Σ-Ⅱ Series SGDH

MECHATROLINK-Ⅱ APPLICATION MODULE

USER'S MANUAL

MODEL: JUSP-NS115

YASKAWA

MANUAL NO. SIEP C710800 01C

Overview

■ About this Manual

This manual provides the following information for the Σ-II Series SGM□H/SGDH-□E servodrives with a JUSP-NS115 MECHATROLINK-II application module (hereinafter called the NS115).

- Procedures for installing and wiring the servomotor, SERVOPACK, and NS115.
- Procedures for trial operation of the servodrive.
- Procedures for using functions and adjusting the servodrives.
- Procedures for using the built-in Panel Operator and the Hand-held Digital Operator.
- Ratings and specifications for standard models.
- Procedures for maintenance and inspection.
- MECHATROLINK-II communications specifications for SGDH SERVOPACK

■ Intended Audience

This manual is intended for the following users.

- Those designing servodrive systems using MECHATROLINK-II
- Those designing Σ-II Series servodrive systems.
- Those installing or wiring Σ-II Series servodrives.
- Those performing trial operation or adjustments of Σ-II Series servodrives.
- Those maintaining or inspecting Σ-II Series servodrives.

■ Description of Technical Terms

In this manual, the following terms are defined as follows:

- Servomotor = Σ-II Series SGMAH, SGMPH, SGMGH, SGMSH, or SGMDH servomotor.
- SERVOPACK = Σ-II Series SGDH-□□□E SERVOPACK.
- Servodrive = A set including a servomotor and Servo Amplifier.
- Servo System = A servo control system that includes the combination of a servodrive with a host controller and peripheral devices.
- Online parameters = Parameters that are enabled as soon as they are set.
- Offline parameters = Parameters that are enabled when the control power is turned OFF and ON again after setting with the Write Non-volatile Parameter command (PPRM_WR), or those that are set with the control power ON and enabled with the Set Up Device command (CONFIG).

■ Indication of Reverse Signals

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

- /S-ON
- /P-CON

Visual Aids

The following aids are used to indicate certain types of information for easier reference.

◀ EXAMPLE ▶ Indicates application examples.

Indicates supplemental information.

IMPORTANT Indicates important information that should be memorized, including precautions such as alarm displays to avoid damaging the devices.

Indicates definitions of difficult terms or terms that have not been previously explained in this manual.

■ Related Manuals

Refer to the following manuals as required.

Read this manual carefully to ensure the proper use of Σ-II Series servodrives. Also, keep this manual in a safe place so that it can be referred to whenever necessary.

Manual Name	Manual Number	Contents
Σ-II Series SGM□H/SGDH User's Manual	SIEPS80000005	Provides detailed information on selecting Σ-II Series Servodrives/Servomotors and capacities, and detailed information on installation, wiring, trial operation, using functions, maintenance, and inspection.
Σ-II Series SGM□H/SGDM Digital Operator Operation Manual	TOE-S800-34	Provides detailed information on the operation of the JUSP-OP02A-2 Digital Operator, which is an optional product.
High-speed Field Network MECHATROLINK System User's Manual	SIE-S800-26.1	Provides detailed information on the MECHATROLINK system.
High-speed Field Network MECHATROLINK Servo Command User's Manual	SIE-S800-26.2	Describes the Servo commands for use in a MECHATROLINK system.

Safety Information

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

⚠ WARNING

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

⚠ CAUTION

Indicates precautions that, if not heeded, could result in relatively serious or minor injury, damage to the product, or faulty operation.

Even items described in ⚠ CAUTION may result in a vital accident in some situations. In either case, follow these important notes.

PROHIBITED

Indicates actions that must never be taken.

MANDATORY

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

The warning symbols for ISO and JIS standards are different, as shown below.

ISO	JIS
⚠	⚠

The ISO symbol is used in this manual.

Both of these symbols appear on warning labels on Yaskawa products. Please abide by these warning labels regardless of which symbol is used.

Safety Precautions

The following precautions are for checking products upon delivery, installation, wiring, operation, maintenance and inspections.

■ Checking Products upon Delivery

⚠ CAUTION

- Always use the servomotor and SERVOPACK in one of the specified combinations.

  Not doing so may cause fire or malfunction.

■ Installation

⚠ CAUTION

- Never use the products in an environment subject to water, corrosive gases, inflammable gases, or combustibles.

  Doing so may result in electric shock or fire.

■ Wiring

⚠ WARNING

- Connect the ground terminal to electrical codes (ground resistance: 100 Ω or less).

  Improper grounding may result in electric shock or fire.

⚠ CAUTION

- Do not connect a three-phase power supply to the U, V, or W output terminals.

  Doing so may result in injury or fire.
- Securely fasten the power supply terminal screws and motor output terminal screws.

  Not doing so may result in fire.

■ Operation

⚠ WARNING

- Never touch any rotating motor parts while the motor is running.

  Doing so may result in injury.

⚠ CAUTION

- Conduct trial operation on the servomotor alone with the motor shaft disconnected from machine to avoid any unexpected accidents.

  Not doing so may result in injury.
- Before starting operation with a machine connected, change the settings to match the parameters of the machine.

  Starting operation without matching the proper settings may cause the machine to run out of control or malfunction.
- Before starting operation with a machine connected, make sure that an emergency stop can be applied at any time.

  Not doing so may result in injury.
- Do not touch the heat sinks during operation.

  Doing so may result in burns due to high temperatures.

■ Maintenance and Inspection

⚠ WARNING

- Never touch the inside of the SERVOPACKs.

  Doing so may result in electric shock.
- Do not remove the panel cover while the power is ON.

  Doing so may result in electric shock.
- Do not touch terminals for five minutes after the power is turned OFF.

  Residual voltage may cause electric shock.

⚠ CAUTION

- Do not disassemble the servomotor.

  Doing so may result in electric shock or injury.
- Do not attempt to change wiring while the power is ON.

  Doing so may result in electric shock or injury.

■ General Precautions

Note the following to ensure safe application.
• The drawings presented 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. • This manual is subject to change due to product improvement, specification modification, and manual improvement. When this manual is revised, the manual code is updated and the new manual is published as a next edition. The edition number appears on the front and back covers. • If the manual must be ordered due to loss or damage, inform your nearest Yaskawa representative or one of the offices listed on the back of this manual. • Yaskawa will not take responsibility for the results of unauthorized modifications of this product. Yaskawa shall not be liable for any damages or troubles resulting from unauthorized modification.

CONTENTS

1

Checking Products and Part Names

This chapter describes the procedure for checking Σ-II Series products and the NS115 upon delivery. It also describes the names of product parts.

1.1 Checking Products on Delivery

The following procedure is used to check products upon delivery. Check the following items when products are delivered.

Check Items	Comments
Are the delivered products the ones that were ordered?	Check the model numbers marked on the nameplates of the NS115. (Refer to the descriptions of model numbers on the following page.)
Is there any damage?	Check the overall appearance, and check for damage or scratches that may have occurred during shipping.
Can the NS115 be installed on the SERVOPACK used?	Check the model number given on the SERVOPACK nameplate and the version seal on the front panel. The model number must contain "SGDH" and "E" as shown below to support the NS115. Model number (MODEL): SGDH-□□□E-□ The latter two numbers on the version seal are more than 33. Version seal: ***33

If any of the above items are faulty or incorrect, contact your Yaskawa sales representative or the dealer from whom you purchased the products.

■ External Appearance and Nameplate Examples

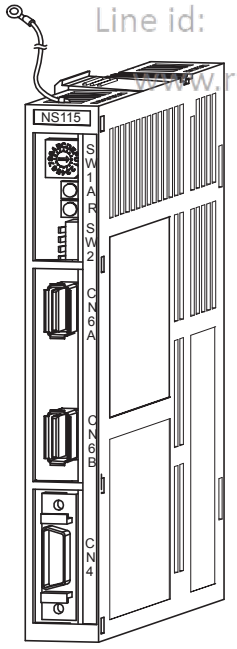


Fig. 1.1 External Appearance of the NS115

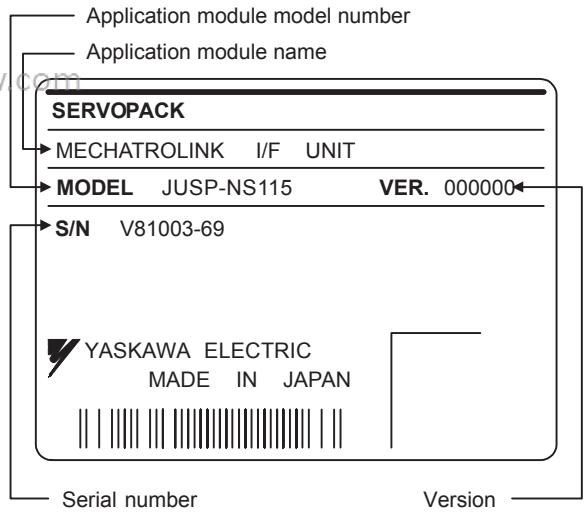
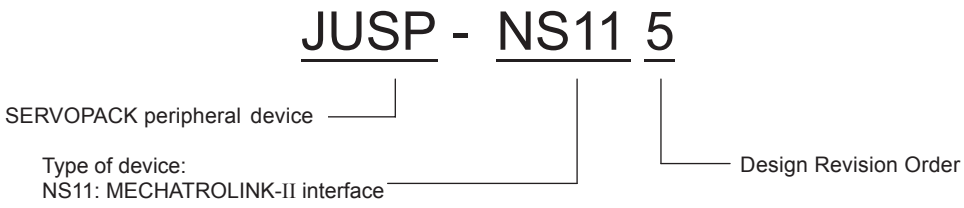


Fig. 1.2 Nameplate

■ Model Numbers

NS115



1.2 Product Part Names

The following diagram illustrates the product part names of the NS115.

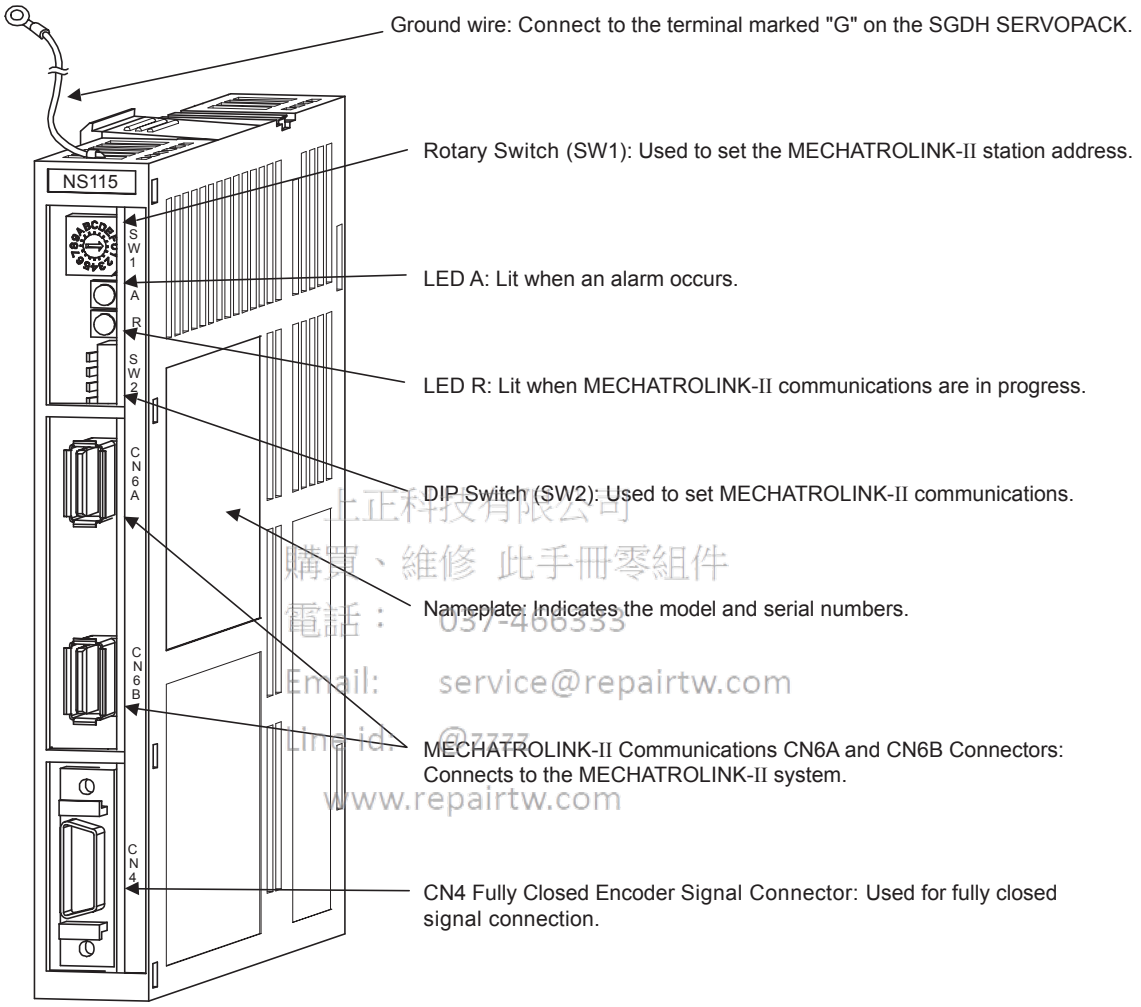


Fig. 1.3 NS115

1.3 Mounting the NS115

This section describes how to mount an NS115 on the SGDH SERVOPACK.

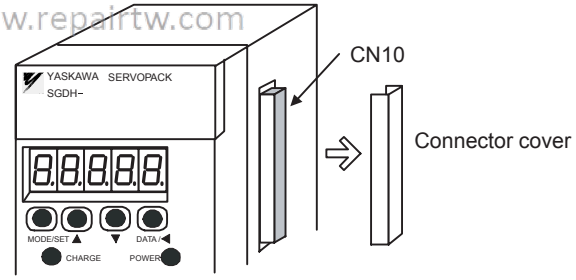
Prepare the screws for connecting the ground wire as shown in the following table:

Mounting Type	SERVOPACK Models	Screw	Remarks
Base Mounted	SGDH-A3 to 02BE SGDH-A3 to 10AE	M3 × 10 round-head screw (spring or flat washer)	Use attached screws on the NS115.
	SGDH-15 to 50AE SGDH-05 to 30DE	M4 × 10 round-head screws (spring or flat washer)	Use attached screws on the NS115.
	SGDH-60/75AE	M4 × 8 round-head screw (spring or flat washer)	Use front panel fixer screws.
Rack Mounted	SGDH-A3 to 02BE-R SGDH-A3 to 50AE-R SGDH-05 to 30DE-R	M4 × 6 round-head screws (spring or flat washer)	Use attached screws on the NS115.
Duct Vent	SGDH-60/75AE-P	M4 × 8 round-head screw (spring or flat washer)	Use front panel fixer screws.

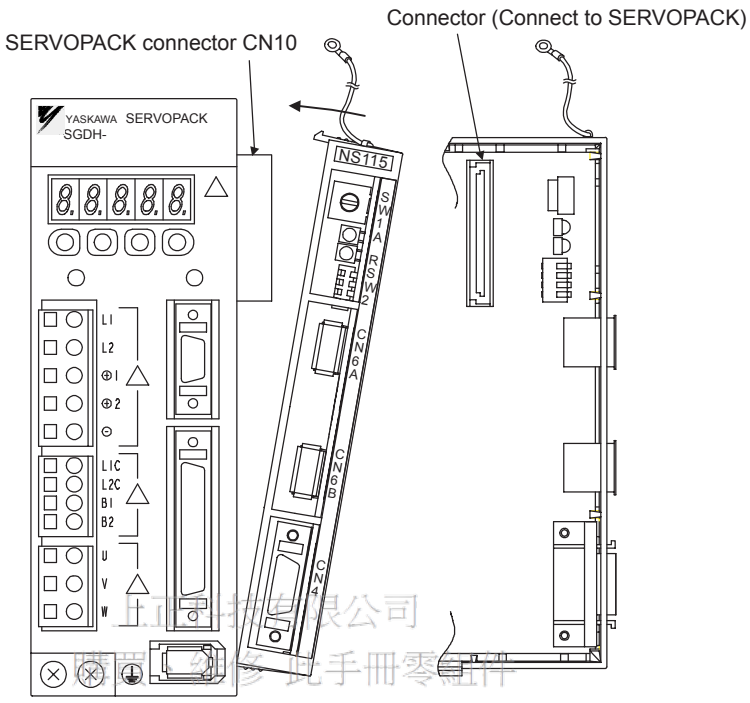
Note: Be sure to use spring washers or flat washers. Failure to do so may result in the screws for connecting the ground wire protruding behind the flange, preventing the SERVOPACK from being mounted.

By mounting an NS115, the SGDH SERVOPACK can be used in a MECHATROLINK-II system. Use the following procedure to ensure NS115 is mounted correctly.

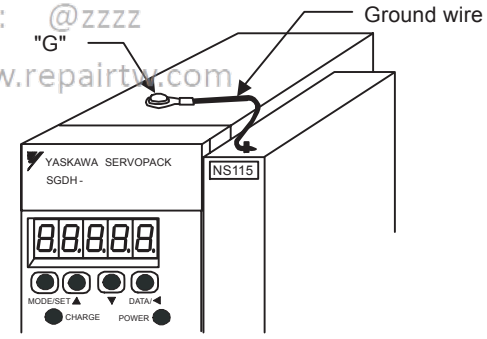
1. Remove the connector cover from the CN10 connector on the SERVOPACK.



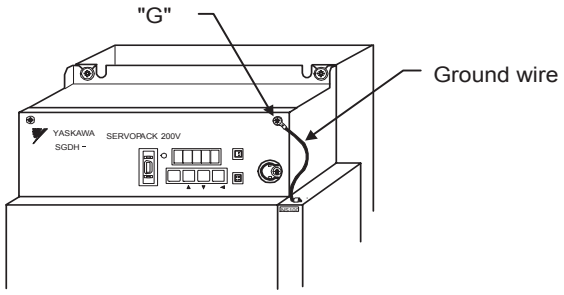
2. Mount the NS115 on the SERVOPACK.



3. For grounding, connect a ground wire of the NS115 to the point marked “G” on the SERVOPACK.

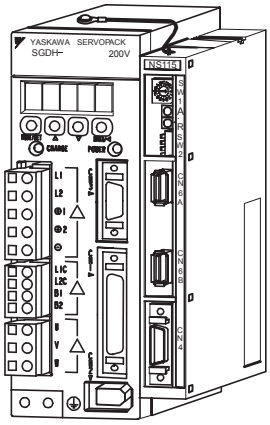


For SERVOPACK (30 W to 5.0 kW)



For SERVOPACK (6.0 kW to 7.5 kW)

When the NS115 has been mounted correctly, the SERVOPACK will appear as shown in the following diagram.



2

Installation

2

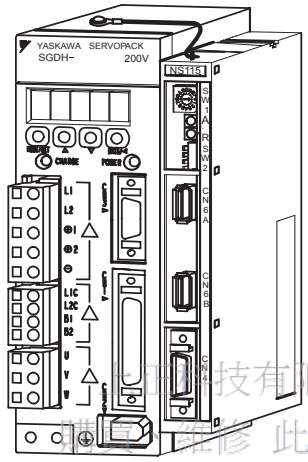
This chapter describes precautions for Σ-II Series product installation.

The SGDH SERVOPACKs are base-mounted servo controller. Incorrect installation will cause problems. Always observe the installation precautions shown in this chapter.

2.1 Storage Conditions

Store the SERVOPACK within the following temperature range when it is stored with the power cable disconnected.

-20 to 85°C



Σ-II Series SGDH SERVOPACK
with NS115 mounted

2.2 Installation Site

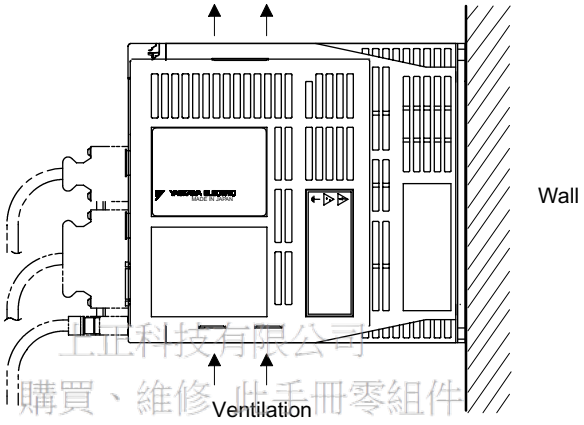
Take the following precautions at the installation site.

Situation	Installation Precaution
Installation in a Control Panel	Design the control panel size, unit layout, and cooling method so that the temperature around the SERVOPACK does not exceed 55°C.
Installation Near a Heating Unit	Minimize heat radiated from the heating unit as well as any temperature rise caused by natural convection so that the temperature around the SERVOPACK does not exceed 55°C.
Installation Near a Source of Vibration	Install a vibration isolator beneath the SERVOPACK to avoid subjecting it to vibration.
Installation at a Site Exposed to Corrosive Gas	Corrosive gas does not have an immediate effect on the SERVOPACK, but will eventually cause electronic components and contactor-related devices to malfunction. Take appropriate action to avoid corrosive gas.
Other Situations	Do not install the SERVOPACK in hot or humid locations, or locations subject to excessive dust or iron powder in the air.

2.3 Orientation

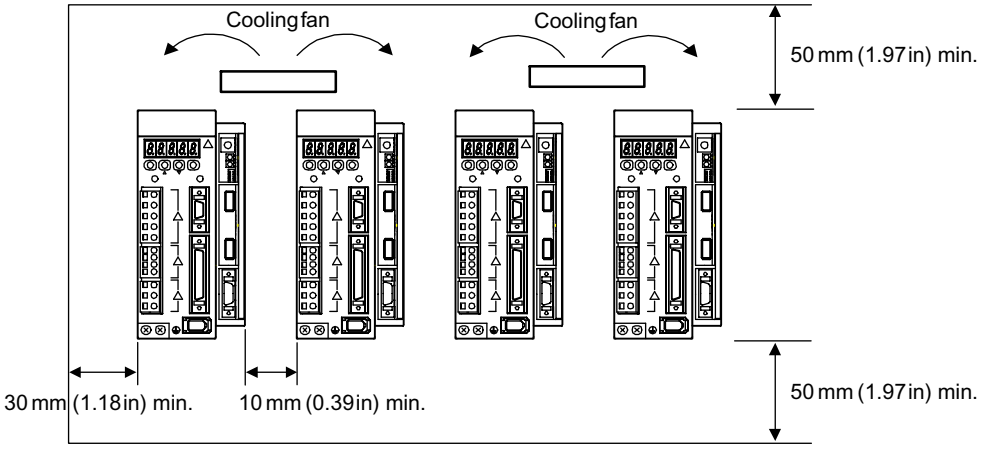
Install the SERVOPACK perpendicular to the wall as shown in the figure. The SERVOPACK must be oriented this way because it is designed to be cooled by natural convection or cooling fan.

Secure the SERVOPACK using 2 to 4 mounting holes. The number of holes depends on the SERVOPACK capacity.



2.4 Installation

Follow the procedure below to install multiple SERVOPACKs side by side in a control panel.



■ SERVOPACK Orientation

Install the SERVOPACK perpendicular to the wall so that the front panel (containing connectors) faces outward.

■ Cooling

As shown in the figure above, provide sufficient space around each SERVOPACK for cooling by cooling fans or natural convection.

■ Side-by-side Installation

When installing SERVOPACKs side by side as shown in the figure above, provide at least 10 mm (0.39 in) between and at least 50 mm (1.97 in) above and below each SERVOPACK. Install cooling fans above the SERVOPACKs to avoid excessive temperature rise and to maintain even temperature inside the control panel.

■ Environmental Conditions in the Control Panel

- Ambient Temperature:0 to 55°C
- Humidity: 90% RH or less
- Vibration: 4.9 m/s^2
- Condensation and Freezing:None
- Ambient Temperature for Long-term Reliability: 45°C max.

3

Wiring

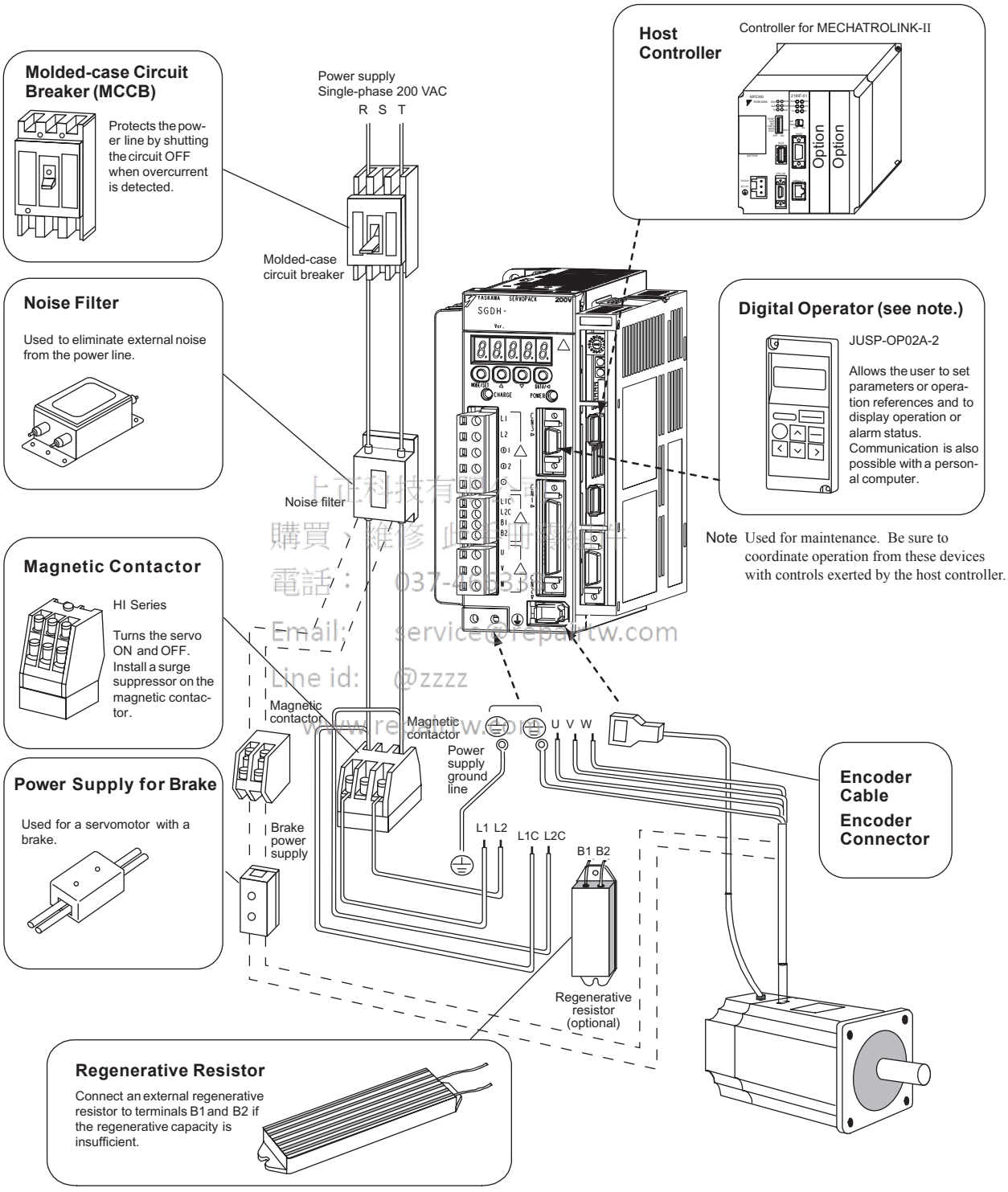
This chapter describes the procedure used to connect Σ-II Series products to peripheral devices when an NS115 is mounted and gives typical examples of I/O signal connections.

3.1 Connecting to Peripheral Devices

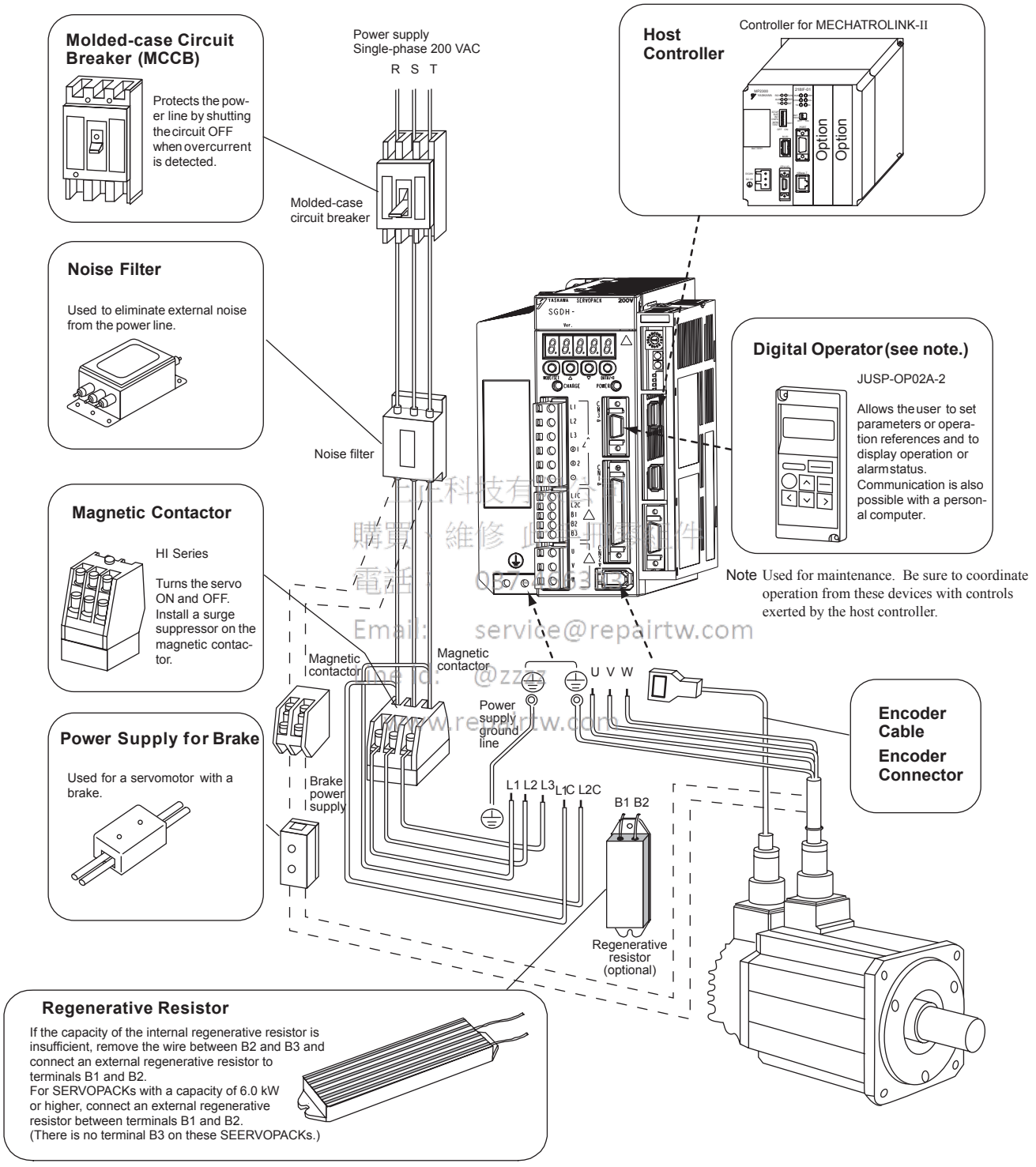
This section provides examples of standard Σ-II Series product connections to peripheral devices.

It also briefly explains how to connect each peripheral device.

3.1.1 Single-phase (100 V or 200 V) Main Circuit Specifications



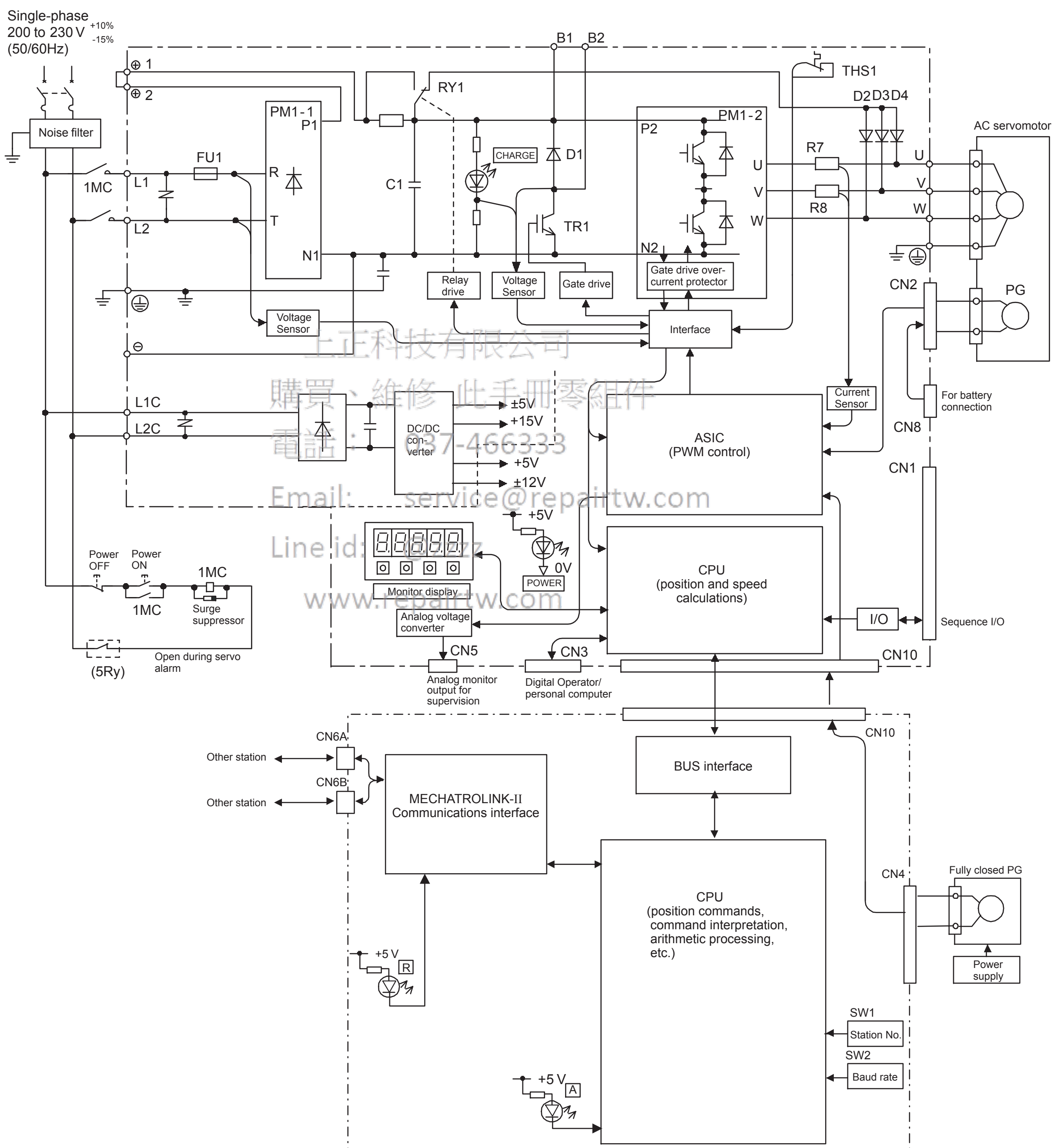
3.1.2 Three-phase (200 V) Main Circuit Specifications



3.2 SERVOPACK Internal Block Diagrams

The following sections show an internal block diagram for the SERVOPACK with an NS115.

30 to 400 W 200-V and 30 to 200 W 100-V Models

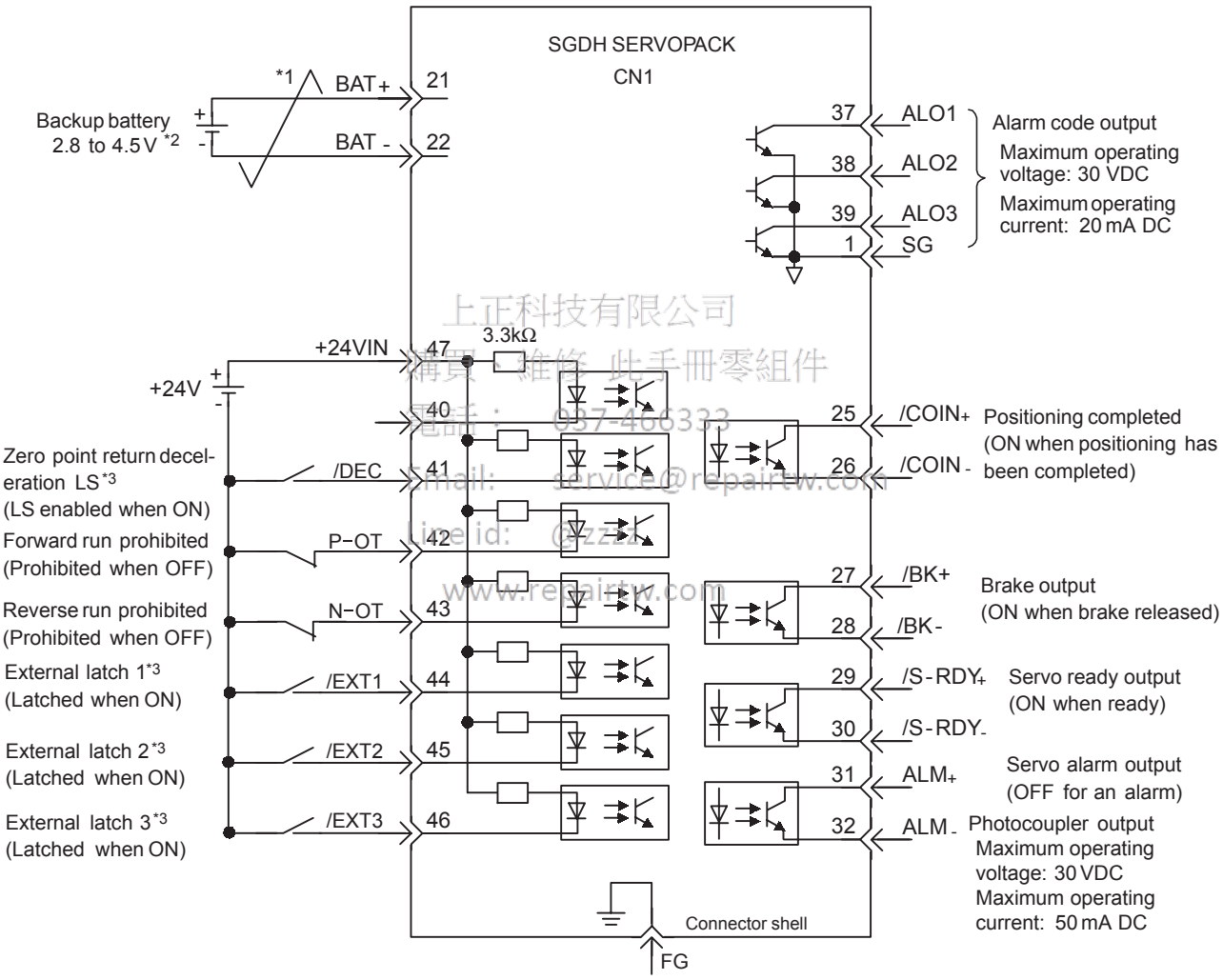


3.3 I/O Signals

This section describes I/O signals for the SERVOPACK with NS115.

3.3.1 Connection Example of I/O Signal Connector (CN1)

The following diagram shows a typical example of I/O signal connections.



* 1. ⫫ P represents twisted-pair wires.
* 2. When using an absolute encoder, connect a backup battery only when there is no battery connected to the CN8.
* 3. Make signal allocations using parameters. (Refer to *6.1.2 Standard Settings for CN1 I/O Signals*.)

Fig. 3.1 I/O Signal Connections for CN1 Connectors

3.3.2 I/O Signals Connector (CN1)

The following diagram shows the layout of CN1 terminals.

■ CN1 Terminal Layout

2	SG	GND	1	SG	GND	27	/BK+ *	Brake interlock output	26	/COIN-	Positioning complete output
4	-	-	3	-	-	29	/S-RDY+	Servo ready output	28	/BK- *	Brake interlock output
6	SG	GND	5	-	-	31	ALM+	Servo alarm output	30	/S-RDY-	Servo ready output
8	-	-	7	-	-	33	-	-	32	ALM-	Servo alarm output
10	SG	GND	9	-	-	35	-	-	34	-	-
12	-	-	11	-	-	37	ALO1	Alarm code output (open-collector output)	36	-	-
14	-	-	13	-	-	39	ALO3		38	ALO2	Alarm code output
16	-	-	15	-	-	41	/DEC *	Zero point return deceleration LS input	40	-	-
18	-	-	17	-	-	43	N-OT	Reverse run prohibited input	42	P-OT	Forward drive prohibited input
20	-	-	19	-	-	45	/EXT2 *	External latch signal 2 input	44	/EXT1 *	External latch signal 1 input
22	BAT (-)	Battery (-)	21	BAT (+)	Battery (+)	47	+24VIN	External power supply input	46	/EXT3 *	External latch signal 3 input
24	-	-	23	-	-	49	-	-	48	-	-
			25	/COIN +	Positioning complete output				50	-	-

* Make signal allocations using parameters. (Refer to *6.1.2 Standard Settings for CN1 I/O Signals.)*

Note: 1. Do not use unused terminals for relays.

2. Connect the shield of the I/O signal cable to the connector shell.
The shield is connected to the FG (frame ground) at the SERVOPACK-end connector.

■ CN1 Specifications

Specifications for SERVOPACK Connectors	Applicable Receptacles		
	Soldered	Case	Manufacturer
10250-52A2JL 50-p Right Angle Plug	10150-3000VE	10350-52A0-008	Manufactured by Sumitomo 3M Ltd.

3.3.3 I/O Signal Names and Functions

The following section describes SERVOPACK I/O signal names and functions.

■ Input Signals

Signal Name		Pin No.	Function	
Common	/DEC	41	Zero point return deceleration limit switch: Deceleration LS used when the motor returns to the zero point.	
	P-OT N-OT	42 43	Forward run prohibited Reverse run prohibited	Overtravel prohibited: Stops servomotor when movable part travels beyond the allowable range of motion.
	/EXT1 /EXT2 /EXT3	44 45 46	External latch signals 1, 2, and 3: External signals for latching the current FB pulse counter.	
	+24VIN	47	Control power supply input for sequence signals: Users must provide the +24-V power supply. Allowable voltage fluctuation range: 11 to 25 V	
	BAT (+) BAT (-)	21 22	Connecting pin for the absolute encoder backup battery. Connect to either CN8 or CN1.	

Note: 1. The functions allocated to /DEC, P-OT, N-OT, /EXT1, /EXT2, /EXT3, P-CL, and N-CL input signals can be changed via parameters.
2. The forward/reverse run prohibited function uses software to stop the SERVOPACK. This method may not satisfy the standards depending on the safety specifications for the application. If necessary, add an external safety circuit.

■ Output Signals

Signal Name		Pin No.	Function
Common	ALM+ ALM-	31 32	Servo alarm: Turns OFF when an error is detected.
	/BK+ /BK-	27 28	Brake interlock: Output that controls the brake. The brake is released when this signal is ON.
	/S-RDY+ /S-RDY-	29 30	Servo ready: ON if there is no servo alarm when the control/main circuit power supply is turned ON.
	ALO1 ALO2 ALO3	37 38 39 (1)	Alarm code output: Outputs 3-bit alarm codes. Open-collector: 30 V and 20 mA rating maximum
	FG	Shell	Connected to frame ground if the shield wire of the I/O signal cable is connected to the connector shell.
Position	/COIN+ /COIN-	25 26	Positioning completed (output in Position Control Mode): Turns ON when the number of error pulses reaches the value set. The setting is the number of error pulses set in reference units (input pulse units defined by the electronic gear).

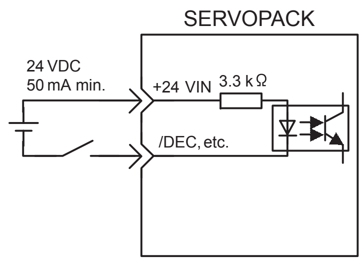
Note: 1. Pin numbers in parenthesis () indicate signal grounds.
2. The functions allocated to /BK, /S-RDY, and /COIN output signals can be changed to /CLT, /VCT, /TGON, /WARN, or /NEAR signals via parameters.

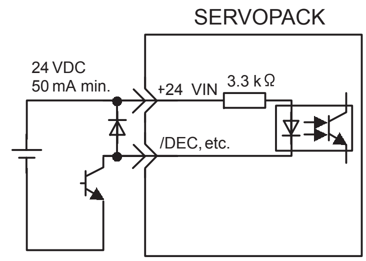
3.3.4 Interface Circuits

This section shows examples of SERVOPACK I/O signal connection to the host controller.

■ Sequence Input Circuit Interface

The sequence input circuit interface connects through a relay or open-collector transistor circuit. Select a low-current relay, otherwise a faulty contact will result.





3

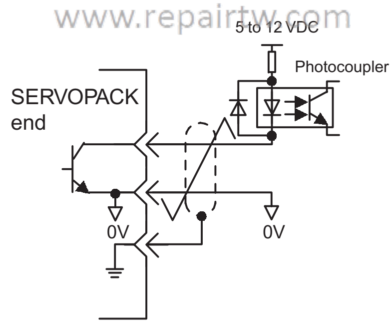
■ Output Circuit Interfaces

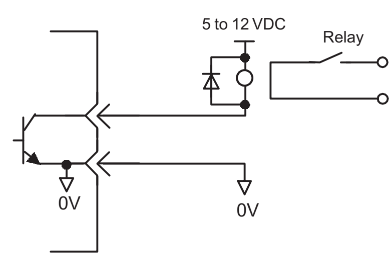
Any of the following two types of SERVOPACK output circuits can be used. Form an input circuit at the host controller that matches one of two types.

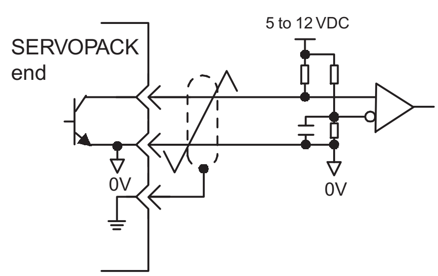
- Connecting to an Open-collector Output Circuit

  Alarm code signals are output from open-collector transistor output circuits.

  Connect an open-collector output circuit through a photocoupler, relay or line receiver circuit.





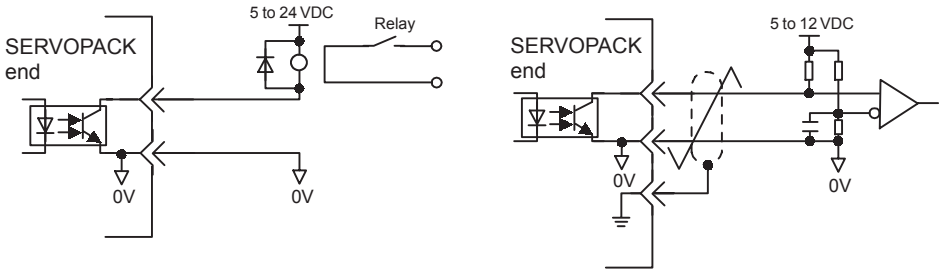


Note: The maximum allowable voltage and current capacities for open-collector output circuits are as follows:

- Voltage: 30VDC max.
- Current: 20 mA DC max.
- Connecting to a Photocoupler Output Circuit

Photocoupler output circuits are used for servo alarm, servo ready, and other sequence output signal circuits.

Connect a photocoupler output circuit through a relay or line receiver circuit.



Note: The maximum allowable voltage and current capacities for photocoupler output circuits are as follows:

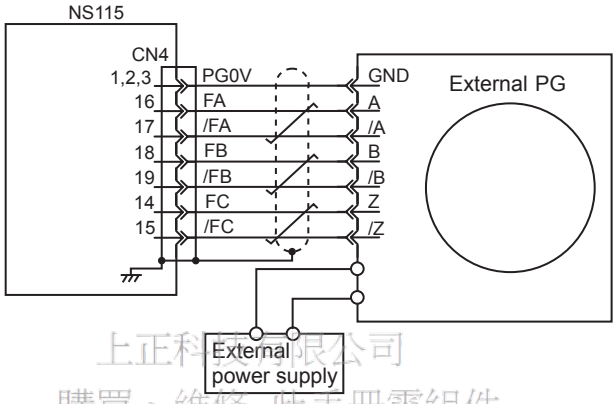
- Voltage: 30 VDC max.
- Current: 50 mA DC max.

3.4 Fully Closed Encoder Signals Connector (CN4)

This section describes the wiring for the fully closed encoder signals connector (CN4).

3.4.1 Fully Closed Encoder Connection Example

The following diagram shows an example of CN4 connections.



Note: ⫫ represents twisted-pair wires.

3.4.2 CN4 Connector Terminal Layout

The following diagram shows the CN4 connector terminal layout and connector specifications.

■ CN4 Connector Terminal Layout

			1	PG0 V	Signal ground				11	-	-
2	PG0 V	Signal ground	3	PG0 V		12	-	-	13	-	-
4	-	-	5	-	-	14	FC	Phase-C input	15	/FC	Phase-C input
6	-	-	7	-	-	16	FA	Phase-A input	17	/FA	Phase-A input
8	-	-	9	-	-	18	FB	Phase-B input	19	/FB	Phase-B input
10	-	-				20	-	-			

Note: 1. The connector shell is connected to the FG (frame ground).
2. Do not use unused terminals as relay terminals.

■ CN4 Specifications

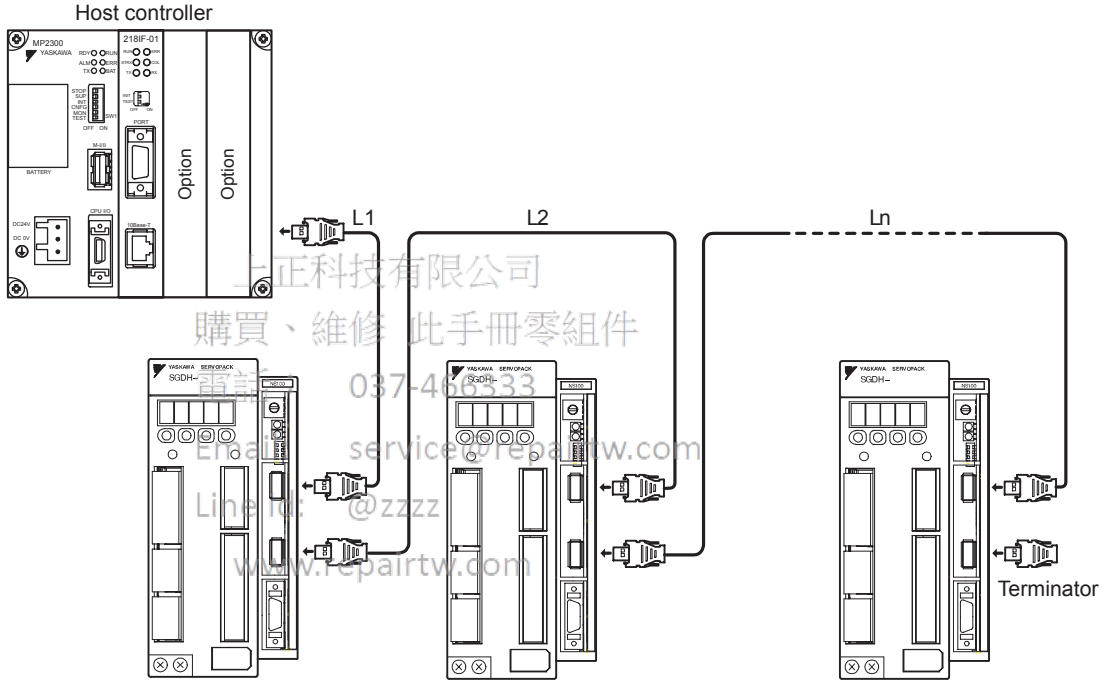
Specifications for SERVOPACK Connectors	Applicable Receptacles		
	Soldered	Case	Manufacturer
10220-52A2JL 20-pin Right Angle Plug	10120-3000VE	10320-52A0-008	SUMITOMO 3M LTD.

3.5 Connections for MECHATROLINK-II Communications

This section describes the connection and wiring of connectors for MECHATROLINK-II communications.

3.5.1 MECHATROLINK-II Communications Connection Example

The following diagram shows an example of connections between a host controller and a SERVOPACK 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. L1 + L2 ... + Ln must be 50 m or less.

3.5.2 MECHATROLINK-II Communications Connectors (CN6A, CN6B)

The terminal layout and specifications of the CN6A and CN6B connectors are shown below.

■ CN6A and CN6B Connectors Terminal Layout

1	2	3	4
-	/S	S	SH
Not connected	Serial data I/O		Not connected

Note: The connector shell is connected to the FG (frame ground).

■ CN6A and CN6B Specifications

Specifications for SERVOPACK Connectors	Applicable Plug (or Socket)	
	Connector (on Cable)	Manufacturer
DUSB-ARA41-T11	DUSB-APA41-B1-C50	DDK Ltd.

3.5.3 Precautions for Wiring MECHATROLINK-II Cables

Observe the following precautions when wiring MECHATROLINK-II cables.

■ Number of Connectable Stations

The number of connectable stations is determined by the settings for the transmission cycle and number of transmission bytes. When the communications retry channel is 1, the number of connectable stations is as follows for the combinations of transmission cycle and transmission bytes.

Table 3.1 Number of Connectable Stations Determined by Transmission Cycle and Transmission Bytes

Transmission Bytes	Transmission Cycle				
	0.5 ms*	1.0 ms	2.0 ms	3.0 ms	4.0 ms
17	6	14	30	30	30
30	3	8	20	30	30

* When the transmission cycle is 0.5 ms, set the communications cycle in multiples of 1.0 ms.

Note: 1. When the number of stations actually connected is less than the number of connectable stations, the remaining channels, up to 7, can be used as communications retry channels.
(Number of communications retry channels = Number of connnectable stations - Number of actual stations connected+1)
2. When not using communications retry, the number of connnectable stations is the number in Table 3.1 increased by one.
3. Connect a repeater for more than 16 stations.

■ Cables

Be sure to use the specified cables.

For more information on cables, refer to *10.2 MECHATROLINK/MECHATROLINK-II Communications Cables and Terminator*.

■ Cable Length

The total cable length must be 50 m or less.

■ Cable Length for Stations

The length of the cable between stations must be 0.5 m or more.

■ Terminal Processing

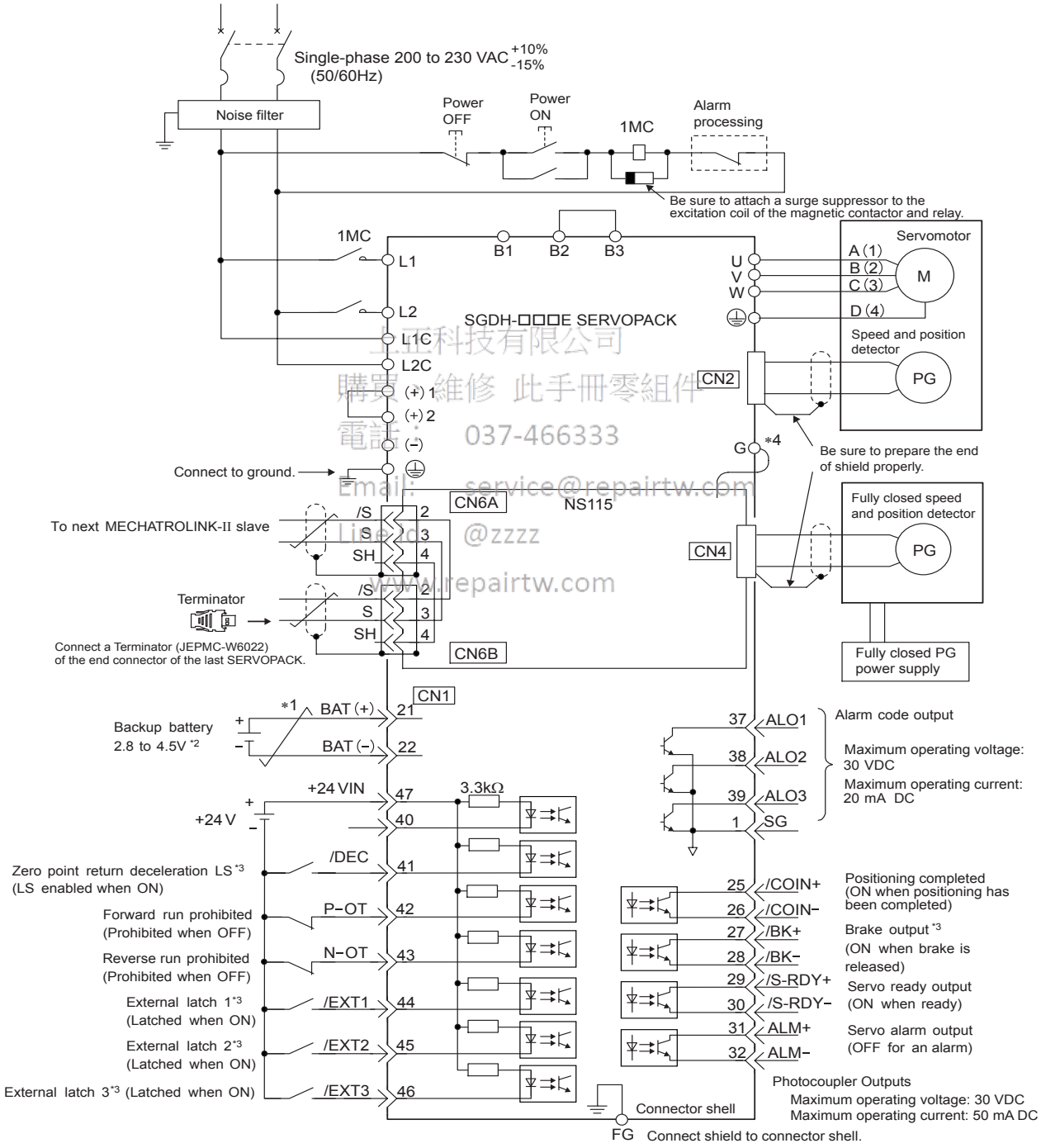
Install a Terminator on the last SERVOPACK and host controller.

For more information on Terminators, refer to *10.2 MECHATROLINK/MECHATROLINK-II Communications Cables and Terminator*.

3.6 Examples of Combined Connections (for Fully Closed Encoders)

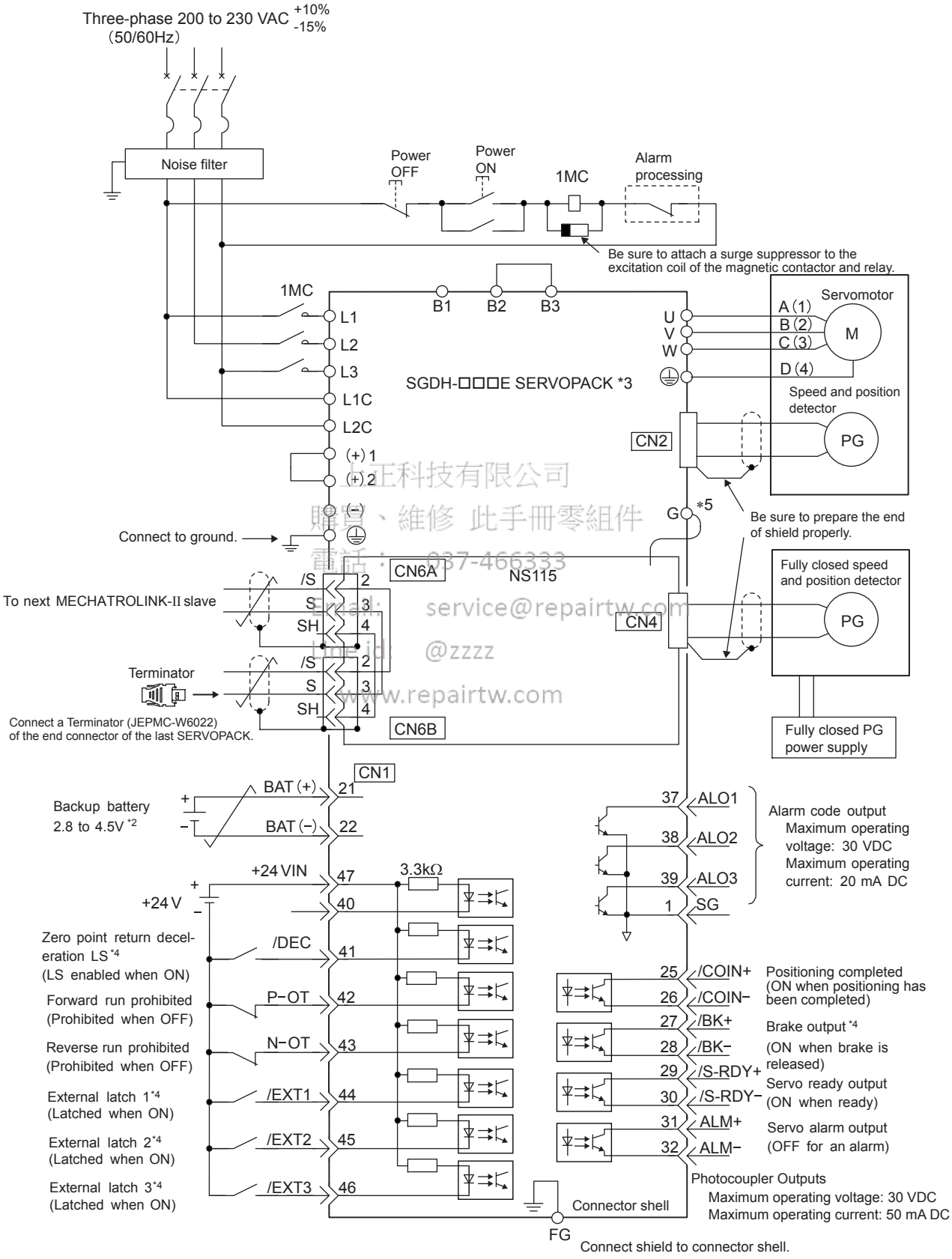
The following diagrams show examples of combined connections.

3.6.1 Single-phase Power Supply Specifications



* 1. ⫧ represents twisted-pair wires.
* 2. When using an absolute encoder, connect a backup battery only when there is no battery connected to the CN8.
* 3. Make signal allocations using parameters.(Refer to *6.1.2 Standard Settings for CN1 I/O Signals*.)
* 4. Connect the ground wire of the NS115 to the marked “G” on the SERVOPACK. (Refer to *1.3 Mounting the NS115*.)

3.6.2 Three-phase Power Supply Specifications



* 1. ⫧ represents twisted-pair wires.
* 2. When using an absolute encoder, connect a backup battery only when there is no battery connected to the CN8.
* 3. Connect an external regenerative resistor between terminals B1 and B2 for SERVOPACKs with a capacity of 6.0 kW or higher.
* 4. Make signal allocations using parameters.(Refer to *6.1.2 Standard Settings for CN1 I/O Signals*.)
* 5. Connect the ground wire of the NS115 to the marked “G” on the SERVOPACK.(Refer to *1.3 Mounting the NS115*.)

4

MECHATROLINK-II Communications

This chapter describes MECHATROLINK-II communications specifications, commands, and power ON sequence.

4.1 Specifications and Configuration

4.1.1 Specifications

Items that are not described in this chapter are based on the MECHATROLINK application layer. For more details, refer to the following manuals.

- *MECHATROLINK System User's Manual* (SIE-S800-26.1)
- *MECHATROLINK Servo Command User's Manual* (SIE-S800-26.2)

4.1.2 System Configuration

The following illustration shows system configuration. Refer to *3.5.3 Precautions for Wiring MECHATROLINK-II Cables* for the number of stations possible to be connected.

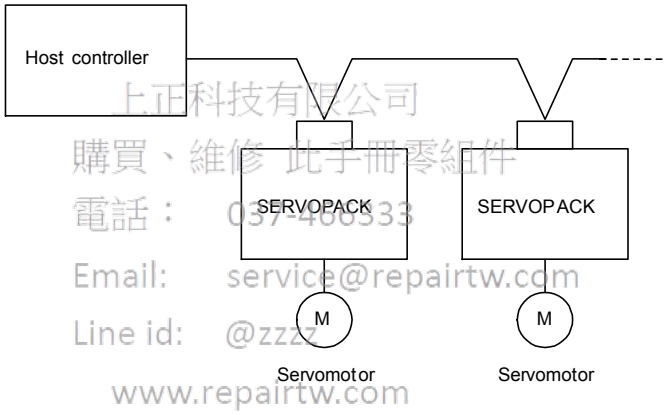


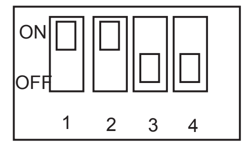
Fig. 4.1 System Configuration

4.2 Switches for MECHATROLINK-II Communications Settings

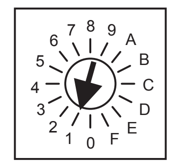
This section describes the switch settings necessary for MECHATROLINK-II communications.

4.2.1 Communications Settings

The SW2 DIP switch sets the MECHATROLINK-II communications settings, as shown below. Settings that have been changed are enabled when the power is turned OFF and ON.



SW2 (factory setting)



SW1 (factory setting)

SW2	Item	Setting	Description	Factory Setting
Bit 1	Baud rate	OFF	4 Mbps	ON
		ON	10 Mbps	
Bit 2	Transmission bytes	OFF	17 bytes	ON
		ON	30 bytes	
Bit 3	Station address	OFF	Station address = 40H+SW1	OFF
		ON	Station address = 50H+SW1	
Bit 4	Reserved	OFF	-	OFF

IMPORTANT

1. When connecting to a MECHATROLINK network, set bits 1 and 2 to OFF.
2. Baud rate: 4 Mbps, transmission bytes: 30 (bit 1 = OFF, bit 2 = ON) cannot be used.

4.2.2 Setting the Transmission Cycle

The transmission cycle and number of stations that can be set with the NS115 are shown below.ì

Table 4.1 Number of Connectable Stations Determined by Transmission Cycle and Transmission Bytes

Transmission Bytes	Transmission Cycle				
	0.5 ms*	1.0 ms	2.0 ms	3.0 ms	4.0 ms
17	6	14	30	30	30
30	3	8	20	30	30

* When the transmission cycle is 0.5 ms, set the communications cycle in multiples of 1.0 ms.

Note: 1. When the number of stations actually connected is less than the number of connectable stations, the remaining channels, up to 7, can be used as communications retry channels.
(Number of communications retry channels = Number of connnectable stations - Number of actual stations connected+1)
2. When not using communications retry, the number of connnectable stations is the number in Table 4.1 increased by one.
3. Connect a repeater for more than 16 stations.

4.2.3 Setting the Station Address

The station address is set as shown in Table 4.2, using the rotary switch (SW1) and piano switch (SW2 bit 3). Settings that have been changed are enabled when the power is turned OFF and ON. The factory setting for the station address is 41H (SW2 bit 3 = OFF, SW1 = 1).

Table 4.2 Station Address Settings

Bit 3 of SW2	SW1	Station Address	Bit 3 of SW2	SW1	Station Address
OFF	0	Disabled	ON	0	50H
OFF	1	41H	ON	1	51H
OFF	2	42H	ON	2	52H
OFF	3	43H	ON	3	53H
OFF	4	44H	ON	4	54H
OFF	5	45H	ON	5	55H
OFF	6	46H	ON	6	56H
OFF	7	47H	ON	7	57H
OFF	8	48H	ON	8	58H
OFF	9	49H	ON	9	59H
OFF	A	4AH	ON	A	5AH
OFF	B	4BH	ON	B	5BH
OFF	C	4CH	ON	C	5CH
OFF	D	4DH	ON	D	5DH
OFF	E	4EH	ON	E	5EH
OFF	F	4FH	ON	F	5FH

4.3 Main Commands

The following sections describe main command specific items that are unique to the NS115.

The MECHATROLINK-II main commands are upwardly compatible with the MECHATROLINK commands. They use the first to the sixteenth bytes of the command and response data. 03H is set in command byte 0, and 01H is returned to response byte 0.

4.3.1 No Operation (NOP: 00H)

<table>
<tr><td rowspan="2">Byte</td><td colspan="2">NOP</td><td colspan="4" rowspan="2">Description</td></tr>
<tr><td>Command</td><td>Response</td></tr>
<tr><td>1</td><td>00H</td><td>00H</td><td>Processing classifications</td><td>Network command group</td><td>Synchronization classifications</td><td>Asynchronous</td></tr>
<tr><td>2</td><td rowspan="15"></td><td>ALARM</td><td>Processing time</td><td>Within transmission cycle</td><td>Subcommand</td><td>Can be used.</td></tr>
<tr><td>3</td><td>STATUS</td><td colspan="4" rowspan="15">• Returns the status of the ALM, WARNG, and CMDRDY in STATUS bytes only. All other bits are not used. The response will be NOP when the power is turned ON until initialization has been completed, and during this time, the following status will be returned: CMDRDY: 0.
• Can be used during any phase.</td></tr>
<tr><td>4</td><td rowspan="14"></td></tr>
<tr><td>5</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>
<tr><td>17</td><td rowspan="13">For subcommands use. Refer to 4.4 Subcommands.</td><td rowspan="13">For subcommands use. Refer to 4.4 Subcommands.</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>

4.3.2 Read Parameter (PRM_RD: 01H)

<table>
<tr><th rowspan="2">Byte</th><th colspan="2">PRM_RD</th><th rowspan="2" colspan="4">Description</th></tr>
<tr><th>Command</th><th>Response</th></tr>
<tr><td>1</td><td>01H</td><td>01H</td><td>Processing classifications</td><td>Data communications command group</td><td>Synchronization classifications</td><td>Asynchronous</td></tr>
<tr><td>2</td><td rowspan="3"></td><td>ALARM</td><td>Processing time</td><td>Refer to the following description</td><td>Subcommand</td><td>Cannot be used.</td></tr>
<tr><td>3</td><td rowspan="2">STATUS</td><td rowspan="14" colspan="4">• Reads current operating parameters. The latest setting value, however, is read for offline parameters. (The setting value is enabled with the Set Up Device command (CONFIG).)
• A warning will occur and the command will be ignored in the following cases. If a warning occurs, PARAMETER will not be dependable.
- If a digital operator is connected: MECHATROLINK-II command warning (A.95)
- If SigmaWin and so on are connected: MECHATROLINK-II command warning (A.95)
- If NO is not within range: Parameter setting warning (A.94)
- If SIZE does not match: Parameter setting warning (A.94)
• If communications are in progress with a Digital Operator, a command execution incomplete alarm (A.ED) may occur.
• For details on NO and SIZE, refer to Appendix B List of Parameters.Chapter
• Processing time
- 1 ms for reading NS115 parameter
- 4 to 6 ms for reading SGDH SERVOPACK parameter</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>

4

4.3.3 Write Parameter (PRM_WR: 02H)

<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>Processing classifications</td><td>Data communications command group</td><td>Synchronization classifications</td><td>Asynchronous</td></tr>
<tr><td>2</td><td rowspan="3"></td><td>ALARM</td><td>Processing time</td><td>Refer to the following description</td><td>Subcommand</td><td>Cannot be used.</td></tr>
<tr><td>3</td><td rowspan="2">STATUS</td><td colspan="4" rowspan="14">• Temporarily writes parameters and does not store them in E^{2}PROM memory. Offline parameters are enabled with the Set Up Device command (CONFIG) after setting.
• Can be used during phases 2 and 3.
• A warning will occur and the command will be ignored in the following cases.
- During phases other than phases 2 and 3: MECHATROLINK-II command warning (A.95)
- If a digital operator is connected: MECHATROLINK-II command warning (A.95)
- If SigmaWin and so on are connected: MECHATROLINK-II command warning (A.95)
- If NO is not within range: Parameter setting warning (A.94)
- If SIZE does not match: Parameter setting warning (A.94)
- If PARAMETER is not within range or would result in a calculation overflow: Parameter setting warning (A.94)
• If communications are in progress with a Digital Operator, a command execution incomplete alarm (A.ED) may occur.
• For details on NO, SIZE, and PARAMETER, refer to Appendix B List of Parameters.
• Processing time
- 1 ms when writing NS115 parameter
- 4 to 6 ms when writing SGDH SERVOPACK parameter</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>

4.3.4 Read ID (ID_RD: 03H)

Byte	ID_RD		Description			
	Command	Response				
1	03H	03H	Processing classifications	Data communications command group	Synchronization classifications	Asynchronous
2		ALARM	Processing time	Within 1 sec	Subcommand	Cannot be used.
3		STATUS	• Reads the ID. The corresponding DEVICE_COD is shown in the table on the following page. • Can be used during phases 2 and 3. • A warning will occur and the command will be ignored in the following cases. - If a digital operator is connected: MECHATROLINK-II command warning (A.95) - If SigmaWin and so on are connected: MECHATROLINK-II command warning (A.95) - If SIZE (1 to 8) does not match: Parameter setting warning (A.94) • If communications are in progress with a digital operator or SigmaWin and so on, a command execution incomplete alarm (A.ED) may occur.			
4						
5	DEVICE_COD	DEVICE_COD				
6	OFFSET	OFFSET				
7	SIZE	SIZE				
8		ID				
9						
10						
11						
12						
13						
14						
15						
16	WDT	RWDT				

■ The ID contents of DEVICE_COD

Type/Name		OFFSET / DEVICE_COD	00	01	02	03	04	05	06	07	08	09	0A	0B	0C	0E	0F	10
SERVOPACK	Model	00H	S	G	D	H	–	0	1	A	E	00						
	Software Ver.	02H	33	00														
Encoder Software Ver.		12H	04	00														
Servomotor Model		20H	S	G	M	A	H	–	0	1	A	A	A	2	1	00		
NS115	Model	50H	J	U	S	P	–	N	S	1	1	5	00					
	Software Ver.	52H	01	00														

Note: 1. Model numbers appear in ASCII code, with the last section as "00."
2. The software version is binary data.
3. Spaces indicate unspecified data.
4. If the SERVOPACK is not operating since an alarm E0, E1, E2, EA, EB, EC occurs at power ON, the SERVOPACK and the servomotor model are "00."
5. If the encoder cable is not connected,the servomotor model and the encoder version are "00."

4.3.5 Set Up Device (CONFIG: 04H)

<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>Processing classifications</td><td>Control command group</td><td>Synchronization classifications</td><td>Asynchronous</td></tr>
<tr><td>2</td><td rowspan="14"></td><td>ALARM</td><td>Processing time</td><td>Within 4 s + α*</td><td>Subcommand</td><td>Cannot be used.</td></tr>
<tr><td>3</td><td>STATUS</td><td colspan="4" rowspan="14">• Recalculates all currently set parameters and initializes positions, signals, etc.
• Can be used during phases 2 and 3.
• The SERVOPACK will change to Servo OFF if this command is received when the SERVOPACK is Servo ON.
• A warning will occur and the command will be ignored in the following cases.
- During phase 1: MECHATROLINK-II command warning (A.95)
- If a digital operator is connected: MECHATROLINK-II command warning (A.95)
- If SigmaWin and so on are connected: MECHATROLINK-II command warning (A.95)
• The following table shows status and output signal during CONFIG command execution.
• If communications are in progress with a Digital Operator, a command warning (A.ED) may occur.</td></tr>
<tr><td>4</td></tr>
<tr><td>5</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>

* +α refers to the amount of delay that is set by parameter for turning the Servo OFF during braking control.

■ Status and Output Signal during CONFIG Command Execution

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)	Alarms currently occurred	Alarms currently occurred	Alarms 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

4.3.6 Read Alarm or Warning (ALM_RD: 05H)

Byte	ALM_RD		Description			
	Command	Response				
1	05H	05H	Processing classifications	Control command group	Synchronization classifications	Asynchronous
2		ALARM	Processing time	Refer to ■ *Details of ALM_RD_MOD.*	Subcommand	Cannot be used.
3		STATUS	• Reads the following alarm or warning status. - Current alarm/warning status - Alarm status history* (warning history is not preserved.) • The ALM_RD_MOD specifications are shown in the following table. • The latest error and warning information is contained from byte 6 onwards of the ALM_DATA. When there are no errors or warnings, the remaining bytes are normal (99H). • A warning will occur and the command will be ignored in the following cases. - If a digital operator is connected: MECHATROLINK-II command warning (A.95) - If SigmaWin and so on are connected: MECHATROLINK-II command warning (A.95) - If ALM_RD_MOD is not within range: Parameter setting warning (A.94)			
4						
5	ALM_RD_MOD	ALM_RD_MOD				
6		ALM_DATA				
7						
8						
9						
10						
11						
12						
13						
14						
15						
16	WDT	RWDT				

* Alarm occurrence history is saved on E^2PROM, and will not be lost if power goes OFF.

■ Details of ALM_RD_MOD

ALM_RD_MOD	Description	Processing Time
0	Read current alarm/warning status 10 items max. (sixth to fifteenth byte)	Within communications cycle
1	Read alarm status history 10 items max. (sixth to fifteenth byte) (Warning history is not preserved.)	Within 2 s

4.3.7 Clear Alarm/Warning (ALM_CLR: 06H)

<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>Processing classifications</td><td>Control command group</td><td>Synchronization classifications</td><td>Asynchronous</td></tr>
<tr><td>2</td><td rowspan="3"></td><td>ALARM</td><td>Processing time</td><td>Refer to
■ Details of ALM_CLR_MOD.</td><td>Subcommand</td><td>Cannot be used.</td></tr>
<tr><td>3</td><td rowspan="2">STATUS</td><td colspan="4" rowspan="14">• Clears the following alarm or warning status.
- Current alarm/warning status
- Alarm status history * (warning history is not preserved.)
• Can be used during any phase.
• The ALM_CLR_MOD specifications are shown in the following table.
• A warning will occur and the command will be ignored in the following cases.
- During phases other than phases 2 and 3:
MECHATROLINK-II command warning (A.95)
- If a digital operator is connected: MECHATROLINK-II command warning (A.95)
- If SigmaWin and so on are connected: MECHATROLINK-II command warning (A.95)
- If ALM_CLR_MOD is not within range: Parameter setting warning (A.94)</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 occurrence history is saved on E^2PROM, and will not be lost if power goes OFF.

■ Details of ALM_CLR_MOD

ALM_CLR_MOD	Description	Processing Time
0	Clear current alarm/warning status	Within 200 ms
1	Clear alarm status history	Within 2 s

4.3.8 Start Synchronous Communications (SYNC_SET: 0DH)

<table>
<tr><td rowspan="2">Byte</td><td colspan="2">SYNC_SET</td><td colspan="4" rowspan="2">Description</td></tr>
<tr><td>Command</td><td>Response</td></tr>
<tr><td>1</td><td>0DH</td><td>0DH</td><td>Processing classifications</td><td>Network command group</td><td>Synchronization classifications</td><td>Asynchronous</td></tr>
<tr><td>2</td><td rowspan="14"></td><td>ALARM</td><td>Processing time</td><td>Transmission cycle or more</td><td>Subcommand</td><td>Cannot be used.</td></tr>
<tr><td>3</td><td>STATUS</td><td colspan="4" rowspan="14">• Starts synchronous communications. Switches from phase 2 to phase 3.
• Processing is completed at the WDT changing edge.
However, if WDT errors are being masked by parameter Pn800.0, processing is completed when this command is received.
• During phase 1, a MECHATROLINK-II command warning (A.95) will occur and the command will be ignored.
• During phase 3, the command will be ignored (without a warning).
• The SERVOPACK will change to Servo OFF if this command is received when the SERVOPACK is Servo ON during phase 2.
• The synchronous communications have to be restarted using this command when the MECHATROLINK-II communications error (A.E6) or the MECHATROLINK-II synchronization error (A.E5) occurs.</td></tr>
<tr><td>4</td><td rowspan="12"></td></tr>
<tr><td>5</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>

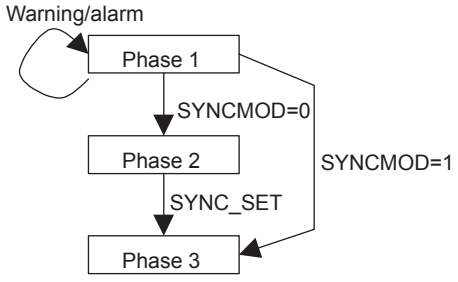
4.3.9 MECHATROLINK-II Connection (CONNECT: 0EH)

Byte Byte	CONNECT		Description Description			
	Command	Response				
1	0EH	0EH	Processing classifications	Network command group	Synchronization classifications	Asynchronous
2		ALARM	Processing time	Communications cycle or more	Subcommand	Cannot be used.
3		STATUS	• Establishes a MECHATROLINK-II connection. Sets the communications mode according to COM_MOD. • VER: Version • Set VER to 21H (Ver. 2.1). • COM_MOD: Communications mode. Refer to the following table. • COM_TIM: Communications cycle Set the multiple number of transmission cycle in the range of 1 to 32. 1 [ms] ≤ transmission cycle [ms] × COM_TIM ≤ 32 [ms] (Set the multiple number of 1 [ms].) • A warning will occur and the command will be ignored in the following cases. - If COM_MOD is not within range: Parameter setting warning (A.94) - If COM_TIM is not within range: Parameter setting warning (A.94) - If the transmission bytes is 17, and SUBCMD is 1: Parameter setting warning (A.94)			
4						
5	VER	VER				
6	COM_MOD	COM_MOD				
7	COM_TIM	COM_TIM				
8						
9						
10						
11						
12						
13						
14						
15						
16	WDT	RWDT				

■ Details of COM_MOD

D7	D6	D5	D4	D3	D2	D1	D0
SUBCMD	0	0	0	DTMOD		SYNCMOD	0

• SYNCMOD*:
0: Asynchronous communication
(The SERVOPACK changes communication to phase 2.)
1: Synchronous communication
(The SERVOPACK changes communication to phase 3.)
* Set SYNC_SET when the SERVOPACK changes communication to phase 3.
• DTMOD: Data transfer method
00, 11: Single transfer
01: Consecutive transfer
10: Multiple transfers (not supported)
• SUBCMD:
0: Subcommand not used
1: Subcommand used



4.3.10 Disconnection (DISCONNECT: 0FH)

<table>
<tr><td rowspan="2">Byte</td><td colspan="2">DISCONNECT</td><td colspan="4" rowspan="2">Description</td></tr>
<tr><td>Command</td><td>Response</td></tr>
<tr><td>1</td><td>0FH</td><td>0FH</td><td>Processing classifications</td><td>Network command group</td><td>Synchronization classifications</td><td>Asynchronous</td></tr>
<tr><td>2</td><td rowspan="15"></td><td>ALARM</td><td>Processing time</td><td>Communications cycle or more</td><td>Subcommand</td><td>Cannot be used.</td></tr>
<tr><td>3</td><td>STATUS</td><td colspan="4" rowspan="15">• Releases the MECHATROLINK-II connection. The SERVOPACK changes communication to phase 1.
• Can be used during any phase.
• When this command is received, the following operations will be performed.
- The SERVOPACK changes communication to phase 1.
- The SERVOPACK changes to Servo OFF.
- The reference point setting will become invalid.</td></tr>
<tr><td>4</td><td rowspan="14"></td></tr>
<tr><td>5</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>

4.3.11 Read Non-volatile Parameter (PPRM_RD: 1BH)

<table>
<tr><th rowspan="2">Byte</th><th colspan="2">PPRM_RD</th><th colspan="4" rowspan="2">Description</th></tr>
<tr><th>Command</th><th>Response</th></tr>
<tr><td>1</td><td>1BH</td><td>1BH</td><td>Processing classifications</td><td>Data communications command group</td><td>Synchronization classifications</td><td>Asynchronous</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>Cannot be used.</td></tr>
<tr><td>3</td><td rowspan="2">STATUS</td><td colspan="4" rowspan="14">• This command is not supported.
• When this command is received, a MECHATROLINK-II command warning (A.95) will occur and the command will be ignored.</td></tr>
<tr><td>4</td></tr>
<tr><td>5</td><td rowspan="2">NO</td><td rowspan="12"></td></tr>
<tr><td>6</td></tr>
<tr><td>7</td><td>SIZE</td></tr>
<tr><td>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>

4.3.12 Write Non-volatile Parameter (PPRM_WR: 1CH)

<table>
<tr><td rowspan="2">Byte</td><td colspan="2">PPRM_WR</td><td colspan="4" rowspan="2">Description</td></tr>
<tr><td>Command</td><td>Response</td></tr>
<tr><td>1</td><td>1CH</td><td>1CH</td><td>Processing classifications</td><td>Data communica-tions command group</td><td>Synchronization classifications</td><td>Asynchronous</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 colspan="4" rowspan="15">• Saves parameters in E^{2}PROM. If parameters are online parameters, those parameters will become effective immediately.
Offline parameters are enabled with the Set Up Device command (CONFIG) after setting.
• Can be used during phases 2 and 3.
• A warning will occur and the command will be ignored in the following cases.
- During phase 1: MECHATROLINK-II command warning (A.95)
- If a digital operator is connected: MECHATROLINK-II command warning (A.95)
- If SigmaWin and so on are connected: MECHATROLINK-II command warning (A.95)
- If NO is not within range: Parameter setting warning (A.94)
- If SIZE does not match: Parameter setting warning (A.94)
- If PARAMETER is not within range or would result in a calculation overflow: Parameter setting warning (A.94)
• If communications are in progress with a Digital Operator, a command execution incomplete alarm (A.ED) may occur.
• For details on NO, SIZE and PARAMETER, refer to the Appendix B List of Parameters.</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>

4.3.13 Set Coordinates (POS_SET: 20H)

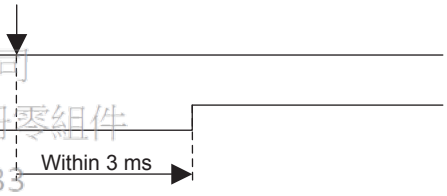
<table>
<tr><td rowspan="2">Byte</td><td colspan="2">POS_SET</td><td colspan="4" rowspan="2">Description</td></tr>
<tr><td>Command</td><td>Response</td></tr>
<tr><td>1</td><td>20H</td><td>20H</td><td>Processing classifications</td><td>Data communications command group</td><td>Synchronization classifications</td><td>Asynchronous</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>Cannot be used.</td></tr>
<tr><td>3</td><td rowspan="2">STATUS</td><td colspan="4" rowspan="9">• Sets coordinates. REFE can also enable zero point (ZPOINT) and software limits.
• Can be used during phases 2 and 3.
• PS_SUBCMD: Refer to the following table for coordinate setting modes.
• Set position in POS_DATA.
• A warning will occur and the command will be ignored in the following cases.
- During phase 1: MECHATROLINK-II command warning (A.95)
- If a number not within the range is set for PS_SUBCMD: Parameter setting warning (A.94)</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>

■ Details of PS_SUBCMD

D7	D6	D5	D4	D3	D2	D1	D0
REFE	0	0	0	POS_SEL			

- REFE: Sets reference point.
  0: Does not set reference point.
  1: Sets reference point.
  The zero point is enabled, ZPOINT and software limits are enabled.
- POS_SEL: Selects coordinates.
  3: When APOS (feedback position in machine coordinate system) is selected, it is also set in the reference and machine coordinate system.

4.3.14 Apply Brake (BRK_ON: 21H)

<table>
<tr><td rowspan="2">Byte</td><td colspan="2">BRK_ON</td><td colspan="4" rowspan="2">Description</td></tr>
<tr><td>Command</td><td>Response</td></tr>
<tr><td>1</td><td>21H</td><td>21H</td><td>Processing classifications</td><td>Control command group</td><td>Synchronization classifications</td><td>Asynchronous</td></tr>
<tr><td>2</td><td rowspan="14"></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>STATUS</td><td colspan="4" rowspan="14">• Applies brake. This command is enabled when Pn005.0 is set to 1.
• Can be used during phases 2 and 3.
• A warning will occur and the command will be ignored in the following cases.
- During phase 1: MECHATROLINK-II command warning (A.95)
- If Pn005.0 is set to 0: MECHATROLINK-II command warning (A.95)
• Brake signal output timing
 
</td></tr>
<tr><td>4</td><td rowspan="5">MONITOR 1</td></tr>
<tr><td>5</td></tr>
<tr><td>6</td></tr>
<tr><td>7</td></tr>
<tr><td>8</td></tr>
<tr><td>9</td><td rowspan="4">MONITOR 2</td></tr>
<tr><td>10</td></tr>
<tr><td>11</td></tr>
<tr><td>12</td></tr>
<tr><td>13</td><td>SEL_MON 1/2</td><td>SEL_MON 1/2</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>

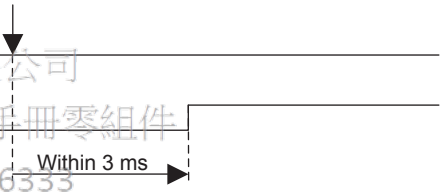
IMPORTANT

When Pn005.0 is set to 1, the brake interlock must be processed at the controller instead of the Servo.

■ Related Parameter

Pn No.	Description
Pn005.0	Brake operation

4.3.15 Release Brake (BRK_OFF: 22H)

<table>
<tr><td rowspan="2">Byte</td><td colspan="2">BRK_OFF</td><td colspan="4" rowspan="2">Description</td></tr>
<tr><td>Command</td><td>Response</td></tr>
<tr><td>1</td><td>22H</td><td>22H</td><td>Processing classifications</td><td>Control command group</td><td>Synchronization classifications</td><td>Asynchronous</td></tr>
<tr><td>2</td><td rowspan="12"></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>STATUS</td><td colspan="4" rowspan="12">• Applies brake. This command is enabled when Pn005.0 is set to 1.
• Can be used during phases 2 and 3.
• A warning will occur and the command will be ignored in the following cases.
- During phase 1: MECHATROLINK-II command warning (A.95)
- If Pn005.0 is set to 0: MECHATROLINK-II command warning (A.95)
• Brake signal output timing
 
</td></tr>
<tr><td>4</td></tr>
<tr><td>5</td><td rowspan="4">MONITOR 1</td></tr>
<tr><td>6</td></tr>
<tr><td>7</td></tr>
<tr><td>8</td></tr>
<tr><td>9</td><td rowspan="4">MONITOR 2</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><td colspan="4"></td></tr>
</table>

IMPORTANT

When Pn005.0 is set to 1, the brake interlock must be processed at the controller instead of the Servo.

■ Related Parameter

Pn No.	Description
Pn005.0	Brake operation

4.3.16 Turn Sensor ON (SENS_ON: 23H):

<table>
<tr><td rowspan="2">Byte</td><td colspan="2">SENS_ON</td><td colspan="4" rowspan="2">Description</td></tr>
<tr><td>Command</td><td>Response</td></tr>
<tr><td>1</td><td>23H</td><td>23H</td><td>Processing classifications</td><td>Control command group</td><td>Synchronization classifications</td><td>Asynchronous</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>STATUS</td><td colspan="4" rowspan="14">• Obtains the initial position data when an absolute encoder is used.
• Position data is received from the encoder and the current position is created.
• The reference point, zero point (ZPOINT), and software limits will be enabled when an absolute encoder is used.
• Can be used during phases 2 and 3.
• If an incremental encoder is being used, the command will be ignored.
• During phase 1, a MECHATROLINK-II command warning (A.95) will occur and the command will be ignored.</td></tr>
<tr><td>4</td></tr>
<tr><td>5</td><td rowspan="4">MONITOR 1</td></tr>
<tr><td>6</td></tr>
<tr><td>7</td></tr>
<tr><td>8</td></tr>
<tr><td>9</td><td rowspan="4">MONITOR 2</td></tr>
<tr><td>10</td></tr>
<tr><td>11</td></tr>
<tr><td>12</td></tr>
<tr><td>13</td><td>SEL_MON 1/2</td><td>SEL_MON 1/2</td></tr>
<tr><td>14</td><td rowspan="2"></td><td>IO_MON</td></tr>
<tr><td>15</td></tr>
<tr><td>16</td><td>WDT</td><td>RWDT</td></tr>
</table>

4.3.17 Turn Sensor OFF (SENS_OFF: 24H)

<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>Processing classifications</td><td>Control command group</td><td>Synchronization classifications</td><td>Asynchronous</td></tr>
<tr><td>2</td><td rowspan="14"></td><td>ALARM</td><td>Processing time</td><td>Within 500 ms</td><td>Subcommand</td><td>Cannot be used.</td></tr>
<tr><td>3</td><td>STATUS</td><td colspan="4" rowspan="14">• Turns sensor OFF. The position data is not specified.
• The reference point, zero point (ZPOINT), and software limits will be enabled.
• Can be used during phases 2 and 3.
• If an incremental encoder is being used, the command will be ignored.
• During phase 1, a MECHATROLINK-II command warning (A.95) will occur and the command will be ignored.</td></tr>
<tr><td>4</td><td rowspan="5">MONITOR 1</td></tr>
<tr><td>5</td></tr>
<tr><td>6</td></tr>
<tr><td>7</td></tr>
<tr><td>8</td></tr>
<tr><td>9</td><td rowspan="4">MONITOR 2</td></tr>
<tr><td>10</td></tr>
<tr><td>11</td></tr>
<tr><td>12</td></tr>
<tr><td>13</td><td>SEL_MON 1/2</td><td>SEL_MON 1/2</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>

4.3.18 Stop Motion (HOLD: 25H)

<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>Processing classifications</td><td>Motion command group</td><td>Synchronization classifications</td><td>Asynchronous</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">• From current motion status, performs a deceleration stop and positioning according to the deceleration value set in the parameters.
• Can be used during phases 2 and 3.
• During phase 1, a MECHATROLINK-II command warning (A.95) will occur and the command will be ignored.
• OPTION can be selected. Refer to 4.5.2 Option Field Specifications: OPTION for details.
• Use DEN (output complete) to confirm the completion of motion processing.
• Latch processing, which is dependent on LATCH, EX_POSING, and SVC-TRL will be cancelled.
• ZRET latch processing and ZRET zero point alignment will be cancelled.
• Upon completion of this command, the reference position (POS) must be read, and the controller coordinate system must be set up.
• The stop method can be selected using HOLD_MOD.
0: Decelerate to a stop according to the deceleration parameter.
1: Stop immediately (output stop).</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_MON 1/2</td><td>SEL_MON 1/2</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">For subcommands use. Refer to 4.4 Subcommands.</td><td rowspan="13">For subcommands use. Refer to 4.4 Subcommands.</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>

■ Related Parameters

Pn No.	Description
Pn80D	First-step Linear Deceleration Parameter
Pn80E	Second-step Linear Deceleration Parameter
Pn80F	Deceleration Parameter Switching Speed

4

4.3.19 Request Latch Mode (LTMOD_ON: 28H)

Byte	LTMOD_ON		Description			
	Command	Response				
1	28H	28H	Processing classifications	Control command group	Synchronization classifications	Asynchronous
2	LT_SGN	ALARM	Processing time	Within communications cycle	Subcommand	Can be used.
3		STATUS	• Sets the modal latch mode. If a latch signal is input during modal latch mode, position latching will be performed. • Can be used during phases 2 and 3. • A MECHATROLINK-II command warning (A.95) will occur and the command will be ignored in the following cases. - During phase 1. - If LTMOD_ON and LATCH, ZRET, EX_POSING, or SVCTRL are executed simultaneously, or if LTMOD_ON is received during LATCH, ZRET, EX_POSING, or SVCTRL execution (the LTMOD_ON command will be ignored). • A latch signal can be selected using LT_SGN. Refer to 4.5.1 Latch Signal Field Specifications (LT_SGN). • Use response command 28H, CMDRDY = 1 to confirm that the Request Latch Mode command has been received. • It takes 4 ms max. for the Request Latch Mode command to start. • Confirm that L_CMP is 1 in STATUS at the completion of latching. - When there is monitor data such as SMON or POSING appended to the command response, LPOS is forcefully returned to MONITOR2. - When there is no monitor data such as PRM_RD or ALM_RD appended to the command response, confirm that L_CMP is 1 in STATUS, then use a command that has monitor data such as SMON in the response and select LPOS to confirm. • Once the latch operation has been performed, it will not be performed again even if a latch signal is input. Send a new LTMOD_ON command. • Interference with another latch mode command - If LATCH, ZRET, EX_POSING, or SVCTRL are received during modal latch mode, the new command is enabled.			
4						
5		MONITOR1				
6						
7						
8						
9		MONITOR2				
10						
11						
12						
13	SEL_MON 1/2	SEL_MON 1/2				
14		IO_MON				
15						
16	WDT	RWDT				
17	For subcommands use. Refer to *4.4 Subcommands.*	For subcommands use. Refer to *4.4 Subcommands.*				
18						
19						
20						
21						
22						
23						
24						
25						
26						
27						
28						
29						

■ Related Parameters

Pn No.	Description
Pn511	Input Signal Selections 5
Pn820	Latching Area Upper Limit
Pn822	Latching Area Lower Limit

4.3.20 Release Latch Mode (LTMOD_OFF: 29H)

<table>
<tr><td rowspan="2">Byte</td><td colspan="2">LTMOD_OFF</td><td colspan="4" rowspan="2">Description</td></tr>
<tr><td>Command</td><td>Response</td></tr>
<tr><td>1</td><td>29H</td><td>29H</td><td>Processing classifications</td><td>Control command group</td><td>Synchronization classifications</td><td>Asynchronous</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="13"></td><td rowspan="2">STATUS</td><td colspan="4" rowspan="13">• Releases the modal latch mode.
• Can be used during phases 2 and 3.
• A MECHATROLINK-II command warning (A.95) will occur and the command will be ignored in the following cases.
- During phase 1.
- If LTMOD_OFF and LATCH, ZRET, EX_POSING, or SVCTRL are executed simultaneously, or if LTMOD_OFF is received during LATCH, ZRET, EX_POSING, or SVCTRL execution (the LTMOD_OFF will be ignored).
• Check that CMDRDY is 1 to confirm that the Release Latch Mode command has been received.
- It takes 4 ms max. for the Release Latch Mode command to start.</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_MON 1/2</td><td>SEL_MON 1/2</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">For subcommands use. Refer to 4.4 Subcommands.</td><td rowspan="13">For subcommands use. Refer to 4.4 Subcommands.</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>

4.3.21 Status Monitoring (SMON: 30H)

<table>
<tr><td rowspan="2">Byte</td><td colspan="2">SMON</td><td colspan="4" rowspan="2">Description</td></tr>
<tr><td>Command</td><td>Response</td></tr>
<tr><td>1</td><td>30H</td><td>30H</td><td>Processing classifications</td><td>Control command group</td><td>Synchronization classifications</td><td>Asynchronous</td></tr>
<tr><td>2</td><td rowspan="28"></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>STATUS</td><td colspan="4" rowspan="28">• Reads the current status of the Servo.
• Can be used during phases 2 and 3.
• During phase 1, a MECHATROLINK-II command warning (A.95) will occur and the command will be ignored.</td></tr>
<tr><td>4</td><td rowspan="4"></td></tr>
<tr><td>5</td><td rowspan="5">MONITOR1</td></tr>
<tr><td>6</td></tr>
<tr><td>7</td></tr>
<tr><td>8</td></tr>
<tr><td>9</td><td rowspan="5">MONITOR2</td></tr>
<tr><td>10</td></tr>
<tr><td>11</td></tr>
<tr><td>12</td></tr>
<tr><td>13</td><td>SEL_MON 1/2</td><td>SEL_MON 1/2</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">For subcommands use. Refer to 4.4 Subcommands.</td><td rowspan="13">For subcommands use. Refer to 4.4 Subcommands.</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>

4.3.22 Servo ON (SV_ON: 31H)

<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>Processing classifications</td><td>Control command group</td><td>Synchronization classifications</td><td>Asynchronous</td></tr>
<tr><td>2</td><td></td><td>ALARM</td><td>Processing time</td><td>Within 50 ms normally</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">• The SERVOPACK changes to Servo ON.
• Can be used during phases 2 and 3.
• A MECHATROLINK-II command warning (A.95) will occur and the command will be ignored in the following cases.
- During phase 1
- During alarm occurrence (when ALM of STATUS is 1)
- If SENS_ON has not been completed when the absolute encoder is used
• OPTION can be selected. Refer to 4.5.2 Option Field Specifications: OPTION for details.
• For linear motors not equipped with a pole sensor, it takes 10 seconds max. until the SERVOPACK changes to Servo ON the first time because the pole must be detected.
• Upon completion of this command, the reference position (POS) must be read, and the controller coordinate system must be set up.</td></tr>
<tr><td>4</td></tr>
<tr><td>5</td><td rowspan="8"></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_MON 1/2</td><td>SEL_MON 1/2</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">For subcommands use. Refer to 4.4 Subcommands.</td><td rowspan="13">For subcommands use. Refer to 4.4 Subcommands.</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>

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4.3.23 Servo OFF (SV_OFF: 32H)

<table>
<tr><td rowspan="2">Byte</td><td colspan="2">SV_OFF</td><td colspan="4" rowspan="2">Description</td></tr>
<tr><td>Command</td><td>Response</td></tr>
<tr><td>1</td><td>32H</td><td>32H</td><td>Processing classifications</td><td>Control command group</td><td>Synchronization classifications</td><td>Asynchronous</td></tr>
<tr><td>2</td><td rowspan="28"></td><td>ALARM</td><td>Processing time</td><td>Follow settings from Pn506 to Pn508.</td><td>Subcommand</td><td>Can be used.</td></tr>
<tr><td>3</td><td>STATUS</td><td colspan="4" rowspan="28">• The SERVOPACK changes to Servo OFF.
• Can be used during phases 2 and 3.
• During phase 1, a MECHATROLINK-II command warning (A.95) will occur and the command will be ignored.</td></tr>
<tr><td>4</td><td rowspan="5">MONITOR1</td></tr>
<tr><td>5</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_MON 1/2</td><td>SEL_MON 1/2</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">For subcommands use. Refer to 4.4 Subcommands.</td><td rowspan="13">For subcommands use. Refer to 4.4 Subcommands.</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>

4.3.24 Interpolation Feed (INTERPOLATE: 34H)

<table>
<tr><td rowspan="2">Byte</td><td colspan="2">INTERPOLATE</td><td colspan="4" rowspan="2">Description</td></tr>
<tr><td>Command</td><td>Response</td></tr>
<tr><td>1</td><td>34H</td><td>34H</td><td>Processing classifications</td><td>Motion command group</td><td>Synchronization classifications</td><td>Synchronous</td></tr>
<tr><td>2</td><td></td><td>ALARM</td><td>Processing time</td><td>Within communi-cations 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="14">• Starts interpolation feeding. Speed feed forward (VFF) can be specified simul-taneously.
• Can be used during phases 2 and 3.
• A warning will occur and the command will be ignored in the following cases.
- During phases other than phase 3:
MECHATROLINK-II command warning (A.95)
- If the SERVOPACK is Servo OFF:
MECHATROLINK-II command warning (A.95)
- If the output speed (difference from the previous target position (TPOS)) exceeds the limit: Parameter setting warning (A.94)
- If VFF is not within the setting range: Parameter setting warning (A.94)
- OPTION can be selected. Refer to 4.5.2 Option Field Specifications: OPTION for details.
• Use DEN (output complete) to confirm the completion of position reference output.</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_MON 1/2</td><td>SEL_MON 1/2</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">For subcommands use. Refer to 4.4 Subcom-mands.</td><td rowspan="13">For subcommands use. Refer to 4.4 Subcom-mands.</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>

4.3.25 Positioning (POSING: 35H)

Byte	POSING		Description			
	Command	Response				
1	35H	35H	Processing classifications	Motion command group	Synchronization classifications	Synchronous
2		ALARM	Processing time	Within communications cycle	Subcommand	Can be used.
3	OPTION	STATUS	• Performs positioning at the target position (TPOS) using the target speed (TSPD). • Can be used during phases 2 and 3. • A warning will occur and the command will be ignored in the following cases. - During phase 1: MECHATROLINK-II command warning (A.95) - If the SERVOPACK is Servo OFF: MECHATROLINK-II command warning (A.95) - If the target speed (TSPD) exceeds the limit: Parameter setting warning (A.94) • OPTION can be selected. Refer to *4.5.2 Option Field Specifications: OPTION* for details. • The target position (TPOS) is a signed 4 bytes. It is set using an absolute position in the reference coordinate system. • The target speed (TSPD) is an unsigned 4 bytes. It is set using units/s. • Changes can be made to the target position and target speed during movement. • Use DEN (output complete) to confirm the completion of position reference output. • The maximum positioning distance referenced by one POSING command is 2147483647 (7FFFFFFFH). Execute the POSING command so that the following equation is satisfied: Target position (TPOS) – current position (POS) ≤ The maximum positioning distance			
4						
5	TPOS	MONITOR1				
6						
7						
8						
9	TSPD	MONITOR2				
10						
11						
12						
13	SEL_MON 1/2	SEL_MON 1/2				
14		IO_MON				
15						
16	WDT	RWDT				
17	For subcommands use. Refer to *4.4 Subcommands.*	For subcommands use. Refer to *4.4 Subcommands.*				
18						
19						
20						
21						
22						
23						
24						
25						
26						
27						
28						
29						

■ Related Parameters

Pn No.	Description
Pn80A	First-step Linear Acceleration Parameter
Pn80B	Second-step Linear Acceleration Parameter
Pn80C	Acceleration Parameter Switching Speed
Pn80D	First-step Linear Deceleration Parameter
Pn80E	Second-step Linear Deceleration Parameter
Pn80F	Deceleration Parameter Switching Speed

4.3.26 Constant Speed Feed (FEED: 36H)

<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>Processing classifications</td><td>Motion command group</td><td>Synchronization classifications</td><td>Asynchronous</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">• Performs constant speed feeding using the target speed (TSPD). Use the Stop Motion command (HOLD: 25H) to stop the constant speed feeding. The position control loop is effective during this command.
• Can be used during phases 2 and 3.
• A command warning will occur and the command will be ignored in the following cases.
- During phase 1: MECHATROLINK-II command warning (A.95)
- If the SERVOPACK is Servo OFF: MECHATROLINK-II command warning (A.95)
- If the target speed (TSPD) exceeds the limit: Parameter setting warning (A.94)
• OPTION can be selected. Refer to 4.5.2 Option Field Specifications: OPTION for details.
• The target speed (TSPD) is a signed 4 bytes. The direction is determined by the sign. It is set using units/s.
• Changes can be made to the target speed during movement.
• Use DEN (output complete) to confirm the completion of position reference output.</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_MON 1/2</td><td>SEL_MON 1/2</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">For subcommands use. Refer to 4.4 Subcommands.</td><td rowspan="13">For subcommands use. Refer to 4.4 Subcommands.</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>

■ Related Parameters

Pn No.	Description
Pn80A	First-step Linear Acceleration Parameter
Pn80B	Second-step Linear Acceleration Parameter
Pn80C	Acceleration Parameter Switching Speed
Pn80D	First-step Linear Deceleration Parameter
Pn80E	Second-step Linear Deceleration Parameter
Pn80F	Deceleration Parameter Switching Speed

4.3.27 Interpolation Feeding with Position Detection (LATCH: 38H)

Byte	LATCH		Description			
	Command	Response				
1	38H	38H	Processing classifications	Motion command group	Synchronization classifications	Synchronous
2	LT_SGN	ALARM	Processing time	Within communications cycle	Subcommand	Can be used.
3	OPTION	STATUS	• Performs interpolation feeding and latches the position using the latch signal simultaneously. Sends speed feedforward (VFF) simultaneously, too. • If the latch signal is input, the position when the input is received is recorded as the counter latch position (LPOS) and LPOS will be indicated as the MONITOR2 forcibly for one communications cycle. • Can be used during phases 2 and 3. • A command warning will occur and the command will be ignored in the following cases. - During phases other than phase 3: MECHATROLINK-II command warning (A.95) - If the SERVOPACK is Servo OFF: MECHATROLINK-II command warning (A.95) - If the output speed (difference from the previous target position (TPOS)) exceeds the limit: Parameter setting warning (A.94) - If VFF is not within the setting range: Parameter setting warning (A.94) - If LTMOD_ON/OFF is received during LATCH execution or simultaneously: MECHATROLINK-II command warning (A.95) (the LTMOD_ON/OFF commands will be ignored.) • LT_SGN can be selected. Refer to *4.5.1 Latch Signal Field Specifications: LT_SGN* (LT_SGN). • OPTION can be selected. Refer to *4.5.2 Option Field Specifications: OPTION* for details. • Use DEN (output complete) to confirm the motion completion. • It takes 4 ms max. for the Request Latch Mode command to start. • If LATCH command is received during modal latch mode, the LACTH command is enabled.			
4						
5	TPOS	MONITOR1				
6						
7						
8						
9	VFF	MONITOR2				
10						
11						
12						
13	SEL_MON 1/2	SEL_MON 1/2				
14		IO_MON				
15						
16	WDT	RWDT				
17	For subcommands use. Refer to *4.4 Subcommands.*	For subcommands use. Refer to *4.4 Subcommands.*				
18						
19						
20						
21						
22						
23						
24						
25						
26						
27						
28						
29						

4

■ Related Parameters

Pn No.	Description
Pn511	Input Signal Selections 5
Pn820	Latching Area Upper Limit
Pn822	Latching Area Lower Limit

4.3.28 External Input Positioning (EX_POSING: 39H)

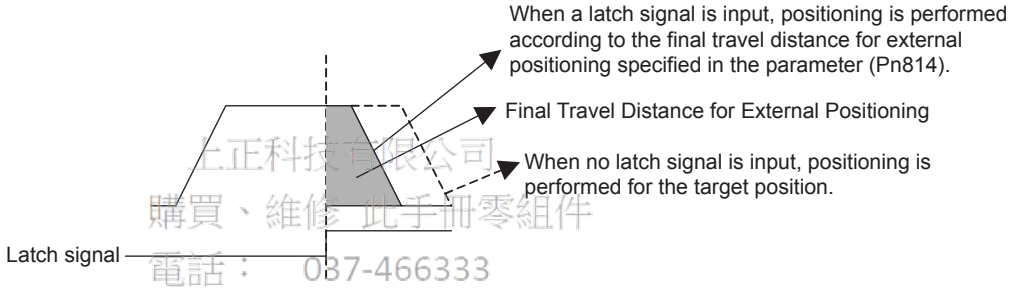
Byte	EX_POSING		Description			
	Command	Response				
1	39H	39H	Processing classifications	Motion command group	Synchronization classifications	Asynchronous
2	LT_SGN	ALARM	Processing time	Within communications cycle	Subcommand	Can be used.
3	OPTION	STATUS	• Moves toward the target position (TPOS) at the 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. When no latch signal is input, positioning is performed for the target position. • Can be used during phases 2 and 3. • A command warning will occur and the command will be ignored in the following cases. - During phase 1: MECHATROLINK-II command warning (A.95) - If the SERVOPACK is Servo OFF: MECHATROLINK-II command warning (A.95) - If the target speed (TSPD) exceeds the limit: Parameter setting warning (A.94) - If LTMOD_ON/OFF is received during EX_POSING execution or simultaneously: MECHATROLINK-II command warning (A.95) (the LTMOD_ON/OFF commands will be ignored.) • OPTION can be selected. Refer to *4.5.2 Option Field Specifications: OPTION* for details. • The target position (TPOS) is a signed 4 bytes [units/s]. It is set using an absolute position in the reference coordinate system. • The target speed (TSPD) is an unsigned 4 bytes. It is set using units/s. • After the latch is input, any changes to the target position during motion will be ignored. • After the latch is input, use DEN (output complete) to confirm the completion of position reference output. • It takes 4 ms max. for the Request Latch Mode command to start. • If EX_POSING command is received during modal latch mode, the EX_POSING command is enabled. • The maximum positioning distance referenced by one POSING command is 2147483647 (7FFFFFFFH). Execute the POSING command so that the following equation is satisfied: Target position (TPOS) – current position (POS) ≤ The maximum positioning distance			
4						
5	TPOS	MONITOR1				
6						
7						
8						
9	TSPD	MONITOR2				
10						
11						
12						
13	SEL_MON 1/2	SEL_MON 1/2				
14		I/O_MON				
15						
16	WDT	RWDT				
17	For subcommands use. Refer to *4.4 Subcommands.*	For subcommands use. Refer to *4.4 Subcommands.*				
18						
19						
20						
21						
22						
23						
24						
25						
26						
27						
28						
29						

4

■ Related Parameters

Pn No.	Description	Pn No.	Description
Pn511	Input Signal Selections 5	Pn820	Latching Area Upper Limit
Pn80A	First-step Linear Acceleration Parameter	Pn822	Latching Area Lower Limit
Pn80B	Second-step Linear Acceleration Parameter		
Pn80C	Acceleration Parameter Switching Speed		
Pn80D	First-step Linear Deceleration Parameter		
Pn80E	Second-step Linear Deceleration Parameter		
Pn80F	Deceleration Parameter Switching Speed		
Pn814	Final Travel Distance for External Positioning		

■ Operation



4.3.29 Zero Point Return (ZRET: 3AH)

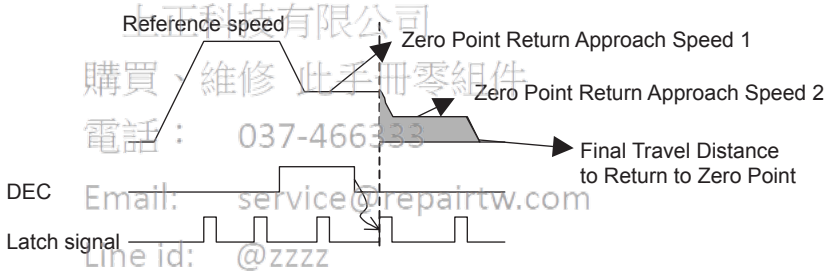
Byte	ZRET		Description			
	Command	Response				
1	3AH	3AH	Processing classifications	Motion command group	Synchronization classifications	Asynchronous
2	LT_SGN	ALARM	Processing time	Within communications cycle	Subcommand	Can be used.
3	OPTION	STATUS	• Accelerates to the target speed (TSPD) in the direction specified in the parameter (Pn816) and continues to move at the target speed. • Decelerates to approach speed 1 (Pn817) at the DEC = 1. • Latch operation will start at the DEC = 0. • When a latch signal is input, zero point return approach speed 2 (Pn818) is used and positioning is performed for the target position specified in the final travel distance to return to zero point (Pn819). When positioning is completed, that position is zero point. • Can be used during phases 2 and 3. • A command warning will occur and the command will be ignored in the following cases. - During phase 1: MECHATROLINK-II command warning (A.95) - If the SERVOPACK is Servo OFF: MECHATROLINK-II command warning (A.95) - If the target speed (TSPD) exceeds the limit: Parameter setting warning (A.94) - If LTMOD_ON/OFF is received during ZRET execution or simultaneously: MECHATROLINK-II command warning (A.95) (the LTMOD_ON/OFF commands will be ignored.) • OPTION can be selected. Refer to *4.5.2 Option Field Specifications: OPTION* for details. • The target speed (TSPD) is an unsigned 4 bytes. It is set using units/s. • Before DEC is input, the target speed during motion can be changed. • Use DEN (output complete) and ZPOINT (zero point) to confirm the completion of position reference output. • If ZRET command is received during modal latch mode, the ZRET command is enabled.			
4						
5		MONITOR1				
6						
7						
8						
9	TSPD	MONITOR2				
10						
11						
12						
13	SEL_MON 1/2	SEL_MON 1/2				
14		IO_MON				
15						
16	WDT	RWDT				
17	For subcommands use. Refer to *4.4 Subcommands.*	For subcommands use. Refer to *4.4 Subcommands.*				
18						
19						
20						
21						
22						
23						
24						
25						
26						
27						
28						
29						

Note: Refer to *4.5.5 IO Monitor Field Specifications: IO_MON* for details of DEC.

4

■ Related Parameters

Pn No.	Description	Pn No.	Description
Pn511	Input Signal Selections 5	Pn820	Latching Area Upper Limit
Pn80A	First-step Linear Acceleration Parameter	Pn822	Latching Area Lower Limit
Pn80B	Second-step Linear Acceleration Parameter		
Pn80C	Acceleration Parameter Switching Speed		
Pn80D	First-step Linear Deceleration Parameter		
Pn80E	Second-step Linear Deceleration Parameter		
Pn80F	Deceleration Parameter Switching Speed		
Pn816	Zero Point Return Direction		
Pn817	Zero Point Return Approach Speed 1		
Pn818	Zero Point Return Approach Speed 2		
Pn819	Final Travel Distance to Return to Zero Point		



4.3.30 Velocity Control (VELCTRL: 3CH)

<table>
<tr><th rowspan="2">Byte</th><th colspan="2">VECTRL</th><th rowspan="2" colspan="4">Description</th></tr>
<tr><th>Command</th><th>Response</th></tr>
<tr><td>1</td><td>3CH</td><td>3CH</td><td>Processing classifications</td><td>Motion command group</td><td>Synchronization classifications</td><td>Asynchronous</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 rowspan="27" colspan="4">• Controls speed. (The Servo does not perform position control, but directly controls the speed of the speed loop.)
Soft-start acceleration/deceleration can also be used by setting the parameters.
• Can be used during phases 2 and 3.
• A warning will occur and the command will be ignored in the following cases.
- During phase 1: MECHATROLINK-II command warning (A.95)
- If the SERVOAPCK is Servo OFF: MECHATROLINK-II command warning (A.95)
• OPTION can be selected. Refer to 4.5.2 Option Field Specifications: OPTION for details.
• VREF (speed reference)
The unit for speed reference is [maximum motor speed/40000000H]. The direction is specified by the sign.
When the designation for VREF is larger than the maximum motor speed, it is clamped at the OS detection speed. (The OS detection speed varies depending on the motor, but is approximately 110% of the maximum speed.)
• STATUS (status)
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 unit for TSPD, CSPD, and FSDP is [maximum motor speed/40000000H].
• Setting the torque reference option (P_TLIM (TFF), N_TLIM)
Setting range: 0 to 4000H (maximum motor torque/4000H)
Refer to ■ Torque Reference Option Operation on page 4-42 for operation details.</td></tr>
<tr><td>4</td></tr>
<tr><td>5</td><td rowspan="2">P_TLIM
(TFF)</td><td rowspan="4">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_MON 1/2</td><td>SEL_MON 1/2</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">For subcommands use. Refer to 4.4 Subcommands.</td><td rowspan="13">For subcommands use. Refer to 4.4 Subcommands.</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>

■ Related Parameters

Pn No.	Description
Pn305	Soft Start Acceleration Time
Pn306	Soft Start Deceleration Time
Pn002.0	Torque Reference Option in Speed/Position Control Mode

■ Torque Reference Option Operation

Pn No. and Digit Place	Set Value	Torque Reference Option Operation
Pn002.0	0	The torque reference option is not effective. Set P_TLIM (TFF), N_TLIM to 0.
	1	P_TLIM operates as the torque limit value. Set N_TLIM to 0.
	2	TFF operates as the torque feed forward. Set N_TLIM to 0.
	3	When P_CL and N_CL of OPTION field = 0, parameters Pn402 and Pn403 operate as torque limit values. When P_CL = 0 and N_CL = 1, N_TLIM operates as the torque limit value. When P_CL = 1 and N_CL = 0, or P_CL and N_CL = 1, P_TLIM operates as the torque limit value.

4.3.31 Torque Control (TRQCTRL: 3DH)

Byte	TRQCTRL Command	TRQCTRL Response	Description			
1	3DH	3DH	Processing classifications	Motion command group	Synchronization classifications	Asynchronous
2		ALARM	Processing time	Within communications cycle	Subcommand	Can be used.
3	OPTION	STATUS	• The Servo does not perform position control and speed control, but directly performs torque control. • Can be used during phases 2 and 3. • A command warning will occur and the command will be ignored in the following cases. - During phases other than phases 2 and 3: MECHATROLINK-II command warning (A.95) - If the SERVOPACK is Servo OFF: MECHATROLINK-II command warning (A.95) • OPTION can be selected. Refer to *4.5.2 Option Field Specifications: OPTION* for details. • TOREF (torque reference) The unit for torque reference is [maximum motor torque/40000000H]. The direction is specified by the sign. When the designation for TOREF is larger than the maximum motor torque, it is clamped at the maximum torque. • STATUS (status) D11: V_LIM (speed limit bit) 0: Speed limit not detected 1: Speed limit detected • MONITOR1, 2, 3, 4 (monitor) The unit for torque is [maximum motor torque/40000000H]. • Setting the speed reference option (VLIM) Setting range: 0 to 40000000H (maximum motor speed/40000000H) Refer to ■ *Speed Reference Option Operation* on *page 4-44*.			
4						
5	VLIM	MONITOR1				
6						
7						
8						
9	TQREF	MONITOR2				
10						
11						
12						
13	SEL_MON 1/2	SEL_MON 1/2				
14		IO_MON				
15						
16	WDT	RWDT				
17	For subcommands use. Refer to *4.4 Subcommands.*	For subcommands use. Refer to *4.4 Subcommands.*				
18						
19						
20						
21						
22						
23						
24						
25						
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29						

4

■ Related Parameters

Pn No.	Description
Rotary: Pn407	Speed Limit at Torque Control
Linear: Pn480	Speed Limit at Thrust Control
Pn002.1	Speed Reference Option in Torque Control Mode

■ Speed Reference Option Operation

Pn No. and Digit Place	Set Value	Speed Reference Option Operation
Pn002.1	0	The speed reference option is not effective. Set VLIM to 0.
	1	VLIM operates as the speed limit value.

4.3.32 Adjusting (ADJ: 3EH)

<table>
<tr><td rowspan="2">Byte</td><td colspan="2">ADJ</td><td colspan="4" rowspan="2">Description</td></tr>
<tr><td>Command</td><td>Response</td></tr>
<tr><td>1</td><td>3EH</td><td>3EH</td><td>Processing classifications</td><td>Data communications command group</td><td>Synchronization classifications</td><td>Asynchronous</td></tr>
<tr><td>2</td><td>00H</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">• This command is for maintenance.
• Refer to Appendix C Using the Adjusting Command (ADJ: 3EH).
• A command warning will occur and the command will be ignored in the following cases.
- During phase 1: MECHATROLINK-II command warning (A.95)
- If a digital operator is connected: MECHATROLINK-II command warning (A.95)
- If SigmaWin and so on are connected: MECHATROLINK-II command warning (A.95)</td></tr>
<tr><td>4</td></tr>
<tr><td>5</td><td>CCMD</td><td>CANS</td></tr>
<tr><td>6</td><td rowspan="2">CADDRESS</td><td rowspan="2">CADDRESS</td></tr>
<tr><td>7</td></tr>
<tr><td>8</td><td rowspan="2">CDATA</td><td rowspan="2">CDATA</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>

4.3.33 General-purpose Servo Control (SVCTRL: 3FH)

Byte	SVCTRL		Description			
	Command	Response				
1	3FH	3FH	Processing classifications	Compound command group	Synchronization classifications	Synchronous, asynchronous
2	SUBCTRL	ALARM	Processing time	Depends on processing.	Subcommand	Can be used.
3	OPTION	STATUS	• Latch Processing: Supported. Select the latch signal using L_SGN in the SUBCTRL and set SET_L to 1. When the selected latch signal is input, L_CMP in STATUS will become 1. To perform latch processing again, set SET_L to 0 for one communications cycle, then set SET_L again to 1. The latch signal cannot be changed while SET_L is set to 1. • Motion: Any of the motions listed in the following table can be executed. Refer to each motion item for operating specifications. • Sequence Signals: Any of the sequence signals listed in the following table can be executed. Refer to each sequence item for operating specifications. • A command warning will occur and the command will be ignored in the following cases. - During phase 1: MECHATROLINK-II command warning (A.95) - If the SERVOPACK is Servo OFF: MECHATROLINK-II command warning (A.95) - If LTMOD_ON/OFF is received during SVCTRL execution or simultaneously: MECHATROLINK-II command warning (A.95) (the LTMOD_ON/OFF commands will be ignored.) • If SVCTRL command is received during modal latch mode, the new command is enabled.			
4						
5	TPOS	MONITOR1				
6						
7						
8						
9	TSPD	MONITOR2				
10	OR					
11	VFF					
12						
13	SEL_MON 1/2	SEL_MON 1/2				
14	SQ_CMD	I/O_MON				
15						
16	WDT	RWDT				
17	For subcommands use. Refer to *4.4 Subcommands.*	For subcommands use. Refer to *4.4 Subcommands.*				
18						
19						
20						
21						
22						
23						
24						
25						
26						
27						
28						
29						

■ Sub-control: SUBCTRL

D7	D6	D5	D4	D3	D2	D1	D0
RESERVE 0	MOTION Select motion			RESERVE 0	SET_L Latch command	L_SGN Select latch signal	

Select Latch Signal: L_SGN

D1	D0	Latch Signal
0	0	Phase C
0	1	EXT1
1	0	EXT2
1	1	EXT3

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, a parameter setting warning (A.94) will occur for POSING and FEED, and the commands will be ignored.
- For INTERPOLATE, in all other phases except phase 3, a parameter setting warning (A.94) will occur and the command will be ignored.
- A warning may not be given depending on the sequence signal status.

Sequence Signals: SQ_CMD

D7	D6	D5	D4	D3	D2	D1	D0
RESERVE 0				ACLR Alarm clear	SEN Sensor ON	BRK Brake ON	SON Servo ON

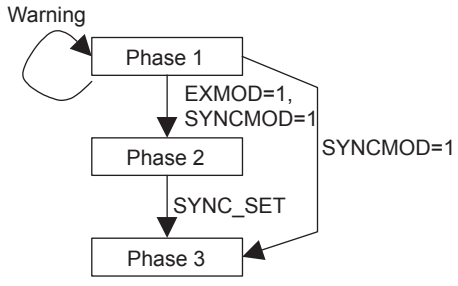
4.3.34 MECHATROLINK Connection (CONNECT: 0EH)

Byte	CONNECT		Description			
	Command	Response				
1	0EH	0EH	Processing classifications	Network command group	Synchronization classifications	Asynchronous
2		ALARM	Processing time	Communications cycle or more	Subcommand	Cannot be used.
3		STATUS	• Establishes a MECHATROLINK connection. Sets the communications mode according to COM_MODE. • VER: Version Set VER to 10H (Ver. 1.0). • Subcommand: Cannot be used. COM_MOD: Communications mode. Refer to the following table. • COM_TIM: Communications cycle [ms] Set the multiple number of 2 [ms] in the range of 2 to 32 [ms]. 2 [ms] ≤ COM_TIM ≤ 32 [ms] • A command warning will occur and the command will be ignored in the following cases. - If COM_MOD is not within range: Parameter setting warning (A.94) - If COM_TIM is not within range: Parameter setting warning (A.94)			
4						
5	VER	VER				
6	COM_MOD	COM_MOD				
7	COM_TIM	COM_TIM				
8						
9						
10						
11						
12						
13						
14						
15						
16	WDT	RWDT				

■ Details of COM_MOD

D7	D6	D5	D4	D3	D2	D1	D0
SUBCMD	0	0	0	DTMOD		SYNCMOD	EXMOD

• EXMOD:
0: Standard connection
1: Extended connection
• SYNCMOD*:
0: Asynchronous communications (The SERVOPACK changes communication to phase 2.)
1: Start synchronous communications (The SERVOPACK changes communication to phase 3.)
* The SERVOPACK changes communication to phase 2 when EXMOD is set to 1. The SERVOPACK changes communication to phase 3 after SYNC_SET setting.
• DTMOD:
00,11: Single transfer
01: Consecutive transfer
10: Multiple transfers (not supported)



4.4 Subcommands

This section describes the subcommands for the NS115. The MECHATROLINK-II subcommands can be used by specifying them with the CONNECT command when the MECHATROLINK-II communications is started.

They use the seventeenth to the twenty-ninth bytes of the command and response data. (They cannot be used with MECHATROLINK-I.)

The subcommands can be used in combination with the main commands described in Table 4.3.

Table 4.3 Combination of Main Commands and Subcommands

Code	Main Command	Subcommand							
		NOP	PRM_RD	PRM_WR	ALM_RD	PPRM_WR	LTMOD_ON	LTMOD_OFF	SMON
00	NOP	OK	OK	OK	OK	OK	OK	OK	OK
01	PRM_RD	OK	NO	NO	NO	NO	NO	NO	OK
02	PRM_WR	OK	NO	NO	NO	NO	NO	NO	OK
03	ID_RD	OK	OK	OK	OK	OK	OK	OK	OK
04	CONFIG	OK	NO	NO	NO	NO	NO	NO	OK
05	ALM_RD	OK	NO	NO	NO	NO	NO	NO	OK
06	ALM_CLR	OK	NO	NO	NO	NO	NO	NO	OK
0D	SYNC_SET	OK	NO	NO	NO	NO	NO	NO	NO
0E	CONNECT	OK	NO	NO	NO	NO	NO	NO	NO
0F	DISCONNECT	OK	NO	NO	NO	NO	NO	NO	NO
1C	PPRM_WR	OK	NO	NO	NO	NO	NO	NO	OK
20	POS_SET	OK	NO	NO	NO	NO	NO	NO	OK
21	BRK_ON	OK	NO	NO	NO	NO	NO	NO	OK
22	BRK_OFF	OK	NO	NO	NO	NO	NO	NO	OK
23	SENS_ON	OK	NO	NO	NO	NO	NO	NO	OK
24	SENS_OFF	OK	NO	NO	NO	NO	NO	NO	OK
25	HOLD	OK	OK	OK	OK	OK	OK	OK	OK
28	LTMOD_ON	OK	OK	OK	OK	OK	OK	OK	OK
29	LTMOD_OFF	OK	OK	OK	OK	OK	OK	OK	OK
30	SMON	OK	OK	OK	OK	OK	OK	OK	OK
31	SV_ON	OK	OK	OK	OK	OK	OK	OK	OK
32	SV_OFF	OK	OK	OK	OK	OK	OK	OK	OK
34	INTERPOLATE	OK	OK	OK	OK	OK	OK	OK	OK
35	POSING	OK	OK	OK	OK	OK	OK	OK	OK
36	FEED	OK	OK	OK	OK	OK	OK	OK	OK
38	LATCH	OK	OK	OK	OK	OK	NO	NO	OK
39	EX_POSING	OK	OK	OK	OK	OK	NO	NO	OK
3A	ZRET	OK	OK	OK	OK	OK	NO	NO	OK
3C	VELCTRL	OK	OK	OK	OK	OK	OK	OK	OK
3D	TRQCTRL	OK	OK	OK	OK	OK	OK	OK	OK

4

Table 4.3 Combination of Main Commands and Subcommands (cont'd)

Code	Main Command	Subcommand							
		NOP	PRM_RD	PRM_WR	ALM_RD	PPRM_WR	LTMOD_ON	LTMOD_OFF	SMON
3E	ADJ	OK	NO	NO	NO	NO	NO	NO	OK
3F	SVCTRL	OK	OK	OK	OK	OK	OK	OK	OK

Note: OK: This combination can be used.
NO: This combination cannot be used.

4.4.1 No Operation (NOP: 00H)

Byte	NOP		Description			
	Command	Response	Processing classifications	Network command group	Processing time	Within communications cycle
17	00H	00H	Not operation command.			
18		Substatus				
19						
20						
21						
22						
23						
24						
25						
26						
27						
28						
29						

4.4.2 Read Parameter (PRM_RD:01H)

Byte	PRM_RD		Description			
	Command	Response	Processing classifications	Data communica-tions command group	Processing time	Within 6 ms
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						

4.4.3 Write Parameter (PRM_WR:02H)

Byte	PRM_WR		Description			
	Command	Response	Processing classifications	Data communica-tions command group	Processing time	Within 6 ms
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						

4.4.4 Read Alarm or Warning (ALM_RD:05H)

Byte	ALM_RD		Description			
	Command	Response	Processing classifications	Data communications command group	Processing time	6 ms to 2 s
17	05H	05H	Reads the alarm or warning. This command has the same function as the main command ALM_RD.			
18		Substatus				
19	ALM_RD_MOD	ALM_RD_MOD				
20		ALM_DATA				
21						
22						
23						
24						
25						
26						
27						
28						
29						

4.4.5 Write Non-volatile Parameter (PPRM_WR:1CH)

Byte	PPRM_WR		Description			
	Command	Response	Processing classifications	Data communications command group	Processing time	Within 200 ms
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						

4.4.6 Request Latch Mode (LTMOD_ON:28H)

Byte	LTMOD_ON		Description			
	Command	Response	Processing classifications	Control command group	Processing time	Within communications cycle
17	28H	28H	Sets the modal 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		MONITOR3				
21						
22						
23						
24		MONITOR4				
25						
26						
27						
28						
29						

4.4.7 Release Latch Mode (LTMOD_OFF:29H)

Byte	LTMOD_OFF		Description			
	Command	Response	Processing classifications	Control command group	Processing time	Within communications cycle
17	29H	29H	Releases the modal 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						
29						

4.4.8 Status Monitoring (SMON:30H)

<table>
<tr><td rowspan="2">Byte</td><td colspan="2">SMON</td><td colspan="4">Description</td></tr>
<tr><td>Command</td><td>Response</td><td>Processing classifications</td><td>Data communica-tions command group</td><td>Processing time</td><td>Within communi-cations cycle</td></tr>
<tr><td>17</td><td>30H</td><td>30H</td><td colspan="4" rowspan="13">Reads the monitoring information specified in SEL_MON3/4. This command has the same function as the main command SMON.</td></tr>
<tr><td>18</td><td></td><td>Substatus</td></tr>
<tr><td>19</td><td>SEL_MON3/4</td><td>SEL_MON3/4</td></tr>
<tr><td>20</td><td rowspan="8"></td><td rowspan="4">MONITOR3</td></tr>
<tr><td>21</td></tr>
<tr><td>22</td></tr>
<tr><td>23</td></tr>
<tr><td>24</td><td rowspan="4">MONITOR4</td></tr>
<tr><td>25</td></tr>
<tr><td>26</td></tr>
<tr><td>27</td></tr>
<tr><td>28</td><td rowspan="2"></td><td rowspan="2"></td></tr>
<tr><td>29</td></tr>
</table>

4.5 Command Data Field

This section describes command data in main commands and subcommands.

4.5.1 Latch Signal Field Specifications: LT_SGN

The latch signal field specifications (LT_SGN) can be designated using the following commands:

LATCH, EX_POSING, ZRET, LTMOD_ON

The latch signal field is used to select latch signals for position data, with the second byte of the above main commands, or the eighteenth byte reserved area of the subcommands.

Refer to the following table for details on bit allocation.

■ Latch Signal Field

D7	D6	D5	D4	D3	D2	D1	D0
0	0	0	0	0	0	LT_SGN	

Latch Signal Selection

D1	D0	Latch Signal
0	0	Phase C
0	1	EXT1
1	0	EXT2
1	1	EXT3

INFO

- EXT1, EXT2, and EXT3 must be allocated to the CN1 input signal using parameter Pn511. If they are not allocated, the latch operation will be undefined.
- The latch operation will also be undefined if phase C is selected for a fully closed encoder that does not use phase C.

4.5.2 Option Field Specifications: OPTION

The option field specifications (OPTION) can be designated using the following main commands:

SV_ON, HOLD, INTERPOLATE, POSING, LATCH, EX_POSING, ZRET, FEED, VELCTRL, TRQCTRL, SVCTRL

The option field is used to add motion command functions for individual products, with the third to fourth byte reserved area of the above main commands.

Refer to the following table for details on bit allocation.

■ Option Field

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	0	PPI	0	0	0	G-SEL

Bit	Name	Description	Set Value	Details
D0			0	
D1			0	
D2			0	
D3	ACCFIL	Position reference filter Note: Never change position reference filter setting during output (when DEN of STATUS is set to 0).	0	No position reference filter
			1	Uses exponential position reference filter.
D4			2	Uses S-curve movement average position reference filter.
			3	Do not set.
D5			0	
D6			0	
D7			0	
D8	G-SEL	Gain switching	0	First gain
			1	Second gain
D9			0	
D10			0	
D11			0	
D12	PPI	Speed loop P/PI control	0	PI control
			1	P control
D13				
D14	P-CL	Forward torque limit	0	Controls torque.
			1	Does not control torque.
D15	N-CL	Reverse torque limit	0	Controls torque.
			1	Does not control torque.

4.5.3 Status Field Specifications: STATUS

The status field is used to monitor the Servo status with the third to fourth byte reserved area of the main commands.

Refer to the following table for details on bit allocation.

■ Status Field

D7	D6	D5	D4	D3	D2	D1	D0
PSET/ VCMP	ZPOINT	MLOCK	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

Bit	Name	Description	Set Value	Details	Control Mode
D0	ALM	Alarm occurrence	0	None	
			1	Alarm occurs.	
D1	WARNG	Warning occurrence	0	None	
			1	Warning occurs.	
D2	CMDRDY	Command ready	0	Command cannot be received (busy).	
			1	Command can be received (ready).	
D3	SVON	Servo ON	0	Servo OFF	
			1	Servo ON	
D4	PON	Main power supply ON	0	Main power supply OFF	
			1	Main power supply ON	
D5	MLOCK	Machine lock status (always released)	0	Machine lock released	
D6	ZPOINT	Zero point	0	Out of zero point range	
			1	Within zero point range	
D7	PSET	Positioning completion Output completion (DEN is set to 1) and APOS is within the positioning complete range	0	Out of positioning complete range	Position control mode
			1	Within positioning complete range	
	V-CMP	Speed coincides.	0	Speed dose not coincide.	Speed control mode
			1	Speed coincides.	
D8	DEN	Output completion	0	During output	Position control mode
			1	Output completed	
	ZSPD	Zero speed	0	Zero speed not detected	Speed control mode
			1	Zero speed detected	

(cont'd)

Bit	Name	Description	Set Value	Details	Control Mode
D9	T_LIM	Torque limit	0	Not during torque limit	
			1	During torque limit	
D10	L_CMP	Latch completion	0	Latch not completed	
			1	Latch completed	
D11	NEAR	Positioning proximity	0	Out of positioning proximity range	Position control mode
			1	Within positioning proximity range	
	V_LIM	Speed limit	0	Speed limit not detected	Torque control mode
			1	Speed limit detected	
D12	P_SOT	Forward software limit	0	Out of range	
			1	Within range	
D13	N_SOT	Reverse software limit	0	Out of range	
			1	Within range	
D14		Reserved			
D15		Reserved			

4.5.4 Monitor Selection and Monitor Information Field Specifications: SEL_MON1/2/3/4, MONITOR1/2/3/4

The monitor selection and monitor information field specifications (SEL_MON1/2/3/4, MONITOR1/2/3/4) can be designated using the following main commands:

SV_ON, SV_OFF, HOLD, INTERPOLATE, POSING, LATCH, EX_POSING, ZRET, SMON, SENS_ON, SENS_OFF, BRK_ON, BRK_OFF

The monitor selection and monitor information field is used to select the Servo monitor information and monitor it, with the thirteenth byte of the above main commands, or the nineteenth byte reserved area of the subcommands.

■ SEL_MON1/2/3/4 Fields

D7	D6	D5	D4	D3	D2	D1	D0
SEL_MON2				SEL_MON1			

D7	D6	D5	D4	D3	D2	D1	D0
SEL_MON4				SEL_MON3			

■ MONITOR1/2/3/4 Monitor Codes

Monitor Codes*	Name	Description	Unit
0	POS	Reference position in the reference coordinate system (position after reference filter procedure)	Reference units
1	MPOS	Reference position in the mechanical coordinate system	Reference units
2	PERR	Position error	Reference units
3	APOS	Feedback position in the mechanical coordinate system	Reference units
4	LPOS	Feedback latch position in the mechanical coordinate system	Reference units
5	IPOS	Reference position in the reference coordinate system (position before reference filter procedure)	Reference units
6	TPOS	Target position in the reference coordinate system	Reference units
7			
8	FSPD	Feedback speed	Position/torque control: reference units/s Speed control: Maximum speed /40000000H
9	CSPD	Reference speed	Position/torque control: reference units/s Speed control: Maximum speed /40000000H
A	TSPD	Target speed	Position/torque control: reference units/s Speed control: Maximum speed /40000000H
B	TRQ	Torque reference (The rated torque is 100%.)	Position/torque control: % Speed control: Maximum torque / 40000000H
C			
D			
E	OMN1	Option monitor 1 selected in Pn813.0	
F	OMN2	Option monitor 2 selected in Pn813.1	

* Up to 4 monitor codes can be set to MONITOR 1 to 4.

4.5.5 IO Monitor Field Specifications: IO_MON

The IO monitor field specifications (IO_MON) can be designated using the following commands:

SMON, SV_ON, SV_OFF, HOLD, INTERPOLATE, POSING, LATCH, EX_POSING, ZRET, SENS_ON, SENS_OFF, BRK_ON, BRK_OFF

The IO monitor field is used to monitor the I/O signal status of the SERVOPACK, with the fourteenth to fifteenth byte reserved area of the above main commands.

■ IO Monitor Field

D7	D6	D5	D4	D3	D2	D1	D0
EXT2	EXT1	PC	PB	PA	DEC	N_OT	P_OT

D15	D14	D13	D12	D11	D10	D9	D8
IO15	IO14	IO13	IO12	–	–	BRK	EXT3

Bit	Name	Description	Set Value	Settings
D0	P_OT	Forward run prohibited input	0	OFF
			1	ON
D1	N_OT	Reverse run prohibited input	0	OFF
			1	ON
D2	DEC	Zero point return 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 C 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		Reserved	0	
D11		Reserved	0	
D12	IO12	CN1 input signal selected in Pn81E.0	0	OFF
			1	ON
D13	IO13	CN1 input signal selected in Pn81E.1	0	OFF
			1	ON
D14	IO14	CN1 input signal selected in Pn81E.2	0	OFF
			1	ON
D15	IO15	CN1 input signal selected in Pn81E.3	0	OFF
			1	ON

4.5.6 Substatus Field Specifications: SUBSTATUS

The substatus field is used to monitor the subcommand status with the eighteenth byte reserved area of the subcommands.

■ SUBSTATUS

D7	D6	D5	D4	D3	D2	D1	D0
–	–	–	–	–	SBCMDRDY	SBWARNG	SBALM

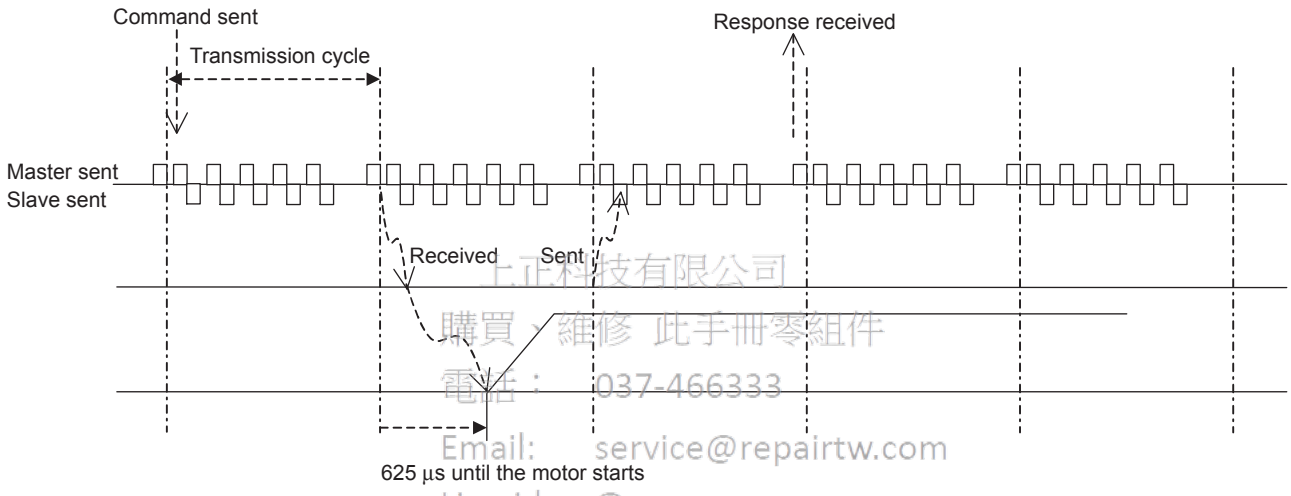
Bit	Name	Description	Set Value	Details
D0	SBALM	Subcommand alarm occurrence	0	None
			1	Alarm occurs.
D1	SBWARNG	Subcommand warning occurrence	0	None
			1	Warning occurs.
D2	SBCMDRDY	Subcommand ready (Subcommand reception enabled)	0	Disabled (busy)
			1	Enabled (ready)

4.6 Command and Response Timing

This section describes the execution timing for command data and the input timing for monitor data. This timing is fixed, regardless of the transmission cycle and communications cycle.

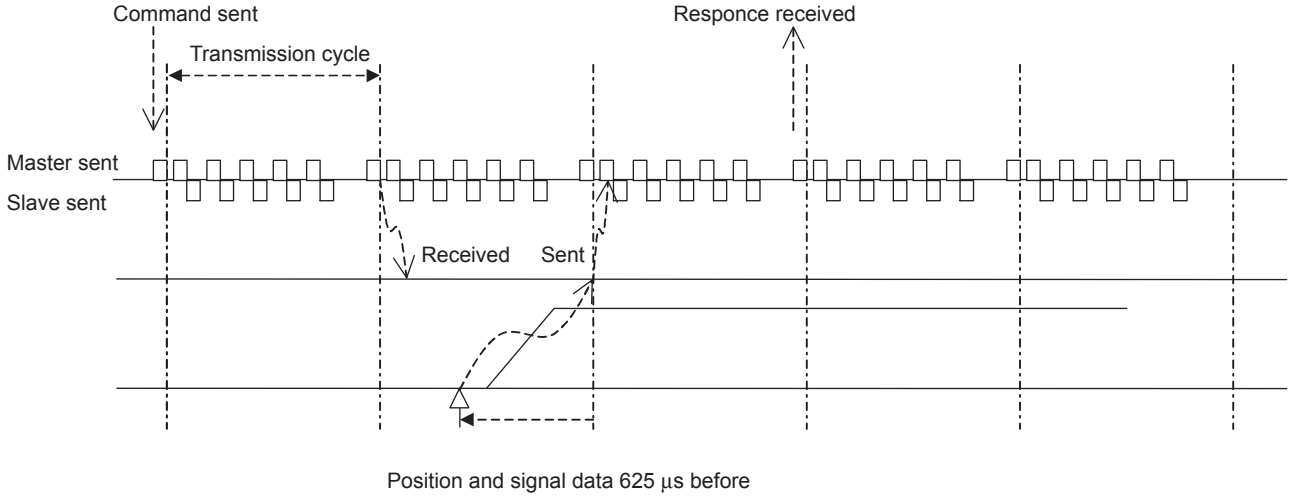
4.6.1 Command Data Execution Timing

Motion commands (POSING, INTERPOLATE) and the OPTION command are executed 625 s after they are received.



4.6.2 Monitor Data Input Timing

The monitor, I/O, and status data is the data 625 s before the response is sent.



4.7 Operation Sequence

This section describes outline of the operation sequence. Refer to *4.3 Main Commands* and *4.4 Subcommands* for details of command functions and settings.

4.7.1 Operation Sequence for Managing Parameters Using a Controller

The following describes the operation sequence for managing parameters using a controller. The controller manages the necessary parameters, and transfers them when the power is turned ON. With this operation sequence, the settings can be managed by the controller even when the SERVOPACK is replaced.

Table 4.4 Operation Sequence for Managing Parameters Using a Controller

Procedure	Item	Command	Description	Phase
1	Turn ON control and main circuit power supplies.	NOP/DISCONNECT*	Turn ON power supplies.	1
2	Establish connection.	CONNECT	Establish communications. Start the WDT count.	2 or 3
3	Check information such as device ID.	ID_RD	Read information such as device type.	2 or 3
4	Set device.	PRM_WR	Set the necessary parameters such as offline parameters.	2 or 3
5	Set up device.	CONFIG	Enable the parameter settings.	2 or 3
6	Turn ON encoder.	SENS_ON	Turn ON encoder and obtain the position data.	2 or 3
7	Operate main circuit.	SV_ON	Turn ON servomotor.	2 or 3
8	Start operation. . . .	 . . .	Start operation. . . .	2 or 3
9	Turn OFF main circuit.	SV_OFF	Turn OFF servomotor.	2 or 3
10	Disconnect connection.	DISCONNECT	Disconnect communications.	4 to 1
11	Turn OFF control and main circuit power supplies.	–	Turn OFF power supplies.	5

* If communication disconnects normally, the NOP command is sent. If communication does not disconnect normally, the DISCONNECT command is sent for two or more communications cycles prior to connection, then the CONNECT command is sent.

4.7.2 Operation Sequence for Managing Parameters Using SERVOPACK

The following describes the operation sequence for managing parameters using the non-volatile memory of the SERVOPACK.

As described below, divide the operation into two steps.

Step 1: Saving parameters (during set-up)

Step 2: Ordinary operation sequence

Table 4.5 Step 1: Saving Parameters (During Set-up)

Procedure	Item	Command	Description	Phase
1	Turn ON control power supply.	NOP/DISCONNECT*1	Turn ON power supply.	1
3	Establish connection.	CONNECT	Establish communications. Start the WDT count.	2 or 3
4	Check information such as device ID.	ID_RD	Read information such as device type.	2 or 3
5	Set device.	PPRM_WR*2	Set the necessary parameters such as offline parameters to non-volatile memory.	2 or 3
6	Disconnect connection.	DISCONNECT	Disconnect communications.	4 to 1
7	Turn OFF control power supply.	–	Turn OFF power supply.	5

* 1. If communication disconnects normally, the NOP command is sent. If communication does not disconnect normally, the DISCONNECT command is sent for two or more communications cycles prior to connection, then the CONNECT command is sent.
* 2. Do not use PRM_WR.

Table 4.6 Step 2: Ordinary Operation Sequence

Proce-dure	Item	Command	Description	Phase
1	Turn ON control and main circuit power supplies.	NOP/DISONNECT*	Turn ON power supplies.	1
2	Establish connection.	CONNECT	Establish communications. Start the WDT count.	2 or 3
3	Check information such as device ID.	ID_RD	Read information such as device type.	2 or 3
4	Turn ON encoder.	SENS_ON	Turn ON encoder and obtain the position data.	2 or 3
5	Operate main circuit.	SV_ON	Change to Servo ON.	2 or 3
6	Start operation. . . .	. . .	Start operation. . . .	2 or 3
7	Turn OFF main circuit.	SV_OFF	Change to Servo OFF.	2 or 3
8	Disconnect connection.	DISCONNECT	Disconnect communications.	4 to 1
9	Turn OFF control and main circuit power supplies.	–	Turn OFF power supplies.	5

* If communication disconnects normally, the NOP command is sent. If communication does not disconnect normally, the DISCONNECT command is sent for two or more communications cycles prior to connection, then the CONNECT command is sent.

4.7.3 Operation Sequence When Being Servo ON

Motor control using a host controller is performed using motion commands only while the SERVOPACK is Servo ON (while current flows to the motor). While the SERVOPACK is Servo OFF (while current to the motor is interrupted), control is performed by the SERVOPACK so that the reference coordinate system (POS, MPOS) and FB coordinate system (APOS) are equal. In order to send appropriate motion commands, it is necessary to use the SMON command after the SERVOPACK changes to Servo ON to read the Servo reference coordinate (POS) and send an appropriate reference position.

4.7.4 Operation Sequence When OT (Overtravel Limit Switch) Signal Is Input

When the OT signal is input, the SERVOPACK prohibits rotation in the OT signal direction. This is performed as specified in parameter Pn001, and the SERVOPACK continues to control the motor while this rotation is prohibited. Use the following sequence for processing or canceling when the OT signal is input.

■ Processing When the OT Signal Is Input

1. To monitor the OT signal and align it with the present movement reference direction, send a stop command. Use either of the following stop commands.
   - Interpolation command (INTERPOLATE, LATCH):
     The interpolation command updates the interpolation position, then stops. As an alternative, send the HOLD command or SMON command.
   - Movement reference command other than the interpolation command:
     Send the HOLD command.
2. Use the output complete flag (DEN = 1) to confirm the completion of SERVOPACK OT processing. By also confirming that PSET = 1, it is possible to detect motor stopping with absolute certainty. The command used in number 1 above is held until these flags are complete.

■ OT Cancellation (Retraction)

OT cancellation (retraction) is performed with a movement command. When retracting with an interpolation command such as INTERPOLATE, read the present reference position (POS) and interpolate the starting position. This process is not necessary when retracting is done using a command other than an interpolation command.

5

Trial Operation

This chapter describes the procedure for trial operation of the NS115.

5.1 Check Items before Trial Operation

Conduct trial operation after wiring has been completed.

Inspect and check the following items when performing trial operation, and be sure to conduct trial operation safely.

5.1.1 Servomotors

Inspect the following items before conducting trial operation. Also conduct the inspections according to *Chapter 10 Inspection, Maintenance, and Troubleshooting* in the Σ-*II Series SGM□H/SGDH User's Manual (SIEPS80000005)* if conducting trial operation on servomotors that have been stored for a long period of time.

- Connection to machines or devices, wiring and grounding are correct.
- Are bolts and nuts securely tightened?
- Is the oil seal undamaged and oiled?

Take appropriate actions immediately if one of the items above is incorrect.

5.1.2 SERVOPACKs

Inspect the following items before conducting trial operation.

- Parameters are properly set for the applicable servomotor and specifications.
- Terminal connections and wiring leads are tightened securely and connectors are inserted securely.
- The power supply turns OFF if a servo alarm occurs.
- The power supplied to the SERVOPACK is the correct voltage.
- The NS115 is installed correctly.

Take appropriate actions immediately if an alarm occurs or one of the items above is incorrect.

5.2 Trial Operation for MECHATROLINK-II Communications

This section describes the trial operation procedure for MECHATROLINK-II communications.

5.2.1 Preparations for Trial Operation

IMPORTANT

To prevent accidents, initially conduct trial operation with no load connected to the servomotor. Before starting operation with a connected load, make sure emergency-stop procedures are in place.

Prepare for operation using the following procedure.

1. Check that wiring has been performed correctly and then connect the signals (CN1 connector).
2. Turn ON the power.

   If power is being supplied correctly, the CHARGE or POWER indicator on the SERVOPACK and the R indicator on the NS115 will light.

   If the R indicator on the NS115 does not light, check to make sure the switches on the NS115 (SW1 and SW2) are set correctly and then turn the power OFF then ON again. For information on switch settings, refer to *4.2 Switches for MECHATROLINK-II Communications Settings*.
3. Send the CONNECT (start connection) command to start communications.
   The status of the SERVOPACK can be checked using the SMON (Status Monitoring) command. The response data from the SERVOPACK will be alarm code 99 (normal).
4. Confirm the model number using the ID_RD (Read ID) command.

   "SGDH-***E" will be returned from the SERVOPACK.

   Alternatively, for the NS115, "JUSP-NS115" will be returned.
5. Write the parameters necessary for trial operation using the PRM_WR (Write Parameter) command.

   Refer to *5.4.1 Minimum Parameters and Input Signals*, for information on the necessary preparations.
6. Execute the SV_ON (Servo ON) command. The power circuit in the SERVOPACK will be activated and the servomotor will be ready to operate. At this point, SVON = 1 (base block currently being released) in STATUS will be returned.

5.2.2 Operating the Servomotor

Only the main circuit can be operated while the base block is being released. Run the servomotor at low speed.

■ Command Transmission Example

POSING (rapid traverse positioning) command

Option = 0

Positioning setting = 10000 (current position +10000 with absolute encoders)

Rapid traverse speed = 400

Make sure the servomotor is operating in the proper direction according to the reference.

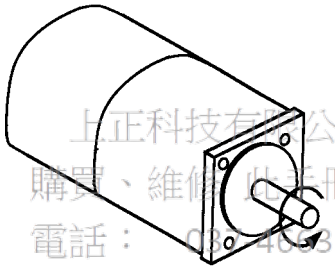


Fig. 5.1 Motor Forward Rotation

If the reference and rotational direction do not match, refer to *5.4.1 Minimum Parameters and Input Signals* and set correctly.

5.3 Trial Operation Inspection

Inspect the following items during the trial operation.

- Unusual vibration
- Abnormal noise
- Excessive temperature rise

Take actions according to *Chapter 9 Troubleshooting* if an alarm occurs. Also note that the servomotor may overload during the trial operation if the load system is not suitably broken in.

5.4 Supplementary Information on Trial Operation

5.4.1 Minimum Parameters and Input Signals

This section describes the minimum parameters and input signals required for trial operation.

■ Parameters

Turn OFF power once after changing any parameter. The change will be valid when power is turned ON again.

Pn202	Electronic Gear Ratio (Numerator)	See *6.3.2*
Pn203	Electronic Gear Ratio (Denominator)	See *6.3.2*

Changing Servomotor Rotation Direction

Use the following parameter to reverse the direction of rotation.

Pn000.0	Function Selection Basic Switches: Direction Selection	See *6.2.1*

■ Input Signals

Refer to the relevant page for details on each input signal.

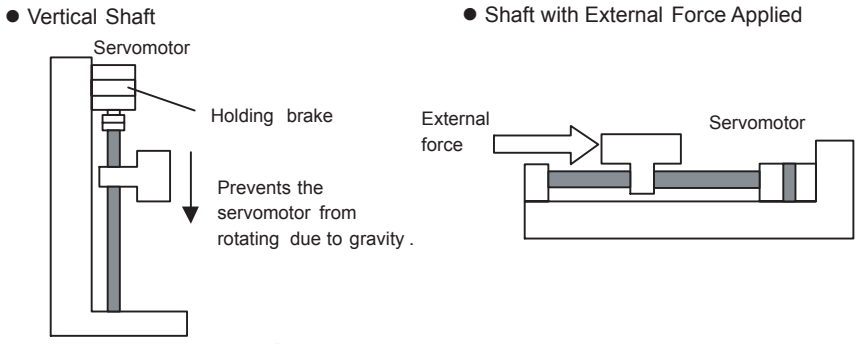
Input signal selection settings through parameters can be used to eliminate the need for external short circuits.

Signal Name		Pin Number	Description
P-OT	Forward run prohibited	CN1-42	The Overtravel Limit Switch Refer to 6.2.2.
N-OT	Reverse run prohibited	CN1-43	

5.4.2 Servomotors with Brakes

Use servomotors with brakes for vertical shaft applications or when external force is applied to the shaft to prevent the shaft from rotating due to gravity or external force when power is lost.

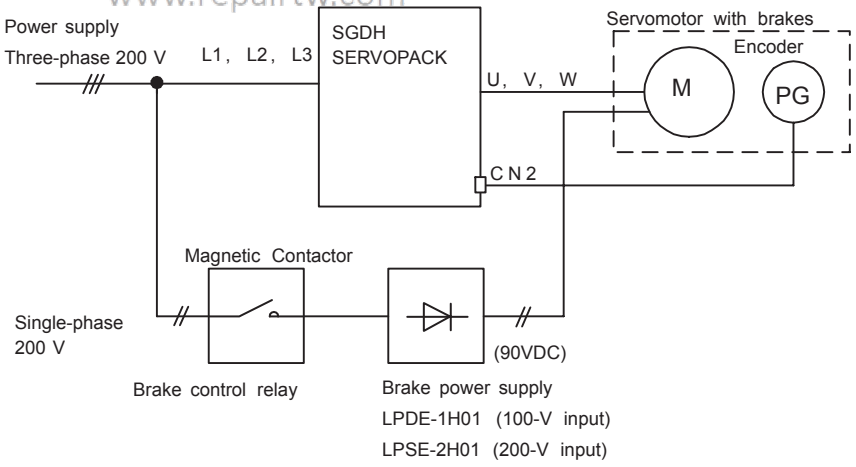
The SERVOPACK uses the brake interlock output (/BK) signal to control holding brake operation when using servomotors with brakes.



IMPORTANT

To prevent faulty operation due to gravity or external force, make sure that the servomotor and holding brake operate normally with the servomotor disconnected from the machine. When both of them operate normally, connect the servomotor to the machine to start trial operation.

The following figure shows wiring for a servomotor with brakes. Refer to *6.5.2 Using the Holding Brake* for details on wiring.



6

Parameter Setting and Functions

This chapter describes the procedure for setting and applying parameters.

■ Before Reading this Chapter

This chapter describes the use of each CN1 I/O signal for the SGDH SERVOPACK with the NS115. It also describes the procedure for setting the related parameters for the intended purposes.

The following sections can be used as references for this chapter.

- CN1 I/O signal list: Refer to *3.3.3 I/O Signal Names and Functions*.
- CN1 I/O signal terminal layout: *3.3.2 I/O Signals Connector (CN1) Terminal Layout*.
- Parameter list: Refer to *Appendix B List of Parameters*.

The CN1 connector is used to exchange signals with external circuits.

■ Parameter Configurations

Parameters are comprised of the types shown in the following table. Refer to *Appendix B List of Parameters*.

Type	Parameter No.	Description
Function Selection Parameters	Pn000 to Pn005	Select basic and application functions such as the type of function or the stop mode used when an alarm occurs.
Servo Gain and Other Parameters	Pn100 to Pn123	Set numerical values such as speed and position loop gains.
Position Parameters	Pn200 to Pn208, Pn804 to Pn808	Set position parameters such as the reference pulse input form and electric gear ratio.
Speed Parameters	Pn300 to Pn308	Set speed parameters such as speed reference input gain and soft start acceleration/deceleration time.
Torque Parameters	Pn400 to Pn409	Set torque parameters such as the torque reference input gain and forward/reverse torque limits.
Acceleration/Deceleration Parameters	Pn80A to Pn812	Set acceleration/deceleration parameters, such as selecting an acceleration/deceleration filter.
Sequence Parameters	Pn500 to Pn512, Pn801 to Pn803	Set output conditions for all sequence signals and changes I/O signal selections and allocations.
Motion Parameters	Pn814 to Pn819	Set motion parameters, such as the zero point return direction.
MECHATROLINK-II Parameters	Pn800 to Pn802, Pn813, Pn816	Set parameters for MECHATROLINK-II communications settings.
Others	Pn600 to Pn601	Specify the capacity for an external regenerative resistor and reserved parameters.
Auxiliary Function Execution	Fn000 to Fn013	Execute auxiliary functions such as JOG Mode operation.
Monitor Modes	Un000 to Un00D	Enable speed and torque reference monitoring, as well as monitoring to check whether I/O signals are ON or OFF.

6.1 Parameter Limits and Standard Settings with NS115

This section explains the limits for parameters and I/O signals standard settings with the NS115 mounted.

6.1.1 Parameter Limits

When an NS115 is mounted on a SGDH SERVOPACK and it is used for MECHATROLINK-II communications, the following parameters are automatically set. The following parameters will be treated as “reserved for system use,” so do not change them.

Table 6.1 List of Parameters for System Use with the NS115

Pn No.	Digit	Parameter Name	Set Value	Contents
Pn004	–	Reserved	0100H	–
Pn200	2	Clear signal status	1	Error counter is not cleared.
Pn207	1	Position control option	1	Uses V-REF as a speed feed-foward input
Pn50A	0	Input signal allocation mode	1	User set
	1	/S-ON signal mapping	8	Not used
	2	/P-CON signal mapping	8	Not used
Pn50B	1	/ALM-RST signal mapping	8	Not used
Pn50C	–	Select input signal 3	8888	Not used
Pn50D	–	Select input signal 4	8888	Not used

INFO

These parameters are set automatically the first time the power to the SERVOPACK is turned ON after the NS115 has been mounted. Startup will take approximately 6 seconds when these parameters are being set.

6.1.2 Standard Settings for CN1 I/O Signals

The standards settings for CN1 I/O signals when the NS115 is mounted are described below. The parameters can be set as described for standard applications.

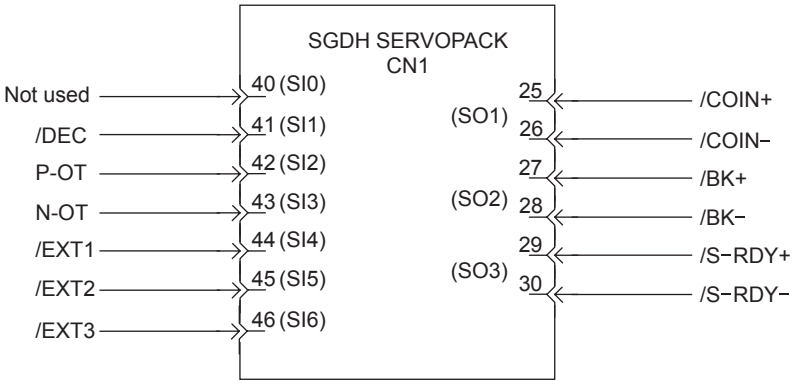


Fig. 6.1 Standard CN1 I/O Signal Settings

Table 6.2 Factory Settings and Standard Settings for CN1 I/O Signals

Pn No.	Description	Factory Setting	Standard Setting
Pn50A	Input signal selections 1	2881	2881
Pn50B	Input signal selections 2	6583	8883
Pn511	Input signal selections 3	8888	6541
Pn50E	Output signal selections 1	3211	3001
Pn50F	Output signal selections 2	0000	0200
Pn510	Output signal selections 3	0000	0000

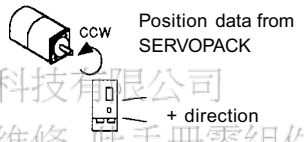
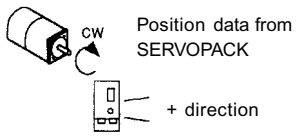
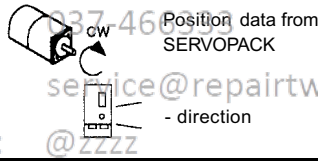
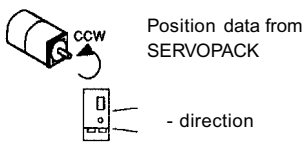
6.2 Settings According to Machine Characteristics

This section describes the procedure for setting parameters according to the dimensions and performance of the machine used.

6.2.1 Switching Servomotor Rotation Direction

The SERVOPACK has a Reverse Rotation Mode that reverses the direction of servomotor rotation without rewiring. Forward rotation in the standard setting is defined as counterclockwise as viewed from the load.

With the Reverse Rotation Mode, the direction of servomotor rotation can be reversed without changing other items. The direction (+, -) of shaft motion is reversed.

	Standard Setting	Reverse Rotation Mode
Forward Reference		
Reverse Reference		

■ Setting Reverse Rotation Mode

Use parameter Pn000.0.

Pn000.0	Direction Selection	Factory Setting: 0	Position Control

Use the following settings to select the direction of servomotor rotation.

Setting	Description	
0	Forward rotation is defined as counterclockwise (CCW) rotation as viewed from the load.	(Standard setting)
1	Forward rotation is defined as clockwise (CW) rotation as viewed from the load.	(Reverse Rotation Mode)

6.2.2 Setting the Overtravel Limit Function

The overtravel limit function forces movable machine parts to stop if they exceed the allowable range of motion.

IMPORTANT

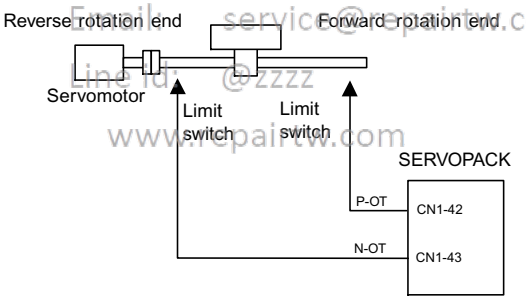
The forward/reverse run prohibited function uses software to stop the SERVOPACK. This method may not satisfy the standards, depending on the safety specifications for the application. If necessary, add an external safety circuit.

■ Using the Overtravel Function

To use the overtravel function, connect the overtravel limit switch input signal terminals shown below to the correct pins of the SERVOPACK CN1 connector.

→ Input P-OT CN1-42	Forward Run Prohibited (Forward Overtravel)	Position Control
→ Input N-OT CN1-43	Reverse Run Prohibited (Reverse Overtravel)	Position Control

Connect limit switches as shown below to prevent damage to the machines during linear motion.



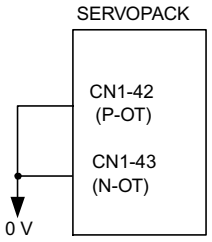
Drive status with an input signal ON or OFF is shown in the following table.

P-OT	CN1-42 at low level when ON	Forward rotation allowed. Normal operation status.
	CN1-42 at high level when OFF	Forward run prohibited (reverse rotation allowed).
N-OT	CN1-43 at low level when ON	Reverse rotation allowed. Normal operation status.
	CN1-43 at high level when OFF	Reverse run prohibited (forward rotation allowed).

■ Enabling/Disabling Input Signals

Set the following parameters to specify whether input signals are used for overtravel or not. The factory setting is “used.”

Pn50A.3	P-OT Signal Mapping (Forward Run Prohibited Input Signal)	Factory Setting: 2	Position Control
Pn50B.0	N-OT Signal Mapping (Reverse Run Prohibited Input Signal)	Factory Setting: 3	Position Control



The short-circuit wiring shown in the figure can be omitted when P-OT and N-OT are not used.

Pn No.	Setting	Description
Pn50A.3	2 (Factory setting)	Uses the P-OT input signal for prohibiting forward rotation. (Forward rotation is prohibited when CN1-42 is open and is allowed when CN1-42 is at 0 V.)
	8	Does not use the P-OT input signal for prohibiting forward rotation. (Forward rotation is always allowed and has the same effect as shorting CN1-42 to 0 V.)
Pn50B.0	3 (Factory setting)	Uses the N-OT input signal for prohibiting reverse rotation. (Reverse rotation is prohibited when CN1-43 is open and is allowed when CN1-43 is at 0 V.)
	8	Does not use the N-OT input signal for prohibiting reverse rotation. (Reverse rotation is always allowed and has the same effect as shorting CN1-43 to 0 V.)

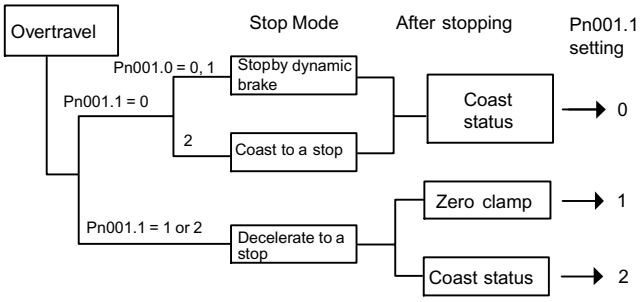
■ Servomotor Stop Mode for P-OT and N-OT Input Signals

Set the following parameters to specify the servomotor Stop Mode when P-OT and N-OT input signals are used.

Specify the servomotor Stop Mode when either of the following signals is input during servomotor operation.

- Forward run prohibited input (P-OT, CN1-42)
- Reverse run prohibited input (N-OT, CN1-43)

Pn001.1	Overtravel Stop Mode	Factory Setting: 0	Position Control

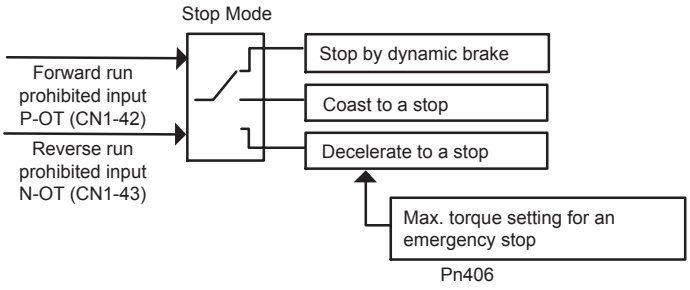


Pn No.	Setting	Description
Pn001.1	0	Stops the servomotor the same way as changing to Servo OFF (according to Pn001.0).
	1	Decelerates the servomotor to a stop at the preset torque value or less, and then locks the servomotor in Zero Clamp Mode. Torque setting: Pn406 emergency stop torque
	2	Decelerates the servomotor to a stop at the preset torque value or less, and puts the servomotor in coast status. Torque setting: Pn406 emergency stop torque

Pn406 specifies the stop torque applied for overtravel when the input signal for prohibiting forward or reverse rotation is used.

The torque limit is specified as a percentage of rated torque.

Pn406	Emergency Stop Torque	Unit: %	Setting Range: 0 to Max. Torque	Factory Setting: 800	Valid when Pn001.1 is 1 or 2



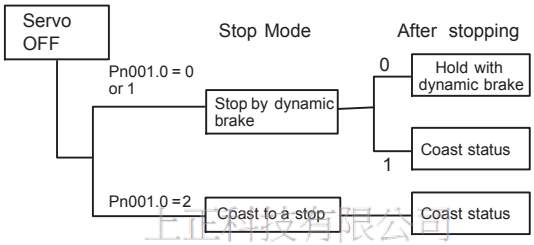
■ Servo OFF Stop Mode Selection

The SGDH SERVOPACK turns OFF under the following conditions:

- The SV_OFF command is transmitted.
- Servo alarm occurs.
- Power is turned OFF.

Specify the Stop Mode if any of these occurs during servomotor operation.

Pn001.0	Servo OFF or Alarm Stop Mode	Factory Setting: 0



The dynamic brake electrically applies a brake by using a resistor to consume servomotor rotation energy.

Refer to *6.5.1 Using the Dynamic Brake.*

Pn No.	Setting	Description
Pn001.0	0 (Factory setting)	Uses the dynamic brake to stop the servomotor, and maintains dynamic brake status after stopping.
	1	Uses the dynamic brake to stop the servomotor, and cancels dynamic brake status after stopping to go into coast status.
	2	Coasts the servomotor to a stop. The servomotor is turned OFF and stops due to machine friction.

Note: If the servomotor is stopped or rotating at extremely low speed when the Pn001.0 is set to 0 (dynamic brake status after stopping with the dynamic brake), then braking power is not generated and the servomotor will stop the same as in coast status.

6.2.3 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.

■ Software Limit Function

The software limits can be enabled or disabled.

The software limit function parameter is used to enable the software limit function.

The software limits 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.

The software limits are also enabled after the SENS_ON command is executed for an absolute encoder.

Pn801.0	Software Limit Function	Factory Setting: 0	Position Control

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

Pn801.0 Setting	Meaning
0 (Factory setting)	Software limits enabled.
1	Forward software limit disabled.
2	Reverse software limit disabled.
3	Both software limits disabled.

■ 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.

Pn801.2	Software Limit Check using References	Factory Setting: 0	Position Control

Pn801.2 Setting	Meaning
0 (Factory setting)	No software limit check using references.
1	Software limit check using references.

■ Software Limit Setting

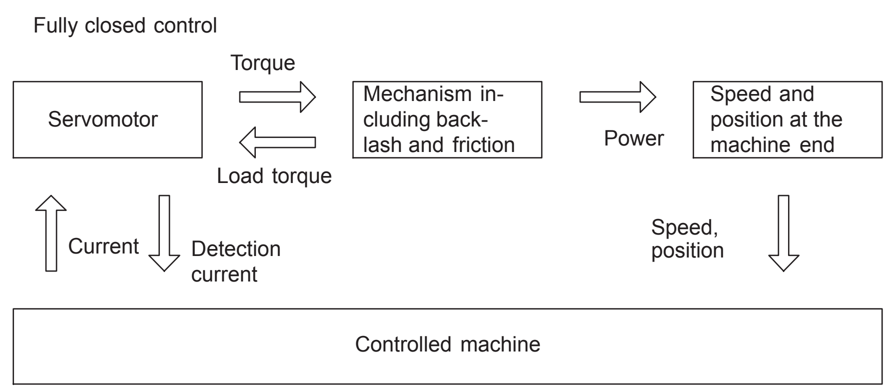
Set software limits in the positive and negative directions.

Pn804	Forward Software Limit	Unit: Reference Unit	Setting Range: -1073741823 to 1073741823	Factory Setting: 81911808	Position Control
Pn806	Reverse Software Limit	Unit: Reference Unit	Setting Range: -1073741823 to 1073741823	Factory Setting: -81911808	Position Control

The negative limit must be less than the positive limit.

6.2.4 Fully Closed Control

A fully closed loop can be formed using the parameter settings on the SGDH SERVOPACK. In previous SERVOPACKs, a semi-closed method was used to control the motor, but with this function even more precise control is achieved because control involves the detection of the position and speed of actual machine operation.



Parameters must be set when using fully closed control. Refer to *6.2.6 Parameter Settings* for details.

6.2.5 Fully Closed System Specifications

This section describes the fully closed system specifications of the SGDH SERVOPACK when an NS115 is mounted.

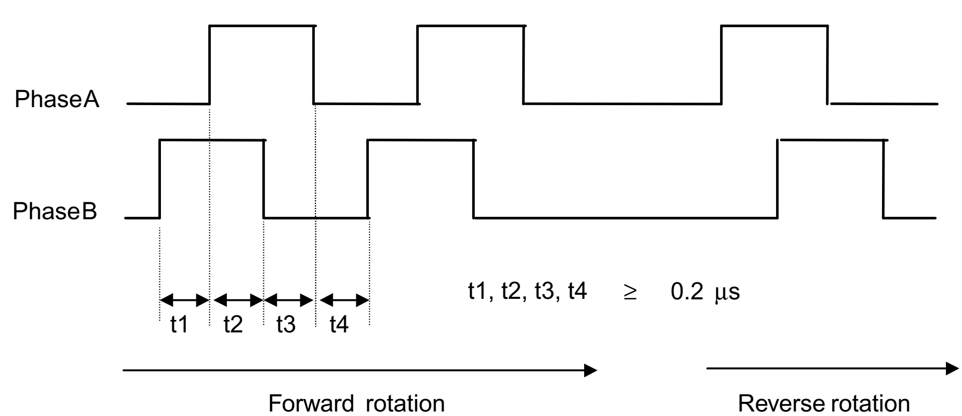
■ Fully Closed Encoder Pulse Output Form

5-V Differential line driver output (complies with EIA Standard RS-422A)

■ Fully Closed Encoder Pulse Signal Form

90° Phase difference 2-phase differential pulse: phase A, phase B

Maximum receivable frequency for SERVOPACK: 1 Mbps



6.2.6 Parameter Settings

This section describes the parameters that must be set when using an NS115.

■ Overflow Level

For information on parameter contents, refer to *9.3.3 Position Loop Gain* of the Σ-*II Series SGM□H/SGDH User's Manual (SIEPS80000005)*. The factory setting is made to minimize the chance of the motor going out of control due to wiring errors or other causes. After performing a trial operation at a low speed, change the setting to a higher value if necessary.

■ Fully Closed Encoder

Set the method for using the fully closed encoder.

Pn002.3	Fully Closed Encoder Usage Method	Factory Setting: 0	Position Control

The setting details are as follows:

Pn No.	Setting	Meaning
Pn002.3	0 (Factory setting)	Fully closed encoder is not used.
	1	Fully closed encoder is used without phase C.
	2	Fully closed encoder is used with phase C.
	3	Fully closed encoder is used in Reverse Rotation Mode without phase C.
	4	Fully closed encoder is used in Reverse Rotation Mode with phase C.

Normal operation with semi-closed control can be performed when Pn002.3 is set to 0.

When changes have been made to this parameter, turn OFF the power once. The set value will become effective when the power is turned ON again.

■ Number of Fully Closed Encoder Pulses

Set the number of fully closed encoder pulses for each motor rotation.

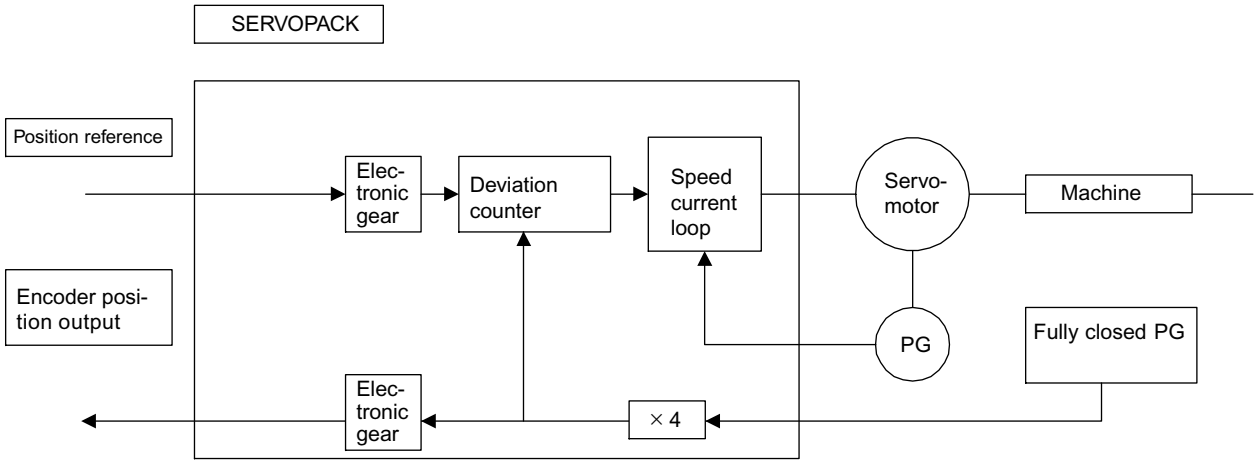
Set the number of pulses with a multiplication factor of 1.

Pn206	Number of Fully Closed Encoder Pulses	Unit: P/R	Setting Range: 513 to 32768	Factory Setting: 16384	Position Control

When changes have been made to this parameter, turn OFF the power once. The set value will become effective when the power is turned ON again.

■ Electronic Gears

For information on the parameters, refer to *6.3.2 Electronic Gear Function*.



■ Reverse Rotation Settings

The settings shown in the following table must be made in order to use the Reverse Rotation Mode.

If this settings are not correct, improper axis control may lead to motor overrun. Confirm the operation carefully.

Direction of Motor as Viewed from Load for Forward Rotation	Relation between Fully Closed PG during Forward Rotation Input Phase	Pn000.0 Setting	Pn002.3 Setting	Relation Between Fully Closed PG during CCW Rotation as Viewed from Motor load Input Phase
CCW direction*1	Figure 6.2	0	1, 2	Figure 6.2
	Figure 6.3		3, 4	Figure 6.3
CW direction*2	Figure 6.2	1	1, 2	Figure 6.3
	Figure 6.3		3, 4	Figure 6.2

* 1. This setting is for when Reverse Rotation Mode is not being used.
* 2. This setting is for when Reverse Rotation Mode is being used.

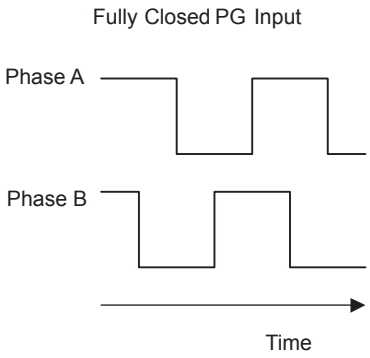


Fig. 6.2

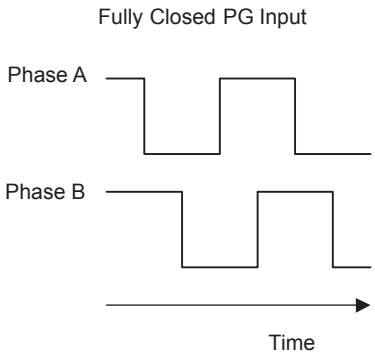


Fig. 6.3

Pn000.0 can be used to change the rotational direction for forward rotation during normal operation. If the motor runs out of control, change Pn002.3.

6.3 Settings According to Host Controller

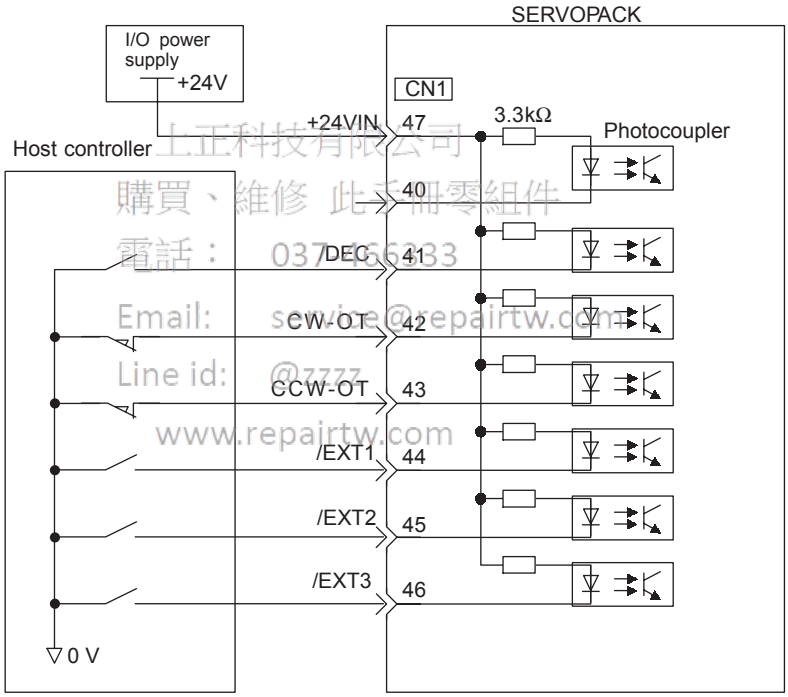
This section describes the procedure for connecting a Σ-II Series Servo to a host controller, including the procedure for setting related parameters.

6.3.1 Sequence I/O Signals

Sequence I/O signals are used to control SERVOPACK operation. Connect these signal terminals as required.

■ Input Signal Connections

Connect the sequence input signals as shown below. (Standard settings)



IMPORTANT

Provide an external input power supply; the SERVOPACK does not have an internal 24-V power supply.

- External power supply specifications for sequence input signal: 24 ± 1 VDC, 50 mA min.

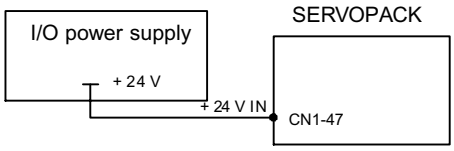
Yaskawa recommends using the same external power supply as that used for output circuits. The allowable voltage range for the 24-V sequence input circuit power supply is 11 to 25 V. Although a 12-V power supply can be used, contact faults can easily occur for relays and other mechanical contacts under low currents. Confirm the characteristics of relays and other mechanical contacts before using a 12-V power supply.

The function allocation for sequence input signal circuits can be changed.

Refer to *6.4.2 Input Circuit Signal Allocation* for more details.

→ Input +24VIN CN1-47	External I/O Power Supply Input	Position Control

The external power supply input terminal is common to sequence input signals.

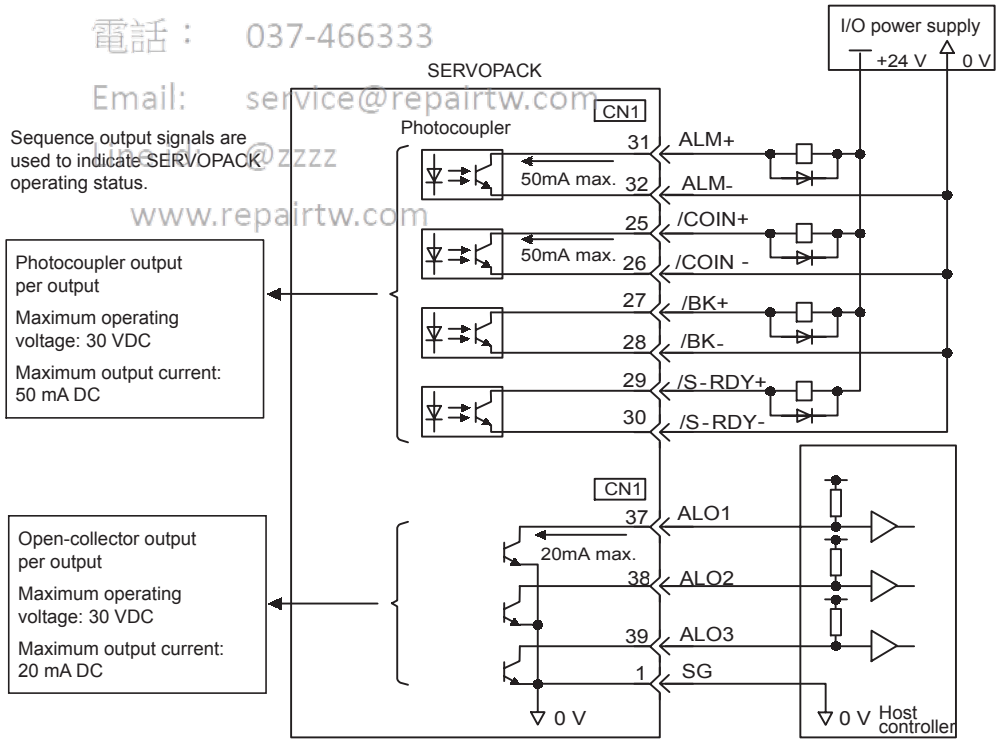


Connect an external I/O power supply.

Contact input signals: /DEC (CN1-41)
P-OT (CN1-42)
N-OT (CN1-43)
/EXT1 (CN1-44)
/EXT2 (CN1-45)
/EXT3 (CN1-46)

■ Output Signal Connections

Connect the sequence output signals as shown in the following figure. (Standard settings)



IMPORTANT

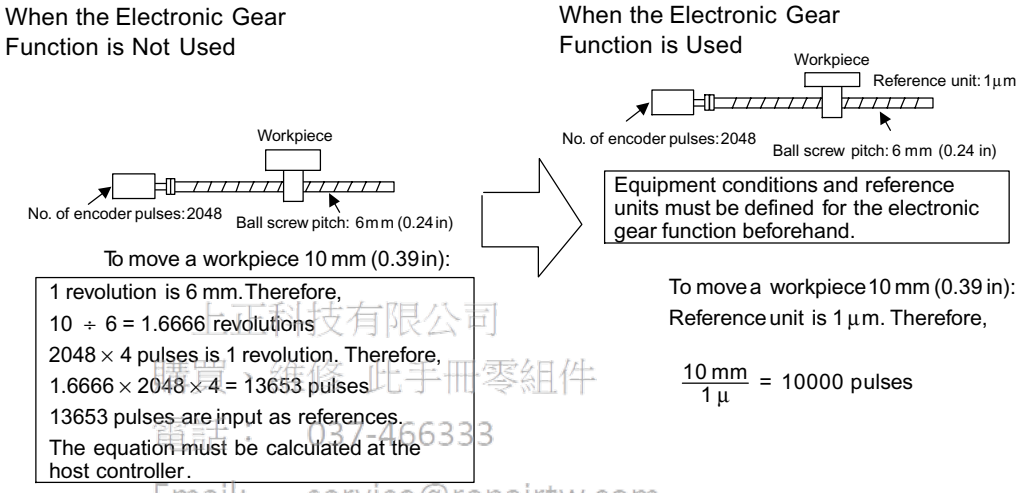
Provide a separate external I/O power supply; the SERVOPACK does not have an internal 24-V power supply. Yaskawa recommends using the same type of external power supply as that used for input circuits.

Function allocation for some sequence output signal circuits can be changed.

Refer to *6.4.3 Output Circuit Signal Allocation* for more details.

6.3.2 Electronic Gear Function

The electronic gear function enables the servomotor travel distance per input reference pulse to be set to any value. It allows the host controller generating pulses to be used for control without having to consider the machine deceleration ratio or the number of encoder pulses.



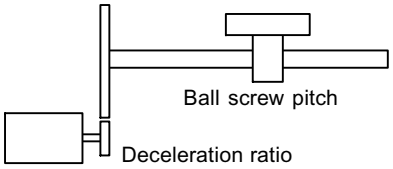
■ Setting the Electronic Gear

Calculate the electronic gear ratio (B/A) using the following procedure, and set the values in parameters Pn202 and 203.

1. Check machine specifications.

   Items related to the electronic gear:

   - Deceleration ratio
   - Ball screw pitch
   - Pulley diameter

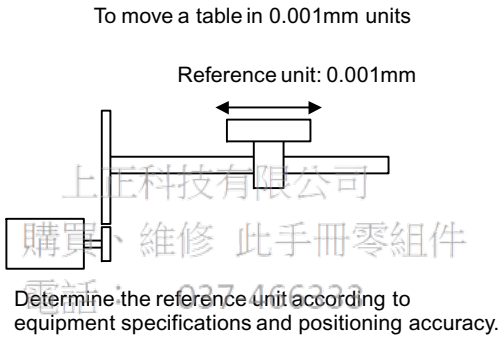


2. Check the number of encoder pulses for the SGM□H servomotor.

Servomotor Model and Encoder Specifications	Encoder Type	Number of Encoder Pulses Per Revolution (P/R)	
A	Incremental encoder	13 bits	2048
B		16 bits	16384
C		17 bits	32768
1	Absolute encoder	16 bits	16384
2		17 bits	32768

3. Determine the reference unit used.

   A reference unit is the minimum position data unit used to move a load. (Minimum unit of reference from the host controller.)



◀ EXAMPLE ▶

- 0.01 mm (0.0004 in), 0.001 mm (0.00004 in), 0.1°, 0.01 inch.
  A reference unit of one pulse moves the load by one reference unit.
- When the reference unit is 1 µm
  If a reference of 50000 units is input, the load moves 50 mm (1.97 in) (50000 x 1µm).

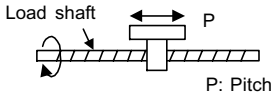
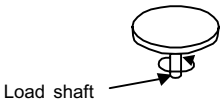
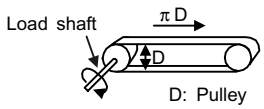
4. Determine the load travel distance per load shaft revolution in reference units.

$$\text{Travel distance per load shaft revolution (reference unit)} = \frac{\text{Travel distance per load shaft revolution}}{\text{Reference unit}}$$

◀ EXAMPLE ▶

- When the ball screw pitch is 5 mm (0.20 in) and the reference unit is 0.001 mm (0.00004 in)

$$\frac{5}{0.001} = 5000 \text{ (reference unit)}$$

Ball Screw	Circular Table	Belt and Pulley
 1 revolution = $\frac{P}{\text{reference unit}}$	 1 revolution = $\frac{360^\circ}{\text{reference unit}}$	 1 revolution = $\frac{\pi D}{\text{reference unit}}$

5. Electronic gear ratio is given as $\left(\frac{B}{A}\right)$.

   If the decelerator ratio of the motor and the load shaft is given as $\frac{n}{m}$
   where m is the rotation of the motor and n is the rotation of the load shaft,

$$\text{Electronic gear ratio}\left(\frac{B}{A}\right) = \frac{\text{No. of encoder pulses} \times 4}{\text{Travel distance per load shaft revolution (reference unit)}} \times \frac{m}{n}$$

IMPORTANT

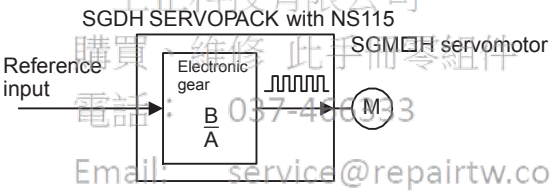
Make sure the electronic gear ratio satisfies the following condition:

$$0.01 \leq \text{Electronic gear ratio}\left(\frac{B}{A}\right) \leq 100$$

The SERVOPACK will not work properly if the electronic gear ratio is outside this range. In this case, modify the load configuration or reference unit.

6. Set the parameters.

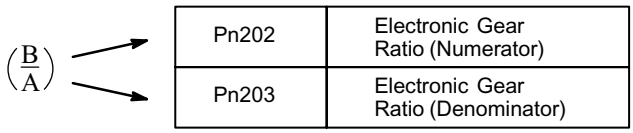
   Set the electronic gear ratio according to machine specifications.



$$\text{Electronic gear ratio}\left(\frac{B}{A}\right) = \frac{Pn202}{Pn203}$$

- B = [(Number of encoder pulses) × 4] × [motor speed]
- A = [Reference units (travel distance per load shaft revolution)] × [load shaft revolution speed]

Reduce the electronic gear ratio $\left(\frac{B}{A}\right)$ to the lower terms so that both A and B are integers smaller than 65535, then set A and B in the respective parameters.



That is all that is required to set the electronic gear ratio.

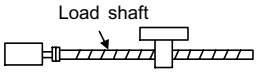
Pn202	Electronic Gear Ratio (Numerator)	Unit: None	Setting Range: 1 to 65535	Factory Setting: 4	Position Control
Pn203	Electronic Gear Ratio (Denominator)	Unit: None	Setting Range: 1 to 65535	Factory Setting: 1	Position Control

■ Electronic Gear Setting Examples

The following examples show electronic gear settings for different load mechanisms.

Ball Screws

Reference unit: 0.001 mm (0.00004 in)



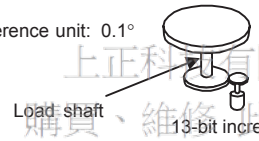
$$\text{Travel distance per load shaft revolution} = \frac{6\,\text{mm}}{0.001\,\text{mm}} = 6000$$

$$\text{Electronic gear ratio}\left(\frac{B}{A}\right) = \frac{2048 \times 4 \times 1}{6000 \times 1} = \frac{Pn202}{Pn203}$$

Preset Values	Pn202	8192
	Pn203	6000

Circular Tables

Reference unit: 0.1°



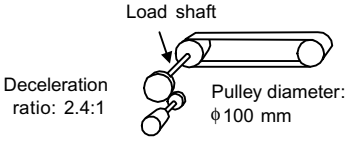
$$\text{Travel distance per load shaft revolution} = \frac{360°}{0.1°} = 3600$$

$$\text{Electonic gear ratio}\left(\frac{B}{A}\right) = \frac{2048 \times 4 \times 3}{3600 \times 1} = \frac{Pn202}{Pn203}$$

Preset Values	Pn202	24576
	Pn203	3600

Belts and Pulleys

Reference unit: 0.0254 mm (0.0010 in)



Set a PG dividing ratio equivalent to 1024 P/R for the absolute encoder.

$$\text{Travel distance per load shaft revolution} = \frac{3.14 \times 100\,\text{mm}}{0.0254\,\text{mm}} = 12362$$

$$\text{Electronic gear ratio}\left(\frac{B}{A}\right) = \frac{1024 \times 4 \times 2.4}{12362 \times 1} = \frac{Pn202}{Pn203}$$

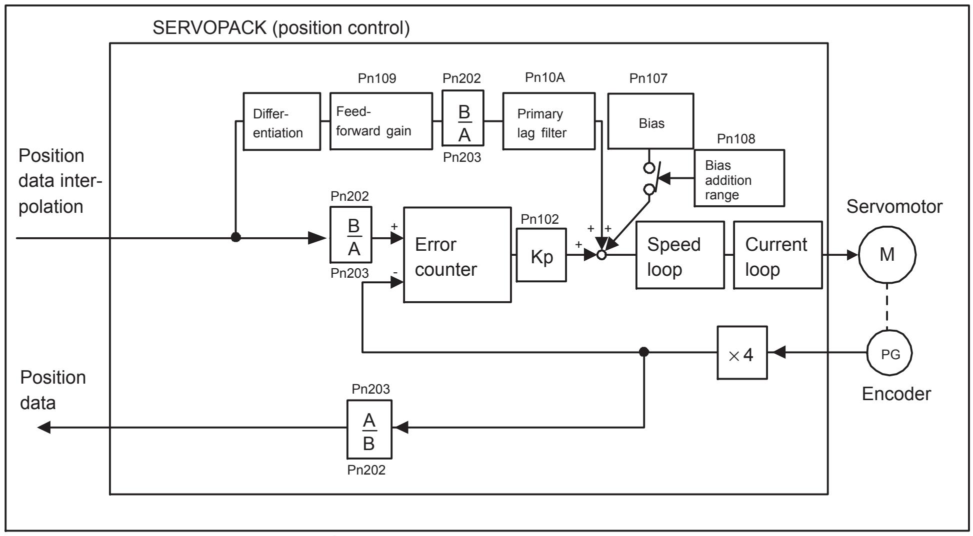
$$= \frac{9830.4}{12362} = \frac{49152}{61810}$$

Preset Values	Pn202	49152
	Pn203	61810

6

■ Control Block Diagram

The following diagram illustrates a control block for position control.



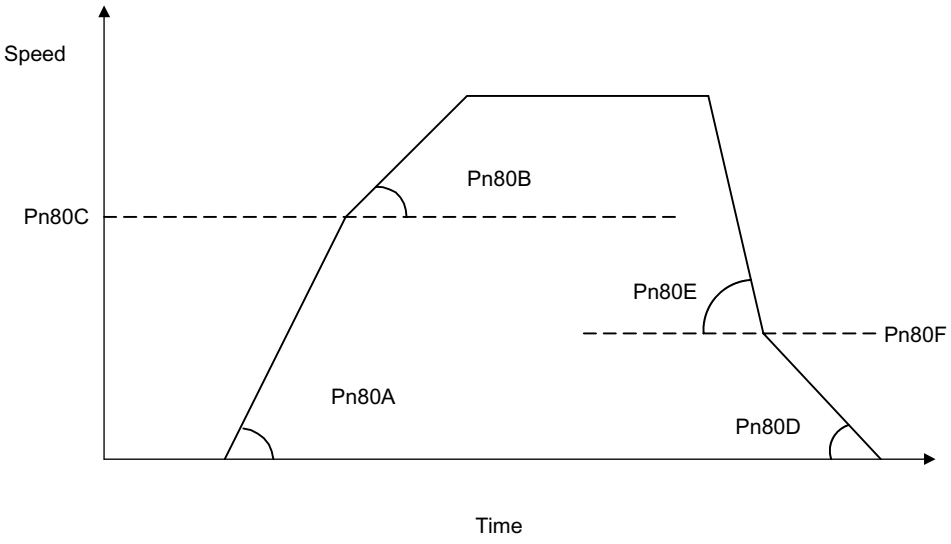
6.3.3 Acceleration/Deceleration Function

Acceleration and deceleration can be performed by setting the following parameters.

Use only after you have fully understood the meaning of each parameter. Settings are changed using MECHATROLINK-II communications.

Related parameters

Type	Pn No.	Outline
Acceleration/deceleration	Pn80A	First-step linear acceleration parameter
	Pn80B	Second-step linear acceleration parameter
	Pn80C	Acceleration switching speed
	Pn80D	First-step linear deceleration parameter
	Pn80E	Second-step linear deceleration parameter
	Pn80F	Deceleration switching speed
Position reference filter	Pn810	Exponential position reference filter bias
	Pn811	Exponential position reference filter time constant
	Pn812	Movement average time of movement average position reference filter



■ First-step Linear Acceleration Parameter

Set the first-step linear acceleration when 2-step acceleration is used.

Pn80A	First-step Linear Acceleration Parameter	Unit: 10,000 reference units/s^2	Setting Range: 1 to 65535	Factory Setting: 100	Position Control

■ Second-step Linear Acceleration Parameter

Set the second-step linear acceleration.

Pn80B	Second-step Linear Acceleration Parameter	Unit: 10,000 reference units/s^2	Setting Range: 1 to 65535	Factory Setting: 100	Position Control

■ Acceleration Switching Speed

Set the speed for switching between first-step and second-step acceleration when 2-step acceleration is used. When 2-step acceleration is not used, set the acceleration switching speed (Pn80C) to 0.

Pn80C	Acceleration switching speed	Unit: 100 reference units/s	Setting Range: 0 to 65535	Factory Setting: 0	Position Control

■ First-step Linear Deceleration Parameter

Set the first-step linear deceleration when 2-step deceleration is used.

Pn80D	First-step Linear Deceleration Parameter	Unit: 10,000 reference units/s^2	Setting Range: 1 to 65535	Factory Setting: 100	Position Control

■ Second-step Linear Deceleration Parameter

Set the second-step deceleration.

Pn80E	Second-step Linear Deceleration Parameter	Unit: 10,000 reference units/s^2	Setting Range: 1 to 65535	Factory Setting: 100	Position Control

■ Deceleration Switching Speed

Set the speed for switching between first-step and second-step deceleration when 2-step deceleration is used. When 2-step deceleration is not used, set the deceleration switching speed (Pn80F) to 0.

Pn80F	Deceleration Switching Speed	Unit: 100 reference units/s	Setting Range: 0 to 65535	Factory Setting: 0	Position Control

■ Exponential Position Reference Filter Bias

Set the bias speed when using exponential position reference filter as position reference filter.

Pn810	Exponential Position Reference Filter Bias	Unit: Reference unit/s	Setting Range: 0 to 32767	Factory Setting: 0	Position Control

■ Exponential Position Reference Filter Time Constant

Set the time constant when using exponential position reference filter as position reference filter.

Pn811	Exponential Position Reference Filter Time Constant	Unit: 0.1 ms	Setting Range: 0 to 5100	Factory Setting: 0	Position Control

■ Movement Average Time of Movement Average Position Reference Filter

Set the movement average time when using movement average position reference filter as position reference filter.

Pn812	Movement Average Time of Movement Average Position Reference Filter	Unit: 0.1 ms	Setting Range: 0 to 5100	Factory Setting: 0	Position Control

6.3.4 Positioning Function

Motion settings are performed using the following parameters.

Set them according to the machine system.

■ Positioning Completed Width

Set the width for positioning completed (PSET) in STATUS. When output has been completed (DEN = 1) and the position is within the positioning completed width of the target position (TPOS), PSET will be set to 1.

Pn500	Positioning Completed Width	Unit: Reference unit	Setting Range: 0 to 250	Factory Setting: 7	Position Control

INFO

This parameter is usually used to set the COIN output signal width, but can also be used as the MECHATROLINK-II PSET width in STATUS. The COIN output signal width will also be changed.

■ Positioning Proximity Width

Set the width for positioning proximity (NEAR) in STATUS. Regardless of whether or not output has been completed (DEN = 1), when the position is within the positioning proximity width of the target position, NEAR will be set to 1.

Pn504	Positioning Proximity Width (NEAR signal width)	Unit: Reference unit	Setting Range: 0 to 250	Factory Setting: 7	Position Control

INFO

This parameter is usually used to set NEAR output signal width, but can also be used as the MECHATROLINK-II NEAR width in STATUS. The NEAR output signal width will also be changed.

6.3.5 Zero Point Return

■ Zero Point Width

Set the zero point position detection (ZPOINT) width.

Pn803	Zero Point Width	Unit: Reference unit	Setting Range: 0 to 65535	Factory Setting: 10	Position Control

■ Final Travel Distance for External Positioning

Set the distance to move after the external signal input when external positioning is used. When the direction is negative or the distance very short, a deceleration stop will be performed and the movement begins again in the reverse direction.

Pn814	Final Travel Distance for External Positioning	Unit: Reference unit	Setting Range: -1073741823 to 1073741823	Factory Setting: 100	Position Control

■ Zero point Return Direction

Set the zero point return direction. Set to 0 to return in the forward direction and set to 1 to return in the reverse direction.

Pn816.0	Zero point Return Direction	Factory Setting: 0	Position Control

The setting details are as show below.

Pn816.0 Setting	Meaning
0	Forward direction
1	Reverse direction

■ Zero point Return Approach Speed 1

Set the speed for searching for the zero point after the deceleration limit switch signal turns ON for zero point returns.

Pn817	Zero point Return Approach Speed 1	Unit: 100 reference units/s	Setting Range: 0 to 65535	Factory Setting: 50	Position Control

■ Zero Point Return Approach Speed 2

Set the speed for searching for the zero point after the deceleration limit switch signal turns ON or OFF for zero point returns.

Pn818	Zero point Return Approach Speed 2	Unit: 100 reference units/s	Setting Range: 0 to 65535	Factory Setting: 5	Position Control

■ Final Travel Distance to Return to Zero Point

Set the distance from the encoder zero point (phase C) to the zero point for zero point returns. When the direction is negative or the distance very short, a deceleration stop will be performed and the movement begins again in the reverse direction.

Pn819	Final Travel Distance to Return to Zero Point	Unit: Reference unit	Setting Range: -1073741823 to 1073741823	Factory Setting: 100	Position Control

6.3.6 Backlash Compensation Function

Set the backlash compensation amount to perform backlash compensation.

Pn81B	Backlash Compensation Amount	Unit: 0.1 reference unit	Setting Range: -32768 to 32767	Factory Setting: 0	Position Control

Pn81D.0	Backlash Compensation Direction	Factory Setting: 0	Position Control

The setting details are as follows:

Pn81D.0 Setting	Meaning
0	Forward direction
1	Reverse direction

The setting unit is 0.1 [reference unit], and the resolution is 1 [pulse].

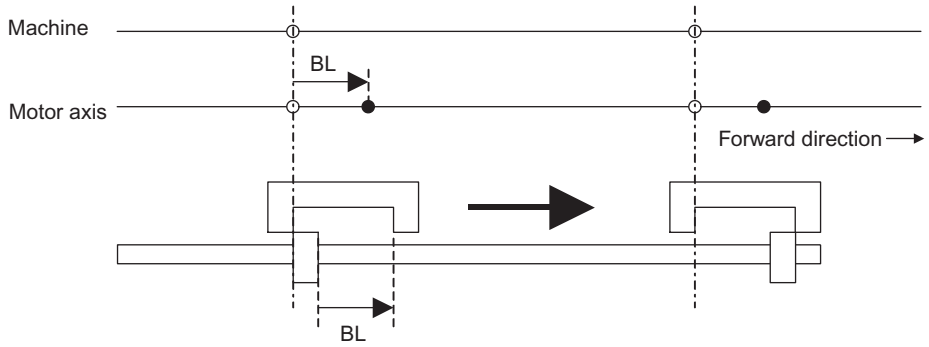
The direction of the backlash compensation is determined by the backlash compensation direction (Pn81D.0) setting.

The backlash compensation is performed according to the motion data. (The backlash compensation is not available after the SERVOPACK is Servo ON.)

The backlash compensation is not available during Servo OFF state or overtravel state.

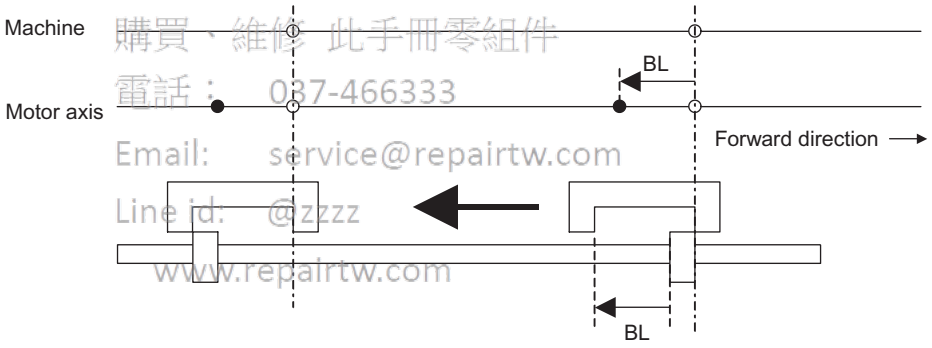
When Pn81D.0 is set to 0

The compensation is performed for the compensation amount (the value set to Pn81B) in the forward direction.



When Pn81D.0 is set to 1

The compensation is performed for the compensation amount (the value set to Pn81B) in the reverse direction.

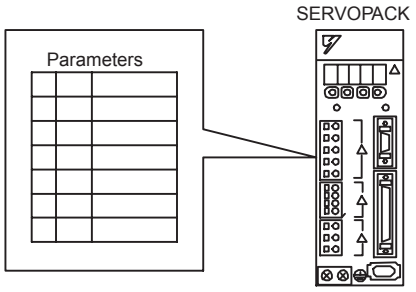


6.4 Setting Up the SERVOPACK

This section describes the procedure for setting parameters to operate the SERVOPACK.

6.4.1 Parameters

The Σ-II Series SERVOPACK provides many functions and has parameters called parameters that allow the user to specify functions and perform fine adjustments.



A Panel Operator, Digital Operator, or MECHATROLINK-II commands are used to set parameters.

Parameters are divided into the following three groups.

Parameter	Function
Pn000 to Pn819	Specify SERVOPACK functions, set servo gains, etc.
Fn000 to Fn013	Execute auxiliary functions such as JOG Mode operations and zero-point searches.
Un000 to Un00D	Enable monitoring the motor speed and torque reference on the panel display.

Refer to *Appendix B List of Parameters*.

6.4.2 Input Circuit Signal Allocation

The functions allocated to sequence input signal circuits can be changed. CN1 connector input signals are allocated with the factory settings as shown in the following table.

In general, allocate signals according to the standard settings in the following table.

CN1 Connector Terminal Numbers	Input Terminal Name	Factory Setting		Standard Setting	
		Symbol	Name	Symbol	Name
40	SI0	–	–	–	–
41	SI1	–	–	/DEC	Zero point return deceleration LS
42	SI2	P-OT	Forward run prohibited	P-OT	Forward run prohibited
43	SI3	N-OT	Reverse run prohibited	N-OT	Reverse run prohibited
44	SI4	–	–	/EXT1	External latch signal 1
45	SI5	/P-CL	Forward run external torque control	/EXT2	External latch signal 2
46	SI6	/N-CL	Reverse run external torque control	/EXT3	External latch signal 3

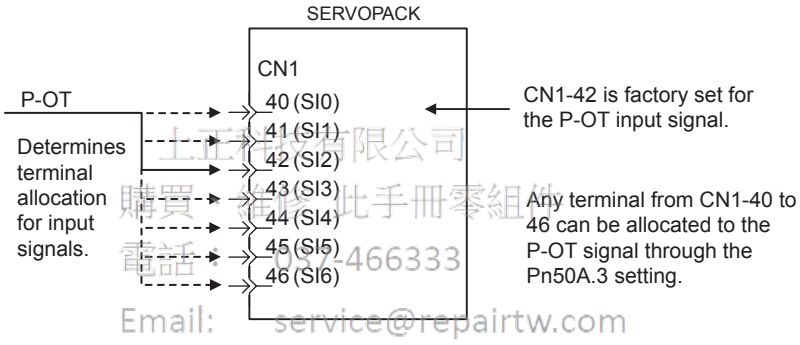
The following parameter is used to enable input signal allocations. Usually this parameter is set to 1. Do not change this setting.

Pn50A.0	Input Signal Allocation Mode	Factory Setting: 1	Position Control

Pn50A.0 Setting	Meaning
0	Reserved
1	Enables any sequence input signal settings.

■ Input Signal Allocation

The following signals can be allocated.



The following table shows the parameter factory settings for input signal selections 1 to 5.

Pn50A	Input Signal Selections 1	Factory Setting: 2881	Standard Setting: 2881
Pn50B	Input Signal Selections 2	Factory Setting: 6583	Standard Setting: 8883
Pn511	Input Signal Selections 5	Factory Setting: 8888	Standard Setting: 6541

Select the input terminal on the CN1 connector that will be used for each input signal.

- Examples of Input Signal Allocation

The procedure used to allocate sequence input signals is described using the P-OT (forward run prohibited) signal as a typical example.

Pn50A.3 Setting	Description	Remarks
0	Inputs the P-OT signal from the SI0 (CN1-40) input terminal.	Signal Polarity Reverse function: Not active Example: Forward run prohibited signal (P-OT) is valid when high (OFF).
1	Inputs the P-OT signal from the SI1 (CN1-41) input terminal.	
2	Inputs the P-OT signal from the SI2 (CN1-42) input terminal.	
3	Inputs the P-OT signal from the SI3 (CN1-43) input terminal.	
4	Inputs the P-OT signal from the SI4 (CN1-44) input terminal.	
5	Inputs the P-OT signal from the SI5 (CN1-45) input terminal.	
6	Inputs the P-OT signal from the SI6 (CN1-46) input terminal.	
7	Sets P-OT signal so that it is always valid.	Set the forward run prohibited signal (P-OT) so that it is always valid or always invalid.
8	Sets P-OT signal so that it is always invalid.	
9	Inputs the P-OT signal from the SI0 (CN1-40) input terminal.	Signal Polarity Reverse function: Active* Example: Forward run prohibited signal (P-OT) is valid when low (ON).
A	Inputs the P-OT signal from the SI1 (CN1-41) input terminal.	
B	Inputs the P-OT signal from the SI2 (CN1-42) input terminal.	
C	Inputs the P-OT signal from the SI3 (CN1-43) input terminal.	
D	Inputs the P-OT signal from the SI4 (CN1-44) input terminal.	
E	Inputs the P-OT signal from the SI5 (CN1-45) input terminal.	
F	Inputs the P-OT signal from the SI6 (CN1-46) input terminal.	

* Settings 9 through F can be used to reverse signal polarity.

IMPORTANT

If reverse polarity is set for the Forward Run Prohibited or Reverse Run Prohibited signals, safe operation may not occur when troubles, such as broken signal lines, occur. You must confirm operational safety if setting reverse polarity is necessary for one or more of these signals.

As shown in the table above, the P-OT signal can be allocated to any input terminal from SI0 to SI6. When Pn50A.3 is set to 1, the signal input to the CN1-41 terminal will be the P-OT signal.

The P-OT signal is not used when Pn50A.3 is set to 8. This setting is used in the following instances.

- When the signal input to the CN1-42 terminal is to be replaced by another input signal.
- When the forward run prohibited (P-OT) input signal is not effective temporarily during trial or normal operation.
- When the forward run prohibited status is not required in the system configuration.

INFO

- The forward run prohibited (P-OT) and the reverse run prohibited (N-OT) input signals are valid when OFF (high level). The input terminals must therefore be wired so that these signals remain ON (low level) in systems where they are not required. The need to wire these terminals can be eliminated by setting the Pn50A.3 to 8.
- Signals are input with OR logic when multiple signals are allocated to the same input circuit.

- Allocating Other Input Signals

  Input signal allocation can be changed as shown below.

Input Signal		Parameter		Description
Name	Applicable Logic	Number	Setting	
Forward Run Prohibited (P-OT)	OFF (high level)	Pn50A.3	0	Inputs the signal on the left from SI0 (CN1-40).
			1	Inputs the signal on the left from SI1 (CN1-41).
			2	Inputs the signal on the left from SI2 (CN1-42).
			3	Inputs the signal on the left from SI3 (CN1-43).
			4	Inputs the signal on the left from SI4 (CN1-44).
			5	Inputs the signal on the left from SI5 (CN1-45).
			6	Inputs the signal on the left from SI6 (CN1-46).
			7	Sets the signal on the left to always enabled.
			8	Sets the signal on the left to always disabled.
			9	Inputs the reverse of the signal on the left from SI0 (CN1-40).
			A	Inputs the reverse of the signal on the left from SI1 (CN1-41).
			B	Inputs the reverse of the signal on the left from SI2 (CN1-42).
			C	Inputs the reverse of the signal on the left from SI3 (CN1-43).
			D	Inputs the reverse of the signal on the left from SI4 (CN1-44).
			E	Inputs the reverse of the signal on the left from SI5 (CN1-45).
			F	Inputs the reverse of the signal on the left from SI6 (CN1-46).
Reverse Run Prohibited (N-OT)	OFF (high level)	Pn50B.0	0 to F	Same as above.
Forward Current Limit (/P-CL)	ON (low level)	Pn50B.1	0 to F	Same as above.
Reverse Current Limit (/N-CL)	ON (low level)	Pn50B.2	0 to F	Same as above.
Zero point Return Deceleration LS (/DEC)	ON (low level)	Pn511.0	0 to F	Same as above.

(cont'd)

Input Signal		Parameter		Description
Name	Applicable Logic	Number	Setting	
External Latch Signal 1 (/EXT1)	ON (low level)	Pn511.1	0 to 3	Sets the signal on the left to always disabled.
			4	Inputs the signal on the left from SI4 (CN1-44).
			5	Inputs the signal on the left from SI5 (CN1-45).
			6	Inputs the signal on the left from SI6 (CN1-46).
			7	Sets the signal on the left to always enabled.
			8	Sets the signal on the left to always disabled.
			D	Inputs the reverse of the signal on the left from SI4 (CN1-44).
			E	Inputs the reverse of the signal on the left from SI5 (CN1-45).
			F	Inputs the reverse of the signal on the left from SI6 (CN1-46).
			9 to F	Sets the signal on the left to always disabled.
External Latch Signal 2 (/EXT2)	ON (low level)	Pn511.2	0 to F	Same as above.
External Latch Signal 3 (/EXT3)	ON (low level)	Pn511.3	0 to F	Same as above.

6.4.3 Output Circuit Signal Allocation

Output signal functions can be allocated to the sequence signal output circuits shown below.

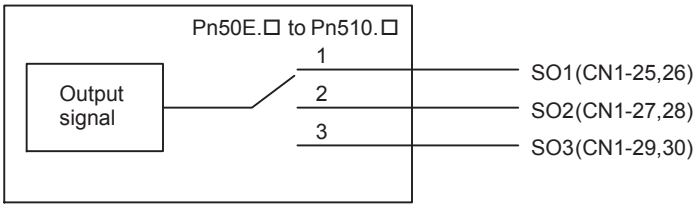
In general, allocate signals according to the standard settings in the following table.

CN1 Connector Terminal Numbers	Output Terminal Name	Factory Setting		Standard Setting	
		Symbol	Name	Symbol	Name
25	SO1	/COIN+	Positioning completed	/COIN+	Positioning completed
26		/COIN-		/COIN-	
27	SO2	/TGON+	Rotation detection	/BK+	Brake interlock
28		/TGON-		/BK-	
29	SO3	/S-RDY+	Servo ready	/S-RDY+	Servo ready
30		/S-RDY-		/S-RDY-	

The output signal selection parameters and their factory settings and standard settings are shown below.

Pn50E	Output Signal Selections 1	Factory Setting: 3211	Standard Setting: 3001
Pn50F	Output Signal Selections 2	Factory Setting: 0000	Standard Setting: 0200
Pn510	Output Signal Selections 3	Factory Setting: 0000	Standard Setting: 0000

Select the CN1 connector terminals that will output the signals.



Output Signal	Parameter		Description
	Number	Setting	
Positioning Completed (/COIN)	Pn50E.0	0	Disabled (Not used for the output signal on the left.)
		1	Outputs the signal on the left from the SO1 (CN1-25 and 26) output terminal.
		2	Outputs the signal on the left from the SO2 (CN1-27 and 28) output terminal.
		3	Outputs the signal on the left from the SO3 (CN1-29 and 30) output terminal.
Speed Coincidence Detection (/V-CMP)	Pn50E.1	0 to 3	Same as above*
Rotation Detection (/TGON)	Pn50E.2	0 to 3	Same as above
Servo Ready (/S-RDY)	Pn50E.3	0 to 3	Same as above
Torque Limit Detection (/CLT)	Pn50F.0	0 to 3	Same as above
Speed Limit Detection (/VLT)	Pn50F.1	0 to 3	Same as above
Brake Interlock (/BK)	Pn50F.2	0 to 3	Same as above
Warning (/WARN)	Pn50F.3	0 to 3	Same as above
Near (/NEAR)	Pn510.0	0 to 3	Same as above
Phase C Detection (/C-PULS)	Pn510.1	0 to 3	Same as above

* Always OFF when an NS115 is mounted.

Note: "Same as above" means output signals are disabled or allocated to output terminals SO1 to SO3 through parameter settings 0 to 3.

INFO

Signals are output with OR logic when multiple signals are allocated to the same output circuit. Signals that are not detected are invalid.

■ Output Signal Reversal

The following parameter can be used to reverse the signals output on output terminals SO1 to SO3.

Pn512	Output Signal Reversal Settings	Factory Setting: 0000	Position Control

The settings specify which of the connector CN1 output signals are to be reversed.

Output Terminals	Parameter		Description
	Number	Setting	
SO1 (CN1-25, 26)	Pn512.0	0	Output signal not reversed.
		1	Output signal reversed.
SO2 (CN1-27, 28)	Pn512.1	0	Output signal not reversed.
		1	Output signal reversed.
SO3 (CN1-29, 30)	Pn512.2	0	Output signal not reversed.
		1	Output signal reversed.
Not used.	Pn512.3	–	–

6.4.4 Monitoring

The monitoring function allows various data to be monitored using the MECHATRONLINK-II communications monitoring function.

■ Option Monitor

Using the MECHATROLINK-II option monitor (OMN1, OMN2), all signals not covered by MECHATROLINK-II can be monitored.

Use the following parameter settings.

Pn813.0	Option Monitor 1	Factory Setting: 0	Position Control
Pn813.1	Option Monitor 2	Factory Setting: 1	Position Control

Settings are as shown in the following table.

Pn813.0, Pn813.1 Settings	Description
0	According to Analog Monitor 1 (Pn003.0).
1	According to Analog Monitor 2 (Pn003.1).
2	Monitors initial multiturn data.
3	Monitors the encoder count value.

■ Analog Monitor

Analog monitor and option monitor (OMN1, OMN2) can be changed with parameters Pn003.0 and Pn003.1.

Pn003.0	Analog Monitor 1	Factory Setting: 2	Position Control
Pn003.1	Analog Monitor 2	Factory Setting: 0	Position Control

The option monitor (OMN1, OMN2) and analog monitor (CN5) signals that can be observed are shown in the following table, along with the monitor signal, unit, and gain.

Settings in Pn003.0 and Pn003.1	Monitor Signal	Analog Monitor Gain (CN5)	Unit of Option Monitor (OMN1, OMN2)
0	Motor speed	1 V/1000 min^{-1}	min^{-1}
1	Speed reference	1 V/1000 min^{-1}	min^{-1}
2	Torque reference	1 V/100% rated torque	%
3	Position error	0.05 V/1 pulse	Pulse
4	Position error	0.05 V/100 pulses	Pulse
5	Reference pulse frequency (converted to motor speed)	1 V/1000 min^{-1}	min^{-1}
6	Motor speed	1 V/250 min^{-1}	min^{-1}
7	Motor speed	1 V/125 min^{-1}	min^{-1}
8 to F	Reserved monitor signals	–	–

INFO

Refer to *9.5 Analog Monitor* of the Σ-*II Series SGM□H/SGDH User's Manual (SIEPS80000005)* for information on the analog monitor.

6.5 Setting Stop Functions

This section describes the procedure used to stop the SERVOPACK stably.

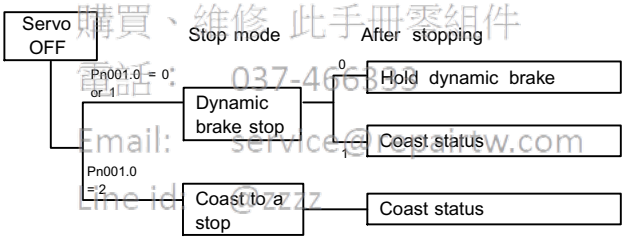
6.5.1 Using the Dynamic Brake

To stop the servomotor by applying the dynamic brake (DB)[1] when the SERVOPACK is Servo OFF, set the desired mode in the following parameter. The servomotor will stop due to machine friction if the dynamic brake is not applied.

Pn001.0	Servo OFF or Alarm Stop Mode	Factory Setting: 0	Position Control

The SERVOPACK turns OFF under the following conditions:

- When the SV_OFF command is transmitted.
- A servo alarm occurs.
- Power is turned OFF.



Specify the Stop Mode during Servo OFF using the following parameter.

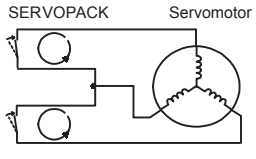
Pn001.0 Setting	Description
0	Uses the dynamic brake to stop the servomotor. Maintains dynamic brake after the servomotor stops. *1
1	Uses the dynamic brake to stop the servomotor. Releases dynamic brake after the servomotor stops, and the servomotor coasts to a stop.
2	Coasts the servomotor to a stop. *2 The servomotor is turned OFF and motion stops due to machine friction.

* 1. If the servomotor is stopped or moving at extremely low speed, the dynamic brake will not have sufficient braking power.
* 2. A dynamic brake is used when the control power are turned OFF.

TERMS

[1] Dynamic brake (DB)

The dynamic brake is a common way of suddenly stopping a servomotor. Built into the SERVOPACK, the dynamic brake suddenly stops a servomotor by electrically shorting its electrical circuit.

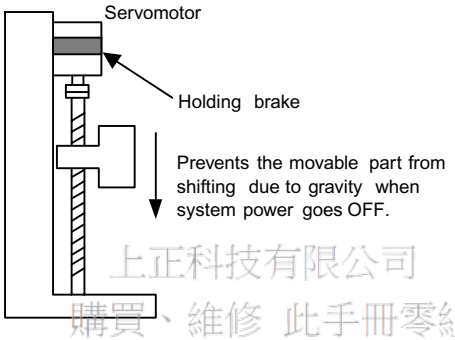


IMPORTANT

The dynamic brake is an emergency stop function. Do not repeatedly start and stop the servomotor using the SV_ON/SV_OFF command or by repeatedly turning power ON and OFF.

6.5.2 Using the Holding Brake

The holding brake is used when a servodrive controls a vertical axis. In other words, a servomotor with brake prevents the movable part from shifting due to gravity when system power goes OFF.

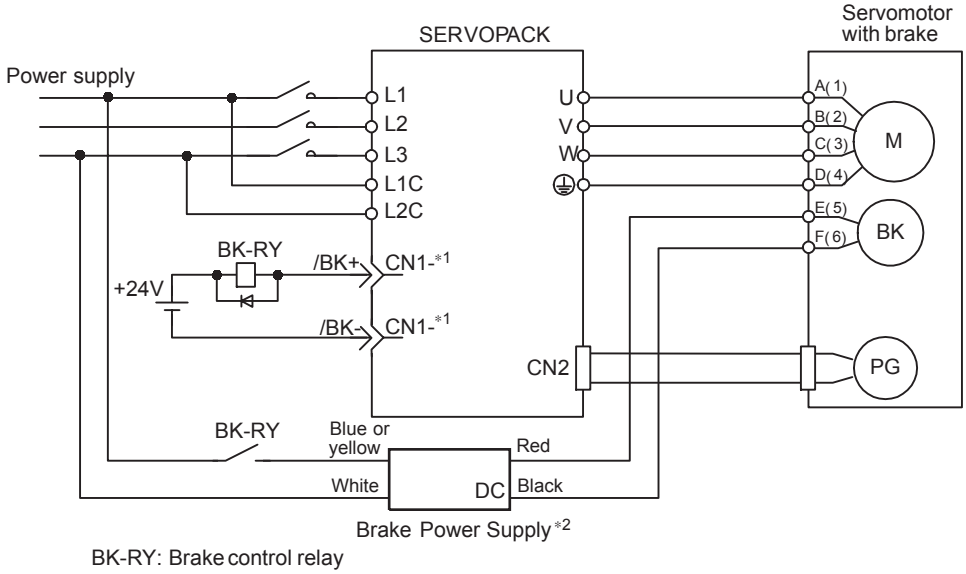


IMPORTANT

The brake built into the SGM□H servomotor with brakes is a de-energization brake, which is used only to hold and cannot be used for braking. Use the holding brake only to hold a stopped motor. Brake torque is at least 120% of the rated motor torque.

■ Wiring Example

Use the SERVOPACK sequence output signal /BK and the brake power supply to form a brake ON/OFF circuit. The following diagram shows a standard wiring example.



BK-RY: Brake control relay

* 1. The output terminal allocated with Pn50F.2
* 2. Brake power supplies are available in 200-V and 100-V models.

Output → /BK	Brake Interlock Output	Position Control

This output signal controls the brake when using a servomotor with a brake and does not have to be connected when using a servomotor without a brake.

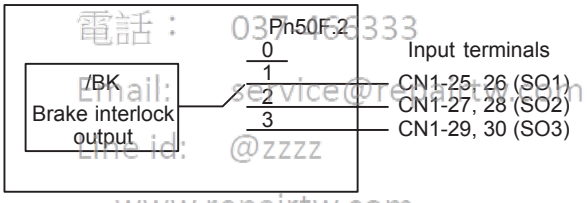
ON: Closed or low level	Releases the brake.
OFF: Open or high level	Applies the brake.

Related Parameters

Pn505	Brake operation
Pn506	Time Delay from Brake Reference until Servo OFF
Pn507	Speed Level for Brake Reference Output during Motor Operation
Pn508	Timing for Brake Reference Output during Motor Operation

The output signal in the following parameter must be selected when the /BK signal is used.

Pn50F	Output Signal Selections 2	Factory Setting: 0000	Position Control



Select the /BK output terminal.

Parameter	Setting	Output Terminal (CN1-)	
		*1	*2
Pn50F.2	0	–	–
	1	25	26
	2	27	28
	3	29	30

Note: Signals are output with OR logic when multiple signals are allocated to the same output circuit. Set other output signals to a value other than that allocated to the /BK signal in order to output the /BK signal alone. Refer to *6.4.3 Output Circuit Signal Allocation.*

■ Brake Operation

Set whether the brake is applied using the SERVOPACK parameter brake command or the controller's BRK_ON/BRK_OFF commands.

Pn005.0	Brake Operation	Factory Setting: 0	Position Control

Pn005.0 Setting	Description
0	Brake operation using the SERVOPACK parameter.
1	Brake operation using the controller's BRK_ON/BRK_OFF commands.

IMPORTANT

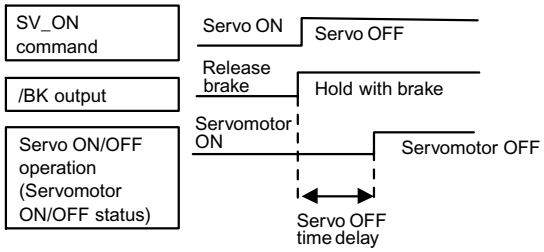
When brake operation is controlled using the controller's BRK_ON/BRK_OFF commands, the SERVOPACK's parameters (Pn506, Pn507, Pn508) settings will be ignored.

■ Brake ON Timing

If the machine moves slightly due to gravity when the brake is applied, set the following parameter to adjust brake ON timing.

Pn506	Brake Reference Servo OFF Delay Time	Unit: 10 ms	Setting Range: 0 to 50	Factory Setting: 0	Position Control

This parameter is used to set the output time from the brake control output signal /BK until the servo OFF operation (servomotor output stop) when a servomotor with a brake is used.



With the standard setting, the SERVOPACK changes to Servo OFF when the /BK signal (brake operation) is output. The machine may move slightly due to gravity depending on machine configuration and brake characteristics. If this happens, use this parameter to delay Servo OFF timing.

This setting sets the brake ON timing when the servomotor is stopped. Use Pn507 and Pn508 for brake ON timing during operation.

IMPORTANT

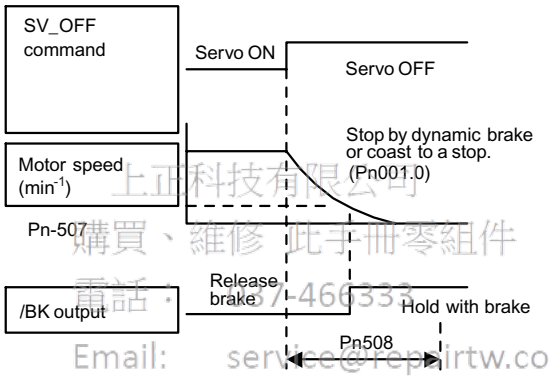
The servomotor will turn OFF immediately if an alarm occurs. The machine may move due to gravity in the time it takes for the brake to operate.

■ Holding Brake Setting

Set the following parameters to adjust brake ON timing so the holding brake is applied when the servomotor stops.

Pn507	Brake Reference Output Speed Level during Motor Operation	Unit: min^{-1}	Setting Range: 0 to 10000	Factory Setting: 100	Position Control
Pn508	Timing for Brake Reference Output during Motor Operation	Unit: 10 ms	Setting Range: 10 to 100	Factory Setting: 50	Position Control

Set the brake timing used when the Servo is turned OFF by the SV_OFF command or alarm occurrence during servomotor with brake operation.



Brake ON timing when the servomotor stops must be adjusted properly because servomotor brakes are designed as holding brakes. Adjust the parameter settings while observing machine operation.

/BK Signal Output Conditions During Servomotor Operation

The circuit is open under either of the following conditions:

1	Motor speed drops below the setting at Pn507 after Servo OFF.
2	The time set at Pn508 has elapsed since Servo OFF.

The actual setting will be the maximum speed even if Pn507 is set higher than the maximum speed.

6.6 Absolute Encoders

If a servomotor with an absolute encoder is used, a zero point setting when the machine setup is stored and normal operation can be performed without zero point return operation.

Motor SGM□H-□□□1□···With 16-bit absolute encoder
SGM□H-□□□2□···With 17-bit absolute encoder

6.6.1 Selecting an Absolute Encoder

Select the absolute encoder usage with the following parameter.

Pn002.2	Absolute Encoder Usage	Factory Setting: 0	Position Control

"0" in the following table must be set to enable the absolute encoder.

Pn002.2 Setting	Description
0	Use the absolute encoder as an absolute encoder.
1	Use the absolute encoder as an incremental encoder.

Note: This parameter setting goes into effect when the power is turned OFF and ON again after the change has been made.

6.6.2 Absolute Encoder Setup

Perform the setup operation for the absolute encoder in the following circumstances:

- When starting the machine for the first time.
- When an encoder backup alarm occurs.
- When the SERVOPACK's power supply is turned OFF and the encoder's cable is removed.

Perform the setup operation in one of the following ways.

- Refer to the Σ-*II Series SGM□H/SGDH User's Manual : Design and Maintenance (*SIE-S800-32.2*)* for details on the absolute encoder setup operation (Fn008) when a Digital Operator is used.
- Refer to *Appendix C.2 Absolute Encoder Setup (Initialization)* for details on the setup operation when the Adjusting command (ADJ: 3EH) is used.

INFO

The absolute encoder setup operation is only possible when the SERVOPACK is Servo OFF. After the setup processing is finished, turn the power back ON again.

IMPORTANT

If the following absolute encoder alarms are displayed, the alarms must be cleared using the method described above for the setup operation. They cannot be cleared by the SERVOPACK alarm clear (ALM-CLR) command.

- Encoder backup alarm (A.81)
- Encoder checksum alarm (A.82)

In addition, if a monitoring alarm occurs in the encoder, the alarm must be cleared by turning OFF the power.

6.6.3 Multiturn Limit Setting

⚠ WARNING

- Changing the multiturn limit may change the absolute position data. Be sure to set the multiturn limit following the controller's designation.

- If the Multiturn Limit Disagreement alarm occurs, check the setting of parameter Pn205 in the SERVOPACK to be sure that it is correct.

  If Fn013 is executed when an incorrect value is set in Pn205, an incorrect value will be set in the encoder. The alarm will disappear even if an incorrect value is set, but incorrect positions will be detected, resulting a dangerous situation where the machine will move to unexpected positions.

When implementing absolute detection systems for machines that turn m times in response to n turns in the load shaft, such as circular tables, it is convenient to reset the multiturn data from the encoder to 0 every m turns. The Multiturn Limit[1] Setting allows the value m to be set for the encoder.

Select the absolute encoder usage with the following parameter.

Pn002.2	Absolute Encoder Usage	Factory Setting: 0	Position Control

"0" in the following table must be set in order to enable the absolute encoder.

Pn002.2 Setting	Description
0	Use the absolute encoder as an absolute encoder.
1	Use the absolute encoder as an incremental encoder.

The multiturn limit is set in the SERVOPACK using the following parameter.

Pn205	Multiturn Limit Setting	Unit: rev	Setting Range: 0 to 65535	Factory Setting: 65535	Position Control

If the Multiturn Limit Setting is set to 65535 (factory setting), the multiturn data will vary from -32768 to 32767. If any other value is set, the multiturn data will vary from 0 to the setting of Pn205.

If the servomotor rotates in the negative direction from 0, the multiturn data will change to the value set in Pn205. If the servomotor rotates in the positive direction from the value set in Pn205, the multiturn data will change to 0. Set Pn205 to m - 1.

TERMS

[1] Multiturn limit

The upper limit of multiturn data. The multiturn data will vary between 0 and the value of Pn205 (multiturn limit setting) when Pn002.2 is set to 0.

INFO

Turn the power OFF and then back ON after changing the setting of parameter Pn002.2 or Pn205.

The multiturn limit value in the encoder is factory set to 65535, the same as the SERVOPACK. If the multiturn limit value in the SERVOPACK is changed with Pn205 and then the SERVOPACK power is turned OFF and ON, the following alarm will occur.

Alarm Name: Multiturn Limit Disagreement

Alarm Display	Alarm Code Outputs			Description of Alarm
	ALO1	ALO2	ALO3	
A.CC	ON	OFF	ON	The multiturn limit value is different in the encoder and SERVOPACK.

Note: ON signals are low level; OFF signals are high level.

When this alarm occurs, the multiturn limit in the encoder must be changed. This operation is performed in one of the following ways.

- Refer to the Σ-*II Series SGM□H/SGDH User's Manual : Design and Maintenance (*SIE-S800-32.2*)* for details on changing the multiturn limit setting (Fn013) using a Digital Operator.
- Refer to *Appendix C.3 Multiturn Limit Setting* for details on changing the value using the Adjusting command (ADJ: 3EH).

INFO

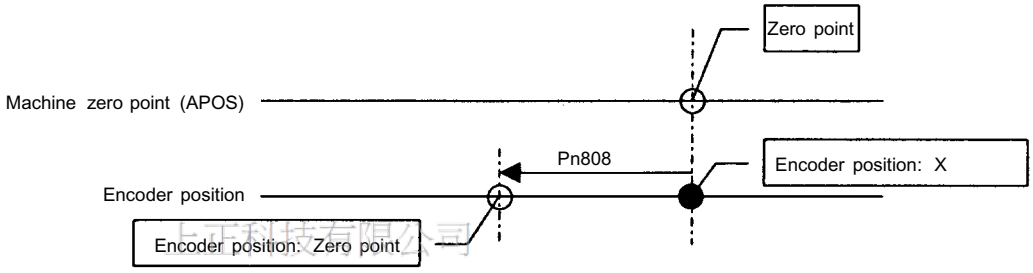
The multiturn limit setting in the encoder can be changed only when the Multiturn Limit Disagreement alarm has occurred. After changing the setting, turn the power supply OFF and then back ON.

6.6.4 Absolute Encoder Zero Point Position Offset

When an absolute encoder is used, the offset between the encoder position and the machine zero point (APOS) can be set.

Pn808	Absolute Encoder Zero Point Position Offset	Unit: Refer-ence unit	Setting Range: -1073741823 to 1073741823	Factory Setting: 0	Position Control

Settings are as shown in the following figure. To set encoder position (X) as the machine zero point (0), set Pn808 to -X.



7

Digital Operator

This chapter describes limitations when using a SERVOPACK with an NS115 mounted and Digital Operator connected. It also describes Panel Operator indicator operation.

7.1 Connecting the Digital Operator

There are two types of Digital Operator. One is a built-in operator incorporating a panel indicator and switches located on the front panel of the SERVOPACK. This type of Digital Operator is also called a Panel Operator. The other one is a Hand-held Digital Operator (i.e., the JUSP-OP02A-2 Digital Operator), which can be connected to the SERVOPACK through connector CN3 of the SERVOPACK.

There is no need to turn OFF the SERVOPACK to connect the Hand-held Digital Operator to the SERVOPACK. For details on how to use the Hand-held Digital Operator, refer to the Σ-*II Series SGM□H/SGDH User's Manual (SIEPS80000005)*.

7.2 Limitations in Using a Hand-held Digital Operator

When an NS115 is mounted, the Hand-held Digital Operator has the following limitations.

INFO

Disconnect the Hand-held Digital Operator during normal operation.

Do not connect SigmaWin and so on, too.

Normal Operation

When a Hand-held Digital Operator is connected or communications with SigmaWin and so on started during normal operation, the following commands are prohibited.

Furthermore, when a Hand-held Digital Operator is connected or communications with a personal computer started while any of the following commands are being executed, a command execution incomplete (A.ED) alarm will be detected.

PRM_RD, PRM_WR

PPRM_WR

CONFIG

ALM_RD, ALM_CLR

SENS_ON

ADJ

ID_RD

7.3 Panel Operator Indicators

The Panel Operator indicator (LED) will not be lit in any of the following circumstances.

- The indicator will not be lit for approximately 3 seconds when the power is turned ON.
- The indicator will not be lit when the Hand-held Digital Operator is connected.
  It will be lit when the Hand-held Digital Operator is disconnected.
- The indicator will not be lit for approximately 1 second when the following commands are received.
  - PRM_RD command
  - PRM_WR/PPRM_WR command
  - CONFIG command
  - SENS_ON command
  - ADJ command
  - ALM_RD/ALM_CLR command for the error history
  - Reading ID_RD command model

8

Ratings, Specifications, and Dimensional Drawings

This chapter provides the ratings, specifications, and dimensional drawings of the NS115.

8.1 Ratings and Specifications

The following table shows ratings and specifications for the NS115.

Table 8.1 NS115 Ratings and Specifications

Item		Details
Applicable SERVOPACK		All SGDH-□□□E models
Installation Method		Mounted on the SGDH SERVOPACK.
Basic Specifications	Power Consumption [W]	2
	External Dimensions [mm]	20 × 142 × 128 (W × H × D)
	Approx. Mass [kg] (lb)	0.2 (0.441)
MECHATROLINK-II Communications	Baud Rate/ Transmission Cycle	10 MHz/500 µs or more (4 MHz/2 ms for MECHATROLINK communications)
Command Format	Operation Specifications	Positioning using MECHATROLINK-I/II communications
	Reference Input	MECHATROLINK-I/II communications Commands: Motion commands (position, speed), Interpolation commands, Parameter read/write, Monitor output
Position Control Functions	Acceleration/ Deceleration Method	Linear first/second-step, asymmetric
	Position Reference Filter	Exponential, movement average
	Fully Closed Control	Position control with fully closed feedback is possible.
Fully Closed System Specifications	Fully Closed Encoder Pulse Output Form	5-V differential line driver output (complies with EIA Standard RS-422A)
	Fully Closed Encoder Pulse Signal Form	90° Phase difference 2-phase differential pulse (phase A, phase B)
	Maximum Receivable Frequency for SERVOPACK	1 Mpps
	Power Supply for Fully Closed Encoder	To be prepared by customer
Input Signals	Input Signal Allocation Function	Forward/reverse run prohibited, zero point return deceleration LS External latch signals 1, 2, 3 Input signal allocation for forward/reverse torque control is possible.
Internal Functions	Position Data Latch Function	Position data latching is possible using phase C and external latch signals 1, 2, and 3.
	Protection	Parameters damage, parameter setting errors, communications errors, WDT errors, fully closed encoder open circuit detection, etc.
	LED Indicators	A: Alarm R: MECHATROLINK-I/II communications in progress

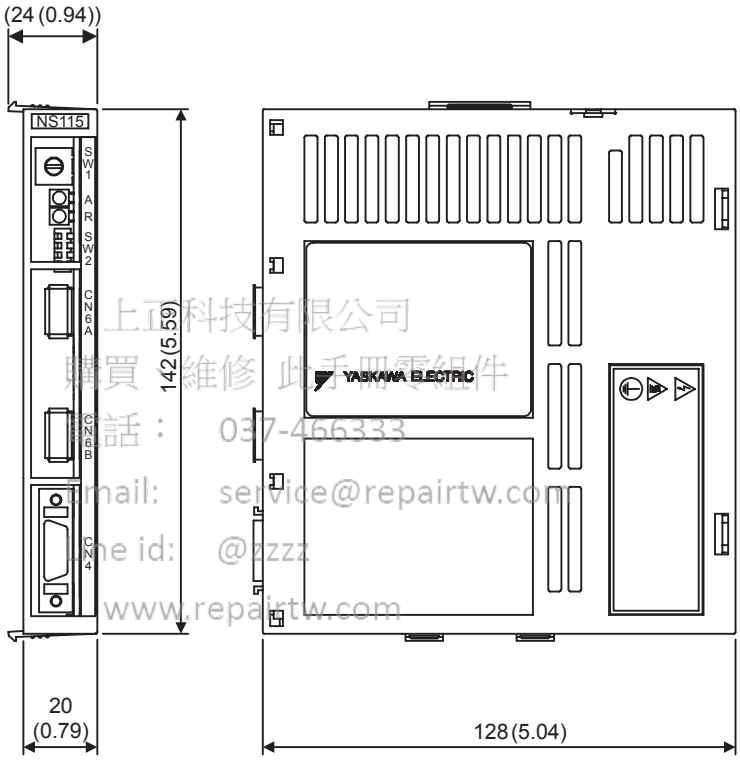
8.2 Dimensional Drawings

Dimensional drawings of the NS115 and SERVOPACKs are shown below.

8.2.1 NS115

Dimensions of the NS115 are shown below.

Unit: mm (in)



Approx. mass: 0.2 kg (0.44 lb)

8

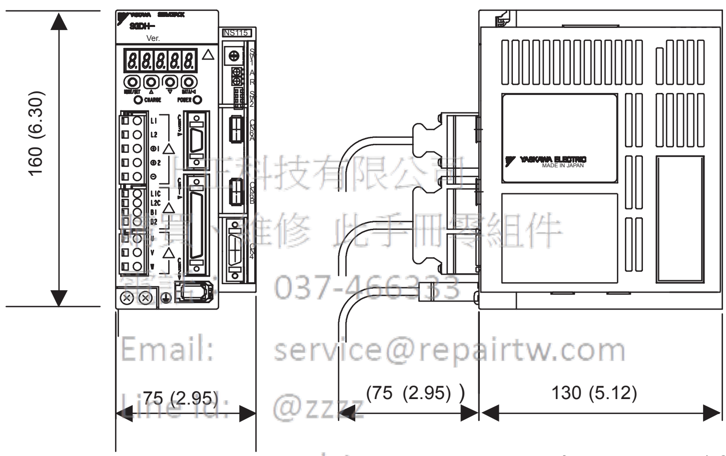
8.2.2 SERVOPACKs

Dimensional drawings of the Base-mounted Standard SERVOPACKs (with NS115 mounted) are shown below. For detailed dimensional drawings, refer to Σ-*II Series SGM□H/SGDH User's Manual (SIEPS80000005).*

For details of the Rack-mounted and Duct-ventilated SERVOPACKs, refer also to Σ-*II Series SGM□H/SGDH User's Manual (SIEPS80000005).*

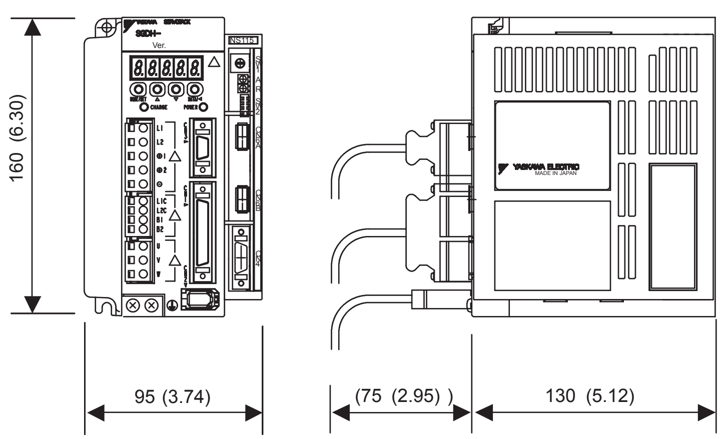
■ Base-Mounted Models

SGDH-A3AE to -02AE (Single-phase, 200 V, 30 to 200 W)
SGDH-A3AE to -01BE (Single-phase, 100 V, 30 to 100 W)



Approx. mass: 1.0 kg (2.21 lb)

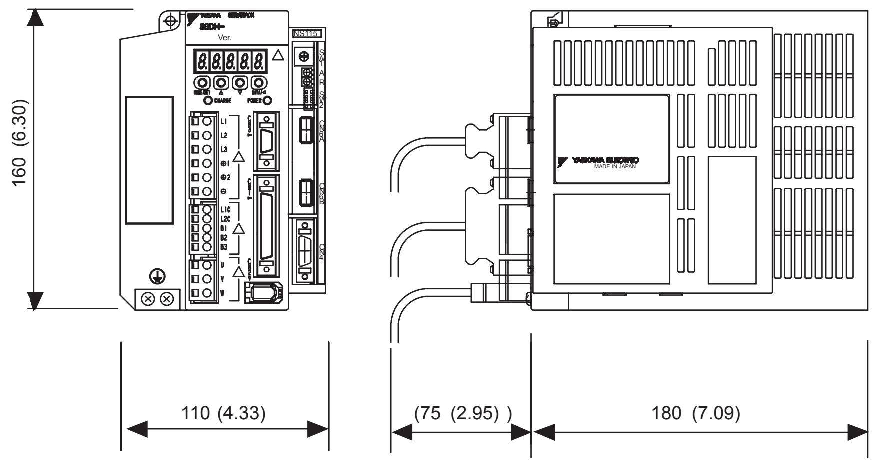
SGDH-04AE (Single-phase, 200 V, 400 W)
SGDH-02BE (Single-phase, 100 V, 200 W)



Approx. mass: 1.3 kg (2.87 lb)

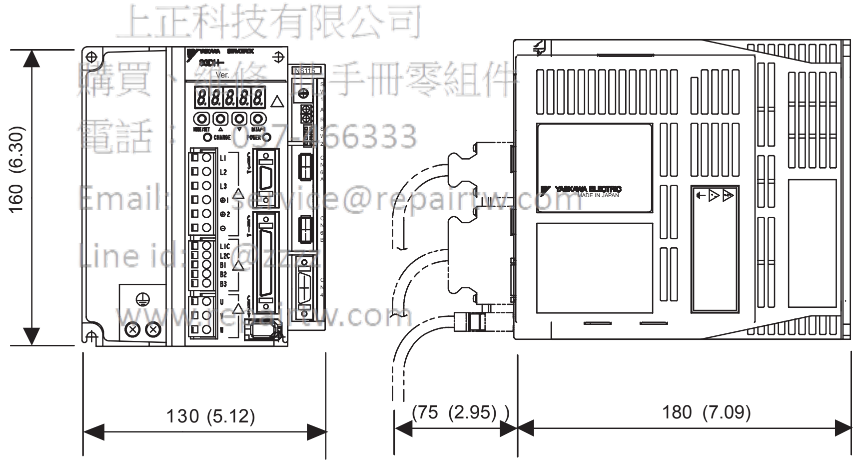
Unit: mm (in)

SGDH-05AE to-10AE (Three-phase, 200 V, 0.5 to 1.0 kW)



Approx. mass: 1.9 kg (4.19 lb)

SGDH-15AE (Three-phase, 200 V, 1.5 kW)

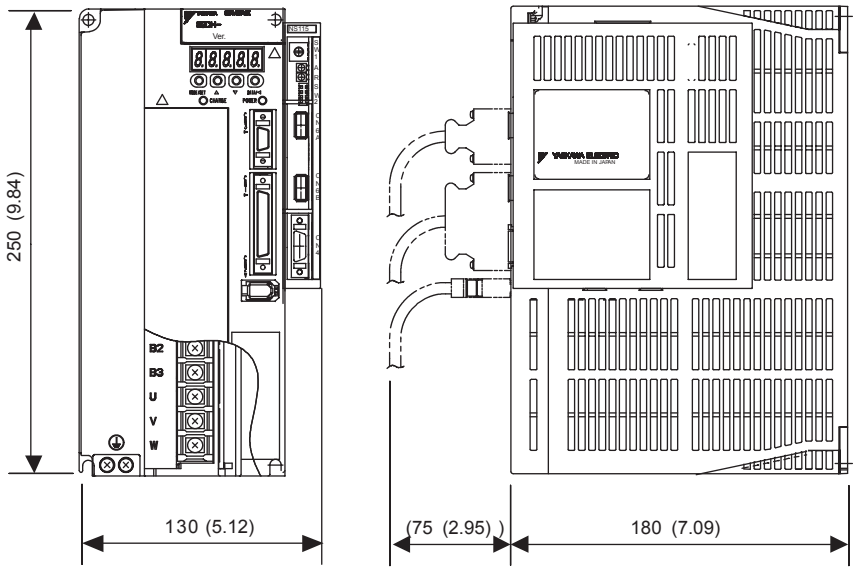


Approx. mass: 3.0 kg (6.61 lb)

Unit: mm (in)

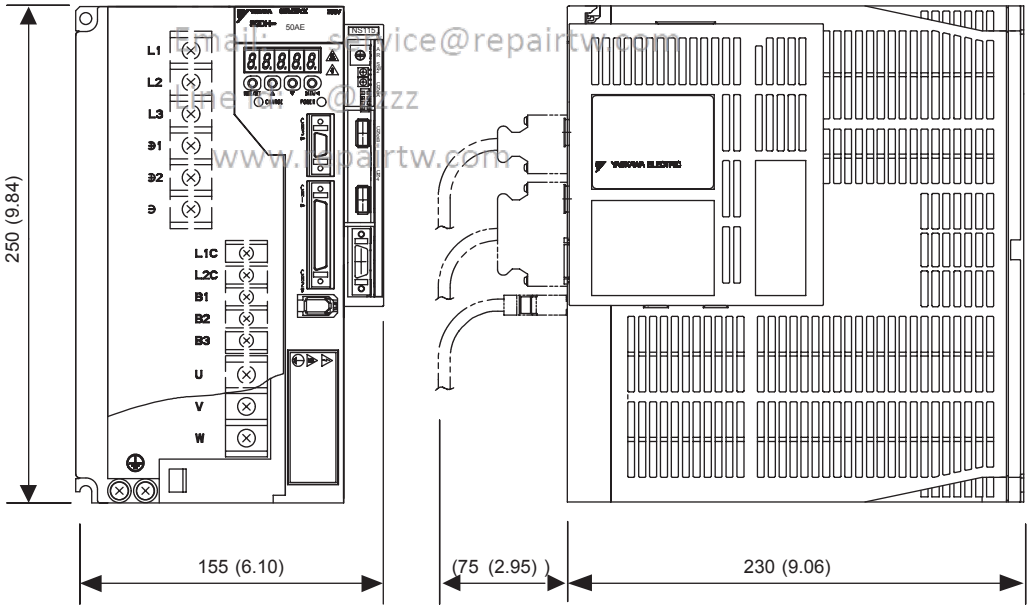
8

SGDH-20AE, -30AE (Three-phase, 200 V, 2.0 kW, 3.0 kW)



Approx. mass: 4.0 kg (8.82 lb)

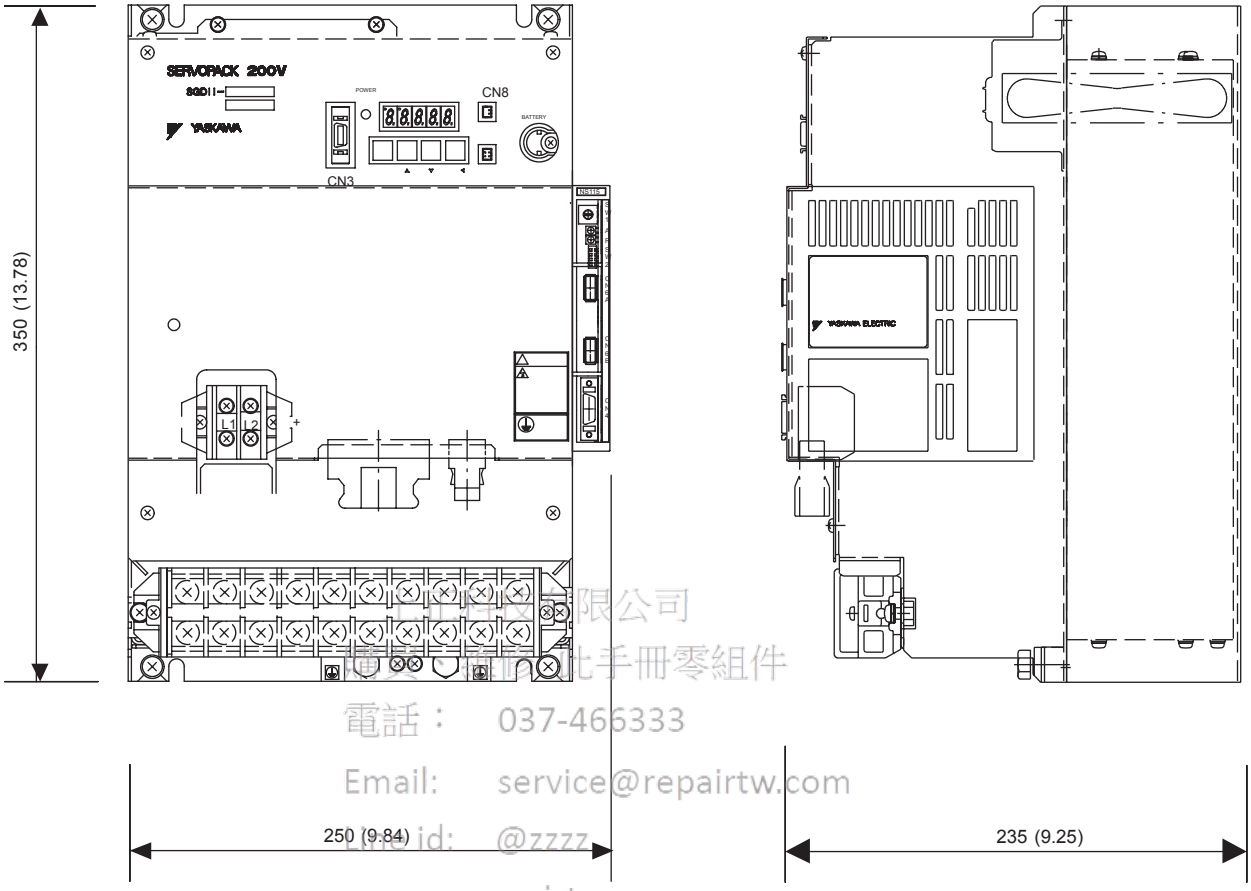
SGDH-50AE (Three-phase, 200 V, 5.0 kW)



Approx. mass: 5.7 kg (12.57 lb)

Unit: mm (in)

SGDH-60AE, -75AE (Three-phase, 200 V, 6.0 kW, 7.5 kW)



Approx. mass: 15.0 kg (33.07 lb)

Unit: mm (in)

8

9

Troubleshooting

This chapter describes troubleshooting procedures for problems which cause an alarm indication and for problems which result in no alarm indication.

9.1 Alarm Displays and Troubleshooting

Problems that occur in the servodrives are displayed on the panel operator as "A.□□" or "CPF□□". "A.– –", however, does not indicate an alarm. Refer to the following sections to identify the cause of an alarm and the action to be taken.

Contact your Yaskawa representative if the problem cannot be solved by the described procedures.

■ A.02

A.02: Parameter Breakdown

Display and Outputs

Alarm Outputs			
Alarm Code Outputs			ALM Output
ALO1	ALO2	ALO3	
OFF	OFF	OFF	OFF

Note: OFF: Output transistor is OFF (alarm state).

Status and Remedy for Alarm

At power ON —— A, B, C

Cause		Remedy
A	Power turned OFF during parameter write. Alarm occurred at next power ON.	• Initialize parameters using Fn005 and reinput user settings. • Replace the SERVOPACK.
B	Circuit board (1PWB) is defective.	Replace the SERVOPACK.
C	NS115 is defective.	Replace the NS115.

■ A.04

A.04: Parameter Setting Error

Display and Outputs

Alarm Outputs			
Alarm Code Outputs			ALM Output
ALO1	ALO2	ALO3	
OFF	OFF	OFF	OFF

Note: OFF: Output transistor is OFF (alarm state).

Status and Remedy for Alarm

	Cause	Remedy
A	An out-of-range parameter was previously set or loaded.	• Reset all parameters in range. • Otherwise, re-load correct parameter.
B	Circuit board (IPWB) is defective.	Replace the SERVOPACK.
C	NS115 is defective.	Replace the NS115.

■ A.81

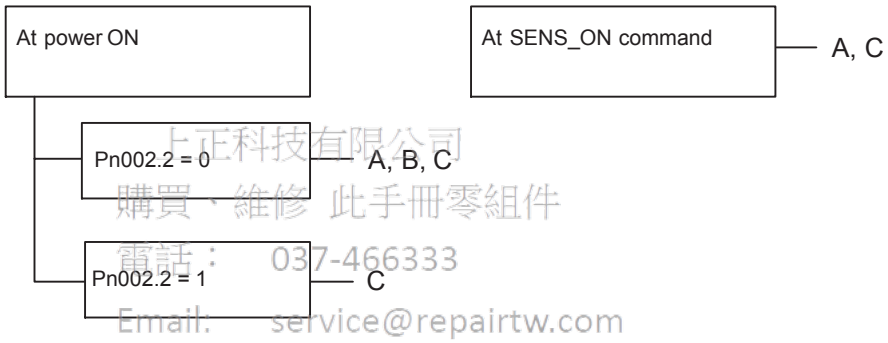
A.81: Encoder Backup Error

Display and Outputs

Alarm Outputs			
Alarm Code Outputs			ALM Output
ALO1	ALO2	ALO3	
OFF	OFF	OFF	OFF

Note: OFF: Output transistor is OFF (alarm state).

Status and Remedy for Alarm



	Cause	Remedy
A	The following power supplies to the absolute encoder all failed: • +5 V supply (supplied from the SEROVPACK) • Battery power	Follow absolute encoder set-up procedure.
B	Absolute encoder malfunctioned.	Replace the servomotor.
C	Circuit board (1PWB) is defective.	Replace the SERVOPACK.

■ A.82

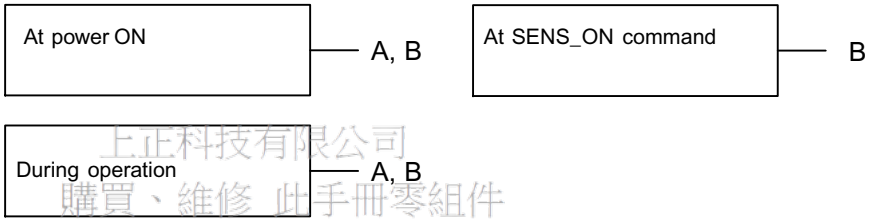
A.82: Encoder Checksum Error

Display and Outputs

Alarm Outputs			
Alarm Code Outputs			ALM Output
ALO1	ALO2	ALO3	
OFF	OFF	OFF	OFF

Note: OFF: Output transistor is OFF (alarm state).

Status and Remedy for Alarm



	Cause	Remedy
A	Error occurred during encoder memory check.	• Follow absolute encoder set-up procedure. • Replace the servomotor if the error occurs frequently.
B	Circuit board (1PWB) is defective.	Replace the SERVOPACK.

■ A.83

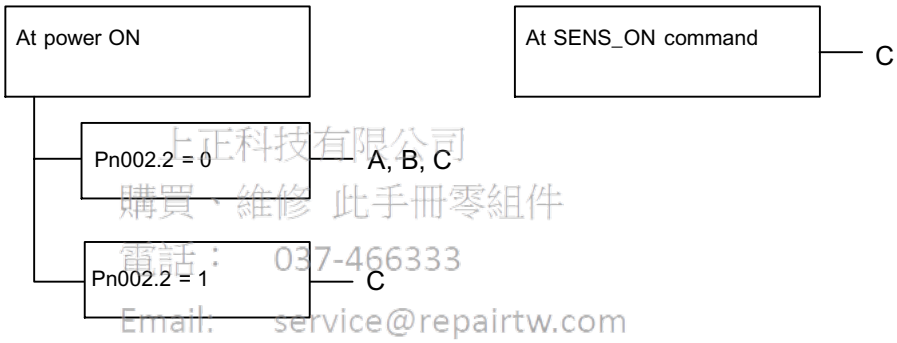
A.83: Encoder Battery Error

Display and Outputs

Alarm Outputs			
Alarm Code Outputs			ALM Output
ALO1	ALO2	ALO3	
OFF	OFF	OFF	OFF

Note: OFF: Output transistor is OFF (alarm state).

Status and Remedy for Alarm



	Cause	Remedy
A	• Battery is not connected. • Battery connection is defective.	Check and correct battery connection.
B	Battery voltage is below specified value. Specified value: 2.7 V.	Install a new battery while the control power to SERVOPACK is ON. After replacement, turn ON the power again.
C	Circuit board (1PWB) is defective.	Replace the servomotor.

Note: No alarm will occur at the SERVOPACK if the battery error occurs during operation.

■ A.84

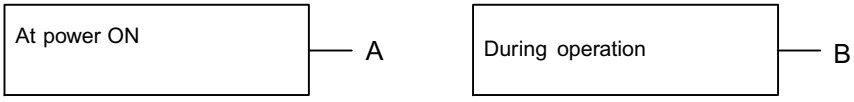
A.84: Encoder Data Error

Display and Outputs

Alarm Outputs			
Alarm Code Outputs			ALM Output
ALO1	ALO2	ALO3	
OFF	OFF	OFF	OFF

Note: OFF: Output transistor is OFF (alarm state).

Status and Remedy for Alarm



	Cause	Remedy
A	Encoder is defective.	Replace the servomotor if the error occurs frequently.
B	Operational error in encoder caused by external noise.	Check and correct wiring around the encoder as follows: • Grounding of the servomotor • Separation between the encoder cable and the servomotor power cable • Insertion of toroidal cores onto cables

■ A.85

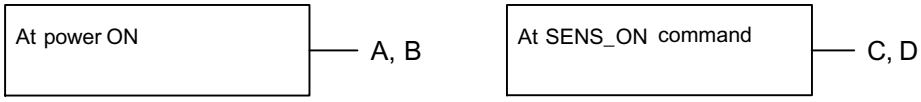
A.85: Encoder Overspeed

Display and Outputs

Alarm Outputs			
Alarm Code Outputs			ALM Output
ALO1	ALO2	ALO3	
OFF	OFF	OFF	OFF

Note: OFF: Output transistor is OFF (alarm state).

Status and Remedy for Alarm



Cause		Remedy
A	Absolute encoder turned ON at a speed exceeding 200 min^{-1}.	Turn ON power supply again with the servomotor stopped.
B	Circuit board (1PWB) is defective.	Replace the SERVOPACK.

■ A.86

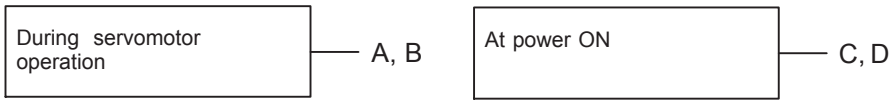
A.86: Encoder Overheated

Display and Outputs

Alarm Outputs			
Alarm Code Outputs			ALM Output
ALO1	ALO2	ALO3	
OFF	OFF	OFF	OFF

Note: OFF: Output transistor is OFF (alarm state).

Status and Remedy for Alarm



Cause		Remedy
A	The ambient temperature of the servomotor is high.	Alter conditions so that the ambient temperature goes below 40°C.
B	Servomotor is operating under overload.	Reduce load.
C	Circuit board (1PWB) is defective.	Replace the SERVOPACK.
D	Encoder is defective.	Replace the servomotor.

■ A.94

A.94: Parameter Setting Warning

Display and Outputs

Alarm Outputs			
Alarm Code Outputs			ALM Output
ALO1	ALO2	ALO3	
ON	ON	OFF	ON

Note: OFF: Output transistor is OFF (alarm state). ON: Output transistor is ON.

Status and Remedy for Alarm

Occurred when the command was sent — A

	Cause	Remedy
A	A value outside the MECHATROLINK-II communications setting range was set.	Reset correctly.

■ A.95

A.95: MECHATROLINK-II command warning

Display and Outputs

Alarm Outputs			
Alarm Code Outputs			ALM Output
ALO1	ALO2	ALO3	
ON	ON	OFF	ON

Note: OFF: Output transistor is OFF (alarm state). ON: Output transistor is ON.

Status and Remedy for Alarm

Occurred when the command was sent — A, B

	Cause	Remedy
A	Presently unable to receive the sent command.	Adjust conditions to match the command. Refer to the specifications for each command.
B	Unsupported command.	Do not sent unsupported commands.

9

■ A.96

A.96: MECHATROLINK-II Communications Warning

Display and Outputs

Alarm Outputs			
Alarm Code Outputs			ALM Output
ALO1	ALO2	ALO3	
ON	OFF	OFF	ON

Note: OFF: Output transistor is OFF (alarm state). ON: Output transistor is ON.

Status and Remedy for Alarm

During MECHATROLINK-II communications — A, B

	Cause	Remedy
A	Contact between the cable and the connector is faulty.	Correct the connector wiring.
B	Malfunction due to noise.	Take noise prevention measures.

■ A.b6

A.b6: Communications LSI Error Alarm

Display and Outputs

Alarm Outputs			
Alarm Code Outputs			ALM Output
ALO1	ALO2	ALO3	
OFF	OFF	OFF	OFF

Note: OFF: Output transistor is OFF (alarm state).

Status and Remedy for Alarm

At power ON — A

	Cause	Remedy
A	NS115 is defective.	Replace the NS115.

■ A.C6

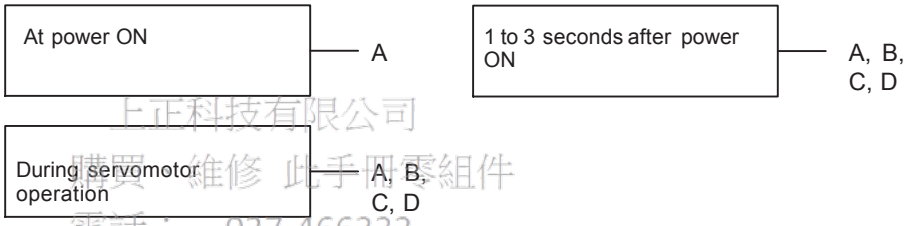
A.C6: Fully Closed Encoder Phase-A, -B Disconnection Alarm

Display and Outputs

Alarm Outputs			
Alarm Code Outputs			ALM Output
ALO1	ALO2	ALO3	
ON	OFF	ON	OFF

Note: OFF: Output transistor is OFF (alarm state). ON: Output transistor is ON.

Status and Remedy for Alarm



	Cause	Remedy
A	Circuit board (1PWB) is defective.	Replace the SERVOPACK.
B	Encoder wiring error or faulty contact.	Check the wiring and check that the connector is fully inserted on the encoder side.
C	There is noise in the encoder wiring.	Separate the encoder wiring from the main circuit.
D	Encoder is defective.	Replace the servomotor.

■ A.C7

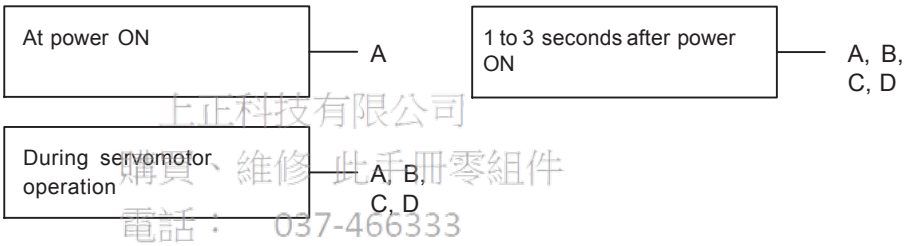
A.C7: Fully Closed Encoder Phase-C Disconnection Alarm

Display and Outputs

Alarm Outputs			
Alarm Code Outputs			ALM Output
ALO1	ALO2	ALO3	
ON	OFF	ON	OFF

Note: OFF: Output transistor is OFF (alarm state). ON: Output transistor is ON.

Status and Remedy for Alarm



	Cause	Remedy
A	Circuit board (1PWB) is defective.	Replace the SERVOPACK.
B	Encoder wiring error or faulty contact.	Check the wiring and check that the connector is fully inserted on the encoder side.
C	There is noise in the encoder wiring.	Separate the encoder wiring from the main circuit.
D	Encoder is defective.	Replace the servomotor.

■ A.CC

A.CC: Multiturn Limit Disagreement Alarm

Display and Outputs

Alarm Outputs			
Alarm Code Outputs			ALM Output
ALO1	ALO2	ALO3	
ON	OFF	ON	OFF

Note: OFF: Output transistor is OFF (alarm state). ON: Output transistor is ON.

Status and Remedy for Alarm

At power ON — A, B

	Cause	Remedy
A	The setting of the Multiturn Limit Setting (Pn205) parameter in the SERVOPACK is incorrect.	Change parameter Pn205.
B	The multiturn limit has not been set in the encoder.	Check to be sure the Multiturn Limit Setting (Pn205) parameter in the SERVOPACK is correct, and then execute the encoder multiturn limit setting change (Fn013) when a Multiturn Limit Disagreement Alarm (A.CC) occurs.

9

■ A.d0

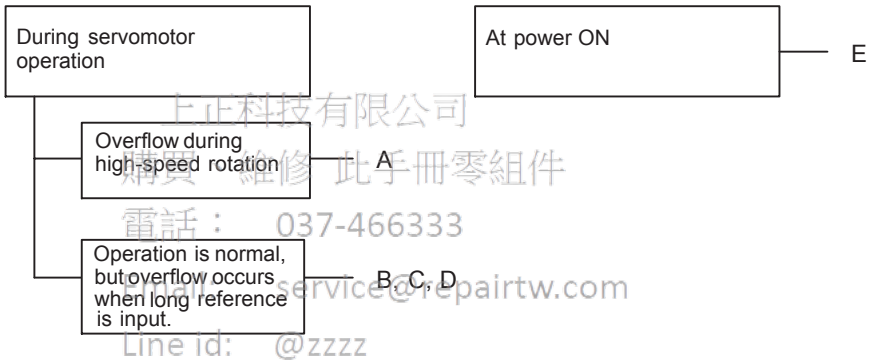
A.d0: Position Error Pulse Overflow

Display and Outputs

Alarm Outputs			
Alarm Code Outputs			ALM Output
ALO1	ALO2	ALO3	
ON	ON	OFF	OFF

Note: OFF: Output transistor is OFF (alarm state). ON: Output transistor is ON.

Status and Remedy for Alarm



Cause		Remedy
A	Servomotor wiring incorrect or poor connection.	Check wiring and connectors at servomotor.
B	SERVOPACK was not correctly adjusted.	Increase speed loop gain (Pn100) and position loop gain (Pn102).
C	Motor load was excessive.	Reduce load torque or moment of inertia. If problem not corrected, replace with a servomotor with larger capacity.
D	Position reference is too high.	• Reduce the acceleration/deceleration rate. • Correct electronic gear ratio.

■ A.E0

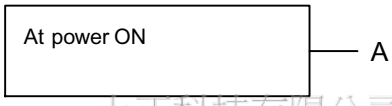
A.E0: NS115 No Response Alarm

Display and Outputs

Alarm Outputs			
Alarm Code Outputs			ALM Output
ALO1	ALO2	ALO3	
OFF	ON	ON	OFF

Note: OFF: Output transistor is OFF (alarm state). ON: Output transistor is ON.

Status and Remedy for Alarm



Cause		Remedy
A	NS115 is defective.	Replace the NS115.

■ A.E1

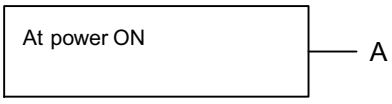
A.E1: NS115 Time Out Alarm

Display and Outputs

Alarm Outputs			
Alarm Code Outputs			ALM Output
ALO1	ALO2	ALO3	
OFF	ON	ON	OFF

Note: OFF: Output transistor is OFF (alarm state). ON: Output transistor is ON.

Status and Remedy for Alarm



Cause		Remedy
A	NS115 is defective.	Replace the NS115.

■ A.E2

A.E2: NS115 WDC Error

Display and Outputs

Alarm Outputs			
Alarm Code Outputs			ALM Output
ALO1	ALO2	ALO3	
OFF	ON	ON	OFF

Note: OFF: Output transistor is OFF (alarm state). ON: Output transistor is ON.

Status and Remedy for Alarm

At power ON — A

During MECHATRONLINK-II communications — B

	Cause	Remedy
A	NS115 is defective.	Replace the NS115.
B	MECHATROLINK-II communications interrupted.	Turn the power ON again.

■ A.E4

A.E4: MECHATROLINK-II Transmission Cycle Setting Error

Display and Outputs

Alarm Outputs			
Alarm Code Outputs			ALM Output
ALO1	ALO2	ALO3	
OFF	ON	ON	OFF

Note: OFF: Output transistor is OFF (alarm state). ON: Output transistor is ON.

Status and Remedy for Alarm

Occurred when a CONNECT command was sent — A

	Cause	Remedy
A	The setting of MECHATROLINK-II transmission cycle is out of range.	Correct the setting of MECHATROLINK-II transmission cycle.

■ A.E5

A.E5: MECHATROLINK-II Synchronization Error

Display and Outputs

Alarm Outputs			
Alarm Code Outputs			ALM Output
ALO1	ALO2	ALO3	
OFF	ON	ON	OFF

Note: OFF: Output transistor is OFF (alarm state). ON: Output transistor is ON.

Status and Remedy for Alarm

Occurred when command was sent — A

Cause		Remedy
A	WDT data does not match.	Update WDT data every communications cycle.

■ A.E6

A.E6: MECHATROLINK-II Communications Error (Twice Consecutively)

Display and Outputs

Alarm Outputs			
Alarm Code Outputs			ALM Output
ALO1	ALO2	ALO3	
OFF	ON	ON	OFF

Note: OFF: Output transistor is OFF (alarm state). ON: Output transistor is ON.

Status and Remedy for Alarm

At control power ON — A, B

Cause		Remedy
A	Contact between the cable and the connector is faulty.	Correct the connector wiring.
B	Malfunction due to noise.	Take noise prevention measures.

■ A.EA

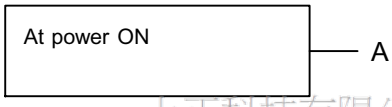
A.EA: An Error which occurs when the SERVOPACK is used with the NS115.

Display and Outputs

Alarm Outputs			
Alarm Code Outputs			ALM Output
ALO1	ALO2	ALO3	
OFF	ON	ON	OFF

Note: OFF: Output transistor is OFF (alarm state). ON: Output transistor is ON.

Status and Remedy for Alarm



Cause		Remedy
A	SERVOPACK is defective.	Replace the SERVOPACK.
B	A software version of SERVOPACK is less than 33.	Replace the SERVOPACK. (A software version is more than 33.)
C	SgimaWin+ is connected.	Disconnect the SigmaWin+.

■ A.EB

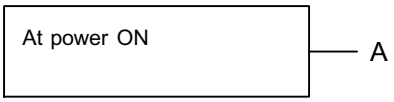
A.EB: SERVOPACK Initial Access Error

Display and Outputs

Alarm Outputs			
Alarm Code Outputs			ALM Output
ALO1	ALO2	ALO3	
OFF	ON	ON	OFF

Note: OFF: Output transistor is OFF (alarm state). ON: Output transistor is ON.

Status and Remedy for Alarm



Cause		Remedy
A	SERVOPACK is defective.	Replace the SERVOPACK.

■ A.EC

A.EC: SERVOPACK WDC Error

Display and Outputs

Alarm Outputs			
Alarm Code Outputs			ALM Output
ALO1	ALO2	ALO3	
OFF	ON	ON	OFF

Note: OFF: Output transistor is OFF (alarm state). ON: Output transistor is ON.

Status and Remedy for Alarm

	Cause	Remedy
A	SERVOPACK is defective.	Replace the SERVOPACK.
B	MECHATROLINK-II communications interrupted.	Turn the power ON again.

■ A.ED

A.ED: Command Execution Incomplete

Display and Outputs

Alarm Outputs			
Alarm Code Outputs			ALM Output
ALO1	ALO2	ALO3	
OFF	ON	ON	OFF

Note: OFF: Output transistor is OFF (alarm state). ON: Output transistor is ON.

Status and Remedy for Alarm

During MECHATROLINK-II communications — A

	Cause	Remedy
A	Command was interrupted.	Do not connect a Hand-held Digital Operator or start communications with a personal computer while any of the following commands are being executed. PRM_RD, PRM_WR PPRM_WR CONFIG ALM_RD, ALM_CLR SENS_ON ADJ, ID_RD

9.2 Troubleshooting with No Alarm Display

Refer to the tables below to identify the cause of a problem which causes no alarm display and take the remedy described.

Turn OFF the servo system power supply before commencing the shaded procedures.

Contact your Yaskawa representative if the problem cannot be solved by the described procedures.

Table 9.1 Troubleshooting Table with No Alarm Display

Symptom	Cause	Inspection	Remedy
Servomotor Does Not Start	Power is not turned ON.	Check voltage between power supply terminals.	Correct the power circuit.
	Loose connection.	Check terminals of connectors (CN1, CN2).	Tighten any loose parts.
	Connector (CN1) external wiring is incorrect.	Check connector (CN1) external wiring	Refer to connection diagram and correct wiring.
	Servomotor or encoder wiring disconnected.	–	Reconnect wiring.
	Overloaded.	Run under no load.	Reduce load or replace with larger capacity servomotor.
	Encoder type differs from parameter setting.	Check the type of encoder being used.	Set parameter Pn002.2 to the encoder type being used.
	P-OT and N-OT inputs are turned OFF.	Refer to section *6.2.2*.	Turn P-OT and N-OT input signals ON.
	Software limits P-SOT and N-SOT are 1.	Refer to section *6.2.3*.	Operate the servomotor within the software limits.
Servomotor Does Not Run	Motion commands have not been sent.	Check using MECHAROLINK-II communications or the MECHATROLINK-II monitor.	Send the motion commands.
	SV_ON command has not been sent.		Send the SV_ON command.
	SENS_ON command has not been sent.		Send the SENS_ON command.
Servomotor Moves Instantaneously, then Stops	Servomotor or encoder wiring incorrect.	–	Refer to *chapter Chapter 3* and correct wiring.
Servomotor Speed Unstable	Wiring connection to motor is defective.	Check connection of power lead (phases U, V, and W) and encoder connectors.	Tighten any loose terminals or connectors.
Servomotor Vibrates at Approximately 200 to 400 Hz.	Speed loop gain value is too high.	–	Reduce speed loop gain (Pn100) preset value.
High Rotation Speed Overshoot on Starting and Stopping.	Speed loop gain value is too high.	–	Reduce speed loop gain (Pn100) preset value. Increase integration time constant (Pn101).
	Speed loop gain is too low compared to position loop gain.	–	Increase speed loop gain (Pn100). Reduce the integration time constant (Pn101).

Table 9.1 Troubleshooting Table with No Alarm Display (cont'd)

Symptom	Cause	Inspection	Remedy
Servomotor Overheated	Ambient temperature is too high.	Measure servomotor ambient temperature.	Reduce ambient temperature to 40°C max.
	Servomotor surface is dirty.	Visual check	Clean dust and oil from motor surface.
	Overloaded.	Run under no load.	Reduce load or replace with larger capacity servomotor.
Abnormal Noise	Mechanical mounting is incorrect.	Check servomotor mounting screws.	Tighten mounting screws.
		Check couplings not centered.	Center coupling.
		Check coupling balance.	Balance coupling.
	Bearing is defective.	Check noise and vibration near bearing.	Consult your Yaskawa representative if defective.
	Machine causing vibrations.	Check foreign object intrusion, damage or deformation of movable parts of machine.	Consult with machine manufacturer.

9.3 Alarm Display Table

A summary of alarm displays and alarm code outputs is given in the following table.

Table 9.2 Alarm Displays and Outputs

Alarm Display	Alarm Code Outputs			ALM Output	Alarm Name	Description
	ALO1	ALO2	ALO3			
A.02	OFF	OFF	OFF	OFF	Parameter Breakdown[*2]	EEPROM data of SERVOPACK is incorrect.
A.03					Main Circuit Detector or Sensor Error	Faulty power circuit sensor.
A.04					Parameter Setting Error[*2]	The parameter setting is outside the allowable setting range.
A.05[*4]					Combination Error	SERVOPACK and servomotor capacities do no match each other.
A.10[*4]	ON	OFF	OFF	OFF	Overcurrent or Heat Sink Overheated[*2]	An overcurrent flowed through the IGBT. Heat sink of SERVOPACK was overheated.
A.30[*4]	ON	ON	OFF	OFF	Regeneration Error	• Regenerative circuit is faulty. • Regenerative resistor is faulty.
A.32[*4]					Regenerative Overload	Regenerative energy exceeds regenerative resistor capacity.
A.40[*4]	OFF	OFF	ON	OFF	Overvoltage[*3]	Main circuit DC voltage is excessively high.
A.41[*4]					Undervoltage[*3]	Main circuit DC voltage is excessively low.
A.51[*4]	ON	OFF	ON	OFF	Overspeed	Rotational speed of the motor is excessively high.
A.71[*4]	ON	ON	ON	OFF	Overload: High Load	The motor was operating for several seconds to several tens of seconds under a torque largely exceeding ratings.
A.72[*4]					Overload: Low Load	The motor was operating continuously under a torque largely exceeding ratings.
A.73[*4]					Dynamic Brake Overload	When the dynamic brake was applied, rotational energy exceeded the capacity of dynamic brake resistor.
A.74[*4]					Overload of Surge Current Limit Resistor	The main circuit power was frequently turned ON and OFF.
A.7A[*4]					Heat Sink Overheated [*1]	The heat sink of SERVOPACK is overheated.

9

Table 9.2 Alarm Displays and Outputs (cont'd)

Alarm Display	Alarm Code Outputs			ALM Output	Alarm Name	Description
	ALO1	ALO2	ALO3			
A.81	OFF	OFF	OFF	OFF	Encoder Backup Error*2	All the power supplies for the absolute encoder have failed and position data was cleared.
A.82					Encoder Checksum Error*2	The checksum results of encoder memory is incorrect.
A.83					Encoder Battery Error	Backup battery voltage for the absolute encoder has dropped.
A.84					Encoder Data Error*2	Data in the encoder is incorrect.
A.85					Encoder Overspeed	The encoder was rotating at high speed when the power was turned ON.
A.86					Encoder Overheated	The internal temperature of encoder is too high.
A.b1					Reference Speed Input Read Error	The A/D converter for reference speed input is faulty.
A.b2					Reference Torque Input Read Error	The A/D converter for reference torque input is faulty.
A.b6					Gate array error	Communications LSI error
A.bF					System Alarm*2	A system error occurred in the SERVOPACK.
A.C1	ON	OFF	ON	OFF	Servo Overrun Detected	The servomotor ran out of control.
A.C6					Fully Closed Encoder Phase A/B Disconnection Alarm	The phase A/B of the fully closed encoder was disconnected.
A.C7					Fully Closed phase C Disconnection Alarm	The phase C of the fully closed encoder was disconnected.
A.C8					Encoder Clear Error and Multiturn Limit Setting Error*2	The multiturn for the absolute encoder was not properly cleared or set.
A.C9					Encoder Communications Error*2	Communications between SERVOPACK and encoder is not possible.
A.CA					Encoder Parameter Error*2	Encoder parameters are faulty.
A.Cb					Encoder Echoback Error*2	Contents of communications with encoder is incorrect.
A.CC					Multiturn Limit Disagreement Alarm	Different multiturn limits have been set in the encoder and SERVOPACK.
A.d0	ON	ON	OFF	OFF	Position Error Pulse Overflow	Position error pulse exceeded parameter (Pn505).

Table 9.2 Alarm Displays and Outputs (cont'd)

Alarm Display	Alarm Code Outputs			ALM Output	Alarm Name	Description
	ALO1	ALO2	ALO3			
A.E0	OFF	ON	ON	OFF	NS115 No Response Alarm*2	No NS115 installed.
A.E1					NS115 Time Out Alarm*2	No response from the board in the NS115.
A.E2					NS115 WDC Error *2	WDC error in the board in the NS115
A.E4					MECHATROLINK-II Transmission Cycle Setting Error	The setting of MECHATROLINK-II transmission cycle is out of range.
A.E5					MECHATROLINK-II Synchronization Error	MECHATROLINK-II synchronization error
A.E6					MECHATROLINK-II Communications Error	MECHATROLINK-II communications error
A.EA					SERVOPACK Malfunction *2	SERVOPACK is defective.
A.EB					SERVOPACK Initial Access Error*2	Initial processing failed.
A.EC					SERVOPACK WDC Error	SERVOPACK WDC error
A.ED					Command Execution Incomplete	Command was interrupted.
A.F1	OFF	ON	OFF	OFF	Power Line Open Phase	One phase is not connected in the main power supply.
CPF00	Not specified				Hand-held Digital Operator Transmission Error	The Hand-held Digital Operator (JUSP-OP02A-2) fails to communicate with SERVOPACK (e.g., CPU error).
CPF01						
A.– –	OFF	OFF	OFF	ON	Not an error	Normal operation status

* 1. This alarm display appears only within the range of 30 W to 1000 W.
* 2. These alarms are not reset for the alarm clear (ALM-CLR) command. Eliminate the cause of the alarm and then turn OFF the power supply to reset the alarms.
* 3. For SERVOPACKs with a capacity of 6.0 kw or more, A.40 indicates a main circuit voltage error alarm. This means that either an overvoltage or an undervoltage has occurred at some stage.
* 4. For corrective actions, refer to *Σ-II Series SGM□H/SGDH User's Manual (SIEPS80000005)*.

Note: OFF: Output transistor is OFF (high). ON: Output transistor is ON (low).

9.4 Warning Displays

The relation between warning displays and warning code outputs are shown in the following table.

Warning code are not normally output, but when warning code output is specified in the parameter, they are as shown in the following table.

Table 9.3 Warning Displays and Outputs

Warning Display	Warning Code Outputs			ALM Output	Warning Name	Description of Warning
	ALO1	ALO2	ALO3			
A.91	OFF	ON	ON	ON	Overload	This warning occurs before the overload alarm (A.71 or A.72) occurs. If the warning is ignored and operation continues, an overload alarm may occur.
A.92	ON	OFF	ON	ON	Regenerative Overload	This warning occurs before the regenerative overload alarm (A.32) occurs. If the warning is ignored and operation continues, a regenerative overload alarm may occur.
A.94	ON	ON	OFF	ON	Parameter Setting Warning	A value outside the setting range was set using MECHATROLINK-II communications.
A.95	OFF	ON	OFF	ON	Command Warning	A command not supported in the product specifications was sent. The command reception conditions were not met.
A.96	ON	OFF	OFF	ON	MECHATROLINK-II Communications Warning	A communications error occurred. (Once)

Note: OFF: Output transistor is OFF (high). ON: Output transistor is ON (low).

10

Peripheral Devices

This chapter describes the peripheral devices for MECHATROLINK/ MECHATROLINK-II and the fully closed encoder.

10.1 Fully Closed Encoder Connector Kit

Name	Connector Kit Model Number	Manufacturer Model Number
Encoder Connector (CN4) Plug	JZSP-VEP02	Manufacturer: Sumitomo 3M ltd. Plug connector: 10120-3000VE Shell system: 10320-52S0-00S

10.2 MECHATROLINK/MECHATROLINK-II Communications Cables and Terminator

The following communications cables and terminator can be used both for MECHATROLINK/MECHATROLINK-II communications.

■ Communications Cables (with Connectors on Both Ends)

Name	Model Number	Cable Length
MECHATROLINK/ MECHATROLINK-II Communications Cables	JEPMC-W6002-A5	0.5 m
	JEPMC-W6002-01	1.0 m
	JEPMC-W6002-03	3.0 m

■ Terminator

Name	Model Number
MECHATROLINK/ MECHATROLINK-II Communications Terminator	JEPMC-W6022

Appendix A

A

List of MECHATROLINK-II Commands and Command Formats

This appendix provides a list of MECHATROLINK-II commands and command formats.

A.1 MECHATROLINK-II Command List

The following table shows main commands such as MECHATROLINK-II common commands, motion common commands, and servo standard commands.

Table A.1 Main Command List

Command Type	Code	Command Name	Function	Processing Classification *1	Synchronization Classification *2	Subcommand	Remarks
Common Command	00	NOP	No Operation command	N	A	Enabled	
	01	PRM_RD	Read Parameter command	D	A	Disabled	
	02	PRM_WR	Write Parameter command	D	A	Disabled	
	03	ID_RD	Read ID command	D	A	Disabled	
	04	CONFIG	Set Up Device command	C	A	Disabled	
	05	ALM_RD	Read Alarm or Warning command	D	A	Disabled	
	06	ALM_CLR	Clear Alarm/Warning command	C	A	Disabled	
	0D	SYNC_SET	Start Synchronous Communications command	N	A	Disabled	
	0E	CONNECT	MECHATROLINK-II Connection command	N	A	Disabled	
	0F	DISCONNECT	Disconnection command	N	A	Disabled	
	1B	PPRM_RD	Read Non-volatile Parameter command	D	A	Disabled	Not supported
	1C	PPRM_WR	Write Non-volatile Parameter command	D	A	Disabled	
Motion Common Command	20	POS_SET	Set Coordinates command	D	A	Disabled	
	21	BRK_ON	Apply Brake command	C	A	Disabled	
	22	BRK_OFF	Release Brake command	C	A	Disabled	
	23	SENS_ON	Turn Sensor ON command	C	A	Disabled	
	24	SENS_OFF	Turn Sensor OFF command	C	A	Disabled	
	25	HOLD	Stop Motion command	M	A	Enabled	
	26	MLOCK_ON	Machine Lock Mode ON command	C	A	Enabled	Not supported
	27	MLOCK_OFF	Machine Lock Mode OFF command	C	A	Enabled	Not supported
	28	LTMODE_ON	Request Latch Mode command	C	A	Enabled	NS115 extended command
	29	LTMODE_OFF	Release Latch Mode command	C	A	Enabled	NS115 extended command

Table A.1 Main Command List (cont'd)

Command Type	Code	Command Name	Function	Processing Classification *1	Synchronization Classification *2	Subcommand	Remarks
Servo Standard Commands	30	SMON	Status Monitoring command	D	A	Enabled	
	31	SV_ON	Servo ON command	C	A	Enabled	
	32	SV_OFF	Servo OFF command	C	A	Enabled	
	34	INTERPOLATE	Interpolation Feed command	M	S	Enabled	
	35	POSING	Positioning command	M	A	Enabled	
	36	FEED	Constant Speed Feed command	M	A	Enabled	
	38	LATCH	Interpolation Feeding with Position Detection command	M	S	Enabled	
	39	EX_POSING	External Input Positioning command	M	A	Enabled	
	3A	ZRET	Zero Point Return command	M	A	Enabled	
	3C	VELCTRL	Speed Reference command	M	A	Enabled	Command special for MECHATROLINK-II
	3D	TRQCTRL	Torque Reference command	M	A	Enabled	Command special for MECHATROLINK-II
	3E	ADJ	Adjusting command	X	A	Disabled	
	3F	SVCTRL	General-purpose Servo Control command	X	S, A	Enabled	

* 1. Main commands are classified as follows:
  N: Network command
  D: Data communications command
  C: Control command
  M: Motion command
  X: Compound command
* 2. Main commands are classified for synchronization as follows:
  S: Synchronous command
  A: Asynchronous command

Table A.2 Subcommand List

Code	Command Name	Function	Remarks
00	NOP	No Operation command	
01	PRM_RD	Read Parameter command	
02	PRM_WR	Write Parameter command	
05	ALM_RD	Read Alarm or Warning command	
1B	PPRM_RD	Read Non-volatile Parameter command	Not supported
1C	PPRM_WR	Write Non-volatile Parameter command	
28	LTMOD_ON	Request Latch Mode command	NS115 extended command
29	LTMOD_OFF	Release Latch Mode command	NS115 extended command
30	SMON	Status Monitoring command	

A.2 MECHATROLINK-II Command Format List

The command formats for MECHATROLINK-II commands are shown in the following table.

Table A.3 Common Command Format

Byte	NOP		PRM_RD		PRM_WR		ID_RD		CONFIG		ALM_RD	
	Command	Response	Command	Response	Command	Response	Command	Response	Command	Response	Command	Response
1	00H	00H	01H	01H	02H	02H	03H	03H	04H	04H	05H	05H
2		ALARM		ALARM		ALARM		ALARM		ALARM		ALARM
3		STATUS		STATUS		STATUS		STATUS		STATUS		STATUS
4												
5			NO	NO	NO	NO	DEVICE_ COD	DEVICE_ COD			ALM_RD_ MOD	ALM_RD_ MOD
6							OFFSET	OFFSET				ALM_ DATA
7			SIZE	SIZE	SIZE	SIZE	SIZE	SIZE				
8				PARAMETER	PARAMETER	PARAMETER		ID				
9												
10												
11												
12												
13												
14												
15												
16	WDT	RWDT	WDT	RWDT	WDT	RWDT	WDT	RWDT	WDT	RWDT	WDT	RWDT
17												
18												
19												
20												
21												
22												
23												
24												
25												
26												
27												
28												
29												

Table A.3 Common Command Format (cont'd)

Byte	ALM_CLR		SYNC_SET		CONNECT		DISCONNECT		PPRM_RD		PPRM_WR	
	Command	Response	Command	Response	Command	Response	Command	Response	Command	Response	Command	Response
1	06H	06H	0DH	0DH	0EH	0EH	0FH	0FH	1BH	1BH	1CH	1CH
2		ALARM		ALARM		ALARM				ALARM		ALARM
3		STATUS		STATUS		STATUS				STATUS		STATUS
4												
5	ALM_CLR _MOD	ALM_CLR _MOD			VER	VER			NO	NO	NO	NO
6					COM_MOD	COM_MOD						
7					COM_TIM	COM_TIM			SIZE	SIZE	SIZE	SIZE
8										PARAME TER	PARAMET ER	PARAMET ER
9												
10												
11												
12												
13												
14												
15												
16	WDT	RWDT	WDT	RWDT	WDT	RWDT	WDT	RWDT	WDT	RWDT	WDT	RWDT
17												
18												
19												
20												
21												
22												
23												
24												
25												
26												
27												
28												
29												

Table A.4 Motion Common Command Format

Byte	POS_SET		BRK_ON		BRK_OFF		SENS_ON	
	Command	Response	Command	Response	Command	Response	Command	Response
1	20H	20H	21H	21H	22H	22H	23H	23H
2		ALARM		ALARM		ALARM		ALARM
3		STATUS		STATUS		STATUS		STATUS
4								
5	PS_SUBCMD	PS_SUBCMD						
6	POS_DATA	POS_DATA						
7								
8								
9								
10								
11								
12								
13								
14								
15								
16	WDT	RWDT	WDT	RWDT	WDT	RWDT	WDT	RWDT
17								
18								
19								
20								
21								
22								
23								
24								
25								
26								
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Table A.4 Motion Common Command Format (cont'd)

Byte	SENS_OFF		HOLD		LTMOD_ON		LTMOD_OFF	
	Command	Response	Command	Response	Command	Response	Command	Response
1	24H	24H	25H	25H	28H	28H	29H	29H
2		ALARM		ALARM	LT-SGN	ALARM		ALARM
3		STATUS	OPTION	STATUS		STATUS		STATUS
4								
5				MONITOR1		MONITOR1		MONITOR1
6								
7								
8								
9				MONITOR2		MONITOR2		MONITOR2
10								
11								
12								
13			SEL_MON1/2	SEL_MON1/2	SEL_MON1/2	SEL_MON1/2	SEL_MON1/2	SEL_MON1/2
14				I/O		I/O		I/O
15								
16	WDT	RWDT	WDT	RWDT	RWDT	WDT	RWDT	RWDT
17			For subcommands use. Refer to *4.4 Subcommands*.	For subcommands use. Refer to *4.4 Subcommands*.				
18								
19								
20								
21								
22								
23								
24								
25								
26								
27								
28								
29								

Table A.5 Servo Standard Command Format

Byte	SMON		SV_ON		SV_OFF		INTERPOLATE	
	Command	Response	Command	Response	Command	Response	Command	Response
1	30HH	30H	31H	31H	32H	32H	34H	34H
2		ALARM		ALARM		ALARM		ALARM
3		STATUS	OPTION	STATUS		STATUS	OPTION	STATUS
4								
5		MONITOR1		MONITOR1		MONITOR1	TPOS	MONITOR1
6								
7								
8								
9		MONITOR2		MONITOR2		MONITOR2	VFF	MONITOR2
10								
11								
12								
13	SEL_MON1/2	SEL_MON1/2	SEL_MON1/2	SEL_MON1/2	SEL_MON1/2	SEL_MON1/2	SEL_MON1/2	SEL_MON1/2
14		I/O		I/O		I/O		I/O
15								
16	WDT	RWDT	WDT	RWDT	WDT	RWDT	WDT	RWDT
17	For subcommands use. Refer to *4.4 Subcommands*.	For subcommands use. Refer to *4.4 Subcommands*.	For subcommands use. Refer to *4.4 Subcommands*.	For subcommands use. Refer to *4.4 Subcommands*.	For subcommands use. Refer to *4.4 Subcommands*.	For subcommands use. Refer to *4.4 Subcommands*.	For subcommands use. Refer to *4.4 Subcommands*.	For subcommands use. Refer to *4.4 Subcommands*.
18								
19								
20								
21								
22								
23								
24								
25								
26								
27								
28								
29								

Table A.5 Servo Standard Command Format (cont'd)

Byte	POSING		FEED		LATCH	
	Command	Response	Command	Response	Command	Response
1	35H	35H	36H	36H	38H	38H
2		ALARM		ALARM	LT_SGN	ALARM
3	OPTION	STATUS	OPTION	STATUS	OPTION	STATUS
4						
5	TPOS	MONITOR1		MONITOR1	TPOS	MONITOR1
6						
7						
8						
9	TSPD	MONITOR2	TSPD	MONITOR2	VFF	MONITOR2
10						
11						
12						
13	SEL_MON1/2	SEL_MON1/2	SEL_MON1/2	SEL_MON1/2	SEL_MON1/2	SEL_MON1/2
14		I/O		I/O		I/O
15						
16	WDT	RWDT	WDT	RWDT	WDT	RWDT
17	For subcommands use. Refer to *4.4 Subcommands*.	For subcommands use. Refer to *4.4 Subcommands*.	For subcommands use. Refer to *4.4 Subcommands*.	For subcommands use. Refer to *4.4 Subcommands*.	For subcommands use. Refer to *4.4 Subcommands*.	For subcommands use. Refer to *4.4 Subcommands*.
18						
19						
20						
21						
22						
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24						
25						
26						
27						
28						
29						

Table A.5 Servo Standard Command Format (cont'd)

Byte	EX_POSING		ZRET		VELCTRL	
	Command	Response	Command	Response	Command	Response
1	39H	39H	3AH	3AH	3CH	3CH
2	LT_SGN	ALARM	LT_SGN	ALARM		ALARM
3	OPTION	STATUS	OPTION	STATUS	OPTION	STATUS
4						
5	TPOS	MONITOR1		MONITOR1	P_TLIM	MONITOR1
6						
7					N_TLIM	
8						
9	TSPD	MONITOR2	TSPD	MONITOR2	VREF	MONITOR2
10						
11						
12						
13	SEL_MON1/2	SEL_MON1/2	SEL_MON1/2	SEL_MON1/2	SEL_MON1/2	SEL_MON1/2
14		I/O		I/O		I/O
15						
16	WDT	RWDT	WDT	RWDT	WDT	RWDT
17	For subcommands use. Refer to *4.4 Subcommands*.	For subcommands use. Refer to *4.4 Subcommands*.	For subcommands use. Refer to *4.4 Subcommands*.	For subcommands use. Refer to *4.4 Subcommands*.	For subcommands use. Refer to *4.4 Subcommands*.	For subcommands use. Refer to *4.4 Subcommands*.
18						
19						
20						
21						
22						
23						
24						
25						
26						
27						
28						
29						

Table A.5 Servo Standard Command Format (cont'd)

Byte	TRQCTRL		ADJ		SVCTRL	
	Command	Response	Command	Response	Command	Response
1	3DH	3DH	3EH	3EH	3FH	3FH
2		ALARM		ALARM	CTRL_CMD	ALARM
3	OPTION	STATUS		STATUS	OPTION	STATUS
4						
5	VLIM	MONITOR1	CCMD	CANS	TPOS	MONITOR1
6			CADDRESS	CADDRESS		
7						
8			CDATA	CDATA		
9	TQREF	MONITOR2			TSPD OR VFF	MONITOR2
10						
11						
12						
13	SEL_MON1/2	SEL_MON1/2			SEL_MON1/2	SEL_MON1/2
14		I/O			SQ_CMD	I/O
15						
16	WDT	RWDT	WDT	RWDT	WDT	RWDT
17	For subcommands use. Refer to *4.4 Subcommands.*	For subcommands use. Refer to *4.4 Subcommands.*	For subcommands use. Refer to *4.4 Subcommands.*	For subcommands use. Refer to *4.4 Subcommands.*	For subcommands use. Refer to *4.4 Subcommands.*	For subcommands use. Refer to *4.4 Subcommands.*
18						
19						
20						
21						
22						
23						
24						
25						
26						
27						
28						
29						

Table A.6 Subcommand Format

Byte	NOP		PRM_RD		PRM_WR		ALM_RD		PPRM_RD	
	Command	Response	Command	Response	Command	Response	Command	Response	Command	Response
17	00H	00H	01H	01H	02H	02H	05H	05H	1BH	1BH
18		SUBSTATUS		SUBSTATUS		SUBSTATUS		SUBSTATUS		SUBSTATUS
19			NO	NO	NO	NO	ALM_RD_MOD	ALM_RD_MOD	NO	NO
20								ALM_DATA		
21			SIZE	SIZE	SIZE	SIZE			SIZE	SIZE
22				PARAMETER	PARAMETER	PARAMETER				PARAMETER
23										
24										
25										
26										
27										
28										
29										

Table A.6 Subcommand Format (cont'd)

Byte	PPRM_WR		LTMOD_ON		LTMOD_OFF		SMON	
	Command	Response	Command	Response	Command	Response	Command	Response
17	1CH	1CH	28H	28H	29H	29H	30H	30H
18		SUBSTATUS	LT_SGN	SUBSTATUS		SUBSTATUS		SUBSTATUS
19	NO	NO	SEL_MON3/4	SEL_MON3/4	SEL_MON3/4	SEL_MON3/4	SEL_MON3/4	SEL_MON3/4
20				MONITOR3		MONITOR3		MONITOR3
21	SIZE	SIZE						
22	PARAMETER	PARAMETER						
23								
24				MONITOR4		MONITOR4		MONITOR4
25								
26								
27								
28								
29								

Appendix B

List of Parameters

B

This appendix lists the parameters, memory switches, input signal selections, and output signal selections for SGDH SERVOPACKs with an NS115 mounted.

B.1 Parameters

The following list shows parameters and their settings.

IMPORTANT

- Parameters marked as “reserved by system” are used internally by the SERVOPACK. As a general rule, access is denied to users.
- SERVOPACK operation cannot be guaranteed if settings other than initial values are made to the “reserved by system” parameters. Be sure to use adequate caution if any of these settings is changed.

Table B.1 Parameter List

Category	Pn No.	Name	Size	Unit	Setting Range	SGDH Factory Setting	Changing Method *1
Function Selection Parameters`	Pn000	Function Selection Basic Switches	2	–	0000H to 1FF1H	0000H	Δ
	Pn001	Function Selection Application Switches 1	2	–	0000H to 1122H	0000H	Δ
	Pn002	Function Selection Application Switches 2	2	–	0000H to 4113H	0000H	Δ
	Pn003	Function Selection Application Switches 3	2	–	0000H to 00FFH	0002H	◎
	Pn004	Reserved by system	2	–	0000H to 1100H	0100H	Δ
	Pn005	Function Selection Application Switches 5	2	–	0000H to 0001H	0000H	Δ
For Linear Motor Only	Pn080	Function Selection Application Switches	2	–	0000H to 0011H	0000H	Δ
Gain-related Parameters	Pn100	Speed Loop Gain	2	Hz	1 to 2000	40	◎
	Pn101	Speed Loop Integral Time Constant	2	0.01 ms	15 to 51200	2000	◎
	Pn102	Position Loop Gain	2	1/s	1 to 2000	40	◎
	Pn103	Moment of Inertia Ratio	2	%	0 to 10000	0	◎
	Pn104	2nd Speed Loop Gain	2	Hz	1 to 2000	40	◎
	Pn105	2nd Speed Loop Integral Time Constant	2	0.01 ms	15 to 51200	2000	◎
	Pn106	2nd Position Loop Gain	2	1/s	1 to 2000	40	◎
For Rotary Motor Only	Pn107	Bias	2	min^{-1}	0 to 10000	0	◎
Gain-related Parameters	Pn108	Bias Width Addition	2	pulse	0 to 250	7	◎
	Pn109	Feed-forward	2	%	0 to 100	0	◎
	Pn10A	Feed-forward Filter Time Constant	2	0.01 ms	0 to 6400	0	◎
	Pn10B	Gain-related Application Switches	2	–	–	0000H	◎
	Pn10C	Mode Switch Torque Reference	2	%	0 to 800	200	◎

Table B.1 Parameter List (cont'd)

Category	Pn No.	Name	Size	Unit	Setting Range	SGDH Factory Setting	Changing Method *1
For Rotary Motor Only	Pn10D	Mode Switch Speed Reference	2	min^{-1}	0 to 10000	0	◎
	Pn10E	Mode Switch Acceleration	2	10 min^{-1}/s	0 to 3000	0	◎
Gain-related Parameters	Pn10F	Mode Switch Position Error	2	pulse	0 to 10000	0	◎
	Pn110	Online Autotuning Switches	2	–	0000H to 3212H	0010H	◎
	Pn111	Speed Feedback Compensation	2	–	1 to 100	100	◎
	Pn112	Reserved by system	2	–	–	100	–
	Pn113		2	–	–	1000	–
	Pn114		2	–	–	200	–
	Pn115		2	–	–	32	–
	Pn116		2	–	–	16	–
	Pn117		2	–	–	100	–
	Pn118		2	–	–	100	–
	Pn119		2	–	–	60	–
	Pn11A		2	–	–	1000	–
	Pn11B		2	–	–	50	–
	Pn11C		2	–	–	70	–
	Pn11D		2	–	–	100	–
	Pn11E		2	–	–	100	–
	Pn11F	Position Integral Time Constant	2	ms	0 to 2000	0	◎
	Pn120	Reserved by system	2	–	–	0	–
	Pn121		2	–	–	50	–
	Pn122		2	–	–	0	–
	Pn123		2	–	–	0	–
For Linear Motor Only	Pn180	Bias	2	mm/s	0 to 450	0	◎
For Linear Motor Only	Pn181	Mode Switch Speed Reference	2	mm/s	0 to 5000	0	◎
For Linear Motor Only	Pn182	Mode Switch Acceleration	2	mm/s^2	0 to 3000	0	◎
Position-related Parameters	Pn200	Position Control Reference Selection Switches	2	–	0000H to 1239H	0100H	Δ
For Rotary Motor Only	Pn201	PG Divider	2	–	16 to 16384	16384	Δ
Position-related Parameters	Pn202	Electronic Gear Ratio (Numerator)	2	–	1 to 65535	4	Δ
	Pn203	Electronic Gear Ratio (Denominator)	2	–	1 to 65535	1	Δ
	Pn204	Reserved by system	2	–	–	0	–
For Rotary Motor Only	Pn205	Multi-turn Limit Setting	2	rev	0 to 65535	65535	Δ

Table B.1 Parameter List (cont'd)

Category	Pn No.	Name	Size	Unit	Setting Range	SGDH Factory Setting	Changing Method *1
For Rotary Motor Only	Pn206	Number of Fully Closed Encoder Pulses	2	P/R	513 to 32768	16384	Δ
Position-related Parameters	Pn207	Reserved by system	2	–	–	0010	–
	Pn208		2	–	–	0	–
For Linear Motor Only	Pn280	Linear Scale Pitch	2	μm	0 to 65535	0	Δ
For Linear Motor Only	Pn281	PG Divider	2	pulse/scale pitch (Pn280)	1 to 256	20	Δ
Speed-related Parameter	Pn300	Reserved by system	2	–	–	600	–
For Rotary Motor Only	Pn301	Reserved by system	2	–	–	100	–
For Rotary Motor Only	Pn302	Reserved by system	2	–	–	200	–
For Rotary Motor Only	Pn303	Reserved by system	2	–	–	300	–
For Rotary Motor Only	Pn304	Jog Speed	2	min^{-1}	0 to 10000	500	◎
Speed-related Parameter	Pn305	Soft Start Acceleration Time	2	ms	0 to 10000	0	◎
	Pn306	Soft Start Deceleration Time	2	ms	0 to 10000	0	◎
	Pn307	Speed Reference Filter Time Constant	2	0.01ms	0 to 65535	40	◎
	Pn308	Speed F/B Filter Time Constant	2	0.01ms	0 to 65535	0	◎
For Linear Motor Only	Pn380	Speed 1	2	mm/s	0 to 5000	10	◎
For Linear Motor Only	Pn381	Speed 2	2	mm/s	0 to 5000	20	◎
For Linear Motor Only	Pn382	Speed 3	2	mm/s	0 to 5000	30	◎
For Linear Motor Only	Pn383	JOG Speed	2	mm/s	0 to 5000	50	◎
Torque-related Parameter	Pn400	Reserved by system	2	–	–	30	–
	Pn401	Torque Thrust Filter Time Constant	2	0.01ms	0 to 65535	100	◎
For Rotary Motor Only	Pn402	Forward Torque Limit	2	%	0 to 800	800	◎
For Rotary Motor Only	Pn403	Reverse Torque Limit	2	%	0 to 800	800	◎
Torque-related Parameter	Pn404	External Input Forward Torque/Thrust Limit	2	%	0 to 800	100	◎
	Pn405	External Input Reverse Torque/Thrust Limit	2	%	0 to 800	100	◎
	Pn406	Emergency Stop Torque/Thrust	2	%	0 to 800	800	◎
For Rotary Motor Only	Pn407	Speed Limit during Torque Control	2	min^{-1}	0 to 10000	10000	◎

Table B.1 Parameter List (cont'd)

Category	Pn No.	Name	Size	Unit	Setting Range	SGDH Factory Setting	Changing Method *1
Torque-related Parameter	Pn408	Torque/Thrust Control Function Switches	2	–	0000H to 0001H	0000H	◎
	Pn409	Notch Filter Frequency	2	Hz	50 to 2000	2000	◎
For Linear Motor Only	Pn480	Speed Limit at Thrust Control	2	mm/s	0 to 5000	5000	◎
For Linear Motor Only	Pn481	Pole Detection Speed Loop Gain	2	Hz	1 to 2000	40	◎
For Linear Motor Only	Pn482	Pole Detection Speed Loop Integral Time	2	0.01ms	15 to 51200	3000	◎
For Linear Motor Only	Pn483	Forward Thrust Limit	2	%	0 to 800	30	◎
For Linear Motor Only	Pn484	Reverse Thrust Limit	2	%	0 to 800	30	◎
Sequence-related Parameters	Pn500	Positioning Completed Width	2	reference unit (pulse for /COIN output)	0 to 250	7	◎
For Rotary Motor Only	Pn501	Zero Clamp Level	2	min^{-1}	0 to 10000	10	◎
For Rotary Motor Only	Pn502	Rotation Detection Level	2	min^{-1}	1 to 10000	20	◎
For Rotary Motor Only	Pn503	Speed Coincidence Signal	2	min^{-1}	0 to 100	10	◎
Sequence-related Parameters	Pn504	NEAR Signal Width	2	reference unit (pulse for /NEAR output)	1 to 250	7	◎
	Pn505	Position Error Overflow Level	2	256 pulses	1 to 32767	1024	◎
	Pn506	Brake Reference Servo OFF Delay Time	2	10 ms	0 to 50	0	◎
For Rotary Motor Only	Pn507	Brake Reference Output Speed Level	2	min^{-1}	0 to 10000	100	◎

Table B.1 Parameter List (cont'd)

Category	Pn No.	Name	Size	Unit	Setting Range	SGDH Factory Setting	Changing Method *1
Sequence-related Parameters	Pn508	Timing for Brake Reference Output during Motor Operation	2	10ms	10 to 100	50	◎
	Pn509	Momentary Hold Time	2	ms	20 to 1000	20	◎
	Pn50A	Input Signal Selections 1	2	–	0000H to FFFFH	2881H	Δ
	Pn50B	Input Signal Selections 2	2	–	0000H to FFFFH	6583H	Δ
	Pn50C	Reserved by system	2	–	–	8888H	–
	Pn50D	Reserved by system	2	–	–	8888H	–
	Pn50E	Output Signal Selections 1	2	–	0000H to 3333H	3211H	Δ
	Pn50F	Output Signal Selections 2	2	–	0000H to 3333H	0000H	Δ
	Pn510	Output Signal Selections 3	2	–	0000H to 0033H	0000H	Δ
	Pn511	Input Signal Selections 3	2	–	0000H to FFFFH	8888H	Δ
	Pn512	Output Signal Reversal	2	–	0000H to 0111H	0000H	Δ
For Rotary Motor Only	Pn51A	Error Level between Motor and Load Position	2	pulse	1 to 32767	10	◎
Sequence-related Parameters	Pn51E	Position Error Over Warning Detection Level	2	%	0 to 100	100	◎
For Linear Motor Only	Pn580	Zero Clamp Level	2	mm/s	0 to 5000	10	◎
For Linear Motor Only	Pn581	Rotation Detection Level	2	mm/s	1 to 5000	20	◎
For Linear Motor Only	Pn582	Speed Coincidence Signal Output Width	2	mm/s	0 to 100	10	◎
For Linear Motor Only	Pn583	Brake Reference Output Speed Level	2	mm/s	0 to 5000	100	◎
Sequence-related Parameters	Pn600	Regenerative Resistor Capacity *2	2	10W	0 to 1000	0	◎
	Pn601	Reserved by system	2	–	–	0	–

* 1. Parameter changing method is as follows:

◎: Can be changed at any time, and immediately enabled after changing. (Called an online parameter.)

○: Can be changed when DEN = 1. Immediately enabled after changing. Do not change when DEN = 0. Doing so may lead to misoperation, such as position errors. (Called an online parameter.)

Δ: Can be changed at any time, and enabled immediately after the power is turned OFF then ON again. Sends a Set Up Device command at power-ON when changing a parameter. (Called an offline parameter.)

–: Do not access.

* 2. When using an External Regenerative Resistor, set the capacity of the regenerative resistor.

Table B.2 NS115 Parameter List

Category	Pn No.	Name	Size	Unit	Setting Range	NS115 Factory Setting	Changing Method *
Communications Parameters	Pn800	Communications Control	2	–	0000H to 0F73H	0400H	◎
Sequence-related Parameters	Pn801	Function Selection Application (Software Limits)	2	–	0000H to 0113H	0000H	◎
	Pn802	Reserved by system	2	–	–	0000H	–
	Pn803	Zero Point Width	2	reference unit	0 to 250	10	◎
Position-related Parameters	Pn804 Pn805	Forward Software Limit	4	reference unit	$-2^{30}+1$ to $2^{30}-1$	819191808	◎
	Pn806 Pn807	Reverse Software Limit	4	reference unit	$-2^{30}+1$ to $2^{30}-1$	-819191808	◎
	Pn808 Pn809	Absolute Encoder Zero Point Position Offset	4	reference unit	$-2^{30}+1$ to $2^{30}-1$	0	Δ
Acceleration/ Deceleration	Pn80A	First-step Linear Acceleration Parameter	2	10000 reference unit/s^2	1 to 65535	100	○
	Pn80B	Second-step Linear Acceleration Parameter	2	10000 reference unit/s^2	1 to 65535	100	○
	Pn80C	Acceleration Parameter Switching Speed	2	100 reference unit/s	0 to 65535	0	○
	Pn80D	First-step Linear Deceleration Parameter	2	10000 reference unit/s^2	1 to 65535	100	○
	Pn80E	Second-step Linear Deceleration Parameter	2	10000 reference unit/s^2	1 to 65535	100	○
	Pn80F	Deceleration Parameter Switching Speed	2	100 reference unit/s	0 to 65535	0	○
Position Reference Filter	Pn810	Exponential Position Reference Filter Bias	2	reference unit/s	0 to 32767	0	○
	Pn811	Exponential Position Reference Filter Time Constant	2	0.1ms	0 to 5100	0	○
	Pn812	Movement Average Time of Movement Average Position Reference Filter	2	0.1ms	0 to 5100	0	○
Monitor	Pn813	Option Monitor	2	–	0000H to 0099H	0010H	◎

Table B.2 NS115 Parameter List (cont'd)

Category	Pn No.	Name	Size	Unit	Setting Range	NS115 Factory Setting	Changing Method *
Supplementary Commands	Pn814 Pn815	Final Travel Distance for External Positioning	4	reference unit	$-2^{30}+1$ to $2^{30}-1$	100	○
	Pn816	Zero Point Return Mode Setting	2	–	0000H to 0001H	0000H	○
	Pn817	Zero Point Return Approach Speed 1	2	100 reference unit/s	0 to 65535	50	○
	Pn818	Zero Point Return Approach Speed 2	2	100 reference unit/s	0 to 65535	5	○
	Pn819 Pn81A	Final Travel Distance to Return to Zero Point	4	reference unit	$-2^{30}+1$ to $2^{30}-1$	100	○
	Pn81B	Backlash Compensation Amount	2	0.1 reference unit	-32768 to 32767	0000H	◎
	Pn81C	Reserved by system	2	–	–	0000H	–
	Pn81D	Compensation Function Selection	2	–	0000H to 0001H	0000H	Δ
Monitor	Pn81E	Input Signal Monitor Selection	2	–	0000H to 7777H	0000H	◎
	Pn81F	Reserved by system	2	–	–	0000H	–
Supplementary Commands	Pn820 Pn821	Latching Area Upper Limit	4	reference unit	-2^{31} to $2^{31}-1$	00000000H	◎
	Pn822 Pn823	Latching Area Lower Limit	4	reference unit	-2^{31} to $2^{31}-1$	00000000H	◎

* Parameter changing method is as follows:

◎: Can be changed at any time, and immediately enabled after changing. (Called an online parameter.)

○: Can be changed when DEN = 1. Immediately enabled after changing. Do not change when DEN = 0. Doing so may lead to misoperation, such as position errors. (Called an online parameter.)

Δ: Can be changed at any time, and enabled immediately after the power is turned OFF then ON again. Sends a Set Up Device command at power-ON when changing a parameter. (Called an offline parameter.)

–: Do not access.

B.2 Function Switches

The following list shows the function switches and their settings.

Table B.3 Function Switches List

Category	Pn No.	Digit Place	Name	Setting	Description	SGDH Factory Setting	Changing Method *
Function Switches	Pn000	0	Direction Selection	0	Sets CCW as forward direction.	0	Δ
				1	Sets CW as forward direction.		
		1	Control Method Selection	0 to B	Settings are invalid. Do not set.	0	Δ
		2	Axis Address	0 to F	Sets the SERVOPACK axis address.	0	Δ
		3	Rotary/Linear Startup Selection (when encoder is not connected)	0	Starts up as rotary motor.	0	Δ
				1	Starts up as linear motor.		
	Pn001	0	Servo OFF or Alarm Stop Mode	0	Stops the motor by applying dynamic brake (DB).	0	Δ
				1	Stops the motor by applying dynamic brake (DB) and then releases DB.		
				2	Makes the motor coast to a stop state without using the dynamic brake (DB).		
		1	Overtravel Stop Mode	0	Same setting as Pn001.0 (Stops the motor by applying DB or by coasting.)	0	Δ
				1	Sets the torque of Pn406 to the maximum value, decelerates the motor to a stop, and then sets it to servolock state.		
				2	Sets the torque of Pn406 to the maximum value, decelerates the motor to a stop, and then sets it to coasting state.		
		2	AC/DC Power Input Selection	0	Not applicable to DC power input: Input AC power supply through L1, L2, and (L3) terminals.	0	Δ
				1	Applicable to DC power input: Input DC power supply through (+)1 and (-) terminals.		
		3	Warning Code Output Selection	0	ALO1, ALO2, and ALO3 output only alarm codes.	0	Δ
				1	ALO1, ALO2, and ALO3 output both alarm codes and warning codes. While warning codes are output, ALM signal output remains ON (normal state).		

Table B.3 Function Switches List (cont'd)

Category	Pn No.	Digit Place	Name	Setting	Description	SGDH Factory Setting	Changing Method *
Function Switches	Pn002	0	Torque Reference Option in Speed/Position Control Mode	0	The torque reference option is not effective. Set P_TLIM (TFF), N_TLIM to 0.	0	Δ
				1	P_TLIM operates as the torque limit value. Set N_TLIM to 0.		
				2	TFF operates as the torque feed forward. Set N_TLIM to 0.		
				3	When P_CL and N_CL of OPTION field = 0, parameters Pn402 and Pn403 operate as torque limit values. When P_CL = 0 and N_CL = 1, N_TLIM operates as the torque limit value. When P_CL = 1 and N_CL = 0, or P_CL and N_CL = 1, P_TLIM operates as the torque limit value.		
		1	Speed Reference Option in Torque Control Mode	0	The speed reference option is not effective. Set VLIM to 0.	0	Δ
				1	VLIM operates as the speed limit value.		
		2	Absolute Encoder Usage	0	Uses absolute encoder as an absolute encoder.	0	Δ
				1	Uses absolute encoder as an incremental encoder.		
		3	Fully Closed Encoder Usage	0	Do not use.	0	Δ
				1	Uses without phase C.		
				2	Uses with phase C.		
				3	Uses in Reverse Rotation Mode without phase C.		
				4	Uses in Reverse Rotation Mode with phase C.		

Table B.3 Function Switches List (cont'd)

Category	Pn No.	Digit Place	Name	Setting	Description	SGDH Factory Setting	Changing Method *
Function Switches	Pn003	0	Analog Monitor 1	0	Motor speed Rotary: 1 V/1000 min^{-1}. Linear: 1 V/1000 mm/s.	2	◎
				1	Speed reference Rotary: 1 V/1000 min^{-1}. Linear: 1 V/1000 mm/s.		
				2	Torque/thrust reference: 1 V/100%		
				3	Position error: 0.05 V/1 pulse		
				4	Position error: 0.05 V/100 pulses		
				5	Reference pulse frequency (converted to min^{-1}) Rotary: 1 V/1000 min^{-1}. Linear: 1 V/1000 mm/s.		
				6	Motor speed: Rotary: 1 V/250 min^{-1}. Linear: 1 V/100 mm/s.		
				7	Motor speed: Rotary: 1 V/125 min^{-1}. Linear: 1 V/10 mm/s.		
				8	Do not set.		
				9	Do not set.		
				A	Do not set.		
				B	Do not set.		
				C	Do not set.		
				D	Do not set.		
				E	Do not set.		
				F	Do not set.		
		1	Analog Monitor 2	0 to F	Same settings as Pn003.0.	0	◎
		2	Reserved by system		Set to 0.	0	
		3	Reserved by system		Set to 0.	0	
	Pn005	0	Brake Control Function Selection	0	Controls brakes with Servo.	0	Δ
				1	Controls brakes with controller.		
		1	Reserved by system		Set to 0.	0	
		2	Reserved by system		Set to 0.	0	
		3	Reserved by system		Set to 0.	0	

Table B.3 Function Switches List (cont'd)

Category	Pn No.	Digit Place	Name	Setting	Description	SGDH Factory Setting	Changing Method *
For Linear Motor Only	Pn080	0	Pole Sensor Selection	0	Enabled	0	Δ
				1	Disabled		
		1	Motor Phase Selection In Order	0	The encoder counts up when the moving coil moves in the forward direction.	0	Δ
				1	The encoder counts down when the moving coil moves in the forward direction.		
		2	Reserved by system		Set to 0.	0	
		3	Reserved by system		Set to 0.	0	
Gain-related Switches	Pn10B	0	Mode Switch Selection	0	Uses internal torque reference as the condition (Level setting: Pn10C).	0	◎
				1	Uses speed reference as the condition (Level setting: Pn10D).		
				2	Uses acceleration as the condition (Level setting: Pn10E).		
				3	Uses error pulse as the condition (Level setting: Pn10F).		
				4	No mode switch function available		
		1	Speed Loop Control Method	0	PI control	0	◎
				1	IP control		
		2	Reserved by system		Set to 0.	0	
		3	Reserved by system		Set to 0.	0	
	Pn110	0	Online Autotuning Method	0	Tunes only at the beginning of operation.	0	◎
				1	Always tunes.		
				2	Does not perform autotuning.		
		1	Speed Feedback Compensation Selection	0	Enabled	1	Δ
				1	Disabled		
		2	Friction Compensation Selection	0	Friction compensation: Disabled	0	◎
				1	Friction compensation: Small		
				2	Friction compensation: Large		
		3	Reserved by system		Set to 0.	0	◎

Table B.3 Function Switches List (cont'd)

Category	Pn No.	Digit Place	Name	Setting	Description	SGDH Factory Setting	Changing Method *
Position-related Switches	Pn200	0	Reference Pulse Form	0 to 9	Set to 0.	0	Δ
		1	Error Counter Clear Signal Form	0 to 3	Set to 0.	0	Δ
		2	Clear Operation	1	Does not clear error counter. (Possible to clear error counter only with CLR signal.) (Automatically sets to 1 when the NS115 is connected.)	1	Δ
		3	Filter Selection	0 to 1	Set to 0.	0	Δ
Position-related Switches	Pn207	0	Reserved by system		Set to 0.	0	Δ
		1	Position Control Option	1	Uses V-REF as a speed feed-forward input. (Automatically sets to 1 when the NS115 is connected.)	1	Δ
		2	Reserved by system		Set to 0.	0	
		3	Reserved by system		Set to 0.	0	
Torque-related Switches	Pn408	0	Notch Filter Selection	0	Disabled	0	◎
				1	Uses a notch filter for torque reference.		
		1	Reserved by system		Set to 0.	0	
		2	Reserved by system		Set to 0.	0	
		3	Reserved by system		Set to 0.	0	

Table B.3 Function Switches List (cont'd)

Category	Pn No.	Digit Place	Name	Setting	Description	SGDH Factory Setting	Changing Method *
Sequence-related Switches	Pn50A	0	Input Signal Allocation Mode	1	Manual signal allocation (Automatically sets to 1 when the NS115 is connected.)	1	
		1	/S-ON Signal Mapping	8	Set to 8. (Automatically sets to 8 when the NS115 is connected.)	8	
		2	/P-CON Signal Mapping	8	Set to 8. (Automatically sets to 8 when the NS115 is connected.)	8	
		3	P-OT Signal Mapping	0	Inputs from the SI0 (CN1-40) input terminal.	2	Δ
				1	Inputs from the SI1 (CN1-41) input terminal.		
				2	Inputs from the SI2 (CN1-42) input terminal.		
				3	Inputs from the SI3 (CN1-43) input terminal.		
				4	Inputs from the SI4 (CN1-44) input terminal.		
				5	Inputs from the SI5 (CN1-45) input terminal.		
				6	Inputs from the SI6 (CN1-46) input terminal.		
				7	Sets signal ON.		
				8	Sets signal OFF.		
				9	Inputs the reverse signal from the SI0 (CN1-40) input terminal.		
				A	Inputs the reverse signal from the SI1 (CN1-41) input terminal.		
				B	Inputs the reverse signal from the SI2 (CN1-42) input terminal.		
				C	Inputs the reverse signal from the SI3 (CN1-43) input terminal.		
				D	Inputs the reverse signal from the SI4 (CN1-44) input terminal.		
				E	Inputs the reverse signal from the SI5 (CN1-45) input terminal.		
				F	Inputs the reverse signal from the SI6 (CN1-46) input terminal.		

Table B.3 Function Switches List (cont'd)

Category	Pn No.	Digit Place	Name	Setting	Description	SGDH Factory Setting	Changing Method *
Sequence-related Switches	Pn50B	0	N-OT Signal Mapping	0 to F	Same settings as Pn50A.3	3	Δ
		1	/ALM-RST Signal Mapping	8	Set to 8. (Automatically sets to 8 when the NS115 is connected.)	8	
		2	/P-CL Signal Mapping	0	Inputs from the SI0 (CN1-40) input terminal.	5	Δ
				1	Inputs from the SI1 (CN1-41) input terminal.		
				2	Inputs from the SI2 (CN1-42) input terminal.		
				3	Inputs from the SI3 (CN1-43) input terminal.		
				4	Inputs from the SI4 (CN1-44) input terminal.		
				5	Inputs from the SI5 (CN1-45) input terminal.		
				6	Inputs from the SI6 (CN1-46) input terminal.		
				7	Sets signal ON.		
				8	Sets signal OFF.		
				9	Inputs the reverse signal from the SI0 (CN1-40) input terminal.		
				A	Inputs the reverse signal from the SI1 (CN1-41) input terminal.		
				B	Inputs the reverse signal from the SI2 (CN1-42) input terminal.		
				C	Inputs the reverse signal from the SI3 (CN1-43) input terminal.		
				D	Inputs the reverse signal from the SI4 (CN1-44) input terminal.		
				E	Inputs the reverse signal from the SI5 (CN1-45) input terminal.		
				F	Inputs the reverse signal from the SI6 (CN1-46) input terminal.		
		3	/N-CL Signal Mapping	0 to F	Same settings as Pn50B.2	6	Δ
	Pn50C	0	/SPD-D Signal Mapping	8	Set to 8. (Automatically sets to 8 when the NS115 is connected.)	8	
		1	/SPD-A Signal Mapping	8	Set to 8. (Automatically sets to 8 when the NS115 is connected.)	8	
		2	/SPD-B Signal Mapping	8	Set to 8. (Automatically sets to 8 when the NS115 is connected.)	8	
		3	/C-SEL Signal Mapping	8	Set to 8. (Automatically sets to 8 when the NS115 is connected.)	8	

Table B.3 Function Switches List (cont'd)

Category	Pn No.	Digit Place	Name	Setting	Description	SGDH Factory Setting	Changing Method *
Sequence-related Switches	Pn50D	0	/ZCLAMP Signal Mapping	8	Set to 8. (Automatically sets to 8 when the NS115 is connected.)	8	
		1	/INHIBIT Signal Mapping	8	Set to 8. (Automatically sets to 8 when the NS115 is connected.)	8	
		2	/G-SEL Signal Mapping	8	Set to 8. (Automatically sets to 8 when the NS115 is connected.)	8	
		3	P-DET Signal Mapping	8	Set to 8. (Automatically sets to 8 when the NS115 is connected.)	8	
	Pn50E	0	/COIN Signal Mapping	0	Disabled	1	Δ
				1	Outputs from the SO1 (CN1-25, 26) output terminal.		
				2	Outputs from the SO2 (CN1-27, 28) output terminal.		
				3	Outputs from the SO3 (CN1-29, 30) output terminal.		
		1	/V-CMP Signal Mapping	0 to 3	Same settings as Pn50E.0	1	Δ
		2	/TGON Signal Mapping	0 to 3	Same settings as Pn50E.0	2	Δ
		3	/S-RDY Signal Mapping	0 to 3	Same settings as Pn50E.0	3	Δ
	Pn50F	0	/CLT Signal Mapping	0 to 3	Same settings as Pn50E.0	0	Δ
		1	/VLT Signal Mapping	0 to 3	Same settings as Pn50E.0	0	Δ
		2	/BK Signal Mapping	0 to 3	Same settings as Pn50E.0	0	Δ
		3	/WARN Signal Mapping	0 to 3	Same settings as Pn50E.0	0	Δ
	Pn510	0	/NEAR Signal Mapping	0 to 3	Same settings as Pn50E.0	0	Δ
		1	Reserved by system		Set to 0.	0	
		2	Reserved by system		Set to 0.	0	
		3	Reserved by system		Set to 0.	0	

Table B.3 Function Switches List (cont'd)

Category	Pn No.	Digit Place	Name	Setting	Description	SGDH Factory Setting	Changing Method *
Sequence-related Switches	Pn511	0	/DEC Signal Mapping	0	Inputs from the SI0 (CN1-40) input terminal.	8	Δ
				1	Inputs from the SI1 (CN1-41) input terminal.		
				2	Inputs from the SI2 (CN1-42) input terminal.		
				3	Inputs from the SI3 (CN1-43) input terminal.		
				4	Inputs from the SI4 (CN1-44) input terminal.		
				5	Inputs from the SI5 (CN1-45) input terminal.		
				6	Inputs from the SI6 (CN1-46) input terminal.		
				7	Sets signal ON.		
				8	Sets signal OFF.		
				9	Inputs the reverse signal from the SI0 (CN1-40) input terminal.		
				A	Inputs the reverse signal from the SI1 (CN1-41) input terminal.		
				B	Inputs the reverse signal from the SI2 (CN1-42) input terminal.		
				C	Inputs the reverse signal from the SI3 (CN1-43) input terminal.		
				D	Inputs the reverse signal from the SI4 (CN1-44) input terminal.		
				E	Inputs the reverse signal from the SI5 (CN1-45) input terminal.		
				F	Inputs the reverse signal from the SI6 (CN1-46) input terminal.		
		1	/EXT1 Signal Mapping	4	Inputs from the SI4 (CN1-44) input terminal.	8	Δ
				5	Inputs from the SI5 (CN1-45) input terminal.		
				6	Inputs from the SI6 (CN1-46) input terminal.		
				7	Sets signal ON.		
				8	Sets signal OFF.		
				D	Inputs the reverse signal from the SI4 (CN1-44) input terminal.		
				E	Inputs the reverse signal from the SI5 (CN1-45) input terminal.		
				F	Inputs the reverse signal from the SI6 (CN1-46) input terminal.		
				0 to 3 9 to C	Sets signal OFF.		
		2	/EXT2 Signal Mapping	0 to F	Same settings as Pn511.1	8	Δ
		3	/EXT3 Signal Mapping	0 to F	Same settings as Pn511.1	8	Δ

Table B.3 Function Switches List (cont'd)

Category	Pn No.	Digit Place	Name	Setting	Description	SGDH Factory Setting	Changing Method *
Sequence-related Switches	Pn512	0	Signal Reversal for SO1 (CN1-25, 26) Terminal	0	Signal is not reversed.	0	Δ
				1	Signal is reversed.		
		1	Signal Reversal for SO2 (CN1-27, 28) Terminal	0	Signal is not reversed.	0	Δ
				1	Signal is reversed.		
		2	Signal Reversal for SO3 (CN1-29, 30) Terminal	0	Signal is not reversed.	0	Δ
				1	Signal is reversed.		
		3	Reserved by system		Set to 0.	0	Δ

* Parameter changing method is as follows:

◎: Can be changed at any time, and immediately enabled after changing. (Called an online parameter.)

○: Can be changed when DEN = 1. Immediately enabled after changing. Do not change when DEN = 0. Doing so may lead to misoperation, such as position errors. (Called an online parameter.)

Δ: Can be changed at any time, and enabled immediately after the power is turned OFF then ON again. Sends a Set Up Device command at power-ON when changing a parameter. (Called an offline parameter.)

−: Do not access.

Table B.4 NS115 Parameters List

Category	Pn No.	Digit Place	Name	Setting	Description	SGDH Factory Setting	Changing Method *
Communi-cations Parame-ters	Pn800	0	MECHATRO LINK-II Com-munications Check Mask (for debug-ging)	0	Detects both communications error (A.E6) and WDT error (A.E5).	0	◎
				1	Ignores communications error (A.E6).		
				2	Ignores WDT error (A.E5).		
				3	Ignores both communications error (A.E6) and WDT error (A.E5).		
		1	Warning Check Mask (for debug-ging)	0	Detects A.94, A,95, and A.96 all.	4	◎
				1	Ignores parameter setting warning (A.94).		
				2	Ignores MECHATROLINK-II command warning (A.95).		
				3	Ignores both parameter setting warning (A.94) and MECHATROLINK-II command warning (A.95).		
				4	Ignores communications error (A.96).		
				5	Ignores both parameter setting warning (A.94) and communications error (A.96).		
				6	Ignores both MECHATROLINK-II command warning (A.95) and communications error (A.96).		
				7	Ignores parameter setting warning (A.94), MECHATROLINK-II command warning (A.95), and communications error (A.96).		
		2	Communica-tions Error Counts at Sin-gle Transmis-sion	0 to F	Detects communications error (A.E6) when a MECHATROLINK-II receive data error occurs the number of times of {set value + 2} continu-ously.	0	◎
		3	Reserved by system		Set to 0.	0	

Table B.4 NS115 Parameters List (cont'd)

Category	Pn No.	Digit Place	Name	Setting	Description	SGDH Factory Setting	Changing Method *
Sequence-related Parame-ters	Pn801	0	Soft Limit Function	0	Soft limit enabled.	0	◎
				1	Forward soft limit disabled.		
				2	Reverse soft limit disabled.		
				3	Soft limit disabled in both directions.		
		1	Reserved by system		Set to 0.	0	◎
		2	Software Limit Check Using Refer-ences	0	No software limit check using references.	0	◎
				1	Software limit check using references.		
		3	Reserved by system		Set to 0.	0	
	Pn802	0	Reserved by system		Set to 0.	0	Δ
		1	Reserved by system		Set to 0.	0	Δ
		2	Reserved by system		Set to 0.	0	
		3	Reserved by system		Set to 0.	0	
Monitor	Pn813	0	Option Monitor 1	0	As for Analog Monitor 1 (Pn003.0)	0	◎
				1	As for Analog Monitor 2 (Pn003.1)		
				2	Monitors initial multi-rotation data (IMTDATA).		
				3	Monitors the encoder count value (PGCNT: × 4 multiple number).		
				4	Monitors the motor encoder initial multi-rotation data value.		
				5	Monitors the motor encoder count value.		
				6	Monitors the motor encoder count latch value.		
				7	Do not set.		
				8	Monitors the fully closed encoder count value.		
				9	Monitors the fully closed encoder count latch value.		
		1	Option Monitor 2	0 to 9	Same settings as Pn813.0	1	◎
		2	Reserved by system		Set to 0.	0	
		3	Reserved by system		Set to 0.	0	

Table B.4 NS115 Parameters List (cont'd)

Category	Pn No.	Digit Place	Name	Setting	Description	SGDH Factory Setting	Changing Method *
Supple-mentary Com-mands	Pn816	0	Return to Zero Point Direction	0	Forward	0	○
				1	Reverse		
		1	Reserved by system		Set to 0.	0	
		2	Reserved by system		Set to 0.	0	
		3	Reserved by system		Set to 0.	0	
	Pn81D	0	Backlash Compensa-tion Direction	0	Forward direction	0	Δ
				1	Reverse direction		
		1	Reserved by system		Set to 0.	0	Δ
		2	Reserved by system		Set to 0.	0	Δ
		3	Reserved by system		Set to 0.	0	Δ
	Pn81E	0	IO12 Mapping	0	No allocation	0	◎
				1	Monitors the SI0 (CN1-40) input terminal.		
				2	Monitors the SI1 (CN1-41) input terminal.		
				3	Monitors the SI2 (CN1-42) input terminal.		
				4	Monitors the SI3 (CN1-43) input terminal.		
				5	Monitors the SI4 (CN1-44) input terminal.		
				6	Monitors the SI5 (CN1-45) input terminal.		
				7	Monitors the SI6 (CN1-46) input terminal.		
		1	IO13 Mapping	0 to 7	Same settings as Pn81E.0	0	◎
		2	IO14 Mapping	0 to 7	Same settings as Pn81E.0	0	◎
		3	IO15 Mapping	0 to 7	Same settings as Pn81E.0	0	◎

* Parameter changing method is as follows:

◎: Can be changed at any time, and immediately enabled after changing. (Called an online parameter.)

○: Can be changed when DEN = 1. Immediately enabled after changing. Do not change when DEN = 0. Doing so may lead to misoperation, such as position errors. (Called an online parameter.)

Δ: Can be changed at any time, and enabled immediately after the power is turned OFF then ON again. Sends a Set Up Device command at power-ON when changing a parameter. (Called an offline parameter.)

Appendix C

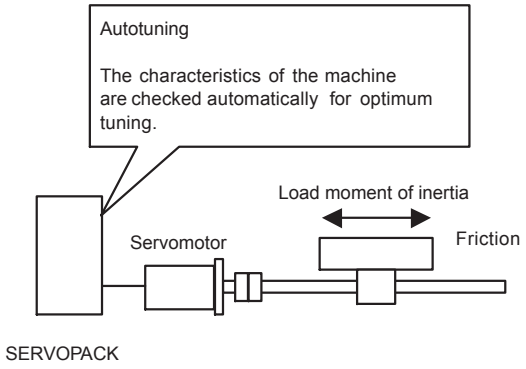
Using the Adjusting Command (ADJ: 3EH)

C

This appendix describes how to use the Adjusting command (ADJ: 3EH).

C.1 Autotuning

If positioning is taking a long time, the speed loop gain or position loop gain of the servo system may not be set properly. If the gain settings are wrong, set them properly in accordance with the configuration and rigidity of the machine.



The SERVOPACK incorporates an online autotuning function, which checks the characteristics of the machine automatically and makes the necessary servo gain adjustments. The function is easy to use and makes it possible for even beginners to perform servo gain tuning and set all servo gains as parameters.

The following parameters can be set automatically by using the online autotuning function.

Parameter	Content
Pn100	Speed loop gain
Pn101	Speed loop integral time constant
Pn102	Position loop gain
Pn401	Torque reference filter time constant

C.1.1 Online Autotuning

Online autotuning is a control function which enables the SERVOPACK to check changes in the load moment of inertia during operation in order to maintain the target value for speed loop gain or position loop gain.

Online autotuning may not work well in the following cases.

- When the cycle for load moment of inertia change is 200 ms or shorter (when the load changes rapidly).
- When the application has slow acceleration or deceleration using the soft start function, and the speed error of the servomotor being driven is small.
- When adjusting the servo gain manually and operating at low gain (a machine rigidity of 1 or less).

Disable the online autotuning function and adjust the gain manually if tuning is not possible. Refer to *9.3 Manual Tuning* of the Σ-*II Series SGM□H/SGDH User's Manual (SIEPS80000005)*.

C

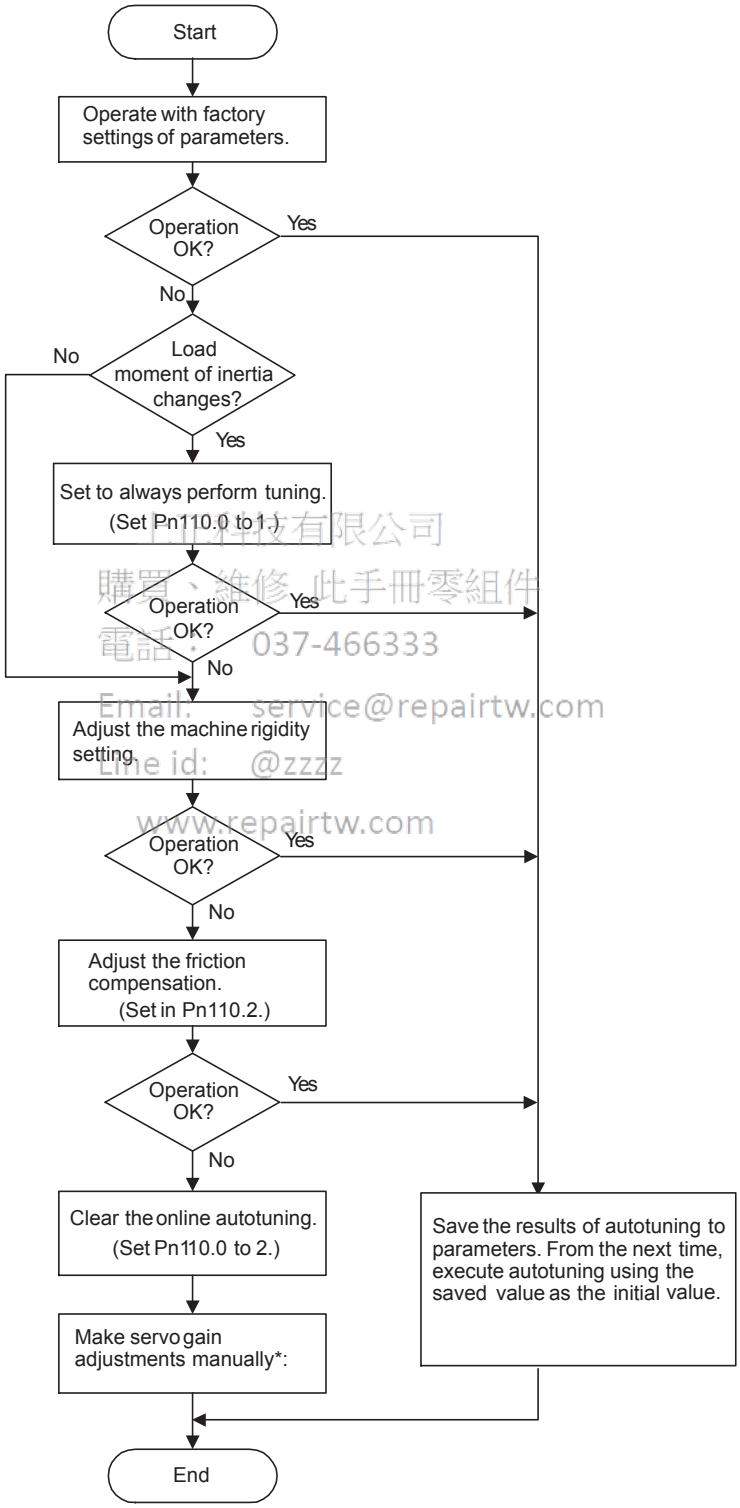
IMPORTANT

Do not use online autotuning in the following cases.

- When using IP control for the speed loop.
- When using the torque feed-forward function.

■ Setting Parameters for Online Autotuning

The following flowchart shows the procedure for setting the parameters for online autotuning.



* Before making servo gain adjustments manually, refer to *9.4 Servo Gain Adjustment Functions* of the *Σ-II Series SGM□H/SGDH User's Manual (SIEPS80000005)*.

C.1.2 Machine Rigidity Settings for Online Autotuning

For the machine rigidity settings at the time of online autotuning, select the target values for speed loop gain and position loop gain of the servo system. Any of the following ten levels of rigidity can be selected.

Machine Rigidity Setting Fn001	Position Loop Gain [S^{-1}] Pn102	Speed Loop Gain [Hz] Pn100	Speed Loop Integral Time Constant [0.01ms] Pn101	Torque Reference Filter Time Constant [0.01ms] Pn401
1	15	15	6000	250
2	20	20	4500	200
3	30	30	3000	130
4	40	40	2000	100
5	60	60	1500	70
6	85	85	1000	50
7	120	120	800	30
8	160	160	600	20
9	200	200	500	15
10	250	250	400	10

Note: The rigidity value is factory-set to 4.

As the rigidity value is increased, the servo system loop gain increases and the time required for positioning is shortened. If the rigidity is excessively high, however, it may cause the machine to vibrate. In that case, decrease the set value.

The rigidity value setting automatically changes the parameters in the above table.

INFO

If parameters Pn102, Pn100, Pn101, and Pn401 are set manually with the online autotuning function enabled, tuning is performed with the manually set values as target values.

■ Changing the Machine Rigidity Setting

The machine rigidity setting is changed using the Adjusting command (ADJ: 3EH).

The procedure for making changes is shown below.

INFO

It is also possible to use a Digital Operator to change settings. Refer to the *Σ-II Series SGM□H/SGDH User's Manual (SIEPS80000005)*.

1. By setting byte 1 of the MECHATROLINK-II command field to ADJ (3EH) and byte 2 to 00H, the following command field can be set.

	Command	Response	
5	CCMD	CANS	CCMD: Command CANS: Answer CADDRESS: Setting/reference address CDATA: Setting/reference data
6	CADDRESS	CADDRESS	
7			
8	CDATA	CDATA	
9			

2. Send the following data setting commands in each command field.
   Set "01H" (Data setting) in the CCMD field.
   Set "2003H" in the CADDRESS field.
   Set 1 to 10 in the CDATA field.
3. After setting the data, send the command. Approximately one second after sending, confirm that the response is correct and that CMDRDY of STATUS is set to 1. It takes one second max. after sending for the setting to be completed.
4. Use the following data reference command to check when settings have been completed.
   Set "00H" (Data reference) in the CCMD field.
   Set "2003H" in the CADDRESS field.
5. After setting the data, send the command. Confirm that the response is correct and that CMDRDY or STATUS is set to 1. Confirm that the value of the CDATA field in the response field is the machine rigidity you set.
   If a response is returned with the rigidity setting that is being made, the rigidity setting has been completed.

This completes changing the machine rigidity setting using online autotuning.

INFO

Confirm that the following items are correct in the response:

- CCMD in the command and CANS in the response are the same.
- CADDRESS is the same in the command and response. (When written, confirm that CDATA is the same in the command and response.)
- The alarm and warning bits in STATUS are 0.

C.1.3 Saving Results of Online Autotuning

Online autotuning always processes the latest load moment of inertia to renew data so that the speed loop gain will reach the target value that has been set. When the SERVOPACK is turned OFF, all the processed data is lost. Therefore, when the SERVOPACK is turned ON again, online autotuning is performed by processing the factory-set values in the SERVOPACK.

To save the results of online autotuning and use them as the initial values set in the SERVOPACK when the SERVOPACK is turned ON again, it is necessary to save them according to the procedures for saving the results of online autotuning. In this case, the moment of inertia ratio set in parameter Pn103 can be changed.

On the basis of the rotor moment of inertia of the servomotor, the inertia ratio is expressed in percentage terms by the load moment of inertia. The value set in Pn103 is used to calculate the load moment of inertia at the time of online autotuning.

C

Pn103	Moment of Inertia Ratio	Unit: %	Setting Range: 0 to 10000	Factory Setting: 0	Position Control

$$\text{Moment of inertia ratio} = \frac{\text{Motor axis conversion load moment of inertia } (J_L)}{\text{Servomotor rotor moment of inertia } (J_M)} \times$$

The moment of inertia ratio is factory-set to 0%.

IMPORTANT

Before making servo gain adjustments manually, be sure to set the inertia ratio in Pn103. If the moment of inertia ratio is incorrect, the speed loop gain (unit: Hz) set in Pn100 will be wrong.

■ Procedure for Saving Results of Online Autotuning

The Adjusting command (ADJ: 3EH) is used to save the results of online autotuning.

The procedure for saving results is shown below.

INFO

It is also possible to use a Digital Operator to save settings. Refer to the *Σ-II Series SGM□H/SGDH User's Manual (SIEPS80000005)*.

1. By setting byte 1 of the MECHATROLINK-II command field to ADJ (3EH) and byte 2 to 00H, the following command field can be set.

	Command	Response	
5	CCMD	CANS	CCMD: Command CANS: Answer CADDRESS: Setting/reference address CDATA: Setting/reference data
6	CADDRESS	CADDRESS	
7			
8	CDATA	CDATA	
9			

2. Send the following data setting commands in each command field.

   Set “01H” (Data setting) in the CCMD field.

   Set “2000H” in the CADDRESS field.

   Set “1007H” in the CDATA field.

3. After setting the data, send the command.

   Confirm that the response is correct and that CMDRDY of STATUS is set to 1.

   The Online Autotuning Results Write Mode will be entered.

4. Continue by using the following data setting command.

   Set “01H” (Data setting) in the CCMD field.

   Set “2001H” in the CADDRESS field.

   Set “01H” (Execute) in the CDATA field.

5. After setting the data, send the command. Approximately one second after sending, confirm that the response is correct and that CMDRDY of STATUS is set to 1.

This completes saving the online autotuning results.

C.1.4 Parameters Related to Online Autotuning

This section provides information on a variety of parameters related to online autotuning.

■ Online Autotuning Method

The following parameter is used to set the autotuning conditions.

Pn110.0	Online Autotuning Method	Factory Setting: 0	Position Control

Pn110.0 Setting	Description
0	Autotuning is performed only when the system runs for the first time after the power is turned ON. After the load moment of inertia is calculated, the calculated data is not refreshed.
1	Autotuning is continuously performed (moment of inertia value calculation).
2	The online autotuning function is not used.

This parameter is factory-set to "0." If the load moment of inertia change is minimal or if the application makes few changes, there is no need to continue calculating the moment of inertia while the system is in operation. Instead, continue to use the value that was calculated when the system was first started up.

Set this parameter to "1" if the load moment of inertia always fluctuates due to the load conditions. Then the response characteristics can be kept stable by continuously refreshing the moment of inertia calculation data and reflecting them in the servo gain.

If the load moment of inertia fluctuation results within 200 ms, the moment of inertia calculation data may not be refreshed properly. If that happens, set Pn110.0 to "0" or "2."

Set Pn110.0 to "2" if autotuning is not available or if the online autotuning function is not used because the load moment of inertia is already known and the SERVOPACK is manually adjusted by setting the moment of inertia ratio data in Pn103.

■ Speed Feedback Compensation Selection

Use the following parameter to enable or disable speed feedback compensation during autotuning. Refer to *9.4.8 Speed Feedback Compensation* of the *Σ-II Series SGM□H/SGDH User's Manual (SIEPS80000005)*.

This parameter can be left as it is if online autotuning is performed. If this parameter is set manually, however, the setting is reflected to the operational setting made during online autotuning.

Pn110.1	Speed Feedback Compensation Selection	Factory Setting: 1	Position Control

Pn110.1 Setting	Description
0	Enabled
1	Disabled

■ Friction Compensation Selection

Use the following parameter to enable or disable friction compensation to determine whether or not the friction of the servo system is to be taken into consideration for the calculation of load moment of inertia.

If this compensation function is enabled, select small or large friction compensation according to the extent of friction in order to ensure highly precise load moment of inertia calculation.

Pn110.2	Friction Compensation Selection	Factory Setting: 0	Position Control

Pn110.2 Setting	Description
0	Friction compensation: Disabled
1	Friction compensation: Small
2	Friction compensation: Large

INFO

1. Do not set friction compensation for loads with low friction (10% rated torque/speed or less).
2. Autotuning will be performed as if the load moment of inertia was 30 times the motor moment of inertia when the load moment of inertia exceeds 30 times the motor moment of inertia.

C.2 Absolute Encoder Setup (Initialization)

The Adjusting (ADJ: 3EH) command can be used to setup (initialize) the absolute encoder.

The setup procedure is outline below.

INFO

Be sure to turn the power OFF then ON again after the encoder setup.

1. By setting byte 1 of the MECHATROLINK-II command field to ADJ (3EH) and byte 2 to 00H, the following command field can be set.

	Command	Response	
5	CCMD	CANS	CCMD: Serial communications command CANS: Serial communications answer CADDRESS: Setting/reference address CDATA: Setting/reference data
6	CADDRESS	CADDRESS	
7			
8	CDATA	CDATA	
9			

2. Send the following data setting commands in each command field.
   Set “01H” (Data setting) in the CCMD field.
   Set “2000H” in the CADDRESS field.
   Set “1008H” in the CDATA field.
3. After setting the data, send the command.
   Confirm that the response is correct and that CMDRDY of STATUS is set to 1.
   The absolute encoder will enter the Setup Mode.
4. Continue by using the following data setting command.
   Set “01H” (Data setting) in the CCMD field.
   Set “2001H” in the CADDRESS field.
   Set “02H” (Save) in the CDATA field.
5. After setting the data, send the command.
   Confirm that the response is correct and that CMDRDY of STATUS is set to 1.
6. Send the following command.
   Set “01H” (Data setting) in the CCMD field.
   Set “2001H” in the CADDRESS field.
   Set “01H” (Execute) in the CDATA field.
7. After setting the data, send the command. Approximately 2 seconds after sending, confirm that the response is correct and that CMDRDY of STATUS is set to 1.

This completes setting up the absolute encoder. Turn the power OFF then ON again to confirm that the SERVOPACK will start up normally.

C

C.3 Multiturn Limit Setting

The Adjusting command (ADJ: 3EH) can be used to set the multiturn limit.

Use the following setting procedure.

INFO Be sure to turn the power OFF then ON again after the multiturn limit setting.

1. By setting byte 1 of the MECHATROLINK-II command field to ADJ (3EH) and byte 2 to 00H, the following command field can be set.

	Command	Response	
5	CCMD	CANS	CCMD: Command CANS: Answer CADDRESS: Setting/reference address CDATA: Setting/reference data
6	CADDRESS	CADDRESS	
7			
8	CDATA	CDATA	
9			

2. Send the following data in each command field.
   Set “01H” (Data setting) in the CCMD field.
   Set “2000H” in the CADDRESS field.
   Set “1013H” in the CDATA field.
3. After setting the data, send the command.
   Confirm that the response is correct and that CMDRDY of STATUS is set to 1.
   The Multiturn Limit Setting Mode will be entered.
4. Continue by using the following data setting commands.
   Set “01H” (Data setting) in the CCMD field.
   Set “2001H” in the CADDRESS field.
   Set “02H” (Save) in the CDATA field.
5. After setting the data, send the command.
   Confirm that the response is correct and that CMDRDY of STATUS is set to 1.
6. Send the following command.
   Set “01H” (Data setting) in the CCMD field.
   Set “2001H” in the CADDRESS field.
   Set “01H” (Execute) in the CDATA field.
7. After setting the data, send the command. Approximately 2 seconds after sending, confirm that the response is correct and that CMDRDY of STATUS is set to 1.

This completes setting the multiturn limit. Turn OFF the power and ON again to confirm that the SERVOPACK will start up normally.

C.4 Automatic Offset Adjustment of Motor Current Detection Signals

The offset adjustment of the motor current detection signals has already been made before shipping the product. Therefore, it is not necessary for the users to make any adjustment. Use the automatic offset adjustment only if the torque ripple due to current offset is considered abnormally high or the torque ripple needs to be reduced to achieve higher accuracy.

The adjustment procedure is outlined below.

The automatic adjustment is possible only when the Servo is set to OFF with the main circuit power turned ON.

1. By setting byte 1 of the MECHATROLINK-II command field to ADJ (3EH) and byte 2 to 00H, the following command field can be set.

	Command	Response	
5	CCMD	CANS	CCMD: Command CANS: Answer CADDRESS: Setting/reference address CDATA: Setting/reference data
6	CADDRESS	CADDRESS	
7			
8	CDATA	CDATA	
9			

2. Send the following data setting commands in each command field.
   Set “01H” (Data setting) in the CCMD field.
   Set “2000H” in the CADDRESS field.
   Set “100EH” in the CDATA field.
3. After setting the data, send the command.
   Confirm that the response is correct and that CMDRDY of STATUS is set to 1.
   The automatic offset adjustment of motor current detection signals will be enabled.
4. Continue by using the following data setting command.
   Set “01H” (Data setting) in the CCMD field.
   Set “2001H” in the CADDRESS field.
   Set “01H” (Execute) in the CDATA field.
5. After setting the data, send the command.
   Approximately 2 seconds after sending, confirm that the response is correct and that CMDRDY of STATUS is set to 1.

This completes setting up the automatic offset adjustment of the motor current detection signals.

C.5 Enabling the Panel Operator

If the Panel Operator indicator (LED) is turned OFF (refer to *7.3 Panel Operator Indicators*) by receiving a MECHATROLINK-II command, it can be lit by using an Adjusting command (ADJ: 3EH) provided that no Hand-held Digital Operator is connected or no communications is taking place with personal computers.

Use the following setting procedure.

1. By setting byte 1 of the MECHATROLINK-II command field to ADJ (3EH) and byte 2 to 00H, the following command field can be set.

	Command	Response	
5	CCMD	CANS	CCMD: Command CANS: Answer CADDRESS: Setting/reference addresses CDATA: Setting/reference data
6	CADDRESS	CADDRESS	
7			
8	CDATA	CDATA	
9			

2. Send the following data setting commands to each command field.

   Set “01H” (Data setting) in the CCMD field.

   Set “2002H” in the CADDRESS field.

   Set “Desired data” in the CDATA field.
3. After setting the data, send the command. Confirm that the response is correct and that CMDRDY of STATUS is set to 1.

When the settings are completed, the Panel Operator is enabled.

The Panel Operator enable setting is not normally required, but can be used to maintain compatibility with the NS100.

Index

P

R

S

T

V

W

Revision History

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

MANUAL NO.   SIEPC71080001B
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- June 2003: Date of printing
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- ◇1: Revision number

Date of Printing	Rev. No.	Section	Revised Content
July 2002	–	–	First edition
June 2003	◇1	3.1	Revision: Diagram of host controller
		3.5	Revision: Replacement of the diagram in 3.5.1 with the wiring diagram in 3.5.3.
			Revision: Host controller and terminator diagram
		3.6	Revision: Terminator diagram
		4.3, 4.4	Revision: Processing classifications, synchronization classifications, processing times, and subcommands moved to table.
			Revision: Conditions that the command warning, A.95 occurs
		4.3.4	Revision: Description of the read ID command and DEVICE_COD
			Revision: Subcommand (deletion of bytes 17 to 29)
		4.3.8	Revision: Subcommand (deletion of bytes 17 to 29)
		8.2.2	Revision: SERVOPACK model (SGDH-50AE-N1-R changed to SGDH-50AE)
		10.2	Revision: Model and diagram of MECHATROLINK/MECHATROLINK-II communications cables and terminator
		B.1	Addition: Pn280 and Pn281
		B.2	Revision: Description of Pn002.0 and Pn002.1
April 2004	◇2	Back cover	Revision: Address
March 2005	◇3	3.5.3, 4,.2.2	Revision: Description of connectable slave stations
		4.3	Revision: Description of main command
		4.4	Addition: Table 4.3 Deletion: Description of combination with main command shown in each subcommand table
		4.5.2, 6.3.3	Revision: Acceleration/deceleration filter → position reference filter
		4.5.2, 8.1	Revision: S-curve acceleration/deceleration → movement average
		6.3.6	Addition: Backlash compensation function
		6.4.2	Revision: Diagram and description of input signal allocation
		6.4.4	Deletion: Debug function
		6.4.4 (6.4.5 in previous version), B.2	Revision: Reference unit → pulse (unit of position error when Pn003.0, Pn003.1 = 3 or 4)
		6.5.1	Revision: Description of dynamic brake
		9.1, 9.3	Addition: Alarm A.E4
		9.1	Addition: Another cause and remedy of alarm A.EA
		Appendix B	Revision: Description of parameter list
		B.2	Addition: Pn81D
		Back cover	Revision: Address

Σ-Ⅱ Series SGDH

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Specifications are subject to change without notice for ongoing product modifications and improvements.

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