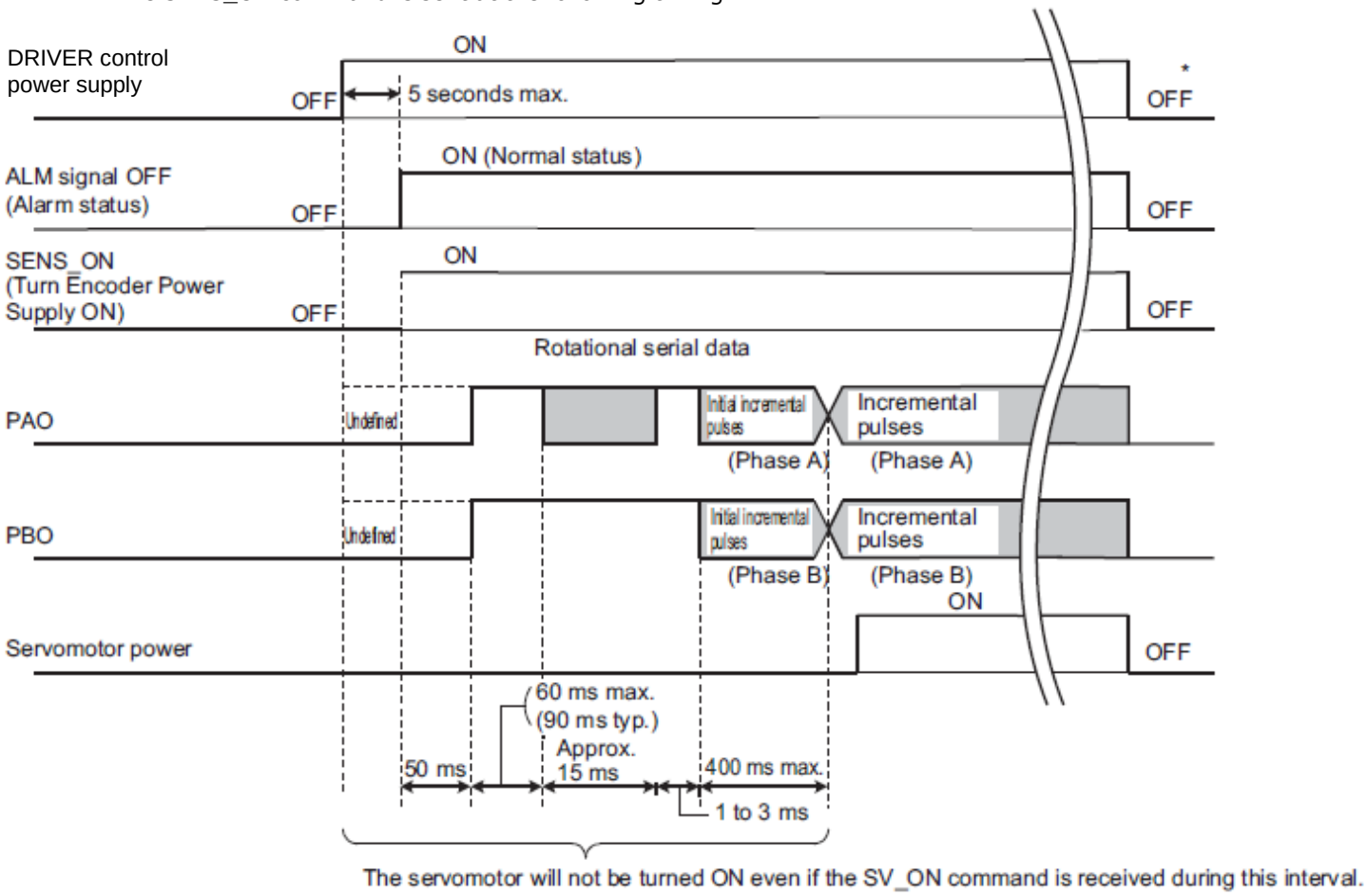
∗2.  : represents shielded twisted-pair wires.

∗3. When using an absolute encoder, provide power by installing an encoder cable with a Battery Case.

4.7.2 Absolute Data Request (SENS ON Command)

The Turn Encoder Power Supply ON command (SENS_ON) must be sent to obtain absolute data as an output from the DRIVER.

The SENS_ON command is sent at the following timing.



* Send the SENS_OFF command to turn OFF the control power supply.

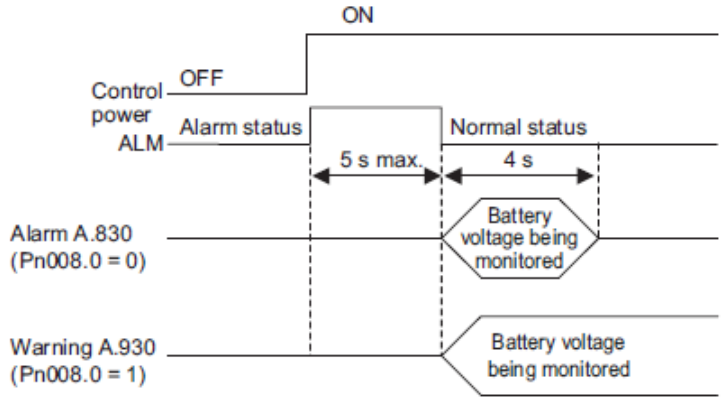
4.7.3 Battery Replacement

If the battery voltage drops to approximately 2.7 V or less, an absolute encoder battery error alarm (A.830) or an absolute encoder battery error warning (A.930) will be displayed.

If this alarm or warning is displayed, replace the batteries using the following procedure. Use Pn008.0 to set either an alarm (A.830) or a warning (A.930).

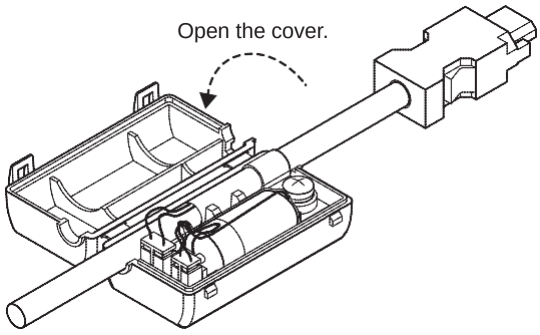
Parameter		Meaning	When Enabled	Classification
Pn008	n.□□□0 [Factory setting]	Outputs the alarm A.830 when the battery voltage drops.	After restart	Setup
	n.□□□1	Outputs the warning A.930 when the battery voltage drops.		

- If Pn008.0 is set to 0, alarm detection will be enabled for 4 seconds after the ALM signal outputs max. 5 seconds when the control power is turned ON.
  No battery-related alarm will be displayed even if the battery voltage drops below the specified value after these 4 seconds.
- If Pn008.0 is set to 1, alarm detection will be always enabled after the ALM signal outputs max. 5 seconds when the control power supply is turned ON.

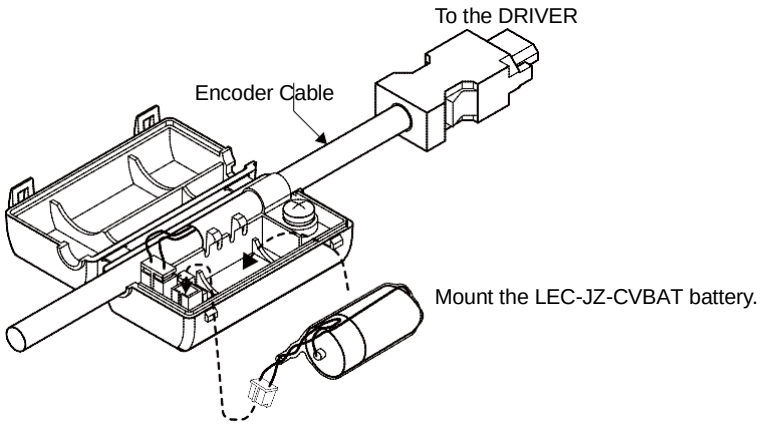


(1) Battery Replacement Procedure

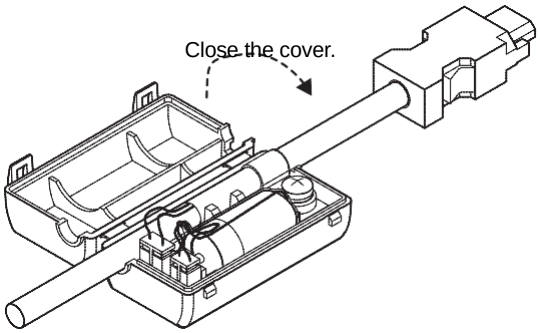
1. Turn ON the control power supply of the DRIVER only.
2. Open the battery case cover.



3. Remove the old battery and mount the new LEC-JZ-CVBAT battery as shown below.



4. Close the battery case cover.



5. After replacing the battery, turn OFF the control power supply to clear the absolute encoder battery error alarm (A.830).
6. Turn ON the control power supply again.
7. Check that the alarm display has been cleared and that the DRIVER operates normally.

IMPORTANT	If the DRIVER control power supply is turned OFF and the battery is disconnected (which includes disconnecting the encoder cable), the absolute encoder data will be deleted.

4.7.4 Absolute Encoder Setup and Reinitialization

⚠ CAUTION

- The rotational data will be a value between -2 and +2 rotations when the absolute encoder setup is executed. The reference position of the machine system will change. Set the reference position of the host PC or PLC...etc to the position after setup.
  If the machine is started without adjusting the position of the host PC or PLC...etc, unexpected operation may cause injury or damage to the machine. Take sufficient care when operating the machine.

Setting up and reinitialization of the absolute encoder are necessary in the following cases.

- When starting the machine for the first time
- When an encoder backup error alarm (A.810) is generated
- When an encoder checksum error alarm (A.820) is generated
- When initializing the rotational serial data of the absolute encoder

Set up the absolute encoder with Fn008.

(1) Precautions on Setup and Reinitialization

- The write prohibited setting parameter (Fn010) must be set to Write permitted (P.0000).
- Set up or reinitialize the encoder when the servomotor power is OFF.
- If the following absolute encoder alarms are displayed, cancel the alarm by using the same method as the set up (initializing) with Fn008. They cannot be canceled with the DRIVER Clear Warning or Alarm com- mand (ALM_CLR).
- Encoder backup error alarm (A.810)
- Encoder checksum error alarm (A.820)
- Any other alarms (A.8□□) that monitor the inside of the encoder should be canceled by turning OFF the power.

(2) Procedure for Setup and Reinitialization

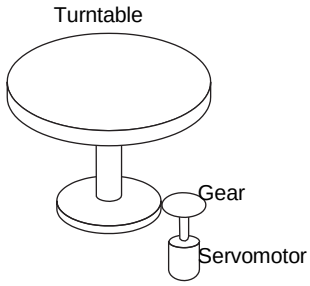
Follow the steps below to setup or reinitialize the absolute encoder.
This setting can be performed using the adjustment command (ADJ). For details, refer to *8 MECHATROLINK-II Commands*.

In the SigmaWin+ Σ-V component main window, click Setup, point to Set Absolute Encoder and click Reset Absolute Encoder.

For more information on the usage of the SigmaWin+, refer to AC Servo Drives Engineering Tool Sigma Win+ ONLINE MANUAL Σ-V Component *4.4.2 Setting the Absolute Encoder.*

4.7.5 Multiturn Limit Setting

The multiturn limit setting is used in position control applications for a turntable or other rotating device. For example, consider a machine that moves the turntable in the following diagram in only one direction.



Because the turntable moves in only one direction, the upper limit for revolutions that can be counted by an absolute encoder will eventually be exceeded. The multiturn limit setting is used in cases like this to prevent fractions from being produced by the integral ratio of the motor revolutions and turntable revolutions.

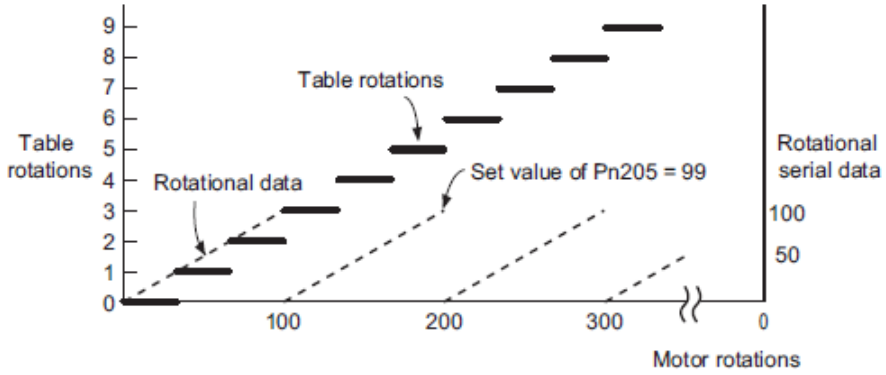
For a machine with a gear ratio of n:m, as shown above, the value of m minus 1 will be the setting for the multiturn limit setting (Pn205).

Multiturn limit setting (Pn205) = m-1

The case in which the relationship between the turntable revolutions and motor revolutions is m = 100 and n = 3 is shown in the following graph.

Pn205 is set to 99.

Pn205 = 100 − 1 = 99



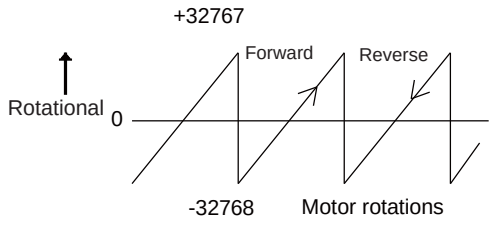
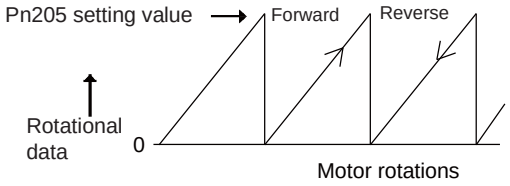
Pn205	Multiturn Limit Setting		Speed Position Torque		Classification
	Setting Range	Setting Unit	Factory Setting	When Enabled	
	0 to 65535	1 Rev	65535	After restart	Setup

Note: This parameter is valid when the absolute encoder is used.

The range of the data will vary when this parameter is set to anything other than the factory setting.

1. When the motor rotates in the reverse direction with the rotational data at 0, the rotational data will change to the setting of Pn205.
2. When the motor rotates in the forward direction with the rotational data at the Pn205 setting, the rotational data will change to 0.

Set the value, the desired rotational amount -1, to Pn205.

Factory Setting (= 65535)	Other Setting (≠65535)
	

4.7.6 Multiturn Limit Disagreement Alarm (A.CC0)

When the multiturn limit set value is changed with parameter Pn205, a multiturn limit disagreement alarm (A.CC0) will be displayed because the value differs from that of the encoder.

Alarm Display	Alarm Name	Alarm Output	Meaning
A.CC0	Multiturn Limit Disagreement	OFF (H)	Different multiturn limits have been set in the encoder and DRIVER.

If this alarm is displayed, perform the operation described below and change the multiturn limit value in the encoder to the value set in Pn205.

This setting can be performed with the adjustment command (ADJ).
For information the adjustment command (ADJ), refer to *8 MECHATROLINK-II Commands*.

In the SigmaWin+ Σ-V component main window, click **Setup**, print to **Set Absolute Encoder** and click **Multi-Turn Limit Setting**.

For more information on the usage of the SigmaWin+, refer to AC Servo Drives Engineering Tool Sigma Win+ ONLINE MANUAL Σ-V Component *4.4.2 Setting the Absolute Encoder.*

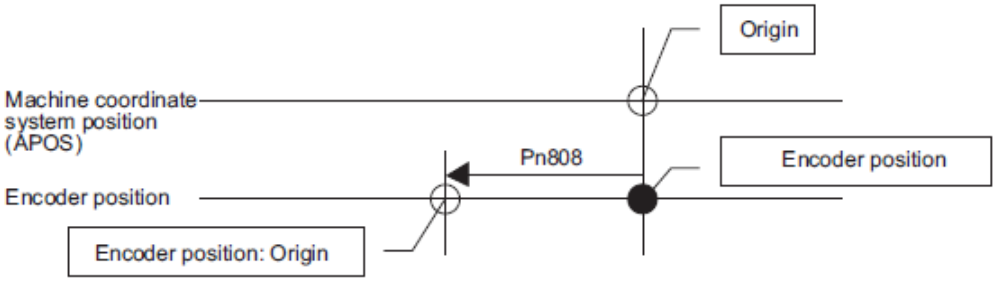
4.7.7 Absolute Encoder Origin Offset

If using the absolute encoder, the positions of the encoder and the offset of the machine coordinate system (APOS) can be set. Use Pn808 to make the setting. After the SENS_ON command is received by MECHATROLINK communications, this parameter will be enabled.

Pn808	Absolute Encoder Origin Offset ~~Position~~				Classification
	Setting Range	Setting Unit	Factory Setting	When Enabled	
	-1073741823 to 1073741823	1 reference unit	0	Immediately	Setup

<Example>

If the encoder position (X) is set at the origin of the machine coordinate system (0), Pn808 = X.

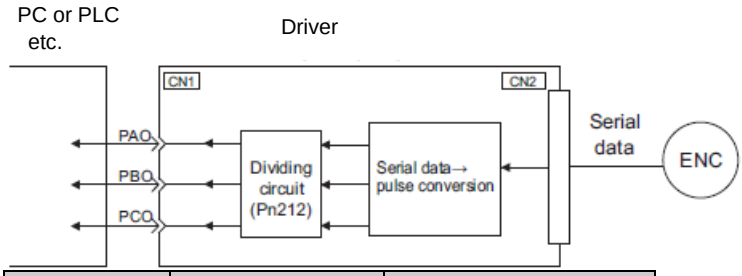


4.7.8 Absolute Data Reception Sequence

The sequence in which the DRIVER receives outputs from the absolute encoder and transmits them to host controller is shown below.

(1) Outline of Absolute Data

The serial data, pulses, etc., of the absolute encoder that are output from the DRIVER are output from the PAO, PBO, and PCO signals as shown below.



Signal Name	Status	Contents
PAO	At initialization	Rotational serial data Initial incremental pulses
	Normal Operations	Incremental pulses
PBO	At initialization	Initial incremental pulses
	Normal Operations	Incremental pulses
PCO	Always	Origin pulses

・Phase-Z Output Specifications

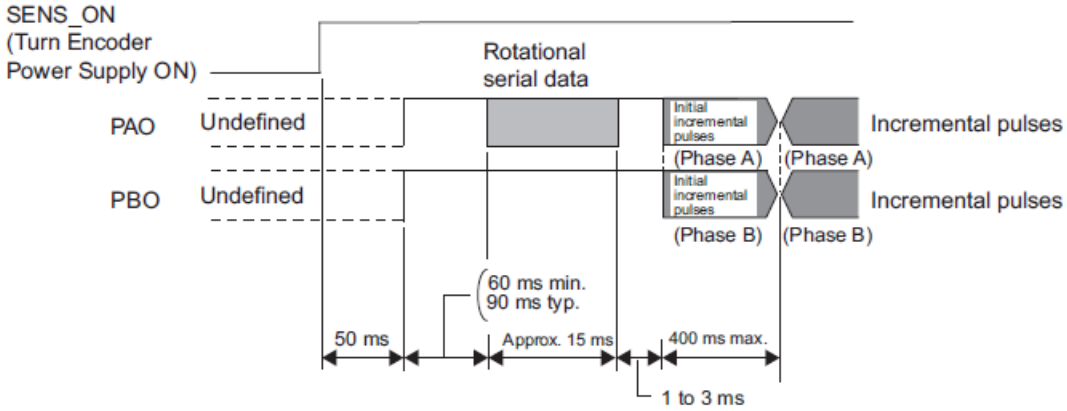
The pulse width of phase Z (origin pulse) changes depending on the encoder output pulse (Pn212), becoming the same width as phase A.
The output timing is one of the following.

- Synchronized with the rising edge of phase A
- Synchronized with the falling edge of phase A
- Synchronized with the rising edge of phase B
- Synchronized with the falling edge of phase B

Note: When host controller receives the data of absolute encoder, do not perform counter reset using the output of PCO signal.

(2) Absolute Data Reception Sequence

1. Send the Turn Encoder Power Supply ON (SENS_ON) command from the host controller.
2. After 100 ms, the system is set to rotational serial data reception standby and the incremental pulse up/ down counter is cleared to zero.
3. Eight characters of rotational serial data is received.
4. The system enters a normal incremental operation state about 400 ms after the last rotational serial data is received.



Note: The output pulses are phase-B advanced if the servomotor is turning forward regardless of the setting in Pn000.0.

Rotational serial data:

Indicates how many turns the motor shaft has made from the reference position, which was the position at setup.

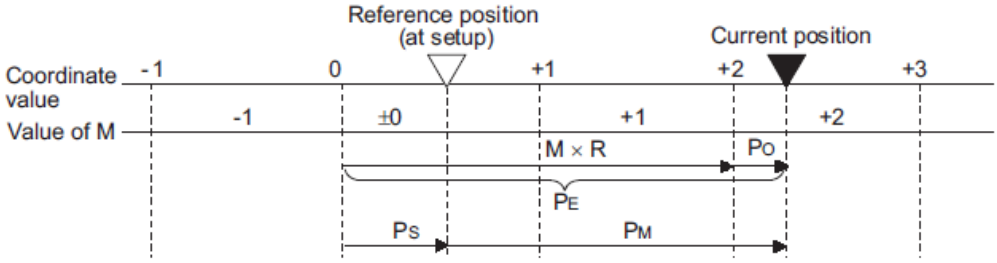
Initial incremental pulses:

Initial incremental pulses which provide absolute data are the number of pulses required to rotate the motor shaft from the servomotor origin to the present position.

Just as with normal incremental pulses, these pulses are divided by the dividing circuit inside the DRIVER and then output.

The initial incremental pulse speed depends on the setting of the encoder output pulses (Pn212). Use the following formula to obtain the initial incremental pulse speed.

Setting of the Encoder Output Pulses (Pn212)	Formula of the Initial Incremental Pulse Speed
16 to 16384	(680 × Pn212) / 16384 [kpps]
16386 to 32768	(680 × Pn212) / 32768 [kpps]
32772 to 65536	(680 × Pn212) / 65536 [kpps]
65544 to 131072	(680 × Pn212) / 131072 [kpps]
131088 to 262144	(680 × Pn212) / 262144 [kpps]



Final absolute data PM is calculated by following formula.

$P_E = M \times R + P_O$

$P_S = M_S \times R + P_S'$

$P_M = P_E - P_S$

Signal	Meaning
P_E	Current value read by encoder
M	Rotational serial data
P_O	Number of initial incremental pulses
P_S	Absolute data read at setup (This is saved and controlled by the host controller.)
M_S	Rotational data read at setup
P_S'	Number of initial incremental pulses read at setup
P_M	Current value required for the user's system
R	Number of pulses per encoder revolution (pulse count after dividing, value of Pn212)

Note: The following formula applies in reverse mode. (Pn000.0 = 1)

$P_E = -M \times R + P_O$

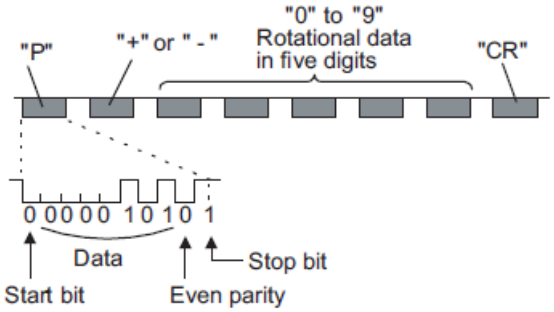
$P_S = M_S \times R + P_S'$

$P_M = P_E - P_S$

(3) Rotational Serial Data Specifications and Initial Incremental Pulses

・Rotational Serial Data Specifications

The rotational serial data is output from PAO signal.

Data Transfer Method	Start-stop Synchronization (ASYNC)
Baud rate	9600 bps
Start bits	1 bit
Stop bits	1 bit
Parity	Even
Character code	ASCII 7-bit code
Data format	8 characters, as shown below.  Note 1. Data is "P+00000" (CR) or "P-00000" (CR) when the number of revolutions is zero. 2. The revolution range is "-32768" to "+32767". When this range is exceeded, the data changes from "+32767" to "-32678" or from "-32678" to "+32767". When changing multiturn limit, the range changes. For details, refer to *4.7.5 Multiturn Limit Setting*.

・Initial Incremental Pulses

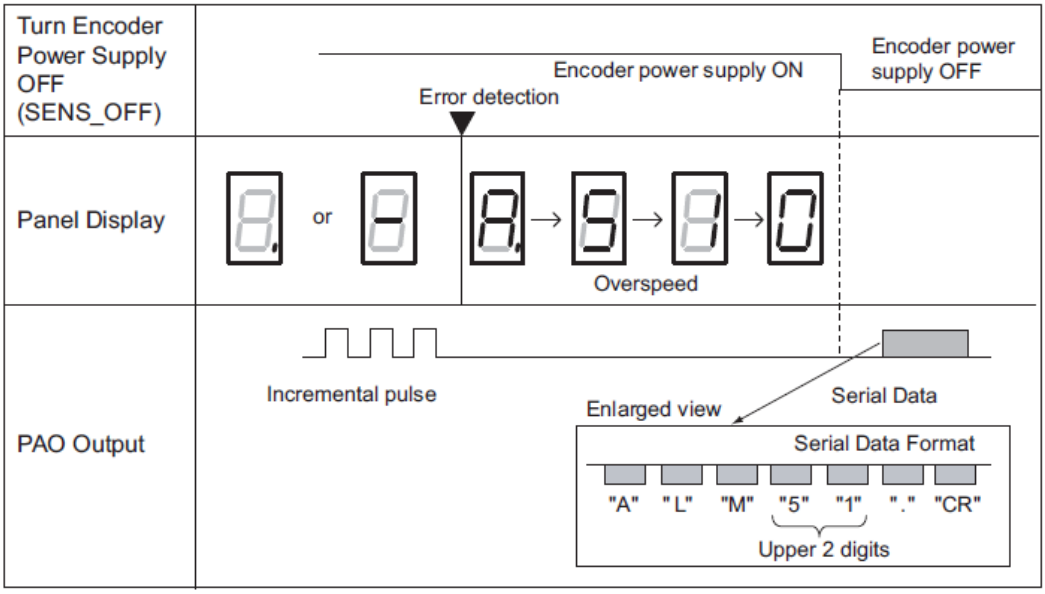
The initial incremental pulses are output after division inside the DRIVER in the same way as for normal incremental pulses. Refer to *4.4.4 Encoder Output Pulses* for details.

(4) Transferring Alarm Contents

If an absolute encoder is used, the contents of alarms detected by the DRIVER are transmitted in serial data to the host controller from the PAO output when the Turn Encoder Power Supply OFF command (SENS_OFF) is received.

Note: The SENS_OFF command cannot be received while the servomotor power is ON.

Output example of alarm contents are as shown below.



4.8 Other Output Signals

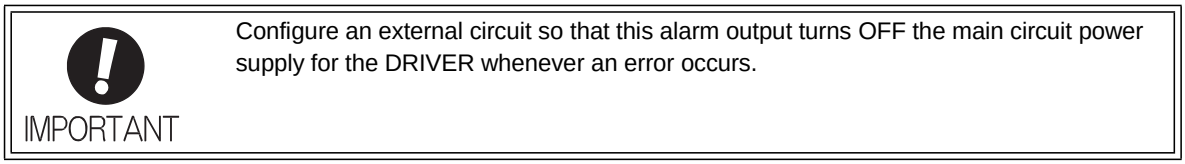
This section explains other output signals.
Use these signals according to the application needs, e.g., for machine protection.

4.8.1 Servo Alarm Output Signal (ALM)

This section describes signals that are output when the DRIVER detects errors and resetting methods.

(1) Servo Alarm Output Signal (ALM)

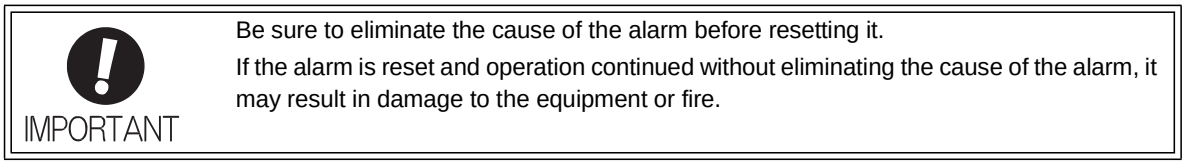
This signal is output when the DRIVER detects an error.



Type	Signal Name	Connector Pin Number	Setting	Meaning
Output	ALM	CN1-3, 4	ON (closed)	Normal DRIVER status
			OFF (open)	DRIVER alarm status

(2) Alarm Reset Method

If a servo alarm (ALM) occurs, use one of the following methods to reset the alarm after eliminating the cause of the alarm.



- Resetting Alarms by Sending Clear Warning or Alarm Command (ALM_CLR)
  For details, refer to 8 MECHATROLINK-II Commands.
- Resetting Alarms Using the SigmaWin+

  In the SigmaWin+ Σ-V component main window, click **Alarm** and then click **Display Alarm**. To clear an alarm, click **Reset** after removing the cause of the alarm.
  For more information on the usage of the SigmaWin+, refer to AC Servo Drives Engineering Tool Sigma Win+ ONLINE MANUAL Σ-V Component *4. 2 Alarm Display.*

4.8.2 Warning Output Signal (/WARN)

This signal is for a warning issued before the occurrence of an alarm. Refer to *9.2.1 List of Warnings*.

(1) Signal Specifications

Type	Signal Name	Connector Pin Number	Setting	Meaning
Output	/WARN	Must be allocated	ON (closed)	Warning status
			OFF (open)	Normal status

Note: Use parameter Pn50F.3 to allocate the /WARN signal for use. For details, refer to *3.3.2 Output Signal Allocations*.

4.8.3 Rotation Detection Output Signal (/TGON)

This output signal indicates that the servomotor is rotating at the speed set for Pn502 or a higher speed.

(1) Signal Specifications

Type	Signal Name	Connector Pin Number	Setting	Meaning
Output	/TGON	Must be allocated	ON (closed)	Servomotor is rotating with the motor speed above the setting in Pn502.
			OFF (open)	Servomotor is rotating with the motor speed below the setting in Pn502.

Note: Use parameter Pn50E.2 to allocate the /TGON signal for use. For details, refer to *3.3.2 Output Signal Allocations.*

(2) Related Parameter

Set the range in which the /TGON signal is output using the following parameter.

Pn502	Rotation Detection Level			Speed Position Torque	Classification
	Setting Range	Setting Unit	Factory Setting	When Enabled	
	1 to 10000	1 min^{-1}	20	Immediately	Setup

4.8.4 Servo Ready Output Signal (/S-RDY)

This signal is turned ON when the DRIVER is ready to accept the servo ON (SV_ON) command.

The /S-RDY signal is turned ON under the following conditions.

- The main circuit power supply is ON.
- No hard wire base block state
- No servo alarms
- The Turn Encoder Power Supply ON (SENS_ON) command is received. (When an absolute encoder is used.)

If an absolute encoder is used, the output of absolute data to the host PC or PLC...etc must have been completed when the SENS_ON command is received.

For details on the hard wire base block function, refer to *4.9.1 Hard Wire Base Block (HWBB) Function*.

(1) Signal Specifications

Type	Signal Name	Connector Pin Number	Setting	Meaning
Output	/S-RDY	Must be allocated	ON (closed)	The SERVOPACK is ready to accept the SV_ON command.
			OFF (open)	The SERVOPACK is not ready to accept the SV_ON command.

Note 1. Use parameter Pn50E.3 to allocate the /S-RDY signal for use. For details, refer to *3.3.2 Output Signal Allocations*.

2. For details on the hard wire base block function and the servo ready output signal, refer to *4.9.1 Hard Wire Base Block (HWBB) Function.*

4.8.5 Speed Coincidence Output Signal (/V-CMP)

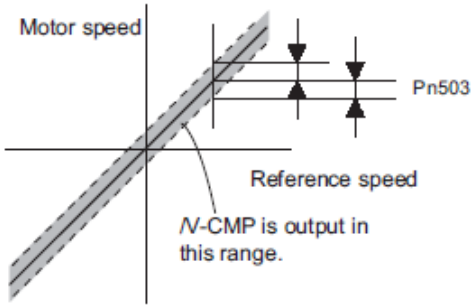
The speed coincidence output signal (/V-CMP) is output when the actual servomotor speed is the same as the reference speed. The host PC or PLC...etc uses the signal as an interlock. This signal is the output signal during speed control.

Type	Signal Name	Connector Pin Number	Setting	Meaning
Output	/V-CMP	Must be allocated	ON (closed)	Speed coincides.
			OFF (open)	Speed does not coincide.

Note: Use parameter Pn50E.1 to allocate the /V-CMP signal for use. Refer to *3.3.2 Output Signal Allocations* for details.

Pn503	Speed Coincidence Signal Output Width [Speed]				Classification
	Setting Range	Setting Unit	Factory Setting	When Enabled	
	0 to 100	1 min^{-1}	10	Immediately	Setup

The /V-CMP signal is output when the difference between the reference speed and actual motor speed is below this setting.



<Example>

The /V-CMP signal is output at 1900 to 2100 min^{-1} if the Pn503 is set to 100 and the reference speed is 2000 min^{-1}.

4.8.6 Positioning Completed Output Signal (/COIN)

This signal indicates that servomotor movement has been completed during position control.

When the difference between the number of references output by the host PC or PLC...etc and the travel distance of the servomotor (position error) drops below the set value in the parameter, the positioning completion signal will be output.

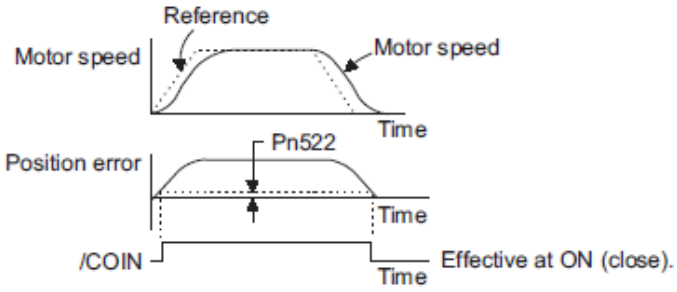
Use this signal to check the completion of positioning from the host PC or PLC...etc.

Type	Signal Name	Connector Pin Number	Setting	Meaning
Output	/COIN	Must be allocated	ON (closed)	Positioning has been completed.
			OFF (open)	Positioning is not completed.

Note: Use parameter Pn50E.0 to allocate the /COIN signal for use. Refer to *3.3.2 Output Signal Allocations* for details.

Pn522	Positioning Completed Width			Position	Classification
	Setting Range	Setting Unit	Factory Setting	When Enabled	
	0 to 1073741824	1 reference unit	7	Immediately	Setup

The positioning completed width setting has no effect on final positioning accuracy.



Note: If the parameter is set to a value that is too large, a positioning completed signal might be output if the position error is low during a low speed operation. This will cause the positioning completed signal to be output continuously. If this signal is output unexpectedly, reduce the set value until it is no longer output.

If the position error is kept to a minimum when the positioning completed width is small, use Pn207.3 to change output timing for the /COIN signal.

Parameter		Name	Meaning	When Enabled	Classification
Pn207	n.0□□□ [Factory setting]	/COIN Output Timing	When the absolute value of the position error is below the positioning completed width (Pn522).	After restart	Setup
	n.1□□□		When the absolute value of the position error is below the positioning completed width (Pn522), and the reference after applying the position reference filter is 0.		
	n.2□□□		When the absolute value of the position error is below the positioning completed width (Pn522), and the position reference input is 0.		

4.8.7 Positioning Near Output Signal (/NEAR)

Before confirming that the positioning completed signal has been received, the host PC or PLC...etc first receives a positioning near signal and can prepare the operating sequence after positioning has been completed. The time required for this sequence after positioning can be shortened.

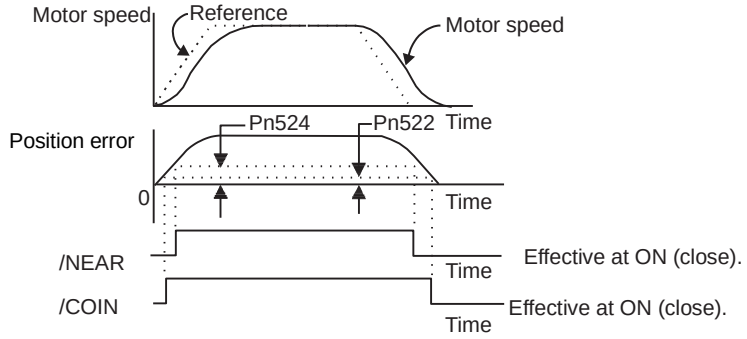
This signal is generally used in combination with the positioning completed output signal.

Type	Signal Name	Connector Pin Number	Setting	Meaning
Output	/NEAR	Must be allocated	ON (closed)	The servomotor has reached a point near to positioning completed.
			OFF (open)	The servomotor has not reached a point near to positioning completed.

Note: Use parameter Pn510.0 to allocate the /NEAR signal for use. Refer to *3.3.2 Output Signal Allocations* for details.

Pn524	NEAR Signal Width			Position	Classification
	Setting Range	Setting Unit	Factory Setting	When Enabled	
	1 to 1073741824	1 reference unit	1073741824	Immediately	Setup

The positioning near signal (/NEAR) is output when the difference between the number of references output by the host PC or PLC...etc and the travel distance of the servomotor (position error) is less than the set value.



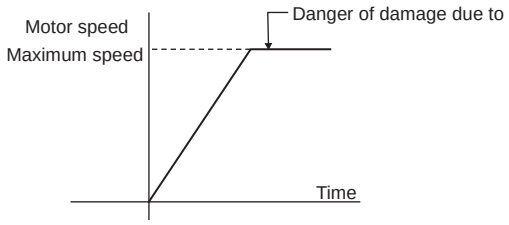
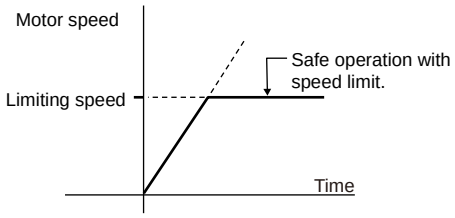
Note: Normally, the value of Pn524 should be larger than that for the positioning completed width (Pn522).

4.8.8 Speed Limit Detection Signal (/VLT)

This function limits the speed of the servomotor to protect the machine.

A servomotor in torque control is controlled to output the specified torque, but the motor speed is not controlled. Therefore, if an excessive reference torque is set for the load torque on the machinery side, the speed of the servomotor may increase greatly. If that may occur, use this function to limit the speed.

Note: The actual limit value of motor speed depends on the load conditions of the servomotor.

With No Speed Limit	With Speed Limit
	

Refer to the following parameters for speed limit.

(1) Signals Output during Servomotor Speed Limit

The following signal is output when the motor speed reaches the limit speed.

Type	Signal Name	Connector Pin Number	Setting	Meaning
Output	/VLT	Must be allocated	ON (closed)	Servomotor speed limit being applied.
			OFF (open)	Servomotor speed limit not being applied.

Note: Use parameter Pn50F.1 to allocate the /VLT signal for use. For details, refer to *3.3.2 Output Signal Allocations*.

(2) Speed Limit Setting

Select the speed limit mode with Pn002.1.

Parameter		Meaning	When Enabled	Classification
Pn002	n.□□0□ [Factory setting]	VLIM (the speed limit value during torque control) is not available. Uses the value set in Pn407 as the speed limit (internal speed limit function).	After restart	Setup
	n.□□1□	VLIM operates as the speed limit value (external speed limit function).		

- Internal Speed Limit Function

If the internal speed limit function is selected in Pn002.1, set the limit of the maximum speed of the servomotor in Pn407. The limit of the speed in Pn408.1 can be either the maximum speed of the servomotor or the overspeed alarm detection speed. Select the overspeed alarm detection speed to limit the speed to the maxi- mum speed of the servomotor or the equivalent.

Pn407	Speed Limit During Torque Control			Torque	Classification
	Setting Range	Setting Unit	Factory Setting	When Enabled	
	0 to 10000	1 min^{-1}	10000	Immediately	Setup

Note: The servomotor's maximum speed or the overspeed alarm detection speed will be used when the setting in this parameter exceeds the maximum speed of the servomotor used.

Parameter		Meaning	When Enabled	Classification
Pn408	n.□□0□ [Factory setting]	Uses the smaller value of the maximum motor speed and the value of Pn407 as the speed limit value.	After restart	Setup
	n.□□1□	Uses the smaller value of the overspeed alarm detection speed and the value of Pn407 as speed limit value.		

- External Speed Limit Function

If the external speed limit function is selected in Pn002.1, the motor speed is controlled by the speed limit value (VLIM). For details, refer to *8 MECHATROLINK-II Commands*.

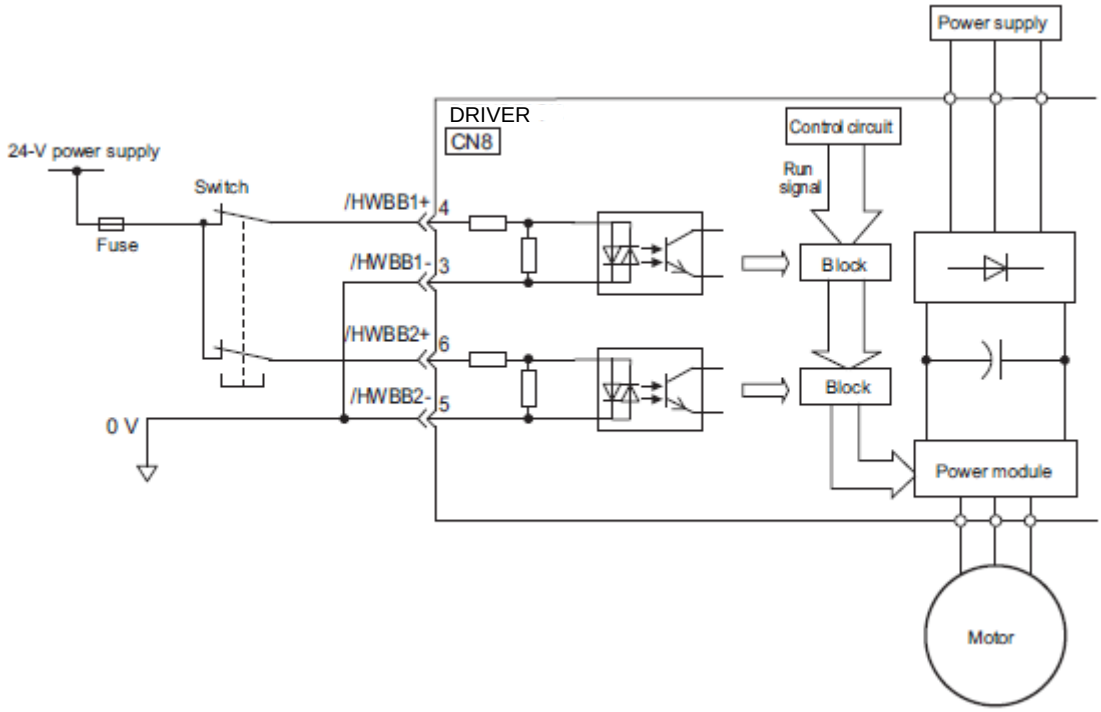
4.9 Safety Function

The safety function is incorporated in the DRIVER to reduce the risk associated with the machine by protecting workers from injury and by securing safe machine operation. Especially when working in hazardous areas inside the safeguard, as for machine maintenance, it can be used to avoid adverse machine movement.

4.9.1 Hard Wire Base Block (HWBB) Function

The Hard Wire Base Block function (hereinafter referred to as HWBB function) is a safety function designed to baseblock the servomotor (shut off the motor current) by using the hardwired circuits. It is a safety function equivalent to the STO function (IEC 61800-5-2) using the hard wire base block function (HWBB).

Each circuit for two channel input signals blocks the run signal to turn off the power module that controls the motor current, and the motor current is shut off. (Refer to the diagram below.)



> **IMPORTANT**
>
> For safety function signal connections, the input signal is the 0 V common and the output signal is the source output. This is the opposite of other signals described in this manual. To avoid confusion, the ON and OFF status of signals for safety functions are defined as follows:
>
> ON: The state in which the relay contacts are closed or the transistor is ON and current flows into the signal line.
>
> OFF: The state in which the relay contacts are open or the transistor is OFF and no cur- rent flows into the signal line.

(1) Risk Assessment

When using the HWBB function, be sure to perform a risk assessment of the servo system in advance. Make sure that the safety level of the standards is met. For details about the standards, refer to *Harmonized Standards* at the front of this manual.

Note: To meet the performance level d (PLd) in EN ISO 13849-1, the EDM signal must be monitored by a host PC or PLC...etc.

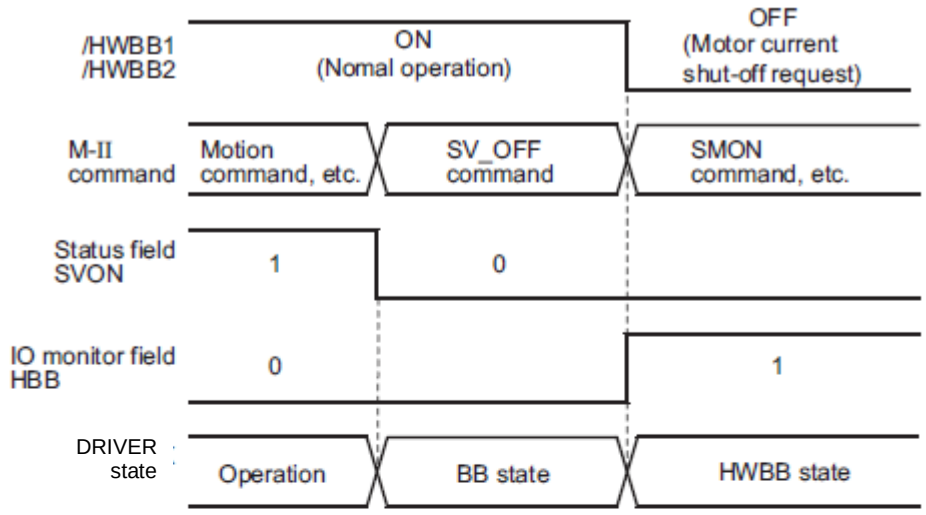
If the EDM signal is not monitored by a host PC or PLC...etc, the system only qualifies for the performance level c (PLc). The following risks can be estimated even if the HWBB function is used. These risks must be included in the risk assessment.

- The servomotor will move in an application where external force is applied to the servomotor (for example, gravity on the vertical axis). Take measures to secure the servomotor, such as installing a mechanical brake.
- The servomotor may move within the electric angle of 180 degrees in case of the power module failure, etc. Make sure that safety is ensured even in that situation. The rotation angle depends on the motor type. The maximum rotation angle is given below. Rotational motor: 1/6 rotation max. (rotation angle at the motor shaft)
- The HWBB function does not shut off the power to the DRIVER or electrically isolate it. Take mea- sures to shut off the power to the DRIVER when performing maintenance on it.

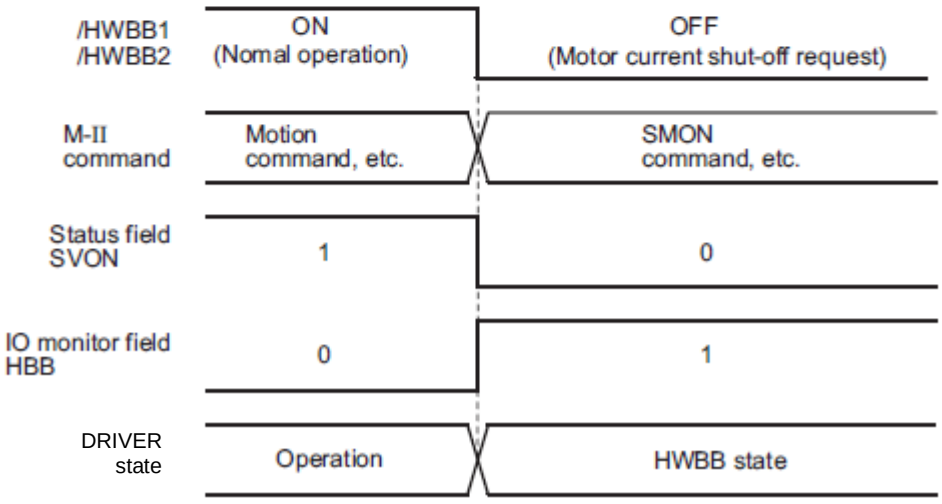
(2) Hard Wire Base Block (HWBB) State

The DRIVER will be in the following state if the HWBB function operates. If the /HWBB1 or /HWBB2 signal is OFF, the HWBB function will operate and the DRIVER will enter a hard wire baseblock (HWBB) state.

The HWBB function operates after the servomotor power is turned OFF.

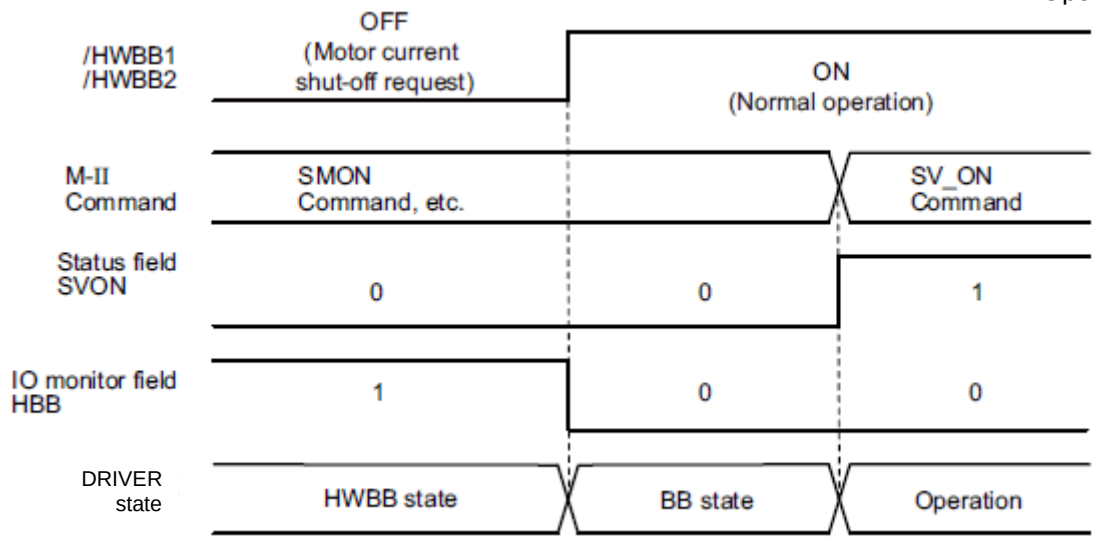


The HWBB function operates while the servomotor power is ON.



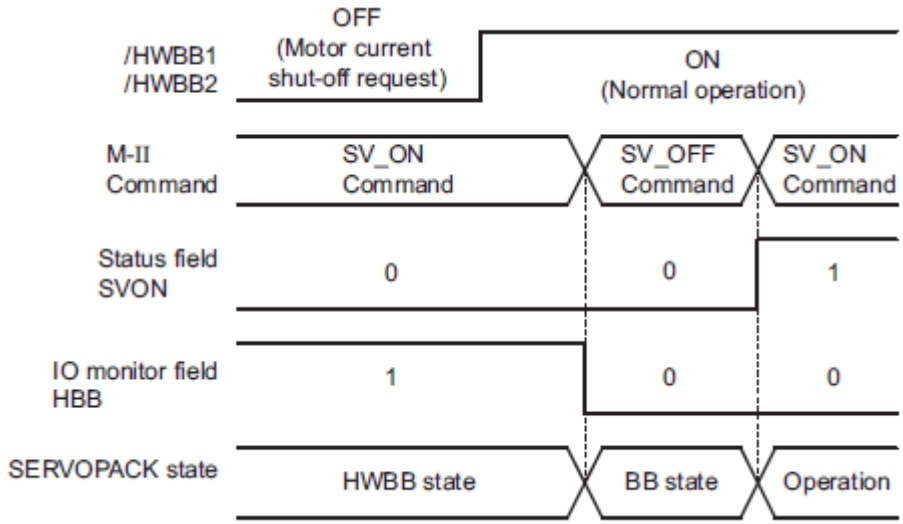
(3) Resetting the HWBB State

Usually after the servo OFF command (SV_OFF: 32H) is received and the servomotor power is OFF, the DRIVER will then enter a hard wire baseblock (HWBB) state with the /HWBB1 and /HWBB2 signals turned OFF. By then turning the /HWBB1 and /HWBB2 signals ON in this state, the DRIVER will enter a baseblock (BB) state and can accept the servo ON command (SV_ON: 31H).



If the /HWBB1 and /HWBB2 signals are OFF and the servo ON command is received, the HWBB state will be maintained after the /HWBB1 and /HWBB2 signals are turned ON.

Send the servo OFF command, and the DRIVER is placed in a BB state. Then send the servo ON command again.



Note: Even if the servomotor power is turned OFF by turning OFF the main circuit power, the HWBB status is retained until a servo OFF command is received.

(4) Related Commands

If the HWBB function is working with the /HWBB1 or /HWBB2 signal turned OFF, the setting of IO monitoring field D10 (HBB) changes to 1, so the status of the upper level apparatus can be known by looking at the setting of this bit.

If the status becomes HWBB status during the execution of the next command, a command warning is issued. If a warning is given, clear the alarm to return to normal operational status. After stopping or canceling the action command, using the sequence of commands to return to the HWBB status is recommended.

Object Action Commands
Servo ON (SV_ON)
Interpolating (INTERPORATE)
Positioning (POSING)
Constant speed feed (FEED)
Interpolating with position detection function (LATCH)
External input positioning (EX_POSING)
Homing (ZRET)

(5) Error Detection in HWBB Signal

If only the /HWBB1 or /HWBB2 signal is input, an A.Eb1 alarm (Safety Function Signal Input Timing Error) will occur unless the other signal is input within 10 seconds. This makes it possible to detect failures, such as disconnection of the HWBB signals.

⚠ CAUTION

- The safety function signal input timing error alarm (A.Eb1) is not a safety-related part of a control system. Keep this in mind in the system design.

(6) Connection Example and Specifications of Input Signals (HWBB Signals)

The input signals must be redundant. A connection example and specifications of input signals (HWBB signals) are shown below.

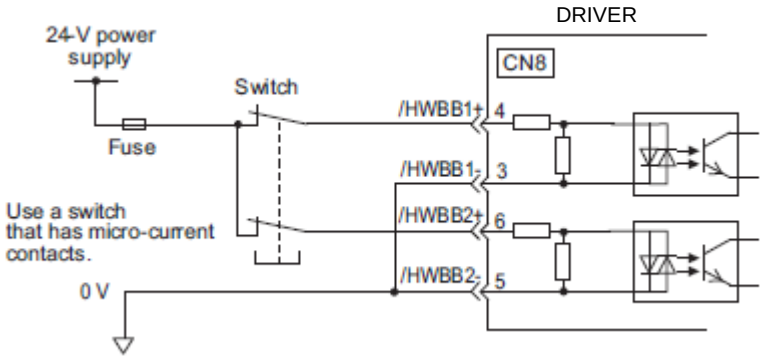
IMPORTANT

For safety function signal connections, the input signal is the 0 V common and the output signal is the source output. This is opposite to other signals described in this manual. To avoid confusion, the ON and OFF status of signals for safety functions are defined as follows:

ON: The state in which the relay contacts are closed or the transistor is ON and current flows into the signal line.

OFF: The state in which the relay contacts are open or the transistor is OFF and no current flows into the signal line.

- Connection Example



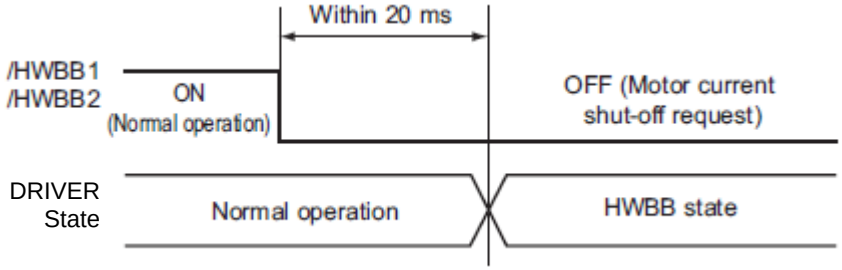
- Specifications

Type	Signal Name	Connector Pin Number	Setting	Meaning
Input	/HWBB1	CN8-4 CN8-3	ON (closed)	Does not use the HWBB function. (normal operation)
			OFF (open)	Uses the HWBB function. (motor current shut-off request)
	/HWBB2	CN8-6 CN8-5	ON (closed)	Does not use the HWBB function. (normal operation)
			OFF (open)	Uses the HWBB function. (motor current shut-off request)

The input signals (HWBB signals) have the following electrical characteristics.

Items	Characteristics	Remarks
Internal Impedance	3.3 kΩ	–
Operation Movable Voltage Range	+11 V to + 25 V	–
Maximum Delay Time	20 ms	Time from the /HWBB1 and /HWBB2 signals are OFF to the HWBB function operates.

If the HWBB function is requested by turning OFF the /HWBB1 and /HWBB2 input signals on the two channels, the power supply to the servomotor will be turned OFF within 20 ms (see below).



Note 1. The OFF status is not recognized if the total OFF time of the /HWBB1 and /HWBB2 signals is 0.5 ms or shorter.
2. The status of the input signals can be checked using monitor displays. Refer to *7.5 Monitoring Safety Input Signals*.

(7) Operation with Utility Functions

The HWBB function works while the DRIVER operates in the utility function.

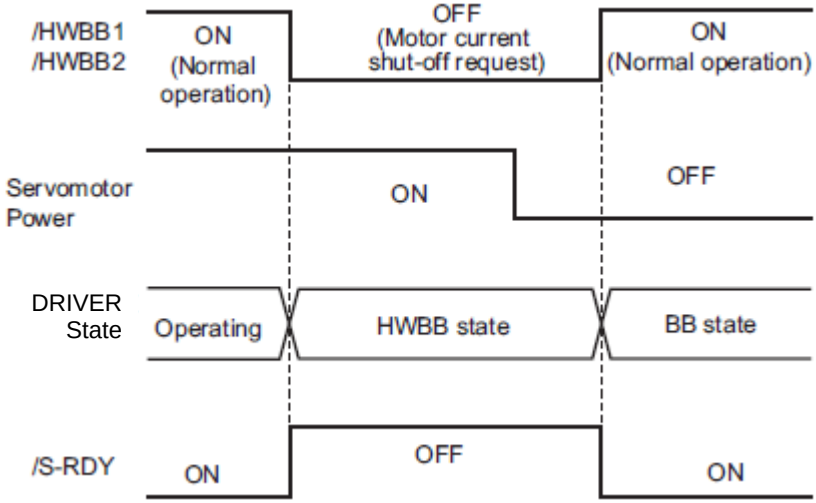
If any of the following utility functions is being used with the /HWBB1 and /HWBB2 signals turned OFF, the DRIVER cannot be operated by turning ON the /HWBB1 and /HWBB2 signals. Cancel the utility function first, and then set the DRIVER to the utility function again and restart operation.

- JOG operation (Fn002)
- Origin search (Fn003)
- Program JOG operation (Fn004)
- Advanced autotuning (Fn201)
- EasyFFT (Fn206)
- Automatic offset-signal adjustment of motor current detection signal (Fn00E)

(8) Servo Ready Output (/S-RDY)

The servo ON (SV_ON) command will not be accepted in the HWBB state. Therefore, the servo ready output will turn OFF. The servo ready output will turn ON if the servomotor power is OFF (set to BB state) when both the /HWBB1 and /HWBB2 signals are ON.

The following diagram shows an example where the main circuit power supply is turned ON, the Turn Encoder Power Supply ON (SENS_ON) command is sent (with an absolute encoder), and no servo alarm occurs.



(9) Lock signal (/BK)

When the /HWBB1 or /HWBB2 signal is OFF and the HWBB function operates, the lock signal (/BK) will turn OFF. At that time, Pn506 (lock Reference - servo OFF delay time) will be disabled. Therefore, the servomotor may be moved by external force until the actual lock becomes effective after the lock signal (/BK) turns OFF.

⚠ CAUTION
• The lock signal is not a safety-related part of a control system. Be sure to design the system so that the system will not be put into danger if the lock signal fails in the HWBB state. Moreover, if a servomotor with a lock is used, keep in mind that the lock for the servomotor is used only to prevent the movable part from being moved by gravity or an external force and it cannot be used to lock the servomotor.

(10) Dynamic Brake

If the dynamic brake is enabled in Pn001.0 (Stopping Method for Servomotor after SV_OFF Command is Received), the servomotor will come to a stop under the control of the dynamic brake when the HWBB function works while the /HWBB1 or /HWBB2 signal is OFF.

⚠ CAUTION

- The dynamic brake is not a safety-related part of a control system. Be sure to design the system so that the system will not be put into danger if the servomotor coasts to a stop in the HWBB state. Usually, use a sequence in which the HWBB state occurs after the servomotor is stopped using the reference.
- If the application frequently uses the HWBB function, do not use the dynamic brake to stop the servomotor. Otherwise element deterioration in the DRIVER may result. To prevent internal elements from deteriorating, use a sequence in which the HWBB state occurs after the servomotor has come to a stop.

(11) Servo Alarm Output Signal (ALM)

In the HWBB state, the servo alarm output signal (ALM) is not sent.

4.9.2 External Device Monitor (EDM1)

The external device monitor (EDM1) functions to monitor failures in the HWBB function. Connect the monitor to feedback signals to the safety function device.

Note: To meet the performance level d (PLd) in EN ISO13849-1, the EDM signal must be monitored by a host PC or PLC...etc. If the EDM signal is not monitored by a host PC or PLC...etc, the system only qualifies for the performance level c (PLc).

- Failure Detection Signal for EDM1 Signal

The relation of the EDM1, /HWBB1, and /HWBB2 signals is shown below.

Detection of failures in the EDM1 circuit can be checked using the following four status of the EDM1 signal in the table. Failures can be detected if the failure status can be confirmed, e.g., when the power supply is turned ON.

Signal Name	Logic			
/HWBB1	ON	ON	OFF	OFF
/HWBB2	ON	OFF	ON	OFF
EDM1	OFF	OFF	OFF	ON

⚠ WARNING

- The EDM1 signal is not a safety output. Use it only for monitoring a failure.

(1) Connection Example and Specifications of EDM1 Output Signal

Connection example and specifications of EDM1 output signal are explained below.

IMPORTANT

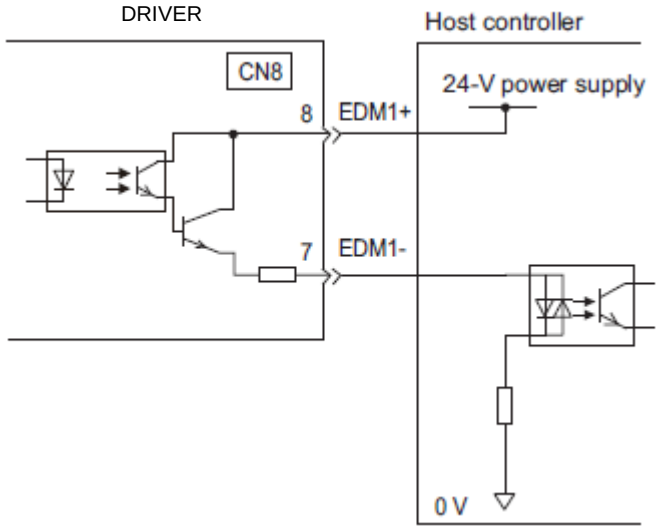
For safety function signal connections, the input signal is the 0 V common and the output signal is the source output. This is opposite to other signals described in this manual. To avoid confusion, the ON and OFF status of signals for safety functions are defined as follows:

ON: The state in which the relay contacts are closed or the transistor is ON and current flows into the signal line.

OFF: The state in which the relay contacts are open or the transistor is OFF and no current flows into the signal line.

- Connection Example

EDM1 output signal is used for source circuit. EDM1 output signal can't use for sink circuit.



- Specifications

Type	Signal Name	Connector Pin Number	Setting	Meaning
Output	EDM1	CN8-8 CN8-7	ON (closed)	Both the /HWBB1 and the /HWBB2 signals are working normally.
			OFF (open)	The /HWBB1 signal, the /HWBB2 signal or both are not working normally.

Electrical characteristics of EDM1 signal are as follows.

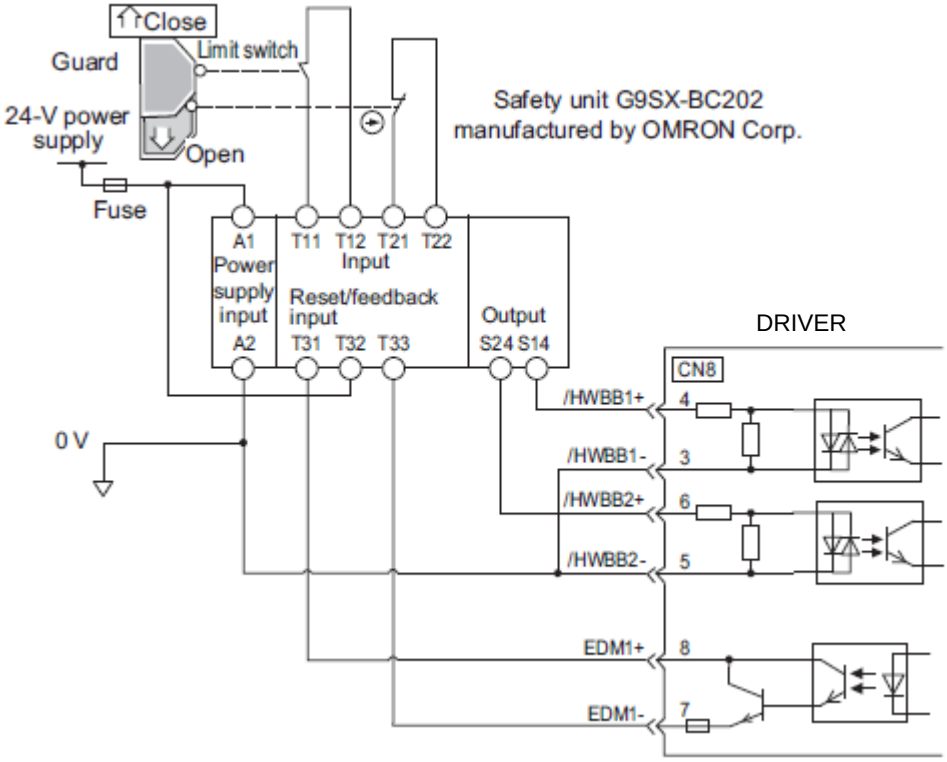
Items	Characteristics	Remarks
Maximum Allowable Voltage	30 VDC	–
Maximum Current	50 mADC	–
Maximum Voltage Drop at ON	1.0 V	Voltage between EDM1+ and EDM1- when current is 50 mA
Maximum Delay Time	20 ms	Time from the change in /HWBB1 or /HWBB2 until the change in EDM1

4.9.3 Application Example of Safety Functions

An example of using safety functions is shown below.

(1) Connection Example

In the following example, a safety unit is used and the HWBB function operates when the guard opens.



When a guard opens, both of signals, the /HWBB1 and the /HWBB2, turn OFF, and the EDM1 signal turns ON. Since the feedback is ON when the guard closes, the safety unit is reset, and the /HWBB1 and the /HWBB2 signals turn ON, and the operation becomes possible.

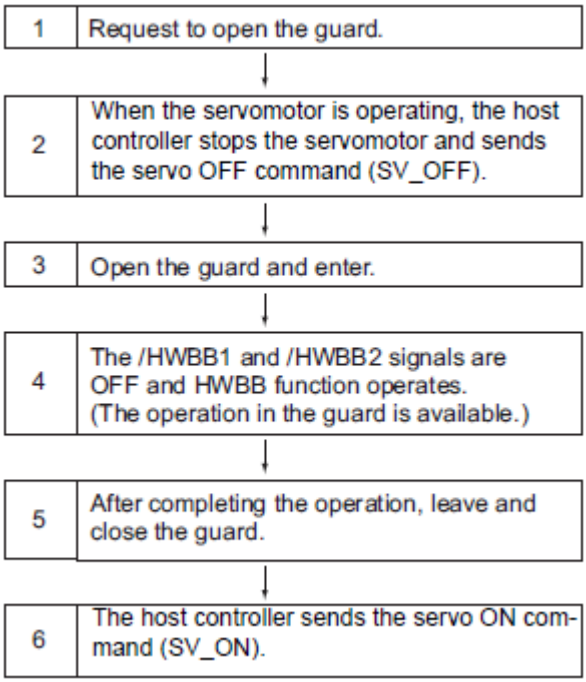
Note: The EDM1 signal is used as a sourcing output. Connect the EDM1 so that the current flows from EMD1+ to EMD1-.

(2) Failure Detection Method

In case of a failure such as the /HWBB1 or the /HWBB2 signal remains ON, the safety unit is not reset when the guard closes because the EDM1 signal keeps OFF. Therefore starting is impossible, then the failure is detected.

In this case, an error in the external device, disconnection or short-circuiting of the external wiring, or a failure in the DRIVER must be considered. Find the cause and correct the problem.

(3) Procedure



4.9.4 Confirming Safety Functions

When starting the equipment or replacing the DRIVER for maintenance, be sure to conduct the following confirmation test on the HWBB function after wiring.

- When the /HWBB1 and /HWBB2 signals turn OFF, check that the digital operator displays "Hbb" and that the servomotor does not operate.
- Check with the display of the feedback circuit input of the connected device to confirm that the EDM1 signal is OFF while in normal operation.

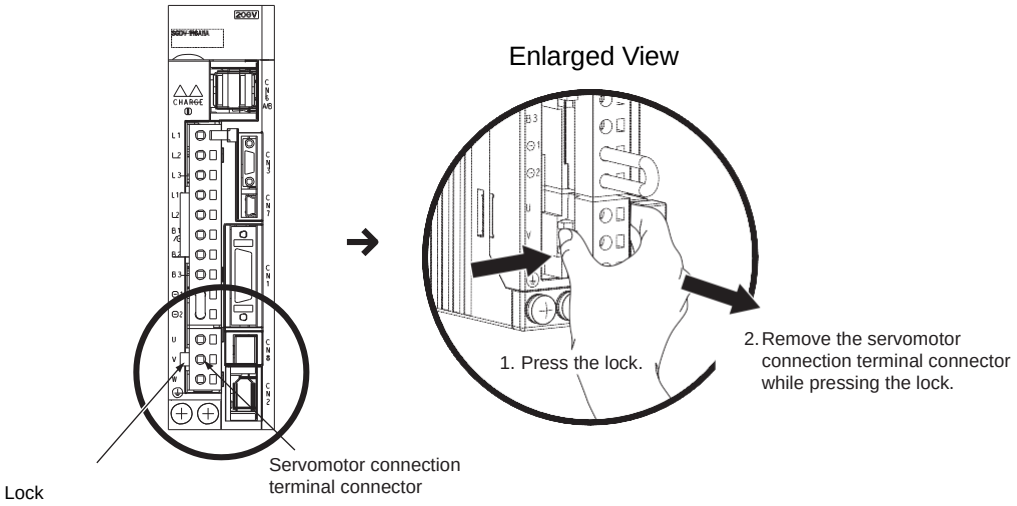
4.9.5 Connecting a Safety Function Device

Connect a safety function device using the following procedure.

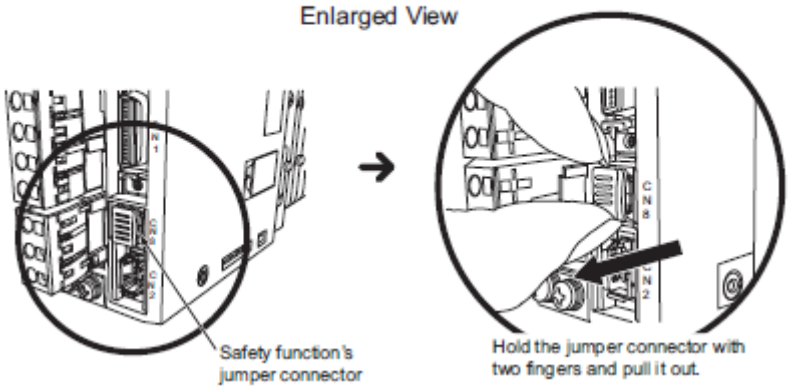
1. Remove the servomotor connection terminal connector while pressing the lock.

Applicable DRIVERs: LECYM2-V5, V7, V8

For DRIVER models not listed above, it is not necessary to remove the servomotor connection terminal connector. Go to step 2.



2. Remove the safety function's jumper connector from CN8.



3. Connect a safety function device to CN8.

Note: When not using the safety function, use the DRIVER with the safety function's jumper connector inserted in CN8. If the DRIVER is used without the jumper connector inserted into CN8, no current will flow to the servomotor and no torque will be output.

4.9.6 Precautions for Safety Function

⚠ WARNING

- To check that the HWBB function satisfies the safety requirements of the system, be sure to conduct a risk assessment of the system.

Incorrect use of the machine may cause injury.

- The servomotor rotates if there is external force (e.g., gravity in a vertical axis) when the HWBB function is operating. Therefore, use an appropriate device independently, such as a mechanical brake, that satisfies safety requirements.

Incorrect use of the machine may cause injury.

- While the HWBB function is operating, the motor may rotate within an electric angle of 180˚ or less as a result of a DRIVER failure. Use the HWBB function for applications only after checking that the rotation of the motor will not result in a dangerous condition.

Incorrect use of the machine may cause injury.

- The dynamic brake and the lock signal are not safety-related parts of a control system. Be sure to design the system that these failures will not cause a dangerous condition when the HWBB function operates. Incorrect use of the machine may cause injury.
- Connect devices meeting safety standards for the signals for safety functions.

Incorrect use of the machine may cause injury.

- If the HWBB function is used for an emergency stop, turn OFF the power supply to the servomotor with independent electric or mechanical parts.

Incorrect use of the machine may cause injury.

- The HWBB function does not shut off the power to the DRIVER or electrically isolate it. Take measures to shut off the power to the DRIVER when performing maintenance on it.

Failure to observe this warning may cause an electric shock.

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5 Adjustment

5.1 Type of Adjustments and Basic Adjustment Procedure

This section describes type of adjustments and the basic adjustment procedure.

5.1.1 Adjustments

Adjustments (tuning) are performed to optimize the responsiveness of the DRIVER. The responsiveness

is determined by the servo gain that is set in the DRIVER.

The servo gain is set using a combination of parameters, such as speed loop gain, position loop gain, filters, friction compensation, and moment of inertia ratio. These parameters influence each other. Therefore, the servo gain must be set considering the balance between the set values.

Generally, the responsiveness of a machine with high rigidity can be improved by increasing the servo gain. If the servo gain of a machine with low rigidity is increased, however, the machine will vibrate and the respon- siveness may not be improved. In such case, it is possible to suppress the vibration with a variety of vibration suppression functions in the DRIVER.

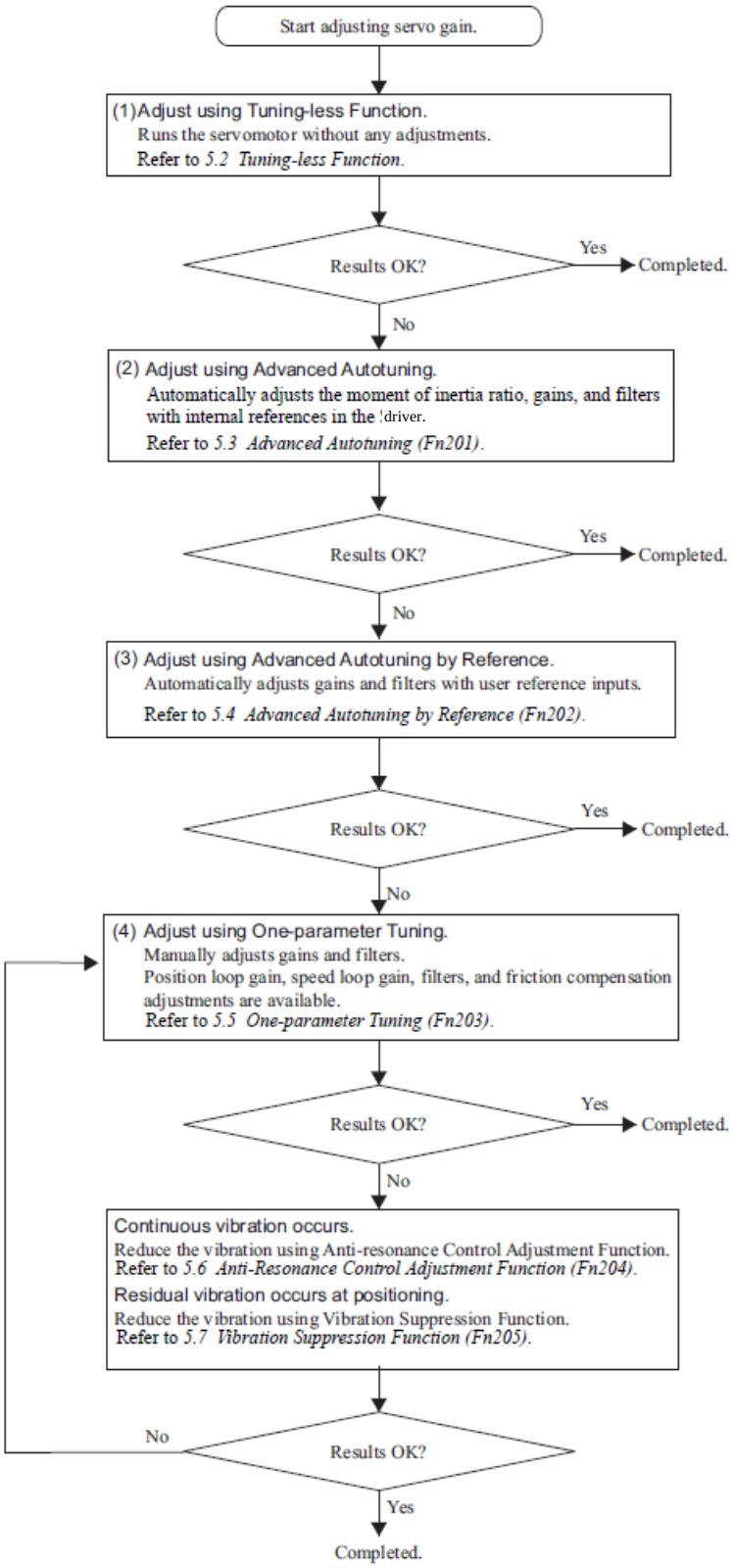
The servo gains are factory-set to appropriate values for stable operation. The following utility function can be used to adjust the servo gain to increase the responsiveness of the machine in accordance with the actual con- ditions. With this function, parameters related to adjustment above will be adjusted automatically and the need to adjust them individually will be eliminated.

This section describes the following utility adjustment functions.

Utility Function for Adjustment	Outline	Applicable Control Method
Tuning-less Levels Setting (Fn200)	This function is enabled when the factory settings are used. This function can be used to obtain a stable response regardless of the type of machine or changes in the load.	Speed and Position
Advanced Autotuning (Fn201)	The following parameters are automatically adjusted using internal references in the DRIVER during automatic operation. • Moment of inertia ratio • Gains (position loop gain, speed loop gain, etc.) • Filters (torque reference filter, notch filter) • Friction compensation • Anti-resonance control adjustment function • Vibration suppression function	Speed and Position
Advanced Autotuning by Reference (Fn202)	The following parameters are automatically adjusted with the position reference input from the host controller while the machine is in operation. • Gains (position loop gain, speed loop gain, etc.) • Filters (torque reference filter, notch filter) • Friction compensation • Anti-resonance control adjustment function • Vibration suppression function	Position
One-parameter Tuning (Fn203)	The following parameters are manually adjusted with the position or speed reference input from the host controller while the machine is in operation. • Gains (position loop gain, speed loop gain, etc.) • Filters (torque reference filter, notch filter) • Friction compensation • Anti-resonance control adjustment function	Speed and Position
Anti-Resonance Control Adjustment Function (Fn204)	This function effectively suppresses continuous vibration.	Speed and Position
Vibration Suppression Function (Fn205)	This function effectively suppresses residual vibration if it occurs when positioning.	Position

5.1.2 Basic Adjustment Procedure

The basic adjustment procedure is shown in the following flowchart. Make suitable adjustments considering the conditions and operating requirements of the machine.



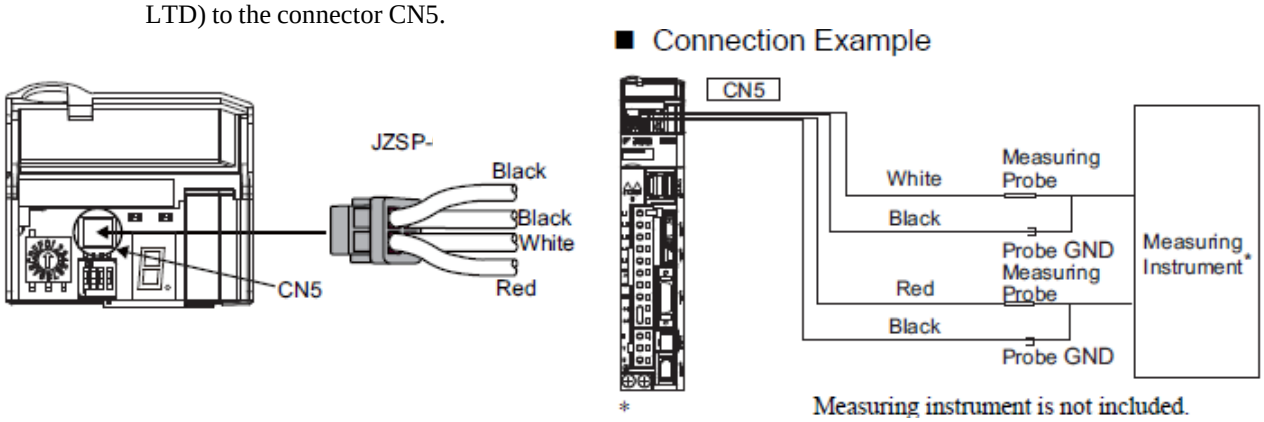
5.1.3 Monitoring Operation during Adjustment

Check the operating status of the machine and signal waveform when adjusting the servo gain. Connect a mea- suring instrument, such as a memory recorder, to connector CN5 analog monitor connector on the DRIVER to monitor analog signal waveform.

The settings and parameters for monitoring analog signals are described in the following sections.

(1) Connector CN5 for Analog Monitor

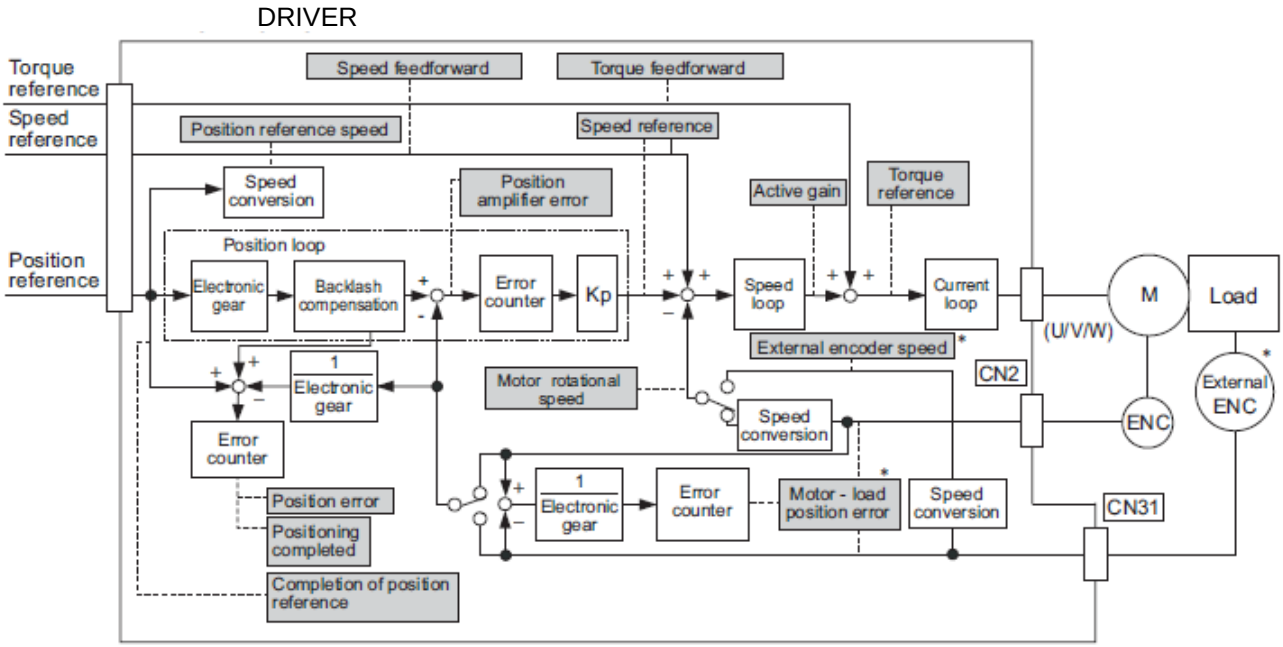
To monitor analog signals, connect a measuring instrument with cable (YASKAWA CONTROLS CO., LTD) to the connector CN5.



Line Color	Signal Name	Factory Setting
White	Analog monitor 1	Torque reference: 1 V/100% rated torque
Red	Analog monitor 2	Motor speed: 1 V/1000 min^{-1} *
Black (2 lines)	GND	Analog monitor GND: 0 V

(2) Monitor Signal

The shaded parts in the following diagram indicate analog output signals that can be monitored.



The following signals can be monitored by selecting functions with parameters Pn006 and Pn007. Pn006 is used for analog monitor 1 and Pn007 is used for analog monitor 2.

Parameter		Description		
		Monitor Signal	Unit	Remarks
Pn006 Pn007	n.□□00 [Pn007 Factory Setting]	Motor rotating speed	1 V/1000 min^{-1}	–
	n.□□01	Speed reference	1 V/1000 min^{-1}	–
	n.□□02 [Pn006 Factory Setting]	Torque reference	1 V/100% rated torque	–
	n.□□03	Position error	0.05 V/1 reference unit	0 V at speed/torque control
	n.□□04	Position amplifier error	0.05 V/1 encoder pulse unit	Position error after electronic gear conversion
	n.□□05	Position reference speed	1 V/1000 min^{-1}	–
	n.□□06	Reserved (Do not change.)	–	–
	n.□□07	Motor-load position error	0.01 V/1 reference unit	–
	n.□□08	Positioning completed	Positioning completed: 5 V Positioning not completed: 0 V	Completion indicated by output voltage.
	n.□□09	Speed feedforward	1 V/1000 min^{-1}	–
	n.□□0A	Torque feedforward	1 V/100% rated torque	–
	n.□□0B	Active gain *1	1st gain: 1 V 2nd gain: 2 V	Gain type indicated by output voltage.
	n.□□0C	Completion of position reference	Completed: 5 V Not completed: 0 V	Completion indicated by output voltage.
	n.□□0D	External encoder speed	1 V/1000 min^{-1}	Value at motor shaft

*1.Refer to *5.8.1 Switching Gain Settings* for details.

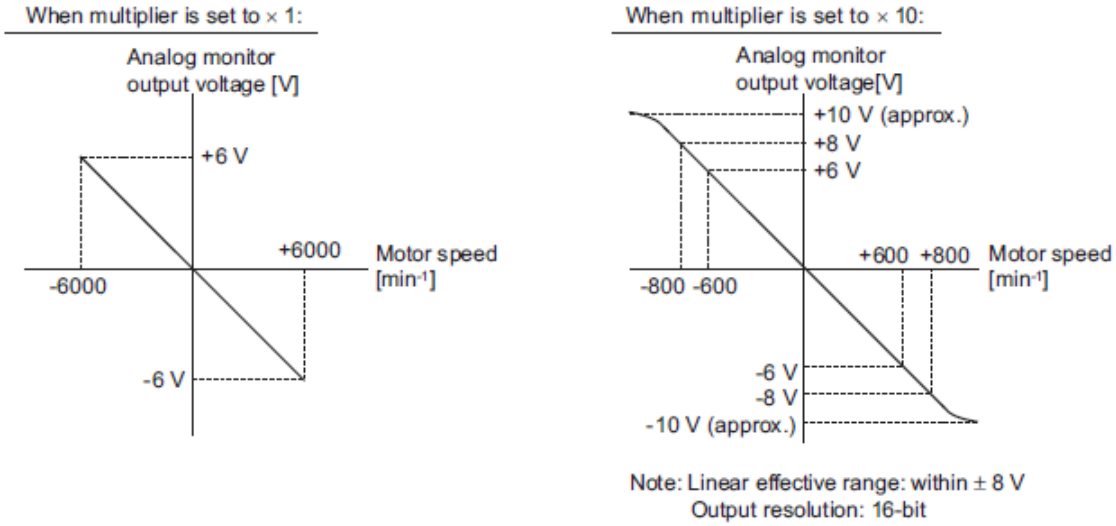
(3) Setting Monitor Factor

The output voltages on analog monitors 1 and 2 are calculated by the following equations.

$$\text{Analog monitor 1 output voltage} = (-1) \times \left(\underset{(\text{Pn006=n.00}\square\square)}{\text{Signal selection}} \times \underset{(\text{Pn552})}{\text{Multiplier}} + \underset{(\text{Pn550})}{\text{Offset voltage [V]}} \right)$$

$$\text{Analog monitor 2 output voltage} = (-1) \times \left(\underset{(\text{Pn007=n.00}\square\square)}{\text{Signal selection}} \times \underset{(\text{Pn553})}{\text{Multiplier}} + \underset{(\text{Pn551})}{\text{Offset voltage [V]}} \right)$$

<Example>
Analog monitor output at n.□□00 (motor rotating speed setting)



Note: Linear effective range: within ± 8 V
Output resolution: 16-bit

(4) Related Parameters

Use the following parameters to change the monitor factor and the offset.

Pn550	Analog Monitor 1 Offset Voltage			Speed Position Torque	Classification
	Setting Range	Setting Unit	Factory Setting	When Enabled	
	-10000 to 10000	0.1 V	0	Immediately	Setup
Pn551	Analog Monitor 2 Offset Voltage			Speed Position Torque	Classification
	Setting Range	Setting Unit	Factory Setting	When Enabled	
	-10000 to 10000	0.1 V	0	Immediately	Setup
Pn552	Analog Monitor Magnification (× 1)			Speed Position Torque	Classification
	Setting Range	Setting Unit	Factory Setting	When Enabled	
	-10000 to 10000	× 0.01	100	Immediately	Setup
Pn553	Analog Monitor Magnification (× 2)			Speed Position Torque	Classification
	Setting Range	Setting Unit	Factory Setting	When Enabled	
	-10000 to 10000	× 0.01	100	Immediately	Setup

5.1.4 Safety Precautions on Adjustment of Servo Gains

⚠ CAUTION

- If adjusting the servo gains, observe the following precautions.
  - Do not touch the rotating section of the servomotor while power is being supplied to the motor.
  - Before starting the servomotor, make sure that the DRIVER can come to an emergency stop at any time.
  - Make sure that a trial operation has been performed without any trouble.
  - Install a safety brake on the machine.

Set the following protective functions of the DRIVER to the correct settings before starting to adjust the servo gains.

(1) Overtravel Function

Set the overtravel function. For details on how to set the overtravel function, refer to *4.3.2 Overtravel*.

(2) Torque Limit

The torque limit calculates the torque required to operate the machine and sets the torque limits so that the out- put torque will not be greater than required. Setting torque limits can reduce the amount of shock applied to the machine when troubles occur, such as collisions or interference. If a torque limit is set lower than the value that is needed for operation, overshooting or vibration can be occurred.
For details, refer to *4.6 Limiting Torque*.

(3) Excessive Position Error Alarm Level

The excessive position error alarm is a protective function that will be enabled when the DRIVER is used in position control.

If this alarm level is set to a suitable value, the DRIVER will detect an excessive position error and will stop the servomotor if the servomotor does not operate according to the reference. The position error indicates the difference between the position reference value and the actual motor position. The position error can be calculated from the position loop gain (Pn102) and the motor speed with the follow- ing equation.

$$\text{Position Error [reference unit]} = \frac{\text{Motor Speed [min}^{-1}\text{]}}{60} \times \frac{\text{Encoder Resolution}^{*1}}{\text{Pn102 [0.1/s]}/10^{*2}} \times \frac{\text{Pn210}}{\text{Pn20E}}$$

· Excessive Position Error Alarm Level (Pn520 [1 reference unit])

$$\text{Pn520} > \frac{\text{Max. Motor Speed [min}^{-1}\text{]}}{60} \times \frac{\text{Encoder Resolution}^{*1}}{\text{Pn102 [0.1/s]}/10^{*2}} \times \frac{\text{Pn210}}{\text{Pn20E}} \times \underline{\underline{(1.2 \text{ to } 2)}}$$

∗1. Refer to *4.4.3 Electronic Gear*.
∗2. To check the Pn102 setting, change the parameter display setting to display all parameters (Pn00B.0 = 1).

At the end of the equation, a coefficient is shown as "× (1.2 to 2)." This coefficient is used to add a margin that prevents a position error overflow alarm (A.d00) from occurring in actual operation of the servomotor.

Set the level to a value that satisfies these equations, and no position error overflow alarm (A.d00) will be generated during normal operation. The servomotor will be stopped, however, if it does not operate according to the reference and the DRIVER detects an excessive position error.

The following example outlines how the maximum limit for position deviation is calculated. These conditions apply.

- Maximum speed = 6000
- Encoder resolution = 1048576 (20 bits)
- Pn102 = 400
- Pn210/Pn20E = 1/1

Under these conditions, the following equation is used to calculate the maximum limit (Pn520).

$$\text{Pn520} = \frac{6000}{60} \times \frac{1048576}{400/10} \times \frac{1}{1} \times 2$$
$$= 2621440 \times 2$$
$$= 5242880 \text{ (The factory setting of Pn520)}$$

If the acceleration/deceleration of the position reference exceeds the capacity of the servomotor, the servomo- tor cannot perform at the requested speed, and the allowable level for position error will be increased as not to satisfy these equations. If so, lower the level of the acceleration/deceleration for the position reference so that the servomotor can perform at the requested speed or increase the excessive position error alarm level (Pn520).

- Related Parameter

Pn520	Excessive Position Error Alarm Level [Position]				Classification
	Setting Range	Setting Unit	Factory Setting	When Enabled	
	1 to 1073741823	1 reference unit	5242880	Immediately	Setup

- Related Alarm

Alarm Display	Alarm Name	Meaning
A.d00	Position Error Overflow	Position errors exceeded parameter Pn520.

(4) Vibration Detection Function

Set the vibration detection function to an appropriate value with the vibration detection level initialization (Fn01B). For details on how to set the vibration detection function, refer to *6.15 Vibration Detection Level Initialization (Fn01B)*.

(5) Excessive Position Error Alarm Level at Servo ON

If position errors remain in the error counter when turning ON the servomotor power, the servomotor will move and this movement will clear the counter of all position errors. Because the servomotor will move sud- denly and unexpectedly, safety precautions are required. To prevent the servomotor from moving suddenly, select the appropriate level for the excessive position error alarm level at servo ON (Pn526) to restrict opera- tion of the servomotor.

-Related Parameters

Pn526	Excessive Position Error Alarm Level at Servo ON [Position]				Classification
	Setting Range	Setting Unit	Factory Setting	When Enabled	
	1 to 1073741823	1 reference unit	5242880	Immediately	Setup

Pn528	Excessive Position Error Warning Level at Servo ON [Position]				Classification
	Setting Range	Setting Unit	Factory Setting	When Enabled	
	10 to 100	1%	100	Immediately	Setup

Pn529	Speed Limit Level at Servo ON [Position]				Classification
	Setting Range	Setting Unit	Factory Setting	When Enabled	
	0 to 10000	1 min^{-1}	10000	Immediately	Setup

- Related Alarms

Alarm Dis-play	Alarm Name	Meaning
A.d01	Position Error Overflow Alarm at Servo ON	This alarm occurs if the servomotor power is turned ON when the position error is greater than the set value of Pn526 while the servomotor power is OFF.
A.d02	Position Error Overflow Alarm by Speed Limit at Servo ON	When the position errors remain in the error counter, Pn529 limits the speed if the servomotor power is turned ON. If Pn529 limits the speed in such a state, this alarm occurs when position references are input and the number of position errors exceeds the value set for the excessive position error alarm level (Pn520).

When an alarm occurs, refer to *9 Troubleshooting* and take the corrective actions.

5.2 Tuning-less Function

The tuning-less function is enabled in the factory settings. If resonance is generated or excessive vibration occurs, refer to *5.2.2 Tuning-less Levels Setting (Fn200) Procedure* and change the set value of Pn170.2 for the rigidity level and the set value in Pn170.3 for the load level.

⚠ CAUTION

- The tuning-less function is enabled in the factory settings. A sound may be heard for a moment when the SV_ON command is received for the first time after the servo drive is mounted to the machine. This sound does not indicate any problems; it means that the automatic notch filter was set. The sound will not be heard from the next time the SV_ON command is received. For details on the automatic notch filter, refer to *(3) Automatically Setting the Notch Filter* on the next page.
- The servomotor may vibrate if the load moment of inertia exceeds the allowable load value. If vibration occurs, set the mode to 2 in Fn200 or lower the adjustment level.

5.2.1 Tuning-less Function

The tuning-less function obtains a stable response without manual adjustment regardless of the type of machine or changes in the load.

(1) Enabling/Disabling Tuning-less Function

The following parameter is used to enable or disable the tuning-less function.

Parameter		Meaning	When Enabled	Classification
Pn170	n.□□□0	Disables tuning-less function.	After restart	Setup
	n.□□□1 [Factory setting]	Enables tuning-less function.		
	n.□□0□ [Factory setting]	Used as speed control.		
	n.□□1□	Used as speed control and host controller used as position control.		

(2) Application Restrictions

The tuning-less function can be used in position control or speed control. This function is not available in torque control. The following application restrictions apply to the tuning-less function.

Function	Availability	Remarks
Vibration detection level initialization (Fn01B)	Available	–
Advanced autotuning (Fn201)	Available (Some conditions apply)	• This function can be used when the moment of inertia is calculated. • While this function is being used, the tuning-less function cannot be used. After completion of the autotuning, it can be used again.
Advanced autotuning by reference (Fn202)	Not available	–
One-parameter tuning (Fn203)	Not available	–
Anti-resonance control adjustment function (Fn204)	Not available	–
Vibration suppression function (Fn205)	Not available	–
EasyFFT (Fn206)	Available	While this function is being used, the tuning-less function cannot be used. After completion of the EasyFFT, it can be used again.
Friction compensation	Not available	–
Gain switching	Not available	–
Offline moment of inertia calculation *	Not available	Disable the tuning-less function by setting Pn170.0 to 0 before executing this function.
Mechanical analysis*	Available	While this function is being used, the tuning-less function cannot be used. After completion of the analysis, it can be used again.

∗ Operate using SigmaWin+.

(3) Automatically Setting the Notch Filter

Usually, set this function to Auto Setting. (The notch filter is factory-set to Auto Setting.) If this function is set to Auto Setting, vibration will be detected automatically and the notch filter will be set when the tuning-less function is enabled.

Set this function to Not Auto Setting only if you do not change the notch filter setting before executing tuning- less function.

Parameter		Meaning	When Enabled	Classification
Pn460	n.□0□□	Does not set the 2nd notch filter automatically with utility function.	Immediately	Tuning
	n.□1□□ [Factory setting]	Set the 2nd notch filter automatically with utility function.		

(4) Tuning-less Level Settings

Two tuning-less levels are available: the rigidity level and load level. Both levels can be set in the Pn170 parameter.

- Rigidity Level

Parameter		Meaning	When Enabled	Classification
Pn170	n.□0□□	Rigidity level 0 (Level 0)	Immediately	Setup
	n.□1□□	Rigidity level 1 (Level 1)		
	n.□2□□	Rigidity level 2 (Level 2)		
	n.□3□□	Rigidity level 3 (Level 3)		
	n.□4□□ [Factory setting]	Rigidity level 4 (Level 4)		

- Load Level

Parameter		Meaning	When Enabled	Classification
Pn170	n.0□□□	Load level : Low (Mode 0)	Immediately	Setup
	n.1□□□ [Factory setting]	Load level : Medium (Mode 1)		
	n.2□□□	Low level : High (Mode 2)		

5.2.2 Tuning-less Levels Setting (Fn200) Procedure

⚠ CAUTION

- To ensure safety, perform the tuning-less function in a state where the DRIVER can come to an emergency stop at any time.

The procedure to use the tuning-less function is given below.

Operate the tuning-less function from the SigmaWin+.

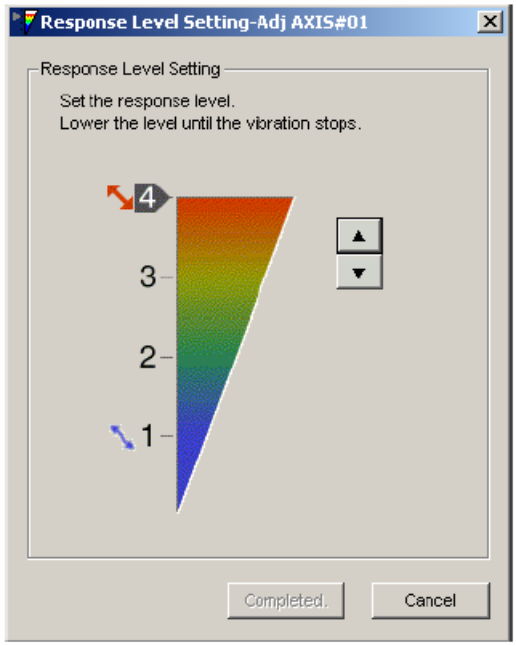
(1) Preparation

Check the following settings before performing the tuning-less function. If the settings are not correct, "NO-OP" will be displayed during the tuning-less function.

- The tuning-less function must be enabled (Pn170.0 = 1).
- The write prohibited setting parameter (Fn010) must be set to Write permitted (P.0000).
- The test without a motor function must be disabled. (Pn00C.0 = 0).

(2) Operating Procedure with Sigma Win+

1. In the SigmaWin+ Σ-V component main window, click **Setup** and then **Response Level Setting**.



2. Click the setting arrows to adjust the response level so that the machine does not vibrate. The factory setting is 4, the maximum level.
3. Click **Completed** to save the setting in the DRIVER.

(3) Alarm and Corrective Actions

The autotuning alarm (A.521) will occur if resonance sound is generated or excessive vibration occurs during position control. In such case, take the following actions.

-Resonance Sound

In the SigmaWin+, reduce the setting of the Response level.

-Excessive Vibration during Position Control

Take one of the following actions to correct the problem.

In the SigmaWin+, reduce the setting of the Response level.
Increase the setting of Pn170.3 (Load level) or reduce the setting of Pn170.2.

(4) Parameters Disabled by Tuning-less Function

When the tuning-less function is enabled in the factory settings, the settings of these parameters are not avail- able: Pn100, Pn101, Pn102, Pn103, Pn104, Pn105, Pn106, Pn160, Pn139, and Pn408. These gain-related parameters, however, may become effective depending on the executing conditions of the functions specified in the following table. For example, if EasyFFT is executed when the tuning-less function is enabled, the set- tings in Pn100, Pn104, Pn101, Pn105, Pn102, Pn106, and Pn103, as well as the manual gain switch setting, will be enabled, but the settings in Pn408.3, Pn160.0, and Pn139.0 will be not enabled.

Parameters Disabled by Tuning-less Function			Related Functions and Parameters*		
Item	Name	Pn Number	Torque Con- trol	Easy FFT	Mechanical Analysis (Ver- tical Axis Mode)
Gain	Speed Loop Gain 2nd Speed Loop Gain	Pn100 Pn104	○	○	○
	Speed Loop Integral Time Constant 2nd Speed Loop Integral Time Constant	Pn101 Pn105	×	○	○
	Position Loop Gain 2nd Position Loop Gain	Pn102 Pn106	×	○	○
	Moment of Inertia Ratio	Pn103	○	○	○
Advanced Control	Friction Compensation Function Selec- tion	Pn408.3	×	×	×
	Anti-resonance Control Adjustment Selection	Pn160.0	×	×	×
Gain Switch- ing	Gain Switching Selection Switch	Pn139.0	×	×	×

∗ ○: Parameter enabled
×: Parameter disabled

(5) Tuning-less Function Type

The following table shows the types of tuning-less functions for the version of DRIVER software.

Software Version*	Tuning-less Type	Meaning
000A or earlier	Tuning-less type 1	–
000B or later	Tuning-less type 2	The level of noise produced is lower than that of Type 1.

∗Refer to "6.13 Product Information Display" for the confirm method of the software version.

The software version number of your DRIVER can be checked with Fn012.

Parameter		Meaning	When Enabled	Classification
Pn14F	n.□□0□	Tuning-less type 1	After restart	Tuning
	n.□□1□ [Factory setting]	Tuning-less type 2		

5.2.3 Related Parameters

The following table lists parameters related to this function and their possibility of being changed while executing this function or of being changed automatically after executing this function.

- Parameters related to this function

  These are parameters that are used or referenced when executing this function.

- Allowed changes during execution of this function

  Yes : Parameters can be changed using SigmaWin+ while this function is being executed.
  No : Parameters cannot be changed using SigmaWin+ while this function is being executed.

- Automatic changes after execution of this function

  Yes : Parameter set values are automatically set or adjusted after execution of this function.
  No : Parameter set values are not automatically set or adjusted after execution of this function.

Parameter	Name	Mid-execution changes	Automatic changes
Pn170	Tuning-less Function Related Switch	No	Yes
Pn401	Torque Reference Filter Time Constant	No	Yes
Pn40C	2nd Notch Filter Frequency	No	Yes
Pn40D	2nd Notch Filter Q Value	No	Yes

5.3 Advanced Autotuning (Fn201)

This section describes the adjustment using advanced autotuning.

IMPORTANT

- Advanced autotuning starts adjustments based on the set speed loop gain (Pn100). Therefore, precise adjustments cannot be made if there is vibration when starting adjustments. In this case, make adjustments after lowering the speed loop gain (Pn100) until vibration is eliminated.
- Before performing advanced autotuning with the tuning-less function enabled (Pn170.0 = 1: Factory setting), always set Jcalc to ON to calculate the load moment of inertia. The tuning-less function will automatically be disabled, and the gain will be set by advanced autotuning.
  With Jcalc set to OFF so the load moment of inertia is not calculated, "Error" will be displayed on the panel operator, and advanced autotuning will not be performed.
- If the operating conditions, such as the machine-load or drive system, are changed after advanced autotuning, then change the following related parameters to disable any values that were adjusted before performing advanced autotuning once again with the setting to calculate the moment of inertia. If advanced autotun- ing is performed without changing the parameters, machine vibration may occur, resulting in damage to the machine.

  Pn00B.0=1 (Displays all parameters.)

  Pn140.0=0 (Does not use model following control.)

  Pn160.0=0 (Does not use anti-resonance control.)

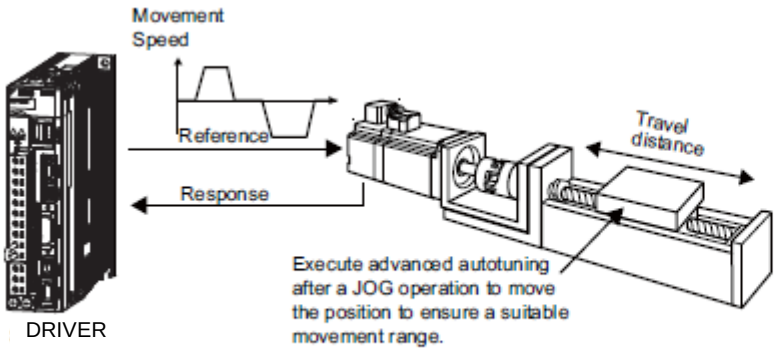
  Pn408=n.00□0 (Does not use friction compensation, 1st notch filter, or 2nd notch filter.)

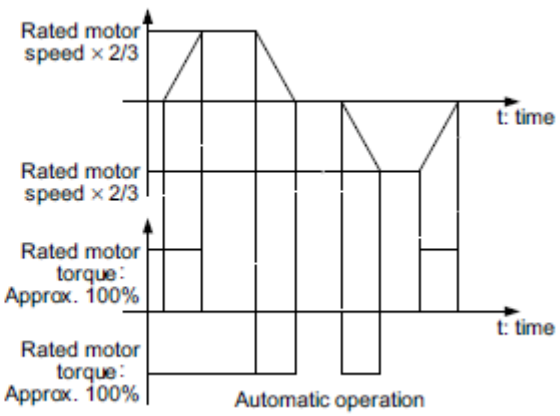
5.3.1 Advanced Autotuning

Advanced autotuning automatically operates the servo system (in reciprocating movement in the forward and reverse directions) within set limits and adjust the DRIVER automatically according to the mechanical characteristics while the servo system is operating.

Advanced autotuning can be performed without connecting the host controller. The following automatic operation specifications apply.

- Maximum speed: Rated motor speed × 2/3
- Acceleration torque: Approximately 100% of rated motor torque
  The acceleration torque varies with the influence of the moment of inertia ratio
  (Pn103), machine friction, and external disturbance.
- Travel distance: The travel distance can be set freely. The distance is factory-set to a value equivalent to 3 motor rotations.





Advanced autotuning performs the following adjustments.

- Moment of inertia ratio
- Gains (e.g., position loop gain and speed loop gain)
- Filters (torque reference filter and notch filter)
- Friction compensation
- Anti-resonance control
- Vibration suppression (Mode = 2 or 3)

Refer to *5.3.3 Related Parameters* for parameters used for adjustments.

⚠ CAUTION

- Because advanced autotuning adjusts the DRIVER during automatic operation, vibration or over- shooting may occur. To ensure safety, perform advanced autotuning in a state where the DRIVER can come to an emergency stop at any time.

(1) Preparation

Check the following settings before performing advanced autotuning.
The message "NO-OP" indicating that the settings are not appropriate will be displayed, if all of the following conditions are not met.

- The main circuit power supply must be ON.
- There must be no overtravel.
- The servomotor power must be OFF.
- The control method must not be set to torque control.
- The gain selection switch must be in manual switching mode (Pn139.0 = 0).
- Gain setting 1 must be selected.
- The test without a motor function must be disabled (Pn00C.0 = 0).
- All alarms and warning must be cleared.
- The hardwire baseblock (HWBB) must be disabled.
- The write prohibited setting parameter (Fn010) must be set to Write permitted (P.0000).
- Jcalc must be set to ON to calculate the load moment of inertia when the tuning-less function is enabled (Pn170.0 = 1: factory setting) or the tuning-less function must be disabled (Pn170.0 = 0).

Note:

- If advanced autotuning is started while the DRIVER is in speed control, the mode will change to position control automatically to perform advanced autotuning. The mode will return to speed control after completing the adjustment. To perform advanced autotuning in speed control, set the mode to 1 (Mode = 1).

(2) When Advanced Autotuning Cannot Be Performed

Advanced autotuning cannot be performed normally under the following conditions. Refer to *5.4 Advanced Autotuning by Reference (Fn202)* and *5.5 One-parameter Tuning (Fn203)* for details.

- The machine system can work only in a single direction.

(3) When Advanced Autotuning Cannot Be Performed Successfully

Advanced autotuning cannot be performed successfully under the following conditions. Refer to *5.4 Advanced Autotuning by Reference (Fn202)* and *5.5 One-parameter Tuning (Fn203)* for details.

- The operating range is not applicable.
- The moment of inertia changes within the set operating range.
- The machine has high friction.
- The rigidity of the machine is low and vibration occurs when positioning is performed.
- The position integration function is used.
- P control operation (proportional control) is used.

Note:If a setting is made for calculating the moment of inertia, an error will result when P control operation is selected using /V_PPI of OPTION field while the moment of inertia is being calculated.

• The mode switch is used.

Note:If a setting is made for calculating the moment of inertia, the mode switch function will be disabled while the moment of inertia is being calculated. At that time, PI control will be used. The mode switch function will be enabled after calculating the moment of inertia.

- Speed feedforward or torque feedforward is input.
- The positioning completed width (Pn522) is too small.

IMPORTANT

- Advanced autotuning makes adjustments by referring to the positioning completed width (Pn522). If the DRIVER is operated in position control (Pn000.1=1), set the electronic gear ratio (Pn20E/Pn210) and positioning completed width (Pn522) to the actual value during operation. If the DRIVER is operated in speed control (Pn000.1=0), set Mode to 1 to perform advanced autotuning.
- Unless the positioning completed signal (/COIN) is turned ON within approximately 3 seconds after positioning has been completed, "WAITING" will flash. Furthermore, unless the positioning completed signal (/COIN) is turned ON within approximately 10 seconds, "Error" will flash for 2 seconds and tuning will be aborted.

Change only the overshoot detection level (Pn561) to finely adjust the amount of overshooting without chang- ing the positioning completed width (Pn522). Because Pn561 is set by default to 100%, the allowable amount of overshooting is the same amount as that for the positioning completed width.
When Pn561 is set to 0%, the amount of overshooting can be adjusted to prevent overshooting the positioning completed width. If the setting of Pn561 is changed, however, the positioning time may be extended.

Pn561	Overshoot Detection Level		Speed Position Torque		Classification
	Setting Range	Setting Unit	Factory Setting	When Enabled	
	0 to 100	1%	100	Immediately	Setup

(4) Restrictions When Using an Encoder

With this function, the following restrictions are applied in accordance with the version number of the DRIVER software and the encoder being used.

Software Version*1	20-bit Encoder	
	Mode	Model Following Control Type
Version 0007 or earlier	No restrictions	Type 1*2
Version 0008 or later		Type 1 or 2 [Factory setting]*3

∗1. The software version number of your DRIVER can be checked with Fn012. Refer to "6.13 Product Information Display" for the confirm method of the software version.

∗2. Position errors may result in overshooting when positioning. The positioning time may be extended if the positioning completed width (Pn522) is set to a small value.

∗3. Model following control type 2 can suppress overshooting resulting from position errors better than Type 1. If compatibility with DRIVER version 0007 or earlier is required, use model following control type 1 (Pn14F.0 = 0).

The control related switch (Pn14F) was added to DRIVER software version 0008 or later.

Parameter		Function	When Enabled	Classification
Pn14F	n.□□□0	Model following control type 1	After restart	Tuning
	n.□□□1 [Factory setting]	Model following control type 2		

5.3.2 Advanced Autotuning Procedure

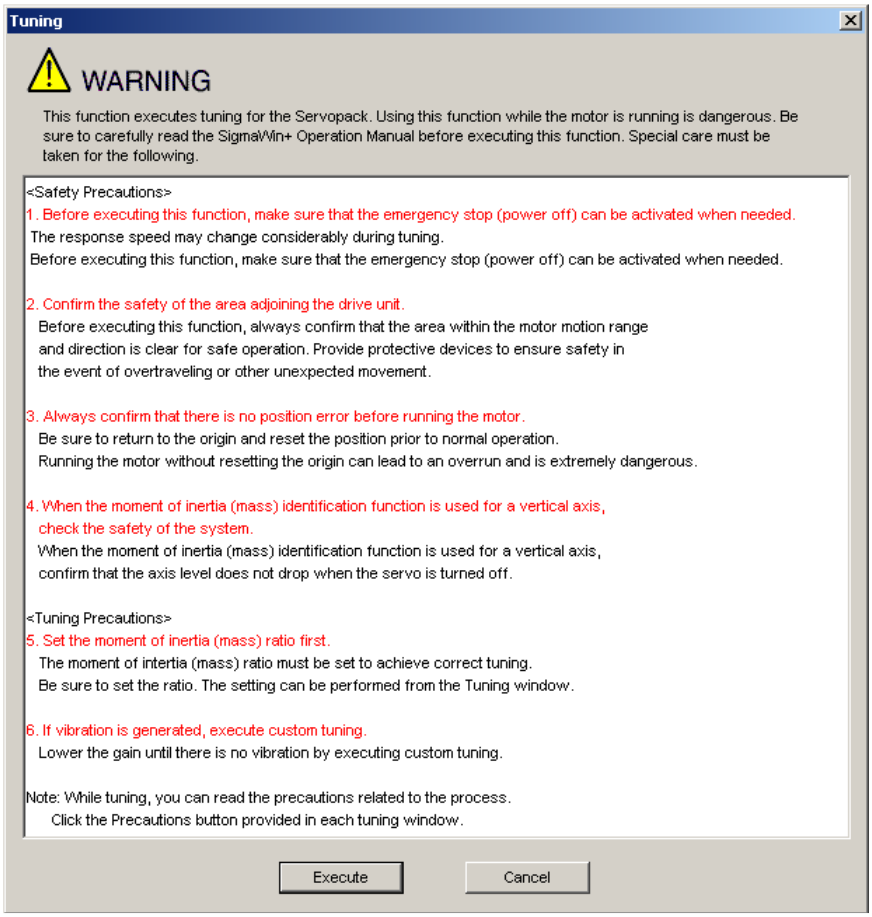
The following procedure is used for advanced autotuning.
Advanced autotuning is performed from the SigmaWin+.
The operating procedure from the SigmaWin+ is described here.

⚠ CAUTION

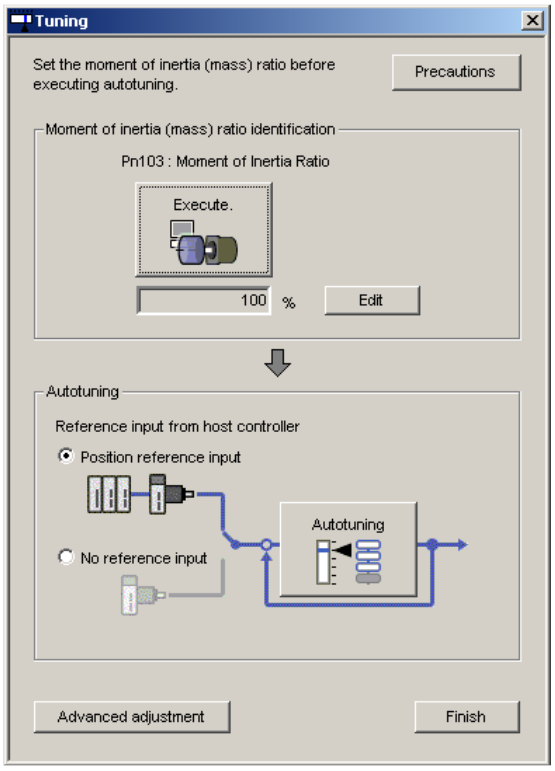
- When using the DRIVER with Jcalc = OFF (load moment of inertia is not calculated), be sure to set a suitable value for the moment of inertia ratio (Pn103). If the setting greatly differs from the actual moment of inertia ratio, normal control of the DRIVER may not be possible, and vibration may result.
- When using the MP2000 Series with phase control, select the mode = 1 (standard level). If 2 or 3 is selected, phase control of the MP2000 Series may not be possible.

(1) Operating Procedure

In the SigmaWin+ Σ-V component main window, click **Tuning** and then click **Tuning**.



Click **Execute**. The Tuning main window appears.

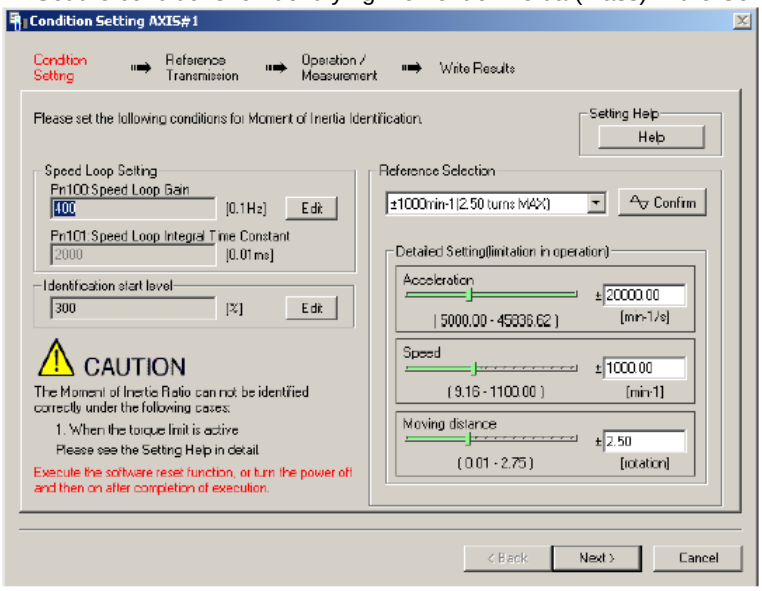


- Moment of Inertia (Mass) Identification

Click **Execute** in the Tuning main window. The Condition Setting box will appear.

1. Setting the Conditions

Set the conditions for identifying moment of inertia (mass) in the Condition Setting box.



Speed Loop Setting: Set the speed loop gain and integral time constant.

[Edit]

Click **Edit** to view the Speed Loop-Related Setting Change box.

Identification Start Level: Set the moment of inertia (mass) identification start level.

[Help]

Click **Help** to open the window for guidelines on the reference condition settings.

Reference Selection: Select the reference pattern for identifying the moment of inertia (mass). (Recommended method.)

Detailed Setting: Create the reference pattern for setting the moment of inertia (mass) by changing the values with the slider or by directly entering the values.

[Next>]

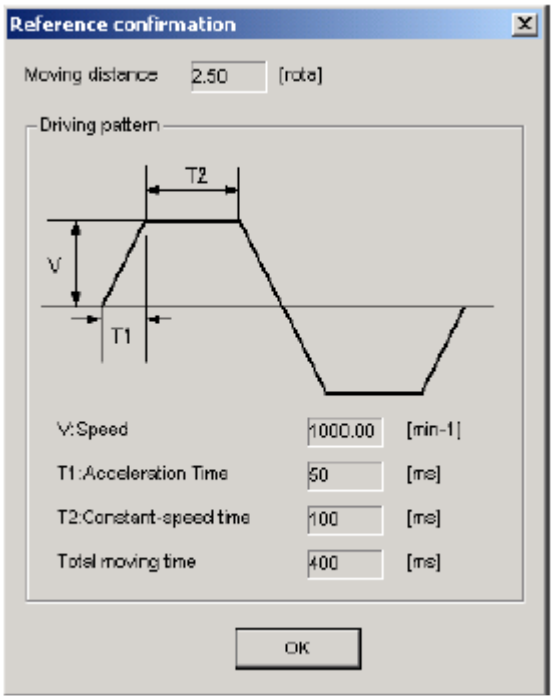
Click **Next** to view the Reference Transmission box.

[Cancel]

Click **Cancel** to return to the main window without changing the conditions.

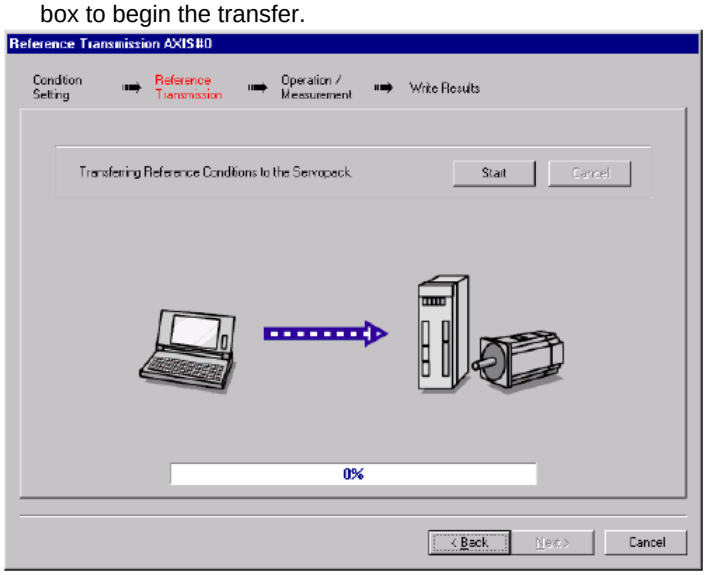
[Confirm]

Click **Confirm** to view the reference wave.



2. Reference Transmission

Transfer the reference conditions to the DRIVER. Click **Start** in the Reference Transmission box to begin the transfer.



[Start]

Click to **Start** to transfer the reference conditions to the DRIVER. A progress bar displays the progress status of the transfer.

[Cancel]

The **Cancel** button is available only during the transfer to the DRIVER. After the transmission is finished, it is unavailable and cannot be selected.

[Next>]

The **Next** button is available if the data is transferred successfully. If an error occurs or if the transmission is interrupted, it is unavailable and cannot be selected.

Click **Next** to view the Operation/Measurement box.

[<Back]

Click **Back** to return to the Condition Setting box. The **Back** button is unavailable during a data transfer.

[Cancel]

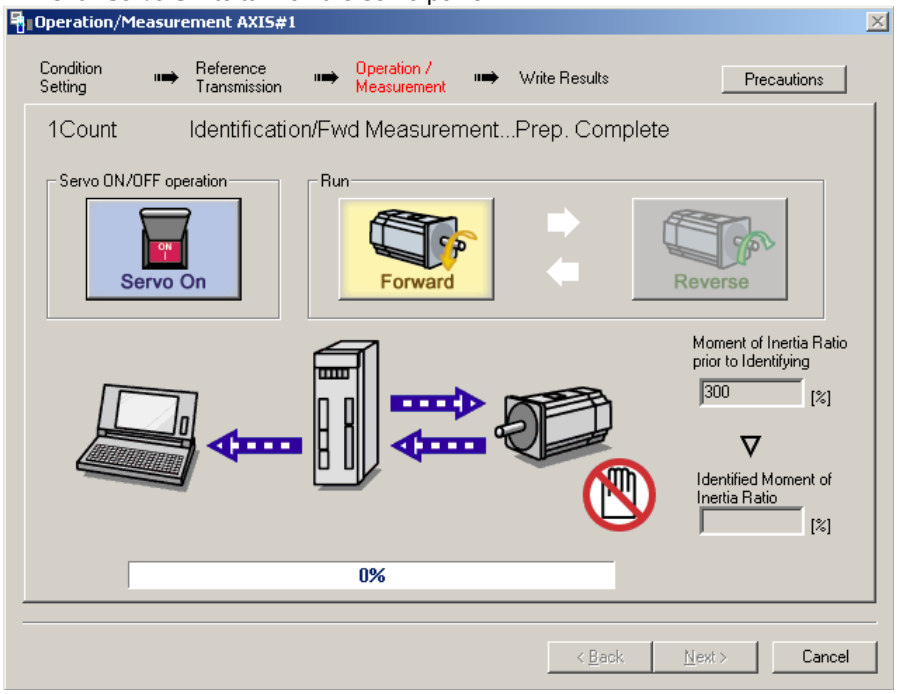
Click **Cancel** to stop processing and return to the main window.

After the data has been successfully transferred, click **Next**, and the Operation/ Measurement box appears.

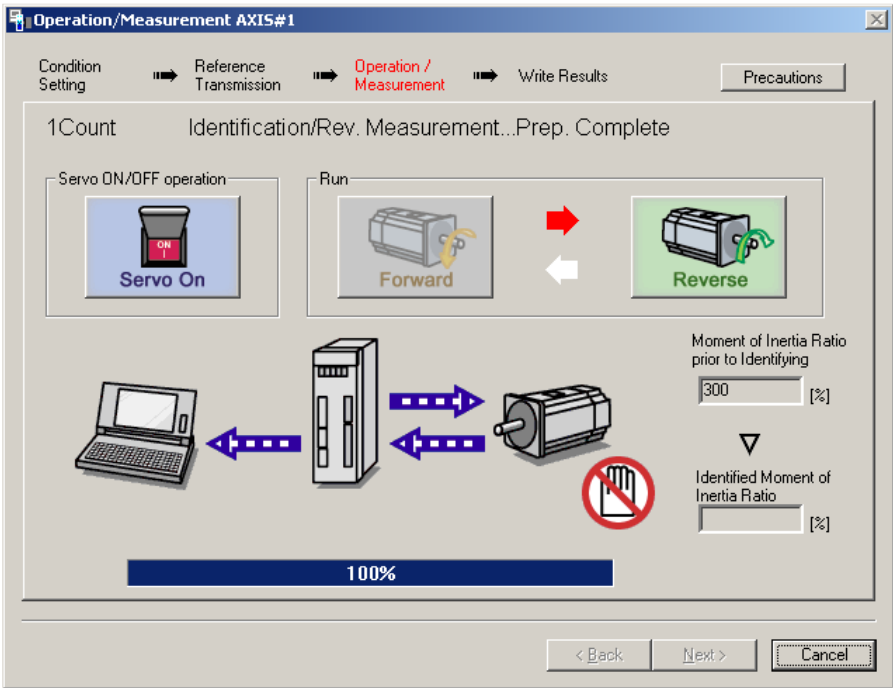
3. Operation/Measurement

In the Operation/Measurement box, run and measure the actual motor. Measurements are taken two to seven times and then verified. Run the motor and take measurements using the following procedure.

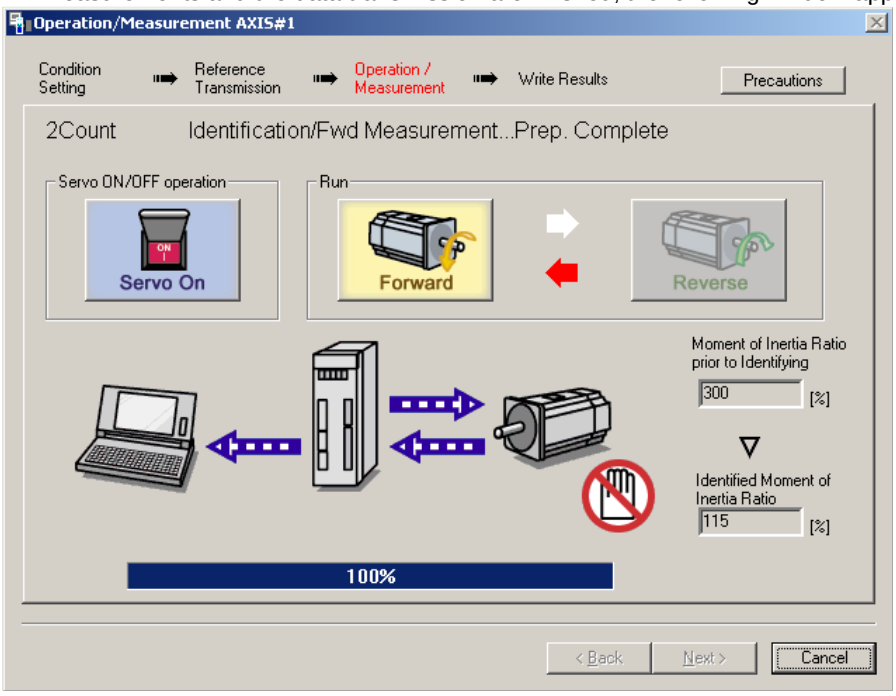
1. Click **Servo ON** to turn on the servo power.



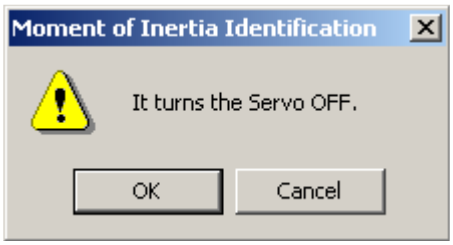
2. Click **Forward** to take measurements by turning (moving) the motor forward. After the measurements and the data transmission are finished, the following window appears.



3. Click **Reverse** to take measurements by turning (moving) the motor in reverse. After the measurements and the data transmission are finished, the following window appears.



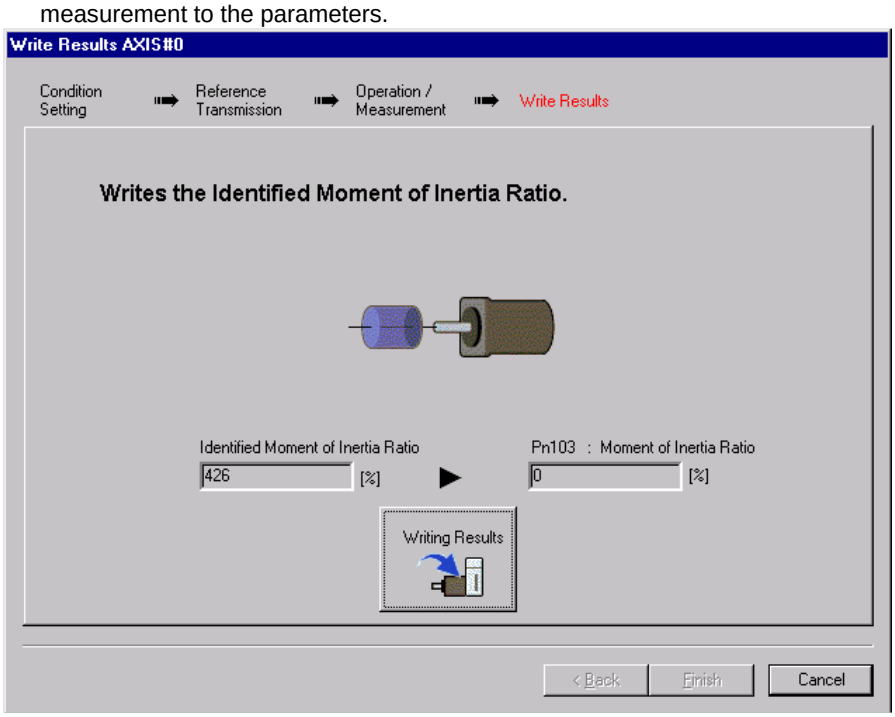
4. Repeat steps 2 through 3 until all the measurements have been taken.
   The actual number of times the measurements have been taken is displayed in the upper left part on the screen.
   The progress bar displays the percentage of data that has been transferred.1
5. After the measurement has been successfully completed, click **Servo ON** to turn to the servo OFF status.
6. Click **Next**, and the Write Results box appears.
   When **Next** is clicked without turning to the servo OFF status, the following message appears.



Click **OK** to turn to the servo OFF status.

4. Writing Results

In the Write Results box, set the moment of inertia (mass) ratio calculated in the operation/ measurement to the parameters.



[Writing Results]

Click **Writing Results** to assign the value displayed in the identified moment of inertia (mass) ratio to DRIVER parameter Pn103.

Pn103: Moment of Inertia (Mass) Ratio

Displays the value assigned to the parameter.

Click **Write Results**, and the new ratio calculated from the operation/measurement will be displayed.

[<Back]

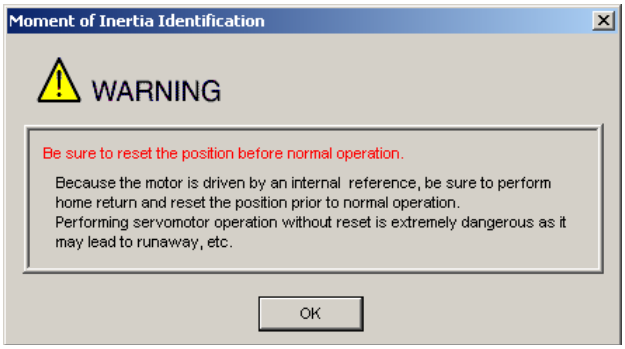
The **Back** button is unavailable.

[Cancel]

Click **Cancel** to return to the main window.

[Finish]

Click **Finish**, and a warning message appears reminding you to reset the origin position. (No warning message appears when the Write Results box has been opened from the Tuning main window.)

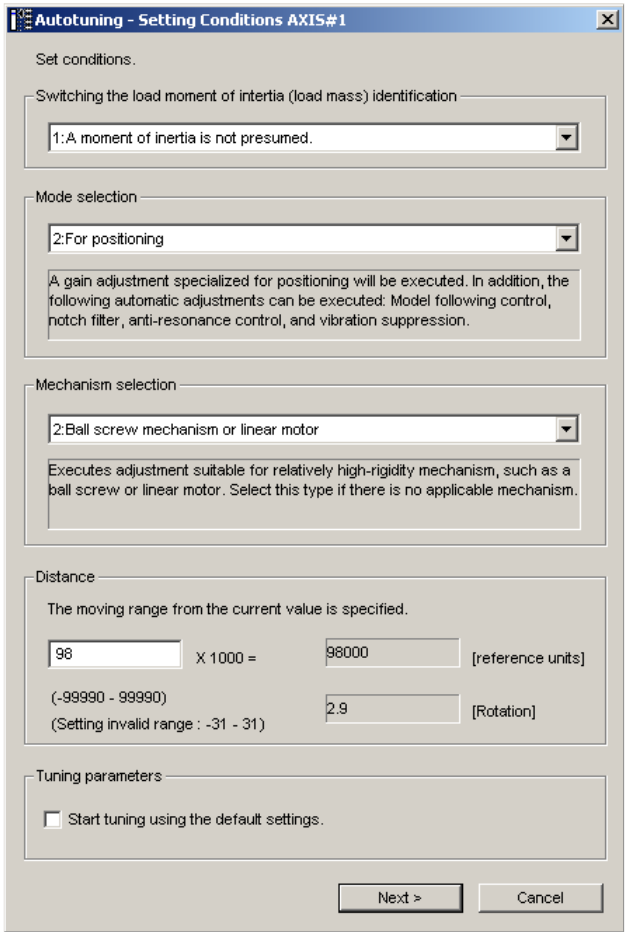


Click **OK** to return to the SigmaWin+ ©-V component Main window. If Pn103 (Moment of Inertia (Mass) Ratio) has been changed, that new value will remain.

- Autotuning without Reference Input

To execute autotuning without using a reference input, use the following procedure.

1. Select the **No reference input** option under **Reference input from host controller** in the Tuning main window, and then click **Autotuning**. The Autotuning-Setting Conditions box will appear.



2. Select whether or not to use the load moment of inertia (load mass) identification from the **Switching the load moment of inertia (load mass) identification** box, the mode from the **Mode selection** box, the mechanism from the **Mechanism selection** box, and enter the moving distance. Then, click **Next**.

•Calculating Moment of Inertia

Select the mode to be used. Usually, set to the Moment of inertia calculated.

•Mode Selection

Select the mode.
Mode = 1: Makes adjustments considering response characteristics and stability (Standard level).
Mode = 2: Makes adjustments for positioning [Factory setting].
Mode = 3: Makes adjustments for positioning, giving priority to overshooting suppression.

•Mechanism Selection

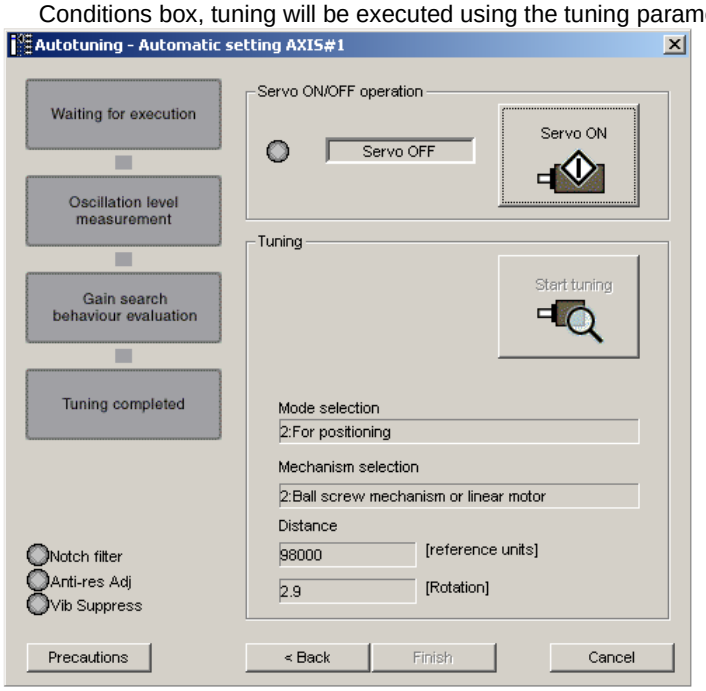
Select the mechanism according to the machine element to be driven. If there is noise or the gain does not increase, bet- ter results may be obtained by changing the rigidity type.
Type = 1: For belt drive mechanisms (LEFB, LEJB)
Type = 2: For ball screw drive mechanisms [Factory setting] (LEY, LEFS, LEJS)

•STROKE (Travel Distance) Setting

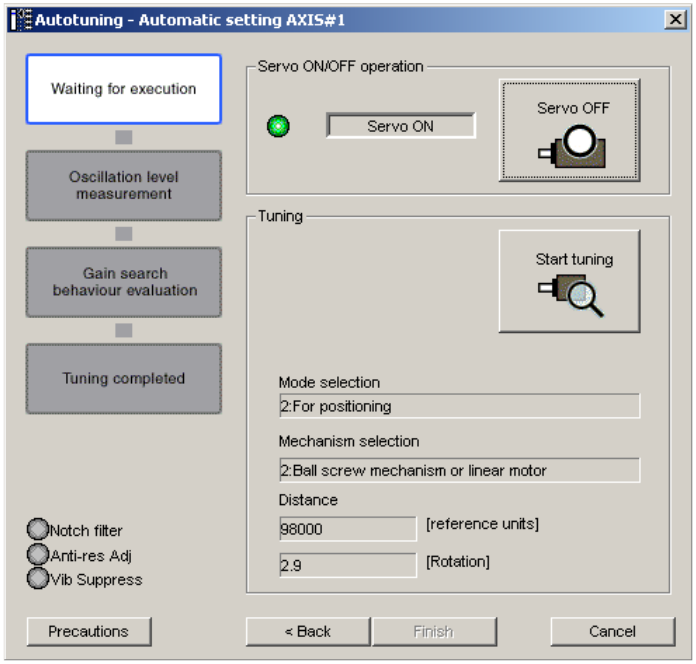
Travel distance setting range:
The travel distance setting range is from -99990000 to +99990000 [reference unit].
Specify the STROKE (travel distance) in increments of 1000 reference units.
The negative (-) direction is for reverse rotation, and the positive (+) direction is for forward rotation.
Initial value: About 3 rotations

Notes:
- Set the number of motor rotations to at least 0.5; otherwise, "Error" will be displayed and the travel distance cannot be set.
- To calculate the moment of inertia and ensure precise tuning, it is recommended to set the number of motor rotations to around 3.

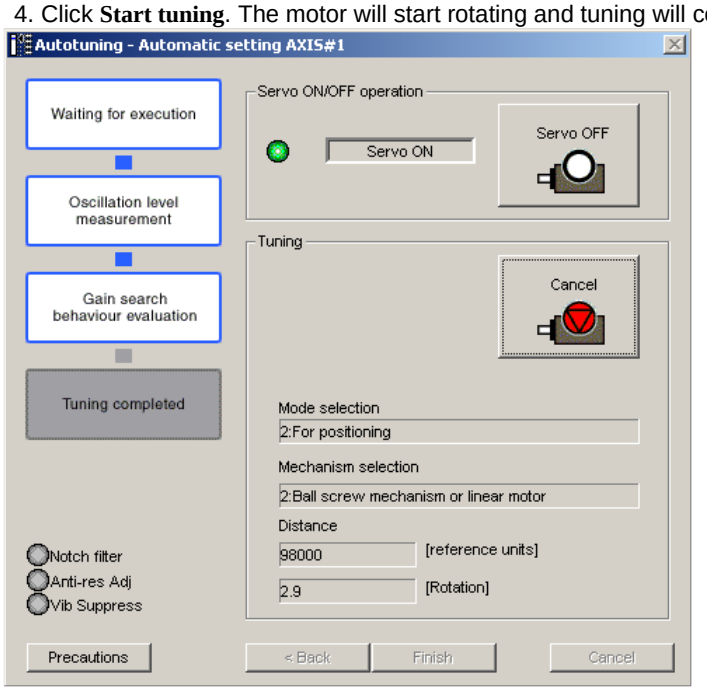
When the **Start tuning using the default settings.** check box is selected in the Autotuning-Setting Conditions box, tuning will be executed using the tuning parameters set to the default values.



3. Click **Servo ON**. The following box will appear.



4. Click **Start tuning**. The motor will start rotating and tuning will commence.



Vibration generated during tuning is automatically detected, and the optimum setting for the detected vibration will be made. When the setting is complete, the LED indicator lamps (bottom left of the box) of the functions used for the setting will light up.

5. When tuning is completed, click **Finish**. The results of tuning will be written in the parameters.

For more information on the usage of the SigmaWin+, refer to AC Servo Drives Engineering Tool Sigma Win+ ONLINE MANUAL Σ-V Component *4.6.3 Autotuning without Reference Input.*

(2) Failure in Operation

When "NO-OP" Flashes on the Display

Probable Cause	Corrective Actions
The main circuit power supply was OFF.	Turn ON the main circuit power supply.
An alarm or warning occurred.	Remove the cause of the alarm or the warning.
Overtraveling occurred.	Remove the cause of the overtravel.
Gain setting 2 was selected by gain switching.	Disable the automatic gain switching.
The HWBB function operated.	Disable the HWBB function.

When "Error" Flashes on the Display

Error	Probable Cause	Corrective Actions
The gain adjustment was not successfully complet- ed.	Machine vibration is occurring or the positioning completed signal (/COIN) is turning ON and OFF when the servomotor is stopped.	1 Increase the set value for Pn522. 2 Change the mode from 2 to 3. 3 If machine vibration occurs, suppress the vibration with the anti-resonance control adjustment function and the vibration suppression function.
An error occurred during the calculation of the mo- ment of inertia.	Refer to the following table • *When an Error Occurs during Calculation of Moment of Inertia*.	
Travel distance setting er- ror	The travel distance is set to approximately 0.5 rotation or less, which is less than the min- imum adjustable travel distance.	Increase the travel distance. It is recommended to set the number of motor rotations to around 3.
The positioning complet- ed signal (/COIN) did not turn ON within approxi- mately 10 seconds after positioning adjustment was completed.	The positioning completed width is too narrow or proportional control (P control) is being used.	1 Increase the set value for Pn522. 2 Set 0 to V_PPI in the OPTION field.
The moment of inertia cannot be calculated when the tuning-less func- tion was activated.	When the tuning-less function was activated, Jcalc was set to the Moment of inertia not calculated so the moment of inertia was not calculated.	1 Turn OFF the tuning-less function. 2 Set to the Moment of inertia calculated, so the moment of inertia will be calculated.

When an Error Occurs during Calculation of Moment of Inertia

The following table shows the probable causes of errors that may occur during the calculation of the moment of inertia with the Moment of inertia calculated, along with corrective actions for the errors.

Error Display	Probable Cause	Corrective Actions
Err1	The DRIVER started calculating the moment of inertia, but the calculation was not completed.	1 Increase the speed loop gain (Pn100). 2 Increase the STROKE (travel distance).
Err2	The moment of inertia fluctuated greatly and did not converge within 10 tries.	Set the calculation value based on the machine specifications in Pn103 and execute the calculation with the Jcalc set to OFF.
Err3	Low-frequency vibration was detected.	Double the set value of the moment of inertia calculating start level (Pn324).
Err4	The torque limit was reached.	(1) When using the torque limit, increase the torque limit. (2) Double the set value of the moment of inertia calcu- lating start level (Pn324).
Err5	While calculating the moment of inertia, the speed control was set to proportional control by setting 1 to V_PPI in the OPTION field.	Operate the DRIVER with PI control while calculating the moment of inertia.

(3) Related Functions on Advanced Autotuning

This section describes functions related to advanced tuning.

-Notch Filter

Usually, set this function to Auto Setting. (The notch filter is factory-set to Auto Setting.)
If this function is set to Auto Setting, vibration will be detected automatically during advanced autotuning and the notch filter will be set.

Set this function to Not Auto Setting only if you do not change the notch filter setting before executing advanced autotuning.

Parameter		Function	When Enabled	Classification
Pn460	n.□□□0	Does not set the 1st notch filter automatically with the utility function.	Immediately	Tuning
	n.□□□1 [Factory setting]	Sets the 1st notch filter automatically with the utility function.		
	n.□0□□	Does not set the 2nd notch filter automatically with the utility function.		
	n.□1□□ [Factory setting]	Sets the 2nd notch filter automatically with the utility function.		

-Anti-Resonance Control Adjustment

This function reduces low vibration frequency, which the notch filter does not detect.

Usually, set this function to Auto Setting. (The anti-resonance control is factory-set to Auto Setting.)
When this function is set to Auto Setting, vibration will be automatically detected during advanced autotuning and anti-resonance control will be automatically adjusted and set.

Parameter		Function	When Enabled	Classification
Pn160	n.□□0□	Does not use the anti-resonance control automatically with the utility function.	Immediately	Tuning
	n.□□1□ [Factory setting]	Uses the anti-resonance control automatically with the utility function.		

-Vibration Suppression

The vibration suppression function suppresses transitional vibration at frequency as low as 1 to 100 Hz that is generated mainly when positioning if the machine stand vibrates.

Usually, set this function to Auto Setting. (The vibration suppression function is factory-set to Auto Setting.) When this function is set to Auto Setting, vibration will be automatically detected during advanced autotuning and vibration suppression will be automatically adjusted and set.
Set this function to Not Auto Setting only if you do not change the setting for vibration suppression before executing advanced autotuning.

Note: This function uses model following control. Therefore, the function can be executed only if the mode is set to 2 or 3.

-Related Parameter

Parameter		Function	When Enabled	Classification
Pn140	n.□0□□	Does not use the vibration suppression function automatically with the utility function.	Immediately	Tuning
	n.□1□□ [Factory setting]	Uses the vibration suppression function automatically with the utility function.		

-Friction Compensation

This function compensates for changes in the following conditions.

- Changes in the viscous resistance of the lubricant, such as the grease, on the sliding parts of the machine
- Changes in the friction resistance resulting from variations in the machine assembly
- Changes in the friction resistance due to aging

The conditions for applying friction compensation depend on the mode. The friction compensation setting in Pn408.3 applies when the Mode is 1. The friction compensation function is always enabled regardless of the friction compensation setting in Pn408.3 when the Mode is 2 or 3.

Mode / Friction Compensation Selecting		[Mode = 1]	[Mode = 2]	[Mode = 3]
Pn408	n.0□□□ [Factory setting]	Adjusted without the friction compensation function	Adjusted with the friction compensation function	Adjusted with the friction compensation function
	n.1□□□	Adjusted with the friction compensation function		

- Feedforward

If Pn140 is set to the factory setting and the mode setting is changed to 2 or 3, the feedforward gain (Pn109), speed feedforward (VFF) input, and torque feedforward (TFF) input will be disabled.

Set Pn140.3 to 1 if model following control is used together with the speed feedforward (VFF) input and torque feedforward (TFF) input from the host controller.

Parameter		Function	When Enabled	Classification
Pn140	n.0□□□ [Factory setting]	Model following control is not used together with the speed/torque feedforward input.	Immediately	Tuning
	n.1□□□	Model following control is used together with the speed/torque feedforward input.		

Refer to 8 *MECHATROLINK-II Commands* for details.

IMPORTANT

- Model following control is used to make optimum feedforward settings in the DRIVER when model following control is used with the feedforward function. Therefore, model following control is not normally used together with either the speed feedfor- ward (VFF) input or torque feedforward (TFF) input from the host controller. However, model following control can be used with the speed feedforward (VFF) input or torque feedforward (TFF) input if required. An improper feedforward input may result in over- shooting.

5.3.3 Related Parameters

The following table lists parameters related to this function and their possibility of being changed while exe- cuting this function or of being changed automatically after executing this function.

• Parameters related to this function

These are parameters that are used or referenced when executing this function.

• Allowed changes during execution of this function

Yes : Parameters can be changed using SigmaWin+ while this function is being executed. No : Parameters cannot be changed using SigmaWin+ while this function is being executed.

• Automatic changes after execution of this function

Yes : Parameter set values are automatically set or adjusted after execution of this function.
No : Parameter set values are not automatically set or adjusted after execution of this function.

Parameter	Name	Mid-execution changes	Automatic changes
Pn100	Speed Loop Gain	No	Yes
Pn101	Speed Loop Integral Time Constant	No	Yes
Pn102	Position Loop Gain	No	Yes
Pn103	Moment of Inertia Ratio	No	No
Pn121	Friction Compensation Gain	No	Yes
Pn123	Friction Compensation Coefficient	No	Yes
Pn124	Friction Compensation Frequency Correction	No	No
Pn125	Friction Compensation Gain Correction	No	Yes
Pn401	Torque Reference Filter Time Constant	No	Yes
Pn408	Torque Related Function Switch	Yes	Yes
Pn409	1st Notch Filter Frequency	No	Yes
Pn40A	1st Notch Filter Q Value	No	Yes
Pn40C	2nd Notch Filter Frequency	No	Yes
Pn40D	2nd Notch Filter Q Value	No	Yes
Pn140	Model Following Control Related Switch	Yes	Yes
Pn141	Model Following Control Gain	No	Yes
Pn142	Model Following Control Gain Compensation	No	Yes
Pn143	Model Following Control Bias (Forward Direction)	No	Yes
Pn144	Model Following Control Bias (Reverse Direction)	No	Yes
Pn145	Vibration Suppression 1 Frequency A	No	Yes
Pn146	Vibration Suppression 1 Frequency B	No	Yes
Pn147	Model Following Control Speed Feedforward Compensation	No	Yes
Pn160	Anti-Resonance Control Related Switch	Yes	Yes
Pn161	Anti-Resonance Frequency	No	Yes
Pn163	Anti-Resonance Damping Gain	No	Yes
Pn531	Program JOG Movement Distance	No	No
Pn533	Program JOG Movement Speed	No	No
Pn534	Program JOG Acceleration/Deceleration Time	No	No
Pn535	Program JOG Waiting Time	No	No
Pn536	Number of Times of Program JOG Movement	No	No

5.4 Advanced Autotuning by Reference (Fn202)

Adjustments with advanced autotuning by reference are described below.

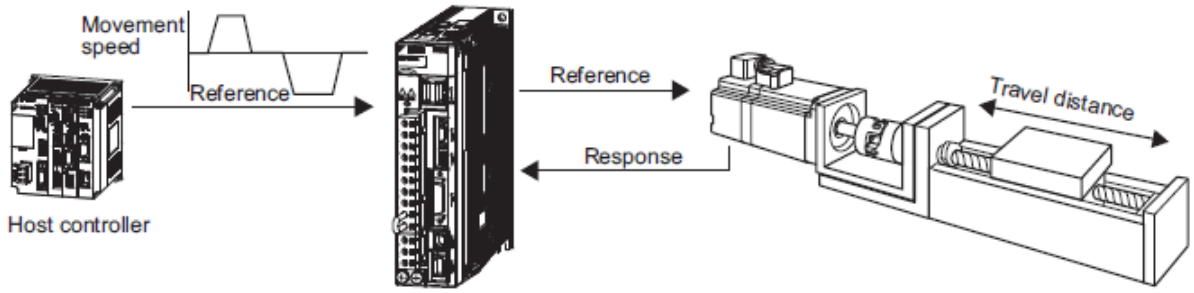
IMPORTANT	-Advanced autotuning by reference starts adjustments based on the set speed loop gain (Pn100). Therefore, precise adjustments cannot be made if there is vibration when starting adjustments. In this case, make adjustments after lowering the speed loop gain (Pn100) until vibration is eliminated.

5.4.1 Advanced Autotuning by Reference

Advanced autotuning by reference is used to automatically achieve optimum tuning of the DRIVER in response to the user reference inputs from the PC or PLC etc.

Advanced autotuning by reference is performed generally to fine-tune the DRIVER after advanced auto- tuning of the DRIVER has been performed.

If the moment of inertia ratio is correctly set to Pn103, advanced autotuning by reference can be performed without performing advanced autotuning.



DRIVER

Advanced autotuning by reference performs the following adjustments.

- Gains (e.g., position loop gain and speed loop gain)
- Filters (torque reference filter and notch filter)
- Friction compensation
- Anti-resonance control
- Vibration suppression

Refer to *5.4.3 Related Parameters* for parameters used for adjustments.

CAUTION
• Because advanced autotuning by reference adjusts the DRIVER during automatic operation, vibration or overshooting may occur. To ensure safety, perform advanced autotuning by reference in a state where the DRIVER can come to an emergency stop at any time.

(1) Preparation

Check the following settings before performing advanced autotuning by reference. The message "NO-OP" indicating that the settings are not appropriate will be displayed, if all of the following conditions are not met.

- The DRIVER must be in Servo Ready status (Refer to *4.8.4*).
- There must be no overtravel.
- The servomotor power must be OFF.
- The position control must be selected when the servomotor power is ON.
- The gain selection switch must be in manual switching mode (Pn139.0 = 0).
- Gain setting 1 must be selected.
- The test without a motor function must be disabled. (Pn00C.0 = 0).
- All warnings must be cleared.
- The write prohibited setting parameter (Fn010) must be set to Write permitted (P.0000).
- The tuning-less function must be disabled (Pn170.0 = 0).

(2) When Advanced Autotuning by Reference Cannot Be Performed Successfully

Advanced autotuning by reference cannot be performed successfully under the following conditions. If the result of autotuning is not satisfactory, perform one-parameter tuning (Fn203). Refer to *5.5 One-parameter Tuning (Fn203)* for details.

- The travel distance in response to references from the host controller is smaller than the set positioning com- pleted width (Pn522).
- The motor speed in response to references from the host controller is smaller than the set rotation detection level (Pn502).
- The stopping time, i.e., the period while the positioning completed /COIN signal is OFF, is 10 ms or less.
- The rigidity of the machine is low and vibration occurs when positioning is performed.
- The position integration function is used.
- P control operation (proportional control) is performed.
- The mode switch is used.
- The positioning completed width (Pn522) is too small.

IMPORTANT

- Advanced autotuning by reference starts adjustments based on the positioning com- pleted width (Pn522). Set the electronic gear ratio (Pn20E/Pn210) and positioning completed width (Pn522) to the actual value during operation.
- Unless the positioning completed signal (/COIN) is turned ON within approximately 3 seconds after positioning has been completed, "WAITING" will flash. Furthermore, unless the positioning completed signal (/COIN) is turned ON within approximately 10 seconds, "Error" will flash for 2 seconds and tuning will be aborted.

Change only the overshoot detection level (Pn561) to finely adjust the amount of overshooting without chang- ing the positioning completed width (Pn522). Because Pn561 is set by default to 100%, the allowable amount of overshooting is the same amount as that for the positioning completed width.
When Pn561 is set to 0%, the amount of overshooting can be adjusted without any overshooting in the posi- tioning completed width. If the setting of Pn561 is changed, however, the positioning time may be extended.

Pn561	Overshoot Detection Level		Speed Position Torque		Classification
	Setting Range	Setting Unit	Factory Setting	When Enabled	
	0 to 100	1%	100	Immediately	Setup

(3) Restrictions When Using an Encoder

With this function, the following restrictions are applied in accordance with the version number of the DRIVER software and the encoder being used.

Software Version*1	20-bit Encoder	
	Mode	Model Following Control Type
Version 0007 or earlier	No restrictions	Type 1*2
Version 0008 or later		Type 1 or 2 [Factory setting]*3

∗1. The software version number of your DRIVER can be checked with Fn012.
∗2. Position errors may result in overshooting when positioning. The positioning time may be extended if the positioning completed width (Pn522) is set to a small value.
∗3. Model following control type 2 can suppress overshooting resulting from position errors better than Type 1. If compatibility with DRIVER version 0007 or earlier is required, use model following control type 1 (Pn14F.0 = 0).

The control related switch (Pn14F) was added to DRIVER software version 0008 or later.

Parameter		Function	When Enabled	Classification
Pn14F	n.□□□0	Model following control type 1	After restart	Tuning
	n.□□□1 [Factory setting]	Model following control type 2		

5.4.2 Advanced Autotuning by Reference Procedure

The following procedure is used for advanced autotuning by reference.

Advanced autotuning by reference is performed from the SigmaWin+.

⚠ CAUTION

- When using the MP2000 Series with phase control, select the mode = 1 (standard level). If 2 or 3 is selected, phase control of the MP2000 Series may not be possible.

(1) Operating Procedure

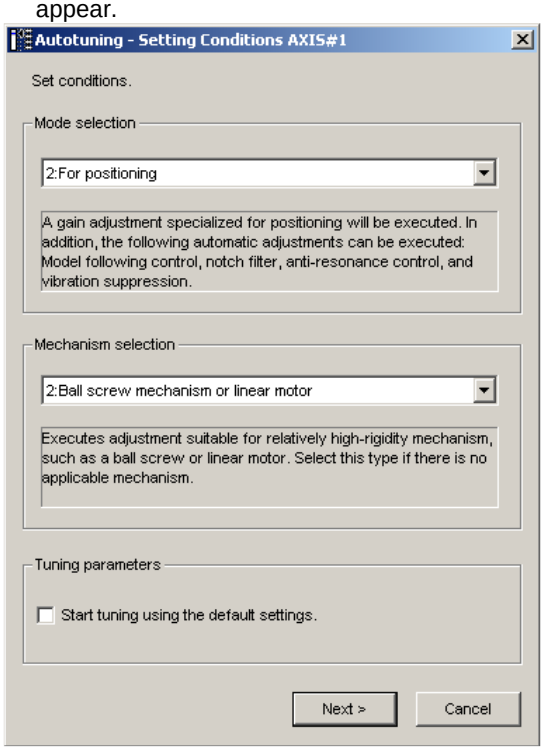
Set the correct moment of inertia ratio in Pn103 by using the advanced autotuning before performing this pro- cedure.

In the SigmaWin+ Σ-V component main window, click **Tuning** and then click **Tuning**.

- Moment of Inertia (Mass) Identification
  It is the same as *5.3.2 Advanced Autotuning Procedure*.

- Autotuning with Reference Input

1. Select the **Position reference input** option under **Reference input from host controller** in the Tuning main window, and then click **Autotuning**. The Autotuning-Setting Conditions box will appear.



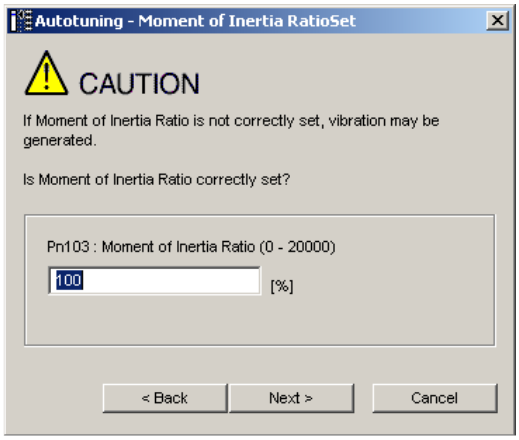
2. Select the mode from the **Mode selection** combo box and the mechanism from **Mechanism selection** combo box, and then click **Next**. The Autotuning-Moment of Inertia Ratio Setting box will appear. When the **Start tuning using the default settings.** check box is selected in the Autotuning-Setting Conditions box, tuning will be executed using tuning parameters set to the default value.

· Mode Selection
  Select the mode.
  Mode = 1: Makes adjustments considering response characteristics and stability (Standard level).

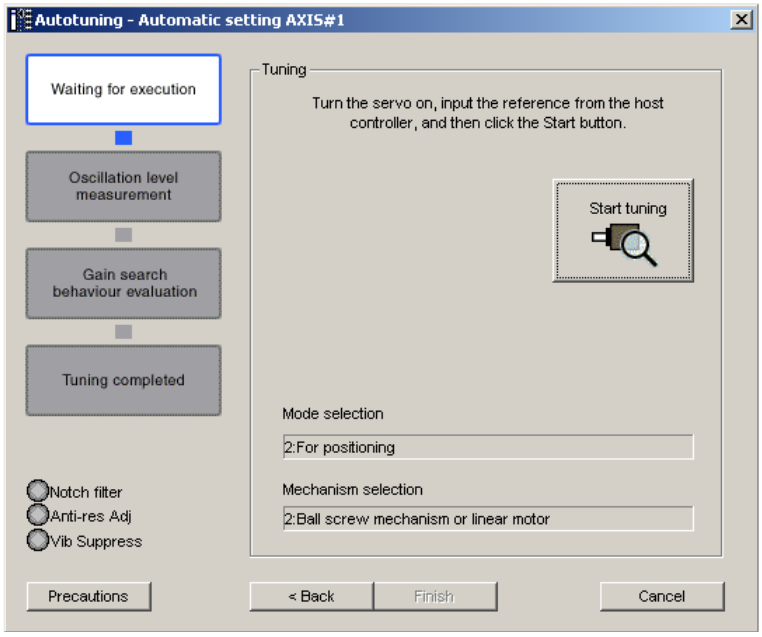
Mode = 2: Makes adjustments for positioning [Factory setting].
Mode = 3: Makes adjustments for positioning, giving priority to overshooting suppression.

•Type Selection

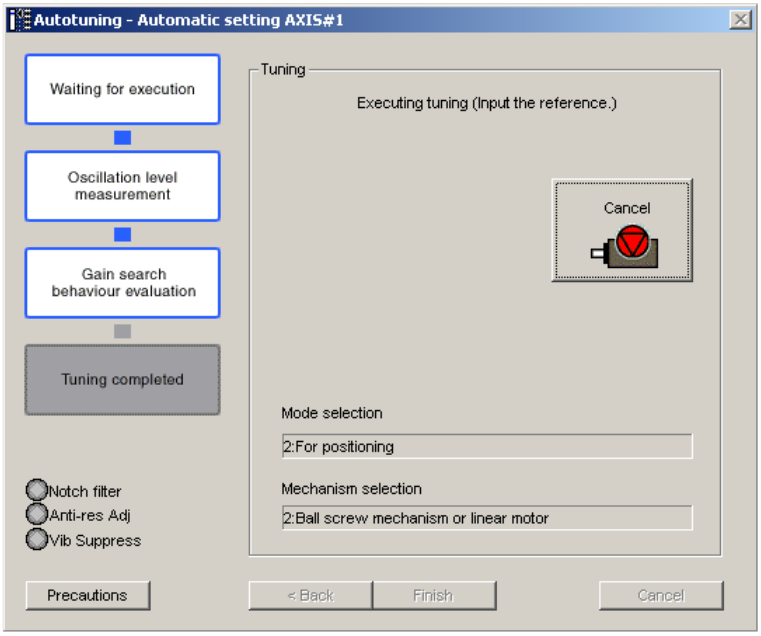
Select the type according to the machine element to be driven.
If there is noise or the gain does not increase, better results may be obtained by changing the rigidity type.
Type = 1: For belt drive mechanisms (LEFB, LEJB)
Type = 2: For ball screw drive mechanisms [Factory setting] (LEY, LEFS, LEJS)



3. Enter the correct moment of inertia ratio and then click **Next**. The following window will appear.



4. Turn the servo on and then input the reference from the host controller. Click **Start tuning** to start tuning.



Vibration generated during tuning is automatically detected and the optimum setting for the detected vibration will be made. When setting is completed, the LED indicator lamps (bottom left of the box) of the functions used for the setting will light up.

5. When tuning is complete, click **Finish**. The results of tuning will be written in the parameters.

For more information on the usage of the SigmaWin+, refer to AC Servo Drives Engineering Tool Sigma Win+ ONLINE MANUAL Σ-V Component *4.6.2 Autotuning with Reference Input*.

(2) Failure in Operation

-When "NO-OP" Flashes on the Display

Probable Cause	Corrective Actions
The main circuit power supply was OFF.	Turn ON the main circuit power supply.
An alarm or warning occurred.	Remove the cause of the alarm or the warning.
Overtraveling occurred.	Remove the cause of the overtravel.
Gain setting 2 was selected by gain switching.	Disable the automatic gain switching.
HWBB operated.	Disable the HWBB function.

-When "Error" Flashes on the Display

Error	Probable Cause	Corrective Actions
The gain adjustment was not successfully completed.	Machine vibration is occurring or the positioning completed signal (/COIN) is turning ON and OFF when the servomotor is stopped.	3 Increase the set value for Pn522. 4 Change the mode from 2 to 3. 5 If machine vibration occurs, suppress the vibration with the anti-resonance control adjustment function and the vibration suppression function.
The positioning completed signal (/COIN) did not turn ON within approximately 10 seconds after positioning adjustment was completed.	The positioning completed width is too narrow or proportional control (P control) is being used.	3 Increase the set value for Pn522. 4 Set 0 to V_PPI of OPTION field.

-Related Functions on Advanced Autotuning by Reference

This section describes functions related to advanced autotuning by reference.

- Notch Filter

Usually, set this function to Auto Setting. (The notch filter is factory-set to Auto Setting.)
If this function is set to Auto Setting, vibration will be detected automatically during advanced autotuning by reference, and the notch filter will be set.

Set this function to Not Auto Setting only if you do not change the notch filter setting before executing advanced autotuning by reference.

Parameter		Function	When Enabled	Classification
Pn460	n.□□□0	Does not set the 1st notch filter automatically with the utility function.	Immediately	Tuning
	n.□□□1 [Factory setting]	Sets the 1st notch filter automatically with the utility function.		
	n.□0□□	Does not set the 2nd notch filter automatically with the utility function.		
	n.□1□□ [Factory setting]	Sets the 2nd notch filter automatically with the utility function.		

- Anti-Resonance Control Adjustment

This function reduces low vibration frequency, which the notch filter does not detect.

Usually, set this function to Auto Setting. (The anti-resonance control is factory-set to Auto Setting.)
When this function is set to Auto Setting, vibration will be automatically detected during advanced autotuning by reference and anti-resonance control will be automatically adjusted and set.

Parameter		Function	When Enabled	Classification
Pn160	n.□□0□	Does not use the anti-resonance control automatically with the utility function.	Immediately	Tuning
	n.□□1□ [Factory setting]	Uses the anti-resonance control automatically with the utility function.		

- Vibration Suppression

The vibration suppression function suppresses transitional vibration at frequency as low as 1 to 100 Hz that is generated mainly when positioning if the machine stand vibrates.

Usually, set this function to Auto Setting. (The vibration suppression function is factory-set to Auto Setting.) When this function is set to Auto Setting, vibration will be automatically detected during advanced autotuning by reference and vibration suppression will be automatically adjusted and set.
Set this function to Not Auto Setting only if you do not change the setting for vibration suppression before executing advanced autotuning by reference.

Note: This function uses model following control. Therefore, the function can be executed only if the mode is set to 2 or 3.

-Related Parameters

Parameter		Function	When Enabled	Classification
Pn140	n.□0□□	Does not use the vibration suppression function automatically.	Immediately	Tuning
	n.□1□□ [Factory setting]	Uses the vibration suppression function automatically.		

- Friction Compensation

This function compensates for changes in the following conditions.

- Changes in the viscous resistance of the lubricant, such as the grease, on the sliding parts of the machine
- Changes in the friction resistance resulting from variations in the machine assembly
- Changes in the friction resistance due to aging

Conditions to which friction compensation is applicable depend on the mode. The friction compensation set- ting in Pn408.3 applies when the mode is 1. Mode = 2 and Mode = 3 are adjusted with the friction compensa- tion function regardless of the friction compensation setting in P408.3.

Friction Compensation Selecting \ Mode		Mode = 1	Mode = 2	Mode = 3
Pn408	n.0□□□ [Factory setting]	Adjusted without the friction compensation function	Adjusted with the friction compensation function	Adjusted with the friction compensation function
	n.1□□□	Adjusted with the friction compensation function		

- Feedforward

If Pn140 is set to the factory setting and the mode setting is changed to 2 or 3, the feedforward gain (Pn109), speed feedforward (VFF) input, and torque feedforward (TFF) input will be disabled.

Set Pn140.3 to 1 if model following control is used together with the speed feedforward (VFF) input and torque feedforward (TFF) input from the host controller.

Parameter		Function	When Enabled	Classification
Pn140	n.0□□□ [Factory setting]	Model following control is not used together with the speed/torque feedforward input.	Immediately	Tuning
	n.1□□□	Model following control is used together with the speed/torque feedforward input.		

Refer to 8 *MECHATROLINK-II Commands* for details.

IMPORTANT

- Model following control is used to make optimum feedforward settings in the DRIVER when model following control is used with the feedforward function. Therefore, model following control is not normally used together with either the speed feedfor- ward (VFF) input or torque feedforward (TFF) input from the host controller. However, model following control can be used with the speed feedforward (VFF) input or torque feedforward (TFF) input if required. An improper feedforward input may result in over- shooting.

5.4.3 Related Parameters

The following table lists parameters related to this function and their possibility of being changed while exe- cuting this function or of being changed automatically after executing this function.

• Parameters related to this function

These are parameters that are used or referenced when executing this function.

• Allowed changes during execution of this function

Yes : Parameters can be changed using SigmaWin+ while this function is being executed. No : Parameters cannot be changed using SigmaWin+ while this function is being executed.

• Automatic changes after execution of this function

Yes : Parameter set values are automatically set or adjusted after execution of this function.

No : Parameter set values are not automatically set or adjusted after execution of this function.

Parameter	Name	Mid-execution changes	Automatic changes
Pn100	Speed Loop Gain	No	Yes
Pn101	Speed Loop Integral Time Constant	No	Yes
Pn102	Position Loop Gain	No	Yes
Pn103	Moment of Inertia Ratio	No	No
Pn121	Friction Compensation Gain	No	Yes
Pn123	Friction Compensation Coefficient	No	Yes
Pn124	Friction Compensation Frequency Correction	No	No
Pn125	Friction Compensation Gain Correction	No	Yes
Pn401	Torque Reference Filter Time Constant	No	Yes
Pn408	Torque Related Function Switch	Yes	Yes
Pn409	1st Notch Filter Frequency	No	Yes
Pn40A	1st Notch Filter Q Value	No	Yes
Pn40C	2nd Notch Filter Frequency	No	Yes
Pn40D	2nd Notch Filter Q Value	No	Yes
Pn140	Model Following Control Related Switch	Yes	Yes
Pn141	Model Following Control Gain	No	Yes
Pn142	Model Following Control Gain Compensation	No	Yes
Pn143	Model Following Control Bias (Forward Direction)	No	Yes
Pn144	Model Following Control Bias (Reverse Direction)	No	Yes
Pn145	Vibration Suppression 1 Frequency A	No	Yes
Pn146	Vibration Suppression 1 Frequency B	No	Yes
Pn147	Model Following Control Speed Feedforward Compensation	No	Yes
Pn160	Anti-Resonance Control Related Switch	Yes	Yes
Pn161	Anti-Resonance Frequency	No	Yes
Pn163	Anti-Resonance Damping Gain	No	Yes

5.5 One-parameter Tuning (Fn203)

Adjustments with one-parameter tuning are described below.

5.5.1 One-parameter Tuning

One-parameter tuning is used to manually make tuning level adjustments during operation with a position ref- erence or speed reference input from the PC or PLC etc.

One-parameter tuning enables automatically setting related servo gain settings to balanced conditions by adjusting one or two tuning levels.

One-parameter tuning performs the following adjustments.

- Gains (e.g., position loop gain and speed loop gain)
- Filters (torque reference filter and notch filter)
- Friction compensation
- Anti-resonance control

Refer to *5.5.4 Related Parameters* for parameters used for adjustments.

Perform one-parameter tuning if satisfactory response characteristics is not obtained with advanced autotun- ing or advanced autotuning by reference.

To fine-tune each servo gain after one-parameter tuning, refer to *5.8 Additional Adjustment Function*.

⚠ CAUTION

- Vibration or overshooting may occur during adjustment. To ensure safety, perform one-parameter tuning in a state where the DRIVER can come to an emergency stop at any time.

(1) Preparation

Check the following settings before performing one-parameter tuning.
The message “NO-OP” indicating that the settings are not appropriate will be displayed, if all of the following
conditions are not met.

- The test without a motor function must be disabled (Pn00C.0 = 0).
- The write prohibited setting parameter (Fn010) must be set to Write permitted (P.0000).
- The tuning-less function must be disabled (Pn170.0 = 0).
- The tuning mode must be set to 0 or 1 when performing speed control.

(2) Restrictions When Using an Encoder

With this function, the following restrictions are applied in accordance with the version number of the DRIVER software and the encoder being used.

Software Version*1	20-bit Encoder	
	Mode	Model Following Control Type
Version 0007 or earlier	No restrictions	Type 1*2
Version 0008 or later		Type 1 or 2 [Factory setting]*3

∗1. The software version number of your DRIVER can be checked with Fn012.
∗2. Position errors may result in overshooting when positioning. The positioning time may be extended if the positioning
completed width (Pn522) is set to a small value.
∗3. Model following control type 2 can suppress overshooting resulting from position errors better than Type 1. If compatibility with DRIVER version 0007 or earlier is required, use model following control type 1 (Pn14F.0 = 0).

The control related switch (Pn14F) was added to DRIVER software version 0008 or later.

Parameter		Function	When Enabled	Classification
Pn14F	n.□□□0	Model following control type 1	After restart	Tuning
	n.□□□1 [Factory setting]	Model following control type 2		

5.5.2 One-parameter Tuning Procedure

The following procedure is used for one-parameter tuning.

There are the following two operation procedures depending on the tuning mode being used.

- When the tuning mode is set to 0 or 1, the model following control will be disabled and one-parameter tun- ing will be used as the tuning method for applications other than positioning.
- When the tuning mode is set to 2 or 3, the model following control will be enabled and it can be used for tuning for positioning.

One-parameter tuning is performed from the SigmaWin+.

Make sure that the moment of inertia ratio (Pn103) is set correctly using advance autotuning before beginning operation.

The following section provides the operating procedure from the SigmaWin+.

⚠ CAUTION

- When using the MP2000 Series with phase control, select the tuning mode = 0 or 1. If 2 or 3 is selected, phase control of the MP2000 Series may not be possible.

(1)SigmaWin+ Operating Procedure

In the SigmaWin+ Σ-V component main window, click **Tuning** and then click **Tuning**.
Click **Advanced adjustment** in the Tuning main window, and then click **Custom tuning** in the Tuning box that will appear. The Custom Tuning - Mode selection box will appear.

For more information on the usage of the SigmaWin+, refer to AC Servo Drives Engineering Tool Sigma Win+ ONLINE MANUAL Σ-V Component *4.6.4 Custom Tuning*.

· Setting the Tuning Mode 0 or 1

·Tuning Mode

Select the tuning mode. Select the tuning mode 0 or 1.
Tuning Mode = 0: Makes adjustments giving priority to stability.
Tuning Mode = 1: Makes adjustments giving priority to responsiveness.

·Type Selection

Select the type according to the machine element to be driven.
If there is noise or the gain does not increase, better results may be obtained by changing the rigidity type.
Type = 1: For belt drive mechanisms (LEFB, LEJB)
Type = 2: For ball screw drive mechanisms [Factory setting] (LEY, LEFS, LEJS)

·Tuning Lebel

Change the tuning level.
Note: The higher the lebel, the greater the responsiveness will be. If the value is too large, however, vibration will occur.

- Setting the Tuning Mode 2 or 3

·Tuning Mode

Select the tuning mode. Select the tuning mode 2 or 3.
Tuning Mode = 2: Enables model following control and makes adjustments for positioning.
Tuning Mode = 3: Enables model following control, makes adjustments for positioning, and suppresses over- shooting.

·Type Selection

Select the type according to the machine element to be driven.
If there is noise or the gain does not increase, better results may be obtained by changing the rigidity type.
Type = 1: For belt drive mechanisms (LEFB, LEJB)
Type = 2: For ball screw drive mechanisms [Factory setting] (LEY, LEFS, LEJS)

·FF Lebel, FB Lebel

Change the FF level and FB level.
Note: The higher the FF lebel, the positioning time will be shorter and the response will be better. If the level is too high, however, overshooting or vibration may occur. Overshooting will be reduced if the FB level is increased.

(2) Related Functions on One-parameter Tuning

This section describes functions related to one-parameter tuning.

- Notch Filter

Usually, set this function to Auto Setting. (The notch filter is factory-set to Auto Setting.)
If this function is set to Auto Setting, vibration will be detected automatically during one-parameter tuning and the notch filter will be set.

Set this function to Not Auto Setting only if you do not change the notch filter setting before executing one- parameter tuning.

Parameter		Function	When Enabled	Classification
Pn460	n.□□□0	Does not set the 1st notch filter automatically with the utility function.	Immediately	Tuning
	n.□□□1 [Factory setting]	Sets the 1st notch filter automatically with the utility function.		
	n.□0□□	Does not set the 2nd notch filter automatically with the utility function.		
	n.□1□□ [Factory setting]	Sets the 2nd notch filter automatically with the utility function.		

- Anti-Resonance Control Adjustment

This function reduces low vibration frequency, which the notch filter does not detect.

Usually, set this function to Auto Setting. (The anti-resonance control is factory-set to Auto Setting.)
When this function is set to Auto Setting, vibration will be automatically detected during one-parameter tun- ing and anti-resonance control will be automatically adjusted and set.

Parameter		Function	When Enabled	Classification
Pn160	n.□□0□	Does not use the anti-resonance control automatically with the utility function.	Immediately	Tuning
	n.□□1□ [Factory setting]	Uses the anti-resonance control automatically with the utility function.		

- Friction Compensation

This function compensates for changes in the following conditions.
Changes in the viscous resistance of the lubricant, such as the grease, on the sliding parts of the machine
Changes in the friction resistance resulting from variations in the machine assembly
Changes in the friction resistance due to aging

Conditions to which friction compensation is applicable depend on the tuning mode. The friction compensa- tion setting in F408.3 applies when the mode is 0 or 1. Tuning Mode = 2 and Tuning Mode = 3 are adjusted with the friction compensation function regardless of the friction compensation setting in P408.3.

Mode / Friction Compensation Selecting		Tuning Mode = 0	Tuning Mode = 1	Tuning Mode = 2	Tuning Mode = 3
Pn408	n.0□□□ [Factory setting]	Adjusted without the friction compensation function	Adjusted without the friction compensation function	Adjusted with the friction compensation function	Adjusted with the friction compensation function
	n.1□□□	Adjusted with the friction compensation function	Adjusted with the friction compensation function		

- Feedforward

If Pn140 is set to the factory setting and the tuning mode setting is changed to 2 or 3, the feedforward gain (Pn109), speed feedforward (VFF) input, and torque feedforward (TFF) input will be disabled.

Set Pn140.3 to 1 if model following control is used together with the speed feedforward (VFF) input and torque feedforward (TFF) input from the host controller.

Parameter		Function	When Enabled	Classification
Pn140	n.0□□□ [Factory setting]	Model following control is not used together with the speed/torque feedforward input.	Immediately	Tuning
	n.1□□□	Model following control is used together with the speed/torque feedforward input.		

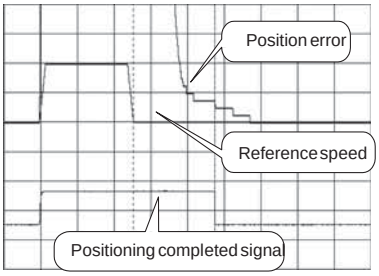
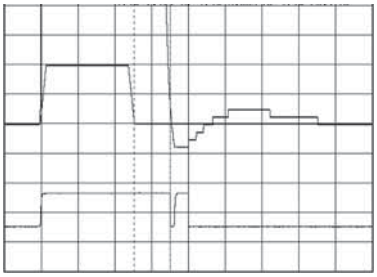
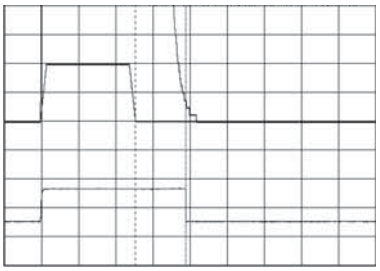
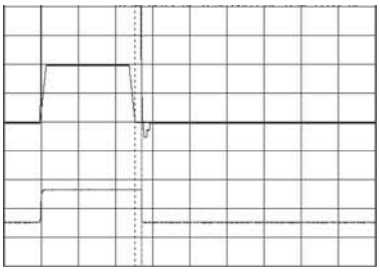
Refer to 8 *MECHATROLINK-II Commands* for details.

IMPORTANT

- Model following control is used to make optimum feedforward settings in the DRIVER when model following control is used with the feedforward function. Therefore, model following control is not normally used together with either the speed feedfor- ward (VFF) input or torque feedforward (TFF) input from the host controller. However, model following control can be used with the speed feedforward (VFF) input or torque feedforward (TFF) input if required. An improper feedforward input may result in over- shooting.

5.5.3 One-parameter Tuning Example

The following procedure is used for one-parameter tuning on the condition that the tuning mode is set to 2 or
3. This mode is used to reduce positioning time.

Step	Measuring Instrument Display Example	Operation
1		Measure the positioning time after setting the moment of inertia ratio (Pn103) correctly. Tuning will be completed if the specifications are met here. The tuning results will be saved in the DRIVER.
2		The positioning time will become shorter if the FF level is increased. The tuning will be completed if the specifications are met. The tuning results will be saved in the DRIVER. If overshooting occurs before the specifications are met, go to step 3.
3		Overshooting will be reduced if the FB level is increased. If the overshooting is eliminated, go to step 4.
4		The graph shows overshooting generated with the FF level increased after step 3. In this state, the overshooting occurs, but the positioning settling time is shorter. The tuning will be completed if the specifications are met. The adjustment results are saved in the DRIVER. If overshooting occurs before the specifications are met, repeat steps 3 and 4. If vibration occurs before the overshooting is eliminated, the vibration will be suppressed by the automatic notch filter and anti-resonance control. Note: The vibration frequencies may not be detected if the vibration is too small. If that occurs, forcibly detect the vibration frequencies.
5		The adjustment results are saved in the DRIVER.

5.5.4 Related Parameters

The following table lists parameters related to this function and their possibility of being changed while executing this function or of being changed automatically after executing this function.

• Parameters related to this function

These are parameters that are used or referenced when executing this function.

• Allowed changes during execution of this function

Yes : Parameters can be changed using SigmaWin+ while this function is being executed. No : Parameters cannot be changed using SigmaWin+ while this function is being executed.

• Automatic changes after execution of this function

Yes : Parameter set values are automatically set or adjusted after execution of this function.
No : Parameter set values are not automatically set or adjusted after execution of this function.

Parameter	Name	Mid-execution changes	Automatic changes
Pn100	Speed Loop Gain	No	Yes
Pn101	Speed Loop Integral Time Constant	No	Yes
Pn102	Position Loop Gain	No	Yes
Pn103	Moment of Inertia Ratio	No	No
Pn121	Friction Compensation Gain	No	Yes
Pn123	Friction Compensation Coefficient	No	Yes
Pn124	Friction Compensation Frequency Correction	No	No
Pn125	Friction Compensation Gain Correction	No	Yes
Pn401	Torque Reference Filter Time Constant	No	Yes
Pn408	Torque Related Function Switch	Yes	Yes
Pn409	1st Notch Filter Frequency	No	Yes
Pn40A	1st Notch Filter Q Value	No	Yes
Pn40C	2nd Notch Filter Frequency	No	Yes
Pn40D	2nd Notch Filter Q Value	No	Yes
Pn140	Model Following Control Related Switch	Yes	Yes
Pn141	Model Following Control Gain	No	Yes
Pn142	Model Following Control Gain Compensation	No	Yes
Pn143	Model Following Control Bias (Forward Direction)	No	Yes
Pn144	Model Following Control Bias (Reverse Direction)	No	Yes
Pn145	Vibration Suppression 1 Frequency A	No	No
Pn146	Vibration Suppression 1 Frequency B	No	No
Pn147	Model Following Control Speed Feedforward Compensation	No	Yes
Pn160	Anti-Resonance Control Related Switch	Yes	Yes
Pn161	Anti-Resonance Frequency	No	Yes
Pn163	Anti-Resonance Damping Gain	No	Yes

5.6 Anti-Resonance Control Adjustment Function (Fn204)

This section describes the anti-resonance control adjustment function.

5.6.1 Anti-Resonance Control Adjustment Function

The anti-resonance control adjustment function increases the effectiveness of the vibration suppression after one-parameter tuning. This function is effective in supporting anti-resonance control adjustment if the vibra- tion frequencies are from 100 to 1000 Hz.

This function rarely needs to be used because it is automatically set by the advanced autotuning or advanced autotuning by reference input. Use this function only if fine-tuning is required, or vibration detection is failed and readjustment is required.

Perform one-parameter tuning (Fn203) or use another method to improve the response characteristics after performing this function. If the anti-resonance gain is increased with one-parameter tuning performed, vibra- tion may result again. If that occurs, perform this function again to fine-tune the settings.

⚠ CAUTION

- If this function is executed, related parameters will be set automatically. Therefore, there will be a large response change after this function is executed. Enable the function in a state where the machine can come to an emergency stop at any time to ensure the safety operation of the machine.
- Be sure to set a suitable value for the moment of inertia ratio (Pn103) using advanced autotuning before executing the anti-resonance control adjustment function. If the setting greatly differs from the actual moment of inertia ratio, normal control of the machine may not be possible, and vibration may result.

IMPORTANT

- This function detects vibration between 100 and 1000 Hz. Vibration will not be detected for frequencies outside of this range, and instead, "F----" will be displayed. If that occurs, use one-parameter tuning with tuning mode 2 selected to automatically set a notch filter or use the vibration suppression function (Fn205).
- Vibration can be reduced more effectively by increasing the anti-resonance damping gain (Pn163). The amplitude of vibration may become larger if the damping gain is excessively high. Increase the damping gain from about 0% to 200% in 10% increments while checking the effect of vibration reduction. If the effect of vibration reduction is still insufficient at a gain of 200%, cancel the setting, and lower the control gain using a different method, such as one-parameter tuning.

(1) Before Performing Anti-Resonance Control Adjustment Function

Check the following settings before performing anti-resonance control adjustment function.
The message “NO-OP” indicating that the settings are not appropriate will be displayed, if all of the following conditions are not met.

- The tuning-less function must be disabled (Pn170.0 = 0).
- The test without a motor function must be disabled (Pn00C.0 = 0).
- The control must not be set to torque control.
- The write prohibited setting parameter (Fn010) must be set to Write permitted (P.0000).

5.6.2 Anti-Resonance Control Adjustment Function Operating Procedure

With this function, an operation reference is sent, and the function is executed while vibration is occurring.

Anti-resonance control adjustment function is performed from the SigmaWin+. The following methods can be used for the anti-resonance control adjustment function.

- Using anti-resonance control for the first time
  - With undetermined vibration frequency
  - With determined vibration frequency
    - For fine-tuning after adjusting the anti-resonance control

The following describes the operating procedure from the digital operator.

In the SigmaWin+ Σ-V component main window, click **Tuning** and then click **Tuning**.
In the Tuning main window, click Advanced adjustment, Custom tuning, and then Anti-resonance control.
For more information on the usage of the SigmaWin+, refer to AC Servo Drives Engineering Tool Sigma Win+ ONLINE MANUAL Σ-V Component *4.6.6 Anti-resonance Control Adjustment Function*.

Note:
If vibration is not detected even when vibration is occurring, lower the vibration detection sensitivity (Pn311). When this parameter is lowered, the detection sensitivity will be increased. Vibration may not be detected accurately if too small value is set.

Increase the damping gain from about 0% to 200% in 10% increments while checking the effect of vibration reduction. If vibration reduc- tion is still insufficient at a gain of 200%, can- cel the setting, and lower the control gain by using a different method, such as one-parame- ter tuning.

5.6.3 Related Parameters

The following table lists parameters related to this function and their possibility of being changed while exe- cuting this function or of being changed automatically after executing this function.

- Parameters related to this function
  These are parameters that are used or referenced when executing this function.

- Allowed changes during execution of this function
  Yes : Parameters can be changed using SigmaWin+ while this function is being executed.
  No : Parameters cannot be changed using SigmaWin+ while this function is being executed.

- Automatic changes after execution of this function
  Yes : Parameter set values are automatically set or adjusted after execution of this function.
  No : Parameter set values are not automatically set or adjusted after execution of this function.

Parameter	Name	Mid-execution changes	Automatic changes
Pn160	Anti-Resonance Control Related Switch	Yes	Yes
Pn161	Anti-Resonance Frequency	No	Yes
Pn162	Anti-Resonance Gain Compensation	Yes	No
Pn163	Anti-Resonance Damping Gain	No	Yes
Pn164	Anti-Resonance Filter Time Constant 1 Compensation	Yes	No
Pn165	Anti-Resonance Filter Time Constant 2 Compensation	Yes	No

5.7 Vibration Suppression Function (Fn205)

The vibration suppression function is described in this section.

5.7.1 Vibration Suppression Function

The vibration suppression function suppresses transitional vibration at frequency as low as 1 to 100 Hz that is generated mainly when positioning if the machine stand vibrates.

This function is set automatically when advanced autotuning or advanced autotuning by reference is executed. In most cases, this function is not necessary. Use this function only if fine-tuning is required or readjustment is required as a result of a failure to detect vibration.

Perform one-parameter tuning (Fn203) if required to improve the response characteristics after performing this function.

⚠ CAUTION

- If this function is executed, related parameters will be set automatically. Therefore, there will be a large response change after this function is enabled or disabled. Enable the function in a state where the machine can come to an emergency stop at any time to ensure the safety operation of the machine.
- Be sure to set a suitable value for the moment of inertia ratio (Pn103) using advanced autotuning before executing the vibration suppression function. If the setting greatly differs from the actual moment of inertia ratio, normal control of the DRIVER may not be possible, and vibration may result.
- Phase control of the MP2000 Series may not be possible, if the vibration suppression function is performed when using the MP2000 Series with phase control.

IMPORTANT

- This function detects vibration frequency between 1 to 100 Hz. Vibration will not be detected for frequencies outside of this range, and instead, "F-----" will be displayed.
- Frequency detection will not be performed if no vibration results from position error or the vibration frequencies are outside the range of detectable frequencies. If so, use a device, such as a displacement sensor or vibration sensor, to measure the vibration frequency.
- If vibration frequencies automatically detected are not suppressed, the actual frequency and the detected frequency may differ. Fine-tune the detected frequency if necessary.

(1) Preparation

Check the following settings before performing the vibration suppression function.
The message “NO-OP” indicating that the settings are not appropriate will be displayed, if all of the following conditions are not met.

- The control must be set to position control.
- The tuning-less function must be disabled (Pn170.0 = 0).
- The test without a motor function must be disabled (Pn00C.0 = 0).
- The write prohibited setting parameter (Fn010) must be set to Write permitted (P.0000).

(2)Items Influencing Performance

If continuous vibration occurs when the servomotor is not rotating, the vibration suppression function cannot be used to suppress the vibration effectively. If the result is not satisfactory, perform anti-resonance control adjustment function (Fn204) or one-parameter tuning (Fn203).

(3) Detection of Vibration Frequencies

No frequency detection may be possible if the vibration does not appear as a position error or the vibration resulting from the position error is too small.

The detection sensitivity can be adjusted by changing the setting for the remained vibration detection width (Pn560) which is set as a percentage of the positioning completed width (Pn522). Perform the detection of vibration frequencies again after adjusting the remained vibration detection width (Pn560).

Pn560	Remained Vibration Detection Width Position				Classification
	Setting Range	Setting Unit	Factory Setting	When Enabled	
	1 to 3000	0.1%	400	Immediately	Setup

Note: As a guideline, change the setting 10% at a time. The smaller the set value is, the higher the detection sensitivity will be. If the value is too small, however, the vibration may not be detected accurately.

The vibration frequencies that are automatically detected may vary somewhat with each positioning operation. Perform positioning several times and make adjustments while checking the effect of vibration suppression.

5.7.2 Vibration Suppression Function Operating Procedure

The following procedure is used for vibration suppression function.

Vibration suppression function is performed from the SigmaWin+. The operating procedure from the SigmaWin+ is described here.

(1)Operating Procedure
In the SigmaWin+ Σ-V component main window, click **Tuning** and then click **Tuning**.
In the Tuning main window, click **Custom tuning,** and then **Vibration suppression.**

For more information on the usage of the SigmaWin+, refer to AC Servo Drives Engineering Tool Sigma Win+ ONLINE MANUAL Σ-V Component *4.6.7 Vibration Suppression Function*.

Note:
Frequency detection will not be performed if there is no vibration or the vibration frequency is outside the range of detectable frequencies. If the vibration frequencies are not detected, prepare a means of detecting and measuring the vibration. When the vibration frequencies are measured, manually set the measured vibration frequency.

IMPORTANT

No settings related to the vibration suppression function will be changed during operation.

If the servomotor does not stop approximately 10 seconds after the setting changes, a timeout error will result and the previous setting will be automatically enabled again. The vibration suppression function will be enabled in sets the displayed frequency. The motor response, however, will change when the servomotor comes to a stop with no reference input.

(2) Related Function on Vibration Suppression Function

This section describes functions related to vibration suppression function.

-Feedforward

The feedforward gain (Pn109), speed feedforward (VFF) input, and torque feedforward (TFF) input will be disabled in the factory setting.

Set Pn140.3 to 1 if model following control is used together with the speed feedforward (VFF) input and torque feedforward (TFF) input from the host controller.

Parameter		Function	When Enabled	Classification
Pn140	n.0□□□ [Factory setting]	Model following control is not used together with the speed/torque feedforward input.	Immediately	Tuning
	n.1□□□	Model following control is used together with the speed/torque feedforward input.		

Refer to 8. *MECHATROLINK-II Commands* for details.

IMPORTANT

Model following control is used to make optimum feedforward settings in the DRIVER when model following control is used with the feedforward function. Therefore, model following control is not normally used together with either the speed feedfor- ward (VFF) input or torque feedforward (TFF) input from the host controller. However, model following control can be used with the speed feedforward (VFF) input or torque feedforward (TFF) input if required. An improper feedforward input may result in over- shooting.

5.7.3 Related Parameters

The following table lists parameters related to this function and their possibility of being changed while exe- cuting this function or of being changed automatically after executing this function.

• Parameters related to this function

These are parameters that are used or referenced when executing this function.

• Allowed changes during execution of this function

Yes : Parameters can be changed using SigmaWin+ while this function is being executed.

No : Parameters cannot be changed using SigmaWin+ while this function is being executed.

• Automatic changes after execution of this function

Yes : Parameter set values are automatically set or adjusted after execution of this function.

No : Parameter set values are not automatically set or adjusted after execution of this function.

Parameter	Name	Mid-execution changes	Automatic changes
Pn140	Model Following Control Related Switch	Yes	Yes
Pn141	Model Following Control Gain	No	Yes
Pn142	Model Following Control Gain Compensation	No	No
Pn143	Model Following Control Bias (Forward Direction)	No	No
Pn144	Model Following Control Bias (Reverse Direction)	No	No
Pn145	Vibration Suppression 1 Frequency A	No	Yes
Pn146	Vibration Suppression 1 Frequency B	No	Yes
Pn147	Model Following Control Speed Feedforward Compensation	No	No
Pn14A	Vibration Suppression 2 Frequency	No	No
Pn14B	Vibration Suppression 2 Compensation	No	No

5.8 Additional Adjustment Function

This section describes the functions that can be used for additional fine tuning after making adjustments with advanced autotuning, advanced autotuning by reference, or one-parameter tuning.

- Switching gain settings
- Friction compensation
- Current control mode selection
- Current gain level setting
- Speed detection method selection

5.8.1 Switching Gain Settings

Two gain switching functions are available, manual switching and automatic switching. The manual switching function uses an external input signal to switch gains, and the automatic switching function switches gains automatically.

By using the gain switching function, the positioning time can be shortened by increasing the gain during posi- tioning and vibration can be suppressed by decreasing the gain while it is stopped.

Parameter		Function	When Enabled	Classification
Pn139	n.□□□0 [Factory setting]	Manual gain switching	Immediately	Tuning
	n.□□□2	Automatic gain switching		

Note: n.□□□1 is reserved. Do not use.

For the gain combinations for switching, refer to *(1) Gain Combinations for Switching*. For the manual gain switching, refer to *(2) Manual Gain Switching*.
For the automatic gain switching, refer to *(3) Automatic Gain Switching*.

(1) Gain Combinations for Switching

Setting	Speed Loop Gain	Speed Loop Integral Time Constant	Position Loop Gain	Torque Reference Filter	Model Following Control Gain	Model Following Control Gain Compensation	Friction Compensation Gain
Gain Setting 1	Pn100 Speed Loop Gain	Pn101 Speed Loop Integral Time Constant	Pn102 Position Loop Gain	Pn401 Torque Reference Filter Time Constant	Pn141* Model Following Control Gain	Pn142* Model Following Control Gain Compensation	Pn121 Friction Compensation Gain
Gain Setting 2	Pn104 2nd Speed Loop Gain	Pn105 2nd Speed Loop Integral Time Constant	Pn106 2nd Position Loop Gain	Pn412 1st Step 2nd Torque Reference Filter Time Constant	Pn148* 2nd Model Following Control Gain	Pn149* 2nd Model Following Control Gain Compensation	Pn122 2nd Gain for Friction Compensation

∗ The switching gain settings for the model following control gain and the model following control gain compensation are available only for manual gain switching. To enable the gain switching of these parameters, a gain switching input signal must be sent, and the following conditions must be met.

- No command being executed.
- Motor having been completely stopped.

If these conditions are not satisfied, the applicable parameters will not be switched although the other parameters shown in this table will be switched.

(2) Manual Gain Switching

Manual gain switching uses G-SEL of OPTION field to switch between gain setting 1 and gain setting 2.

Type	Command Name	Setting	Meaning
Input	G-SEL of OPTION field	0	Switches to gain setting 1.
		1	Switches to gain setting 2.

(3) Automatic Gain Switching

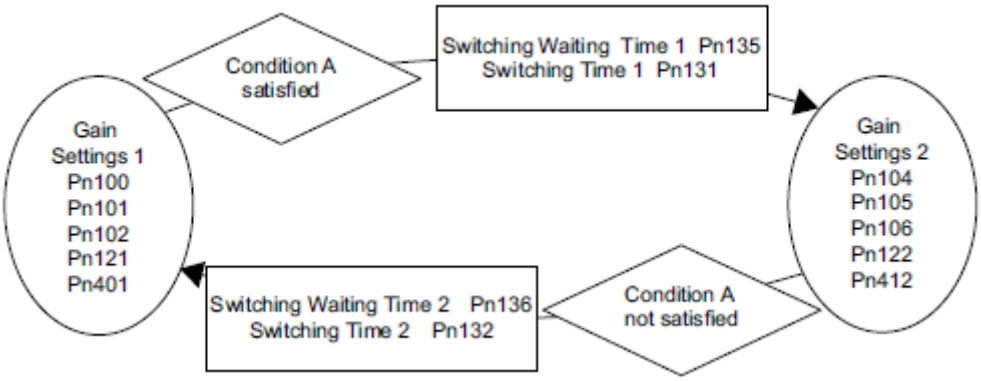
Automatic gain switching is enabled only in position control. The switching conditions are specified using the following settings.

Parameter Setting		Switching Condition	Setting	Switching Wait Time	Switching Time
Pn139	n.□□□2	Condition A satisfied.	Gain setting 1 to gain setting 2	Pn135 Gain Switching Waiting Time 1	Pn131 Gain Switching Time 1
		Condition A not satisfied.	Gain setting 2 to gain setting 1	Pn136 Gain Switching Waiting Time 2	Pn132 Gain Switching Time 2

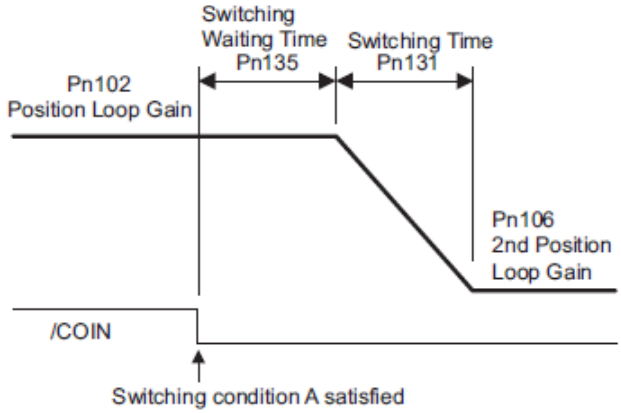
Select one of the following settings for switching condition A.

Parameter		Switching Condition A for Position Control	For Other than Position Control (No Switching)	When Enabled	Classification
Pn139	n.□□0□ [Factory setting]	Positioning completed signal (/COIN) ON	Fixed in gain setting 1	Immediately	Tuning
	n.□□1□	Positioning completed signal (/COIN) OFF	Fixed in gain setting 2		
	n.□□2□	Positioning near signal (/NEAR) ON	Fixed in gain setting 1		
	n.□□3□	Positioning near signal (/NEAR) OFF	Fixed in gain setting 2		
	n.□□4□	No output for position reference filter and position reference input OFF	Fixed in gain setting 1		
	n.□□5□	Position reference input ON	Fixed in gain setting 2		

Automatic switching pattern 1 (Pn139.0 = 2)



- Relationship between the Waiting and Switching Times for Gain Switching
  In this example, the "positioning completed signal (/COIN) ON" condition is set as condition A for automatic gain switching. The position loop gain is switched from the value in Pn102 (position loop gain) to the value in Pn106 (2nd position loop gain). When the /COIN signal goes ON, the switching operation begins after the waiting time set in Pn135. The switching operation changes the position loop gain linearly from Pn102 to Pn106 within the switching time set in Pn131.



Note: Automatic gain switching is available in the PI and I-P controls (Pn10B).

(4) Related Parameters

Pn100	Speed Loop Gain			Speed Position	Classification
	Setting Range	Setting Unit	Factory Setting	When Enabled	
	10 to 20000	0.1 Hz	400	Immediately	Tuning
Pn101	Speed Loop Integral Time Constant			Speed Position	Classification
	Setting Range	Setting Unit	Factory Setting	When Enabled	
	15 to 51200	0.01 ms	2000	Immediately	Tuning
Pn102	Position Loop Gain			Position	Classification
	Setting Range	Setting Unit	Factory Setting	When Enabled	
	10 to 20000	0.1/s	400	Immediately	Tuning
Pn401	Torque Reference Filter Time Constant			Speed Position Torque	Classification
	Setting Range	Setting Unit	Factory Setting	When Enabled	
	0 to 65535	0.01 ms	100	Immediately	Tuning
Pn141	Model Following Control Gain			Position	Classification
	Setting Range	Setting Unit	Factory Setting	When Enabled	
	10 to 20000	0.1/s	500	Immediately	Tuning
Pn142	Model Following Control Gain Compensation			Position	Classification
	Setting Range	Setting Unit	Factory Setting	When Enabled	
	500 to 2000	0.1%	1000	Immediately	Tuning
Pn121	Friction Compensation Gain			Speed Position	Classification
	Setting Range	Setting Unit	Factory Setting	When Enabled	
	10 to 1000	1%	100	Immediately	Tuning
Pn104	2nd Speed Loop Gain			Speed Position	Classification
	Setting Range	Setting Unit	Factory Setting	When Enabled	
	10 to 20000	0.1 Hz	400	Immediately	Tuning

(cont'd)

Pn105	2nd Speed Loop Integral Time Constant		Speed	Position	Classification
	Setting Range	Setting Unit	Factory Setting	When Enabled	
	15 to 51200	0.01 ms	2000	Immediately	Tuning
Pn106	2nd Position Loop Gain			Position	Classification
	Setting Range	Setting Unit	Factory Setting	When Enabled	
	10 to 20000	0.1/s	400	Immediately	Tuning
Pn412	1st Step 2nd Torque Reference Filter Time Constant		Speed Position	Torque	Classification
	Setting Range	Setting Unit	Factory Setting	When Enabled	
	0 to 65535	0.01 ms	100	Immediately	Tuning
Pn148	2nd Model Following Control Gain			Position	Classification
	Setting Range	Setting Unit	Factory Setting	When Enabled	
	10 to 20000	0.1/s	500	Immediately	Tuning
Pn149	2nd Model Following Control Gain Compensation			Position	Classification
	Setting Range	Setting Unit	Factory Setting	When Enabled	
	500 to 2000	0.1%	1000	Immediately	Tuning
Pn122	2nd Gain for Friction Compensation		Speed	Position	Classification
	Setting Range	Setting Unit	Factory Setting	When Enabled	
	10 to 1000	1%	100	Immediately	Tuning

(5) Parameters for Automatic Gain Switching

Pn131	Gain Switching Time 1			Position	Classification
	Setting Range	Setting Unit	Factory Setting	When Enabled	
	0 to 65535	1 ms	0	Immediately	Tuning
Pn132	Gain Switching Time 2			Position	Classification
	Setting Range	Setting Unit	Factory Setting	When Enabled	
	0 to 65535	1 ms	0	Immediately	Tuning
Pn135	Gain Switching Waiting Time 1			Position	Classification
	Setting Range	Setting Unit	Factory Setting	When Enabled	
	0 to 65535	1 ms	0	Immediately	Tuning
Pn136	Gain Switching Waiting Time 2			Position	Classification
	Setting Range	Setting Unit	Factory Setting	When Enabled	
	0 to 65535	1 ms	0	Immediately	Tuning

(6) Related Monitor

Monitor No. (Un)	Name	Value	Remarks
Un014	Effective gain monitor	1	For gain setting 1
		2	For gain setting 2

Note: When using the tuning-less function, gain setting 1 is enabled.

Parameter No.	Analog Monitor	Name	Output Value	Remarks
Pn006 Pn007	n.□□0B	Effective gain monitor	1 V	Gain setting 1 is enabled.
			2 V	Gain setting 2 is enabled.

5.8.2 Manual Adjustment of Friction Compensation

Friction compensation rectifies the viscous friction change and regular load change.

The friction compensation function can be automatically adjusted with advanced autotuning (Fn201), advanced autotuning by reference input (Fn202), or one-parameter tuning (Fn203). This section describes the steps to follow if manual adjustment is required.

(1) Required Parameter Settings

The following parameter settings are required to use friction compensation.

Parameter		Function	When Enabled	Classification
Pn408	n.0□□□ [Factory setting]	Does not use friction compensation.	Immediately	Setup
	n.1□□□	Uses friction compensation.		

Pn121	Friction Compensation Gain		Speed	Position	Classification
	Setting Range	Setting Unit	Factory Setting	When Enabled	
	10 to 1000	1%	100	Immediately	Tuning
Pn123	Friction Compensation Coefficient		Speed	Position	Classification
	Setting Range	Setting Unit	Factory Setting	When Enabled	
	0 to 100	1%	0	Immediately	Tuning
Pn124	Friction Compensation Frequency Correction		Speed	Position	Classification
	Setting Range	Setting Unit	Factory Setting	When Enabled	
	-10000 to 10000	0.1 Hz	0	Immediately	Tuning
Pn125	Friction Compensation Gain Correction		Speed	Position	Classification
	Setting Range	Setting Unit	Factory Setting	When Enabled	
	1 to 1000	1%	100	Immediately	Tuning

(2) Operating Procedure for Friction Compensation

The following procedure is used for friction compensation.

⚠ CAUTION

Before using friction compensation, set the moment of inertia ratio (Pn103) as accurately as possible. If the wrong moment of inertia ratio is set, vibration may result.

Step	Operation
1	Set the following parameters for friction compensation to the factory setting as follows. Friction compensation gain (Pn121): 100 Friction compensation coefficient (Pn123): 0 Friction compensation frequency correction (Pn124): 0 Friction compensation gain correction (Pn125): 100 Note: Always use the factory-set values for friction compensation frequency correction (Pn124) and friction compensation gain correction (Pn125).
2	To check the effect of friction compensation, gradually increase the friction compensation coefficient (Pn123). Note: Usually, set the friction compensation coefficient value to 95% or less. If the effect is insufficient, increase the friction compensation gain (Pn121) by 10% increments until it stops vibrating. Effect of Parameters for Adjustment Pn121: Friction Compensation Gain This parameter sets the responsiveness for external disturbance. The higher the set value is, the better the responsiveness will be. If the equipment has a resonance frequency, however, vibration may result if the set value is excessively high. Pn123: Friction Compensation Coefficient This parameter sets the effect of friction compensation. The higher the set value is, the more effective friction compensation will be. If the set value is excessively high, however, the vibration will occur easily. Usually, set the value to 95% or less.
3	Effect of Adjustment The following graph shows the responsiveness with and without proper adjustment. Without friction compensation With friction compensation

5.8.3 Current Control Mode Selection Function

This function reduces high-frequency noises while the servomotor is being stopped. This function is enabled by default and set to be effective under different application conditions. Set Pn009.1 = 1 to use this function.

*This function can not be used with LECYM2-V□.

Parameter		Meaning	When Enabled	Classification
Pn009	n. □□0□	Selects the current control mode 1.	After restart	Tuning
	n. □□1□ [Factory setting]	Selects the current control mode 2 (low noise).		

5.8.4 Current Gain Level Setting

This function reduces noises by adjusting the parameter value for current control inside the DRIVER according to the speed loop gain (Pn100). The noise level can be reduced by reducing the current gain level (Pn13D) from its factory setting of 2000% (disabled). If the set value of Pn13D is decreased, the level of noise will be lowered, but the response characteristics of the DRIVER will also be degraded. Adjust the current gain level within the allowable range at which DRIVER response characteristics can be secured.

	Current Gain Level		Speed Position		Classification
Pn13D	Setting Range	Setting Unit	Factory Setting	When Enabled	
	100 to 2000	1%	2000	Immediately	Tuning

IMPORTANT

- If the parameter setting of the current gain level is changed, the responses character- istics of the speed loop will also change. The DRIVER must, therefore, be read- justed again.

5.8.5 Speed Detection Method Selection

This function can ensure smooth movement of the servomotor while the servomotor is running. Set the value of Pn009.2 to 1 and select speed detection 2 to smooth the movement of the servomotor while the servomotor is running.

Parameter		Meaning	When Enabled	Classification
Pn009	n. □0□□ [Factory setting]	Selects speed detection 1.	After restart	Tuning
	n. □1□□	Selects speed detection 2.		

IMPORTANT

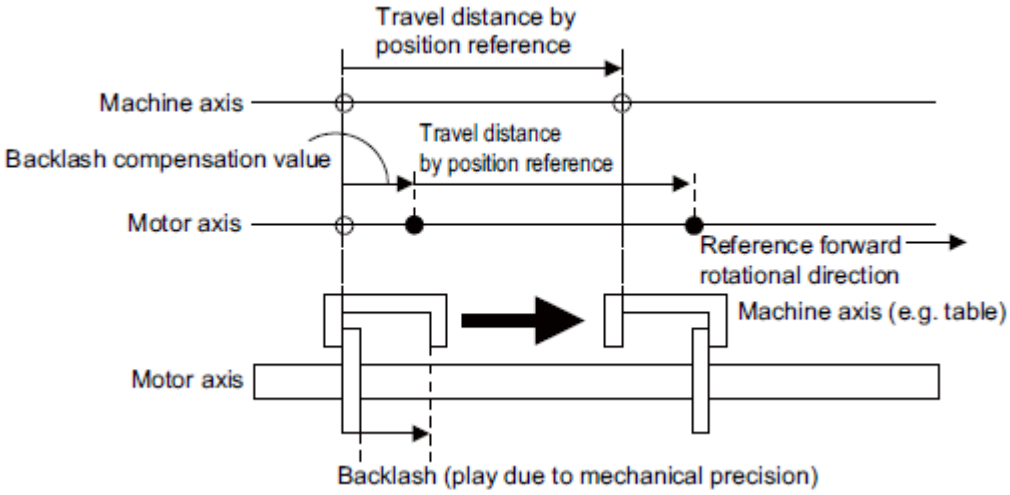
- If the speed detection method is changed, the response characteristics of the speed loop will change and the DRIVER must be readjusted again.

5.8.6 Backlash Compensation Function

(1) Overview

When driving a machine with backlash, there will be a deviation between the travel distance in the position reference that is managed by the host controller and the travel distance of the actual machine. Use backlash compensation function to add the backlash compensation value to the position reference and use the result to drive the servomotor. This means that the travel distance of the actual machine will be the same as the travel distance in the host controller.

Note 1. This function is supported only for position control.
2. Software version 0023 or higher is required to use this function. For details, refer to *6.13 Product Information Display*.



(2) Related Parameter

Set the following parameter to use backlash compensation.

- Backlash Compensation Direction

Set the direction in which to apply backlash compensation.

Parameter		Function	When Enabled	Classification
Pn230	n. □□□0 [Factory setting]	Compensates with a reference in the forward direction.	After restart	Setup
	n. □□□1	Compensates with a reference in the reverse direction.		

- Backlash Compensation Value

Set the amount of backlash compensation to add to the position reference.
The amount is set in increments of 0.1 reference unit. However, when the amount is converted to encoder pulses, it is rounded off at the decimal point.

Example: If Pn231 is set to 6,553.6 [reference unit] and the electronic gear ratio (Pn20E/Pn210) is set to 4/1, then the pulse equivalent is 6,553.6 × 4 = 26,214.4 [pulses].
⇒The backlash compensation value will be 26,214 encoder pulses.

Pn231	Backlash compensation value			Position	Classification
	Setting Range	Setting Unit	Factory Setting	When Enabled	
	-500000 to 500000	0.1 reference unit	0	Immediately	Setup

IMPORTANT

· The backlash compensation value is restricted by the following formula. The specified compensation is not performed if this condition is not met.

$$Pn231 \leq \frac{Pn210}{Pn20E} \times \frac{\text{Maximum motor speed [min}^{-1}\text{]}}{60} \times \text{Encoder resolution}^{*} \times 0.00025$$

∗ For details on encoder resolution, refer to *8.3.5 Electronic Gear*.

Example 1:

Assuming Pn20E = 4, Pn210 = 1, maximum motor speed = 6000 [min^{-1}], encoder resolution = 1048576 (20 bits):

1/4 × 6000/60 × 1048576 × 0.00025 = 6553.6 [reference units]
⇒The upper limit for the backlash compensation is 6553.6 [reference units].

Example 2:

When using the conditions Pn20E = 4, Pn210 = 1, maximum motor speed = 6000 [min^{-1}], external encoder pitch count (Pn20A) = 500, signal resolution: 1/256:

1/4 × 6000/60 × (500 × 256) × 0.00025 = 800.0 [reference units]

⇒ The upper limit for the backlash compensation is 800.0 [reference units].

• Do not exceed the upper limit of the backlash compensation value. The upper limit of the backlash compensation value can be confirmed in Un031.

- Backlash Compensation Time Constant

Set a time constant for a first order lag filter to use when adding the backlash compensation value (Pn231) to the position reference.
If you set Pn233 to 0, the first order lag filter is disabled.

Pn233	Backlash compensation time constant			Position	Classification
	Setting Range	Setting Unit	Factory Setting	When Enabled	
	0 to 65535	0.01 ms	0	Immediately	Setup

Note: Changes to the set value are applied when there is no position reference input and the servomotor is stopped. The current operation is not affected if the set value is changed during servomotor operation.

(3) Related Monitor

The following monitoring parameters provide information on backlash compensation.

Displayed Information	Unit
The current backlash compensation value	0.1 reference unit
Backlash compensation setting limit value	0.1 reference unit

(4) Compensation Operation

This section describes the operation that is performed for backlash compensation.

Note: The following figures are for when backlash compensation is applied for references in the forward direction (Pn230.0 = 0). The following monitoring information is provided in the figures: TPOS (target position in the refer- ence coordinate system), POS (reference position in the reference coordinate system), and APOS (feedback position in the machine coordinate system). The monitoring information includes the feedback position in machine coordi- nate system (APOS) and other feedback information. The backlash compensation value is subtracted from the feed- back positions in the monitoring information, so it is not necessary for the PC or PLC etc. to consider the backlash compensation value.

⚠ CAUTION
• The encoder output pulse will output the number of encoder pulses for which driving was actually per- formed, including the backlash compensation value. If using the encoder output pulse for position feed- back at the host controller, must consider the backlash compensation value.

- When Servo is ON

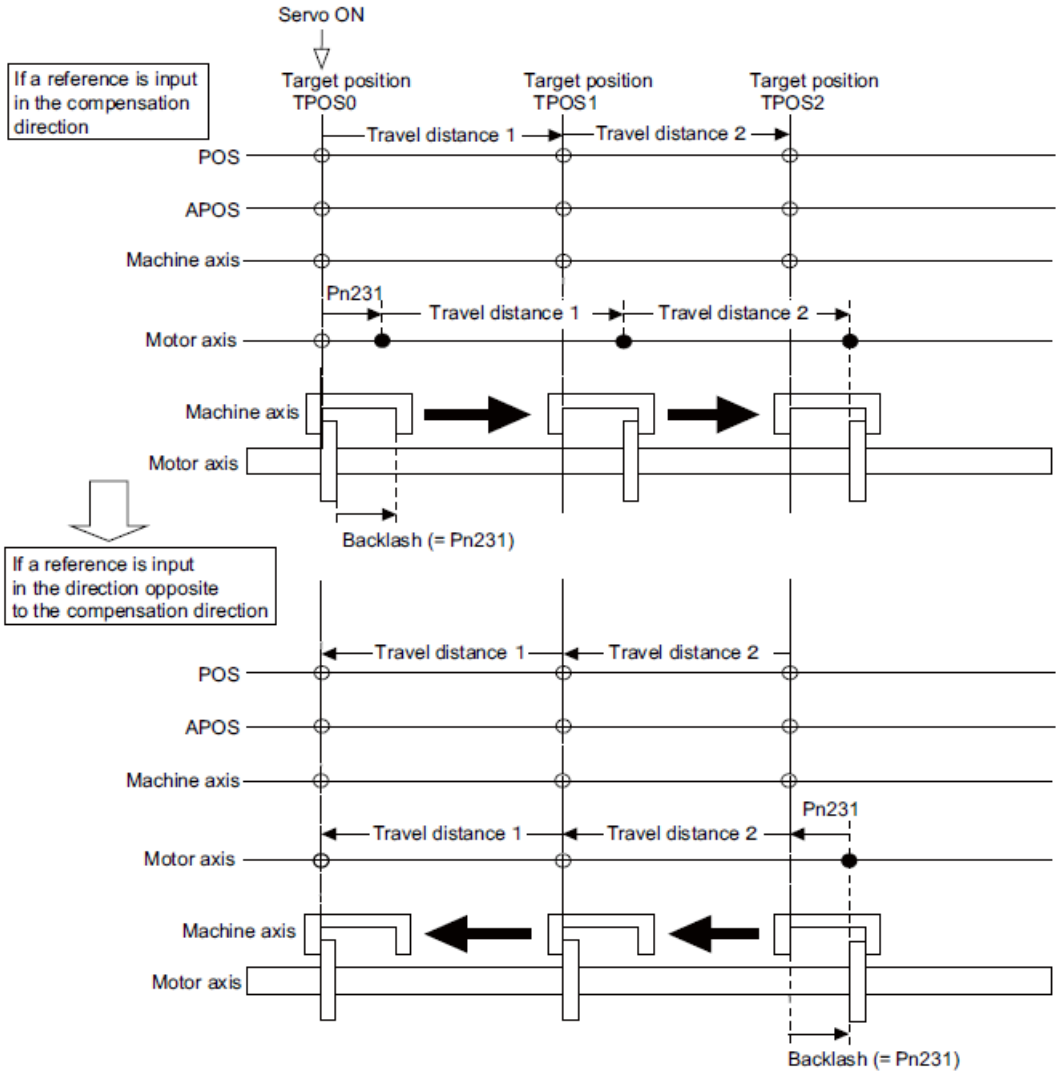
The backlash compensation value (Pn231) is added in the compensation direction when the servo is ON (i.e., the servomotor is powered) and a reference is input in the same direction as the backlash compensation direc- tion (Pn230.0). If there is a reference input in the direction opposite to the backlash compensation direction, the backlash compensation value is not added (i.e., backlash compensation is not performed).

The relationship between APOS and the servomotor shaft position is as follows:

- If a reference is input in the compensation direction: APOS = Motor shaft position - Pn231
- If a reference is input in the direction opposite to the compensation direction: APOS = Motor shaft position

The following figure shows driving the servomotor in the forward direction from target position TPOS0 to TPOS1 and then to TPOS2, and then returning from TPOS2 to TPOS1 and then to TPOS0.

Backlash compensation is applied when moving from TPOS0 to TPOS1, but not when moving from TPOS2 to TPOS1.



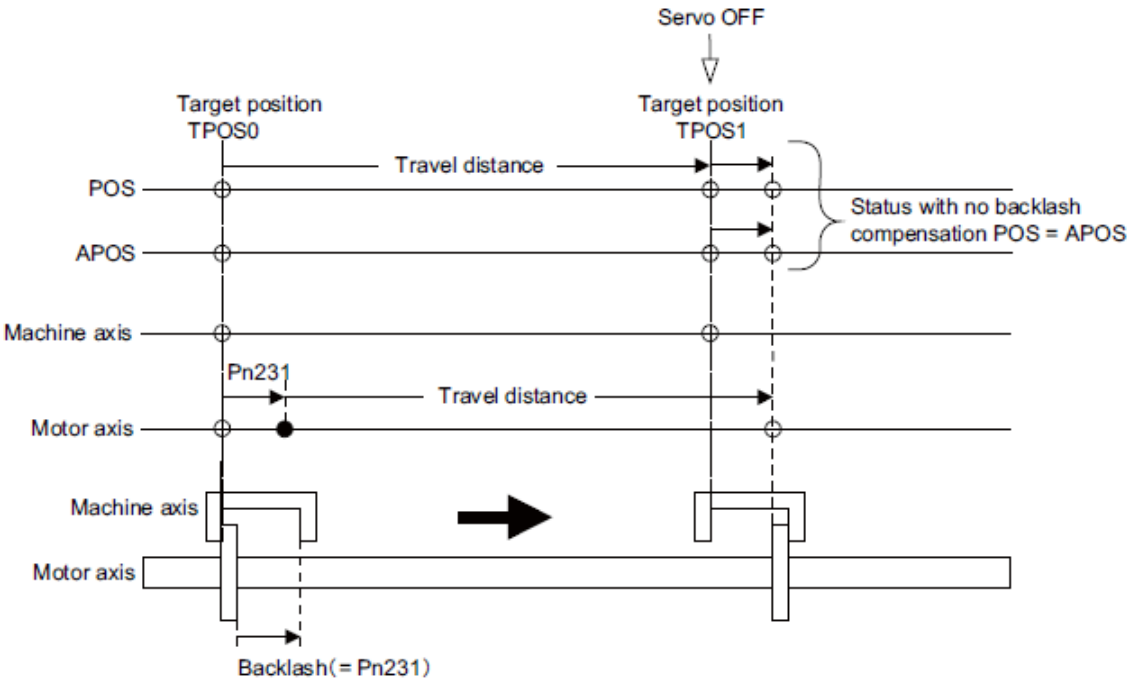
- When Servo is OFF

Backlash compensation is not applied when the servo is OFF (i.e., when the servomotor is not powered). Therefore, the reference position POS moves by only the backlash compensation value.

The relationship between APOS and the servomotor shaft position is as follows:

• When servo is OFF: APOS = Servomotor shaft position

The following figure shows what happens when the servo is turned OFF after driving the servomotor in the forward direction from target position TPOS0 to TPOS1. Backlash compensation is not applied when the servo is OFF (i.e., the DRIVER manages the position data so that APOS and POS are the same).



- When There is Overtravel

When there is overtravel (i.e., when driving is prohibited due to an overtravel signal or software limit), the operation is the same as for • *When Servo is OFF*, i.e., backlash compensation is not applied.

- When Control is Changed

Backlash compensation is performed only for position control.
Backlash compensation is not applied if changing from position control to any other type of control. Backlash compensation is applied in the same way as • *When Servo is ON* if changing from any other type of control to position control.

(5) Monitor Functions (Un Monitoring)

Displayed Information	Unit	Specification
Input reference speed	min^{-1}	Indicates the input reference speed before backlash compensation.
Position error amount	Reference unit	Displays the position error with respect to the position reference after backlash compensation.
Input reference counter	Reference unit	Displays the input reference counter before backlash compensation.
Feedback pulse counter	Encoder pulse	Displays the pulse count of the actually driven motor encoder.
Fully-closed feedback pulse counter	External encoder resolution	Displays the pulse count of the actually driven external encoder.
Feedback pulse counter	Reference unit	Displays the pulse count of the actually driven encoder in reference units.

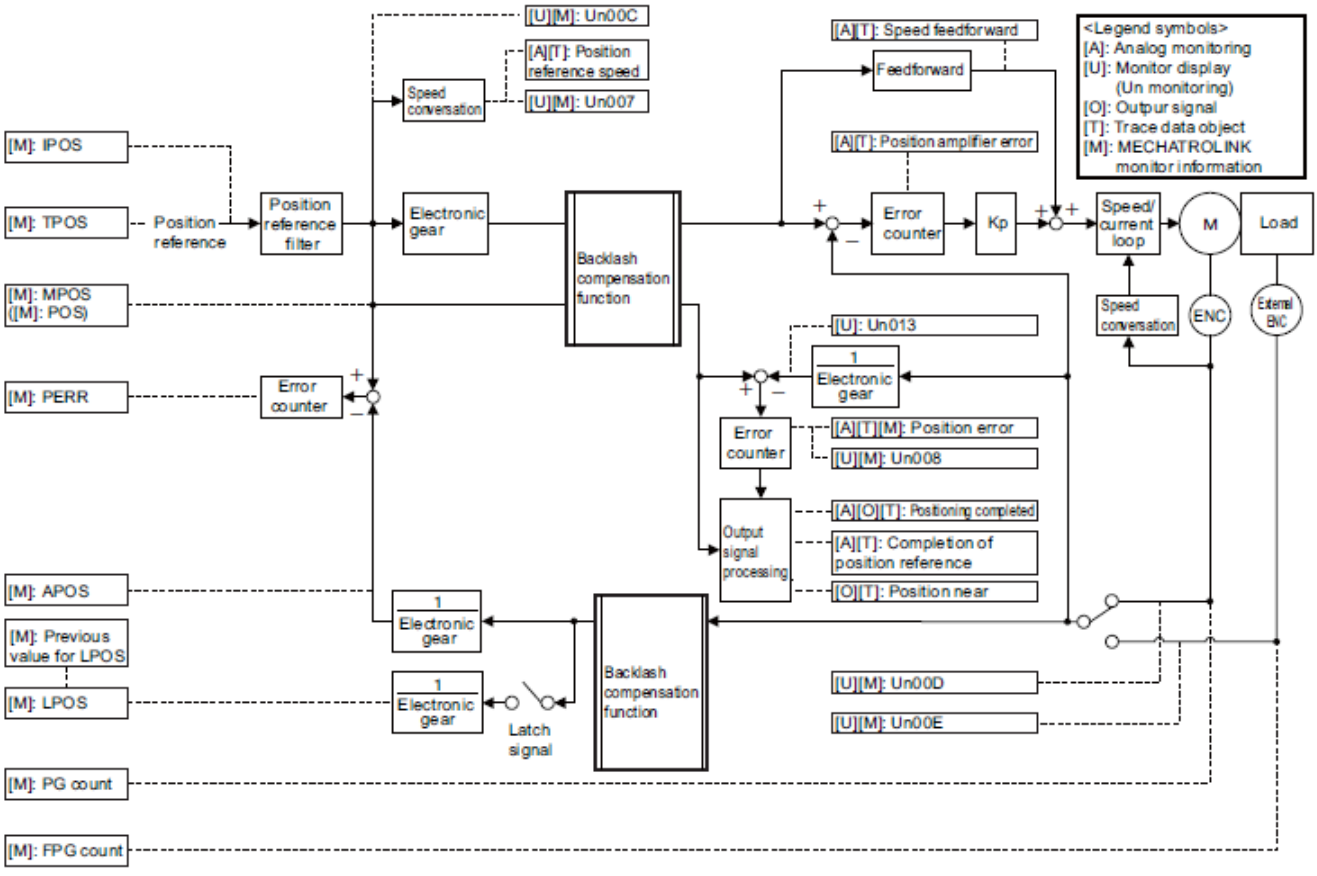
(6) MECHATROLINK Monitor Information

This section describes the information that is set for the MECHATROLINK monitoring information (Monitor 1, Monitor 2, Monitor 3, and Monitor 4) and the backlash compensation operation.

Monitor Code	Designation	Meaning	Unit	Remarks
0	POS	Reference position in the reference coordinate system (after the position reference filter)	Reference unit	–
1	MPOS	Reference position	Reference unit	–
2	PERR	Position error	Reference unit	–
3	APOS	Feedback position in the machine coordinate system	Reference unit	Feedback position with the backlash compensation subtracted
4	LPOS	Feedback latch position in the machine coordinate system	Reference unit	Feedback position with the backlash compensation subtracted
5	IPOS	Reference position in the reference coordinate system (before the position reference filter)	Reference unit	–
6	TPOS	Target position in the reference coordinate system	Reference unit	–
E	OMN1	Option monitor 1 (selected with Pn824)	–	–
F	OMN2	Option monitor 2 (selected with Pn825)	–	–

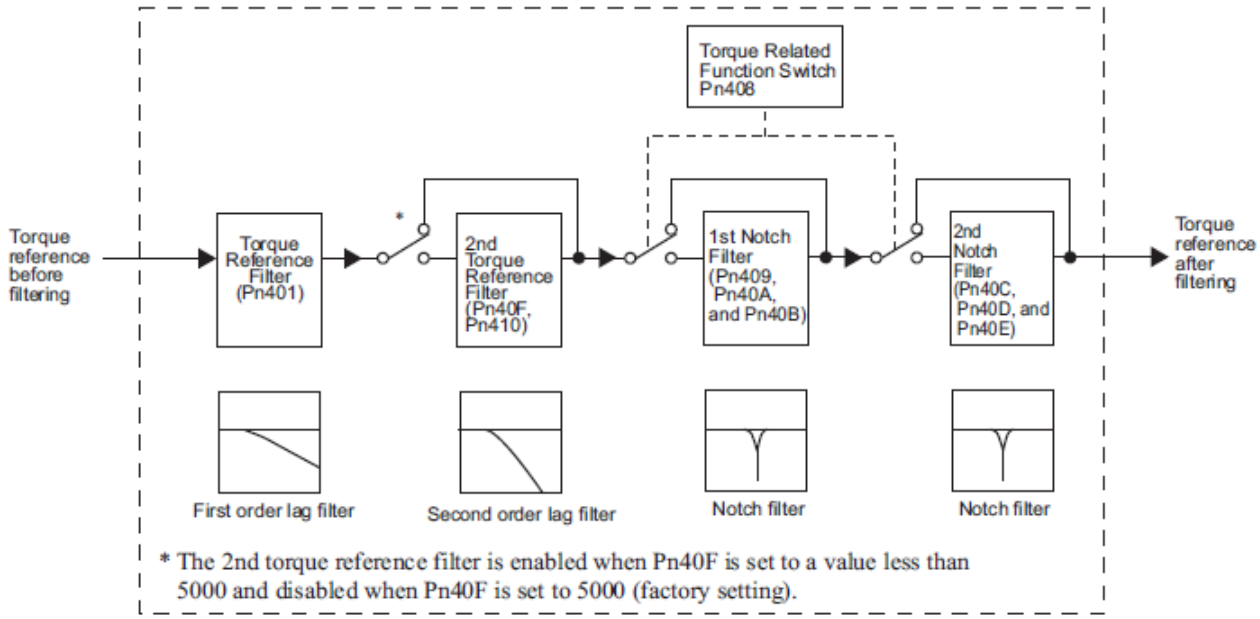
Parameters		Monitor Information	Output Unit	Remarks
Pn824 Pn825	0003H	Position error (lower 32 bits)	Reference unit	–
	0004H	Position error (upper 32 bits)	Reference unit	–
	000AH	Encoder count (lower 32 bits)	Reference unit	Count value of the actually driven motor encoder
	000BH	Encoder count (upper 32 bits)	Reference unit	
	000CH	FPG count (lower 32 bits)	Reference unit	Count value of the actually driven external encoder
	000DH	FPG count (upper 32 bits)	Reference unit	
	0017H	Input reference speed	min^{-1}	Same as monitor display Un007
	0018H	Position error amount	Reference unit	Same as monitor display Un008
	001CH	Input reference counter	Reference unit	Same as monitor display Un00C
	001DH	Feedback pulse counter	Encoder pulse	Same as monitor display Un00D
	001EH	Fully-closed feedback pulse counter	External encoder resolution	Same as monitor display Un00E
	0080H	Previous value of latched feedback position (LPOS)	Encoder pulse	Feedback position with the backlash compensation subtracted

- Related Monitoring Diagrams



5.8.7 Torque Reference Filter

As shown in the following diagram, the torque reference filter contains first order lag filter and notch filters arrayed in series, and each filter operates independently. The notch filters can be enabled and disabled with the Pn408.



(1)Torque Reference Filter

If you suspect that machine vibration is being caused by the servo drive, try adjusting the filter time constants with Pn401. This may stop the vibration. The lower the value, the better the response will be, but there may be a limit that depends on the machine conditions.

Pn401	Torque Reference Filter Time Constant Speed Position Torque				Classification
	Setting Range	Setting Unit	Factory Setting	When Enabled	
	0 to 65535	0.01 ms	100	Immediately	Tuning

o
Trque Reference Filter Setting Guide

Use the speed loop gain (Pn100 [Hz]) and the torque filter time constant (Pn401 [ms]) to set the torque refer- ence filter.

Adjusted value for stable control: Pn401 [ms] ≤ 1000/ (2π × Pn100 [Hz] × 4)
Critical gains: Pn401 [ms] < 1000/ (2π × Pn100 [Hz] × 1)

Pn40F	2nd Step 2nd Torque Reference Filter Frequency Speed Position Torque				Classification
	Setting Range	Setting Unit	Factory Setting	When Enabled	
	100 to 5000	1 Hz	5000*	Immediately	Tuning
Pn410	2nd Step 2nd Torque Reference Filter Q Value Speed Position Torque				Classification
	Setting Range	Setting Unit	Factory Setting	When Enabled	
	50 to 100	0.01	50	Immediately	Tuning

∗ The filter is disabled if 5000 is set.

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6. Utility Functions (Fn□□□)

6.1 List of Utility Functions

Utility functions are used to execute the functions related to servomotor operation and adjustment.
The following table lists the utility functions and reference section.

Function No.	Function	Reference Section
Fn000	Alarm history display	6.2
Fn002	JOG operation	6.3
Fn003	Origin search	6.4
Fn004	Program JOG operation	6.5
Fn005	Initializing parameter settings	6.6
Fn006	Clearing alarm history	6.7
Fn008	Absolute encoder multiturn reset and encoder alarm reset	4.7.4
Fn00C	Offset adjustment of analog monitor output	6.8
Fn00D	Gain adjustment of analog monitor output	6.9
Fn00E	Automatic offset-signal adjustment of the motor current detection signal	6.10
Fn00F	Manual offset-signal adjustment of the motor current detection signal	6.11
Fn010	Write prohibited setting	6.12
Fn011	Product Information display	6.13
Fn013	Multiturn limit value setting change when a multiturn limit disagreement alarm occurs	4.7.6
Fn014	Resetting configuration error in option modules	6.14
Fn01B	Vibration detection level initialization	6.15
Fn020	Origin setting	6.16
Fn030	Software reset	6.17
Fn200	Tuning-less levels setting	5.2.2
Fn201	Advanced autotuning	5.3.2
Fn202	Advanced autotuning by reference	5.4.2
Fn203	One-parameter tuning	5.5.2
Fn204	Anti-resonance control adjustment function	5.6.2
Fn205	Vibration suppression function	5.7.2
Fn206	EasyFFT	6.18
Fn207	Online vibration monitor	6.19

Note: Execute the utility function with SigmaWin+.

6.2 Alarm History Display (Fn000)

This function displays the last ten alarms that have occurred in the DRIVER. The latest ten alarm numbers and time stamps* can be checked.

∗ Time Stamps
A function that measures the ON times of the control power supply and main circuit power supply in 100-ms units and displays the total operating time when an alarm occurs. The time stamp operates around the clock for approximately 13 years.

<Example of Time Stamps>
If 36000 is displayed,
3600000 [ms] = 3600 [s] = 60 [min] = 1 [h]
Therefore, the total number of operating hours is 1 hour.

(1) Preparation

There are no tasks that must be performed before displaying the alarm history.

(2) Operating Procedure

In the SigmaWin+ Σ-V component main window, click **Alarm** and then click **Display Alarm**.
Click Alarm Traceback tab page, and are shown in order of occurrence with alarm codes and details about the type of alarm, such as name.

For more information on the usage of the SigmaWin+, refer to AC Servo Drives Engineering Tool Sigma Win+ ONLINE MANUAL Σ-V Component *4.2 Alarm Display.*

Note:
If the same alarm occurs after more than one hour, the alarm will be saved. If it occurs in less than one hour, it will not be saved.
Click **Clear** to delete or clear the alarm history. The alarm history is not cleared on alarm reset or when the DRIVER main circuit power is turned OFF.

6.3 JOG Operation (Fn002)

JOG operation is used to check the operation of the servomotor under speed control without connecting the DRIVER to the host controller.

⚠ CAUTION

While the DRIVER is in JOG operation, the overtravel function will be disabled. Consider the operating range of the machine when performing JOG operation for the DRIVER.

(1) Preparation

The following conditions must be met to perform a jog operation.

The write prohibited setting parameter (Fn010) must be set to Write permitted (P.0000).
The main circuit power supply must be ON.
All alarms must be cleared.
The hardwire baseblock (HWBB) must be disabled.
The servomotor power must be OFF.
The JOG speed must be set considering the operating range of the machine. Set the jog speed in Pn304.

Pn304	Jog Speed Speed Position Torque				Classification
	Setting Range	Setting Unit	Factory Setting	When Enabled	
	0 to 10000	1 min^{-1*}	500	Immediately	Setup

(2) Operating Procedure

Use the following procedure. The following example is given when the rotating direction of servomotor is set as Pn000.0=0 (Forward rotation by forward reference).

1. In the SigmaWin+ Σ-V component main window, click **Test Run**, and then click **Jog**.
2. Set up the JOG speed. To change the JOG speed, click **Edit**.
3. Click **Servo ON**.
4. Press **Forward** or **Reverse**. A JOG operation is performed only while one of these buttons is pressed.

For more information on the usage of the SigmaWin+, refer to AC Servo Drives Engineering Tool Sigma Win+ ONLINE MANUAL Σ-V Component *4.7.1 JOG Operation*.

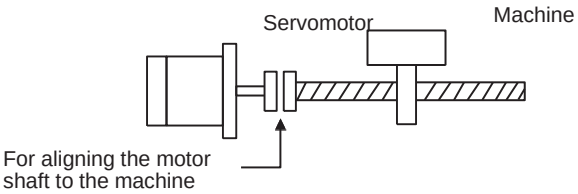
6.4 Origin Search (Fn003)

The origin search is designed to position the origin pulse position of the incremental encoder (phase Z) and to clamp at the position.

⚠ CAUTION

Perform origin searches without connecting the coupling.
The forward run prohibited (P-OT) and reverse run prohibited (N-OT) signals are not effective in origin search mode.

This function is used when the motor shaft needs to be aligned to the machine.
Motor speed at the time of execution: 60 min^{-1}
(For SGMCS direct drive motors, the speed at the time of execution is 6 min^{-1}.)



(1) Preparation

The following conditions must be met to perform the origin search.

The write prohibited setting parameter (Fn010) must be set to Write permitted (P.0000).
The main circuit power supply must be ON.
All alarms must be cleared.
The hardwire baseblock (HWBB) must be disabled.
The servomotor power must be OFF.

(2) Operating Procedure

Use the following procedure.

1. In the SigmaWin+ Σ-V component main window, click **Setup**, and then click **Search Origin**.
2. Click Servo ON.
3. Press **Forward** or **Reverse**. The search is performed while one of these buttons is pressed. The axis stops when the search is complete.

For more information on the usage of the SigmaWin+, refer to AC Servo Drives Engineering Tool Sigma Win+ ONLINE MANUAL Σ-V Component *4.4.4 Origin Search*.

6.5 Program JOG Operation (Fn004)

The program JOG operation is a utility function, that allows continuous operation determined by the preset operation pattern, movement distance, movement speed, acceleration/deceleration time, waiting time, and number of times of movement.
This function can be used to move the servomotor without it having to be connected to a host controller for the machine as a trial operation in JOG operation mode. Program JOG operation can be used to confirm the operation and for simple positioning operations.

(1) Preparation

The following conditions must be met to perform the program JOG operation.

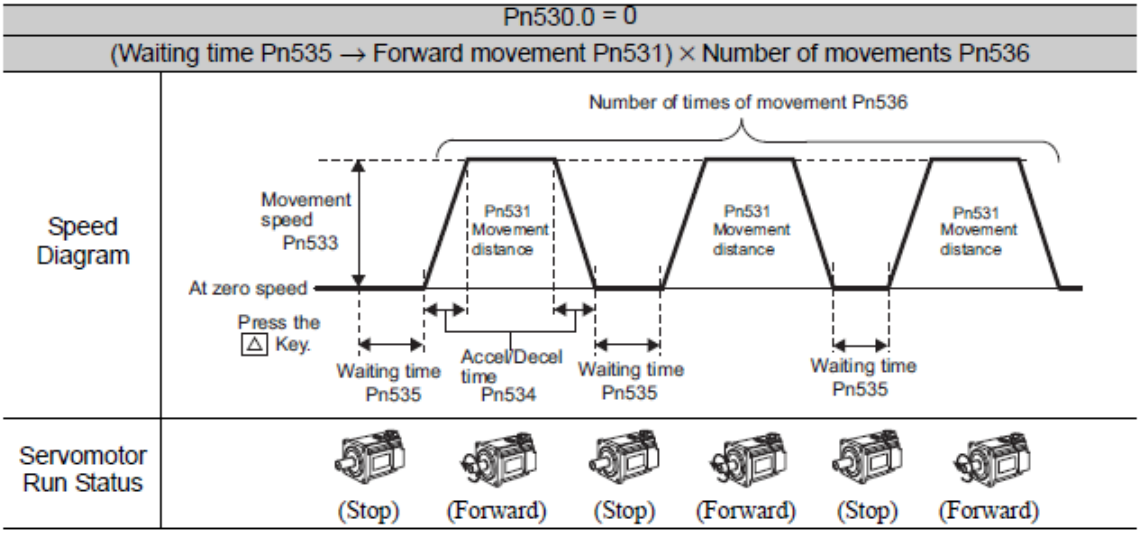
The write prohibited setting parameter (Fn010) must be set to Write permitted (P.0000).
The main circuit power supply must be ON.
All alarms must be cleared.
The hardwire baseblock (HWBB) must be disabled.
The servomotor power must be OFF.
The travel distance and speed must be set correctly considering the machine operation range and safe operation speed.
There must be no overtravel.

(2) Additional Information

The functions that are applicable for position control, such as position reference filter, can be used.
The overtravel function is enabled in this function.

(3) Program JOG Operation Patterns

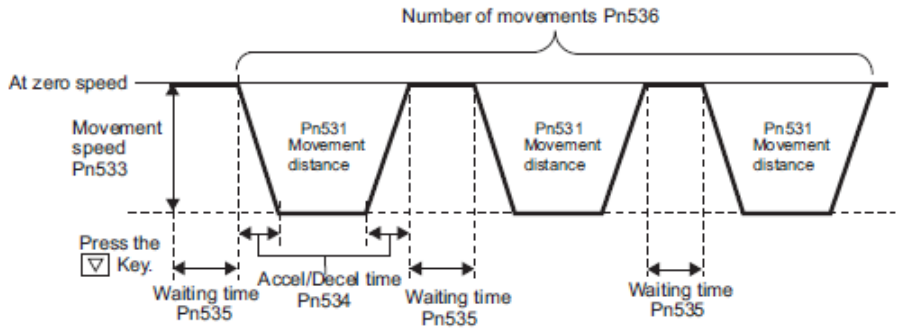
The following describes an example of program JOG operation pattern. The following example is given when the rotating direction of the servomotor is set as Pn000.0 = 0 (Forward rotation by forward reference).



Note: When Pn536 (number of times of program JOG movement) is set to 0, infinite time operation is enabled.

Pn530.0 = 1
(Waiting time Pn535 → Reverse movement Pn531) × Number of movements Pn536

Speed Diagram

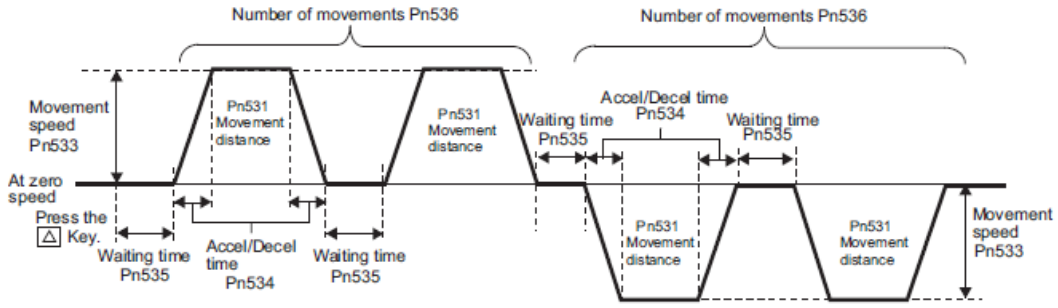


Servomotor Run Status

Note: When Pn536 (Number of Times of Program JOG Movement) is set to 0, infinite time operation is enabled.

Pn530.0 = 2
(Waiting time Pn535 → Forward movement Pn531) × Number of movements Pn536 (Waiting time Pn535 → Reverse movement Pn531) × Number of movements Pn536

Speed Diagram

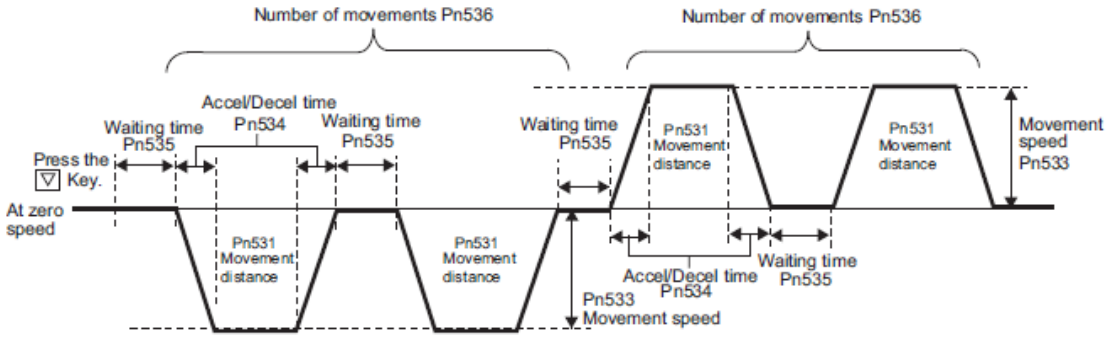


Servomotor Run Status

Note: When Pn530.0 is set to 2, infinite time operation is disabled.

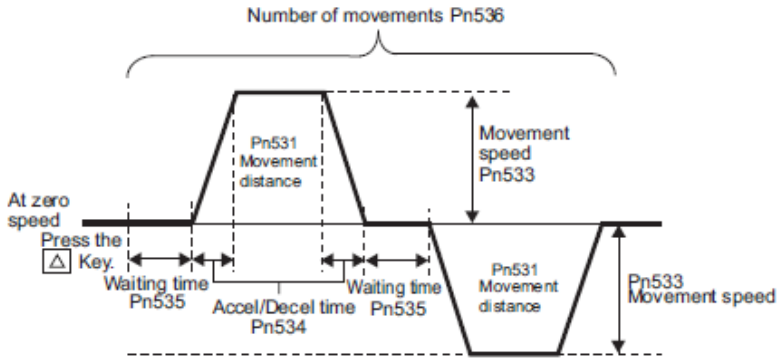
Pn530.0 = 3
(Waiting time Pn535 → Reverse movement Pn531) × Number of movements Pn536 (Waiting time Pn535 → Forward movement Pn531) × Number of movements Pn536

Speed Diagram

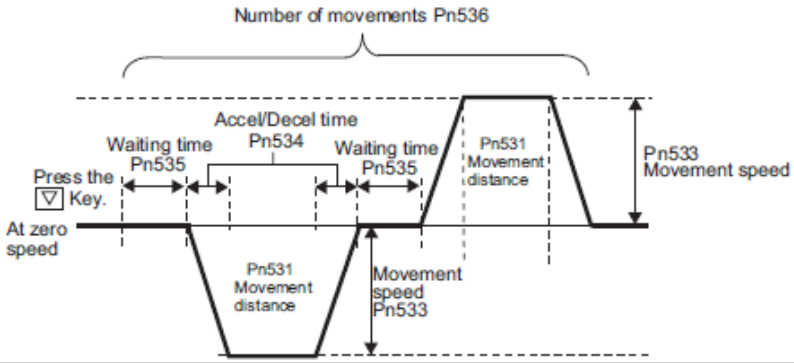


Servomotor Run Status

Note: When Pn530.0 is set to 3, infinite time operation is disabled.

Pn530.0 = 4	
(Waiting time Pn535 → Forward movement Pn531 → Waiting time Pn535 → Reserve movement Pn531) × Number of movements Pn536	
Speed Diagram	
Servomotor Run Status	

Note: When Pn536 (number of times of program JOG movement) is set to 0, infinite time operation is enabled.

Pn530.0 = 5	
(Waiting time Pn535 → Reverse movement Pn531 → Waiting time Pn535 → Forward movement Pn531) × Number of movements Pn536	
Speed Diagram	
Servomotor Run Status	

Note: When Pn536 (number of times of program JOG movement) is set to 0, infinite time operation is enabled.

(4) Related Parameters

The following parameters set the program JOG operation pattern. Operation pattern can change setting at Running Condition Setting box of program JOG operation.
Do not change the settings while the program JOG operation is being executed.

Pn530	Program JOG Operation Related Switch			Speed Position Torque	Classification
	Setting Range	Setting Unit	Factory Setting	When Enabled	
	0000 to 0005	–	0000	Immediately	Setup
Pn531	Program JOG Movement Distance			Speed Position Torque	Classification
	Setting Range	Setting Unit	Factory Setting	When Enabled	
	1 to 1073741824	1 reference unit	32768	Immediately	Setup
Pn533	Program JOG Movement Speed			Speed Position Torque	Classification
	Setting Range	Setting Unit	Factory Setting	When Enabled	
	1 to 10000	1 min^{-1*}	500	Immediately	Setup
Pn534	Program JOG Acceleration/Deceleration Time			Speed Position Torque	Classification
	Setting Range	Setting Unit	Factory Setting	When Enabled	
	2 to 10000	1 ms	100	Immediately	Setup
Pn535	Program JOG Waiting Time			Speed Position Torque	Classification
	Setting Range	Setting Unit	Factory Setting	When Enabled	
	0 to 10000	1 ms	100	Immediately	Setup
Pn536	Number of Times of Program JOG Movement			Speed Position Torque	Classification
	Setting Range	Setting Unit	Factory Setting	When Enabled	
	0 to 1000	1 time	1	Immediately	Setup

(5) Operating Procedure

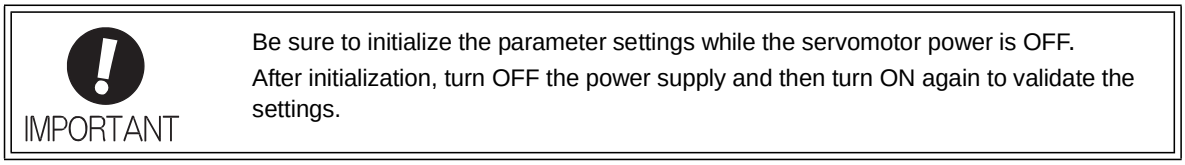
Use the following procedure.

1. In the SigmaWin+ Σ-V component main window, click **Test Run** and then click **Program JOG Operation**.
2. Set the running conditions and click **Apply**. The graph for the operation pattern is displayed.
3. Click **Run** and the Program JOG Operation box appears.
4. Click **Servo ON** and **Execute**. The program JOG operation starts.

For more information on the usage of the SigmaWin+, refer to AC Servo Drives Engineering Tool Sigma Win+ ONLINE MANUAL Σ-V Component *4.7.2 Program JOG Operation*.

6.6 Initializing Parameter Settings (Fn005)

This function is used when returning to the factory settings after changing parameter settings.



Note: Any value adjusted with Fn00C, Fn00D, Fn00E, and Fn00F cannot be initialized by Fn005.

(1) Preparation

The following conditions must be met to initialize the parameter values.

The write prohibited setting parameter (Fn010) must be set to Write permitted (P.0000).
The servomotor power must be OFF.

(2) Operating Procedure

Use the following procedure.

1. In the SigmaWin+ Σ-V component main window, click **Parameters** and then click **Edit Parameters**. The Parameter Editing window for the online mode appears.
2. Click Initialize.
3. To enable the change in the setting, turn the power OFF and ON again.

For more information on the usage of the SigmaWin+, refer to AC Servo Drives Engineering Tool Sigma Win+ ONLINE MANUAL Σ-V Component *4.1.1 Editing Parameter*.

6.7 Clearing Alarm History (Fn006)

The clear alarm history function deletes all of the alarm history recorded in the DRIVER.

Note: The alarm history is not deleted when the alarm reset is executed or the main circuit power supply of the DRIVER is turned OFF.

(1) Preparation

The follow conditions must be met to clear the alarm history.
The write prohibited setting parameter (Fn010) must be set to Write permitted (P.0000).

(2) Operating Procedure

Use the following procedure.

1. In the SigmaWin+ Σ-V component main window, click **Alarm** and then click **Display Alarm**.
2. To clear an alarm, click **Reset** after removing the cause of the alarm.

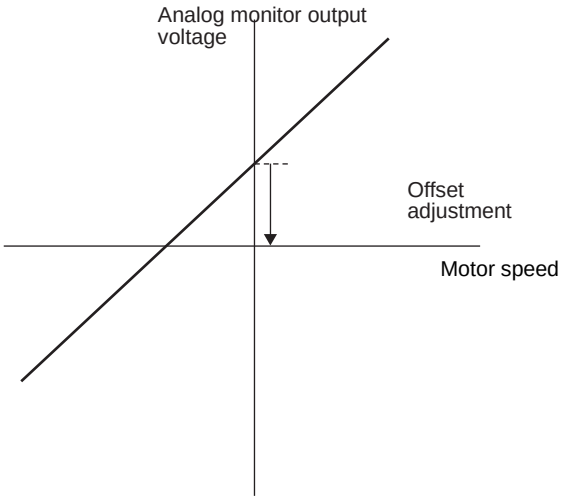
For more information on the usage of the SigmaWin+, refer to AC Servo Drives Engineering Tool Sigma Win+ ONLINE MANUAL Σ-V Component *4.2 Alarm Display*.

6.8 Offset Adjustment of Analog Monitor Output (Fn00C)

This function is used to manually adjust the offsets for the analog monitor outputs (torque reference monitor output and motor speed monitor output). The offset values are factory-set before shipping. Therefore, the user need not usually use this function.

(1) Adjustment Example

An example of offset adjustment to the motor speed monitor is shown below.



Item	Specifications
Offset Adjustment Range	-2.4 V to + 2.4 V
Adjustment Unit	18.9 mV/LSB

Note:
-The adjustment value will not be initialized when parameter settings are initialized using Fn005.
-Make offset adjustment with a measuring instrument connected, so that the analog monitor output is zero.
An example of settings for a zero analog monitor output is shown below.

- While the servomotor is not turned ON, set the monitor signal to the torque reference.
- In speed control, set the monitor signal to the position error.

(2) Preparation

The following condition must be met to adjust the offsets of the analog monitor output.
-The write prohibited setting parameter (Fn010) must be set to Write permitted (P.0000).

(3) Operating Procedure

Use the following procedure to perform the offset adjustment of analog monitor output.

1. In the SigmaWin+ Σ-V component main window, click **Setup**, point to **Adjust Offset** and click **Adjust the Analog Monitor Output**.
2. Click the Zero Adjustment tab.
3. While watching the analog monitor, use the **+1** and **-1** buttons to adjust the offset.

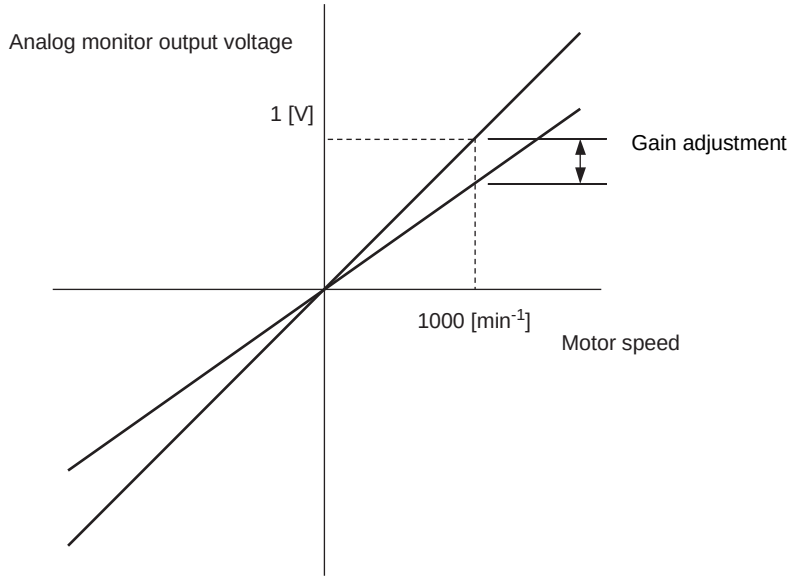
For more information on the usage of the SigmaWin+, refer to AC Servo Drives Engineering Tool Sigma Win+ ONLINE MANUAL Σ-V Component *4.4.3 Offset Adjustment*.

6.9 Gain Adjustment of Analog Monitor Output (Fn00D)

This function is used to manually adjust the gains for the analog monitor outputs (torque reference monitor output and motor rotating speed monitor output). The gain values are factory-set before shipping. Therefore, the user need not usually use this function.

(1) Adjustment Example

An example of gain adjustment to the motor rotating speed monitor is shown below.



Item	Specifications
Gain-adjustment Range	100±50%
Adjustment Unit	0.4%/LSB

The gain adjustment range is made with a 100% output set as a center value (adjustment range: 50% to 150%). The following is a setting example.

<Setting the Set Value to −125>
100% + (−125 × 0.4) = 50%
Therefore, the monitor output voltage is 0.5 time as high.

<Setting the Set Value to 125>
100% + (125 × 0.4) =150%
Therefore, the monitor output voltage is 1.5 times as high.

Note: The adjustment value will not be initialized when parameter settings are initialized using Fn005.

(2) Preparation

The following condition must be met to adjust the gain of the analog monitor output.

- The write prohibited setting parameter (Fn010) must be set to Write permitted (P.0000).

(3) Operating Procedure

Use the following procedure to perform the gain adjustment of analog monitor output.

1. In the SigmaWin+ Σ-V component main window, click **Setup**, point to **Adjust Offset** and click **Adjust the Analog Monitor Output**.
2. Click the **Gain Adjustment tab**.
3. While watching the analog monitor, use the +**1** and **-1** buttons to adjust the gain.

For more information on the usage of the SigmaWin+, refer to AC Servo Drives Engineering Tool Sigma Win+ ONLINE MANUAL Σ-V Component *4.4.3 Offset Adjustment*.

6.10 Automatic Offset-Signal Adjustment of the Motor Current Detection Signal (Fn00E)

Perform this adjustment only if highly accurate adjustment is required for reducing torque ripple caused by current offset. The user need not usually use this function.

- Be sure to perform this function while the servomotor power is OFF.
- Execute the automatic offset adjustment if the torque ripple is too big when compared with those of other DRIVERs.

Note: The adjusted value is not initialized by executing the Fn005 function (Initializing Parameter Settings).

(1) Preparation

The following conditions must be met to automatically adjust the offset of the motor current detection signal.
- The write prohibited setting parameter (Fn010) must be set to Write permitted (P.0000).
- The DRIVER must be in Servo Ready status (Refer to *4.8.4*).
- The servomotor power must be OFF.

(2) Operating Procedure

Use the following procedure.

1. In the SigmaWin+ Σ-V component main window, click **Setup**, point to **Adjust Offset** and click **Adjust the Motor Current Detection Offset**.
2. Click **Continue**, and then click the **Automatic Adjustment tab**.
3. Click **Adjust**. The automatically adjusted values are displayed in the New box.

For more information on the usage of the SigmaWin+, refer to AC Servo Drives Engineering Tool Sigma Win+ ONLINE MANUAL Σ-V Component *4.4.3 Offset Adjustment*.

6.11 Manual Offset-Signal Adjustment of the Motor Current Detection Signal (Fn00F)

Use this function only if the torque ripple is still high after the automatic offset-signal adjustment of the motor current detection signal (Fn00E).

IMPORTANT

If this function is adjusted incorrectly and then executed, characteristics of the servomotor performance could be affected.

Observe the following precautions when performing manual servo tuning.

- Run the servomotor at a speed of approximately 100 min^{-1}.
- Adjust the offset while monitoring the torque reference with the analog monitor until the ripple of torque reference monitor's waveform is minimized.
- Adjust the phase-U and phase-V offset amounts alternately several times until these offsets are well balanced.

Note: The adjusted value is not initialized by executing the Fn005 function (Initializing Parameter Settings).

(1) Preparation

The following condition must be met to manually adjust the offset of the motor current detection signal.
- The write prohibited setting parameter (Fn010) must be set to Write permitted (P.0000).

(2) Operating Procedure

Use the following procedure.

1. Turn the motor at 100 min-1.
2. In the SigmaWin+ Σ-V component main window, click **Setup**, point to **Adjust Offset** and click **Adjust the Motor Current Detection Offset**.
3. Click **Continue**, and then click the **Manual Adjustment** tab.
4. While watching the analog monitor, use the **+1** and **-1** buttons to adjust the offset to minimize the ripple on the torque reference monitor. The U-phase and V-phase currents must be adjusted so that they balance. Repeat the adjustment alternately between them several times.

Repeat the operations of steps 4 to 6 (phase-U and-V alternately) until adjusting the offset amounts both for phase-U and -V in both directions cannot reduce the torque ripple any more.
Then, perform the same operation by adjusting by smaller amount.

For more information on the usage of the SigmaWin+, refer to AC Servo Drives Engineering Tool Sigma Win+ ONLINE MANUAL Σ-V Component *4.4.3 Offset Adjustment.*

6.12 Write Prohibited Setting (Fn010)

This function prevents changing parameters by mistake and sets restrictions on the execution of the utility function.

Parameter changes and execution of the utility function become restricted in the following manner when Write prohibited (P.0001) is assigned to the write prohibited setting parameter (Fn010).
- Parameters: Cannot be changed. If you attempt to change it, "NO-OP" will flash on the display and the screen will return to the main menu.
- Utility Function: Some functions cannot be executed. (Refer to the following table.) If you attempt to exe- cute these utility functions, "NO-OP" will flash on the display and the screen will return to the main menu.

Parameter No.	Function	Write Prohibited Setting	Reference Section
Fn000	Alarm history display	Executable	6.2
Fn002	JOG operation	Cannot be executed	6.3
Fn003	Origin search	Cannot be executed	6.4
Fn004	Program JOG operation	Cannot be executed	6.5
Fn005	Initializing parameter settings	Cannot be executed	6.6
Fn006	Clearing alarm history	Cannot be executed	6.7
Fn008	Absolute encoder multiturn reset and encoder alarm reset	Cannot be executed	4.7.4
Fn00C	Offset adjustment of analog monitor output	Cannot be executed	6.8
Fn00D	Gain adjustment of analog monitor output	Cannot be executed	6.9
Fn00E	Automatic offset-signal adjustment of the motor current detection signal	Cannot be executed	6.10
Fn00F	Manual offset-signal adjustment of the motor current detection signal	Cannot be executed	6.11
Fn010	Write prohibited setting	–	6.12
Fn011	Product Information display	Executable	6.13
Fn013	Multiturn limit value setting change when a multiturn limit dis- agreement alarm occurs	Cannot be executed	4.7.6
Fn014	Resetting configuration error in option modules	Cannot be executed	6.14
Fn01B	Vibration detection level initialization	Cannot be executed	6.15
Fn020	Origin setting	Cannot be executed	6.16
Fn030	Software reset	Executable	6.17
Fn200	Tuning-less levels setting	Cannot be executed	5.2.2
Fn201	Advanced autotuning	Cannot be executed	5.3.2
Fn202	Advanced autotuning by reference	Cannot be executed	5.4.2
Fn203	One-parameter tuning	Cannot be executed	5.5.2
Fn204	Anti-resonance control adjustment function	Cannot be executed	5.6.2
Fn205	Vibration suppression function	Cannot be executed	5.7.2
Fn206	EasyFFT	Cannot be executed	6.18
Fn207	Online vibration monitor	Cannot be executed	6.19

Operating Procedure

Follow the steps to set enable or disable writing. Setting values are as follows:
- "P.0000": Write permitted (Releases write prohibited mode.) [Factory setting]
- "P.0001": Write prohibited (Parameters become write prohibited from the next power ON.)

1. In the SigmaWin+ Σ-V component main window, click **Setup**, and then click **Write Prohibited Setting**.

<If the Write Prohibited Setting is ON>
2. Click the ▼ button to change the value to "0000" and click **Setting**. The write prohibited setting is off.

<If the Write Prohibited Setting is OFF>
2. Click the ▲ button to change the value to "0001" and click Setting. The write prohibited setting is on.

3. Click **OK** and restart the SERVOPACK.

For more information on the usage of the SigmaWin+, refer to AC Servo Drives Engineering Tool Sigma Win+ ONLINE MANUAL Σ-V Component *4.4.5 Write Prohibited Setting*.

6.13 Product Information Display (Fn011)

This function is used to check the servomotor model, voltage, capacity, encoder type, encoder resolution, software version, and ID. If the DRIVER has been custom-made, you can also check the specification codes of DRIVERs.

(1) Preparation

There are no tasks that must be performed before the execution.

(2) Operating Procedure

In the SigmaWin+ Σ-V component main window, click **Monitor** and then click **Product Information**. Information about the DRIVER, the motor, and the option modules will be displayed.

For more information on the usage of the SigmaWin+, refer to AC Servo Drives Engineering Tool Sigma Win+ ONLINE MANUAL Σ-V Component *4.3.1 Product Information.*

6.14 Resetting Configuration Errors in Option Modules (Fn014)

The DRIVER with option module recognizes installation status and types of option modules that are connected to DRIVER. If an error is detected, the DRIVER issues an alarm. This function clears these alarms.

Note 1. Alarms related to option module can be cleared only by this function. These alarms cannot be cleared by alarm reset or turning OFF the main circuit power supply.
2. Before clearing the alarm, perform corrective action for the alarm.

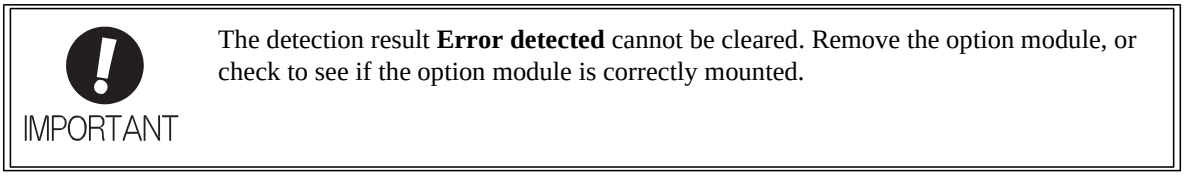
(1) Preparation

The following condition must be met to clear detection alarms of the option module.
-The write prohibited setting parameter (Fn010) must be set to Write permitted (P.0000).

(2) Operating Procedure

Use the following procedure.

1. In the SigmaWin+ Σ-V component main window, click **Setup** and then **Reset Configuration Error of Option Card**.
2. Check to see if the **Clear** check box of the option module whose detection result to be cleared is selected, and then click **Execute**.
3. To enable the change in the setting, turn the power OFF and ON again.



The detection result **Error detected** cannot be cleared. Remove the option module, or check to see if the option module is correctly mounted.

For more information on the usage of the SigmaWin+, refer to AC Servo Drives Engineering Tool Sigma Win+ ONLINE MANUAL Σ-V Component *4.4.9 Resetting the Configuration Error of Option Module*.

6.15 Vibration Detection Level Initialization (Fn01B)

This function detects vibration when servomotor is connected to a machine in operation and automatically adjusts the vibration detection level (Pn312) to output more exactly the vibration alarm (A.520) and the vibration warning (A.911).

The vibration detection function detects vibration elements according to the motor speed.

Parameter		Meaning	When Enabled	Classification
Pn310	n.□□□0 [Factory setting]	Does not detect vibration.	Immediately	Setup
	n.□□□1	Outputs the warning (A.911) when vibration is detected.		
	n.□□□2	Outputs the alarm (A.520) when vibration is detected.		

If the vibration exceeds the detection level calculated by the following formula, the alarm or warning will be output according to the setting of vibration detection switch (Pn310).

$$\text{Detection level} = \frac{\text{Vibration detection level (Pn312 [min}^{-1}\text{])} \times \text{Vibration detection sensitivity (Pn311 [\%])}}{100}$$

Use this function if the vibration alarm (A.520) or the vibration warning (A.911) is not output correctly when a vibration at the factory setting of the vibration detection level (Pn312) is detected. In other cases, it is not necessary to use this function.
The vibration alarm or warning detection sensibility differs depending on the machine conditions. In this case, fine-tune the setting of the vibration detection sensitivity (Pn311) using the above detection level formula as a guide.

Pn311	Vibration Detection Sensitivity		Speed Position Torque		Classification
	Setting Range	Setting Unit	Factory Setting	When Enabled	
	50 to 500	1%	100	Immediately	Tuning

IMPORTANT

- The vibration may not be detected because of improper servo gains. Also, not all kinds of vibrations can be detected. Use the detection result as a guideline.
- Set a proper moment of inertia ratio (Pn103). Improper setting may result in the vibration alarm, warning misdetection, or non-detection.
- The references that are used to operate your system must be input to execute this function.
- Execute this function under the operating condition for which the vibration detection level should be set.
- Execute this function while the motor speed reaches at least 10% of its maximum.

(1) Preparation

The following conditions must be met to initialize the vibration detection level.
- The write prohibited setting parameter (Fn010) must be set to Write permitted (P.0000).
- The test without a motor function must be disabled (Pn00C.0 = 0).

(2) Operating Procedure

Use the following procedure.

1. In the SigmaWin+ Σ-V component main window, click **Setup**, and then click **Initialize Vibration Detection Level**.
2. Select a percentage as the degree of vibration detection sensitivity and the vibration detection switch, and then click **Detection Start**.
3. Click **Execute**. The level at which the vibrations are detected is automatically adjusted, and the setting is displayed in the box on the right and saved in the DRIVER.

For more information on the usage of the SigmaWin+, refer to AC Servo Drives Engineering Tool Sigma Win+ ONLINE MANUAL Σ-V Component *4.4.7 Initializing Vibration Detection Level.*

(3) Related Parameters

The following table lists parameters related to this function and their possibility of being changed while executing this function or of being changed automatically after executing this function.

- Parameters related to this function
  These are parameters that are used or referenced when executing this function.

- Allowed changes during execution of this function
  Yes : Parameters can be changed using SigmaWin+ while this function is being executed.
  No : Parameters cannot be changed using SigmaWin+ while this function is being executed.

- Automatic changes after execution of this function
  Yes : Parameter set values are automatically set or adjusted after execution of this function.
  No : Parameter set values are not automatically set or adjusted after execution of this function.

Parameter	Name	Mid-execution changes	Automatic changes
Pn311	Vibration Detection Sensitivity	Yes	No
Pn312	Vibration Detection Level	No	Yes

6.16 Origin Setting (Fn020)

When using an external absolute encoder for fully-closed loop control, this function is used to set the current position of the external absolute encoder as the origin (zero point position).
(Do not use origin setting in LECY series.)

This function can be used with the following products.
Mitutoyo Corporation ABS ST780A series
Model: ABS ST78□A/ST78□AL

IMPORTANT

• After execution of origin setting, the servo ready (/S-RDY) signal will become inactive because the system position data will have been changed. Always turn the power supply OFF and then ON again after execution of origin setting.

(1) Preparation

The following conditions must be met to set the origin.

- The write prohibited setting parameter (Fn010) must be set to Write permitted (P.0000).
- The servomotor power must be OFF.

(2) Operating Procedure

Use the following procedure.

1. In the SigmaWin+ Σ-V component main window, click **Setup** and then **Zero Point Position Setting**.
2. Click **Execute**.
3. Click **Continue** to execute the zero point position setting.
4. To enable the change in the setting, turn the power OFF and ON again.

For more information on the usage of the SigmaWin+, refer to AC Servo Drives Engineering Tool Sigma Win+ ONLINE MANUAL Σ-V Component *4.4.14 Setting the Zero Point Position.*

6.17 Software Reset (Fn030)

This function enables resetting the DRIVER internally from software. This function is used when reset- ting alarms and changing the settings of parameters that normally require restarting the DRIVER. This function can be used to change those parameters without restarting the DRIVER.

- Start software reset operation after the servomotor power is OFF.
- This function resets the DRIVER independently of host controller. The DRIVER carries out the same processing as when the power supply is turned ON and outputs the ALM signal. The status of other output signals may be forcibly changed.

(1) Preparation

The following condition must be met to perform a software reset.
- The servomotor power must be OFF.

(2) Operating Procedure

Use the following procedure.

1. In the SigmaWin+ Σ-V component main window, click Setup and then click Software Reset.
2. Click Execute. The Software Reset window will appear.
3. Click Execute. When execution of the software reset function is complete, a warning message will appear, asking you to reconnect the SigmaWin+ to the DRIVER.
4. Click OK to close the Software Reset window. All settings including parameters have been re-calculated. Disconnect the SigmaWin+ from the DRIVER, and then reconnect.

For more information on the usage of the SigmaWin+, refer to AC Servo Drives Engineering Tool Sigma Win+ ONLINE MANUAL Σ-V Component *4.4.14 Setting the Zero Point Position.*

6.18 EasyFFT (Fn206)

EasyFFT sends a frequency waveform reference from the DRIVER to the servomotor and slightly rotates the servomotor several times over a certain period, thus causing machine vibration. The DRIVER detects the resonance frequency from the generated vibration and makes notch filter settings according to the resonance frequency detection. The notch filter is effective for the elimination of high-frequency vibration and noise.

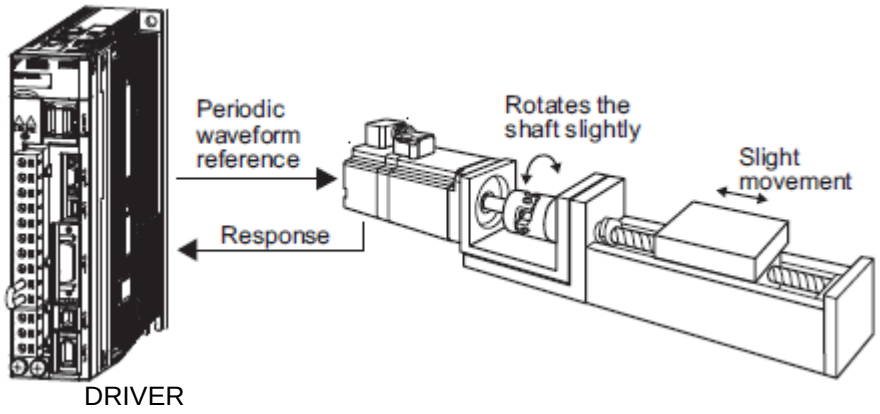
Execute this function after the servomotor power is turned OFF if operation of the DRIVER results in high-frequency noise and vibration.

⚠ WARNING

The servomotor rotates slightly when EasyFFT is executed. Do not touch the servomotor or machine dur- ing execution of EasyFFT, otherwise injury may result.

⚠ CAUTION

Use the EasyFFT when the servo gain is low, such as in the initial stage of servo adjustment. If EasyFFT is executed after increasing the gain, the servo system may vibrate depending on the machine character- istics or gain balance.



In addition to this function, online vibration monitor (Fn207) can be used to detect machine vibration and automatically make notch filter settings.

If a LECYM2−V□ Series is used to make adjustments, it is recommended to use advanced autotuning. EasyFFT is normally no need to use it.

(1) Preparation

The following conditions must be met to perform EasyFFT.

- The write prohibited setting parameter (Fn010) must be set to Write permitted (P.0000).
- The main circuit power supply must be ON.
- All alarms must be cleared.
- The hardwire baseblock (HWBB) must be disabled.
- The servomotor power must be OFF.
- There must be no overtravel.
- The test without a motor function must be disabled (Pn00C.0 = 0).
- An external reference must not be input.

(2) Operating Procedure

Use the following procedure.

1. In the SigmaWin+ Σ-V component main window, click **Setup** and then click **EasyFFT**.
2. Click **OK**, and the EasyFFT box appears.
3. Click **Servo ON**.
4. Select the instruction amplitude and the rotation direction, and click **Start**. The motor begins to rotate, and the measurement of the frequency starts. After the measurements have been taken, the results are displayed in the lower section of the box.
   Note: When making the initial settings for EasyFFT, do not change the setting for the reference amplitude. Start with the original value of 15. Increasing reference amplitude increases the detection accuracy, but the vibration and noise from the machine will increase. Increase the amplitude value little by little.
5. Click **Measurement complete**.
6. Click **Result Writing** to assign the results as parameter settings.
7. To enable the change in the setting, turn the power OFF and ON again.

< Important >
If two seconds or more are required for the operation although detection was successfully completed, the detection accuracy might be insufficient. Increasing reference amplitude more than 15 increases the detection accuracy, but the vibration and noise from the machine will increase. Increase the amplitude value little by little.

For more information on the usage of the SigmaWin+, refer to AC Servo Drives Engineering Tool Sigma Win+ ONLINE MANUAL Σ-V Component *4.4.8 EasyFFT*.

(3) Related Parameters

The following table lists parameters related to this function and their possibility of being changed while executing this function or of being changed automatically after executing this function.

- Parameters related to this function
  These are parameters that are used or referenced when executing this function.

- Allowed changes during execution of this function
  Yes : Parameters can be changed using SigmaWin+ while this function is being executed.
  No : Parameters cannot be changed using SigmaWin+ while this function is being executed.

- Automatic changes after execution of this function
  Yes : Parameter set values are automatically set or adjusted after execution of this function.
  No : Parameter set values are not automatically set or adjusted after execution of this function.

Parameter	Name	Mid-execution changes	Automatic changes
Pn408	Torque Related Function Switch	Yes	Yes
Pn409	1st Notch Filter Frequency	No	Yes
Pn40A	1st Notch Filter Q Value	No	No
Pn40C	2nd Notch Filter Frequency	No	Yes
Pn40D	2nd Notch Filter Q Value	No	No
Pn456	Sweep Torque Reference Amplitude	No	No

6.19 Online Vibration Monitor (Fn207)

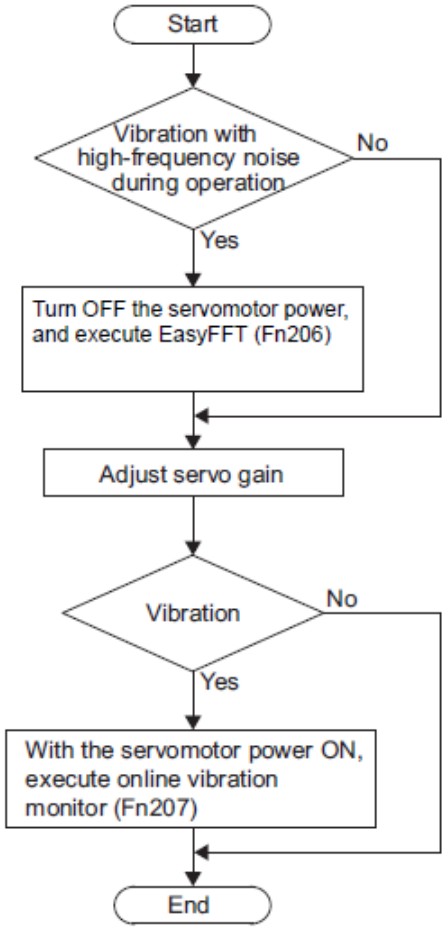
If vibration is generated during operation and this function is executed while the servomotor power is still ON, the machine vibration can sometimes be suppressed by setting a notch filter or torque reference filter for the vibration frequencies.

When online, vibration frequency caused by machine resonance will be detected and the frequency that has the highest peak will be displayed on the panel operator. The effective torque reference filter or notch filter frequency for the vibration frequencies will be automatically selected and the related parameters will be automatically set.

In addition to this function, EasyFFT (Fn206) can be used to detect machine vibration and automatically make notch filter settings. Use the following flowchart to determine how these functions should be used.

If a LECYM2−V□ Series DRIVER is used to make adjustments, it is recommended that you use advanced autotuning. This function is normally no need to use it.

How to use EasyFFT (Fn206) and online vibration monitor (Fn207), when they are mainly used for servo gain adjustment.



(1) Preparation

The following conditions must be met to perform online vibration monitoring.
- The write prohibited setting parameter (Fn010) must be set to Write permitted (P.0000).
- The servomotor power must be ON.
- There must be no overtravel.
- The correct moment of inertia (Pn103) must be set.
- The test without a motor function must be disabled (Pn00C.0 = 0).

(2) Operating Procedure

Use the following procedure.

1. In the SigmaWin+ Σ-V component main window, click **Monitor**, and then click **Online Vibration Monitor**.
2. Click **OK**, and the Online Vibration Monitor box appears.
3. Click **Execute** to activate the vibration sensor. The peak frequencies of the vibrations are displayed.
4. Click **Auto Setting**. In the "Previous" column, the current settings are displayed.
5. Click **Write result**. The adjusted values for detected frequencies are displayed in the "Current" column, and the values are stored in the SERVOPACK.

For more information on the usage of the SigmaWin+, refer to AC Servo Drives Engineering Tool Sigma Win+ ONLINE MANUAL Σ-V Component *4.3.4 Online Vibration Monitor*.

(3) Related Parameters

The following table lists parameters related to this function and their possibility of being changed while executing this function or of being changed automatically after executing this function.

- Parameters related to this function
  These are parameters that are used or referenced when executing this function.

- Allowed changes during execution of this function
  Yes : Parameters can be changed using SigmaWin+ while this function is being executed.
  No : Parameters cannot be changed using SigmaWin+ while this function is being executed.

- Automatic changes after execution of this function
  Yes : Parameter set values are automatically set or adjusted after execution of this function.
  No : Parameter set values are not automatically set or adjusted after execution of this function.

Parameter	Name	Mid-execution changes	Automatic changes
Pn401	Torque Reference Filter Time Constant	No	Yes
Pn408	Torque Related Function Switch	Yes	Yes
Pn409	1st Notch Filter Frequency	No	Yes
Pn40A	1st Notch Filter Q Value	No	No
Pn40C	2nd Notch Filter Frequency	No	No
Pn40D	2nd Notch Filter Q Value	No	No

7. Monitor Displays....2
7.1 Monitor Displays....2
7.1.1 System Monitor....2
7.1.2 Status Monitor....2
7.1.3 Motion Monitor....2
7.1.4 Input Signal Monitor....2
7.1.5 Output Signal Monitor....3

7. Monitor Displays

7.1 Monitor Displays

The monitor displays can be used for monitoring the I/O signal status, and DRIVER internal status.
There are five types of monitor windows: System Monitor, Status Monitor, Motion Monitor, Input Signal Monitor, and the Output Signal Monitor.
The monitor windows are independent of each other, but several windows can be displayed at the same time.
Select the items to be monitored in the Monitor Item Setting Window (For System Monitor, the items to be monitored are fixed and cannot be selected.)

The monitor display can be checked or viewed in the SigmaWin+. For more information on the usage of the SigmaWin+, refer to AC Servo Drives Engineering Tool Sigma Win+ ONLINE MANUAL Σ-V Component *4.3.2 Monitor*.

7.1.1 System Monitor

The System Monitor window will automatically open when the SigmaWin+ starts. Or, in the SigmaWin+ Σ-Vcomponent window, click **Monitor**, point to **Monitor**, and then click **System Monitor**.
The display is as follows.

- DRIVER current status
  Same as the status displayed on the panel operator on the front of DRIVER.
- DRIVER signal current status
  Same as the signal status displayed in bit data on the panel operator on the front of DRIVER.
- Starts the main functions directly from the System Monitor window.

7.1.2 Status Monitor

The status monitor function monitors the DRIVER status.
To monitor the status of the DRIVER, use the following procedure.

1. In the SigmaWin+ Σ-V component main window, click Monitor, point to Monitor and click Status Monitor. The items which can be monitored are listed.
2. Select the items to be monitored. The current status of a selected item is displayed in "Value" column.

7.1.3 Motion Monitor

The motion monitor function monitors the DRIVER motion.
To monitor the motions of the DRIVER.

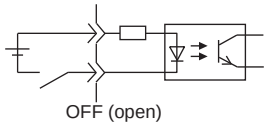
1. In the SigmaWin+ Σ-V component main window, click **Monitor**, point to **Monitor** and click **Motion Monitor**. The items which can be monitored are listed.
2. Select the items to be monitored. The current status of a selected item is displayed in the "Value" column.

7.1.4 Input Signal Monitor

The input signal monitor function monitors the DRIVER input signals.
To monitor the input signals of the DRIVER.

1. In the SigmaWin+ Σ-V component main window, click **Monitor**, point to **Monitor** and click **Input Signal Monitor.** The items which can be monitored are listed.
2. Select the items to be monitored. The current status of a selected item is displayed in the "Value" column.

Note: Input signals use the following circuit configuration.
OFF: Open
ON: Short-circuited
Example

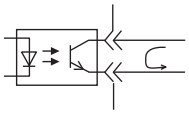


7.1.5 Output Signal Monitor

The output signal monitor function monitors the DRIVER output signals.
To monitor the output signals of the DRIVER, use the following procedure.

1. In the SigmaWin+ Σ-V component main window, click **Monitor**, point to **Monitor** and click **Output Signal Monitor**. The items which can be monitored are listed.
2. Select the items to be monitored. The current status of a selected item is displayed in the "Value" column.

Note: Input signals use the following circuit configuration.
OFF: Transistor OFF
ON: Transistor ON
Example



ON: Transistor ON

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8. MECHATROLINK-II Commands

8.1 MECHATROLINK-II Communications

8.1.1 Layers

The MECHATROLINK-II communications layers have functions equivalent to layers 1, 2, and 7 in the OSI (Open System Interconnection) reference model.

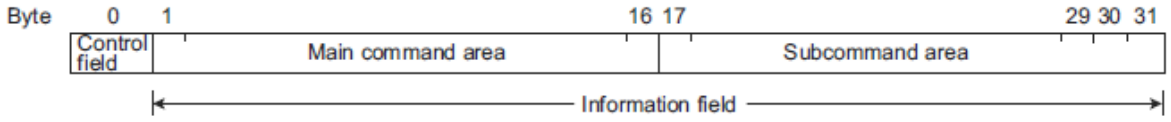
OSI Reference Model and MECHATROLINK-II Model

OSI	MECHATROLINK-II
Layer 7: Application layer	MECHATROLINK-II application layer
Layers 3 to 6	None
Layer 2: Data link layer	MECHATROLINK-II data link layer
Layer 1: Physical layer	MECHATROLINK-II physical layer

This manual describes commands for the application layer.

8.1.2 Frame Structure

A MECHATROLINK-II command is composed of a main command and a subcommand as shown below. It can also be used only with a main command.



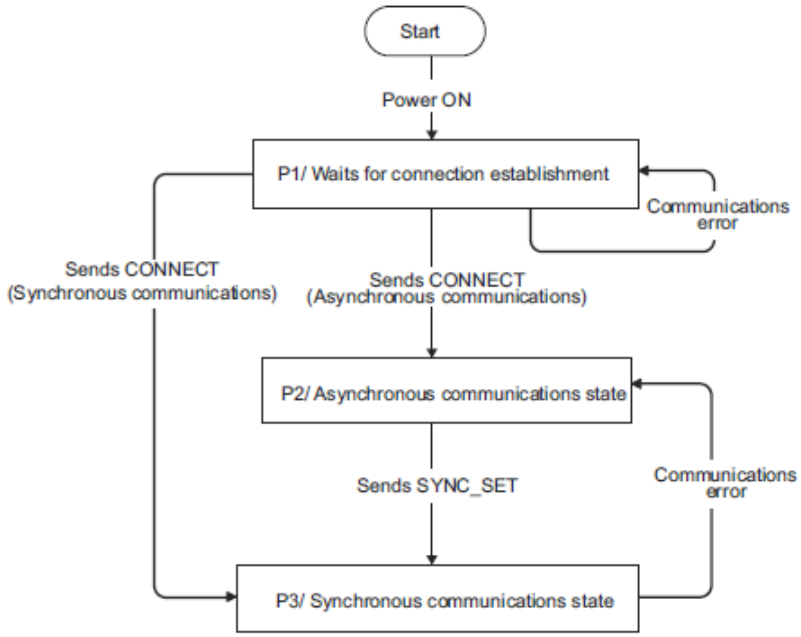
Classification	Byte	Command	Response
Control Field	0	03H (Fixed)	01H (Fixed)
Information Field	1 to 16	Used by main command.	
	17 to 31	Used by subcommands. The subcommands for servo drives use only 17th to 29th byte. Therefore, only 17th to 29th byte are described in this manual. Note: In some main commands, subcommand cannot be used.	

The application layer interfaces with only the information field.

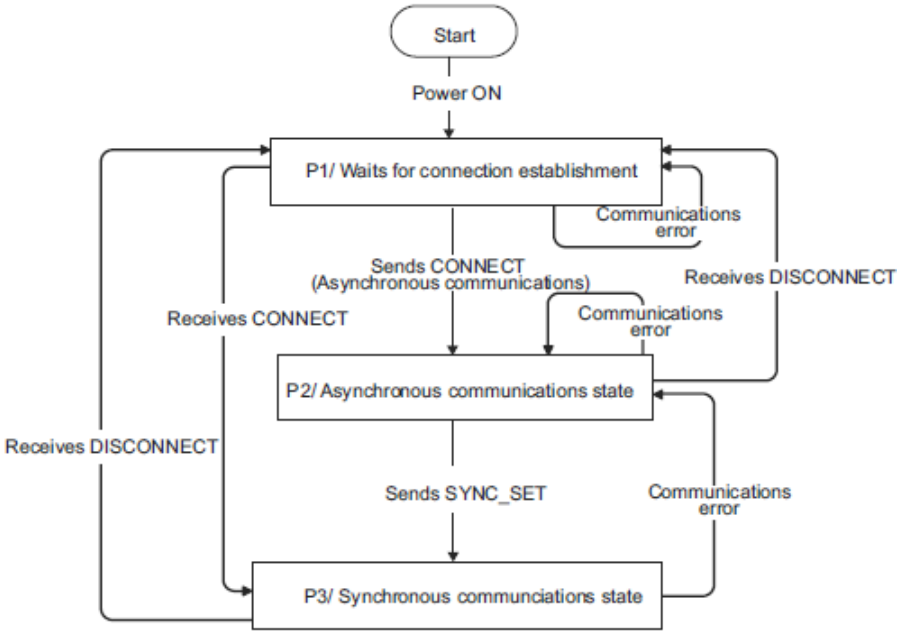
8.1.3 State Transition Diagram

The primary (master) and secondary (slave) station state transitions are shown in the following diagrams.

Primary Station (Master Station) State Transition



Secondary Station (Slave Station) State Transition



Phase	Abbreviation	Description
1	P1	Waiting for establishment of connection.
2	P2	Asynchronous communications enabled. Only asynchronous commands can be used.
3	P3	Synchronous communications enabled. Both synchronous and asynchronous commands can be used.

8.1.4 Terminology

(1) Transmission Cycle and Communications Cycle

- Transmission Cycle:

The transmission cycle is the cycle in the MAC (Media Access Control) layer. It is the communications cycle for physically sending data to the transmission path.

The transmission cycle is unaffected by the services provided by the application layer.

- Communications Cycle:

The communications cycle is the cycle for application layer. The communications cycle is set to an integral multiple of the transmission cycle.

(2) Synchronization Classification

MECHATROLINK-II commands include both synchronous and asynchronous commands.

- Synchronous Commands (Classification S):

For commands of this type, commands are sent and response are received every communications cycle.
A response to a command that has been sent to a slave station is received at the next communications cycle.
The WDT (Watchdog Timer) in the frames are refreshed and checked every communications cycle.
Synchronous commands can be used only during synchronous communications (Phase 3).

- Asynchronous Commands (Classification A):

For commands of this type, commands are sent asynchronously to the communications cycle.

Subsequent commands can be sent after confirming the completion of processing of the slave station that received the command.

The WDT (Watchdog Timer) in the frames are not checked.

8.2 MECHATROLINK-II Command List

8.2.1 Main Commands (In command code order)

The MECHATROLINK-II main commands used for LECYM2-V□ series servo drives are listed below.

Command Code	Command	Function	Reference
00H	NOP	Nothing is performed.	8.11.1
01H	PRM_RD	Reads the specified parameter.	8.11.13
02H	PRM_WR	Saves the specified parameter.	8.11.6
03H	ID_RD	Reads the device ID.	8.11.5
04H	CONFIG	Enables the current parameter settings.	8.11.8
05H	ALM_RD	Reads the current alarm or warning status, and the alarm history.	8.11.15
06H	ALM_CLR	Clears the current alarm or warning status, and the alarm history.	8.11.16
0DH	SYNC_SET	Starts synchronous communications.	8.11.4
0EH	CONNECT	Requests to establish a MECHATROLINK connection.	8.11.3
0FH	DISCONNECT	Requests to releases connection.	8.11.2
1CH	PPRM_WR	Saves the parameters in non-volatile memory.	8.11.7
20H	POS_SET	Sets the coordinates.	8.11.17
21H	BRK_ON	Turns the lock signal off and applies the holding lock.	8.11.19
22H	BRK_OFF	Turns the lock signal on and release the holding lock.	8.11.19
23H	SENS_ON	Turns the encoder power supply on, and gets the position data.	8.11.9
24H	SENS_OFF	Turns the encoder power supply off.	8.11.11
25H	HOLD	From current motion status, performs a deceleration stop and positioning according to the deceleration value set in the parameter.	8.13.1
28H	LTMOD_ON	Enables the position data latch by the external signal input.	8.13.2
29H	LTMOD_OFF	Disables the position data latch by the external signal input.	8.13.3
30H	SMON	Monitors the DRIVER status.	8.11.14
31H	SV_ON	Turns the servo of the motor on.	8.11.10
32H	SV_OFF	Turns the servo of the motor off.	8.11.12
34H	INTERPOLATE	Starts interpolation feeding.	8.13.4
35H	POSING	Starts positioning to the target position (TPOS) at the target speed (TSPD).	8.13.5
36H	FEED	Starts constant speed feeding at the target speed (TSPD)	8.13.6
38H	LATCH	Performs interpolation feeding and latches the position using the specified latch signal.	8.13.7
39H	EX_POSING	Moves toward the target position (TPOS) at the target speed (TSPD). When a latch signal is input midway, positioning is performed according to the final travel distance for external position specified in the parameter from the latch signal input position.	8.13.8
3AH	ZRET	Performs a homing.	8.13.9
3CH	VELCTRL	Controls speed.	8.13.10
3DH	TRQCTRL	Controls torque (force).	8.13.11
3EH	ADJ	Used to monitor and adjust data for maintenance.	8.11.18
3FH	SVCTRL	Performs general-purpose servo control. This command is compatible with MECHATROLINK version 1.0 and earlier.	8.13.12

8.2.2 Subcommands (In command code order)

The MECHATROLINK-II subcommands used for LECYM2−V□ series servo drives are listed below.

Command Code	Command	Function	Reference
00H	NOP	Same function as of the main command NOP	6.2.1
01H	PRM_RD	Same function as of the main command PRM_RD	6.2.2
02H	PRM_WR	Same function as of the main command PRM_WR	6.2.3
05H	ALM_RD	Same function as of the main command ALM_RD	6.2.4
1CH	PPRM_WR	Same function as of the main command PPRM_WR	6.2.5
28H	LTMOD_ON	Same function as of the main command LTMOD_ON	6.2.6
29H	LTMOD_OFF	Same function as of the main command LTMOD_OFF	6.2.7
30H	SMON	Same function as of the main command SMON	6.2.8

8.2.3 Combination of MECHATROLINK-II Main Commands and Subcommands

Subcommands can be used by combining as listed below.

CODE	Main Command	Subcommand							
		NOP	PRM_RD	PRM_WR	ALM_RD	PPRM_ WR	LTMOD_ ON	LTMOD_ OFF	SMON
00	NOP	√	√	√	√	√	√	√	√
01	PRM_RD	√	×	×	×	×	×	×	√
02	PRM_WR	√	×	×	×	×	×	×	√
03	ID_RD	√	√	√	√	√	√	√	√
04	CONFIG	√	×	×	×	×	×	×	√
05	ALM_RD	√	×	×	×	×	×	×	√
06	ALM_CLR	√	×	×	×	×	×	×	√
0D	SYNC_SET	√	×	×	×	×	×	×	√
0E	CONNECT	√	×	×	×	×	×	×	×
0F	DISCONNECT	√	×	×	×	×	×	×	×
1C	PPRM_WR	√	×	×	×	×	×	×	√
20	POS_SET	√	×	×	×	×	×	×	√
21	BRK_ON	√	×	×	×	×	×	×	√
22	BRK_OFF	√	×	×	×	×	×	×	√
23	SENS_ON	√	×	×	×	×	×	×	√
24	SENS_OFF	√	×	×	×	×	×	×	√
25	HOLD	√	√	√	√	√	√	√	√
28	LTMOD_ON	√	×	×	×	×	×	×	√
29	LTMOD_OFF	√	×	×	×	×	×	×	√
30	SMON	√	√	√	√	√	√	√	√
31	SV_ON	√	√	√	√	√	√	√	√
32	SV_OFF	√	√	√	√	√	√	√	√
34	INTERPOLATE	√	√	√	√	√	√	√	√
35	POSING	√	√	√	√	√	√	√	√
36	FEED	√	√	√	√	√	√	√	√
38	LATCH	√	√	√	√	√	×	×	√
39	EX_POSING	√	√	√	√	√	×	×	√
3A	ZRET	√	√	√	√	√	×	×	√
3C	VELCTRL	√	√	√	√	√	√	√	√
3D	TRQCTRL	√	√	√	√	√	√	√	√
3E	ADJ	√	×	×	×	×	×	×	√
3F	SVCTRL	√	√	√	√	√	×	×	√

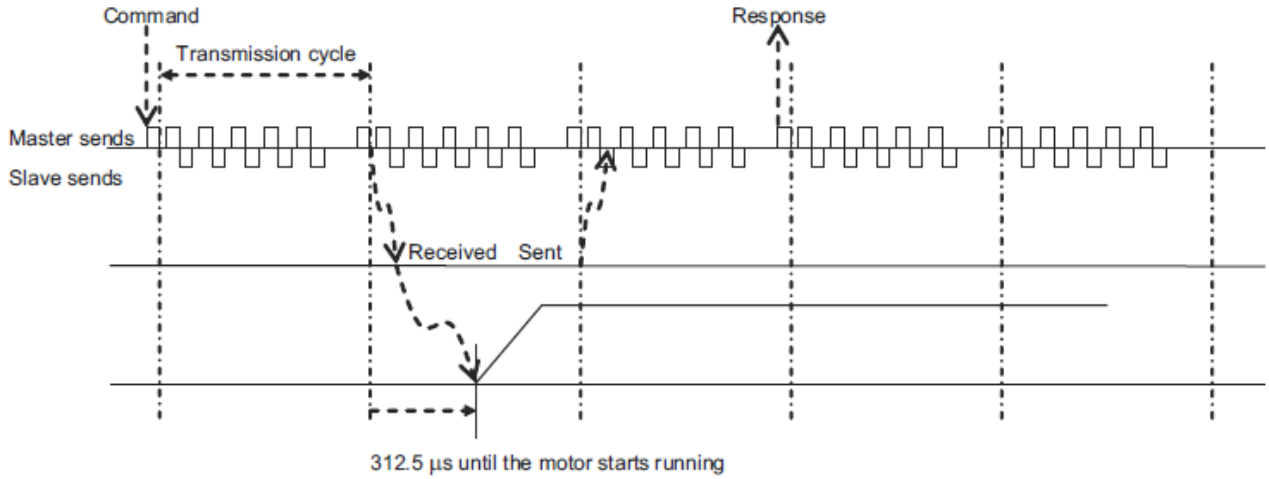
Note: √: Can be combined, ×: Cannot be combined

8.3 Command and Response Timing

This section describes command execution timing at a slave station and monitored data input timing at the master station. These timings are constant, regardless of the transmission cycle and communications cycle.

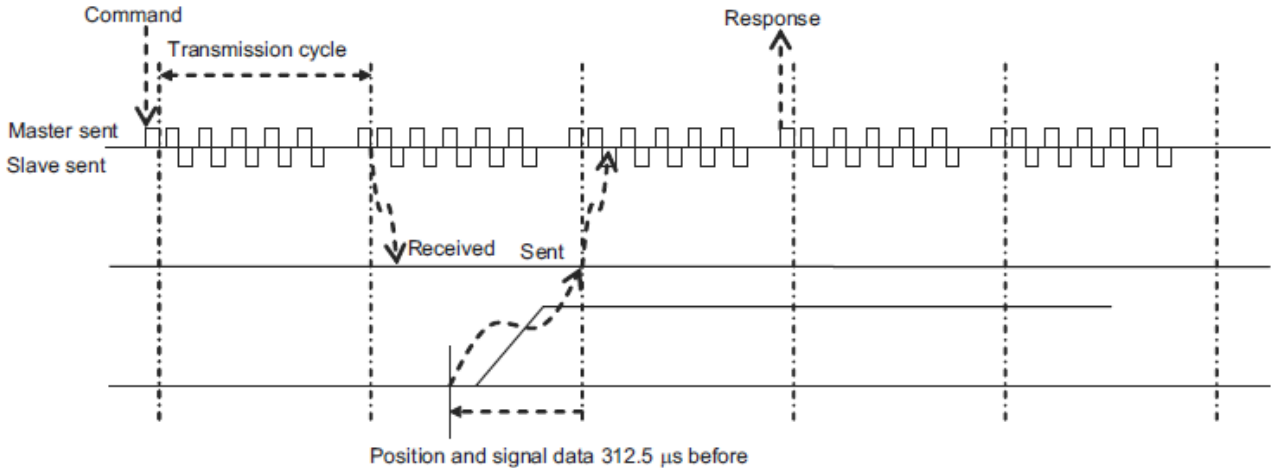
8.3.1 Command Data Execution Timing

Motion commands (such as POSING and INTERPOLATE) and the OPTION in the command data field are executed 312.5 µs after they are received.



8.3.2 Monitored Data Input Timing

The monitor, I/O, and status data are the data of 312.5 µs before the response is sent.



8.4 Data Order

Data in MECHATROLINK-II commands and responses is stored in little endian byte order.
For example, 4-byte data “0x1234ABCD” in hexadecimal is stored from the least significant byte as shown below.

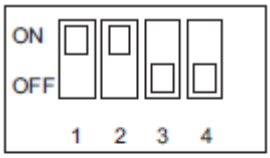
Byte	Data
1	CD
2	AB
3	34
4	12

8.5 Preparing for Operation

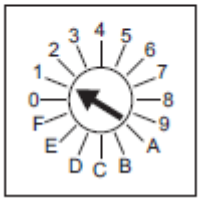
This section describes how to set communications specifications before starting communications, and how to confirm the communications status.

8.5.1 Communications Setting

The SW2 DIP switch is used to make the settings for MECHATROLINK-II communications. The station address is set using the rotary switch (SW1) and the DIP switch (SW2).



SW2 (factory settings)



SW1 (factory setting)

(1) Settings for the SW2 DIP Switch

The following table shows the settings of the DIP switch (SW2).

SW2	Function	Setting	Description	Factory setting
Pin 1	Sets the baud rate.	OFF	4 Mbps (MECHATROLINK-I)	ON
		ON	10 Mbps (MECHATROLINK-II)	
Pin 2	Sets the number of transmission bytes.	OFF	17 bytes	ON
		ON	32 bytes	
Pin 3	Sets the station address.	OFF	Station address = 40H + SW1	OFF
		ON	Station address = 50H + SW1	
Pin 4	Reserved. (Do not change.)	OFF	–	OFF

IMPORTANT

When connecting to a MECHATROLINK-I network, turn OFF pins 1 and 2.
When using a MECHATROLINK-I network (Baud rate: 4 Mbps), the settings for the number of transmission bytes is disabled and the number of transmission bytes is always 17.

(2) Setting the Station Address

The following table lists the possible settings of the rotary switch (SW1) and the DIP switch (SW2) that can be combined to form a station address.

The factory setting for the station address is 41H (SW2 = OFF, SW1 = 1).

Bit 3 of SW2	SW1	Station Address
OFF	0	Disabled
OFF	1	41H
OFF	2	42H
OFF	3	43H
OFF	4	44H
OFF	5	45H
OFF	6	46H
OFF	7	47H
OFF	8	48H
OFF	9	49H
OFF	A	4AH
OFF	B	4BH
OFF	C	4CH
OFF	D	4DH
OFF	E	4EH
OFF	F	4FH

Bit 3 of SW2	SW1	Station Address
ON	0	50H
ON	1	51H
ON	2	52H
ON	3	53H
ON	4	54H
ON	5	55H
ON	6	56H
ON	7	57H
ON	8	58H
ON	9	59H
ON	A	5AH
ON	B	5BH
ON	C	5CH
ON	D	5DH
ON	E	5EH
ON	F	5FH

IMPORTANT

Turn the power OFF and then ON again to validate the new settings.

8.5.2 Checking the Communications Status

Turn ON the control and main circuit power supplies and use the following procedure to confirm that the DRIVER is ready for communications.

(1) Operation Procedure

Procedure	Operation
1	Confirm that the wiring is correctly made.
2	Turn ON the DRIVER control and main circuit power supplies. When the control power is being normally supplied to the DRIVER, POWER LED on the DRIVER is lit. When the main circuit power supply is ON, CHARGE is lit.
3	Turn ON the PC or PLC...etc power supply and start MECHATROLINK communications.
4	Check the communications status. When communications in the data link layer have started, COM LED on the DRIVER is lit. Note: If COM LED is not lit, check the communications settings of SW1, SW2, and the PC or PLC...etc, and then turn the power supplies OFF and ON again. When the MECHATROLINK-II connection in the application layer is established, the 7-segment LED indicates the completion of CONNECT execution as shown below. When lit: CONNECT execution completed When unlit: CONNECT execution not completed

8.6 Operation Sequence for Managing Parameters Using a PC or PLC...etc

When the parameters are managed by a PC or PLC...etc, the parameters are automatically transmitted from the PC or PLC...etc to the DRIVER when the power is turned ON. Therefore, the settings of DRIVER do not need to be changed when the DRIVER is replaced.

Procedure	Operation	Command to Send
1	Turn on the control and main circuit power supplies.	NOP
2	Reset the previous communications status.	DISCONNECT*
3	Establish communications connection and starts WDT count.	CONNECT
4	Check information such as device ID.	ID_RD
5	Get device setting data such as parameters.	PRM_RD, ADJ
6	Set the parameters required for device.	PRM_WR
7	Enable the parameter settings (Setup).	CONFIG
8	Turn the encoder power supply to the position data.	SENS_ON
9	Turn the servo on.	SV_ON
10	Start operation.	–
11	Turn the servo off.	SV_OFF
12	Disconnect the communications connection.	DISCONNECT
13	Turn the control and main circuit power supplies.	–

∗If the connection cannot be released normally, send DISCONNECT command for 2 or more communications cycles, and then send CONNECT command.

8.7 Operation Sequence for Managing Parameters Using a DRIVER

To manage the parameters by using DRIVER's non-volatile memory, save the parameters in the non-volatile memory at setup and use an ordinary operation sequence.

8.7.1 Setup Sequence

Procedure	Operation	Command to Send
1	Turn on the control and main circuit power supply.	NOP
2	Reset the previous communications status.	DISCONNECT*
3	Establish communications connection and start WDT count.	CONNECT
4	Check information such as device ID.	ID_RD
5	Get device setting data such as parameters.	PRM_RD, ADJ
6	Save the parameters required for device in the non-volatile memory.	PPRM_WR Note: Do not use PRM_WR.
7	Disconnect the communications connection.	DISCONNECT
8	Turn off the control and main circuit power supplies.	–

∗If the connection cannot be released normally, send a DISCONNECT command for 2 or more communications cycles, and then send a CONNECT command.

8.7.2 Ordinary Operation Sequence

Procedure	Operation	Command to Send
1	Turn on the control and main circuit power supplies.	NOP
2	Reset the previous communications status.	DISCONNECT*
3	Establish communications connection and start WDT count.	CONNECT
4	Check information such as device ID.	ID_RD
5	Get device setting data such as parameters.	PRM_RD, ADJ
6	Turn on the encoder power supply to get the position data.	SENS_ON
7	Turn the servo on.	SV_ON
8	Start operation.	POSING, INTERPOLATE, etc.
9	Turn the servo off.	SV_OFF
10	Disconnect the communications connection.	DISCONNECT
11	Turn off the control and main circuit power supplies.	–

∗If the connection cannot be released normally, send a DISCONNECT command for 2 or more communications cycles, and then send a CONNECT command.

8.8 Specific Operation Sequences

This section describes operations that use commands in specific sequences.

8.8.1 Operation Sequence When Turning the Servo ON

Motor control using a PC or PLC...etc is performed using motion commands only during Servo ON (motor power ON).

While the DRIVER is in Servo OFF status (while current to the motor is interrupted), the DRIVER manages position data so that the reference coordinate system (POS, MPOS) and the feedback coordinate sys- tem (APOS) are equal. For correct execution of motion commands, therefore, it is necessary to use the SMON (Status Monitoring) command after the DRIVER status changes to Servo ON, to read the servo reference coordinates (POS) and send an appropriate reference position.
Confirm the following bit status before sending the SV_ON command: STATUS field: PON = 1 and ALM = 0
IO Monitor field: HBB = 0

8.8.2 Operation Sequence When OT (Overtravel Limit Switch) Signal Is Input

When an OT signal is input, the DRIVER prohibits the motor from rotating in the way specified in the parameter Pn001. The motor continues to be controlled by the DRIVER while its rotation is prohibited.

When an OT signal is input, use the following procedure to process the OT signal.

Procedure	Operation
1	Monitor OT signals (P_OT and N_OT of IO Monitor field). When an OT signal is input, send an appropriate stop command: While an interpolation command (INTERPOLATE, LATCH) is being executed: Leave the interpolation command as it is and stop updating the interpolation position. Or, send a HOLD command and SMON command. While a move command (such as POSING) other than interpolation commands is being executed: Send a HOLD command.
2	Check the output completion flag DEN. If DEN = 1, the DRIVER completed the OT processing. At the same time, check the flag PSET. If PSET = 1, the motor is completely stopped. Keep the command used in procedure 1 active until both of the above flags are set to 1.
3	Read out the current reference position (POS) and use it as the start position for retraction processing.
4	Use a move command such as POSING or INTERPOLATE for retraction processing. Continue to use this command until the retraction is finished. If the move command ends without finishing the retraction, restart the move command continuously from the last target position.

Note: When an OT signal is input during execution of motion command ZRET or EX_POSING, the execution of the command will be cancelled. For retraction, always send a stop command described in procedure 1 first, and then send a retraction command (move command).
In case of OT ON (P-OT or N-OT of IO_MON field = 1) or Software-Limit ON (P_SOT or N_SOT of STATUS field = 1), the motor may not reach the target position that the PC or PLC...etc specified. Make sure that the axis has stopped at a safe position by confirming the feedback position (APOS).

The PC or PLC...etc may not be able to monitor a brief change in the P-OT or N-OT signal to P-OT=1 or N-OT=1. Proper selection, installation and wiring in the limit switch is required to avoid chattering and malfunctions in the OT signal.

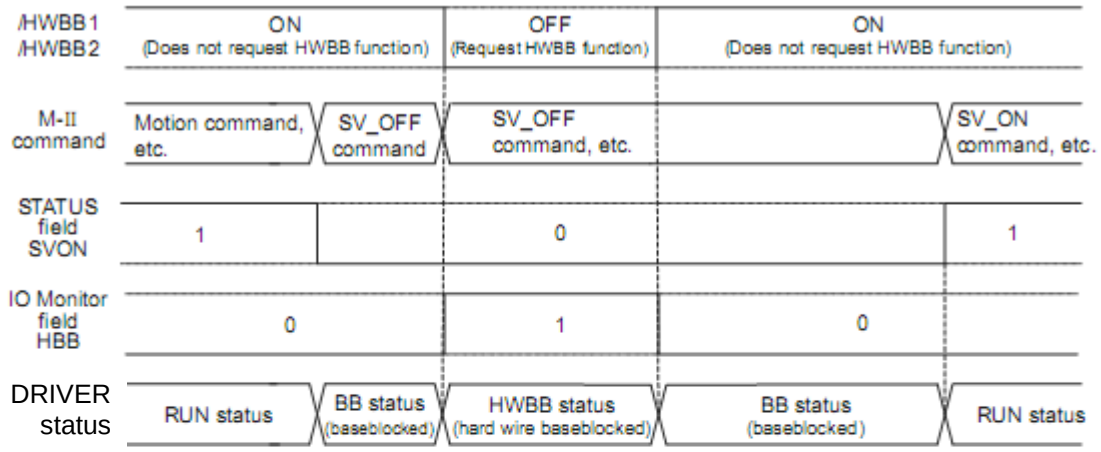
8.8.3 Operation Sequence at Emergency Stop (Main Circuit OFF)

After confirming that SV_ON or PON bit in the response data STATUS field is OFF (= 0), send an SV_OFF command. During emergency stop, always monitor the DRIVER status using a command such as the SMON (Status Monitoring) command.

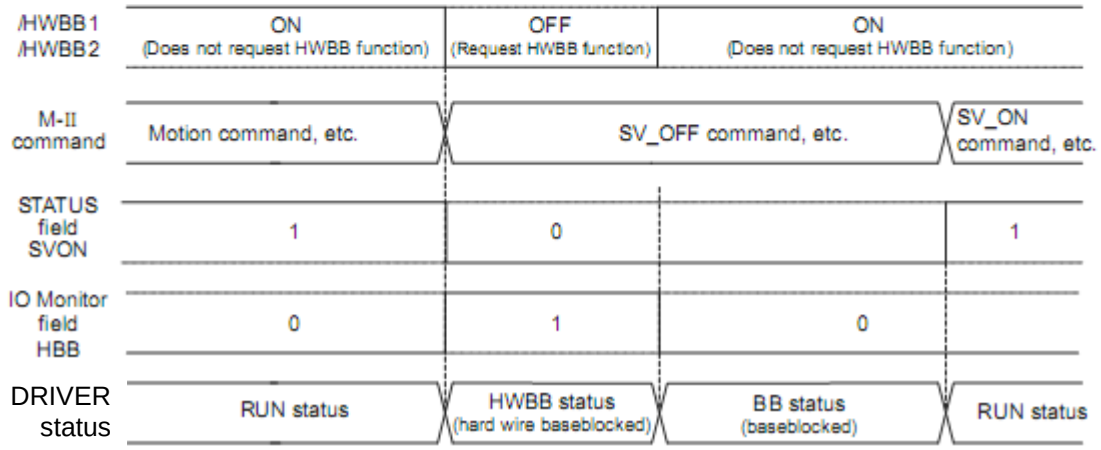
8.8.4 Operation Sequence When a Safety Signal is Input

When an HWBB1 or HWBB2 signal is input while the motor is being operated, current to the motor will be forcibly stopped, and the motor will be stopped according to the setting of the 1st digit of parameter Pn001.

[When an HWBB signal is input after the DRIVER stops powering the motor]



[When an HWBB signal is input while the DRIVER is powering the motor]



- When an HWBB Signal is Input

Monitor the HWBB input signal and SCM output signal status, or HBB signal status in IO Monitor field. If a forced stop status is detected, send a command such as SV_OFF to stop the motor.

- Restoration from Stop Status

Reset the HWBB1 or HWBB2 signal, and then send a command other than SV_ON, such as SV_OFF. Then, restore the PC or PLC...etc and system. When the PC or PLC...etc and system are restored, turn the servo ON using the operation sequence to turn the servo ON.

Note 1. If the DRIVER enters HWBB status while sending an SV_ON command, reset the /HWBB1 or /HWBB2 signal and then send a command other than SV_ON, such as SV_OFF. Then, send the SV_ON command again to restore the normal operation status.

2. If the DRIVER enters HWBB status during execution of an SV_OFF, INTERPOLATE, LATCH, POSING, FEED, EX_POSING, or ZRET command, a command warning will occur since the DRIVER status changes to Servo OFF status. Execute the Clear Alarm or Warning (ALM_CLR) command to restore normal operation.

8.8.5 Operation Sequence at Occurrence of Alarm

When the ALM bit in STATUS field of response turns on (= 1), send SV_OFF command. Use ALM_RD command to check the alarm occurrence status.
To clear the alarm status, send ALM_CLR command after removing the cause of alarm. However, the alarms that require turning the power supply off and then on again to clear the alarm status, sending ALM_CLR command will not clear the alarm status.
If a communications alarm A.E5□or A.E6□ occurs, send ALM_CLR command to reset the alarm and then send SYNC_SET command.

8.8.6 When Motion Command Is Interrupted and Servomotor Is in Position

During execution of a Motion command, any one of the following statuses on the DRIVER will cause interruption of the motion command and an in-position status of PSET=1.

- Alarm occurrence (ALM of STATUS field =1) causes Servo-Off (SVON of STATUS field =0).
- Main power supply OFF (PON of STATUS field =0) causes Servo-Off (SVON of STATUS field =0).
- OT ON (P-OT or N-OT of IO_MON field = 1) or Software-Limit ON (P_SOT or N_SOT of STATUS field= 1) causes dathe motor to stop.

Even when PSET is 1 in these cases, the motor may not reach the target position that the PC or PLC...etc specified. Obtain the feedback position (APOS) to make sure that the axis has stopped at a safe position.

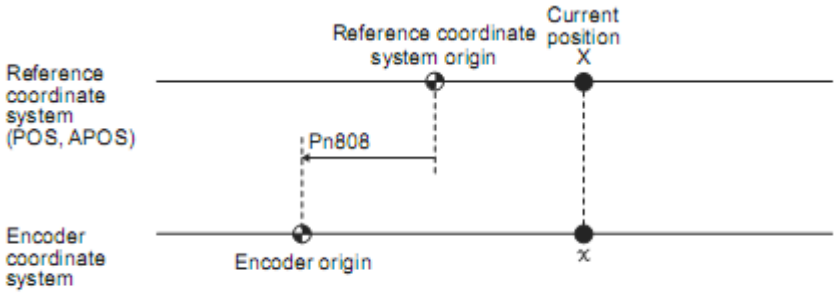
The PC or PLC...etc may not be able to monitor a brief change in the P-OT or N-OT signal to P-OT=1 or N-OT=1. Proper selection, installation and wiring in the limit switch is required to avoid chattering and malfunctions in the OT signal.

8.9 Setting the Origin Before Starting Operation

8.9.1 When Using an Absolute Encoder

When an absolute encoder is used in the slave station, SENS_ON command can be used to set the reference coordinate system of the slave station. The reference coordinate system will be set according to the position detected by the absolute encoder and the coordinate system offset of the encoder (i.e., the offset between the encoder's coordinate system and the reference coordinate system (device built-in parameter).
The relationship between the reference coordinate system (POS and APOS), the encoder's coordinate system, and the coordinate system offset of the encoder are shown in the following figure.

POS: Reference position
APOS: Feedback position



X= x+Pn808
Pn808: Absolure Encoder Origin Offset

8.10 Commands List for Preparation Process

Operation	Command to Send	Description
Confirmation of completion of DRIVER initialization	NOP, DISCONNECT	Checks if the DRIVER has been initialized to be ready for communications or not.
Establishment of MECHA-TROLINK-II connection	CONNECT	Establishes communications connection and starts WDT count.
Synchronous communications start	SYNC_SET	Starts synchronous communications.
Device ID check	ID_RD	Checks information such as device ID.
Parameter setting	PRM_WR	Sets the parameters required for device. (When parameters are managed by a PC or PLC...etc)
Parameter setting and saving	PPRM_WR	Sets the parameters required for device and saves them in the non-volatile memory. (When parameters are managed by DRIVER.)
Validation of parameter settings (Setup)	CONFIG	Enables the set parameters.
Encoder power supply ON	SENS_ON	Turns on the encoder power supply to get position data.
Servo ON	SV_ON	Turns the servo on.
Encoder power supply OFF	SENS_OFF	Turns off the encoder power supply off.
Servo OFF	SV_OFF	Turns the servo off.
Parameter read-out	PRM_RD	Reads active parameters. (When parameters are managed by a PC or PLC...etc)
DRIVER status monitoring	SMON	Monitors the DRIVER status.
Alarm and warning read-out	ALM_RD	Reads the current alarm or warning and the alarm occurrence history.
Clearing alarm or warning status	ALM_CLR	Clears the current alarm or warning status and the alarm occurrence history.
Coordinate system setting	POS_SET	Sets the coordinate system.
Data monitoring and adjustment	ADJ	Monitors and adjusts the set data.

8.11 Commands Details for Preparation Process

8.11.1 No Operation (NOP: 00H)

After turning on the control and main circuit power supplies, send NOP command to check if initialization of DRIVER has been completed or not.

(1) NOP Command (00H)

The specifications of the NOP command are shown below.

<table>
<tr><th rowspan="2">Byte</th><th colspan="2">NOP</th><th colspan="4" rowspan="2">Description</th></tr>
<tr><th>Command</th><th>Response</th></tr>
<tr><td>1</td><td>00H</td><td>00H</td><td>Phases in which the command can be executed</td><td>All phases</td><td>Synchronization classification</td><td>Asynchronous command</td></tr>
<tr><td>2</td><td rowspan="15"></td><td>ALARM</td><td>Processing time</td><td>Within communications cycle</td><td>Subcommand</td><td>Can be used.</td></tr>
<tr><td>3</td><td rowspan="2">STATUS</td><td colspan="4" rowspan="29">• Returns the ALM, WARNG, and CMDRDY bits in STATUS field. Other bits will not be specified.
• The response will be NOP from the moment the power is turned on until the initialization of DRIVER is completed. During this time, CMDRY = 0.</td></tr>
<tr><td>4</td></tr>
<tr><td>5</td><td rowspan="14"></td></tr>
<tr><td>6</td></tr>
<tr><td>7</td></tr>
<tr><td>8</td></tr>
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<tr><td>12</td></tr>
<tr><td>13</td></tr>
<tr><td>14</td></tr>
<tr><td>15</td></tr>
<tr><td>16</td><td>WDT</td><td>RWDT</td></tr>
<tr><td>17</td><td rowspan="13">Subcommand area</td><td rowspan="13">Subcommand area</td></tr>
<tr><td>18</td></tr>
<tr><td>19</td></tr>
<tr><td>20</td></tr>
<tr><td>21</td></tr>
<tr><td>22</td></tr>
<tr><td>23</td></tr>
<tr><td>24</td></tr>
<tr><td>25</td></tr>
<tr><td>26</td></tr>
<tr><td>27</td></tr>
<tr><td>28</td></tr>
<tr><td>29</td></tr>
</table>

(2) ALARM

The uppermost two digits of the DRIVER alarm code are set in the ALARM field of the response. For example, ALARM = 02 when a parameter checksum error 1 (A.020) occurs. If no alarm occurs, ALARM = 00.
For details on alarms and alarm codes, refer to *9 Troubleshooting*.

(3) Status Field Specifications

The status field is used to monitor the DRIVER status. The following table shows the bit allocation in the status field.

D7	D6	D5	D4	D3	D2	D1	D0
PSET/ V_CMP	ZPOINT	–	PON	SVON	CMDRDY	WARNG	ALM

D15	D14	D13	D12	D11	D10	D9	D8
–	–	N_SOT	P_SOT	NEAR/ V_LIM	L_CMP	T_LIM	DEN/ZSPD

The following table explains each bit value and its status.

Bit	Name	Value	Description
D0	ALM	0	No alarm
		1	Alarm occurs.
D1	WARNG	0	No warning
		1	Warning occurs.
D2	CMDRDY	0	Command cannot be received (busy).
		1	Command can be received (ready).
D3	SVON	0	Servo OFF
		1	Servo ON
D4	PON	0	Main power supply OFF
		1	Main power supply ON
D5	–	–	–
D6	ZPOINT	0	Out of home position range
		1	Within home position range
D7	PSET (During position control)	0	Out of positioning complete range
		1	Within positioning complete range (The output is completed (DEN = 1) and APOS is within the positioning complete range.)
	V_CMP (During speed control)	0	Speed does not coincide.
		1	Speed coincides.
D8	DEN (During position control)	0	During output
		1	Output completed
	ZSPD (During speed control)	0	Zero speed not detected
		1	Zero speed detected
D9	T_LIM	0	Not during torque (force) limit
		1	During torque (force) limit
D10	L_CMP	0	Latch not completed
		1	Latch completed
D11	NEAR (During position control)	0	Out of positioning proximity
		1	Within positioning proximity
	V_LIM (During speed control)	0	Speed limit not detected
		1	Speed limit detected
D12	P_SOT	0	OT signal is OFF.
		1	OT signal is ON.

Bit	Name	Value	Description
D13	N_SOT	0	OT signal is OFF.
		1	OT signal is ON.
D14	–	–	–
D15	–	–	–

(4) Details WDT and RWDT

The watchdog timer data will be set in WDT and RWDT of NOP command and response as shown below.

	D7 – D4	D3 – D0
WDT	SN: Copy of RSN in RWDT	MN: Incremented by 1 each communications cycle
RWDT	RSN: Incremented by 1 each communications cycle	RMN: Copy of MIN in WDT

MN: Master station watchdog timer count

RSN: DRIVER's watchdog timer count

The watchdog timer is checked after synchronous communications has been established.
The DRIVER watchdog timer data will be refreshed whether synchronous communications is established or not.

8.11.2 Release MECHATROLINK-II Connection (DISCONNECT: 0FH)

The connection must be released at the end of communications.
Send a DISCONNECT command to release the connection.

(1) DISCONNECT Command (0FH)

The specifications of the DISCONNECT command are shown below.

<table>
<tr><th rowspan="2">Byte</th><th colspan="2">DISCONNECT</th><th colspan="4" rowspan="2">Description</th></tr>
<tr><th>Command</th><th>Response</th></tr>
<tr><td>1</td><td rowspan="2">0FH</td><td>0FH</td><td>Phases in which the command can be executed</td><td>All phases</td><td>Synchronization classification</td><td>Asynchronous command</td></tr>
<tr><td>2</td><td>ALARM</td><td>Processing time</td><td>Communications cycle or more (Within 5 s)</td><td>Subcommand</td><td>Cannot be used</td></tr>
<tr><td>3</td><td rowspan="13"></td><td rowspan="2">STATUS</td><td colspan="4" rowspan="14">• Releases the MECHATROLINK-II connection, and the DRIVER changes communications to Phase 1.
• When this command is received, the following operations will be performed.
- The DRIVER changes communications to Phase 1.
- The DRIVER changes to Servo OFF.
- The reference point setting becomes invalid.
- The position data is initialized.
- Lock signal turns ON.
- If an alarm has occurred, releasing the connection will not clear the alarm status. The set parameter data (saved in the volatile memory) will remain valid.
- To re-establish connection, carry out operations in the same sequence as when turning ON the power supply and set the required parameters again.</td></tr>
<tr><td>4</td></tr>
<tr><td>5</td><td rowspan="12"></td></tr>
<tr><td>6</td></tr>
<tr><td>7</td></tr>
<tr><td>8</td></tr>
<tr><td>9</td></tr>
<tr><td>10</td></tr>
<tr><td>11</td></tr>
<tr><td>12</td></tr>
<tr><td>13</td></tr>
<tr><td>14</td></tr>
<tr><td>15</td><td></td></tr>
<tr><td>16</td><td>WDT</td><td>RWDT</td></tr>
</table>

Note: Always send a DISCONNECT command for at least two communications cycles.

8.11.3 Establish MECHATROLINK-II Connection (CONNECT: 0EH)

Send a CONNECT command to establish a MECHATROLINK-II communications connection. When the connection is established, the WDT (watchdog timer) count starts.

(1) CONNECT Command (0EH)

The specifications of the CONNECT command are shown below.

<table>
<tr><th rowspan="2">Byte</th><th colspan="2">CONNECT</th><th colspan="4" rowspan="2">Description</th></tr>
<tr><th>Command</th><th>Response</th></tr>
<tr><td>1</td><td>0EH</td><td>0EH</td><td>Phases in which the command can be executed</td><td>Phase 1</td><td>Synchronization classification</td><td>Asynchronous command</td></tr>
<tr><td>2</td><td rowspan="2"></td><td>ALARM</td><td>Processing time</td><td>Communications cycle or more (Within 5 s)</td><td>Subcommand</td><td>Cannot be used</td></tr>
<tr><td>3</td><td rowspan="2">STATUS</td><td rowspan="14" colspan="4">• Establishes a MECHATROLINK-II connection and sets the communications mode according to COM_MODE.
• VER: Version. Set VER to 21H (Version 2.1)
• COM_MOD: Sets the communications mode. Refer to (2) Details of COM_MOD for details.
• COM_TIM: Sets the communications cycle. The communications cycle must satisfy the following equation within the range between 1 and 32.
0.25 [ms] ≤ Transmission cycle [ms] × COM_TIM ≤ 32 [ms]
• A warning will occur and the command will be ignored in the following cases.
- If COM_MODE is out of the setting range: Data setting warning 2 (A.94B)
- If COM_TIM is out of the settting range: Data setting warning 2 (A.94B)
- If the transmission bytes is 17 but SUBCMD = 1: Data setting warning 2 (A.94B)
- If the transmission speed is set to 10 Mbps but VER is not set to 21H: Data setting warning 2 (A.94B)
• Slave stations will not accept commands other than CONNECT, DISCONNECT, and NOP before the connection is established. If a command other than CONNECT, DISCONNECT, and NOP is sent before the connection is established, NOP is always returned as the response.</td></tr>
<tr><td>4</td></tr>
<tr><td>5</td><td>VER</td><td>VER</td></tr>
<tr><td>6</td><td>COM_MOD</td><td>COM_MOD</td></tr>
<tr><td>7</td><td>COM_TIM</td><td>COM_TIM</td></tr>
<tr><td>8</td><td rowspan="8"></td><td rowspan="8"></td></tr>
<tr><td>9</td></tr>
<tr><td>10</td></tr>
<tr><td>11</td></tr>
<tr><td>12</td></tr>
<tr><td>13</td></tr>
<tr><td>14</td></tr>
<tr><td>15</td></tr>
<tr><td>16</td><td>WDT</td><td>RWDT</td></tr>
</table>

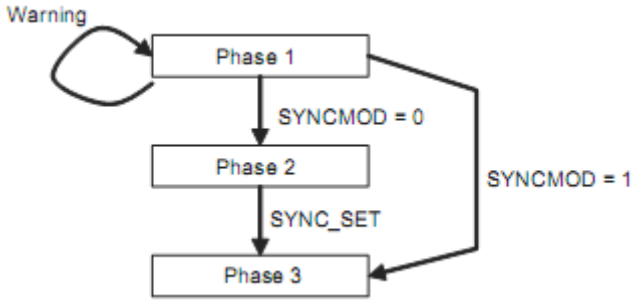
Note: Slave stations will not accept any MECHATROLINK-II command while a motion command such as JOG is being executed to run the motor through SigmaWin+.

(2) Details of COM_MOD

COM_MOD bit allocation and each bit status are described below.

D7	D6	D5	D4	D3	D2	D1	D0
SUBCMD	0	0	0	DTMOD		SYNCMOD	0

- SYNCMOD: Sets the synchronization mode.
  SYNCMOD = 0: Asynchronous communications
  SYNCMOD = 1: Synchronous communications
- DTMOD: Sets the data transmission method.
  DTMOD = 00 or 11: Single transmission
  DTMOD = 01: Continuous transmission
  Normally, set DTMOD to 00.
- SUBCMD: Specify whether to use subcommands or not.
  SUBCMD = 0: Do not use subcommands
  SUBCMD = 1: Use subcommands
  Note: When SYNCMOD = 0, it is necessary to send SYNC_SET command to enter Phase 3.



(3) Transmission Cycle and Communications Cycle

The table below provides the applicable communications cycle and the maximum number of connectable stations for each transmission cycle setting.

Transmission Cycle	Applicable Communications Cycle	Transmission Bytes	
		17-byte	32-byte
		Connectable Max. Number of Stations	
0.25 ms	0.25 ms to 8.00 ms (in 0.25-ms units)	2	1
0.50 ms	0.50 ms to 16.00 ms (in 0.50-ms units)	7	4
0.75 ms	0.75 ms to 24.00 ms (in 0.75-ms units)	11	7
1.00 ms	1.00 ms to 32.00 ms (in 1.00-ms units)	15	9
1.50 ms	1.50 ms to 32.00 ms (in 1.50-ms units)	23	15
2.00 ms	2.00 ms to 32.00 ms (in 2.00-ms units)	30	21
2.50 ms	2.50 ms to 2.00 ms (in 2.50-ms units)	30	26
3.00 ms	3.00 ms to 32.00 ms (in 3.00-ms units)	30	30
3.50 ms	3.50 ms to 32.00 ms (in 3.50-ms units)	30	30
4.00 ms	4.00 ms to 32.00 ms (in 4.00-ms units)	30	30

Note: Communications retry stations can be connected as long as the total number of connected stations, including the retry stations, is within the connectable max. number of stations. The maximum number of retry stations is the difference between the connectable max. number of stations and the number of actually connected slave stations, but limited to 7.
Note that the connectable max. number of stations may differ depending on the PC or PLC...etc specifications.

8.11.4 Start Synchronous Communications (SYNC_SET: 0DH)

This section describe how to start synchronization to change a communications phase from phase 2 to phase 3.

When SYNCMOD bit of the COM_MOD of CONNECT command is set to 1, the communications phase will change from phase 1 to phase 3 at the moment the connection is established. In this case, it is not necessary to send a SYNC_SET command.

(1) SYNC_SET Command (0DH)

The specifications of the SYNC_SET command are described below.

<table>
<tr><th rowspan="2">Byte</th><th colspan="2">SYNC_SET</th><th colspan="4" rowspan="2">Description</th></tr>
<tr><th>Command</th><th>Response</th></tr>
<tr><td>1</td><td>0DH</td><td>0DH</td><td>Phases in which the command can be executed</td><td>Phase 2</td><td>Synchronization classification</td><td>Asynchronous command</td></tr>
<tr><td>2</td><td rowspan="15"></td><td>ALARM</td><td>Processing time</td><td>Communications cycle or more (Within 5 s)</td><td>Subcommand</td><td>Cannot be used</td></tr>
<tr><td>3</td><td rowspan="2">STATUS</td><td rowspan="15" colspan="4">• Starts synchronous communications. Switched from phase 2 to phase 3.
• Synchronization is made at the WDT changing edge. However, if WDT errors are masked by parameter Pn800.0, processing is completed when this command is received.
• During phase 3, the slave ignores this command and returns a normal response without a warning.
• If the slave station in Servo ON status receives this command in phase 2, the slave station enters Servo OFF status.
• At occurrence of the following alarms and warnings, this command must be transmitted to restart synchronous communications.
- Command warning 1 (A.95A) occurs when this command is used in phase 1
- MECHATROLINK-II synchronization Error (A.E50)
- MECHATROLINK-II synchronization failed (A.E51)
- MECHATROLINK-II Communications Error (A.E60)
- MECHATROLINK-II Transmission Cycle Error (A.E61)
- Command warning 1 (A.95A) occurs when this command is used while operating the servo using SigmaWin+.</td></tr>
<tr><td>4</td></tr>
<tr><td>5</td><td rowspan="13"></td></tr>
<tr><td>6</td></tr>
<tr><td>7</td></tr>
<tr><td>8</td></tr>
<tr><td>9</td></tr>
<tr><td>10</td></tr>
<tr><td>11</td></tr>
<tr><td>12</td></tr>
<tr><td>13</td></tr>
<tr><td>14</td></tr>
<tr><td>15</td></tr>
<tr><td>16</td><td>WDT</td><td>RWDT</td></tr>
</table>

8.11.5 Check Device ID (ID_RD: 03H)

Send ID_RD command to read the device ID for confirmation.

(1) ID_RD Command (03H)

The specifications of the ID_RD command are described below.

<table>
<tr><th>Byte</th><th colspan="2">ID_RD</th><th colspan="4" rowspan="2">Description</th></tr>
<tr><th></th><th>Command</th><th>Response</th></tr>
<tr><td>1</td><td>03H</td><td>03H</td><td>Phases in which the command can be executed</td><td>Phase 2 and 3</td><td>Synchronization classification</td><td>Asynchronous command</td></tr>
<tr><td>2</td><td rowspan="3"></td><td>ALARM</td><td>Processing time</td><td>Within communications cycle</td><td>Subcommand</td><td>Can be used</td></tr>
<tr><td>3</td><td rowspan="2">STATUS</td><td colspan="4" rowspan="15">• Reads the device ID for contirmation.
• Use DEVICE_CODE to specify the device ID to be read.
• Use OFFSET to specify which data of the device ID is to be read out.
• Use SIZE to specify the number of data (bytes) to be read out.
• A warning will occur and the command will be ignored in the following case.
- DEVICE_CODE is set out of the range: Data setting warning 2 (A.94B)</td></tr>
<tr><td>4</td></tr>
<tr><td>5</td><td>DEVICE_ CODE</td><td>DEVICE_ CODE</td></tr>
<tr><td>6</td><td>OFFSET</td><td>OFFSET</td></tr>
<tr><td>7</td><td>SIZE</td><td>SIZE</td></tr>
<tr><td>8</td><td rowspan="8"></td><td rowspan="8">ID</td></tr>
<tr><td>9</td></tr>
<tr><td>10</td></tr>
<tr><td>11</td></tr>
<tr><td>12</td></tr>
<tr><td>13</td></tr>
<tr><td>14</td></tr>
<tr><td>15</td></tr>
<tr><td>16</td><td>WDT</td><td>RWDT</td></tr>
<tr><td>17</td><td rowspan="13">Subcommand area</td><td rowspan="13">Subcommand area</td></tr>
<tr><td>18</td></tr>
<tr><td>19</td></tr>
<tr><td>20</td></tr>
<tr><td>21</td></tr>
<tr><td>22</td></tr>
<tr><td>23</td></tr>
<tr><td>24</td></tr>
<tr><td>25</td></tr>
<tr><td>26</td></tr>
<tr><td>27</td></tr>
<tr><td>28</td></tr>
<tr><td>29</td></tr>
</table>

(2) Device ID Specifications

The specifications of the device ID are described below.

Device Type/Name		DEVICE_ CODE	OFFSET																		
			00	01	02	03	04	05	06	07	08	09	0A	0B	0C	0D	0E	0F	10	11	12
DRIVER	Model	00H	S	G	D	*1	*1	*2	*2	*2	*3	*4	*4	*5	*6	*6	*6	*6	*6	*6	00
	Software version	02H	Ver.																		
Servomotor	Model	20H	S	G	M	*7	*7	–	*8	*8	*9	*10	*11	*12	*13	00					
	Encoder software version	12H	Ver.																		
External Encoder	Model	30H																			
	Software version	32H	Ver.																		

- DRIVER Model
  *1: Model code, *2: Current capacity, *3: Power supply voltage specifications, *4: Interface specifications,
  *5: Design revision order, *6: Options
- Servomotor Model
  *7: Model code, *8: Rated output, *9: Power supply voltage, *10: Encoder type, *11: Design revision order,
  *12: Shaft-end specifications, *13: Options
- Software version is binary data.
- Model is expressed in ASCII code and “00 (NULL)” is added at the end of each character string.
- 50H and 52H of DEVICE_CODE are reserved for system.
- When the Safety Option unit or/and Feedback Option unit are not connected, 0 is set to all the ID data.
- For an external encoder, the ID of the encoder connected to the Feedback Option unit is set. (Therefore, 0 is set to all the ID data when no Feedback Option unit is connected.)
- When an encoder option for fully-closed loop control is connected to the Feedback Option unit, 0 is set to all the ID data of Feedback Option unit.

Refer to Use the SigmaWin+ of *before* for the correspondence of Device ID and SMC model.

8.11.6 Set Parameters (PRM_WR: 02H)

Send PRM_WR command to set parameters when parameters are managed by a PC or PLC...etc. Parameters will be set without being saved in the non-volatile memory of DRIVER.

(1) PRM_WR Command (02H)

The specifications of the PRM_WR command are described below.

<table>
<tr><th rowspan="2">Byte</th><th colspan="2">PRM_WR</th><th colspan="4" rowspan="2">Description</th></tr>
<tr><th>Command</th><th>Response</th></tr>
<tr><td>1</td><td>02H</td><td>02H</td><td>Phases in which the command can be executed</td><td>Phase 2 and 3</td><td>Synchronization classification</td><td>Asynchronous command</td></tr>
<tr><td>2</td><td rowspan="4"></td><td>ALARM</td><td>Processing time</td><td>Within 200 ms</td><td>Subcommand</td><td>Cannot be used</td></tr>
<tr><td>3</td><td rowspan="2">STATUS</td><td colspan="4" rowspan="15">• Writes parameters.
The parameters will not be saved in the non-volatile memory.
• For parameters that require turning the power supply OFF and ON again to be validated, it is necessary to send a CONFIG command to validate the settings.
• Use NO to specify the parameter to be written.
• Use SIZE to specify the number of data (bytes) of the parameter to be written.
• PARAMETER is the data to be written.
• A warning will occur and the command will be ignored in the following cases.
- When writing parameters that affect utility functions currently being used for operations with SigmaWin+: Command warning 1 (A.95A)
- NO is set out of the range: Data setting warning 1 (A.94A)
- SIZE does not match: Data setting warning 4 (A.94D)
- PARAMETER is out of the range: Data setting warning 2 (A.94B)</td></tr>
<tr><td>4</td></tr>
<tr><td>5</td><td rowspan="2">NO</td><td rowspan="2">NO</td></tr>
<tr><td>6</td></tr>
<tr><td>7</td><td>SIZE</td><td>SIZE</td></tr>
<tr><td>8</td><td rowspan="8">PARAMETER</td><td rowspan="8">PARAMETER</td></tr>
<tr><td>9</td></tr>
<tr><td>10</td></tr>
<tr><td>11</td></tr>
<tr><td>12</td></tr>
<tr><td>13</td></tr>
<tr><td>14</td></tr>
<tr><td>15</td></tr>
<tr><td>16</td><td>WDT</td><td>RWDT</td></tr>
</table>

- Example of NO

For the parameter Pn80D, the data is set in little endian as shown below.

Byte	Data
5	0D
6	08

8.11.7 Set and Save Parameters in Non-volatile Memory (PPRM_WR: 1CH)

Send a PPRM_WR command to save parameters in the DRIVER.

(1) PPRM_WR Command (1CH)

The specifications of the PPRM-WR command are described below.

<table>
<tr><th rowspan="2">Byte</th><th colspan="2">PPRM_WR</th><th colspan="4" rowspan="2">Description</th></tr>
<tr><th>Command</th><th>Response</th></tr>
<tr><td>1</td><td>1CH</td><td>1CH</td><td>Phases in which the command can be executed</td><td>Phase 2 and 3</td><td>Synchronization classification</td><td>Asynchronous command</td></tr>
<tr><td>2</td><td rowspan="2"></td><td>ALARM</td><td>Processing time</td><td>Within 200 ms</td><td>Subcommand</td><td>Cannot be used</td></tr>
<tr><td>3</td><td rowspan="2">STATUS</td><td rowspan="15" colspan="4">• Saves parameters in the non-volatile memory.
• For parameters that require turning the power supply OFF and ON again to be validated, it is necessary to send a CONFIG command to validate the settings.
• A warning will occur and the command will be ignored in the following cases.
- NO is out of the range: Data setting warning 1 (A.94A)
- SIZE does not match: Data setting warning 4 (A.94D)
- PARAMETER is out of the range: Data setting warning 2 (A.94B)
- When writing parameters that affect utility functions currently being used for operations with SigmaWin+: Command warning 1 (A.95A)</td></tr>
<tr><td>4</td></tr>
<tr><td>5</td><td rowspan="2">NO</td><td rowspan="2">NO</td></tr>
<tr><td>6</td></tr>
<tr><td>7</td><td>SIZE</td><td>SIZE</td></tr>
<tr><td>8</td><td rowspan="8">PARAMETER</td><td rowspan="8">PARAMETER</td></tr>
<tr><td>9</td></tr>
<tr><td>10</td></tr>
<tr><td>11</td></tr>
<tr><td>12</td></tr>
<tr><td>13</td></tr>
<tr><td>14</td></tr>
<tr><td>15</td></tr>
<tr><td>16</td><td>WDT</td><td>RWDT</td></tr>
</table>

Do not turn off the power supply while the parameter is being written (CMDRDY = 0).

8.11.8 Validate Parameters (Setup) (CONFIG: 04H)

The set parameters need to be validated (setup) using a CONFIG command.
Executing this command recalculates all currently set parameters and initializes positions, output signals, etc.

(1) CONFIG Command (04H)

The specifications of the CONFIG command are described below.

<table>
<tr><th rowspan="2">Byte</th><th colspan="2">CONFIG</th><th colspan="4" rowspan="2">Description</th></tr>
<tr><th>Command</th><th>Response</th></tr>
<tr><td>1</td><td>04H</td><td>04H</td><td>Phases in which the command can be executed</td><td>Phase 2 and 3</td><td>Synchronization classification</td><td>Asynchronous command</td></tr>
<tr><td>2</td><td rowspan="15"></td><td>ALARM</td><td>Processing time</td><td>Within 5 s</td><td>Subcommand</td><td>Cannot be used</td></tr>
<tr><td>3</td><td rowspan="2">STATUS</td><td colspan="4" rowspan="15">• Recalculates all currently set parameters and initializes position, etc.
• The DRIVER will change to Servo OFF if this command is received when the DRIVER is Servo ON.
• A warning will occur and the command will be ignored if this command is sent:
- When using SigmaWin+ to execute utility functions: Command warning 1 (A.95A)
• Refer to (2) Status and Output Signal during CONFIG Command Execution for details on status and output signal during CONFIG command execution.</td></tr>
<tr><td>4</td></tr>
<tr><td>5</td><td rowspan="13"></td></tr>
<tr><td>6</td></tr>
<tr><td>7</td></tr>
<tr><td>8</td></tr>
<tr><td>9</td></tr>
<tr><td>10</td></tr>
<tr><td>11</td></tr>
<tr><td>12</td></tr>
<tr><td>13</td></tr>
<tr><td>14</td></tr>
<tr><td>15</td></tr>
<tr><td>16</td><td>WDT</td><td>RWDT</td></tr>
</table>

(2) Status and Output Signal during CONFIG Command Execution

The status and output signal during CONFIG command execution are listed below.

Status and Output Signal	Before CONFIG	During CONFIG	After CONFIG
ALM (status)	Current status	Current status	Current status
CMDRDY (status)	1	0	1
Other status	Current status	Not specified	Current status
ALARM (code)	Alarm currently occurred	Alarm currently occurred	Alarm currently occurred
ALM (CN1 output signal)	Current status	Current status	Current status
/S-RDY (CN1 output signal)	Current status	OFF	Current status
Other output signals	Current status	Not specified	Current status

8.11.9 Turn Encoder Power Supply ON (SENS_ON: 23H)

Send SENS_ON command to turn ON the encoder power supply.

(1) SENS_ON Command (23H)

The specifications of the SENS_ON command are described below.

<table>
<tr><th rowspan="2">Byte</th><th colspan="2">SENS_ON</th><th colspan="4" rowspan="2">Description</th></tr>
<tr><th>Command</th><th>Response</th></tr>
<tr><td>1</td><td>23H</td><td>23H</td><td>Phases in which the command can be executed</td><td>Phase 2 and 3</td><td>Synchronization classification</td><td>Asynchronous command</td></tr>
<tr><td>2</td><td rowspan="12"></td><td>ALARM</td><td>Processing time</td><td>Within 2 s</td><td>Subcommand</td><td>Cannot be used</td></tr>
<tr><td>3</td><td rowspan="2">STATUS</td><td colspan="4" rowspan="14">• Obtains the initial position data and creates the present position when an absolute encoder is used.
• The reference point, home position (ZPOINT), and software limits will be enabled when an absolute encoder is used.
• After having used this command, the position data must be monitored and the coordinate system of PC or PLC...etc must be setup.</td></tr>
<tr><td>4</td></tr>
<tr><td>5</td><td rowspan="4">MONITOR1</td></tr>
<tr><td>6</td></tr>
<tr><td>7</td></tr>
<tr><td>8</td></tr>
<tr><td>9</td><td rowspan="4">MONITOR2</td></tr>
<tr><td>10</td></tr>
<tr><td>11</td></tr>
<tr><td>12</td></tr>
<tr><td>13</td><td>SEL_MON1/2</td><td>SEL_MON1/2</td></tr>
<tr><td>14</td><td rowspan="2"></td><td rowspan="2">IO_MON</td></tr>
<tr><td>15</td></tr>
<tr><td>16</td><td>WDT</td><td>RWDT</td></tr>
</table>

(2) Monitor Selection Field Specifications: SEL_MON1/2/3/4

The monitor selection (SEL_MON1/2/3/4) field is used to select the Servo monitor information.

- Applicable Commands:

  SV_ON, SV_OFF, HOLD, INTERPOLATE, POSING, FEED, LATCH, EX_POSING, ZRET, VELCTRL, TRQCTRL, SMON, SENS_ON, SENS_OFF, BRK_ON, BRK_OFF, LTMOD_ON, LTMOD_OFF

- Setting Method:

  Set MONITOR 1/2/3/4 monitor codes in SEL_MON1/2/3/4 allocated in the thirteenth byte of the main command or in the reserved area of the nineteenth byte of the subcommand.

SEL_MON1/2/3/4 allocation is shown below.

D7	D6	D5	D4	D3	D2	D1	D0
SEL_MON2				SEL_MON1			

D7	D6	D5	D4	D3	D2	D1	D0
SEL_MON4				SEL_MON3			

(3) Monitor Information Field Specifications: MONITOR 1/2/3/4

The monitor information (MONITOR 1/2/3/4) field is used to monitor information selected by the monitor codes in the monitor selection field.

- Applicable Commands:
  SV_ON, SV_OFF, HOLD, INTERPOLATE, POSING, FEED, LATCH, EX_POSING, ZRET, VELCTRL, TRQCTRL, SMON, SENS_ON, SENS_OFF, BRK_ON, BRK_OFF, LTMOD_ON, LTMOD_OFF

The MONITOR 1/2/3/4 monitor codes are listed below.

Monitor Code	Name	Description	Unit
0	POS	Reference position in reference coordinate system (position after reference filtering)	Reference unit
1	MPOS	Reference position	Reference unit
2	PERR	Position error	Reference unit
3	APOS	Feedback position in machine coordinate system	Reference unit
4	LPOS	Feedback latch position in machine coordinate system	Reference unit
5	IPOS	Reference position in reference coordinate system (position before reference filtering)	Reference unit
6	TPOS	Target position in reference coordinate system	Reference unit
7	–	–	–
8	FSPD	Feedback speed	Position/torque (force) control: reference units/s Speed control: Maximum speed/ 40000000H
9	CSPD	Reference speed	Position control: Reference units/s Speed control: Maximum speed/ 40000000H
A	TSPD	Target speed	Position control: Reference units/s Speed control: Maximum speed/ 40000000H
B	TRQ	Torque (force) reference (The rated torque is 100%.)	Position/speed control: % (The rated torque is 100%.) Torque (force) control: Maximum torque (force)/40000000H
C	–	–	–
D	–	–	–
E	OMN1	Option monitor 1 selected in Pn824	–
F	OMN2	Option monitor 2 selected in Pn825	–

(4) IO Monitor Field Specifications: IO_MON

The IO monitor field is used to monitor the I/O signal status of the DRIVER.

- Applicable Commands:
  SMON, SV_ON, SV_OFF, SV_CTRL, FEED, HOLD, INTERPOLATE, POSING, LATCH, EX_POSING, ZRET, VELCTRL, TRQCTRL, SENS_ON, SENS_OFF, BRK_ON, BRK_OFF, LTMOD_ON, LTMOD_OFF

I/O signal allocation is shown below.

D7	D6	D5	D4	D3	D2	D1	D0
EXT2	EXT1	PC	PB	PA	DEC	N_OT	P_OT

D15	D14	D13	D12	D11	D10	D09	D08
IO15	IO14	IO13	IO12	–	HBB	BRK	EXT3

Bit	Name	Contents	Value	Status
D0	P_OT	Forward run prohibited input	0	OFF
			1	ON
D1	N_OT	Reverse run prohibited input	0	OFF
			1	ON
D2	DEC	Homing deceleration LS input	0	OFF
			1	ON
D3	PA	Encoder phase A input	0	OFF
			1	ON
D4	PB	Encoder phase B input	0	OFF
			1	ON
D5	PC	Encoder phase Z input	0	OFF
			1	ON
D6	EXT1	First external latch signal input	0	OFF
			1	ON
D7	EXT2	Second external latch signal input	0	OFF
			1	ON
D8	EXT3	Third external latch signal input	0	OFF
			1	ON
D9	BRK	Brake output	0	Released
			1	Locked
D10	HBB	Stop signal input, OR of HWBB1 signal and HWBB2 signal	0	OFF (Forced stop released)
			1	ON (Forced stop)
D11		Reserved	0	
D12	IO12	CN1 input signal selected in Pn81E.0	0	OFF (open)
			1	ON (closed)
D13	IO13	CN1 input signal selected in Pn81E.1	0	OFF (open)
			1	ON (closed)
D14	IO14	CN1 input signal selected in Pn81E.2	0	OFF (open)
			1	ON (closed)
D15	IO15	CN1 input signal selected in Pn81E.3	0	OFF (open)
			1	ON (closed)

8.11.10 Turn Servo ON (SV_ON: 31H)

Send the SV_ON command to power the servomotor and make it ready for operation.

(1) SV_ON Command (31H)

The specifications of the SV_ON command are described below.

<table>
<tr><th rowspan="2">Byte</th><th colspan="2">SV_ON</th><th colspan="4" rowspan="2">Description</th></tr>
<tr><th>Command</th><th>Response</th></tr>
<tr><td>1</td><td>31H</td><td>31H</td><td>Phases in which the command can be executed</td><td>Phase 2 and 3</td><td>Synchronization classification</td><td>Asynchronous command</td></tr>
<tr><td>2</td><td></td><td>ALARM</td><td>Processing time</td><td>Normally 50 ms (10 s max.)</td><td>Subcommand</td><td>Can be used</td></tr>
<tr><td>3</td><td rowspan="2">OPTION</td><td rowspan="2">STATUS</td><td colspan="4" rowspan="16">• Powers the servomotor and makes it ready for operation.
• Command warning 1 (A.95A) will occur and the command will be ignored if the command is sent:
- During alarm occurrence (When ALM of STATUS is 1)
- When the main power supply is OFF (PON of STATUS is 0)
- When the HWBB signal is ON (HWBB of IO_MON is 1)
- Before completion of execution of SENS_ON when an absolute encoder is used
• OPTION field can be selected
• Upon completion of execution of this command, the reference position (POS) must be read, and the PC or PLC...etc coordinate system must be set up.</td></tr>
<tr><td>4</td></tr>
<tr><td>5</td><td rowspan="4"></td><td rowspan="4">MONITOR1</td></tr>
<tr><td>6</td></tr>
<tr><td>7</td></tr>
<tr><td>8</td></tr>
<tr><td>9</td><td rowspan="4">MONITOR2</td></tr>
<tr><td>10</td></tr>
<tr><td>11</td></tr>
<tr><td>12</td></tr>
<tr><td>13</td><td>SEL_MON1/2</td><td>SEL_MON1/2</td></tr>
<tr><td>14</td><td rowspan="2"></td><td rowspan="2">IO_MON</td></tr>
<tr><td>15</td></tr>
<tr><td>16</td><td>WDT</td><td>RWDT</td></tr>
<tr><td>17</td><td rowspan="13">Subcommand area</td><td rowspan="13">Subcommand area</td></tr>
<tr><td>18</td></tr>
<tr><td>19</td></tr>
<tr><td>20</td></tr>
<tr><td>21</td></tr>
<tr><td>22</td></tr>
<tr><td>23</td></tr>
<tr><td>24</td></tr>
<tr><td>25</td></tr>
<tr><td>26</td></tr>
<tr><td>27</td></tr>
<tr><td>28</td></tr>
<tr><td>29</td></tr>
</table>

(2) OPTION Field Specifications

The option field is used to add functions to a motion command.

- Applicable Commands

SV_ON, HOLD, INTERPOLATE, POSING, FEED, LATCH, EX_POSING, ZRET, VELCTRL, TRQCTRL, SVCTRL

Set the functions to be added to a motion command in the main command third and forth bytes reserved for the option field.

The option field of the LECYM2-V□ series DRIVER is set by default as shown below.
To change the default setting, set the parameter Pn81F as Pn81F = □□□1, and set the bits to which functions are to be allocated using the parameters Pn82A to Pn82E. The change must be validated by turning the power supply OFF and then ON again or by sending a CONFIG command.

- OPTION Field Default Setting

D7	D6	D5	D4	D3	D2	D1	D0
0	0	0	ACCFIL		0	0	0

D15	D14	D13	D12	D11	D10	D9	D8
N_CL	P_CL	P_PI_CLR	V_PPI	0	0	G_SEL	

- Functions That Can Be Allocated to Bits of the OPTION Field

Name	Description	Value	Details	Default Setting
ACCFIL (2 bits)	Acceleration/Deceleration filter	0	No acceleration/deceleration filter	D3, D4
		1	Exponential function acceleration/deceleration	
		2	S-curve acceleration/deceleration	
		3	Do not set.	
G_SEL (2 bits)	Gain switching	0	First gain	D8, D9
		1	Second gain	
		2	Reserved (invalid)	
		3	Reserved (invalid)	
V_PPI (1 bit)	Speed loop P/PI control	0	PI control	D12
		1	P control	
P_PI_CLR (1 bit)	Position loop position integral clear	0	Does not clear.	D13
		1	Clears.	
P_CL (1 bit)	Forward torque (force) limit	0	Does not control torque (force).	D14
		1	Controls torque (force).	
N_CL (1 bit)	Reverse torque (force) limit	0	Does not control torque (force).	D15
		1	Controls torque (force).	
LT_DISABLE (1 bit)	Latch signal input disabled	0	Enables latch signal input.	Not allocated
		1	Disables latch signal input.	
BANK_SEL1 (4 bits)	Bank selector 1 (Bank for acceleration/deceleration parameter switching)	0 to 15	Bank 0 to Bank 15	Not allocated

Name	Description		Value	Details	Default Setting
OUT_SIGNAL (3 bits)	I/O signal output command	BIT 0	0	SO1 output signal OFF	Not allocated
			1	SO1 output signal ON	
		BIT 1	0	SO2 output signal OFF	
			1	SO2 output signal ON	
		BIT 2	0	SO3 output signal OFF	
			1	SO3 output signal ON	

Note 1. Do not allocate more than one signal to one bit. Otherwise, multiple signals will be controlled by one bit.
2. The bits to which no function is allocated will act as it is set to 0 (zero).
3. To enable the OUT_SIGNAL function, set the following parameters to Zero: Pn50E, Pn50F, and Pn510.

8.11.11 Turn Encoder Power Supply OFF (SENS_OFF: 24H)

Send a SENS_OFF command to turn OFF the encoder power supply.

(1) SENS_OFF Command (24H)

The specifications of the SENS_OFF command are described below.

<table>
<tr><th rowspan="2">Byte</th><th colspan="2">SENS_OFF</th><th colspan="4" rowspan="2">Description</th></tr>
<tr><th>Command</th><th>Response</th></tr>
<tr><td>1</td><td>24H</td><td>24H</td><td>Phases in which the command can be executed</td><td>Phase 2 and 3</td><td>Synchronization classification</td><td>Asynchronous command</td></tr>
<tr><td>2</td><td rowspan="14"></td><td>ALARM</td><td>Processing time</td><td>Within 2 sec</td><td>Subcommand</td><td>Cannot be used</td></tr>
<tr><td>3</td><td rowspan="2">STATUS</td><td colspan="4" rowspan="14">• Turn the encoder OFF. The position data will not be specified when an absolute encoder is used.
• The reference point, origin (ZPOINT), and software limits will be invalid.
• Command warning 1 (A.95A) will occur and the command will be ignored if the command is sent:
- While the servo is ON</td></tr>
<tr><td>4</td></tr>
<tr><td>5</td><td rowspan="4">MONITOR1</td></tr>
<tr><td>6</td></tr>
<tr><td>7</td></tr>
<tr><td>8</td></tr>
<tr><td>9</td><td rowspan="4">MONITOR2</td></tr>
<tr><td>10</td></tr>
<tr><td>11</td></tr>
<tr><td>12</td></tr>
<tr><td>13</td><td>SEL_MON1/2</td><td>SEL_MON1/2</td></tr>
<tr><td>14</td><td rowspan="2"></td><td rowspan="2">IO_MON</td></tr>
<tr><td>15</td></tr>
<tr><td>16</td><td>WDT</td><td>RWDT</td></tr>
</table>

8.11.12 Turn Servo OFF (SV_OFF: 32H)

Send an SV_OFF command to stop current flow through the servomotor.

(1) SV_OFF Command (32H)

The specifications of the SV_OFF command are described below.

<table>
<tr><th rowspan="2">Byte</th><th colspan="2">SV_OFF</th><th colspan="4" rowspan="2">Description</th></tr>
<tr><th>Command</th><th>Response</th></tr>
<tr><td>1</td><td>32H</td><td>32H</td><td>Phases in which the command can be executed</td><td>Phase 2 and 3</td><td>Synchronization classification</td><td>Asynchronous command</td></tr>
<tr><td>2</td><td rowspan="28"></td><td>ALARM</td><td>Processing time</td><td>The time set in Pn506
(500 ms max.)</td><td>Subcommand</td><td>Can be used</td></tr>
<tr><td>3</td><td rowspan="2">STATUS</td><td colspan="4" rowspan="28">• Stops current flow through the servomotor.
• When Pn829 (SVOFF waiting time at deceleration to stop) is set to a value other than 0, the servo will be turned OFF after the servomotor decelerates to a stop according to the deceleration constant for stopping set by the parameter. (The servomotor decelerates to a stop in position control mode.)
• When Pn829 (SVOFF waiting time at deceleration to a stop) is set to 0, the servo will be turned OFF immediately after reception of this command.
(The control mode before receiving SV_OFF command remains unchanged.)
• Executing the SV_OFF command will cancel the speed reference, speed feed forward, torque (force) feed forward, and torque (force) limits set by a position/speed control command.</td></tr>
<tr><td>4</td></tr>
<tr><td>5</td><td rowspan="4">MONITOR1</td></tr>
<tr><td>6</td></tr>
<tr><td>7</td></tr>
<tr><td>8</td></tr>
<tr><td>9</td><td rowspan="4">MONITOR2</td></tr>
<tr><td>10</td></tr>
<tr><td>11</td></tr>
<tr><td>12</td></tr>
<tr><td>13</td><td>SEL_MON1/2</td><td>SEL_MON1/2</td></tr>
<tr><td>14</td><td rowspan="2"></td><td rowspan="2">IO_MON</td></tr>
<tr><td>15</td></tr>
<tr><td>16</td><td>WDT</td><td>RWDT</td></tr>
<tr><td>17</td><td rowspan="13">Subcommand area</td><td rowspan="13">Subcommand area</td></tr>
<tr><td>18</td></tr>
<tr><td>19</td></tr>
<tr><td>20</td></tr>
<tr><td>21</td></tr>
<tr><td>22</td></tr>
<tr><td>23</td></tr>
<tr><td>24</td></tr>
<tr><td>25</td></tr>
<tr><td>26</td></tr>
<tr><td>27</td></tr>
<tr><td>28</td></tr>
<tr><td>29</td></tr>
</table>

8.11.13 Read Parameters (PRM_RD: 01H)

Send a PRM_RD command to read out parameters.

(1) PRM_RD Command (01H)

The specifications of the PRM_RD command are described below.

<table>
<tr><th rowspan="2">Byte</th><th colspan="2">PRM_RD</th><th colspan="4" rowspan="2">Description</th></tr>
<tr><th>Command</th><th>Response</th></tr>
<tr><td>1</td><td>01H</td><td>01H</td><td>Phases in which the command can be executed</td><td>Phase 2 and 3</td><td>Synchronization classification</td><td>Asynchronous command</td></tr>
<tr><td>2</td><td rowspan="3"></td><td>ALARM</td><td>Processing time</td><td>Within 200 ms</td><td>Subcommand</td><td>Can be used</td></tr>
<tr><td>3</td><td rowspan="2">STATUS</td><td colspan="4" rowspan="8">• Reads out parameters.
• A warning will occur and the command will be ignored in the following cases.
- NO is out of the range: Data setting warning 1 (A.94A)
- SIZE does not match: Data setting warning 4 (A.94D)</td></tr>
<tr><td>4</td></tr>
<tr><td>5</td><td rowspan="2">NO</td><td rowspan="2">NO</td></tr>
<tr><td>6</td></tr>
<tr><td>7</td><td>SIZE</td><td>SIZE</td></tr>
<tr><td>8</td><td rowspan="8"></td><td rowspan="8">PARAMETER</td></tr>
<tr><td>9</td></tr>
<tr><td>10</td></tr>
<tr><td>11</td></tr>
<tr><td>12</td></tr>
<tr><td>13</td></tr>
<tr><td>14</td></tr>
<tr><td>15</td></tr>
<tr><td>16</td><td>WDT</td><td>RWDT</td></tr>
</table>

8.11.14 Check DRIVER Status (SMON: 30H)

Send a SMON command to check the DRIVER status.

(1) SMON Command (30H)

The specifications of the SMON command are described below.

<table>
<tr><th rowspan="2">Byte</th><th colspan="2">SMON</th><th colspan="4" rowspan="2">Description</th></tr>
<tr><th>Command</th><th>Response</th></tr>
<tr><td>1</td><td>30H</td><td>30H</td><td>Phases in which the command can be executed</td><td>Phase 2 and 3</td><td>Synchronization classification</td><td>Asynchronous command</td></tr>
<tr><td>2</td><td rowspan="14"></td><td>ALARM</td><td>Processing time</td><td>Within commu-nications cycle</td><td>Subcommand</td><td>Can be used</td></tr>
<tr><td>3</td><td rowspan="2">STATUS</td><td colspan="4" rowspan="27">• Reads the current status of the DRIVER.</td></tr>
<tr><td>4</td></tr>
<tr><td>5</td><td rowspan="4">MONITOR1</td></tr>
<tr><td>6</td></tr>
<tr><td>7</td></tr>
<tr><td>8</td></tr>
<tr><td>9</td><td rowspan="4">MONITOR2</td></tr>
<tr><td>10</td></tr>
<tr><td>11</td></tr>
<tr><td>12</td></tr>
<tr><td>13</td><td>SEL_MON1/2</td><td>SEL_MON1/2</td></tr>
<tr><td>14</td><td rowspan="2"></td><td rowspan="2">IO_MON</td></tr>
<tr><td>15</td></tr>
<tr><td>16</td><td>WDT</td><td>RWDT</td></tr>
<tr><td>17</td><td rowspan="13">Subcommand area</td><td rowspan="13">Subcommand area</td></tr>
<tr><td>18</td></tr>
<tr><td>19</td></tr>
<tr><td>20</td></tr>
<tr><td>21</td></tr>
<tr><td>22</td></tr>
<tr><td>23</td></tr>
<tr><td>24</td></tr>
<tr><td>25</td></tr>
<tr><td>26</td></tr>
<tr><td>27</td></tr>
<tr><td>28</td></tr>
<tr><td>29</td></tr>
</table>

8.11.15 Read Alarm or Warning (ALM_RD: 05H)

Send an ALM_RD command to read out the current alarm/warning and the alarm history.

(1) ALM_RD Command (05H)

The specifications of the ALM_RD command are described below.

<table>
<tr><th rowspan="2">Byte</th><th colspan="2">ALM_RD</th><th colspan="4" rowspan="2">Description</th></tr>
<tr><th>Command</th><th>Response</th></tr>
<tr><td>1</td><td>05H</td><td>05H</td><td>Phases in which the command can be executed</td><td>Phase 2 and 3</td><td>Synchronization classification</td><td>Asynchronous command</td></tr>
<tr><td>2</td><td rowspan="3"></td><td>ALARM</td><td>Processing time</td><td>See ALM_RD_MOD Specifications on the next page.</td><td>Subcommand</td><td>Cannot be used</td></tr>
<tr><td>3</td><td rowspan="2">STATUS</td><td rowspan="15" colspan="4">• Reads the following alarm and warning status.
- Current alarm/warning status
- Alarm history* (Warnings and communications alarms A.E50 and A.E60 will not be read out since they are not preserved in the history.)
• See (2) ALM_RD_MOD Specifications for details on ALM_RD_MOD.
• Alarm and warning codes are set in ALM_DATA from byte 6 in order from the most recent, and 0 is set in the bytes that are blank. Accordingly, the data in byte 6 is the latest alarm or warning code.
• A warning will occur and the command will be ignored in the following cases.
-If ALM_RD_MOD is out of the range: Data setting warning 2 (A.94B)</td></tr>
<tr><td>4</td></tr>
<tr><td>5</td><td>ALM_RD_ MOD</td><td>ALM_RD_ MOD</td></tr>
<tr><td>6</td><td rowspan="9"></td><td rowspan="9">ALM_DATA</td></tr>
<tr><td>7</td></tr>
<tr><td>8</td></tr>
<tr><td>9</td></tr>
<tr><td>10</td></tr>
<tr><td>11</td></tr>
<tr><td>12</td></tr>
<tr><td>13</td></tr>
<tr><td>14</td></tr>
<tr><td>15</td></tr>
<tr><td>16</td><td>WDT</td><td>RWDT</td></tr>
</table>

∗ Alarm history is saved in the non-volatile memory, and will not be lost if the control power goes OFF.

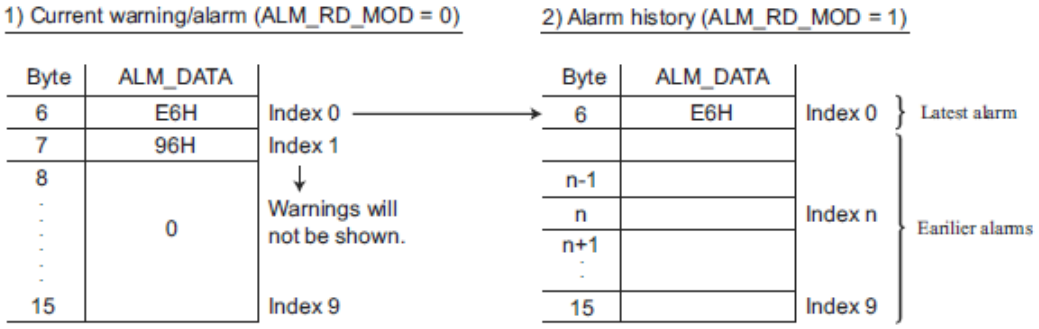
(2) ALM_RD_MOD Specifications

<table>
<tr><th>ALM_RD_MOD</th><th>Description</th><th>Processing Time</th></tr>
<tr><td>0</td><td>Read current alarm/warning status
10 items max. (sixth to fifteenth byte)</td><td>Within com-munications cycle</td></tr>
<tr><td>1</td><td>Read alarm history (warnings and communications alarms A.E50 and A.E60 are not preserved in the history.)
10 records max. (sixth to fifteenth byte)</td><td>Within 60 ms</td></tr>
<tr><td>2</td><td>Gets the detailed information of current alarm or warning one by one.
Set the occurrence order from 0 (the latest) to 9 for the alarm index.
<table>
<tr><th>Byte</th><th>Command</th><th>Response</th></tr>
<tr><td>6</td><td>Alarm index</td><td>Alarm index</td></tr>
<tr><td>7</td><td>0</td><td rowspan="2">Alarm code</td></tr>
<tr><td>8</td><td>0</td></tr>
</table></td><td rowspan="2">Within 12 m</td></tr>
<tr><td>3</td><td>Gets the detailed information of alarm history one by one.
Set the occurrence order from 0 (the latest) to 9 for the alarm index.
<table>
<tr><th>Byte</th><th>Command</th><th>Response</th></tr>
<tr><td>6</td><td>Alarm index</td><td>Alarm index</td></tr>
<tr><td>7</td><td>0</td><td rowspan="2">Alarm code</td></tr>
<tr><td>8</td><td>0</td></tr>
</table></td></tr>
</table>

1. When ALM_RD_MOD=0 or 1

An alarm code of 1-byte length is returned.

Example) The warning A.960 occurred and then, the communications error alarm A.E61 occurred.



Note 1. The current warning or alarm status can be cleared by executing the ALM_CLR (ALM_CLR_MOD = 0) command.

2. The alarm history will not be cleared until the ALM_CLR(ALM_CLR_MOD = 1) command is executed.

-When ALM_RD_MOD = 2 or 3

- An alarm code of 2-byte length is returned.

If ALM_RD_MOD is set to 2 in the above example, the following alarm codes will be read out. 0xE61 for alarm index 0, and 0x960 for alarm index 1.

8.11.16 Clear Warning or Alarm (ALM_CLR: 06H)

Send an ALM_CLR command to clear the warning/alarm status and the alarm history.

(1) ALM_CLR Command (06H)

The specifications of the ALM_CLR command are described below.

<table>
<tr><th rowspan="2">Byte</th><th colspan="2">ALM_CLR</th><th colspan="4" rowspan="2">Description</th></tr>
<tr><th>Command</th><th>Response</th></tr>
<tr><td>1</td><td>06H</td><td>06H</td><td>Phases in which the command can be executed</td><td>Phase 2 and 3</td><td>Synchronization classification</td><td>Asynchronous command</td></tr>
<tr><td>2</td><td rowspan="3"></td><td>ALARM</td><td>Processing time</td><td>See (2) ALM_CLR_MOD Specifications.</td><td>Subcommand</td><td>Cannot be used</td></tr>
<tr><td>3</td><td rowspan="2">STATUS</td><td rowspan="14" colspan="4">• Clears the followings.
- Current alarm/warning status
- Alarm history *
• A warning will occur and the command will be ignored in the following cases.
- When using SigmaWin or a digital operator to execute utility functions: Command warning 1 (A.95A)
- ALM_CLR_MOD is out of the setting range: Data setting warning 2 (A.94B)
• The alarm status will not be cleared in the following cases.
- An alarm that cannot be reset occurs.
- An alarm that cannot be reset occurs but the cause of the alarm has not yet been removed.</td></tr>
<tr><td>4</td></tr>
<tr><td>5</td><td>ALM_CLR_MOD</td><td>ALM_CLR_MOD</td></tr>
<tr><td>6</td><td rowspan="10"></td><td rowspan="10"></td></tr>
<tr><td>7</td></tr>
<tr><td>8</td></tr>
<tr><td>9</td></tr>
<tr><td>10</td></tr>
<tr><td>11</td></tr>
<tr><td>12</td></tr>
<tr><td>13</td></tr>
<tr><td>14</td></tr>
<tr><td>15</td></tr>
<tr><td>16</td><td>WDT</td><td>RWDT</td></tr>
</table>

∗ Alarm history is saved in the non-volatile memory, and will not be lost if the control power goes OFF.

(2) ALM_CLR_MOD Specifications

ALM_CLR_MOD	Description	Processing Time
0	Clears current alarm/warning status.	Within 200 ms
1	Clears alarm history.	Within 2 s

8.11.17 Set Coordinate System (POS_SET: 20H)

Send a POS_SET command to set the position coordinate system.

(1) POS_SET Command (20H)

The specifications of the POS_SET command are described below.

<table>
<tr><th rowspan="2">Byte</th><th colspan="2">POS_SET</th><th colspan="4" rowspan="2">Description</th></tr>
<tr><th>Command</th><th>Response</th></tr>
<tr><td>1</td><td>20H</td><td>20H</td><td>Phases in which the command can be executed</td><td>Phase 2 and 3</td><td>Synchronization classification</td><td>Asynchronous command</td></tr>
<tr><td>2</td><td rowspan="2"></td><td>ALARM</td><td>Processing time</td><td>Within communications cycle</td><td>Subcommand</td><td>Cannot be used</td></tr>
<tr><td>3</td><td rowspan="2">STATUS</td><td colspan="4" rowspan="10">• Sets the current position to the position specified by POS_DATA.
• The origin (ZPOINT) and software limit settings are enabled by setting a reference point.
• See (2) PS_SUBCMD Specifications for details on PS_SUBCMD.
• Specify the position (coordinates) in POS_DATA.
• A warning will occur and the command will be ignored in the following cases.
- A number out of the range is set in PS_SUBCMD: Data setting warning 2 (A.94B)</td></tr>
<tr><td>4</td></tr>
<tr><td>5</td><td>PS_SUBCMD</td><td>PS_SUBCMD</td></tr>
<tr><td>6</td><td rowspan="4">POS_DATA</td><td rowspan="4">POS_DATA</td></tr>
<tr><td>7</td></tr>
<tr><td>8</td></tr>
<tr><td>9</td></tr>
<tr><td>10</td><td rowspan="6"></td><td rowspan="6"></td></tr>
<tr><td>11</td></tr>
<tr><td>12</td></tr>
<tr><td>13</td></tr>
<tr><td>14</td></tr>
<tr><td>15</td></tr>
<tr><td>16</td><td>WDT</td><td>RWDT</td></tr>
</table>

(2) PS_SUBCMD Specifications

The specifications of PS_SUBCMD are described below.

D7	D6	D5	D4	D3	D2	D1	D0
REFE	0	0	0	POS_SEL			

- REFE (Reference Point Setting)
  - 0: Does not set reference point.
  - 1: Sets reference point. The coordinates will be determined and the zero point position (ZPOINT) and soft- ware limit setting will be enabled.
- POS_SEL (Coordinate system selection)
  - 3: Sets APOS (feedback position in machine coordinate system), and sets the positions of all coordinate sys- tems (TPOS, IPOS, POS, MPOS, APOS) to POS_DATA.

8.11.18 Monitor and Adjust Settings (ADJ: 3EH)

Send an ADJ command to monitor and adjust settings.

(1) ADJ Command (3EH)

The specifications of the ADJ command are described below.

<table>
<tr><th rowspan="2">Byte</th><th colspan="2">ADJ</th><th rowspan="2" colspan="4">Description</th></tr>
<tr><th>Command</th><th>Response</th></tr>
<tr><td>1</td><td>3EH</td><td>3EH</td><td>Phases in which the command can be executed</td><td>Phase 2 and 3</td><td>Synchronization classification</td><td>Asynchronous command</td></tr>
<tr><td>2</td><td>SUBCODE=01</td><td>ALARM</td><td>Processing time</td><td>Depends on processing</td><td>Subcommand</td><td>Cannot be used</td></tr>
<tr><td>3</td><td rowspan="2"></td><td rowspan="2">STATUS</td><td colspan="4" rowspan="14">• Use this command as SUBCODE = 01H.
The DRIVER will be in maintenance mode. And, data monitoring and adjustment will be enabled.
• See (2) How to Send an ADJ Command for Adjustment for details on ADJ for adjustment.
• See (3) How to Send an ADJ Command for Monitoring Data for details on ADJ for monitoring data.
• A warning will occur and the command will be ignored in the following cases.
- While editing using SigmaWin or digital operator: Command warning 1 (A.95A)
- CADDRESS is out of the range: Parameter setting warning 1 (A.94A)
- CSIZE does not match: Parameter setting warning 4 (A.94D)
- CCMD and/or CDATA are out of the range: Parameter setting warning 2 (A.94B)</td></tr>
<tr><td>4</td></tr>
<tr><td>5</td><td rowspan="2">CCMD</td><td rowspan="2">CANS</td></tr>
<tr><td>6</td></tr>
<tr><td>7</td><td rowspan="2">CADDRESS</td><td rowspan="2">CADDRESS</td></tr>
<tr><td>8</td></tr>
<tr><td>9</td><td rowspan="2">CSIZE</td><td rowspan="2">CSIZE/ ERRCODE</td></tr>
<tr><td>10</td></tr>
<tr><td>11</td><td rowspan="5">CDATA</td><td rowspan="5">RDATA</td></tr>
<tr><td>12</td></tr>
<tr><td>13</td></tr>
<tr><td>14</td></tr>
<tr><td>15</td></tr>
<tr><td>16</td><td>WDT</td><td>RWDT</td></tr>
</table>

(2) How to Send an ADJ Command for Adjustment

The table below lists the adjustments that can be executed by sending an ADJ command.

List of Executable Adjustments

Adjustment	Request Code	Preparation Before Execution	Processing Time	Execution Conditions
Normal mode	0000H	None	200 ms max.	–
Parameter initialization	1005H	None	20 s max.	Initialization is impossible while the servo is ON. After initialization, the power supply must be turned OFF and then ON again.
Absolute encoder reset	1008H	Required	5 s max.	When using an incremental encoder, it is impossible to reset the encoder while the servo is ON. After initialization, the power supply must be turned OFF and then ON again.
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. After initialization, the power supply must be turned OFF and then ON again.

ADJ Command Execution Procedure for Adjustment:

Details of Command for Adjustment

	Command	Response
CCMD/CANS	CCMD = 04H	CANS = 04H (copy of the command)
CADDRESS	Setting address	Reference address (copy of the command)
CSIZE/ ERRCODE	2 or 4	At normal reception: 0000H At error occurrence: A value other than 0
CDATA/RDATA	Setting data	Setting data (copy of the command)

1. Send the following data and set the request code of the adjustment to be executed.

CCMD = 0004H
CADDRESS = 2000H
CSIZE = 0002H
CDATA = Request code of the adjustment to be executed

When the slave station receives the command normally, CMDRDY of status field will be set to 1. Also check ERRCODE. 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.

CCMD = 0004H
CADDRESS = 2001H
CSIZE = 0002H
CDATA = 0002H

When the slave station receives the command normally, CMDRDY of status field will be set to 1. Also check ERRCODE. If an error occurs, carry out the operation in step 4 to abort execution.

3. Send the following data to execute adjustment.

CCMD = 0004H
CADDRESS = 2001H
CSIZE = 0002H
CDATA = 0001H

When the slave station receives the command normally, CMDRDY of status field will be set to 1. Also check ERRCODE. If an error occurs, carry out the operation in step 4 to abort execution.

4. Send the following data to abort the execution.

CCMD = 0004H
CADDRESS = 2000H
CSIZE = 0002H
CDATA = 0000H

When the execution is aborted, CMDRDY of status field will be set to 1.

Note:
If a communications alarm (A.E50 or A.E60) occurs after the request code has been set and before adjustment has been executed, the adjustment can not be carried out. Remove the cause of the alarm and restart the adjustment procedure.

(3) How to Send an ADJ Command for Monitoring Data

The table below lists the data that can be monitored.

List of Data that Can be Monitored

Name	Reference Address	Data Size	Unit
Motor capacity	C00FH (Lower-most) C010H (Upper-most)	2 bytes	[W]
Motor voltage	C011H	2 bytes	[V]
Motor rated speed	C01CH	2 bytes	[×10 C01EH reference value min^{-1}]
Motor max. speed	C01DH	2 bytes	[×10 C01EH reference value min^{-1}]
Motor speed exponent	C01EH	2 bytes	–
Motor rated torque (force)	C01FH	2 bytes	[×10 C021H reference value N.m]
Motor torque (force) exponent	C021H	2 bytes	–
Encoder resolution	C022H (Lower-most) C023H (Upper-most)	2 bytes	[pulse / rev]
Maximum motor torque (force) that can be output	E701H	2 bytes	[%]
Motor max. output speed	C027H	2 bytes	[×10 C01EH reference value min^{-1}]

ADJ Command Execution Procedure for Monitoring Data:

Details of Command to Monitor Data

	Command	Response
CCMD/CANS	CCMD = 03H	CANS = 03H (copy of the command)
CADDRESS	Reference address	Reference address (copy of the command)
CSIZE/ ERRCODE	– (Not required)	At normal reception: SIZE (2 or 4) At error occurrent: A value other than 2 and 4
CDATA/RDATA	– (Not required)	Reference data

1. Set the reference address to be monitored, and send the ADJ command.

CCMD =0003H

CADDRESS = Reference address

When the slave station receives the command normally, CMDRDY of status field will be see to 1. Also check ERRCODE.

2. When the command transmission is completed normally, CDATA of RSP will be read out for CSIZE to obtain the data.

Speed/Torque (Force) Data Normalization

The following data used in position, speed, or torque (force) control commands will be normalized:
Speed data: VREF, VLIM :[maximum motor speed/40000000H]
Torque (force) data: TFF/P_TLIM/N_TLIM/TLIM [maximum motor torque (force)/4000H] TQREF [maximum motor torque (force)/40000000H]

The maximum motor speed and maximum motor torque (force) used in the above data can be obtained by the following equations.

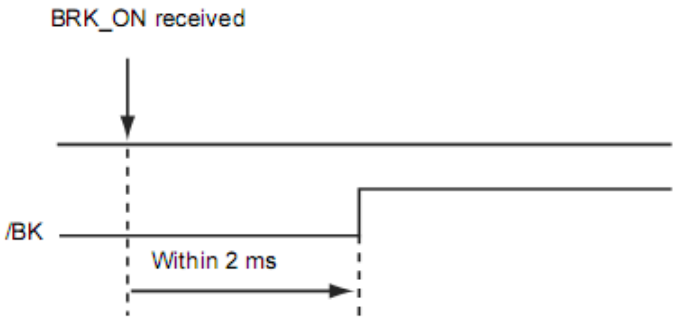
Maximum motor speed = C027H reference value $\times 10^{\text{C01EH reference value}}$ [Rotational servomotor: min^{-1}, Linear servomotor: mm/s]
Maximum motor torque (force) = C01FH reference value $\times 10^{\text{C021H reference value}} \times$ E701H reference value/100 [Rotational servomotor: N.m, Linear servomotor: N]

8.11.19 Brake Control Commands

Command Code	Command	Function
21H	BRK_ON	Turns the Lock signal off and applies the holding brake.
22H	BRK_OFF	Turns the Lock signal on and releases the holding brake.

(1) Apply Brake (BRK_ON: 21H)

The specifications of BRK_ON (21H) command are described below.

<table>
<tr><th rowspan="2">Byte</th><th colspan="2">BRK_ON</th><th colspan="4" rowspan="2">Description</th></tr>
<tr><th>Command</th><th>Response</th></tr>
<tr><td>1</td><td>21H</td><td>21H</td><td>Phases in which the command can be executed</td><td>Phase 2 and 3</td><td>Synchronization classification</td><td>Asynchronous command</td></tr>
<tr><td>2</td><td rowspan="12"></td><td>ALARM</td><td>Processing time</td><td>Within commu-nications cycle</td><td>Subcommand</td><td>Cannot be used</td></tr>
<tr><td>3</td><td rowspan="2">STATUS</td><td colspan="4" rowspan="14">• Turns the Lock signal (/BK) off and apply brake.
• This command is enabled only while the servo is OFF.
• This command is enabled when the parameter Pn50F.2is not set to 0.
• Lock signal output timing
 
</td></tr>
<tr><td>4</td></tr>
<tr><td>5</td><td rowspan="4">MONITOR1</td></tr>
<tr><td>6</td></tr>
<tr><td>7</td></tr>
<tr><td>8</td></tr>
<tr><td>9</td><td rowspan="4">MONITOR2</td></tr>
<tr><td>10</td></tr>
<tr><td>11</td></tr>
<tr><td>12</td></tr>
<tr><td>13</td><td>SEL_MON1/2</td><td>SEL_MON1/2</td></tr>
<tr><td>14</td><td rowspan="2"></td><td rowspan="2">IO_MON</td></tr>
<tr><td>15</td></tr>
<tr><td>16</td><td>WDT</td><td>RWDT</td></tr>
</table>

(2) Combination of BRK_ON Command (21H) and Subcommands

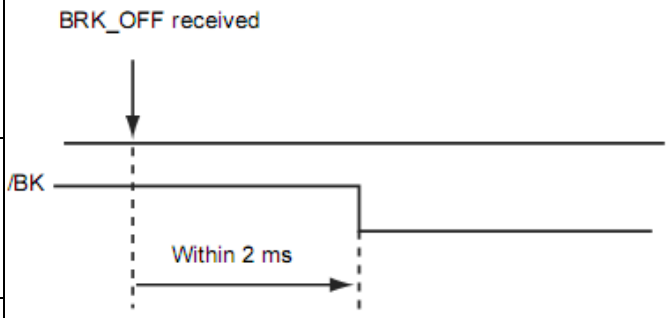
The following table shows which subcommands can be combined with BRK-ON command.

Main Command	Subcommand							
	NOP	PRM_RD	PRM_WR	ALM_ RD	PPRM_ WR	LTMOD_ ON	LTMOD_ OFF	SMON
BRK_ON	√	×	×	×	×	×	×	√

Note: √: Can be combined, ×: Can not be combined

(3) Release Brake (BRK_OFF: 22H)

The specifications of BRK_OFF command (22H) are described below.

<table>
<tr><th rowspan="2">Byte</th><th colspan="2">BRK_OFF</th><th colspan="4" rowspan="2">Description</th></tr>
<tr><th>Command</th><th>Response</th></tr>
<tr><td>1</td><td>22H</td><td>22H</td><td>Phases in which the command can be executed</td><td>Phase 2 and 3</td><td>Synchronization classification</td><td>Asynchronous command</td></tr>
<tr><td>2</td><td rowspan="12"></td><td>ALARM</td><td>Processing time</td><td>Within commu-nications cycle</td><td>Subcommand</td><td>Cannot be used</td></tr>
<tr><td>3</td><td rowspan="2">STATUS</td><td colspan="4" rowspan="12">• Turns the Lock signal (/BK) ON and releases the brake.
• This command is enabled when Pn50F.2 is not set to 0
• Lock signal output timing
 
</td></tr>
<tr><td>4</td></tr>
<tr><td>5</td><td rowspan="4">MONITOR1</td></tr>
<tr><td>6</td></tr>
<tr><td>7</td></tr>
<tr><td>8</td></tr>
<tr><td>9</td><td rowspan="4">MONITOR2</td></tr>
<tr><td>10</td></tr>
<tr><td>11</td></tr>
<tr><td>12</td></tr>
<tr><td>13</td><td>SEL_MON1/2</td><td>SEL_MON1/2</td></tr>
<tr><td>14</td><td rowspan="2"></td><td rowspan="2">IO_MON</td></tr>
<tr><td>15</td></tr>
<tr><td>16</td><td>WDT</td><td>RWDT</td></tr>
</table>

IMPORTANT

BRK_ON and BRK_OFF commands are always valid as command as long as no warning occurs.

Therefore, sending BRK_OFF command while the servomotor is being powered (Servo ON) will not change the operation status.

However, it is very dangerous to send SV_OFF command in the above status since the brake is kept released.

Always make sure of the status of brake control command when using BRK_ON or BRK_OFF command.

(4) Combination of BRK_OFF Command (22H) and Subcommands

The following table shows which subcommands can be combined with BRK-OFF command.

Main Command	Subcommand							
	NOP	PRM_RD	PRM_WR	ALM_ RD	PPRM_ WR	LTMOD_ ON	LTMOD_ OFF	SMON
BRK_OFF	√	×	×	×	×	×	×	√

Note: √: Can be combined, ×: Can not be combined

8.12 Motion Commands for Operation List

The motion commands described in this chapter are listed below.

Items		Command to Send	Description
Position Control	Stop Motion	HOLD	From current motion status, performs a deceleration stop in the set pattern and positioning.
	Set Latch Mode	LTMOD_ON	Requests the latch mode. If a latch signal is input in latch mode, position latching will be performed.
	Release Latch Mode	LTMOD_OFF	Releases the latch mode.
	Interpolation Feed	INTERPOLATE	Starts interpolation feeding.
	Positioning	POSING	Performs positioning to the target position (TPOS) at the target speed (TSPD).
	Constant Speed Feed	FEED	Performs constant speed feeding in position by position control.
	Interpolation Feeding with Position Detection	LATCH	Performs interpolation feeding and latches the position when a external signal is input.
	External Input Positioning	EX_POSING	Moves toward the target position (TPOS) at the target speed (TSPD). When a latch signal is input midway, positioning is performed according to the final travel distance for external position specified in the parameter from the latch signal input position.
	Homing	ZRET	Performs a homing.
Speed Control	Velocity Control	VELCTRL	Controls speed. (The DRIVER does not perform position control, but directly controls the speed of the speed loop.)
Torque (Force) Control	Torque (Force) Control	TRQCTRL	Controls torque (force). (The DRIVER does not perform position control and speed control, but directly performs torque (force) control.)

8.13 Motion Commands for Operation Details

8.13.1 Stop Motion (HOLD: 25H)

(1) HOLD Command (25H)

The HOLD command is used to perform a deceleration to stop from the current run status, at a deceleration ratio specified by the parameter for positioning.

<table>
<tr><th rowspan="2">Byte</th><th colspan="2">HOLD</th><th colspan="4" rowspan="2">Description</th></tr>
<tr><th>Command</th><th>Response</th></tr>
<tr><td>1</td><td>25H</td><td>25H</td><td>Phases in which the command can be executed</td><td>Phase 2 and 3</td><td>Synchronization classification</td><td>Asynchronous command</td></tr>
<tr><td>2</td><td></td><td>ALARM</td><td>Processing time</td><td>Within commu-nications cycle</td><td>Subcommand</td><td>Cannot be used</td></tr>
<tr><td>3</td><td rowspan="2">OPTION</td><td rowspan="2">STATUS</td><td colspan="4" rowspan="16">• From the current state, performs a stop specified by the HOLD_MOD command.
• Use DEN (output complete) to confirm position data output completion.
• Option field can be used.
• This command will cancel the latch processing specified by the LATCH or EX_POSING command.
• This command will cancel ZRET latch processing and ZRET homing.
• Upon completion of execution of this command, the reference position (POS) must be read, and the PC or PLC...etc coordinate system must be setup.
• The stopping method can be selected using HOLD_MOD.
0 = Stop according to the 1st or 2nd linear deceleration constant.
1 = Stop immediately (stop reference output)
2 = Stop according to the linear deceleration constant for stopping</td></tr>
<tr><td>4</td></tr>
<tr><td>5</td><td>HOLD_MOD</td><td rowspan="4">MONITOR1</td></tr>
<tr><td>6</td><td rowspan="7"></td></tr>
<tr><td>7</td></tr>
<tr><td>8</td></tr>
<tr><td>9</td><td rowspan="4">MONITOR2</td></tr>
<tr><td>10</td></tr>
<tr><td>11</td></tr>
<tr><td>12</td></tr>
<tr><td>13</td><td>SEL_MON1/2</td><td>SEL_MON1/2</td></tr>
<tr><td>14</td><td rowspan="2"></td><td rowspan="2">IO_MON</td></tr>
<tr><td>15</td></tr>
<tr><td>16</td><td>WDT</td><td>RWDT</td></tr>
<tr><td>17</td><td rowspan="13">Subcommand area</td><td rowspan="13">Subcommand area</td></tr>
<tr><td>18</td></tr>
<tr><td>19</td></tr>
<tr><td>20</td></tr>
<tr><td>21</td></tr>
<tr><td>22</td></tr>
<tr><td>23</td></tr>
<tr><td>24</td></tr>
<tr><td>25</td></tr>
<tr><td>26</td></tr>
<tr><td>27</td></tr>
<tr><td>28</td></tr>
<tr><td>29</td></tr>
</table>

(2) Related Parameters

Deceleration is specified by the following parameters.

Parameter No.	Name
Pn80D (Pn83A)	1st Linear Deceleration Constant
Pn80E (Pn83C)	2nd Linear Deceleration Constant
Pn80F (Pn83E)	Deceleration Constant Switching Speed
Pn827 (Pn840)	Linear Deceleration Constant for Stopping

Parameter number in parenthesis is when Pn833 = 1.

8.13.2 Set Latch Mode (LTMOD_ON: 28H)

(1) LTMOD_ON Command (28H)

The LTMOD_ON command is used to start latching the external signal input position data. Execution on the LTMOD_ON command allows latch operation while a command such as POSING and VELCTRL is being executed.

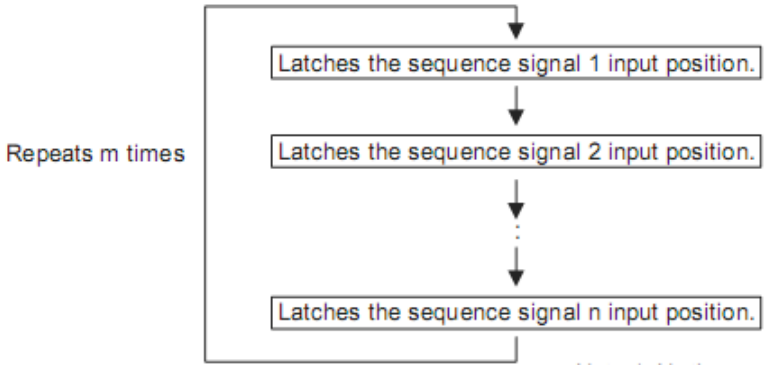
<table>
<tr><th rowspan="2">Byte</th><th colspan="2">LTMOD_ON</th><th colspan="4" rowspan="2">Description</th></tr>
<tr><th>Command</th><th>Response</th></tr>
<tr><td>1</td><td>28H</td><td>28H</td><td>Phases in which the command can be executed</td><td>Phase 2 and 3</td><td>Synchronization classification</td><td>Asynchronous command</td></tr>
<tr><td>2</td><td>LT_SGNL</td><td>ALARM</td><td>Processing time</td><td>Within communications cycle</td><td>Subcommand</td><td>Can be used</td></tr>
<tr><td>3</td><td rowspan="2"></td><td rowspan="2">STATUS</td><td colspan="4" rowspan="15">• Starts latch operation.
• Use LT_MOD to switch the latch mode:
= 0: Normal latch mode (Latches the position data when a signal selected by LT_SGNL is input)
= 1: Continuous latch (Latches the position data according to the values set in Pn850 to Pn853
Note: When LT_MOD ≠ 1, the normal latch mode is always selected.
• When CMDRDY = 1, this command has been received.
• Confirm that L_CMP of status field is set to 1 at completion of latching.
• When there is monitor data such as SMON and POSING appended to the command response, LPOS is forcefully returned to MONITOR 2 for one communications cycle.
• When there is no monitor data such as PRM_RD or ALM_RD appended to the command response, confirm that L_CMP of status field is set 1, then use a command that has monitor data such as SMON in the response and select LPOS to confirm.
• A warning will occur and the command will not be executed.
- Interference with another latch mode command (If this command is sent while another latch mode command such as EX_POSING, LATCH, ZRET, and SVCTRL is being executed): Command warning 4 (A.95D)
- LT_MOD = 1 and Pn850 = 0: Data setting warning 5 (A.94E)
• Latch time lag
- From reception of the command to latching start: 250ms max.
- From completion of latching to transmission of a response: One communications cycle max.</td></tr>
<tr><td>4</td></tr>
<tr><td>5</td><td>LT_MOD</td><td rowspan="4">MONITOR1</td></tr>
<tr><td>6</td><td rowspan="7"></td></tr>
<tr><td>7</td></tr>
<tr><td>8</td></tr>
<tr><td>9</td><td rowspan="4">MONITOR2</td></tr>
<tr><td>10</td></tr>
<tr><td>11</td></tr>
<tr><td>12</td></tr>
<tr><td>13</td><td>SEL_MON1/2</td><td>SEL_MON1/2</td></tr>
<tr><td>14</td><td rowspan="2"></td><td rowspan="2">IO_MON</td></tr>
<tr><td>15</td></tr>
<tr><td>16</td><td>WDT</td><td>RWDT</td></tr>
<tr><td>17</td><td rowspan="13">Subcommand area</td><td rowspan="13">Subcommand area</td></tr>
<tr><td>18</td></tr>
<tr><td>19</td></tr>
<tr><td>20</td></tr>
<tr><td>21</td></tr>
<tr><td>22</td></tr>
<tr><td>23</td></tr>
<tr><td>24</td></tr>
<tr><td>25</td></tr>
<tr><td>26</td></tr>
<tr><td>27</td></tr>
<tr><td>28</td></tr>
<tr><td>29</td></tr>
</table>

(2) Normal Latch Mode

In normal latch mode, the latch operation is started by sending an LTMOD_ON command, and it is completed when the input position of the latch signal LT_SGNL specified in the LTMOD_ON command is latched
To restart the latch operation, send the LTMOD_OFF command once, then send the LTMODE_ON command again. Use LT_MOD in the LTMOD_ON command to select either normal or continuous latch mode.

(3) Continuous Latch Mode

This function sequentially latches the input positions of sequence signal 1 to sequence signal n (n = 1 to 8) for a specified number of times. The continuous latch operation can be aborted by executing the LTMOD_OFF command. This function can shorten the time between latch completion and the start of the next latch, and enables sequential latch operations at high speed.



Note 1: N, the number of sequence signals, is specified by Pn850.
2: The signals for sequence signal n are selected by Pn852 and Pn853.
3: The number of times of continuous latching m is set by Pn851.

- How to Start and Stop Continuous Latch Operation

Set the following parameters, and then set LT_MOD to 1 to execute the LTMOD_ON command. The continuous latch operation will start. To abort the operation, execute the LTMOD_OFF command.

Pn850: Latch Sequence Number n
Pn851: Continuous Latch Count m (When m = 0, the continuous latch operation will be infinitely repeated.)
Pn852: Latch Sequence Signal 1 to 4 Setting
Pn853: Larch Sequence Signal 5 to 8 Setting

Note: If the LTMOD_ON command is executed by setting Pn850 to 0 and LT_MOD to 1, the latch mode error warning (A.94E) will occur and the latch operation will not start.

- Latch Status

Latch completion can be confirmed by the following status.

[STATUS Field: The 3rd and 4th byte]
L_CMP (D10): L_CMP is set to 1 for one communications cycle every time the external signal is input.

[EX_STATUS Field: The 28th and 29th byte]
L_SEQ_NO (D8-D11): The latch sequence signal number (value n) at latch completion
L_CMP_CNT (D0-D7): The continuous latch count (value m)
(Added at completion of position latch when the latch sequence signal n is input.)

Note: LPOS is forcibly output to MONITOR 2 for one communications cycle while L_CMP = 1 every time the external signal is input.

- Latched Position Data

The latest latched position data at completion of latching can be obtained by using the following monitor.

Name	Code	Remarks
Feedback Latch Position	LPOS	The latest latch signal input position

The previously latched position data can be obtained by using the following option monitor.

Name	Code	Option Monitor Selection (Pn824 and Pn825)
Option Monitor 1 and 2	OMN1, 2	80H: Previous latch signal input position

(4) LT_SGNL Specifications

- Applicable Commands:

LATCH, EX_POSING, ZRET, LTMOD_ON (when Pn850=0), SVCTRL

The latch signals can be specified in the following latch signal (LT_SGNL) field.

D7	D6	D5	D4	D3	D2	D1	D0
0	0	0	0	0	0	LT_SGNL	

D1	D0	Latch Signal	Signal Details
0	0	Phase Z	Encoder origin signal
0	1	EXT1	External input signal 1
1	0	EXT2	External input signal 2
1	1	EXT3	External input signal 3

(5) Related Parameters

The parameters related to latch operation are listed below.

Parameter No.	Name
Pn820	Forward Latching Allowable Area
Pn822	Reverse Latching Allowable Area
Pn850	Latch Sequence Number
Pn851	Continuous Latch Count
Pn852 and Pn853	Latch Sequence Signal Setting

Note 1. EXT1, EXT2, and EXT3 signals must be assigned as the input signals of CN1 by using the parameter Pn511. If they are not assigned, the latch operation will be undefined.
2. If encoders without phase Z (origin signal) and linear scales are used and the phase Z is selected, the latch opera- tion will be undefined.

8.13.3 Release Latch Mode (LTMOD_OFF: 29H)

(1) LTMOD_OFF Command (29H)

The LTMOD_OFF command is used to release the latch mode.

<table>
<tr><th rowspan="2">Byte</th><th colspan="2">LTMOD_OFF</th><th colspan="4" rowspan="2">Description</th></tr>
<tr><th>Command</th><th>Response</th></tr>
<tr><td>1</td><td>29H</td><td>29H</td><td>Phases in which the command can be executed</td><td>Phase 2 and 3</td><td>Synchronization classification</td><td>Asynchronous command</td></tr>
<tr><td>2</td><td rowspan="15"></td><td>ALARM</td><td>Processing time</td><td>Within communications cycle</td><td>Subcommand</td><td>Can be used</td></tr>
<tr><td>3</td><td rowspan="2">STATUS</td><td colspan="4" rowspan="28">• Check that CMDRDY is 1 to confirm that this command has been received.
• It takes 250 µs max. to release the latch mode.
• This command cannot be used while LATCH, ZRET, EX_POSING, or SVCTRL command is being executed.
If used, the command warning 4 (A.95D) will occur.</td></tr>
<tr><td>4</td></tr>
<tr><td>5</td><td rowspan="4">MONITOR1</td></tr>
<tr><td>6</td></tr>
<tr><td>7</td></tr>
<tr><td>8</td></tr>
<tr><td>9</td><td rowspan="4">MONITOR2</td></tr>
<tr><td>10</td></tr>
<tr><td>11</td></tr>
<tr><td>12</td></tr>
<tr><td>13</td><td>SEL_MON1/2</td><td>SEL_MON1/2</td></tr>
<tr><td>14</td><td rowspan="2"></td><td rowspan="2">IO_MON</td></tr>
<tr><td>15</td></tr>
<tr><td>16</td><td>WDT</td><td>RWDT</td></tr>
<tr><td>17</td><td rowspan="13">Subcommand area</td><td rowspan="13">Subcommand area</td></tr>
<tr><td>18</td></tr>
<tr><td>19</td></tr>
<tr><td>20</td></tr>
<tr><td>21</td></tr>
<tr><td>22</td></tr>
<tr><td>23</td></tr>
<tr><td>24</td></tr>
<tr><td>25</td></tr>
<tr><td>26</td></tr>
<tr><td>27</td></tr>
<tr><td>28</td></tr>
<tr><td>29</td></tr>
</table>

8.13.4 Interpolation Feeding (INTERPOLATE: 34H)

(1) INTERPOLATE Command (34H)

The INTERPOLATE command is used to start interpolation feeding. Speed feed forward and torque (force) feed forward can be specified simultaneously.

<table>
<tr><th rowspan="2">Byte</th><th colspan="2">INTERPOLATE</th><th colspan="4" rowspan="2">Description</th></tr>
<tr><th>Command</th><th>Response</th></tr>
<tr><td>1</td><td>34H</td><td>34H</td><td>Phases in which the command can be executed</td><td>Phase 3</td><td>Synchronization classification</td><td>Synchronous command</td></tr>
<tr><td>2</td><td></td><td>ALARM</td><td>Processing time</td><td>Within communications cycle</td><td>Subcommand</td><td>Can be used</td></tr>
<tr><td>3</td><td rowspan="2">OPTION</td><td rowspan="2">STATUS</td><td colspan="4" rowspan="27">• OPTION field can be selected.
• Interpolation feeding is performed by specifying the target position (TPOS) every communications cycle.
The target position (TPOS) is a signed 4-byte data.
Note: The target position is not an incremental value (travel amount), but the absolute position in the reference coordinate system.
• The speed feed forward (VEF [reference units/s]) is a signed 4-byte data.
• Either torque (force) feed forward (TFF) or torque (force) limit (TLIM) can be used. It can be selected by setting Pn81F and Pn002.
- TFF setting range: A signed 2-byte data [maximum motor torque (force)/ 4000H]
Use the ADJ command to obtain the maximum motor torque (force).
- TLIM setting range: 0 to 4000H [maximum motor torque (force)/ 4000H]
(If a value between 4000H and FFFFH is set, the maximum motor torque (force) will be applied as the limit.
• Use DEN (output complete) to confirm the completion of position reference output.
• When a command in execution is switched to another command, the feed forward value (VFF or TFF) will be cleared.
• A warning will occur and the command will not be executed in the following cases.
- If this command is used in communications phase other than phase 3: Command warning 1 (A.95A)
- If this command is sent while the servo is OFF: Command warning1 (A.95A)
- The travel amount (Target position (TPOS) - Current position (IPOS)) exceeds the limit value: Data setting warning 2 (A.94B)
- When using SigmaWin+ for motor operations such as JOG: Command warning 1 (A.95A)</td></tr>
<tr><td>4</td></tr>
<tr><td>5</td><td rowspan="4">TPOS</td><td rowspan="4">MONITOR1</td></tr>
<tr><td>6</td></tr>
<tr><td>7</td></tr>
<tr><td>8</td></tr>
<tr><td>9</td><td rowspan="4">VFF</td><td rowspan="4">MONITOR2</td></tr>
<tr><td>10</td></tr>
<tr><td>11</td></tr>
<tr><td>12</td></tr>
<tr><td>13</td><td>SEL_MON1/2</td><td>SEL_MON1/2</td></tr>
<tr><td>14</td><td rowspan="2">TFF/TLIM</td><td rowspan="2">IO_MON</td></tr>
<tr><td>15</td></tr>
<tr><td>16</td><td>WDT</td><td>RWDT</td></tr>
<tr><td>17</td><td rowspan="13">Subcommand area</td><td rowspan="13">Subcommand area</td></tr>
<tr><td>18</td></tr>
<tr><td>19</td></tr>
<tr><td>20</td></tr>
<tr><td>21</td></tr>
<tr><td>22</td></tr>
<tr><td>23</td></tr>
<tr><td>24</td></tr>
<tr><td>25</td></tr>
<tr><td>26</td></tr>
<tr><td>27</td></tr>
<tr><td>28</td></tr>
<tr><td>29</td></tr>
</table>

(2) Related Parameters

Either torque (force) feed forward (TFF) or torque (force) limit (TLIM) can be selected by setting the following parameters.

Parameter No.	Set Value	Meaning
Pn81F	n.□□1□	Enables the torque (force) feed forward (TFF).
Pn002	n.□□□2	
Pn81F	n.□□1□	Enables forward/reverse torque (force) limit using TLIM.
Pn002	n.□□□1	
Pn81F	n.□□1□	When P_CL of OPTION field is set to 1: Uses TLIM as positive torque (force) limit. When N_CL of OPTION field is set to 1: Uses TLIM as negative torque (force) limit.
Pn002	n.□□□3	

8.13.5 Positioning (POSING: 35H)

(1) POSING Command (35H)

The POSING command is used to start positioning to the target position (TPOS) at the target speed (TSPD).

<table>
<tr><th rowspan="2">Byte</th><th colspan="2">POSING</th><th colspan="4" rowspan="2">Description</th></tr>
<tr><th>Command</th><th>Response</th></tr>
<tr><td>1</td><td>35H</td><td>35H</td><td>Phases in which the command can be executed</td><td>Phase 2 and 3</td><td>Synchronization classification</td><td>Asynchronous command</td></tr>
<tr><td>2</td><td></td><td>ALARM</td><td>Processing time</td><td>Within communications cycle</td><td>Subcommand</td><td>Can be used</td></tr>
<tr><td>3</td><td rowspan="2">OPTION</td><td rowspan="2">STATUS</td><td colspan="4" rowspan="15">• OPTION field can be selected.
• The target position (TPOS) is a signed 4-byte data.
It is sent by using an absolute position in the reference coordinate system.

Set the target position (TPOS) so that the movement distance (TPOS - IPOS) is 2,147,483,647 ($2^{31}-1$) or less.
• Set the target speed (TSPD) to a value between 0 and the motor max. speed [reference unit/s].
• Changes can be made to the target position and target speed during movement.
• The torque (force) limit (TLIM) can be used by setting Pn81F and Pn002.
- TLIM setting range: 0 to 4000H [maximum motor torque (force)/ 4000H]
If TLIM is set to a value between 4000H and FFFFH, the maximum motor torque (force) will be applied as the limit.
Use the ADJ command to obtain the maximum motor torque (force).
• Use DEN (output complete) to confirm the completion of position reference output.
• A warning will occur and the command will be ignored in the following case.
- This command is used while the servo is OFF: Command warning 1 (A.95A)
- The target speed (TSPD) exceeds the limit: Data setting warning 2 (A.94B)
- When using SigmaWin+ for motor operations such as JOG: Command warning 1 (A.95A)</td></tr>
<tr><td>4</td></tr>
<tr><td>5</td><td rowspan="4">TPOS</td><td rowspan="4">MONITOR1</td></tr>
<tr><td>6</td></tr>
<tr><td>7</td></tr>
<tr><td>8</td></tr>
<tr><td>9</td><td rowspan="4">TSPD</td><td rowspan="4">MONITOR2</td></tr>
<tr><td>10</td></tr>
<tr><td>11</td></tr>
<tr><td>12</td></tr>
<tr><td>13</td><td>SEL_MON1/2</td><td>SEL_MON1/2</td></tr>
<tr><td>14</td><td rowspan="2">TLIM</td><td rowspan="2">IO_MON</td></tr>
<tr><td>15</td></tr>
<tr><td>16</td><td>WDT</td><td>RWDT</td></tr>
<tr><td>17</td><td rowspan="13">Subcommand area</td><td rowspan="13">Subcommand area</td></tr>
<tr><td>18</td></tr>
<tr><td>19</td></tr>
<tr><td>20</td></tr>
<tr><td>21</td></tr>
<tr><td>22</td></tr>
<tr><td>23</td></tr>
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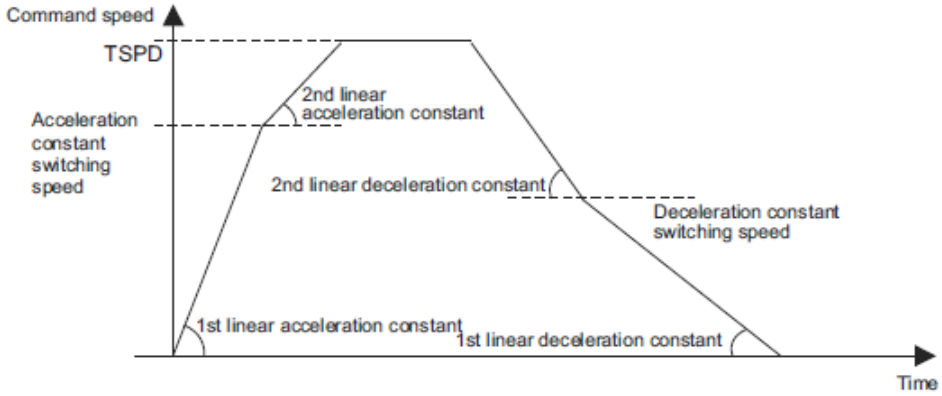
<tr><td>25</td></tr>
<tr><td>26</td></tr>
<tr><td>27</td></tr>
<tr><td>28</td></tr>
<tr><td>29</td></tr>
</table>

Positioning will be performed as illustrated below.



(2) Related Parameters

The parameters related to the execution of POSING command are listed below.
Parameter number in parentheses is when Pn833=1.

Parameter No.	Name
Pn80A (Pn834)	1st Linear Acceleration Constant
Pn80B (Pn836)	2nd Linear Acceleration Constant
Pn80C (Pn838)	Acceleration Constant Switching Speed
Pn80D (Pn83A)	1st Linear Deceleration Constant
Pn80E (Pn83C)	2nd Linear Deceleration Constant
Pn80F (Pn83E)	Deceleration Constant Switching Speed
Pn81F	Position Control Command TFF/TLIM Function Allocation
Pn002	Torque (Force) Reference Option During Speed/Position Control

Set the parameters as shown below to use TLIM.

Parameter No.	Set Value	Meaning
Pn81F	n.□□1□	Enables forward/reverse torque (force) limit using TLIM.
Pn002	n.□□□1	
Pn81F	n.□□1□	When P_CL of OPTION field is set to 1: Uses TLIM as positive torque (force) limit. When N_CL of OPTION field is set to 1: Uses TLIM as negative torque (force) limit
Pn002	n.□□□3	

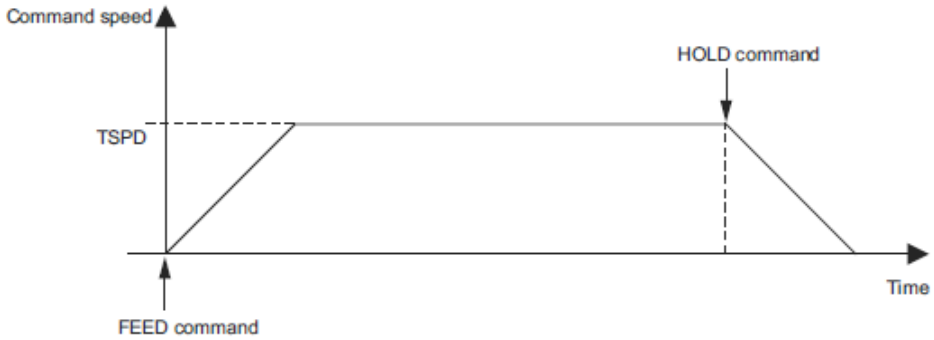
8.13.6 Constant Speed Feeding (FEED: 36H)

(1) FEED Command (36H)

The FEED command is used to start constant speed feeding at the specified target speed (TSPD) by position control.
Use Stop Motion command (HOLD: 25H) to stop constant speed feeding executed by this command.

<table>
<tr><th rowspan="2">Byte</th><th colspan="2">FEED</th><th colspan="4" rowspan="2">Description</th></tr>
<tr><th>Command</th><th>Response</th></tr>
<tr><td>1</td><td>36H</td><td>36H</td><td>Phases in which the command can be executed</td><td>Phase 2 and 3</td><td>Synchronization classification</td><td>Asynchronous command</td></tr>
<tr><td>2</td><td></td><td>ALARM</td><td>Processing time</td><td>Within communications cycle</td><td>Subcommand</td><td>Can be used</td></tr>
<tr><td>3</td><td rowspan="2">OPTION</td><td rowspan="2">STATUS</td><td colspan="4" rowspan="15">• OPTION field can be selected.
• The target speed (TSPD) is a signed 4-byte data. The feeding direction is determined by the sign.
Constant speed feeding is carried out at the specified target speed.
TSPD setting range: From the negative (-) motor max. speed to the positive (+) motor max. speed [reference unit/s]
• Changes can be made to the target speed during movement.
Change the target speed as required and send this command.
• The torque (force) limit (TLIM) can be used by setting Pn81F and Pn002.
- TLIM setting range: 0 to 4000H [maximum motor torque (force)/ 4000H]
If TLIM is set to a value between 4000H and FFFFH, the maximum motor torque (force) will be applied as the limit.
Use the ADJ command to obtain the maximum motor torque (force).
• Use the DEN (output complete) to confirm the completion of position reference output.
• A warning will occur and the command will not be executed in the following cases.
- The command is used while the servo is OFF: Command warning 1 (A.95A)
- The target speed (TSPD) exceeds the limit: Data setting warning 2 (A.94B)
- When using SigmaWin+ for motor operations such as JOG: Command warning 1 (A.95A)</td></tr>
<tr><td>4</td></tr>
<tr><td>5</td><td rowspan="4"></td><td rowspan="4">MONITOR1</td></tr>
<tr><td>6</td></tr>
<tr><td>7</td></tr>
<tr><td>8</td></tr>
<tr><td>9</td><td rowspan="4">TSPD</td><td rowspan="4">MONITOR2</td></tr>
<tr><td>10</td></tr>
<tr><td>11</td></tr>
<tr><td>12</td></tr>
<tr><td>13</td><td>SEL_MON1/2</td><td>SEL_MON1/2</td></tr>
<tr><td>14</td><td rowspan="2">TLIM</td><td rowspan="2">IO_MON</td></tr>
<tr><td>15</td></tr>
<tr><td>16</td><td>WDT</td><td>RWDT</td></tr>
<tr><td>17</td><td rowspan="13">Subcommand area</td><td rowspan="13">Subcommand area</td></tr>
<tr><td>18</td></tr>
<tr><td>19</td></tr>
<tr><td>20</td></tr>
<tr><td>21</td></tr>
<tr><td>22</td></tr>
<tr><td>23</td></tr>
<tr><td>24</td></tr>
<tr><td>25</td></tr>
<tr><td>26</td></tr>
<tr><td>27</td></tr>
<tr><td>28</td></tr>
<tr><td>29</td></tr>
</table>

Constant speed feeding is performed as illustrated below.



(2) Related Parameters

The parameters related to the execution of this command are listed below.
Parameter number in parentheses is when Pn833 = 1.

Parameter No.	Name
Pn80A (Pn834)	1st Linear Acceleration Constant
Pn80B (Pn836)	2nd Linear Acceleration Constant
Pn80C (Pn838)	Acceleration Constant Switching Speed
Pn81F	Position Control Command TFF/TLIM Function Allocation
Pn002	Torque (Force) Reference Option During Speed/Position Control

Set the parameters as shown below to use TLIM.

Parameter No.	Set Value	Meaning
Pn81F	□□1□	Enables torque (force) limit (TLIM).
Pn002	n.□□□1	
Pn81F	n.□□1□	When P_CL of OPTION field is set to 1: Uses TLIM as positive torque (force) limit. When N_CL of OPTION field is set to 1: Uses TLIM as negative torque (force) limit.
Pn002	n.□□□3	

8.13.7 Interpolation Feeding with Position Detection (LATCH: 38H)

(1) LATCH Command (38H)

The LATCH command is used to start interpolation feeding and to latch the current position when the external signal is input during positioning.
Speed feed forward, torque (force) feed forward, and torque (force) limit can be applied.

<table>
<tr><th rowspan="2">Byte</th><th colspan="2">LATCH</th><th colspan="4" rowspan="2">Description</th></tr>
<tr><th>Command</th><th>Response</th></tr>
<tr><td>1</td><td>38H</td><td>38H</td><td>Phases in which the command can be executed</td><td>Phase 3</td><td>Synchronization classification</td><td>Synchronous command</td></tr>
<tr><td>2</td><td>LT_SGNL</td><td>ALARM</td><td>Processing time</td><td>Within communications cycle</td><td>Subcommand</td><td>Can be used</td></tr>
<tr><td>3</td><td rowspan="2">OPTION</td><td rowspan="2">STATUS</td><td colspan="4" rowspan="29">• Use LT_SGNL to select the latch signal.
For details on LT_SGNL, refer to 8.18.6 LT_SGNL Specifications.
The position data when the latch signal is input is stored in the feedback latch position (LPOS) and is forcibly output to MONITOR2 for one communications cycle.
• OPTION field can be used.
• Interpolation feeding is performed by specifying the target position (TPOS) every communications cycle.
The target position (TPOS) is a signed 4-byte data.
Note: The target position is not an incremental value (travel amount), but the absolute position in the reference coordinate system.
• The speed feed forward (VEF [reference units/s]) is a signed 4-byte data.
• Either torque (force) feed forward (TFF) or torque (force) limit (TLIM) can be used. It can be selected by setting Pn81F and Pn002.
- TLIM setting range: 0 to 4000H [maximum motor torque (force)/4000H]
(If a value between 4000H and FFFFH is set, the maximum motor torque (force) will be applied as the limit.)
Use the ADJ command to obtain the maximum motor torque (force).
- TFF setting range: A signed 2-byte data [maximum motor torque (force)/4000H]
• Use DEN (output complete) to confirm the completion of position reference output.
• When a command in execution is switched to another command, the feed forward values (VFF and TFF) will be cleared.
• A warning will occur and the command will not be executed in the following cases.
- The command is used in a phase other than phase 3: Command warning 1 (A.95A)
- The command is sent while the servo is OFF: Command warning 1 (A.95A)
- The travel amount (Target position (TPOS) - Current position (IPOS)) exceeds the limit: Data setting warning 2 (A.94B)
- When using SigmaWin+ for motor operations such as JOG: Command warning 1 (A.95A)
• Latch time lag
- From reception of the command to latching start: 250 µs max.
- From completion of latching to transmission of a response: One communications cycle max.</td></tr>
<tr><td>4</td></tr>
<tr><td>5</td><td rowspan="4">TPOS</td><td rowspan="4">MONITOR1</td></tr>
<tr><td>6</td></tr>
<tr><td>7</td></tr>
<tr><td>8</td></tr>
<tr><td>9</td><td rowspan="4">VFF</td><td rowspan="4">MONITOR2</td></tr>
<tr><td>10</td></tr>
<tr><td>11</td></tr>
<tr><td>12</td></tr>
<tr><td>13</td><td>SEL_MON1/2</td><td>SEL_MON1/2</td></tr>
<tr><td>14</td><td rowspan="2">TFF/TLIM</td><td rowspan="2">IO_MON</td></tr>
<tr><td>15</td></tr>
<tr><td>16</td><td>WDT</td><td>RWDT</td></tr>
<tr><td>17</td><td rowspan="13">Subcommand area</td><td rowspan="13">Subcommand area</td></tr>
<tr><td>18</td></tr>
<tr><td>19</td></tr>
<tr><td>20</td></tr>
<tr><td>21</td></tr>
<tr><td>22</td></tr>
<tr><td>23</td></tr>
<tr><td>24</td></tr>
<tr><td>25</td></tr>
<tr><td>26</td></tr>
<tr><td>27</td></tr>
<tr><td>28</td></tr>
<tr><td>29</td></tr>
</table>

(2) Related Parameters

The parameters related to the execution of LATCH command are listed below.

Parameter No.	Name
Pn820	Forward Latching Allowable Area
Pn822	Reverse Latching Allowable Area
Pn81F	Position Control Command TFF/TLIM Function Allocation
Pn002	Torque (Force) Reference Option during Speed/Position Control

Either torque (force) feed forward (TFF) or torque (force) limit (TLIM) can be selected by setting the following parameters.

Parameter No.	Set Value	Meaning
Pn81F	n.□□1□	Enables the torque (force) feed forward (TFF).
Pn002	n.□□□2	
Pn81F	n.□□1□	Enables forward/reverse torque (force) limit using TLIM.
Pn002	n.□□□1	
Pn81F	n.□□1□	When P_CL of OPTION field is set to 1: Uses TLIM as positive torque (force) limit. When N_CL of OPTION field is set to 1: Uses TLIM as negative torque (force) limit.
Pn002	n.□□□3	

8.13.8 External Input Positioning (EX_POSING: 39H)

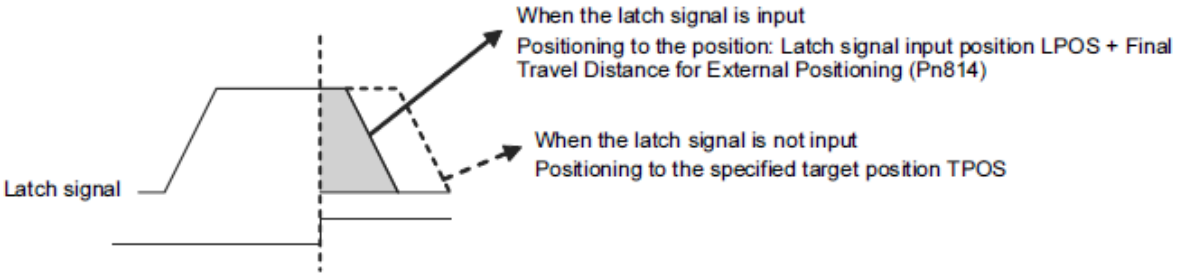
(1) EX_POSING Command (39H)

The EX_POSING command is used to start positioning to the target position (TPOS) at the target speed (TSPD). When a latch signal is input midway, positioning is performed according to the final travel distance for external positioning from the latch signal input position. When no latch signal is input, positioning is per- formed for the target position (TPOS).

<table>
<tr><th rowspan="2">Byte</th><th colspan="2">EX_POSING</th><th colspan="4" rowspan="2">Description</th></tr>
<tr><th>Command</th><th>Response</th></tr>
<tr><td>1</td><td>39H</td><td>39H</td><td>Phases in which the command can be executed</td><td>Phase 2 and 3</td><td>Synchronization classification</td><td>Asynchronous command</td></tr>
<tr><td>2</td><td>LT_SGNL</td><td>ALARM</td><td>Processing time</td><td>Within commu- nications cycle</td><td>Subcommand</td><td>Can be used</td></tr>
<tr><td>3</td><td rowspan="2">OPTION</td><td rowspan="2">STATUS</td><td colspan="4" rowspan="17">• Use LT_SGNL to select the latch signal.
For details on LT_SGNL, refer to 7.1.6 LT_SGNL Specifications.
When the latch signal is input, positioning is performed according to the final travel distance for external positioning specified in Pn814 from the latch signal input position. And, the latch signal input position is stored in the feedback latch position (LPOS) and is forcibly output to MONITOR2 for one communications cycle.
When no latch signal is input, positioning is performed for the specified target position (TPOS).
• OPTION field can be used.
• The target position (TPOS) is a signed 4-byte data, and the absolute position in reference coordinate system.
Set the target position (TPOS) so that the travel distance (TPOS - IPOS) is a value of 31 bits (24...) or less.
• The target speed (TSPD) is an unsigned 4-byte data.
Set a value in the range between 0 and the motor max. speed [reference unit/s].
• The target position and target speed can be changed during positioning executed by this command.
However, any change in the target position and/or target speed after the latch signal input will be invalid.
• The torque (force) limit (TLIM) can be used by setting Pn81F and Pn002.
- TLIM setting range: 0 to 4000H [maximum motor torque (force)/ 4000H]
If a value between 4000H and FFFFH is set, the maximum motor torque (force) will be applied as the limit.
Use the ADJ command to obtain the maximum motor torque (force).
• Use DEN (output complete) to confirm the completion of position reference output.
• When the command in execution is switched from this command to another command, latching will be cancelled and positioning will be performed for the specified target position (TPOS).
• A warning will occur and the command will not be executed in the following cases.
- This command is used when the servo is OFF: Command warning 1 (A.95A)
- The target speed (TSPD) exceeds the limit: Data setting warning 2 (A.94B)
- When using SigmaWin+ for motor operations such as JOG: Command warning 1 (A.95A)</td></tr>
<tr><td>4</td></tr>
<tr><td>5</td><td rowspan="4">TPOS</td><td rowspan="4">MONITOR1</td></tr>
<tr><td>6</td></tr>
<tr><td>7</td></tr>
<tr><td>8</td></tr>
<tr><td>9</td><td rowspan="4">TSPD</td><td rowspan="4">MONITOR2</td></tr>
<tr><td>10</td></tr>
<tr><td>11</td></tr>
<tr><td>12</td></tr>
<tr><td>13</td><td>SEL_MON1/2</td><td>SEL_MON1/2</td></tr>
<tr><td>14</td><td rowspan="2">TLIM</td><td rowspan="2">IO_MON</td></tr>
<tr><td>15</td></tr>
<tr><td>16</td><td>WDT</td><td>RWDT</td></tr>
<tr><td>17</td><td rowspan="13">Subcommand area</td><td rowspan="13">Subcommand area</td></tr>
<tr><td>18</td></tr>
<tr><td>19</td></tr>
<tr><td>20</td></tr>
<tr><td>21</td></tr>
<tr><td>22</td></tr>
<tr><td>23</td></tr>
<tr><td>24</td></tr>
<tr><td>25</td></tr>
<tr><td>26</td></tr>
<tr><td>27</td></tr>
<tr><td>28</td></tr>
<tr><td>29</td></tr>
</table>

(1) Operation

The operation executed by EX_POSING command is illustrated below.



(3) Related Parameters

The parameters related to the execution of EX_POSING command are listed below.
Parameter number in parentheses is when Pn833 = 1.

Parameter No.	Name	Parameter No.	Name
Pn80A (Pn834)	1st Linear Acceleration Constant	Pn80F (Pn83E)	Deceleration Constant Switching Speed
Pn80B (Pn836)	2nd Linear Acceleration Constant	Pn814	Final Travel Distance for External Positioning
Pn80C (Pn838)	Acceleration Constant Switching Speed	Pn820	Forward Latching Allowable Area
Pn80D (Pn83A)	1st Linear Deceleration Constant	Pn822	Reverse Latching Allowable Area
Pn80E (Pn83C)	2nd Linear Deceleration Constant	Pn81F	Position Control Command TLIM Function Allocation
–	–	Pn002	Torque (Force) Reference Option during Speed/ Position Control

Set the parameters as shown below to use TLIM.

Parameter No.	Set Value	Meaning
Pn81F	n.□□1□	Enables positive/negative torque (force) limit (TLIM).
Pn002	n.□□□1	
Pn81F	n.□□1□	When P_CL of OPTION field is set to 1: Uses TLIM as positive torque (force) limit. When N_CL of OPTION field is set to 1: Uses TLIM as negative torque (force) limit.
Pn002	n.□□□3	

8.13.9 Homing (ZRET: 3AH)

(1) ZRET Command (3AH)

The ZRET command is used to perform homing motion in the following sequence.

1. Accelerates to the target speed (TSPD) in the direction specified in Pn816 (Homing Direction).
2. Decelerates to the homing approach speed 1 (Pn817 or Pn842) at the DEC = 1.
3. Latch operation will start at the DEC = 0.
4. When a latch signal is input, positioning is performed to define the target position at the homing approach speed 2 (Pn818 or Pn844). The target position is calculated by adding the final travel distance for homing (Pn819). After the completion of positioning, the coordinate system is set so that the position reached is 0.

<table>
<tr><th rowspan="2">Byte</th><th colspan="2">ZRET</th><th colspan="4" rowspan="2">Description</th></tr>
<tr><th>Command</th><th>Response</th></tr>
<tr><td>1</td><td>3AH</td><td>3AH</td><td>Phases in which the command can be executed</td><td>Phase 2 and 3</td><td>Synchronization classification</td><td>Asynchronous command</td></tr>
<tr><td>2</td><td>LT_SGNL</td><td>ALARM</td><td>Processing time</td><td>Within communications cycle</td><td>Subcommand</td><td>Can be used</td></tr>
<tr><td>3</td><td rowspan="2">OPTION</td><td rowspan="2">STATUS</td><td colspan="4" rowspan="16">• Use LT_SGNL to select the latch signal.
For details on LT_SGNL, refer to 7.1.6 LT_SGNL Specifications.
When the latch signal is input, positioning is performed to define the target position at the homing approach speed 2 (Pn818). The target position is calculated by adding the homing final travel distance (Pn819).
The position data is recorded as the feedback latch position (LPOS) of the machine coordinate system, and the LPOS will forcibly be indicated as the MONITOR2 for one communications cycle.
When the latch signal is input, L_CMP of STATUS field is set to 1, and then reset to 0 at the completion of homing. Therefore, when the homing final travel distance is short, the duration L_CMP = 1 is too short so that the status L_CMP = 1 can not be confirmed.
• OPTION field can be used.
• Set the target speed (TSPD) to a value in the range between 0 and the motor max. speed [reference unit/s].
• The target speed during motion can be changed until DEC is input.
• The torque (force) limit (TLIM) can be used by setting Pn81F and Pn002.
- TLIM setting range: 0 to 4000H [maximum motor torque (force/ 4000H]
If a value between 4000H and FFFFH is set, the maximum motor torque will be applied as the limit.
Use the ADJ command to obtain the maximum motor torque (force).
• Use DEN (output complete) and ZPOINT (home position) to confirm the completion of position reference output.
• If any of the following commands is received during execution of ZRET command, homing motion will be interrupted.
DISCONNECT, SYNC_SET, CONFIG, HOLD, SV_OFF, INTERPOLATE, POSING, FEED, LATCH, EX_POSING, VELCTRL, TRQCTRL, SVCTRL
When a command other than the above commands is received, homing operation will continue.
• A warning will occur and the command will be ignored in the following cases.
- This command is used while the servo is OFF.: Command warning 1 (A.95A)
- The target speed (TSPD) exceeds the limit: Data setting warning 2 (A.94B)
- When using SigmaWin+ for motor operations such as JOG: Command warning 1 (A.95A)</td></tr>
<tr><td>4</td></tr>
<tr><td>5</td><td rowspan="4"></td><td rowspan="4">MONITOR1</td></tr>
<tr><td>6</td></tr>
<tr><td>7</td></tr>
<tr><td>8</td></tr>
<tr><td>9</td><td rowspan="4">TSPD</td><td rowspan="4">MONITOR2</td></tr>
<tr><td>10</td></tr>
<tr><td>11</td></tr>
<tr><td>12</td></tr>
<tr><td>13</td><td>SEL_MON1/2</td><td>SEL_MON1/2</td></tr>
<tr><td>14</td><td rowspan="2">TLIM</td><td rowspan="2">IO_MON</td></tr>
<tr><td>15</td></tr>
<tr><td>16</td><td>WDT</td><td>RWDT</td></tr>
<tr><td>17</td><td rowspan="13">Subcommand area</td><td rowspan="13">Subcommand area</td></tr>
<tr><td>18</td></tr>
<tr><td>19</td></tr>
<tr><td>20</td></tr>
<tr><td>21</td></tr>
<tr><td>22</td></tr>
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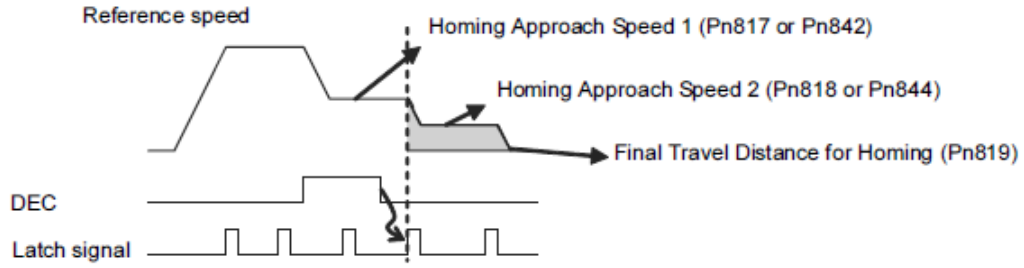
<tr><td>26</td></tr>
<tr><td>27</td></tr>
<tr><td>28</td></tr>
<tr><td>29</td></tr>
</table>

(2) Operation

The motion executed by ZRET command is illustrated below.



(3) Related Parameters

The parameters related to ZRET command are listed below.
Parameter number in parentheses is when Pn833 = 1.

Parameter No.	Name	Parameter No.	Name
Pn816	Homing Direction	Pn002	Torque (Force) Reference Option during Speed/Position Control
Pn817	Homing Approach Speed 1*1	Pn80A (Pn834)	1st Linear Acceleration Constant
Pn842		Pn80B (Pn836)	2nd Linear Acceleration Constant
Pn818	Homing Approach Speed 2*2	Pn80C (Pn838)	Acceleration Constant Switching Speed
Pn844		Pn80D (Pn83A)	1st Linear Deceleration Constant
Pn819	Final Travel Distance for Homing	Pn80E (Pn83C)	2nd Linear Deceleration Constant
Pn820	Forward Latching Allowable Area	Pn80F (Pn83E)	Deceleration Constant Switching Speed
Pn822	Reverse Latching Allowable Area	Pn81F	Position Control Command TLIM Function Allocation

∗1. The value of Pn842 is effective only when the value of Pn817 is 0.
∗2. The value of Pn844 is effective only when the value of Pn818 is 0.

Set the parameters as shown below to use TLIM.

Parameter No.	Set Value	Meaning
Pn81F	n.□□1□	Enables positive/negative torque (force) limit (TLIM).
Pn002	n.□□□1	
Pn81F	n.□□1□	When P_CL of OPTION field is set to 1: Uses TLIM as positive torque (force) limit. When N_CL of OPTION field is set to 1: Uses TLIM as negative torque (force) limit.
Pn002	n.□□□3	

8.13.10 Velocity Control (VELCTRL: 3CH)

(1) VELCTRL Command (3CH)

The VELCTRL command is used to control speed. (The Servo does not perform position control, but directly controls the speed of the speed loop.)

<table>
<tr><th rowspan="2">Byte</th><th colspan="2">VELCTRL</th><th colspan="4" rowspan="2">Description</th></tr>
<tr><th>Command</th><th>Response</th></tr>
<tr><td>1</td><td>3CH</td><td>3CH</td><td>Phases in which the command can be executed</td><td>Phase 2 and 3</td><td>Synchronization classification</td><td>Asynchronous command</td></tr>
<tr><td>2</td><td></td><td>ALARM</td><td>Processing time</td><td>Within communications cycle</td><td>Subcommand</td><td>Can be used</td></tr>
<tr><td>3</td><td rowspan="2">OPTION</td><td rowspan="2">STATUS</td><td colspan="4" rowspan="17">• OPTION field can be used.
• VREF is a speed reference and has a signed 4-byte data. The unit for speed reference is [maximum motor speed/40000000H]. The direction is specified by the sign.
• Soft-start function can be used. See (2)Soft Start Functionon the next page for details on soft-start.
• Either torque (force) limit (P_TLIM, N_TLIM) or torque (force) feed forward (TFF) can be used. Use Pn002 to select.
- TLIM setting range: 0 to 4000H [maximum motor torque (force)/ 4000H]
(If a value between 4000H to FFFFH is set, the maximum motor torque (force) will be applied as the limit.
Use the ADJ command to obtain the maximum motor torque (force).
- TFF setting range: A signed 2-byte data [maximum motor torque (force)/4000H]
• During execution of this command, the following bits for STATUS are allocated.
D8: ZSPD (zero speed bit)
0: Zero speed not detected
1: Zero speed detected
D7: V_CMP (speed coincidence bit)
0: Speed coincidence not detected
1: Speed coincidence detected
• Monitor (MONITOR 1, 2, 3, 4)
The units for TSPD, CSPD, and FSDP is [maximum motor speed / 40000000H].</td></tr>
<tr><td>4</td></tr>
<tr><td>5</td><td rowspan="2">P_TLIM /TFF</td><td rowspan="3">MONITOR1</td></tr>
<tr><td>6</td></tr>
<tr><td>7</td><td rowspan="2">N_TLIM</td></tr>
<tr><td>8</td></tr>
<tr><td>9</td><td rowspan="4">VREF</td><td rowspan="4">MONITOR2</td></tr>
<tr><td>10</td></tr>
<tr><td>11</td></tr>
<tr><td>12</td></tr>
<tr><td>13</td><td>SEL_MON1/2</td><td>SEL_MON1/2</td></tr>
<tr><td>14</td><td rowspan="2"></td><td rowspan="2">IO_MON</td></tr>
<tr><td>15</td></tr>
<tr><td>16</td><td>WDT</td><td>RWDT</td></tr>
<tr><td>17</td><td rowspan="13">Subcommand area</td><td rowspan="13">Subcommand area</td></tr>
<tr><td>18</td></tr>
<tr><td>19</td></tr>
<tr><td>20</td></tr>
<tr><td>21</td></tr>
<tr><td>22</td></tr>
<tr><td>23</td></tr>
<tr><td>24</td></tr>
<tr><td>25</td></tr>
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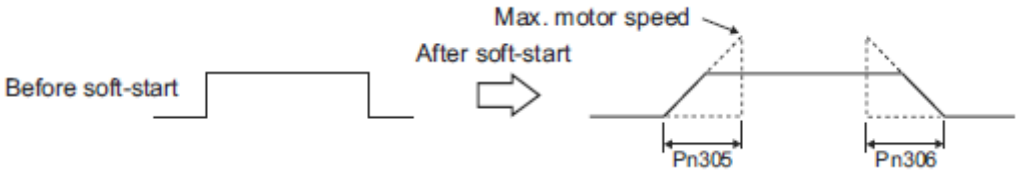
<tr><td>27</td></tr>
<tr><td>28</td></tr>
<tr><td>29</td></tr>
</table>

(2) Soft Start Function

The soft start function converts input speed references from sudden step progression to steady diagonal progression. Set the acceleration speed and deceleration speed in the following parameters.
Use this function to achieve a smooth speed control in speed control mode (including internal set speed selection).

Pn305	Soft Start Acceleration Time: Time of period the motor speed reaches the maximum from zero (the stop status)			
	Setting Range	Unit	Factory Setting	When Enabled
	0 to 10000	1 ms	0	Immediately
Pn306	Soft Start Deceleration Time: Time of period the motor speed decreases to zero (stop status) from the maximum.			
	Setting Range	Unit	Factory Setting	When Enabled
	0 to 10000	1 ms	0	Immediately



Note: For normal speed control, set Pn305 and Pn306 to 0 (factory setting).

(3) Torque (Force) Reference Option

The settings of the parameters related to the torque (force) reference option for VELCTRL command are listed below.

Parameter		Description
Pn002	n.□□□0	The set values of P_TLIM and N_TLIM are invalid. (factory setting)
	n.□□□1	Uses the set value of P_TLIM/N_TLIM as forward/reverse torque (force) limit.
	n.□□□2	Uses TFF as the torque (force) feed forward. Set N_TLIM to 0.
	n.□□□3	When P_CL of OPTION field is set to 1, uses P_TLIM as the torque (force) limit. When N_CL of OPTION field is set to 1, uses N_TLIM as the torque (force) limit.

8.13.11 Torque (Force) Control (TRQCTRL: 3DH)

(1) TRQCTRL (3DH)

The TRQCTRL command is used to control torque (force). (The Servo does not perform position control and speed control, but directly performs torque (force) control.)

<table>
<tr><th rowspan="2">Byte</th><th colspan="2">TRQCTRL</th><th colspan="4" rowspan="2">Description</th></tr>
<tr><th>Command</th><th>Response</th></tr>
<tr><td>1</td><td>3DH</td><td>3DH</td><td>Phases in which the command can be executed</td><td>Phase 2 and 3</td><td>Synchronization classification</td><td>Asynchronous command</td></tr>
<tr><td>2</td><td></td><td>ALARM</td><td>Processing time</td><td>Within communications cycle</td><td>Subcommand</td><td>Can be used</td></tr>
<tr><td>3</td><td rowspan="2">OPTION</td><td rowspan="2">STATUS</td><td colspan="4" rowspan="16">• OPTION field can be used.
• VLIM is a speed limit value and has an unsigned 4-byte data.
The unit for the speed limit is [maximum motor speed /40000000H].
(Set Pn002 to enable VLIM.)
Use the ADJ command to obtain the maximum motor speed.
• TQREF is a torque (force) reference and has a signed 4-byte data.
The unit for torque (force) reference is [maximum motor torque (force)/ 40000000H]. The direction is specified by the sign.
When the designation for TQREF exceeds the maximum motor torque (force), it is clamped at the maximum motor torque (force).
Use ADJ command to obtain the maximum motor torque (force).
• During execution of this command, the following bits of STATUS field are allocated.
D11: V_LIM (speed limit bit)
0: Speed limit not detected
1: Speed limit detected
• Monitor (MONITOR 1, 2, 3, 4)
The unit for TRQ is [maximum motor torque (force)/40000000H].</td></tr>
<tr><td>4</td></tr>
<tr><td>5</td><td rowspan="4">VLIM</td><td rowspan="4">MONITOR1</td></tr>
<tr><td>6</td></tr>
<tr><td>7</td></tr>
<tr><td>8</td></tr>
<tr><td>9</td><td rowspan="4">TQREF</td><td rowspan="4">MONITOR2</td></tr>
<tr><td>10</td></tr>
<tr><td>11</td></tr>
<tr><td>12</td></tr>
<tr><td>13</td><td>SEL_MON1/2</td><td>SEL_MON1/2</td></tr>
<tr><td>14</td><td rowspan="2"></td><td rowspan="2">IO_MON</td></tr>
<tr><td>15</td></tr>
<tr><td>16</td><td>WDT</td><td>RWDT</td></tr>
<tr><td>17</td><td rowspan="13">Subcommand area</td><td rowspan="13">Subcommand area</td></tr>
<tr><td>18</td></tr>
<tr><td>19</td></tr>
<tr><td>20</td></tr>
<tr><td>21</td></tr>
<tr><td>22</td></tr>
<tr><td>23</td></tr>
<tr><td>24</td></tr>
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<tr><td>26</td></tr>
<tr><td>27</td></tr>
<tr><td>28</td></tr>
<tr><td>29</td></tr>
</table>

(2) Speed Limit Option 1

- When Using a Rotational Servomotor

Use Pn407(Speed Limit during Torque Control) to set the speed limit.

Pn407	Speed Limit during Torque Control			
	Setting Range	Unit	Factory Setting	When Enabled
	0 to 10000	1 min^{-1}	10000	Immediately

Note: If a speed higher than the maximum speed of the connected servomotor is set, the servomotor speed will be limited to its maximum speed.

(3) Speed Limit Option 2

Set the following parameter to enable VLIM (Speed Limit) specified in TRQCTRL command.

Parameter		Description
Pn002	n.□□0□	Disables VLIM. (factory setting)
	n.□□1□	Enables VLIM (Uses VLIM as the speed limit.)

8.13.12 General-purpose Servo Control Command

The specifications of general-purpose servo control command are described below.

<table>
<tr><th rowspan="2">Byte</th><th colspan="2">SVCTRL</th><th colspan="4" rowspan="2">Description</th></tr>
<tr><th>Command</th><th>Response</th></tr>
<tr><td>1</td><td>3FH</td><td>3FH</td><td>Phases in which the command can be executed</td><td>Phase 2 and 3</td><td>Synchronization classification</td><td>Asynchronous command</td></tr>
<tr><td>2</td><td>SUBCTRL</td><td>ALARM</td><td>Processing time</td><td>Depends on processing</td><td>Subcommand</td><td>Can be used</td></tr>
<tr><td>3</td><td rowspan="2">OPTION</td><td rowspan="2">STATUS</td><td colspan="4" rowspan="16">• This command is compatible with MECHATROLINK versions before Ver 1.0. It is used to perform the general-purpose servo control.
• Latch Processing
Supported.
Select the latch signal using L_SGN in SUBCTRL and set SET_L to 1.
When the selected latch signal is input, L_CMP in STATUS field will become 1.
Perform latch processing again after setting SET_L to 0.
The latch signal cannot be changed while SET_L = 1.
• Motion
Any of the motions selected for Motion Selection is executed.
• Sequence Signals
Any of the sequence signals listed in the following table is input.</td></tr>
<tr><td>4</td></tr>
<tr><td>5</td><td rowspan="4">TOPS</td><td rowspan="4">MONITOR1</td></tr>
<tr><td>6</td></tr>
<tr><td>7</td></tr>
<tr><td>8</td></tr>
<tr><td>9</td><td rowspan="4">TSPD/
VFF</td><td rowspan="4">MONITOR2</td></tr>
<tr><td>10</td></tr>
<tr><td>11</td></tr>
<tr><td>12</td></tr>
<tr><td>13</td><td>SEL_MON1/2</td><td>SEL_MON1/2</td></tr>
<tr><td>14</td><td rowspan="2">SQ_CMD</td><td rowspan="2">IO_MON</td></tr>
<tr><td>15</td></tr>
<tr><td>16</td><td>WDT</td><td>RWDT</td></tr>
<tr><td>17</td><td rowspan="13">Subcommand area</td><td rowspan="13">Subcommand area</td></tr>
<tr><td>18</td></tr>
<tr><td>19</td></tr>
<tr><td>20</td></tr>
<tr><td>21</td></tr>
<tr><td>22</td></tr>
<tr><td>23</td></tr>
<tr><td>24</td></tr>
<tr><td>25</td></tr>
<tr><td>26</td></tr>
<tr><td>27</td></tr>
<tr><td>28</td></tr>
<tr><td>29</td></tr>
</table>

- Sub-control (SUBCTRL)

D7	D6	D5	D4	D3	D2	D1	D0
RESERVE 0	MOTION Select motion			RESERVE 0	SET_L Latch com-mand	L_SGN Select latch signal	

Select Motion (MOTION)

D6	D5	D4	Motion
0	0	0	HOLD
0	0	1	INTERPOLATE
0	1	0	FEED
0	1	1	POSING

- During phase 1, Command warning 1 (A.95A) will occur for POSING and FEED, and the command will be ignored.
- For INTERPOLATED, in all other phases except phase 3, Command warning 1 (A.95A) will occur and the command will be ignored.

Select Latch Signal (L_SGN)

D1	D0	Latch Signal	Meaning
0	0	Phase Z	Encoder zero-point signal
0	1	EXT1	External latch signal 1
1	0	EXT2	External latch signal 2
1	1	EXT3	External latch signal 2

- Sequence Signals: SQ_CMD

D7	D6	D5	D4	D3	D2	D1	D0
Reserved	Reserved	Reserved	Reserved	ACLR Alarm clear	SEN Sensor ON	BRK Brake ON	SON Servo ON

- Combination of SVCTRL (3F) and Subcommands

CODE	Main Command	Subcommand						
		NOP	PRM_WR	ALM_RD	PPRM_ WR	LTMOD_ ON	LTMOD_ OFF	SMON
3F	SVCTRL	√	√	√	√	×	√	√

Note: √: Can be combined, ×: Can not be combined

8.14 Command Related Parameters List

This chapter describes the following parameters related to command actions.

Classification	Parameter	Name	Description
Settings According to Machine	Pn20E, Pn210	Electronic Gear Ratio	Sets the unit of position data.
	Pn000	Direction Selection	Sets the servomotor rotation direction.
	Pn50A, Pn50B	Overtravel Signal Setting	Sets the overtravel function and software limit operation.
	Pn801	Software Limit Function Setting	
	Pn804, Pn806	Software Limit	
	Pn808	Absolute Encoder Origin Offset	Sets the origin when using an absolute encoder.
Motion Acceleration/ Deceleration Function Settings	Pn833	Motion Setting	Sets the acceleration/deceleration speed for POSING, EX_POSING, FEED, ZRET, HOLD commands
	Pn80A, Pn834	1st Linear Acceleration Constant	
	Pn80B, Pn836	2nd Linear Acceleration Constant	
	Pn80C, Pn838	Acceleration Constant Switching Speed	
	Pn80D, Pn83A	1st Linear Deceleration Constant	
	Pn80E, Pn83C	2nd Linear Deceleration Constant	
	Pn80F, Pn83E	Deceleration Constant Switching Speed	
	Pn827, Pn840	Linear Deceleration Constant for Stopping	Sets the deceleration speed for HOLD, SV_OFF commands.
	Pn829	SVOFF Waiting Time	
	Pn810	Exponential Function Acceleration/Deceleration Bias	Sets the position reference filter.
	Pn811	Exponential Function Acceleration/Deceleration Time Constant	
	Pn812	Movement Average Time	
Motion Sequence Setting	Pn814	Final Travel Distance for External Positioning	Sets the travel distance after the external signal is input for positioning.
	Pn816	Homing Mode Setting	Sets the homing operation.
	Pn817, Pn818, Pn842, Pn844	Homing Approach Speed	
	Pn819	Final Travel Distance for Homing	
Command Data Option Setting	Pn81F, Pn002	Torque (Force) Reference Options for Speed/Position Control	Sets the usage of torque (force) limit and torque (force) feed forward during position/ speed control.
	Pn002 Pn407, Pn480	Speed Limit during Torque (Force) Control	Sets the usage of speed limit during torque (force) control.
	Pn81F, Pn82A to Pn82E	OPTION Field Allocation	Selects function bits to be assigned in OPTION field.
Position Data Latch Function Setting	Pn820, Pn822	Latching Allowable Area	Sets the range to latch position data.
	Pn850	Latch Sequence Number	Sets continuous latch operation executed by LTMOD_ON command.
	Pn851	Continuous Latch Count	
	Pn852, Pn853	Latch Sequence Signal Selection	
Acceleration/ Deceleration Parameter High-speed Switching Function Setting	Pn900	Parameter Bank Number	Sets the acceleration/deceleration parameter high-speed switching function.
	Pn901	Parameter Bank Member Number	
	Pn902 to Pn910	Parameter Bank Member Definition	
	Pn920 to Pn95F	Parameter Bank Data	

Classification	Parameter	Name	Description
STATUS Field and Monitor Related Settings	Pn803	Origin Range	Sets the following monitoring items. • STATUS field signal status detection level • Input signal allocation to the D12 to D15 bits of I/O Monitor field • Data mapping to option monitors
	Pn522	Positioning Completed Width	
	Pn524	NEAR Signal Width	
	Pn502, Pn581	Rotation Detection Level	
	Pn503, Pn582	Speed Coincidence Signal Output Width	
	Pn81E	Input Signal Monitor Selection	
	Pn824, Pn825	Option Monitor Selection	

8.15 Command Related Parameters Details

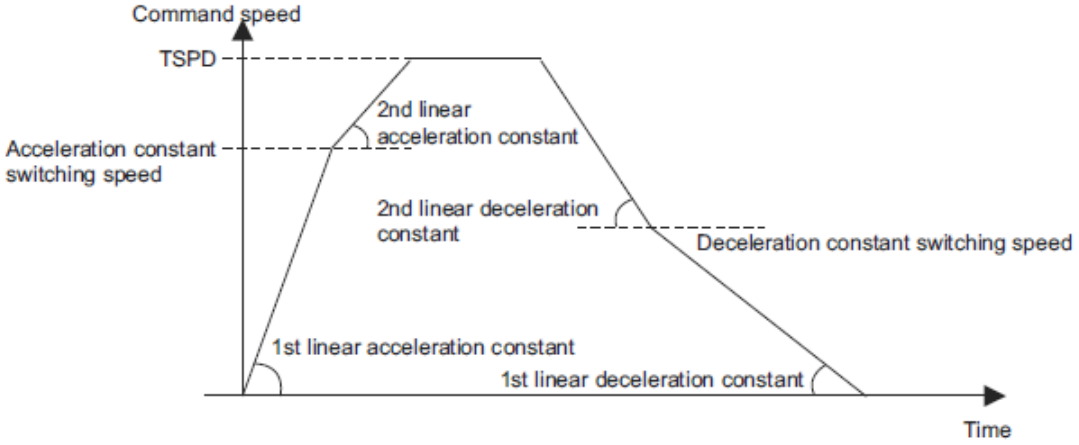
8.15.1 Motion Acceleration/Deceleration Function Setting

This section describes the parameters used to set the acceleration/deceleration function for motion commands for positioning.

(1) Linear Acceleration/Deceleration Function

Use the following parameters to set the acceleration/deceleration constants used to execute POSING, FEED, EX_POSING, ZRET, or HOLD commands.

The 1st digit of Pn833 is used to switch the parameters used for acceleration/deceleration: the parameters Pn80A to Pn80F and Pn827 or the parameters Pn834 to Pn840.



- Acceleration/Deceleration Constant Switching Setting

Parameter		Meaning	Factory Setting
Pn833	n.□□□0	Use parameters Pn80A to Pn80F and Pn827. (Parameters Pn834 to Pn840 are invalid.)	n.□□□0
	n.□□□1	Use parameters Pn834 to Pn840. (Parameters Pn80A to Pn80F and Pn827 are invalid.)	

Note: The setting will be validated by turning the power supply OFF and then ON again, or by executing the CONFIG command.

- Acceleration/Deceleration Parameters when Pn833=n.□□□0

Parameter No.	Name	Data Size (byte)	Setting Range	Unit	Factory Setting
Pn80A	1st Linear Acceleration Constant 1	2	1 to 65535	10000 reference units/s^2	100
Pn80B	2nd Linear Acceleration Constant 1	2	1 to 65535	10000 reference units/s^2	100
Pn80C	Acceleration Constant Switching Speed 1	2	0 to 65535	100 reference units/s	0
Pn80D	1st Linear Deceleration Constant 1	2	1 to 65535	10000 reference units/s^2	100
Pn80E	2nd Linear Deceleration Constant 1	2	1 to 65535	10000 reference units/s^2	100
Pn80F	Deceleration Constant Switching Speed 1	2	0 to 65535	100 reference units/s	0
Pn827	Linear Deceleration Constant 1 for Stopping	2	0 to 65535	10000 reference units/s^2	100

- Acceleration/Deceleration Parameters when Pn833=n.□□□1

Parameter No.	Name	Data Size (byte)	Setting Range	Unit	Factory Setting
Pn834	1st Linear Acceleration Constant 2	4	1 to 20971520	10000 reference units/s^2	100
Pn836	2nd Linear Acceleration Constant 2	4	1 to 20971520	10000 reference units/s^2	100
Pn838	Acceleration Constant Switching Speed 2	4	0 to 2097152000	Reference unit/s	0
Pn83A	1st Linear Deceleration Constant 2	4	1 to 20971520	10000 reference units/s^2	100
Pn83C	2nd Linear Deceleration Constant 2	4	1 to 20971520	10000 reference units/s^2	100
Pn83E	Deceleration Constant Switching Speed 2	4	0 to 2097152000	Reference unit/s	0
Pn840	Linear Deceleration Constant 2 for Stopping	4	0 to 20971520	10000 reference units/s^2	100

Note: If the deceleration distance exceeds 1073741823 reference units during positioning, the motor cannot be accelerated to the target speed TSPD specified in the motion command. Set the parameter for deceleration speed to a value that satisfies the following equation.

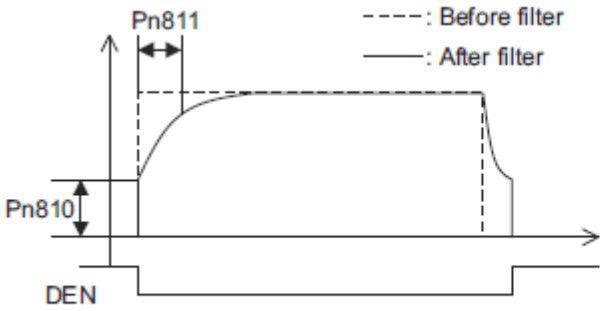
Deceleration speed [reference unit/s^2] ≥ Max. command speed^2 [reference unit/s] / (Max. deceleration distance [reference unit] × 2)

(2) Position Reference Filter

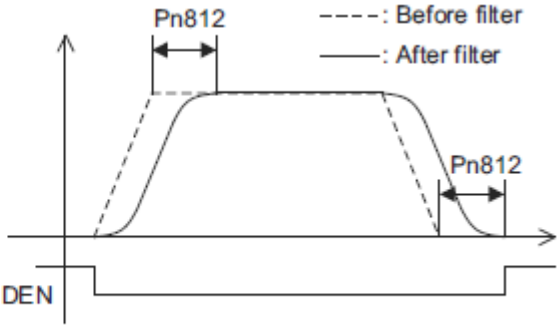
A filter can be applied to the position reference output of a positioning command such as INTERPOLATE, LATCH, POSING, FEED, EX_POSINT, ZRET, and HOLD.

- Position Reference Filter Setting Parameters

Parameter No.	Name	Data Size (byte)	Setting Range	Unit	Factory Setting
Pn810	Exponential Function Acceleration/Deceleration Bias	2	0 to 65535	100 reference units/s	0
Pn811	Exponential Function Acceleration/Deceleration Time Constant	2	0 to 5100	0.1 ms	0
Pn812	Movement Average Time	2	0 to 5100	0.1 ms	0



Exponential Function Acceleration/Deceleration Curve



Movement Average Time Curve

- Position Reference Filter Type Selection

Use the ACCFIL bit of the OPTION field to specify the position reference filter type.

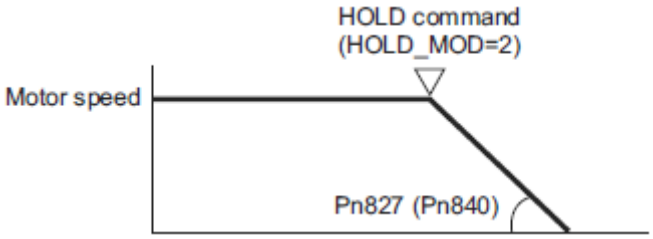
ACCFIL	Meaning
0	Without position reference filter
1	Exponential function acceleration/deceleration position reference filter
2	Movement average time position reference filter

Information: While a position reference is being output (STATUS.DEN = 0), the parameter or the filter type cannot be changed. Wait for completion of the position reference output (STATUS.DEN = 1) to change the setting.

(3) Linear Deceleration Speed Setting for Commands to Stop a Motor

Set the deceleration speed when using either of the following commands to stop a motor.
HOLD (When HOLD_MOD = 2)
SV_OFF (When Pn829 ≠ 0)

- Setting for Deceleration to a Stop by Executing HOLD Command (HOLD_MOD = 2)

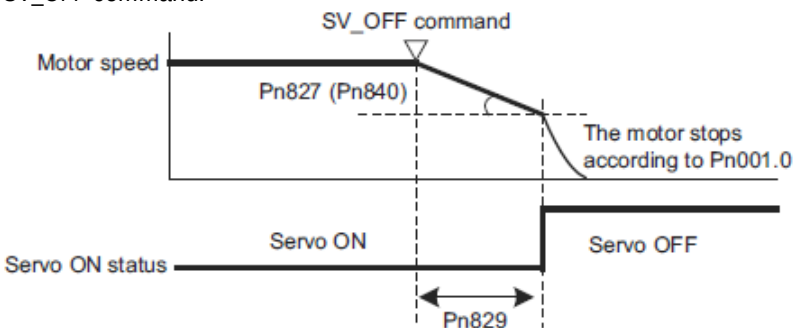


The parameter number in parentheses is when Pn833 = 1.

Parameter No.	Name	Data Size (byte)	Setting Range	Unit	Factory Setting
Pn827	Linear Deceleration Constant 1 for Stopping	2	0 to 65535	10000 reference units/s^2	100
Pn840	Linear Deceleration Constant 2 for Stopping	4	0 to 20971520	10000 reference units/s^2	100

- Setting for Deceleration to a Stop by Executing SV_OFF Command

When SV_OFF command is executed while a motor is running, the servo can be turned OFF after deceleration to a stop.
When Pn829 is set to 0 (factory setting), the servo will turn OFF immediately upon reception of the SV_OFF command.



The parameter number in parentheses is when Pn833 = 1.

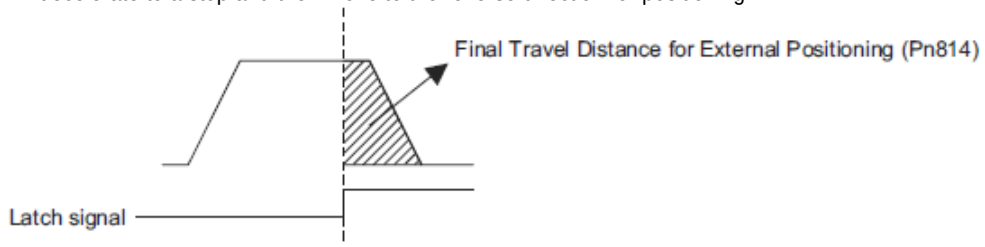
Parameter No.	Name	Data Size (byte)	Setting Range	Unit	Factory Setting
Pn827	Linear Deceleration Constant 1 for Stopping	2	0 to 65535	10000 reference units/s^2	100
Pn829	SVOFF Waiting Time (SVOFF at deceleration to stop)	2	0 to 65535	10 ms	0
Pn840	Linear Deceleration Constant 2 for Stopping	4	0 to 20971520	10000 reference units/s^2	100

8.15.2 Motion Sequence Setting

This section describes parameters related to the actions of EX_POSING and ZRET commands.

(1) Settings for EX_POSING Command

Set the travel distance from the external signal input position to the final target position for execution of an EX_POSING command. If a negative value (distance to the negative direction) or a small value is set, the axis will decelerate to a stop and then move to the reverse direction for positioning.

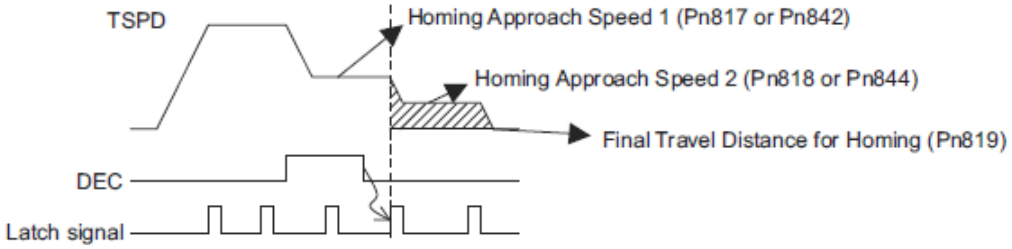


Parameter No.	Name	Data Size (byte)	Setting Range	Unit	Factory Setting
Pn814	Final Travel Distance for External Positioning	4	–1073741823 to 1073741823	Reference unit	100

(2) Settings for ZRET Command

This section describes the parameters to set the following items for ZRET command.

- Pn816: Homing direction selection
- Pn817 or Pn842: Approach speed after the origin limit signal is input (DEC signal turns ON)
- Pn818 or Pn844: Approach (creep) speed after the latch signal is input
- Pn819: Final travel distance from the latch signal input position to the origin



Parameter		Meaning	Factory Setting
Pn816	n.□□□0	Forward direction homing	n.□□□0
	n.□□□1	Reverse direction homing	

Parameter No.	Name	Data Size (byte)	Setting Range	Unit	Factory Setting
Pn817	Homing Approach Speed 1*1	2	0 to 65535	100 reference units/s	50
Pn842		4	0 to 20971520		0
Pn818	Homing Approach Speed 2*2	2	0 to 65535	100 reference units/s	5
Pn844		4	0 to 20971520		0
Pn819	Final Travel Distance for Homing	4	–1073741823 to 1073741823	Reference unit	100

∗1. The value of Pn842 is effective only when the value of Pn817 is 0.

∗2. The value of Pn844 is effective only when the value of Pn818 is 0.

Information: Set Pn819 (Final Travel Distance for Homing) to a value that satisfies the following equation.

When Pn816=n.□□□0: Origin = Latch signal input position + Pn819

When Pn816=n.□□□1: Origin = Latch signal input position – Pn819

8.15.3 Command Data Options

(1)Torque (Force) Limiting Function

The torque (force) limiting function limits the output torque (force) to protect the connected machine, etc. There are three ways to limit the output torque (force).

1. Internal torque (force) limit
2. External torque (force) limit using P_CL/N_CL signal of OPTION field
3. Torque (force) limit by position/speed control command

Note: If all of the above three methods are used, the smallest torque (force) limit will be applied.

- Internal Torque (Force) Limit

This method always limits the maximum output torque (force) to the set values of the following parameters.

Parameter No.	Name	Data Size (byte)	Setting Range	Unit	Factory Setting
Pn402	Forward Torque Limit (For rotational servomotors)	2	0 to 800	%	800
Pn403	Reverse Torque Limit (For rotational servomotors)	2	0 to 800	%	800
Pn483	Forward Force Limit (For linear servomotors)	2	0 to 800	%	30
Pn484	Reverse Force Limit (For linear servomotors)	2	0 to 800	%	30

Note: Set the limit value in percentage (%) of the motor rated torque (force).

- External Torque (Force) Limit Using P_CL/N_CL Signal of OPTION Field

This method uses the P_CL/N_CL signal of the OPTION field to limit the output torque (force) to the set values of the following parameters.

Parameter No.	Name	Data Size (byte)	Setting Range	Unit	Factory Setting
Pn404	Forward External Torque (Force) Limit	2	0 to 800	%	100
Pn405	Reverse External Torque (Force) Limit	2	0 to 800	%	100

Note: Set the limit value in percentage (%) of the motor rated torque (force).

-Torque (Force) Limit By Position/Speed Control Command

This methods limits the output torque (force) by setting a desired limit value in the command data (TLIM/P_TLIM/N_TLIM).

[Torque (Force) Limiting Function Settable Commands]
INTERPOLATE, LATCH, FEED, EX_POSING, ZRET, and VELCTRL

[Setting Parameters]

Set the following parameters to apply a torque (force) limit from a position/speed control command.

Pn81F	Position Control Command TFF/TLIM Function Allocation	
	n.□□1□	Enables allocation (Set TFF/TLIM operation using Pn002.)
Pn002	Torque (force) Reference Option During Speed/Position Control	
	n.□□□1	Enables positive/negative torque (force) limit by *TLIM.
	n.□□□3	Uses TLIM/P_TLIM as positive torque (force) limit when OPTION.P_CL=1. Uses TLIM/N_TLIM as negative torque (force) limit when OPTION.N_CL=1.

Note 1. When using a torque (force) limit set in a position control command, set Pn81F and Pn002 as follows: Pn81F = n.□□1□, and Pn002 = n.□□□1 or n.□□□3
If Pn81F = n.□□0□, the torque (force) limit set in the position control command will not applied.

2. When using a torque (force) limit set in a speed control command, set Pn002 as follows.
Pn002 = n.□□□1 or n.□□□3

3. When a command other than the commands listed in [Torque (Force) Limiting Function Settable Commands], the torque (force) limit of the previously executed TLIM/P_TILM/N_TLIM remains valid. During execution of HOLD, SV_OFF, SVCTRL, or TRQCTRL command, the torque (force) limit specified by TLIM/P_TRIM/ N_TLIM is invalid.

(2)Torque (Force) Feed Forward Function

This function is used to apply a torque (force) feedforward (TFF) from a position/speed control command to shorten positioning time. The PC or PLC...etc differentiates a position reference to generate a torque (force) feedforward reference.

[Torque (Force) Feed Forward Reference Settable Commands]

INTERPOLATE, LATCH, and VELCTRL

[Setting Parameters]

Set the following parameters to use TFF as the torque (force) feed forward.

Pn81F	Position Control Command TFF/TLIM Function Allocation	
	n.□□1□	Enables allocation (Set TFF/TLIM operation using Pn002.)
Pn002	Torque (force) Reference Option During Speed/Position Control	
	n.□□□2	Enables the torque (force) feed forward by TFF.

Note 1. To use the torque (force) feed forward in a position control command, set the parameters as follows.
Pn81F = n.□□1□ and Pn002 = n.□□□2
If Pn81F = n.□□0□, the torque (force) feed forward by a position control command is disabled.

2. To use the torque (force) feed forward in a speed control command, set the parameter as follows.
Pn002 = n.□□□2

(3) Speed Limiting Function During Torque (Force) Control

This function limits the servomotor speed during torque (force) control to protect the connected machine, etc. There are two ways to control the speed during torque control:

1. Internal speed limit
2. Speed limit by the torque (force) control command TRQCTRL

Note: If both of the above methods are used, the smaller speed limit will be applied.

- Internal Speed Limit

This method always limits the servomotor speed to either of the following set parameter values.

Parameter No.	Name	Data Size (byte)	Setting Range	Unit	Factory Setting
Pn407	Speed Limit during Toque Control (For rotational servomotors)	2	0 to 10000	min^{-1}	10000
Pn480	Speed Limit during Force Control (For linear servomotors)	2	0 to 10000	mm/s	10000

- Speed Limit by Torque (Force) Control Command TRQCTRL

This method limits the speed by setting a desired speed limit value in the command data (VLIM).

[Setting Parameter]

Set the following parameter to use the speed limit set in TRQCTRL command.

Pn002	Torque (Force) Reference Option	
	n.□□0□	Disables the speed limit set in the VLIM. (Factory setting)
	n.□□1□	Enables the speed limit set in the VLIM.

(4) OPTION Field Allocation

The commands can be allocated to the OPTION field using the following parameters. To change the factory setting, set Pn81F = □□□1 and allocate the function bits using parameters Pn82A to Pn82E. The setting will be validated by turning the power supply OFF and then ON again, or by executing CONFIG.

[Setting Parameters]

Parameter No.	Digit		Name	Setting Range	Factory Setting
Pn81F			Command Data Allocation	0000h to 0011h	0000h
	0		OPTION Field Allocation	0 or 1	0
		0	Disables OPTION field allocation.		
		1	Enables OPTION field allocation.		
Pn82A			OPTION Field Allocation 1	0000H to 1E1EH	1813H
	0	0 to E	ACCFIL bit position		3
	1	0	Disables ACCFIL bit allocation.		1
		1	Enables ACCFIL bit allocation.		
	2	0 to E	GSEL bit position		8
	3	0	Disables GSEL bit allocation.		1
		1	Enables GSEL bit allocation.		
Pn82B			OPTION Field Allocation 2	0000H to 1F1FH	1D1CH
	0	0 to F	V_PPI bit position		C
	1	0	Disables V_PPI bit allocation		1
		1	Enables V_PPI bit allocation.		
	2	0 to F	P_PI_CLR bit position		D
	3	0	Disables P_PI_CLR bit allocation.		1
		1	Enables P_PI_CLR bit allocation.		
Pn82C			OPTION Field Allocation 3	0000H to 1F1FH	1F1EH
	0	0 to F	P_CL bit position		E
	1	0	Disables P_CL bit allocation.		1
		1	Enables P_CL bit allocation.		
	2	0 to F	N_CL bit position		F
	3	0	Disables N_CL bit allocation.		1
		1	Enables N_CL bit allocation.		

Parameter No.	Digit		Name	Setting Range	Factory Setting
Pn82D		OPTION Field Allocation 4		0000H to 1F1CH	0000H
	0	0 to C	BANK_SEL1 bit position		0
	1	0	Disables BANK_SEL1 bit allocation.		0
		1	Enables BANK_SEL1 bit allocation.		
	2	0 to F	LT_DISABLE bit position		0
	3	0	Disables LT_DISABLE bit allocation.		0
		1	Enables LT_DISABLE bit allocation.		
Pn82E		OPTION Field Allocation 5		0000H to 1D1FH	0000H
	0	0 to F	Reserved		0
	1	0	Reserved		0
		1	Reserved		
	2	0 to D	OUT_SIGNAL bit position		0
	3	0	Disables OUT_SIGNAL bit allocation.		0
		1	Enables OUT_SIGNAL bit allocation.		

Note: 1. Do not allocate more than one signal to one bit. If more than one signal is allocated to one bit, the bit will control more than one signal.
2. An unallocated function bit acts as if it is set to 0.
3. Set the bit to the least significant bit position to be allocated.
4. To enable the OUT_SIGNAL function, set the following parameters to ZERO: Pn50E, Pn50F, and Pn510.

8.15.4 Position Data Latch Function Setting

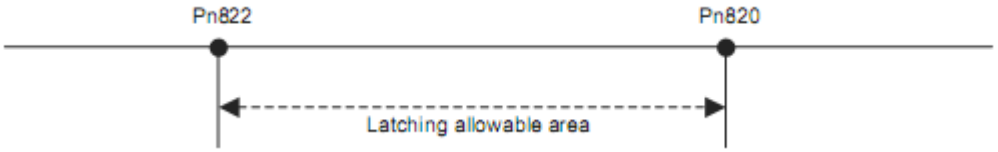
This section describes the parameters for setting the position data latch function.

(1) Latching Allowable Area

Use the following parameters to set the range to input the latch signal for position data latching by LTMOD_ON, LATCH, EX_POSING, or ZRET command. If the latch signal is input out of the set range, position data will not be latched.

Parameter No.	Name	Data Size (byte)	Setting Range	Unit	Factory Setting
Pn820	Forward Latching Allowable Area	4	–2147483648 to 2147483647	Reference unit	0
Pn822	Reverse Latching Allowable Area	4	–2147483648 to 2147483647	Reference unit	0

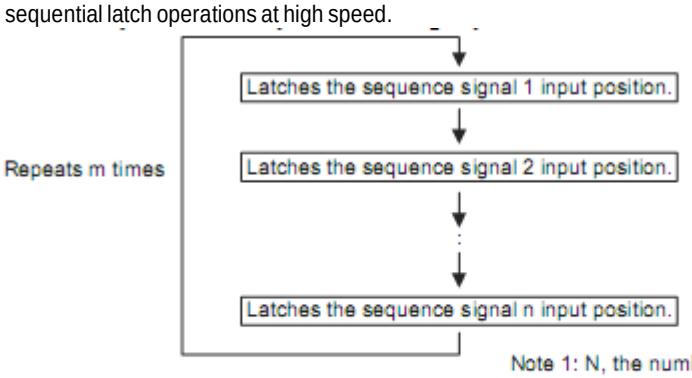
- When Pn820 > Pn822



- When Pn820 ≤ Pn822

(2) Continuous Latch Function

This function sequentially latches the input positions of sequence signal 1 to sequence signal n (n = 1 to 8) for a specified number of times. The continuous latch operation can be aborted by executing the LTMOD_OFF command. This function can shorten the time between latch completion and the start of the next latch, and enables sequential latch operations at high speed.



Note 1: N, the number of sequence signals, is specified by Pn850.
2: The signals for sequence signal n are selected by Pn852 and Pn853.
3: The number of times of continuous latching m is set by Pn851.

[How to Start and Stop Continuous Latch Operation]

Set the following parameters, and then set LT_MOD to 1 to execute the LTMOD_ON command. The continuous latch operation will start. To abort the operation, execute the LTMOD_OFF command.

Pn850: Latch Sequence Number n
Pn851: Continuous Latch Count m (When m = 0, the continuous latch operation will be infinitely repeated.)
Pn852: Latch Sequence Signal 1 to 4 Setting
Pn853: Larch Sequence Signal 5 to 8 Setting

Note: If the LTMOD_ON command is executed by setting Pn850 to 0 and LT_MOD to 1, the latch mode error warning (A.94E) will occur and the latch operation will not start.

[Latch Status]

Latch completion can be confirmed by the following status.

[STATUS Field: The 3rd and 4th byte]

L_CMP (D10): L_CMP is set to 1 for one communications cycle every time the external signal is input.

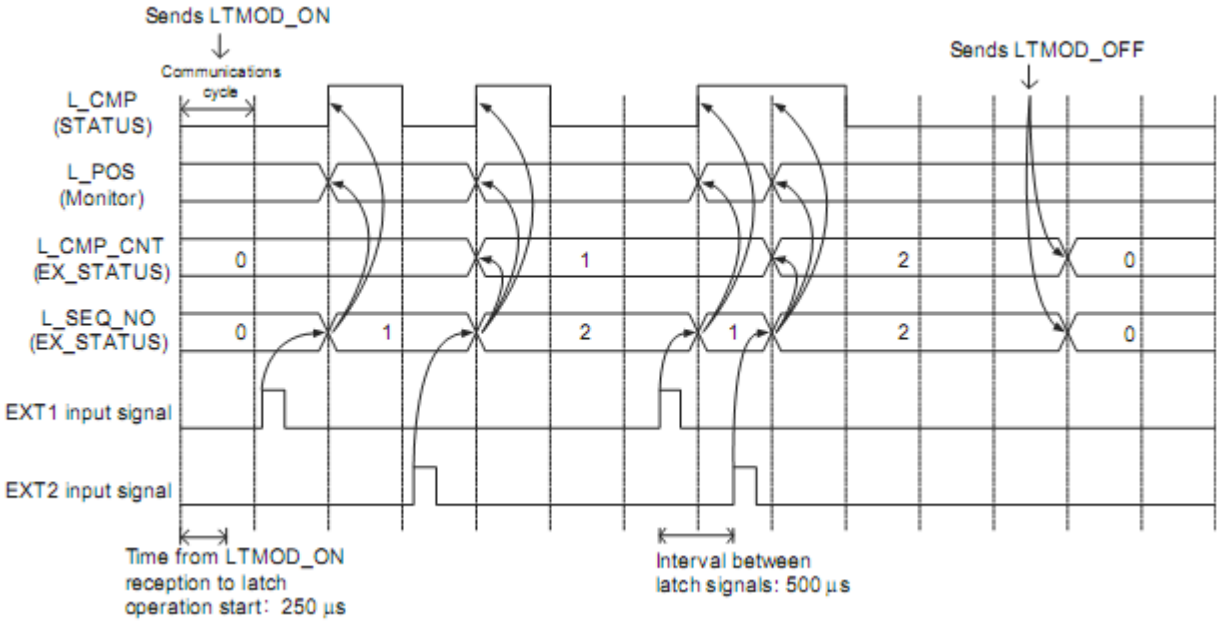
[EX_STATUS Field: The 28th and 29th byte]

L_SEQ_NO (D8-D11): The latch sequence signal number (value n) at latch completion
L_CMP_CNT (D0-D7): The continuous latch count (value m)
(Added at completion of position latch when the latch sequence signal n is input.)

Note: LPOS is forcibly output to MONITOR 2 for one communications cycle while L_CMP = 1 every time the external signal is input.

[Operation Example]

An example of a continuous latch operation using two latch sequence signals EXT1 and EXT2 is illustrated below. (The parameters are set as follows: Pn850 = 2, Pn851 = 2 or more, Pn852 = 0021H, Pn853 = any)



[Setting Parameters]

Parameter No.	Digit	Name			Data Size (byte)	Setting Range	Unit	Factory Setting
Pn850		Latch Sequence Number			2	0 to 8	–	0
Pn851		Continuous Latch Count			2	0 to 255	–	0
Pn852		Latch Sequence Signal 1 to 4 Setting			2	0000H to 3333H	–	0000H
	0	Latch sequence 1 signal selection	0	Phase Z	–	0 to 3	–	0
			1	EXT1 signal				
			2	EXT2 signal				
			3	EXT3 signal				
	1	Latch sequence 2 signal selection	0	Phase Z	–	0 to 3	–	0
			1	EXT1 signal				
			2	EXT2 signal				
			3	EXT3 signal				
	2	Latch sequence 3 signal selection	0	Phase Z	–	0 to 3	–	0
			1	EXT1 signal				
			2	EXT2 signal				
			3	EXT3 signal				
	3	Latch sequence 4 signal selection	0	Phase Z	–	0 to 3	–	0
			1	EXT1 signal				
			2	EXT2 signal				
			3	EXT3 signal				
Pn853		Latch Sequence Signal 5 to 8 Setting			2	0000H to 3333H	–	0000H
	0	Latch sequence 5 signal selection	0	Phase Z	–	0 to 3	–	0
			1	EXT1 signal				
			2	EXT2 signal				
			3	EXT3 signal				
	1	Latch sequence 6 signal selection	0	Phase Z	–	0 to 3	–	0
			1	EXT1 signal				
			2	EXT2 signal				
			3	EXT3 signal				
	2	Latch sequence 7 signal selection	0	Phase Z	–	0 to 3	–	0
			1	EXT1 signal				
			2	EXT2 signal				
			3	EXT3 signal				
	3	Latch sequence 8 signal selection	0	Phase Z	–	0 to 3	–	0
			1	EXT1 signal				
			2	EXT2 signal				
			3	EXT3 signal				

[Application Notes]

1. The minimum interval between latch signals is 500 µs. An interval between latch signals that is longer than the communications cycle is required to continuously obtain latched position data.
2. If two latch signals are input without allowing the minimum required interval, only the first latch signal input position will be latched. The second latch signal will be ignored.
3. Use a subcommand to monitor completion status of continuous latch count, etc.
4. The parameters Pn850 to Pn853 can be changed only while the continuous latch operation is stopped.

8.15.5 Acceleration/Deceleration Parameter High-speed Switching Function

This function switches, at high-speed, the acceleration/deceleration parameters that are used for positioning executed by the POSING, FEED, EX_POSING, ZRET, or HOLD commands.

Register the acceleration/deceleration parameter settings in a bank before starting operation, and execute the bank selector BANK_SEL to switch the acceleration/deceleration parameter settings to those of the registered bank.

[Bank Selector Allocation]

Allocate the following bank selector BANK_SEL1 in the OPTION field. (The allocation is disabled by default. Refer to (5) OPTION Field Specifications of chapter 7 Data Field for details on bit allocation methods.)

Name	Description	Setting Data
BANK_SEL1	Bank selector	Bank 0 to 15

[Parameter Bank Setting]

Set the following parameters.

Parameter No.	Name	Data Size (byte)	Setting Range	Factory Setting
Pn900	Parameter Bank Number	2	0 to 16	0
Pn901	Parameter Bank Member Number	2	0 to 15	0
Pn902 to Pn910	Parameter Bank Member Definition	2	0000H to 08FFH	0
Pn920 to Pn95F *	Parameter Bank Data	2	0000H to FFFFH Depends on bank member.	0

* The parameters Pn920 to Pn95F will not be stored in the non-volatile memory. They need to be set every time the power is turned ON.

[Parameters that Can be Registered as Bank Members]

The following parameters can be registered as parameter bank members among parameters Pn902 to Pn910. For 4-byte parameters, one parameter must be registered as two consecutive members.
(See Setting Example 2.)

Parameter No.	Name	Data Size (byte)	Setting Range	Unit	Factory Setting
Pn80A	1st Linear Acceleration Constant 1	2	1 to 65535	10000 reference units/s^2	100
Pn80B	2nd Linear Acceleration Constant 1	2	1 to 65535	10000 reference units/s^2	100
Pn80C	Acceleration Constant Switching Speed 1	2	0 to 65535	100 reference units/s	0
Pn80D	1st Linear Deceleration Constant 1	2	1 to 65535	10000 reference units/s^2	100
Pn80E	2nd Linear Deceleration Constant 1	2	1 to 65535	10000 reference units/s^2	100
Pn80F	Deceleration Constant Switching Speed 1	2	0 to 65535	100 reference units/s	0
Pn834	1st Linear Acceleration Constant 2	4	1 to 20971520	10000 reference units/s^2	100
Pn836	2nd Linear Acceleration Constant 2	4	1 to 20971520	10000 reference units/s^2	100
Pn838	Acceleration Constant Switching Speed 2	4	0 to 2097152000	Reference unit/s	0

Parameter No.	Name	Data Size (byte)	Setting Range	Unit	Factory Setting
Pn83A	1st Linear Deceleration Constant 2	4	1 to 20971520	10000 reference units/s^2	100
Pn83C	2nd Linear Deceleration Constant 2	4	1 to 20971520	10000 reference units/s^2	100
Pn83E	Deceleration Constant Switching Speed 2	4	0 to 2097152000	Reference unit/s	0
Pn810	Exponential Function Acceleration/Deceleration Bias	2	0 to 65535	100 reference units/s	0
Pn811	Exponential Function Acceleration/Deceleration Time Constant	2	0 to 5100	0.1 ms	0
Pn812	Movement Average Time	2	0 to 5100	0.1 ms	0

[Setting Procedure]

STEP 1:

1. Set Pn900 (Parameter Bank Number) to m.
2. Set Pn901 (Parameter Bank Member Number) to n.
   Set Pn900 and Pn901 so that Pn900 × Pn901 ≤ 64.
3. Register bank member parameter numbers using parameters Pn902 to Pn910.
4. To enable the bank function, execute the CONFIG command or turn the power supply OFF and then ON again.

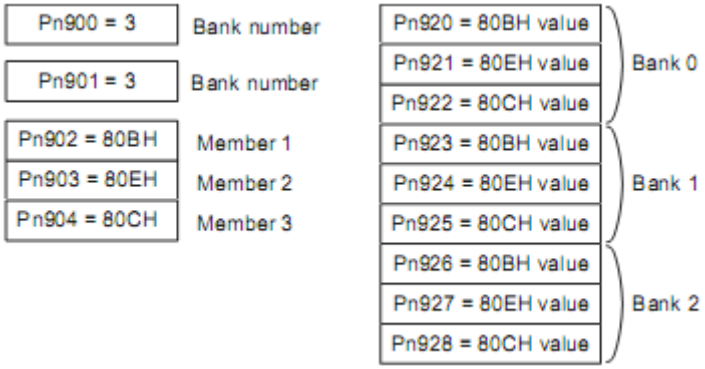
STEP 2:

5. Set the data of each bank in the parameter bank data area from the leading parameter Pn920 in order as shown below.

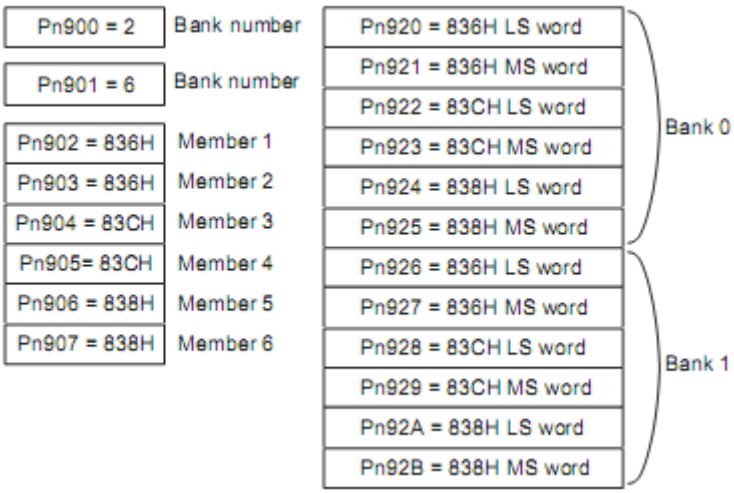
Bank 0: Pn920 to Pn (920+n-1)
Bank 1: Pn (920+n) to Pn (920+2n-1)
…
Bank m-1: Pn {920+(m-1)×n} to Pn (920+m×n-1)

Note: 1. If parameters Pn900 to Pn910 set in STEP 1.1, 1.2, and 1.3 are saved in the non-volatile memory, carry out STEP2.5 only after power up.
However, if you turn the power supply OFF and then ON again after saving parameters Pn900 to Pn910 in the non-volatile memory, and start the operation without setting parameters Pn920 to Pn95F, the operation will be carried out under the condition that all bank data is set to 0 (zero) or the minimum setting.
2. If parameters Pn900 to Pn910 set in STEP 1.1, 1.2, and 1.3 are not saved in the non-volatile memory, carry out STEP 1.1 to 2.5 each time the power supply is turned ON.

Setting Example 1: Switching three banks of members Pn80B, Pn80E, and Pn80C



Setting Example 2: Switching two banks of members Pn836, Pn83C, and Pn838



[Application Notes]

1. If Pn900 (Parameter Bank Number) or Pn901 (Parameter Bank Member Number) is set to 0, the bank function will be disabled.
2. If one parameter is registered for more than one bank member definition, the bank data of the biggest bank member definition parameter number will be applied.
3. If the bank selector BANK_SEL is not allocated to the function bit of the OPTION field, the data of Bank 0 will be always applied.
4. The acceleration/deceleration parameter high-speed switching function is enabled only while DEN = 1 (Distribution Completed). The parameters will not switch while DEN = 0 (Distributing).
5. In the following cases, error A.04A (parameter setting error 2) will occur when the power supply is turned ON or CONFIG command is executed.
   • One 4-byte parameter is not registered for two bank members.
   • The total number of bank data entries exceeds 64 (Pn900 × Pn901 > 64).
6. If a parameter that is not allowed to be a bank member is registered, the bank data of the parameter-registered member will become invalid.
7. Bank data that exceeds the setting range of the registered bank member parameter will be clamped to a value within the setting range.
8. If a bank number larger than the bank number set in Pn900 is specified (BANK_SEL1≥Pn900), the parameter bank will not switch and the currently active bank will be used.
9. Parameters Pn920 to Pn95F will not be saved in the non-volatile memory. Therefore, they must be set each time the power supply is turned ON.

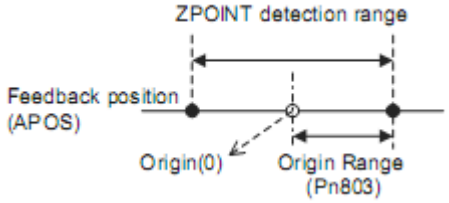
8.15.6 STATUS Field and Monitor Related Settings

(1) STATUS Field Status Detection Level Setting

This section describes the parameters for setting the status detection levels for the STATUS field data.

- Origin (ZPOINT) Range Setting

Set the ZPOINT signal status detection range.



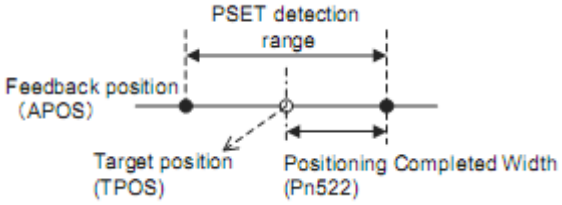
Parameter No.	Name	Data Size (byte)	Setting Range	Unit	Factory Setting
Pn803	Origin Range	2	0 to 250	Reference unit	10

Note: ZPOINT detection will be performed only after completion of the following operations. Otherwise, it will not be performed.

- When an incremental encoder is connected
  - Homing operation by ZRET command is completed.
  - The coordinate setting is completed after reference point setting (REFE = 1) by executing POS_SET command.
- When an absolute encoder is connected
  - Execution of SENS_ON command is completed.

- Positioning Completed (PSET) Width Setting

Set the PSET signal status detection range.

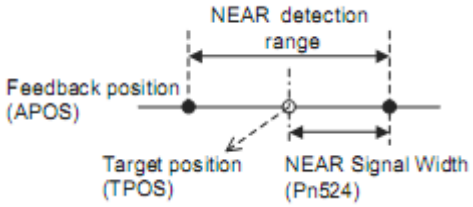


Parameter No.	Name	Data Size (byte)	Setting Range	Unit	Factory Setting
Pn522	Positioning Completed Width	4	0 to 1073741824	Reference unit	7

Note: PSET = 1 when output is completed (DEN = 1) and the feedback position (APOS) is within the positioning completed (PSET) detection range.

- NEAR Signal Width Setting

Set the NEAR signal status detection range.



Parameter No.	Name	Data Size (byte)	Setting Range	Unit	Factory Setting
Pn524	NEAR Signal Width	4	0 to 1073741824	Reference unit	7

Note: NEAR = 1 when the feedback position (APOS) is within the NEAR signal detection range.

- Zero-speed (ZSPD) Detection Level Setting

Set the ZSPD signal status detection level during speed control (VELCTRL command).

Parameter No.	Name	Data Size (byte)	Setting Range	Unit	Factory Setting
Pn502	Rotation Detection Level (For rotational servomotors)	2	1 to 10000	min^{-1}	20
Pn581	Travel Detection Level (For linear servomotors)	2	1 to 5000	mm/s	20

- Speed Coincidence (VCMP) Detection Level Setting

Set the VCMP signal status detection level during speed control (VELCTRL command).

Parameter No.	Name	Data Size (byte)	Setting Range	Unit	Factory Setting
Pn503	Speed Coincidence Signal Output Width (For rotational servomotors)	2	0 to 100	min^{-1}	10
Pn582	Speed Coincidence Signal Output Width (For linear servomotors)	2	0 to 100	mm/s	10

(2) I/O Monitor Field Signal Allocation

Allocate CN1 connector input signals to bits D12 to D15 of the I/O monitor field.

Parameter		Function	Setting	Allocation	Factory Setting
No.	Digit				
Pn81E	0	IO12 Signal Mapping	0	No mapping	0
			1	Monitors the CN1-13 input terminal	
			2	Monitors the CN1-7 input terminal	
			3	Monitors the CN1-8 input terminal	
			4	Monitors the CN1-9 input terminal	
			5	Monitors the CN1-10 input terminal	
			6	Monitors the CN1-11 input terminal	
			7	Monitors the CN1-12 input terminal	
	1	IO13 Signal Mapping	1 to 7	Refer to IO12 signal mapping	0
	2	IO14 Signal Mapping	1 to 7	Refer to IO12 signal mapping	0
	3	IO15 Signal Mapping	1 to 7	Refer to IO12 signal mapping	0

(3) Option Monitor Setting

Set the contents to be monitored when Option Monitor 1 and Option Monitor 2 are selected for MONITOR 1/ 2/3/4.

Parameter No.	Name	
Pn824	Option Monitor 1 Selection	
	0000H	Motor rotation speed [1000000H/OS]
	0001H	Speed reference [1000000H/OS]
	0002H	Torque (Force) [1000000H/max. torque (force)]
	0003H	Position error (lowermost 32 bits) [reference unit]
	0004H	Position error (uppermost 32 bits) [reference unit]
	0005H	System reserved
	0006H	System reserved
	000AH	Encoder count (lowermost 32 bits) [reference unit]
	000BH	Encoder count (uppermost 32 bits) [reference unit]
	000CH	External encoder count (lowermost 32 bits) [reference unit]
	000DH	External encoder count (uppermost 32 bits) [reference unit]
	0010H	Un000: Motor rotation speed [min^{-1}]
	0011H	Un001: Speed reference [min^{-1}]
	0012H	Un002: Torque (Force) reference [%]
	0013H	Un003: Rotation angle 1 [pulse]
	0014H	Un004: Rotation angle 2 [degree]
	0015H	Un005: Input signal monitor
	0016H	Un006: Output signal monitor
	0017H	Un007: Input position reference speed [min^{-1}]
	0018H	Un008: Position error [reference unit]
	0019H	Un009: Accumulated load ratio [%]
	001AH	Un00A: Regenerative load ratio [%]
	001BH	Un00B: DB resistance consumption power [%]
	001CH	Un00C: Input reference pulse [reference unit]
	001DH	Un00D: Feedback pulse [pulse]
	001EH	Un00E: Fully-closed loop feedback pulse [pulse]
	0023H	Initial multiturn data [rev]
	0024H	Initial incremental pulse
	0025H	Initial absolute position data lowermost 32 bits [pulse]
	0026H	Initial absolute position data uppermost 32 bits [pulse]
	0027H	Un022: Installation environment monitor [%]
	0080H	Previous value of latched feedback position (LPOS)
	Others	Reserved parameters (Do not use.)
Pn825	Option Monitor 2 Selection (Same as for Pn824)	

8.16 MECHATROLINK-II Subcommands List

The MECHATROLINK-II subcommands can be used by specifying them with the CONNECT command when MECHATROLINK-II communications starts.

The specifications of each MECHATROLINK-II subcommand are described below.

Refer to 8.2.3 Combination of MECHATROLINK-II Main Commands and Subcommands for information on applicable combinations with main commands.

8.17 MECHATROLINK-II Subcommands Details

8.17.1 No Operation (NOP: 00H)

Byte	NOP		Description
	Command	Response	
17	00H	00H	• Not operation command
18		SUBSTATUS	
19			
20			
21			
22			
23			
24			
25			
26			
27			
28			
29			

(1) Substatus Field Specification

This substatus field is used to monitor status of subcommands.

- Substatus Field

Byte	D7	D6	D5	D4	D3	D2	D1	D0
18	Reserved	Reserved	Reserved	Reserved	Reserved	SBCM-DRDY	SBWARNG	SBALM

Bit	Name	Description	Value	Status
D0	SBALM	Subcommand alarm occurs.	0	No alarm
			1	Alarm occurs
D1	SBWARNG	Subcommand warning occurs.	0	No warning
			1	Warning
D2	SBCMDRDY	Subcommand Ready (Subcommand can be received)	0	Busy
			1	Ready

8.17.2 Read Parameter (PRM_RD: 01H)

Byte	PRM_RD		Description
	Command	Response	
17	01H	01H	• Reads the parameters. This command has the same function as the main command PRM_RD.
18		SUBSTATUS	
19	NO	NO	
20			
21	SIZE	SIZE	
22		PARAMETER	
23			
24			
25			
26			
27			
28			
29			

8.17.3 Write Parameter (PRM_WR: 02H)

Byte	PRM_WR		Description
	Command	Response	
17	02H	02H	• Writes the parameters. This command has the same function as the main command PRM_WR.
18		SUBSTATUS	
19	NO	NO	
20			
21	SIZE	SIZE	
22	PARAMETER	PARAMETER	
23			
24			
25			
26			
27			
28			
29			

8.17.4 Read Alarm or Warning (ALM_RD: 05H)

Byte	ALM_RD		Description
	Command	Response	
17	05H	05H	• Reads the alarm or warning. This command has the same function as the main command ALM_RD. • When ALM_RD_MOD is set to 2 or 3, an alarm index will be assigned to byte 20 in the command and the response. An alarm code is assigned to both byte 21 and byte 22 in the response.
18		SUBSTATUS	
19	ALM_RD_MOD	ALM_RD_MOD	
20		ALM_DATA	
21			
22			
23			
24			
25			
26			
27			
28			
29			

8.17.5 Write Non-volatile Parameter (PPRM_WR: 1CH)

Byte	PPRM_WR		Description
	Command	Response	
17	1CH	1CH	• Writes the parameters. This command has the same function as the main command PPRM_WR.
18		SUBSTATUS	
19	NO	NO	
20			
21	SIZE	SIZE	
22	PARAMETER	PARAMETER	
23			
24			
25			
26			
27			
28			
29			

8.17.6 Set Latch Mode (LTMOD_ON: 28H)

Byte	PPRM_WR		Description
	Command	Response	
17	28H	28H	• Enables the latch mode. This command has the same function as the main command LTMOD_ON.
18	LT_SGN	SUBSTATUS	
19	SEL_MON3/4	SEL_MON3/4	
20	LT_MOD	MONITOR3	
21			
22			
23			
24		MONITOR4	
25			
26			
27			
28		EX_STATUS	
29			

(1) Extension Status Field Specifications

This field is used to monitor extension status.
The SMON, LTMOD_ON, and LTMOD_OFF subcommands can be used to enable monitoring.

Byte	D7	D6	D5	D4	D3	D2	D1	D0
28	L_CMP_CNT							
Byte	D15	D14	D13	D12	D11	D10	D9	D8
29	–	–	–	–	L_SEQ_NO			

- L_CMP_CNT (D0-D7)
  This counter indicates how many times the latch sequence has been completed during continuous latch operation. It remains 0 during a normal latch operation.
- L_SEQ_NO (D8-D11)
  This number indicates the number of latch sequence being completed during a continuous latch operation. It remains 0 during a normal latch operation.

8.17.7 Release Latch Mode (LTMOD_OFF: 29H)

Byte	LTMOD_OFF		Description
	Command	Response	
17	29H	29H	• Releases the latch mode. This command has the same function as the main command LTMOD_OFF.
18		SUBSTATUS	
19	SEL_MON3/4	SEL_MON3/4	
20		MONITOR3	
21			
22			
23			
24		MONITOR4	
25			
26			
27			
28		EX_STATUS	
29			

8.17.8 Status Monitoring (SMON: 30H)

Byte	SMON		Description
	Command	Response	
17	30H	30H	• Reads the monitoring information specified in SEL_MON3/4. This command has the same function as the main command SMON.
18		SUBSTATUS	
19	SEL_MON3/4	SEL_MON3/4	
20		MONITOR3	
21			
22			
23			
24		MONITOR4	
25			
26			
27			
28		EX_STATUS	
29			

8.18 Main Command Data Field

The data of each field in the main commands or subcommands is described below.

8.18.1 Status Field Specifications

The status field is used to monitor the DRIVER status. The following table shows the bit allocation in the status field.

D7	D6	D5	D4	D3	D2	D1	D0
PSET/ V_CMP	ZPOINT	–	PON	SVON	CMDRDY	WARNG	ALM

D15	D14	D13	D12	D11	D10	D9	D8
–	–	N_SOT	P_SOT	NEAR/ V_LIM	L_CMP	T_LIM	DEN/ZSPD

The following table explains each bit value and its status.

Bit	Name	Value	Description
D0	ALM	0	No alarm
		1	Alarm occurs.
D1	WARNG	0	No warning
		1	Warning occurs.
D2	CMDRDY	0	Command cannot be received (busy).
		1	Command can be received (ready).
D3	SVON	0	Servo OFF
		1	Servo ON
D4	PON	0	Main power supply OFF
		1	Main power supply ON
D5	–	–	–
D6	ZPOINT	0	Out of home position range
		1	Within home position range
D7	PSET (During position control)	0	Out of positioning complete range
		1	Within positioning complete range (The output is completed (DEN = 1) and APOS is within the positioning complete range.)
	V_CMP (During speed control)	0	Speed does not coincide.
		1	Speed coincides.
D8	DEN (During position control)	0	During output
		1	Output completed
	ZSPD (During speed control)	0	Zero speed not detected
		1	Zero speed detected
D9	T_LIM	0	Not during torque (force) limit
		1	During torque (force) limit
D10	L_CMP	0	Latch not completed
		1	Latch completed

Bit	Name	Value	Description
D11	NEAR (During position control)	0	Out of positioning proximity
		1	Within positioning proximity
	V_LIM (During torque control)	0	Speed limit not detected
		1	Speed limit detected
D12	P_SOT	0	OT signal is off.
		1	OT signal is on.
D13	N_SOT	0	OT signal is OFF.
		1	OT signal is ON.
D14	–	–	–
D15	–	–	–

8.18.2 OPTION Field Specifications

The option field is used to add functions to a motion command.

(1) Applicable Commands

SV_ON, HOLD, INTERPOLATE, POSING, FEED, LATCH, EX_POSING, ZRET, VELCTRL, TRQCTRL, SVCTRL

Set the functions to be added to a motion command in the main command third and forth bytes reserved for the option field.

The option field of the LECYM2-V□ series DRIVER is set by default as shown below.

To change the default setting, set the parameter Pn81F as Pn81F = □□□1, and set the bits to which functions are to be allocated using the parameters Pn82A to Pn82E. The change must be validated by turning the power supply OFF and then ON again or by sending a CONFIG command.

(2) OPTION Field Default Setting

D7	D6	D5	D4	D3	D2	D1	D0
0	0	0	ACCFIL		0	0	0

D15	D14	D13	D12	D11	D10	D9	D8
N_CL	P_CL	P_PI_CLR	V_PPI	0	0	G_SEL	

(3) Functions That Can Be Allocated to Bits of the OPTION Field

Name	Description		Value	Details	Default Setting
ACCFIL (2 bits)	Acceleration/Deceleration filter		0	No acceleration/deceleration filter	D3, D4
			1	Exponential function acceleration/deceleration	
			2	S-curve acceleration/deceleration	
			3	Do not set.	
G_SEL (2 bits)	Gain switching		0	First gain	D8, D9
			1	Second gain	
			2	Reserved (invalid)	
			3	Reserved (invalid)	
V_PPI (1 bit)	Speed loop P/PI control		0	PI control	D12
			1	P control	
P_PI_CLR (1 bit)	Position loop position integral clear		0	Does not clear.	D13
			1	Clears.	
P_CL (1 bit)	Forward torque (force) limit		0	Does not control torque (force).	D14
			1	Controls torque (force).	
N_CL (1 bit)	Reverse torque (force) limit		0	Does not control torque (force).	D15
			1	Controls torque (force).	
LT_DISABLE (1 bit)	Latch signal input disabled		0	Enables latch signal input.	Not allocated
			1	Disables latch signal input.	
BANK_SEL1 (4 bits)	Bank selector 1 (Bank for acceleration/deceleration parameter switching)		0 to 15	Bank 0 to Bank 15	Not allocated
OUT_SIGNAL (3 bits)	I/O signal output command	BIT 0	0	SO1 output signal OFF	Not allocated
			1	SO1 output signal ON	
		BIT 1	0	SO2 output signal OFF	
			1	SO2 output signal ON	
		BIT 2	0	SO3 output signal OFF	
			1	SO3 output signal ON	

Note 1. Do not allocate more than one signal to one bit. Otherwise, multiple signals will be controlled by one bit.
2. The bits to which no function is allocated will act as it is set to 0 (zero).
3. To enable the OUT_SIGNAL function, set the following parameters to Zero: Pn50E, Pn50F, and Pn510.

8.18.3 Monitor Selection Field Specifications: SEL_MON1/2/3/4

The monitor selection (SEL_MON1/2/3/4) field is used to select the Servo monitor information.

(1) Applicable Commands

SV_ON, SV_OFF, HOLD, INTERPOLATE, POSING, FEED, LATCH, EX_POSING, ZRET, VELCTRL, TRQCTRL, SMON, SENS_ON, SENS_OFF, BRK_ON, BRK_OFF, LTMOD_ON, LTMOD_OFF

(2) Setting Method

Set MONITOR 1/2/3/4 monitor codes in SEL_MON1/2/3/4 allocated in the thirteenth byte of the main command or in the reserved area of the nineteenth byte of the subcommand.

SEL_MON1/2/3/4 allocation is shown below.

D7	D6	D5	D4	D3	D2	D1	D0
SEL_MON2				SEL_MON1			

D7	D6	D5	D4	D3	D2	D1	D0
SEL_MON4				SEL_MON3			

8.18.4 Monitor Information Field Specifications: MONITOR 1/2/3/4

The monitor information (MONITOR 1/2/3/4)field is used to monitor information selected by the monitor codes in the monitor selection field.

- Applicable Commands

SV_ON, SV_OFF, HOLD, INTERPOLATE, POSING, FEED, LATCH, EX_POSING, ZRET, VELCTRL, TRQCTRL, SMON, SENS_ON, SENS_OFF, BRK_ON, BRK_OFF, LTMOD_ON, LTMOD_OFF

The MONITOR 1/2/3/4 monitor codes are listed below.

Monitor Code	Name	Description	Unit
0	POS	Reference position in reference coordinate system (position after reference filtering)	Reference unit
1	MPOS	Reference position	Reference unit
2	PERR	Position error	Reference unit
3	APOS	Feedback position in machine coordinate system	Reference unit
4	LPOS	Feedback latch position in machine coordinate system	Reference unit
5	IPOS	Reference position in reference coordinate system (position before reference filtering)	Reference unit
6	TPOS	Target position in reference coordinate system	Reference unit
7	–	–	–
8	FSPD	Feedback speed	Position/torque (force) control: reference units/s Speed control: Maximum speed/ 40000000H
9	CSPD	Reference speed	Position control: Reference units/s Speed control: Maximum speed/ 40000000H
A	TSPD	Target speed	Position control: Reference units/s Speed control: Maximum speed/ 40000000H
B	TRQ	Torque (force) reference (The rated torque is 100%.)	Position/speed control: % (The rated torque is 100%.) Torque (force) control: Maximum torque (force)/40000000H
C	–	–	–
D	–	–	–
E	OMN1	Option monitor 1 selected in Pn824	–
F	OMN2	Option monitor 2 selected in Pn825	–

8.18.5 IO Monitor Field Specifications: IO_MON

The IO monitor field is used to monitor the I/O signal status of the DRIVER.

- Applicable Commands

SMON, SV_ON, SV_OFF, SV_CTRL, FEED, HOLD, INTERPOLATE, POSING, LATCH, EX_POSING, ZRET, VELCTRL, TRQCTRL, SENS_ON, SENS_OFF, BRK_ON, BRK_OFF, LTMOD_ON, LTMOD_OFF

I/O signal allocation is shown below.

D7	D6	D5	D4	D3	D2	D1	D0
EXT2	EXT1	PC	PB	PA	DEC	N_OT	P_OT

D15	D14	D13	D12	D11	D10	D09	D08
IO15	IO14	IO13	IO12	–	HBB	BRK	EXT3

Bit	Name	Contents	Value	Status
D0	P_OT	Forward run prohibited input	0	OFF
			1	ON
D1	N_OT	Reverse run prohibited input	0	OFF
			1	ON
D2	DEC	Homing deceleration LS input	0	OFF
			1	ON
D3	PA	Encoder phase A input	0	OFF
			1	ON
D4	PB	Encoder phase B input	0	OFF
			1	ON
D5	PC	Encoder phase Z input	0	OFF
			1	ON
D6	EXT1	First external latch signal input	0	OFF
			1	ON
D7	EXT2	Second external latch signal input	0	OFF
			1	ON
D8	EXT3	Third external latch signal input	0	OFF
			1	ON
D9	BRK	Brake output	0	Released
			1	Locked
D10	HBB	Stop signal input, OR of HWBB1 signal and HWBB2 signal	0	OFF (Forced stop released)
			1	ON (Forced stop)
D11		Reserved	0	
D12	IO12	CN1 input signal selected in Pn81E.0	0	OFF (open)
			1	ON (closed)
D13	IO13	CN1 input signal selected in Pn81E.1	0	OFF (open)
			1	ON (closed)
D14	IO14	CN1 input signal selected in Pn81E.2	0	OFF (open)
			1	ON (closed)
D15	IO15	CN1 input signal selected in Pn81E.3	0	OFF (open)
			1	ON (closed)

8.18.6 LT_SGNL Specifications

- Applicable Commands

LATCH, EX_POSING, ZRET, LTMOD_ON (When Pn850 = 0), SVCTRL

The latch signal can be specified in the following latch signal (LT_SGNL) field.

D7	D6	D5	D4	D3	D2	D1	D0
0	0	0	0	0	0	LT_SGNL	

D1	D0	Latch Signal	Signal Details
0	0	Phase Z	Encoder origin signal
0	1	EXT1	External input signal 1
1	0	EXT2	External input signal 2
1	1	EXT3	External input signal 3

8.19 Substatus Data Field

8.19.1 Substatus Field Specification

The substatus field is used to monitor status of subcommands.

- Substatus Field

	D7	D6	D5	D4	D3	D2	D1	D0
Byte 18	Reserved	Reserved	Reserved	Reserved	Reserved	SBCM-DRDY	SBWARNG	SBALM

Bit	Name	Description	Value	Status
D0	SBALM	Subcommand alarm occurs.	0	No alarm
			1	Alarm occurs
D1	SBWARNG	Subcommand warning occurs.	0	No warning
			1	Warning
D2	SBCMDRDY	Subcommand Ready (Subcommand can be received)	0	Busy
			1	Ready

8.19.2 Extension Status Field Specifications

This field is used to monitor extension status.
The SMON, LTMOD_ON, and LTMOD_OFF subcommands can be used to enable monitoring.

	D7	D6	D5	D4	D3	D2	D1	D0
Byte 28	L_CMP_CNT							
	D15	D14	D13	D12	D11	D10	D9	D8
Byte 29	–	–	–	–	L_SEQ_NO			

- L_CMP_CNT (D0-D7)

  This counter indicates how many times the latch sequence has been completed during continuous latch operation. It remains 0 during a normal latch operation.

- L_SEQ_NO (D8-D11)

  This number indicates the number of latch sequence being completed during a continuous latch operation. It remains 0 during a normal latch operation.

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9. Troubleshooting

9.1 Alarm Displays

The following sections describe troubleshooting in response to alarm displays.
The alarm name, alarm meaning, alarm stopping method, and alarm reset capability are listed in order of the alarm numbers in *9.1.1 List of Alarms*.
The causes of alarms and troubleshooting methods are provided in *9.1.2 Troubleshooting of Alarms*.

"6" of the figure, "B" of the alphabet, and "D" are displayed as follows.

6→

B→

D→

9.1.1 List of Alarms

This section provides list of alarms.

After its cause has been removed, the alarm can be deactivated in any of the methods marked ○ in the alarm reset column.

	Alarm Number	Alarm Name	Servo motor Stop ping Method*1	Alarm reset			
				Power OFF ↓ ON	Alarm warning clear command [ALM-CLR]	SigmaWin+ [Alarm] | [Display Alarm] | Reset button	SigmaWin+ [Setup] | [Software Reset] | Execute button
Alarm	A. 020	Parameter Checksum Error 1	Gr. 1	○	–	–	○
	A. 021	Parameter Format Error 1	Gr. 1	○	–	–	○
	A. 022	System Checksum Error 1	Gr. 1	○	–	–	○
	A. 030	Main Circuit Detector Error	Gr. 1	○	○	○	○
	A. 040	Parameter Setting Error 1	Gr. 1	○	–	–	○
	A. 041	Encoder Output Pulse Setting Error	Gr. 1	○	–	–	○
	A. 042	Parameter Combination Error	Gr. 1	○	–	–	○
	A. 044	Semi-closed/Fully-closed Loop Control Parameter Setting Error	Gr. 1	○	–	–	○
	A. 04A	Parameter Setting Error 2	Gr. 1	○	–	–	○
	A. 050	Combination Error	Gr. 1	○	○	○	○
	A. 051	Unsupported Device Alarm	Gr. 1	○	–	–	○
	A. 0B0	Cancelled Servo ON Command Alarm	Gr. 1	○	○	○	○
	A. 100	Overcurrent or Heat Sink Overheated	Gr. 1	○	–	–	○
	A. 300	Regeneration Error	Gr. 1	○	○	○	○
	A. 320	Regenerative Overload	Gr. 2	○	○	○	○
	A. 330	Main Circuit Power Supply Wiring Error	Gr. 1	○	○	○	○
	A. 400	Overvoltage	Gr. 1	○	○	○	○
	A. 410	Undervoltage	Gr. 2	○	○	○	○
	A. 450	Main-Circuit Capacitor Overvoltage	Gr. 1	○	–	–	○
	A. 510	Overspeed	Gr. 1	○	○	○	○
	A. 511	Overspeed of Encoder Output Pulse Rate	Gr. 1	○	○	○	○
	A. 520	Vibration Alarm	Gr. 1	○	○	○	○
	A. 521	Autotuning Alarm	Gr. 1	○	○	○	○
	A. 710	Overload: High Load	Gr. 2	○	○	○	○
	A. 720	Overload: Low Load	Gr. 1	○	○	○	○
	A. 730	Dynamic Brake Overload	Gr. 1	○	○	○	○
	A. 731	Overload of Surge Current Limit Resistor	Gr. 1	○	○	○	○
	A. 740	Heat Sink Overheated	Gr. 1	○	○	○	○
	A. 7A0	Built-in Fan in DRIVER Stopped	Gr. 2	○	○	○	○
	A. 7AB	Encoder Backup Error	Gr. 1	○	○	○	○
	A. 810	Encoder Checksum Error	Gr. 1	○	–	–	○
	A. 820	Absolute Encoder Battery Error	Gr. 1	○	–	–	○
	A. 830	Encoder Data Error	Gr. 1	○	○	○	○
	A. 840	Encoder Overspeed	Gr. 1	○	–	–	○
	A. 850	Encoder Overheated	Gr. 1	○	–	–	○
	A. 860	External Encoder Error	Gr. 1	○	–	–	○
	A. 8A0	External Encoder Error of Module	Gr. 1	○	○	○	○
	A. 8A1	External Encoder Error of Sensor	Gr. 1	○	○	○	○
	A. 8A2	External Encoder Error of Position	Gr. 1	○	○	○	○
	A. 8A3	External Encoder Overspeed	Gr. 1	○	○	○	○
	A. 8A5	External Encoder Overheated	Gr. 1	○	○	○	○
	A. 8A6	Regeneration Error	Gr. 1	○	○	○	○

(cont'd)

	Alarm Number	Alarm Name	Servo motor Stop ping Method*1	Alarm reset			
				Power OFF ↓ ON	Alarm warning clear command [ALM-CLR]	SigmaWin+ [Alarm] | [Display Alarm] | Reset button	SigmaWin+ [Setup] | [Software Reset] | Execute button
Alarm	A.B31	Current Detection Error 1	Gr.1	○	–	–	○
	A.B32	Current Detection Error 2	Gr.1	○	–	–	○
	A.B33	Current Detection Error 3	Gr.1	○	–	–	○
	A.B6A	MECHATROLINK Communications ASIC Error 1	Gr.1	○	–	–	○
	A.B6B	MECHATROLINK Communications ASIC Error 2	Gr.2	○	–	–	○
	A.BF0	System Alarm 0	Gr.1	○	–	–	○
	A.BF1	System Alarm 1	Gr.1	○	–	–	○
	A.BF2	System Alarm 2	Gr.1	○	–	–	○
	A.BF3	System Alarm 3	Gr.1	○	–	–	○
	A.BF4	System Alarm 4	Gr.1	○	–	–	○
	A.C10	Servo Overrun Detected	Gr.1	○	○	○	○
	A.C80	Absolute Encoder Clear Error and Multiturn Limit Setting Error	Gr.1	○	–	–	○
	A.C90	Encoder Communications Error	Gr.1	○	–	–	○
	A.C91	Encoder Communications Position Data Error	Gr.1	○	–	–	○
	A.C92	Encoder Communications Timer Error	Gr.1	○	–	–	○
	A.CA0	Encoder Parameter Error	Gr.1	○	–	–	○
	A.CB0	Encoder Echoback Error	Gr.1	○	–	–	○
	A.CC0	Multiturn Limit Disagreement	Gr.1	○	–	–	○
	A.CF1	Feedback Option Module Communications Error (Reception error)	Gr.1	○	–	–	○
	A.CF2	Feedback Option Module Communications Error (Timer stop)	Gr.1	○	–	–	○
	A.D00	Position Error Overflow	Gr.1	○	○	○	○
	A.D01	Position Error Overflow Alarm at Servo ON	Gr.1	○	○	○	○
	A.D02	Position Error Overflow Alarm by Speed Limit at Servo ON	Gr.2	○	○	○	○
	A.D10	Motor-load Position Error Overflow	Gr.2	○	○	○	○
	A.E02	MECHATROLINK Internal Synchronization Error 1	Gr.1	○	○	○	○
	A.E40	MECHATROLINK Transmission Cycle Setting Error	Gr.2	○	○	○	○
	A.E50	MECHATROLINK Synchronization Error	Gr.2	○	○	○	○
	A.E51	MECHATROLINK Synchronization Failed	Gr.2	○	○	○	○
	A.E60	MECHATROLINK Communications Error (Reception error)	Gr.2	○	○	○	○
	A.E61	MECHATROLINK Transmission Cycle Error (Synchronization interval error)	Gr.2	○	○	○	○
	A.E71	Safety Option Module Detection Failure	Gr.1	○	–	–	○
	A.E72	Feedback Option Module Detection Failure	Gr.1	○	–	–	○
	A.E74	Unsupported Safety Option Module	Gr.1	○	–	–	○
	A.E75	Unsupported Feedback Option Module	Gr.1	○	–	–	○
	A.EA2	DRV Alarm 2 (DRIVER WDC error)	Gr.2	○	○	○	○
	A.EB1	Safety Function Signal Input Timing Error	Gr.1	○	–	–	○
	A.ED1	Command Execution Timeout	Gr.2	○	○	○	○
	A.F10	Main Circuit Cable Open Phase	Gr.2	○	○	○	○
	FL-1*2	System Alarm	–	○	–	–	–
	FL-2*2		–	○	–	–	–
	CPF00	Digital Operator Transmission Error 1	–	○	–	–	–
	CPF01	Digital Operator Transmission Error 2	–	○	–	–	–
	A.--	Not an error	–	–	–	–	–

*1 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 stopping method to prevent machine damage that may result due to differences in the stop method.

*2 These alarms are not stored in the alarm history and are displayed only in the panel display.

9.1.2 Troubleshooting of Alarms

If an error occurs in servo drives, an alarm display such as A.□□□ and CPF□□ will appear on the panel display.

Refer to the following table to identify the cause of an alarm and the action to be taken.

AlarmNumber: Alarm Name (Alarm Description)	Cause	Investigative Actions	Corrective Actions
A.020: Parameter Checksum Error 1 (The parameter data in the DRIVER is incorrect.)	The power supply voltage suddenly dropped.	Measure the power supply voltage.	Set the power supply voltage within the specified range, and set Fn005 to initialize the parameter.
	The power supply went OFF while changing a parameter setting.	Check the circumstances when the power supply went OFF.	Set Fn005 to initialize the parameter and then set the parameter again.
	The number of times that parameters were written exceeded the limit.	Check to see if the parameters were frequently changed through the host controller.	The DRIVER may be faulty. Replace the DRIVER. Reconsider the method of writing parameters.
	Malfunction caused by noise from the AC power supply or grounding line, static electricity noise, etc.	Turn the power supply ON and OFF several times. If the alarm still occurs, there may be noise interference.	Take countermeasures against noise.
	Gas, water drops, or cutting oil entered the DRIVER and caused failure of the internal components.	Check the installation conditions.	The DRIVER may be faulty. Replace the DRIVER.
	A DRIVER fault occurred.	Turn the power supply ON and OFF several times. If the alarm still occurs, the DRIVER may be faulty.	The DRIVER may be faulty. Replace the DRIVER.
A.021: Parameter Format Error 1 (The parameter data in the DRIVER is incorrect.)	The software version of DRIVER that caused the alarm is older than that of the written parameter.	Check Fn012 to see if the set software version agrees with that of the DRIVER. If not, an alarm may occur.	Write the parameter of another DRIVER of the same model with the same software version. Then turn the power OFF and then ON again.
	A DRIVER fault occurred.	−	The DRIVER may be faulty. Replace the DRIVER.
A.022: System Checksum Error 1 (The parameter data in the DRIVER is incorrect.)	The power supply voltage suddenly dropped.	Measure the power supply voltage.	The DRIVER may be faulty. Replace the DRIVER.
	The power supply went OFF while setting an utility function.	Check the circumstances when the power supply went OFF.	The DRIVER may be faulty. Replace the DRIVER.
	A DRIVER fault occurred.	Turn the power supply ON and OFF several times. If the alarm still occurs, the DRIVER may be faulty.	The DRIVER may be faulty. Replace the DRIVER.
A.030: Main Circuit Detector Error	A DRIVER fault occurred.	−	The DRIVER may be faulty. Replace the DRIVER.
A.040: Parameter Setting Error 1 (The parameter setting was out of the setting range.)	The DRIVER and servomotor capacities do not match each other.	Check the combination of DRIVER and servomotor capacities.	Select the proper combination of DRIVER and servomotor capacities.
	A DRIVER fault occurred.	−	The DRIVER may be faulty. Replace the DRIVER.
	The parameter setting is out of the setting range.	Check the setting ranges of the parameters that have been changed.	Set the parameter to a value within the setting range.
	The electronic gear ratio is out of the setting range.	Check the electronic gear ratio. The ratio must satisfy: 0.001< (Pn20E/Pn210) < 4000.	Set the electronic gear ratio in the range: 0.001< (Pn20E/Pn210) < 4000.

(cont'd)

Alarm Number: Alarm Name (Alarm Description)	Cause	Investigative Actions	Corrective Actions
A.041: Encoder Output Pulse Setting Error	The encoder output pulse (Pn212) is out of the setting range and does not satisfy the setting conditions.	Check the parameter Pn212.	Set Pn212 to a correct value.
A.042:*1 Parameter Combination Error	The speed of program JOG operation (Fn004) is lower than the setting range after having changed the electronic gear ratio (Pn20E/Pn210) or the servomotor.	Check if the detection conditions*1 are satisfied.	Decrease the setting of the electronic gear ratio (Pn20E/Pn210).
	The speed of program JOG operation (Fn004) is lower than the setting range after having changed the setting of the program JOG movement speed (Pn533).	Check if the detection conditions*1 are satisfied.	Increase the setting of the program JOG movement speed (Pn533).
	The moving speed of advanced autotuning is lower than the setting range after having changed the electronic gear ratio (Pn20E/ Pn210) or the servomotor.	Check if the detection conditions*1 are satisfied.	Decrease the setting of the electronic gear ratio (Pn20E/Pn210).
A.044: Semi-closed/Fully-closed Loop Control Parameter Setting Error	The setting of the fully-closed module does not match with that of Pn002.3.	Check the settings of Pn002.3.	The setting of fully-closed module must be compatible with the setting of Pn002.3.
A.04A: Parameter Setting Error 2	For a 4-byte parameter bank, no registration in two consecutive bytes for two bank members.	–	Change the number of bytes for bank members to an appropriate value.
	The total amount of bank data exceeds 64. (Pn900 × Pn901 > 64)	–	Reduce the total amount of bank data to 64 or less.
A.050: Combination Error (The DRIVER and servomotor capacities do not correspond.)	The DRIVER and servomotor capacities do not match each other.	Check the capacities to see if they satisfy the following condition: (1/4) ≦ (Servomotor capacity / DRIVER capacity ≦ 4)	Select the proper combination of DRIVER and servomotor capacities.
	An encoder fault occurred.	Replace the servomotor and see if the alarm occurs again.	Replace the servomotor (encoder).
	A DRIVER fault occurred.	–	The DRIVER may be faulty. Replace the DRIVER.
A.051: Unsupported Device Alarm	An unsupported serial converter unit, encoder, or external encoder is connected to the DRIVER.	Check the product specifications, and select the correct model.	Select the correct combination of units.
A.0b0: Cancelled Servo ON Command Alarm	After executing the utility function to turn ON the power to the motor, the servo ON command (SV_ON) was sent from the PC or PLC etc....	–	Turn the DRIVER power sup- ply OFF and then ON again or execute a software reset.

∗1. Detection conditions

If one of the following conditions detected, an alarm occurs.

- $\text{Pn533 } [\text{min}^{-1}] \times \dfrac{\text{Encoder resolution}}{6 \times 10^5} \leq \dfrac{\text{Pn20E}}{\text{Pn210}}$
- $\text{Max Motor Speed } [\text{min}^{-1}] \times \dfrac{\text{Encoder resolution}}{\text{About } 3.66 \times 10^{12}} \geq \dfrac{\text{Pn20E}}{\text{Pn210}}$

(cont'd)

Alarm Number: Alarm Name (Alarm Description)	Cause	Investigative Actions	Corrective Actions
A.100: Overcurrent or Heat Sink Overheated (An overcurrent flowed through the IGBT or heat sink of DRIVER overheated.)	Incorrect wiring or contact fault of main circuit cables.	Check the wiring. Refer to *3.1 Main Circuit Wiring.*	Correct the wiring.
	Short-circuit or ground fault of main circuit cables.	Check for short-circuits across the servomotor terminal phases U, V, and W, or between the grounding and servomotor terminal phases U, V, or W. Refer to *3.1 Main Circuit Wiring*.	The cable may be short-circuited. Replace the cable.
	Short-circuit or ground fault inside the servomotor.	Check for short-circuits across the servomotor terminal phases U, V, and W, or between the grounding and servomotor terminal phases U, V, or W. Refer to *3.1 Main Circuit Wiring*.	The servomotor may be faulty. Replace the servomotor.
	Short-circuit or ground fault inside the DRIVER.	Check for short-circuits across the servomotor connection terminals U, V, and W on the DRIVER, or between the grounding and terminal U, V, or W. Refer to *3.1 Main Circuit Wiring*.	The DRIVER may be faulty. Replace the DRIVER.
	Incorrect wiring or contact fault of the regenerative resistor.	Check the wiring. Refer to *3.7 Connecting Regenerative Resistors*.	Correct the wiring.
	The dynamic brake (DB: Emergency stop executed from the DRIVER) was frequently activated, or the DB overload alarm occurred.	Check the power consumed by DB resistance (Un00B) to see how many times the DB has been used. Or, check the alarm history display Fn000 to see if the DB overload alarm A.730 or A.731 was reported.	Change the DRIVER model, operating conditions, or the mechanism so that the DB does not need to be used so frequently.
	The generated regenerative resistor value exceeded the DRIVER regenerative energy processing capacity.	Check the regenerative load ratio (Un00A) to see how many times the regenerative resistor has been used.	Check the operating condition including overload, and reconsider the regenerative resistor value.
	The DRIVER regenerative resistance is too small.	Check the regenerative load ratio (Un00A) to see how many times the regenerative resistor has been used.	Change the regenerative resistance value to a value larger than the DRIVER minimum allowable resistance value.
	A heavy load was applied while the servomotor was stopped or running at a low speed.	Check to see if the operating conditions are outside servo drive specifications.	Reduce the load applied to the servomotor or increase the operating speed.
	Malfunction caused by noise interference.	Improve the wiring or installation environment, such as by reducing noise, and check to see if the alarm recurs.	Take countermeasures for noise, such as correct wiring of the FG. Use an FG wire size equivalent to the DRIVER main circuit wire size.
	A DRIVER fault occurred.	–	Turn the power supply OFF and then ON again. If the alarm still occurs, the DRIVER may be faulty. Replace the DRIVER.

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Alarm Number: Alarm Name (Alarm Description)	Cause	Investigative Actions	Corrective Actions
A.300: Regeneration Error	Regenerative resistor capacity (Pn600) is set to a value other than 0 for a LECYM2-V5, V7, and V8, and an regenerative option is notconnected.	Check the regenerative option connection and the value of the Pn600.	Connect the regenerative option, or set Pn600 to 0 if no regenerative resistor is required.
	The jumper between the power supply terminals B2 and B3 is removed for the DRIVERs other than the DRIVERs shown above.	Confirm that a jumper is mounted between the power supply terminals B2 and B3.	Correctly mount a jumper.
	The regenerative option is incorrectly wired, or is removed or disconnected.	Check the regenerative option connection.	Correctly connect the regenerative option.
	A DRIVER fault occurred.	–	While the main circuit power supply is OFF, turn the control power supply OFF and then ON again. If the alarm still occurs, the DRIVER may be faulty. Replace the DRIVER.
A.320: Regenerative Over-load	The power supply voltage exceeds the specified limit.	Measure the power supply voltage.	Set the power supply voltage within the specified range.
	Insufficient external regenerative resistance, regenerative resistor capacity, or DRIVER capacity. Or, regenerative power has been continuously flowing back.	Check the operating condition or the capacity.	Change the regenerative resistance, regenerative resistor capacity, or DRIVER capacity. Reconsider the operating conditions.
	Regenerative power continuously flowed back because negative load was continuously applied.	Check the load applied to the servo-motor during operation.	Reconsider the system including servo, machine, and operating conditions.
	The setting of parameter Pn600 is smaller than the regenerative option's capacity.	Check the regenerative option connection and the value of the Pn600.	Set the Pn600 to a correct value.
	The external regenerative resistance is too high.	Check the regenerative resistance.	Change the regenerative resistance to a correct value or use an regenerative option of appropriate capacity.
	A DRIVER fault occurred.	–	The DRIVER may be faulty. Replace the DRIVER.

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Alarm Number: Alarm Name (Alarm Description)	Cause	Investigative Actions	Corrective Actions
A.330: Main Circuit Power Supply Wiring Error (Detected when the power to the main circuit is turned ON.)	The regenerative resistor disconnected when the DRIVER power supply voltage was high.	Measure the resistance of the regenerative resistor using a measuring instrument.	When using a regenerative resistor built in the DRIVER: Replace the DRIVER. When using an regenerative option: Replace the regenerative option.
	In the AC power input mode, DC power was supplied.	Check the power supply to see if it is a DC power supply.	Correct the settings to match the actual power supply specifications.
	In the DC power input mode, AC power was supplied.	Check the power supply to see if it is an AC power supply.	Correct the settings to match the actual power supply specifications.
	Regenerative resistor capacity (Pn600) is set to a value other than 0 for a LECYM2-V5, V7, and V8, and an regenerative option is not connected.	Check the regenerative option connection and the value of the Pn600.	Connect the regenerative option, or set Pn600 to 0 if no regenerative resistor is required.
	The jumper between the power supply terminals B2 and B3 is removed for the DRIVERs other than the DRIVERs shown above.	Confirm that a jumper is mounted between the power supply terminals B2 and B3.	Correctly mount a jumper.
	A DRIVER fault occurred.	–	The DRIVER may be faulty. Replace the DRIVER.
A.400: Overvoltage (Detected in the DRIVER main circuit power supply section.)	- For 200-VAC DRIVERs: The AC power supply voltage exceeded 290 V. - For 200-VAC DRIVERs: with DC power supply input: The DC power supply voltage exceeded 410 V.	Measure the power supply voltage.	Set AC/DC power supply voltage within the specified range.
	The power supply is unstable, or was influenced by a lightning surge.	Measure the power supply voltage.	Improve the power supply conditions by installing a surge absorber, etc. Then, turn the power supply OFF and ON again. If the alarm still occurs, the DRIVER may be faulty. Replace the DRIVER.
	Voltage for AC power supply was too high during acceleration or deceleration.	Check the power supply voltage and the speed and torque during operation.	Set AC power supply voltage within the specified range.
	The external regenerative resistance is too high for the actual operating conditions.	Check the operating conditions and the regenerative resistance.	Select a regenerative resistance value appropriate for the operating conditions and load.
	The moment of inertia ratio exceeded the allowable value.	Confirm that the moment of inertia ratio is within the allowable range.	Increase the deceleration time, or reduce the load.
	A DRIVER fault occurred.	–	Turn the control power OFF and then ON again while the main circuit power supply is OFF. If the alarm still occurs, the DRIVER may be faulty. Replace the DRIVER.

(cont'd)

Alarm Number: Alarm Name (Alarm Description)	Cause	Investigative Actions	Corrective Actions
A.410: Undervoltage (Detected in the DRIVER main circuit power supply section.)	- For 200-VAC DRIVERs: The AC power supply voltage is 120 V or less.	Measure the power supply voltage.	Set the power supply voltage within the specified range.
	The power supply voltage dropped during operation.	Measure the power supply voltage.	Increase the power supply capacity.
	Occurrence of instantaneous power interruption.	Measure the power supply voltage.	When the instantaneous power cut hold time (Pn509) is set, decrease the setting.
	The DRIVER fuse is blown out.	–	Replace the DRIVER, connect a reactor, and run the DRIVER.
	A DRIVER fault occurred.	–	The DRIVER may be faulty. Replace the DRIVER.
A.450: Main-Circuit Capacitor Overvoltage	A DRIVER fault occurred.	–	Replace the DRIVER.
A.510: Overspeed (The servomotor speed exceeds the maximum.)	The order of phases U, V, and W in the servomotor wiring is incorrect.	Check the motor wiring.	Confirm that the servomotor is correctly wired.
	A reference value exceeding the overspeed detection level was input.	Check the input value.	Reduce the reference value or adjust the gain.
	The motor speed exceeded the maximum.	Check the motor speed waveform.	Reduce the speed reference input gain, adjust the servo gain, or reconsider the operating conditions.
	A DRIVER fault occurred.	–	The DRIVER may be faulty. Replace the DRIVER.
A.511: Overspeed of Encoder Output Pulse Rate	The encoder output pulse frequency exceeded the limit.	Check the encoder output pulse setting.	Decrease the setting of the encoder output pulse (Pn212).
	The encoder output pulse output frequency exceeded the limit because the motor speed was too high.	Check the encoder output pulse output setting and motor speed.	Decrease the motor speed.
A.520: Vibration Alarm	Abnormal vibration was detected at the motor speed.	Check for abnormal noise from the servomotor, and check the speed and torque waveforms during operation.	Reduce the motor speed or reduce the speed loop gain (Pn100).
	The moment of inertia ratio (Pn103) value is greater than the actual value or is greatly changed.	Check the moment of inertia ratio.	Set the moment of inertia ratio (Pn103) to an appropriate value.
A.521: Autotuning Alarm (Vibration was detected while executing the one-parameter tuning, Easy-FFT, or tuning-less function.)	The servomotor vibrated considerably while performing tuning- less function.	Check the motor speed waveform.	Reduce the load so that the moment of inertia ratio falls within the allowable value, or raise the load level using the tuning-less levels setting (Fn200) or reduce the rigidity level.
	The servomotor vibrated considerably during one-parameter tuning or EasyFFT.	Check the motor speed waveform.	Check the operation procedure of corresponding function and take a corrective action.

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Alarm Number: Alarm Name (Alarm Description)	Cause	Investigative Actions	Corrective Actions
A.710: A.720: Overload A.710: High Load A.720: Low Load	Incorrect wiring or contact fault of servomotor and encoder.	Check the wiring.	Confirm that the servomotor and encoder are correctly wired.
	Operation beyond the overload protection characteristics.	Check the servomotor overload characteristics and executed run command.	Reconsider the load conditions and operating conditions. Or, increase the motor capacity.
	Excessive load was applied during operation because the servomotor was not driven due to mechanical problems.	Check the executed operation reference and motor speed.	Remove the mechanical problems.
	A DRIVER fault occurred.	–	The DRIVER may be faulty. Replace the DRIVER.
A.730: A.731: Dynamic Brake Overload (An excessive power consumption of dynamic brake was detected.)	The servomotor rotates because of external force.	Check the operation status.	Take measures to ensure the servomotor will not rotate because of external force.
	The rotating energy at a DB stop exceeds the DB resistance capacity.	Check the power consumed by DB resistance (Un00B) to see how many times the DB has been used.	Reconsider the following: - Reduce the motor reference speed. - Reduce the moment of inertia ratio. - Reduce the number of times of the DB stop operation.
	A DRIVER fault occurred.	–	The DRIVER may be faulty. Replace the DRIVER.
A.740: Overload of Surge Current Limit Resistor (The main circuit power is turned ON/OFF too frequently.)	The inrush current limit resistor operation frequency at the main circuit power supply ON/OFF operation exceeds the allowable range.	–	Reduce the frequency of turning the main circuit power supply ON/OFF.
	A DRIVER fault occurred.	–	The DRIVER may be faulty. Replace the DRIVER.
A.7A0: Heat Sink Overheated (Detected when the heat sink temperature exceeds 100˚C.)	The surrounding air temperature is too high.	Check the surrounding air temperature using a thermostat.	Decrease the surrounding air temperature by improving the DRIVER installation conditions.
	The overload alarm has been reset by turning OFF the power too many times.	Check the alarm history display (Fn000) to see if the overload alarm was reported.	Change the method for resetting the alarm.
	Excessive load or operation beyond the regenerative energy processing capacity.	Check the accumulated load ratio (Un009) to see the load during operation, and the regenerative load ratio (Un00A) to see the regenerative energy processing capacity.	Reconsider the load and operating conditions.
	Incorrect DRIVER installation orientation or/and insufficient space around the DRIVER.	Check the DRIVER installation conditions.	Install the DRIVER correctly as specified.
	A DRIVER fault occurred.	–	The DRIVER may be faulty. Replace the DRIVER.
A.7AB: Built-in Fan in DRIVER Stopped	The fan inside the DRIVER stopped.	Check for foreign matter or debris inside the DRIVER.	Remove foreign matter or debris from the DRIVER. If the alarm still occurs, the DRIVER may be faulty. Replace the DRIVER.

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Alarm Number: Alarm Name (Alarm Description)	Cause	Investigative Actions	Corrective Actions
A.810: Encoder Backup Error (Only when an absolute encoder is connected.) (Detected on the encoder side.)	Alarm occurred when the power to the absolute encoder was initially turned ON.	Check to see if the power was turned ON initially.	Set up the encoder (Fn008).
	The encoder cable disconnected, and connected again.	Check to see if the power was turned ON initially.	Confirm the connection and set up the encoder (Fn008).
	The power from both the control power supply (+5 V) from the DRIVER and the battery power supply is not being sup- plied.	Check the encoder connector battery or the connector contact status.	Replace the battery or take similar measures to supply power to the encoder, and set up the encoder (Fn008).
	An absolute encoder fault occurred.	–	If the alarm cannot be reset by set- ting up the encoder again, replace the servomotor.
	A DRIVER fault occurred.	–	The DRIVER may be faulty. Replace the DRIVER.
A.820: Encoder Checksum Error (Detected on the encoder side.)	An encoder fault occurred.	–	• Absolute encoder Set up the encoder again using Fn008. If the alarm still occurs, the servomotor may be faulty. Replace the servomotor. • Absolute encoder that shows values for a single rotation The servomotor may be faulty. Replace the servomotor.
	A DRIVER fault occurred.	–	The DRIVER may be faulty. Replace the DRIVER.
A.830: Absolute Encoder Battery Error (The absolute encoder battery voltage is lower than the specified value.)	The battery connection is incorrect.	Check the battery connection.	Reconnect the battery.
	The battery voltage is lower than the specified value 2.7 V.	Measure the battery voltage.	Replace the battery.
	A DRIVER fault occurred.	–	The DRIVER may be faulty. Replace the DRIVER.
A.840: Encoder Data Error (Detected on the encoder side.)	An encoder malfunctioned.	–	Turn the power supply OFF and then ON again. If the alarm still occurs, the servomotor may be faulty. Replace the servomotor.
	Malfunction of encoder because of noise interference, etc.	–	Correct the wiring around the encoder by separating the encoder cable from the motor cable or by checking the grounding and other wiring.
A.850: Encoder Overspeed (Detected when the control power supply was turned ON.) (Detected on the encoder side.)	The servomotor speed is higher than 200 min^{-1} when the control power supply was turned ON.	Check the motor rotating speed (Un000) to confirm the servomotor speed when the power is turned ON.	Reduce the servomotor speed to a value less than 200 min^{-1}, and turn ON the control power supply.
	An encoder fault occurred.	–	Turn the power supply OFF and then ON again. If the alarm still occurs, the servomotor may be faulty. Replace the servomotor.
	A DRIVER fault occurred.	–	Turn the power supply OFF and then ON again. If the alarm still occurs, the DRIVER may be faulty. Replace the DRIVER.

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Alarm Number: Alarm Name (Alarm Description)	Cause	Investigative Actions	Corrective Actions
A.860: Encoder Overheated (Only when an absolute encoder is connected.) (Detected on the encoder side.)	The ambient operating temperature around the servomotor is too high.	Measure the ambient operating temperature around the servomotor.	The ambient operating temperature must be 40˚C or less.
	The motor load is greater than the rated load.	Check the accumulated load ratio (Un009) to see the load.	The motor load must be within the specified range.
	An encoder fault occurred.	–	Turn the power supply OFF and then ON again. If the alarm still occurs, the servomotor may be faulty. Replace the servomotor.
	A DRIVER fault occurred.	–	Turn the power supply OFF and then ON again. If the alarm still occurs, the DRIVER may be faulty. Replace the DRIVER.
A.8A0: External Encoder Error	Setting the zero point position of external absolute encoder failed because the servomotor rotated.	Before setting the zero point position, use the fully-closed feedback pulse counter (Un00E) to confirm that the servomotor is not rotating.	The servomotor must be stopped while setting the zero point position.
	An external encoder fault occurred.	–	Replace the external encoder.
A.8A1: External Encoder Error of Module	An external encoder fault occurred.	–	Replace the external encoder.
	A serial converter unit fault occurred.	–	Replace the serial converter unit.
A.8A2: External Encoder Error of Sensor (Incremental)	An external encoder fault occurred.	–	Replace the external encoder.
A.8A3: External Encoder Error of Position (Absolute)	An external absolute encoder fault occurred.	–	The external absolute encoder may be faulty. Refer to the encoder manufacturer's instruction manual for corrective actions.
A.8A5: External Encoder Overspeed	The overspeed from the external encoder occurred.	Check the maximum speed of the external encoder.	Keep the external encoder below its maximum speed.
A.8A6: External Encoder Overheated	The overheat from the external encoder occurred.	–	Replace the external encoder.
A.b31: Current Detection Error 1	The current detection circuit for phase U is faulty.	–	Turn the power supply OFF and then ON again. If the alarm still occurs, the DRIVER may be faulty. Replace the DRIVER.
A.b32: Current Detection Error 2	The current detection circuit for phase V is faulty.	–	Turn the power supply OFF and then ON again. If the alarm still occurs, the DRIVER may be faulty. Replace the DRIVER.
A.b33: Current Detection Error 3	The detection circuit for the current is faulty.	–	Turn the power supply OFF and then ON again. If the alarm still occurs, the DRIVER may be faulty. Replace the DRIVER.
	The motor cable is disconnected.	Check for disconnection of the motor cable.	Correct the servomotor wiring.
A.b6A: MECHATROLINK Communications ASIC Error 1	DRIVER MECHATROLINK communication section fault.	–	Turn the power supply OFF and then ON again. If the alarm still occurs, the DRIVER may be faulty. Replace the DRIVER.

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Alarm Number: Alarm Name (Alarm Description)	Cause	Investigative Actions	Corrective Actions
A.b6b: MECHATROLINK Communications ASIC Error 2	MECHATROLINK data reception error occurred due to noise interference.	–	Take measures against noise. Check the MECHATROLINK communications cable and FG wiring and take measures such as adding ferrite core on the MECHATROLINK communications cable.
	DRIVER MECHATROLINK communication section fault.	–	Turn the power supply OFF and then ON again. If the alarm still occurs, the DRIVER may be faulty. Replace the DRIVER.
A.bF0: System Alarm 0	A DRIVER fault occurred.	–	Turn the power supply OFF and then ON again. If the alarm still occurs, the DRIVER may be faulty. Replace the DRIVER.
A.bF1: System Alarm 1	A DRIVER fault occurred.	–	Turn the power supply OFF and then ON again. If the alarm still occurs, the DRIVER may be faulty. Replace the DRIVER.
A.bF2: System Alarm 2	A DRIVER fault occurred.	–	Turn the power supply OFF and then ON again. If the alarm still occurs, the DRIVER may be faulty. Replace the DRIVER.
A.bF3: System Alarm 3	A DRIVER fault occurred.	–	Turn the power supply OFF and then ON again. If the alarm still occurs, the DRIVER may be faulty. Replace the DRIVER.
A.bF4: System Alarm 4	A DRIVER fault occurred.	–	Turn the power supply OFF and then ON again. If the alarm still occurs, the DRIVER may be faulty. Replace the DRIVER.
A.C10: Servo Overrun Detected (Detected when the servomotor power is ON.)	The order of phases U, V, and W in the servomotor wiring is incorrect.	Check the motor wiring.	Confirm that the servomotor is correctly wired.
	An encoder fault occurred.	–	If the alarm still occurs after turning the power OFF and then ON again, even though the servomotor is correctly wired, the servomotor may be faulty. Replace the servomotor.
	A DRIVER fault occurred.	–	Turn the power supply OFF and then ON again. If the alarm still occurs, the DRIVER may be faulty. Replace the DRIVER.
A.C80: Absolute Encoder Clear Error and Multi-turn Limit Setting Error	An encoder fault occurred.	–	Turn the power supply OFF and then ON again. If the alarm still occurs, the servomotor may be faulty. Replace the servomotor.
	A DRIVER fault occurred.	–	Turn the power supply OFF and then ON again. If the alarm still occurs, the DRIVER may be faulty. Replace the DRIVER.

(cont'd)

Alarm Number: Alarm Name (Alarm Description)	Cause	Investigative Actions	Corrective Actions
A.C90: Encoder Communications Error	Contact fault of connector or incorrect wiring for encoder cable.	Check the connector contact status for encoder cable.	Re-insert the connector and confirm that the encoder is correctly wired.
	Cable disconnection for encoder cable or short-circuit. Or, incorrect cable impedance.	Check the encoder cable.	Use the cable with the specified rating.
	Corrosion caused by improper temperature, humidity, or gas, short-circuit caused by intrusion of water drops or cutting oil, or connector contact fault caused by vibration.	Check the operating environment.	Improve the operating environmental conditions, and replace the cable. If the alarm still occurs, replace the DRIVER.
	Malfunction caused by noise interference.	–	Correct the wiring around the encoder by separating the encoder cable from the motor cable or by checking the grounding and other wiring.
	A DRIVER fault occurred.	–	Connect the servomotor to another DRIVER, and turn ON the control power. If no alarm occurs, the DRIVER may be faulty. Replace the DRIVER.
A.C91: Encoder Communications Position Data Error	Noise interference occurred on the I/O signal line because the encoder cable is bent and the sheath is damaged.	Check the encoder cable and connector.	Confirm that there is no problem with the cable layout.
	The encoder cable is bundled with a high-current line or near a high-current line.	Check the cable layout for encoder cable.	Confirm that there is no surge voltage on the cable.
	The FG potential varies because of influence from machines on the servomotor side, such as the welder.	Check the cable layout for encoder cable.	Properly ground the machines to separate from the encoder FG.
A.C92: Encoder Communications Timer Error	Noise interference occurred on the I/O signal line from the encoder.	–	Take countermeasures against noise for the encoder wiring.
	Excessive vibration and shocks were applied to the encoder.	Check the operating environment.	Reduce the machine vibration or correctly install the servomotor.
	An encoder fault occurred.	–	Turn the power supply OFF and then ON again. If the alarm still occurs, the servomotor may be faulty. Replace the servomotor.
	A DRIVER fault occurred.	–	Turn the power supply OFF and then ON again. If the alarm still occurs, the DRIVER may be faulty. Replace the DRIVER.
A.CA0: Encoder Parameter Error	An encoder fault occurred.	–	Turn the power supply OFF and then ON again. If the alarm still occurs, the servomotor may be faulty. Replace the servomotor.
	A DRIVER fault occurred.	–	Turn the power supply OFF and then ON again. If the alarm still occurs, the DRIVER may be faulty. Replace the DRIVER.

(cont'd)

Alarm Number: Alarm Name (Alarm Description)	Cause	Investigative Actions	Corrective Actions
A.Cb0: Encoder Echoback Error	The wiring and contact for encoder cable are incorrect.	Check the wiring.	Correct the wiring.
	Noise interference occurred due to incorrect cable specifications of encoder cable.	–	Use tinned annealed copper shielded twisted-pair or screened unshielded twisted-pair cable with a core of at least 0.12 mm^2.
	Noise interference occurred because the wiring distance for the encoder cable is too long.	–	The wiring distance must be 50 m max.
	The FG potential varies because of influence from machines on the servomotor side, such as the welder.	Check the cable layout for encoder cable.	Properly ground the machines to separate from encoder FG.
	Excessive vibration and shocks were applied to the encoder.	Check the operating environment.	Reduce the machine vibration or correctly install the servomotor.
	An encoder fault occurred.	–	Turn the power supply OFF and then ON again. If the alarm still occurs, the servomotor may be faulty. Replace the servomotor.
	A DRIVER fault occurred.	–	Turn the power supply OFF and then ON again. If the alarm still occurs, the DRIVER may be faulty. Replace the DRIVER.
A.CC0: Multiturn Limit Disagreement	When using a direct drive (DD) servomotor, the multiturn limit value (Pn205) is different from that of the encoder.	Check the value of the Pn205.	Correct the setting of Pn205 (0 to 65535).
	The multiturn limit value of the encoder is different from that of the DRIVER. Or, the multi- turn limit value of the DRIVER has been changed.	Check the value of the Pn205 of the DRIVER.	Execute Fn013 at the occurrence of alarm.
	A DRIVER fault occurred.	–	Turn the power supply OFF and then ON again. If the alarm still occurs, the DRIVER may be faulty. Replace the DRIVER.
A.CF1: Feedback Option Module Communications Error (Reception error)	Wiring of cable between serial converter unit and DRIVER is incorrect or contact is faulty.	Check the external encoder wiring.	Correct the cable wiring.
	The specified cable is not used between serial converter unit and DRIVER.	Confirm the external encoder wiring specifications.	Use the specified cable.
	Cable between serial converter unit and DRIVER is too long.	Measure the length of this cable.	Use 20-m cable max.
	Sheath of cable between serial converter unit and DRIVER is broken.	Check the cable for damage.	Replace the cable.
A.CF2: Feedback Option Module Communications Error (Timer stop)	Noise interferes with the cable between serial converter unit and DRIVER.	–	Correct the wiring around serial converter unit, e.g., separating I/O signal line from main circuit cable or grounding.
	A serial converter unit fault occurred.	–	Replace the serial converter unit.
	A DRIVER fault occurred.	–	Replace the DRIVER.

(cont'd)

Alarm Number: Alarm Name (Alarm Description)	Cause	Investigative Actions	Corrective Actions
A.d00: Position Error Overflow (Position error exceeded the value set in the excessive position error alarm level (Pn520).)	The servomotor U, V, and W wirings is faulty.	Check the motor cable connection.	Confirm that there is no contact fault in the motor wiring or encoder wiring.
	The position reference speed is too high.	Reduce the reference speed, and operate the DRIVER.	Reduce the position reference speed or acceleration of position reference. Or, reconsider the electronic gear ratio.
	The acceleration of the position reference is too high.	Reduce the reference acceleration, and operate the DRIVER.	Reduce the reference acceleration of the position reference using a MECHATROLINK command, or smooth the acceleration of the position reference by selecting the position reference filter (ACCFIL) using a MECHATROLINK command.
	Setting of the excessive position error alarm level (Pn520) is low against the operating condition.	Check the alarm level (Pn520) to see if it is set to an appropriate value.	Set the Pn520 to proper value.
	A DRIVER fault occurred.	–	Turn the power supply OFF and then ON again. If the alarm still occurs, the DRIVER may be faulty. Replace the DRIVER.
A.d01: Position Error Overflow Alarm at Servo ON	This alarm occurs if the servomotor power is turned ON when the position error is greater than the set value of Pn526 while the servomotor power is OFF.	Check the position error amount (Un008) while the servomotor power is OFF.	Correct the excessive position error alarm level at servo ON (Pn526).
A.d02: Position Error Overflow Alarm by Speed Limit at Servo ON	When the position errors remain in the error counter, Pn529 limits the speed if the servomotor power is ON. If Pn529 limits the speed in such a state, this alarm occurs when position references are input and the number of position errors exceeds the value set for the excessive position error alarm level (Pn520).	–	Correct the excessive position error alarm level (Pn520). Or, adjust the speed limit level at servo ON (Pn529).
A.d10: Motor-load Position Error Overflow	Motor rotation direction and external encoder installation direction are opposite.	Check the and the external encoder installation direction.	Install the external encoder in the opposite direction, or change the setting of the external encoder usage method (Pn002.3) to reverse the direction.
	Mounting of the load (e.g., stage) and external encoder joint installation are incorrect.	Check the external encoder mechanical connection.	Check the mechanical joints.
A.E02: MECHATROLINK Internal Synchronization Error 1	MECHATROLINK transmission cycle fluctuated.	–	Remove the cause of transmission cycle fluctuation at PC or PLC etc....
	A DRIVER fault occurred.	–	Turn the power supply OFF and then ON again. If the alarm still occurs, the DRIVER may be faulty. Replace the DRIVER.
A.E40: MECHATROLINK Transmission Cycle Setting Error	Setting of MECHATROLINK transmission cycle is out of specifications range.	Check the MECHATROLINK transmission cycle setting.	Set the transmission cycle to the proper value.

(cont'd)

Alarm Number: Alarm Name (Alarm Description)	Cause	Investigative Actions	Corrective Actions
A.E50: MECHATROLINK Synchronization Error	WDT data of PC or PLC etc... was not updated correctly.	Check the WDT data updating for the PC or PLC etc....	Update the WDT data at the PC or PLC etc... correctly.
	A DRIVER fault occurred.	–	Turn the power supply OFF and then ON again. If the alarm still occurs, the DRIVER may be faulty. Replace the DRIVER.
A.E51: MECHATROLINK Synchronization Failed	WDT data of PC or PLC etc... was not updated correctly at the synchronization communications start, and synchronization communications could not start.	Check the WDT data updating for the PC or PLC etc....	Update the WDT data at the PC or PLC etc... correctly.
	A DRIVER fault occurred.	–	Turn the power supply OFF and then ON again. If the alarm still occurs, the DRIVER may be faulty. Replace the DRIVER.
A.E60: MECHATROLINK Communications error (Reception error)	MECHATROLINK wiring is incorrect.	Check the MECHATROLINK wirings.	Correct the MECHATROLINK wiring. Connect the terminator correctly.
	MECHATROLINK data reception error occurred due to noise interference.	–	Take measures against noise. Check the MECHATROLINK communications cable and FG wiring and take measures such as adding ferrite core on the MECHATROLINK communications cable.
	A DRIVER fault occurred.	–	Turn the power supply OFF and then ON again. If the alarm still occurs, the DRIVER may be faulty. Replace the DRIVER.
A.E61: MECHATROLINK Transmission Cycle Error (Synchronization interval error)	MECHATROLINK transmission cycle fluctuated.	Check the MECHATROLINK transmission cycle setting.	Remove the cause of transmission cycle fluctuation at PC or PLC etc....
	A DRIVER fault occurred.	–	Turn the power supply OFF and then ON again. If the alarm still occurs, the DRIVER may be faulty. Replace the DRIVER.
A.E71: Safety Option Module Detection Failure	The connection between the DRIVER and the safety option module is faulty.	Check the connection between the DRIVER and the safety option module.	Correctly connect the safety option module.
	The safety option module was disconnected.	–	Execute Fn014 (Resetting configuration error of option module) with using the SigmaWin+ and turn the power supply OFF and then ON again.
	A safety option module fault occurred.	–	Replace the safety option module.
	A DRIVER fault occurred.	–	Replace the DRIVER.
A.E72: Feedback Option Module Detection Failure	The connection between the DRIVER and the Feedback Option Module is Faulty.	Check the connection between the DRIVER and the Feedback Option Module.	Correctly connect the Feedback Option Module.
	The Feedback Option Module was disconnected.	–	Execute resetting configuration error in option modules (Fn014) and turn the power supply OFF and then ON again.
	A Feedback Option Module fault occurred.	–	Replace the Feedback Option Module.
	A DRIVER fault occurred.	–	Replace the DRIVER.

(cont'd)

Alarm Number: Alarm Name (Alarm Description)	Cause	Investigative Actions	Corrective Actions
A.E74: Unsupported Safety Option Module	A safety option module fault occurred.	–	Replace the safety option module.
	A unsupported safety option module was connected.	Refer to the catalog of the connected safety option module.	Connect a compatible safety option module.
A.E75: Unsupported Feed-back Option Module	A feedback option module fault occurred.	–	Replace the feedback option module.
	A unsupported feedback option module was connected.	Refer to the catalog of the connected feedback option module or the manual of the	Connect a compatible feedback option module.
A.EA2: DRV Alarm 2 (DRIVER WDT error)	MECHATROLINK transmission cycle fluctuated.	Check the MECHATROLINK transmission cycle setting.	Remove the cause of transmission cycle fluctuation at PC or PLC
	A DRIVER fault occurred.	–	Turn the power supply OFF and then ON again. If the alarm still occurs, the DRIVER may be faulty. Replace the DRIVER.
A.Eb1	Please contact SMC.		
A.Ed1: Command Execution Timeout	A timeout error occurred when using an MECHATROLINK command.	Check the motor status when the command is executed.	Execute the SV_ON or SENS_ON command only when the motor is not running.
		For fully-closed loop control, check the status of the external encoder after an output is made to execute the command.	Execute the SENS_ON command only when an external encoder is connected.
A.F10: Main Circuit Cable Open Phase (With the main power supply ON, voltage was low for more than 1 second in an R, S, or T phase.) (Detected when the main power supply was turned ON.)	The three-phase power supply wiring is incorrect.	Check the power supply wiring.	Confirm that the power supply is correctly wired.
	The three-phase power supply is unbalanced.	Measure the voltage at each phase of the three-phase power supply.	Balance the power supply by changing phases.
	A single-phase power is input without setting Pn00B.2 (power supply method for three-phase DRIVER) to 1 (single-phase power supply).	Check the power supply and the parameter setting.	Match the parameter setting to the power supply.
	A DRIVER fault occurred.	–	Turn the power supply OFF and then ON again. If the alarm still occurs, the DRIVER may be faulty. Replace the DRIVER.

(cont'd)

Alarm Number: Alarm Name (Alarm Description)	Cause	Investigative Actions	Corrective Actions
FL-1*2: System Alarm	DRIVER failure	–	Turn the power supply OFF and then ON again. If the alarm still occurs, the DRIVER may be faulty. Replace the DRIVER.
FL-2*2: System Alarm		–	
CPF00*3: Digital Operator Transmission Error 1	The contact between the digital operator and the DRIVER is faulty.	Check the connector contact.	Insert securely the connector or replace the cable.
	Malfunction caused by noise interference.		Keep the digital operator or the cable away from noise sources.
CPF01*3: Digital Operator Transmission Error 2	A digital operator fault occurred.		Disconnect the digital operator and then re-connect it. If the alarm still occurs, the digital operator may be faulty. Replace the digital operator.
	A DRIVER fault occurred.		Turn the power supply OFF and then ON again. If the alarm still occurs, the DRIVER may be faulty. Replace the DRIVER.

∗2. These alarms are not stored in the alarm history and are displayed only in the panel display.

∗3. Digital operator is made of the YASUKAWA ELECTRIC CORPORATION.

9.2 Warning Displays

The following sections describe troubleshooting in response to warning displays.
The warning name and warning meaning output are listed in order of the warning numbers in *9.2.1 List of Warnings*.

The causes of warnings and troubleshooting methods are provided in *9.2.2 Troubleshooting of Warnings*.

9.2.1 List of Warnings

This section provides list of warnings.
After its cause has been removed, the warning can be deactivated in any of the methods marked ○ in the warning reset column.

	Warning Number	Warning Name	Warning reset			
			Power OFF ↓ ON	Alarm warning clear command [ALM-CLR]	SigmaWin+ [Alarm] | [Display Alarm] | Reset button	SigmaWin+ [Setup] | [Software Reset] | Execute button
Warning	A.900*3	Position Error Overflow	○	○	○	○
	A.901*3	Position Error Overflow Alarm at Servo ON	○	○	○	○
	A.910*3	Overload	○	○	○	○
	A.911*3	Vibration	○	○	○	○
	A.920*3	Regenerative Overload	○	○	○	○
	A.921*3	Dynamic Brake Overload	○	○	○	○
	A.930*3	Absolute Encoder Battery Error	○	○	○	○
	A.94A*4	Data Setting Warning 1 (Parameter Number Error)	○	○	○	○
	A.94B*4	Data Setting Warning 2 (Out of Range)	○	○	○	○
	A.94C*4	Data Setting Warning 3 (Calculation Error)	○	○	○	○
	A.94D*4	Data Setting Warning 4 (Parameter Size)	○	○	○	○
	A.94E*4	Data Setting Warning 5 (Latch Mode Error)	○	○	○	○
	A.95A*4	Command Warning 1 (Unsatisfying Command)	○	○	○	○
	A.95B*4	Command Warning 2 (Non-supported Command)	○	○	○	○
	A.95D*4	Command Warning 4 (Command Interference)	○	○	○	○
	A.95E*4	Command Warning 5 (Subcommand Disable)	○	○	○	○
	A.95F*4	Command Warning 6 (Undefined Command)	○	○	○	○
	A.960*4	MECHATROLINK Communications Warning	○	○	○	○
	A.971*5	Undervoltage	○	○	○	○
	A.9A0*3	Overtravel	○	○	○	○

∗3. Use Pn008.2 to activate or not the warning detection.
∗4. Use Pn800.1 to activate or not the warning detection.
∗5. Use Pn008.1 to activate or not the warning detection.

9.2.2 Troubleshooting of Warnings

Refer to the following table to identity the cause of a warning and the action to be taken. Contact SMC if the problem cannot be solved by the described corrective action.

Warning Number: Warning Name (Warning Description)	Cause	Investigative Actions	Corrective Actions
A.900: Position Error Overflow	The servomotor U, V, and W wirings is faulty.	Check the motor cable connection.	Confirm that there is no contact fault in the motor wiring or encoder wiring.
	The DRIVER gain is too low.	Check the DRIVER gain.	Increase the servo gain by using the function such as advanced autotuning.
	The acceleration of the position reference is too high.	Reduce the reference acceleration, and operate the DRIVER.	Reduce the reference acceleration of the position reference using a MECHATROLINK command, or smooth the acceleration of the position reference by selecting the position reference filter (ACCFIL) using a MECHATROLINK command.
	Setting of the excessive position error alarm level (Pn520) is low against the operating condition.	Check the alarm level (Pn520) to see if it is set to an appropriate value.	Set the Pn520 to proper value.
	A DRIVER fault occurred.	–	Turn the power supply OFF and then ON again. If the alarm still occurs, the DRIVER may be faulty. Replace the DRIVER.
A.901: Position Error Overflow Alarm at Servo ON	When the servomotor power is ON, the position error exceeded the parameter setting (Pn526×Pn528/100).	–	Set an appropriate value for the excessive position error warning level at servo ON (Pn528).
A.910: Overload (Warning before alarm A.710 or A.720 occurs)	Incorrect wiring or contact fault of servomotor and encoder.	Check the wiring.	Confirm that the servomotor and encoder are correctly wired.
	Operation beyond the overload protection characteristics.	Check the motor overload characteristics and executed run command.	Reconsider the load conditions and operating conditions. Or, increase the motor capacity.
	Excessive load was applied during operation because the servomotor was not driven due to mechanical problems.	Check the executed operation reference and motor speed.	Remove the mechanical problems.
	A DRIVER fault occurred.	–	The DRIVER may be faulty. Replace the DRIVER.
A.911: Vibration	Abnormal vibration was detected at the motor speed.	Check for abnormal noise from the servomotor, and check the speed and torque waveforms during operation.	Reduce the motor speed or reduce the servo gain by using the function such as one-parameter tuning.
	The moment of inertia ratio (Pn103) value is greater than the actual value or is greatly changed.	Check the moment of inertia ratio.	Set the moment of inertia ratio (Pn103) to an appropriate value.

(cont'd)

Warning Number: Warning Name (Warning Description)	Cause	Investigative Actions	Corrective Actions
A.920: Regenerative Overload (Warning before the alarm A.320 occurs)	The power supply voltage exceeds the specified limit.	Measure the power supply voltage.	Set the power supply voltage within the specified range.
	Insufficient external regenerative resistance, regenerative resistor capacity, or DRIVER capacity. Or, regenerative power has been continuously flowing back.	Check the operating condition or the capacity.	Change the regenerative resistance, regenerative resistor capacity, or DRIVER capacity. Reconsider the operating conditions.
	Regenerative power continuously flowed back because negative load was continuously applied.	Check the load to the servomotor during operation.	Reconsider the system including servo drives, machine, and operating conditions.
A.921: Dynamic Brake Overload (Warning before the alarm A.731 occurs)	The servomotor rotates because of external force.	Check the operation status.	Take measures to ensure the servomotor will not rotate because of external force.
	The rotating energy at a DB stop exceeds the DB resistance capacity.	Check the power consumed by DB resistance (Un00B) to see how many times the DB has been used.	Reconsider the following: - Reduce the motor reference speed. - Reduce the moment of inertia ratio. - Reduce the number of times of the DB stop operation.
	A DRIVER fault occurred.	_	The DRIVER may be faulty. Replace the DRIVER.
A.930: Absolute Encoder Battery Error (The absolute encoder battery voltage is lower than the specified value.) ∗ Only when an absolute encoder is connected.	The battery connection is incorrect.	Check the battery connection.	Reconnect the battery.
	The battery voltage is lower than the specified value 2.7 V.	Measure the battery voltage.	Replace the battery.
	A DRIVER fault occurred.	_	The DRIVER may be faulty. Replace the DRIVER.
A.94A: Data Setting Warning 1 (Parameter Number Error)	Disabled parameter number was used.	Refer to *9.3 Monitoring Communication Data on Occurrence of an Alarm or Warning* to determine which command was the cause of the warning.	Use the correct parameter number.
A.94B: Data Setting Warning 2 (Out of Range)	Attempted to send values outside the range to the command data.	Refer to *9.3 Monitoring Communication Data on Occurrence of an Alarm or Warning* to determine which command was the cause of the warning.	Set the value of the parameter within the allowable range.
A.94C: Data Setting Warning 3 (Calculation Error)	Calculation result of set value is incorrect.	Refer to *9.3 Monitoring Communication Data on Occurrence of an Alarm or Warning* to determine which command was the cause of the warning.	Set the value of the parameter within the allowable range.
A.94D: Data Setting Warning 4 (Parameter Size)	Parameter size set in command is incorrect.	Refer to *9.3 Monitoring Communication Data on Occurrence of an Alarm or Warning* to determine which command was the cause of the warning.	Use the correct parameter size.

(cont'd)

Warning Number: Warning Name (Warning Description)	Cause	Investigative Actions	Corrective Actions
A.94E Data Setting Warning 5 (Latch mode error)	Latch mode error is detected.	Refer to *9.3 Monitoring Communication Data on Occurrence of an Alarm or Warning* to determine which command was the cause of the warning.	Change the setting value of Pn850 or the LT_MOD data for the LTMOD_ON command sent by the PC or PLC etc... to the proper value.
A.95A Command Warning 1 (Unsatisfying Command)	Command sending condition is not satisfied.	Refer to *9.3 Monitoring Communication Data on Occurrence of an Alarm or Warning* to determine which command was the cause of the warning.	Send a command after command sending condition is satisfied.
A.95B Command Warning 2 (Non-supported Command)	DRIVER received unsupported command.	Refer to *9.3 Monitoring Communication Data on Occurrence of an Alarm or Warning* to determine which command was the cause of the warning.	Do not sent an unsupported command.
A.95D Command Warning 4 (Command Interference)	Command sending condition for latch-related commands is not satisfied.	Refer to *9.3 Monitoring Communication Data on Occurrence of an Alarm or Warning* to determine which command was the cause of the warning.	Send a command after command sending condition is satisfied.
A.95E Command Warning 5 (Subcommand Disable)	Subcommand sending condition is not satisfied.	Refer to *9.3 Monitoring Communication Data on Occurrence of an Alarm or Warning* to determine which command was the cause of the warning.	Send a command after command sending condition is satisfied.
A.95F Command Warning 6 (Undefined Command)	Undefined command was sent.	Refer to *9.3 Monitoring Communication Data on Occurrence of an Alarm or Warning* to determine which command was the cause of the warning.	Do not use an undefined command.
A.960 MECHATROLINK Communications Warning	MECHATROLINK wiring is incorrect.	Confirm the wiring.	Correct the MECHATROLINK wiring. Or, connect a terminal to the terminal station.
	MECHATROLINK data reception error occurred due to noise interference.	Confirm the installation conditions.	Take measures against noise. Check the MECHATROLINK communications cable and FG wiring and take measures such as adding ferrite core on the MECHATROLINK communications cable.
	A DRIVER fault occurred.	_	A fault occurred in the DRIVER. Replace the DRIVER.

(cont'd)

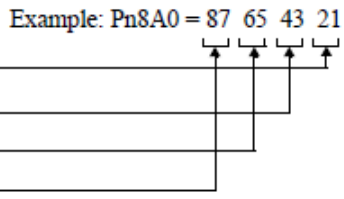
Warning Number: Warning Name (Warning Description)	Cause	Investigative Actions	Corrective Actions
A.971: Undervoltage	For 200-VAC DRIVERs: The AC power supply voltage is 140 V or less.	Measure the power supply voltage.	Set the power supply voltage within the specified range.
	The power supply voltage dropped during operation.	Measure the power supply voltage.	Increase the power supply capacity.
	Occurrence of instantaneous power interruption.	Measure the power supply voltage.	When the instantaneous power cut hold time (Pn509) is set, decrease the setting.
	The DRIVER fuse is blown out.	–	Replace the DRIVER and connect a reactor to the DRIVER.
	A DRIVER fault occurred.	–	The DRIVER may be faulty. Replace the DRIVER.
A.9A0: Overtravel (Overtravel status is detected.)	When the servomotor power is ON, overtravel status is detected.	Check the input signal monitor (Un005) to check the status of the overtravel signals.	Refer to *9.4 Troubleshooting Malfunction Based on Operation and Conditions of the Servomotor*. Even if overtravel signals were not shown by the input signal monitor (Un005), momentary overtravel may have been detected. Take the following precautions. - Do not specify movements that would cause overtravel from the PC or PLC etc.... - Check the wiring of the overtravel signals. -Take countermeasures for noise.

9.3 Monitoring Communication Data on Occurrence of an Alarm or Warning

The command data received on occurrence of an alarm or warning, such as a data setting warning (A.94□) or a command warning (A.95□) can be monitored using the following parameters. The following is an example of the data when an alarm/warning has occurred in the normal state.

Command Data Monitor at Alarm/Warning Occurrence: Pn890 to Pn89E
Response Data Monitor at Alarm/Warning Occurrence:Pn8A0 to Pn8AE

Command Byte Order	Command Data Storage at Alarm/Warning Occurrence	
	CMD	RSP
1	Pn890.1 to 0	Pn8A0.1 to 0
2	Pn890.3 to 2	Pn8A0.3 to 2
3	Pn890.5 to 4	Pn8A0.5 to 4
4	Pn890.7 to 6	Pn8A0.7 to 6
5 to 8	Pn892	Pn8A2
9 to 12	Pn894	Pn8A4
13 to 16	Pn896	Pn8A6
17 to 20	Pn898	Pn8A8
21 to 24	Pn89A	Pn8AA
25 to 28	Pn89C	Pn8AC
29 to 32	Pn89E	Pn8AE



Note 1. Data is stored in little endian byte order and displayed in the hexadecimal format.
2. For details on commands, refer to *8 MECHATROLINK-II Commands.*

9.4 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	The control power supply is not ON.	Check voltage between control power terminals.	Correct the wiring.
	The main circuit power supply is not ON.	Check the voltage between main circuit power terminals.	Correct the wiring.
	Wiring of I/O signal connector CN1 is faulty or disconnected.	Check if the connector CN1 is properly inserted and connected.	Correct the connector CN1 connection.
	Wiring for motor cable or encoder cable is disconnected.	Check the wiring.	Correct the wiring.
	Overloaded	Run under no load and check the load status.	Reduce load or replace with larger capacity servomotor.
	Encoder type differs from parameter setting (Pn002.2).	Check the settings for parameter Pn002.2.	Set parameter Pn002.2 to the encoder type being used.
	Settings for the input signal selections (Pn50A, Pn50B and Pn511) is incorrect.	Check the settings for parameters Pn50A, Pn50B and Pn511.	Correct the settings for parameter Pn50A, Pn50B and Pn511.
	SV_ON command is not sent.	Check the command sent from the host controller.	Send the SV_ON command.
	SENS_ON command is not sent.	Check the command sent from the host controller.	Send the command in the correct DRIVER sequence.
	The forward run prohibited (P-OT) and reverse run prohibited (N-OT) input signals are turned OFF.	Check P-OT or N-OT input signal.	Turn P-OT or N-OT input signal ON.
	The safety input signal (/HWBB1 or /HWBB2) remains OFF.	Check the /HWBB1 and /HWBB2 input signal.	Set the /HWBB1 and /HWBB2 input signal to ON. When not using the safety function, mount the safety function jumper connector (provided as an accessory) on the CN8.
	A DRIVER fault occurred.	–	Replace the DRIVER.
Servomotor Moves Instantaneously, and then Stops	Servomotor wiring is incorrect.	Check the wiring.	Correct the wiring.
	Encoder wiring is incorrect.	Check the wiring.	Correct the wiring.
Servomotor Speed Unstable	Wiring connection to servomotor is defective.	Check connections of power line (phases U, V, and W) and encoder connectors.	Tighten any loose terminals or connectors and correct the wiring.
Servomotor Rotates Without Reference Input	A DRIVER fault occurred.	–	Replace the DRIVER.
Dynamic Brake Does Not Operate	Improper Pn001.0 setting	Check the setting for parameter Pn001.0.	Correct the setting for parameter Pn001.0.
	DB resistor disconnected	Check if excessive moment of inertia, motor overspeed, or DB frequently activated occurred.	Replace the DRIVER, and reduce the load.
	DB drive circuit fault	–	There is a defective component in the DB circuit. Replace the DRIVER.

(cont'd)

Problem	Probable Cause	Investigative Actions	Corrective Actions
Abnormal Noise from Servomotor	The servomotor largely vibrated during execution of tuning-less function.	Check the motor 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 levels 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 I/O signal cable specifications.	The I/O signal cable must be tinned annealed copper shielded twistedpair or screened unshielded twistedpair cable with a core of 0.12 mm^2 min.	Use the specified I/O signal cable.
	Noise interference due to length of I/O signal cable.	Check the length of the I/O signal cable.	The I/O signal cable length must be no more than 3 m.
	Noise interference due to incorrect cable specifications of encoder cable.	The encoder cable must be tinned annealed copper shielded twisted-pair or screened unshielded twistedpair cable with a core of 0.12 mm^2 min.	Use the specified encoder cable.
	Noise interference due to length of encoder cable.	Check the length of the encoder cable.	The encoder cable must be no more than 50 m.
	Noise interference due to damaged encoder cable.	Check if the encoder cable is bent and the sheath is damaged.	Replace the encoder cable and correct the cable layout.
	Excessive noise to the encoder cable.	Check if the encoder cable is bundled with a high-current line or near a high-current line.	Correct the cable layout so that no surge is applied.
	The FG potential varies because of influence from machines on the servomotor side, such as the welder.	Check if the machines are correctly grounded.	Properly ground the machines to separate from the encoder FG.
	DRIVER pulse counting error due to noise interference	Check if there is noise interference on the I/O 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.

(cont'd)

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 (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 (Pn102). Factory setting: Kp = 40.0/s	Reduce the position loop gain (Pn102).
	Incorrect speed loop integral time constant (Pn101)	Check the speed loop integral time constant (Pn101). Factory setting: Ti = 20.0 ms	Correct the speed loop integral time constant (Pn101).
	Incorrect moment of inertia ratio (Pn103)	Check the moment of inertia ratio (Pn103).	Correct the moment of inertia ratio (Pn103).
High Motor 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 (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 (Pn102). Factory setting: Kp = 40.0/s	Reduce the position loop gain (Pn102).
	Incorrect speed loop integral time constant (Pn101)	Check the speed loop integral time constant (Pn101). Factory setting: Ti = 20.0 ms	Correct the speed loop integral time constant (Pn101).
	Incorrect moment of inertia ratio data (Pn103)	Check the moment of inertia ratio (Pn103).	Correct the moment of inertia ratio (Pn103).
Absolute Encoder Position Difference Error (The position saved in the PC or PLC etc... when the power was turned OFF is different from the position when the power was next turned ON.)	Noise interference due to incorrect cable specifications of encoder cable.	The encoder cable must be tinned annealed copper shielded twistedpair or screened unshielded twistedpair cable with a core of 0.12 mm^2 min.	Use the specified encoder cable.
	Noise interference due to length of encoder cable.	Check the length of the encoder cable.	The encoder cable must be no more than 50 m.
	Noise interference due to damaged encoder cable.	Check if the encoder cable is bent and the sheath is damaged.	Replace the encoder cable and correct the cable layout.
	Excessive noise to the encoder cable.	Check if the encoder cable is bundled with a high-current line or near a high-current line.	Correct the 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 on the encoder side.
	DRIVER pulse counting error due to noise interference	Check if there is noise interference on the I/O 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.
	A DRIVER fault occurred. (The pulse count does not change.)	–	Replace the DRIVER.
	PC or PLC etc... multiturn data reading error	Check the error detection section of the PC or PLC etc....	Correct the error detection section of the PC or PLC etc....
		Check if the PC or PLC etc... is executing data parity checks.	Execute a multiturn data parity check.
		Check noise in the cable between the DRIVER and the PC or PLC etc....	Take measures against noise, and again execute a multiturn data parity check.

(cont'd)

Problem	Probable Cause	Investigative Actions	Corrective Actions
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 parameters Pn50A and Pn50B.	Correct the settings for parameters Pn50A and Pn50B.
	Forward or reverse run prohibited signal malfunctioning.	Check the fluctuation of the external power supply (+24 V) voltage for the input signal.	Stabilize the external power supply (+24 V) voltage.
		Check if the overtravel limit switch operates correctly.	Correct the overtravel 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, allocate P-OT.
		Check if the N-OT signal is allocated in Pn50B.0.	If another signal is allocated in Pn50B.0, allocate N-OT.
	Incorrect servomotor stop method selection	Check the settings for parameters Pn001.0 and Pn001.1 when the servomotor power is OFF.	Select a servomotor stop method other than "coast to stop."
		Check the settings for parameters Pn001.0 and Pn001.1 when in torque control.	Select a servomotor stop method other than "coast to stop."
Improper Stop Position by Overtravel (OT) Signal	Improper limit switch position and dog length	–	Install the limit switch at the appropriate position.
	The overtravel limit switch position is too short for the coasting distance.	–	Install the overtravel limit switch at the appropriate position.

(cont'd)

Problem	Probable Cause	Investigative Actions	Corrective Actions
Position Error (Without Alarm)	Noise interference due to incorrect encoder cable specifications	The encoder cable must be tinned annealed copper shielded twistedpair or screened unshielded twistedpair cable with a core of 0.12 mm^2 min.	Use the specified encoder cable.
	Noise interference due to length of encoder cable.	Check the length of the encoder cable.	The encoder cable must be no more than 50 m.
	Noise influence due to damaged encoder cable.	Check if the encoder cable is bent and the sheath is damaged.	Replace the encoder cable and modify the cable layout.
	Excessive noise to encoder cable.	Check if the encoder cable is bundled with a high-current line or near a high-current line.	Change the cable layout so that no surge is applied.
	The FG potential varies because of influence from machines on the servomotor side such as the welder.	Check if the machines are correctly grounded.	Properly ground the machines encoder FG.
	DRIVER pulse count error due to noise	Check if the I/O signal line from the encoder is influenced by noise.	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 the machine vibration or mount the servomotor securely.
	Unsecured coupling between machine and servomotor	Check if a position error occurs at the coupling between machine and servomotor.	Secure the coupling between the machine and servomotor.
	Noise interference due to improper I/O signal cable specifications	The I/O signal cable must be tinned annealed copper shielded twistedpair or screened unshielded twistedpair cable with a core of 0.12 mm^2 min.	Use input signal cable with the specified specifications.
	Noise interference due to length of I/O signal cable	Check the I/O signal cable length.	The I/O signal cable length must be no more than 3 m.
	An encoder fault occurred. (The pulse count does not change.)	–	Replace the servomotor.
	A DRIVER fault occurred.	–	Replace the DRIVER.
Servomotor Overheated	Ambient operating temperature too high	Measure the servomotor ambient operating temperature.	Reduce the ambient operating 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 with larger capacity DRIVER and servomotor.

10. List of Parameters 2
10.1 List of Parameters 2
10.1.1 Utility Functions 2
10.1.2 Parameters 3
10.2 Parameter Recording Table 34

10. List of Parameters

10.1 List of Parameters

10.1.1 Utility Functions

The following list shows the available utility functions.

Parameter No.	Function	Reference Section
Fn000	Alarm history display	6.2
Fn002	JOG operation	6.3
Fn003	Origin search	6.4
Fn004	Program JOG operation	6.5
Fn005	Initializing parameter settings	6.6
Fn006	Clearing alarm history	6.7
Fn008	Absolute encoder multiturn reset and encoder alarm reset	4.7.4
Fn00C	Offset adjustment of analog monitor output	6.8
Fn00D	Gain adjustment of analog monitor output	6.9
Fn00E	Automatic offset-signal adjustment of the motor current detection signal	6.10
Fn00F	Manual offset-signal adjustment of the motor current detection signal	6.11
Fn010	Write prohibited setting	6.12
Fn011	Production information display	6.13
Fn013	Multiturn limit value setting change when a multiturn limit disagreement alarm occurs	4.7.6
Fn014	Resetting configuration error in option modules	6.14
Fn01B	Vibration detection level initialization	6.15
Fn020	Origin setting	6.16
Fn030	Software reset	6.17
Fn200	Tuning-less levels setting	5.2.2
Fn201	Advanced autotuning	5.3.2
Fn202	Advanced autotuning by reference	5.4.2
Fn203	One-parameter tuning	5.5.2
Fn204	Anti-resonance control adjustment function	5.6.2
Fn205	Vibration suppression function	5.7.2
Fn206	EasyFFT	6.18
Fn207	Online vibration monitor	6.19

Note: Execute the utility function with SigmaWin+.

10.1.2 Parameters

Parameter No.	Size	Name	Setting Range	Units	Factory Setting	When Enabled	Classification	Reference Section
Pn000	2	Basic Function Select Switch 0	0000 to 00B3	–	0000	After restart	Setup	–

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

Direction Selection		Reference Section
0	Sets CCW as forward direction.	4.3.1
1	Sets CW as forward direction. (Reverse Rotation Mode)	
2 to 3	Reserved (Do not change.)	

Reserved (Do not change.)

Reserved (Do not change.)

Reserved (Do not change.)

Parameter No.	Size	Name	Setting Range	Units	Factory Setting	When Enabled	Classification	Reference Section
Pn001	2	Application Function Select Switch 1	0000 to 1122	–	0000	After restart	Setup	–

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

Servomotor power OFF or Alarm Gr.1 Stop Mode		Reference Section
0	Stops the servomotor by applying DB (dynamic brake).	4.3.5
1	Stops the servomotor by applying DB and then releases DB.	
2	Makes the servomotor coast to a stop state without using the DB.	

Overtravel (OT) Stop Mode		Reference Section
0	Stops in accordance with the setting of Pn001.0.	4.3.2
1	Sets the torque of Pn406 to the maximum value, decelerates 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		Reference Section
0	Applicable to AC power input: Input AC power supply through L1, L2, and L3 terminals.	3.1.4
1	Applicable to DC power input: Input DC power supply between B1/ + and –2, or input DC power supply between B1/ + and –.	

Reserved (Do not change.)

(cont'd)

Parameter No.	Size	Name	Setting Range	Units	Factory Setting	When Enabled	Classification	Reference Section
Pn002	2	Application Function Select Switch 2	0000 to 4113	–	0000	After restart	Setup	–

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

MECHATROLINK Command Position and Speed Control Option		Reference Section
0	The set value of P_TLIM, NTLIM, and TFF are ignored.	*1
1	P_TLIM and NTLIM operate as the torque limit values.	
2	TFF operates as the torque feed forward.	
3	When P-CL and N-CL in the OPTION field are available, P_TLIM and NTLIM operate as the torque limit value.	

Torque Control Option		Reference Section
0	VLIM is not available.	*1
1	VLIM operates as the speed limit value.	

Absolute Encoder Usage		Reference Section
0	Uses absolute encoder as an absolute encoder.	4.7
1	Uses absolute encoder as an incremental encoder.	

Maker setting：Do not change.

∗1. For details, refer to *8 MECHATROLINK-II Commands*.

(cont'd)

Parameter No.	Size	Name	Setting Range	Units	Factory Setting	When Enabled	Classification	Reference Section
Pn006	2	Application Function Select Switch 6	0000 to 005F	–	0002	Immediately	Setup	5.1.3

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

Analog Monitor 1 Signal Selection (2nd digit)

00	Motor rotating speed (1 V / 1000 min^{-1})
01	Speed reference (1 V / 1000 min^{-1})
02	Torque reference (1 V/100% rated torque)
03	Position error (0.05 V/1 reference unit)
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)
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% rated torque)
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}: Values at motor shaft)

Reserved (Do not change.) (3rd digit)

Reserved (Do not change.) (4th digit)

Parameter No.	Size	Name	Setting Range	Units	Factory Setting	When Enabled	Classification	Reference Section
Pn007	2	Application Function Select Switch 7	0000 to 005F	–	0000	Immediately	Setup	5.1.3

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

Analog Monitor 2 Signal Selection (2nd digit)

00	Motor rotating speed (1 V / 1000 min^{-1})
01	Speed reference (1 V / 1000 min^{-1})
02	Torque reference (1 V/100% rated torque)
03	Position error (0.05 V/1 reference unit)
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)
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% rated torque)
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}: Values at motor shaft)

Reserved (Do not change.) (3rd digit)

Reserved (Do not change.) (4th digit)

(cont'd)

Parameter No.	Size	Name	Setting Range	Units	Factory Setting	When Enabled	Classification	Reference Section
Pn008	2	Application Function Select Switch 8	0000 to 7121	–	4000	After restart	Setup	–

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

Lowered Battery Voltage Alarm/Warning Selection		Reference Section
0	Outputs alarm (A.830) for lowered battery voltage.	4.7.3
1	Outputs warning (A.930) for lowered battery voltage.	

Function Selection for Undervoltage		Reference Section
0	Does not detect undervoltage.	4.3.7
1	Detects warning and limits torque by host controller.	
2	Detects warning and limits torque by Pn424 and Pn425. (Only in the DRIVER)	

Warning Detection Selection		Reference Section
0	Detects warning.	9.2.1
1	Does not detect warning (except for A.971).	

Reserved (Do not change.)

Pn009	2	Application Function Select Switch 9	0000 to 0111	–	0010	After restart	Tuning	–

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

Reserved (Do not change.)

Current Control Method Selection		Reference Section
0	Current control method 1	5.8.3
1	Current control method 2	

Speed Detection Method Selection		Reference Section
0	Speed detection 1	5.8.5
1	Speed detection 2	

Reserved (Do not change.)

(cont'd)

Parameter No.	Size	Name	Setting Range	Units	Factory Setting	When Enabled	Classification	Reference Section
Pn00B	2	Application Function Select Switch B	0000 to 1111	–	0000	After restart	Setup	–

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

Parameter Display Selection		Reference Section
0	Setup parameters	2.4.1
1	All parameters	

Alarm Gr.2 Stop Method Selection		Reference Section
0	Stops the motor by setting the speed reference to "0".	4.3.5
1	Same setting as Pn001.0 (Stops the motor by applying DB or by coasting).	

Power Supply Method for Three-phase DRIVER		Reference Section
0	Three-phase power supply	3.1.3
1	Single-phase power supply	

Reserved (Do not change.)

Parameter No.	Size	Name	Setting Range	Units	Factory Setting	When Enabled	Classification	Reference Section
Pn00C	2	Application Function Select Switch C	0000 to 0111	–	0000	After restart	Setup	4.5, 4.5.1

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

Selection of Test without a Motor	
0	Disables test without a motor.
1	Enables test without a motor.

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

Encoder Type for Test without a Motor	
0	Incremental encoder
1	Absolute encoder

Reserved (Do not change.)

Parameter No.	Size	Name	Setting Range	Units	Factory Setting	When Enabled	Classification	Reference Section
Pn00D	2	Application Function Select Switch D	0000 to 1001	–	0000	Immediately	Setup	–

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

Reserved (Do not change.)

Reserved (Do not change.)

Reserved (Do not change.)

Overtravel Warning Detection Selection		Reference Section
0	Does not detect overtravel warning.	4.3.2
1	Detects overtravel warning.	

(cont'd)

Parameter No.	Size	Name	Setting Range	Units	Factory Setting	When Enabled	Classification	Reference Section
Pn081	2	Maker setting	Do not change.					
Pn100	2	Speed Loop Gain	10 to 20000	0.1 Hz	400	Immediately	Tuning	5.8.1
Pn101	2	Speed Loop Integral Time Constant	15 to 51200	0.01 ms	2000	Immediately	Tuning	
Pn102	2	Position Loop Gain	10 to 20000	0.1/s	400	Immediately	Tuning	
Pn103	2	Moment of Inertia Ratio	0 to 20000	1%	100	Immediately	Tuning	
Pn104	2	2nd Speed Loop Gain	10 to 20000	0.1 Hz	400	Immediately	Tuning	
Pn105	2	2nd Speed Loop Integral Time Constant	15 to 51200	0.01 ms	2000	Immediately	Tuning	
Pn106	2	2nd Position Loop Gain	10 to 20000	0.1/s	400	Immediately	Tuning	
Pn109	2	Feedforward Gain	0 to 100	1%	0	Immediately	Tuning	5.9.1
Pn10A	2	Feedforward Filter Time Constant	0 to 6400	0.01 ms	0	Immediately	Tuning	
Pn10B	2	Application Function for Gain Select Switch	0000 to 5334	–	0000	–	–	–

4th digit 3rd digit 2nd digit 1st digit

n. □ □ □ □

Mode Switch Selection		When Enabled	Classification	Reference Section
0	Uses internal torque reference as the condition (Level setting: Pn10C).	Immediately	Setup	5.9.2
1	Uses speed reference as the condition (Level setting: Pn10D).			
2	Uses acceleration as the condition (Level setting: Pn10E).			
3	Uses position error as the condition (Level setting: Pn10F).			
4	No mode switch function available.			

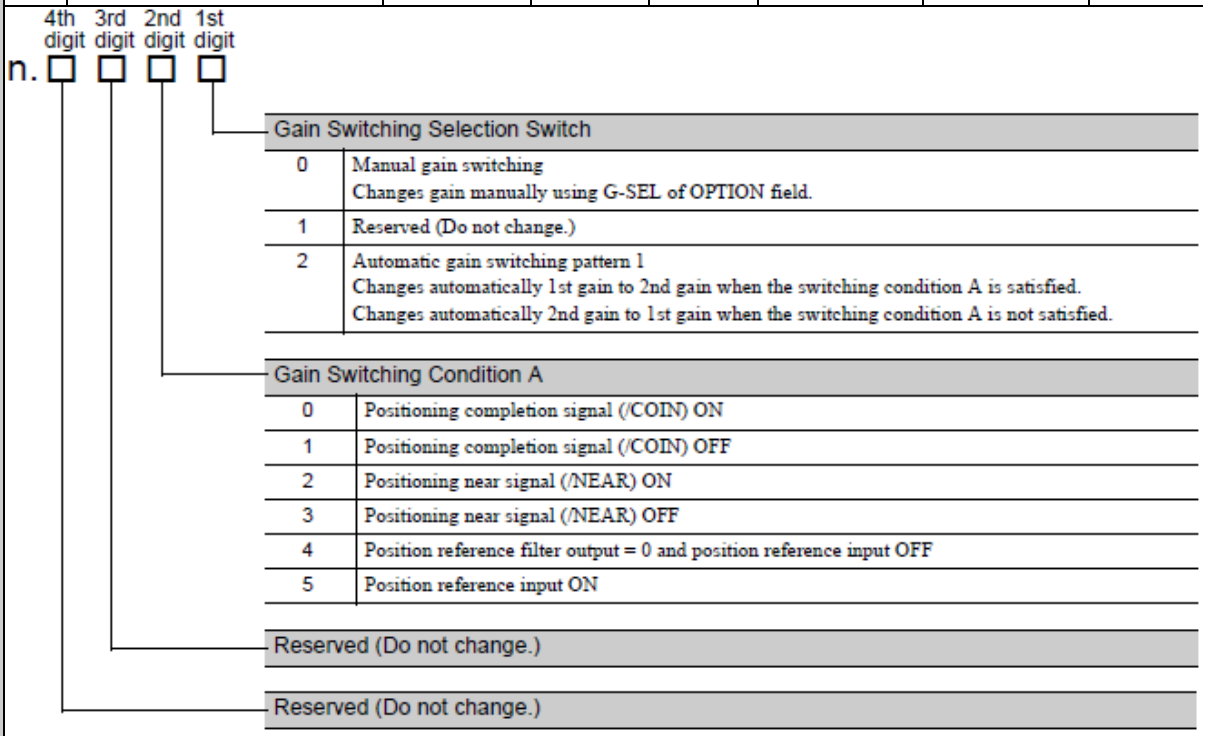
Speed Loop Control Method		When Enabled	Classification	Reference Section
0	PI control	After restart	Setup	–
1	I-P control			
2 to 3	Reserved (Do not change.)			

Reserved (Do not change.)

Reserved (Do not change.)

(cont'd)

Parameter No.	Size	Name	Setting Range	Units	Factory Setting	When Enabled	Classification	Reference Section
Pn10C	2	Mode Switch (torque reference)	0 to 800	1%	200	Immediately	Tuning	5.9.2
Pn10D	2	Mode Switch (speed reference)	0 to 10000	1 min^{-1}	0	Immediately	Tuning	
Pn10E	2	Mode Switch (acceleration)	0 to 30000	1 min^{-1}/ s	0	Immediately	Tuning	
Pn10F	2	Mode Switch (position error)	0 to 10000	1 reference unit	0	Immediately	Tuning	
Pn11F	2	Position Integral Time Constant	0 to 50000	0.1 ms	0	Immediately	Tuning	5.9.4
Pn121	2	Friction Compensation Gain	10 to 1000	1%	100	Immediately	Tuning	5.8.2
Pn122	2	2nd Gain for Friction Compensation	10 to 1000	1%	100	Immediately	Tuning	
Pn123	2	Friction Compensation Coefficient	0 to 100	1%	0	Immediately	Tuning	
Pn124	2	Friction Compensation Frequency Correction	-10000 to 10000	0.1 Hz	0	Immediately	Tuning	
Pn125	2	Friction Compensation Gain Correction	1 to 1000	1%	100	Immediately	Tuning	
Pn131	2	Gain Switching Time 1	0 to 65535	1 ms	0	Immediately	Tuning	5.8.1
Pn132	2	Gain Switching Time 2	0 to 65535	1 ms	0	Immediately	Tuning	
Pn135	2	Gain Switching Waiting Time 1	0 to 65535	1 ms	0	Immediately	Tuning	
Pn136	2	Gain Switching Waiting Time 2	0 to 65535	1 ms	0	Immediately	Tuning	
Pn139	2	Automatic Gain Changeover Related Switch 1	0000 to 0052	–	0000	Immediately	Tuning	5.8.1
Pn13D	2	Current Gain Level	100 to 2000	1%	2000	Immediately	Tuning	5.8.4



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Parameter No.	Size	Name	Setting Range	Units	Factory Setting	When Enabled	Classification	Reference Section
Pn140	2	Model Following Control Related Switch	0000 to 1121	–	0100	Immediately	Tuning	–
Pn141	2	Model Following Control Gain	10 to 20000	0.1/s	500	Immediately	Tuning	–
Pn142	2	Model Following Control Gain Compensation	500 to 2000	0.1%	1000	Immediately	Tuning	–
Pn143	2	Model Following Control Bias (Forward Direction)	0 to 10000	0.1%	1000	Immediately	Tuning	–
Pn144	2	Model Following Control Bias (Reverse Direction)	0 to 10000	0.1%	1000	Immediately	Tuning	–
Pn145	2	Vibration Suppression 1 Frequency A	10 to 2500	0.1 Hz	500	Immediately	Tuning	–
Pn146	2	Vibration Suppression 1 Frequency B	10 to 2500	0.1 Hz	700	Immediately	Tuning	–
Pn147	2	Model Following Control Speed Feedforward Compensation	0 to 10000	0.1%	1000	Immediately	Tuning	–
Pn148	2	2nd Model Following Control Gain	10 to 20000	0.1/s	500	Immediately	Tuning	–
Pn149	2	2nd Model Following Control Gain Compensation	500 to 2000	0.1%	1000	Immediately	Tuning	–
Pn14A	2	Vibration Suppression 2 Frequency	10 to 2000	0.1 Hz	800	Immediately	Tuning	–
Pn14B	2	Vibration Suppression 2 Compensation	10 to 1000	1%	100	Immediately	Tuning	–

Pn140

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

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

		Reference Section
0	Does not adjust vibration suppression automatically using utility function.	5.3.1, 5.4.1, 5.5.1, 5.7.1
1	Adjusts vibration suppression automatically using utility function.	

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

		Reference Section
0	Does not use model following control and speed/torque feedforward together.	5.3.1, 5.4.1
1	Uses model following control and speed/torque feedforward together.	

(cont'd)

Parameter No.	Size	Name	Setting Range	Units	Factory Setting	When Enabled	Classification	Reference Section
Pn14F	2	Control Related Switch	0000 to 0011	–	0011	After restart	Tuning	–

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

Model Following Control Type Selection		Reference Section
0	Model Following Control 1	5.3.1, 5.4.1, 5.5.1
1	Model Following Control 2	

Tuning-less Type Selection		Reference Section
0	Tuning-less type 1	5.2.2
1	Tuning-less type 2	

Reserved (Do not change.)

Reserved (Do not change.)

Parameter No.	Size	Name	Setting Range	Units	Factory Setting	When Enabled	Classification	Reference Section
Pn160	2	Anti-Resonance Control Related Switch	0000 to 0011	–	0010	Immediately	Tuning	5.3.1, 5.4.1, 5.5.1, 5.7.1

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

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

Anti-Resonance Control Adjustment Selection	
0	Does not 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.)

Parameter No.	Size	Name	Setting Range	Units	Factory Setting	When Enabled	Classification	Reference Section
Pn161	2	Anti-Resonance Frequency	10 to 20000	0.1 Hz	1000	Immediately	Tuning	–
Pn162	2	Anti-Resonance Gain Compensation	1 to 1000	1%	100	Immediately	Tuning	–
Pn163	2	Anti-Resonance Damping Gain	0 to 300	1%	0	Immediately	Tuning	–
Pn164	2	Anti-Resonance Filter Time Constant 1 Compensation	-1000 to 1000	0.01 ms	0	Immediately	Tuning	–
Pn165	2	Anti-Resonance Filter Time Constant 2 Compensation	-1000 to 1000	0.01 ms	0	Immediately	Tuning	–

(cont'd)

Parameter No.	Size	Name	Setting Range	Units	Factory Setting	When Enabled	Classification	Reference Section
Pn170	2	Tuning-less Function Related Switch	0000 to 2411	–	1401	–	–	–
Pn205	2	Multiturn Limit Setting	0 to 65535	1 rev	65535	After restart	Setup	4.7.5
Pn207	2	Position Control Function Switch	0000 to 2210	–	0010	After restart	Setup	–
Pn20A	4	Maker setting	Do not change.					
Pn20E	4	Electronic Gear Ratio (Numerator)	1 to 1073741824	1	4	After restart	Setup	4.4.3
Pn210	4	Electronic Gear Ratio (Denominator)	1 to 1073741824	1	1	After restart	Setup	
Pn212	4	Encoder Output Pulses	16 to 1073741824	1 P/rev	2048	After restart	Setup	4.4.5

Pn170

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

Tuning-less Function Selection		When Enabled	Classification	Reference Section
0	Disables tuning-less function.	After restart	Setup	5.2
1	Enables tuning-less function.			

Control Method during Speed Control		When Enabled	Classification	Reference Section
0	Uses as speed control.	After restart	Setup	5.2
1	Uses as speed control and uses the host controller for position control.			

Rigidity Level		When Enabled	Classification	Reference Section
0 to 4	Sets rigidity level.	Immediately	Setup	5.2

Load Level		When Enabled	Classification	Reference Section
0 to 2	Sets load level.	Immediately	Setup	5.2

Pn207

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

Reserved (Do not change.)

Reserved (Do not change.)

Reserved (Do not change.)

/COIN Output Timing		Reference Section
0	Outputs when the position error absolute value is the same or less than the positioning completed width (Pn522).	4.8.6
1	Outputs when the position error absolute value is the same or less than the positioning completed width (Pn522), and the reference after position reference filtering is 0.	
2	Outputs when the position error absolute value is the same or less than the positioning completed width (Pn522), and the position reference input is 0.	

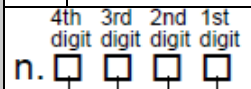
(cont'd)

Parameter No.	Size	Name	Setting Range	Units	Factory Setting	When Enabled	Classification	Reference Section
Pn22A	2	Maker setting	Do not change.					
Pn230	2	Position Control Expanded Function Switch	0000 to 0001	–	0000	After reset	Setup	5.8.6
	4th digit 3rd digit 2nd digit 1st digit n. □ □ □ □							
	Backlash Compensation Direction 0: Compensates with a reference in the forward direction. 1: Compensates with a reference in the reverse direction.							
	Reserved (Do not change.)							
	Reserved (Do not change.)							
	Reserved (Do not change.)							
Pn231	4	Backlash Compensation Value	-500000 to 500000	0.1 reference unit	0	Immediately	Setup	5.8.6
Pn233	2	Backlash Compensation Time Constant	0 to 65536	0.01 ms	0	Immediately	Setup	5.8.6
Pn281	2	Maker setting	Do not change.					
Pn304	2	JOG Speed	0 to 10000	1 min^{-1}	500	Immediately	Setup	6.3
Pn305	2	Soft Start Acceleration Time	0 to 10000	1 ms	0	Immediately	Setup	*1
Pn306	2	Soft Start Deceleration Time	0 to 10000	1 ms	0	Immediately	Setup	

∗1. For details, refer to *8 MECHATROLINK-II Commands*.

(cont'd)

Parameter No.	Size	Name	Setting Range	Units	Factory Setting	When Enabled	Classification	Reference Section
Pn310	2	Vibration Detection Switch	0000 to 0002	–	0000	Immediately	Setup	–



Vibration Detection Selection		Reference Section
0	Does not detect vibration.	6.15
1	Outputs warning (A.911) when vibration is detected.	
2	Outputs alarm (A.520) when vibration is detected.	

Reserved (Do not change.)

Reserved (Do not change.)

Reserved (Do not change.)

Pn311	2	Vibration Detection Sensibility	50 to 500	1%	100	Immediately	Tuning	6.15
Pn312	2	Vibration Detection Level	0 to 5000	1 min^{-1}	50	Immediately	Tuning	
Pn324	2	Moment of Inertia Calculating Start Level	0 to 20000	1%	300	Immediately	Setup	5.3.2
Pn401	2	Torque Reference Filter Time Constant	0 to 65535	0.01 ms	100	Immediately	Tuning	5.9.3
Pn402	2	Forward Torque Limit	0 to 800	1%	800	Immediately	Setup	4.6.1
Pn403	2	Reverse Torque Limit	0 to 800	1%	800	Immediately	Setup	
Pn404	2	Forward External Torque Limit	0 to 800	1%	100	Immediately	Setup	4.6.2
Pn405	2	Reverse External Torque Limit	0 to 800	1%	100	Immediately	Setup	
Pn406	2	Emergency Stop Torque	0 to 800	1%	800	Immediately	Setup	4.3.2
Pn407	2	Speed Limit during Torque Control	0 to 10000	1 min^{-1}	10000	Immediately	Setup	4.8.8

(cont'd)

Parameter No.	Size	Name	Setting Range	Units	Factory Setting	When Enabled	Classification	Reference Section
Pn408	2	Torque Related Function Switch	0000 to 1111	–	0000	–	–	–

4th digit 3rd digit 2nd digit 1st digit

n. □ □ □ □

1st Step Notch Filter Selection — When Enabled: Immediately; Classification: Setup; Reference Section: 5.9.3

0	N/A
1	Uses 1st step notch filter for torque reference.

Speed Limit Selection — When Enabled: After restart; Classification: Setup; Reference Section: 4.8.8

0	Uses the smaller of the maximum motor speed and the value of Pn407 as the speed limit value.
1	Uses the smaller of the overspeed detection speed and the value of Pn407 as the speed limit value.

2nd Step Notch Filter Selection — When Enabled: Immediately; Classification: Setup; Reference Section: 5.9.3

0	N/A
1	Uses 2nd step notch filter for torque reference.

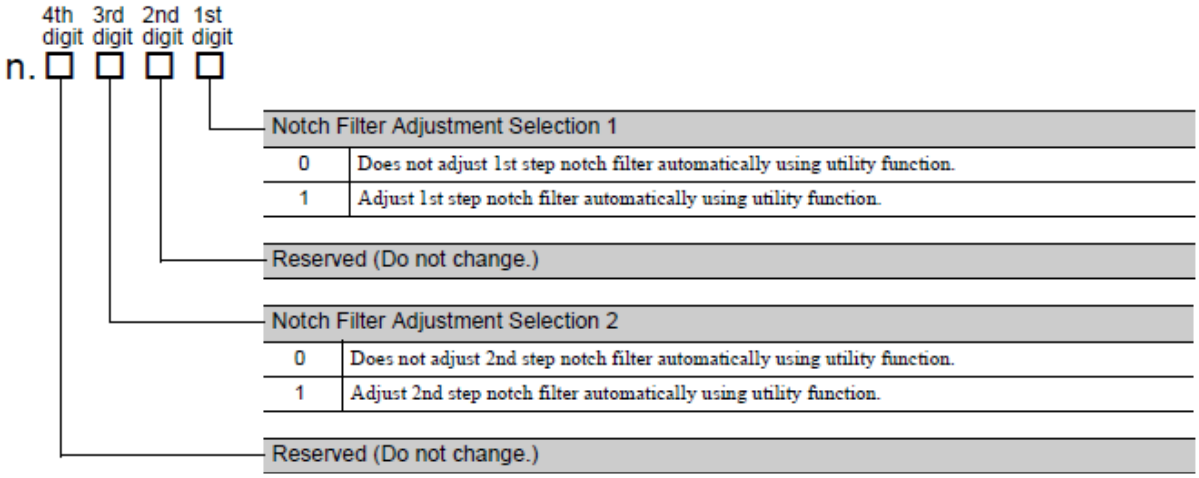
Friction Compensation Function Selection — When Enabled: Immediately; Classification: Setup; Reference Section: 5.8.2

0	Disables friction compensation function.
1	Enables friction compensation function.

Pn409	2	1st Notch Filter Frequency	50 to 5000	1 Hz	5000	Immediately	Tuning	5.9.3
Pn40A	2	1st Notch Filter Q Value	50 to 1000	0.01	70	Immediately	Tuning	
Pn40B	2	1st Notch Filter Depth	0 to 1000	0.001	0	Immediately	Tuning	
Pn40C	2	2nd Notch Filter Frequency	50 to 5000	1 Hz	5000	Immediately	Tuning	
Pn40D	2	2nd Notch Filter Q Value	50 to 1000	0.01	70	Immediately	Tuning	
Pn40E	2	2nd Notch Filter Depth	0 to 1000	0.001	0	Immediately	Tuning	
Pn40F	2	2nd Step 2nd Torque Reference Filter Frequency	100 to 5000	1 Hz	5000	Immediately	Tuning	
Pn410	2	2nd Step 2nd Torque Reference Filter Q Value	50 to 100	0.01	50	Immediately	Tuning	
Pn412	2	1st Step 2nd Torque Reference Filter Time Constant	0 to 65535	0.01 ms	100	Immediately	Tuning	5.8.1
Pn415	2	Reserved (Do not change.)	–	–	0	–	–	–
Pn423	2	Reserved (Do not change.)	–	–	0000	–	–	–
Pn424	2	Torque Limit at Main Circuit Voltage Drop	0 to 100	1%	50	Immediately	Setup	4.3.7
Pn425	2	Release Time for Torque Limit at Main Circuit Voltage Drop	0 to 1000	1 ms	100	Immediately	Setup	
Pn456	2	Sweep Torque Reference Amplitude	1 to 800	1%	15	Immediately	Tuning	6.18

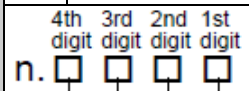
(cont'd)

Parameter No.	Size	Name	Setting Range	Units	Factory Setting	When Enabled	Classification	Reference Section
Pn460	2	Notch Filter Adjustment Switch	0000 to 0101	–	0101	Immediately	Tuning	5.2.1 5.3.1 5.5.1
Pn501	2	Zero Clamp Level	0 to 10000	1 min^{-1}	10	Immediately	Setup	–
Pn502	2	Rotation Detection Level	1 to 10000	1 min^{-1}	20	Immediately	Setup	4.8.3
Pn503	2	Speed Coincidence Signal Output Width	0 to 100	1 min^{-1}	10	Immediately	Setup	4.8.5
Pn506	2	Lock Reference - Servo OFF Delay Time	0 to 50	10 ms	0	Immediately	Setup	4.3.4
Pn507	2	Lock Reference Output Speed Level	0 to 10000	1 min^{-1}	100	Immediately	Setup	
Pn508	2	Waiting Time for Lock Signal When Motor Running	10 to 100	10 ms	50	Immediately	Setup	
Pn509	2	Instantaneous Power Cut Hold time	20 to 1000	1 ms	20	Immediately	Setup	4.3.6



(cont'd)

Parameter No.	Size	Name	Setting Range	Units	Factory Setting	When Enabled	Classification	Reference Section
Pn50A	2	Input Signal Selection 1	0000 to FFF1	–	1881	After restart	Setup	–



Reserved (Do not change.)

Reserved (Do not change.)

Reserved (Do not change.)

P-OT Signal Mapping (Forward run prohibited when OFF (open))		Reference Section
0	Forward run allowed when CN1-13 input signal is ON (closed).	4.3.2
1	Forward run allowed when CN1-7 input signal is ON (closed).	
2	Forward run allowed when CN1-8 input signal is ON (closed).	
3	Forward run allowed when CN1-9 input signal is ON (closed).	
4	Forward run allowed when CN1-10 input signal is ON (closed).	
5	Forward run allowed when CN1-11 input signal is ON (closed).	
6	Forward run allowed when CN1-12 input signal is ON (closed).	
7	Forward run prohibited.	
8	Forward run allowed.	
9	Forward run allowed when CN1-13 input signal is OFF (open).	
A	Forward run allowed when CN1-7 input signal is OFF (open).	
B	Forward run allowed when CN1-8 input signal is OFF (open).	
C	Forward run allowed when CN1-9 input signal is OFF (open).	
D	Forward run allowed when CN1-10 input signal is OFF (open).	
E	Forward run allowed when CN1-11 input signal is OFF (open).	
F	Forward run allowed when CN1-12 input signal is OFF (open).	

(cont'd)

Parameter No.	Size	Name	Setting Range	Units	Factory Setting	When Enabled	Classification	Reference Section
Pn50B	2	Input Signal Selection 2	0000 to FFFF	–	8882	After restart	Setup	–

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

N-OT Signal Mapping (Reverse run prohibited when OFF (open))		Reference Section
0	Reverse run allowed when CN1-13 input signal is ON (closed).	4.3.2
1	Reverse run allowed when CN1-7 input signal is ON (closed).	
2	Reverse run allowed when CN1-8 input signal is ON (closed).	
3	Reverse run allowed when CN1-9 input signal is ON (closed) .	
4	Reverse run allowed when CN1-10 input signal is ON (closed).	
5	Reverse run allowed when CN1-11 input signal is ON (closed).	
6	Reverse run allowed when CN1-12 input signal is ON (closed).	
7	Reverse run prohibited.	
8	Reverse run allowed.	
9	Reverse run allowed when CN1-13 input signal is OFF (open).	
A	Reverse run allowed when CN1-7 input signal is OFF (open).	
B	Reverse run allowed when CN1-8 input signal is OFF (open).	
C	Reverse run allowed when CN1-9 input signal is OFF (open).	
D	Reverse run allowed when CN1-10 input signal is OFF (open).	
E	Reverse run allowed when CN1-11 input signal is OFF (open).	
F	Reverse run allowed when CN1-12 input signal is OFF (open).	

Reserved (Do not change.)

/P-CL Signal Mapping (Torque Limit when ON (closed))		Reference Section
0	Active when CN1-13 input signal is ON (closed).	4.6.2
1	Active when CN1-7 input signal is ON (closed).	
2	Active when CN1-8 input signal is ON (closed).	
3	Active when CN1-9 input signal is ON (closed).	
4	Active when CN1-10 input signal is ON (closed).	
5	Active when CN1-11 input signal is ON (closed).	
6	Active when CN1-12 input signal is ON (closed).	
7	Always active (fixed).	
8	Not active (fixed).	
9	Active when CN1-13 input signal is OFF (open).	
A	Active when CN1-7 input signal is OFF (open).	
B	Active when CN1-8 input signal is OFF (open).	
C	Active when CN1-9 input signal is OFF (open).	
D	Active when CN1-10 input signal is OFF (open).	
E	Active when CN1-11 input signal is OFF (open).	
F	Active when CN1-12 input signal is OFF (open).	

/N-CL Signal Mapping (Torque Limit when ON (closed))		Reference Section
0 to F	Same as /P-CL signal mapping	4.6.2

(cont'd)

Parameter No.	Size	Name	Setting Range	Units	Factory Setting	When Enabled	Classification	Reference Section
Pn50E	2	Output Signal Selection 1	0000 to 3333	—	0000	After restart	Setup	—

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

Positioning Completion Signal Mapping (/COIN) — Reference Section: 4.8.6

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) — Reference Section: 4.8.5

0 to 3	Same as /COIN Signal Mapping.

Servomotor Rotation Detection Signal Mapping (/TGON) — Reference Section: 4.8.3

0 to 3	Same as /COIN Signal Mapping.

Servo Ready Signal Mapping (/S-RDY) — Reference Section: 4.8.4

0 to 3	Same as /COIN Signal Mapping.

Parameter No.	Size	Name	Setting Range	Units	Factory Setting	When Enabled	Classification	Reference Section
Pn50F	2	Output Signal Selection 2	0000 to 3333	—	0100	After restart	Setup	—

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

Torque Limit Detection Signal Mapping (/CLT) — Reference Section: 4.6.3

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) — Reference Section: 4.8.8

0 to 3	Same as /CLT Signal Mapping.

Brake Signal Mapping (/BK) — Reference Section: 4.3.4

0 to 3	Same as /CLT Signal Mapping.

Warning Signal Mapping (/WARN) — Reference Section: 4.8.2

0 to 3	Same as /CLT Signal Mapping.

(cont'd)

Parameter No.	Size	Name	Setting Range	Units	Factory Setting	When Enabled	Classification	Reference Section
Pn510	2	Output Signal Selection 3	0000 to 0333	–	0000	After restart	Setup	–

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

Near Signal Mapping (/NEAR)		Reference Section
0	Disabled (the above signal is not used.)	4.8.7
1	Outputs the signal from CN1-1, 2 terminal.	
2	Outputs the signal from CN1-23, 24 terminal.	
3	Outputs the signal from CN1-25, 26 terminal.	

Reserved (Do not change.)

Reserved (Do not change.)

Reserved (Do not change.)

(cont'd)

Parameter No.	Size	Name	Setting Range	Units	Factory Setting	When Enabled	Classification	Reference Section
Pn511	2	Input Signal Selection 5	0000 to FFFF	—	6543	After restart	Setup	3.3.1

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

Homing Deceleration Switch Signal Mapping (/DEC)

0	Active when CN1-13 input signal is ON (closed).
1	Active when CN1-7 input signal is ON (closed).
2	Active when CN1-8 input signal is ON (closed).
3	Active when CN1-9 input signal is ON (closed).
4	Active when CN1-10 input signal is ON (closed).
5	Active when CN1-11 input signal is ON (closed).
6	Active when CN1-12 input signal is ON (closed).
7	Not active (fixed).
9	Active when CN1-13 input signal is OFF (open).
A	Active when CN1-7 input signal is OFF (open).
B	Active when CN1-8 input signal is OFF (open).
C	Active when CN1-9 input signal is OFF (open).
D	Active when CN1-10 input signal is OFF (open).
E	Active when CN1-11 input signal is OFF (open).
F	Active when CN1-12 input signal is OFF (open).

External Latch Signal Mapping (/EXT1)

4	Active when CN1-10 input signal is ON (closed).
5	Active when CN1-11 input signal is ON (closed).
6	Active when CN1-12 input signal is ON (closed).
7	Not active (fixed).
D	Active when CN1-10 signal is OFF (open).
E	Active when CN1-11 signal is OFF (open).
F	Active when CN1-12 signal is OFF (open).
0 to 3 9 to C	Not active (fixed).

External Latch 2 Signal Mapping (/EXT2)

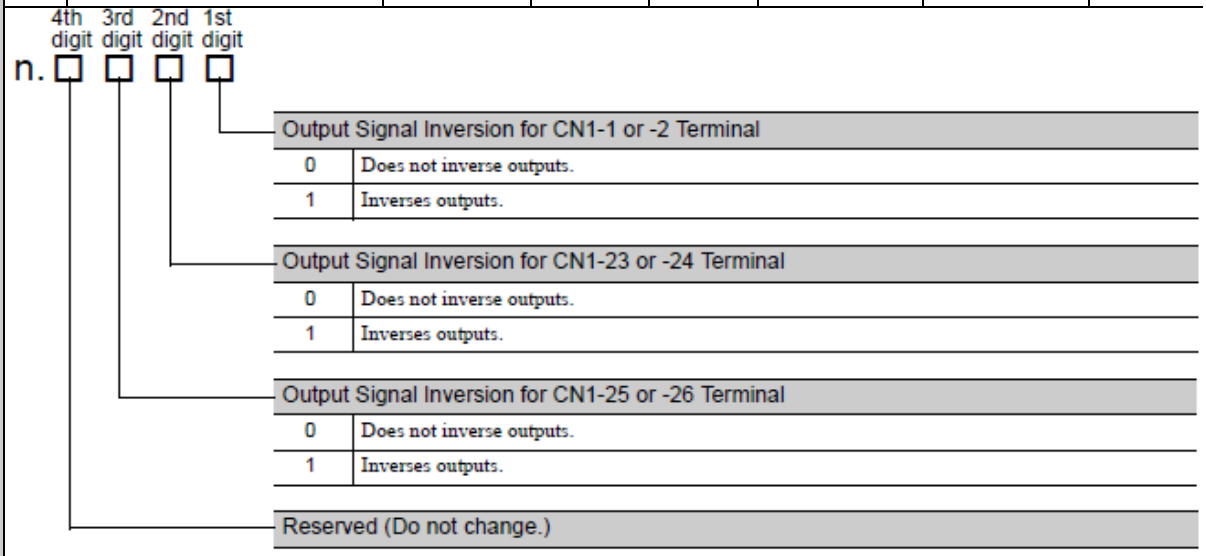
0 to C	Same as /EXT1 signal mapping.

External Latch 3 Signal Mapping (/EXT3)

0 to C	Same as /EXT1 signal mapping.

(cont'd)

Parameter No.	Size	Name	Setting Range	Units	Factory Setting	When Enabled	Classification	Reference Section
Pn512	2	Output Signal Inverse Setting	0000 to 0111	–	0000	After restart	Setup	3.3.2
Pn517	2	Reserved (Do not change.)	–	–	0000	–	–	–
Pn51B	4	Maker setting	Do not change.					
Pn51E	2	Excessive Position Error Warning Level	10 to 100	1%	100	Immediately	Setup	9.2.1
Pn520	4	Excessive Position Error Alarm Level	1 to 1073741823	1 reference unit	5242880	Immediately	Setup	5.1.4 9.1.1
Pn522	4	Positioning Completed Width	0 to 1073741824	1 reference unit	7	Immediately	Setup	4.8.6
Pn524	4	NEAR Signal Width	1 to 1073741824	1 reference unit	1073741824	Immediately	Setup	4.8.7
Pn526	4	Excessive Position Error Alarm Level at Servo ON	1 to 1073741823	1 reference unit	5242880	Immediately	Setup	5.1.4
Pn528	2	Excessive Position Error Warning Level at Servo ON	10 to 100	1%	100	Immediately	Setup	
Pn529	2	Speed Limit Level at Servo ON	0 to 10000	1 min^{-1}	10000	Immediately	Setup	
Pn52A	2	Maker setting	Do not change.					
Pn52B	2	Overload Warning Level	1 to 100	1%	20	Immediately	Setup	4.3.8
Pn52C	2	Derating of Base Current at Detecting Overload of Motor	10 to 100	1%	100	After restart	Setup	
Pn52D	2	Reserved (Do not change.)	–	–	50	–	–	–
Pn52F	2	Reserved (Do not change.)	–	–	0FFF	–	–	–



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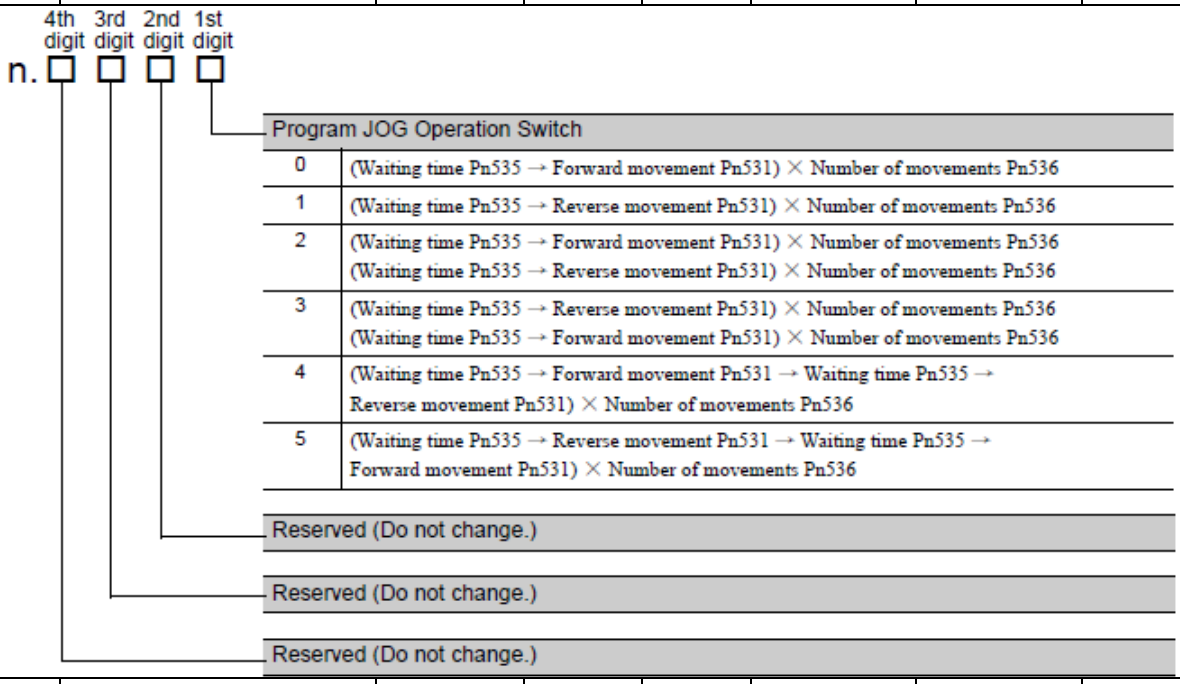
Parameter No.	Size	Name	Setting Range	Units	Factory Setting	When Enabled	Classification	Reference Section
Pn530	2	Program JOG Operation Related Switch	0000 to 0005	–	0000	Immediately	Setup	6.5



Pn531	4	Program JOG Movement Distance	1 to 1073741824	1 reference unit	32768	Immediately	Setup	6.5
Pn533	2	Program JOG Movement Speed	1 to 10000	1 min^{-1}	500	Immediately	Setup	
Pn534	2	Program JOG Acceleration/ Deceleration Time	2 to 10000	1 ms	100	Immediately	Setup	
Pn535	2	Program JOG Waiting Time	0 to 10000	1 ms	100	Immediately	Setup	
Pn536	2	Number of Times of Program JOG Movement	0 to 1000	1 time	1	Immediately	Setup	
Pn550	2	Analog Monitor 1 Offset Voltage	-10000 to 10000	0.1 V	0	Immediately	Setup	5.1.3
Pn551	2	Analog Monitor 2 Offset Voltage	-10000 to 10000	0.1 V	0	Immediately	Setup	
Pn552	2	Analog Monitor Magnification (×1)	-10000 to 10000	×0.01	100	Immediately	Setup	
Pn553	2	Analog Monitor Magnification (×2)	-10000 to 10000	×0.01	100	Immediately	Setup	
Pn560	2	Remained Vibration Detection Width	1 to 3000	0.1%	400	Immediately	Setup	5.7.1
Pn561	2	Overshoot Detection Level	0 to 100	1%	100	Immediately	Setup	5.3.1 5.4.1
Pn600	2	Regenerative Resistor Capacity *2	Depends on DRIVER Capacity *3	10 W	0	Immediately	Setup	3.7.2
Pn601	2	Reserved (Do not change.)	–	–	0	–	–	–

∗2. Normally set to "0." When using a regenerative resistor, set the capacity (W) of the regenerative resistor.
∗3. The upper limit is the maximum output capacity (W) of the DRIVER.

(cont'd)

Parameter No.	Size	Name	Setting Range	Units	Factory Setting	When Enabled	Classification	Reference Section
Pn800	2	Communications Control	–	–	0040	Immediately	Setup	*1

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

MECHATROLINK-II Communications Check Mask (for debug)

0	No mask
1	Ignores MECHATROLINK communications error (A.E6□).
2	Ignores WDT error (A.E5□).
3	Ignores both MECHATROLINK communications error (A.E6□) and WDT error (A.E5□).

Warning Check Mask

0	No mask
1	Ignores data setting warning (A.94□).
2	Ignores command warning (A.95□).
3	Ignores both data setting warning (A.94□) and command warning (A.95□).
4	Ignores communications warning (A.96□).
5	Ignores both data setting warning (A.94□) and communications warning (A.96□).
6	Ignores both command warning (A.95□) and communications warning (A.96□).
7	Ignores data setting warning (A.94□), command warning (A.95□) and communications warning (A.96□).

Reserved (Do not change.)

Reserved (Do not change.)

Parameter No.	Size	Name	Setting Range	Units	Factory Setting	When Enabled	Classification	Reference Section
Pn801	2	Application Function Select 6 (Software LS)	–	–	0003	Immediately	Setup	4.3.3

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

Software Limit Function

0	Enables forward and reverse software limit.
1	Disables forward software limit.
2	Disables reverse software limit.
3	Disables software limit in both directions.

Reserved (Do not change.)

Software Limit for Reference

0	Disables software limit for reference.
1	Enables software limit for reference.

Reserved (Do not change.)

Parameter No.	Size	Name	Setting Range	Units	Factory Setting	When Enabled	Classification	Reference Section
Pn803	2	Origin Range	0 to 250	1 reference unit	10	Immediately	Setup	*1

∗1. For details, refer to *8 MECHATROLINK-II Commands*.

(cont'd)

Parameter No.	Size	Name	Setting Range	Units	Factory Setting	When Enabled	Classification	Reference Section
Pn804	4	Forward Software Limit	-1073741823 to 1073741823	1 reference unit	1073741823	Immediately	Setup	4.3.3
Pn806	4	Reverse Software Limit	-1073741823 to 1073741823	1 reference unit	-1073741823	Immediately	Setup	
Pn808	4	Absolute Encoder Origin Offset	-1073741823 to 1073741823	1 reference unit	0	Immediately*4	Setup	4.7.7
Pn80A	2	1st Linear Acceleration Constant	1 to 65535	10000 reference unit/s^2	100	Immediately*5	Setup	*1
Pn80B	2	2nd Linear Acceleration Constant	1 to 65535	10000 reference unit/s^2	100	Immediately*5	Setup	*1
Pn80C	2	Acceleration Constant Switching Speed	0 to 65535	100 reference unit/s	0	Immediately*5	Setup	*1
Pn80D	2	1st Linear Deceleration Constant	1 to 65535	10000 reference unit/s^2	100	Immediately*5	Setup	*1
Pn80E	2	2nd Linear Deceleration Constant	1 to 65535	10000 reference unit/s^2	100	Immediately*5	Setup	*1
Pn80F	2	Deceleration Constant Switching Speed	0 to 65535	100 reference unit/s	0	Immediately*5	Setup	*1
Pn810	2	Exponential Function Acceleration/Deceleration Bias	0 to 65535	100 reference unit/s	0	Immediately*6	Setup	*1
Pn811	2	Exponential Function Acceleration/Deceleration Time Constant	0 to 5100	0.1 ms	0	Immediately*6	Setup	*1
Pn812	2	Movement Average Time	0 to 5100	0.1 ms	0	Immediately*6	Setup	*1
Pn814	4	Final Travel Distance for External Positioning	-1073741823 to 1073741823	1 reference unit	100	Immediately	Setup	*1

∗1. For details, refer to *8 MECHATROLINK-II Commands*.

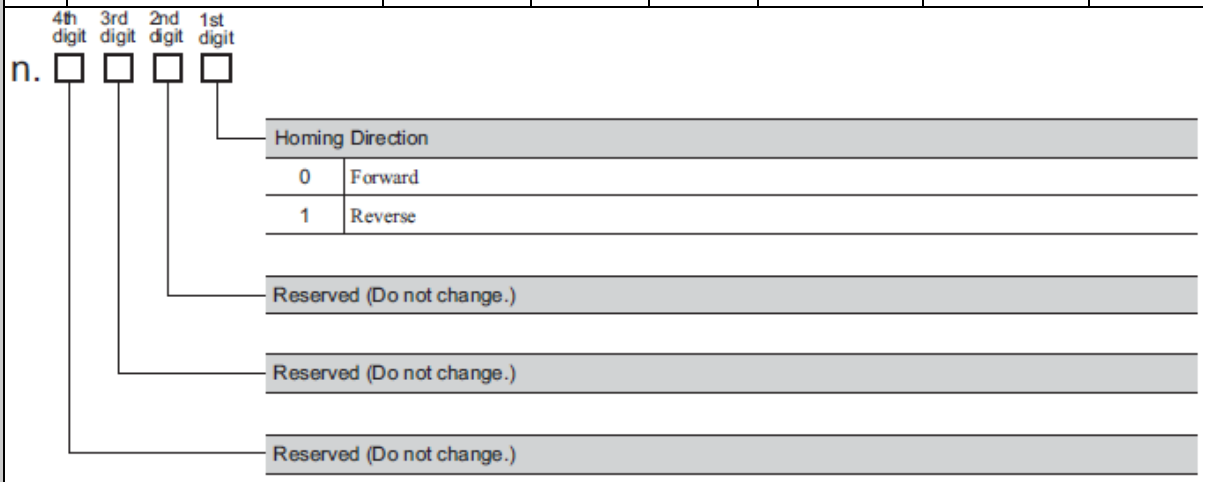
∗4. Available after the SENS_ON command is input.

∗5. Change the setting when the reference is stopped (DEN is set to 1), because the change will affect the output during operation.

∗6. The settings are updated only if the sending of the reference has been stopped (DEN is set to 1).

(cont'd)

Parameter No.	Size	Name	Setting Range	Units	Factory Setting	When Enabled	Classification	Reference Section
Pn816	2	Homing Mode Setting	–	–	0000	Immediately	Setup	*1
Pn817[*7]	2	Homing Approach Speed 1	0 to 65535	100 reference unit/s	50	Immediately[*5]	Setup	*1
Pn818[*8]	2	Homing Approach Speed 2	0 to 65535	100 reference unit/s	5	Immediately[*5]	Setup	*1
Pn819	4	Final Travel Distance for Homing	-1073741823 to 1073741823	1 reference unit	100	Immediately	Setup	*1



∗1. For details, refer to *8 MECHATROLINK-II Commands* .

∗5. Change the setting when the reference is stopped (DEN is set to 1), because the change will affect the output during operation.

∗7. The set value of Pn842 is valid when the set value of Pn817 is 0. Software version 0023 or higher is required to use Pn842.

∗8. The set value of Pn844 is valid when the set value of Pn818 is 0. Software version 0023 or higher is required to use Pn844.

(cont'd)

Parameter No.	Size	Name	Setting Range	Units	Factory Setting	When Enabled	Classification	Reference Section
Pn81E	2	Input Signal Monitor Selection	–	–	0000	Immediately	Setup	*1

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

IO12 Signal Mapping

0	No mapping
1	Monitors CN1-13 input terminal.
2	Monitors CN1-7 input terminal.
3	Monitors CN1-8 input terminal.
4	Monitors CN1-9 input terminal.
5	Monitors CN1-10 input terminal.
6	Monitors CN1-11 input terminal.
7	Monitors CN1-12 input terminal.

IO13 Signal Mapping

0 to 7	Same as IO2 signal mapping.

IO14 Signal Mapping

0 to 7	Same as IO2 signal mapping.

IO15 Signal Mapping

0 to 7	Same as IO2 signal mapping.

Parameter No.	Size	Name	Setting Range	Units	Factory Setting	When Enabled	Classification	Reference Section
Pn81F	2	Command Data Allocation	–	–	0000	After restart	Setup	*1

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

Option Field Allocation

0	Disables OPTION bit allocation.
1	Enables OPTION bit allocation.

Position Control Command TFF/TLIM Function Allocation

0	Disables allocation.
1	Enables allocation.

Reserved (Do not change.)

Reserved (Do not change.)

Parameter No.	Size	Name	Setting Range	Units	Factory Setting	When Enabled	Classification	Reference Section
Pn820	4	Forward Latching Allowable Area	-2147483648 to 2147483647	1 reference unit	0	Immediately	Setup	*1
Pn822	4	Reverse Latching Allowable Area	-2147483648 to 2147483647	1 reference unit	0	Immediately	Setup	*1

∗1. For details, refer to *8 MECHATROLINK-II Commands*.

(cont'd)

Parameter No.	Size	Name		Setting Range	Units	Factory Setting	When Enabled	Classification	Reference Section
Pn824	2	Option Monitor 1 Selection		–	–	0000	Immediately	Setup	*1
		0000H	Motor rotating speed [1000000H/overspeed detection position]						
		0001H	Speed reference [1000000H/overspeed detection position]						
		0002H	Torque [1000000H/max. torque]						
		0003H	Position error (lower 32 bits) [reference unit]						
		0004H	Position error (upper 32 bits) [reference unit]						
		0005H	System reserved						
		0006H	System reserved						
		000AH	Encoder count (lower 32 bits) [reference unit]						
		000BH	Encoder count (upper 32 bits) [reference unit]						
		000CH	FPG count (lower 32 bits) [reference unit]						
		000DH	FPG count (upper 32 bits) [reference unit]						
		0010H	Un000: Motor rotating speed [min^{-1}]						
		0011H	Un001: Speed reference [min^{-1}]						
		0012H	Un002: Torque reference [%]						
		0013H	Un003: Rotational angle 1 (encoder pulses from the phase-Z origin: decimal display)						
		0014H	Un004: Rotational angle 2 [deg]						
		0015H	Un005: Input signal monitor						
		0016H	Un006: Output signal monitor						
		0017H	Un007: Input position reference speed [min^{-1}]						
		0018H	Un008: Position error [reference unit]						
		0019H	Un009: Accumulated load ratio [%]						
		001AH	Un00A: Regenerative load ratio [%]						
		001BH	Un00B: DB resistance consumption power [%]						
		001CH	Un00C: Input reference counter [reference unit]						
		001DH	Un00D: Feedback pulse counter [encoder pulse]						
		001EH	Un00E: Fully-closed loop feedback pulse counter [external encoder resolution]						
		001FH	System reserved						
		0023H	Primary multi-turn data [Rev]						
		0024H	Primary incremental data [pulse]						
		0027H	Un022: Installation environment monitor [%]						
		0080H	Previous value of latched feedback position (LPOS) [encoder pulse]						
Pn825	2	Option Monitor 2 Selection		–	–	0000	Immediately	Setup	*1
		0000H to 0080H	Same as Option Monitor 1 Selection.					–	–

∗1. For details, refer to *8 MECHATROLINK-II Commands*.

(cont'd)

Parameter No.	Size	Name	Setting Range	Units	Factory Setting	When Enabled	Classification	Reference Section
Pn827	2	Linear Deceleration Constant 1 for Stopping	1 to 65535	10000 reference unit/s^2	100	Immediately*5	Setup	*1
Pn829	2	SVOFF Waiting Time (SVOFF at deceleration to stop)	0 to 65535	10 ms	0	Immediately*5	Setup	*1
Pn82A	2	Option Field Allocation 1	0000 to 1E1E	–	1813	After restart	Setup	*1

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

0 to E	ACCFIL bit position
0	Disables ACCFIL bit allocation.
1	Enables ACCFIL bit allocation.
0 to E	GSEL bit position
0	Disables GSEL bit allocation.
1	Enables GSEL bit allocation.

Parameter No.	Size	Name	Setting Range	Units	Factory Setting	When Enabled	Classification	Reference Section
Pn82B	2	Option Field Allocation 2	0000 to 1F1F	–	1D1C	After restart	Setup	*1

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

0 to F	V_PPI bit position
0	Disables V_PPI bit allocation.
1	Enables V_PPI bit allocation.
0 to F	P_PI_CLR bit position
0	Disables P_PI_CLR bit allocation.
1	Enables P_PI_CLR bit allocation.

∗1. For details, refer to *8 MECHATROLINK-II Commands*.

∗5. Change the setting when the reference is stopped (DEN is set to 1), because the change will affect the output during operation.

(cont'd)

Parameter No.	Size	Name	Setting Range	Units	Factory Setting	When Enabled	Classification	Reference Section
Pn82C	2	Option Field Allocation 3	0000 to 1F1F	–	1F1E	After restart	Setup	*1

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

0 to F	P_CL bit position
0	Disables P_CL bit allocation.
1	Enables P_CL bit allocation.
0 to F	N_CL bit position
0	Disables N_CL bit allocation.
1	Enables N_CL bit allocation.

Parameter No.	Size	Name	Setting Range	Units	Factory Setting	When Enabled	Classification	Reference Section
Pn82D	2	Option Field Allocation 4	0000 to 1F1C	–	0000	After restart	Setup	*1

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

0 to C	BANK_SEL1 bit position
0	Disables BANK_SEL1 bit allocation.
1	Enables BANK_SEL1 bit allocation.
0 to F	LT_DISABLE bit position
0	Disables LT_DISABLE bit allocation.
1	Enables LT_DISABLE bit allocation.

Parameter No.	Size	Name	Setting Range	Units	Factory Setting	When Enabled	Classification	Reference Section
Pn82E	2	Option Field Allocation 5	0000 to 1D1F	–	0000	After restart	Setup	*1

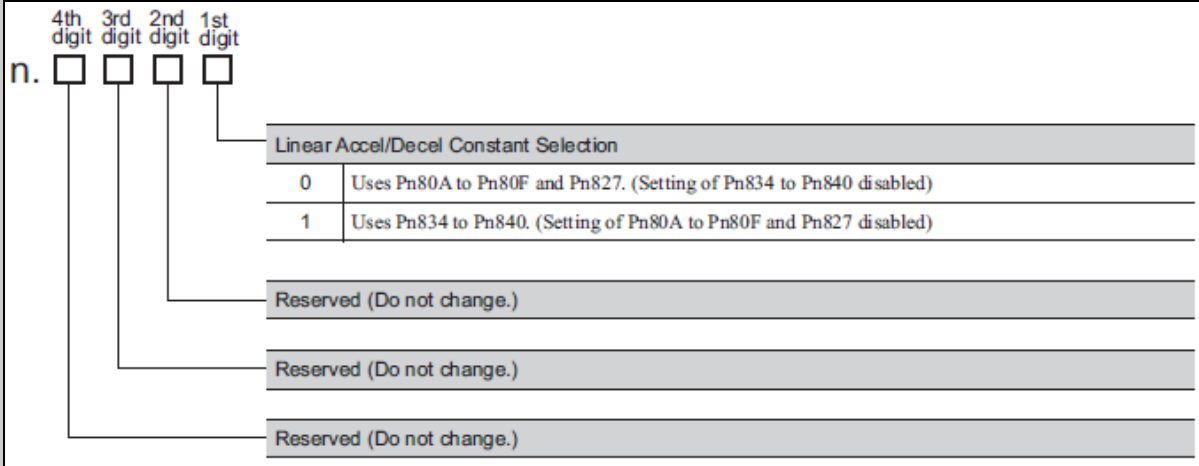
n. □ □ □ □ (4th digit, 3rd digit, 2nd digit, 1st digit)

Reserved (Do not change.)	
Reserved (Do not change.)	
0 to D	OUT_SIGNAL bit position
0	Disables OUT_SIGNAL bit allocation.
1	Enables OUT_SIGNAL bit allocation.

∗1. For details, refer to *8 MECHATROLINK-II Commands*.

(cont'd)

Parameter No.	Size	Name	Setting Range	Units	Factory Setting	When Enabled	Classification	Reference Section
Pn833	2	Motion Setting	0000 to 0001	–	0000	After restart	Setup	*1



Pn834	4	1st Linear Acceleration Constant 2	1 to 20971520	10000 reference unit/s^2	100	Immediately *5	Setup	*1
Pn836	4	2nd Linear Acceleration Constant 2	1 to 20971520	10000 reference unit/s	100	Immediately *5	Setup	*1
Pn838	4	Acceleration Constant Switching Speed 2	0 to 2097152000	1 reference unit/s	0	Immediately *5	Setup	*1
Pn83A	4	1st Linear Deceleration Constant 2	1 to 20971520	10000 reference unit/s^2	100	Immediately *5	Setup	*1
Pn83C	4	2nd Linear Deceleration Constant 2	1 to 20971520	10000 reference unit/s^2	100	Immediately *5	Setup	*1
Pn83E	4	Deceleration Constant Switching Speed 2	0 to 2097152000	1 reference unit/s	0	Immediately *5	Setup	*1
Pn840	4	Linear Deceleration Constant 2 for Stopping	1 to 20971520	10000 reference unit/s^2	100	Immediately *5	Setup	*1
Pn842[*7]	4	Homing Approach Speed 12	0 to 20971520	100 reference unit/s	0	Immediately *5	Setup	*1
Pn844[*8]	4	Homing Approach Speed 22	0 to 20971520	100 reference unit/s	0	Immediately *5	Setup	*1
Pn850	2	Latch Sequence Number	0 to 8	–	0	Immediately	Setup	*1
Pn851	2	Continuous Latch Count	0 to 255	–	0	Immediately	Setup	*1

∗1. For details, refer to *8 MECHATROLINK-II Commands*.

∗5. Change the setting when the reference is stopped (DEN is set to 1), because the change will affect the output during operation.

∗7. The set value of Pn842 is valid when the set value of Pn817 is 0. Software version 0023 or higher is required to use Pn842.

∗8. The set value of Pn844 is valid when the set value of Pn818 is 0. Software version 0023 or higher is required to use Pn844.

(cont'd)

Parameter No.	Size	Name	Setting Range	Units	Factory Setting	When Enabled	Classification	Reference Section
Pn852	2	Latch Sequence Signal 1 to 4 Setting	0000 to 3333	–	0000	Immediately	Setup	*1

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

Latch sequence 1 signal selection.

0	Phase C
1	EXT1 signal
2	EXT2 signal
3	EXT3 signal

Latch sequence 2 signal selection.

0 to 3	Same as latch sequence 1 signal selection.

Latch sequence 3 signal selection.

0 to 3	Same as latch sequence 1 signal selection.

Latch sequence 4 signal selection.

0 to 3	Same as latch sequence 1 signal selection.

Parameter No.	Size	Name	Setting Range	Units	Factory Setting	When Enabled	Classification	Reference Section
Pn853	2	Latch Sequence Signal 5 to 8 Setting	0000 to 3333	–	0000	Immediately	Setup	*1

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

Latch sequence 5 signal selection

0	Phase C
1	EXT1 signal
2	EXT2 signal
3	EXT3 signal

Latch sequence 6 signal selection.

0 to 3	Same as latch sequence 5 signal selection.

Latch sequence 7 signal selection.

0 to 3	Same as latch sequence 5 signal selection.

Latch sequence 8 signal selection.

0 to 3	Same as latch sequence 5 signal selection.

Parameter No.	Size	Name	Setting Range	Units	Factory Setting	When Enabled	Classification	Reference Section
Pn880	2	Station Address Monitor (for maintenance, read only)	40 to 5FH	–	0	Immediately	Setup	–
Pn881	2	Setting Transmission Byte Monitor [byte] (for maintenance, read only)	17, 32	–	0	Immediately	Setup	–

*1. For details, refer to *8 MECHATROLINK-II Commands*.

(cont'd)

Parameter No.	Size	Name	Setting Range	Units	Factory Setting	When Enabled	Classification	Reference Section
Pn882	2	Transmission Cycle Setting Monitor [0.25 µs] (for maintenance, read only)	0 to FFFFH	–	0	Immediately	Setup	–
Pn883	2	Communications Cycle Setting Monitor [x transmission cycle] (for maintenance, read only)	0 to 32	–	0	Immediately	Setup	–
Pn88A	2	MECHATROLINK Receive Error Counter Monitor (for maintenance, read only)	0 to 65535	–	0	Immediately	Setup	–
Pn890 to Pn89E	4	Command Data Monitor at Alarm/Warning Occurs (for maintenance, read only)	0 to FFFFFFFFH	–	0	Immediately	Setup	*1
Pn8A0 to Pn8AE	4	Response Data Monitor at Alarm/Warning Occurs (for maintenance, read only)	0 to FFFFFFFFH	–	0	Immediately	Setup	*1
Pn900	2	Parameter Bank Number	0 to 16	–	0	After restart	Setup	*1
Pn901	2	Parameter Bank Member Number	0 to 15	–	0	After restart	Setup	*1
Pn902 to Pn910	2	Parameter Bank Member Definition	0000H to 08FFH	–	0	After restart	Setup	*1
Pn920 to Pn95F	2	Parameter Bank Data (non-volatile memory save disabled)	0000H to FFFFH	–	0	Immediately	Setup	*1

∗1. For details, refer to *8 MECHATROLINK-II Commands*.

10.2 Parameter Recording Table

Use the following table for recording parameters.

Note: Pn10B, Pn170, and Pn408 have two kinds of digits: the digit which does not need the restart after changing the set- tings and the digit which needs the restart. The underlined digits of the factory setting in the following table show the digit which needs the restart.

Parameter	Factory Setting						Name	When Enabled
Pn000	0000						Basic Function Select Switch 0	After restart
Pn001	0000						Application Function Select Switch 1	After restart
Pn002	0000						Application Function Select Switch 2	After restart
Pn006	0002						Application Function Select Switch 6	Immediately
Pn007	0000						Application Function Select Switch 7	Immediately
Pn008	4000						Application Function Select Switch 8	After restart
Pn009	0010						Application Function Select Switch 9	After restart
Pn00B	0000						Application Function Select Switch B	After restart
Pn00C	0000						Application Function Select Switch C	After restart
Pn00D	0000						Application Function Select Switch D	After restart
Pn081	0000						Maker setting	-
Pn100	400						Speed Loop Gain	Immediately
Pn101	2000						Speed Loop Integral Time Constant	Immediately
Pn102	400						Position Loop Gain	Immediately
Pn103	100						Moment of Inertia Ratio	Immediately
Pn104	400						2nd Speed Loop Gain	Immediately
Pn105	2000						2nd Speed Loop Integral Time Constant	Immediately
Pn106	400						2nd Position Loop Gain	Immediately
Pn109	0						Feedforward Gain	Immediately
Pn10A	0						Feedforward Filter Time Constant	Immediately
Pn10B	0000						Application Function for Gain Select Switch	–
Pn10C	200						Mode Switch (torque reference)	Immediately
Pn10D	0						Mode Switch (speed reference)	Immediately
Pn10E	0						Mode Switch (acceleration)	Immediately
Pn10F	0						Mode Switch (position error)	Immediately
Pn11F	0						Position Integral Time Constant	Immediately
Pn121	100						Friction Compensation Gain	Immediately
Pn122	100						2nd Gain for Friction Compensation	Immediately
Pn123	0						Friction Compensation Coefficient	Immediately
Pn124	0						Friction Compensation Frequency Correction	Immediately
Pn125	100						Friction Compensation Gain Correction	Immediately
Pn131	0						Gain Switching Time 1	Immediately
Pn132	0						Gain Switching Time 2	Immediately
Pn135	0						Gain Switching Waiting Time 1	Immediately
Pn136	0						Gain Switching Waiting Time 2	Immediately

(cont'd)

Parameter	Factory Setting						Name	When Enabled
Pn139	0000						Automatic Gain Changeover Related Switch 1	Immediately
Pn13D	2000						Current Gain Level	Immediately
Pn140	0100						Model Following Control Related Switch	Immediately
Pn141	500						Model Following Control Gain	Immediately
Pn142	1000						Model Following Control Gain Compensation	Immediately
Pn143	1000						Model Following Control Bias (Forward Direction)	Immediately
Pn144	1000						Model Following Control Bias (Reverse Direction)	Immediately
Pn145	500						Vibration Suppression 1 Frequency A	Immediately
Pn146	700						Vibration Suppression 1 Frequency B	Immediately
Pn147	1000						Model Following Control Speed Feedforward Compensation	Immediately
Pn148	500						2nd Model Following Control Gain	Immediately
Pn149	1000						2nd Model Following Control Gain Compensation	Immediately
Pn14A	800						Vibration Suppression 2 Frequency	Immediately
Pn14B	100						Vibration Suppression 2 Compensation	Immediately
Pn14F	0011						Control Related Switch	After restart
Pn160	0010						Anti-Resonance Control Related Switch	Immediately
Pn161	1000						Anti-Resonance Frequency	Immediately
Pn162	100						Anti-Resonance Gain Compensation	Immediately
Pn163	0						Anti-Resonance Damping Gain	Immediately
Pn164	0						Anti-Resonance Filter Time Constant 1 Compensation	Immediately
Pn165	0						Anti-Resonance Filter Time Constant 2 Compensation	Immediately
Pn170	1401						Tuning-less Function Related Switch	–
Pn205	65535						Multiturn Limit Setting	After restart
Pn207	0010						Position Control Function Switch	After restart
Pn20A	32768						Maker setting	-
Pn20E	4						Electronic Gear Ratio (Numerator)	After restart
Pn210	1						Electronic Gear Ratio (Denominator)	After restart
Pn212	2048						Encoder Output Pulses	After restart
Pn22A	0000						Maker setting	-
Pn230	0000						Position Control Expanded Function Switch	After reset
Pn231	0						Backlash Compensation Value	Immediately
Pn233	0						Backlash Compensation Time Constant	Immediately
Pn281	20						Maker setting	-
Pn304	500						JOG Speed	Immediately
Pn305	0						Soft Start Acceleration Time	Immediately

(cont'd)

Parameter	Factory Setting						Name	When Enabled
Pn306	0						Soft Start Deceleration Time	Immediately
Pn310	0000						Vibration Detection Switch	Immediately
Pn311	100						Vibration Detection Sensibility	Immediately
Pn312	50						Vibration Detection Level	Immediately
Pn324	300						Moment of Inertia Calculating Start Level	Immediately
Pn401	100						Torque Reference Filter Time Constant	Immediately
Pn402	800						Forward Torque Limit	Immediately
Pn403	800						Reverse Torque Limit	Immediately
Pn404	100						Forward External Torque Limit	Immediately
Pn405	100						Reverse External Torque Limit	Immediately
Pn406	800						Emergency Stop Torque	Immediately
Pn407	10000						Speed Limit during Torque Control	Immediately
Pn408	0000						Torque Related Function Switch	–
Pn409	5000						1st Notch Filter Frequency	Immediately
Pn40A	70						1st Notch Filter Q Value	Immediately
Pn40B	0						1st Notch Filter Depth	Immediately
Pn40C	5000						2nd Notch Filter Frequency	Immediately
Pn40D	70						2nd Notch Filter Q Value	Immediately
Pn40E	0						2nd Notch Filter Depth	Immediately
Pn40F	5000						2nd Step 2nd Torque Reference Filter Frequency	Immediately
Pn410	50						2nd Step 2nd Torque Reference Filter Q Value	Immediately
Pn412	100						1st Step 2nd Torque Reference Filter Time Constant	Immediately
Pn415	0						Reserved	–
Pn423	0000						Reserved	–
Pn424	50						Torque Limit at Main Circuit Voltage Drop	Immediately
Pn425	100						Release Time for Torque Limit at Main Circuit Voltage Drop	Immediately
Pn456	15						Sweep Torque Reference Amplitude	Immediately
Pn460	0101						Notch Filter Adjustment Switch	Immediately
Pn501	10						Zero Clamp Level	Immediately
Pn502	20						Rotation Detection Level	Immediately
Pn503	10						Speed Coincidence Signal Output Width	Immediately
Pn506	0						Lock Reference - Servo OFF Delay Time	Immediately
Pn507	100						Lock Reference Output Speed Level	Immediately
Pn508	50						Waiting Time for Lock Signal When Motor Running	Immediately
Pn509	20						Instantaneous Power Cut Hold Time	Immediately
Pn50A	1881						Input Signal Selection 1	After restart
Pn50B	8882						Input Signal Selection 2	After restart
Pn50E	0000						Output Signal Selection 1	After restart

(cont'd)

Parameter	Factory Setting						Name	When Enabled
Pn50F	0100						Output Signal Selection 2	After restart
Pn510	0000						Output Signal Selection 3	After restart
Pn511	6543						Input Signal Selection 5	After restart
Pn512	0000						Output Signal Inverse Setting	After restart
Pn517	0000						Reserved	–
Pn51B	1000						Maker setting	-
Pn51E	100						Excessive Position Error Warning Level	Immediately
Pn520	5242880						Excessive Position Error Alarm Level	Immediately
Pn522	7						Positioning Completed Width	Immediately
Pn524	1073741824						NEAR Signal Width	Immediately
Pn526	5242880						Excessive Position Error Alarm Level at Servo ON	Immediately
Pn528	100						Excessive Position Error Warning Level at Servo ON	Immediately
Pn529	10000						Speed Limit Level at Servo ON	Immediately
Pn52A	20						Maker setting	-
Pn52B	20						Overload Warning Level	Immediately
Pn52C	100						Derating of Base Current at Detecting Overload of Motor	After restart
Pn52D	50						Reserved	–
Pn52F	0FFF						Reserved	–
Pn530	0000						Program JOG Operation Related Switch	Immediately
Pn531	32768						Program JOG Movement Distance	Immediately
Pn533	500						Program JOG Movement Speed	Immediately
Pn534	100						Program JOG Acceleration/Decelera-tion Time	Immediately
Pn535	100						Program JOG Waiting Time	Immediately
Pn536	1						Number of Times of Program JOG Movement	Immediately
Pn550	0						Analog Monitor 1 Offset Voltage	Immediately
Pn551	0						Analog Monitor 2 Offset Voltage	Immediately
Pn552	100						Analog Monitor Magnification (×1)	Immediately
Pn553	100						Analog Monitor Magnification (×2)	Immediately
Pn560	400						Remained Vibration Detection Width	Immediately
Pn561	100						Overshoot Detection Level	Immediately
Pn600	0						Regenerative Resistor Capacity	Immediately
Pn601	0						Reserved	–
Pn800	0040						Communications Control	Immediately
Pn801	0003						Application Function Select 6 (Software LS)	Immediately
Pn803	10						Origin Range	Immediately
Pn804	1073741823						Forward Software Limit	Immediately
Pn806	-1073741823						Reverse Software Limit	Immediately

(cont'd)

Parameter	Factory Setting						Name	When Enabled
Pn808	0						Absolute Encoder Origin Offset	Immediately ∗1
Pn80A	100						1st Linear Acceleration Constant	Immediately ∗2
Pn80B	100						2nd Linear Acceleration Constant	Immediately ∗2
Pn80C	0						Acceleration Constant Switching Speed	Immediately ∗2
Pn80D	100						1st Linear Deceleration Constant	Immediately ∗2
Pn80E	100						2nd Linear Deceleration Constant	Immediately ∗2
Pn80F	0						Deceleration Constant Switching Speed	Immediately ∗2
Pn810	0						Exponential Function Acceleration/ Deceleration Bias	Immediately ∗2
Pn811	0						Exponential Function Acceleration/ Deceleration Time Constant	Immediately ∗2
Pn812	0						Movement Average Time	Immediately ∗2
Pn814	100						Final Travel Distance for External Positioning	Immediately ∗2
Pn816	0000						Homing Mode Setting	Immediately ∗2
Pn817	50						Homing Approach Speed 1	Immediately ∗2
Pn818	5						Homing Approach Speed 2	Immediately ∗2
Pn819	100						Final Travel Distance for Homing	Immediately ∗2
Pn81E	0000						Input Signal Monitor Selection	Immediately
Pn81F	0000						Command Data Allocation	After restart
Pn820	0						Forward Latching Allowable Area	Immediately
Pn822	0						Reverse Latching Allowable Area	Immediately
Pn824	0000						Option Monitor 1 Selection	Immediately
Pn825	0000						Option Monitor 2 Selection	Immediately
Pn827	100						Linear Deceleration Constant 1 for Stopping	Immediately ∗2
Pn829	0						SVOFF Waiting Time (SVOFF at deceleration to stop)	Immediately
Pn82A	1813						Option Field Allocation 1	After restart
Pn82B	1D1C						Option Field Allocation 2	After restart
Pn82C	1F1E						Option Field Allocation 3	After restart
Pn82D	0000						Option Field Allocation 4	After restart
Pn82E	0000						Option Field Allocation 5	After restart
Pn833	0000						Motion Setting	After restart
Pn834	100						1st Linear Acceleration Constant 2	Immediately∗2

∗1. Enabled after the SENS_ON is entered.

∗2. Change the setting when the reference is stopped (DEN is set to 1), because the change will affect the output during operation.

(cont'd)

Parameter	Factory Setting						Name	When Enabled
Pn836	100						2nd Linear Acceleration Constant 2	Immediately ∗2
Pn838	0						Acceleration Constant Switching Speed 2	Immediately ∗2
Pn83A	100						1st Linear Deceleration Constant 2	Immediately ∗2
Pn83C	100						2nd Linear Deceleration Constant 2	Immediately ∗2
Pn83E	0						Deceleration Constant Switching Speed 2	Immediately ∗2
Pn840	100						Linear Deceleration Constant 2 for Stopping	Immediately ∗2
Pn842	0						Homing Approach Speed 12	Immediately ∗2
Pn844	0						Homing ApproachCreep Speed 22	Immediately ∗2
Pn850	0						Latch Sequence Number	Immediately
Pn851	0						Continuous Latch Count	Immediately
Pn852	0000						Latch Sequence Signal 1 to 4 Setting	Immediately
Pn853	0000						Latch Sequence Signal 5 to 8 Setting	Immediately
Pn880	0						Station Address Monitor (for maintenance, read only)	Immediately
Pn881	0						Setting Transmission Byte Monitor [byte] (for maintenance, read only)	Immediately
Pn882	0						Transmission Cycle Setting Monitor [0.25 μs] (for maintenance, read only)	Immediately
Pn883	0						Communications Cycle Setting Monitor [x transmission cycle] (for maintenance, read only)	Immediately
Pn88A	0						MECHATROLINK Receive Error Counter Monitor (for maintenance, read only)	Immediately
Pn890 to Pn89E	0						Command Data Monitor at Alarm/ Warning Occurs (for maintenance, read only)	Immediately
Pn8A0 to Pn8AE	0						Response Data Monitor at Alarm/ Warning Occurs (for maintenance, read only)	Immediately
Pn900	0						Parameter Bank Number	After restart
Pn901	0						Parameter Bank Member Number	After restart
Pn902 to Pn910	0						Parameter Bank Member Definition	After restart
Pn920 to Pn95F	0						Parameter Bank Data (nonvolatile memory save disabled)	Immediately

∗2. Change the setting when the reference is stopped (DEN is set to 1), because the change will affect the output during operation.

App Recommended parameter by actuator 2
Recommended parameter values[LEF] 2
Recommended parameter values[LEJ] 3
Recommended parameter values[LEY] 4
Recommended parameter values[LESYH] 5
Recommended parameter values[LET] 5

App Recommended parameter by actuator

Please change the parameter values according to the customer application.
Since the response of acceleration/deceleration may vary depending on the shape of the object to be conveyed and its installation condition, please make adjustments in the parameters.
If the response is set too high, oscillation may occur.
See section 4,5,and10 “LECYM□ Operation Manual” for details.

Recommended parameter values[LEF]

Series			LEFS25			LEFS32			LEFS40		
	Lead symbol		H	A	B	H	A	B	H	A	B
	Lead		20	12	6	24	16	8	30	20	10
Parameter *1,*2	Para. No	Initial value	Recommended parameter value								
Rotation direction selection	Pn000	0000	**0001 (+ : Control motors side)**								
Adjustmentless related switches	Pn170	1401	1401								
Electron Gear Ratio (Numerator) *3	Pn20E	4	**65536**								
Electronic gear ratio (denominator) *3	Pn210	1	**1250**	**750**	**375**	**1500**	**1000**	**500**	**1875**	**1250**	**625**

Series			LEFS25(L,R)			LEFS32(L,R)			LEFS40(L,R)		
	Lead symbol		H	A	B	H	A	B	H	A	B
	Lead		20	12	6	24	16	8	30	20	10
Parameter *1,*2	Para. No	Initial value	Recommended parameter value								
Rotation direction selection	Pn000	0000	0000 **(+ : Control motors side)**								
Adjustmentless related switches	Pn170	1401	1401								
Electron Gear Ratio (Numerator) *3	Pn20E	4	**65536**								
Electronic gear ratio (denominator) *3	Pn210	1	**1250**	**750**	**375**	**1500**	**1000**	**500**	**1875**	**1250**	**625**

Series			LEFB25	LEFB25U	LEFB32	LEFB32U	LEFB40	LEFB40U
	Lead symbol		S					
	Lead		54					
Parameter *1,*2	Para. No	Initial value	Recommended parameter value					
Rotation direction selection	Pn000	0000	**0001 (+ :** Counter motors side**)**	0000 (+:Counter motors side)	**0001 (+ :** Counter motors side**)**	0000 (+:Counter motors side)	**0001 (+ :** Counter motors side**)**	0000 (+:Counter motors side)
Adjustmentless related switches	Pn170	1401	1401				**2301**	
Electron Gear Ratio (Numerator) *3	Pn20E	4	**65536**					
Electronic gear ratio (denominator) *3	Pn210	1	**3375**					

: Differs to initial value

*1: Parameter is set to the recommended value. Please set parameter according to customer application.
*2: Since the response of acceleration/deceleration may vary depending on the shape of the object to be conveyed and its installation condition, please adjust in the parameters.
If the response is set too high, oscillation may occur.
(Parameter initialization => Set recommended parameter values => Start operation)
*3: This is the case where the amount of actuator movement per instruction unit = 1 [μm].
Depending on the PLC used, the electronic gear ratio may need to be set on the PLC side.

Recommended parameter values[LEJ]

Series			LEJS40			LEJS63			LEJB40	LEJB63
	Lead symbol		H	A	B	H	A	B	T	
	Lead		24	16	8	30	20	10	27	42
Parameter *1,*2	Para. No	Initial value	Recommended parameter value							
Rotation direction selection	Pn000	0000	**0001 (+ :** Counter motors side**)**						0000 (+ : Counter motors side)	
Adjustmentless related switches	Pn170	1401	1401							
Electron Gear Ratio (Numerator) *3	Pn20E	4	**65536**						**131072**	**65536**
Electronic gear ratio (denominator) *3	Pn210	1	**1500**	**1000**	**500**	**1875**	**1250**	**625**	**3375**	**2625**

: Differs to initial value

*1: Parameter is set to the recommended value. Please set parameter according to customer application.
*2: Since the response of acceleration/deceleration may vary depending on the shape of the object to be conveyed and its installation condition, please make adjustments in the parameters.
If the response is set too high, oscillation may occur.
(Parameter initialization => Set recommended parameter values => Start operation)
*3: This is the case where the amount of actuator movement per instruction unit = 1 [μm].
Depending on the PLC used, the electronic gear ratio may need to be set on the PLC side.

Recommended parameter values[LEY]

Series			LEY25/ LEYG25			LEY25D/ LEYG25D			LEY32/LEYG32			LEY32D/ LEYG32D		
Lead symbol			A	B	C	A	B	C	A	B	C	A	B	C
Lead			12	6	3	12	6	3	20	10	5	16	8	4
Parameter *1,*2	Para. No	Initial value	Recommended parameter value											
Rotation direction *4	Pn000	0000	0000 (+ : Counter motors side)			**0001 (+ :** Counter motors side**)**			0000 (+ : Counter motors side)			**0001 (+ :** Counter motors side**)**		
Adjustmentless related switches	Pn170	1401	1401											
Electron Gear Ratio (Numerator) *3	Pn20E	4	**65536**		131072	**65536**		131072	**65536**		131072	**65536**		
Electronic gear ratio (denominator) *3	Pn210	1	**750**	**375**	**375**	**750**	**375**	**375**	**1250**	**625**	**625**	**1000**	**500**	**250**

Series			LEY63				LEY63D		
Lead symbol			A	B	C	L	A	B	C
Lead (Including pulley ratio)			20	10	5	5(2.86) (Pulley ratio 4/7)	20	10	5
Parameter *1,*2	Para. No	Initial value	Recommended parameter value						
Rotation direction selection *4	Pn000	0000	0000 (+ : Counter motors side)				**0001** (+ : Counter motors side)		
Adjustmentless related switches	Pn170	1401	1401						
Electron Gear Ratio (Numerator) *3	Pn20E	4	**65536**		**131072**	**229376**	**65536**		**131072**
Electronic gear ratio (denominator) *3	Pn210	1	**1250**	**625**	**625**	**625**	**1250**	**625**	**625**

: Differs to initial value

*1: Parameter is set to the recommended value. Please set parameter according to customer application.
*2: Since the response of acceleration/deceleration may vary depending on the shape of the object to be conveyed and its installation condition, please make adjustments in the parameters.
If the response is set too high, oscillation may occur.
(Parameter initialization => Set recommended parameter values => Start operation)
*3: This is the case where the amount of actuator movement per instruction unit = 1 [μm].
Depending on the PLC used, the electronic gear ratio may need to be set on the PLC side.
*4: When the motor arrangement is right-hand turn (LEY*R) or left-hand turn (LEY*L), direction is 0 (+ direction: anti-motor side)).

Recommended parameter values[LESYH]

Series			LESYH16		LESYH16D		LESYH25		LESYH25D	
	Lead symbol		A	B	A	B	A	B	A	B
	Lead		12	6	12	6	20	10	16	8
Parameter *1,*2	Para. No	Initial value	Recommended parameter value							
Rotation direction selection *4	Pn000	0000	0000 (+ : Counter motors side)		**0001** (+ : Counter motors side)		0000 (+ : Counter motors side)		**0001** (+ : Counter motors side)	
Adjustmentless related switches	Pn170	1401	1401							
Electron Gear Ratio (Numerator) *3	Pn20E	4	**65536**		**65536**		**65536**		**65536**	
Electronic gear ratio (denominator) *3	Pn210	1	**750**	**375**	**750**	**375**	**1250**	**625**	**1000**	**500**

: Differs to initial value

*1: Parameter is set to the recommended value. Please set parameter according to customer application.
*2: Since the response of acceleration/deceleration may vary depending on the shape of the object to be conveyed and its installation condition, please make adjustments in the parameters.
If the response is set too high, oscillation may occur.
(Parameter initialization => Set recommended parameter values => Start operation)
*3: This is the case where the amount of actuator movement per instruction unit = 1 [μm].
Depending on the PLC used, the electronic gear ratio may need to be set on the PLC side.
*4: When the motor mounting position is right side parallel (LESYH*R) or left side parallel (LESYH*L), the rotation direction selection is 0(+: Counter motors side).

Recommended parameter values[LET]

Series			LET80		
	Lead symbol		D	L	M
	Lead (Including pulley ratio)		130(43.3) (Pulley ratio 1/3)	130(26) (Pulley ratio 1/5)	130(14.4) (Pulley ratio 1/9)
Parameter *1,*2	Para. No	Initial value	Recommended parameter value		
Rotation direction selection	Pn000	0000	**1 : Motor arrangement RL,FL 0 : Motor arrangement RR,FR**		
Adjustmentless related switches	Pn170	1401	1401		
Electron Gear Ratio (Numerator) *3	Pn20E	4	**589824**		
Electronic gear ratio (denominator) *3	Pn210	1	**24375**	**14625**	**8125**

: Differs to initial value

*1: Parameter is set to the recommended value. Please set parameter according to customer application.
*2: Since the response of acceleration/deceleration may vary depending on the shape of the object to be conveyed and its installation condition, please make adjustments in the parameters.
If the response is set too high, oscillation may occur.
*3: This is the case when the actuator travel per command unit = 1 [μm].
Depending on the PLC used, the electronic gear ratio may need to be set on the PLC side.

Revision history
No.LEC-OM06901 Feb./2014 1st printing No.LEC-OM06902 Aug./2014 2nd printing Correction of words No.LEC-OM06903 (No.JXC※-OMT0064) Jan./2017 3nd printing Correction of words No.JXC※-OMT0064-A Apr./2023 Add note to chapter1.3, 1.4 and 1.5 No.JXC※-OMT0064-B Oct./2023 Add recommended parameters to Appendix

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